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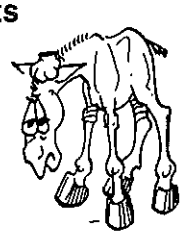


DDx - Differential diagnosis: pg 334

Abbreviations: Last page - 412

Normal Laboratory Values: Inside back cover

Inside front cover

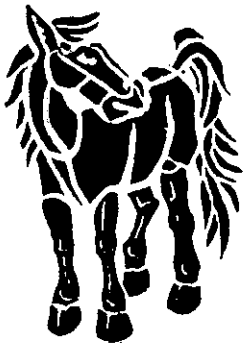
Quick Reference: see page 2 for complete information

C4T, C3T, C2T: *Current Therapy in Equine Medicine 4, 3* or 2 **1997**
E: *Equine Medicine and Surgery*, 3, Mansmann, 1982
EM&S: *Equine Medicine & Surgery*, Colahan, 1991
ER: Equine *Reproduction*, Mckinnon, 1993
I2M: *Large Animal Internal Medicine*, Smith, 1997
IM: *Large Animal Internal Medicine*, Smith, 1990
J: *The Practice of Large Animal Surgery*, Jennings, 1984
LA-D: *Large Animal Dermatology*, Scott, 1988
LAS: *Textbook of Large Animal Surgery*, Oehme, 1988
M: *Manual of Equine Practice*, Rose & Hodgson, 1993
M8k or Mk: *The Merck Veterinary Manual*, 8th or 7th ed., 1998, 1991
Pic: *Color Atlas of Diseases & Disorder of the Horse*, Knottenbelt, 1994
POP: *the Horse*, Herbert editor
PP/USA/C: *Poisonous Plants of US & Canada*, Kingsbury, 1964
PP/M, PP/O, PP/A: *Poisonous Plants/Montana, Ok.* or *Al.*
R: *Veterinary Obstetrics & Genital Diseases*, Roberts, 1986
R-Y: *Current Therapy in Large Animal Theriogenology*, Youngquist, 1997
S: *Equine Surgery*, Auer, 1992
T: *Current Therapy in Theriogenology*, 2: Marrow, 1986
T&W: *Techniques in Large Animal Surgery*, Turner, 1989
T&W-A: *Equine Surgery, Advanced Techniques*, McIlwraith, 1989
Tox: *Clinical & Diagnostic Veterinary Toxicology*, Osweiler, 1985

Volume **1**

Guide to Equine Clinics

3rd edition



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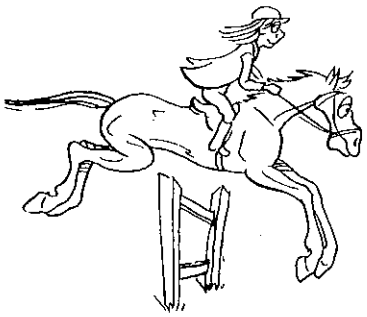
Volume 2: Lameness
Volume 3: Lameness diagnosis



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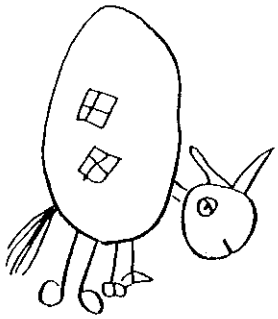
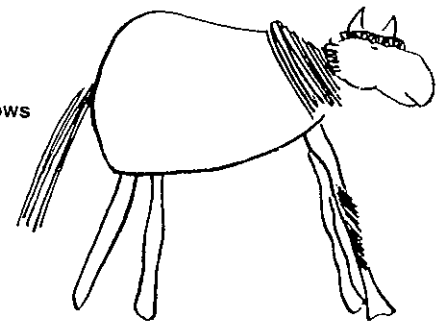


by Gina Pasquini: Horse w/ Windows



by Abbey Pasquini: Leg problem

3rd EDITION

Quick Reference

Each condition is keyed by abbreviation & page number to the commonly used reference books listed below

C4T, C3T, C2T: *Current Therapy in Equine Medicine* 4, 3 or 2; E. Robinson, W.B. Saunders Co., 1997, 1987, 1992

E: *Equine Medicine and Surgery*, 3rd edition, Mansmann, American Veterinary Pub., 1982

EM&S: *Equine Medicine and Surgery*, Colahan et al, American Veterinary Pub., Inc., 1991

ER: Equine *Reproduction*, A. McKinnon & J. Voss, Lea & Febiger, 1993

I2M, IM: *Large Animal Internal Medicine*, B.P. Smith, 2nd or 1st editions, Mosby, 1996 or 1990

J: *The Practice of Large Animal Surgery*, P.B. Jennings, W.B. Saunders, 1984

LA-D: *Large Animal Dermatology*, DW Scott, WB Saunders, 1988

LAS: *Textbook of Large Animal Surgery*, F. Oehme, Williams & Wilkins, 1988

M: *Manual of Equine Practice*, Rose & Hodgson, W.B. Saunders, 1993

M8k or **Mk**: *The Merck Veterinary Manual*, 8th or 7th edition, 1998

Pic: *Color Atlas of Diseases and Disorder of the Horse*. D.C. Knottenbelt, R.R. Pascoe, Wolf, 1994

POP: *the Horse, your guide to equine health care*, a magazine, K.S. Herbert editor

PP/USA/C: *Poisonous Plants of the United States and Canada*, Kingsbury, Prentice Hall, 1964

PP/M, PP/O, PP/A: *Poisonous Plants/Montana, Oklahoma* or *Alabama*, printed by the Extension Service of each state

R: *Veterinary Obstetrics and Genital Diseases*, S.J. Roberts, Woodstock, 1986

R-Y: *Current Therapy in Large Animal Theriogenology*, R.S. Youngquist. WB Saunders, 1997

S: *Equine Surgery*, Auer, W.B. Saunders, 1992

T: *Current Therapy in Theriogenology*, 2: D. Marrow, W.B. Sounders Co., 1986

T&W: *Techniques in Large Animal Surgery*, Turner & McIlwraith, Lea & Febiger, 1989

T&W-A: *Equine Surgery, Advanced Techniques*, McIlwraith & Turner, Lea & Febiger, 1989

Tox: *Clinical and Diagnostic Veterinary Toxicology*, Osweiler et al, Kendal/Hunt Pub. Co., 1985

Condition

References: see inside front cover or above

Facts/Cause: important information (cause, pathophysiology, Hx (history), transmission, etc.)

Presentation/CS: clinical signs that can be visualized from a distance, or that an owner might report

Diagnosis: CS, palpation, auscultation, lab tests, radiographs, postmortem [PM], etc.)

Treatment

Condition	Facts/Cause	Presentation/CS	Diagnosis	Treatment
Blister Beetle/ Cantharidin toxicity Mk 1643, IM2 729, 1795; IM 664; EM&S 1555, 655; CT 368; C2T 120	• **Horses** >>> sheep & cattle • **Blister beetle (*Epicaura*)** • **Swarm in alfalfa** during harvest • **Cantharidin**: potent irritant - Contact damage, vesicle formation - Mucosal surfaces - **GI, renal & heart damage** - **Hypocalcemia** • Tiny part of beetle causes clinical diz • **Southwest USA**	• **Endotoxic shock & renal failure** • **Found dead peracute** • **Colic** • Salivation • **Cardiovascular shock, death** • Anorexic, severely depressed • **Vesicles mouth, tongue & GI** • **Watery feces** • **Cardiac arrhythmias** • **Renal tubular damage** • **"Thumps"** • Stiff gaited	• Clinical signs, Hx • **Find beetle in alfalfa** • Cantharidin in urine or stomach • ↑ TPR • Lab: ↓ **Ca**, Mg - **Low specific gravity**, 1.003-1.006 - **Hematuria** - ↑ **BUN & creatinine** - Leukopenia in toxic • PM (post mortem) - Erythema & edema of **urinary bladder**	• **No specific antidote** • **Supportive (intensive)** - IV **fluids**, Tx hypocalcemia • **Activated charcoal** • Gastric protectants: Pepto-Bismol • Mineral oil (remove toxins) • If concern of renal failure - Diuretics (furosemide) • Analgesics • Antibiotics • Tx hypocalcemia **Prevention** • ID feed source Prognosis: • **Guarded** if obvious CS & lot of blood in feces & urine

Swarm in alfalfa
CS: Endotoxic shock: Renal, GI, Heart
Dx: Hx, CS
Tx: No antidote, Supportive Tx

DDx:
• Acute abdominal crisis
• Lameness
• Heart problems
• Renal failure

Prognosis (Px):
• Excellent = 95%
• Good = 75%
• Guarded = 50%
• Poor = 25%
• Grave = 5%

Summary Box: Key words

DDx: Differential diagnosis

Page Setup,

an example

HE WAS OK YESTERDAY...THEN BINGO!

"Doc, I called you just as soon
as I seen ol' Buck was sick.
He's been a little poorly
But he never missed a lick.

Last winter he got picky
And wouldn't eat his grain
So I gave him Doctor Bell's
Tied garlic in his mane.

Then several months ago
When he started losin' weight
I give him Copenhagen
And a pound of catfish bait.

He come down with the splatters
And all his hair fell out!
So I fed him Larramycin
And Mother's sauerkraut.

Then last week after ridin'
He got as stiff as pine!
His navel needed smokin'
So I used the turpentine.

He went plum down on Sunday.
His kidneys, so I guessed.
I doctored up his water
And tied him facing west.

Last night I got to thinkin'.
You were here two years ago.
You gave him some concoction
For a cough and runny nose.

I wondered if your treatment,
Which then improved his luck
Had later turned against him
And poisoned my 0l' Buck?

"Whattya think Doc?"

Baxter Black

"Cowboy" by
Abbey Pasquini,
1994

Table of Contents

INTRODUCTION

The ***Guide to Equine Clinics*** is a quick reference guide for veterinarians and veterinary students. It should be especially helpful during the senior year in clinics.

Fashioned after Heidi Tschauner's ***Senior Veterinary Student's Guide to Small Animal Clinics*** and a direct continuation of The ***Guide to Bovine Clinics***, it should help assess cases quickly until a more thorough reference can be located. This is not meant to replace reference texts, but to encourage the use of other references by keying each condition by page number to commonly used veterinary texts. During my veterinary education no teacher hinted how valuable ***The Merck Manual*** was for getting a handle on veterinary medicine. Board certified professors or those studying for board certification probably want the student to read the latest journal article on each condition. Admirable, but students don't have the time to search the journals and can carry *The Merck Manual.*

Susan Pasquini, my wife, typed her junior veterinary school class lectures on a portable computer. I then tightened them using the different veterinary texts, including The *Merck Manual,* Smith's *Large Animal Internal Medicine*, and *Equine Medicine and Surgery.* Susan would proof read and correct the charts as she studied for tests. This summer we have been revising & correcting for her senior year.

The key words in the first box provide a handle on each condition. Bold type allows skimming facts/causes, clinical signs, diagnosis and treatment. More in-depth information is given in light type and small type. Other texts keyed under the condition allow for quick references; while the cartoons hopefully add life and help page recognition. Differential diagnoses, the key to diagnosis, are highlighted in a rounded box for most conditions. The last chapter is lists of differential diagnoses for different syndromes to help you start making a rule out list. The index tries to list every name for the different conditions for convenience and quickness of use. The first page of each chapter has an alphabetical list of the conditions and their pages.

Many professors in the clinics expect you to remember everything presented in classes from semesters earlier. You won't! When in a panic about what a professor may ask, slide around a corner and quickly read through a condition in the guide. Short term memory may allow an intelligent answer to the professor in front of your peers. If the professor will allow, when a classmate is questioned about a condition; quickly find it and read along. This will give you an overall view and may raise questions you can ask.

The key to learning is reading as many texts and articles on each condition over and over as you take care of an animal with the condition. Time constraints make this impossible; and students often only have time to read about the cases assigned to them. The mini indexes at the start of each chapter allow quickly finding conditions. The outline format allows a quick review of each condition. At the minimum read the guide for each condition seen by all the students. The *Merck Manual* or *Manual of Equine Practice* by Rose and Hodgson are small texts that bring you to the next level. Then, when there is time, read the other texts referenced in the guide. Every day as long as the case is in the clinic skim the condition in the guide.

Hopefully this guide will open up the clinics for the lower classmen who are put off by trying to read an incomprehensible 200 page chart. Classes such as pathology, clinical pathology, parasitology, virology, bacteriology, neurology, etc. deal with conditions not fully discussed until later in medicine and surgery classes. Read about them in this guide to get an overview of facts, clinical signs, diagnosis and treatment. This should make these conditions less disconnected, thus, more meaningful and easier to learn. Go and see animals in the clinic. Examine an animal at your level of knowledge. Pretend you are the veterinarian in charge. Find in the animal's chart the physical exam findings and the differential diagnosis. Think about these. Check the diagnosis and look up the condition in this guide. Then see if you can detect any of the clinical signs. Hold the medicine being used and imagine yourself administering it. Guess if the animal will survive. Check on its progress over time, refreshing your memory with the guide and other texts if you have the time, over and over. Later in lectures, when a condition comes up, you will have a specific animal to relate it to.

This Guide is incomplete, some sections are good and others weak. We will keep working on it during our senior year. With help from other seniors and faculty members it may turn into the key to Equine Clinics. There are pages at the back of the guide to write any ideas, criticisms, praise, corrections, cartoons or new charts. When through with your senior year, please tear these out and send them for inclusion & credit to:

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Pilot Point, Tx 76258
(817) 686-9208

Most of all, as you go through veterinary school, remember your elation on acceptance into veterinary school and your realization that you will one day be a veterinarian. Veterinary school seems to kill this excitement. Don't let it!

Chris Pasquini

Acknowledgment: Susan Pasquini's work makes up the heart of this book. Her revisions and corrections make up its complexion. Thanks goes to Dr. Kerstin Thorén-Tolling for the Clinical Pathology Chart. Pamela Pinchuk corrected the vaccination and parasite control pages. Rick Linkenheimer and Robert Diliberto created the basis of the Toxicology chapter. Alicia Emerson and Mark Sminkey edited the text. Thanks to Anne Couger, Oklahoma State Veterinary librarian, for her assistance. Special thanks to the authors of the books to which this guide is keyed. Hopefully the guide will encourage the student to use these more often.

I would like to thank Dr. James Brendenmehl from Oregon State University and the following teachers at Oklahoma State Veterinary School for the information and insight of their rounds that I have sat in on:

Dr. Pamela Pinchuk
Dr. David Stevens
Dr. Mary Ann Guglick
Dr. Michael G. Collier
Dr. Karen Copedge
Dr. Charles MacAllister
Dr. Greg Pullin
Dr. Henry Jann

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Lisa VanNieuwal
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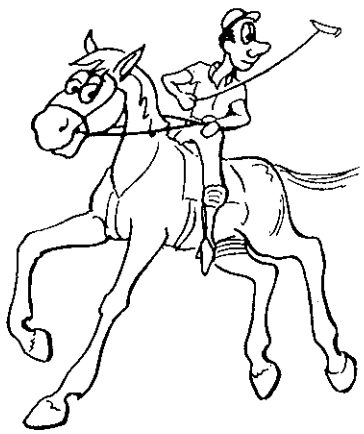
Marilyn Wolgamott
Dawn Goldacker
Cari Satterfield
Ann Coffin

And lastly, I would like to thank the Students of Ross University who made my three years in paradise just that.



Memory = Notebooks

Welcome to the clinics. This should by far be your most exciting year in veterinary school. If it isn't , think about becoming a virology teacher. You have been given and remember (?) all the facts needed to function in this new world of hands on medicine. It can be terribly confusing. As you move from Equine medicine rotation to Theriogenology to Radiology to Small Animal Medicine you may lose track of your cases and may wonder what ever happened to "Amber", the mare with acute renal failure.

Notebooks: The major advice I can give you is get a pocket notebook (2.5x4") and a 5.5x8" notebook and write things down. Carry the pocket notebook everywhere and write down instructions the clinician gives you. Give up on trying to impress people with your phenomenal memory, clinicians won't care if you remember 99% of the things they told you, they will be upset if you forget to give a horse its life saving medicine. Write down things that you want to look up. Use the larger notebook for rounds, when, as a group, you talk about the horses everyone is treating. Below is a scheme that I am trying to iron out. Perfect it for your needs or idiosyncrasies or come up with your own scheme.

Number all the pages in the big notebook in the lower outside corner.

Table of contents: When you are waiting for something to happen in the clinic make a table of contents. On the first page, write page numbers along the left hand side, skipping a line between numbers. Continue this onto the next pages until all the pages in the notebook have two corresponding lines in your table of contents. As you fill out the pages in the notebook, name them after their contents and record them in your table of contents. This will be invaluable as you try to find vital information you wrote in the notebook last week.

Cases: Label the four pages following the table of contents "CASES". As cases are passed out, draw an opened box at the start of a line. Follow this with the case number, horse's name. Later when the diagnosis is made, write it on the same line in bold **BLOCK LETTERS**. This will obviously give you a list of all the cases seen. If you move to another rotation before the horse is discharged the open box will help you follow the case through (an important thing to do!). Ask the clinician in charge what happened or go look up the chart with the case number. Check the box off when the animal is discharged or necropsied. An open box indicates an unfinished learning experience.

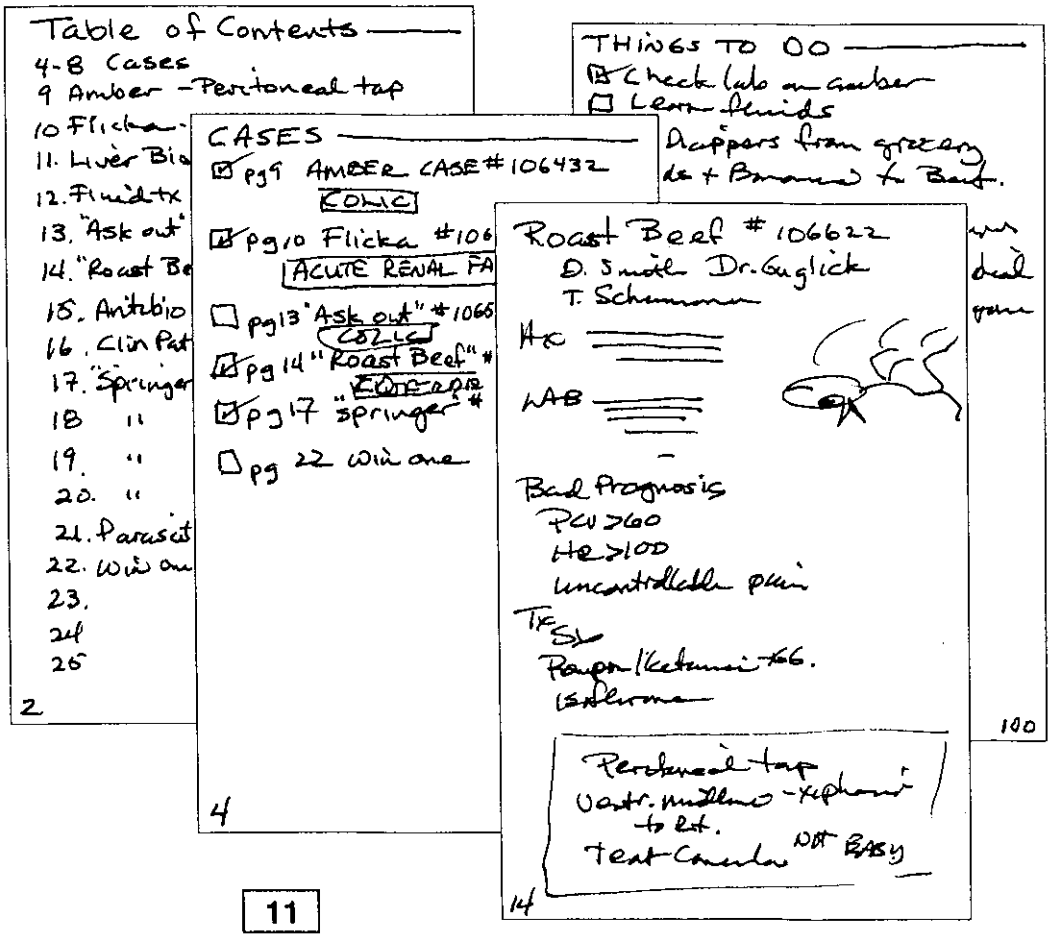
Information, confusion, drugs cases, etc.: The pages following the CASES pages are for the mass of information that will be coming towards you. For your own case give yourself enough pages to cover it (3 or 4 pages per case). For all cases write the case number, horse's name, owner's name, clinician's name and assigned student. Later write the diagnosis in bold **BLOCK LETTERS** enclosed in a box.

For all cases write down the history, signalment, etc. Be sure to write down all the instructions preceded by open boxes for you to check off as things get done. As you read up on the condition, jot down notes and organize your thinking. Write down things to ask the clinician. As lab data, radiology and other information comes in, write it down. If you run into another case's pages, put continued on an open page and continue on that page.

Miscellaneous: Fluid therapy, drugs, clinpath, etc. may need to be reviewed. Write down pertinent information for you to use in other cases and put page number in the table of contents.

Things to do! On the last page list the things to remember to do as they come up. Put a box on the left hand side and write down what task to do. When each task gets done, check it off.

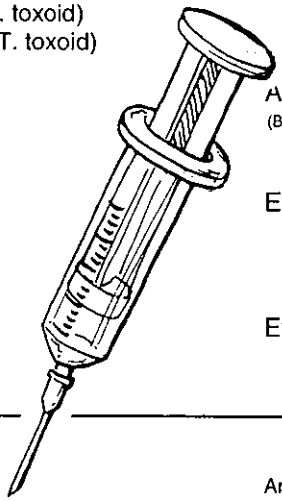
Optional: Draw case horses, trying to characterize their clinical signs. These can be stick figures, but they will help you observe the horse and remember it in the future.

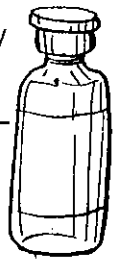


Vaccines

	Foals/Weanlings	Performance	Pleasure	Brood mares
Tetanus toxoid				
• **Foal from Vac. mare**	3 mo 4 mo 12 mo	Annually (Injury - Toxoid*)	Annually (Injury - Toxoid*)	Annually (preferably in last mo of gestation) (Injury - Toxoid*)
• **Dam unvaccinated**	Day 1 T. antitoxin + T. toxoid 4 wk (T. toxoid) 4 mo (T. toxoid) 12 mo (T. toxoid)			
EEE, WEE, VEE	3 mo 4 mo 12 mo	Annually (spring) (Biannually - warm areas)	Annually (spring) (Biannually - warm areas)	Annually (spring) (3-6 wks prior to foaling) (Biannually - warm areas - mosquitoes all year)
Influenza	3 mo 4 mo 12 mo	Every 2-3 mo	Biannually	Biannually (1 vac. 3-6 weeks prior to foaling)
Rhinopneumonitis	3 mo 4 mo 12 mo	Every 2-3 mo	Biannually	5th, 7th, 9th mo of gestation (both MLV & KV available & approved for use in pregnant mares)
Optional				
Rabies	3 mo 4 mo	Annual	Annual	Annual
Strangles	3 mo - 15 wk - 18 wk 12 mo	Annual/ biannual	Annual/ biannual	Biannual (last 3-6 wk of gestation) Dubious efficacy

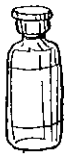
Anaphaylaxis infrequent to vaccines
- Life threatening emergency
- Prompt Tx w/ epinephrine (5 ml of 1:1,000 IM or IV), less severe reactions (1-2 ml, 1:1,000 IM or SQ)
- Solu-Delta Cortef® 500 mg/450 kg by slow IV





Minimum vaccination schedule

- **For foal from immunized mare:**
  - **3, 4,12 mo: T. Toxoid, EEE, WEE, Influenza & Rhinopneumonitis**
- For foals from unimmunized mare
  - Day 1, T. antitoxin + T. toxoid, 4 wk T. toxoid then like other foals
- **Revaccinate**
  - **Annually with T. Toxoid, EEE & WEE**
  - **Performance - every 2-3 mo w/ Influenza & Rhinopneumonitis**
  - **Pleasure - biannually w/ Influenza & Rhinopneumonitis**
  - **Brood mares**: during gestation
    - **-- Annually w/ T. toxoid & EEE & WEE in spring**
    - **-- Biannually for Influenza**
    - **-- 5th, 7th, 9th mo of gestation for Rhinopneumonitis**



Tetanus toxoid
- *Injuries or surgery: revaccinate w/ toxoid after injury or surgery if not vaccinated in last 6 mo
  - **Tetanus antitoxin is contraindicated** in horse previously immunized w/ tetanus toxoid because of possible serum hepatitis (pg. 88)
    - Tetanus antitoxin has been associated w/ fatal serum hepatitis, so restrict its use to horses that have never been vaccinated w/ toxoid or those of unknown vaccination status who need immediate tetanus protection
- Injury or surgery to unvaccinated or unknown vaccination history
  - Tetanus toxoid & tetanus antitoxin in 2 separate injection sites & then toxoid 1 mo later
- Foals from unimmunized mares: give t. antitoxin + T. toxoid on day 1, revaccinate at 4 weeks and then put on same schedule as other foals
- Conveniently sold in 4 way combo w/ EEE, WEE & Influenza

Influenza
- For high risk foals (shows) primary series: 1 mo, 2 mo, 3 mo, then every 2-3 mo
- If started before 3 mo, need 3 dose primary series
- Sold in 4 way combo w/ Tetanus toxoid, WEE & EEE

WEE & EEE
- Warm areas - biannual where mosquitoes are present all year
- Annual revaccination prior to insect season in spring
- VEE not seen in USA, horses transported to potentially endemic areas (Texas, Calif., Cen. Amer., Mexico) should be vaccinated
- 4 way combo w/ Tetanus toxoid & Influenza

Rhinopneumonitis
- If start before 3 mo need 3 dose primary series
- Highly recommended for brood mares even though protection not 100%, sporadic abortions & rare abortion storms do occur in vaccinated mares
- Vaccination in face of abortion storm recomended
- Foals at high risk: revaccinate every 2-3 mo after 4 mo, for life

Rabies
- Use in endemic areas or where horses are near wild animals; it is a safe vaccine & the diz is fatal, so use w/o hesitation
- Do not used unapproved modified live vac.

Strangles
- Usefulness of vaccine questioned:
  - Outbreak of strangles have occurred in vaccinated horses
  - Strangles vaccinations have local (injection reactions) & systemic side effects
  - Therefore recommended only on farms where strangles is a persistent endemic problem or if transporting to such a farm
  - Not routinely recommended in pleasure or performance horses in low-risk situations
- Must have a primary series of 2-3 injection at 3 wk intervals
- Use alternate injection sites (bec. of injection reactions)
- Performance horses previously unvaccinated: 2-3 primary vaccinations at 3 wk intervals before shipping
- **M-protein** extract preferred over whole cell

Other vaccines available: VEE, Potomac fever, Botulism, Eq. viral arteritis, Anthrax

Taken from Equine Vaccination Guidlines, Pamela A. Pintchuk, DVM, 1993

Parasite control

Basic - assume all horses are parasitized

- Ivermectin every 2 months for life (no resistance noted yet)

Interval deworming program

- 6-10 week-old: first dose of anthelmintic for foals
- 8 week intervals for Ivermectin
- 4-6 week intervals for drugs other than ivermectin (recommended)

- Rotation of drugs
  - Fast: change Rx every time
  - Slow: change every 1-2 years

Foals - example program (from CT 52 by J.A. DiPietro)	
2 mo	Ivermectin (nematodes)
4 mo	Oxibendazole (nematodes)
6 mo	Pyrantel pamoate (nematodes)
8 mo	Ivermectin (nematodes & bots)
10 mo	Pyrantel pamoate (nematodes)
12 mo	Ivermectin (nematodes & bots)

Adult - interval program (J.A. DiPietro)	
Feb.	Pyrantel pamoate (nematodes)
April	Oxibendazole (nematodes)
June	Fenbendazole & piperazine (nematodes)
Aug.	Ivermectin (nematodes & bots)
Oct	Ivermectin (nematodes & bots)
Dec.	Pyrantel pamoate (nematodes)

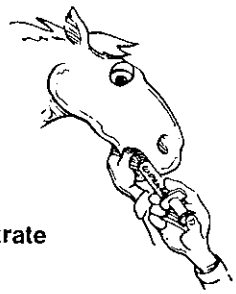
- 1 control program recommendation is impossible because of the wide range of climatic, economic & management conditions across the USA
- Interval programs: determined by fecals taken 2 wks after deworming in 1st year of program or from past experience
  - A boticide should be given in bot season & 1 mo after first frost
  - Foals start at 8 wk-old bec. when ascarids first present

- After 1 yr-old on adult program
- Strongyloides problem area - treat foals w/ ivermectin or oxibendazole (15 mg/kg) at 3 wk-old
- Treat mares 12 hours postpartum (reduce S. westerii in milk & other nematodes)
- Deworm mare on same schedule as foal
- Use slow acting agents (pyrantel pamoate, ivermectin or benzimidazoles) for heavy ascarid infections to avoid possible impaction (not piperazine)
- Major problem w/ Benzimidazole resistent sm. strongyles

Integrated or seasonal program (northern temperate zones) where there is a spring rise in number of adult strongyles. Cheaper & m/ prevent development of resistance

- Foals on interval program for first year
- Adults - anthelmintic in spring
- Boticide at end of bot season, m/b also in middle of bot season

Seasonal program - Adults	
May	Oxibendazole (nematodes)
July	Ivermectin (nematodes & bots)
Dec	Ivermectin (nematodes & bots)



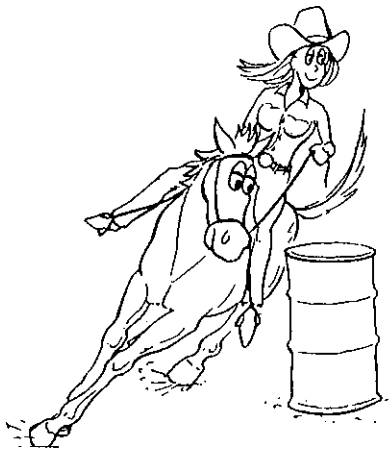
Continuous low-level feeding of pyrantel tartrate

- 6-10 wk-old: first dose of anthelmintic for foals
- Ivermectin at start of program
- Then continuous feeding of 2.64 mg/kg of pyrantel tartrate base in alfalfa pellet
- Administer a boticide to kill Gastrophilus during & at end of botfly season
  - Ivermectin and organophosphates

Check efficacy of all programs with fecal tests periodically

Anthelmintic	Trade name	Strongyles Large	Strongyles Small	S. westerii	"Round"	Bot	Pinworms	Comments
Ivermectin	Eqvalan® Zimectrin®	+*	+	+	+	+	+	• **Broadest spectrum, safe, no resistance noted** • Effective against mature, immature & migrating forms of *"Round worms" (Parascaris equorum)* • Ineffective against tapeworms
Piperazine (PPZ)	Many	+/-	+		+	-	-/+	• Fast acting so shouldn't use in foals w/ heavy ascarid infections (m/ result in impaction) • Added to BZDs for BZD resistent sm. strongyles
Pyrantel Pamoate	Strongid T Strongid P® Imathel®	+	+		+	-	-/+	• **Popular & effective** • **2 x dose for tapeworms**
Organophosphates								
Trichlorfon, TCF	(Combot®, Dyrex®)	-	-		+	+	+	• **Narrow margin of safety**
Dichlorvos	(Equigard®, Equigel®)	-	-		+	+	+	
Benzimidazoles (BZD) & Pro-BZD		+	-/+		+	-	+	• **BZD resistent sm. strongyles - emerging problem** • **+/-** = ineffective for benzimidazole resistent strongyles, effective for other small strongyles
Thiabendazole, TBZ	(Equizole®), Cambendazole, CBZ (Camvet®)							
Mebendazole	(Telmin®), Fenbendazole (Panacur®)							
Oxfendazole	(Benzelmin®)							
Oxibendazole	Anthecide®, Equipar®	+	+	+	+	-	+	• **Only Benzimidazole or Pro-BZD effective against BZD resistent sm. strongyles**
Pro-BZD (Febantel)	**Rintal®**	+	-/+		+	-	+	
Benzimidazole combos								• Piperazine or trichlorfon added to thiobendazole increases effectiveness against resistent sm. strongyles
TBZ - PPZ	Equizole A®	+	+		+	-	+	
TBZ + TCF	Equizole B®	+	+		+	+	+	
MBZ + TCF	Telmin B®	-	-		+	+	+	

* (+) Indicates 90-100 % efficacy against non-migrating stages of nematodes at recommended doses, (-) indicates less then 90%



DIGESTIVE SYSTEM

Teeth

DIGESTIVE SYSTEM

Condition	Facts/Cause	Presentation/CS	Diagnosis	Treatment
Dental disorders M8k 133; Mk 115; I2M 688; IM 625; EM&S 550; M 218; C4T 149. 139; C2T 6; C3T 49 ★★★★ **Common** **CS: Loss of condition, "Quid", Salivation** **Dx: PE**	• **Common in horses**, rare in cattle • Causes: - Broken teeth - Irregular dental arches - "Points" - Malocclusion - Cribbing - Retained premolar caps	• **Loss of condition** • **Weight loss** • Poor breeding or nursing behavior • Difficult & slow feeding - Stop & start chewing - Reluctance to drink cold water • Head held to one side • **"Quid"** (form bolus of food then drop it) • **Bolt food** (avoid painful chewing - m/ result in recurrent esophageal choke or intestinal impaction) • **Excessive salivation** • Fetid breath • ± Nasal discharge (extension of dental decay to paranasal sinuses) • Facial or mandibular swelling & draining tracts	• **Physical mouth exam** (see box) • History (gradual onset) • Whole grain in feces • **Radiographs: Oblique views** (30-45°) to separate arcades	• **Routine dental exam & prophylaxis** • **Treat cause** **Mouth Exam** M 219 • Handle head before mouth until horse relaxes • Reach in large interdental space, grab tongue & pull to outside (stops animal from biting) • Stand to side, hold tongue out of mouth, using it as a gag • Slide finger up teeth to feel for points • Mouth gags (speculum)
Wolf teeth I2M 692; IM 627, EM&S 557, 564; C3T 49; S 300; Pic 13	• **PM 1** (premolar 1): small vestigial premolar, m/ or m/not be present • **Usually no problem**	• **May interfere w/ bit** • Buccal ulceration if sharp, unusually placed or impacted	• **CS, PE** (physical exam)	• **Traditionally removed:** short roots, loosened w/ root elevator or sharpened screwdriver between 12-18 months old
Enamel points **Float (filing) teeth** Mk 116; I2M 692; IM 630; EM&S 525; M 221; C4T 151; C3T 50; LAS 373, 378; Pic 17 **Inside lower** **Outside upper** **Float teeth**	• Cheek teeth, table surface • Chewing from side to side - Mandibular arcade narrower than maxillary arcade - **Points on inside (lower) & outside (upper)** - **Sharp, irritate soft tissues**	• **Difficulty in mastication** • **Lacerations & ulcers on side of tongue & cheek** • Head tossing	• Rubbing cheeks on outside will get painful response • **Run fingers** between teeth & cheek to feel points on upper arcade	• **Float teeth** (2 times/ year as permanent dentition is developing, then annually) - **Rasp off points on outside of upper cheek teeth, inside of lower** - Angle float at 45° to table surface - Start slowly & increase pressure (generally cuts as pulling out) - Most don't mind it being done, tend to bite down on float • Easy to do traumatize horse • Restraint safety
Caps, **Retained deciduous teeth** M8k 127; I2M 692; IM 627; EM&S 557; C4T 151; C3T 49, 173; Pic 13 **PM 2-3-4** **Erupt 2-3-4 yr** **Same yr as #**	• Retained deciduous incisors - Permanents come in behind • **"Caps"** (retained deciduous premolars) - Demarcation between deciduous & permanent teeth seen above gum line - M/ interfere w/ normal eruption (pain) - M/ trap irritating food	• **Eating disorders** • Pain if delay eruption of permanent premolars PM2, PM3 & PM4 roughly erupt same age as their number (2,3,4 yr). Look for caps at these ages. • Molars don't have precursors so don't have caps	• **Retained deciduous teeth** - Deciduous incisors in front of permanent incisors - **Caps** on top of permanent PMs	• **Retained incisors** - remove • **Caps: knock off w/ screwdriver** **Lampas** Mk 123, C4T 155; Pic 16: transient inflammation of mucosa of hard palate during eruption of teeth; self limiting
PM2 & M3 hooks I2M 694, 19; EM&S 557; M 221; C4T 151; C3T 50 **"Quidding"**	• **Malocclusions - rostral & caudal** - Hook on 1st upper cheek tooth (PM2) - Hook on last lower cheek tooth (M3)	• **If long enough, hits gum, causing pain when eating** • Weight loss • Head tossing w/ bit	• **Good** oral exam	• **If small, file (float)** • **If long & causing problem, cut** - Special molar cutters, like large bolt cutters. Sounds like rifle going off, horse reacts (be ready), careful about palatine arteries - Chisel, 1 sharp blow, hooks at back easier to do • Need good restraint or tranquilization
Wave mouth M8k 134; Mk 116; I2M 695; IM 630 LAS 374; Pic 8 **Undulating surface** **CS: "Quidding"** **Tx: Float**	• **In old horses & ponies** • Abnormal undulating surface due to wear • May cause death • Often in conjunction w/ parrot mouth & hook on 1st cheek tooth	• Feeding abnormalities • **"Quidding"** (dropping feed out of mouth) • Weight loss	• Whole grain in feces • Physical exam	• **Flatten occlusal surface** - Float if mild - Combine floating & cutting if really bad
Step mouth M8k 134; Mk 116; I2M 695; IM 630; LAS 374; Pic 18, 19 **Change in height** **CS: "Quidding"** **Tx: Float**	• **Abrupt change in height of teeth** • Growth of tooth controlled by usage (wear) • Cause: - Opposite tooth missing - Cap still stuck on permanent • Often occurs between 3rd & 4th cheek teeth	• Feeding abnormalities • **"Quidding"** (dropping feed out of mouth) • Weight loss	• Physical mouth exam	• Retained cap - pry off w/ screwdriver • Missing tooth - file or cut off opposite tooth (every 6 mo.)
Sheer mouth I2M 695, IM 630; EM&S 562; Pic 11, 18	• Oblique occlusal surface to incisors when viewed from front • CS: Inefficient eaters; sling jaw from side to side when ridden • Tx: Level with saw & drumel			

Teeth

Condition	Facts/Cause	Presentation/CS	Diagnosis	Treatment
Dental cysts, Dental teratomas, Dentigerous cysts, **Heterotropic polydontia** M8k 127; C4T 144; IM 630; EM&S 562; M 214; T&W-A 373; Pic 15	• Dentigerous cysts arise from **tooth germ** tissue in the ear or **temporal region** - Occasionally in cranial vault or maxillary sinus - Lined by stratified squamous epithelium	• **Fluxuant swelling at base of ear**, often w/ fistula opening into ear or out skin • **Seromucous discharge** in area of ear	• **Discharge from area of ear** • Rads: see teeth attached to temporal bone - Occasionally may not see teeth	• **Surgically remove** - Cranium close so must be careful - Dissect bluntly around capsule w/o going into cyst - Using chisel or periosteal elevators, loosen & break away from temporal lobe
Parrot mouth, Sow mouth M8k 126, 134; IM 630; EM&S 561; C3T 49; Pic 10	• **Brachygnathia**: **parrot mouth or overshot**, shortened lower jaw **- Most common deformity** • Prognathia: sow mouth, undershot, long lower jaw, less common • Inherited	• **Malocclusion**: parrot mouth becomes "Rabbit mouth" if no occlusion	• **PE**	• Parrot mouth: if caught early enough, treated w/ braces to incisors to try to slow down growth of jaw
Abscessation of tooth roots, Periodontal diz, **Apical, periapical, dental abscessation, Infundibular necrosis. Alveolar periostitis** M8k 135; I2M 695; IM 628; EM&S 558; C4T 152; C3T 49; M 220; T&W-A 260; S 300; LAS 374, 380 Pic 21	• **Common**, especially cheek teeth **- #1 Molar 1**, either arcade • **Infundibulum, cup** or dark spot, normal indentation in occlusal surfaces • Teeth don't fall out because packed tightly together • **Old loose teeth** in aged horses should be removed, cause discomfort that leads to infection Causes: • Trauma (kicks) • Broken or split tooth • Any malocclusion: step mouth • Patent infundibulum • Carries	• **Difficulty in mastication** • **"Quidding"** (dropping half chewed feed) • Only chew on one side • **Lose weight** & not eating as much • **Swelling** on ventral aspect of mandible, or on side of face if first 2 cheek teeth, caudal 4 in maxillary sinus • **#1 cause of maxillary sinusitis,** **- Unilateral purulent nasal discharge** • Chronic: distortion of face, swelling w/n sinus • Tearing if pressure builds up on lacrimal duct	• **Grain in feces** due to not chewing • **Good oral exam** • **Smell**, w/ rotten tooth first clue • Looseness (must be very rotten) • Dental pick into each tooth **- Patent infundibulum** • Periodontal diz starts w/ gingivitis • **Radiographs** to confirm (best) **- Obliques, 30°** to horizontal, centering beam in maxillary sinus - Air density between teeth roots & alveoli normal, location of periodontal membrane **- Destruction of lamina dura** (side of alveoli) radiolucent area - Sequestra of dead dental tissue - Fistulae Lamina dura	**Remove tooth** (see box pg 21) • **Pulled inside mouth** (older horses) **- Pack w/ gauze** • **Repulsed into mouth** (**younger horses**) - Identify tooth by finger - Trephine hole over its root - Dental punch, knock out into mouth - Must be directly over tooth or will hammer out 2 teeth or m/ fracture maxilla or mandible - Flush out socket (chips of bone, tissue) **- After care** (difficult part of procedure) - Pack off alveoli (so doesn't become impacted w/ feed) (see box) • **Float opposite tooth every 6 mo.** • Often drainage as well as swelling, seec r u s t y area, if removed, see drainage tract **DDx:** • Eruption: swelling, but no drainage, normal

Tooth removal:

- **Old, loose tooth** (short root) - m/be extracted by hand or w/ small molar forceps
- **Loose infected tooth** (especially those split longitudinally)
  - Detach buccal & lingual gingiva from crown
  - Occasionally m/be removed by rocking w/ a long-handled molar forceps
  - Introduce fulcrum & lever tooth out
  - If young horse m/be too long to move straight out between 2 arcades
    - May be able to push sideways by finger, or
    - Cut off w/ tooth shears, then repeat & shear until tooth removed
- **Infected teeth that are not loose** or too short to grip must be repulsed

Tooth repulsion:

- **Maxillary** (upper) **cheek teeth**
  - **PM2 & 3** in front of maxillary sinus
    - Trephine directly above occlusal (table) surface of tooth (find w/ finger in mouth)
    - Repel tooth w/ angled punch & mallet
  - **PM4, M1 & M2** - located in maxillary sinus
    - 5-8 yr-olds - trephine hole above caudal edge of tooth
    - Over 8 yr-old trephine more & more towards center of table surface as age
  - **M3** - far back in caudal maxillary sinus, below orbit
    - Trephine over frontal sinus (conchofrontal) - medial to medial canthus of eye
    - Long, curved punch so can go through **frontomaxillary opening** & caudally
- **Mandibular cheek teeth**
  - **P2** - trephine hole over center of table surface (any age)
  - **P3, P4, M1 & M2**
    - Trephine ventrolateral at jaw border (protects med. structures, good drainage)
    - 5-8 yr-olds - progressively more caudal, so over caudal border of last 2 (M1, M2)
    - > 8 yrs-old - trephine more over center of occlusal surface
  - **M3 (third molar)**
    - Trephine close to border of mandible through masseter muscle on a line from table of M3 to farthest point of angle of jaw
    - Careful, mandible thin at this point

#1 - Molar 1
CS: Wt. loss, odor
CS: PE, Rads
Tx: Repel

"Cup"

After care:

- **Pulled tooth**
  - Pack alveolus w/ gauze, or
  - Pack w/ dental wax (softens in hot water, then hardens)
    - Granulation squeezes wax out
    - Methylmethacrylate m/ be used to pack
- **Repulsed tooth** (see box)
  - Pack off alveolus (so doesn't become impacted w/ feed)
  - 4x4 gauzes rolled into circle
  - Tie w/ umbilical tape 3' long, leaving long tags
  - 1 tag through trephine hole, 1 out of mouth, pull gauze into tooth socket
  - Tie two tag arms together
  - Change every other day
  - Takes 3-4 wk to granulate in, must always maintain string tag ends
- Use lots of flushing & cleaning

Oligodontia, Pic 12: Absence of teeth, rare
Polydontia, Pic 12: supernumerary incisor & molars
Sand mouth, Pic 19: incisors worn down to gum line in area with lot of sand - "Florida

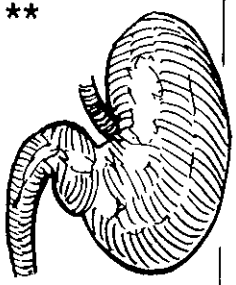
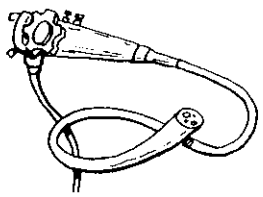
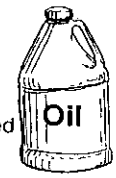
Redrawn from Tom McCracken's illustration in T&W-A, pg 260

Jaw & Esophagus

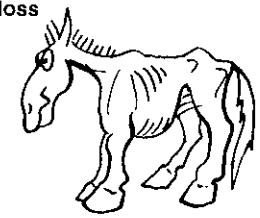
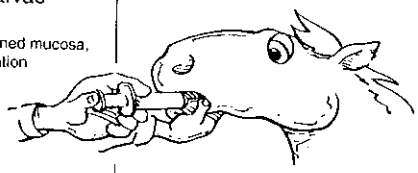
Condition	Facts/Cause	Presentation/CS	Diagnosis	Treatment
Jaw fractures I2M 696; C4T 159; EM&S 1461; S 108; Pic 21 **Difficult eating** **Tx: Immobilize**	• Trauma • Most commonly: interdental area of mandible	• **Difficulty eating**	• **Usually not difficult** • **Malocclusion** **Prognosis:** • Depends on mobility, if both sides unstable, need lot to stabilize of jaw	• **Surgical correction** - Bone plates used (miss roots of teeth) - Intermedullary pins passed through - **Wire teeth together**, drill at base of tooth to get through - Use various combinations to wire together - Aluminum rod bent around, then wire it to teeth
Oral Tumors M8k 196; I2M 696 • Rare in Eq, Melanomas				
Cleft palate, Palatoschisis M8K 125; Mk 109, C4T 387; EM&S 544; M 213; S 453; LAS 388, 344; S 453; Pic 9, 93; POP 90-1/98 **Defect at back** **CS: Milk out of nose** **Tx: Euthanize or Sx**	• **Palate closes from rostral to caudal** • **Defect always at back** • M/b genetic component	• Nurses, then stops • **Milk comes out nose** when head is down • Dies of starvation if not corrected	• Oral exam • **M/b difficult if just in soft palate** **DDx:** • Choke (pg. 23)	• **Euthanatize if gross defect** • **If short, pharyngostomy**, (soft palate) - If severe do mandibular symphysiectomy for better visualization . Dissection in along muscles below tongue, opening bottom jaw - Soft palate pulled together after "freshen" edges (cutting off edges of cleft) • **If hard palate** - Incision made right against teeth on oral side - Cut to bone (palatine a. just away from teeth) - Incise edge of cleft - Flap of mucosa & periosteum slid together to close gap - End up w/ 2 large layers of exposed bone next to teeth
Gingivitis, Stomatitis M8k 196; IM 740; M 215; C4T 387, 158; EM&S 547, 1707; Pic 25, 27; Pop 14-7/98, 8-7/97	• 1° - **vesicular stomatitis (report diz)**, horse pox, candidiasis, pseudomonas, Rhodococcus, trauma grass, blister beetle toxicity; 2° due to periodontal diz, phenylbutazone (PBZ) toxicity, photosensitization, uremia, Mg toxicity • **CS:** Reluctance to eat (ulceration, swelling & redness), depression, salivation • **DDx:** Lampas, Neoplasia, Dental problems, Foot & mouth diz (reportable, horse resistant) • **Tx:** Lavage mouth (povidone-iodine), ± Fluids, Tx 1° diz			
Esophageal stricture I2M 195; M 638; C3T 181; S 315; Pic 33, 36 **Recurrent choke** **Tx: Slurry food, Bougienage**	• Constriction of esophagus • Causes: - **Prolonged choke** - Trauma to neck - Reflux esophagitis - **Esophageal surgeries** - Squamous cell carcinoma • **Wound contraction**	• Recurrent esophageal feed impaction • Dysphagia • **Dietary management:** - Long term slurry of pelleted feed & roughage - "Complete" pellets & no roughage . Council owner m/ lead to GI problems (e.g., lg. colon impaction or enteritis) • **Indirect bougienage** (safe, nonsurgical method to dilate stenotic region) - Earlier done the better, Fast animal, Daily sessions of dilation • **Esophageal surgery** - Hi potential for complications, but m/ be necessary - Esophagomyotomy, esophagoplasty & patch grafting	• **Hx: Recurrent choke** • **Contrast esophagram** • **Esophagoscopy**	• **Dietary:** Slurry of pelleted feed & roughage • **Indirect bougienage:** dilate stenotic region • **Esophageal surgery (AVOID!)** H_2O +

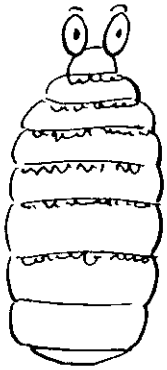
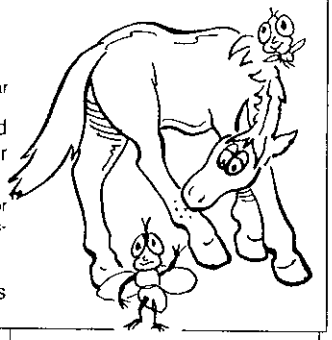
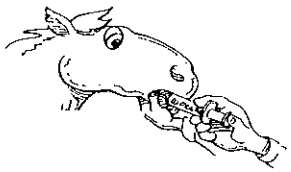
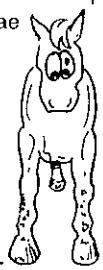
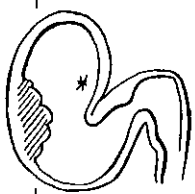
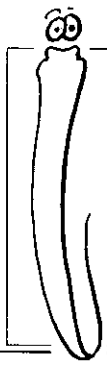
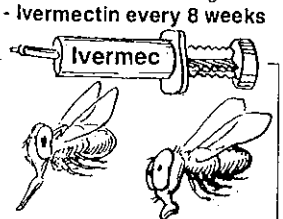
Choke, **Esophageal obstruction** M8k 194; Mk 173; I2M 701; IM 636; EM&S 583; C3T 175; C2T 12; M 223; T&W-A 264; S 310; LAS 395; Pic 34, 35 **Greedy - dry food** **CS: Salivation, anxiety** **Dx: CS, PE** **Tx: Stomach tube** **Esophagostomy last resort!**	• **Most commonly diagnosed esophageal disorder** of the horse • **Causes:** - **Greedily eating dry grain** (swells) or pelleted feed - Improper mastication by old (defective teeth) & young (erupting teeth) - During recovery from anesthesia - Exhausted animals - Occasionally medicinal boluses, ears of corn, potatoes or bolus of hay • **M/ get strictures chronically** **Sequelae:** • **Aspiration pneumonia** • Necrosis of esophagus	• **Anxiety & distress** (pawing ground, get up & down) • Arched neck • **Retching** • **Profuse salivating** • **Regurgitation of food & saliva through nostrils,** bilateral (milk in foals) • Coughing • Drink water & sputter • Anorexia, depression • **Stomach tube down & gently lavage** (pumping & siphoning) (careful of aspiration pneumonia) - **Heavy sedation**: Rompun/Torbugesic, Detomidine/Torbugesic, lowering of head for ventral drainage & to avoid aspiration - **Never use mineral oil** or dioctyl Na sulfosuccinate (DSS) (softener) as too easy to aspirate - Very small amounts of water only • Large bore stomach tube w/ cuff in esophagus & smaller lavage tube placed inside for more aggressive lavage (fluid passes back through larger tube, bypassing larynx) • **More aggressively** pumping & siphoning - Endotracheal tube into larynx, w/ cuff inflated - Under general anesthesia, head down so water drains out • **Esophagostomy last resort!** - Milk back toward pharynx - If really damaged must incise & remove, put stomach tube in & feed through tube - Let heal by 2nd intention - Complication: esophageal fistula & stricture	• **Hx, CS** • **Palpate**, usually large, soft mass, not easy to palpate • Nasogastric tube to locate, m/ pull back plug of feed • Survey radiographs	• **Tends to resolve spontaneously** as saliva softens, few hours to several days • **Don't be hasty** - Tranquilize - Confine & give water, but no feed - M/b spontaneous recovery • **Stomach tube & gently lavage** - **Never use mineral oil** • **More aggressively** lavage under general anesthesia • **Esophagostomy last resort**, complication: esophageal fistula & stricture • **NSAIDs** to control pain & inflammation (Banamine®, PBZ/phenylbutazone) • Broad spectrum ABs (if aspiration) • **Evaluate esophageal mucosa** after choke is resolved: - If minimal mucosal damage, return to normal feeding - Irritation &/or ulceration . Withhold food for 24 -72 hours . Nonirritating, moist feed (slurry of pelleted feed) - **Free choice water**
Salivary gland disorder Ptyalism I2M 697; IM 631; M 216; C4T 161, 156; C2T 3; S 306; Pic 29	• **Ptyalism** (↑ saliva production, caused by pain in mouth, pharynx or esophagus; heavy metals, slaframine, swallowing problems (choke, CNS) • Wounds & infections of glands usually heal well by 2° intention • Wounds or blockage of salivary ducts m/ cause fistulae or mucoceles: **Ranula**: cystic dilatation in mouth - **Mucocele**: swelling of parotid duct; **Sialoliths**: Ca carbonate - cause blockage • 1° **Salivary tumors rare** (benign adenomas or adenocarcinomas [excise]; Adenocarcinomas m/ metastasize to lymph nodes) 2° metastatic tumors (malignant melanoma in old gray horses & squamous cell carcinoma)			

Gastrointestinal Diseases

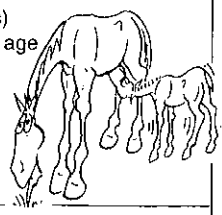
Condition	Facts/Cause	Presentation/CS	Diagnosis	Treatment
Gastritis; **Gastric catarrh** Mk 193; EM&S 604 ** 	• **Uncommon in the horse** • **Manifestation of other dizs** • Causes: - **Irritating substances** (see box) - Overeating, grain overload - Sudden diet changes - Ingestion of hot, frozen, moldy, or spoiled feed - Ingestion of sand or FB (foreign body) - Cribbing - **Parasites** (see below) - **Reflux from small intestine** (associated w/ small intestinal obstruction, material refluxed into stomach, can't vomit so gastritis) - Carcinoma, delaying emptying	• CS may be masked by 1° disease - **Drooling, excess salivation** - **Don't eat** - **Colicy (subacute)** - Feces dark or tarry if hemorrhage - Habronema ulceration m/b inapparent clinically • **Gastric dilatation & pylorospasm** - Temp elevation - Severe colic - Pulse fast & weak - Profuse sweating - Retching uncommon - ± Vomit - Sitting dog stance • **Chronically** - Weight loss, debilitation - Intermittent colic as apposed to acute colic • Sequelae: - Laminitis accompanies or follows gastritis - Gastric rupture	• History, CS • **Endoscopy**  **Irritable substances** • Blister Beetles (pg. 47) • Coarse feed (foals) • Lead paint (pg. 259) • Arsenic • Mercury (from "Blistering" limbs) - Mercurial counter-irritants (horse eats off bandage) • DSS	• **Remove cause** • Restricted, easily digested diet (bran gruels or mashes & green feed or fine hay) • **Mineral oil** (laxative if ingested spoiled or irritant feeds) • Protectant, Pepto-Bismol®, Kaolin® • **Stomach tube** (relieves gas or fluid distention) • Gastric lavage (for chemical gastritis or impaction, difficult with solids) • H2 blockers • Torbugesic® (butorphanol) (pain) • Spasmolytics • IV fluids for shock • Gastrotomy, severe impaction or dilation • When CS abate slowly back on feed 
Uncommon **CS: Upset stomach, laminitis**				

Stomach parasites - Gastritis: Clinical signs rare; infection common

Trichostrongylus infection **Small stomach worms** M8k 205; Mk 196; EM&S 602; M 227; C2T 323  **Small stomach worm** **CS: Gastritis, wt. loss** **Dx: Eggs like strongyles** **Tx: Ivermectin**	• *Trichostrongylus axei* • **Small stomach worm** • Same as in cattle • Adults small & slender (8 mm)	• Chronic catarrhal gastritis • **Weight loss** 	• **Difficult because eggs similar to strongyle eggs** • Fecal culture, ID larvae • Post mortem: - Nodular areas of thickened mucosa, small erosions & ulceration	• **Ivermectin** routinely deworm every 8 weeks 

Bots, **Gastrophilus** M8k 200; Mk 194; EM&S 601; M 241, 227; C2T 323, 697; POP 46-7/98  **Stomach parasite** **CS: Mild** **Dx: Assume in fall** **Tx: Ivermectin**	• Adult fly lives 2 weeks • ***Gastrophilus intestinalis*** (common bot fly) • ***G. nasales*** • ***G. haemorrhoidalis*** (nose or lip bot) • Lay eggs in summer months - Annoyance of flies • Attachment to stomach mucosa - Ulceration & erosions	• **Asymptomatic** • **Mild gastritis** • Stomatitis & pain on eating when in mouth **Life cycle** • Adult flies live 2 weeks • Eggs glued to hair (*G. intestinalis* - forelegs & shoulder; *G. nasalis* - submandibular area; *G. haemorrhoidalis* - lips) • Larvae hatch, enter mouth & embed in tongue or mucous membrane for 1 month • Pass to stomach, attaching to cardiac or pyloric portion (*G. nasalis* - proximal small intestine) 8 months • Overwinter in stomach • Pass in feces, pupate for 3-5 weeks 	• **Larvae in feces** • **Infection often assumed in fall** • Bot eggs on hair 	• **Assume infection** of most horses in temperate areas by end of summer • **Anthelmintic Tx** in late fall or early winter after frost kills flies (See pg 12) - M/ need treatment at beginning of bot season - **Ivermectin** or organophosphates (trichlorfon, dichlorvos) 
Habronema infections, Stomach worms M8k 201; Mk 195; EM&S 602; M 241; C2T 323; C3T 679; Pop 46-7/98  **Drashchia only bad one!** **CS: Gastritis** **Dx: Difficult** **Tx: Ivermectin**	• **Stomach worm** • *Habronema muscae* *H. microstoma* • ***Drashchia (H.) megastoma*** • Adults worms 6-25 mm • **"Summer sores"**: larvae m/ invade skin wounds • Eye: conjunctivitis 	• **Catarrhal gastritis** w/ heavy mucus production when large numbers • ***Drashchia*** spp. most severe - **Tumorlike** enlargements (4") in stomach wall - Rarely rupture (if do, fatal peritonitis) • **Other habronema spp. asymptomatic** • **"Summer sores"** migrate to wounds (see pg. 284) • Conjunctivitis if migrate to eye (see pg 295) 	• **Difficult,** easily missed in fecal exam • Gastric lavage m/ find eggs or larvae 	• Anthelmintics & management - **Ivermectin every 8 weeks**  **Life cycle** • Eggs or larvae ingested by larvae of house or stable flies (intermediate host) • Horse ingests flies/larvae • Draschia (Habronema) occur in tumorlike swellings on stomach wall • Others free on stomach mucosa

Gastroduodenal Ulceration

Condition	Facts/Cause	Presentation/CS	Diagnosis	Treatment
Gastroduodenal ulceration M8k 219; Mk 135; I2M 710; IM 648; M 226, 287; EM&S 605; C4T 191; C3T 184; Pic 51	• Foals & adults (50% or more horses have ulcers) • **More pathogenic in foals**, but important at any age • Protective mechanisms in stomach break down • Aggressive effects of acid • Predisposing factors (see box pg 27)		**1 • Asymptomatic** - Incidental finding at PM, single ulcer usually **2 • Symptomatic** - CS, Hx (stricture, see CS then improvement) - Predisposing factors - **Endoscopy** (easy for stomach in foals, difficult for duodenum) . Withhold feed at least 12 hours, milk &/or water 5 hours from those suckling . Helps to distinguish from other intestinal diseases - **Occult blood** in feces (dipstick) - Contrast rads, more difficult to get to duodenum to see stricture . **Ringlike** lesions in stomach . Delayed emptying (should empty in 90 min. or less) - **Not associated w/ anemia** (look for other causes if anemic) **3 • Perforation** - CS, History, then shock - **Abdominocentesis** (ingesta) - Exploratory laparotomy for definitive Dx	Management: ↓ acidity & further damage to gastric mucosa • **Antacids**: Mylanta, Maalox, Riopan, Amphogel • **Protectants** Pepto-Bismol® • **Sucralfate (Carafate®)** PO, a coating agent, adheres to ulcer, "band aid" & stimulates PGE2: - PGE2 from gastric mucosa, a protectant, ↓gastric acid secretion from parietal cells • **H2 blockers** used commonly - **Cimetidine (Tagamet®)**, Ranitidine (**Zantac®**) (BID PO or IV) ($$ & given w/ sucralfate & antacids) • PGE2 or its analogs $$, ↑ viscosity of gastric mucus, mucosal blood flow (aiding in healing of ulcers), & ↑ gastric bicarb secretion • **Fluid** replacement in dehydrated - Lactated Ringer's (LR) (for metabolic acidosis) • **Indwelling nasogastric tube** (decompression of stomach when refluxing from small intestine) • Pain relief? NSAIDs (but may contribute to further ulcer development) • Surgery difficult due to tremendous amount of adhesions
4 divisions in foals				
1• Asymptomatic	• Majority	• Asymptomatic		
2• Symptomatic	• Foals from 1 day - 4 months	• **Excess salivation** (m/b frothy) • **Grinding of teeth** (bruxism) • **Abdominal pain** (last 3 classic CS) • **Diarrhea** • **Occult blood in feces** • Depression • Restlessness to lying in dors. recumbency • "Pot belly" appearance, rough hair coat, poor growth • Poor appetite to anorexia • Foul breath, due to retching • Plaques & erosions in mouth • ↑ RR, HR due to pain		
3• Symptomatic ulcers that perforate	• Less ability to wall off material from GI tract than cattle • **Diffuse peritonitis** • **High mortality rate**	• **Abdominal pain** • **Excess salivation** • **Teeth grinding** (bruxism) • Occult blood in feces • **Death** (cardiovascular collapse, severe shock)		Antacids, Carafate, Tagamet, Zantac
4• Ulcers assoc. w/ gastroduodenal stricture	• **Previous ulcer diz that has healed & strictured** • ↓ Gastric emptying w/ accumulation of gastric material in stomach • Older foals (3-5 months - as it must have time to heal)	• ↑ **Salivation** • **Grinding of teeth** (bruxism) • **Pain** • **Gastric reflux**, blood, hypochloremic m/b • Anorexia, reluctance to swallow, m/ develop esophagitis • Metabolic acidosis • Dehydrated, PCV elev. due to dehydration, also TP (inflammatory gastric diz), azotemia	**DDx:** • Gastrointestinal obstruction partial or complete (pg. 64)	• **Duodenal stricture** - Sx to bypass stricture - Gastrojejunostomy - watch for bile duct & bile reflux problems
Ulcers in adult horses	• **More common than thought** • **Causes** - **Stress**: Training performance horses, Transportation - **NSAIDs suspected**	• Intermittent pain • Periods of anorexia, restlessness, gets up & down	**Predisposing factors** • NSAIDs, especially PBZ (phenylbutazone), Banamine® • Stress due to handling or intensive Tx if no colostrum • Diarrhea causing diz, m/ cause ulcers • Corticosteroid use • Gastric parasites • Coarse feed meant for adults • Foreign bodies associated w/ gastric ulcers • Infections w/ Candida	NSAIDs
Phenylbutazone (PBZ), NSAIDs toxicity M8k 248; I2M 730; IM 665; EM&S 535, 1554; C2T 118; M 454	• **NSAIDs** (nonsteroidal anti-inflammatory drugs) • **Phenylbutazone**, flunixin meglumine (Banamine®), meclofenamic acid, naproxen • Widely used in horse practices • Aspirin & dipyrone less effective in horse so not used at levels to give problems • **Inhibits prostaglandin synthesis** in all systems -PgE mucosal protectant, ↑ blood flow • **Overdose:** - ↑ **intestinal secretion & villous atrophy** - **Damage to mucosa** (hypoproteinemia) - Renal crest necrosis & tubular damage - Gastrointestinal CS - pony breeds, foals or in ill promised horses	**CS - GI & kidney** • **Hypoproteinemia** (mild to severe) • **Ventrum & limb edema** (pectoral to mammary or prepuce [protruding penis]) • **Ulcers & erosions GI tract** (stomach, small & large intestine, mucocutaneous junction of lips, mouth, esophagus) • Anorexia • **Diarrhea** • Colic (mild to severe) • Endotoxemia & septicemia (disrupted mucosal barrier, acid/base abnormalities) • **Laminitis sequela** (digital pulse) • **Azotemia** (renal damage) • ↑ HR, RR • Anemic w/ pale mm, slow capillary refill time, cold extremities	• **Hx** of inappropriate NSAIDs given, owner administered usually - Overdosing, or normal level in stressed foals • ↓ Total protein • **Edema, oral ulceration** • **Occult blood in feces** due to mucosal damage • Renal diz (generally doesn't develop) - Proteinuria - ↑ BUN & creatinine (granular casts in urine indicate tubular damage before seeing BUN/creatinine ↑) • Endoscopy m/ or m/not be helpful due to 1° ulcer disease • **Postmortem:** - **Ulcers in large intestine** - **Right dorsal colitis** **Prognosis:** • Guarded in severe cases • Recovery slow • Renal damage complicates recovery	• **Stop NSAIDs** • Symptomatic • **Plasma** (hypoproteinemia, > 5 L) • **Fluid & electrolyte Tx** • **Broad spectrum ABs** (septicemia) (renal consideration - aminoglycosides carefully or not at all) (trimethoprim-sulfa, ticarcillin, cephalosporins) • **Pain** (NSAIDs contraindicated) - Narcotic agonists (butorphanol tartrate, pentazocine, meperidine) - Laminitis pain - long acting local anesthetic (bupivicaine) • **Gastric protectants** (bismol subsalicylate [Corrective Mixture®], doesn't reach large intestines however) • Metabolic acidosis, low K+ value, ↓ Tx IV fluids administered • Easily digestible, high protein diets (if still eating)

Misused, Toxicity rare
CS: Ulcers, Kidney, Edema
Dx: Hx
Tx: Stop, Symptomatic

Gastric Diseases

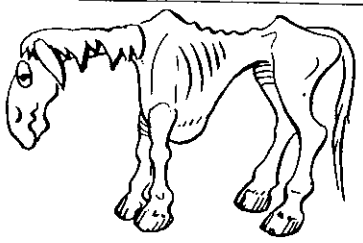
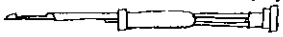
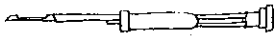
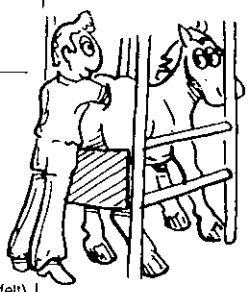
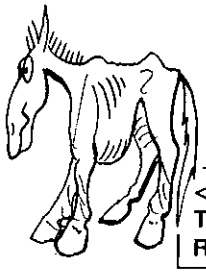
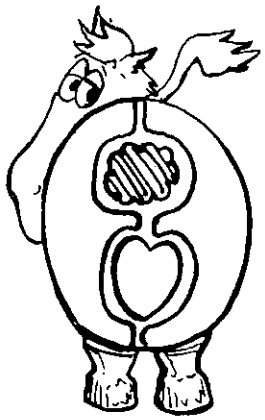
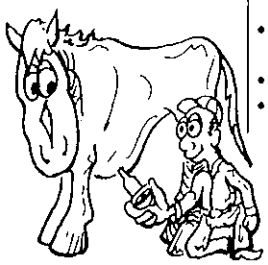
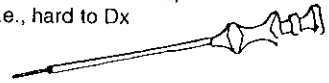
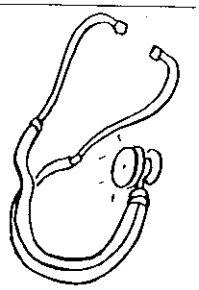
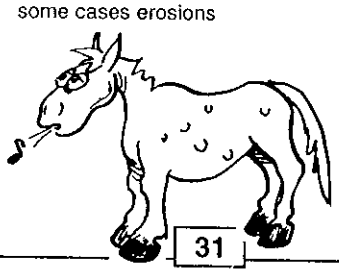
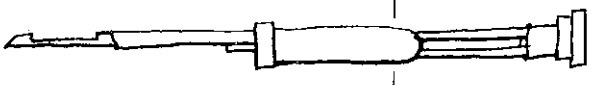
Condition	Facts/Cause	Presentation/CS	Diagnosis	Treatment
Gastric neoplastic diz I2M 717; IM 653; EM&S 603; M 226; Pic 76 **	• **Infrequent** • **#1 Squamous cell carcinoma** - Gastric squamous epithelium, rarely glandular area - **Cauliflower-like** growth intramural & extramural surfaces of stomach • More invasive than metastatic • **Teens or older** (6-17 yrs) • Less common: adenocarcinoma, metastatic lymphosarcoma, mesothelioma, leiomyomas. • **Lymphosarcoma** (less common) - 1° proximal part of small intestine & sometimes stomach - Less common than in cattle • Papillomas in young animal's stomach - obstructive	• Anorexia, depression • **Chronic weight loss** • **Anemia,** pale mucous membranes • Nasal reflux • Colic • ↑ Salivation, trouble swallowing, reflux causing esophagitis • Extensively invasive - Ascites, abdominal distention	**Dx difficult antemortem**, may euthanatize due to weight loss; history helpful, but nonspecific • **Anemia common** • **No diarrhea** • **Occult blood** in feces often • Rectal exam - **enlarged lnn., adhesions** • **Endoscopy & biopsy** • Stress leukograms (neutrophilia & lymphopenia) • **Abdominocentesis: look for squamous cells** m/b • Difficulty passing stomach tube if involves cardia • Ultrasound if not lot of gas in rt. colons • Contrast rads on small breeds • Definitive - exploratory laparotomy & biopsy (not often done) • **PM** (postmortem) - **Cauliflower-like** growth on intramural & extramural surfaces of stomach	• **No treatment** • **Euthanasia** • **Prognosis: Grave,** once Dx suggested or confirmed, deteriorate rapidly & euthanized on bases of weight loss in approximately 1 month
Chronic eosinophilic gastroenteritis Mk 793; M 351 *	• **Rare** • Hypersensitivity reaction • Infiltration of small intestine w/ eosinophils • Granulomatous	• **Weight loss** • **Dermatologic signs** - **Diffuse alopecia** • **Pruritus m/b** • Exudative dermatitis or coronitis of coronary band • Edema	• Skin biopsy shows tremendous eosinophilia in skin - No parasites are implicated • PM: eosinophilic infiltrate in small intestine	• No therapy • Can demonstrate malabsorption **No Tx**
Gastric dilatation, **Reflux gastritis,** **Gastric impaction** M8k 173; I2M 716; IM 653, EM&S 600; C2T 41; M 225; S 323; Pic 54	• **1° impaction of stomach** - **Grain overload:** mass of grain or pelleted feed packed in stomach, ferments & swells, drawing fluid into itself • Aerophagia (air) - animals that crib • Errors in management (water after exercise & not cooled out, usually cold water, doesn't empty) • **Gastric reflux** - Associated w/ **ileus** or shut down of GI, or w/ displacement - Alkaline fluid accumulates in stomach - **Extensive ulceration** of squamous mucosa (**margo plicatus** dorsally) • *Draschia (Habronema) megastoma*, weakening wall (rarely ruptures)	• **Dilatation** - **Acute & violent colic** . Kicking at abdomen . Looking back at stomach - **Anorexia** - Retching, attempt to vomit, can be severely systemically ill - Vomition occasionally - ominous (horses usually can't vomit) • **Sequelae:** - **Gastric rupture (see box)** - **Laminitis**, check digital pulse	• **History of getting into grain** (client m/not want to tell you) • **Stomach tube** (fluid or gas, ingesta) • **pH**: stomach (acidic) or reflux (alkaline) • Auscultation - ileus, no normal borborygmi (sounds, m/b 2° to pain) • Rectal exam: - **Med. displacement of spleen** • Pain - responds to analgesics • No feed intake for at least 12 hours • **Gastroendoscopy** - large amount of ingesta (impaction) or fluid (reflux) • **Abdominocentesis** - **Rupture: ingesta present** (repeat bec. if Dx, euthanasia) - CBC w/ rupture: severe leukopenia w/ degenerative left shift	• **Stomach tube left in stomach** during transport to hospital • **Empty stomach** - **Nasogastric tube** to evacuate - **DSS** (dioctyl sodium succinate) softens ingesta if impacted . **Lavage & withdrawal of fluid repeatedly** • **Fluids** • **Mineral oil** as antifermentor **RUPTURE:** • **Euthanasia** (even if Dx early because stomach not accessible to surgery)
Stenosis or **obstruction of cardia** S 323	• **Phytobezoar (FB), gastric ulcers** • CS: Ptyalism, retching & regurgitation • Dx: Contrast X-ray • Tx: **Surgery**			
Pyloric stenosis I2M 717; M 225; Pic 43	• **Rare** in horse; Congenital pyloric stenosis rare; 2° to gastroduodenal ulcers or fibrotic mass in pylorus			

Infrequent, #1 SCC
CS: Weight Loss
Dx: Difficult
Tx: Euthanize in 1 mo.

Grain overload
CS: Gastric reflux - Violent colic - Laminitis
Nasogastric tube
Rupture - Ingesta in Abdomen - Euthanasia

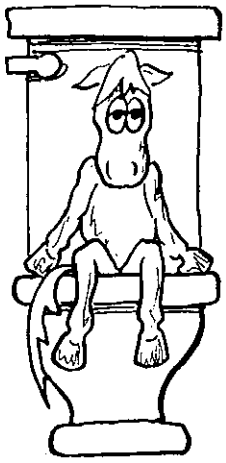
Gastric rupture:
- **Classic history of acute pain suddenly relieved**
- In 20 min starts sweating
- **Rapid progression to shock & death**
- Mucous membranes purple; extremities very cold
- **Universally fatal** w/ massive contamination of peritoneum
- Successful repair of **seromuscular tears** w/o contamination

Lymphosarcoma

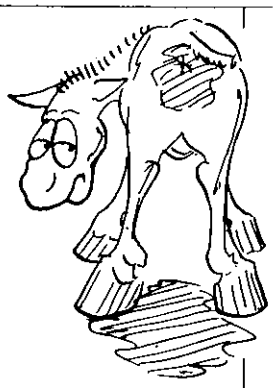
Condition	Facts/Cause	Presentation/CS	Diagnosis	Treatment
Lymphosarcoma M8k 705; I2M 1242; IM 1112, 658; M 240; 334; EM&S 621 **	• **Infrequent** • 2nd most common neoplasia • Age 6-10 yr (birth —> 20+ yr) • **Anemia common** • **Frank leukemia rare** (lymphocyte count normal or decreased) • **Four clinical forms**		• **Dx based on demonstrating neoplastic cells** • Cytological - Bone marrow or histological exam - Pleural fluid - Peritoneal fluid • Cytology of needle aspiration of lymph node or tumor often nondiagnostic (biopsy preferred) 	• **No Tx**
• **Generalized or Multicentric lymphosarcoma** **Most common form - Emaciation**	• **Most common form** • **Anemia common** • **Leukemia rare** • Lymph nodes • Intestinal organs	• **Emaciation** • Depression • **Generalized lymphadenopathy** • **Ventral edema** • **Additional CS of internal organ dysfunction** 	• **Dx is difficult** • Anemia • **Lymph node aspirate** • Leukemia rare, but most commonly found w/ this form • **Bone marrow aspirate** (from ilium or xiphoid) • PM: **Widespread lesions** of lymph nodes, liver, spleen, intestine, kidney &, in some cases, lung 	
• **Alimentary lymphosarcoma**  **< 5 yrs old** **Thin horse** **Rectal: thickened sm. intest**	• **< 5 yrs old** • **Small bowel** • Causes intestinal malabsorption • **Protein losing enteropathy** (malabsorption)	• **Thin horse** (malabsorption) • ↓ Appetite, intermittent fever • Intermittent colic • Malabsorption disease - **Edema of ventrum & limbs** - **Ascites** • **Intestinal lymph nodes enlargement** (intestinal, splenic & hepatic) • **Peripheral lymph nodes not enlarged** • Diarrhea more common than w/ SCC **Leukemia rare**	• Hx, CS • **Anemia** • Abdominocentesis doesn't reflect abnormal cells • **Glucose & xylose absorption test** (malabsorption) • Fecal occult blood • Leukemia rare • Rectal exam - **Thickened small intestine** (not normally felt) - **Abdominal masses** **DDx:** • Small intestine obstructional diz - Fluid filled, not thickened (pg 64)	
• **Mediastinal lymphosarcoma**  **CS: Resp.** **Dx: Difficult to Dx**	• **Adults** • **Mediastinal lymph nodes** (lnn)	• **Respiratory signs** - Pleural effusion - Edema on ventrum • Lymph nodes enlarged, unlike alimentary form (thoracic inlet & retropharyngeal regions) • **Weight loss**, anorexia • ↑ RR, HR 	• **Hx, CS** • **Auscultation:** dorsal abnormal lung sounds due to dorsal displacement, fluid - Ventral absence of lung sounds due to compression & effusions • Difficult to Dx this form • TTW (transtracheal wash) m/ show abn. cells • Thoracocentesis (no abnormal cells) - Effusion transudate in nature • Radiographs show pleural effusion - Elevation of trachea & esophagus - Enlarged bronchial lymph nodes • **Biopsy, lymph nodes** - lymphocytes w/ mitotic figures, bizarre shapes • Bone marrow aspirate (if suspected) • Seldom leukemic, so no abnormal peripheral lymphocytes, often not abnormal in bone marrow either; i.e., hard to Dx 	 
• **Cutaneous lymphosarcoma**  **Don't Tx - Horse does OK**	• **SQ nodules** m/ appear suddenly, m/ regress & reappear - M/ gradually grow or remain static • Seldom generalized lymphadenopathy or internal organ involvement • ± Local lymph node involvement • **Horse m/ do fine for years w/ lesions**	• **Single or multiple nodules** in SQ (1- 20 cm) • Alopecia overlying nodules & in some cases erosions 	• **Clinical signs** • **Aspirate of nodules**: lymphocytes, normal or bizarre, both suggestive of lymphosarcoma 	• **Usually not treated** because horse can live w/ this • Steroids: dexamethasone often causes regression, but must be tapered off or it returns more aggressively

Diarrhea in Foals

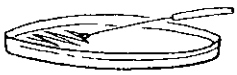
Condition	Facts/Cause	Presentation/CS	Diagnosis	Treatment
Diarrhea in foals M8k 246; Mk 184, I2M 391, 723; IM 343; C4T 631; C3T 449; M 235 ****	• **Very common < 6 mos** • **Potential for systemic diz** (neonate > adults) leading to death • Mild & transient in nature, usually • **FPT** (failure of passive transfer) w/ bacteremia & diarrhea	• **Diarrhea** • **Depression** • **Dehydration** • **Colic** • Abdominal distention • **< 7 d-old diarrhea w/ depression or loss of suckle reflex, immediate evaluate for FPT** (pg 39)	• History: age related, FPT, ABs • Colic • Blood cultures (bacteremia) • Often bacteremia associated w/ FPT (see box) • Dehydration • Metabolic acidosis • ↓ K^+ (hypokalemic) • Prerenal azotemia • Hypoglycemia significant (no fat to compensate for not eating) which m/ cause death	• **Fluid therapy** (see box) • Intestinal protectants absorbents • **Systemic ABs** (if bacterial) (see box) - Blood cultures first - Broad spectrum ABs - Monitor renal function because of dehydration w/ nephrotoxic drugs **Prevention:** • No crowding • Separate age groups • Sanitation & hygiene - Eliminate contamination • **Adequate colostrum!!!**

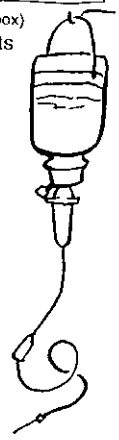


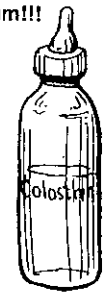
Bacteremia often associated w/ FPT (failure of passive transfer)
- < 7 days-old
- Depression & loss of suckle reflex +diarrhea
- Small & large intestinal diz
- Needs immediate evaluation



Causes see pg 337
- Failure of passive transfer (FPT) (pg 39)
- Foal heat (pg 35)
- Nutritional (pg 38)
  - Milk (lactase defc)
  - Milk replacers
  - Concentrates
- Parasites (*S. westerii,* large & small strongyles, Cryptosporidia) (pg 36)
- Viruses - Rota, corona (pg 38)
- Bacterial Salmonellosis, *Clostridium perfringens, Rhodococcus equi, C. difficile,* Campylobacter *B. fragilis,*
- Mechanical obstructions (FB, volvulus, intussusception, colon torsion)
- FB (foreign body)
- Antibiotics (pg 43)



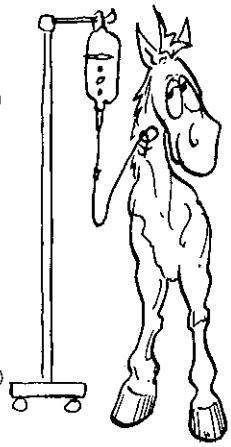




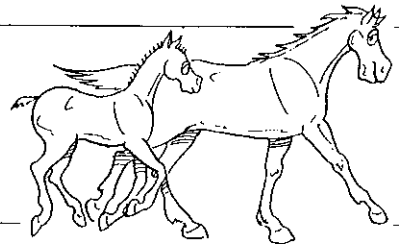
Very common, FPT
CS: Diarrhea
Dx: Hx, CS, FPT
Tx: Fluids, ABs
Prevention: Colostrum

Treatment - Neonatal Diarrhea

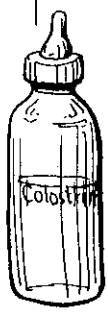
Fluid Therapy (IV or oral)
- Lactated Ringers (LR) (bec. most have metab. acidosis)
- Hypokalemia (↓ potassium) - add KCl to fluids (15-29 mEq/L) (milk has K^+ so only if not suckling)
- Glucose if not nursing (add 1-2% dextrose to fluids in those of concern)
- Bicarb (1.3%) if Lactated Ringers can't handle acidosis (give slowly & separate from Lactated Ringers due to binding effeC3T of Ca)
  - 3-5% dehydration - use 3 mEq HCO_3
  - 5-8% use 5 mEq HCO_3
  - 8-10% use 7 mEq HCO_3
  - 1.3% gm/dl is isotonic HCO_3 = 13 g/100 ml
  - Must be cautious or will "knock" pH the opposite way

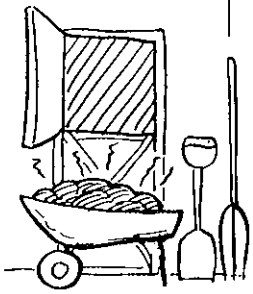


Plasma therapy (Expensive, 450 ml costs $100 so have plasma donors)
- Hypoproteinemia 2-4 L (< 2 g/dL albumin) in FPT
  - Monitoring amount needed based on PCV & total protein, 50-100 ml/kg/d maintenance



Withholding milk - especially in clostridial diarrheas
- Muzzle foal 8-12 hours
- Milk out mare
- Oral fluids by stomach tube (calf replacers, for short periods bec. insufficient energy)

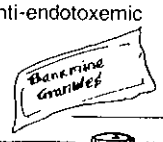




Pepto-Bismol

Intestinal protectants/absorbents
- **Bismuth subsalicylate** (Pepto-Bismol®) (neutralizes bacterial toxins & antisecretory effeC3T [antiprostaglandin])
  - Use 24 hr & stop if diarrhea persists, makes feces dark in color, making feces occult blood falsely positive
  - Give 1 liter on call (have owner give 4 oz. [120 mls] QID) (if in hospital 1 liter QID)
- **Kaolin + pectin** (Kaopectate®)

Flunixin meglumine (Banamine®) - anti-endotoxemic drug, interfering w/ cyclo-oxygenase
- Anti-endotoxemic dose: 0.25 mg/kg, lower than analgesic dose



Antibiotics
- Indications
  - Septicemia or toxemia
  - FPT (Failure of passive transfer)
  - Immuno-compromised
  - Prophylactic
- Contraindicated if cannot recognize diz cause
  - Disadvantage: disrupts normal gastric flora, allowing pathogens to "set up house"
  - Blood cultures first
  - Broad spectrum antibiotics
  - Monitor renal function because of dehydration w/ nephrotoxic drugs

Bacterial & Foal Heat Diarrheas

Condition	Facts/Cause	Presentation/CS	Diagnosis	Treatment
Foal salmonella M8k 120, 241, 247; Mk 184; I2M 392; IM 344; C3T 451; C2T 88; EM&S 643; M 235; Pic 69	• **Important in adults & young** • **Tremendous economic losses** • **Weanlings > neonates** • Septicemia to endotoxemia, esp. FPT (failure of passive transfer) • **Multiple organ systems** • Small & large intestine (damages mucosa) • Hard to disinfect area - Adult w/o CS often source • *S. typhimurium*, public health • **Death**	• **Acute bacteremia & septicemia** w/o diarrhea m/b • **Diarrhea (fetid smelling)** • **Blood & fibrin in manure** • ↑ Temperature 103-5° F • Depressed • Stop suckling • Colic or abdominal pain (abdominal pain m/be before diarrhea) • **Dehydration** due to diarrhea • **Bacteremia**: lungs, joint, vertebral bodies, renal, uveitis or CNS CS Chronic diarrhea due to Salmonella < adults	• **Isolate (difficult)** - Multiple cultures, especially when manure is watery - 5 negative bacterial cultures before ruling it out - Easier when manure firms up - 10-15 g of feces for fecal culture • Rectal swabs or biopsy less effective • **Blood cultures** • **Lab:** - Hypoglycemic - Loss of electrolytes into intestinal tract 1° K^+ defc - Metabolic acidosis (K^+ in blood normal, but total body K^+ defc) - ↑ PCV (dehydration) & total protein, or - Hypoprotein (if no immune response) - Neutropenia (endotoxin causing margination of neutrophils) . Toxic granulation of PMNs (not pathognomonic) - Prerenal azotemia, iBUN & creatinine (dehydration) (Normally foal's BUN < adult's)	• Tx see preceding pg. • **Fluid therapy** • Intestinal protectants • **Systemic ABs** for septicemia • No way to prevent diarrhea once animal is exposed Prevention: No vaccine
\$\$\$ Losses, Weanlings > Neonates **CS: Septicemia, Diarrhea** **Dx: Isolate - difficult** **Tx: Fluids, Protectants, ABs**				
Clostridium perfringens M8k 244; Mk 184; I2M 391; IM 344; C3T 451; EM&S 820; M 235; Pop 12-2/98	• **Types A, B & C**, less commonly *Cl. sordelli* • Less common cause of diarrhea - Usually sporadic, but occasion farm outbreak • **Marked & fatal diarrhea** • Large & small intestine • **Death in 48 hr**	• Peracute: **Found dead** - No diarrhea - PM shows GI lesions • Acute - Live only 1 or 2 days - Hemorrhagic diarrhea - Colic • **If peracute or acute, usually die w/in 1-2 ds**	• **Isolation difficult** & if isolated, difficult to say it caused diz (gram positive rods in small intestine) • **Need to isolate exotoxin** (toxin neutralization tests in mice) • PM - tremendous necrosis of large &, to some extent small intestine	• **Fluid therapy** (see box, pg. 33) • Intestinal protectants/ absorbents • Systemic ABs (see box pg. 33) **Prevention:** • **Autogenous vaccine** more effective than lamb & children vaccine • No crowding • Separate age groups • Sanitation & hygiene • **Adequate colostrum!!!**
Death in 48 hr				
Rhodococcus *equi* diarrhea M8k 247; I2M 392; IM 344, 510, 663	• **1° affects lung - pneumonia** • **Diarrhea in foals 1-4 months** • Transm. oral, endemic to some farms • Localization in intestinal wall, damages villi - Granulomatous reaction - Hemorrhagic & necrotic - Abscessation in ileocolic & mesenteric lnn	• Asymptomatic • Acute - Abd. pain in acute phase - Diarrhea causes severe electrolyte & acid/base abnormalities • Chronic (GI heals, necrosis & ulceration) - Weight loss - **Diarrhea** intermittent (flare ups) - **Respiratory signs**	• **Difficult to Dx** (isolated from feces of asymptomatic & symptomatic animals) • Usually done by rule out (R/O) **History of respiratory diz** **Erythromycin** **Rifampin**	• Antibiotics (respiratory diz), **erythromycin & rifampin** **Prognosis:** • Respiratory diz responsive to Tx, GI less so
Foals, Diarrhea, Respiratory signs				
Foal heat diarrhea M8k 246; Mk 184; I2M 393; IM 345; C3T 449; C2T 87	• **7-14 d old** (time of post foaling estrus in dam) • **Cause unknown** - not caused by estrus or *S. westeri* - M/b due to coprophagy (bacteria) & eating hay • Occurs in majority of foals - 75- 80% between 6-14 d old	• **Mild requires no Tx**, usually - Diarrhea soft to watery, not profuse - If diarrhea persists, fever or depression (reduced suckling), need further evaluation	• CS, if mild; self-limiting • Persistent diarrhea, fever or depression (reduced suckling) need re-evaluation - CBC - Electrolyte & acid-base determination • Profuse diarrhea - more aggressive evaluation	• **Mild, self-limiting** • Persistent - Fluids - Protectants • Profuse diarrhea - More aggressive Tx (risk of septicemia w/ diarrhea)
Not due to estrus **Self-limiting**				
Rotavirus diarrhea M8k 247; Mk 184; I2M 392; IM 344, C3T 449; EMS 619; Pic 69	• **#1 virus diarrhea in foals** • **< 2 months** (older less severe) • Stress, crowding • **Malabsorption** & ↑ secretion (destruction of villus tips) - CHO intolerance - **Milk intolerance** (lactase producing epithelial cells lost) - osmotic pull into intestine • Endemic on specific farms year by year • M/ be epidemic on same farm • Foals & mares carriers & shed (for months) • Resistant to environment (up to 9 months)	• **Asymptomatic** • Depression • Anorexia • **Watery diarrhea** • 5-7 d typically lasts, m/ become chronic problem, months (chronic CHO intolerance)	• **Virus isolation** - ELISA test - Rotatest m/b - Electron microscopy (feces from 1st day, w/in 5-7 d) **Corona & adenovirus** • Isolated from foals w/ diarrhea • Relationship needs more investigation	• **Lact-Aid®** (lactase) in those not suckling via nasogastric tube • **Electrolytes** • Wean early & put on solid feedstuff when chronic • Control diarrhea, ↓ milk intake (off mares), thus ↓ osmotic effect, but feed expensive, so usually not done • Hygiene (formaldehyde, chlorinated hydrocarbons, "One-Stroke®") **Lact-Aid**
Self limiting **Looks like yeast**				

Parasitic Diarrheas

Condition	Facts/Cause	Presentation/CS	Diagnosis	Treatment
***Strongyloides westerii,* Threadworm** M8k 205; Mk 184,199; I2M 393; EM&S 616; C3T 452; M 240; Pic 71; Pop 47-7/98 **In milk, Foals**	• Occurs w/ foal heat • Massive numbers required • **Diarrhea m/b seen from 10 d** • **In milk**- L3 shed heavily 2-3 wk postpartum; prepatent 8-14 d (before ova in feces) (overlaps w/ foal heat 9-18 d) • Resistant by 12-16 wk & maintain minimal infection	• **Diarrhea mild to moderate** • **BAR** (bright, alert & responsive) **& suckling** • Electrolyte deficit not signif.	• If dehydrated, must consider other causes • Egg count in fecal flotation	• **Deworm**, TOC (treatment of choice) (if suspected), - Ivermectin at 3 wk-old in problem areas Prevention • Deworm mare postpartum (endemic areas) (see pg 14)
Strongyle infection • **Large strongyles** (Blood Worms, Palisade worms, Sclerostomes, Red Worms) **Strongylosis** M8k 202, 245; Mk 196; I2M 393, 1689; IM 1517; M 24; EM&S 649; C3T 452; M 241; Pic 72; Pop 45-7/98 ***S. vulgaris* Cran. mesenteric a.**	• ***Strongylus vulgaris, S. edentatus, S. equinus*** • **Most pathogenic parasite** • 1-2 wk-old (L3 larvae irritating GI) (largemouths, bite out plugs of mucosa in large intestine) • ***S. vulgaris*** migrate to **cranial mesenteric artery** & its branches, cause parasitic thrombosis & arteritis leading to: **- Infarction & ischemia** to segments of bowel • *S. edentatus* & *S. equinus* migrate to other places (liver, perirenal tissue, flanks & pancreas, not to cranial mesenteric a.)	• ***S. vulgaris*** (see pg 75) - Colic **- Gangrenous enteritis** - Intestinal stasis, torsion or intussusception & rupture - Acute or chronic diarrhea - Mild infections . Dullness . Progressive weight loss . Intermittent colic (thromboembolic)	• **Dx difficult - small & large** • **Ova in feces after 9-12 mo** • **Fecal culture** of larvae to DDx different strongyles • Rectal palpation of cran. mesenteric artery (if colic) • Suspected parasite problem • Rule out (R/O) everything else	• **Routine deworming every 8 wk** (grazing horses assumed to be infected)(see pg 14) • Foals 1st treated - 6-10 wk-olds • Treat all horses on pasture • **Anthelmintic resistance of cyathostomes an emerging problem**, see pg 14 - Resistance to benzimidazoles (fenbendazole [Telmin®]) except **oxibendazole** (Equipar®) - Ivermectin Pyrantel pamoate (Strongid T®), oxibendazole & piperazine effective - Not recommended: phenothiazine (traditional Tx) due to toxicity & drug resistance • Periodic fecals to check
• **Small strongyles, Cyathostomiasis** M8k 203; Mk 196; IM 1517; M 24; EM&S 649; C3T 452; M 241; Pic 74; Pop 35-9/97	• **Small strongyles** over 50 spp. (cyanthostomes) - Young or parasite-naive horses - Damage gut wall (encyst) - Rapid emergence of encysted larvae in Spring	• **Cyathostomes** **- Colic & diarrhea** when larvae rapidly emerge from the gut wall in Spring - Weight loss - ± Severe nonresponsive diarrhea	**Life cycle, large & small - direct** • Eggs passed in feces • Infective L3 larvae 7-14 days • Ingestion to intestine • Migrate extensively • Mature in large intestine • Prepatent period 6-12 months (see in feces in 9-12 months)	
"Roundworm" Parascaris infection Ascariasis M8k 202, 174; Mk 196; I2M 1694; IM 686; EM&S 621; M 241; Pic 71; Pop 44-7/98 **Large worm** **CS: Resp. CS, Diarrhea, Obstruction** **Dx: Eggs** **Tx: Thiabendazole**	• ***Parascaris equorum*** - Round worm, snout whitish, three prominent lips • Prepatent 10-12 weeks • **Large parasite**, both adult (up to 12") & larvae • Transmission, ingestion from environment (eggs from last year's foals) • Eggs persist in soil for years • Infected soon after birth, adult worms about 4-5 months of age • **Larvae migrate through lungs & liver** • Progressively less significant w/ age - Clinically insignificant > 2 yrs old	Heavy infestation • **Respiratory signs** (migrating larvae) • Unthriftiness, loss of energy • Potbellied • Poor hair coat • **Diarrhea** (need massive #s of worms) • Obstruction (see pg. 61), blockage, intussusception - Colic occasionally	• **Hx, CS** • **Eggs (thick-shelled) in feces** • Administer anthelmintic & see large # of immature worms in feces (prepatent period) • Hygiene & inadequate deworming history	• Anthelmintic at 8 wks old - Repeat at 6-8 wk intervals until yearlings - **Thiabendazole**, massive infec. . Don't want to kill all at once (obstructive diz) . Give once, then repeat • **Controlled w/ proper deworming program** •Hygiene
Cryptosporidiosis Mk 141; I2M 393; IM 345; EM&S 618; C3T 453 **Self limiting** **Looks like yeast**	• Foals << **calves** • Cryptosporidium, protozoan (minute, transparent) • Transm. - oral/fecal • Sporulated oocysts shed in feces (immediately infective) • Incubation period - 4 days • **Immunocompromised & Arabian foals** w/ combined immunodeficient diz	• Diarrhea (more common in calves) • **Not a proven pathogen**	• Fecal flotation or mucosal scraping in sucrose of zinc sulfate sol. (small & transparent, hard to see, hi-powered microscope) • Fecal smear heat fixed & acid fast stained or iodine (coccidia stain red to distinguish from **yeast** (same size & shape) ***Eimeria leukarti*** - commonly found in feces of foals 30-125 days old - Unlikely to cause diarrhea	• No therapy • **Self limiting** • Supportive therapy

Foal Diarrhea

Condition	Facts/Cause	Presentation/CS	Diagnosis	Treatment
Nutritional diarrheas M8k 247; Mk 184; I2M 393; IM 345; C3T 449	• **Over-ingestion of milk** (see box) • **Ingestion of foreign material** - Large quantity of coarse feedstuff (irritation) . Generally by 4-5 weeks mature enough to handle these feedstuffs better - Coprophagic, ingested **parasites**, irritates mucosa . Parasites a problem for longer period than feedstuff • **Orphan foals** introduce to milk slowly (20-25% body wt., fed at 1-2 hr intervals) - Milk replacers not readily available, best is nurse mare, or goat . Teach to drink out of bucket or to suckle dairy goat (also provides company) • **Lactase deficiency** (temporary): CHO intolerance - assoc. with viral diz (lactase produced in mucosal cells)	• **Mild & transient**, except if systemic signs (systemic CS, usually infectious causes)	• **Hx, CS** • Lactase deficiency - Administer lactose orally & check glucose levels hourly	• **Self limiting**, no Tx if transient • Lact-Aid® to milk prior to feeding (esp. if viral diarrhea) (in animals being force fed due to not eating) **Over-ingestion of milk** (mare separated & rejoined, e.g., foal heat mating) (overwhelms intestinal ability to absorb, so milk into colon, osmotic diarrhea)
Septicemia in foals Mk 308; IM 309; C4T 595; C3T 435; C2T 222; M 287; EM&S 159, 1812; Pic 69; Pop35-1/98 ***	• **Very important in foals** • 1st week of life (1-5 days) • **Mostly generalized**, multiple organ system; some localized • **Failure of passive transfer** (FPT) (most important predisposing factor) - Overcrowding & poor management - Hx of abortions, death of foals, dystocia, premature foal **Bacteria:** • ***E.coli*** • ***Actinobacillus equuli*** • β-hemolytic Strep. • Klebsiella • **Salmonella**	• **Systemic diz - acute** • **Behavioral CS** **- Lethargy, weakness, loss of suckle reflex, inability to stand** • Meningitis • **Pneumonia** • Uveitis • Acute lameness (joint ill), swollen joints • ↑ HR, RR • Seizures - paddling, rigidity & opisthotonus • **Progresses to coma** • **Diarrhea w/ or w/o colic terminally**	• **Hx & CS in conjunction w/:** • **Blood cultures** (take before AB Tx) - May take 5-6 d to grow • **TTW** (transtracheal wash) because of high incidence of pneumonia • **CITE test**: immunoglobulin titers • Leukogram: early normal, terminally neutropenia w/ ↑ bands & toxic changes • ↑ Fibrinogen m/b > 500 mg/dl • Hypoglycemia • Temperature no help: normal, ↑ or ↓ • Auscultation no help - even in pneumonia because abnormal sounds m/ not be heard, unlike adult •**Rads: chest**: atelectasis, ↑ density	• **Broad spectrum ABs** - Na or K **Penicillin** IV **+ Gentamicin** as wait for cultures - 6-7 d to 2 wks, dep. on clinical response • **Plasma & fluids** (immunoglob. deficiency, septic shock & metabolic acidosis, hypoglycemia) • **Diazepam** (Valium®) for seizures **Prognosis:** • **Poor, mortality high w/ Tx** • Recovery: polyarthritis, chronic debilitation
Self limiting				

FPT, Mortality hi w/ Tx
CS: Systemic, Behavior
Dx: Hx, CS, Cultures, TTW, CITE test
Tx: ABs, Fluids

CITE test

E. coli Mk 184; IM 344
- Not an important cause of diarrhea in foals
- Associated w/ **septicemia in FTP** (failure of passive transfer)
  - Seed multiple organ systems
- Diarrhea can occur if animal becomes septicemic
- #1 blood culture isolate from septicemic foals

DDx of systemic diz
- Neonatal maladjustment syn. (pg 270)
- Combined immunodeficiency (pg 303)
- Autoim. hemolytic anemia (pg 141)
- Congenital white muscle diz
- Uroperitoneum (pg 154)
- Retained meconium (pg 83)
- Equine herpes infec.

Gen

Pen

Failure of passive transfer, FPT

Mk 1519; IM 1610; C4T 581, 582; C3T 422, C2T 210; EM&S 1824; M 286
***

- **Born w/out circulating immunoglobulins**
- **Colostrum** (first milk) contains high % of immunoglobulin (passive transfer)
- **Failure #1 cause of mortality in first week**
- Intestinal absorption limited to first **12-18 hr** of life (see box)
- **Specialized intestinal epithelial cells**
  - Absorb Large proteins intact (immunoglobulins)
  - Cells replaced in 36 hr
  - **18 hr** is a better cut off for good colostrum intake
  - **Stress** or steroids m/ cause premature closure of specialized cells
- Peak immunoglobulin levels 12-24 hr after intake, protection against pathogens

- **Diarrhea & respiratory diz**
- **Mare udder distended** (foal not suckling)
- **Bacteremia:**
  - Depression
  - Weakness
  - Rapid or labored breathing
  - Diarrhea
  - Anorexia
  - Injected sclera
- Survivors of bacteremia, sequelae:
  - **"Joint ill"**
  - **Meningitis**
  - **Panophthalmitis** (inflammation of all structures of eye)

- **Hx, CS**
- **Can't be determined by PE**
- Laboratory evaluation (see box)
  - **CITE test**: measure immunoglobulins

- **If less than 24 hr feed colostrum**
  - 1 L w/in first 8-12 hr of birth
- **> 24 hr: plasma or serum** transfusion (20-40 ml/kg IV)
  - If diseased, not as successful

Prevention:
- Most feed colostrum automatically w/o testing
- Make sure suckle in first 6 hours of life
  - Leaving foal w/ dam gets better absorption
  - More difficult to monitor if nursing mother
- If not, force feeding w/ bottle is preferable over stomach tube (better absorption)
- 2 liters of colostrum in first 4 hr after birth
- **Colostrum bank** (freeze colostrum from first milkings)
  - Thaw or microwave & feed
- **Colostrometer**: measures specific gravity (immunoglobulin levels) of colostrum, < **1.050** associated w/ low antibody concentrations

Prevention:
Colostrum, **Colostrum, Colostrum < 18 hrs**

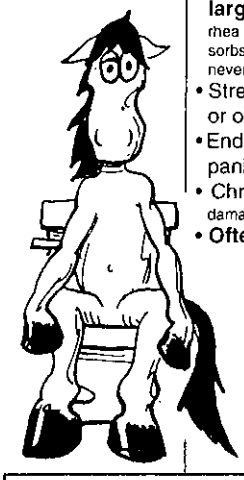
Measuring immunoglobulins
Normal: 12-1500 mg/dl immunoglobulins
- Failure of passive transfer = < 200 mg/dl
- Partial failure = 200-400 mg/dl

- **Field tests done at 12 hrs old** (6 hr to get immunoglobulins into blood) - if failure, give colostrum
  - Zn sulfate turbidity test - field test, 1 hr, cheap
  - **CITE test**, relatively expensive
  - Sodium sulfite turbidity test - field test (1 hr) - looking for turbidity
  - Single radioimmune diffusion test - takes 24 hr, so not a field test (the standard test)
- **Refractometer** (total serum protein) - > 6 g/dl passive transfer, < 5 inadequate, 5-6 questionable

#1 mortality of 1st week
CS: Diarrhea & Respiratory
Dx: Hx, CS, Ig
Tx: Colostrum or Plasma
Prevention: Colostrum, Fluids

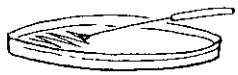
Adult Diarrhea

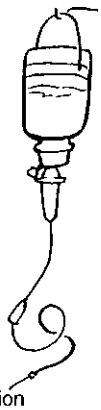
Condition	Facts/Cause	Presentation/CS	Diagnosis	Treatment
Adult diarrhea M8k 241; Mk 184; I2M 723; IM 117, 659; EM&S 649; M 235	• **Passage of fecal material w/ ↑water content** • Poorly understood in horses • Often treated symptomatically • Chronic diarrhea m/be associated w/ many dizs • **#1: Salmonellosis** • **Colitis: almost exclusively large intestine** (small intestine diarrhea compensated by large intestine, absorbs excess water, stomach diz almost never causes diarrhea in adults) • Stress diarrhea - change in diet or overfeeding • Endotoxemia frequently accompanies diarrhea (mucosal damage) • Chronic malabsorption (mucosal damage) • **Often cause not determined**	• **Acute, peracute or chronic** • **Perfuse watery diarrhea** • Often foul smelling • **Dehydrated** - Injected vasculature of mucous membranes - Prolonged capillary refill time • **Peracute picture w/o diarrhea** - Very low volume of diarrhea w/ no systemic signs - Often die w/in 12 hr or sometimes 1-2 hr w/ no diarrhea - #1 cause is Salmonella • **Chronic: diarrhea > 1 month** (pg 46)	• **Many cases - cause not determined** • History: - Change in diet, deworming program - Acute or chronic • PE (see box) - Dehydration - Purplish to brick-red mucous membrane • Lab: - Initially ↓WBCs & PMNs (Salmonellosis & other acute causes) - Toxic changes - Hypokalemia - Hyponatremia - Hypocalcemic - Metabolic acidosis (total CO_2 or bicarb or blood gases) - Prerenal azotemia w/ BUN ↑ or not • **Multiple fecals for Salmonella on all horses w/ diarrhea** • Potomac horse fever areas - Paired acute & convalescent blood samples IFA for antibodies to *Ehrlichia* • **Chronic diarrhea > 1 mo** - **Often perplexing diagnostic problem** (see pg 46)	• **Fluids 1° importance** - IV initially • Plasma (3-10 L IV initially for hypoproteinemia) • **Nutrition** • **NSAIDs** (Flunixin meglumine [Banamine®] for effect on endotoxins) • **ABs** - Ehrlichia - tetracyclines IV - Salmonellosis - detrimental? - Septic, neutropenic horse - broad spectrum ABs, justified (prevent bacteremia) **Prevention:** • No crowding • Separate age groups • Sanitation & hygiene - Eliminate contamination

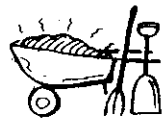


#1 Salmonellosis
CS: Watery feces
Dx: Often undiagnosed, Multiple fecals
Tx: Fluids - **Fluids - Fluids!**

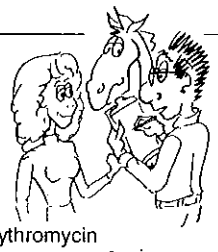
DDx see pg 337



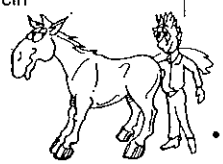


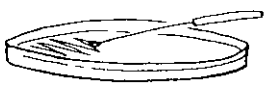


Diagnosing adult diarrhea

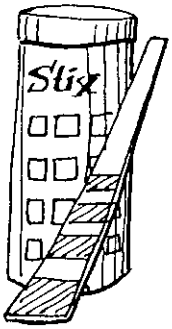


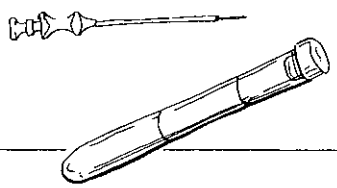
- History
  - Change in diet, deworming program
  - Acute or chronic
  - Single or multiple cases
  - Concurrent disease
  - Medication
  - Antibiotics (**lincomycin**, tetracyclines & erythromycin implicated), discontinue if diarrhea develops
  - Exposure to toxins
- **PE** (physical exam)
  - Vital signs (often normal in chronic diarrhea)
  - Rectal exam
  - Note any weight loss
  - Hydration (skin turgor, gum moisture, capillary refill time)
  - Septicemic CS (injected sclera, conjunctiva, muc. membr., capillary refill time)
    . Toxemia &/or dehydration often accompanies acute colitis, Salmonellosis, ehrlichiosis & many other acute diseases
  - Cardiovascular system (HR, pulse, capillary refill time)
  - Laminitis CS (lameness, digital pulse, temp. of foot)
- **Fecal exam**
  - Gross inspection - blood
  - Microscopic exam - ova & protozoa
  - **Multiple cultures for Salmonella & Campylobacter** if onset acute &/or febrile, or fibrin & mucin in feces
  - Fecal occult blood
- **Blood**
  - CBC
    . ↑PP/ total solids (dehydration)
    . ↑fibrinogen indicates inflammation
    . ↓TPP: protein losing enteropathy
    . WBCs, differential & morphology

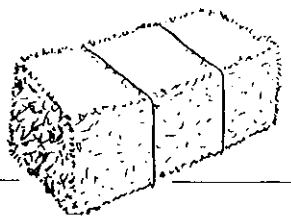




  - Acid-base values (Chem Micro CO_2 device) if acute & dehydration or toxic, not for diagnosis, but for supportive therapy
- **Serum -Chemistries**
  . Electrolytes (Na, Cl, K & Ca), nonspecific
  . BUN: prerenal azotemia common w/ dehydration, recheck after hydrated
  . Albumin/globulin values: hypoalbuminemia seen in chronic protein-losing (granulomatous bowel diz, pure toxicity, acute colitis)
  . IgA, IgM, IgG levels; immunodeficient in chronic diarrhea
  . Paired sera for *Ehrlichia risticii* titer in acute diarrhea w/ fever
- **Paracentesis**: chronic cases
  - Cytology, protein & fibrinogen (to rule out peritonitis, tumors & mesenteric abscesses) creatine, blood pH, or total CO_2
- **Function & absorption tests**:
  - Oral glucose or xylose small intestine absorption tests - chronic cases, especially w/ hypoalbuminemia; if indicates malabsorption, biopsy gut or evaluate Tx w/ anthelmintic after 60 d
  - Liver function tests, BSP half life if hypoalbuminemia or elev. liver enzymes (in enterocolitis elev. liver enzymes secondary)
- **Rectal biopsy**: microscopic & FA for immune mediated disease
  . Culture for Salmonella
- **Response to Tx in undiagnosed chronic diarrhea**
  - Put on grass hay
  - Stop "bute" if suspected







Many cases - Dx can't be made

Adult Diarrhea

Condition	Facts/Cause	Presentation/CS	Diagnosis	Treatment
Salmonellosis M8k 241, 120; Mk 184, I2M 723; IM 660; EM&S 643; M 235; Pic 69 ★★★	• ***S. typhimurium*** (60% isolates), *S. enteritidis, S. anatum, S. heidiberg* (> 2200 serotypes) - ↑ of *S. krefeld* in Oklahoma • Severity depends on # of org., virility • Transmission: - From environ. (fecal/oral, feed & water) - **Passive & active carriers** (aerosols) 1-5% normal horses asymptomatic carriers . Shed for weeks, so **isolate** others • Predisposing factors - **Stress: in 2-4 d** see Salmonellosis . **Esp. surgical stress** (horse clinic prblm.) . Overtraining, deworming, hot weather, transport, food deprivation, changes in feed - **Antibiotics** - changes in GI flora • Pathophysiology: - **Inflammation of bowel wall** . Organism invades GI mucosa (ileum, colon & cecum) . Multiples intracellularly - Disrupts normal absorption, secretory mechanisms in crypts - **Loss of protein** into GI lumen - **Endotoxin** into gen. circulation, passes to regional lymph nodes • **> 10 d, septicemia & diarrhea, unlikely to live** (even w/ Tx)	**4 clinical syndromes** **1) Asymptomatic carriers** - Organisms in GI, active or passive shedders - W/ disruption of GI m/ develop diz **2) Chronic diarrhea** **3) Septicemia**: most commonly occurring in foals **- > 10 d of septicemia & diarrhea = death** **4) Acute colitis - peracute** - Most common syndrome **- May die w/n 12 hr** - Sudden onset of pyrexia (fever) - Off feed - Prox. enteritis w/ gastric reflux **- Colic** (abd. pain w/ or w/o diarrhea) **- Profuse diarrhea** **- Improve in 7-10 d w/ Tx**	• **Hx, CS** • **Fecal cultures (5 negative before Dx Salmonella free)** - Difficult to grow, 20 gr. of feces needed - Clinical isolate organisms when feces starts to firm up - Special enrichment broth, tetrathionate & selinite agar plate • **Rectal biopsy more sensitive than fecal** in picking up Salmonella - Do both if think it's being shed into envir. • PM (post mortem) - Catarrhal enteritis - Necrotic hemorrhagic lining (distal small intestine, cecum & large colon) - Lymph nodes enlarged & bulge on cut surface - Adhesions of large colon (tremendous damage, get leakage to serosal surface) • Lab: **- Neutropenia w/toxic degenerative left shift** - ↓ in Na, K, Cl - Metabolic acidosis - ↓ in protein due to loss of albumin - Prerenal azotemia ↓ in creatinine - TPP: m/be up, down, or normal	• **Fluids: 1° importance** - IV initially • **Plasma** (3-10 L IV initially for hypoproteinemia TPP < 4 g/dl) • **Nutrition** • **NSAIDs** (Banamine® [Flunixin meglumine] for effect on endotoxins & pain) • **DMSO** IV, antiinflam., antibact. & O2 free-radical-scavenger • **ABs m/b detrimental** - AB administration often precedes diz, doesn't appear to alter duration of diz, rapid resistance to ABs • Septic, neutropenic horse - broad spectrum ABs justified (prevents bacteremia)

Stress (Sx) - Carriers
CS: Diarrhea
Dx: 5 fecals, biopsy
Tx: #1 fluids

DDx:
• Acute obstruction (pg 64), nonresponsive to analgesic therapy - mistaken & taken to surgery, culture shows positive for Salmonella

Potomac horse fever, Ehrlichiosis, **Ehrlichia colitis, Equine monocytic ehrlichiosis** M8k 243; Mk 185, I2M 724, 1640; IM 660; C3T 92; C2T 250; EM&S 651; M 235	• Reported in Potomac River Valley • **1° river valleys** (more in the North) • Seasonal: July & August (May - Nov.) • Transmission unknown - Multiple vectors (Dermacenter ticks?) - Noncontagious, occurs sporadically, nonhorse to horse transmission • Endemic to certain farms • ***Ehrlichia risticii*** - Predilection for **monocytes** • Incubation period - 10 d • Mortality rates between 20-35% • 1° cause of death due to laminitis, not enterocolitis	• **Clinical syndrome similar to Salmonella** • Acute onset of depression • **107° F** (important for Tx) • Off feed • 24-72 hrs: **Diarrhea**, perfuse, watery, not as fetid as Salmonella • **Colic** preceding, during, or following diarrhea • Often resolves w/in 1-10 d w/out specific therapy, but supportive w/ IV fluids • **Laminitis 3-5 d after diarrhea** **- 1° cause of death due to laminitis, not enterocolitis** • **Sequelae:** - Ileus, toxemia, DIC	• **50% of cases undiagnosed** • Hx & CS **- River valley location** • Serologic titers • **Indirect immunofluorescence antibody test** TOC - 4-fold rise in titer • Vaccine makes Dx difficult due to titer ↑ & those vaccine still can develop diz • **Absolute peripheral monocytosis** (DDx from Salm.) • Leukopenia (as in Salm.) • **PM** (post mortem) **- ID organism in monocytes** of GI (not in peripheral blood) & in enterocytes (intestinal epithelial cells) of mucosa of lg. intest. (colon & cecum) - No severe tissue damage - EM: find damage to enterocytes associated most commonly w/ disruption of secretory mechanisms - In crypt area	• **Fluids** • **DOC: oxytetracycline, 7-10 d**, IV sid effective w/in 24 hr after temp. elev. (prevents progression of diz); m/not be showing signs of diarrhea at this time so hard to recognize unless taking temp. - Once develop enterocolitis tends to follow course, drug not effective - Oxytetracycline may predispose to Salmonella if carrier • **Supportive care** similar to any cause of enterocolitis • Recurrence common **Prevention:** • Vaccine bacterin administered prior to hi season - 2 shots 3 wk apart - Short lived, protected for 4 months - Revaccinated yearly - Not completely efficacious - During outbreak, vaccine not effective - 3-4 weeks post vaccine to develop antibody levels - Incidence of diz decr. since vaccine, but keep getting new areas popping up

River valleys - Summer - *Ehrlichia*
CS: #1 Laminitis - #2 Diarrhea
Dx: Hx, Monocytosis
Tx: Fluids, Oxytetracycline

NSAIDs IM2 725; IM 661
• Excessive doses of nonsteroidal anti-inflammatory drugs (NSAIDs) associated w/ diarrhea secondary to development of hypoproteinemia & cecal & colonic edema. NSAIDs inhibit prostaglandin synthesis, disrupting mucosal blood flow & resulting in hypoproteinemia & septicemia. Many are slow to respond to Tx (long intensive care)

Lincomycin Mk 1446, I2M 725; IM 661; C4T 666
• An antibiotic
• **Contraindicated in horse** because severe, m/b fatal colitis may develop

Tetracyclines Mk 1438; I2M 725, IM 661 • **M/ cause severe & even fatal diarrhea in horse**, especially if severely stressed or critically ill

Trimethoprim-Sulfa, Erythromycin & Penicillin IM2 725; IM 661 • Associated w/ mild-to-moderate diarrhea in small percentage of horses treated

Adult Diarrhea

Condition	Facts/Cause	Presentation/CS	Diagnosis	Treatment
Clostridiosis, Peracute diarrhea, Clostridial diarrhea Mk 186; I2M 725; IM 660; C2T 97; M 235; Pic 70	• **Perfuse, profound diarrhea w/ high mortality rates** • **Edematous bowel syndrome** • ***Clostridium perfringens*** type A • Toxin - Acute diarrhea - Toxemia - affects heart • Resembles peracute salmonellosis, but m/ die before diarrhea occurs • All ages, sporadic • Mortality 90-100% • Morbidity is low • **Stress** often precedes disease - **Surgery** - **Transport**	• **Peracute** - **Found dead w/o prior signs** • Hypothermic • **Profound depression** • **Severe pain**, frequently unresponsive to Tx • **Explosive diarrhea** present acutely • **Extreme dehydration** • **Hypovolemic (endotoxic) shock rapidly** - Poor capillary refill time - Purplish mucous membranes - Cold extremities, thready pulse • **Die peracutely (w/in 3 hr or 24-48 hr)**, in many cases despite Tx	• **Hx, CS: Peracuteness of diz** - **Severe colic** • CS, Discolored mucous membr. • **Fecal culture** (clostridium rarely cultured from normal feces) • **PCV > 65%** (tremendous losses of water & electrolytes) ↓ TP • Leukopenia m/b followed by leukocytosis, • Liver biopsy • PM - GI, Cardiac & lung lesions **PCV > 65%**	• **Fluids 1° importance** - IV initially - huge amounts - Electrolytes & bicarbonate necessary • **Analgesics** - **Xylazine** (Rompun®) IV - **Detomidine** - **Butorphanol** m/b combined w/ Rompun® or detomidine to ↑ potency (IV) • **Penicillin**: Na or K benzyl m/b (IV qid) • *C. perfringens* types C & D antitoxin m/b • Rest for over 1 mo to allow heart to heal • Nutrition • Banamine® (flunixin meglumine) for effect on endotoxins • **Strict hygiene** Rompun

Peracute - Fatal
CS: Pain, Diarrhea, Shock
Dx: Hx, CS, PCV > 65%
Tx: Massive fluids

Colitis X M8k 245; Mk 186; I2M 725; IM 660; EM&S 653; C2T 94; Pic 69
- **Peracute diarrhea of unknown cause**
  - M/b peracute Salmonellosis or clostridiosis, but can't be cultured
  - Lincomycin & tetracycline also mimics
- Mortality 90-100%, No age predilection, Morbidity is low
- **Stress** often precedes disease - **Surgery - Transport**

DDx:
- Salmonellosis (pg 42)
- *C. perfringens* - endotoxin (pg 44)
- Potomac fever (pg 43)
- Anaphylaxis (pg 117)
- Lincomycin & tetracycline Tx (pg 43)

Toxicology

Selenium toxicity	• **See TOX pg 321**; Cattle, sheep & horses, **"accumulator" & "converter"; W USA, Se supplementation = ± toxicosis** • **CS:** Acute: **diarrhea**, Chronic "alkali diz" or "blind staggers" • **Tx: Acute: no Tx**; Chronic: **arsenic** dangerous in horse
Algae	• **See TOX pg 324**; Toxic blue-green algae, fresh water; **ruminants more sensitive than monogastrics** • **CS:** Death w/in min, **diarrhea**, hemorrhagic gastroenteritis, **dyspnea**, ± **CNS, hepatic diz** • **Tx: Often dead or before Tx**

Blister Beetle/ Cantharidin toxicity Mk 1643, I2M 729, 1895; IM 664; EM&S 1555, 655; C4T 666; C3T 368; C2T 120	• **Horses** >>> sheep & cattle • **Blister beetle (*Epicaura*)** • **Swarm in alfalfa** during harvest • **Cantharidin**: potent irritant & vesicant - Contact damage, vesicle formation . Mucosal surfaces - **GI, renal & heart damage** - **Hypocalcemia** • Storage of hay or pellets does not reduce toxicity • Tiny part of beetle causes clinical disease • **Southwest USA**	• **Endotoxic shock & renal failure** • **Found dead peracute** • **Colic** • Salivation • **Cardiovascular shock, death** w/ in 48 hr m/b • Anorexic, severely depressed • **Skin - vesicles** - **Vesicles mouth, tongue** & GI (short lived vesicles, usually denuded [erosions]) - Toxic line present, purple or brown colored • **Watery feces**, dark colored due to digested blood (melena) • **Cardiac arrhythmias**, hypocalcemia & damage of myocardium (mitochondria) • **Renal tubular damage** - **Hematuria**, pollakiuria (frequent attempts) - **Blood in urine** m/be w/ clots in urine & feces • **"Thumps"**: synchronous contraction of abdominal musculature (hypocalcemia) • Stiff gaited thought to be due to muscle damage & ↑ creatinine & CPK	• **CS, Hx** • **Find beetle in alfalfa** • Cantharidin in urine or stomach (chromatography) $ expensive - Look for early diz process, after 4-5 d urine is negative for cantharidin • ↑ TPR • Lab: - ↓ Ca, Mg - **Low specific gravity**, 1.003-1.006 - ↑ **PCV & TP** (dehydration) - **Hematuria** - ↑ **BUN & creatinine** - ↑ **prerenal azotemia** - Leukopenia in toxic, due to neutropenia acutely w/ toxic changes - Rebound leukocytosis due to neutrophilia (if lives long enough) - ↑ fibrinogen & gamma globulins - Generally hyperglycemic initially - Electrolytes & acid/base normal early on, live longer, metabolic acidosis, hypokalemia • PM (post mortem) - **Erythema & edema of urinary bladder**	• **No specific antidote** • **Supportive (intensive)** - **IV fluids**, Tx hypocalcemia . LR for hypocalcemia & supplement very small amounts of Ca . More of a problem in Tx if endotoxic . Collapse when giving Ca w/ endotoxemia • **Activated charcoal** (evacuate toxins from GI) • Gastric protectants: Pepto-Bismol®, Malox®, Carafate® (sucralfate) • **Mineral oil** (remove toxins) • If concern of renal failure - Diuretics (furosemide) • **Analgesics** for abd. pain (short acting such as xylazine) - problem w/ Banamine® is potential nephrotoxicity • Antibiotics, empirical, prophylactic • Tx hypocalcemia **Prevention** • ID feed source Oil **Prognosis:** • **Guarded** if obvious CS & lot of blood in feces & urine

Swarm in alfalfa
CS: Endotoxic shock: Renal, GI, Heart - ↓ Ca
Dx: Hx, CS
Tx: No antidote, Supportive Tx

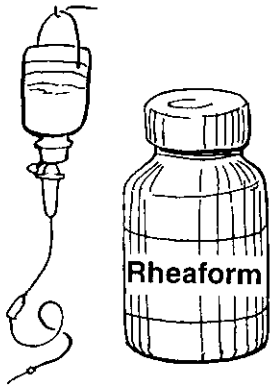
Toxic causes of diarrhea	• **Phenylbutazone**, pg 27; **Blister beetle toxicity**, pg 45; **Monensin**, pg 129; **Slaframine**, pg 332; **Sulfur**; **Phosphorus**, pg 315; **Organophosphate**, pg 312; **Mercury**, pg 313; **Arsenic**, pg 312; **Nicotine**, pg 329; **Propylene glycol**; **Salt poisoning**, pg 313; **Amitraz, Dioctyl sodium sulfosuccinate** (DSS), pg 317
Poisonous plants	• **Oleander**, pg 329; **Castor bean**, pg 327; **Algae**, pg 324, Potato; Avocado; **Japanese Yew, Thorn apple**, pg 326; **St John's Wort**, pg 323; **Mycotoxicosis**, pg 330
Oak, acorn	• **See TOX pg 324; SW USA, Midwest & NE.**, #1 Cattle, **rarely in horses (colic, hemorrhagic diarrhea)**; Not urinary problem as seen in cattle

Chronic Diarrhea

Condition	Facts/Cause	Presentation/CS	Diagnosis	Treatment
Chronic diarrhea I2M 728, IM 663; C2T 100; M 239	• **Most frustrating to Dx & Tx** • **Diarrhea > 1 month** • **Disease of large colon** • 3 groups of chronic diarrhea 1) Chronic inflammation - Histologic changes of colon 2) Physiologic disruption - No morphologic changes in colon - Abnormal volatile fatty acid synthesis &/or absorption from cellulose 3) Disorder of other systems besides GI, small % (CHF & hepatic diz)	• **Diarrhea > 1 month** • Hydration m/b OK if drinking keeps up w/ loss • **Moderate weight loss** • ± Signs of septicemia (injected, congested or hyperemic mucous membranes) • Feces soft, slightly watery, m/b intermittent	• **Hx, CS (> 1 mo)** • Attempt to differentiate inflammation from physiologic causes • **Work up m/ be extensive & expensive - M/ never Dx cause (idiopathic)** • CBC for chronic inflammatory signs - Chronic inflammatory anemia (↓RBCs & PCV) - WBC normal to moderately ↑ - Fibrin - normal to ↑ - Normal CBC doesn't rule out inflam. (m/be localized or mild) • Peritoneal fluid analysis - ± ↑ protein &/or WBC (indicates inflammation), often inflammation of colon - values normal • Serum chemistry - Varies - severe to mild chem. abnormalities (hyponatremia, hypochloremia, azotemia & metab. acidosis) - Total serum protein usually decr. due to leakage from damaged colonic capillaries (hypoalbuminemia) - ↑ hepatic enzymes indicate hepatic diz (SDH, GGT, AST & serum bile acids) • **Feces:** - **Salmonella** - m/ need 15 fecal cultures to get a positive - Rotavirus in weanlings (ELISA) • Rectal biopsy & culture for Salmonella **OFTEN THE ABOVE DOESN'T TELL CAUSE! (idiopathic)** • **Exploratory laparotomy** - Masses or abscesses - Biopsy of colon & cecum & mesenteric lymph nodes for histopath, & culture of Salmonella - No abnormalities except water in large colon (idiopathic)	• **Empirical** (from experience) • **Inflammation often untreatable** (lymphosarcoma, granulomatous enteritis) • **Chronic Salmonella** generally doesn't respond to antibiotics) • **Chronic parasitism - anthelmintics** • Sand: Metamucil® • Bismuth subsalicylate effective in some cases (inhibits prostaglandins) • **Rheaform®** (Iodochlorhydroxyquin) for some cases of maldigestion of cellulose (mechanism unknown). If effective, must be continued or diarrhea resumes **Empirical Tx**

Diarrhea > 1 mo
Often idiopathic
Dx: $ - ?
Tx: ? - Empirical

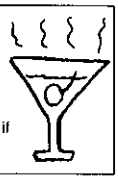
DDx:
- **Idiopathic (unknown) most common** (pg 47)
- Infectious agents
  - Chronic Salmonellosis (pg 48)
  - Chronic parasitism - *Strongylus vulgaris*, sm. strongyles
  - *Rhodococcus equi* infection (pg 48)
  - Rotavirus in weanling foals (pg 38)
- Noninfectious inflammation
  - Infiltrative disorders
    . Granulomatous enteritis
  - Lymphosarcoma (pg 30, 51)
  - Sand enteropathy (pg 49)
- Physiologic disruption - Noninflammatory disorders
  - Abnormal fermentation of cellulose
- Small % disorder of another system besides GI
  - Congestive heart failure 2° hepatic fibrosis (pg 125)
  - Chronic hepatic diz (inflam., fibrosis or fatty infiltration) (pg 90)
    . Chronic hepatopathies & cholelithiasis



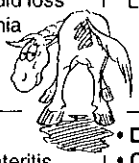
Idiopathic chronic diarrhea I2M 728, IM 663	• **Most common cause of chronic diarrhea** • Stress prior to onset of CS • M/b due to ↑ volatile fatty acids in large intestine so ↑ fermentation (theories)	• **Chronic diarrhea** • Normal appetite • **Mild weight loss** • Performance poor • M/ resolve by itself	• Hx of stress prior to onset of CS • **PM: no gross histologic abnormalities** • **No lab abnormalities** - Animal can compensate for loss of electrolytes - No changes in CBC • **Exploratory laparotomy** **- No abnormalities except water in large colon** - Edema in lamina propria, no specific cause	• **Rheaform®** Iodochlorhydroxyquin (which may exacerbate problem) resolves while on drug, once withdrawn, recurs • **Eliminating grain in diet** - in some cases diarrhea will resolve • Alter environment (stress) • Nonspecific • **Fecal cocktail** (see box) • Corticosteroids (Dexamethasone & prednisolone due to the theory that it may be hypersensitivity reaction to feedstuff) Prognosis: • **All poor**

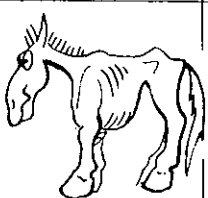
#1 Chronic diarrhea, Stress
Dx: Hx, CS
Tx: Rheaform, Fecal cocktail
Px: Poor

Fecal cocktail
- Fresh feces from normal horse, or from freshly dead animal that has not been ill)
- Mixed w/ warm water, buffered w/ bicarb
- Via stomach tube
- Warn owner of possible more severe diarrhea if Salmonella in cocktail feces

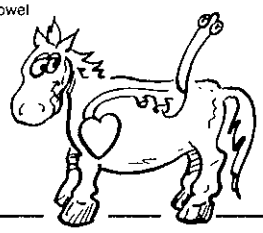


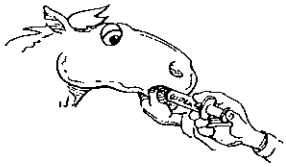
Small strongyles, Cyathostomiasis Mk 196; IM 1517; EM&S 649	• **Cyathostomes** • Chronic diarrhea due to digestion of larval stages in Spring - Encyst in gut wall - Rapidly leave gut in spring • Rehydrate themselves w/ oral solutions	• **Severe weight loss** • **M/b severe non-responsive diarrhea** • Not extreme fluid loss • Hypoproteinemia • Ventral edema	• **Hx, CS** • **Strongyles in feces**, L4 in feces, L4 on rectal sleeve	• **Routine deworming every 8 weeks** (grazing horses assumed to be infected) **see pg 14** • Foals: 6-10 wks old • Treat all horses on pasture • **Anthelmintic resistance of cyathostomes an emerging problem, see pg. 14** - Resistance to benzimidazoles except **oxibendazole** - Ivermectin, Pyrantel pamoate (Strongid T®), oxibendazole & piperazine effective • Periodic fecals to check • Corticosteroids





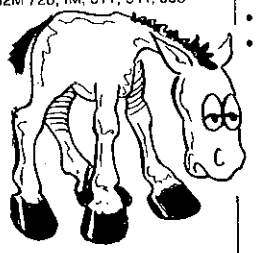
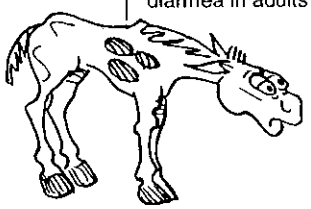
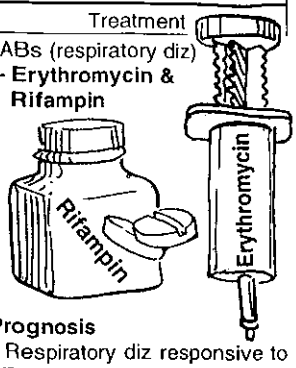
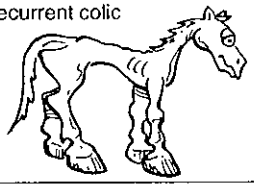
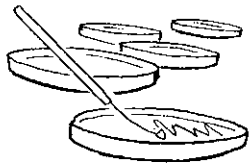
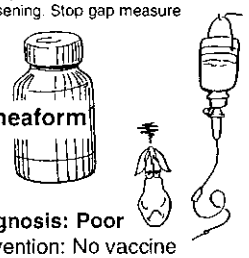
Strongylus vulgaris **Blood worms, Palisade worms, Sclerostomes, Red worms**	**Large strongyles** - see pg. 75 • ***S. vulgaris*** migrate to **cranial mesenteric artery** & its branches causing parasitic thrombosis & arteritis leading to: • **Infarction & ischemia** to segments of bowel	• **Colic** • Gangrenous enteritis • Intestinal stasis, torsion or intussusception & rupture • Acute or **chronic diarrhea** • Mild infections - Dullness, progressive weight loss, intermittent colic - Due to larvae in GI tract • Intermittent signs of colic • Hypoproteinemia	• **Dx difficult** • **Ova in feces** • **Fecal culture** of larvae to DDx different strongyles • Rectal palpation of cranial mesenteric artery (if colic) • Suspected parasite problem • Rule out everything else	

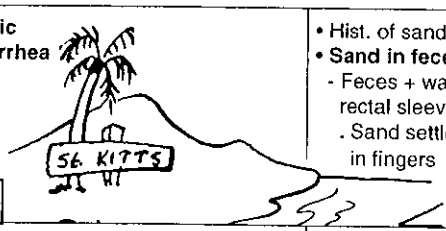
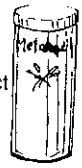
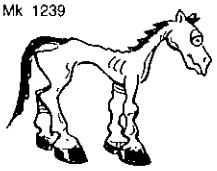
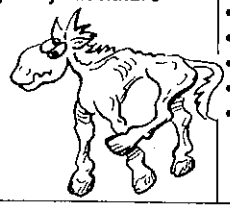
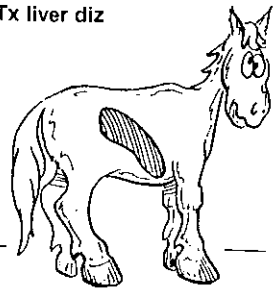
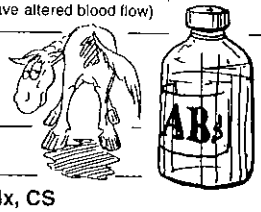
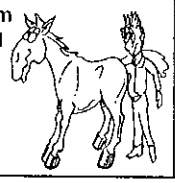
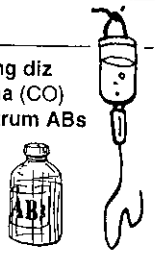




Large strongyles
Dx: Difficult
CS: Colic, diarrhea
Tx: Ivermectin

Chronic Diarrhea

Condition	Facts/Cause	Presentation/CS	Diagnosis	Treatment
Rhodococcus equi I2M 728; IM, 511, 344, 663 	• **Chronic diarrhea in foals 1-4 months, uncommon in adult** • **1° affects lungs - pneumonia** • Transmission: oral • Endemic to certain farms • Damages intestinal villi - **Granulomatous** & abscesses in small & m/b large intestine **Foals** **CS: Chronic diarrhea, Resp. diz** **Dx: Difficult, Hx, CS** **Tx: Erythromycin & Rifampin**	• Asymptomatic • **Acute** - Abdominal pain in acute phase - Diarrhea • **Chronic** (necrosis & ulceration) - Weight loss - **Diarrhea** intermittent (flare ups of bacteria) • **Respiratory signs** 	• **Difficult to Dx** (isolated from feces of asymptomatic & symptomatic animals) • Usually done by rule out • **History of respiratory diz** • Low on rule outs for chronic diarrhea in adults	• ABs (respiratory diz) - **Erythromycin & Rifampin**  **Prognosis** • Respiratory diz responsive to Tx; GI diz less so
Chronic salmonellosis Mk 184; I2M 723; IM 663 	• **Important in adults & young** • Tremendous economic losses • Weanlings > neonates • **Chronic diarrhea, adults >>> young** • Septicemia to endotoxemia, esp. FPT • **Multiple organs systems** • Small & large intestine (damages mucosa) • Hard to disinfect area - Adult w/out CS often source (carriers) • *S. typhimurium*, public health **Consider in all cases of diarrhea** **CS: Diarrhea, Weight loss, Death** **Dx: Difficult, 15 fecal cultures** **Tx: ABs useless, Fluids, Rheaform**	• Acute - **Bacteremia & septicemia** w/out diarrhea m/b - **Diarrhea** (fetid smelling), blood & fibrin in manure - Depressed - **Colic** or abdominal pain - **Dehydration** - **Bacteremia:** lungs, joint, vertebral bodies, renal, uveitis or CNS CS • **Chronic diarrhea: adults** > young - **Diarrhea mild to moderate** - **Weight loss** - History of acute episode m/be - Dx of recurrent colic • **Death** 	• **Even more difficult to Dx than acute Salmonellosis** • **15 cultures** to get positive m/b - Shed intermittently (for normal diarrhea needed 5 negative cultures to rule out) • Rectal swabs or biopsy less effective • **Blood cultures** • Hypoglycemic • Loss of electrolytes into intestinal tract, 1° K^+ defc, metab. acidosis, ↑ PCV (dehydration) & total protein or hypoprotein (if no immune response) • Neutropenia - toxic granulation of PMNs (not pathognomonic) 	• **Symptomatic** • **ABs - don't respond** • Oral fluids adequate (as apposed to those needing fluid therapy) • Rheaform® (iodochlorhydroxyquinone), slows diarrhea, chronic cases, may resolve while being used, reappears w/ stop. Slows down feces passage, incr. absorption of toxins & m/ cause acute worsening. Stop gap measure  **Prognosis: Poor** Prevention: No vaccine

Sand enteropathy M8k 245; Mk 187; I2M 768; IM 698 	• **Pick up sand w/ grass (eat)** - inadvert ent digestion • Sand accumulates w/in GI tract • Irritation to bowel mucosa • Impacted, blocks the GI, water can pass, diarrhea **Florida, Sand in sleeve, Metamucil**	• **Colic** • **Diarrhea** 	• Hist. of sandy environment • **Sand in feces** - Feces + water in rectal sleeve . Sand settles in fingers 	• **Metamucil®** (Psyllium hydrophilia mucilloid): laxative, binds w/ sand • Hemicellulose product via nasogastric tube or added to feed 
Chronic liver disease Mk 1239 	• Signs compatible to hepatopathy • **Icterus** seen in sclera • Hepatitis & hepatoencephalopathy (acute)	• **Generally thin, lethargy** • **Feces "cow paddy" in nature** • **Icterus** • ± **CNS signs** 	• **↓ Albumin m/b in chronic,** in acute normal due to long half life • **Prolonged BSP** • **Prolonged PT, PTT** • Abnormal liver biopsy • Thin, poor condition • D-xylose or glucose absorption tests (but results misleading, suggesting GI diz bec. of malabsorption - instead have altered blood flow)	• **Tx liver diz** 
Fungal-related diarrhea 	• **Very rare**, *Aspergillus fumigatus*, a normal inhabitant of GI tract • Problem when **excess ABs** use • **Diarrhea**, generally mild & persistent in nature	**Excess ABs**		
Eimeria - problem in young horses primarily				
Peritonitis Mk 146; IM 674, 784, 124; EM&S 670; C3T 455 	• **See pg 53** • **Inflammation of peritoneal serosa** • Exudate of serum, fibrin & prot. into peritoneal cavity • Exudate can disrupt GI motility, resulting in diarrhea	• Chronic - M/b diarrhea or normal fecal output - Chronic or intermittent colic - Depression, anorexia - **Weight loss** - Absent intestinal sounds (ileus) - Mild dehydration • **Chronic localized** - Debilitating, but no pain or temp.	• **Hx, CS** • **Abdominocentesis** - **↑ Fibrinogen & PMNs** - Cytology • **Rectal exam** - **Distended intestines** 	• **Tx underlying diz** • **Fluid, plasma** (CO) • **Broad spectrum ABs**  **Prognosis:** • Chronic diarrhea w/ chronic peritonitis, responds poorly to Tx

Weight Loss

Condition	Facts/Cause	Presentation/CS	Diagnosis	Treatment
Malabsorption syndromes, Villous atrophy M8k 263, 129; Mk 141, I2M 721; IM 118; C2T 102 Pic 68	• **Small intestines** • Villous atrophy results in ↓ surface area	• **Chronic weight loss** • **No diarrhea** usually	• Villous atrophy not Dx as it is too nonspecific • Absorption tests (see box below pg 51)	• See specific diseases
Chronic protein-losing enteropathy, Granulomatous enterocolitis or enteritis I2M 721; IM 658, EM&S 624; Pic 71	• **#1 granulomatous enterocolitis** (see box for others) • **Small intestine, diffuse granulomatous infiltration** • Linear lesions w/in large intestinal mucosa which don't appear to be a tremendous problem • **Protein losing enteropathy** • **Malabsorption** • All breeds, esp. Standardbreds • Age 1-5 years • Specific cause unknown (some cases Mycobacterium isolated) - Histoplasmosis - Genetic?	• **Weight loss** • History of intermittent colic • Intermittent fever • **Ventral edema** (hypoproteinemia) • Alopecia localized to nonspecific areas (randomly patchy) • **Rarely diarrhea**, indicates colonic involvement • A small intestinal diz, compensation in large intestine in adults	• **Hx, CS** • **Hypoalbuminemia in absence of proteinuria** (intestinal protein loss) • **Flat xylose or glucose absorption tests** (no rise in blood glucose as in normal animal) (see box pg 51 below) • Abdominocentesis: ↓ in macrophages • **PM** (postmortem) - Diffuse, patchy infiltrates - Granulomas w/ epithelioid macrophages, giant cells	• **No known effective Tx** • Chronic steroids: prednisolone, but improvement only while drug is being administered • Parasitic infection: use corticosteroids & deworming

Idiopathic villus atrophy
CS: Chronic wt. loss, No diarrhea
Dx: Absorption tests

Cause: most enteric diseases
- Neonatal diz - rotavirus & coronavirus
- Cryptosporidiosis
- Acute inflammatory diz
- Salmonella
- Granulomatous diz
- **Idiopathic villous atrophy**: most common malabsorption diz seen at PM
- Inflammatory bowel disease
- Lymphosarcoma

Inflammatory bowel infiltrate disease

- Nonspecific in horses > 1 year
- Disruption of bowel mucosa of **small intestine**; large intestine not involved (compensation)
- Infiltrative neutrophils, monocytes in large numbers in intestinal walls. Presence of these cells tends to cause physical barrier to normal absorption. Why they are there has not been determined.

Malabsorption
CS: Thin, Ventral edema
Tx: No Tx

Causes:
- Granulomatous enteritis #1
- *S. vulgaris*
- Intestinal neoplasia
- Eosinophilic, basophilic & granulomatous colitis (Histoplasma)

DDx:
- Alimentary lymphosarcoma (pg 51)

No Tx

Alimentary lymphosarcoma	• **See PG 31** • **< 5 yrs** • **Small bowel** • Causes intestinal malabsorption • **Protein losing enteropathy** (malabsorption)	• Same signs as granulomatous enteritis • **Thin horse** (malabsorption) • Malabsorption diz - **Edema of ventrum & limbs** - **Ascites** • **Peripheral lymph nodes not enlarged** • **Diarrhea** more common than w/ SCA	• Hx, CS • **Anemia** • Abdominocentesis doesn't reflect abnormal cells • **Glucose & xylose absorption test** (see box) • Fecal occult blood • Leukemia rare • Rectal exam - **Thickened small intestine** - **Abdominal masses**	• No Tx **No Tx**
Iatrogenic bowel resection	• **Removal of part of small intestine** • Removal of part of colon has no effect	• **> 60% removal of bowel** - Get weight loss - Abnormal xylose absorption test • Can become malabsorption & hypoproteinemia - Ventral edema - Thin	• Hx, CS • **Glucose absorption test**	

DDx:
- Small intestine obstruction (pg 64)
  - Fluid filled, not thickened
- Diarrhea (pg 32-49)
- Malabsorptive syndromes (pg 50)
- Eosinophilic, basophilic, & granulomatous colitis (pg, 50, 28)

< 5 yrs, Malabsorption
CS: Thin, Edema, Diarrhea
Dx: Absorptive tests, Rectal
Tx: No Tx

Glucose absorption test, cheaper than D-xylose, but rapidly absorbed so misses problems further along GI
- Fasted 18-24 hours
- Feed glucose, 1 gm/kg in water sol. by stomach tube
- Blood samples in grey top tubes. Samples 0, 30, 60, 90 & 120 min
- Normally should ↑ by 80-100% by 60-90 min.

D-xylose

D-xylose test more expensive, but picks up abnormalities throughout intestinal tract
- Fasted
- Use 0.5 gm/kg in 10% solution by stomach tube
- Heparinized tube. Peak normally 60-120 min. after administration (checking plasma)
- Flat curve suggests malabsorption of small intestine, some problems in interpretation

> 60% of small intestine
CS: Wt. loss
Dx: Glucose absorption test

Enterotoxemia - Peritonitis

Condition	Facts/Cause	Presentation/CS	Diagnosis	Treatment

Endotoxemia

Mk 184; I2M 733; IM 668; C3T 225, C2T 81

- **Endotoxin from gram neg. org.**
- **Protective mechanisms of body** normally keeps endotoxin out of blood
  - **Mucosa barrier to endotoxins**
  - **Kupffer cells** (liver macrophages) remove if toxins get through mucosa
- Causes (see box)
  - Any disruption of GI mucosa can result in absorption of toxins
  - Local or systemic gram neg. infec.
- **Endotoxins in general circulation**
  - **Inadequate tissue perfusion**
  - **Multisystem organ failure**
  - **Cardiovascular collapse**
  - **Acute renal failure**
  - **Ileus**
- Complication:
  - **Laminitis** if get endotoxic for any reason
- Early, late & end stages (see box)

Bacteremia- bacteria in blood
Endotoxemia - endotoxins in blood
Septicemia - both in blood

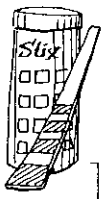
Gram (-) organisms
CS: Multiple system failures, Laminitis
Dx: CS
Tx: Empirical Tx

- **↑HR** (tachycardia), **↑RR**
- Initially depressed, then convulse, then coma
- **Pyrexia** in late (not end stage in which they reach a point where they can't thermoregulate so hypothermic
- **Mucous membranes from pink to purple to brown**
  - **Toxic line** (over upper incisors)
- Colic
- Diarrhea
- Dehydration, anorexia
- **Laminitis**

Causes of Endotoxemia
Any disruption of GI mucosa can result in absorption of toxins
- Strangulating & nonstrangulating obstruction (pg 64, 68)
- Parasitism (pg 24, 36)
- Enteritis
- Colitis
- Grain overload (pg 29)

Local/systemic gram neg. infec.
- Pleuritis (pg 118)
- Pneumonia (pg 118)
- Metritis (pg 183)
- Mastitis (pg 241)
- Septicemia
- Colitis (Salmonellosis) (pg 34, 42)

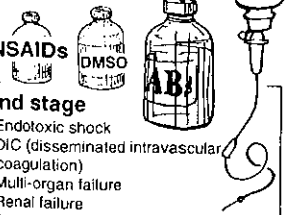
- **CS mostly: Toxic line**, ↑HR, RR; Gum color
- Lab:
  - Neutropenia & margination w/ toxic changes, immature PMNs - myelocytes
  - Glucose varies depending on stage
  - Liver dysfunction can shown in liver enzymes, ↑BUN & creatinine



Early stage
- Hypoxemia - PaO2 low
- Hyperpnea (fast breathing)
- ↑HR
- **↓WBCs (Leukopenia:** margination of PMNs)
- Thrombocytopenia
- ↑PCV, hemoconcentration
- **↑Glucose**
- Respiratory alkalosis

Late stage (reversal of early)
- **↑WBCs (Leukocytosis**
- **↓Glucose**
- Metabolic acidosis that overrides respiratory alkalosis
- Hepatic dysfunction, ↑liver enzymes
- Coagulation disorders developing, pyrexia, hypotensive, weak pulse

- **Empirical, unfortunately**
- Underlying diz so treat other systems
  - **ABs** for gram - organisms, removal of foci of infection, if ischemic intestinal diz, correction
- **Fluids:** ↑blood volume (prevent or correct shock) (hypo-perfusion, hypovolemia) Underlying diz process correct acid/base abn.
- Maintain or ↑blood flow
  - Dopamine: ↑cerebral, coronary, mesenteric & renal blood flow
- Anti-endotoxins, not common, to neutralize
- NSAIDs (flunixin meglumine) to combat production of prostaglandins & endotoxemia
- DMSO, scavenge toxic oxygen radicals
- Anti-pruritic
- Anti-inflammatory



End stage
- Endotoxic shock
- DIC (disseminated intravascular coagulation)
- Multi-organ failure
- Renal failure
- Acute respiratory distress syndrome
- Heart may fail
- CHF & simultaneously comatose due to lack of glucose to brain
- Once reach this point, death

Peritonitis

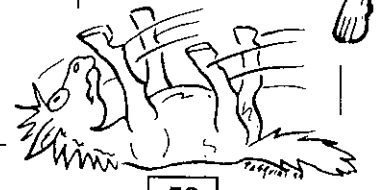
Mk 146; I2M 742; IM 674, 784, 124; EM&S 670; M 243; C4T 206; C3T 236, 285; C2T 79; Pic 89

- **Inflammation of peritoneal serosa**
  - Acute or chronic
  - Diffuse > local (in horse usually diffuse because of inability to wall off)
  - Exudate of serum, fibrin & protein into peritoneal cavity
  - Exudate can disrupt GI motility, resulting in diarrhea
- **Bacterial infection:**
  - ***Streptococcus equi*** **&** ***Rhodococcus*** *(Corynebacterium)* ***equi,*** *Streptococcus zooepidemicus*
  - Anaerobes, including *Bacteroides fragilis*; Enterobacter
- Omentum or mesentery m/ localize a septic peritonitis (less so than cattle)

Causes: usually 2° to contamination
- GI perforation or surgical contamination
- Perforation of other infected organs (prostatic or hepatic abscess, pyometra)
- Penetrating abdominal wounds
- Chemical insult (urine or bile)
- Neoplasia, visceral ischemia (transmural bacterial migration)
- Parasitic: verminous arteritis (*S. vulgaris*), larval migration (*S. edentatus*), perforating lesions (ascarids, tapeworm)

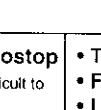
2° to Contamination
CS: Colic, ± death
Tx: Long-term ABs, lavage
Px: Guarded

- **ACUTE:**
  - **Severe colic** - rigid, "splint" abdomen, lie down & roll
  - **Ileus** (↓borborygmi)
  - Anorexia, depression, lethargy
  - Pyrexia (elev. temp.)
  - Occasionally diarrhea, low volume, watery feces, or constipation
- **PERACUTE** (intestinal rupture)
  - Toxemia
  - **Hypovolemic shock**, circulatory failure
  - **Death m/b 4-24 hrs**
- **CHRONIC:**
  - **± Diarrhea or normal fecal output**
  - Chronic or intermittent colic
  - Depression, anorexia
  - **Weight loss**
  - ↓or absent intestinal sounds (ileus)
  - Mild dehydration
- **CHRONIC, LOCALIZED**
  - Debilitating, but no pain or temp.

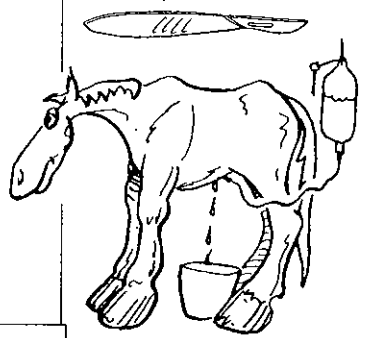


- **History, especially if postop**
- **Abdominocentesis** (difficult to interpret if postop)
  - ↑PMNs, macrophages (bacteria-free or phagocytized) & proteins
  - Cytology: determine chronicity
  - Gram stain bacteria
  - Creatinine (suspect uroperitoneum)
  - **↑Fibrinogen & PMNs:** suggests chronic infection in horses & cattle, ↑PMNs w/ acute & chronic infection, unlike dogs (↓w/ endotoxemia)
- **Lab:**
  - Acute leukopenia w/ toxic left shift, neutropenia
  - ↑PCV (dehydration)
- **Rectal exam:**
  - **Distended intestines**

"Dilution is Solution to Pollution"



- Tx underlying diz
- **Fluids, plasma** (CO)
- **Long term broad spec. ABs** (started, change if C&S indicates) (aminoglycoside w/ pen., Metronidazole for Bacteroides)
- NSAIDs for endotoxemia & colic
- **Exploratory Sx** once stabilized, to repair defect
- **Peritoneal lavage** (gallons of sterile saline in & siphoned off)
  - Lose protein, m/b hypoproteinemic
  - Standing lavage in flank & out ventral drains
- Withhold food until condition improves
- Heparin to ↓adhesion formation
- Feed hi protein/hi CHO diet



Prognosis:
- **Septic peritonitis frequently fatal despite intensive Tx**
- Chronic diarrhea w/ chronic peritonitis, poor

Colic

DIGESTIVE SYSTEM

Condition	Facts/Cause	Presentation/CS	Diagnosis	Treatment

Colic

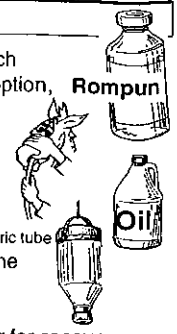
M8k 165; Mk 168; IM 124, 680; I2M 749; EM&S 514; E 524; C4T 174; C3T 190; M 206; S 348; Pic 42

- **Manifestation of abd. pain**
  - **Visceral abdominal pain** (pushing on abdomen doesn't cause pain unless touching effected organ)
  - **Parietal abdominal pain**: peritonitis
    . External palpation elicits pain
- **Basic causes**
  1• Distention of gut w/ fluid, gas or ingesta
  2• Pulling on root of mesentery
  - 3• Ischemia or infarction
- Horses: low threshold of pain, mild indigestion causes pain
- **If severe - shock**
  - Infarctive diz (volvulus, torsion, thromboembolism)
  - Severe visceral distention (extreme flatulence, impaction or dilation)
- **Severe, unrelenting pain potentially life threatening**
- **90% uncomplicated & respond to analgesic Tx**

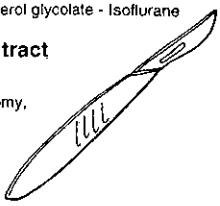
- **Signs of pain variable**, acute, chronic, or intermittent
  - Restlessness
  - Lying down & getting up
  - **Rolling**
  - **Sweating**
  - Kicking at abdomen
  - Sudden drop to ground in pain
  - **Flank watching**
  - Abnormal posturing
- **Self inflicted trauma**
- Anorexia & depression
- ↑ HR w/ weak pulse
- ↑ Capillary refill time
- Cold extremities
- Mucous membranes
  - Bright red (vasodilation) followed by dark red (vasoconstriction) if cardiovascular involvement
- **Shock if severe**

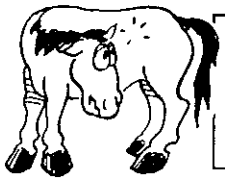
- **History** (Hx)
  - **Insurance**
- **10 P's** (see pg 56):
  - Physical exam (attitude, teeth, breath)
  - Pain - severity: continuous & progressive or intermittent
  - Pulse: **> 60 beats/min.**; pass nasogastric tube
    . Digital pulse - laminitis
  - Perfusion - mucous membranes, refill time, temp. extremities
  - Peristalsis: absent; ominous
  - Percussion: "ping" for gas
  - Pass nasogastric tube
  - Palpation per rectum
  - Peritoneal tap
    . Protein: normal < 2.5 g/dl
    . Cells: normal belw. 5-10,000
    . Bact. in WBCs or free
    . Plant material w/ WBCs: rupture = euthanasia
  - PCV & TPR
    - PCV ≤ 45% PCV: > 85% survival
      > 60% PCV: 25% survival

COLIC SURGERY OR MEDICINE? approach depending on value of horse, if Sx not an option, treat medically or euthanize (insurance?)



- **Medical Tx of Colic**
  - **Analgesia** - Xylazine DOC, Banamine®
  - **Decompression** - nasogastric tube
  - **Fluid** therapy, oral or IV, usually both
  - **Gallon of mineral oil**: need pump on nasogastric tube
  - NO phenothiazine tranquilizers, no atropine
- **Colic Surgery**
  - **Do NOT do unnecessary laparotomies**
  - **Earlier** the decision for surgery, the better for recovery
    . Stabilize before surgery, pre-op fluids, ABs - Ampicillin DOC, Banamine®
    . Anesthesia: - Xylazine/ketamine comb. w/ glycerol glycolate - Isoflurane
    . Dors. recumbency, ventral midline incision
  - **Work through all of the intestinal tract**
  - **Decompress intestine**
  - **Correct problem** (Pelvic flexure enterotomy, Small intestine - resection & anastomosis)
  - Post op:
    . Incidence of infection high
    . Abdominal bandaging
    . Fast 24 hr post op, started back on small. amount of hay
    . Intestinal motility stimulators (drugs), metoclopramide





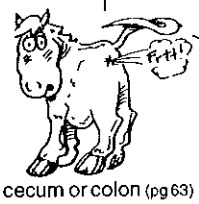
Abdominal pain
CS: Sequela - Shock
Dx: 10 P's
Sx or Rx Tx?
90% Respond to analgesics

CS requiring surgery
- Severe abd. pain poorly or nonresponsive to analgesics
- Discolored peritoneal fluid w/ ↑ prot., RBCs & WBCs
- Rectal exam: obstruction &/or displacement of viscera
- Progressive deterioration of cardiovascular status w/ abd. pain & uncertain Dx
- Significant gastric reflux
- Recurrent abdominal pain w/ uncertain cause

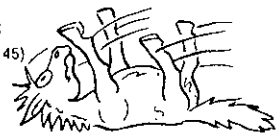
Prognosis:
- **Colic: excellent, 90% respond to analgesics**
- **Surgery: Guarded to poor**
  - 50% recovery from colic surgery
  - HR of 100, survival about 30%
  - PCV > 60%, 25% survival

CAUSES - COLIC

pg 337 or IM 127, 128



COMMON CAUSES:
- **GI - common causes**
  - Gas distention of intest., cecum or colon (pg 63)
  - Hypermotility & intestinal spasms (pg 63)
  - Feed impaction, constipation (pg 77, 78)
  - Meconium impaction (newborn) (pg 83)
  - Gastric ulcers (foal) (pg 26)
- **Extra - GI**
  - Mesenteric abscess (pg 65)
  - Ovarian tumor, abscess, or hematoma (pg 188)
  - Parturition (pg 224)
  - Acute hepatitis or hepatic lipidosis (pg 88)
  - Diaphragmatic hernia (pg 71)
  - Ruptured bladder (foal) (pg 155)
  - Urinary tract, urolithiasis (pg 152)
  - Uterine torsions (pg 232)
- **TOXIC CAUSES:**
  - Blister beetle (pg 45)
  - Warfarin (pg 143)
  - Herbicides
  - Lead (pg 269)
  - Phenylbutazone or other NSAIDs (pg 27)
  - Poisonous plants (pg 313-332)



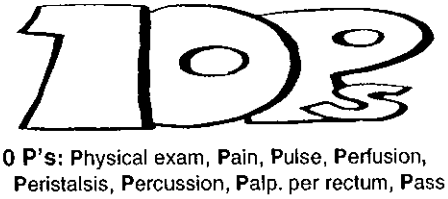
LESS & UNCOMMON CAUSES

(See pg 336 or IM 127, 128)

From *Large Animal Internal Medicine*, B.P. Smith, Mosby Co., pg. 127-128

DIAGNOSIS (expanded)

History (Hx)
- **Nature & duration** (continuous, severe colic worse than intermittent mild colic)
- **Progression of pain**
- **Medication** (given by owner or another vet that could mask pain)
  - Evaluate cardiovascular status before giving any drug
- **Initiating factors**: changes in diet, water consumption, exercise or weather; but m/ have no apparent initiating factors
- Deworming history
- Past episodes of colic, history of colic on farm?
- Breeding hist. (uterine torsions [late gestation], colonic impaction [postpartum], scrotal or inguinal hernias [stud])
- Feces: when last passed?
- Value of horse to owner, esp. if surgery possible
- **Insurance:** notify insurance carrier if surgery is considered, need permission



10 P's: Physical exam, Pain, Pulse, Perfusion, Peristalsis, Percussion, Palp. per rectum, Pass nasogastric tube, PCV & TPR & Peritoneal tap

1• Physical exam
- Attitude of horse
  . Fever &/or CNS depression rather than colic need medical Tx, not surgical usually
- Abrasions, rolling, or standing calmly
- Xylazine, better if not used (sometimes so painful, hard to examine w/o)
- **Sweating**
- **Abdominal distention**
  . Adult - distended flank - lg. intest. disorder causing obstruction & distention
  . Foal - distention w/ small or large intestinal lesions
- **TPR** - Rectal temp.
  . Respiratory rate (rate & quality [eupnea, tachypnea, dyspnea])
- Check teeth for points (poor mastication m/ predispose to intestinal impaction)
- Foul breath - implies anorectic or spontaneously refluxing gastric contents (suspect a serious disorder)

2• Pain- severity; continuous & progressive, or intermittent

3• Pulse
- Pulse (rate & quality [strong, fair, poor])
- Pulse rate > 52 beats/min of fair or poor quality = hypovolemia
- If pulse > 60 beats/min pass nasogastric tube immediately
- **Digital** - check at pasterns & monitor due to associated between abdominal disorder & laminitis, endotoxemia causing both

4• Perfusion

- Open mouth & check color of mucous membranes, capillary refill time
  . Pink, pale (peripheral vasoconstriction)
  . Light blue due to cyanosis
- Purple due to pre-capillary sphincter failure, pooling of deoxygenated blood, shock due to strangulation
- Feel temp. of extremities (ears & dist. limbs); Shock: ice cold

Hypovolemia &/or poor perfusion:
- Pulse rate > 52 beats/min of fair or poor quality
- Prolonged capillary refill time (> 2 sec)
- Poor skin turgor (dehydration)
- Cool extremities
- Need for fluid therapy

Colic - Diagnosis

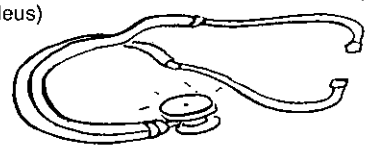
Colic

Mk 168; I2M 749; IM 680; EM&S 515; C3T 201; S 206, 348

Colic - diagnosis (cont.)

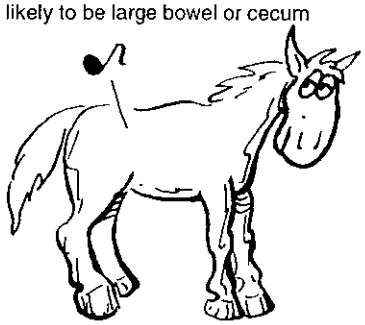
5• Peristalsis/auscultation: split the paralumbar fossa on each side into dorsal & ventral parts & listen for gurgling or silence

- **Borborygmi** (intestinal sounds)
  - . Present? a favorable sign (low-pitched progressive sounds in all 4 quadrants)
  - . **Absent? ominous**, suggests absence of motility (ileus)



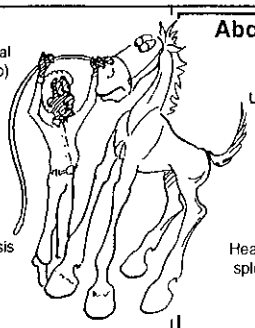
6• Percussion: flick abdomen, detect gas distended organs ("ping")

- Small bowel distention unlikely to hear
- "Ping" likely to be large bowel or cecum



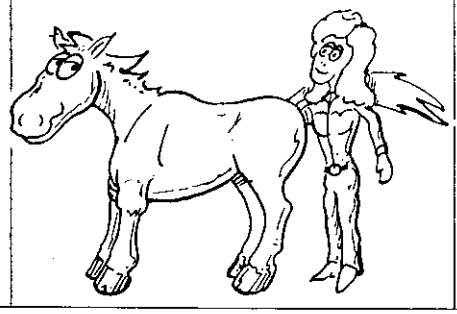
7• Passage of nasogastric tube

- Indicated for most, if not all colics
- If pulse > 60 beats/min pass immediately (can relieve pain & prevent stomach rupture)
- Stomach fluid (gastric reflux, siphoning)
  - . **Eval. for pH**
    - .. pH > 5 - alkaline, small intestinal contents (obstruction & back up)
    - .. pH < 5 acid, stomach contents
  - . **Evaluate for color**
    - .. Dark brown or coffee grounds - Suggests gastric or duodenal hemorrhage
    - .. Brown & foul - often in prox. enteritis (duodenitis/jejunitis)
    - .. Foul odor - assoc. w/ presence of blood, bile, or prolonged stasis

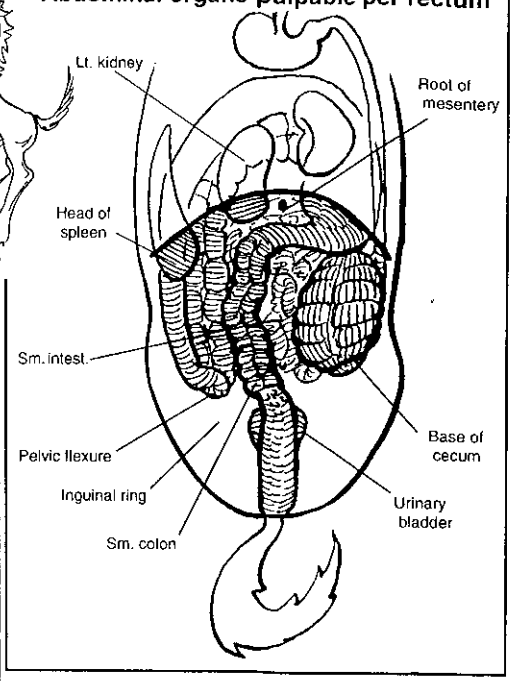


8• Palpation per rectum

- Used w/ PE & lab. to make presumptive Dx
- Only caudal abdominal accessible, 60% beyond reach
  - . Pelvic flexure impaction & nephrosplenic entrapment are among few that can be diagnosed rectally
- Easy to tear rectum (see box)
- **Feces** (hard & dry & mucous, or diarrhea)
  - . Look for sand (feces & water in rectal sleeve, sand settles out in fingers)
  - . Mucous & no feces suggests prolonged duration



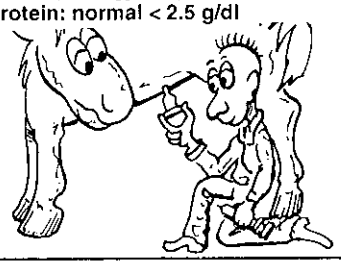
Abdominal organs palpable per rectum



- **Systematic palpation** (ID of structures difficult in obstruction, but information can be obtained)
  - . Left kidney, then across to spleen & nephrosplenic ligament
  - . **Distended bowel**, large or small intestine? 1 or many loops? Displaced? Impacted?
    - .. Distended loops always abnormal
    - .. Small colon (fecal balls & bands & sacculations)
    - .. Cecum (medial band) & ventral large colon (bands)
    - .. Try to find pelvic flexure (no bands felt, but has 1)
  - . **Gas or ingesta distention**
    - .. Gas & fluid: springs back following pressure
    - .. Ingesta: doughy & indents to pressure
    - .. Impacted - colon distended, heavy & hard to move
  - . Dehydration - colon contracted & sacculations distinct
  - . Palpate intestinal wall thickness, thickened indicates tissue edema (m/b strangulation needing Sx)
  - . Pain during palpation m/ help locate
  - . Inguinal rings
  - . Urinary bladder

9• Peritoneal tap - EDTA & Sterile tube

- **Color:** normally clear, straw-colored serous & doesn't coagulate
  - . Turbid: ↑ # of WBCs & protein
  - . Pink or red: free hemoglobin or hemorrhage
  - . Darker brown or green w/ fetid odor: bowel rupture suggested (do culture to confirm)
- **Protein: normal < 2.5 g/dl**



  - . > 2.5 g/dl: 1st sign of abnormality, inflammation or vascular occlusion & leakage of fluid & protein
- **Fibrinogen >10 mg/dl**: suggests acute inflammation or blood contamination
- **Cells** (WBCs): **normal between 5-10,000**
  - . >10,000: progressive vascular damage & diapedesis into abdomen
  - . ↑ WBCs & protein w/o ↑ RBCs: abdominal abscesses or peritonitis
- **Differential WBC count**
  - . Acute infection.: ↑ neutrophils
  - . Chronic: ↑ total WBCs + hi # of mononuclear cells
- **Bacteria in WBCs or free**: indicates ischemia & release of bacteria & endotoxins (poor Px), need to differentiate peritoneal fluid from intestinal fluid (needle into intestine)
  - . Peritoneal fluid: phagocytized bacteria w/in PMNs
  - . Intestine: numerous mixed bacteria, plant material & **few WBCs**
- **Plant material w/ WBCs:** rupture = euthanasia

10• PCV & TPP (packed cell volume & total plasma protein)

- Hydration status (↑ PCV = dehydration)
  - . PCV ≤ 45% - 85% survival
  - > 60% - 25% survival
  - . Serial measurements useful for response to fluid therapy
- WBCs in blood helps detect nonsurgical conditions
- **Electrolyte changes**
  - . Happens quickly, usually not severe changes, metabolic alkalosis or lactic acidosis
  - . Fluid therapy usually corrects

PROCEDURES:

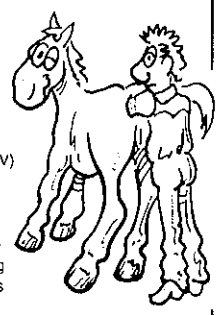
• PERITONEAL TAP:

- Ventral midline, caudal to xiphoid & to right of midline (to avoid spleen), lowest point of abdomen
- Teat cannula through nick in skin or 18-g 1.5" needle
  - . Peritoneum tents so push cannula through
- **Anticoagulant tube (EDTA)** for cytologic exam
- **Sterile tube** (w/o anticoagulants) for visual inspection & culture
- Wait patiently, drops will eventually appear

• PASSAGE OF NASOGASTRIC TUBE:

- Indicated for most if not all colics
- If pulse > 60 beats/min pass immediately (can relieve pain & prevent stomach rupture)
- Check for stomach fluid (gastric reflux) by siphoning
- Large diameter tube, if trouble getting it in, use xylazine
- Not easy: must work to siphon off GI contents, add water, negative pressure & move around
- Grain in stomach will continue to plug tube, keep pumping in water & keep trying

• PALPATION PER RECTUM:



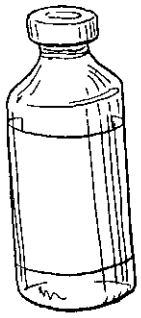
- Easy to tear rectum, so take necessary precautions
  - . Restraint (nose twitch, etc.)
  - . Tranquilize if necessary (Xylazine 0.3-0.5 mg/kg IV, can add butorphanol 0.01-0.02 mg/kg IV)
  - . Tenesmus - topical anesthetic into rectum (20 ml of lidocaine) or epidural
- **Lots of lubrication** on arm (many dehydrated), be gentle, don't fight peristaltic waves
- **Palpate backwards**: sigmoid loop (long mesocolon in front of pelvic inlet), so go in as far as possible initially & palpate backwards

Colic

Mk 168; IM 680; I2M 749; EM&S 515; C4T 179, 182; C3T 201

COLIC SURGERY OR MEDICINE?

- Approach depending on value of horse
  - If Sx not an option, treat medically or euthanize
  - Ask about insurance, must have permission to do Sx or to euthanize
- **Cardinal CS requiring surgery** (all m/ not be present)
  - Severe abdominal pain poorly or nonresponsive to analgesics
  - Discolored peritoneal fluid containing incr. prot., RBCs & WBCs
  - Rectal exam: obstruction &/or displacement of viscera
- **Other factors indicating surgery**
  - Progressive deterioration of cardiovascular status, w/ abdominal pain & uncertain Dx
  - Significant gastric reflux
  - Recurrent abdominal pain w/ uncertain etiology
- All cardinal signs m/not be present so make decision on a number of factors
  - History & signalment
    . Duration & severity of abd. pain &/or sweating
    .. Usually intest. tympany, spastic colic or gastric dilation improve in 2-4 hours
    . If uncertain do serial peritoneal fluid taps as a diagnostic aid
- **Do NOT do unnecessary laparotomies**
- **Earlier the decision for surgery the better for recovery**
  - Perform before bowel necrosis & marked changes in peritoneal fluid
    . Large intestine greater need for quick surgery than small because:
      .. Peritoneal changes later than in small
      .. Surgical resection harder
  - Often need to go to Sx before final Dx can be made
  - Many diagnoses not confirmed until exploratory laparotomy



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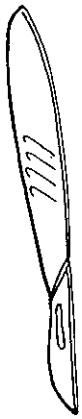


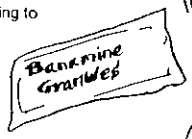
Medical Tx of Colic: 1) analgesia, 2) decompression 3) fluid therapy

1• **Analgesia** as soon as clinical exam is finished
- **Xylazine (Rompun®) DOC** most potent
  . Monitor, take away feed (muzzle), nasogastric tube
  . 20-30 min before wears off, interferes a little w/ GI motility
  - Dosage typical for sedation 300 mg/1000 lb horse IV

- **Banamine® (NSAIDs)** - onset slower, duration much longer, TID or BID, as w/ phenylbutazone get in vein, longer acting & m/ cover up some CS, so diagnosis first
  . Anti-endotoxic effect also

2• **Decompression**
- Nasogastric tube - stand to the side to do this!
- Decompress cecum w/ trochar, not very safe - only if going to surgery or if transporting 2-3 hours to hospital

3• **Fluids**: oral or IV, usually both
- **Oral fluids cheaper**, via nasogastric tube
  . 1-2 gallons every hour
  . **Not if refluxing**



- **Gallon of mineral oil** - need pump on nasogastric tube
  . If get it on the skin, wash off as it will cause scalding

- **DSS** (dioctyl sodium sulfosuccinate) - osmotically active surface acting agent) pulls fluid into impaction, 5% solution, 8 ounces in 4-6 L of water
  . **Need a hydrated patient**
- **IV fluids** - use 14 gauge or larger catheter at least 4 inches, can secure w/ super glue
  . Fastest way to soften impaction is IV fluids if $$$ is no problem
  . **Lactated Ringer's** (Fluid of Choice), but saline is OK if that is only one available
    .. Give at least distilled water, tap water will lyse RBCs - massive hemoglobinuria (red)
    .. Needs to be put in sterilely
    .. Cover w/ Betadyne® ointment
    .. Bandage
    .. Change every couple of days, must care for jugular veins or will get thromboembolism
    .. Attach extension tubing so you don't have to handle the catheter
    .. Use large 5 liter bags of fluids

- **Avoid peripheral vasodilators**: vasoconstriction in shock maintains atrial pressure to vital organs. Vasodilatation m/ cause catastrophic fall in blood pressure
  . NO phenothiazine tranquilizers

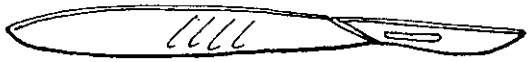
Prognosis EM&S 517; C3T 206

- Based on degree of pain, rectal exam findings, presence of gastric reflux & peritoneal fluid tap
- **50% recover from colic surgery**
  - **Resection & anastomosis, 75% die**
    . Must tell owners what chance this animal has to survive
- **Duration**: continuous uncontrollable pain negative prognosis
- **Guarded to poor prognosis if:**
  - Systolic blood pressure < 100 mm Hg or weak to impalpable pulse
  - HR > 80 bpm
    . HR of 100, survival about 30%
    . HR 120, purple mucous membranes, colons distended
    - Euthanize (waste of money to do Sx)
  - Cyanotic membranes bad sign
  - **PCV > 60% - bad**
  - Profound leukopenia
  - Blood lactate conc. > 8 mmol/L
  - Elev. BUN > 42 mg/dl
  - Blood pH < 7.28 concern
    . < 7.00 death eminent (normal 7.32 -7.44)
- **↓Survival rates associated w/:**
  - ↑Fibrin degradation products > 20 µg/ml
  - Prolonged PTT > 1.25
  - ↓antithrombin III < 85% control
  - ↓platelets < 100,000 µl
- **Bad rectal findings**
  - Distended small intestine (strangulation most common, so resection)
  - Large bowel: severe gas distension is negative sign (probably twisted & obstruction)
    . Grittiness or crepitation - bad sign (ruptured)

Bad Px
- **HR > 80 bpm**
- **PCV > 60%**
- **Uncontrollable pain**

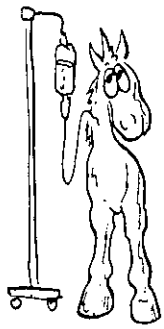
Colic Surgery

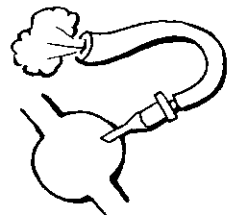
EM&S 518; CT 201; S 355, 210; LAS 437



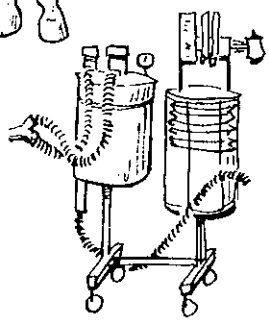
- Surgery for colic, the earlier the better
- **Decompress intestine**
- **Correct problem**

Stabilize before surgery

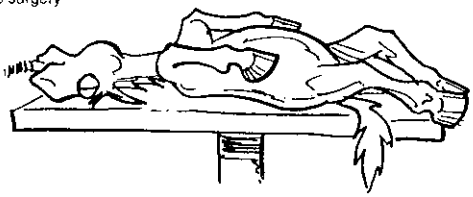




- Anesthesia major concern because m/b in shock
- **Do not waste excessive time**, many instances surgery before completely stabilized
- **Pre-op fluids** - hydration & acid/base balance & electrolyte imbalances corrected
- **Antibiotics - Ampicillin DOC** (pen gets anaerobes, except *Bacteroides fragilis*, not gram neg.)
  - Metronidazole (Flagyl®) for anaerobes, gentamicin - nephrotoxic
  - Sx will be clean-contaminated or contaminated if spillage
  - **Banamine®** (flunixin meglumine) for endotoxins released by worms & opening blockage



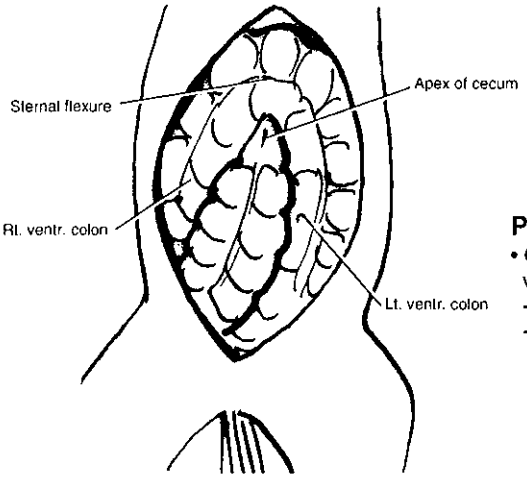
Anesthesia - ability to ventilate a horse a must in colic Sx
- **Xylazine/ketamine combined w/ glycerol glycolate** (centrally acting neuromuscular blocker) pre op. Then:
- **Isoflurane** (excreted through lungs 75% & least cardiovascular depressing)
  - Halothane more likely to potentiate arrhythmias due to epinephrine release & direct affect on arterial blood press. & depth of anesthesia
- **Clipping** done prior to induction
- **Intubate** in sternal recumbency (before going to surgery
  - Often has full stomach, may get reflux)
- Surgery can be fairly long: 3-4 hours
  - **Complication of myositis** - paralysis of limb, looking like radial n. paralysis - positioning & weight
  - Fast surgery to minimize anesthetic signs
  - Keep light (keep blood pressure up)
  - Support w/ fluids, well padded or floating on air bags
- **Dorsal recumbency**



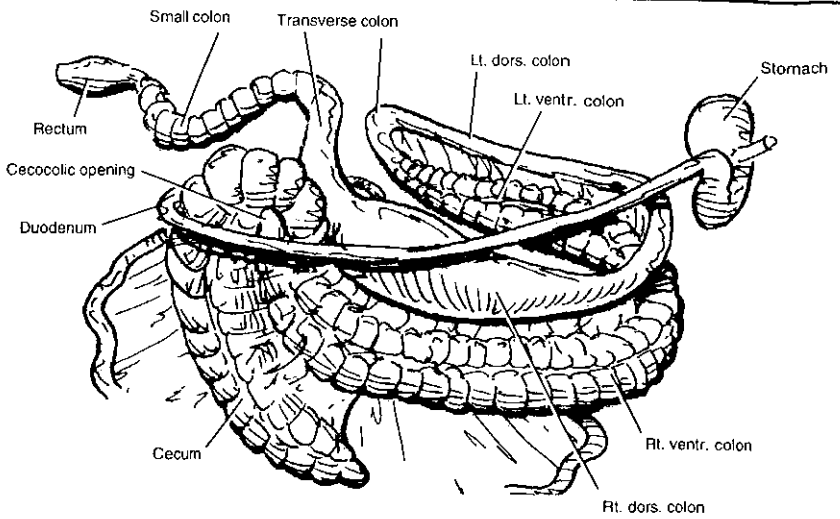
Exploratory laparotomy S 356

Ventral midline incision: less hemorrhagic, umbilicus to xiphoid cartilage

Open abdomen & note what you see
- **Apex of cecum** on ventral midline
- **Ventral colon** surrounds the apex
- **Abdominal cavity**:
  - Look for ingesta (bad Px)
  - Distended loops of intestine ballooning out incision,
    . Decompress w/ needle & tubing to continue exploration



Ventral Incision - Structures seen



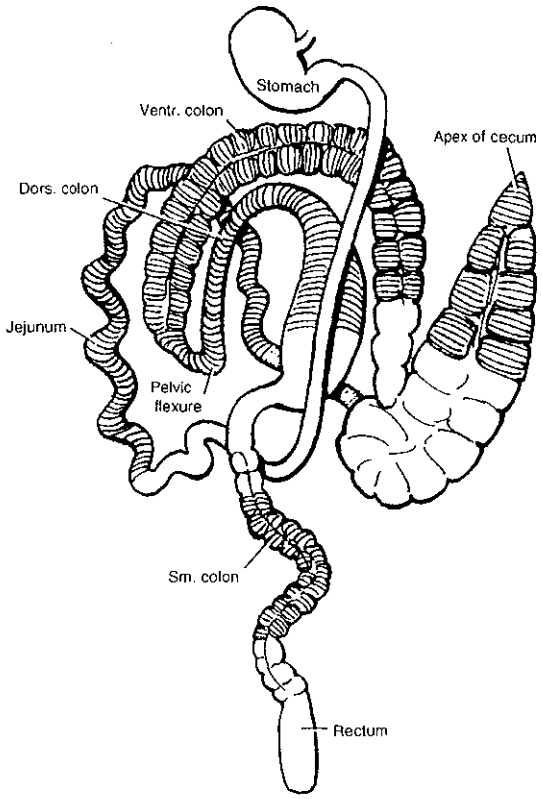
Preliminary exploration:
- Gently explore abdomen by gently sweeping viscera w/ hand
  - Cause of colic m/b immediately apparent
  - Look for:
    1. Turgid loops of bowl
    2. Hard masses
    3. Tight mesenteric bands
    4. Roughened peritoneal surfaces & fibrin adhesions
    5. Root of mesentery & connection of cecum & colon for volvulus

Deeper exploration: cecum is reference point
- If cause not apparent, systematically explore abdomen
- **Apex of cecum**: on ventral midline
- **Ventral colon** surrounds the apex (right ventral, sternal flexure, left ventral)
  - Note 4 bands & sacculations of ventral colon & cecum
  - Locate cecocolic lig. between lateral band of cecum & right ventral colon

Find small intestine
- **Ileocecal ligament**: pull apex of cecum up & locate the ligament connected to its dorsal band
- **Ileum** - follow ileocecal fold from cecum to ileum, or reach down left side of base of cecum to blindly find
- **Jejunum**: trace small intestine forward (pull out & replace, go along entire length, point thumb in direction your going to keep track)
  - Ascending duodenum becomes jejunum at duodenojejunal flexure
- **Ascending duodenum** located by its connection to small colon, duodenocolic ligament on left side of cecum (can't be exteriorized)
  - Duodenocolic ligament: connects ascending duodenum to the small colon
- **Descending duodenum:** reach between the base of the cecum and the right body wall dorsally (only tubular structure located here) (can't be exteriorized)
- **Pylorus**: found by following descending duodenum cranially (can't be exteriorized)
- **Liver**: located against right body wall & touching base of cecum
- **Right kidney**: nestled in the renal impression of the caudate lobe of the liver dorsally
- **Epiploic foramen** (opening between peritoneal cavity & omental bursa)
  - Pass your hand between the descending duodenum & right body wall to the liver & right kidney
  - If no bowel in this area, no need to check epiploic foramen
  - To enter epiploic foramen: pass finger under the caudate lobe of liver forward into epiploic foramen between portal vein (ventrally) & caudal vena cava (dorsally)

Find large intestine by returning to cecum
- **Cecum:** palpate up body to base in right paralumbar fossa
- **Body of cecum**: along right abdominal wall from base to apex (can be partially exteriorized)
- **Base of cecum** in right paralumbar fossa anchored to dorsal abdomen (can't be exteriorized)
- **Ventral colon**: around apex & body of cecum (4 bands)
- **Cecocolic lig.** pull up cecum & see connection between lateral band & right ventral colon
  - **Pelvic flexure**: found on left side near pelvic inlet, junction between ventral & dorsal colon

Pull out pelvic flexure very carefully or may tear, place on drape between horse's thighs or on a special table
- **Dorsal colon** (ID left dorsal, diaphragmatic flexure & right dorsal parts)
  - Left dorsal colon is small w/ 1 band in mesentery
  - Note right dorsal colon's stomach-like expansion (3 bands, but no noticeable sacculations)
- **Mesocolon** connects ventral & dorsal colon
  - Contains blood supply (colic branch to ventral colon & right colic artery to dorsal colon)
  - Connects to dorsal abdomen at root of mesentery
- **Small colon** (descending colon): located to left of base of cecum heading into pelvic cavity (2 bands, sacculations & **fecal balls**) (part can be exteriorized)
- **Transverse colon:** connects right dorsal colon w/ small colon
  - Transverses abdomen from right to left in front of cranial mesenteric artery
- **Spleen**: on left side attached to right kidney & against right body wall
- **Nephrosplenic ligament**: palpated in dorsal left side (find spleen & follow to ligament dorsally)



Structures that can be exteriorized through a ventral midline incision (shaded)

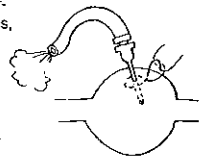
Abdominal Surgeries

Surgical team of several surgeons preferred, as colic surgery is very tiring

Surgeries (T&W-A 268, 383; LAS 443)

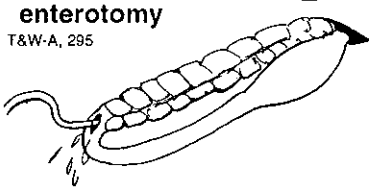
Decompression surgery

- Distended bowel (jejunum, cecum or large colon)
- Punctured w/ needle through purse string suture, tie as remove needle
  - 12-14-gauge needle attached to rubber tubing (through strong bands of large intestine)
- Don't do multiple enterotomies to decompress, end up w/ adhesions
- Do decompression in sections & milk to one opening



Pelvic flexure enterotomy

T&W-A, 295

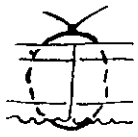


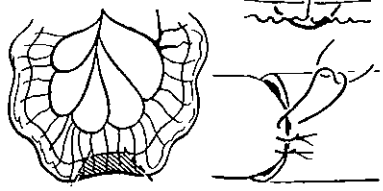
- Opened to empty out large colons (dirty, special table used))
- Incision toward ventral or dorsal colon, not in pelvic flexure
- Empty colon: **Garden hose** up enterotomy. May take up to hour of flushing (sand) to get all out. If enteroliths, must milk down to incision site. Closure of colon by direct apposition
- Wash & put GI back in correct position
- Other enterotomies also done: jejunum, cecum, large & small colons

End to end anastomosis

T&W-A 306; S 337

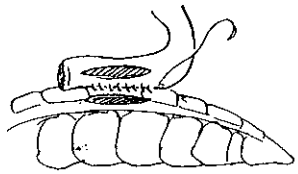
- Jejunum to jejunum
- Jejunum to small colon
- Large ventral colon





Small intestine - resection & anastomosis T&W-A 298

- M/ remove roughly half of small intestine in horse
  - If ≥60% get small bowel syndrome
  - About 50-60 feet of small intestine
- **Check viability**
  - Responds to pinch w/ peristalsis
  - Pink color indicates viability
  - Inject w/ fluorescein & see if fluoresces (not as reliable in horse as dog)
  - Dopplers used, oxygen tension, etc.
- **Procedure** - resection & anastomosis
  - **Occlude lumen** by making tiny hole in mesentery & tying a penrose drain tight enough to occlude (3-4" back from proposed cut)
  - **Angle cut across bowel**
    . Antimesenteric side of necrotic piece longer than mesenteric side so all remaining bowel retains blood supply
    . Angle important so large opening to help prevent constriction of lumen when healing
  - **Direct appositional closure** (can't invert or evert bowel as it shrinks lumen)
    . **Take full thickness**, but coming out at edge of mucosa (simple continuous, adhesions at knot of suturing)
  - **Close mesentery** (prevent internal hernias)



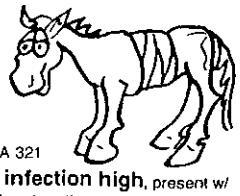
Side to side anastomosis

T&W-A 318; S 337

- Used to unite unequal sizes of bowel (adjacent segments of lg. colon w/ short mesocolon, jejunocecostomy, cecocolostomy, colocolostomy)
- Parker-Kerr oversew stumps
- 2 layer hand suturing technique usually
- **Jejunocecal anastomosis** (jejunocecostomy)
  - If ileum must be resected (can't anastomose jejunum to ileum because get tremendous thickening & blockage)
  - **Cut off ileum, leaving 6-8" blind stump** due to inability to exteriorize (connected to base of cecum)
  - Closed w/ a Parker-Kerr
  - **Anastomose end to side jejunum to dorsal band** of cecum as far towards base as possible

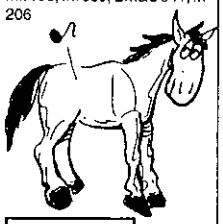
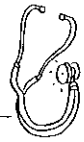
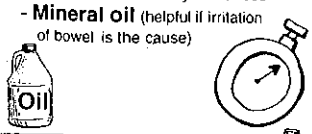
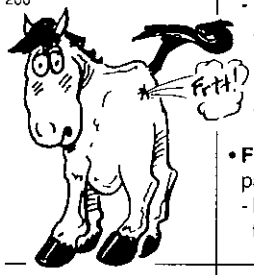
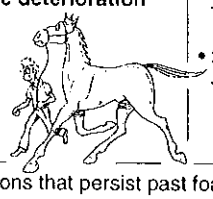
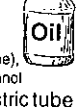
Closure of abdomen

- Large suture material, #2 Vicryl
- Near far/far near suture pattern (knot in near bites)
- Sometimes do simple interrupted
  - Speed is of essence
  - Important to lavage between layers
  - Then SQ & skin closure



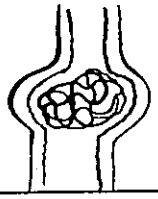
Postop T&W-A 321

- **Incidence of infection high**, present w/ temp. elev. after a few days, then may have diarrhea
  - Look closely at incision for pus (drain)
- **Abdominal bandaging** (Elasticon® right on skin, w/ sterile pad on incision, otherwise get lot of edema)
- Often need at least a week of intensive care to get them through, ileus, diarrhea, etc.
- Monitored by auscultation
- **Fast 24 hr post op**, depending on motility
  - **Started back on sm. amounts of hay**, no grain, or let graze for a bit, monitor, IV fluids 3-4 days, follow 10 P's
- Intestinal motility stimulators (drugs)
  - **Metoclopramide** better drug, if given too quickly causes CNS side effects, ataxic, excitable. Usually added to IV & given slowly
  - Neostigmine - parasympathomimetic
  - Rule out K & Ca problems 1st, make sure electrolytes normal
  - These drugs can be dangerous as they make the bowel contract
    . If enterolith, will contract over it, causing damage

Condition	Facts/Cause	Presentation/CS	Diagnosis	Treatment
Spastic colic Mk 168; IM 680; EM&S 541; M 206  **#1 Colic ? Spasms**	• Spasm & hypermotility of intest. tract • **Probably most common cause of colic** • **Pain caused by spasms** of gut • Hyperexcitable horses predisposed • Causes unknown, implicated: - Autonomic nervous system imbalances - Irritation of gut by parasites, enteritis & moldy feed - *S. vulgaris* • **Rarely life threatening** • **Spontaneous recovery common**	• **Loud gassy intestinal sounds** (m/b heard standing next to horse) • **Intermittent abdominal pain** - Acute onset, lasting several minutes - Patchy sweating on neck • **No systemic deterioration** • Frequent passage of feces • Spontaneous recovery common • Diarrhea suggests onset of enteritis 	• Clinical signs • **Auscultation**: loud rumbling borborygmi (frequently) • Pulse rate elevated • Rectal exam - normal 	• **Many spontaneously recover in 10-60 min** • If don't spontaneously recover - Dipyrone (antispasmotic, since spasms cause pain) - Rompun® (Xylazine) suppresses intestinal motility & an analgesic - **No atropine** as antispasmotic because m/ cause adynamic ileus - **Mineral oil** (helpful if irritation of bowel is the cause) 
Intestinal tympany & Flatulent colic Mk 168; IM 696; EM&S 542; M 206 	• **Accumulation of gas** in large colon or cecum • **1° tympany** - **Microbial fermentation of lush grass, grains or pelleted feeds** • **2° tympany** - **Obstruction** of colon or cecum . Mechanical: .. Fecoliths or enteroliths in sm. colon .. Large colon displacement . Functional .. Adynamic ileus • **Flatulent colic**: tympanic horse that passes large amount of gas - No obstruction - synonymous w/ 1° tympany	• **1° tympany** - Moderate to severe abd. pain . Usually intermittent - Bloat - **Flatulence** - Little systemic deterioration early • **2° tympany** - Severe distention of cecum & large colon - **Dyspnea** (pressure on diaphragm) - **Severe bloat** - **Systemic deterioration** **1° OK - 2° not**	• **Must DDx 1° from 2°** • **1° tympany** - **Flatulence** - Auscultation: gas sounds & loud borborygmi - Rectal: distended colon & cecum - Little systemic deterioration • **2° tympany** - No feces passed - **Systemic deterioration** 	• **DDx 1° from 2° tympany** • **1° tympany** - **Analgesics**: dipyrone, Banamine® (flunixin meglumine), Rompun® (xylazine), butorphanol - **Mineral oil** via nasogastric tube . Not if gastric distention (gas, fluid or ingesta) - Antifermentative Rx (questionable efficacy) - **Walking to promote flatus** - No need for trocharization if flatulence • **2° tympany** - **Usually require surgery, see cecal & colonic causes of colic** 
Postpartum colic E 1361	• See **REPRO pg. 240**; Common, normal postpartum pain caused by uterine contractions that persist past foaling • DDx from severe colic: Inversion of tip of uterine horn, rupture of vessel in broad ligament, trauma to large colon, uterine rupture			

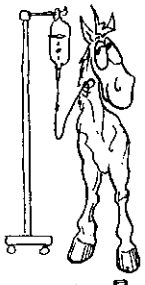
Small Intestinal Obstruction

Condition	Facts/Cause	Presentation/CS	Diagnosis	Treatment
Simple obstruction - small intestine M8k 23 160, 173; Mk 100; I2M 755; IM 685; EM&S 606; C2T 47; M 229; S 364; Pic 55, 42, 59	• **Obstruction w/o strangulation, uncommon, most obstruction are w/ strangulations** • **Secreting:** small intestine usually absorptive, w/ obstruction becomes a secreting organ - **Intestinal distention** (from saliva, fluids from pancreas, stomach & ingesta) - **Dehydration** - **Mucosal barrier intact initially** - **Loss of barrier w/ time** (distention causes necrosis of mucous membrane) . **Endotoxin absorption** • Partial or complete obstruction • Proximal or distal location . Proximal - rapid fluid into stomach, sequesters HCl	• **Partial obstruction** - **Slow onset** - **Slow dehydration** - **Mild pain** (anorexia, lethargy, pawing) • **Complete obstruction** - **Acute, sometimes violent colic** - **Severe hypovolemia** (dehydration) • **Proximal vs distal obstruction** - Proximal more intense - Stomach rupture if not treated	• **DDx from anterior enteritis first for Tx** • **Proximal obstruction** - **Metabolic alkalosis** (sequestration of HCl) - Prolonged m/b metabolic acidosis due to hypovolemic shock • Distal obstruction - Normal electrolytes until hypovolemic shock, then metab. acidosis • **Peritoneal fluid - normal** • **Rectal exam - distended loops**	• **Medical for partial obstruction & stable condition** - **IV Fluids** may soften things up - **Mineral oil** (laxative) (1 gal./1000 lbs.) . **Not if refluxing** into stomach - **Banamine®** • **Surgery if complete obstruction**, deteriorating condition or if peritoneal evidence of intestinal damage



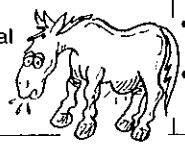
Uncommon, Absorber to secretor
CS: Dehydration, Pain
DDx: from anterior enteritis
Tx: Partial: Medical; Complete: Surgery

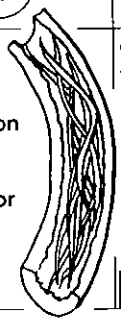
Types of Simple Obstruction
- Feed impaction (pg 64)
- Ascarid impaction (pg 65)
- Muscular hypertrophy of ileum (pg 65)
- Pedunculated lipoma (pg 67)
- Abdominal abscesses (pg 65)
- Adhesions (pg 66)
- Neoplasia (pg 66)
- Ileus (pg 66)

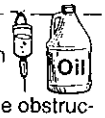


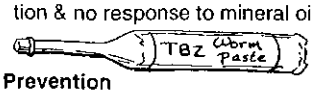
DDx from
• **Anterior enteritis** pg 67

• **Ascarid impaction, Ascariasis** M8k 174, 202; Mk 202; I2M 756; IM 685; EM&S 617; E 1411; J 606	• ***Parascaris equorum*** • **Foals & yearlings**, rare in adults • **Anthelmintics that paralyze worms** (piperazine, organophosphates, pyrantel) in heavily parasitized foals lead to obstruction or rupture • Obstruction: complete or partial • Migrate through lungs	• **Thin & potbellied** • **Poor hair coat** • **Colic** • **Complete obstruction** - **Severe pain** - **Reflux in stomach** • **Sequela: intestinal or gastric rupture** • **"Summer colds"** - Respiratory signs if lung migration	• **History: just dewormed** • Ascarids in feces (m/b no eggs) • Gastric distention, can't rectally palpate foals • Alkaline fluid in stomach (reflux) • Dehydration (↑ PCV, TPP) • Abdominocentesis: monitor for intestinal damage • Tx to see if problem stops	• Mineral oil if incomplete obstruction • Fluid • Enterotomy if complete obstruction & no response to mineral oil **Prevention** • Deworm at 8 wk-old, repeat at 6-8 wk intervals until yearling - Piperazine or any anthelmintic









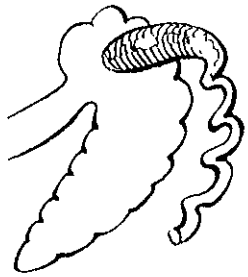
Potbellied - "Spaghetti"

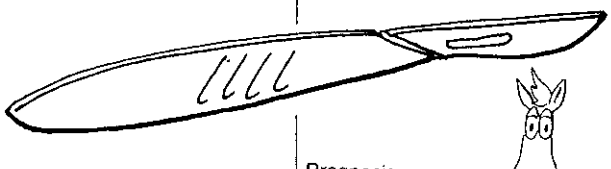
• Feed/Foreign body impaction: I2M 756 Large >> small intestine, distal ileal impaction observed, Cause unknown, Hi fiber diet contributes

• **Ileal impaction, Muscular hypertrophy of ileum** M8k 174; IM 686; I2M 756; EM&S 623; E 566; M 229; J 608; S 371; Pic 55, 60	• **Thickening of distal end of ileum** before it enters cecum (ileocecal valve) - Get dilatation, if total, backs up to stomach • M/ go from partial to complete	• **Incomplete to complete obstruction CS**	• No peritoneal fluid changes due to just thickening • No necrosis of tissue • Stenotic • **Laparotomy to confirm**	• **Ileomyotomy**, ↑ luminal diameter • Side to side anastomosis to bypass lesion Prognosis: • **Good** after surgery

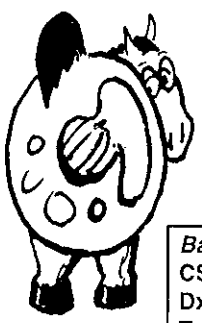
Associated w/ mucosal lesions
- *S. vulgaris* migration
- Intussusception
- Neurogenic stenosis w/ prolonged closure of ileocecal valve
- Idiopathic

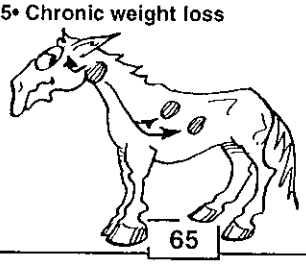
Thickened walled
CS: Obstruction
Dx & Tx: Exploratory ileomyotomy

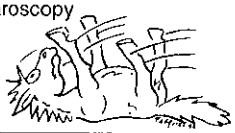


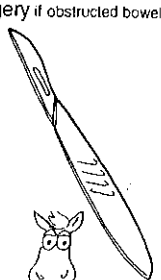


• **Abdominal abscesses** IM 687; I2M 757; EM&S 674; E 576; M 229	• ***Strep. equi*** (bastard strangles) ***Strep. zooepidemicus***, Corynebacterium, Salmonella, *E. coli* • **Mesentery most common site** • Also liver, spleen, kidney, umbilicus or uterus • < 5 yr-old • Routes of infection: - Respiratory infections spread via lymphatics, umbilical infections, hematogenous, foreign body penetration & parasite migration	1• **Fever of unknown origin** 2• **Intermittent/prolonged colic** - **small amount of leakage** from abscess, nonresponsive to Tx, depressed, off feed, mild ↑ in RR/HR, intermittent fever, variable GI signs 3• **Severe pain** - nonresponsive to analgesic Tx, go to Sx, abscess pressing on mesentery or causing **obstruction** 4• **Toxemia - rupture of abscess** 5• **Chronic weight loss**	• **Hx, CS** • **Rectal palpation** - **Peritoneal masses** (most cases) • **Laboratory** - **Neutrophilia, left shift** - **↑ fibrinogen** (> 500 mg/dl) - Abd. fluid - exudate - will vary . Cultures generally negative • Abdominal rads in small horses/foals - difficult to see unless gas cap is present • Ultrasound • **Exploratory laparotomy** (most diagnostic) • Laparoscopy	• **Conservative** - **Long term ABs** (weeks - months) - Analgesic - NSAIDs for endotoxemia • **Surgery** if significant bowel involvement - Remove if possible - Drain (marsupialization or through skin) - Bypass surgery if obstructed bowel **Prognosis:** • Good prognosis









***Bastard strangles*, Mesentery**
CS: Fever from where? Colic
Dx: Rectal, exploratory
Tx: Medical or Sx

Small Intestinal Obstruction (cont.)

Condition	Facts/Cause	Presentation/CS	Diagnosis	Treatment
• Adhesions JAVMA 211(12)1571,1997; M8k 174; IM 687; I2M 757; EM&S 609, 677; M 229; J 607	• **Cause simple or strangulation obstruction** • Nonelastic bands & restrictions • Multiple > single • **#1 peritonitis <15% of Sx develop adhesions** (in first 2 weeks), small bowel (adult), any abdominal Sx in foals **#1 peritonitis** **CS: Recurrent colic** **Dx: Hx, CS, exploratory** **Tx: Sx**	• **Recurrent colic** • **Obstruction or strangulation signs** **Causes:** •Trauma • Infection, FB (foreign bodies) • **#1 peritonitis** • Abdominal abscessation • Intestinal ischemia • ***S. vulgaris***	• **Hx (previous surgery)** • CS • **Exploratory laparotomy** • Rectal exam - Small intestine distention Consider if recurrent colic & recent surgery	• Medical if no obstruction • **Obstruction:** - **Surgical** resection if possible - **Intestinal bypass** (side to side) **Prognosis:** • Fair to good - single or localized • Poor: multiple • Poor if 2° to Sx • Euthanize if extensive **Prevention** of surgical adhesions • Meticulous surgical technique • AB's & NSAIDS • Frequent lavage of abdomen/ heparin
• Ileus IM 705; I2M 783; M 229; EM&S 516, 539; S 379	• **Lack of effective intestinal motility** - functional obstruction Cause: • **#1 Post op** • Exhaustion • Colic • Peritonitis • Septicemia • Hypoglycemia in foals • Atropine administration **#1 post op** **CS: Gastric reflux**	• **Gastric reflux** (hallmark) • **Intermittent colic** often • Systemic deterioration	• Hx, CS • ± Absence of borborygmi (intestinal sounds) • Systemic deterioration (↑ pulse rate, RR, capillary perfusion time, PCV) • Rectal: **Distended loops** • Abdominocentesis	• **Tx causes** • **Decompression** of small bowel • Nasogastric intubation - repeatedly • Rarely trocharize cecum • 2nd abd. surgery if refractory to med. Tx • Contraindicated: Rx that suppress intest. (atropine, glycopyrrolate & xylazine) • Regalan® (metoclopramide), • Walking horses every hour
• Neoplasia small intestine M8k 248; IM 687, J 607	• **Lipoma common** • **Obstruction** - Compression infiltration & stenosis or adhesions • **Metastasize to lymph nodes & liver** **Lipoma - Wt. loss**	• **Emaciated - weight loss** • **Obstruction CS** • **Diarrhea** • **Ascites** **Other neoplasms rare** (SCC [squamous cell carcinoma], intestinal lymphosarcoma, adenocarcinoma, leiomyoma [smooth muscle tumor], fibroma)	• Rectal palpation - masses • Flank laparotomy to confirm **Prognosis:** • Favorable if localized & no metastasis • **Poor to grave** - metastasis or extensive invasion	• **Surgical removal** if localized & no metastasis • **Surgical resection** m/b necessary • Check for metastasis

Anterior enteritis, "Duodenitis", **DPJ** **Duodenitis-proximal jejunitis** **Proximal enteritis** M8k 175; Mk 189; IM 655; I2M 719; EM&S 626; CT 211, C2T 44; M 228; Pic 70	• **DPJ** (Duodenitis-Proximal Jejunitis) • **Cause: unknown** • **Proximal** small intestine slows down, fluid & gas builds up, **refluxes into stomach** • **Adynamic ileus** • 1° in adult • **Mimics small intestinal obstruction so need to DDx right away** • **Untreated: shock or gastric rupture**	• **Acute onset moderate to severe colic** • **Gastric reflux**, enormous amounts • **Colic abates after decompression,** but horse remains depressed • ↑ Temperature, depressed • ± Toxemia • **Dehydrated**, injected oral membranes, increased HR • Begin w/ normal feces, but diarrhea m/b present in resolution stage • Tachycardia • **Complications:** - **Laminitis** - Renal dysfunction due to prolonged hypovolemia - Fibrous adhesions - Multifocal abscessation - Aspiration pneumonia (due to tubing) - Diarrhea in resolution stage - Peritonitis - **Shock or gastric rupture**	• **Decompression relieves colic** • ↓ Borborygma • Small intestine filled (not distended), palpable • Neutrophilia & toxic WBC, electrolyte abnormalities, hypochloremic, hypokalemic • ↑ PCV & TP (total protein), dehydration • **Metabolic acidosis** • **Abdominocentesis**: ↑ Protein, WBC normal/elevated • **Postmortem: definitive Dx** - Duodenum > jejunum - **Transmural hemorrhage**, mucosa to serosa, Necrosis of mucosa - **Thickened intestinal wall** - Moderate distention w/ reddish-brown fluid - Slough mucosal epithelium, 1° villi **DDx:** • **Small intestinal obstruction** (pg 64) • Gastric compression: - DPJ greatly relieved - Obstruction, continues to deteriorate • Rectal palpation - DPJ - slightly distended - Obstruction - greatly distended	• **Empirical** (since agent not known) • **Labor intensive, $$** • **Medical better Px than Sx** - **Continuous gastric decompression (indwelling nasogastric tube)** 3-7 days - Do not feed - **IV fluids** (m/b 40-60 L/d) for metabolic acidosis - **NSAIDs** (low dose flunixin meglumine) - **ABs** - penicillin, aminoglycosides - Analgesics m/b, xylazine (short-acting) - **Medical Tx usually enough:** • **Sx:** if over 7 days, excessive fluid loss or signs suggestive of intestinal obstruction • Laminitis prophylaxis - Analgesics (NSAIDs) - Heparin BID or TID **Prognosis:** • **Guarded**, aggressive Tx saves many • Poor prognosis for Surgery

Reflux, Mimics obstruction - DDx
CS: Acute colic
Dx: Decompress - Ahhhhh!!
Tx: Med (continuous nasal tube) better than Sx

Strangulation Obstructions

Condition	Facts/Cause	Presentation/CS	Diagnosis	Treatment
Strangulation /Obstructions - Small intestine IM 688; I2M2 758; EM&S 606; C3T 214; M 229; S 370; Pic 57, 42, 48	• **Long mesentery** allows # of ways to strangulate • Pathophysiology: - **Venous return stopped** - **Area swells** as arterial still pumps (stronger walls not closed initially) - Arterial supply then shut off - **Ischemia & necrosis** - **Loss of mucosal barrier** . **Bacteria & endotoxin** absorption systemic &/or peritoneal . Distention proximally . **Fluids & electrolytes** • **Dehydration** & hemoconcentration (fluid into intestine + lack of intake) - **Metabolic acidosis** & severe cardiopulmonary dysfunction (due to loss of electrolytes & endotoxin shock) - Peripheral perfusion markedly ↓ - ↑ **Lactate** formation - If rupture -> peritonitis	• **Clinical course - acute rapid & severe** • **Severe unrelenting pain** - Lay down, roll from side to side - Maintain dorsal recumbency to ease pain • Initially feces passed, then not • ↑ **HR** > 60 bpm • **Sweating** • ↑ **RR** (pain, distention, endotoxemia &/or metabolic acidosis) • **Dehydration** • No abdominal distention in adults, abdominal distention in foals	• **Clinical signs** • **Nasogastric tube** - **Enterogastric reflux:** relieves large amount (> 5 L) • Prolonged capillary refill time • **Dehydration** & hemoconcentration (fluid into intestine + lack of intake) - **PCV > 55%** grave Px, do not delay Sx more than 4 **hrs** • **Dark red conjunctiva** indicates complete obstruction • Auscultation - Initially peristaltic sounds - Later stops & only splashing sounds - **Silent abdomen ominous** • Lab: **Metabolic acidosis** • Rectal exam: - **Distended small intestinal loops** - Thickened intest walls (edema) • **Abdominocentesis**: rapid change - **Cloudy to serosanguinous & turbid** (normally clear yellow) - **TP > 3 g/dl** - ↑ **cell count** (norm. < 5,000) > 5000 - 100,000 - **Free bacteria & plant material** indicates intestine rupture & grave Px	• **Stabilize before surgery** - Intense fluid therapy - Correct Acid/base & electrolyte imbalances - **Don't waste time**, many instances surgery before completely balanced • **Surgery:** - **Decompress intestine** - **Correct problem** . Resection & anastomosis of nonviable sections

Vascular cut off - Necrosis
CS: Colic
Dx: Gastric reflux, dehydration
Tx: Stabilize - Surgery

Different types of strangulation
- Volvulus (pg 69)
- Strangulating lipomas (pg 69)
- External hernias (pg 70)
- Internal hernias (pg 73)
- Intussusception (pg 74)
- Meckel's diverticulum

Surgery
- Linea alba incision
- Handle distended loops w/ extreme care
- Decompress w/ purse string suture & needle
- Correct problem
- Close

Prognosis:
- Varies depends on extent of damage
- Guarded if resection required (89% died in 1 study, sounds grave to me)

Volvulus of small intestine

M8k 176; IM 689; I2M 759; EM&S 614; E 575; Pic 58

- **Very common**
- Strangulation usually (little fat as in cattle to prevent strangulation)
- 360° twist & strangulation
- **< 3 yrs** higher incidence (2-4 mo)
  - < 1 yr assoc. w/ ascarid impaction
  - Weaning period when diet changes
- Strangulating lipomas
- Hernias
- Ileum commonly involved (anchored to cecum & prone to vascular damage because of vascular architectural different than jejunum)

Causes:
- 1° w/ no predisposing factors
  - Ascarid impaction altering mobility
  - Diet changes altering mobility
- 2° to conditions providing fulcrum to twist on
  - Internal hernias (Epiploic foramen entrapment, Mesodiverticular bands, Meckel's diverticulum, Adhesions, Inguinal & mesenteric hernias, Gastrosplenic ligament, Mesovarium incarcerations)

2° Fulcrum
CS: Colic
Tx: Sx

- **Acute colic** (rolling, kicking)
- ↑ Pulse rate
- **Sweating**
- No distention of abd. in adults, abdominal distention in foals
- ↑ **RR** (pain, distention, endotoxemia &/or metabolic acidosis)
- **Dehydration**

- **Nasogastric tube**
  - **Enterogastric reflux**
- Prolonged capillary refill time
- **Dehydration**
  - PCV > 55% grave Px, do not delay Sx more than 4 hours
- **Dark red conjunctiva**
- **Silent abd. ominous sign**
- **Metabolic acidosis**
- Rectal exam:
  - **Distended small intestinal loops**
  - Thickened intest walls (edema)
- Abdominocentesis - rapid changes
  - **Cloudy & turbid**
  - **TP > 3 g/dl**
  - ↑ **cell count** > 5000 - 100,000
  - **Free bacteria & plant material**

- **Stabilize before surgery**
  - Intense fluid therapy
  - Acid/base balance & electrolytes
- **Don't waste excessive time**
- **Surgery**
  - **Decompress intestine**
  - **Correct problem**
  . Resection & anastomosis of nonviable sections

Prognosis:
- Varies dep. on extent of damage
- Grave if resection required

Strangulating lipomas

M8k 176; IM 689; I2M 759; EM&S 615; E 576; S 372; Pic 58

- **Pedunculated lipomas**
  - Mass of fat on a fibrovascular stalk of varying length
  - Usually arises from mesentery
- Older horses
- M/ twist around intestine & occlude vascular supply
  - **Strangulation**

Surgery

- **Acute colic** (rolling, kicking)
- ↑ Pulse rate
- **Sweating**
- No distention of abdomen in adults, distention in foals
- ↑ **RR** (pain, distention, endotoxemia &/or metabolic acidosis)
- **Dehydration**

- **Nasogastric tube**
  - **Enterogastric reflux**
- Prolonged capillary refill time
- **Dehydration**: PCV > 55% grave Px, do not delay Sx > 4 hrs
- **Dark red conjunctiva**
- **Silent abdomen: ominous**
- Lab - **Metabolic acidosis**
- Rectal: **distended small intestinal loops**
- Abdominocentesis - rapid changes
  - **Cloudy & turbid**
  - **TP > 3 g/dl**
  - ↑ **Cell count** > 5000 - 100,000
  - **Free bacteria & plant material**

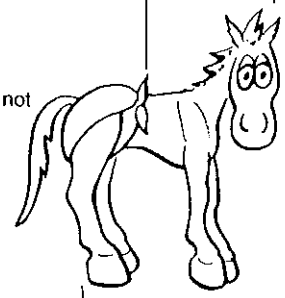
- **Stabilize before surgery**
  - Intense fluid therapy
  - Acid/base balance & electrolytes
- **Don't waste excessive time**
- **Surgery**
  - **Decompress intestine**
  - **Correct problem**
  . Resection & anastomosis of nonviable sections

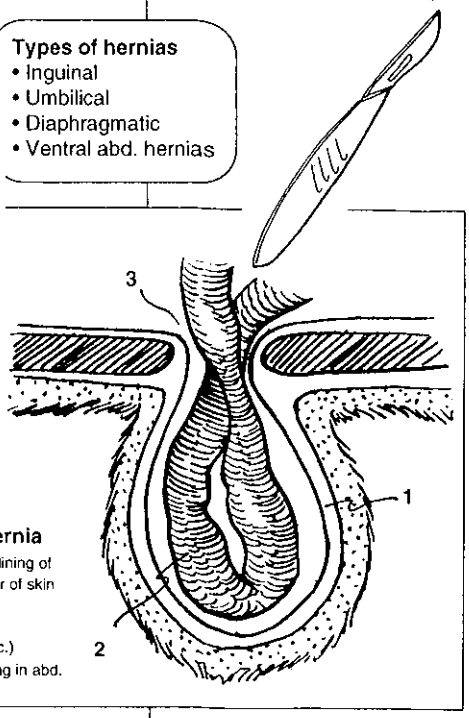
Prognosis:
- Varies dep. on extent of damage
- Guarded if resection required (89% died in 1 study, sounds grave to me!)

External Hernias

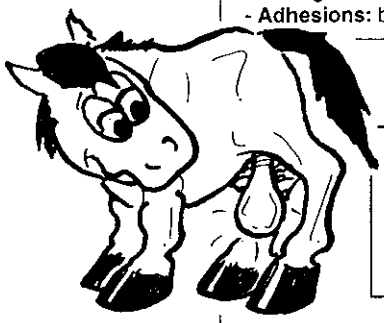
Condition	Facts/Cause	Presentation/CS	Diagnosis	Treatment
External hernias M8k 128; Mk 111; IM 690; I2M 759; EM&S 612; E 569; S 415; T&W-A 279	• **Protrusion of abdominal viscera through hole in abdominal wall** • **Classification:** - **Location** (umbilical, ventral, scrotal, inguinal, diaphragmatic, perineal) - **Contents** (enterocele [intestine], omentocele [omentum]) - **Condition:** reducible, irreducible, incarcerated, strangulated - **Cause**: inherited, traumatic, incisional • **Inherited**: if hernia at birth or develop shortly after - Animal should not be bred - Occasionally umbilical hernias develop after infection & are not consider inherited • Ventral hernias usually traumatic or incisional • **Condition** - **Reducible**: contents can be pushed back into abdomen, if small may disappear in time - **Incarceration of bowel**: m/b obstructed, but not compromise to vasculature - **Strangulation**: more serious, compromises blood supply - **Adhesions:** between sac & contents	• **Swelling** • Variable - No CS (incarcerated, no obstruction or strangulation) - Obstructive CS - Strangulation CS	• Hx, CS • Palpation	• **Most allow to spontaneously recover** • **Strangulation requires surgery**

Types of hernias
- Inguinal
- Umbilical
- Diaphragmatic
- Ventral abd. hernias



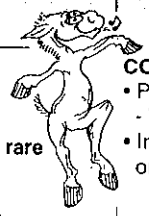


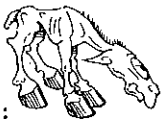
Parts of external hernia
1. **Hernial sac** - inner lining of peritoneum & outer layer of skin & subcutaneous tissue
2. **Hernial contents** (omentum, intestines etc.)
3. **Hernial ring** opening in abd. wall natural or acquired

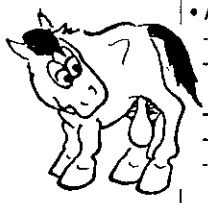


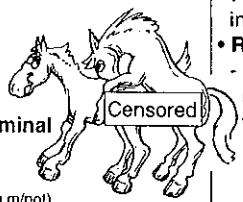
"Gut through wall"
CS: Variable: Swelling to strangulation
Dx: Hx, CS, PE
Tx: Most spontaneously heal
Strangulation: Sx

• **Inguinal hernias** M8k 129, 177; Mk 111; I2M 760; IM 690; EM&S 612, 684; E 670; T&W-A 333; S 419; T&W-A 279; R-Y 24; Pic 49	• **Newborn colts & adult stallions** • Direct or indirect (see box) • **NEWBORN COLTS** - Direct: strangulation - painful condition - Indirect usually reducible . Often corrects spontaneously w/ little CS - **Most commonly reducible & heal spontaneously** • **ADULT STALLION** - Acquired - **Unilateral & indirect usually** . Intestinal incarceration (not strangulation) - **Strangulation frequent** - **Left side > right** - Causes: Traumatic event, **breeding**, physical exertion	**COLT** (male foal) • **Indirect** - No CS • **Direct: strangulation: rare** - Depression &/or mild abdominal pain - Swelling over inguinal area . Skin cold & edematous . **Intestine not reducible** **STALLION:** • **Acute abdominal pain** • ± Swelling (if in inguinal ring m/not)	**COLT** • Palpation over inguinal canal - Try to reduce • Irreducible - strangulation or adhesions **STALLION:** • Palpation swelling over inguinal canal • **Rectal exam** - Intestine through inguinal ring (if can't palpate externally because just through canal)	• **Most nonstrangulated & spontaneously correct w/o surgery** (wait for Sx) • Surgery required when strangulation diagnosed - Castration **Direct or indirect** • **Direct: explodes through abdominal wall directly** pushing peritoneum ahead of it (has a peritoneal sac) • " Ruptured inguinal hernia" direct in foal usually through vaginal tunic (peritoneum) so intestine subQ w/ no peritoneal sac • **Indirect meanders through vaginal ring** (peritoneal ring) & down inguinal canal into vaginal cavity



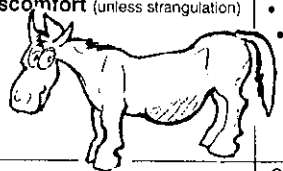


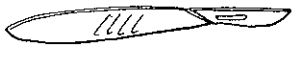




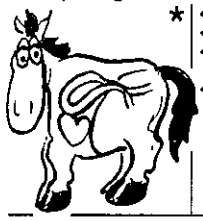
Colts: OK
Stallions: Strangulate

• **Abdominal wall/ventral hernia** Mk 111; I2M 761; IM 691; E 572; T&W-A 280; S 418	• **Acquired in ventral or ventrolateral abdominal wall** • **Cause**: direct trauma, parturition or incisional complications following abdominal surgery • **Strangulations - rare**	• **Mild discomfort** (unless strangulation)	• Hx, CS, PE • **Lump** under skin on ventral or ventrolateral abdominal wall	• **Wait for local inflammation to subside** & hernial ring to form • **Herniorrhaphy** after ring forms

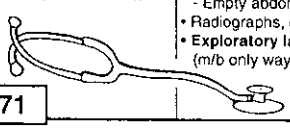


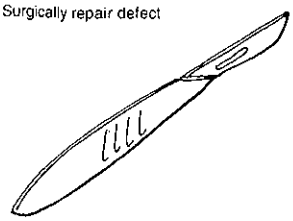


• **Diaphragmatic hernia** M8k 1058; Mk 111; IM 691; I2M 761; E 572; S 415; T&W-A 281; Pic 49



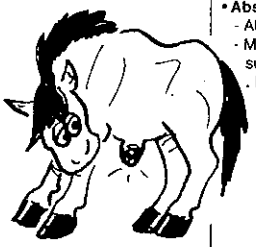
★ • **Rare in horse** • Acquired or congenital • Congenital - failure of fusion of diaphragmatic parts or compression during parturition • Acquired - trauma or i abdominal pressure (parturition, severe intestinal distention, strenuous exercise, direct blow) **Rare** **CS: Resp. & GI CS** **Tx: Sx**	• Vary due to amount of bowel & obstruction • **Both respiratory & GI CS** • **Acute colic m/b** • **Respiratory compromise**, exercise intolerance or lethargy m/b	• **Gastrointestinal sounds in thorax** m/b (not pathognomonic because normal horses m/ have referred sounds) • Muffled heart sound m/b • Rectal palpation - Empty abdomen m/b • Radiographs, especially in foals • **Exploratory laparotomy** (m/b only way to get definitive Dx)	• Surgically repair defect





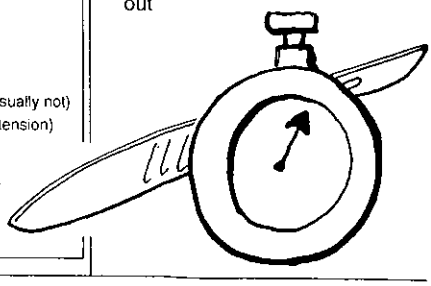
Hernias (cont.)

Condition	Facts/Cause	Presentation/CS	Diagnosis	Treatment
• Umbilical hernia, **Omphaloceles** M8k 129; Mk 111; IM 691; I2M 761; C4T 601; EM&S 613, 683; E 671; M 229; S 374; T&W-A 280; Pic 49, 50; Pop 98-5/98	• **#2 congenital lesion in horses** • **Acquired** (after birth) (predisposing factors) - Manually breaking umbilical cord - Infection of umbilicus (omphalophlebitis) - Excessive straining - Ligation of cord instead of leaving untied • **Types:** - **Most uncomplicated, small (< 2 ")** which spontaneously close w/ time . **Reducible viscera through ring:** hallmark - **Rare: strangulating intestinal obstruction** - **"Richter's hernias"**: incomplete obstruction, some ingesta passes • 1° DDx for lumps on bellies of foals • Incarceration: jejunum, ileum, ventral colon, cecum or omentum • **Abscesses in umbilicus common cause of hernia** - Abscesses w/ hernia, or just abscess & no hernia - Must differentiated abscess from hernia prior to surgery . Physical exam & needle aspiration	• **Uncomplicated small or reducible hernias** - None, spontaneously reduce • Strangulation - rare - ↑ in size of hernia - Warmth, firmness, edema & pain on palpation • Enterocutaneous fistula - Weight loss - Electrolyte imbalance • Sequelae: - Abscess formation - Enterocutaneous fistula to outside (intestinal rupture to outside), rare . Loss of intestinal fluid & ingesta	• Swelling at umbilicus  **DDx:** **• Umbilical abscesses**	• **Most self reducing** - Custom to wait 6-12 mo before surgery on small hernias • **Large hernias need help** - Counterirritants used freely in past (hydrochloric acid applied to sac to get scarring [cicatrizing] reaction) • Belts to hold hernia in while heals • **Skewers or clamps** (hernias < 3") - Keep hernia reduced & cause sac to slough • **"Open reduction" surgery** (see box) • **Mesh: rarely required** to fill wall defect that can't close due to tension - Marlex® mesh or Proxplast® - Can't place where infection - absorbable • **Abscess & hernia** - Open & drain abscess, flush w/ Betadyne® - Repair hernia later . Hernia m/ heal after abscess drained - Small abscesses m/b dissected out



#2 congenital lesion
CS: Most asymptomatic
Dx: Hx, CS, PE
Tx: Time (most heal spontaneously)

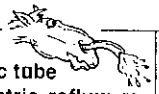
"Open reduction" surgery
- General anesthesia in dorsal recumbency, sterile prep
- **Fusiform incision** around hernial sac
- Dissect skin away from sac & throw away
- **Invert hernial sac** into abdomen
- Or remove sac after viscera returned to abdomen
- Check intestine to see if need to be resected & anastomosed (usually not)
- **"Vest-over-pants" closure** of abd. wall (causes more tension)
- Preplace overlapping horizontal mattress sutures
- Draw all sutures tight & individually tie sutures
- Free overlapping edge sutured to fascia w/ a continuous pattern
- Close subQ w/ continuous pattern
- Close skin w/ interrupted pattern (nonabsorbable silk, nylon, polypropylene, polyester, Vetafil®)

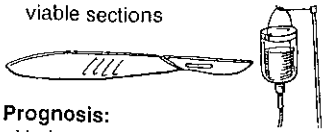


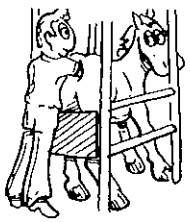
Internal hernias M8k 176; IM 689; I2M 759; E 569; M 229; S 421, 368, 373; Pic 48; T&W-A 274	• Displacement of intestine through a normal or pathologic foramen w/in abdominal cavity w/out presence of hernial sac • **Simple or strangulation obstruction** • Incarceration - intestine goes through hole & gets trapped • Types - **Mesenteric defects,** acquired or congenital (gastrosplenic, cecocolic, broad ligament) - Congenital fibrous bands or adhesions - Epiploic foramen	• Similar to other strangulations • **Clinical course - acute rapid & severe** • **Severe unrelenting pain** • **↑ HR** > 60 bpm • Prolonged capillary refill time • **↑ RR** (pain, distention, endotoxemia &/or metabolic acidosis) • **Dehydration** & hemoconcentration (fluid into intestine + lack of intake)	• **Hx, CS, PE** • **Nasogastric tube** - **Enterogastric reflux**: relieves large amount (> 5 L) • Rectal exam: - **Distended small intestinal loops** - Epiploic m/be too far cranial - Thick intestinal walls (edema) • Abdominocentesis: - **Cloudy to serosanguinous & turbid** (normally clear yellow) - **TP > 3 g/dl** - **↑ cell count** (normal < 5,000) > 5000 - 100,000 - **Free bacteria** & plant material indicates intestinal rupture & poor Px	• **Stabilize before surgery** - Intense fluid therapy - Correct acid/base & electrolyte imbalances • **Don't waste excessive time,** many instances surgery before completely balanced • **Surgery:** - **Decompress intestine** - **Correct problem** - Resection & anastomoses of nonviable sections **Prognosis:** • Varies dep. on extent of damage • Guarded if resection required

Strangulation
CS: Colic
Tx: Sx resection & anastomosis

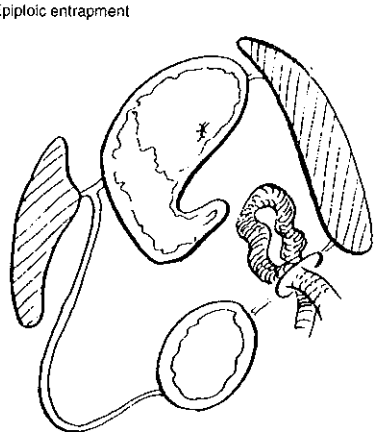
Internal vs External
- **Internal** often causes **strangulation**/intestinal obstruction
- **External often doesn't** cause strangulation

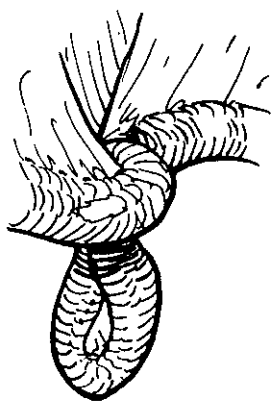




• Epiploic entrapment	• Epiploic foramen (Foramen of Winslow) - Opening betw. peritoneal cavity & omental bursa • Location - rt. dorsal abdomen - Beneath caudate lobe of liver - Betw. caud. vena cava & portal vein • **Old horse more susceptible** - **Hepatic atrophy** ↑ size of foramen	
• Gastrosplenic ligament entrapment	• Gastrosplenic ligament: between left greater curvature of stomach & spleen • Distal jejunum & ileum most commonly incarcerated	
• Mesodiverticular bands	• Connective tissue that forms between mesentery & antimesenteric border of small intestine • Forms a passage for a possible internal hernia	

Epiploic entrapment





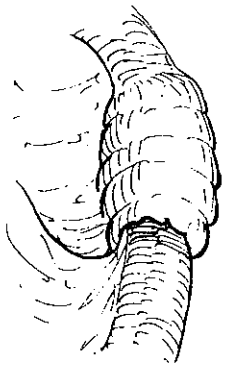
Mesodiverticular bands

Strangulation

Condition	Facts/Cause	Presentation/CS	Diagnosis	Treatment

Intussusception

M8k 175; IM 692; I2M 762; EM&S 613; E 574; M 229; S 369; T&W-A 271; Pic 55



- **Telescoping** of a piece of bowel into an adjacent segment
- **Frequent** in < 3-yr-olds (less in adults)
- **Ileum** or **ileocecal junction** most common
  - **2-3 ft** usual length
  - **Ileal-ileal: partial obstruction**
  - **Jejunal-jejunal** or **ileocecal: complete obstruction**
- Cause: change **in intestinal motility** (see box)
- **No classical CS or strangulation,** blood supply to inside piece strangulated
  - **Minimal systemic absorption of bacteria & endotoxins**
- **Obstruction**
  - **Distends proximally**
  - **Empties distally**
- Pathophysiology of strangulation:
  - Venous return stopped
  - Swells as arteries still pumps
  - Arterial supply then shut off
  - Ischemia & necrosis
    . If rupture = peritonitis

- **Ileal-ileal** (partial obstruction)
  - **Chronic abdominal pain**
- **Jejunal or ileocecal** (complete obstruction)
  - **Acute**
  - **Colic** (kicking)
  - Depression, anorexia
  - Gradually shocky & dehydrated
  - Fever if peritonitis develops

- **Hx, CS**
- **Peritoneal tap**
  - M/b normal because damaged intestinal isolated
  - ↑ RBC, WBC & protein
  - Bacteria if rupture
- **Rectal exam** Dx 50% of intussusceptions
  - **Distended loops**
  - M/ palpate intussusception
    . Painful & firm
  - Ileocecal: m/ feel firm, turgid intestine w/in cecum
- **Exploratory**

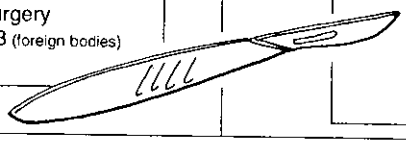
- **Stabilize before surgery**
  - Intense fluid therapy
  - Correct acid/base & electrolyte imbalances
- **Don't waste excessive time,** many instances Sx before completely balanced
- **Surgery**
  - **Decompress intestine**
  - **Surgical resection & anastomosis** (never reducible)
  - Necrotic bowel

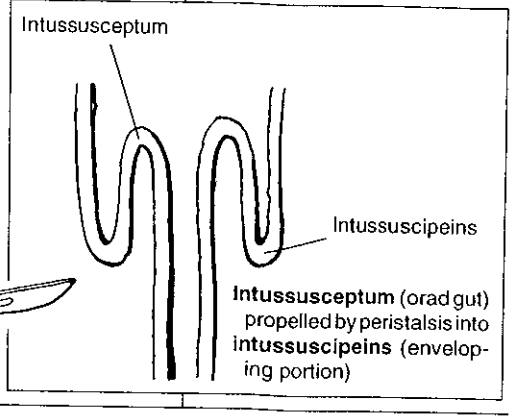
Prognosis:

- Depends on duration, damage & intestine involved
- **Ileal-ileal better** than jejunal or ileocecal

Causes - change in motility

- Enteritis
- Intestinal polyps
- Diet changes
- Heavy ascarid load
- Tapeworm (*A. perfoliata*)
- Parasite migration
- Anthelmintic treatment
- Intestinal surgery
- Intestinal FB (foreign bodies)

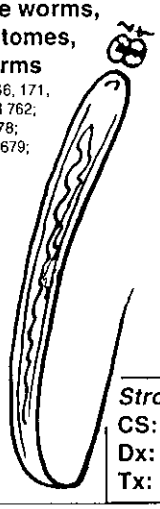




Obstruction & strangulation, ileocecal
CS: No classic CS
Dx: Hx, CS, Tap, Rectal
Tx: Surgical resection & Anastomosis

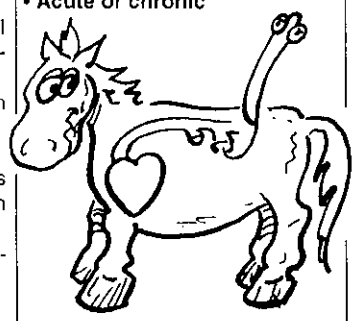
Nonstrangulating infarction, *Strongylus vulgaris*, Blood worms, Palisade worms, Sclerostomes, Red worms

M8k 202, 166, 171, Mk 202; I2M 762; IM 692; E 578; EM&S 538, 679; C2T 70; S 375, 399

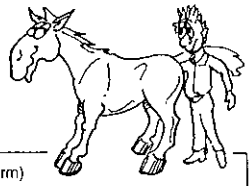


- **Cause:**
  - ***Strongylus vulgaris***
  - **Shock**
- ***S. vulgaris*** (blood worm)
  - **Verminous arteritis**
  - **Thrombus in walls of cranial mesenteric or ileocolic arteries** (larvae inside wall)
- History: recently moved to high parasite area
- **Pathophysiology:**
  - Emboli or vasoactive substances from thrombus cause obstruction or constriction of vessels
  - Ischemia (lack or oxygen) resulting in infarction of intestine

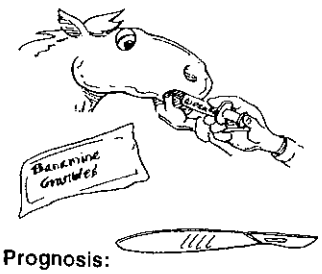
- **Obstruction** - variable CS
- Fever
- Depression
- **Colic** (abdominal pain)
- **Acute or chronic**



- **Dx difficult** -presumptive
  - Often suspected on history, exam, CS & peritoneal fluid
  - Difficult w/o exploratory
- Hx often recently moved to hi parasite area
- **Rectal exam inconclusive**
  - Enlarged mesenteric a., m/ b chronic inactive lesion
- Fecal - m/b CS before patent
- Peritoneal tap
  - M/b hi # of cells (variable)
- **Exploratory** - definitive Dx (don't want to do if don't have to)
- Postmortem: definitive Dx, but a little late



- **Mild CS & suspected** *S. vulgaris*
  - **Ivermectin** every 2 mo for life see pg 14
  - **Banamine®** (flunixin meglumine) reduce inflammation & endotoxins
  - Aspirin m/b for anticoagulant (not proven)
- Surgery
  - Resection & anastomosis



Prognosis:

- Depending on severity & extent of necrosis
- **Poor:** if surgery & extensive resection
- **Good: mild colic episode**

Prevention:

- **Effective anthelmintic program** & farm management

***Strongylus vulgaris*, Cran. mesenteric a.**
CS: Colic
Dx: Difficult
Tx: Ivermectin

S. vulgaris (blood worm)

- Diz during all 3 migratory phases
  - Initial migration through intestinal wall
  - 4th stage larvae migrate through vascular system to cranial mesenteric a.
  - 5th stage larvae migrate back through mucosa into lumen of intest

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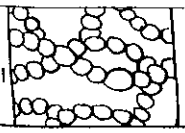
Ergotism, Ergot

- See TOX pg 330; **Parasitic fungi, *Claviceps*** of rye, oats, wheat & Kentucky blue grass, Paspalum or Dallis grass)
- **CS:** **GI** - Vomiting, **colic** & constipation or diarrhea, Lameness, **Gangrenous ergotism** of extremities, **Convulsive** ergotism
- **Tx:** Remove contaminated grain, Supportive Tx, Supplemental feeding, Antibiotics, **Pain control**

Toxic blue - green algae

- See TOX pg 324, **Ruminants more sensitive than monogastrics**
- **CS:** Acute death, **colic**, bloody, **diarrhea, dyspnea,** ± **CNS**: seizures, photosensitization, **hepatic diz**
- **Tx:** No specific antidote, **Often animal dead or dying, before Tx**, Supportive care, Activated charcoal & oil
- **Px:** Poor, die in 24 hrs



Cecum

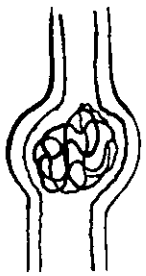
Condition	Facts/Cause	Presentation/CS	Diagnosis	Treatment
Cecal tympanitis IM 696; I2M 766	• 1° tympanitis (gas distention) - **rare** • **Usually 2° other problems (large intestinal obstruction)**	• **1° tympanitis** - Acute abdominal pain - Breathing problems (pressure on thorax from enlarged cecum) - Appear bloated	• **"Ping" in right flank** (percussion & auscultation) • Rectal exam: - Distended base of cecum in right paralumbar region • If repeated decompression needed than probably 2 condition	• Correct problems w/ motility • **Relieve distention** (see box) - Trocharization & decompression - **Cover w/ antibiotics** • **Xylazine (Rompun®)** if severe pain (avoid repeated use because of effect on motility)
	2° large intestinal obstruction **Dx: "Ping" in rt. flank** **Tx: Decompress**			**Trocharization & decompression** • Through right flank • Large trochar or 14 gauge catheter • Aseptically • Still causes peritonitis (usually benign) • **Cover w/ antibiotics,** especially if fever **Prognosis:** • **Good for 1°** • 2° depends on 1° condition
Cecal intussusception IM 697; I2M 767; EM&S 632; E 632; T&W-A 290; S 389; Pic 56	• **Apex into cecum** (cecocecal) or right ventral colon into cecum (cecocolic) • Causes uncertain - Verminous arteritis - *Anaplocephala perfoliata* (tapeworm) (pg 77) - Intramural masses - Organophosphate compounds	• **Mild-to-moderate colic** (incomplete obstruction, ingesta passes into large colon) • Severe & unrelenting colic (complete obstruction)	• Clinical signs (CS) • **Rectal exam** - Mass in cecum - Retraction of cecum eliciting pain m/b	• **Surgical correction required** - Ventral median celiotomy - Manually reduce - Resect nonviable cecum • Often impossible to reduce cecocolic intussusception - Enterotomy in right ventral colon to assist reduction - Partial typhlectomy (removal of cecum) - Difficult to control contamination
	Apex into cecum **CS: Mild colic** **Dx: Rectal exam** **Sx: correction**			
Cecal impaction IM 697; I2M 767; T&W-A 283; S 386	• 1° condition or • **2° to post operative** • Predisposing to 1° impaction - Poor nutrition or dentition - Dietary changes - Previous colic • Risk of rupture	• ↓ Feces • Anorexia • Mild-to-moderate pain • **If after anesthesia** **- Severe pain of short duration**	• Rectal exam: **- Firm, heavy cecum** in right paralumbar fossa	• **Tx controversial** **- Medicine or Sx?** (see box) • Medical - Banamine® control & monitor pain **- IV or oral fluids** (extensive amounts to soften) - Mineral oil - Saline cathartics (Epsom salts) - Often sufficient for 1° impaction of short duration **- Risk of cecal rupture & poor response to medical Tx** • **Immediate surgery** **- Cecocolic anastomosis** . Easiest w/ stapler due to being unable to exteriorize . Cecum atrophies to some degree
	Post op sequela	**Cecal perforation** (S 388): Uniformly **fatal diz**; idiopathic in brood mares near parturition or 2° to cecal motility disruption leading to impaction		
Cecal volvulus IM 698; I2M 768; T&W-A 290; S 397; Pic 60	• 1° rare • **Usually 2° to large colon volvulus** • ≥ 270° obstruction of blood vessels & tissue damage	• **Acute colic** • Balloted on right side • Systemic shock	• **"Pinging" in right flank** • Rectal exam - Large, distended, often edematous cecum	• **Laparotomy** **- Decompression** **- Correction of cecal torsion**
	2° to lg. bowel volvulus **CS: Colic** **Dx: Ping** **Tx: Sx**			
Tapeworm infection M8k 205; Mk 204; IM 689, 692; I2M 1697; EM&S 618; Pic 75	• *Anaplocephala perfolata* (most common): ileocecal junction, cecum • *Paranaplocephala mamillana* - duodenum & jejunum • *Anaplocephala magna* - sm. intest, cecum • Young more than old horses • Life cycle indirect through orbatid mite • **Not proven to cause clinical disease,** implicated in intussusception of small intestine & small intestinal impaction • **Tx:** Pyrantel pamoate (2 x normal dose) or Niclosamide (100 mg/kg)			

Large Colon

Condition	Facts/Cause	Presentation/SC	Diagnosis	Treatment

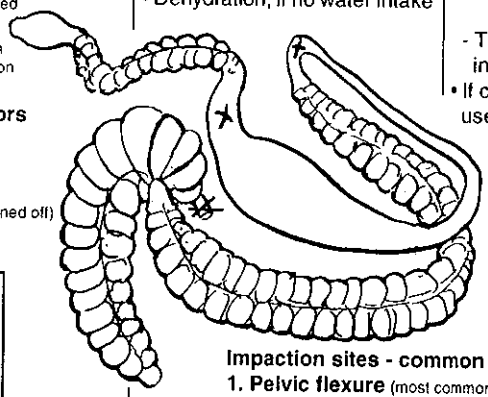
Impaction - large colon

M8k 177; IM 698; I2M 768; E 561; C2T 53; M 230; S 390; T&W-A 283; Pic 61

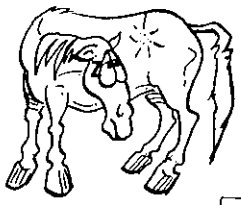


- **#1 cause of colic**
- **Simple obstruction** much more common than strangulation obstruction
- **#1 Feed impaction** of large intestine due to decrease in diameter size at pelvic flexure & transverse colon. Cecum & small colon also become impacted
- Ileocolic impaction due to hypertrophy of ilium or ileocecal intussusception
- No reflux
- **Predisposing factors**
  - Coarse feed
  - Poor dentition
  - Dehydration (common when water turned off)
  - Cold weather
  - ↓ Water intake

- **Mild to moderate pain**
- **↓ Fecal output**
- Feces hard, dry & often mucous covered
- Progressive anorexia due to no dietary intake
- Dehydration, if no water intake



- CS, History (Hx)
- Rectal exam:
  - **Firm ingesta-filled colon**
    - Pelvic flexure (junction between sacculated ventral & nonsacculated dorsal colons)
    - M/not be able to find; usually just forward of pelvic inlet on left side of abdomen
  - Transverse colon rectal exam inconclusive
- If can't make Dx by rectal exam use CS & rule out other causes



CONSERVATIVE - aggressive

- **Fluid**, lots, 2 large bore catheters in both jugular veins - soften up
  - Oral fluids (if no reflux), IV
- **Gallon of mineral oil** (laxative) by stomach tube every 12-24 hours
- **DSS** (anionic surfactant) (hi doses & prolonged Tx results in diarrhea)
- **Saline cathartics** (Mg sulfate or Epsom salts) retain water by osmotic properties, thus softening impaction
  - Need adequate hydration

SURGERY: **often burst** when try surgery
- Be aggressive in medical therapy

Prognosis:
- If reach early can shift quickly
- If late, pelvic flexure will rot

#1 Colic, Feed impaction
Sites: Pelvic flexure, Transverse colon, Ileocolic opening
CS: Colic, ↓ Feces
Dx: Hx, CS, Rectal
Tx: Aggressive Conservative Tx

Impaction sites - common sites
1. **Pelvic flexure** (most common)
2. **Transverse colon** (junction w/ large right dorsal colon)
3. **Ileocecal opening** (hypertrophy, intussusception)

Surgical indication
- Unrelenting pain
- ↑ Peritoneal nucleated cells &/or protein
- Colonic displacement

White foal diz, Lethal white foal,

Ileocolonic aganglionosis (IA)
M8k 130; Pic 48

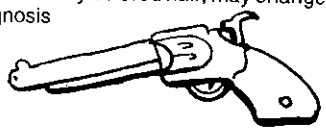
- **Completely white foal w/ blue eyes**
- "Overo" paint sire & dam
- Autosomal recessive trait
- **Born dead or weak w/ colic**

White Overo paint foal, GI defects, Euthanize

- Appear normal at birth
- Develop colic & die on 2nd day
  - **Acute abdominal pain**
  - M/ be recumbent
  - No meconium passed

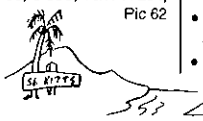
- History: **Overo parents**
- Signalment, CS
- No meconium on rectal exam
- PM: diffuse colonic hypoplasia
- Histopath.: absence of submucosal & myenteric ganglia in terminal ileum, cecum & colon

- **No Tx: Euthanasia**
- Check for any colored hair, may change prognosis

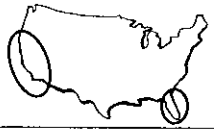


Sand impactions

Mk 187; IM 698; I2M 768; E 547, 565; M 232; C2T 55; S 393; T&W-A 284; Pic 62

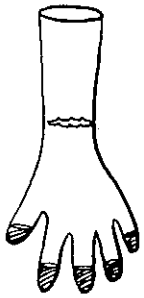


- **Sandy regions** (in environment & hay)
  - Florida, California
- Some horses have a "sand tooth"
  - Fine sand accumulates in ventral colon
  - Course sand in dorsal colon, transverse colon & pelvic flexure
- Fills right dorsal colon (dried out ingestion here so filters out)
- Fluid & gas can flow through, present w/ soft feces



Regional, Obstruction
Dx: Feces in glove
Tx: Metamucil®

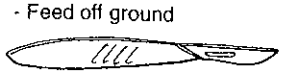
- Similar to ingesta impaction, but also:
- **Diarrhea**



- Hx, CS
- Rectal exam
  - Sand in colon (if in dist. rt. dors. or transverse colon, difficult to Dx)
- **Feces in glove & fill w/ water**
  - Sand settle out in fingers (know normal amount of sand in horses of area)

- M/b able to shift medically
  - **Metamusil®** by nasogastric tube (see box)
- **Surgical indications**
  - Unrelenting pain, Incr. peritoneal nucleated cells &/or protein, Colonic displacement

Prevention:
- In sandy areas monitor feeding
  - Feed off ground



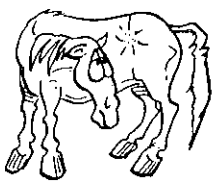
Metamucil® (Psyllium hydrophilia mucilloid) by nasogastric tube
- Lubricates & binds sand to move it out
- Forms gel when mixed w/ water so have tube place in before mixing
- After initial dose mix dry w/ feed (prolonged use)

Enteroliths/ Fecoliths

Mk2 179; IM 699; I2M 769; E 564, C3T 223, C2T 68; S 392; T&W-A 285; Pic 63

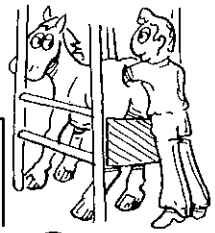
- **California** (hay high in Mg)
- **Arabians** more than others
- **5-10 years** (rarely < 4 yr)
- **Enteroliths**: magnesium ammonium (mineral concretions); starts from a nidus (broken tooth, stone, string, hair, FB, silicon dioxide [flint-like stone]); Calif. hay hi in Mg
- Fecoliths: concretion of fecal material
  - Can get as big as a soccer ball
  - Single (smooth) or multiple (squared from rubbing, tetrahedral)
- **Obstruction at junction of right dorsal & transverse colon** (diameter change). **Right dorsal colon > transverse colon, small colon**
  - Intermittent due to swelling & falling back eventually blocks

- Pain variable depending on extent of distention
- **↓ Feces, scant liquid feces**, if partial obstruction



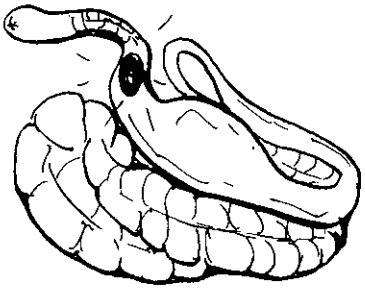
Mineral concretions
Obstruction transverse colon
CS: ↓ Feces
Tx: Sx Remove

- History, CS, PE
- Rectal exam:
  - **Distension of colons**
  - Back up to cecum, but all in normal position
- Peritoneal tap normal until pressure necrosis of intestine



- **Conservative**
  - Apple cider vinegar
- **Remove surgically**
  - If stuck in small colon remove from there
  - Otherwise move back to small colon to take out, watch for squared sides (multiple)

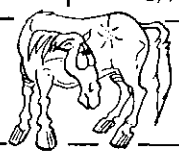
Obstruction at junction of right dorsal & transverse colon (diameter change)



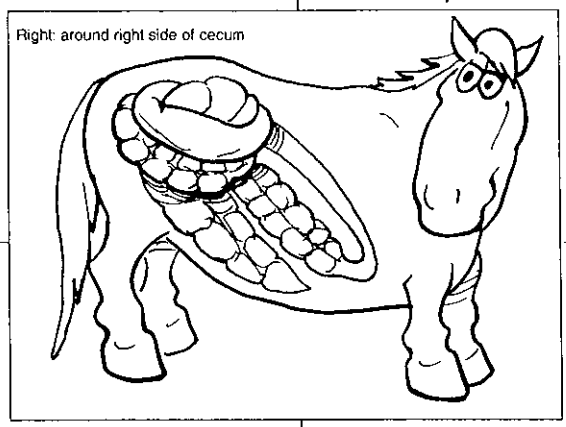
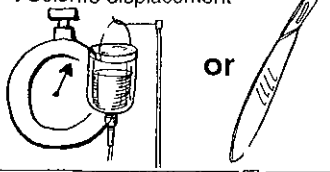
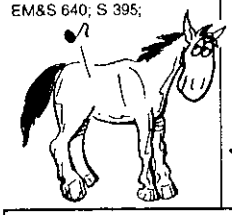
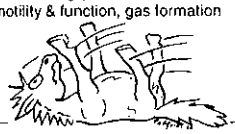
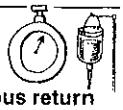
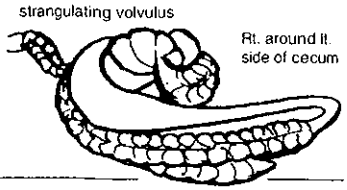
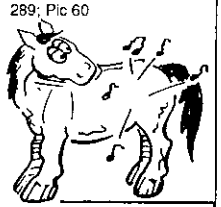
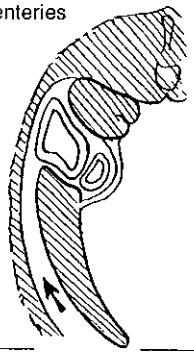
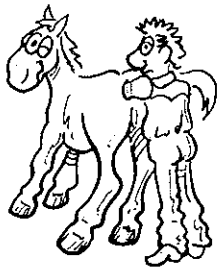
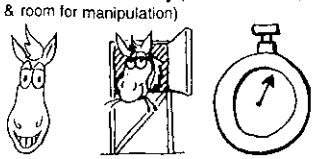
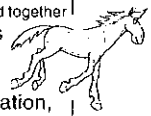
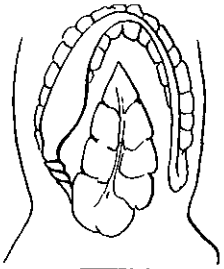
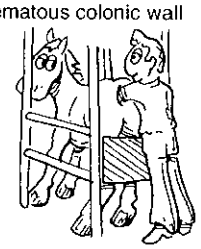
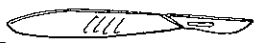
Foreign body (FB) obstruction

IM 699; I2M 769; E 563; T&W-A 284; S 401

- **Similar to enterolith**
- **Usually in small colon or transverse colon**
- Young horses eating bedding, rope, fence material, rubber
- Fecoliths



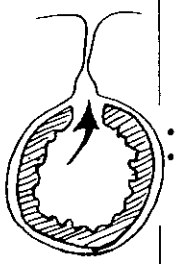
Displacement of Ascending Colon

Condition	Facts/Cause	Presentation/CS	Diagnosis	Treatment
Displacement of ascending/ large colon M8k 179; IM 699; I2M 770; EM&S 637; E 566; C3T 218; C2T 60, M 234; T&W-A 287; Pic 60 ***  **Obst./Strang. Gas distention Colic - "Pings"**	• **Very common** • **Ascending colon** or large colon, 3-4 yds long, in a double "U" shape w/ only proximal & distal ends attached - Rest of "U" (w/ pelvic flexure at its center) free to move around • Other organs usually keep it in place • Alteration in motility or digestive mechanisms can flip or kink the large colon • **Resulting in obstruction** **- Colon & cecum fill w/ gas** **- Ileocecal junction efficient so no back up into small intestine**	• **CS of obstruction:** - **Colic,** ↑ HR & RR, sweating - **↓ Fecal output** • **Gas distention of colon & cecum**  Right: around right side of cecum	• **CS** (clinical signs) • **Rectal: Colon out of place** - Normally: sacculations on bottom, smooth on top - If reversed, obstructed • **"Pings"** due to gas distension i • **Peritoneal tap**	• **Be ready for surgery** • Conservative attempted 1st in right & left displacement • Surgical for volvulus w/ strangulation - **Surgical indications** . Unrelenting pain . ↑ Peritoneal nucleated cells &/or protein . Colonic displacement  or
• Right dorsal displacement M8k 179; IM 701; I2M 771; EM&S 640; S 395;  **Colon around cecum CS: Obstruction Tx: Conservative or Sx**	• **Twist** (180 - 360°) of large colon at mesentery - Large colon displaces between cecum & right body wall **- Pelvic flexure pointed cranially** - 2 possible ways to twist . Twist clockwise around cecum (viewed from above) (most common) . Twist counterclockwise around cecum • Cause unknown (idiopathic) - Nutrition, feeding practices, alteration in colonic motility & function, gas formation 	• **CS of obstruction:** - **Colic,** ↑ HR & RR, sweating - **↓ Fecal output** • **Gas distention of colon & cecum** • No gastric reflux (ileocecal valve efficient)	• **CS** • **Rectal exam: large gas distended colon** **- Can't find pelvic flexure** **- Cecum medial to colon** (abnormal) • "Pings" • Peritoneal tap: usually normal unless compromised	• **Conservative** **- Fasting** **- Maintain hydration** **- Wait for spontaneous return**  • **Surgical** correction for severe displacement or if associated w/ volvulus  **Prognosis: Good** unless strangulating volvulus  Rt. around lt. side of cecum
• Nephrosplenic entrapment, Left dorsal displacement M8k 179; IM 699; I2M 770; EM&S 641; S 396; T&W-A 289; Pic 60  **Obstruction No strangulation Tx: Roll or Sx**	• **Large colon caught in nephrosplenic (renosplenic) space** - Left side between dorsal spleen, nephrosplenic ligament, left kidney & left abdominal wall • Warmbloods & large Thoroughbreds more prone  • Theories of etiology 1. Pelvic flexure migration to space & trapped 2. Gas causes the large colon to rise between left wall & spleen & over top of spleen - 180° twist at least (because ventral colon falls over dorsal side of spleen first, & then dorsal colon to switch places (w/ dorsal becoming ventral & ventral dorsal) • **Usually no strangulation,** but edema & congestion (vessels aren't cut off)	• **Similar to left displacement**- obstruction: ↑ HR & RR, sweating, ↓ Fecal output, distention of colon & cecum • **↑ Pain & systemic shock** as more colon entrapped & ↑ pull on mesenteries 	• Clinical signs (CS) • Rectal exam **- Distended large colon** **- Spleen displaced away from body wall** (caudomed.) - M/b colon transversely over nephrosplenic lig. 	• **Conservative** **- Deny access to food** **- Allow to spontaneously return** • **Rolling:** if no response to conservative, let gas cause colon to rise & return to position - **Xylazine & ketamine** (short acting anesthetic) - **Put in right lateral recumbency** (spleen up) - **Hoist by legs** & held for 1 min. & shaken - **Return to dorsal recumbency** - Slowly turn to left lateral recumbency - 360° complete as horse stands • **Surgical correction** if conservative doesn't work or horse's condition deteriorates - **Ventral celiotomy** (better visualization & room for manipulation) 
• Colonic volvulus M8k 179; IM 702; I2M 772; EM&S 637; C2T 66; E 573; S 395, 397; T&W-A 291  **Strangulation CS: Obstruction, Shock Sx survival low**	• **Vascular occlusion** & severe colonic devitalization at > 270° twist • **Surgical survival low < 40%** • Sites of volvulus - **#1 base of colon** (proximal & distal ends attached) - #2 sternal & diaphragmatic flexures - Most dramatic cecum & colon twisted together • Adult horses & brood mares (1 wk postpartum due to extra room) - Summer • Twists 360°, lots of strangulation, endotoxemia, no venous return to thorax  	• **Severe colic** (usually) • **Bloat** (marked distention) • **Shock:** Dehydration - Cold extremities, weak pulse - Poor mucous membranes 	• CS - shock - ↑ Capillary refill time - ↑ HR & RR • Peritoneal fluid variable • "Pings" • Rectal exam: **- Large gas distention** - Edematous colonic wall 	• **Stabilize before surgery** **- Large volume of fluids** (2 large gauge [10-14 g] catheters in jugulars (dehydration & electrolyte imbalances) • **Analgesics for pain** • **Surgically untwist** - Colonic resection has been tried & if away from base m/ help survival rate  **Prognosis: poor** • If catch w/n 2 hours can surgically correct • If later than 4 hours poor • Px depends on amount of devitalization (watch to see if colonic vasculature, color & motility returns) 

Colonic intussusception (IM 773) • Rare

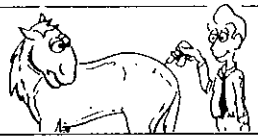
Rectum

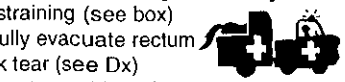
Condition	Facts/Cause	Presentation/CS	Diagnosis	Treatment
Rectal tears M8k 151; Mk 134, EM&S 664;C3T 232; C2T 75; M 242; S 407 T&W-A 326; Pic 66	• **#1 reason for law suits (eq)** - **Iatrogenic: during rectal exam** - Males > females, Arabians • **Take precautions for rectals** - Good restraint . Stocks ideally . Hold against wall, if right handed - wall on left, stand at side . Nose twitches . Xylazine if necessary - Lots of lubrication - Take out feces & repeat lube - Don't fight peristaltic waves • **Peritoneal pouches** 8" from anus • Most tears at 12", so into peritoneal cavity (G4) (see box) or into dorsal mesorectum separated from peritoneal cavity by thin connecting peritoneum (**G3**) • Dorsal tears most common (splits over knuckle w/ peristaltic wave)	• **See blood on palpation hand** • If undetected when tears - **Sweat (horse & vet!)** - **Uncomfortable** - **Start straining** • Grade 4: rapidly progressive - Progressive elevated HR - Progressive colic - Endotoxemia/shock • Grade 3: similar to grade 4, but slower progression	• **Feel rectum tearing** when hand in rectum • Physically examine tear - Heavily sedate animal - Epidural - Access depth of tear using bare fingers • Peritoneal tap - Massive response, huge peritonitis - Grade 4 - feces	• **Grade 1: heal by 2° intention** - ABs - heal on their own. Swelling of 2°, may become Grade 3 tear • **Grade 4: cannot be treated, Px is terrible** • **Grade 3: Emergency** - **Tell owner immediately!!!** - **Prepare to ship to surgical facility** . Stop straining (see box) . Carefully evacuate rectum . Check tear (see Dx) . Pack rectum w/ Betadyne® (povidone iodine) soaked cotton . Start on broad spectrum ABs - Procaine penicillin G + gentamicin or m/b metronidazole (Flagyl®) . Banamine® to counteract toxemia - **Ship to surgical facility (refer)** • **Surgical facility - Various Tx** - Temporary colostomy - allows torn part to heal, stopping feces from entering tear • **Best to prevent them!**

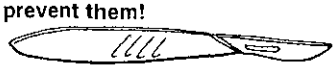


#1 Lawsuit, G3 (into mesorectum)
CS: Blood, Sweating
Dx: PE
Tx: Emerg., Refer for Sx

Stop straining:
• Acepromazine, xylazine or detomide
• Propantheline bromide
• Lidocaine lubricant enema (25-50 ml of each mixed together)
• Epidural: Rompun® (xylazine) (longer lasting than lidocaine)







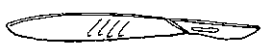
GRADES
• **Grade 1 (G1):** only through mucosa & submucosa
• Grade 2 (G2): muscle layers only, mucosa intact
• **Grade 3 (G3):** through mucosa, submucosa & muscle layers into space between layers of mesorectum, serosa only separation from peritoneal cavity **(most common tear)**, Fecal balls jammed up between layers of mesorectum
• **Grade 4 (G4)**: full thickness into peritoneal cavity

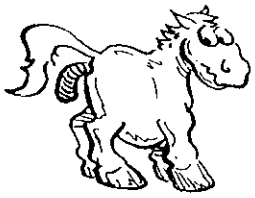
1. Temporary colostomy - allows torn part to heal, stopping feces from entering
• Sx through flank, not easy, lot narrower (18 ribs) than cow, smaller paralumbar fossa & thick body wall
• Exteriorize loop of small colon, cran. to tear
• Suture colon to muscle wall
• Open colon & suture cut to edge of skin
- Fecal balls come out the side of animal
- Disadvantage doesn't completely rest torn colon some feces pass

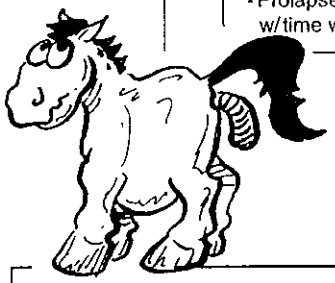
2. Cut small colon
• Bring 1 end out colostomy & suture to wall
- Close off the other distal end of colon
• Allowing distal end to rest from peristalsis
• Problem: distal portion becomes atrophied during healing period

3. Piece of fenestrated plastic pushed into small colon proximal to tear, fenestrations used to suture sleeve to colon, hope fecal balls will go down tube

Rectal prolapse M8k 150; Mk 133; IM 835; I2M 911; EM&S 666; C2T 73; E 576; S 411; LAS 444; Pic 65	• Bowel turns out of anus, external intussusception-like • Straining causes prolapse - Prolapse = strains more, so w/ time worsens more prolapses • Mares > males **Causes - Prolapse** • **Straining, tenesmus** - Constipation - Diarrhea - Parasitism - Chronic cough - Urethral obstruction - Advanced pregnancy - Prolapsed, strains more, so w/time worsens	• Type 1: initially & acutely - **Red doughnut of mucosa** most common • Type 2 & 3: longer, more tissue hanging out (complete prolapse) - Type 2: complete prolapse - Type 3: complete w/ invagination of colon, much longer than type 2 • Type 4: intussusception of rectum &/or small colon - Double-layered: 2 entrances, a trench around the prolapse • **Straining, tenesmus** • **W/ time worsens** - **Desiccated, edematous** (due to strangulation (venous return), dries & cracks) - More comes out due to gravity	• **Prolapse** • **Differentiate Type 1-3 from Type 4** - Probe between prolapsed mass & inner rectal wall . Type 1-3 can't pass probe much past anus . Type 4 passes freely	• **Clean tissue** • Decide if viable • **Return if healthy prolapse**, caught early - **Epidural to stop straining** - Massage, warm, wet, squeezing edema out - Purse string sutures to close down anus (animals w/ soft feces, pigs especially) Doesn't work on horses • **Necrotic**, usually exposed mucosa (outer layer) - **Resect & remove** . Circumferential incision around base & another at end . Connecting w/ a horizontal incision . Peel off outer layer down to submucosa (do not remove submucosa) . Remove everything that is necrotic - End edge must be closed to base end . Skewer w/ long needles to hold in place • Take off only the mucosa, NOT submucosa • Usually it is not full thickness necrotic

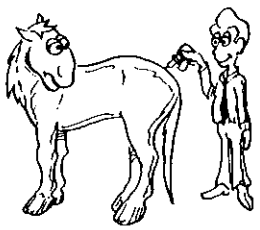


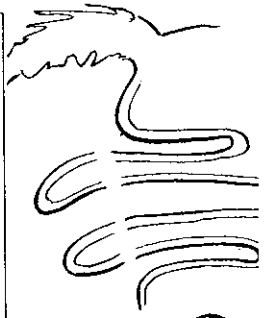




CS: Straining, Desiccates w/ time
Tx: Epidural return or Sx

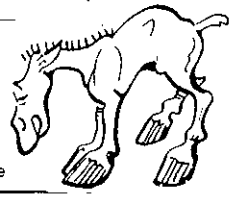
Epidural to stop straining
• Between sacrum & 1st caudal vertebra, 1st movable spot - wag tail
• Must be right on midline, 45° horizontal; go through ligamentum flavum (yellow ligament)
- Negative pressure, put drops on end of needle (fill hub w/ lidocaine)
- When in epidural space drop disappears, put on more & it also should disappear
• 7 ml of lidocaine, if too much, ataxic
- **Xylazine** 100 mg in 7-8 mls saline for 1000 lb Takes 40 min onset, lasts longer & doesn't make them ataxic





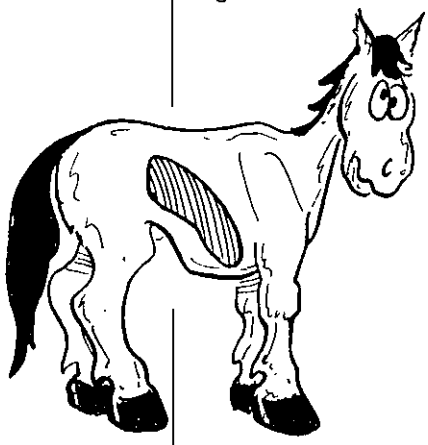
Meconium retention IM 335; I2M 380; E 333; EM&S 659; C3T 446; C2T 117; Pic 51; Pop 34-1/98	• **The 1st feces of life,** usually passed by 12-48 hrs; Retained if not passed by **12 hours** w/ attempts to pass • **#1 cause of abdominal discomfort in newborn**; colts > fillies (smaller pelvis) • **CS:** Colic, depression, ↓ nursing, restlessness, frequent straining to defecate, tail switching & elevation, back arched • **Dx:** Digital exam, CS, Dehydration, Prerenal azotemia, Stress WBCs • **Tx:** Stool softeners, Laxatives, Analgesics, Soapy water enema (DSS), Fleet enemas, Sx intervention in refractory cases

Atresia ani, anal atresia S 413
• Rare; Imperforate anus
• Dx: visually • Tx: Surgical correction possible



Liver Disease

Condition	Facts/Cause	Presentation/CS	Diagnosis	Treatment
Liver disease M8k 220, 130; Mk 138; IM 837; I2M 913; EM&S 692; E 634; C4T 214; C3T 353; M 245; Pic 79	• Liver m/b diseased long before it fails to function • CS not seen in early stages of liver diz • **Loss of 80%** of liver before regeneration & recovery impossible • **Remarkable ability to regenerate**	• **No pathognomonic CS for liver diz** • **No CS of liver diz consistently present** • **Most signs related to failure of liver function** (except pain) • **Icterus** (common in acute, not always in chronic) - Also seen in anorexic or fasting horses - Hemolysis can also cause ↑ bilirubin - Failure of uptake, conjugation or excretion of bilirubin • **Wt. loss** common, but not specific for chronic diz • **Diarrhea** possible in chronic liver diz • **Dermatitis** (hepatic photosensitization) due to phylloerythrin (normally excreted in bile) accumulating in skin • Pruritus sometimes (mechanism unknown) • Hemorrhage terminally (clotting factors made in liver) • Pharyngeal or taryngeal collapse w/ loud stertorous inspiratory noises & dyspnea in some (especially ponies) (mechanism unknown) • **Hepatoencephalopathy** - **Behavioral changes**: docile animal becomes aggressive, aggressive becomes docile - **Depression, incoordination, aimless walking, head pressing, yawning** - Multiple causes: low blood glucose levels, ↑ ammonia, altered plasma/amino acid ratio	• **History** (Hx), CS • **Lab** - **Slightly ↓ blood glucose** - **Ammonia** (4x) - **↓ BUN** (urease needed) - **Terminally ↓ serum albumin** - **Enzymes:** . **↑ GGT** fairly specific for liver diz . **↑ ALP in chronic**, also in bone, intestine, placenta & macrophages . **SDH, LDH & GDH** .. **↑ In acute diz, normal or ↓ in chronic** . **SDH**: active hepatocellular necrosis - **Excretion tests** . **Bilirubin**: ↑ indicates liver diz, bile blockage, hemolysis, or fasting horse . **Bile acids**: > 15 µm/l indicates hepatic diz, cholestasis or portal systemic shunting . **BSP**, normal < 3.5 min • **Liver biopsy**: safe & simple, but avoid if liver abscesses suspected	**Rx for liver failure** - **1st sedate (xylazine)** - **10% glucose IV** • **↓ Blood ammonia** (↓ # of bacteria producing ammonia) - Nasogastric tube . Mild laxative . Lactulose® - Limit CHO • Correct any acidosis slowly • **Slow 5-10% dextrose drip** • **Dietary management** - Small meals 4-6 x/d - **Vit. B1**, folic acid & **Vit. K1** weekly • Fresh plasma transfusions • Steroids: if not infectious • Protect from sun when grazing • Colchicine • **Antibiotics**: avoid those metabolized by liver such as tetracycline & chloramphenicol



No pathognomonic CS of liver diz
CS: Icterus, Weight loss, CNS
Dx: GGT, ALP, SDH, BA
Sedate

Liver biopsy site
• Right 14th ICS (intercostal space) intersection w/ line from tuber coxae to point of shoulder

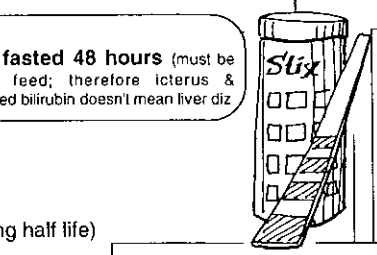
Poor prognostic indicators:
• Albumin < 2.5 g/dl &/or ↑ globulin level
• Prothrombin time > 30% of normal
• Greatly ↓ GGT & ALP w/ normal or ↓ SDH or LDH
• BSP half life > 8 min.
• Marked fibrosis
Grave w/ pyrrolizidine alkaloid toxicosis, mitotic inhibition

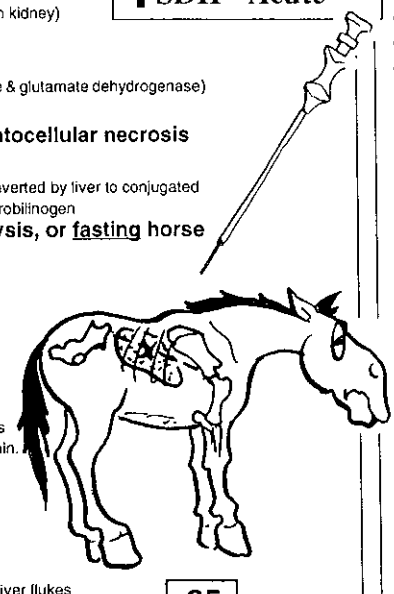
Diagnosis of liver diz:
• **History**
• **Lab:**
- **Slightly ↓ blood glucose** (gluconeogenesis)
- **Ammonia** (4x) (urease of liver needed to convert)
. ↑ of ammonia doesn't correlate to level of CNS signs
- **↓ BUN** (urease needed)
- **Terminally ↓ serum albumin** (liver makes albumin, long half life)
- **Enzymes:**
. **↑ GGT** in chronic diz fairly specific (gamma glutamyl transferase)
.. Found in biliary tract (cholestatic instead of hepatocellular)
.. Also in pancreas, lungs & kidney (renal diz, not ↑ because excreted in kidney)
. **↑ ALP in chronic** (alkaline phosphatase)
.. Also in bone, intestine, placenta & macrophages
. **SDH, LDH & GDH** (sorbitol dehydrogenase, lactate dehydrogenase & glutamate dehydrogenase)
.. **↑ In acute diz; normal or ↓ in chronic**
.. **SDH, liver specific, good indicator of active hepatocellular necrosis**
• **Excretion tests** (checks liver's excretory function)
- **Bilirubin**: from heme, mainly from RBCs, unconjugated bilirubin is converted by liver to conjugated which is secreted by bile system into intestine where it is converted into urobilinogen
. **Elevation indicates liver diz, bile blockage, hemolysis, or <u>fasting</u> horse**
. Liver diz - mostly unconjugated (indirect reacting)
.. Direct to total ratio usually < 0.3
. Bile blockage or intrahepatic cholestasis
.. ↑ Conjugated (direct reacting) & unconjugated
.. Direct to total ratio > 0.3
- **Bile acids** - synthesized by liver from cholesterol & excreted in bile
. Bile acids > 15 um/l indicates hepatic diz, cholestasis or portal systemic shunting
- **BSP** (sulfabromophthalein) dye, clearance (halflime) used in lg. animals more than retention test. Inject IV & blood samples taken 5 times in 12 min.
. Normal < 3.5 min
• **Liver biopsy** - safe & simple
- Do not do if liver abscesses suspected
- Diffuse or zonal lesions seen in most toxic, infections & metabolic liver diz - usually Dx by biopsy
- Easily miss focal lesions - abscesses, granulomas, neoplasia & liver flukes

Color me Yellow

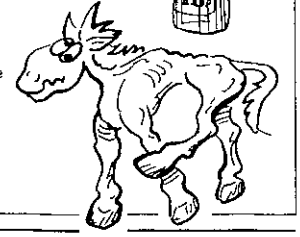
DDx:
• **Icterus - fasted 48 hours** (must be acutely off feed; therefore icterus & ↑ unconjugated bilirubin doesn't mean liver diz

↑ GGT - Chronic
↑ SDH - Acute





Treatment for Liver Failure
• **1st Sedate (xylazine)** for hepatoencephalopathy
- Diazepam, chloralhydrate or barbiturates
• **10% glucose IV** (if low blood glucose)
• **↓ Blood ammonia** (↓ # of bact. producing ammonia)
- Nasogastric tube
. Mild laxative (mineral oil) + neomycin or lactulose
. Neomycin (may induce diarrhea, so not commonly used)
. Lactulose® (↑ acidity in GI to incr. amount of ammonia converted to ammonium, therefore not absorbable)
- Limit CHO, low protein diet to minimize ammonia
• Correct any acidosis slowly (exacerbates hepatoencephalopathy)
• **Slow 5-10% dextrose drip** (decr. hepatic work load)
• **Dietary management**
- Small meals 4-6 x/d, beet pulp, cracked corn, molasses
- Force feed mixed paste if not eating (by rehydrating pellets & nasogastric tube)
- Dextrose to water (ready source of energy)
- IV feeding expensive. Amino acid supplementation
- **Vit. B1 folic acid & Vit. K1 weekly**
• **Fresh plasm transfusions** for clotting abnormalities & m/b Vit. K
• **Corticosteroids**: if suspect acute hepatitis not due to infectious agent, & in chronic w/ unknown cause (prednisolone doesn't require hepatic transformation)
• Grazing, protect from sun
• Colchicine used empirically in chronic liver cirrhosis to ↓ fibrosis, but may cause laminitis
• **Antibiotics**: w/ liver biopsy & positive results of bacteria
- Culture & sensitivity should be done
- Avoids those metabolized by the liver, such as erythromycin, tetracycline, chloramphenicol



Liver Diseases

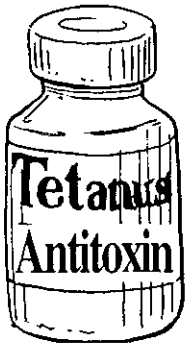
Condition	Facts/Cause	Presentation/CS	Diagnosis/Differential Dx	Treatment
Neonatal toxic hepatic failure, Iron toxicity, Hepatic failure in foals M8k 232; Mk 138; IM 848; I2M 926, 1906;	• **Iron fumarate toxicity** - **When given to foals before nursing** - If given after colostrum consumed, ↓ toxicity because of protection of **glutathione** in colostrum - Fed w/ lactobacillus products containing ferrous fumarate • **Products taken off market**	• **CS in 2-5 days** (rarely when older) • **Hepatoencephalopathy** - Seizures - Marked depression - Ataxia, aimless wandering - **Head pressing** - **Icterus,** unless die peracutely - **Comatose in hrs & death,** regardless of Tx	• **History of iron administered before colostrum, 2-5 d** • **Lab:** - **Hi serum bilirubin** (conjugated & unconjugated) - **Hi ammonia** - **Prolonged prothrombin time** - Serum liver enzymes not always diagnostic . SDH (sorbitol dehydrogenase) normal or slightly ↑ . GGT (gamma glutamyl transferase) m/b hi in normal foals - Serum glucose frequently low - Tremendous ↑ in BUN, PCV m/b normal • **PM** (postmortem) - **Small liver** - Red-brown areas of necrosis (massive hepatocellular necrosis) - Alzheimer Type II astrocytes in brain - Fibrosis of areas not necrosed	• Supportive Tx • IV dextrose temporary improvement **Prognosis:** • **Poor**: most don't recover w/ Tx • If develop liver diz w/o liver failure usually recover • Rarely liver failure w/ severe fibrosis several months after birth
Product off market, Fe before colostrum **CS: Hepatoencephalopathy** **Dx: Hx, CS, Lab, PM** **Tx: Supportive • Px: Poor**			**DDx:** • Perinatal herpes infec. • Tyzzer's diz (> 8 ds) (pg 87) • Bacteremia (*Actinobacillus equuli*) • Congenital anomalies - Atresia of bile ducts - Portocaval shunts • Hepatotoxicities (pg 86, 89)	
Mycotoxins - Hepatotoxin M8k 2076; IM 853; EM&S 700	• **Aflatoxin & Rubratoxin** • **Toxic metabolites of molds** • **Grow on feed** (certain grains, corn, peanuts & cottonseed) • Diz may be as short as 5 d, if less severely affected will survive w/ supplemental therapy	• **Liver failure**: - Icterus - Weight loss - Diarrhea - Dermatitis - Hepatoencephalopathy • Acute liver insufficiency	• **Analysis of feeds for mycotoxin conc.** - M/ have eaten it weeks-months before • **Liver biopsy:** - Microscopic biliary hyperplasia - Fatty changes - Central lobular fat infiltration & hepatic necrosis	• **Tx not usually successful** • **Activated charcoal slurry orally & oxytetracycline IM** for 5 d m/ reduce losses if given under 24 hr after ingestion • Variable responses to Tx, depending on amount of destruction **Oxytetracycline** **Charcoal**
Toxic metabolites of molds in feeds **CS: Liver failure** **Dx: Analysis of feed** **Tx: Unsuccessful**				
Tyzzer's Diz, *Bacillus piliformis* infection, Dead foal diz Mk 152; IM 848, 378; I2M 925; EM&S 698; E 640; C4T 218; C3T 442; C2T 110, 242; Pic 87	• ***Bacillus piliformis*** (motile, filamentous, gram (-), spore forming, obligate intracellular bacteria) • **Fatal diz of foals 7-40 days** (also fatal in lab animals) • **Focal bacterial hepatitis** • Mares m/b carriers • Sporadic, generally only one foal affected	• **Most found dead or in coma** • Depression • Anorexia • Recumbency • ± ↑ Temp. (102 - 106° F) • **Marked jaundice** usually • **Convulsions** (hypoglycemia) • **Coma terminally**	• **Definitive Dx difficult,** CS nonspecific • **Jaundice** if live long enough • Lab - nonspecific: - **Marked ↑ of liver enzymes SDH,** LDH, ALP, AST, GGT - Marked ↑ bilirubin (mostly indirect) - **Profound hypoglycemia** (< 20 mg/dl terminally) • PM (postmortem) - **Marked jaundice** - **Huge liver** (hepatomegaly) - Pale, diffuse foci of necrosis (1-2 mm) - Colitis, lymphoid necrosis & focal myocardial necrosis - Histo.: multifocal areas of necrosis, bile duct proliferation • Definitive Dx: - **Giemsa or silver stained liver sections** . **Long, slender bacillus,** alone, in stacks &/or bundles in hepatocytes	• **Nearly 100% fatal** • **50% dextrose IV** • Fluid therapy • IV antibiotics (tetracyclines, penicillins, erythromycin, steptomycin) **Prognosis** • **Grave: nearly 100% death** **Prevention:** • Sporadic, so not indicated • If confirmed case, monitor all foals for first 40 d of life • Subsequent foals of a mare that have had a Tyzzer's foal monitored carefully
"Dead foal diz", *Bacillus piliformis* **CS: Jaundice, Dead** **Dx: Difficult, Stain liver** **Tx/Px: nearly 100% fatal**				
Fetal liver damage IM 867; I2M 945	• Infection or toxic damage to foal's liver; EHV (equine herpes virus) - hepatocyte necrosis • CS: Usually aborted or weak w/ CS or other system • Dx: Liver lesions (Hepatocyte necrosis, Intranuclear inclusion bodies in hepatocytes)			
Hepatic neoplasia IM 867; I2M 945; Pic 88	• **Uncommon in large animals**; 1° Hepatic carcinoma (most common); 1° in yearlings & 2-yr-olds; Lymphosarcoma (2°) • **CS:** Weight loss, Icterus, ↑ hepatic enzymes • **Tx:** None			
Liver abscesses IM 858; I2M 935	• **More common in cattle**; common incidental fining in horses on necropsy • **CS:** Similar to other abdominal abscesses (intermittent colic, intermittent fever, weight loss) • **Dx:** CS; Can't be palpated per rectum • **Tx:** Rarely drained to outside or removed; Long term ABs (penicillin or ampicillin - m/b in combined w/ rifampin or metronidazole)			

Liver

Condition	Facts/Cause	Presentation/CS	Diagnosis	Treatment

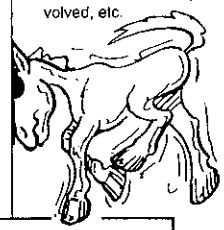
Serum hepatitis, Acute hepatitis, Theiler's diz, Idiopathic hepatitis

Mk 138; IM 843; I2M 920; EM&S 700; E 640; M 245; Pic 83



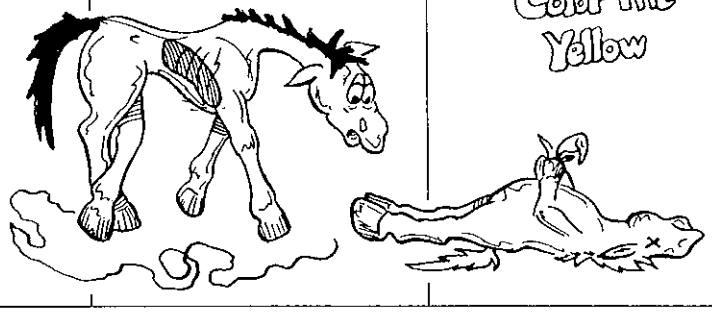
Facts/Cause

- **Acute to subacute hepatitis in adult horses**
- **Equine origin biologicals**
  - **Tetanus antitoxin**, antiserum of equine origin, pregnant mare serum
- Occurs more commonly on certain farms
- Occurs in horses hyperimmunized w/ tetanus antitoxin
- Diz occurs 4-10 week after last tetanus antitoxin administration
- Other cases w/ no equine biologic show similar type of acute hepatic diz (idiopathic hepatitis)
- Occur in late summer & fall
  - Suggested infectious or blood borne agent involved
  - Seasonal occurrence, multiple horses involved, etc.



Presentation/CS

- **Malaise & weight loss wk-mo before acute signs** (liver has to lose more than half its functional capacity before failure signs)
- **Acute hepatoencephalopathy** (incoordination, walk in circles, oblivious to surroundings)
  - Delirious, head pressing, fall, make repeated attempts to rise, unmanageable
- **Icterus**
- **Photodermatitis** (white muzzle & limbs)
  - May appear centrally blind
- Intravascular hemolysis
- **Clin. course rapidly progressive**
- **Dying in 2-5 d after initial CS**
- Acute abdominal pain, may get violent & cause damage to themselves
- **Comatose, generally die**



Diagnosis

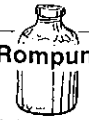
- Hx, CS
- Lab:
  - ↑ **in all liver enzymes**
  - ↑ Bilirubin, glucose variable, clotting profiles prolonged, BSP prolonged
- **PM** (postmortem):
  - **Small, flaccid liver** ("dishrag" liver) (swollen acutely)
  - Microscopically necrosis & bile duct proliferation

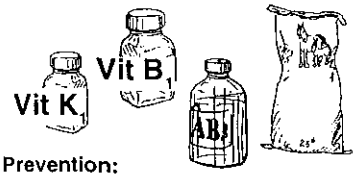
Color me Yellow

Treatment

Treat as for liver failure:

- **Sedate (xylazine)** for hepatoencephalopathy
- **10% glucose IV** (if low blood glucose)
- ↓ **Blood ammonia** (nasogastric tube & mild laxative (mineral oil) + neomycin (but kills GI flora) or lactulose (acidifies GI to ↑ ammonia to ammonium)
- Correct any acidosis slowly (exacerbates hepatoencephalopathy)
- **Slow 5-10% dextrose drip** (↓ hepatic work load)
- **Dietary management** (small meals 4-6 x/d (beet pulp, cracked corn, molasses)
  - Force feed mixed paste if not eating
  - IV feeding, but $$
- **Vit. B1, folic acid & Vit. K1 weekly**
- Protect from sun when grazing





Prevention:

- **Avoid using T. antitoxin**: use only on horses w/ wounds who are unimmunized or those of questionable immunization & foals from mares not immunized during late gestation (see

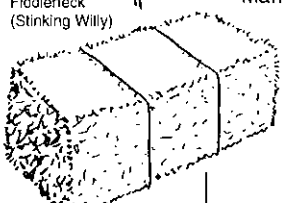
Adult, acute, T. antitoxin
CS: Wt. loss, CNS, Icterus, Die
Dx: Hx, CS, Lab, PM
Tx: Tx HF

Ingestion of waste oil (spread to control dust), tetrachlordibenzodioxin • Tx: Supportive, additionally show acute signs after being exposed fairly recently. Use of intestinal protectants and/or cathartic is indicated

Pyrrolizidine alkaloid toxicity

Mk 1698; IM 850; I2M 928, 1878, 1884, 1443; C4T 222; EM&S 699; E 641; M 245; PP/US/C 425; Pic 80, 85

Fiddleneck (Stinking Willy)

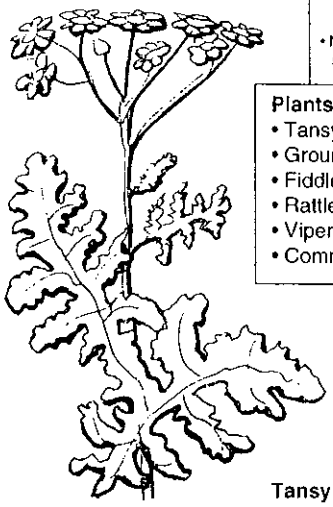


- See TOX pg 323
- **Poisonous plants**: Crotalaria, Senecio, Amsinckia, Heliotropium, Echium
  - **Not very palatable** (eaten when thick or other forage sparse [drought])
  - 1st cut **hay**, alfalfa or hay cubes
- **Cumulative & progressive**
  - Acute when ingest tremendous amts.
  - Chronic disorder (more common)
  - Problem 1-5 months later
  - Material often no longer on farm to identify
- **Western US** (also in pastures through out US)

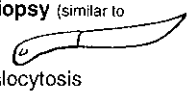
- **Pathology:**
  - Alkaloids, liver metabolized into pyrroles
  - **Pyrroles inhibit mitotic division** so get megalocytes & death of hepatocytes
  - **Fibrosis** replaces cell & liver fails
  - Marked portal hypertension

Poisonous plants in hay
CS: Liver failure, CNS, icterus
Dx: Hx, CS, PM (fibrosis)
Tx: Euthanasia, Tx HF; Px: poor to grave

- **Liver failure**
- Onset of CS acute
- **Weight loss**
- **Hepatoencephalopathy** (abnormal behavior, ataxia, wandering)
- **Icterus** (slight to moderate)
- **Photosensitization** (white areas)
- Rarely diarrhea
- Abortions



- **Geographic area** or where hay grows, usually not a definitive Dx, but suggested
- Feed analysis, time consuming & expensive
- Lab: nonspecific
  - Clotting abnormalities
  - Liver enzymes normal or elevated
  - BSP is prolonged
- **Liver biopsy** (similar to aflatoxins)
  - Triad:
    - . Megalocytosis
    - . **Fibrosis**
    - . Bile duct proliferation
- None of above specific for this toxicity so Dx difficult if no longer consuming



Plants

- Tansy ragwort *(S. jacobea)*
- Groundsel *(S. redellii, S. longilobus)*
- Fiddleneck *(Amsinckia intermedia)*
- Rattlebox *(Crotalaria)*
- Viper's bugloss *(E. plantagineum)*
- Common heliotrope *(H. europeaum)*

Color me Yellow

DDx

- Other plants
- Fungal hepatotoxins

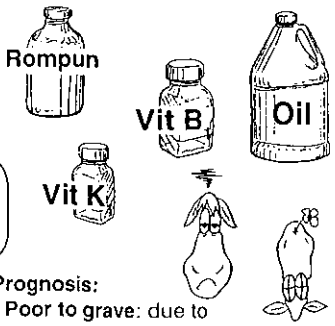
Tansy ragwort *(S. jacobea)*

- Description
  - 1-4' tall
  - Leaves: deeply irregular
  - Flowers" composite, showy, yellow

- **Euthanasia**: if severe fibrosis liver can't regenerate so Tx no good
- Remove plant source

If appetite & little fibrosis

- **Treat for liver failure**
  - **1st sedate (xylazine)** for CNS CS
  - **10% glucose IV** + methionine
  - ↓ **blood ammonia:** nasogastric tube (mineral oil) + neomycin (but kills GI flora)) or lactulose (acid GI ammonia to ammonium)
  - Correct any acidosis slowly
  - **Slow 5-10% dextrose drip**
  - **Dietary management**
    - . Small meals 4-6 x/d
      - .. Beet pulp, cracked corn, molasses
    - . Force feed mixed paste if not eating
    - . IV feeding $$
    - . **Vit. B1, folic acid & Vit. K1 weekly**
    - . Protect from sun when grazing

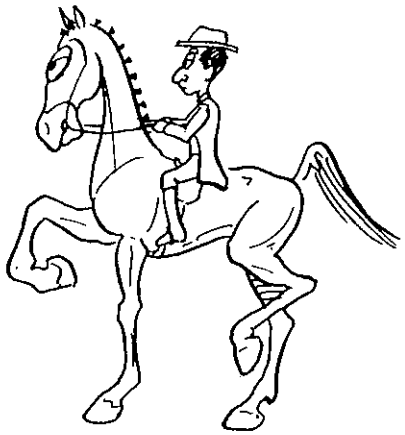


Prognosis:

- **Poor to grave**: due to tremendous amount of fibrosis
- Mildly affected cases: use serial liver biopsy & enzyme activity to help w/ prognosis

Liver

Condition	Facts/Cause	Presentation/SC	Diagnosis/Differential Dx	Treatment
Chronic active hepatitis, Idiopathic¢ IM 849; I2M 927; EM&S 701; C4T 221; C2T 112; M247; Pic 83, 85	• **Substantial inflammatory process w/in liver** • Cause unknown (idiopathic) - Toxins - Bacterial infection from portal vein or up bile duct • Sporadic occurrence Color me Yellow	• **Depression** • **Progressive weight loss** • **Intermittent fever** • **Icterus** • **Intermittent CNS signs** - Disorientation, not full blown hepatoencephalopathy	• History, CS • Nonspecific signs • **Liver biopsy** - Bacterial culture & sensitivity - **Fibrosis** • Laboratory - Elevated liver enzymes - BSP prolonged • Postmortem: - **Inflammatory cell infiltrate** (mononuclear in some cases, PMNs in others) - Loss of hepatocytes - **Fibrosis** - Focal granulomas - Nodular hyperplasia (trying to regenerate) - Biliary hyperplasia if cholangiohepatitis **DDx:** • Pyrrolizidine alkaloid toxicity (pg 89) • Bile stones • Abdominal abscesses • Other chronic wasting diz (pg 48-49)	• Supportive & similar to other chronic hepatic problems • **Treat for liver failure** - **10% glucose IV** (if low blood glucose) - **↓Blood ammonia** -nasogastric tube mineral oil + neomycin (but kills GI flora) or lactulose (acid GI ammonia to ammonium) - **Slow 5-10% dextrose drip** - **Dietary management** . Small meals 4-6 x/d (beet pulp, cracked corn, molasses) **Vit K_1** . Force feed mixed paste if not eating . IV feeding - $. **Vit. B_1, folic acid & Vit. K_1 weekly** - **Steroids** - in lymphocytic plasmocytic hepatic infiltrate **Vit B_1** . Increases appetite, stabilizes cell membranes, reduces inflammation & connective tissue formation - **Antibiotics** if bacterial cholangiohepatitis (culture & sensitivity) . Trimethoprim sulfa (gram neg.) **Prognosis:** • **Poor**, depends on amount of fibrosis
Idiopathic **CS: Intermittent CNS signs** **Dx: Biospy** **Tx: Tx for liver failure**				
Cholangitis Mk 138; IM 868; I2M 948; C3T 263 ★	• **Rare** inflammation of bile system associated w/ chronic active liver diz • Horses have no gall bladders	• **Weight loss** • **Variable icterus** • Subtle behavior changes • **Colic** • Variable changes in appetite	• Laboratory: - **SDH, GGT & AST** ↑ if active hepatocellular damage, but variable - **If both GGT & AP elevated** suspect cholangitis or cholelithiasis • Liver biopsy • Endoscopic culture of bile duct	• **ABs** based on culture of liver biopsy - Trimethoprim-sulfamethoxazole **Prognosis:** • Guarded to poor if fibrosis marked
Rare inflam. of bile system CS: Liver failure Dx: ↑ GGT & AP Tx: ABs				
Bile stones, Cholelithiasis Mk 138; IM 867; I2M 947; M 247; EM&S 701; C4T 216; C3T 259; Pic 85	• **Calculi (bile stones) in bile duct** - **Horse has no gall bladder** • **Choledocholithiasis**: presence of calculi in bile duct • Cause (debatable): infection, inflammation of biliary tree, bile stasis, alteration of bile composition, ascarid eggs • **Cholangitis** • Hepatocellular diz: if multiple small or single large stones obstructs bile outflow Color me Yellow	• **Chronic, intermittent colic**, mild in nature • **Icterus** • **CNS signs**: sudden depression • Anorexia • Weight loss • Fever	• **Dx is difficult** - CS (icterus, colic, CNS) • **Ultrasound** - dilated bile ducts - Chronic, hepatomegaly - Echogenic stone in bile duct • ± Exploratory, palpate bile ducts • Laboratory: - **Dramatic ↑ in cholestatic enzymes, especially GGT** - ↑ Hepatocellular enzymes - BSP normal unless complete obstruction	• **Many untreated because asymptomatic &/or not diagnosed** - **ABs** (because associated w/ infection) Trimethoprim-sulfonamide, penicillin w/ gentamicin - ± Fluids & plasma • Surgical attempted in limited # of cases - Manually crush stone & push into duodenum (difficult to do w/o causing additional inflam.) - Anatomically difficult area to reach **Prognosis: Guarded**: 2° infection in bile ducts & liver itself
Bile stones **CS: Colic, CNS** **Dx: Ultrasound** **Tx: ABs**				
Hyperlipemia, Lipidosis Mk 138; IM 862; I2M 940; C4T 217, 543; C2T 114; M 2 '8; Pic 83	• **Prolonged negative energy balance - Starvation** • Liver diz between acute & chronic • **1° ponies**, adult horses in association w/ azotemia (inhibits uptake of FFA) • Similar to fatty liver syndrome in cattle • Pathophysiology: - Fat mobilized from adipose tissue, free fatty acids to liver - Overload liver . Fat accumulation in liver & triglycerides in plasma . Fat accumulates in kidneys, heart, etc.	• **Lethargy, dullness** • **Severely depressed** • **Comatose** • ± **Death** w/in 10 ds of CS • **Hyperlipidemia** - Dullness & lethargy - Nervous excitability - **Diarrhea**, fever	• Hx, CS • **White or yellow opacity to plasma** (lipids) • **↑ triglycerides in blood (> 500 mg/dl)** - Metabolic acidosis - ↑ Serum hepatic enzymes - Prolonged BSP clearance time - Azotemia in horses - ↑ Bilirubin • **Postmortem: fatty infiltration of liver & kidney (pale**, swollen & greasy)	• **Tx 1° diz:** pregnancy (induce), lactating (take foal off), parasites • **Correct negative energy balance** - **Hyperlipidemia,** feed alfalfa gruels • **Hyperlipemia** (severe) - **Fluids** for dehydration, LR for acidosis . Slow IV drip of glucose (↑ release of insulin, if too fast ↑ acidosis) - **Insulin + glucose or galactose** on alternate days - Heparin, alters lipoprotein lipase activity to ↑ uptake into tissues (hemorrhage m/b, check clotting profiles) - **Tx until plasma clear** (< 400 mg/dl) **Prognosis:** • **Hyperlipidemia: good** nothing wrong w/ liver **Hyperlipemia - poor** even w/ intensive therapy
Hyperlipidemia: less severe than hyperlipemia, < 500 mg/dl triglycerides				
Ponies, Neg. energy, Fatty liver **CS: HF, Diarrhea** **Dx: Lipids in blood** **Tx: Tx 1° diz**		Causes: • **Starvation** - Off feed - Late pregnancy - Lactating - Parasitized - 2° to other diz	**White opacity - plasma**	
Pancreatitis Mk 121; IM 871; I2M 950; E 643; C2T 46; Pic 90 ★	• **Rare in horse**; Etiology unknown, pancreatic duct obstruction, duodenal inflammation, parasitic migration)strongylus or parascaris • CS of inflammation of exocrine pancreas: colic, shock, tachycardia, gastric dilation w/ reflux; Chronic: hyperkeratotic dermatitis - rare • Dx: Serum **amylase > 700 IU/L** • Tx: Symptomatically: gastric decompression (nasogastric tube) & shock therapy (fluid & electrolytes, m/b Ca) • Prognosis: **Poor**			
				Pancreatic Diz • Rare in horses



RESPIRATORY SYSTEM

Upper Respiratory Tract Diz

Condition	Facts/Cause	Presentation/CS	Diagnosis	Treatment

Nasal cavity problems

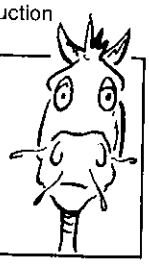
M8k 1096; Mk 426; IM 56; I2M 56; E 738; EM&S 392; M 150; C3T 270; S 435; T&W-A 239; Pop 22-7/98

- **CS of nasal problems: Nasal discharge, respiratory noise & dyspnea usually**
- **1° viral or bacterial diz**: other CS that go with bacteria or viral diz
- **Foreign bodies**: **CS:** often malodorous discharge, **Dx:** endoscope & X-rays, **Tx:** Forceps - removal
- **Fungal infection**: rare, Cryptococcus, gen. bilaterally in nares; seen in SW, devastating due to meningitis; Rhinosporidia causes rhinitis
- **Fungal granulomatous polyps** in nasal cavity & turbinates, **Dx:** CS, endoscope, smears & cultures, histo., **Tx:** surgical removal, Amphotericin B, ketoconazole
- **Nasal septum**: usually congenital disorders, relatively rare; cystic degeneration, abscesses, neoplasms, **CS:** M/ cause obstruction - **Tx:** Resection of nasal septum
- **Wry nose, squify mouth:** congenital, CS: deviated nasal septum, severe malocclusion of incisors, No Tx, Px: depends on degree of distortion
- **Nasal polyps: Dx: endoscope, X-rays • Tx: surgical removal**
- **Pedunculated alar fold - CS:** Respiratory noise, **Tx:** bilat. resection of alar fold
- **Atheroma** - Sebaceous cyst in false nostril, young horses, swelling, painless, doesn't obstruct airflow, **Tx:** Cosmetic surgical removal
- **Amyloidosis**: nodular or plaque-like deposits of glycoprotein in upper respiratory tract in response to continued immunological stimulus, **Tx:** Stop stimulus, Sx

Nasal discharge, Rhinitis

- **CS, not a diz**
- **Dx: CS, Endoscope**
- **Tx: 1° cause**

Common causes: See pg 340



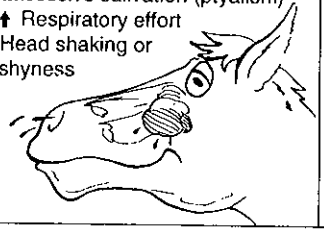
Ethmoid hematoma, Progressive ethmoidal hematoma, Hemorrhagic nasal polyps

M8k 1098; IM 557; I2M 618; E 741; M 147; C3T 274; S 440; POP 71-7/97

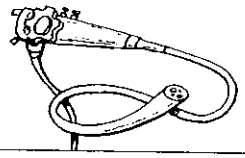
- Slowly expanding angiomatous masses
  - **Mucosa lining ethmoid conchae**
- **Cause unknown**
- **Uncommon condition**
- Generally > 8 yr
- Thoroughbred, Arabian

Uncommon
CS: Intermittent epistaxis
Dx: Endoscope
Tx: Sx ablation

- **Intermittent epistaxis**
  - Uni- or bilateral
  - Blood-tinged to mucopurulent
  - Rarely fatal epistaxis (as in guttural mycosis)
- Abnormal respiratory noise if occludes nasal passages
- Coughing, choking
- Excessive salivation (ptyalism)
- ↑ Respiratory effort
- Head shaking or shyness

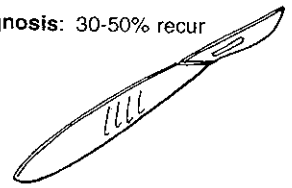


- **Hx** (history), **CS** (clinical signs)
- **Endoscope**
  - In ventral meatus & viewed w/ tip up
  - Color: deep red-purple, yellow-brown
  - Irregular, rounded surface
  - Partially covered w/ yellow-white mucopurulent material
  - Blood & mucopurulent - nasal cavity
  - **Both sides** (50% bilateral)
- Radiography - Radiodensity
- Surgical specimens - hemosiderophages



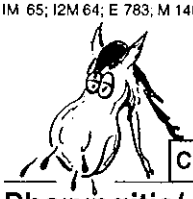
- **Surgical ablation**
  - Sx curettage - bleeding (pack nose w/ gauze)
  - Cryosurgery extirpation, minimal blood loss, impractical for lg. hematomas
  - Laser (photoablation) minimum bleeding, but requires multiple procedures for large hematoma
    - Can be done in standing horse

Prognosis: 30-50% recur



Epistaxis

IM 65; I2M 64; E 783; M 146



- **Presence of blood at external nares** from nasal cavity, nasopharynx, guttural pouches or lungs (unilateral or bilateral)
- **Hemoptysis**: blood out of mouth; rare from lungs in horse because long soft palate with epiglottis over it closes off mouth
- Blood from lung hemorrhage often not seen because swallowed, if seen associated w/ strenuous activity
- **Dx**: Hx (uni- or bilateral; exercise, etc.), Physical exam, CBC, Feces for occult blood, Endoscopic exam, Transtracheal wash, Radiographs of lungs, Biopsy

CS, not a disease

Common causes: See pg 341

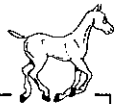
- Ethmoid hematoma (pg 95)
- Nasal polyps (pg 94)
- Fungal granulomas
- Tumors of nasal cavity
- Trauma from nasogastric or endoscope
- Guttural pouch mycosis
- Thrombocytopenia
- Purpura hemorrhagica
- EIPH (rarely see epistaxis)(pg 101)

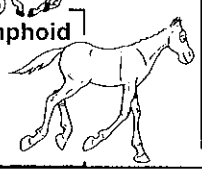
Toxicity
- Arsenic
- Warfarin/dicoumerol
- Moldy sweet clover
- Pyrrolizidine alkaloids

Pharyngitis/ chronic pharyngitis, Pharyngeal lymphoid hyperplasia, Chronic lymphoid follicular hyperplasia, Follicular pharyngitis, Follikelkatarrh

M8k 1095; Mk 719; IM 546; I2M 607; E 747; EM&S 748; M 153; S 446

- **Inflam. of pharyngeal tissues**
- **Not a specific diz,** but a response to other dizs
  - Sequel to bacterial & viral respiratory diz
  - Local physical, chem. &/or allergic causes
- Acute & chronic forms
- **Chronic follicular hyperplasia**
  - **Lymphoid hyperplasia** (most common cause of chronic pharyngitis)
  - Associated w/ chronic cough
  - Associated w/ guttural pouch emphysema
  - **Diz of young** (more prominent lymphoid follicles than older horses)
  - So important to know age
  - Normal follicles m/b mistaken for pathology (young)
  - **Usually spontaneously disappears at 3 yr**



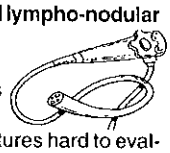


Nonspecific diz, Young, lymphoid follicular hyperplasia
CS: Cough
Dx: Endoscope
Tx: Spontaneous recovery

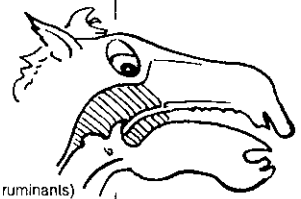
- **ACUTE pharyngitis**
  - **Cough**
  - **Pharyngeal pain** (odynophagia, dysphagia [difficult swallowing])
  - Nasal discharge (bilateral)
  - Regional lymphadenopathy (submandibular, retropharyngeal lnn.)
  - Respiratory noise (often inspiratory)
  - Pharyngeal swelling
- **CHRONIC pharyngitis**
  - Similar to acute - cough, pain
  - Swelling, narrowed airways

Causes:
- Associated w/ other infections
  - Streptococcus spp. (*Strep. equi*)
  - Herpesvirus (EHV-1 & EHV-2)
  - Parainfluenza
  - Influenza
  - Rhinopneumonitis
- Other causes:
  - Irritation by nasogastric tube
  - Smoke inhalation
  - Trauma (endoscope or nasogastric tube)
  - Abscesses caused by *Strep. equi* (Strangles)
  - FB (foreign body)(horses less commonly than ruminants)
  - Retropharyngeal lnn. rupture into pharynx
  - Toxic causes

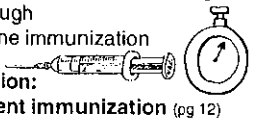
- Endoscope
  - Chronic - **hyperplasia of pharyngeal lympho-nodular follicles**
- Biopsy
- Radiographs
- Ultrasound
- Microbial cultures hard to evaluate (always contaminated)



DDx:
- Rhinitis (pg 94)
- Laryngitis (pg 104)
- Guttural pouch diz
- Neoplasia (biopsy)(pg 98)



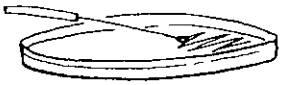
- **Mild pharyngitis - none**
- **Symptomatic:**
  - NSAIDs to ↓ pharyngeal pain
  - Soft feed (green grass)
  - Fluids if dehydrated
  - ABs for 2° infections
  - Topical preparation (ABs, anti-inflam. drug, glycerine (spray through intranasal catheter TID, commonly used, efficacy unknown)
- **Chronic lymphoid hyperplasia:**
  - **Tends to resolve w/ age**
  - Empirical & palliative
  - Rest 4-8 wk (often returns when start retraining)
  - If kept in training - sulfa compounds & throat preps. - Penicillin & broad spec. ABs
  - Cautery if doesn't improve (obliterates reactive tissue)
    - Trichloroacetic acid, electrocautery, or freezing w/ liquid nitrogen
  - Syrupy expectorants on tongue for cough
  - Routine immunization



Prevention:
- **Frequent immunization** (pg 12)
  - Every 60 d, influenza & rhinopneumonitis

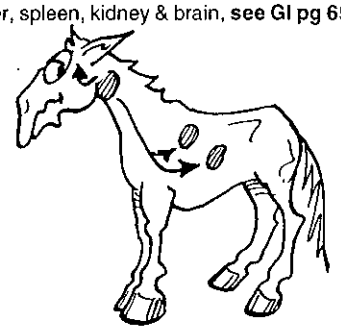
Strep. equi - Strangles — RESPIRATORY SYSTEM

Condition	Facts/Cause	Presentation/CS	Diagnosis	Treatment
Strangles, Distemper, *Strep. equi* infection, **Retropharyngeal lymph node abscessation** M8k 1090; Mk 744; IM 1639, 580; I2M 1639, 580; E 734; EM&S 674, 434; Pop 11-5/98, 32-7/98	• *S. equi*: gram-positive cocci w/ Ig capsules • Named because untreated horses sound like strangling (swelling of lymph nodes closes off pharynx) - See retropharyngeal lymph node abscessation pg. 97 • **1-5 yr-olds** predisposed (all horses susceptible) • **Worldwide, contagious** • Direct contact - Morbidity 30-100% - Mortality 9-10% **. 2° pneumonia** • ± Spread to guttural pouch, sinuses & to rest of body - **"Bastard strangles"** (see box)	• **Sudden onset of fever 2-6 d** after exposure • Upper respiratory tract catarrh • **Swelling & abscess of lnn.** of upper neck (lymphadenopathy) **- Submandibular & retropharyngeal lymph nn.** • Depression, anorexia • May stand w/ neck stretched • Reluctance to swallow • **Nasal discharge** (serous, then mucopurulent) • **Rupture of abscess** onto skin eventually - Preceded by epilation & oozing of serum	• **History & clinical signs** • **Abscesses + High fever** - Firm at 1st, then fluctuate as liquefaction & suppuration develops • **Culture *Strep. equi*** - *S. zooepidemicus* quickly invades causing confusing bact. Dx	• **Early CS** (pyrexia & depression) **- Hi doses of Procaine pen G, DOC** - Stops further development • **Lymph node abscessation** **- Encourage abscess** to rupture (hot packs) . Isolate . Aspirate swollen lymph nodes **. Lance** ripe abscess ventrally **- ABs contraindicated** (prolong diz by halting ripening of abscesses) • **Advanced strangles** - Prolonged fever, anorexia, depression, lethargy or dyspnea in some horses **- Systemic penicillin** - Tracheostomy (rare) • **Just exposed to strangles** **- Penicillin m/ prevent diz**



Submandibular & retropharyngeal lnn.
CS: Swelling, nasal discharge
Dx: Hx, CS
Tx: Abscesses - rupture - heal
"Bastard strangles"

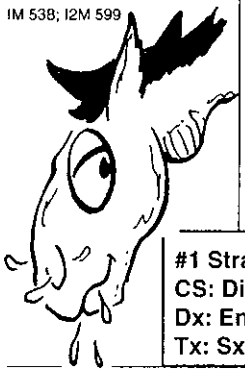
Sequelae & complications
• **"Bastard strangles"**: metastasis of *S. equi* to other organs, commonly to lung, mesentery, liver, spleen, kidney & brain, **see GI pg 65**
- Low incidence
- Difficult to Tx
. Often results in death
• **Suppurative necrotic bronchopneumonia**
- Aspiration of pus or metastatic spread
• **Guttural pouch empyema**
• **Myocarditis**
• **Purpura hemorrhagica**



Control:
• Commercial vaccines not completely successful & cause injection abscesses
• Isolate new horses
• If nasal discharge: culture for *S. equi* & keep isolated until eliminated

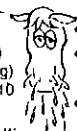
Retropharyngeal lymph node abscesses

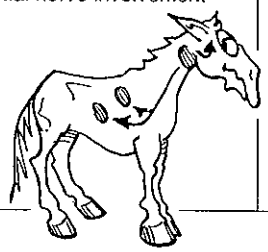
IM 538; I2M 599



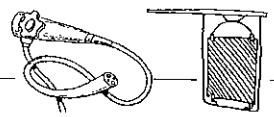
- **Medial & lateral retropharyngeal lymph nodes**
  - Latera; chain along lateral side of guttural pouch
  - Medial chain over dorsolateral pharynx & under caudoventral guttural pouch
- Cause:
  - **#1 Strangles/*Strep. equi*** (from contact) or trauma
  - *Strep. zooepidemicus*, *Corynebacterium pseudotuberculosis* & Actinobacillus spp.
  - Extension of guttural pouch infections
- In area of vagus (CN 10), glossopharyngeal (9), hypoglossal (12), spinal accessory (11) & sympathetic trunk

- **Excessive salivation**
  - **Dysphagia** (difficult swallowing)
  - Odynophagia (painful swallowing)
  - Both due to Cranial nerves 9 & 10
- **Dyspnea**
- Painful "throat-latch" swelling
- **Purulent nasal discharge**
- Nasal or oral regurgitation
- Extension of head & neck
- Weight loss
- Cranial nerve involvement





- **Hx, CS**
- **Endoscope**: reduced size or collapse of lumen of pharynx
- **Lateral radiographs**
  - **Soft tissue mass** between pharynx & guttural pouch (pharyngeal wall appears enlarged) m/ contain gas
  - M/b compression of larynx & trachea
- Percutaneous needle aspiration of purulent material
- Ultrasound
- Lab - inflammatory response
  - Leukocytosis, neutropenia
- Postmortem: Abscess - *S. equi* (liquid) *C. pseudotuberculosis* (caseous)



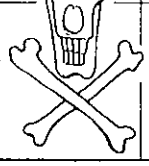
- **Relieve respiratory distress**
  - Temporary tracheotomy if needed
  - **Surgical drainage** often necessary
  - **Ventral approach** recommended over dors. or Viborg's triangle because less vital structures
  - **Broad spec. ABs** immediately (procaine pen.); first take C&S (culture & sensitivity)
  - NSAIDs to reduce swelling & inflammation

DDx:
- Cellulitis (pg 143)
- Guttural pouch empyema or tympany (pg 98)
- Parotiditis
- Lymphadenopathy
- Neoplasia
- Hematoma

#1 Strangles - Press on pharynx
CS: Difficult swallowing & breathing
Dx: Endoscope, rads
Tx: Sx drainage - ABs

Toxicology

PCP, penta	• **See TOX pg 314**; Pressure wood treatment, **Horses like to lick "leaky" wood, ↑ O_2 demand**, Irritating to skin & resp. tract • **CS**: **Gasping** • Dx: **Rapid rigor mortis** • **Tx**: No specific therapy, Fluids to flush kidney
H_2S	• **See TOX pg 314**; Toxic gas, **"Rotten egg" smell, Agitation of liquid manure holding pits**, Irritant to eyes & respiratory system • **CS**: Pulmonary edema, Hyperpnea, Apnea, Asphyxia • **Tx: Fresh air**, Artificial respiration
Smog, SO_2	• **See TOX pg 314**; **Smog**, Sulfur oxides + H_2SO_4, Eye irritation & salivation, emphysema, respiratory distress • Tx: No specific Tx
Smoke	• **See TOX pg 314**; Barn fires: alveolar damage, interstitial edema, hypoxia & 2° bronchopneumonia • **CS:** Oral burns, **Respiratory problems** (cough, stridor, tachypnea) • **Tx:** Patent airway, O_2 therapy, Bronchodilators
ANTU	• **See TOX 315**; **Rare**: Use declining, ↑ permeability of pulmonary capillaries, Strong emetic • **CS:** Pulmonary edema "drowns in own fluid", Death w/o convulsions • Tx: No specific Tx, emetics early
Zn_3P_2	• **See TOX pg 315**; Kilrat®, Goph-rid®, Release of **phosphine gas** on contact w/ water (more rapid at low pH), Odor of rotted fish, Emetic • **CS**: **Exposure, rapid death, dyspnea, Garlic smell** to stomach • **Tx**: **No specific Tx**, Gastric lavage, Symptomatic

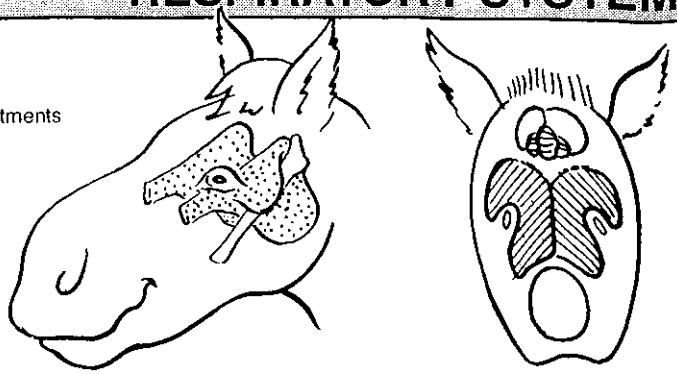


Guttural Pouch Diseases

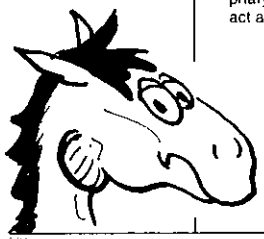
Guttural pouch

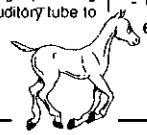
M8k 1098; Mk 739; IM 549; I2M 610; EM&S 402; E 743; C3T 275, S 480; Pop 26-7/98

- **Guttural pouches are unique to the horse**
- Air-filled diverticulum of auditory tube betw. pharynx & middle ear
  - Paired pouches betw. atlas & pharynx
  - Divided by stylohyoid bone into large medial & small lateral compartments
  - Median septum: mucous membranes of 2 pouches on midline
  - Structures crossing dorsocaudal aspect of medial pouch
    - . **Cranial nerves 7, 9, 10, 11 & 12**
    - . **Cranial sympathetic trunk**
    - . **Internal carotid artery**
  - Lateral pouch crossed by external carotid artery
  - Pharyngeal opening of auditory tube, thus of guttural pouch
    - . Located in lateral walls of nasopharynx below pharyngeal recess
    - . Mucosal fold (plica salpingopharyngea) helps make up opening
- Not sterile, normally contains *Strep. zooepidemicus*



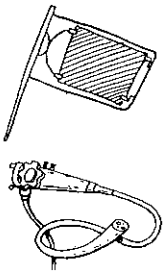
Condition	Facts/Cause	Presentation/CS	Diagnosis	Treatment
Guttural pouch tympany M8k 1099; Mk 740; IM 549; I2M 610; EM&S 404; E 744; M 150; S 481; LAS 344; Pic 94; Pop 26-7/98	• **Infrequent** • **Foals** from birth to 1 1/2 yr - Fillies more than colts • Unilateral >> bilateral distention of guttural pouch • Cause unknown (idiopathic) - M/b congenital redundancy of mucosal fold (plica salpingopharyngea) causing pharyngeal opening of auditory tube to act as a 1-way valve	• **Retropharyngeal swelling,** **- Nonpainful**, soft, fluctuant • Mild cases just swelling • Severe swelling (press on pharynx) - Variable respiratory distress - Extension of head & neck - Dysphagia (difficult swallowing) - Unilateral, can appear bilateral if large enough	• **CS: Swelling**, retropharyngeal space • Unilateral or bilateral - Deflation by catheterization through pharyngeal opening or percutaneous needle aspiration & ext. compression • **Radiographs** • **Endoscope** - pharyngeal opening	• Aspiration of air only temporary, pouch rapidly refills. Use needle in Viborg's triangle or pharyngeal opening • Surgery: **- Fenestration of median septum** (through pharyngeal opening). Ineffective if bilateral **- Sx excision of redundant tissue** of pharyngeal opening of auditory tube (plica salpingopharyngea) **Prognosis:** • **Good** if surgery successful

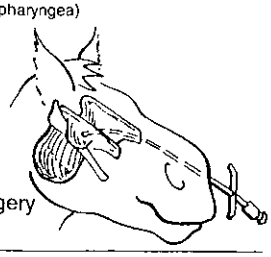




Foals - Uncommon
CS: Nonpainful swelling
Dx: CS, Scope, rads
Tx: Sx - release air

DDx:
- Guttural pouch empyema (pg 99)
- Retropharyngeal abscesses or cellulitis (pg 97)
- Strangles (pg 96)





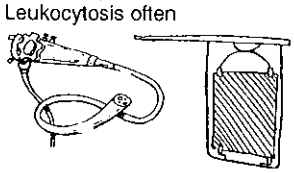
Guttural pouch empyema

M8k 1098; Mk 739; IM 550; I2M 611; EM&S 406; E 744; C3T 279; M 148; S 482; LAS 342; Pop 26-7/98

- **Purulent material in guttural pouch**
- Infection through pharyngeal opening of auditory tube or lymphatic spread
  - 2° to chronic, localized from generalized ascending respiratory infection
- Usually unilateral
- **Strangles (*Strep. equi*)** common extension
- Rupture of retropharyngeal abscess

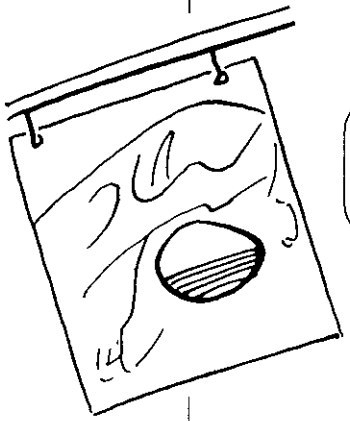
- **Intermittent nasal discharge**
  - Worsens when head lowered
  - Unilateral or bilateral because pharyngeal opening of auditory tube behind nasal septum
  - Non-odorous, white or opaque
- Lymphadenitis
- Parotid swelling & pain
- **Difficult swallowing** (dysphagia) due to pharyngeal compression
- **Difficult breathing** (dyspnea)
- **Chondroids** (hard concretions of inspissated pus)

- **CS: Chronic nonresponsive nasal discharge**
- **Radiographs** - standing lateral
  - Fluid line of radiodense masses (chondroids)
  - Oblique rads to tell which pouch
- **Endoscope** through pharyngeal opening
- Aspiration of fluid - C&S (culture & sensitivity), microbial analysis (β hemolytic streptococcus)
- Leukocytosis often



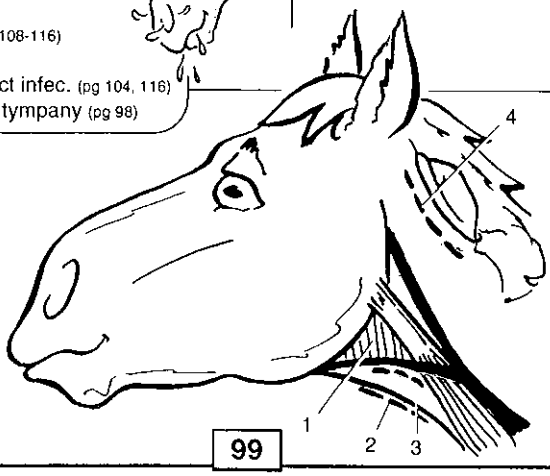
- Tx complicated by poor drainage because pharyngeal opening above floor of pouch (rostrodors.)
  - Need to lower head for drainage
- Medical or surgical depending on duration & nature of diz
- Medical:
  - **Parenteral ABs, relapse common**
  - **Daily lavage w/ saline AB solution** through AI pipette or Chamber's catheter
    - . 500 ml, lower head to prevent aspiration
    - . Irrigation w/ **indwelling** catheter m/ cause severe inflam. changes
    - . Daily catheters better
    - . Course of Tx protracted
- **Surgical drainage** if medical Tx ineffective
- **Chondroids: Sx always indicated**

Prognosis:
- Favorable if recognized early & treated properly



Pus in pouch - presses on pharynx
CS: Chronic nasal discharge
Dx: Endoscope, rads
Tx: ABs/ lavage, Chondroids - Sx

DDx:
- Pneumonia (pg 108-116)
- Sinusitis (pg 103)
- Upper resp. tract infec. (pg 104, 116)
- Guttural pouch tympany (pg 98)

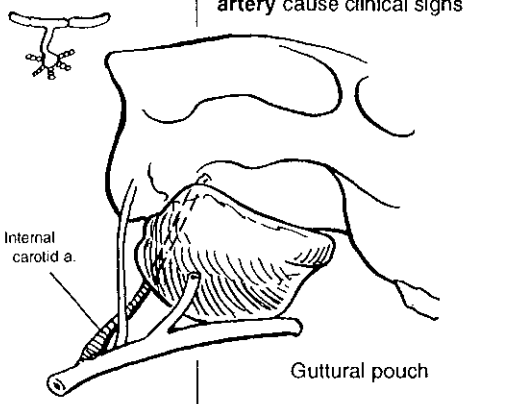


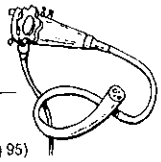
Locations or approaches to guttural pouch

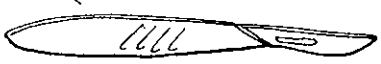
- **1. Viborg's triangle**: bound by tendon of sternocephalicus m., linguofacial vein & ramus or mandible
- **2. Whitehouse**: ventral midline incision, split sternothyrohyoideus muscles
- **3. Modified Whitehouse**: skin incision ventr. to linguofacial vein, blunt dissect along larynx to guttural pouch
- **4. Hyovertebrotomy**: incise ventral to wing of atlas

Epistaxis

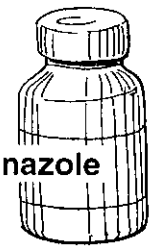
Condition	Facts/Cause	Presentation/CS	Diagnosis	Treatment
Guttural pouch mycosis, **Diphtheria** Mk 739; IM 613; I2M 613; EM&S 408; E 744; C4T 423; C3T 278; M 149; S 483; T&W-A 228; Pop 26-7/98	• **Fungal infection** of guttural pouch • **Typically affects dorsocaudal medial compartment** • Specific cause unknown (idiopathic) - M/b initiated by stress to wall of pouch - *Aspergillus nidulans* isolated - Warmer months • Erosion of pouch & inflammation of **Cranial nerves & internal carotid artery** cause clinical signs	• Wide spectrum of CS • **Epistaxis** - intermittent, spontaneous - Erosion of dorsal wall of med. compartment into internal carotid artery - Usually unilateral, but m/b bilateral **- Mild to severe - fatal** - M/ recur from 24 hrs - 3 weeks • **Dysphagia** (difficult swallowing) - Vagus & glossopharyngeal nn. **- Coughing while eating** **- Food out of nose** • Parotid pain, abnormal head position, unilateral or bilat. nasal discharge, head shyness, abnormal resp. noise, sweating & shivering • Horner's syndrome (sympathetic trunk) • Laryngeal hemiplegia • Visual disturbances, colic • Facial paralysis	• **Hx, Clinical signs (CS)** • **Endoscope** **- Diphtheritic lesion** on dorsocaudal aspect of med. compartment . Brown, yellow, black or white; discrete nodules of diffuse irregular patches . M/b obscured w/ clotted blood - Bleeding from internal carotid a. (medial compartment) or maxillary a. (lateral compart ment) • Postmortem: - Blood clots - Diphtheritic plaque on roof of medial compartment . Clearly demarcated	• **Medical:** - Topical therapy, endoscope . Fungicidal & fungistatic Rx, topical enzymes & organic iodine compounds . Variable success **- Itraconazole** - Parenteral ABs, corticosteroids, thiabendazole, ketoconazole & iodine compounds of questionable efficacy **- Tx protracted so danger of fatal epistaxis during therapy** • **Surgical - best prognosis** **-Balloon-tipped catheter** into distal internal carotid a. combined w/ proximal ligation of internal carotid a. . Closes off artery over guttural pouch . Stops blood entering from common carotid or Circle of Willis



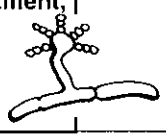




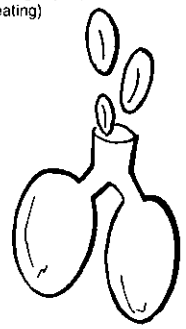
DDx:
- Epistaxis (pg 95)
  - EIPH (Exer.-induced pulm. hemorrhage) (pg 101)
  - Ethmoid hematoma (pg 94)
  - Guttural pouch or pharyngeal neoplasia
  - Tracheobronchial foreign bodies
- Dysphagia
  - Fxs of hyoid apparatus
  - Pharyngeal/guttural pouch fistula
  - Cleft palate (pg 22)
  - Esophagitis
  - Pharyngeal paralysis
  - Foreign body entrapment in mouth or esophagus
  - Pharyngeal neoplasia
  - Lead poisoning (pg 269)
  - Bacteria, viral, & mycotic CNS infections

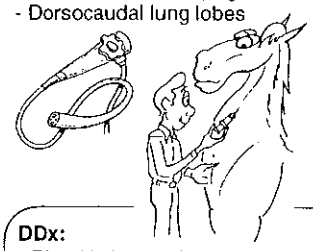


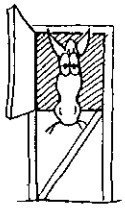
Fungal, Roof of med. compartment, CN 9-12 & Int. carotid a.
CS: Epistaxis - Dysphagia
Dx: Endoscope
Tx: Sx - tie off int. carotid

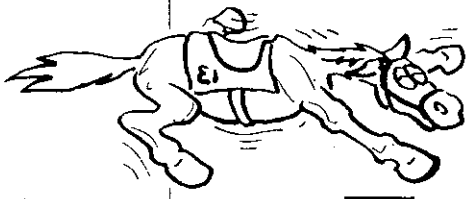


"Bleeders", Exercise induced pulmonary hemorrhage, EIPH, "Bobbling", "Choking", "Gurgling" M8k 1093; Mk 738; IM 603; I2M 603; EM&S 451; C4T 441; C3T 335; M 162; Pop 20-9/97	• **Bleeding from lungs because of exercise** - "Bleeders": misnomer because bleeding from lungs through nose, not from nose • **Big economic concern for owners** of performance horses ("don't finish race") - Race tract terms: "bobbling", "choking" & "gurgling" - Flat racers (Thoroughbreds, Quarterhorses & Appaloosas) freq. betw. 43-75% EIPH - Highest percentage in Arabians - Epistaxis low % of EIPH - Possibly all Thoroughbreds experience EIPH - ↑ W/ ↑ in distance & intensity of races (sprinters highest incidence) - ↑ W/ age (ongoing lung damage, accumulative effects) • Pathogenesis not understood: - Follows exercise at speed, mechanical effort of lungs - Previous pulmonary damage, dust & respiratory diz - Pulmonary damage over time - Bleed from dorsal caud. lung lobes - Once start bleeding, continue w/ subsequent working	• **Epistaxis** after strenuous exercise (race) **- Only in 10%** of EIPH horses - Dyspnea, ↓ RR & effort • **Poor (race) performance** - Slowing or stopping toward end of race - Difficult, labored or abnormal breathing • **Excessive swallowing** after a race (swallowing blood) • Coughing after exercise (m/b clearing blood) • **Exercise intolerance** • **"Cool out" slowly** from exercise (↑ RR, prolonged peripheral vasodilation & sweating)	• **Hx, CS** • **Endoscope** **- Blood in lower airways** just after exercise (30-60 min. after exercise; by 6 hours, blood is cleared) • **TTW** (transtracheal wash) **- Hemosiderophages** (macrophages containing hemosiderin) - Sano's trichrome or Perl's stains • Auscultation: - Harsh bronchial tones over trachea due to blood & in some causes over bronchi in caud. area • Laboratory: usually normal hemogram & chemistries • Rads: dorsocaudal lung fields • Postmortem: - Intra-alveolar hemosiderophages - Dorsocaudal lung lobes	•**Tx difficult** because of chronic nature plus little understanding of causes • Environment free of dust & infectious diz (impossible at racetrack) • **Enforced rest** (3-6 mo) helps some, most continue when return to training • **Lasix® (furosemide) allowed at some state racetracks** - Diuretic, mechanism unknown - **Efficacy not proven** - Reduces bleeding, doesn't prevent EIPH **- Must prove bleeder 1st** (endoscopy, TTW evaluation by board certified clinical pathologist) - Diuretic helps clear system of illegal drugs









DDx:
- Blood in lower airways
  - Bleeding lung abscess
  - Neoplastic mass
  - Foreign body
  - Nasal trauma
  - Nasal turbinate necrosis
  - Ethmoid hematoma (pg 94)
  - Guttural pouch mycosis (pg 100)
  - Airway foreign bodies
  - Neoplasia
- Exercise intolerance
  - Many conditions (see pg. 348)
- Excessive swallowing
- Inappropriate breathing
  - Diffuse pulmonary hemorrhage
  - Subpleural or parenchymal hematoma
  - Focal or diffuse pulmonary diz
  - Neoplasia

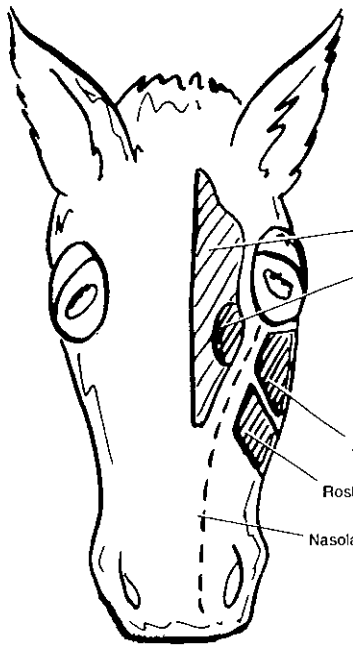
Lungs bleeds w/ exercise
CS: Bleeding w/ exercise - $
Dx: Endoscope, TTW
Tx: Rest, Lasix

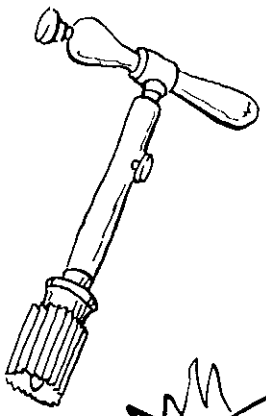
Paranasal sinuses

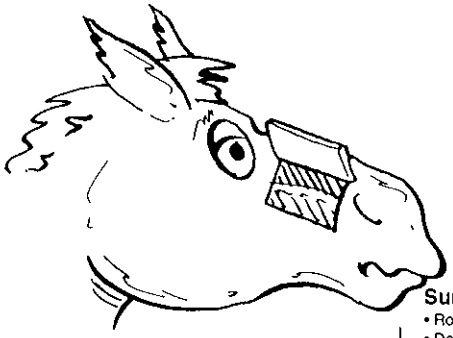
I2M 615, IM 555; C4T 140; C3T 271; S 434, 442

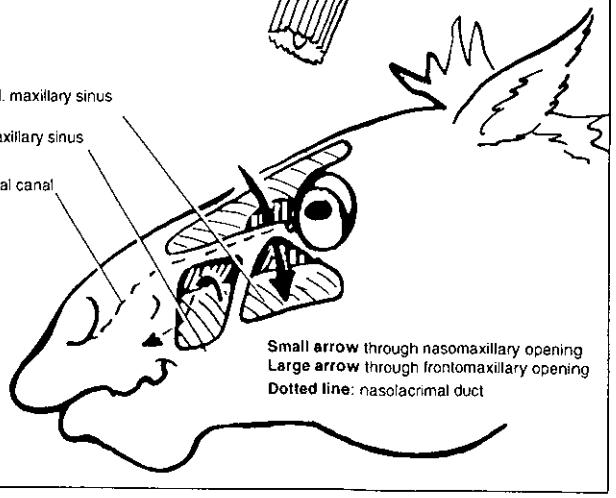
Anatomy or paranasal sinuses:

- Evagination of the respiratory mucosa into bony cavities of skull
- Frontal (conchofrontal) sinus
  - **Frontomaxillary opening** connects conchofrontal sinus w/ maxillary sinus
  - **Maxillary sinus**, rostral & caudal compartments separated by oblique septum
    - . All sinuses empty into maxillary sinus
    - . Teeth roots project up into maxillary sinus
    - . Infraorbital canal passes through maxillary sinus
  - **Nasomaxillary opening** connects maxillary sinus, thus all other sinuses w/ the middle nasal meatus
    - . Located rostral to caudal edge of nasal septum, so any discharge is **unilateral** out nose







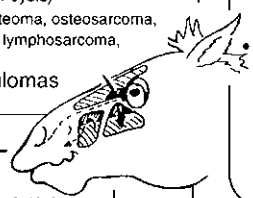


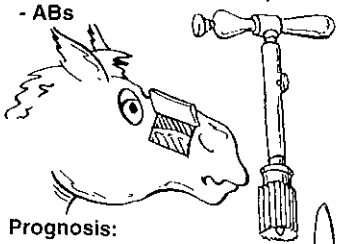
Small arrow through nasomaxillary opening
Large arrow through frontomaxillary opening
Dotted line: nasolacrimal duct

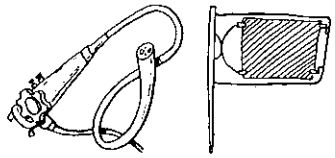
Surgical boundaries of maxillary sinuses

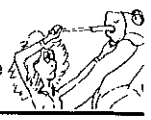
- Rostral: line from infraorbital foramen to rostral end of facial crest
- Dorsal: from infraorbital foramen to medial canthus of eye
- Caudal: line from med. canthus parallel to rostral boundary
- Ventral: facial crest

Condition	Facts/Cause	Clinical Signs	Diagnosis	Treatment
Sinusitis M8k 1097; IM 555; IM2 615; E 747; EM&S 392; C4T 419; C3T 272; M 158; S 442; T&W-A 244; Pop 22-7/98	• **Inflammation of paranasal sinuses** • Sinus empyema: accumulation of pus in sinus cavities - Highest in 4-10 yr olds Cause: 1° or 2° bacterial infection • **2° sinusitis** - **Maxillary sinusitis** . **Often 2° to dental diz** allowing feed into sinus .. Alveolar periostitis .. Patent infundibulum .. Fractures of split teeth - Frontal (conchofrontal) sinusitis m/b extension from maxillary sinus through frontomaxillary opening • **1° sinusitis, less common** - Bacterial or viral upper respiratory tract infection (URI), usually ***Streptococcus* spp.** • Additional causes: - Trauma - Developmental disorder (maxillary follicular cysts) - Neoplasia (osteoma, osteosarcoma, adenocarcinoma, lymphosarcoma, SCC & fibroma) - Fungal granulomas	• Vary (depending on cause, location & extent of involvement) • **UNILATERAL nasal discharge** - Chronic - Serous to mucopurulent - **Unilateral** because nasomaxillary opening rostral to caudal edge of nasal septum - Intermittent or continuous - 1° not unpleasant odor - 2° fetid smelling • Ipsilateral ocular discharge • Draining tract • **Obstruction of nasomaxillary opening by inspissated pus** - Facial distortion . Not if patent nasomaxillary opening - No nasal discharge - Respiratory distress (swelling occludes nasal passages) **DDx:** • Fetid odor - Nasal neoplasia - Turbinate necrosis • Facial distortion - Infection - Neoplasia - Fx • Nasal discharge - Acute pharyngitis (strangles [pg 96], rhinopneumonitis & influenza [pg 109, 111]) - Guttural pouch empyema or mycosis (pg 99, 100) - Neoplasia or necrosis of turbinates - Ethmoid hematoma (pg 95)	• **Presumptive PE & CS** • Physical exam: **asymmetry of face** • Percussion - Dullness or pain over sinus - Normal resonance doesn't rule out sinusitis - Rarely ↑ resonance if gas over fluid (maxillary cyst) • **Dental pick oral exam** - Patent infundibulum • Lab: Hemogram usually normal (m/b neutrophilia), Chronic m/b ↑ fibrinogen • Percutaneous centesis - Cytology (gram stain, C&S) - Single organism isolated = 1° - Multiple organisms = 2° • **Radiographs**: Lat, DV & obliques - Fluid lines & soft tissue densities in sinuses - Fractures, ↓ bone densities & dental abnormalities - Dental root diz: lysis of tooth root or surrounding bone (loss of continuity of lamina dura) • **Endoscope:** - **Drainage from nasomaxillary opening** into middle nasal meatus • Postmortem: - Fluid, pus in sinuses: odor if from dental diz - ± Distortion of bones	• **1° sinusitis or empyema** - **Daily lavage** through percutaneous centesis w/ 1 L of ABs/saline 14 d (change if C&S indicates) - Sx if medical Tx ineffective . **Sinusotomy** (trephination or bone flap) - **Chronic** (> 6 mo) . **Sx removal of thickened mucous membrane** • **2° sinusitis or empyema** - Gen. not responsive to medical Tx - **Tx 1° cause**, remove diseased tooth, granulomas or neoplasia - **ABs** **Prognosis:** • 1° sinusitis - Good if not long standing or mucous membrane not thickened - Poor in chronic (> 6 mo) - **Pseudomonas: poor** • 2° sinusitis to dental diz - Good if diseased tooth removed - Guarded to poor - neoplasia (usually metastasized) **Prevention:** • Regular dental care • Proper diet

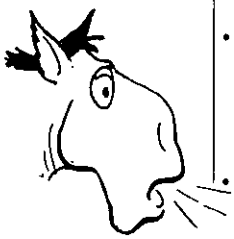
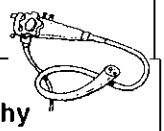
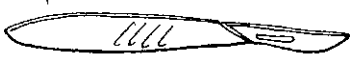
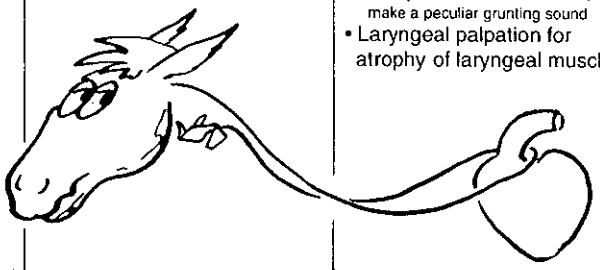
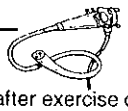




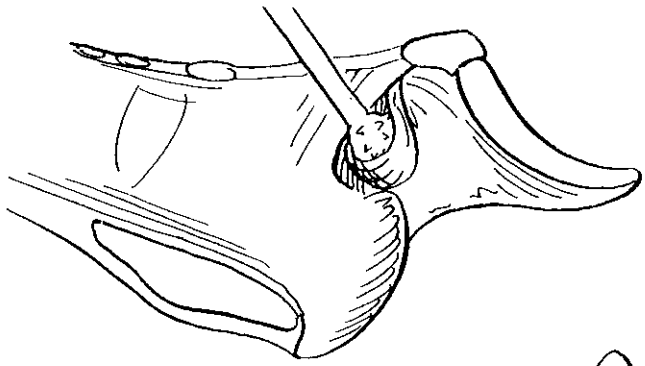


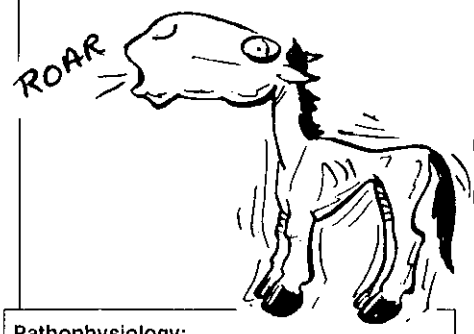


2° to Dental diz
CS: Unilateral nasal discharge
Dx: Endoscope, Dental pick, Rads
Tx: Medial or Sx

Condition	Facts/Cause	Presentation/CS	Diagnosis	Treatment
Laryngitis M8k 1059; Mk 712; EM&S 412; E 757, 766; S 460, 473 	• Inflammation of mucosa or cartilages • **2° to respiratory infections** - Strangles, Herpesvirus, Equine viral arteritis, Infectious bronchitis • Other causes: - **Smoke inhalation**, irritating gases - Trauma (endoscope or nasogastric tube) - Toxic causes - FB (foreign body) (horses less commonly than ruminants) • Laryngeal edema m/ lead to arytenoid chondropathy (see box)	• **Cough**, harsh, dry & short initially, then soft & moist & painful • ± ↑ Temperature • Nasal discharge - bilateral • **Swelling**, narrowed airway - **Dysphagia** (difficult swallowing) - **Dyspnea** (difficult breathing) - Stridor if edema - Head lowered, mouth open - ± Death due to asphyxiation (especially if exercised) - Cyanotic membranes - ↑ Pulse rate - M/ sweat profusely • Systemic signs due to 1° cause	• **CS** (clinical signs), Hx • **Laryngoscopy** (flexible endoscope) - Definitive Dx - Edematous, inflamed mucosa  **Arytenoid chondropathy** M8k 1059; Mk 712 • Laryngeal edema m/ lead to • Arytenoid condritis - suppurative condition of cartilage matrix of young colts - Distinct breed predilection in Thoroughbreds • Tx: subtotal arytenoidectomy • Px: uncertain for complete return to athletic capacity	• **Laryngeal obstruction** - **Tracheotomy** tube immediately - Corticosteroids to reduce inflammation (hydrocortisone IV) - Systemic ABs  • **Tx 1° disease** • Humidified air • Clean, warm confinement • Soft or liquid feed • Avoid dust • Antitussive to suppress cough 
2° to Resp. - Cough - Scope				
"Roaring", Laryngeal hemiplegia, **Recurrent laryngeal neuropathy, Idiopathic laryngeal hemiplegia** M8k 1094; Mk 740, IM 497; I2M 84; E 758; M 152; EM&S 414, 782; C4T 404; C3T 285, S 466; T&W 204; Pop 30-7/98 	• **Paralysis of vocal cords - obstruction** - **Damaged recurrent laryngeal nerve** - Inability to abduct the vocal cord - Partial to complete obstruction of glottic cleft (opening through larynx) • Causes: - **#1: Axonal degeneration** - unknown cause (congenital, heritable) - Direct trauma to vagus or recurrent laryngeal n. - Iatrogenic injection into nerves - Toxic plants (*Cicer arietinum* [chick peas] & *Lathyrus* spp), temporary - Chemicals: lead, organophosphates • Large male breeds, all susceptible • **Left side > 90%**	• Asymptomatic at rest • **"Roaring"** or "whistling" during exercise (inspiration), as air is inspired through restricted glottic cleft • Inspiratory dyspnea • **Exercise intolerance** 	• **Hx, CS** • **Endoscope** - Immediately after exercise or preferably on tread mill - Visualize vocal fold hanging immobile in glottic cleft - "Slap test": hit horse on ribs, they make a peculiar grunting sound • Laryngeal palpation for atrophy of laryngeal muscles 	• **Incurable** • **Laryngeal ventriculectomy** for pleasure horses (see box) • **Prosthetic laryngoplasty +** laryngeal ventriculectomy for race horses (see box)  **DDx:** • Arytenoid chondropathy (chondritis) (pg 104) check conformation of arytenoids • Tumors • Retention cysts • Pharyngeal edema

Laryngotomy & laryngeal ventriculectomy
For pleasure horses: quiets breathing
Procedure:
- General anesthesia in dorsal recumbency or standing w/ sedation & local anesthesia
- 4" midline incision over cricoid & thyroid cartilages
- Bluntly separate sternothyrohyoid (strap) muscles
- Incise the cricothyroid lig. in the thyroid notch, self retaining retractors
- **Laryngeal bur** twisted into the laryngeal ventricle (just cran. to vocal fold)
- Evert laryngeal mucosa & remove (scarring will pull vocal fold laterally)
- **DO NOT suture** laryngotomy incision, heals by 2° intention in 3-4 wk (larynx not sterile)
- Post op: clean wound BID, ABs not necessary





Pathophysiology:
- **Permanent paresis or paralysis of vocal cord & arytenoid cartilage**
- Degeneration of the recurrent laryngeal nerve
  - Lt. more commonly affected (longer, wraps around aortic arch)
- Paralysis of intrinsic laryngeal mm., except lat. cricoarytenoid
  - **Dorsal cricoarytenoid m.** can't abduct the vocal cord to open glottic cleft
- **"Roaring"** caused by vocal cord & arytenoid cartilage hanging in glottic cleft & decreasing inspiratory air flow, no resistance to expiration

Laryngeal prosthesis and laryngeal ventriculectomy
For race horses to help performance
Procedure: general anesthesia, right lateral recumbency
- 5" incision over larynx parallel & ventral to the external jugular & maxillary veins
- Dissect to the caudal edge of the dorsal part of the cricoid cartilage
  - Place a mattress suture through the caudal edge of the cricoid cartilage near dorsal midline
- Bluntly dissect between cricopharyngeal & thyropharyngeal muscles to locate the **muscular process** of arytenoid cartilage
- Drill a hole through the vocal process w/ a 14 or 16 gauge needle
- Reach under the cricopharyngeal m. & pull suture through the hole in muscular process
- Tie the suture tight (mimics cricoarytenoideus dorsalis m. abducting the vocal cord laterally)
- Suture the skin incision
- Do a laryngeal ventriculectomy as outlined above

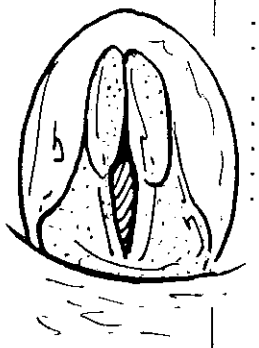
Soft Palate - Epiglottis

Condition	Facts/Cause	Presentation/CS	Diagnosis	Treatment

Dorsal displacement of the soft palate, Laryngopalatal subluxation

I2M 367; C4T 415; EM&S 400; M 155; T&W 221; POP 29-7/98

- **Normally epiglottis overlaps dorsal side of soft palate**
- Pathological displacement:
  - No predisposing factors in roughly 1/3 of cases
  - Forced contraction of sternothyrohyoid & omohyoid mm. pull larynx caudally
  - Numerous dizs change stability of larynx & soft palate/pharyngeal arch seal
    - . Exercise despite painful disorders
    - . Caudal retraction of larynx during exercise
    - . Epiglottic hypoplasia
    - . Rostral displacement of palato-pharyngeal arch
    - . Pharyngeal lymphoid hyperplasia
    - . Laryngeal chondroma & chondritis
    - . Subepiglottic cysts
    - . Epiglottic entrapment
    - . Laryngeal hemiplegia

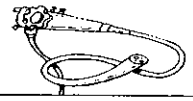


Epiglottis normally dorsal to soft palate
CS: Tiring
Dx: Endoscope: no epiglottis
Tx: Tx other diz, Sx

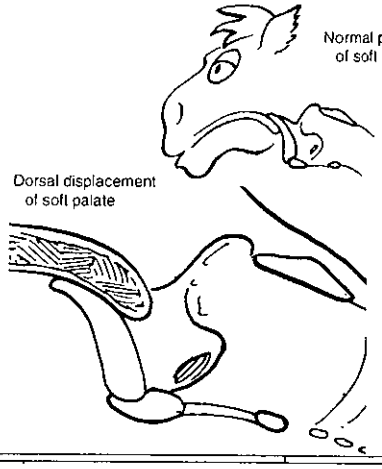
- **Exercise intolerance**

DDx:
- Epiglottic entrapment (pg 107) (outline of epiglottis not obscured)

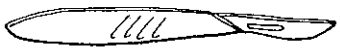
- **Endoscope**
  - Epiglottis not visualized, covered by soft palate



- **Normally the epiglottis overlaps dorsal side soft palate**
  - Caudal edge of soft palate & palatopharyngeal folds (extensions of caudal edge of soft palate onto pharynx) form a seal around the larynx normally
  - Dorsal displacement is normal during deglutition (swallowing)
  - Can be induced in all horses if external nostrils are closed off, so they are forced to breath through their mouth



- **Tx other diz conditions first**
- Limit ability to dislocate larynx if no predisposing diz
  - **Tongue tie** helps restrict caudal retraction of larynx
  - Excision of portions of free border of soft palate
    - . Doesn't prevent displacement, but eliminates part of soft palate that gets sucked into larynx once displaced
  - **Sternothyromyectomy** (see box)



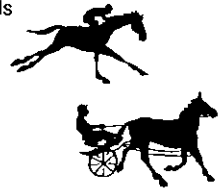
Prognosis:
- Value of Sx is of controversial success rate

Sternothyromyectomy
- Standing, sedated & local in form of a "U-block" or
- Dorsal recumbency (anesthetized & intubated)
- Procedure:
  - 5-6" ventral midline incision rostral to cricoid cartilage
  - Bluntly dissect between sternohyoid muscles
  - Undermine sternohyoid & omohyoid
  - Cut out a 4" portion of both muscles (transect through sternohyoid & omohyoid until close to external jugular v.
  - Repeat on opposite side
  - Place a Penrose drain & suture to SQ & skin
- Postop:
  - Remove Penrose drain in 5 d
  - Remove sutures in 12-14 d
  - Begin training when sutures removed

Epiglottic entrapment

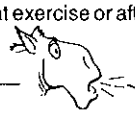
EM&S 421; E 764; C3T 281; M 146; S 462; Pop 30-7/98

- **Displacement of subepiglottic tissue over epiglottis**
  - Normally subepiglottic tissue is folded accordion fashion to allow free movement of epiglottis
- Most common in Standardbreds & Thoroughbreds



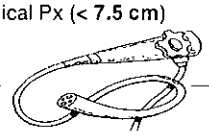
Subepiglottic tissue
CS: Exercise intolerance
Dx: Endoscope
Tx: Sx

- **Exercise intolerance**
- Abnormal resp. noise during fast work (inspir. or expir.)
- Uneven respiratory pattern
- Coughing at exercise or after eating



DDx:
- Ulceration of epiglottic apex
- Dors. displacement of soft palate (pg 106) (outline of epiglottis can't be distinguished)

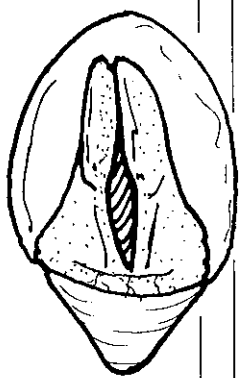
- **Endoscopic exam** - definitive
  - **Obscures normal serrated margin** of epiglottis & freq. its dors. vascular pattern
  - **Epiglottis not obscured** (thicker & blunted at apex)
  - **Free edge** of entrapping tissue seen over laryngeal surface of epiglottis
  - M/ only entrap lateral margins of epiglottis
  - Ulcerations of entrapping tissue
  - Oral endoscope if concurrent dorsal displacement of soft palpate
- **Lateral radiograph**: shows thickness, length & shape of epiglottis
  - **Measure** of length of epiglottis
    - . From tip to thyroid cartilage (normal 8.76-9.35 cm)
    - . Short length poorer post surgical Px (**< 7.5 cm**)

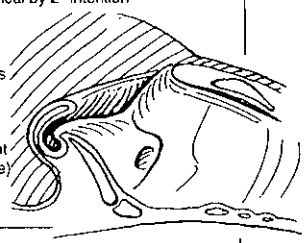


- **Surgical removal or transection of entrapping tissue** (see box)

Prognosis:
- Depends on preoperative complication (palatal or epiglottal anomalies)
  - **Length of epiglottis < 7.5 poor**

Surgical removal or transection of entrapping tissue
- Short surgery if experienced so just IV anesthesia, less experienced use general
- Dorsal recumbency
- **Ventral laryngotomy approach** (midline over larynx, separate strap mm.)
- Approach through cricothyroid ligament (filling caudal thyroid notch)
- Grasp free edge of entrapping tissue & retract epiglottis into laryngeal lumen (if intermittent entrapment, tissue m/ not be over epiglottis, then grasp tissue lateral to epiglottis)
- V-shaped incision or crescentic incision (controversy on how much to remove)
- Subepiglottic tissue & laryngeal incision allowed to heal by 2° intention
- Laser surgery in future
- Postop:
  - Withhold food to prevent contamination of wound
  - Phenylbutazone & prophylactic ABs for several days
  - Stall rest up to 45 d
- Endoscope before return to training
- Complication of surgery
  - Removing too much m/ result in dorsal displacement of soft palate (horse worse after surgery than before)
    - . Expected if concurrent problem before surgery
  - Remove too little, recurrence of entrapment



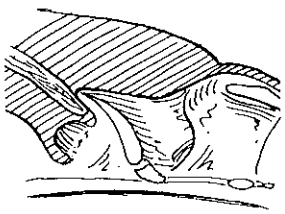


Cause - unclear
- Happens during swallowing
- Assoc. w/ palatine & epiglottic defects (hypoplasia of soft palpate, persistent laryngopalatine dislocation, cleft palate, hypoplasia of epiglottis & epiglottic deformities)
- Congenital & acquired forms

Subepiglottic cyst

CT 281; M 156; T&W 225; S 461

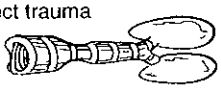
- **Relatively uncommon**
- **CS:** respiratory obstruction
- **DX:** Endoscope
- **Tx:** Surgical removal



Tracheal stenosis

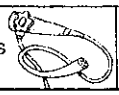
I2M 367; C4T 424; EM&S 424; E 728; M 156; S 488

- **"Scabbard" trachea**
- Congenital in ponies & miniature horses
- Acquired - direct trauma
  - Retire horse

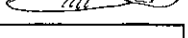


- **Often incidental finding**
- **Chronic cough**
- Dyspnea during exercise - Stridor
- Poor performance

- Endoscope
- Palpation of stenosis
- Lateral X-ray

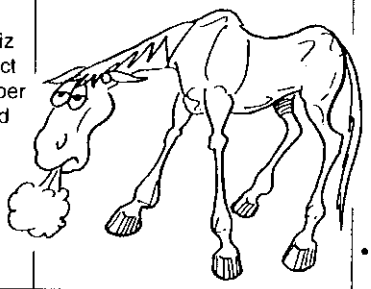


- Refer for surgery (difficult & complications)
- Retire horse

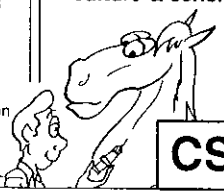


Tracheitis E 770 • Bacterial or viral, associated w/ endotracheal tube, tracheostomy or smoke inhalation

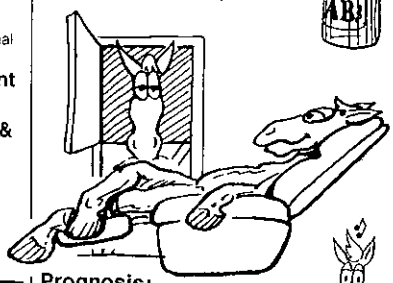
Condition	Facts/Cause	Presentation/CS	Diagnosis	Treatment
Viral respiratory diz M8k 1080; Mk 732; C4T 443; E 732; I2M 584, IM 524	• **#2 cause of poor performance** (musculoskeletal #1) • **Economic concern** (loss of athletic time, abortion & vet costs) • **Transmission:** - **Contact** - Aerosolization & inhalation & contact w/ contaminated objects - Short IP (incubation period) • **Epidemics** because hi contact rate, short IP in unvaccinated population • **2° bacterial infection** - *S. zooepidemicus* • Seldom cause lower resp. diz • Restricted to upper resp. tract • See lower descend from upper • Also in immunocompromised & poorly nourished • Transported in large groups • Trained intensively at very young age	• Severity depends on immunological experience & type of virus • **Present as URT infection** (m/ extend to LRT) - **↑ temperature** - **Cough** - **Nasal discharge** - **Exercise intolerance** - Fever > 5d + mucopurulent discharge - 2° bacteria	• **Difficult to DDx** one type from another • **Usually presumptive on CS & physical exam** • **Viral testing NOT performed** usually because: - No Tx benefit to knowing which virus - Several weeks for ID - horse recovering • Justification for viral testing - Large population at risk - Vaccination in face of outbreak - No need to use antibiotics if virus • Virus tests: - **Acute & convalescent antibody titers (compared)** . Most used, least expensive . Test for Eq influenza, EHV-1 & Eq viral arteritis (EVA) . **4 fold** or greater i signific. . Know vaccination history . Single antibody titer usually not Dx - **Viral isolation** - $ Expensive $ - Time consuming (2-4 weeks) - Frequently unsuccessful - Nasopharyngeal swabs & transtracheal aspirates to lab • **If Fever > 5 d & mucopurulent** nasal discharge - 2° bacteria **- Transtracheal wash (TTW) & culture & sensitivity (C&S)**	• **Rest** - minimum of 1 week - Convalescence 3-4 weeks even if CS gone, to allow regeneration of epithelium • **Well ventilated stall**, protected from weather, keep down dust • **NSAIDs** - lower fever, ↑ appetite, ↓ myalgia (muscle pain) - Disadvantages: masks CS if developing bacterial infection& allows owners to return animal to work sooner than it should • If cough after start exercise, continue rest • **2° bacteria** (Fever > 5 days & snotty nose) **- Antibiotics 7 d** (transtracheal wash [TTW] & culture & sensitivity [C&S]) (esp. in foals) - Controversial, important to foals, usually put on prophylactically, potential for resistant bacterial infections • Isolation of affected animals ideal (not done)



Immunity (due to cellular & humoral)
- **IgA**: immunoglobulin of nasal passages (neutralizes, immobilizes & blocks penetration of mucosa, does NOT kill organisms)
- **IgM & IgG** in lungs, enhances PMN & macrophage phagocytosis of virus
- Immunization or exposure stim. production of these antibodies
- Re-exposure - anamnestic response



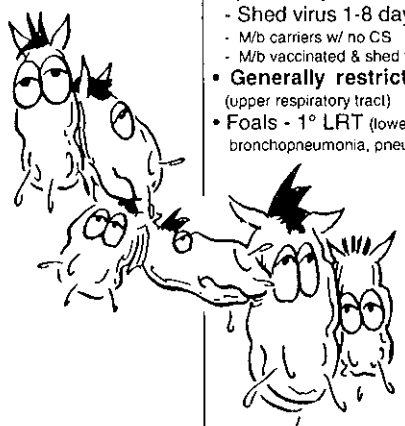
CS + PE

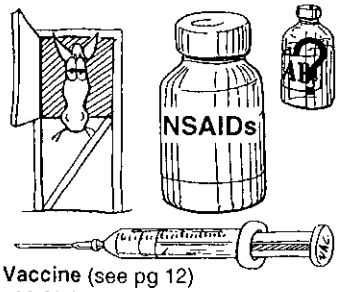


Prognosis:
- **Excellent** in uncomplicated cases

#2 cause of poor performance
CS: Cough, Nasal discharge
Exercise intolerance
Dx: Difficult - CS & PE
Tx: Rest, ABs for 2° bact.

Influenza 1; Equine influenza M8k 1084; Mk 737; IM 525; I2M 585, 1636; EM&S 380; E 732; C4T 446; C3T 316; Pop 17-7/97	• Most common respiratory virus • **Myxovirus** w/ 2 antigen types - No cross species infection - Subject to **antigenic "drift"** - Inactivated by most common detergents • Epidemiology: - **Oubreaks: spreads rapidly** through group of susceptible animals - IP (Incubation) 1-3 days - Throughout herd in 7-10 days - 1-3 yr-olds, all ages susceptible - Most severe in unexposed previously or unvaccinated - Shed virus 1-8 days - M/b carriers w/ no CS - M/b vaccinated & shed w/o CS • **Generally restricted to URT** (upper respiratory tract) • Foals - 1° LRT (lower resp. tract), bronchopneumonia, pneumonitis	• **↑ Temp** (biphasic, usually missed) 103-106° F • Lethargic, depressed & partially off feed • **Nonproductive hacking cough** characteristic of influenza • **Serous or mucoid nasal discharge**, unlike other 1° viral causes • No lymph node involvement • Weakness • Uncomplicated cases, heal w/ in few weeks • **Complicated - 2° bacterial infection** (those having no rest, no defense mechanisms of respiratory tract, immunocompromised & foals) - **Mucopurulent discharge** - **Productive cough** - **CS of pneumonia** • **Uncommon complications** - Myocarditis - Myositis - Limb edema (severe & significant - stock up due to no exercise when previously used to lots of exercise)	• **History of explosive outbreak** suggestive of influenza • However, CS very similar to other viral infec. • Acute & convalescent antibody titers (3-4 weeks apart compared) - **4 fold** or greater incr. signif. - M/not see if previously vaccinated - Not usually done, recommended if many animals to provide preventative med. such as vaccinations • Viral isolation from nasal swabs early, first 48-72 hours, not usually done: $, time) • Lab: - Lymphopenia, short lived - Monocytosis m/ occurs later - 2° bacterial infection: ↑ PMNs	• **Stall rest for 3 weeks** w/ hand walking • **Well ventilated stall**, protected from weather, keep down dust • **NSAIDs**, use to decrease fever so animal continues to eat & drink • Antibiotics minimum 7 d (controversial) - Important to foals - Usually put on prophylactically • Isolation of affected horses





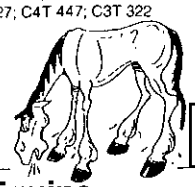
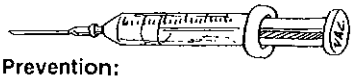
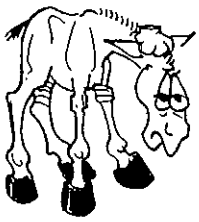
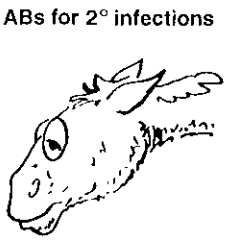
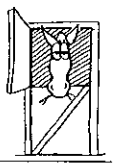
DDx:
- Rhinopneumonitis (pg 111)
- Eq. viral arteritis (pg 110)
- Other resp. infec. (pg 112-115

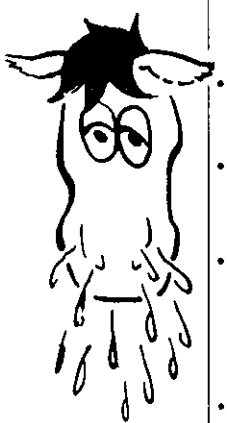
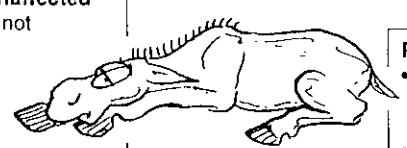
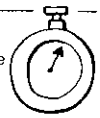
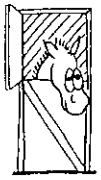
Vaccine (see pg 12)
- Multiple killed vaccines
- **Initial vac at 3 month**, (at 1 month if dam not vaccinated)
- **Booster in 3-4 weeks** (weanling)
. If started before 3 months need 3 dose primary series
. If at risk revaccinate every 2-3 months for life after 4 month vaccine
- **Revaccinate at 12 months**
- **Performance horses: every 2-3 months for life**
- **Pleasure horses: Biannually**
. If backyard & no new animals, don't need to revaccinate beyond 2-3 years of age
- Manufact. recommends annual revac., not sufficient for young & performance horses
- **Brood mares: Biannually**
- If pregnant 1 month prior to foaling

Explosive outbreaks
CS: URT - Nasal discharge
Dx: Hx
Tx: Isolate, Rest, ABs, NSAIDs
Vaccinate

- **Pathogenesis:**
- Inhalation &/or direct contact w/ nasal secretions
- Invades respiratory epithelial cells, causing hyperemia, edema & desquamation of epithelial cells of the nose, pharynx, larynx & trachea
- Superficial erosion & loss of ciliary clearance mechanisms (potential to develop lower respiratory tract diz)
- Repair time up to 3 weeks (re-epithelialization)
- Must be rested or develop complications

Viral Respiratory Diz

Condition	Facts/Cause	Clinical Signs	Diagnosis	Treatment
Equine viral arteritis, EVA, **Equine typhoid, Epizootic cellulitis,** Mk 376, I2M 588, 1641; IM 527; C4T 447; C3T 322  **Edema - Repro Quarantine**	• **See CARDIOVASCULAR** pg 134 • 1° a vasculitis • Togaviridae - **Damages smaller arteries** - Epizootic cellulitis - **Edema** due to leakage • Transm. - respiratory or venereal - **Carrier stallion**, not mares • Mortality rare	 • **Most mild** • Fever • **Conjunctivitis & rhinitis** - Reddening of third eyelid to push it forward • **Very sick**, severe depression, quit eating • **Limb edema** (esp. hindlimbs) • M/b colic & diarrhea, photophobia, ventr. edema, skin rash, myalgia (muscle pain), arthralgia (joint pain), icterus • **Abortion** (over 1/2 mares abort. during illness at various stages of preg.) - **5-10 months**	• **CS to provisionally Dx** • Leukopenia • Virus isolation, histopath. • Serology 	• **No specific Tx** • ABs (2° bacteria) & symptomatic Tx • Good nursing & absolute rest  **Prevention:** • **MLV vaccine**: if allowed by USDA in area - Know regulations for vaccinations - Economics, if no problem w/ EVA, don't vac. • Seropositive stallions only bred to seropositive or vaccinated mares • Know current restrictions in your area (quarantine)
Equine adenovirus I2M 588; IM 528; E 733 	• **Normal inhabitant of URT** (upper resp. tract) • Lower respiratory tract infection • Causes diz - **CID Arabian foals** (combined immuno-defc diz) - **FPT** foals (failure of passive transfer) • **Fatal pneumonia**, attacks lower resp. bronchi, bronchioles, loss of epithelium then 2° bact. (bronchial pneumonia) or such severe interstitial pneumonia that death ensues • **Most common cause of death in CID or FPT foals**	 • **↑ Temperature** • **Nasal & ocular discharge** • **Cough** • **↑** RR (respiratory rate) • **Dyspnea** (difficult breathing) m/be, in assoc. w/ interstitial or bronchial pneumonia • **Foals w/ CID** - GI signs such as **diarrhea** - Poor doers w/ scruffy hair coats - Chronically depressed • Lymphopenia (esp. CID - persistent lymphopenia > 1,000 per microliter)	• **Signalment - Arabian** • **History of FPT** • CS referable to upper & lower resp. tract suggestive • Auscultation - crackles & wheezes • Viral isolation can be done, but normal inhabitant in upper resp. tract • Serology only helpful in animals that can mount an immune response (don't have CID or FPT) • **PM (postmortem)** - Virus isol. from lung tissue culture - Intranuclear inclusion bodies from swab of nasopharynx or lungs suggestive	• **Plasma** • **ABs for 2° infections**   **CID & FPT**
Equine rhinovirus IM 528; E 734; C4T 446 	• **Questionable clinical significance** • Antibodies found in most horses • Causes little epithelial damage	• **Doesn't cause signif. diz** in most • Mild, low-grade pyrexia • Mild cough • Mild serous discharge • M/ have enlarged lnn. 	• Acute & convalescent serum titers w/ 4x increase 	• **Usually not treated** • Rest • **No vaccine available** 

"Snots" EHV-1, Rhino-pneumonitis, Herpesvirus 1, Equine viral rhinopneumonitis, Eq. abortion virus M8k 1081; Mk 734, IM 526; I2M 587, 1638; E 733, C4T 444; C3T 319; Pop 28-9/97  **Rhinopneumonitis** **CS: "Snots" - foals, Abortion storms** **Dx: Hx, CS, Serology** **Tx: Rest, Vaccination**	• **4 separate syndromes**, resp, abortions, neonatal & CNS diz • **Herpes virus 1**, 2 serotypes, Type 1 causes abortion, CNS & resp. diz, Type 2 resp. • **Transmission:** - **Inhalation** - direct or indirect from nasal discharge, aborted fetuses, placenta - IP (incubation period) 3-7 d - **Carrier animals** - recrudescence - **Introduced to farm by new horses** - **Rapid spread**, in susceptible horses - High morbidity, low mortality - **Annual outbreaks in foals** (in horse areas); herd immunity determines if episode occurs • **Pathophysiology:** - Multiply in epithelium of nasal, pharyngeal & tonsil areas, damaging epithelium - T-lymphocytes transmit virus through body • **Respiratory problems in foals** - Weanling (maternal ABs waning) - Stress - groups moved so can't hear moms - Starts as upper then moves to lower in foals • **Asymptomatic in mares** - **Abortion storms weeks to months later** . **Most common infectious cause** (1/4 of all Dx abortions) - **Future breeding unaffected** • Immunity on recovery not permanent	• **Foals** - **"Snots"** - runny (copious), serous nasal discharge (purulent if 2° bact) - Conjunctivitis m/b - Malaise, inappetence, edematous mandibular &/or retropharyngeal lnn., constipation followed by diarrhea - ± Dry cough (self limiting, wk - 10 d), m/ have dry cough for longer (3-4 wk) - **2° bacterial infection common** . **Mucopurulent** nasal discharge - Appetite good, except in foals, poor due to more systemically affected, more depressed - Lymph node involvement, submandibular & retropharyngeal lnn. enlargement - Biphasic temp. 102-106°F • **Mares** - asymptomatic - **Abortion 4-5 mo later** . Last trimester (7-11 mo) • **Neonatal death** die in a few days - M/b normal at birth then weak, resp. distress, irretractable diarrhea to death - **Interstitial pneumonia** • CNS (myeloencephalopathy) - some - Mild ataxia & posterior paresis to posterior paralysis & recumbency - Most frequent in mares shortly after foaling during an abortion outbreak (m/b also in barren mares, males, foals, etc.) • Can redevelop diz w/in 4-5 mo following infection 	• **Hx (history), CS** • **"Snots"**: can't be DDx from other viral diz by CS - Virus isolation - from nasopharyngeal swabs & citrated blood early in course of diz (rarely done) - Serology of acute & convalescent sera (more commonly done) - Leukopenia (neutropenia & lymphopenia) • **Abortion: Hx of storm of "snots" on farm 4-5 mo prior**  **DDx: "Snots"** • Other viral infec. - Eq. Influenza (pg 109), CS similar so can't distinguish, although Herpes gen. is milder - Eq. viral arteritis (pg 110) • *S. equi* **Prognosis:** • **"Snots": self limiting** - Immunity lasts couple of years, not permanent • Abortion: - **Future breeding unaffected**	**"Snots"**  • **Self limiting** (no $ advantage of treating all) • Monitor - **Antibiotics** empirically for 2° bact., if mucopurulent discharge or lung involvement • Similar to influenza • **Stall rest for 3 wks**, to heal resp. epith. • **NSAIDs**, though masks CS, esp. bact. infec. • Isolate infected animals • Disinfect environment  **Abortion**  • Isolate • Vaccinate all  **Prevention:** • **Isolate new horses** 3-4 weeks • **Reduce stress** (latent carriers) • **Segregate** breeding & training horses • Keep at farm for 3 weeks after resp. or abortion outbreak • **Vaccine** see pg 13, almost mandatory due to constant movement of horses - Give to all horses on premises, not just mares - MLV (Rhinomune®) only lessening CS - Immunity for only 2-4 mo - **Foals 3, 4, & 12 months** - Foals at risk - booster every 3-4 mo to maturity - **Adults** - **Performance: 2-3 mo boosters** - **Pleasure: biannually** - **Broad mares: Vac 5th, 7th & 9th months of gestation** . Vac. in abortion storm (recommended) . Both MLV & killed virus vaccines available & approved for use in pregnant mares

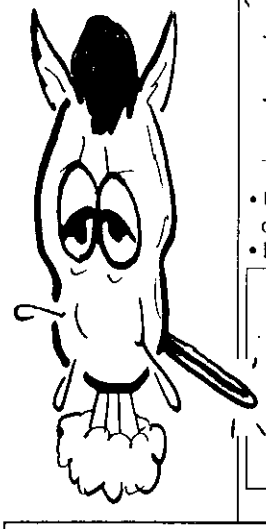
Pneumonia — RESPIRATORY SYSTEM

Condition	Facts/Cause	Presentation/CS	Diagnosis	Treatment

Foal pneumonia

Bacterial pneumonia in foals

Mk 733; IM 511; I2M 572, 367; E 770; EM&S 441; C4T 612; C3T 466; M 287



- **#1 mortality of foals 1-6 months**
- **Bacteria:** same spectrum of organisms as in adults
  - **#1 *Strep. zooepidemicus*** (as in adults)
  - ***Rhodococcus equi:*** severe & m/b endemic
  - *E. coli* & *Actinobacillus equuli* from gen. septicemia ("navel ill") assoc. w/ failure of passive transfer < 7 d old
  - *Klebsiella pneumonii* - associated w/ septicemia in FPT, w/ shavings - direct contact, pneumonia 2° to viral, or 1°
  - Salmonella, usually GI diz, foals < 2-3 wks m/b systemic diz, & pneumonia, w/ diarrhea, joint. infec. of periphery & vertebral bodies
  - *Bordetella bronchioseptica* (uncommon, problem if on antibiotic Tx for other infection)
- Unlike adults, anaerobes rarely cultured
- **Predisposing factors** (see box)

- **Similar to adults**
- **Lethargy** & anorexia
- **Fever**
- ↑ **RR** (resp. rate) or effort
- **Nasal discharge**
- **Coughing**
- **Exercise intolerance**

FPT (failure of passive transfer)

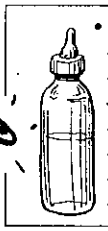
- **Respiratory CS part of general septicemia**
  - **Pneumonia**
  - Enteritis
  - Depression, anorexia
  - Convulsions
  - Polyarthritis
  - Omphalophlebitis
  - Peritonitis

- **CS:** check more closely (on large breeding farms, foals not monitored closely every day)
- Differs from adults: need to evaluate immunologic function
  - General septicemia
  - Pneumonia & enteritis
  - Zinc sulfate turbidity, glutaraldehyde coagulation test, latex agglutination test or single radial immunodiffusion (IgG levels < 400 mg/dl)
- **Radiographs:**
  - **Bronchopneumonia**
  - **Abscesses**
  - Rad signs lag behind CS & resolution of signs
- Auscultation
- Lab: ↑ WBC & fibrinogen - *R. equi*
- **TTW: Chinese letter organism- *R. equi***, Gram stain 1st

- **Vigorous antibiotic therapy** (culture & sensitivity important)
- **Penicillin** initially best (IV or IM)
  - **Long term 1-2 mo,** usually well beyond duration of CS
  - Monitoring discontinued on
    - Bases of WBC counts
    - Fibrinogen values back to normal
    - Rads by looking for resolution of pneumonia (rads last longer than diz)
  - Temporarily stop antibiotics 24-48 hrs. & re-culture if WBC count & fibrinogen return to normal & rads show resolving
- Trimethoprim-Sulfa (orally) switch from IM pen in very young if pain & long term muscular problems

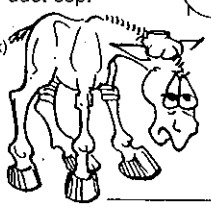
Rhodococcus equi

- **DOC Erythromycin + Rifampin 4-10 weeks $**
- Penicillin & aminoglycosides combo (less effective)

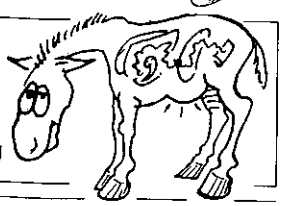


- **Predisposing factors**
  - Stress: overcrowding, weaning, transport
  - Tx for concurrent diz
  - **Inadequate colostrum (FPT), CID**
  - Other org. (virus) damaging resp. epithelium
  - Inadequate ventilation, w/ dust esp.
  - Inadequate nutrition
  - Parasitic migration (see box)

DDx:
- Neonatal maladjust. syndrome
- Combined immunodef. syndr.



Parascaris equorum
- Migrates through lung
- Damaging lower resp. tract & allowing bacteria to 2° invade
- Larvae may even carry bacteria to lung

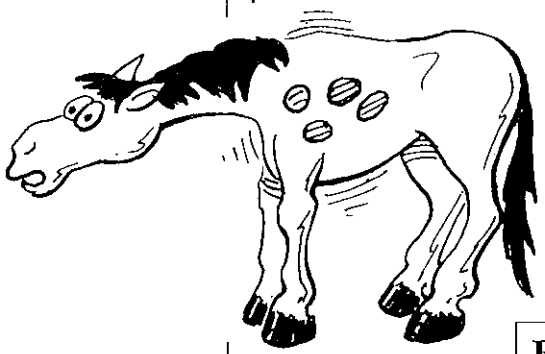


#1 *Strep. zooepi.*, R. Equi severe, FPT
CS: Coughing, rhinitis
Tx: Vigorous ABs (Pen.)

Rhodococcus equi lung, Abscessation in foals, Granulomatous pneumonia, "Rattles"

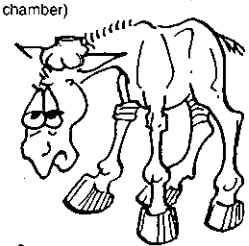
M8k 1087; Mk 743, I2M 580; IM 511; E 736; EM&S 436; C2T 230; M 291

- ***Rhodococcus (Corynebacterium) equi***
  - **Gram positive pleomorphic rod**
  - In soil & manure of adults
  - Very resistant, disinfect w/ phenol
- **Hides in macrophages**
- **Strong immune defense to fight**
  - **FPT & CID Arabs more susceptible**
- Endemic to some areas
- Continue to cause problems yr after yr
- # of organism in environment ↑ in Spring
- **Affects 2-6 month-old** (maternal antibodies waning)
  - Summer (↑ incidence in hot, dusty, dry part)
- Route unknown: Aerosolization or ingestion & possible hematogenous spread from GI, parasitic larvae may carry it to lungs
- **Suppurative pyogranulomatous pneumonia**

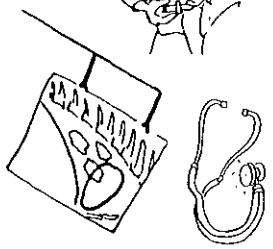


- ↑ **RR (> 40/min)**
- **Abdominal "tucking"** on inspiration
- **Fever**
- **Nasal discharge**
- **Coughing**
- ± Insidious onset & 1st noticed when advanced diz
- **Diarrhea** (if ulcerative colitis)(usually no GI CS w/o pneumonia)

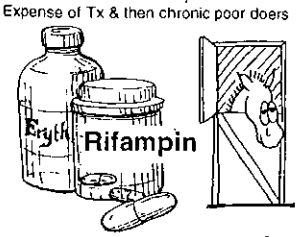
- Other diz manifestations
  - Enterocolitis
  - Arthritis
  - Hepatic or more commonly splenic abscesses
  - Vertebral abscesses
  - Hypopion (pus in anterior eye chamber)



- **Hx, CS**
- **Auscultation**
  - Adventitial sounds initially
  - Some severe diz w/ no sounds
- **Lab: ↑ WBC & Fibrinogen**
- **Radiology:**
  - Alveolar pattern (alveoli filled) m/b air bronchograms
  - **Nodular & cavitary** lesions (abscesses)
  - Diffuse suppurative bronchial pneumonia
  - Enlarged lnn
- **TTW** (transtracheal wash)
  - **Chinese letter organisms** (pleomorphic rods) on gram stain highly suggestive
  - Large number of PMNs
- Gram stain 1st to choose AB & start before culture & sensitivity results
- In past associated w/ high mortality



- **DOC Erythromycin + Rifampin 4-10 weeks $** (always use together or get resistant strains)
  - Erythromycin IV, then orally - may cause severe diarrhea (discontinue)
- Pen & aminoglycoside combo (less effective, not > 7 d w/o checking for nephrotoxicosis), used when can't tolerate erythromycin
- Trimethoprim-Sulfa (not as effective)
- Stop using antibiotics based on CS, rads & blood values
- **Stall rested & hand walked**
- Isolate, although present in soil, so less important than w/ *S. zooepidemicus*
- Expense of Tx & then chronic poor doers



Prevention:
- Remove manure
- Change location
- Disinfect stalls w/ phenol
- ↓ dust (water down)
- **Endemic farms monitor foals** (RR, temp & auscultation) every 2-3 d during 1st 4 mo
- Adequate deworming
- Vaccinate for viral resp. dizs

Prognosis:
- **Most foals recover w/ early Tx**
- Based on ↑ of fibrinogen & age
- Younger the foal, higher mortality & longer Tx

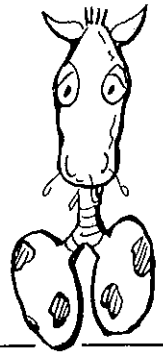
Foals, FPT & CID, Hides in macrophages
CS: Pneumonia
Dx: Chinese letters, Rads: abscesses
Tx: DOC Erythromycin + Rifampin 4-10 wk

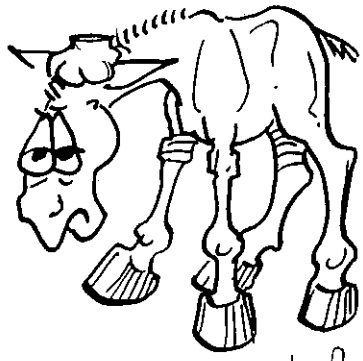
FPT

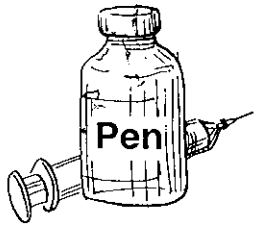
CID

Pneumonia — RESPIRATORY SYSTEM

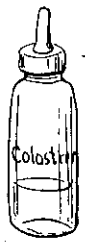
Condition	Facts/Cause	Presentation/CS	Diagnosis	Treatment
***Strep. zooepidemicus* Pneumonia - Foals** IM 511; E 736; EM&S 433	• **#1 pneumonia** in neonates & adults • Septicemia in lung & 1° bact. pneumonia • Adults 2° to resp. viral infec. • Normal inhabitant of upper respiratory tract • Doesn't invade intact mucous membrane • **Acute** infection develops: - Fibrinopurulent pneumonia - Hemorrhage in some cases • **Subacute** : - **Abscesses** in lower respiratory tract including lungs, lymph nodes, & occasionally visceral pleura - Pyogranulomatous pneumonia i.e., abscesses	• Similar to adults • Lethargy & anorexia • **Fever** • ↑ RR (resp. rate) or effort • Nasal discharge • **Coughing** • **Exercise intolerance**	• **Hx, CS** • **TTW** (transtracheal wash) - **ID gram positive cocci** - Culture • Radiographs in field - Bronchopneumonia - **Abscesses** • Lab: hematologically typical of bacterial infection, except in those septicemic, in which neutropenic & toxic changes	• **Penicillin**, initially (IV or IM) - **Long term 1-2 months**, well beyond duration of CS • Monitoring - discontinued 24 - 48 hr & reculture & base Tx on WBC, fibrinogen values back to normal, & rads • Trimethoprim-Sulfa (orally) if IM muscle prblms w/ pen • **Restrict exercise** (hand walk or small paddock) **Control:** • Isolate infected animals • No vaccine • Proper care of umbilicus • Adequate colostrum, etc.







#1 pneumonia of foals & adults
CS: Coughing - Exercise intolerance
Dx: Gr. + cocci - Abscesses
Tx: Pen - long term 1-2 mo



Pneumocystis pneumonia
IM 511; EM&S 441

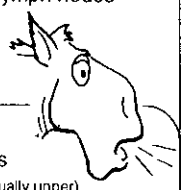
- *Pneumocystis carinii*
- Usually a nonpathogenic opportunist
- Problem in immunocompromised foals (FPT or CID)
- Causes severe interstitial pneumonia
- Occasionally seen in foals w/ concurrent lower respiratory diz
- Always associated w/ another infection

CID & FPT

Bacterial pneumonia - Adults
IM 505; I2M 566; C4T 449; E 734, 737

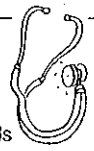
- **Lower Resp. Diz** - mostly bacterial usually 2° to viral resp. diz)
- **#1 *Strep. zooepidemicus*** (ß-hemolytic)
  - Normal inhabitant of mucous membranes, skin & tonsillar tissue
- ***S. equi*** (less common)
- 2° Gram negative complication of Strep.
  - ***Pasteurella spp*** (most common), Klebsiella spp, *E. coli*, *Bordetella bronchioseptica*
  - **Anaerobe** complication recently: *Bacteroides fragilis* & *B. melaninogenicus*
  - Not normal inhabitant so consider significant if cultured
- **Pathophysiology:**
  - **Overwhelming or compromising normal defense mech.**
    . Cilia clearance, phagocytic cells, mucous membr. barrier
  - **Stress** (transport, weather, training)
  - **Mixed infections - synergy**
  - **Aspiration**

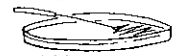
- **Similar to foals**
- **Fever** (m/b intermittent, take multiple to see fever spike)
- **↑ RR** (resp. rate) (resting rate sensitive parameter)
- **Nasal discharge**
- **Coughing** (m/ or m/not be spontaneous, induced by tracheal palpation)
- **Exercise intolerance**
- Chronic - weight loss
- Enlarged lymph nodes



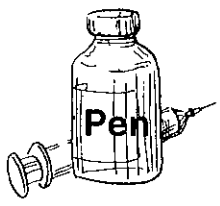
DDx:
- Infectious
  - Viral (usually upper)
  - Fungal & parasitic (less common)
- Noninfectious
  - COPD (chronic obstructive pulmonary diz) (pg 120)
  - 1° neoplasms (rare in horse)
  - Metastatic neoplasms (renal or gastric carcinoma or melanoma)
  - Thoracic lymphosarcoma (pg 31)

- **Hx, CS**
- **PE (physical exam)**
- **Auscultation**
  - Early - harshness & intense expiratory sounds
  - When expiratory as loud as inspiratory sounds = significant airway diz)
  - Advanced: end inspiratory crackles (suggests transient atelectasis &/or ↑ secretions)
  - Pleural rubs (extend to pleura)
  - If ventral thorax quiet - subpleural abscessation or pleural effusion
- Percussion: fluid line if pleural effusion
- **Lab:**
  - **↑ WBCs w/ neutrophilia** (often)
  - ↑ Fibrinogen (500-1000 mg/dl) (often inflam. hepatocytes stim. to produce)
    . Hi levels indicate chronic pneumonia or abscessation
  - TPP ↑ wk- mo due to chronic antigenic stim.
- **Rads** - Dx, Px & progressive evaluation
  - **Cranioventral opacity**
  - **Abscesses** - multiple opacities
  - Horizontal line - free fluid in pleural space
- **Ultrasound**
  - Pleural fluid & fibrin w/in fluid
- **TTW** (transtracheal wash) - culture, gram stain & sensitivity (EDTA tube for cytology & syringe for aerobic & anaerobic cultures)
  - Degenerative PMNs w/ engulfed bacteria
- **Thoracocentesis** (if pleural fluid present)
  - Drainage if interfering w/ respiration
  - Cytology, culture (include anaerobic) & sensit.
  - Foul odor suggests anaerobes
- **Necropsy**: Consolidation (cranioventral), Adhesions, Necrotic debris in airways

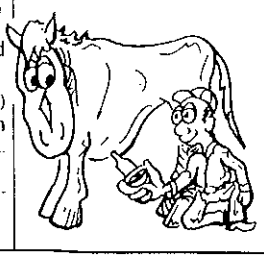




- **Tx same as foals**
- **Vigorous antibiotic therapy** (culture & sensitivity important)
- **Penicillin** initially best (IV or IM)
  - **Long term 1-2 mo**, usually well beyond duration of signs
  - Monitoring - discontinued on basis of
    . WBC counts
    . Fibrinogen values back to normal
    . Rads - resolution of pneumonia (rad CS last longer than diz)
  - Temporarily stop ABs for 24-48 hr & re-culture, if WBC count & fibrinogen return to normal & rads resolving stop ABs
- Trimethoprim-Sulfa (orally) switch from IM pen in very young if pain & long term muscular problems
- Thoracocentesis drainage (if pleural fluid interfering w/ resp.)

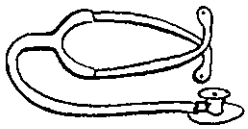
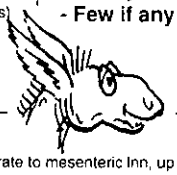
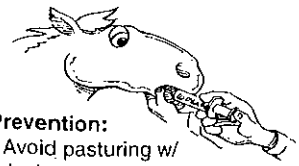
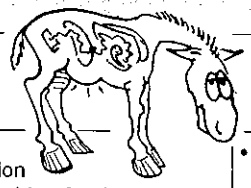
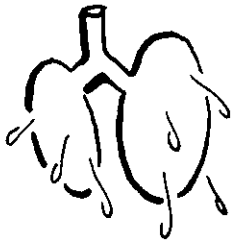
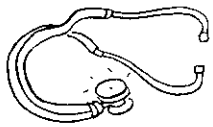
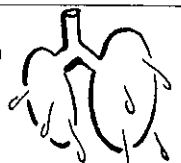


#1 *Strep. zooepidemicus*, Similar to foals
CS: Abscesses - Cough - Nasal discharge
Dx: Hx, CS, PE, TTW
Tx: Penicillin long term 1-2 mo



Tuberculosis
IM2 594

- Rare in horses, especially in USA

Condition	Facts/Cause	Presentation/CS	Diagnosis	Treatment
Aspiration, inhalation, gangrenous pneumonia M8k 1056; Mk 709; IM 591; I2M 650; EM&S 431 **CS: Dyspnea / Death** **Dx: Hx, TTW** **Tx: Support, Px - poor**	• **Causes:** - **Iatrogenic mineral oil or anthelmintic** - **2° to choke** or esophageal obstruction - Organisms from GI get into lungs - **Laryngeal or pharyngeal paralysis** - 2 common causes . **Guttural pouch mycosis**, nerves near guttural pouch injured, loss of innervation (dysphagia results) . **Lead toxicity** peripheral neuropathy w/ dysphagia	• **± Peracute death** • **Inspiratory & expir. dyspnea** • Food present in nostrils (choke or pharyngeal paralysis) • Often systemically ill • M/b gram negative in lungs, endotoxemia results • Pleuritis m/ develop w/ its own CS 	• **History** • **CS - dysphagia**, presence of FB • Auscultation: - Crackles & wheezes dorsally - **Ventral silence** due to consolidation • **Endoscope**: ID purulent material or feed material in airways • **TTW: purulent material/feed** • **Postmortem:** - Acute: pulmonary edema, Hemorrhagic necrotizing pneumonia - Chronic: granulomas & abscesses	• **Intensive supportive therapy** - **Short acting corticosteroids** (hydrocortisone) - **NSAIDs** for anti-inflam. & endotoxemic effects - **Broad spec. antibiotics** - **Expectorants** (potassium iodide) - **IV fluids**  **Prognosis:** • **Poor** - generally (based on amount of foreign material in lungs & ability to correct 1° problem, choke or paralysis)
Lungworms Mk 714; IM 529; I2M 590, 1705; E 781; EM&S 442; C3T 332  ***Dictyocaulus*** **Donkey to horses** **Tx: Ivermectin, NO donkeys**	• *Dictyocaulus arnfeldi* - **Definitive host - donkey** - No CS/patent infec. in donkeys, mules & **foals** - **Horses housed w/ donkeys develop diz** - Not patent infections (not contagious) • **Transmission** - Infective larvae on pasture - Wet pastures  **Life cycle - direct** • Ingested infec. larvae, migrate to mesenteric lnn, up thoracic duct to lung • 1° alveoli & bronchioles, larvae into adults in **donkey & foals**, produce eggs • Coughed up, swallowed & passed in feces • Hatch in feces 1st stage larvae - infec. 3rd stage larvae in 1 wk - Find eggs in feces up to 14 wks following 1st infec.	• **Older horses** - **Chronic nonproductive cough** - ↑ RR & rexpiratory effort - Unthriftiness - Often audible wheezes & rales • **Donkeys & foals** - **Few if any signs**	• **History of grazing w/ donkeys** • **Auscultate prominent wheezes thru/out lung fields** • **Baermann flotation** (stain w/ iodine) - Multiple fecals m/b necessary, even if patent • **TTW**: Large # eosinophils, ↑ PMNs, occasionaladult parasites, larvae or ova - Eosinophilia alone not diagnostic • Blood eosinophilia variable & non-diagnosis, suggestive • **No response to other cough Tx** • PM (postmortem) - Circumscribed pale, raised, overinflated areas of lung - **Baermann flotation** of lung tissue	• **Ivermectin**, every 8 wk • Separate from donkeys or treat donkeys concurrently  **Prevention:** • Avoid pasturing w/ donkeys or mules • Ivermectin every 8 weeks **DDx:** • COPD (chronic obstructive pulmonary diz)(pg 120) both dizs lose wt, do not eat (due to coughing), not febrile
"Summer colds" EM&S 442 	• **SEE GI, pg 65**; Parascaris larvae **migration through the lungs** • M/ produce respiratory signs, usually GI signs • Worm at 6 wk & repeat every 8 wk until a yearling 			
Pulmonary edema Mk 707; IM 532; I2M 592; E 776  **Left CHF** **CS: Dyspnea** **Dx: Bronchograms** **Tx: Tx cause**	• **Fluid in lungs** • **M/b life threatening complication** of other pulmonary diz Causes: • **Lt. sided CHF** (↑ lt. atrial pressure) • ↑ pulmonary artery pressure • Acute renal failure • **Rapid IV fluids** (iatrogenic) • ↑ microvascular permeability - Sepsis - Hypoxic acidosis - DIC (dissem. intravas. coagulation) • Inhalation of noxious vasoactive fumes • **Anaphylaxis**	• **Rapid, shallow breathing** • **Dyspnea m/b** - **Open mouth breathing** • Fluid from nostril (clear, yellow to pink tinged) m/ become frothy 	• **Hx, CS** • Auscultation - **Fine crackles & rales** • Rads (hi quality difficult in adults) - Peribronchial & perivascular cuffing - **Air bronchiograms** - Hazy reticular or lattice-like pattern 	• **Correct cause** (reverse hypoxemia, ↓ plasma volume & left atrial pressure & ↑ plasma colloid osmotic pressure) • **Intranasal O_2 or ventilation** • **Lasix®** (furosemide), diuretic • Stop any IV fluids • **Colloid sol.** (plasma or dextrans) • **Aminophylline** • Antiprostaglandins (Banamine®, phenylbutazone, aspirin) • Corticosteroids controversial (if use, cover w/ ABs, impairs bact. defense mech) • Anaphylaxis - epinephrine 
Anaphylaxis, Shock Mk 423; IM 1263; IM2 1408   **Life threatening** **Epinephrine IV**	• **Acute, transient** • **Life-threatening** - Alters vascular permeability & smooth muscle contractions - Many stimuli • Anaphylactic reactions - Type 1 - Allergic reaction to allergen • Anaphylactoid reactions - initiated by nonallergenic mech., chemical or physical stimuli • Both reactions cause release of chemical mediators (histamines, kinins) • **Shock organs of horse** - **Lungs** - **Large colon**	• **Anxiety** • **Tachycardia** • **Dyspnea** • **Sweating** • Piloerection • **Diarrhea** • **Severe respiratory distress, recumbency, convulsion & death**  	• **CS - respiratory distress, iHR** • Crackles on auscultation • Rads for pulmonary edema • PM (postmortem) - Vascular engorgement - **Pulmonary edema** - Emphysema - Edema & hemorrhage of large intestine - Laminitis 	• **Life threatening**, immediate Tx - **Epinephrine IV**, diluted 1:10,000 (0.01 mg/ml empirically, gen. 3-5 ml slowly) • Less acute cases or if IV can't be admin. - Epinephrine IM or subQ diluted 1:1000 • **Repeat 15 min** - epinephrine at 15 min. intervals if necessary • **Corticosteroids** - Methylprednisolone Na succinate (1-2 mg/kg IV or IM) or - Dexamethasone (0.25 - 1 mg/kg IV or IM) • **Antihistamine** - Diphenhydramine (0.25 - 1 mg/kg IV or IM)  **Epi** **Prognosis:** • **Guarded**: depends on speed of vet.

Pleuropneumonia

Condition	Facts/Cause	Presentation/CS	Diagnosis	Treatment
Pleuro-pneumonia, Pleuritis, Pleurisy	• **Pleuritis & pleural effusion**	• Similar to cattle • **Resp. distress** (pleural effusion) • **Acutely painful** - **"Grunts"**, intercostal muscle spasm - Abduct elbows, "catch" to inspiration - Guarded shallow respiration - Reluctant to lie down or move around • **Guarded cough**, appear anxious • Non-specifically off feed • Nasal discharge m/b, mucopurulent, often bilateral - ± Foul smell if **anaerobes** • Fever, anorexia, depression • Stiff gait • **Colic** • **CHRONIC:** - Continued depression, anorexia - **Not painful**, nerve fibers in parietal pleura destroyed as fluid builds up - **Weight loss** - **Sternal or limb edema** 2° to fluidin pleural cavity & peritoneal cavity (protein loss), & due to blockage of lymphatics	• **CS - resp. distress & pain** • **Putrid breath if anaerobic infec.** • **No lung sounds ventrally**: auscultation: • **Percussion:** - **Dull resonance ventrally**, normal dorsally - **Horizontal fluid line** • **US**: picks up small amount of fluid • **Thoracocentesis** - Cytology, culture & sensitivity (include anaerobic) . Gram stain for tentative bacteria . **Anaerobes in 46%** of cases - **Cloudiness: ↑# of WBCs** - **Foul odor suggests anaerobes** - WBC count - normal < 10,000/µl . Pleuropneumonia WBCs betw. 1600 - 300,000 cells/Ml - Protein in pleural fluid > 3g/dl • Hematology usually nonspecific	• **Long term Systemic ABs** - Empirically until C&S, Brd. spectrum ABs - Follow IV or IM w/ oral ABs - **Anaerobic pleuropneumonia** . **Metronidazole/combo Tx** • **Pleural drainage** (see box) • Anti-inflammatory Rx for pain & ↓ productivity (Banamine®, PBZ) • Corticosteroids controversial (Contraindicated?) • **Rest** • Adequate diet - Encourage eating because of prolonged course **Prognosis:** • **Guarded** in all cases • Poor - anaerobes • Poor survival rate - foul odor to peritoneal fluid or breath • Pleural fluid cell count & prot. no prognostic value

Cause: Pleurisy
- **Most commonly w/ pneumonia or lung abscessation**
  - General anesthesia & recumbency due to underlying pneumonia
  - Viral respiratory infections
  - Uncommon causes include trauma, perforating wounds or open chest wounds
  - Esophageal perforations
  - Less commonly, EIA, mycoplasma, Norcardia
- **Pneumonia**, w/ or w/o lung abscessation
  - 90% ***Strep. zooepidemicus***
  - *E. coli*, Pasteurella spp, Actinobacillus spp, *Klebsiella pneumoniae*
  - **Majority mixed infec. - aerobes & anaerobes**
  - **Anaerobes: *Bacteroides fragilis***
- **Seen after stress**
  - Transport, shows, races
  - More common in Thoroughbred & Standardbred race horses

Pain - "Grunts" - *S. zooepidemicus*
CS: Putrid breath - Anaerobes
Dx: Auscult/Percuss - Thoracocentesis
Tx: Long term ABs - Metronidazole/anaerobes
Px: Guarded

Diagnosis:
- **CS - respiratory distress & pain**
  - **Pleximeter** (spoon) to percuss chest for pain
- **Putrid breath if anaerobic infection**
- Auscultation
  - **Absence of lung sounds ventrally** (or only bronchotracheal sounds)
  - **Normal dorsal** lung sounds
  - M/ or m/not be adventitial sounds, underlying pneumonia, lung compressed dorsal, can be due to lung consolidation
  - Heart sounds louder & wider area than normal due to fluids
  - Pleural friction rubs acutely **only**
- **Percussion**
  - **Dull resonance ventrally**, & norm. lung resonance dorsally unless abscess against body wall
  - **Horizontal fluid line**
- **Ultrasound**
  - Picks up small amount of fluid missed by auscultation, percussion & radiographs
  - Hypoechoic & anechoic fluid
  - Abscesses if contiguous at lung surface
  - Pulmonary consolidation & atelectasis
- **Thoracocentesis** - EDTA + sterile tube
  - Cytology, C&S (culture & sensitivity) include anaerobic
  - . Gram stain for tentative bact.
  - . **Anaerobes in 46%** of cases (routinely use anaerobic transport media, do not refrigerate/kills)
  - Visualize - normally clear & yellow
  - . **Cloudiness: ↑# of WBCs**
  - . **Foul odor suggest anaerobes** (no odor doesn't rule out [R/O] anaerobes, compare to breath odor)
  - WBC count - norm. < 10,000/µl
  - . Pleuropneumonia WBCs betw. 1600-300,000 cells/µl
  - Protein in pleural fluid > 3 g/dl
- Hematology usually nonspecific
  - Chronic: anemia & elev. TPP > 8 g/dl
  - WBCs not always elevated
  - Fibrinogen usually elevated, indicates inflammation

Treatment:
- **Long term Systemic ABs**
  - Empirically until C&S (culture & sensitivity)
  - Broad spectrum ABs (because many have mixed infec.; gram pos. & neg., aerobes & anaerobes
    - . Penicillin + aminoglycosides (procaine pen/Na pen/gentamicin)
    - . Trimethoprim & sulfamethazole
    - . Chloramphenicol
  - Follow IV or IM w/ oral ABs (after condition is stable)
  - **Anaerobic pleuropneumonia**
    - . Empirically (from experience) bec. hard to do culture & sensitivity
    - . *Bacteroides fragilis* resistant to penicillin
    - . **Metronidazole**: effective, but not against aerobes so always combo therapy

Metronidazole combos

- **Pleural drainage** (to drain or not to drain?)
  - If thick pus, drain w/ chest tube
  - No pus, but gram positive & WBC count ↑, drainage recommended

Thoracocentesis:
- 6th or 7th ICS at level of costochondral junction
- Ultrasound to guide
- EDTA (anticoagulant tube) + sterile tube (routinely use anaerobic transport media, do NOT refrigerate, cold kills)

Pleural drainage:
- Use cannula, chest tubes or thoracotomy
- Thoracocentesis w/ cannula easy
- Indwelling chest tube - continued pleural effusions
  - 1 way flutter valve so air doesn't get in
  - Aseptic placement & maintenance - can leave for wks
  - Remove when nonfunctional
  - Heparinization after drainage to maintain patency
- Open drainage if chest drain insufficient
  - Open chest & treat as a draining abscess

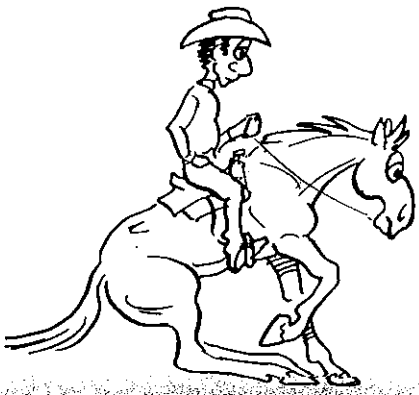
Pneumothorax - Heaves

Condition	Facts/Cause	Presentation/CS	Diagnosis	Treatment
Heaves, COPD, Chronic obstructive pulmonary diz, Broken wind M8k 1092; Mk 733, I2M 594; IM 533; EM&S 443, C4T 431; C3T 329; Pop 57-7/98, 9-7/98	• Alveolar emphysema misnomer • **Chronic, noninfect. resp. diz** • Characterized by dyspnea, chronic coughing, nasal discharge & lack of stamina • **Cause - debatable** - **Dust, molds** or other air pollutants - Correlate change in feed, weather or environment - **Hypersensitivity reaction** • Lower airway diz (exudate fills lower airways) no air exchange • Uncommon in horses < 6 yr-old • M/ have resp. diz preceding CS • Pulm. hypertension & pulm. rt. sided heart failure • **Common in winter** (stabled), less common summer syndrome of animals at pasture • 2° infections, but usually 1° lower airway diz w/ no infection	• **Insidious progressive onset** • Many mildly affected or only during certain seasons • **Acute "asthmatic" attacks** - Commonly when stabled in dusty area - Exercise or feeding moldy or dusty roughage • Expiration labored • **"Heave line"** hypertrophy abd. mm. & formation of ridge along costal arch • **Flared nostrils** & protruding anus in severe cases • **Coughing**: persistent often paroxysmal (often productive & common during exercise & feeding) • Nasal discharge • **Exercise intolerance** • ± ↑ temperature w/ 2° bacteria **DDx:** • Lung worms (pg 116)	• **Hx, CS** • **PE mildly affected** - ± Minimal respiratory signs - Exercise or put rectal sleeve over nose to get deeper breathing • **TTW** (transtracheal wash) Dx early - Cytologically aspirate - ↑ Amounts of mucous - ↑ PMNs - Damaged epithelial cells - M/ see multinucleated cells - Eosinophils inconsistent, absence doesn't rule out (R/O) heaves - Gram stains for 2° bacteria, normally none; if present, see degenerative PMNs • **Auscultation**: loud bronchial tones, 1° on **expiration**, though w/ progression on inspr. - **Wheezes & clicks** characteristic of diz . Worse after coughing & loudest caudoventral & caudodorsal - Occas. also m/ hear crackles w/ progression • Percussion: early - normal; w/ time percussion line extends further caudally • CBC norm., fibrinogen norm. unless 2° bacteria • Allergy skin tests, helpful in identifying animals w/ skin allergies, however, also get normal horses reacting • **Low dose atropine test:** 5 mg SQ (w/ CS) & CS dissipate after administration, RR ↓ - Can develop colic due to atropine • **Endoscopy**	• **Dust free environment - outside best - for life** (some owners unwilling) - Stable in open stall w/ wood shavings, paper or peat bedding (remove all hay & straw) • Pelleted ration instead of hay (m/ gulp & develop choke, so put stones in w/ ration to make them eat ration more slowly) - Alternatively feed soaked hay on the ground • **Drugs:** - **Steroids: prednisolone IM** (can't be in urine of race horses) - **Bronchodilators** (Clenbutoral®), ß agonist in Canada, in US illegally added to feed, very effective, but not for performance horses because shows up in urine . Aminophylline (but can produce toxic signs - anxiousness) • **If acute bronchospasm** - **Atropine SQ (5 mg)** to ↓ airway resistance, block bronchoconstriction - ONLY in emergency - Duration of action relatively short - Then move animal • Chromolyn (mast cell stabilizer) prophylactically when put in known bad environment - Works several hours (brood mares especially)

? Hypersensitivity ? - Molds, Dust
CS: "Heave line", Asthma, Tiring, Wheezes
Dx: TTW, Atropine Test
Tx: Dust free - Steroids - Bronchodilators

Steroids

Pneumothorax Mk 635, 708; IM 531; I2M 591; EM&S 457 *	• **Rare in horses** • Causes: - **#1 trauma** (out of starting gates) . Rib fxs., puncture of trachea, rib punctures lung - Rupture of emphysematous lung bullae - Rupture of esophagus • **Types of pneumothorax** - Closed: air trapped in thorax - Open: air out of thorax through wound - Tension pneumothorax . Flap of tissue allows air in thorax, but stops escape • On PE m/not find open chest wound, m/ have fx rib that penetrated parietal pleura • 2 sides of thorax communicate - Air in both sides	• ± **External wound** • SQ emphysema • **Dyspnea** • Tachypnea • ± Cyanosis • ↓ Movement of chest wall	• Auscultation: - **Absence of lung sounds dorsally** (lung partially collapsed) • Percussion - **Hyperresonance over area of pneumothorax** • Rads diagnostic, not usually done • **Aspiration of air** from thorax • Ultrasound (SQ emphysema m/ prevent use) • SQ emphysema + dyspnea, suspect pneumothorax because SQ emphysema doesn't cause dyspnea **Prognosis:** • **Good** if seals & air removed • Poor if air leaking from pulmonary or esophageal lesions	• **Relieve pneumothorax & Tx cause** • Telanus antitoxin • **Broad spectrum ABs** • **Open "sucking" wounds** - Closed & chest tube • **Extremely dyspnic** - Get negative pressure by putting tube in dorsal & aspirate air off pleural cavity, or - Sterile needle dorsal to tubing into bottle of water (suction apparatus) • **If not severely distressed:** - Leave alone & air will be resorbed • If Sx necessary - stabilize horse 1st & place chest tubes • Recurring pneumothorax - Leave tubes in place for continuous drainage (indwelling chest catheter & Heimlich chest drainage valve)
Rare, Trauma **CS: Dyspnea** **Tx: Relieve**				
Neonatal respiratory distress syndromes, RDS, Immaturity IM 327; I2M 363, 372; C4T 604, 609; EM&S 429; M 290	• Complex of diseases: 1) Birth asphyxia in associated w/ dystocia, placentitis, C-sections 2) Meconium aspiration 3) Prematurity (less than 320 d) or dysmaturity (320 ds or older, but immature resp. tract) - **No surfactant:** ↑ surface tension - alveoli collapse, inability to expand lungs 4) 2° to placentitis (*E. coli, Strep. zooepidemicus)* 5) Utero acquired rhinopneumonitis (Herpes virus 1)	• **Foals** born normally or weak at birth, then become more sick w/n week • **Respir. stress & diarrhea** - Poor suckle reflex, depressed - **Generally die w/n 1-2 wk** • 2° bronchopneumonia	• **Hx** of doing well for couple of days, then respiratory stress & diarrhea • ↓ RR (respiratory rate) • Auscultation - No adventitial sound - Loud bronchial tones • Nonfetid diarrhea • Postmortem - White focal lesions on liver - Intranuclear inclusion bodies present in multiple cells throughout body - Hyaline membranes rare • Serum titer in foal prior to suckling, if positive, mother had it	• **Therapy unrewarding** • Intensive nursing • Antibiotics to prevent 2° infections • Usually get adequate colostrum, but tend to stop suckling so IV fluids indicated • **Usually euthanasia** **Prognosis: Poor**
No surfactant **CS: Dyspnea, Diarrhea & Death** **Dx: Hx** **Tx: Euthanasia**				



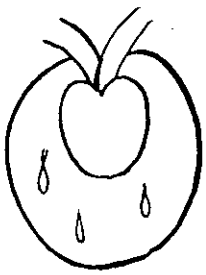
CIRCULATORY SYSTEM

Condition	Facts/Cause	Presentation/CS	Diagnosis	Treatment

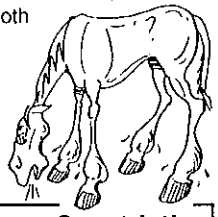
Pericarditis

M8k 91; Mk 52; IM 476; I2M 532; EM&S 330; E 681; C3T 402; C2T 171

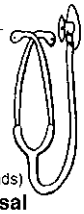
**



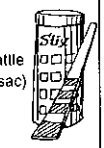
- **Uncommon** (more common in cattle)
- **Fluid into sac** (pericardial)
- Generally 2° to pleuritis
- **#1 cause - Idiopathic,** not uncommon. No bacteria, nonsuppurative w/ pericardial effusion transudative in nature, not relative to infectious diz
- **Heart failure due to compression**
  - Sudden death
- Pathophysiology:
  - **Inflammation of pericardium**
  - **Accumulation of fluid** &/or exudate in pericardial cavity
  - **Compression** of heart w/ decr. ability to pump
  - Compensates by vasoconstriction, ↑HR, Na^+ retention
  - Circulatory collapse if fail to maintain cardiac output
  - Fibrin constrictive
- **Types:**
  - **Effusive** (removal of fluid helps)
  - **Constrictive** (fluid removal doesn't help)
  - Both

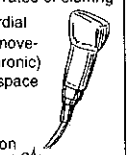


- Nonspecific: fever, anorexia, depression, weight loss
- **Peripheral edema**
- **Jugular venous distention** & pulsation
- **↑HR & RR**
- Colic
- Syncopic episodes
- Congested mucous membranes - Cyanotic
- **CHF** (congestive heart failure)

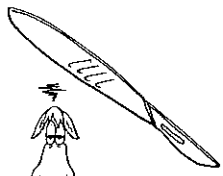


- **Clinical signs**
- **Tachycardia**
- **↑ Capillary refill time**
- **Arterial pulse weak**
- Auscultation
  - **Absence ventral** (lung sounds)
  - **Louder than normal dorsal**
  - **Muffled heart sounds**
  - **. No splashing, washing machine murmur** as in cattle (no gas producing organisms in sac)
  - Pericardial friction rubs
- Ascites
- Lab: CBC not specific, fibrinogen often elevated
  - Chem. usually normal, except m albumin often & ↓globulin
  - Dehydration (↑PCV, TPP, BUN & creatinine)
  - **↑AST, CK, LDH** (myocardial isoenzymes)
- Rads not sensitive
- **ECG:** ↓QRS, S-T segment elevated or slurring
- **Ultrasound** confirms pericardial effusion, note changes of heart movement, thickened myocardium (chronic)
  - Echo-free space in pericardial space
  - M/b echo dense fibrin
- **Pericardiocentesis**
  - Lt. 5th ICS 1-4" above olecranon
  - Incr protein > 2.5 g/dl
  - Bacteria & viral culture m/b neg.
- Pleural & peritoneal fluid (if any) moderate transudate
- **PM** (postmortem)
  - Distended pericardial sac (serosanguinous or urine colored, foamy fluid)
  - Fibrin & pleural effusion
  - CS of congestive heart failure (CHF)





- **Tx unrewarding**
- **EFFUSIVE**
  - Pericardiocentesis w/ or w/o lavage
  - Local infusion of antibiotics
- **CONSTRICTIVE**
  - **Pericardectomy** TOC (Tx of choice)
  - Prolonged surgery, expensive & risky
- **ABs** (gram negative & pos. & anaerobes)
  - Initial gram stain or empirically
  - Culture & sensitivity (C&S)
- **NSAIDs**
- **Steroids** if negative bacteria culture
- Contraindicated - diuretics (improve ventral edema, but reduce venous return further compromising heart failure)



Prognosis:

- **Poor,** in many cases no Tx; & even if intensive Tx, end up euthanized

Prevention:

- **Routine vaccine for respiratory viruses**

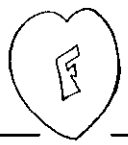
Causes: pericarditis

- **#1 Idiopathic,** not uncommon
- **Trauma** (ingestion of penetrating FB, external punctures)
- **Hematogenous spread** (septicemia) *Strep. zooepidemicus* > *S. equi*
- **Extension of infection from lungs or pleura** (pleuritis)
- Viral infection: parainfluenza & equine arteritis
- Neoplasia

Uncommon, Effusive or Constrictive
CS: Edema, jugular pulse
Dx: Auscultation, US, Tap
Tx: Px - Poor

Congestive heart failure, CHF

M8k 81; Mk 46; IM 100; I2M 325, 521; EM&S 271, 273; E 701



Right sided CHF, fluid backs out to the **periphery** (caudal & cranial vena cava)

- Peripheral edema: brisket, submandibular, limbs
- **Jugular pulsation,** jugular distension (pulse should only go 1/3rd of the way up the neck)
- **Ascites** (abdominal fluid)
- Splitting of 2nd heart sound, pulmonic & aortic valves not closing synchronously due to dilation of right ventricle

Left sided CHF: fluid backs up into **lungs**

- Poor peripheral perfusions
- **Pulmonary edema** w/ crackles on auscultation
- **Respiratory dyspnea**
  - Prominent S3 (third heart sound)
  - Tachycardia
- Pleural effusions

Often see bilateral heart failure in horses & cattle

Cor pulmonale (EM&S 273): Right heart failure due to underlying chronic respiratory failure due to progressive pulmonary hypertension

Fluid backup:
Rt. side: into body - edema, ascites, pulsation
Lt. side: into lungs - dyspnea

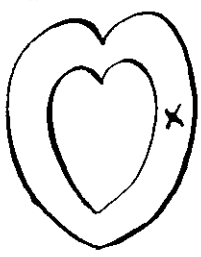
DDx:

- Right heart failure (pg 125)
- Bacterial endocarditis (pg 132)
- Right AV insufficiency
- Cardiomyopathies (pg 126)
- Pericarditis (pg 124)
- Left side failure (pg 125)
- Pleuritis or pleural effusions (pg 118)
- Congenital pulmonic valve stenosis
- Cardiac neoplasm (pg 127)

Myocarditis

Mk 50; IM 472; I2M 527; EM&S 320; E 688; C3T 393

**



- **Uncommon**
- **Inflammation of myocardial wall**

Cause - Myocarditis

- **Bacteria** from septicemia, pericarditis, endocarditis
- *Staph. aureus, Strep. equi,* Clostridium, Mycobacterium
- Virus: Eq. influenza, Eq. viral arter-itis (EVA), Eq. infectious anemia (EIA)
- Parasite (strongyloides, onchocerciasis) migration
- Thromboembolic diz from bacterial, viral or parasitic dizs (rare in large animals)

- **Variable or unnoticed**
- **1° diz m/ mask** vague heart signs (Strangles)
- Tachycardia
- Febrile
- Muscle pain (myalgia)
- Reluctance to move
- Exercise intolerance
- Congestive heart failure CS - Peripheral edema
- **Sudden death** after exercise
- M/ lead to idiopathic dilated cardiomyopathy

- **Rarely diagnosed,** mild vague signs of heart involvement
- 1° cause masks heart signs
- **↑AST, CK, LDH** (aspartate aminotransferase, creatine kinase, lactate dehydrogenase, which are also ↑in hepatic & skeletal muscle problems)
- **PM:** M/b no gross lesions

DDx:

Masked heart signs

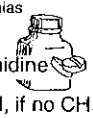
- Septicemia (pg 35)
- Respiratory diz (pg 93)
- Colic (pg 54)
- Lameness

Heart signs

- Endocarditis (pg 132)
- Cardiac neoplasia (pg 127)
- CHF (pg 125)
- Cardiomyopathy (pg 126)

- Treat 1° agent

- **1° Digoxin,** positive inotropic agent
- Quinidine to control arrhythmias
- Lasix® (furosemide) diuretic (make sure electrolytes are normal, esp. K^+)
- **Rest**
- Control complications
  - CHF
  - Shock
  - Dysrhythmias



Px: Good, if no CHF
Guarded to poor with CHF

Prevention

- Vaccination for bacteria & viruses
- Parasite control

Uncommon
CS: Sudden death
Dx: Rarely Dx
Tx: Digoxin, rest

Cardiovascular Diseases

CIRCULATORY SYSTEM

Condition	Facts/Cause	Presentation/CS	Diagnosis	Treatment

Cardiomyopathy, Dilatative cardiomyopathy

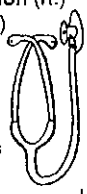
IM 472; I2M 527; EM&S 329

Rt. side

Lt. side

Dilated
CS: CHF, sudden death, tiring
Tx: Digoxin, Lasix • Px: poor

- **Dilated:** only significant cardiomyopathy in large animals
- Associated w/:
  - Ventricular dilation ♡⬆
  - ⬆ Ventricular mass
  - ⬇ Systolic function
- Cause:
  - **Frequently undetermined**
  - Associated w/:
    - . Vit. E/Se defc
    - . Ingestion of monensin, Lasalocid, Gossypol, *Cassia occidentalis*, Phalaris spp.
    - . Lympho- or fibrosarcoma



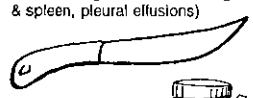
Cardiac failure
- **Peripheral edema** (rt.)
- **Jugular venous distention** (rt.)
- **Respiratory distress** (lt.)
  - Tachypnea
  - **Dyspnea** (pleural effusions)
  - Bloody froth in nostrils
- **Syncope** (fainting)
- **Weak peripheral pulses**
- High HR, RR
- **Exercise intolerance**
- Often arrhythmias
- **Sudden death** after exercise
- Chronic
  - Bilateral enlargement
  - ± Diarrhea
  - **Murmurs** due to ventricular dilatation
- **Sudden death** following stress or exercise

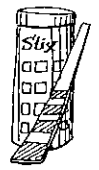
DDx:
Young animal
- Congenital heart defects (pg 130)
- Cor pulmonale (pg 125)
- Nutritional: myodegenerations (pg 128)

Adult:
- Bacterial endocarditis (pg 132)
- Thoracic abscesses
- Cardiac neoplasia (pg 127)
- Pericarditis (pg 124)
- Pleuritis (pg 118)
- Diaphragmatic hernia (pg 71)

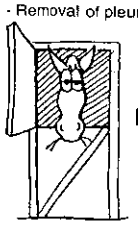
Determine cause of dilatation (See causes)

- **Clinical Signs**
- Auscultation abnormal
  - Tachycardia, gallop rhythm
  - Muffled heart sounds
  - Cardiac dysrhythmia, murmurs 2° to dilatation
- Percussion: ± pleural or pericardial fluid
- **ECG**: can't ID lt. ventral enlargement
  - No way to define lt. or rt. axis deviation
  - Use it for arrhythmias
  - QT prolongation
- **Ultrasound**: ventricle enlargement
- Lab:
  - **⬆ LDH, AST, CK** (lactic dehydrogenase, aspartate aminotransferase, creatine kinase) (hepatic & skeletal m. problems also ⬆ these)
- **Postmortem**
  - Grossly enlarged heart
  - Heart failure signs (general edema, congestion of liver, lungs & spleen, pleural effusions)



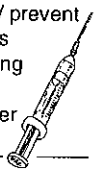


- **1° Digoxin**, positive inotropic agent
- Quinidine to control arrhythmias
- **Lasix®** (furosemide) diuretic (make sure electrolytes are normal, esp. K^+)
- **Rest**
  - Removal of pleural or abdominal fluid



Prognosis:
- Poor, recovery unusual, constant Tx for maintenance & sudden death can occur any time

Prevention:
- Vaccination program m/ prevent virus & bacteria causes
- Prevent horse from eating monensin (cattle feed)
- Vit. E, selenium & copper supplementation



Cardiac tumors

IM 481; I2M 536; EM&S 324

★

Rare in horse
Dx = death in 6 mo

- **Rare in large animals**
- 1° or 2° to tumors of lungs, pleura, lymph nodes or diaphragm
- Lymphosarcoma & squamous cell carcinoma most common in horse
  - Fibroma, adenocarcinoma

- CS nonspecific & depend on part of heart involved
  - **Anorexia, depression, weight loss & fever**
- Tumor of pericardium
  - Pericarditis, pericardial effusion, pain, tachycardia, jugular venous peripheral edema & weak arterial pulses
- Myocardial involvement
  - Tachycardia, Murmurs
  - CHF (peripheral edema, ascites, diarrhea)

- Histopathology of tumor tissue
  - Tumor cells in pericardial or pleural fluids or adjacent lnn.
- M/b neoplastic lymphocytes (lymphosarcoma) - absence doesn't rule out (R/O)
- ECG nonspecific
- Rads: abnormal soft tissue densities
- PM: tumor of heart or adjacent structures

- **No definitive Tx**

Prognosis: **Grave** for survival, death expected in 6 mo post Dx

DDx:
- Nonspecific signs
- Any chronic diz
  - Pneumonia (pg 112-116)
  - Peritonitis (pg 49, 53)
  - Enteritis (pg 67)
  - Liver & kidney diz (pg 84)

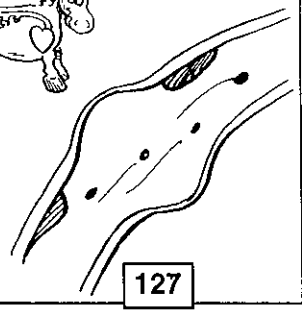
Vascular diz, Aneurysms - Thrombosis - Embolism

M8k 99; IM 483; I2M 538; EM&S 284, 287; E 685; C4T 267; C3T 383, 406, 510; C2T 173

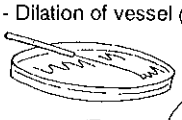
Catheter: thrombosis; Embolism: *S. vulgaris*
Tx: Catheter: rest vessel; Worms: anthelmintic

- **Aneurysm**: vascular dilation (weakening of medial tunic; pseudoaneurism weakening of all tunics)
- **Thrombosis**: clot formation in vessel
  - **#1 Catheterization**
    - . Trauma, venous stasis
  - **Thrombophlebitis**: inflam. of vein associated w/ a thrombus
- **Embolism**: foreign material carried in bloodstream
  - Frequently arise from thrombus
  - **Parasitic arteritis** most common cause in horse (aorta & cranial mesenteric a.) *S. vulgaris*
  - **Aorticoiliac thrombosis in heavily exercised horses**
    - Bacterial endocarditis, thrombophlebitis, omphalophlebitis
- **Arteriosclerosis**: thickening of arterial wall
  - Cause: ***Strongylus vulgaris***

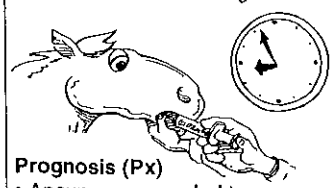
- **Thrombophlebitis:**
  - Painful swelling, redness & thickening of veins
  - Occurs 12-24 hr after removal of catheter
- **Thrombosis** of terminal aorta or iliac arteries
  - Vague hindlimb lameness, exercise intolerance & poor performance, heavy sweating, except for hindlimbs, cold hindlimbs
- **Emboli: cranial mesenteric a.**
  - **Chronic episodes of colic**



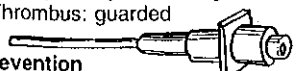
- **Catheter** assoc. thrombosis
  - Positive catheter tip culture (> 103 CFU [colony forming units])
  - Positive blood culture
- Thrombosis of terminal aorta or iliac aa.
  - Rectal palpation of enlarged, firm terminal aorta
- Radiographs:
  - Aneurysm: soft tissue extensions of vessels
- Ultrasound
- Postmortem:
  - ***S. vulgaris*** in cranial mesenteric a. or aortic wall
  - Dilation of vessel (aneurysm)



- **Catheter thrombosis**
  - Remove catheter & rest vessel
  - DMSO
  - Surgical removal of thrombus rarely attempted, except for jugular vein
- **Anthelmintic** for *S.vulgaris*



Prognosis (Px)
- Aneurysms: guarded to grave
- Thrombus: guarded



Prevention
- **IV catheters**: asepsis & replacement when phlebitis occurs
  - Silicone rubber or polyurethane catheters for prolonged use
  - Septic or endotoxic patients:
    - . Aspirin (17 mg/kg every other day)
    - . Low dose heparin (30 U/kg SQ BID)
- Parasite control for *S. vulgaris* (see pg 14)

Heart - Toxicity

Condition	Facts/Cause	Presentation/CS	Diagnosis	Treatment
Vit. E / Selenium deficiency diz, **Nutritional myodegeneration, NMD,** **White Muscle diz,** **Enzootic muscular dystrophy** Mk 538, IM 1352; I2M 1513, 1881; E 98	• **Vit. E/Se defc. in foals 1°** • **Rapidly growing** 2 wk to 4 mo • White muscle diz uncommon in adults • Mechanism not understood - Selenium (Se) or Vit. E defc (antioxidants, protect from free radicals) - **PUFA**, polyunsaturated fatty acids in diet (produce free radicals) - lead to Vit. E defc, especially in calves • **2 syndromes** of degeneration - **Cardiac form**: pulmonary edema - **Skeletal muscle form** (more common) • Se deficient soils **(NE, NW USA, E Seaboard)** - Acid soils - Hi sulphur inhibits Se uptake • Vit. E defc - poor quality hay, straw or root crops • Congenital: death 2-3 ds old • Delayed type: 2 wk - 6 mo	• **Sudden death**, handling/exercise brings on signs, or death • **SKELETAL FORM** - **Slower onset** - **Muscular weakness** - **Trembling** - **Recumbent** (unable to rise) - **Stiffness in gait, BAR** - **Swollen, hard supporting mm.** (gastrocnemius, semitendinosus, semimembranosus, biceps femoris, lumbar, gluteal & neck muscles) - **Dyspnea** if diaphragm & intercostal muscles affected) • CARDIAC FORM - Sudden onset - Sudden agonal death, or - Depression - Dyspnea (foamy nasal discharge) - Profound weakness, recumbency - Rapid, irregular heart beat - Short course, death in 24 hr. despite Tx	• **Hx**: CS: foals, calves & lambs - Weak - Sudden death - Vit. E, Selenium not supplemented • **Lab:** - **Se levels in whole blood** or tissue biopsy (lab) - ↑ **CPK** in 1000's IU/L, AST, LDH - Myoglobinuria - Glutathione peroxidase levels • **Postmortem:** - **Pale muscles**, linear pale areas in skeletal mm., symmetrical - Myocardium: necrosis in cardiac areas even if no cardiac diz	• **1 mg of Se/d** • Vit. E/Se to asymptomatic animals • Vit. E/Se to affected, every 2 wk, not to exceed 4 doses • Vit. E/Se: birth in defc areas • Selenium toxicity- follow manufacturer's suggestion • Use E-SE® made for horses (not bovine, too potent) **Prognosis (Px):** • Cardiac form: grave • Skeletal muscle form: better **Prevention** • Supplementation to pregnant & lactating mares in defc areas • Periodic blood (or tissue) tests for animals at risk

DDx:
- **Sudden death**
  - Enterotoxemia, pneumonia (pg 112-116), toxemia
- **Cardiotoxic plants**
  - Lasalocid, gossypol, *Cassia occidentalis*, Phalaris spp.
- Copper deficiencies (pg 129)
- Excessive molybdenum/sulfates
- Lymphosarcoma, fibrosarcoma
- **Stiffness in gait, BAR**
  - Spinal cord compression, trauma (pg 236)
  - Cerebellar diz (pg 251)
  - Meningitis (pg 258)
  - Polyarthritis
  - Neurotoxins (organophosphates)
  - Tetanus (pg 241)
  - Clostridial myositis

Some myopathies respond only to Se or Vit. E, some to both

Foals, Skeletal > cardiac forms
CS: MM: Weak, trembling; Heart:
Dx: Hx, CS, Lab, PM: Pale muscles
Tx: Vit. E / Se defc

Monensin toxicity, **Ionophore toxicity** Mk 472; IM 1639; I2M 1917; E 198; EM&S 321; C4T 665; C3T 366	• **Coccidostat in feedstuff** for growing cattle • **Dilated cardiomyopathy** • Myocardial necrosis • Not seen often, but **fatal** • **Highly toxic to horses** >> cattle - Lethal dose for horses 1/10th that given to cattle safely - A single oral LD_{50} 2-3 mg/kg • **Eating cow feed** - Reports of feed for horses mixed in same mixers of cow feed • Acute monensin toxicity involves multiple organ systems	• Anorexia in hrs • Mild colic, diarrhea • **Sweating** (intermittent perfuse) in 8-15 hr, recurs prior to death • ↑ RR, HR • **Progressive respir. distress** • Often cardiac murmurs • Progressive weakness • **Staggering** - ↓ Fecal output - Initially polyuric then oliguria & in some cases anuria • **Hypovolemic shock, hypotensive & die** w/n 24 hr • If survive get 2° consequences that lead to demise • Survive acute, CS of CHF in 2-5 wk - **Drop dead** in training • **Sublethal**: unthriftiness, poor performance, myocardial damage, heart failure, death - Clinically poor performance	• History (Hx), Clinical signs (CS) • Auscultation - ↑ or ↓ GI sounds - Muffled heart sounds - Arrhythmias • **Lab: Hemoglobinuria** - ↑ PCV & TP, Hemoconcentration - ↓ Urine SG - ↑ BUN/creatinine - ↓ K^+, then returns to normal - ↓ Serum P having to do w/ marked increase in P clearance - Urine pH acidic due to by-products of monensin breakdown - ↑ Unconjugated bilirubin (RBC injury) • **"Horse-side" test**: heparinized tube of blood, **darkens** rapidly • ECG: - Depression of "t" waves which coincides w/ hypocalcemia - ST segment deviation (myocardial damage suggestion) • Postmortem - Hemopericardium, epicardial hemorrhage, edema around coronary aa. - Pleural effusion & abdominal effusion - Myocardia pale & symmetrical	• **No antidote** • **Tx intensively** - Empty intestinal tract to ↓ absorption - Avoid parasympathomimetic drugs due to potential for cardiac arrhythmias - **Mineral oil, activated charcoal** - **IV fluids,** LR safest (hypotensive), K^+ supplementation, hypokalemic phase, indicated initially, however can't monitor K^+ levels - If diz associated w/ renal failure, caution - **No digoxin**, even though arrhythmias, m/ kill monensin-poisoned cardiac cells, causing further harm - **Mainly rest** • Many die in short period of time **Prevention:** • Clean silo between mixing feeds • Settles from bag to bag so watch feeding horses "cow feed" w/ this additive • Now using Lasalocid® instead

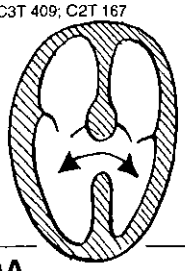
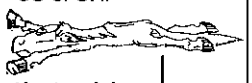
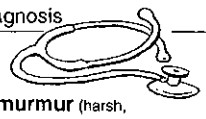
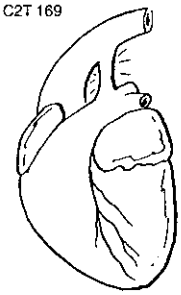
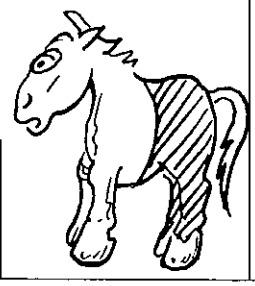
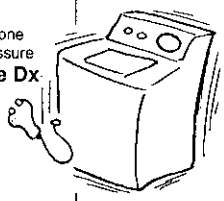
Other ionophores
- Lasalocid
- Salmonycin
- Narasin

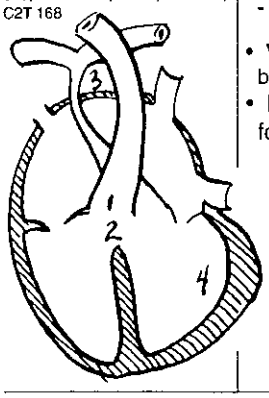
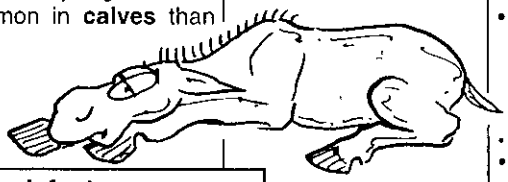
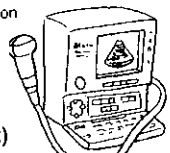
Cow feed, Coccidiostat, Horses >> Cattle
CS: Dilated cardiomyopathy
Dx: Hx, CS, "Horse-side" test
Tx: Rest, Oil, Fluids, No digoxin

Horse side test

Copper deficiency, **Cu⁺** Hypocuprosis Mk 1237; IM 1104, 166, 1192,1127; C4T 392	• Apparent relationship between Cu deficiency & bleeding in aged parturient mares	• **Bleeding in aged parturient mares** • ± Loss of pigmentation	• History • Clinical signs	• **Copper** (injectable or dietary) Prevention: • **Cu supplementation**

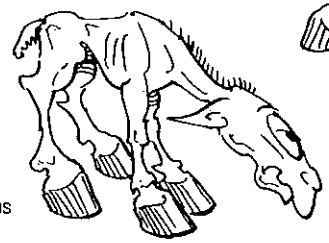
Congenital Heart Defects

Condition	Facts/Cause	Presentation/CS	Diagnosis	Treatment
VSD, Ventricular septal defect M8k 72, 63; Mk 37; IM 459; I2M 512; E 678; EM&S 262, 315; C4T 255; C3T 409; C2T 167 	• **#1 congenital heart defect** • Occurs singly or w/ other defects • Failure of the interventricular septum to close (usually high up) - Allows left to right shunting (left ventricle higher pressure) - Pressure overload - pulmonary hypertension, dilation of right ventricle & left atrium • Cause unknown  **#1 heart defect** **CS: Asymptomatic to tiring** **Dx: Holosystolic murmur** **Tx: None**	• **Asymptomatic if small defect** • Moderate w/ large defects - **Poor growth**, lethargy - Dyspnea - **Exercise intolerance** - CS of CHF 	• Hx (foal), CS • Auscultation - **Holosystolic murmur** (harsh, plateau-shaped) - Heard on both sides of thorax (PMI generally rt. side, because shunt directed to right) - Palpable cardiac thrill - Splitting of 2nd heart sound • **Angiocardiography - definitive Dx** • Postmortem - VSD - Lung congestion - Right ventral hypertrophy 	• **None** **No Tx** Px (prognosis) • **Good: small defect - m/b asymptomatic for life** • Poor: moderate to large defects • Intensity of murmur not correlated w/ size
PDA, Patent ductus arteriosus M8k 68, 63; Mk 35; IM 461; I2M 515; E 676; EM&S 262; C4T 256; C2T 169 	• **Ductus arteriosus**: fetal connection between pulmonary trunk & aorta (shunts blood from right ventricle to aorta, bypassing the lungs) - **Closes w/in 4 days** of birth normally to form ligamentum arteriosum - If patent, results in **left to right shunt** (aortic press >> than pulmonary) . Overload of rt. ventricle & pulmonary arteries . Right ventricle fails or dilates & hypertrophies (to raise pressure) . Pulmonary congestion & hypertension . Right to left shunt when pulmonic circulation pressure ≥ systemic circulation pressure • Occurs by itself or w/ other defects **Lt to rt shunt** **CS: Asymptomatic to cyanosis** **Dx: Washing machine murmur** **Tx: Correct early**	**CS depends on size** • Asymptomatic if small • CS of CHF • Cyanosis to caudal body if switches from lt.-rt. shunt to rt.-lt. shunt 	• Hx, CS • Auscultation - **Continuous "washing machine" ("machinery") murmur** (hi pitched, alternating in intensity) in systole & diastole (aortic press >> pulmonic during both) - PMI: left 3rd-4th ICS at level of shoulder (heard on both sides) - Later murmur during systole & finally none when right & left sides are of equal pressure • **Angiocardiography definitive Dx** • Radiology - Cardiomegaly (not specific) - Pulmonary overcirculation (not specific) • ECG no consistent pattern • PM (postmortem) - PDA (patent ductus arteriosus) - Lung & chamber changes dep. on size of shunt (cardiomegaly, left & right ventricular hypertrophy, pulmonary congestion & edema) 	• **Surgical correction in neonates** (before right side pressure builds up, if pressure in right ≥ left will blow out lungs when Sx close shunt)  Px (prognosis) • Insufficient data

Tetralogy of Fallot M8k 72, 63; Mk 38; IM 462; I2M 516; EM&S 262; E 679; C4T 257; C2T 168 	• Multiple congenital heart defects - **Overriding aorta** - **VSD (ventricular septal defect)** - **Pulmonic stenosis** - **Right ventricle hypertrophy** (due to pulmonic stenosis) • **Ventricular pressures equalize**, because VSD usually large • More common in **calves** than foals  **Multiple defects** **CS: Cyanosis, slow growth** **Dx: Holosystolic murmur** **Tx: No Tx**	• **Cyanosis** (mucous membranes of mouth, nose & vagina) • **Slow growth** (owner's complaint) • Exercise intolerance • Dyspnea • Collapse	• Hx, CS • Auscultation: - **Loud holosystolic murmur** (lt. 4-6th ICS) - Gallop rhythm w/ exercise, early systolic ejection click • Palpable thrill associated w/ murmur • ECG: generally nonspecific, right axis deviation • **Ultrasound** - Right ventricular hypertrophy - Equal sized ventricular lumens - **Overriding aorta** - **VSD (ventricular septal defect)** • Cardiac catheterization: equal ventricular pressure • PM (postmortem) - Round apex, hypertrophy of right & left atria, right ventricle & ventricle septum - **Overriding aorta** - **VSD** (ventricular septal defect) - **Pulmonic stenosis**  	• **None** **No Tx** Px (Prognosis) • Poor w/ cyanosis, exercise intolerance or poor growth • Intensity of murmur not correlated w/ severity

Other **Congenital heart defects** M8k 71; Mk 34; IM 463; I2M 518; C4T 257; EM&S 262; E 676

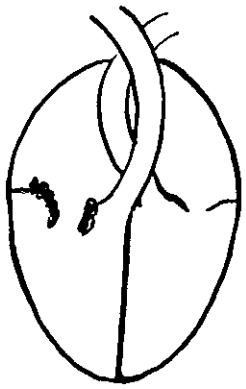
- **Atrial septal defects (ASD)**: most commonly patent foramen ovale, common in calves, often asymptomatic
- **Pulmonic stenosis**: uncommon by itself, in foals w/ VSD • CS murmur & cyanosis variable
- Tricuspid valve atresia: rare in foals w/ other defects, cyanosis, murmur
- **Ventricular hypoplasia**: foals & calves, usually associated w/ early death
- **Aortic anomalies**: persistent rt. aortic arch & double aortic arches • CS: esophageal obstruction
- **Persistent right aortic arch**: forms a ring around the esophagus with the pulmonary trunk, ligamentum arteriosum & base of heart, constriction of the esophagus



Condition	Facts/Cause	Presentation/CS	Diagnosis	Treatment

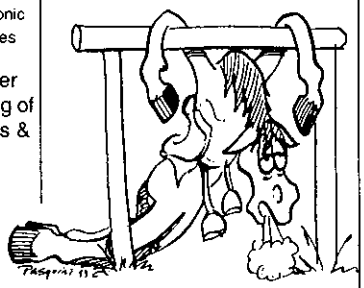
Endocardial diz, Bacterial endocarditis, Vegetative endocarditis, Valvular heart diz

M8k 62; Mk 49; IM 465; I2M 520; EM&S 302; E 684; C3T 399

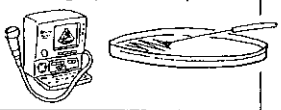


Facts/Cause
- **Usually acquired**, common
- **Older horses**
- Cause: unknown
  - **Bacteremia**
    - Streptococcus most common
    - *Actinomyces pyogenes* (formerly *Corynebacterium pyogenes*)
    - Subclinical bacteremia
    - **Septic thrombus** - 2° to pyemia, mastitis or prostatitis
    - Iatrogenic jugular sticks
  - **Migrating strongyles** (no proof)
- **Vegetation on AV valves**
  - Layers of fibrin, blood cells, bacteria & necrotic tissue on endocardium of valves
- **Aortic valve** > left (mitral) AV > Right (tricuspid) AV, uncommon pulmonic
- **Insufficiency murmurs** (valves don't close & blood leaks backwards)
  - PMI over 4th ICS at shoulder
- **Disseminate sepsis**: seeding of other systems, lungs, kidneys & joints
- **Can progress to CHF**

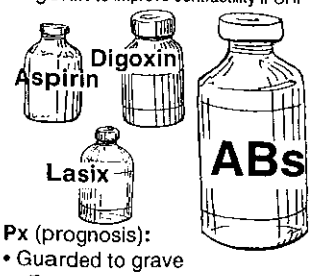
Presentation/CS
- **Exercise intolerance**
- Weight loss
- **CHF signs**
  - **Jugular distention**
  - **SQ edema**
  - **Ascites**
- Intermittent fever, anorexia
- **Disseminated sepsis,** CS to other organ systems
  - Pyelonephritis
  - Pneumonia (adventitial sounds, ↓bronchial tones)
  - Lameness, hematuria or pyuria



Diagnosis
- **Hx (older) CS**
- **#1 Cardiac murmur**
  - Holodiastolic, decrescendo, musical murmurs
  - Intensity doesn't correlate to severity
- **Water-hammer or bounding arterial pulse**
- **Ultrasound** (B-mode, 2 dimensional)
  - Chamber enlargement
  - Ventricular dysfunction
  - Thickening of valve, ragged or cystic appearance
- **Pos. blood culture,** bacteremia,
  - Cultures not always positive
  - Ideally blood cultures collected at temp. elevation, before peaking
  - Monitoring temperature necessary. 5 cultures taken, usually 10 min. apart
- PM (postmortem)
  - **Vegetations on valves, shaggy,** changes of nodules, fibrous thickening, fenestrations or holes through valves
- Lab: Leukocytosis
- ECG: not reliable
- Radiographs: nonspecific



Treatment
- **Long term antibiotics $$**
  - Fibrous tissue of vegetation m/ protect from antibiotics
  - Initially for gram positive
  - Culture & sensitivity (C&S)
    - Gram negative: pen + aminoglycosides
    - Rifampin in combo w/ another improves short term outlook
- Aspirin (to prevent platelet adhesions)
- Lasix® (Furosemide): diuretics for CHF
- Digoxin to improve contractility if CHF



Px (prognosis):
- Guarded to grave
  - Frequently sudden death
  - Chronic poor doers

DDx:
- Endocarditis of other causes
- Degeneration of valves
- Viral
- Inflammation
- Trauma
- Rupture of rt. chordae tendinae
- Cardiomyopathies (pg 126)

Valvular diz: Aortic,
CS: Tiring, CHF, Disseminate sepsis
Dx: Murmur, US, Culture
Tx: Long term ABs • Px: Poor

Vegetation valves: growth stops valves from completely closing, blood backs up through them - murmur of insufficiency [leaky], in horse aortic valve most commonly, then lt. AV (mitral), rt. AV (bicuspid) valve, rarely pulmonic (Cow - tricuspid most commonly)

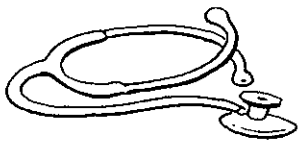
Atrial fibrillation

M8k 80, 63; Mk 45; IM 485; I2M 541; EM&S 241; E 691; C4T 240, 244, 253; C3T 387

***

- **Common in horses**
- **Irregular heart beat**
  - Rapid uncoordinated atrial contractions **(ECG - "f" waves)**
    - Resulting in insufficient filling of ventricles
  - Irregular spaced ventricular beats
  - No 4th heart sound
- **Idiopathic,** not related to heart diz
  - **Generally not 2° to heart diz** (if underlying heart diz, Px is worse)
  - Not associated w/ GI diz as in cattle
- Geldings
- **Benign condition** usually

- **Exercise intolerance,** #1 presenting complaint
  - **Exercise induced epistaxis** (nose bleeding)
  - Underlying respiratory diz
  - Weakness, syncope (fainting)
  - CHF (congestive heart failure)

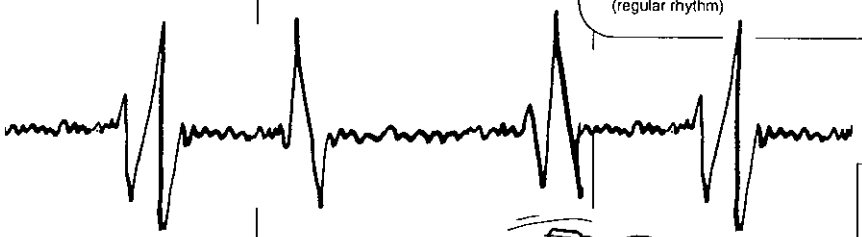


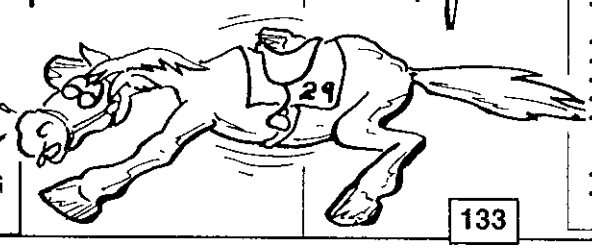
- Auscultation:
  - **No 4th heart sound**
  - **Murmurs in less than 50%**
- HR slow, normal or elevated
  - Resting < 50 bpm generally
  - Exercise m/b 240 bpm
- Generally no pulse rate deficit unless hi HR
- **ECG to Dx**
  - **Undulating "f" waves replace "P" waves**
  - Irregular cardiac rhythm w/ no underlying regularity
  - Irregular R-R interval
  - QRS irregularly spaced
- Ultrasound to detect underlying heart diz
  - Generally no underlying heart diz
  - Abnormal echocardiographic dimensions suggest heart diz

DDx:
- Sinus dysrhythmia (4th heart sound)
- Ventricular & atrial ectopic beats (regular rhythm)

- **Benign** atrial fibrillation
  - **Quinidine sulfate** orally
    - Check ECG in 2 hr
    - Every 2 hr - maximum of 6 doses/day
  - Repeat on day 2 if not converted
  - Rest 4-6 wk best, but usually not done
- High heart rate
  - **Digoxin** 4-5 d to slow HR to < 60 bpm
  - Then quinidine therapy
- CHF or underlying heart diz
  - Try quinidine, but conversion low, usually revert

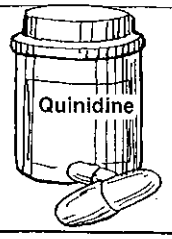
Prognosis:
- Good - benign atrial fibrillation
- Guarded to grave: > 60 bpm or CS of CHF





Quinidine sulfate orally (1 g/100 lb)
- Negative inotrope, causes systemic hypotension, ventricular response rate
- M/b bad side effects
- Use w/ caution (w/ CHF - risky)
- Monitor w/ PE, auscultation & ECG
- Normal acid base balance & hydration before Tx
- Check if side effects & do EKG in 2 hours
  - Side effects: colic, diarrhea, ventricular rhythm, supraventricular dysrhythmia or laminitis - discontinue if side effects
- Every 2 hr until convert to normal or maximum of 6 doses/d
- If no conversion, repeat on day 2, longer atrial fibrillation time harder to convert, best to catch early

Quinidine



"f" waves, benign
CS: Tiring, epistaxis
Dx: Auscultation, ECG
Tx: Quinidine

Condition	Facts/Causes	Presentation/CS	Diagnosis	Treatment
Anemia M8k 8; IM 423; I2M 423, 1213; C4T 273; EM&S 1802; M 331	• ↑ O_2-carrying capacity of blood • Pathophysiology of causes **1. Blood loss** **2. Hemolysis** (↑ destruction) **3. Inadequate erythrocyte prod.** (bone marrow) Types • **Regenerative** or responsive **anemias** - Blood loss & hemolysis - bone marrow responds by ↑ erythropoiesis - **Nonregenerative**: inadequate RBC production in bone marrow • **MCV** (mean corpuscular volume): reflects the size of RBCs $MCV\ (fl) = \frac{PCV \times 10}{RBC\ count\ (millions/\mu l)}$ - ↑ **MCV** indicates regen. anemia (immature RBCs larger than mature RBCs) - ↓ **MCV** (microcytosis) indicates iron deficiency	**CS due to inadequate O_2 to body tissue** • ↑ HR (tachycardia) • ↑ RR (tachypnea) • ↓ **Exercise tolerance (tiring)** • Depression • Pale mucous membranes	• **History:** - Deworming - Diet & access to pasture - Housing - Drug history - Immune status (last Coggin's test) - Travel history (babesiosis) - Past illness (chronic anemia) - Mare history (isoerythrolysis) - Exposure to new horses • **PE** (physical exam) - Color of mucous membrane . **Icterus** in horses associated w/ hemolysis, fasting or cholestatic liver diz - **Epistaxis** (chronic blood loss) - Respiratory or GI diz (any chronic inflammatory diz (abdominal abscess, pneumonia, or lymphosarcoma) will cause mild to moderate nonregenerative anemia) • **CBC** - **PCV reduced** - **Pink plasma** (IV hemolysis) - **MCV > 60 fl** (rare) suggests regenerative anemia - **Heinz bodies**: suggests toxicosis by phenothiazine, red maple leaves, or wild onions - **Agglutination** suggests immune-mediated anemia . **Coggin's & Coomb's tests** in adults . Newborn: hemolytic cross-matching w/ mare - **WBCs** . ↑ PMNs (neutrophilia), ↑ globulin (hyperglobulinemia) &/or ↑ fibrin (hyperfibrinogenemia) suggest chronic infection . Hypoproteinemia: indicates blood-loss anemia or underlying diz causing blood loss (granulomatous bowel diz or intest. lymphosarcoma) • **Bone marrow analysis**: necessary to adequately characterize anemia as regenerative or nonregenerative **Diagnosis (cont. below)**	• **Treat underlying cause**

Blood loss, hemolysis or ↓ production
PCV unstable - Spleen stores
CS: Tiring
Dx: Hx, PE, CBC, Bone marrow, Tests
Tx: Tx cause

Horse RBCs have different characteristics than other species

1. Unstable PCV
- Spleen stores up to 1/3rd of RBCs
  - Adrenergic stimulation releases splenic stores, incr. PCV by as much as 50%
  - Exercise, excitement or blood loss cause adrenergic stimulation
  - Therefore must evaluate PCV serially under dif. levels of excitement
- Can't use PCV to estimate magnitude of blood loss in hemorrhage for at least 24 hr because of possible splenic release

2. Rouleaux formation: normal alignment of RBCs like stacked coins
- Gives a false high RBC sedimentation rate
- Must be differentiated from auto-agglutination

3. Icteric plasma: normal in horse (hyperbilirubinemia increases yellow color)

4. No peripheral signs or regeneration
- Only mature RBCs are released into circulation from bone marrow
  - Polychromasia (reticulocytes), macrocytosis extremely rare

5. Howel-Jolly bodies: normally found in blood
- Doesn't indicate a responsive anemia as in other species

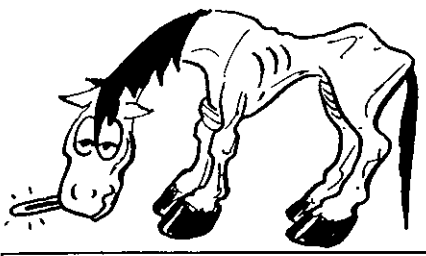
Diagnosis (cont.)
- **Urine analysis**
  - Occult blood: hemoglobinuria (from IV hemolysis) or myoglobinuria (myopathy)
- **Fecal occult blood**: indicates GI loss of blood (gastric ulcers [foals] or gastric SCC [squamous cell carcinoma])
- Serum iron & total iron-binding capacity (TIBC)
  - Low serum iron & high TIBC - iron deficiency
  - Low serum iron & norm. TIBC - chronic anemia
- **Coggin's test positive** indicates EIA (eq. infectious anemia)
- **Coombs' test**: positive indicates immune-mediated anemia (eq. infectious anemia, autoimmune hemolytic anemia, drug-induced hemolytic anemia, neonatal isoerythrolysis)

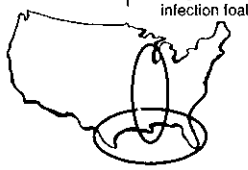
DDx - Anemia (large print indicates common causes, small print less common)

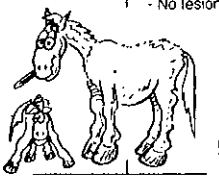
- **Blood loss**
  - Intestinal parasites (strongyloides) (pg 36)
  - Ectoparasites (lice [pg 272], ticks)
  - Gastric ulcers (pg 26)
  - Immune-mediated thrombocytopenia
  - Gastric SCC (squamous cell carcinoma) (pg 28)
  - Equine purpura hemorrhagica (pg 140)
  - DIC (disseminated intravascular coagulation) (pg 142)
  - Moldy sweet clover toxicosis (pg 143)
  - Warfarin poisoning (pg 143)
  - Hemophilia A or other congenital factor defc.
  - Guttural pouch mycosis (pg 100)
- **Hemolysis**
  - Neonatal isoerythrolysis (pg 139)
  - EIA (equine infectious anemia) (pg 138)
  - Red maple leaf toxicosis (pg 141)
  - Equine ehrlichiosis (pg 135)
  - Onion poisoning (pg 141)
  - Autoimmune hemolytic anemia
  - Babesiosis (piroplasmosis) (pg 144)
  - Clostridial infections
  - Incomplete blood transfusion
- **Inadequate RBC production**
  - Abdominal abscess or other chronic abscessation
  - Chronic pneumonia/pleuritis (pg 118)
  - Equine purpura hemorrhagica (pg 140)
  - Equine ehrlichiosis (pg 135)
  - Lymphosarcoma (pg 30)
  - Myelogenous leukemia
  - Eq. viral arteritis (pg 134)
  - Chronic renal failure (glomerulonephritis) (pg 148)
  - Radiation toxicosis
  - Idiopathic aplastic anemia

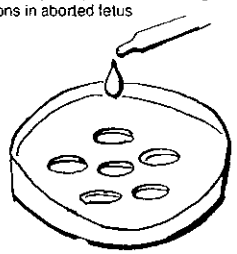
Anemia

Condition	Facts/Cause	Presentation/CS	Diagnosis	Treatment
EIA, Equine infectious anemia, Swamp fever M8k 499; Mk 28; IM 1073-4, 1401; I2M 1204, 1223; C4T 280; T 703, 707; EM&S 1804, 1837; Pop 14-1/98, 90-7/97	• **Rarely see clinically because controlled through testing** • **Mechanical transmission of blood of infectious horse** - Needles, blood sucking flies (deer, stable) - In utero - Colostrum (foals sucking infectious mare) • Infected pregnant mares generally abort (but rare because test & euthanize) • **Retrovirus: lifetime infection** (whether show CS or not) • Horses, mules & donkeys • Stress exacerbates CS • **"Hot zone"** (92% of EIA+ horses around Gulf of Mexico & Mississippi River)	• **Intermittent fever** • Depression, progressive weakness • **Weight loss** • Edema (pitting) • **Icterus** • ± Melena or epistaxis • Mucosal hemorrhages & petechiation (ocular, vulvar & ventral aspect of tongue) • **Usually inapparent** • **± Acutely fatal hemolytic anemia** • **Periodic flare-ups of CS** • **± CNS** - **Ataxia, weakness** (encephalomyelitis, meningitis) • **Abortions** any stage of gestation, especially during febrile episode - Or, give birth to normal, live, free of infection foal	• **Hx: wt. loss + periodic fever: suspect EIA** • **Lab:** **- Progressive or transitory anemia** - ↓ PCV & platelet count (thrombocytopenia) - ↑ Monocytes - ± ↑ MCV - ↑ Bilirubin • **Coggin's test** (agar immunodiffusion) for serum antibodies 95% effective - Foals nursing infected dams temporarily positive (up to 6 mo. due to colostrum) - Recently infected horses negative for 1 wk-45 d until antibodies form - If aged, will be positive sometimes **- State labs run test** • Viral isolation impossible • PM (postmortem) - Splenomegaly, hepatomegaly - Deposition of antibody/antigen in kidney (glomerulonephritis) incidental finding - No lesions in aborted fetus	• **Euthanize positives** • **No vaccination or specific Tx** • **No Tx clears the carrier state** • Isolate when diagnosed & keep isolated for life if don't euthanize **Control:** • **Stable fly control** • **Foals from infected mares isolated** until Dx free of infectious by disappearance of maternal antibodies (up to 6 mo) • **Tested for transport across state lines & at racetracks** **- Once positive can't transport** - Tested every 6 months If positive, euthanize (depends on state), or put in quarantine for life & never breed



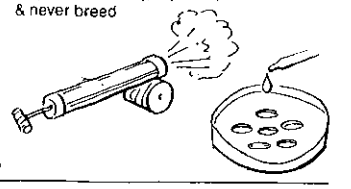




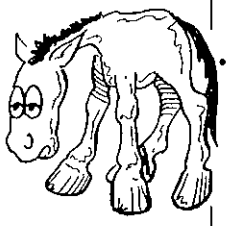


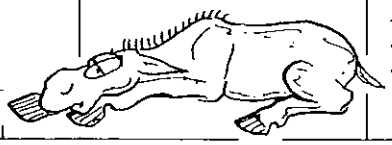
Rare because of test, Infected for life
CS: Recurrent fever, Wt. loss, Icterus
Dx: Coggin's test
Tx: Euthanasia positives

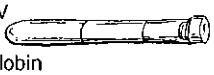
Pathophysiology:
- Short IP (incubation period)
- Viremic
- Multiplies in macrophages, stim. production of T & B lymphocytes
- Complement fixation antibodies & attach to RBCs
- Both intra- & extravascular hemolysis

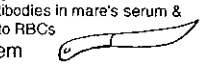


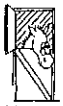
Neonatal isoerythrolysis, NI, Hemolytic diz of newborn M8k 16; Mk 22; IM 1619; I2M 423; C4T 592; EM&S 1804; M 289	• **Destruction of foal's RBC by mare's antibodies in colostrum** • Blood group factors: Aa, Qq, Rr or Ss - **Aa or Qq** (antigens) most severe • Facts: - 1% of horses, but not all show CS - **Multiparous mares** (previously sensitized) higher titers than 1st preg. - 1st pregnancy possible if transplacental contamination of foals - High incidence in A+ Arabians - Select donors A & Q negative • Variable onset of CS, depending on amount of colostrum & antigen type (types A & Q the worst)	• **Foals normal at birth** • **CS 24-36 hrs after suckle** (colostrum) - Lethargic & weak - **Icteric**, especially sclera - **Pale mucous membranes** - **↑ HR, RR** due to anemia - Labored breathing (hypoxia) - Progressively weak & recumbent - **Often yawn** (need O2), shiver - Afebrile - Seizures w/ severe anemia • Milder syndrome w/ anti-R or anti-S, more tolerant	• **Anemia** - Low PCV - ↓ RBCs - ↓ Hemoglobin • **↑ Total bilirubin** up to 20 mg/dl (mainly unconjugated) due to RBC destruction (hypokalemic if not suckling) • Hemoglobinuria, hemoglobinemia • **Lytic &/or agglutination tests** **- Antibodies in colostrum** or mare's serum against foal's RBCs **- Coomb's test** (direct antiglobulin test) - Detect antibodies attached to foal's RBCs - Indirect antiglobulin tests . Detect antibodies in mare's serum & attached to RBCs • Postmortem - Pale &/or icteric - Splenomegaly - Severe anemia lesions (centrolobular hepatic necrosis)	• Withholding milk questionable when Dx at 24 hrs (colostrum depleted & foal's absorption diminished) • **Minimize stress** • **↓ Exercise (rest)** • **Generalized support** **- IV fluids** for diuresis of hemoglobin load on kidney, acid base balance - IV dextrose • **Transfusions if severe** anemia (PCV 10-15%) not if above 15%, just rest - Stop gap measure as cells don't last long - Also sensitizes foal to future transfusions - Mare's RBCs washed; transfused or other horse blood free of Q or A **Prognosis** (Px) • Varies depends on quantity of antibodies ingested, type of antibodies, severity of anemia, rapidity of CS • Peracute m/ die • Others, support & transfusion if PCV continues to fall; may save

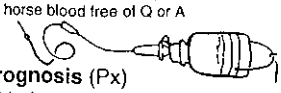




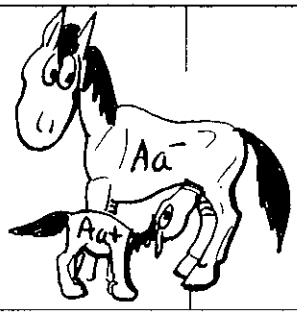








Mares Abs in colostrum lyses foals RBCs
CS: 24-36 hrs, icteric & anemia
Dx: Anemia, Tests
Tx: Rest, Fluids



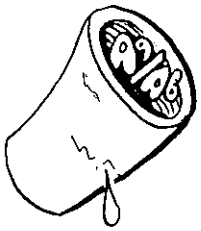
Pathophysiology: requirements for NI ("Aa" used as an example)
1. Mare negative for factor (Aa-) considered at risk
2. Sensitization of mare to antigen (Aa+) & production of antibodies (anti-Aa)
   - Exposure during previous pregnancy
   - Blood transfusion
   - Transplacental contamination of foal's RBCs
3. **Foal w/ antigen Aa+**
   - Inherited from stallion Aa+
4. **Ingestion of colostrum** w/ Anti-Aa antibodies = RBC hemolysis or agglutination
   - Antibodies (anti-Aa) attach to antigen (Aa+) on foal's RBCs
   - Spleen (reticuloendothelial system) removal or lyzed (intravascular) by complement (agglutination or lysis)
   - **Anemia if can't compensate**

Prevention:
- **Detect mares at risk**: blood type for negative Aa & Qq
- Breed negative Aa or Qq mares to negative Aa or Qq stallions
  - Problem: not many negative stallions & hard to find
- Tests to tD foals & mares
- **If unknown or incompatible mating**
  - **Screen "at risk" mares 30 d before foaling** for antigens to foal RBCs
    . ACD anticoagulated sample to lab
    . Repeat closer to parturition if results equivocal
  - **If positive give alternate source of colostrum**
    . Muzzle foal & keep w/ mare
    . Milk out mare
    . 36-48 hrs allow to suckle from mare (colostrum gone & specialized epithelial of foal to absorb antibodies lost by 19-24 hr)

Condition	Facts/Causes	Presentation/CS	Diagnosis	Treatment

Purpura hemorrhagica

Mk 43; IM 1073; I2M 1203; C4T 293; EM&S 1836



Facts/Causes

- **Arthrus Type 3** reaction, similar to "serum sickness"
  - 1-3 wk after initial *S. equi* illness
  - **Excess antigens** (presumably Strep. protein)
  - Ag/Ab bind into small **complexes** (because of Ag excess)
  - **Small complexes remain soluble** & are not filtered by reticuloendothelial system
  - **Complement** taken up by Ag/AB complexes
  - Immune complexes cause vascular endothelial damage **(vasculitis & thrombosis)**
  - Result in edema & purpura **(purplish discoloration)**
  - Normally antibodies in excess & form large complexes w/ antigens which are filtered by the reticuloendothelial system

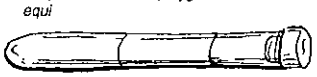
Cause: sequel to another diz
- **#1 *Strep. equi* infec.** (strangles)
- Influenza
- Chronic suppurating wounds
- **Vaccination w/ *S. equi* Bacterin**

Presentation/CS

- **Edema**
  - **Urticarial wheals** (elevated patches of skin) progressing to:
  - **Sharply demarcated edema** of muzzle, eye, head, belly & limbs (hot, dependent)
- **Purpura** (petechiation, ecchymoses of mucous membranes usually more extensive than in EIA
- Muscle soreness due to swelling, don't move
- Pain associated w/ edema
- **Stridor & dyspnea** (due to edema around nares & pulmonary edema)
- **Diarrhea** or **colic** due to edema & hemorrhage of gut
- ± Fever, anorexia & depression, depending on whether animal still has *S. equi*
- **Diz lasts 1-2 wk**, 50% recover
  - Death due to asphyxia, anemia or toxemia of 2° infection
- **Chronically** (wks later)
  - Weight loss
  - Skin sloughing (edema compromises vasculature)
- ± Mild renal diz (due to immune complex deposition)
- Sequelae:
  - Sloughing, laminitis, cellulitis, pneumonia & diarrhea common, prolong recovery

Diagnosis

- **Hx: recent strangles or bacterin**
- **CS: Edema, purpura**
- Lab:
  - **Mild to moderate anemia or hemoconcentration** if plasma loss > RBC loss
  - **↓ Compliment**
  - **Normal platelet counts**
  - Normal body profiles, neutrophilia
  - **↑** gamma globulins & fibrinogen due to *S. equi*
- PM (postmortem)
  - Marked edema: airways, intest.
  - Hemorrhage: sparse or extensive
  - Focal muscle ischemia (pale) or hemorrhage (dark)
  - Deep abscesses or polygenic cellulitis - *E. equi*

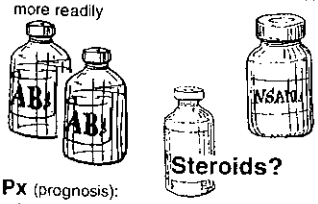


DDx:
- EIA (pg 138)
- EVA (pg 134)
- *Ehrlichia equi* (pg 135)

Treatment

Tx to:
1. Remove Ag
2. Reduce immune response
3. Reduce vessel inflammation
4. Supportive care

- **ABs** to clear circulating bacterial protein
  - **2 X dose of pen.**, streptomycin, tetracycline, oxytetracycline, Triple sulfa
  - Drain any abscesses
- **NSAIDs** for inflammation & analgesia (Bute & Banamine®)
- **Steroids** for hypersensitivity vasculitis to reduce edema (controversial)(dexamethasone, prednisolone) m/b 4 wk
  - Cover w/ ABs because of 2° sepsis
- **Tracheostomy** if asphyxia eminent
- **Blood transfusion** if anemia severe
- **Bandaging limbs**
- **Good nursing**
- Lasix® to ↓ edema after well hydrated
- **Some cases refractory to Tx, death from 2° septic processes**
- Elevate feed & water to muzzle level will eat more readily

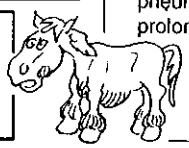


Steroids?

Px (prognosis):
- **Good** w/ early aggressive therapy

Prevention: avoid exposure of previously sensitized horses to *S. equi* antigen

Ag/Ab/C complexes = vascular damage
CS: Edema & purpura
Dx: Earlier Strangles or bacterin
Tx: 2X ABs, NSAIDS, Steroids



Purpura: disorder characterized by purplish discoloration of mucus membranes caused by hemorrhage

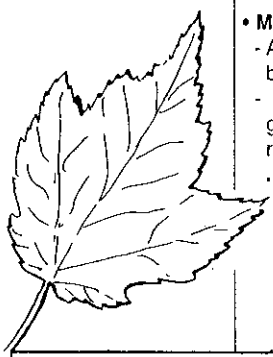
Red maple leaf toxicity, Heinz body hemolytic anemia

M8k 2116, 2122; IM 1098; I2M 1227; EM&S 1806; C4T 650, 278; C3T 375; C2T 679

Facts/Causes

- **Oxidizing agents causing acute hemolytic anemia**
  - **Phenothiazine** (piperazine, [dewormer] or methylene blue)
  - Plants: See **Toxic plants**: 325,
    - . **Onions: wild** or domestic
    - . Brassica family (rape, kale)
    - . **Red maple**: wilted leaves of (*Acer rubrum*) (fresh leaves less toxic)
      - 1° in NE US, seasonal severe in Fall when leaves falling off & wilting
- Specific substance not identified
- **Heinz bodies** formed by oxidative denaturing of hemoglobin in RBC
  - **Removed by spleen** (reticuloendothelial system) - RBCs w/ Heinz bodies less deformible, oxidized & broken down (extravascular hemolysis)
    - . Also change tonicity so some intravascular hemolysis

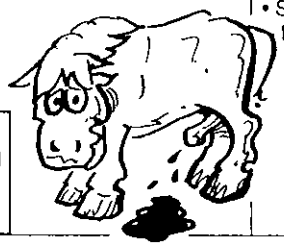
- **Methemoglobin** (chocolate color)
  - Also produced w/ Heinz bodies by **Red maple toxicity**
  - Oxidative change of hemoglobin iron to nonfunctional ferric state)
    - . Can't carry O2, resulting in brown color of peripheral blood & mucous membranes



Presentation/CS

- Weakness, depression, anorexia
- **Exercise intolerance**
- **Icteric** mucous membranes
- **Brownish colored** mucous membranes w/ **Red maple** toxicity (methemoglobinemia)
- **No fever**
- **↑** HR & RR

Acute event - 2 syndromes
- **Type 1**
  - Moderate to severe **anemia** w/ large # of Heinz bodies present
  - Progressive **↑** in MCV as animal responds to anemia present
  - **No methemoglobinemia** or -uria
  - **Most will live**
  - **↑** PCV also
- **Type 2: more severe**
  - Severe **anemia**
  - **Methemoglobinemia**, -uria: brown discoloration
  - **Tend to die**
  - **Few to no Heinz bodies**, tell they have already been destroyed. Also have hemo-globinuria. Suggests more severe hemolytic crisis
- Sequela:
  - **Hemoglobin nephrosis**

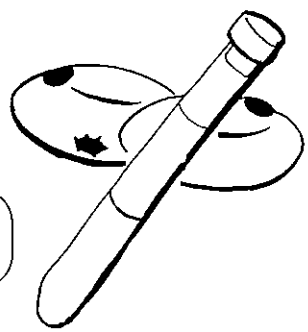


DDx:
- EIA (pg 138)
- Purpura hemorrhagica (pg 140)

Diagnosis

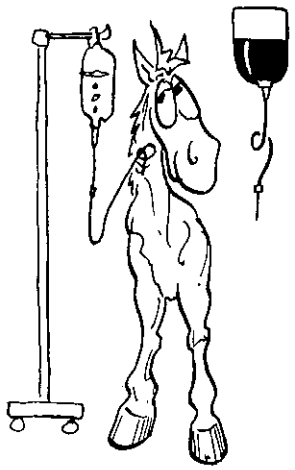
- **CS**
- **Hx of exposure** (drugs or leaves)

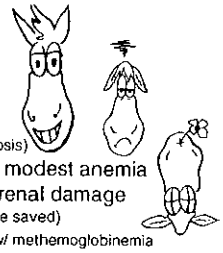
- Lab:
  - **Anemia** (varying degrees)
  - **Heinz bodies** in all, round to oval to serrated refractile granules
    - . Located near cell margin or protruding
    - . **Crystal violet** or new methylene blue stains to unfixed blood smears
  - No hematologic evidence of regenerative anemia in horse (because RBCs mature (not reticulocytes) when leave bone marrow normally)
  - **Hemoglobinemia & hemoglobinuria** (profound RBC destruction)
  - **↑** Serum bilirubin (indirect)
  - **Modest to marked ↑ BUN & creatinine** (reflect risk of hemoglobin nephrosis)
  - **Methemoglobinemia** w/ **red maple toxicity**



Treatment

- **Remove source of toxicity**
- **Supportive:**
  - Blood transfusion if PCV < 10 - 12%
- **IV fluid** if evidence of renal damage
- Cathartic to empty GI to rid toxins





Px (prognosis)
- Good if modest anemia
- Poor if renal damage (but can be saved)
- Grave w/ methemoglobinemia

Oxidation = hemolysis
CS: Anemia, icterus, tiring
Dx: CS, Hx, Heinz bodies,
Tx: Support, Fluids

Condition	Facts/Cause	Presentation/CS	Diagnosis	Treatment
DIC, Disseminated intravascular coagulation Mk 24; IM 1077; I2M 1207; EM&S 1838; E 404; C3T 504; C2T 306; M 332	• **Never a 1° disease entity** • **Dizs causing vasculitis, activate platelets & clotting mechanism (see box)** - **Acute GI disorders** (strangulation, acute enteritis, protein losing enteropathy, embolic infarction) . Horse: prevalent in acute GI disorders that cause colic . Endotoxins absorbed through damaged mucosa .. Initiating factor for laminitis • Spectrum from diffuse thrombosis - Ischemic organ failure to severe hemorrhagic diathesis (predisposition to abnormal homeostasis) • RBCs are damaged passing through damaged arterioles & removed by endoreticular system **Causes:** •Septic processes (salmonellosis, metritis) • Neoplasia •**Acute GI disorders** (strangulation, acute enteritis, protein losing enteropathy, embolic infarction) • **Renal diz** • Hemolytic anemia • EIA • Thrombotic purpura • Strongyloides migration	• **Variable - depending on 1° diz** • **Rarely overt hemorrhage Thrombosis & ischemic organ failure** • **Renal failure**: common - Oliguria, azotemia (↑BUN) - Depression & ileus • **Colic**: due to GI microthrombosis - Occult fecal blood, rarely melena • Rarely respiratory (microvascular thrombosis) - Tachypnea, & hypoxia • **CNS: microvascular thrombosis** - Delirium, convulsions, coma • ± **Acute laminitis**: digital ischemia • **"Blown" jugulars: thrombosis of major veins** - Catheters, & needles • **Petechial or ecchymotic hemorrhages** (depletion of clotting factors) - Life threatening hemorrhage very rare - Trauma or Sx m/ induce uncontrollable hemorrhage • Chronic, compensated DIC - Few or no CS - M/ become clinically obvious DIC due to stress, concurrent diz	• Systemic CS • Lab: **no test definitive Dx** - Strongly suggestive . **Thrombocytopenia** . **< 100,000/ml platelets suspect DIC** Mild to moderate prolongation of PT &/or APTT time - **Findings often NOT helpful** - Occult blood in feces **DDx:** • **Septicemia** • Warfarin toxicosis (pg 143) • Moldy sweet clover toxicosis (pg 143) • Inherited coagulation abnormalities **DIC = "Death Is Coming" 2° to other dizs** **CS: Multiple systems** **Dx: < 100,000 platelets** **Tx: Tx 1° diz, support**	• **Treat 1° disorder** • **Supportive Tx** to combat shock & maintain tissue perfusion - IV fluids - ABs for septic conditions - Sx for strangulating intestinal obstructions - Banamine® (flunixin meglumine) IV, q8h) for endotoxins - Corticosteroids not indicated, may worsen - Life threatening hemorrhage rare (fresh plasma, if platelet concentrates < 50,000/µl) • Heparin - highly controversial **Heparin???** **Px** (prognosis) • Poor if doesn't coagulate • Depends on underlying diz
Iron-defc anemia IM 1103; I2M 1232; EM&S 1809; E 412	• **Less common in horse than other species** • Due to chronic blood loss: parasitism, bleeding, GI lesions or hemostatic defects • Dietary deficiency seldom a cause even in neonates • **Tx:** Correct chronic blood loss; Iron cacodylate only safe preparation for horses, avoid injectable iron dextran (for pigs) bec. can cause anaphylaxis			

Moldy sweat clover toxicosis Mk 1682, 1733; IM 1081; I2M 1884; PP/Mt 40; EM&S 1838; C3T 371; C2T 325; PP/O 18	• *Melilotus* spp. - **Moldy** sweet clover hay (especially small bails) or silage • **Dicoumerol** synthesized from coumarin by **molds** • Winter on moldy hay, Palatable - Grazing fields not dangerous • **#1 in cattle**, all animals susceptible • Consumption over long time	• **Hemorrhagic diathesis** (predisposition to abnormal homeostasis) • **Swellings** (shoulders, thighs, neck, back & chest) - due to hematoma formation • **Hemorrhage** where body traumatized (brisket, tuber coxae, carpi) hematoma • Ecchymoses (small hemorrhagic spot, > petechiae) in mucous membranes - Petechial hemorrhage uncommon because no thrombocytopenia • **Epistaxis** • Periarticular swelling • Hematuria • No fever	• Exposure • Hemorrhages • Prolonged PT (later also APTT) • **No other abnormalities of clotting profile** (normal platelet count, plasma fibrinogen) • **Anemia** • Hypoproteinemia • **No fever** • Chemical analysis for dicoumerol - feed, blood & liver (absence doesn't rule out)	• **Remove source** - Stop warfarin if PT exceeds 2x therapeutics value Tx - Remove plants • **Vit. K1** (IM) every 6 hrs until PT normal - Not K3 since poor action & nephrotoxic in horses • Fresh plasma (control hemorrhage by providing clotting factors) • Whole blood transfusion (if life threatening anemia) **Vit K1** **Px** (prognosis): • Good if early Dx & prompt Vit. K1
Anticoagulants (Warfarin, coumarins)	• Source - **Rodenticides** - **Tx of navicular diz in horses** • **Mechanism of action** - Competitive inhibition of Vit. K - Vit. K needed for production of clotting factors (II, VII, IX & X) - Thrombin formation depressed • Rapidly absorbed from GI • Potentiated by - Vit. K deficiency in diet - Concurrent protein bound therapy (phenylbutazone & chloral hydrate) Vit K1	**Prevention:** • Easily by careful forage preparation &/ or inspection of hay & silage - Discard moldy portions • Limit access to rodenticides or plants • Careful monitoring Warfarin Tx in horses - Hepatic diz strong contraindicated for Tx - Limit other drugs (especially Bute) - Daily monitoring PT until dose doubles PT time - Check PT 2 x wk during therapy		**DDx:** • DIC (thrombocytopenia) (pg 142) • Mycotoxicosis • Septicemia (fever) (pg 35) • Liver failure (pg 84)
Autoimmune hemolytic anemia, AIHA M8k 14; Mk 21, 248; IM 1096; I2M 1225; E 408; C4T 279; C3T 495; C2T 295	• **Cats, horses & dogs** • **Anti-erythrocyte antibodies against horse's own RBCs** - Antibodies complex w/ antigens on RBCs causing destruction & removal **Causes:** • 1° idiopathic, or • **More commonly 2° to:** - Purpura hemorrhagica - Lymphosarcoma, esp. GI form - Chronic bacterial infection - EIA, piroplasmosis of ehrlichiosis - Rarely procaine penicillin	• Variable • Typical of 1° problem + hemolytic anemia • Hemolytic anemia CS - Depression - **Pale mucous membranes** - **Variable icterus** - ↑HR & RR - Variable to intermittent fever	• Anemia variable - PCV < 10% is life threatening - Horse only species that doesn't show regenerative hematological signs • **Direct Coomb's test for antibodies** • Response to corticosteroid Tx **Steroids**	• **If 2° treat 1° cause** - Remove from drugs - Lymphosarcoma - "punt" - unrewarding - Steroids contraindicated in viremia & EIA so get neg. Coggin's test 1st • **1° Autoimmune hemolytic anemia** - **Systemic steroids** if neg. Coggin's . **Dexamethasone** (parenterally 3-5 d, gradually decrease over 7-14 d . If no response in 5-7 d reevaluate cause of bone marrow suppression . Once controlled: oral prednisolone - Quite environment - Nutrition (Vit supplements) - Blood translusion of little value

Vasculitis

Condition	Facts/Cause	Presentation/CS	Diagnosis	Treatment
Ehrlichiosis Mk 375; IM 1073, 1115; I2M 1204; EM&S 1806, 1837; C4T 282; C2T 300	• **Rickettsia *Ehrlichia equi*** • **Necrotizing vasculitis in horses**, donkeys & mules • Transmission: tick suspected • **Seasonal in N. Calif** - Late fall, winter & spring • Severity age related	• < 1 yr m/ only have fever • 1-3 yr old: fever, depression, mild limb edema & ataxia • **Horses > 3 yr** - **Undulating fever** (102-106°F for 6-12 d) - Depressed, partial anorexia - Mucosal petechiation - Icterus - **Reluctant to move** - **Edema of all legs** (more in hind limb) • **Progressively worse in 1st 3-7 d w/gradual resolution in 2-3 wk if untreated**	• Hx, CS • Lab - Mild to moderate leukopenia - Mild to moderate anemia - **Inclusion bodies** in neutrophils w/in 3-4 ds of CS . **Giemsa stain**: blue-gray **DDx:** • EIA (pg 138) • Purpura hemorrhagica (pg 140) • Chronic liver diz (pg 84) • Viral encephalitis (pg 256) • Viral arteritis (pg 134)	• **Oxytetracycline,** 7-14 d (prompt remission of fever & CS w/in 1 d) • Recovery usually w/in 10 d • Penicillin, chloramphenicol & streptomycin have no inhibitory effect • Corticosteroids m/b for severe edema & ataxia **Px** (prognosis) • **Good** • Recovery gives immunity for 2 yr & no carrier
Immunemediated thrombocytopenia, IMTP M8k 44; Mk 56, 428; IM 1075; I2M 1205; E 403; CT 507; C2T 310; M 335	• **Platelet count < 100,000** • Rule out (R/O) DIC right away **Causes:** • 1° (idiopathic) • 2° to: - Drug administration (penicillin, heparin, quinidine, thiazides, digoxin, sulfas & erythromycin) - Infections - Neoplasia - Immunologic disorders (EIA, lymphosarcoma & autoimmune hemolytic anemia)	• Vary w/ underling diz process • **Hemorrhagic diathesis** - Petechial hemorrhages w/ or w/o ecchymotic hemorrhage - Oral, nasal &/or vaginal mucosa - Epistaxis, melena, hyphema - Spontaneous hemorrhage unusual unless < 10,000/ul - Prolonged bleeding from wounds or injection sites - **Hematoma** formation w/ trauma (< 40,000 ul)	• Hx, CS • Lab: - **Prolonged bleeding time** & abnormal clot retraction - No effect on clotting time or plasma fibrinogen • **Response to Tx supports Dx**	• **Unexplained case** - **Stop all other drugs**, if Rx necessary replace w/ most-dissimilar Rx - **Dexamethasone** (IV or IM) 10-15 d . Usually platelets ↑ in 4-7 d . Prednisolone (IM q12h) for cases refractory to Dex • **Prognosis: Good**

Platelets < 100,000
CS: Bleeding
Dx: Hx, CS, Lab, Tx
Tx: Stop Rx, Steroids

Other causes of thrombocytopenia
1. ↓ Platelet production
- Myelogenous neoplasia (granulocytic leukemia, myelomonocytic leukemia, monocytic leukemia, eosinophilic myeloproliferative disorders
- Phenylbutazone toxicity, rarely (pg 27)
- Hypoplastic anemia
2. Abnormal sequestration (spleen)
3. Shortened platelet life span #1 cause (destruction or consumption)
- DIC (pg 140), Vasculitis

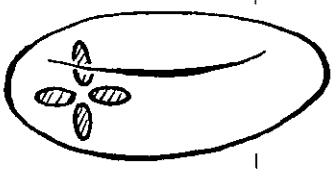
Steroids

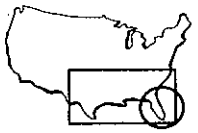
Anemia of chronic diz I2M 1233; C4T 283; EM&S 1808	• **#1 anemia of horses** • Mild to moderate nonregenerative anemia • Causes: - **Neoplasia** - **Chronic inflammatory or infectious process** (pleuritis & internal abdominal abscessation) - Disturbance of iron metabolism			• **Tx underlying cause & anemia resolves**
Hemolytic syndrome related to liver failure IM 1102; I2M 1231, 1233; E 410	• Near terminal event in acute or chronic liver failure, Sudden & rapidly progressive • Intense icterus sclera & conjunctiva (reddish orange), hemoglobinemia & hemoglobinuria, "burr cells" (RBCs) • Px highly unfavorable - nearly all die			
Equine viral arteritis, EVA, **Equine typhoid, Epizootic cellulitis, Pinkeye** Mk 376; IM 527, 1401,1397; I2M 1204; EM&S 1836; E 734; C4T 294; C2T 313	• Togavirus • Diz not commonly diagnosed • **Damages smaller arteries** - Panvasculitis of entire cardiovascular system - **Edema**: leakage due to necrosis of small arteries • **Transmission** - Inhalation (aerosol), or - Venereal (semen, vaginal discharge) - Feces - **Carrier stallion**, not mares • **Abortion rare**	• Vary from subclinical to severe • **Most mild** - Poor appetite, Stiff hindlimbs - Fever (105°F) - **Conjunctivitis & rhinitis** - reddening of 3rd eyelid, push forward **(pinkeye)** • **Very sick**, severe depression - **Cough** - **Limb edema** (esp. hind limbs) - **Ventral edema** of eyelids, ventral abdomen (prepuce, scrotum, mammae) - ± Colic & diarrhea - Photophobia - Skin rash (neck or generalized) - Myalgia (muscle pain), Arthralgia (joint pain) - Icterus - Papules on upper muzzle • **Abortion** (see pg 216)	• **CS to provisionally Dx** • **Virus isolation, serology, histopathology** - Nasopharyngeal & conjunctival swabs, citrated blood samples & semen - Serology difficult to interpret; asymptomatic animals can have titers • Lab: only leukopenia **Abortion:** (pg 216) • **Abortion during or following illness** **DDx:** • EHV-1 (abortion mos later, PM - inclusion bodies) • Eq. influenza (abortion rare) (pg 109) • EIA (pg 138) • Purpura hemorrhagica (pg 140)	• **No specific Tx** • Antibiotics & symptomatic therapy • Good nursing & absolute rest • **Quarantine** Reportable in some states **Prevention:** • **MLV vaccine, closely regulated**, - Know current USDA restrictions in your area - Must be seronegative to vaccinate - Given annually - Economics, if no problem w/ EVA, don't vaccinate • Seropositive stallions bred only to seropositive or vaccinated mares - Don't ship mares to positive stallions - Semen culture all positive stallions for shedding

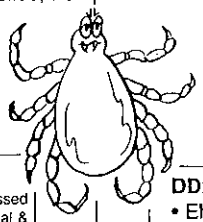
Necrotic vasculitis
CS: Pinkeye, edema, abortion
Dx: Virus isolation
Tx: Rest, ABs, Quarantine
Prevention: vaccine

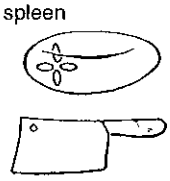
Anemia

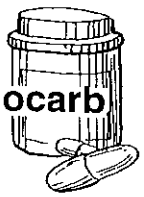
Condition	Facts/Cause	Presentation/CS	Diagnosis	Treatment
Babesiosis, Piroplasmosis, Tick fever, Texas fever, Red water M8k 23; Mk 71; IM 1088; I2M 1217; C4T 281; EM&S 1806	• S. USA, endemic in SE Florida • **Not a big problem** in USA • ***Babesia equi*** (most pathogenic) - Hemoglobinuria & death • ***B. caballi*** (persistent fever & anemia) • **Tick, *Dermacenter*** *nitens* in USA - *B. equi* different from other Babesia, has an exoerythrocytic (lymphocytic) stage • Chronic carriers once infected	• **Fever** 102-107° F • Malaise & anorexia • **Hemolytic anemia**, rapid • Hemoglobinuria, dark yellow-colored urine • Death • Depression, anorexia, incoordination, lacrimation, nasal discharge, swelling of eyelids, frequent lying down	• Hx (area) CS: fever, anemia, jaundice & hemoglobinuria • Tick infested area • **Organisms** in Geimsa stained RBCs of thin blood smear • PM (postmortem) - Jaundice - Enlarged spleen	• Babesiacidal Rx - **Bernil®** (diminazene diaceturate) • Fluids • Imidocarb® (protozoocide) eliminates carrier state **Px** (prognosis) • Recovery rule if Tx'd early • No vaccine **Controlling endemic areas:** • Control ticks - Range fires, reduction of tick pop.

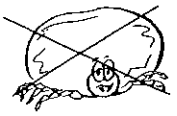












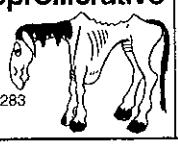
Tick, Dermacenter, protozoa
CS: Fever, anemia
Dx: Hx, CS, Organism
Tx: Bernil®

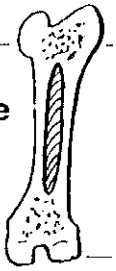
Tick life cycle - 3 weeks
- Female ingests parasites in a blood meal, these are passed transovarially to larval progeny. The tick drops off the animal & lays eggs. The eggs develop into larvae which attach to a new host & complete their life cycle.
- Parasites in tick saliva enter bloodstream to RBCs, merozoites break out of RBCs to infect others
- Animals infected on new pastures w/ infected tick larva

DDx:
- Ehrlichiosis (pg 142)
- EIA (pg 134)
- Liver failure (pg 186)
- Hemolytic anemias (pg 142, 143)

Anaplasmosis M8k 21, I2M 1214: **in ruminants not in horses**

Myeloproliferative diz IM 1114; I2M 1244; C4T 295, 283 *	• **Rare** • **Abnormal proliferation of bone marrow elements** • Failure of normal - RBC - Thrombocytes (platelet) - WBC production • Often young < 5 yr-old	• **Depression** • **Intermittent fever** • **Petechial & ecchymotic hemorrhages** • **Anemia** • Weight loss, lymphadenopathy, splenomegaly, edema • Poor performance	• **CS of depression, recurrent fever, petechial hemorrhages** • Lab: - Thrombocytopenia - Neutropenia - Nonregenerative anemia - Abnormal cells in circulation - Neoplastic infiltrate of bone marrow aspiration	• **No effective Tx** **None effective** **Prognosis: Poor**





Bone marrow - Fever, Hemorrhage, Anemia (WBCs, Platelets, RBCs)

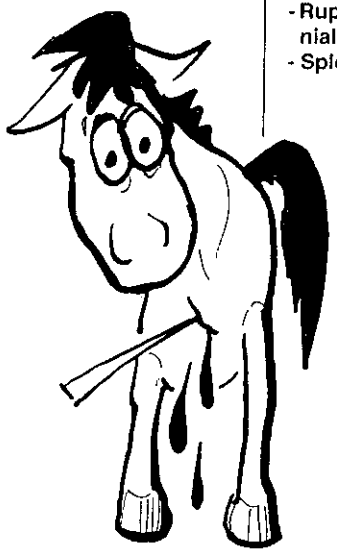
Hemorrhage, Blood loss anemia, Hypovolemic shock Mk 26; IM 1068; I2M 1198; E 402; EM&S 1807; C4T 276, 290; C3T 492, 517; C2T 300; Pop 71-7/98

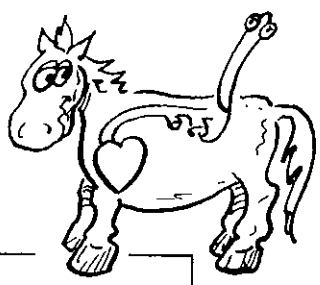
- External:
  - **Trauma** (laceration, splenic rupture, reticulopericarditis)
  - **Surgery** (castration)
  - **Erosion of carotid artery by guttural pouch mycosis**
- Internal:
  - **Rupture of middle uterine a.**
  - **Rupture of aneurysm of cranial mesenteric artery**
  - **Splenic rupture**

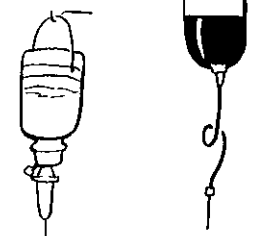
- Blood in external hemorrhage
- **Occult in internal bleeding**
- Acute massive loss = **hypovolemic shock**
  - Tachycardia
  - Tachypnea
  - Cold extremities
  - Muscle weakness
  - Cardiovascular collapse
  - Renal damage
- **Anemia**
- **No icterus**

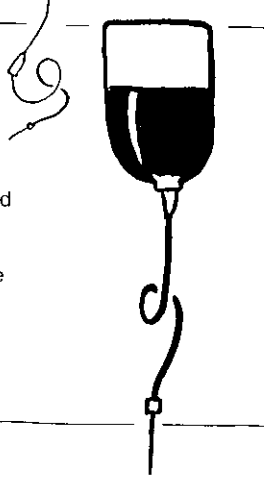
- Hx, CS of hemorrhage
  - **Anemia**
  - **Hypoproteinemia**
  - Abdominocentesis & thoracocentesis
- Bone marrow responds in 5 d
- Peripheral signs or regeneration in horses minimum (no basophilic stippling as in cow)
- **Lab:**
  - Acutely PCV & TP normal (declines in 24 hr due to mobilization of extracellular fluid to maintain volume)
  - RBC (polychromasia, basophilic stippling, Howell-Jolly bodies & nucleated RBC w/in 4 d)

- **Stop hemorrhage**
  - External - suture or pressure bandages
  - Internal (m/ not attempt if animal is poor surgical risk because cause often not found)
- **Tx hypovolemic shock** (see box)
- PCV < 12% consider whole blood transfusions (see box)

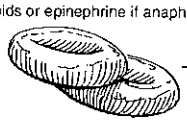




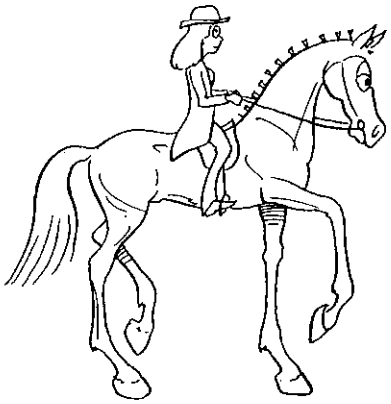




- **Tx hypovolemic shock ($)** C4T 290; C3T 517
  - IV 40-80 ml/kg sodium containing crystalloid solution (even though dilutes PCV)
  - Give more than blood loss because distributes to intracellular space
- **Whole blood transfusion** ($ expensive & rarely done)
  - Only a temporary measure because RBCs survive only 4 d
  - 1st transfusion usually tolerated
  - 2nd not, due to trillions of blood types & incompatibility
  - Replace 20-40% of blood loss to allow bone marrow time to respond
  - Monitor for adverse reaction (20 ml/kg/hr) (tachypnea, tachycardia, dyspnea, muscle fasciculations or sudden collapse: slow down infusion or discontinue steroids or epinephrine if anaphylaxis [.2 to .5 mls IV (1: 1,000 dilution)])



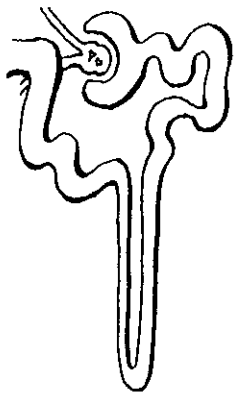
External & internal
CS: Hypovolemic shock, anemia, no icterus
Dx: Hx, CS, Lab
Tx: Stop bleeding, Tx shock

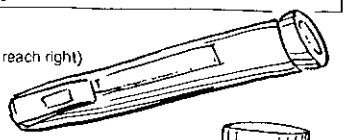


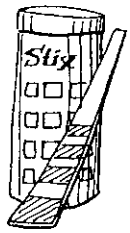
URINARY SYSTEM

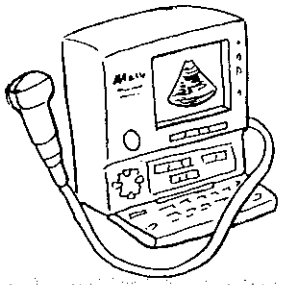
Acute Renal Failure (ARF)

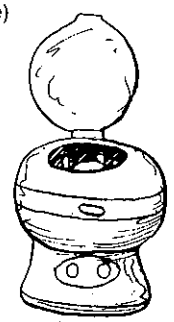
Condition	Facts/Cause	Presentation/CS	Diagnosis
Acute renal failure, ARF M8k 1136; IM 872; I2M 953; C4T 472; C3T 623; E 910; EM&S 1547; M 304	• **Tubular necrosis** (most common cause of ARF) - due to 2 broad categories - **Ischemia** (vasomotor nephropathy) - **Nephrotoxins**	• **CS fairly nonspecific** • **CS of 1° diz** (i.e., diarrhea, septic shock, myositis, colic) • **Depression & anorexia** nonspecific • ± Abdominal pain, mild colic • **Dehydration** • **Oliguric** (diminished urine secretion; anuria very uncommon in large animals) • **Complications to RF** - Diarrhea - Laminitis - Hemolysis (may also be result of renal failure) - Endotoxemia	• History, CS • Rectal palpation: enlarged left kidney (can't reach right) • Lab: - ↑ **Creatinine - azotemia** - **Hyponatremia, hypochloremia** - **Low/normal K⁺** due to restricted oral intake if polyuria; slightly ↑ if oliguric - Often hypercalcemia - **Low specific gravity** (< 1.020) (isosthenuria) - Microscopic hematuria - Urinary casts, granular or leukocytic, pigment casts w/ RBCs, or hyaline (noncellular due to mucoprotein in urine) • **Ultrasound (US)**: enlarged or abnormally-shaped kidneys, w/ abnormal consistency to renal parenchyma - Contrast studies only in small ponies & foals • **PM** (postmortem) - Maybe normal on gross exam, heavy, cut surface bulges - Perirenal edema - Histopathology . **Tubular necrosis** . **Casts in tubules** . Interstitial edema, interstitial cellular infiltration, vascular thrombosis • Renal biopsy (generally not done due to risk of hemorrhage) • Can't easily measure urine output, GFR











Tubular necrosis
CS: CS of 1° diz, oliguria
Dx: Lab, Creatinine, US, PM
Tx 1° - Fluids

Causes of ARF

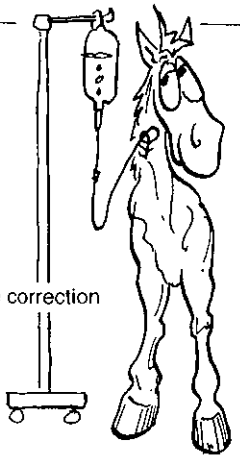
Aminoglycosides

- **Aminoglycosides** (pg 157)
  - **One of the most common causes of tubular nephrosis**
- **NSAIDs** (nonsteroidal anti-inflammatory drugs) (pg 157)
- Heavy metals (pg 156) • Rare
  - Hg (mercury), Arsenic, Cadmium, Lead
- **Oxalate-containing plants** (pg 156)
  - Pigweed, sorrel, dock, rhubarb
- **Chlorinated hydrocarbons** (See TOX pg 312)
- **Pigment nephropathy - myositis**
  - Nephrosis associated w/ large amounts of myoglobin or hemoglobin
    . Myoglobin - myositis, severe tying up episode, or several milder episodes
    . Hemolysis less likely - DIC
- **Vasomotor nephropathy**
  - Any condition predisposing to hypotension &/or release of endogenous pressor agents
    . Acute blood loss, marked hemoconcentration, dehydration, septic shock, thromboembolic episodes, severe intravascular volume deficits
    . **Tubular necrosis** (predominant lesion)
- Acute glomerulopathy (rare)
- **Acute interstitial nephritis** (sporadic)

Prognosis:
- Good if cause removed & oliguria resolved (& no 2° complications)
  - Reverse hemodynamic causes & renal failure will resolve
- Renal failure > 1 d or perirenal edema or kidney enlargement, Px goes down
- Px monitored daily by checking creatinine

Treatment of ARF

- **Tx predisposing cause**
- **Initial**
  - **Fluids:** correct volume deficiencies, electrolyte & acid-base abnormalities
    . Monitor serum Na, Cl, K, & HCO_3 IONS daily & correct
    . Na & Cl IONS low in polyuric ARF
    . K usually normal or low in ARF so don't need to lower it
    . HCO_3 often normal in ARF - $NaHCO_3$ to correct metabolic acidosis by BW kg x .03 x base deficit mEq HCO_3
- **Determine if oliguric or polyuric** after volume & electrolyte correction
  - If oliguric monitor volume changes by:
    . Daily body weight & PCV/TP
    . Central venous pressure (manometer in jugular vein)
    . Fluid needed = % dehydration x body weight
  - Unless oliguric or anuric replace fluids over 4-6 hrs
  - If oliguric slowly & w/ diuretic therapy
- **Oliguric diuretic therapy** to ↑ urine production (↑ renal bloodflow, ↑ GFR) after fluid replacement therapy, done early, after few days doesn't work well, nor if tremendous number of casts from kidney
  - Mannitol (20% - IV) (expensive)
  - **Lasix® (furosemide)** (1 mg/kg/2 hr)
  - Dopamine in 5% dextrose solution w/ furosemide in anuric or severe oliguric ARF
    . Must intensely monitor to insure that blood pressure doesn't ↑ during infusion (cardiac arrhythmias)
- **Normal urine flow** (nonoliguric) more likely than oliguria after initial fluid therapy
  - 40-80 ml/kg/day **until marked ↓ in serum creatinine,** then
  - 10-20 ml/kg/d until creatinine normal & horse is eating & drinking
  - Check creatinine 2-4 d after fluid therapy is stopped
- Hypertension after diuretic therapy - acepromazine (.02 mg/kg)
- Avoid prostaglandin inhibitors (being used if diarrhea & endotoxemia), can use small amount of Banamine®
- Xylazine IV for pain if hydration & blood pressure normal
- Peritoneal dialysis used in foals, especially beneficial if ruptured bladder or nephrotoxic renal failure, helping to bring electrolytes back to normal



Chronic Renal Failure — URINARY SYSTEM

Condition	Facts/Cause	Presentation/CS	Diagnosis	Treatment

Chronic renal failure, CRF

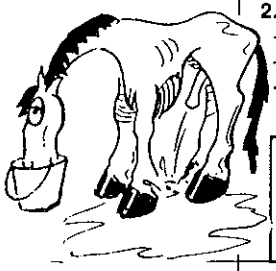
M8k 1135; IM 876; I2M 958; E 911; EM&S 1548, 1550; C4T 478; C3T 6 ; M 305

- **Not uncommon**, especially in adults
- **2 classes of CRF**
  1. **Glomerular diz**
     - **Proliferative glomerulonephritis #1 cause of CRF**
     - Nonspecific glomerulopathy
     - Renal glomerular hypoplasia
     - Amyloidosis
  2. **Tubulo-interstitial diz**
     - From acute tubular necrosis
     - Pyelonephritis
     - Hydronephritis

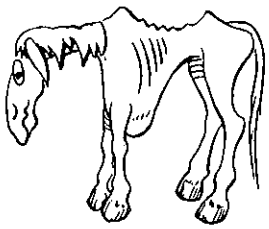
- **Weight loss**, 1° presenting complaint
- PU/PD (rarely noticed, stall more wet than normal)
- **Pitting ventral edema** (hypoproteinemia) (glomerular apposed to tubular diz)
- **Dysuria** (frequently in pyelonephritis)
- Hematuria &/or pyuria (pyelonephritis, urinary calculi, or neoplasia)
- ↑ Dental tartar & melena due to chronic uremia
- **Oral ulcerations** (chronic azotemia)
- Stunted growth (glomerular hypoplasia)
- Pain rare (w/ bilateral nephroliths)

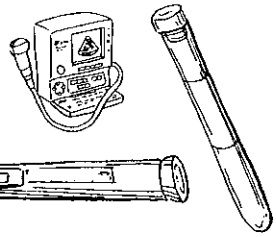
- **Azotemia + low Sp. gr. + wt. loss**
- **Cause difficult to determine**
  - **Proteinuria**: separates glomerular diz from tubulo-interstitial diz
- **Rectal exam**
  - **Enlarged ureters** (ureteral calculi & pyelonephritis)
- **Lab:**
  - **Azotemia**
  - **↑ Serum creatinine, BUN**
  - Significant ↓ in Na, Cl variable (if PU/PD)
  - ↑ Potassium (hyperkalemia)
  - Moderate anemia (glomerular diz)
  - Hypoproteinemia (chronic glomerular diz)
- **Urinalysis:**
  - **SG 1.008 - 1.015** (isosthenuric usually)
  - **WBC** (> 5/hi-power field)
  - **Bacteria** (> 10^4/ml)
  - **± Proteinuria**
- **Ultrasound**: estimate size & amount of fibrosis present & nephroliths
- Renal biopsy (confirm renal diz)

- **Unrewarding** (many cases irreversible)
- **Correct rapidly other diz component by ARF Tx** (diarrhea, sepsis w/ volume depletion, urinary infections, obstruction or nephrotoxic products)
  - To prevent CRF & uremia
- **Determine if polyuric or oliguric**
  - **Polyuric CRF** (> 8 ml/kg/d of urine)
    - . **Fluids, electrolyte**
    - . **Limit protein & gradually ↑ CHO & fat**): force feed by nasogastric tube if anorexic
    - .. **Water available**
    - .. **Free salt** unless edema or hypertension present, then restrict salt)
    - . Frequent blood tests of Na, K, Ca & HCO_3
    - . Anabolic steroids used, but unknown efficacy
    - . **Vit. B complex** & soluble vitamins
    - . Anabolic steroids m/b helpful
    - . Avoid NSAIDs in severe tubulo-interstitial diz
  - **Oliguric CRF**
    - . **No Tx**, peritoneal dialysis prolongs life only a short period

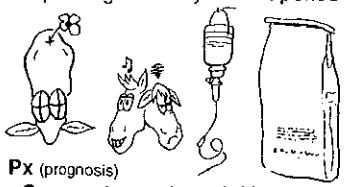


Proliferative glomerulonephritis #1
CS: Wt. loss, PU/PD, Oral ulcers
Dx: BUN, Sp. gr. 1.008-1.015
Tx: Unrewarding





SG 1.008-1.015



Px (prognosis)
- **Grave**: glomerulonephritis
- **Guarded**: tubulo-interstitial diz

Proliferative glomerulonephritis

- **#1 cause of CRF in horses**
- Deposition of circulating antigen/antibody complexes in glomeruli
- Streptococcal antigens incriminated, not proven
- EIA proven to be associated

Renal glomerular hypoplasia

- **Common cause of CRF**
- **Congenital anomaly** (abnormally low # of glomeruli)

Chronic interstitial nephritis & fibrosis

- **Predominately tubulointerstitial diz**
- **Common cause of CRF**
- **Sequela** to drug-induced interstitial nephritis, urinary obstruction, pyelonephritis, papillary necrosis
- Causes: aminoglycoside antibiotics or other toxins, NSAIDs, pigmenturia, septic causes &nephrolithiasis
- *E. coli* & leptospira
- **Most recover in 2-4 weeks,** a low % get chronic renal fibrosis & CRF

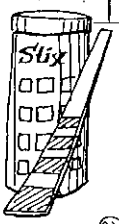
Pyelonephritis

- Rare cause of CRF
- Ascending infec. (urinary calculi & nephroliths)
- Gram neg. org. most common cause, *Actinobacillus equuli* in foals; Strep. & *E. coli* in adults

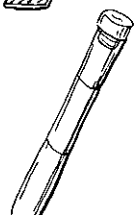
Miscellaneous

- **Amyloidosis** (only in horses used for production of antiserum)
- **Neoplasia/tumor**
- Focal glomerulosclerosis-like diz
- Chronic oxalate nephrosis (oxalates in kidney more likely the result of CRF than the cause)
- Chronic interstitial nephritis
- Parasite migration (strongyles affecting vascular supply to kidney)

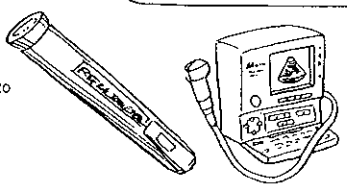
Diagnosis:
- **Azotemia + low Specific gr. + weight loss** (initial Dx)
- Cause hard to determine
- **Rectal exam:**
  - **Enlarged ureters** (ureteral calculi & pyelonephritis)
    - Left kidney can be palpated (right usually can't)
    - Smaller than normal, or irregular surface (hard to determine cause of changes)
- **Lab:**
  - **Azotemia** (excess urea or other nitrogenous bodies in blood)
  - **↑ Serum creatinine**
  - If PU/PD, significant ↓ in Na, Cl variable
  - ↑ Potassium (hyperkalemia) & cholesterol (normally don't measure cholesterol)
  - Hypercalcemia due to ↓ oral intake
    - ↓ Rate of breakdown of parathyroid hormone by tubular renal cells
    - P concentration depends on Ca concentration, can be low or normal
  - Generally mildly acidotic
  - **Hypoproteinemic** associated w/ chronic glomerular diz
  - Moderate anemia (chronic glomerular diz)
- **Urinalysis:**
  - **SG 1.008 - 1.014** (isosthenuric usually)
    - . Proteinuria or glucosuria will raise a little (glomerulonephritis), then need to look at urine osmolality
  - **Proteinuria**: separates glomerular diz from tubulo-interstitial diz
  - Hematuria (in pyelonephritis, urinary calculi or neoplasia)
  - Casts may be present
  - **WBC (> 5/hi-power field)** w/ septic pyelonephritis
  - **Bacteria (> 10^4 /ml)** w/ septic pyelonephritis (single type bact.)
- **Ultrasound** - estimate size & amount of fibrosis present & nephroliths
- **Renal biopsy** (confirm renal diz)
  - Ultrasound guidance, helps for left; required for right
  - Left kidney pushed to abdominal wall per rectum
  - Tissue in formalin for histology exam (glomerulonephritis)

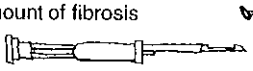


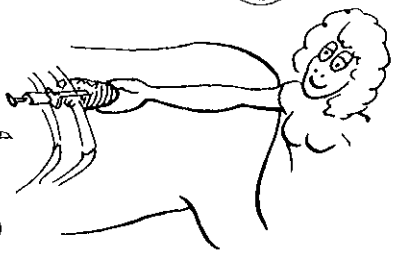
DDx:
- Acute renal failure (pg 148)
- Pyelonephritis (pg 151)
- Obstructive urolithiasis (pg 155)
- Abdominal peritonitis/abscesses (pg 53)
- Neoplasia
- Malabsorption syndromes (pg 50)



DDx:
- **Psychogenic Renal Failure** (mimics renal failure), animal drinks tremendous amounts of water & urinates tremendous volumes of dilute urine
- Water deprivation test (not commonly done & must be careful) performed over 48-72 hr - Expect SG above 1.030 in normal animal







Urinary Tract Infections

Condition	Facts/Cause	Presentation/CS	Diagnosis	Treatment
Lower urinary tract infection, LUT, Cystitis, Urethritis Mk 1132; IM 880; I2M 962; C3T 616; E 912, 924; EM&S 1560; M 300	• **Affect bladder &/or urethra** • **Common in horses** • Associated w/ *E. coli* infections, others include Pseudomonas, Strep. & Staph.	• Many chronic conditions • **Pollakiuria** (frequent small passage or urine) • **Straining to urinate** • Hematuria (blood positive on urine dip stick), often foul smelling, especially if Pseudomonas or Proteus - Hematuria of bladder origin at end of urination • Mild pain, kick at abdomen, tread w/ hindlimbs • **Scalding of perineum** (mares) • Staining of ventral abdomen (males) • M/ stand w/ protruded penis • Vaginal discharge • Systemic signs fairly mild (no fever or weight loss) • Continue to eat and drink	• **CS: Dysuria, pollakiuria, straining** • Lab: CBC normal, ↑ fibrinogen, normal BUN, creatinine & serum electrolytes • **Urinalysis** - **Hematuria** - Pyuria - **Bacteria (> 10^4 /ml)** , Gram stain & culture & sensitivity (many *E. coli* & Pseudomonas resistant, so do sensitivity) - often combination of many bacteria . Examine & culture w/in 30 min or store in refrigeration 48 hr (bacteria rapidly multiply at room temp) - **WBC** (> 10/hi-powered field) 1° neutrophils - Desquamated epithelial cells • **Rectal exam:** - Thickened or irregular bladder wall in adults (hard to feel) • Endoscope into bladder: hyperemic areas w/ ecchymotic hemorrhage, edema, mucosa appears roughened • Ultrasound used to identify foals w/ urachal abscesses or in adults if thickened wall (bladder) • Catheterization sample w/ greater than 10^4 of a single organism	• **Antibiotics** that concentrate in urine - Penicillins, aminoglycoside, sulfonamides, cephalosporins, tetracyclines (but upset GI flora) - 7 d, but usually up to 1 mo - Therapeutic response depends on chronicity & effectiveness of antibiotic • **Tx for 1-2 wk, reculture after 1wk, then readdress** • ± NSAIDs for inflammation
Common **CS: Straining, Scalding** **Dx: UA (Bact. > 10^4/ml. WBCs)** **ABs & Reculture**	**Causes:** • **1° in foals** - **Patent urachus** - **Omphalitis** (inflammation of umbilical a. or v.) • **Trauma to urethra** - Adult mare w/ repeated uterus infusions • Habronemiasis (pg 284) • Grazing Sudan grass containing fungal toxin (pg 159) • Bladder paralysis diz (neurologic diz) causing urine stasis (pg 254)		**DDx:** • **Pyelonephritis** (↑ temp., large ↑ in WBCs, casts, ↑ BUN & creatinine & rectal exam shows large painful kidney, very sick) • **Metritis** • **Neurologic diz causing urinary stasis** (Cauda equina neuritis, Sudan grass, Sorghum, Herpes (rhinopneumonitis), lumbosacral compression causing obstruction, or vertebral abscesses)	NSAIDs
Upper urinary tract infection, UUT, Pyelonephritis, Ureteritis IM 880; I2M 962; M 303	• **Kidney &/or ureters** • Less frequent than LUT infections, but more severe & life threatening • Less common in horses than in cattle • Hematogenous or ascending - Showering of embolic from septic focus (e.g., foals w/ omphalitis, or endocarditis) - Urinary calculi & nephroliths • **Gram negative organisms** most common cause - *Actinobacillus equuli, Strep. equi, S. zooepidemicus, E. coli,* Salmonella • **Rare** cause of CRF	• **Signs of systemic infec.** - **Weight loss** - **↑ Temperature** - **Depressed**, off feed • ± LUT CS when LUT infection - Dysuria - Pollakiuria	• Clinical signs • ? Other focus of infection • **Rectal Palpation:** - **Large kidney (lt.)** acutely, painful on palpation, **smaller** chronically - **Enlarged ureters** - Palpation on back also, colic m/b • Lab: - **WBCs** - neutrophilic leukocytosis - Anemia - chronic infection - ↑ Fibrinogen & gamma globulin conc. - **Azotemia, ↑ BUN & creatinine** (even if only 1kidney) • Urinalysis: - Bacturia, neutrophils, casts - Hematuria (not grossly discolored) - **Urine culture bacteria >10^4/ml** • Ultrasound: abnormal size, shape & consistency - Improve biopsy accuracy	• **Long term antibiotics 2-6 wk** - Based on culture & sensitivity - Amoxi- & ampicillin, trimethoprim-sulfa - *E. coli* resistant strains - Aminoglycosides, but not gentamicin as resistant . Ticaracillin, but expensive - Tetracycline not used due to diarrhea • Reculture 2-4 wk (midstream) • Reculture 1-4 wk after therapy stopped • If positive, suspect uroliths (ultrasound) • **If only 1 kidney affected, can remove**
Less common than LUT **CS: Wt. loss, fever, LUT CS** **Tx: Long term ABs**				
Patent urachus M8k 1131; IM 370; E 919; M 292, T&W-A 364; C4T 493, 602	• Urachus connects bladder w/ allantoic sac during gestation • Should close at birth when umbilical cord is severed • **Common in foals** • **Excessive handling** of neonate implicated • M/b infected	• **Moist hair around navel** • **Dribbling of urine from umbilicus**	• **Moist dribbling umbilicus**	• **Chemical cauterization**: Tincture of iodine on cotton swab & swirl around inside urachus, must not be infected. **Most respond** • **Sx:** remove urachus, taking off tip of bladder - Remove umbilical v. & aa. as well
			Prevention: minimum handling of neonate	
Navel ill **Omphalitis/ Omphalophlebitis, Umbilical abscess** IM 371; I2M 972, 328, 757; C4T 602; M 288	• **Inflammation of umbilical structures** (umbilical aa. & v., urachus) • **Source of septicemia** • *E. coli,* Proteus & Strep. spp.	• **Hot enlarged navel** • **Purulent drainage** • **Severely ill** (septicemia) m/b - Joint infection, pneumonia, diarrhea, meningitis or uveitis	• CS - purulent navel • **Ultrasound** - visualize size of structures	• **Early ABs & supportive care** • **Sx: remove structures involved**

Obstruction — URINARY SYSTEM

Condition	Facts/Cause	Presentation/CS	Diagnosis	Treatment

Ruptured bladder (neonate), Uroperitoneum in foals

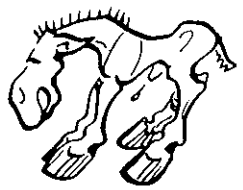
M8k 1156; Mk 894; IM 886; I2M 971, 380; C4T 494; E 917; EM&S 1559; M 307; T&W-A 368; S 777; Pop 35-1/98

Parturition, urachal infection
CS: Stranguria, ill
Dx: Tap - creatine
Tx: Sx repair

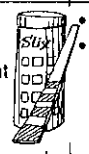
Facts/Cause
- **Neonatal colts** (male foals) most commonly
- Congenital weakness in dors. aspect of urinary bladders, break during parturition
- **Associated w/ parturition** (dystocia) trauma
- **Associated w/ urachal infections** w/ abscess or inflammation focus adjacent to bladder wall causing defect in bladder mucosa and rupture or leakage

DDx:
- Retained meconium (pg
- Septicemia (pg 38)
- Neonatal maladjustmer syndrome (pg 270)
- Obstruction of large co subsequent abdominaldistentic
- Peritonitis (pg 53)
- Hydrops in adult

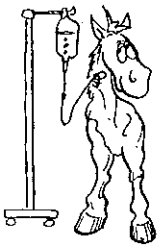
Presentation/CS
- **CS first 2 days of life**
- Depression, progressive loss of suckle reflex
- Frequent attempts to urinate (small amounts or normal)
  - Stranguria, pollakiuria, dysuria
- Progressive distention of abdomen
- Flank watching
- **Dehydration** (not suckling & pulled into peritoneal cavity)

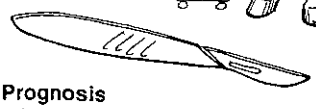


Diagnosis
- **Dx fairly easy**
- **History (colt), CS**
- Fluid wave: ballottement
- Cardiac arrhythmias, 2nd & 3rd degree heart blocks, ↑ RR
- Lab:
  - Hyponatremia, hypochloremia
  - ↑ P due to ↓ GFR
  - **↑ Serum K⁺** (hyperkalemic, so cardiac arrhythmias)
  - Metabolic acidosis
  - **↑ BUN & creatinine**
  - **↑ PCV, TP** (dehydration)
- **Peritoneal fluid**: clear w/ low cell count, low specific gravity, both K⁺ & creatinine 2-3 x that in serum
- **Peritoneal to serum creatinine ratio > or = 2:1** definitive (Creatinine more reliable than BUN due to BUN equilibrating)
  - Methylene blue into bladder & peritoneal tap to find dye
- Radiographs: helpful for small tea s
  - Urachal abscesses, ground glass abdomen



Treatment
- **Surgical repair**
- **Stabilize 1st** : hyperkalemia & hyponatremia commonly cause fatal cardiac arrhythmias during anesthesia
  - **IV fluids 0.9% NaCl** & dextrose (hyperkalemic) (1-2%)
  - Insulin (drive K⁺ into cell) +10% dextrose (prevent hypoglycemia) for those w/ long duration - 5 d
  - Drain peritoneal cavity slowly or shock
  - Plasma if failure of passive transfer
  - **Antibiotics** (Ampi- or Amoxi- or penicillin/aminoglycosides)

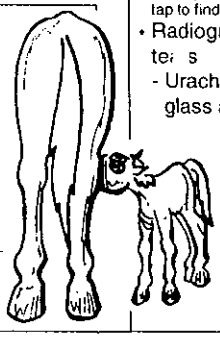


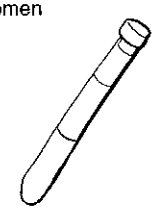


Prognosis
- **Good** if corrected day 3-4 instead of day 6-7, foals do well post-op
- **Guarded**
  - Urachal abscess & septicemia
  - Corrected after day 6-7 (electrolytes abnormalities)
- Adult horses, Px more guarded, more difficult to repair bladder

Ruptured bladder (adults) (IM 885; I2M 971)

- **Uncommon**, Obstructed urolithiasis in adult castrated males, Mare associated w/ parturition
- **CS:** Mild depression few days after foaling
- **Dx:** Definitive: peritoneal fluid creatinine compared to serum creatinine ratio 1.5:1.0; Calcium carbonate calculi also diagnostic; cytoscopic exam for tear; rectal: small bladder floating in fluid; azotemic (hyperkalemia, hypernatremia & hypochloremia)
- **Tx:** Surgery generally unless just a small tear
- **Px:** More guarded than for foal, harder to repair





Bladder displacement/prolapse C4T 485

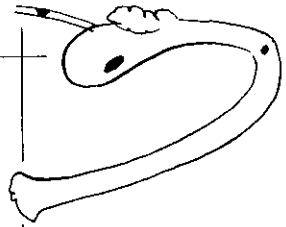
- Rare cause of dysuria, Cause: parturition & colic
- Tx: Return to right position

Urolithiasis

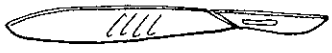
M8k 1155; Mk 893; IM 884; I2M 968; E 913; EM&S 1558; C4T 483, 489; C3T 613; M 309; T&W-A 369

- **Infrequent condition**
- 1° involves urinary bladder, rarely in renal pelvis
- 99% due to cystic calculi

- CS depend on location of calculus



- **Surgical removal** usually
- ABs, diuretics & urinary acidifiers



• Urethral calculi

Mk 893; IM 884; I2M 968; E 921; EM&S 1558; M 311; C4T 485; C3T 615; S 789

Assoc. w/ cystitis
CS: Stranguria
Tx: Sx

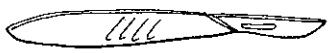
- **Urethral obstruction**
- 1° Ca carbonate
- Infrequent
- **Pelvic urethra** (common site)
- Pathophysiology:
  - Crystals always in urine
  - Precipitate around 1° nidus (desquamated cells), can cause obstruction
  - **1° associated w/ cystitis**
- **Adult male geldings**
- Obstruction at turn of the pelvic inlet
- M/b in females, but not obstructive due to short urethra, large diameter

- **Stranguria**
- **Pollakiuria**
- **Dysuria**
- Vague abd. discomfort
- Discolored urine

- **CS**
- **Rectal exam**
- **Catheterization of urethra**
- **Urethroscopic exam**
- **Ultrasound** (transrectal)

DDx: Obstruction Causes
- Blood
- Smegma (pg 200)
- Edema (inflam. urinary obstruction)
- Neoplasia (squamous cell carcinoma)
- Cellulitis
- Habronema - most common cause of inflammation of urethra (pg 200)

- Surgery usually
  - **Subischial urethrostomy**
- Correct fluid & electrolytes
- Parasympathomimetic drug (bethanechol) stretched wall (detrusor m.)
- Anti-inflam. drugs
- Diuretics
- Local cleaning & hydrotherapy
- Antimicrobial drugs
- Anthelmintic drugs (parasites)



• Nephroliths & Ureteral calculi

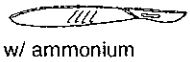
C4T 483; EM&S 1558

- **Ureteral calculi** m/ obstruct ureter or renal pelvis
  - **Bilateral (usually)** or unilat., complete or incomplete, chronic or intermittent
- Young Thoroughbreds
- **Leads to CRF** because bilateral & insidious nature not noticed

- **Weight loss & poor performance**
- **CRF**, mild or inapparent signs until CRF
- Pain is rare
- Pyuria uncommon

- **Difficult**, esp. if unilat. bec. of mild CS
- **Rectal - enlarged ureter**
  - Bilateral
  - Azotemia & isosthenuria
- **Ultrasound** - dilated ureter, dilated renal pelvis, nephroliths & fibrosis w/in kidney or ureter

- **Surgical removal** if Dx before chronic azotemia
  - Nephrotomy (incision into kidney) not nephrostomy (permanent opening into kidney)
  - Ureterotomy



- **Acidification** w/ ammonium chloride if surgery not possible

• Cystic calculi

Mk 893; IM 884; I2M 969; C4T 484; E 913; EM&S 1562; S 789; M 310

Associated w/ cystitis

- 1° Ca carbonate or Ca phosphate
  - Usually single, large & smooth or small & irregular
  - Sludge (fine sand) less common
- Sporadic occurrence
- Crystals always in urine (need nidus)
  - **1° associated w/ cystitis**

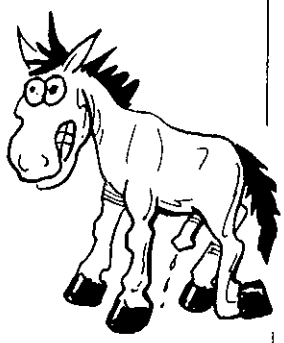
- Stranguria
- Pollakiuria
- Dysuria
- Vague abdominal colic
- Discolored urine
- **Incontinence** (if sludge in bladder)

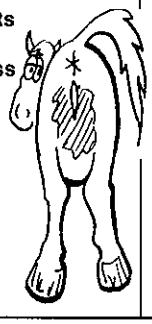
- **CS**
- **Rectal exam** hand & wrist's breadth from anus, (feel stone in bladder)
- **Ultrasound** (transrectal)

- **Celiotomy & cystotomy** or urethrascopy

- Mares - ureteral sphincterotomy
- Antibiotics - prophylaxis or if recurrence
- Flush out sludge
- Urinary acidifiers
- Bethanechol (parasympathomimetic)

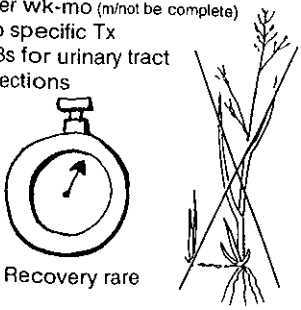
Condition	Facts/Cause	Presentation/CS	Diagnosis	Treatment
Sorghum cystitis/ataxia, Sudan/Johnson grass; Bladder paralysis, Lathyrism M&k 2154, 2138; Mk 594, IM 1038; I2M 1164, 965, 1887; E 211; EM&S 1561; C3T 376; C2T 678; LA-D 86; Tox 457; PP/US/C 488	• **Usually valuable forage** • **Grazing *Sorghum*** spp. & Sudan grasses • **Myelomalacia** of lower spinal cord - **Degeneration of nerve roots of lumbar, sacral & caudal segments** • **Poisonous plants** - **Johnson grass** - **Columbus grass** - **Sudan grass** - **Sorghum**	• **CNS: Posterior incoordination**, swaying rear limb gait, knuckle over, hopping gait • **"Dribbling"** (urinary incontinence), Flaccid distended bladder, vulva opens & closes repeatedly - Penis relaxed & protruded - **Cystitis 2°** to urine retention . Scalding of skin & dermatitis . Pyelonephritis sequela • Abortions: foals from Sudan grass grazed mares . Articular ankylosis or . Arthrogryposis	• **Hx & CS** • No specific tests • Urinalysis for cystitis • PM: Wallerian degeneration & swelling of axons	• **Withdraw Sorghum**, improve over wk-mo (m/not be complete) • No specific Tx • ABs for urinary tract infections **Px:** Recovery rare **Control:** Diversify diet (Sorghum not complete diet)

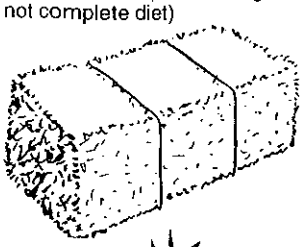




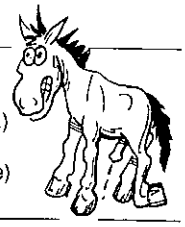
Usually good forage
Degeneration of caud. spinal cord
Ataxia - "Dribbling" urine
Remove - ABs for cystitis

Johnson grass
• **Description**
- 3-6' coarse perennials
- Leaves 3/4" wide, 1.5' long

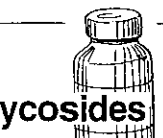


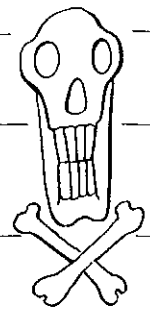


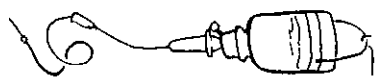
Bladder paralysis EM&S 1651 **Neuro + Full bladder & Dribbling**	• See **NEURO: Spinal trauma to S3- Cd5 (pg 245); Cauda equina neuritis** pg 248, **"Snots"** pg 254, **Sudan grass** pg 156, **lumbosacral vertebral fxs or osteomyelitis** pg 246 • **CS: Dribbling of urine & distended, flaccid bladder, Neurological signs** (Decr. to absent anal tone, ataxia, etc.) • **Tx:** Treat cause, Empty distended bladder (catheterization or manually), culture urine repeatedly & Tx any infec. (prophylactic ABs), TLC, Bethanechol (stim. bladder emptying), Phenoxybenzamine (relaxes urethral musculature) • **Px:** Longer neurologically impaired, poorer Px

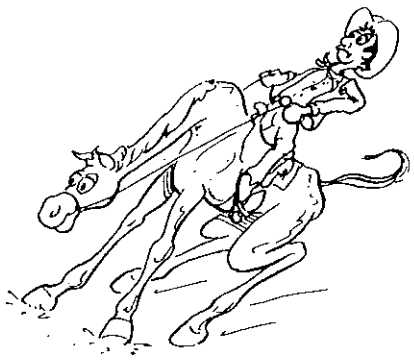


Aminoglycosides EM&S 1553; C4T 476; C3T 356	• **One of most common causes of tubular nephrosis** • Neomycin most nephrotoxic > gentamicin > kanamycin > amikacin > streptomycin (least) • Accumulate in tubular epith. cells, disrupt metabolism & die • ARF not due to overdose, but decr. renal perfusion when given • **Dehydrated, hypovolemic, septic** horses
Oxalate	• See **TOX pg 328**; Halogeton, Greasewood, 1° cattle, **Rare - horse**, West, Insoluble pcpt. w/ Ca, Vascular necrosis & renal tubular blockage • **CS:** Colic, Weakness, Frequent urination, **Crystals in urine** • **Tx:** Hopeless once CS; Fluids, Ca gluconate
Ethylene Glycol, Antifreeze	• See **TOX pg 317**; Rare in horse Sweet tasting alcohol, **form insoluble Ca oxalate in renal tubules** • **CS:** Hind limb ataxia, salivation, depressed sensorium, nystagmus, seizures, • **Dx: Azotemia, ↑ creatine, oxalate crystals in kidney** • **Tx:** Early: **20% ethanol** (50 ml/hr), activated charcoal, NaHCO3 IV, Replace fluids
NSAIDs Phenylbutazone Toxicity	• See **GI, pg 27; NSAIDs**, widely used & misused, overdose; damage to GI mucosa, kidney (acute tubular necrosis from abnormal amounts of drugs, more commonly subacute or chronic interstitial nephritis from prolonged drug use); No problems if proper dosage & hydrated animal, **Not a common diz process** • **CS:** GI & **kidney**, laminitis sequela, **renal damage (azotemia)** • **Tx: Stop NSAIDs**, symptomatic • **Px:** Guarded in severe cases
Blister beetle toxicity	• See **GI pg 45**; Horses >>> sheep & cattle, **Cantharidin. Swarm in alfalfa, Southwest** • **CS: Endotoxic shock = death 2 d, renal failure** & ulceration of GI mucosa, colic • **Tx:** No antidote, supportive • Px: guarded if CS
Heavy metals	• See **TOX pg 313**; **Rare, Hg** (mercury), Arsenic, Cadmium, Lead • **CS:** GI signs (incr. salivation, oral erosions, colic, hemorrhagic diarrhea); **CS of uremia** (depression, seizures, oliguria) • **Dx:** Tubular necrosis, azotemia, isosthenuria, enzymuria, & electrolyte imbalances • **Tx:** Dimercaprol, 1 lb of activated charcoal orally, ARF Tx
Phosphorus	• See **TOX pg 315**; **Garlic odor**, Corrosive & hepatotoxic, Protoplasmic poison • **CS: Biphasic**, GI irritation; **Latent phase**; **2nd phase**, Depression, **Hepatic & renal failure - death**, oliguria, icterus & bleeding tendencies • **Dx: Biphasic CS, ↑** liver enzymes, **↑** BUN; PM: enlarged liver, icterus, GI irritation, hemorrhage & necrosis; Histo: liver & renal lesions • **Tx: Emergency, Symptomatic Tx, Mineral oil, activated charcoal, No fat in diet for 3-4 d** (absorbs phosphorus) • **Px: Grave**
Dogbane, Indian hemp	• See **TOX pg 327**; Resin containing plant • **CS: Abnormalities of urinary system, Crystals in urine** • **Tx:** Fluids to dilute, Diuresis









REPRODUCTIVE SYSTEM

Breeding soundness exam (BSE)

C4T 505; T 654; R 623; R-Y 179; EM&S 949; ER 196; E 1305, EM&S 949; M 250

Be very thorough & detailed

- Keep thorough records
  - Society for Theriogenology has standardized forms
- **When BSE performed**
  - **If doesn't settle in 3 cycles**
  - Routinely required of barren mares at end of breeding season
  - Before each breeding season
  - Before buying a broodmare or maiden mare
  - Often asked for after purchase when problem is suspected

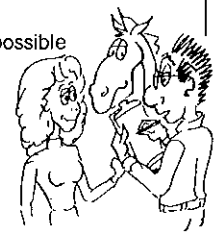
General history, m/not be a lot available, especially if young

- Helps direct you toward physical exam
- **Age** is important
  - >15 yrs, fertility falls off, esp. if producing foals on yearly basis
  - Older maiden harder to breed than young maiden
- **General health of horse** - Bad teeth? Parasitism? Chronic laminitis, etc. not good candidate for carrying foal
- **Medical history:**
  - **Abdominal surgery, uninsurable** - bias against mare, especially if bowel has been opened, adhesions & good chance il will colic again, w/ growing fetus, adhesions cause discomfort, lay down & roll, recolic, etc.
  - Palpate midline for scars (steel staples)
  - Worming & vaccination history
  - Drug therapy, especially steroids
- **Infectious diseases:**
  - **CEM** (contag. eq. metritis) or eq. viral arteritis (EVA)
    . Can't take horse on farm - quarantined
- **Mare's purpose** (show, racing)
  - Training &/or anabolic steroids
  - Time required for body to shift gears into being a brood mare if in training
  - If bought in Jan., will not necessarily be cycling
- **Flushing effect**: change from poor rations to high quality increases chance of getting pregnant
- **Overweight problem**, may reflect hypothyroid condition, get weight off & if necessary, measure T3/T4 w/ a TSH stimulation test
  - Supplement w/ feed additive
- **Herd problems** - viral arteritis, etc., management

Brief stallion history

- Number of mares bred
- Number conceived & foaled
- Historical evidence of mares infected by stallion
- Number settled per cycle

Breeding history



- Last year's breeding record if possible
- Last foaling date: number & dates of foalings
- Age at 1st heat
- Heat & breeding dates
- Number of live offspring
- Abnormal foalings
- Abnormal pregnancies
  - Hx of early embryonic death (EED) or abortions & possible causes
- Intervals between heats
- Previous year's breeding cycle pattern
- Number of breedings required for last conception
- Method to tease & breed mare (AI, pasture or natural hand breeding)
- Barren or not
  - Length of time barren
  - History of services (AI or natural to what stallion)
- Prior possible exposure to venereal diz (CEM or infected stallion)
- Hx of uterine infections & treatment
- Endometrial biopsy report
- Genetic or hereditary background of family infertility

Physical exam:

- Physical condition
  - Excessively heavy or thin
  - Hirsutism (abnormal hairiness), long winter hair coat normally lost at time of estrus, be suspicious of pituitary disorder causing anestrus
- Some breed 2 year-olds - too early
- Presence of disease
  - Body systems: teeth, eyes, locomotor, circulatory, respiratory & nervous systems
  - Laminitis (rotated P3, reluctant to stand for breeding)
  - Hypertrophic pulmonary osteopathy assoc. w/ ovarian tumors

• Visual exam of genital organs

- Vulvar discharge
- Check for predisposition to pneumovagina or need for Caslick's operation
  . Apposition & tone of vulva
  . Vulvar conformation (normal: vertical; poor: dorsocranisl w/ anus cranial to vulva)
  . > 70% of vulvar openings below the pelvic floor
- Gently pull vulva apart & listen for aspiration of air
- Vulvar or perineal scars or tumors
- Mammary glands for mastitis, abscessation, neoplasia or injury

Rectal exam - carefully

- Preparation: tail wrapped & tied out of way, use lots of lubrication
  - **" Calibrate one's hand"**: so can use as measurements while palpating (e.g. 1st joint of index finger 1")
- **Uterus 1st**
  - **Palpate for pregnancy** or twin conceptus
    . Bulging & thinning of uterine horn near bifurcation (vesicle) for pregnancy
    . if pregnant discontinue palpation; if nonpregnant continue
- Uterine horns for size, shape, tone, thickness, width
  - Abnormalities or irregularities (adhesions, large endometrial cysts, uterine dilations, edema, atrophy, excessive small size, mucometra or pyometra)
- **Cervix**: width, length & tone for where in cycle
- **Uterine tubes: seldom palpated in mare**
- **Ovaries**
  - Small & firm (< 35 mm/1.5") in anestrus, doubles in estrus
  - Presence & size of follicles (follicle > 35 mm/1.5" ovulation soon)
  - Ovulation fossa
  - Abnormalities (parovarian cysts, adhesions, tumors, hematomas, varicosities, etc.)
- **Bony pelvis,** palpated for abnormalities that m/ interfere w/ parturition (knocked down hip, asymmetrical, palpate pelvic canal for adequate room)

Ultrasound exam (per rectum)

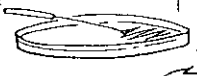
- Must be a routine part of an equine repro exam
- Uterus
  - Twins
  - Pathology: endometritis, cysts, abscess, tumors
  - Pregnancy, vesicle can detect earlier than 15 days of gestation
- Ovaries
  - Follicles > 1.5" (35 mm) imminent ovulation, depending on the time of year

Speculum exam

- Preparation: tail wrapped, thoroughly clean & dry vulva & perineum
  - Insert speculum
    . Transverse fold of hymen at vaginovestibular junction m/ cause resistance, expand w/ constant pressure of speculum
- 1st cervix for color & tone (before air affects it)
  . Exudate
  - Vaginal wall for inflammation or congestion, lacerations, scars, stenosis or tumors, varicosities
    . Pale, pink, red or inflamed; moist or dry & character of mucus
  - Vaginal floor for exudate, urine pooling
  - Withdraw speculum & evaluate vestibular area

Culture: (pg 172) if not bred recently, uterine culture before contaminating by palpation per vaginum

- **Should be taken**
  - Especially if uterine discharge observed
  - Protected swab (sterile sleeve or speculum)
  - **Uterine culture is superior to cervical culture**
    . Better results during estrus
  - Culture urethra & clitoral fossa & sinuses (for Klebsiella & CEM)
  - Repeated cultures often needed



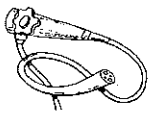
Cytologic exam & sensitivity

- **Absolutely necessary**
- Smears from uterine culture swab or flush
- Presence of PMNs indicates infection

Manual palpation per vagina

- Digitally palpate cervix opening
  - Indicates where in cycle by how many fingers can easily be inserted in cervix
  - Cervical competency, adhesions, scarring or stenosis

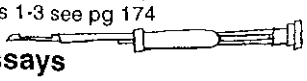
Fiberoptic or endoscopic exam



- Cervix & uterus: adhesions, cysts, tumors, fluid accum., fibrosis, etc.

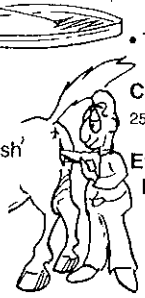
Uterine biopsy (pg 174)

- **Most valuable tool for predicting ability to carry to full term** (especially in older mares), cost justified
- Doesn't tell if mare can get pregnant
  - Valuable indication of present & past diz conditions
  - Amount of scar tissue present determines ability to carry to term
  - PMNs characteristic of active acute inflammation
  - Experienced pathologist to interpret, takes time
- Kenney categories 1-3 see pg 174



Endocrine assays

- Progestins for persistent CL associated w/ prolonged anestrus
- ECG (equine chorionic gonadotropin (formerly PMSG)) is secreted by endometrial cups which are formed at 35 d of gestation (poor means to differentiate EED [early embryonic death] (hi ECG] from failure to conceive)
- Testosterone, Progestin, Inhibition for GCT



Chromosome analysis or cytogenetic study (ER 258): Some infertile maiden mares

Evaluate managerial factors & competence of breeding farm personnel

Note: Not all of the above will be used for every mare, it depends on reason for exam, stage of cycle, etc.

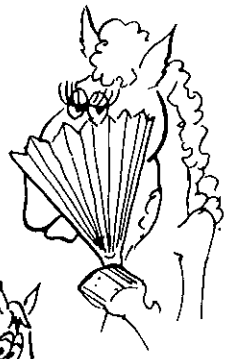
Anestrus

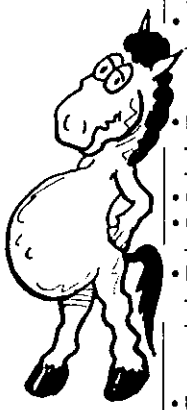
IM 242; I2M 1523, 247; E 1321; T 663, 654

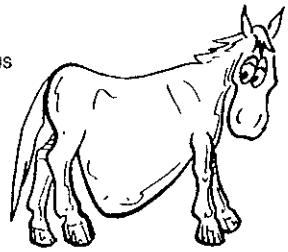
- **Anestrus:** lack of estrus
- CS, not a diz
  - M/b normal physiological phenomenon, a sign of diz, or indicate poor heat detection
- **Pregnancy #1** cause of anestrus - rule it out 1st

Causes - Anestrus

- Normal physiologic phenomena
  - **Pregnancy**
  - **Seasonal anestrus/Transitional** - fall & winter (mare long day breeder)
- **Inadequate heat detection**
- **Psycological problems**
  - Cycling, but not showing estrus
    - . Nervous mares
    - . Mares w/ foals
- **Nutrition - poor**
  - **Weight loss**
  - Fat mares
- Chronic debilitating diz
- Congential anomalies
  - Gonadal dysgenesis (uncommon)
- **Persistent corpora lutea**
  - Spontaneous
  - **Fetal death** after endometrial cups start secreting ECG
    - . 1-4 mo of anestrus during breeding season
- Uterine pathology
  - Pyometra if prevents PGF release
- Pituitary tumor
- Ovarian tumor
- Fescue toxicity (fungus - *Acremonium coenophialum*)

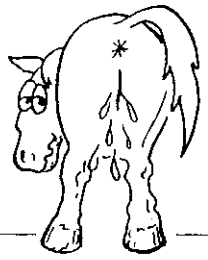






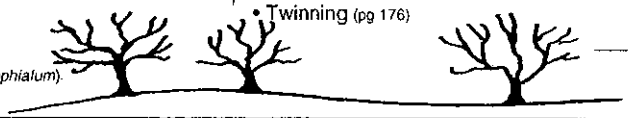
Diagnosis:

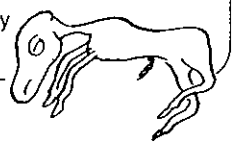
- **Reproductive & general Hx**
- **Thorough breeding soundness exam** (BSE)
- **Evaluate estrus detection program**
- **Rule out (R/O) pregnancy 1st**
- **Animal side milk or serum progesterone test kits**



Causes of Anestrus IM 243, 1367; I2M 246, 1525

- **Pregnancy**
- **Seasonal** (pg 164)
- **Inadequate heat detection/** Unobserved estrus (pg 169)
- Transitional (pg 164)
- Prolonged estrus ("split estrus") (pg 165)
- Persistent corpus luteum (pg 166)
- Silent heat (pg 166)
- Nymphomania (pg 168)
- Nutritional infertility (pg 168)
- Twinning (pg 176)
- EED, early embryonic death (pg 176)
- Urine pooling (pg 186)
- Windsucker (pg 177)
- Granulosa theca cell tumor (pg 188)
- Ovarian hypoplasia/dysgenesis (pg 190)
- Lymphangiectasis of uterus (pg 191)
- Chronic diz
- Pituitary tumors (p 298)
- Weight loss
- Fescue toxicity





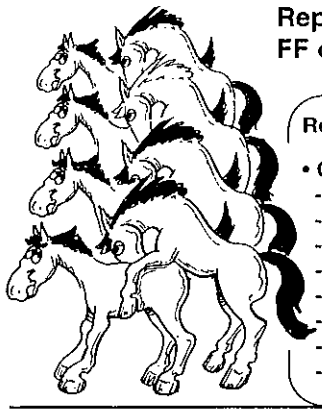
Repeat breeder

IM 244; I2M 249; CT 633

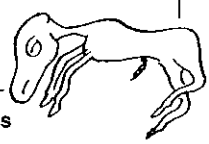
- **Definition: mare bred during 3 or more successive periods w/o becoming pregnant**
- Management of repeat breeders is frustrating & expensive
  - If expensive mare, still economically sound to breed
- Pathogenesis:
  - **FF: failure of fertilization - either male or female**
    - . Multiple females affected check stallion
    - . Individual female affected check female
  - **EED: early embryonic death**
    - . 5-8% lose pregnancy in first 4 mos. of gestation

DDx FF from EED

- FF no affected on interestrus interval
- EED prolongs interestrus interval (intermediate length to multiples of normal cycle lengths); after maternal recognition of pregnancy at 14-16 d



Repeat breeders = FF or EED



Diagnosis:

- **Evaluate heat detection**
- **Evaluate breeding technique**
- History:
- **If herd problem: evaluate stallion**
  - Physical condition
  - Semen quality
  - Libido & ability to mount
  - CEM, if other factors ruled out (R/O)
  - AI (artificial insemination) technique
    - . Semen quality
    - . Evaluate thawing, transportation, timing & deposition techniques
  - Errors in heat detection & timing of breeding
    - . Question & observe
    - . Milk or serum progesterone (detect heat)
- **Individual problems: check mare**
  - Body condition - poor nutrition
  - Reproductive exam
    - . Conformation of vulva - pneumovagina & endometritis
    - . Urine pooling - FF (spermicidal), EED

(open cervix, cervicitis)

- .. Cervical canal occlusion - FF
- .. Postpartum metritis - pus & debris
- FF, **failure of fertilization**
  - .. Endometritis & minimum pus - EED, not FF
- **Uterinm culture** (pg 172)
- **Cytological smear**
- **Endometrial biopsy** (pg 174)
- Embryo flushing to DDx FF from EED
  - . Collecting degenerating embryo - EED
  - . Failure to collect either doesn't indicate oviduct blockage as in cow
- **Ultrasound detection of pregnancy**
  - . Loss of embryo after detection w/ ultrasound confirms EED
- **Hormonal assays**
  - . ECG (equine chorionic gonadotropin, formerly pregnant mares serum gonadotropin [PMSG])
    - .. Detects if pregnant for 40 ds at least (endometrial cups produce ECG after 40 d of gestation to 120-150 d, even if fetus dies)
    - .. Can confirm EED, not FF
  - . Progesterone levels can't confirm pregnancy, but low levels early in expected pregnancy can confirm nonpregnant (< 1 ng/ml)

Prognosis: often treatment unrewarding

Repeat Breeding in Mares

- **Common causes**
  - **Transitional season** (pg 164)
  - **Windsucker** (pg 177)
  - **Endometritis/fibrosis** (pg 183)
  - **Twins** (pg 176)
  - **Poor AI timing**
  - **Poor heat detection** (pg 169)
  - **EED** (early embryonic death) (pg 176)
  - **Uterine lymphagectasis** (pg 191)
- Less common causes
  - Urine pooling (pg 186)
  - Rectovaginal fisula (pg 236)
  - Malnutrition (pg 168)
  - Metritis (pg 183)
  - Pyometra (pg 183)
  - Heat stress
  - Poor semen quality
- Uncommon causes
  - CEM (contagious eq. metritis) (pg179)
  - Gonadal dysgenesis (pg 190)
  - Neoplasia, uterine or cervical (pg 190)
  - Ovarian neoplasia (pg 188)
  - Paraovarian cyst (pg 190)
  - Oophoritis
  - Salpingitis (pg 190)
  - Iodine defc
  - Phosphorus defc
  - Zearalenone toxicity
  - Intersexuality

Estrus - Infertility

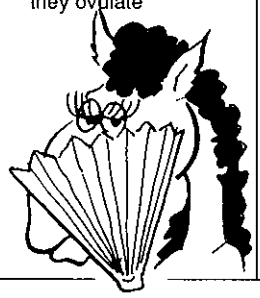
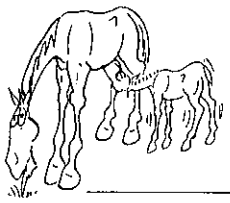
Condition	Facts/Cause	Presentation/CS	Diagnosis	Treatment
Seasonal anestrus IM 1366; I2M 1523; R 591; R-Y 71; ER 145; E 1321; C4T 525; C3T 635	• **Normal** Fall-Winter anestrus - Normal in temperate latitudes • Anestrus also normal during pregnancy	• **Failure to respond to stallion teasing** **- No signs of estrus**	• **History: Winter season** • No response to stallion teasing • Rectal palpation - Uterus thin-walled & flaccid - Ovaries small, firm, inactive • Speculum: - Vagina dry, pale w/o much mucus (difficult to insert glass speculum) - Cervix flaccid, usually tight (but m/b partially or fully dilated • **Rule out (R/O) causes of anestrus**	• **Spontaneously resolve w/ ↑ day length** **Prognosis: Excellent** Control • Artificially ↑ length of light brings on seasonal estrus sooner
Normal - Winter & pregnancy **Dx: Hx, Rectal** **Tx: Resolves w/ ↑ light or time**		**DDx:** • Pregnancy • Pyometra (pg 183) • Prolonged diestrus • Undernutrition • Gonadal dysgenesis (pg 190)		
Transitional period, **Vernal transition** I2M 1523; R 592 R-Y 71, 167; E 1322	• **At beginning & end of seasonal anestrus** (transition between anestrus & estrus or estrus & anestrus) - Late Fall & **Spring** • Inconsistency of mare's cycle is concern to vets & owners • Prolonged estrus included (see pg 65 below)	• **Only consistency of estrus is mare's inconsistency** - Anestrus or prolonged estrus - Erratic follicular growth - Ovulation or anovulation - Other cyclic & reproductive irregularities	• Time of year: early Spring • Rectal palpation • Ovarian changes - ↑ in size of ovaries days before follicles can be palpated . Usually associated w/ loss of winter coat - From firm to rubbery	• Regular teasing & examining genital organs & breeding will get some, but most must wait until physiological breeding time arrives • Goal: hasten regular physiological breeding season 1. Keep mares in good health - Not overly fat - Good nutrition to cause gradual weight gain m/ hasten estrus 2. Regular frequent teasing w/ stallion 3. **Artificial light** - gradually ↑ light to 15-16 hr/d to initiate ovarian activity, most satisfactory means of hastening breeding season 4. Hormonal methods: limited & inconsistent results (see box)
Consistently inconsistent mares **CS: Anestrus** **Dx: Hx & Palpation** **Tx: Artificial light**				
Prolonged estrus, **"Split" estrus,** **Seasonal prolonged estrus** IM 1363; R 593; R-Y 71, 169; C3T 634; M 257 ***	• Type of **transitional period** problem • Prolonged periods of estrus - At end of transitional period o r start of spring breeding season - **Natural & common** (up to 90% of maidens & barren mares) - **8-30 days** of estrus (average 18 d) may be > 30 days • Physiology: - Graafian follicles develop & secrete enough estrogen to cause CS of estrus - Estrogen low until last follicular wave, absence of progesterone - Follicles regress (atresia) instead of ovulate - Eventually normal cycle begins (w/ time 1 follicle ovulates later in response to ↑ LH [luteinizing hormone]) • **"Split" estrus** - Uncommon condition - In & out of estrus - M/b related to stress, improper teasing or transportation	• **Mating w/o pregnancy** early in breeding season - Responds to teasing - Receptive to stallion . **Allow stallion to mount** for 8-30 days, m/b ≥ 30 days **- No pregnancy** • Prolonged receptivity ends & normal ovulation occurs • **"Split" estrus** - In & out of receptivity to stallion	• **Hx: Mating w/o pregnancy** early in breeding season • Rectal palpation **- Small & firm ovaries** - Uterus lacks tone **DDx:** • Granulosa-theca cell tumors (pg 188) • Exogenous steroid Tx • Nymphomania (pg 158)	• **Wait a month** (will start to ovulate) then breed • **Hasten start of breeding season** (see box) - **Artificial light** - 15-16 hr/day will cause prolonged estrus earlier in year & not affect breeding season - GnRH - During last follicular wave . HCG (human chorionic gonadotropin) . Progesterone for period of time
Start of breeding season, natural & common **CS: Breeding w/o pregnancy** **Tx: Wait a month & breed**				

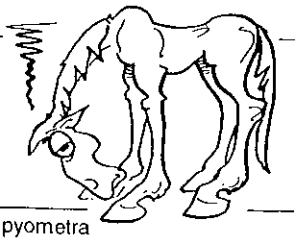
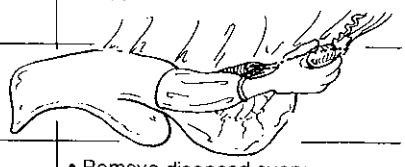
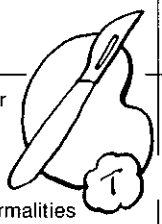
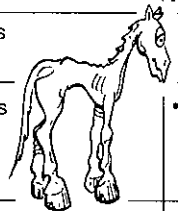
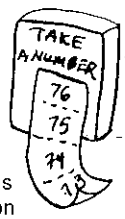
Hasten start of breeding season ER 179; E 1326

- **Artificial light** will cause prolonged estrus earlier in year & will not effect breeding season
  - Gradually ↑ light to 15-16 hr/day to initiate ovarian activity
    . 200 watt incandescent bulb in box stall started in mid November or early December to get ovulation by **February**
  - 60-90 d between 16 hrs of light & start of physiologic breeding
  - **Most satisfactory means of hastening breeding season**
- **Hormonal methods**: limited & inconsistent results
  - Altrenogest® (synthetic progestin) orally for 15 d m/ hasten estrus w/in 4-5 d after Tx stops, only during last follicular wave
  - Progesterone, shortens transitional period, 100 mg in oil IM for 7-10 days
    . Normal estrus 3-5 days after Tx stopped, only during last follicular wave
    . Normal cycles thereafter w/ 50% conception on 1st service
  - HCG (human chorionic gonadotropin) causes ovulation of follicles > 3.5 cm w/in 48 hr
    . Reduces duration of estrus & extra services by the stallion, only during last follicular wave
  - **GnRH** (gonadotropin-releasing hormone) more reliable than others
    . Repeated small doses (not single dose) m/ induce follicular development & ovulation

Infertility

REPRODUCTIVE SYSTEM

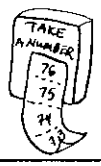
Condition	Facts/Cause	Presentation/CS	Diagnosis	Treatment
Persistent CL, Persistent corpus luteum, **Prolonged diestrus** IM 1370; I2M 1526; R 594; R-Y 168; ER 149; E 1328; EM&S 1027; C4T 530; C3T 633 ***  **Progesterin blocks estrus, No PGF** **CS: Anestrus during breeding season** **Dx: Hx, CS, rectal, US, ↓ progesterone** **Tx: 2 PGF shots**	• **Common** problem in mares • **#1 cause of anestrus** during breeding season - **± Ovulating, but nonreceptive to stallion** (progesterone from CL blocks estrus signs) • Cause unknown (iatrogenic) - **Insufficient PGF** from endometrium of nonpregnant mares - Insufficient synthesis of PGF2a (partial destruction of endometrium)	• **Anestrus during breeding season** 1-3 months of anestrus (nonreceptivity) (average 60 days) - **Nonreceptive to stallion** • **Anestrus after estrus** **DDx:** • Pregnancy (eliminate by rectal palpation & ultrasound) • Inadequate teasing (pg 169) • Granulosa-theca cell tumors • Pyometra (pg 183) • Emaciation • Gonadal dysgenesis (pg 190) • Embryonic death (pg 176) • Resorption	• **Hx, CS** • **No response to teasing** • **Rectal palpation:** - Cervix closed & high on vaginal wall, tight & dry - ↑ Uterine tone - **Follicles** on ovaries (ovulation common) confusing because follicle says should be in heat, but rejects stallion - **No CL palpated** (because buried in ovary in horses) • Laboratory: - **↑ Progesterone** (similar to diestrus & pregnancy) - Elevated plasma protein • Ultrasound (US)	• **2 PGF2a injection if 4-5 days old CL** - Luteolizes persistent CL so ovulates promptly • Douching w/ sterile saline + ABs is not as effective as prostaglandins • Uterine curettage is of questionable value • Estrogen of no value (prolongs CL) **PGF2a injection if 4-5 days old CL**  • 10-15 mg of PGF2alpha (**Lutalyse®**) • 250-500 µg of fluprostenol (**Equimate®**) • Luteolizes persistent CL • Ovulation after Tx from 1 or 2-9 d - 4+ cm follicle, ovulate promptly - 2/3rds ovulate 3-7 days (5 days average) - 1/3rd large follicles regresses & ovulation in 6-12 days (average 9 days) - **CL < 4-5 days old** refractory to PGF2a - **2nd dose** 7-10 days later
"Silent heat", Psychological anestrum, **Anestrus due to abnormal behavior, Subestrum, Covert heat** I2M 1527; R 595; ER 193; E 1347 **Estrus but no sings, Management**	• **No estrus signs** (nonreceptive to stallion), **but normal estrus cycle** • "Lactational anestrus" misnomer - Nervous foaling mares, don't breed when foal is by side (still cycle) - Not true lactational anestrus as seen in sows, ewes & cows • **Shy maiden mares** • **"Impersonal", quiet, undemonstrative mares** • Inadequate teasing fails to show estrus signs in cycling mares	• No external signs of estrus, or only occasionally - When they show signs, they ovulate 	• Hx: foaling mare, no CS of estrus • Genital exam - **Cycling mares**: . Follicles on ovaries . Vaginal exam show cycling .. Edematous cervix 	• **Frequent persistent teasing** • Paddock mare next to penned stallion • Pasture breeding to quiet stallion • Careful repeated rectal & vaginal exams + AI • Twitch & hobble mares as approaching ovulation - Often "break down" & accept stallion & show external signs of estrus • Try different stallion (some mares picky) • Restrict foal suckling to 4, 1 hour periods/d (m/ work) • Estrogen of no value

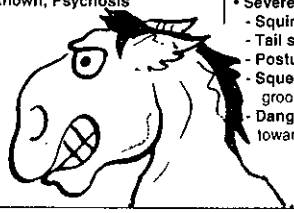
Anestrus - pathological conditions R 595; ER 148; EM&S 1028	• Pathological conditions affecting uterus & ovaries, or systemic disease	• Failure to exhibit signs of estrus on teasing 	• Do not use anabolic steroids on mares for breeding 	
• **Pyometra**	• Failure of endometrial cells to produce prostaglandins	• Anestrus	• Persistent CL (can't palpate)	• Tx pyometra 
• **Hysterectomy & ovariectomy** 		• Anestrus	• No ovaries	
• **Granulosa-theca cell tumors** 	• Most common tumor of ovaries	• Either anestrus, stallion-like behavior or intermittent estrus behavior	• 1 ovary large • Opposite ovary small, firm & inactive - Occasionally bilateral	• Remove diseased ovary
• **Gonadal dysgenesis**	• Chromosomal abnormalities	• Anestrus 	Cytogenetic studies	• No Tx
• **Emaciation**	• Parasitism, pituitary tumors, old debilitated mares w/ poor teeth, chronic debilitating diz, underfed & overworked	• Anestrus	• Sm., hard & inactive; uterus flaccid & no estrus CS	• Correct underlying problem 
• **"Nymphomania"**	• Dangerous • See pg 168	• Squeal, kick & squirt urine	• Dangerous to palpate, mild & severe forms	• Euthanize severe, ovariectomizemild
• **Pseudo-pregnancy, "Spurious conception"** IM2 1526	• Pregnancy terminated after endometrial cups developed, 38-40 d - **Early embryonic death (EED)** • Doesn't come into estrus until endometrial cups regress - **100-150 days** - **Stops secreting ECG (eq. chorionic gonadotropic hormone)**	• Anestrus, then estrus in a few months	• Hx, CS 	• Untreated - Cyclic activity returns after ECG secretion stops

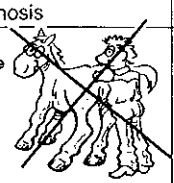
Infertility

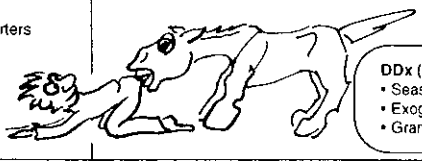
REPRODUCTIVE SYSTEM

Condition	Facts/Cause	Presentation/CS	Diagnosis	Treatment
Nymphomania IM 1364; I2M 1526; R 596 *	• **Wanton estrus behavior** (abnormal & undesirable) • During estrus (associated w/ developing Graafian follicle) • Diestrus behavior normal • **Cause unknown, Psychosis**	• **Rare** • **Psychosis** • **Mild nymphomania** - Exaggerated behavioral estrus during estrus, abating during diestrus • **Severe nymphomania** - **Squirt urine** - **Tail switching** - **Posturing** - **Squealing** when rear quarters groomed or touched - **Dangerous, aggression** towards horses & people	• **Hx, CS** • **Dangerous to palpate** - No genital organ abnormalities - Cycle normally	• **Euthanasia for dangerous mares** • Progesterone Tx generally poor results (progesterone blocks estrus & ovulation in normal mares) • **Dexamethasone** for show mares (CS reported to disappear from 1- 5 d after Tx) • **Ovariectomy** - **Mild cases respond** - **Severe - do not respond, euthanize**







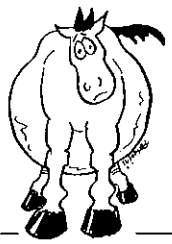


Neurotic mares
CS: Wanton, Dangerous
Hx, CS, Don't palpate
Tx: Destroy!

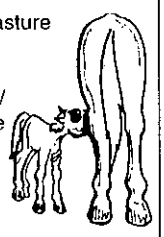
DDx (all eliminated by history, season & PE)
- Seasonal prolonged estrus (pg 165)
- Exogenous steroid Tx
- Granulosa-theca cell tumors (pg 188)

Nutritional infertility

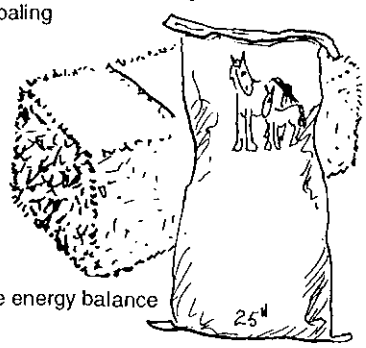
R 598



- **Thin mares** & those losing weight rapidly usually fail to ovulate normally
- **Poor nutrition 1st month after ovulation ↑ early embryonic death & fetal resorption**
  - Poor nutrition after 35 d pregnant, maintain normal foals
- **Overly obese mares** on lush pasture reported to be poor breeders
- **Foals** of mares on hi nutrition m/ have scours 1st 1-2 weeks of life
  - Monitor foal intake & milk out mare manually
- **Racing mares** in training m/ nail ı "deep" anestrus (stress, overwork, lack of energy)



Treatment:
- **Breeding season:** positive energy balance so gain weight slowly (barren, foaling & lactating mares)
- **Gestation:**
  - Maintenance ration in only moderate body condition 1st 8 months of gestation
  - 9th month - modest ↑ in nutrition & protein until foaling
- **↑ Foal heat conception**
  - ↑ Feed last few wks of gestation
  - Rapidly ↑ nutrition (grain?) after foaling
  - High energy ration 1 mo. or more after breeding
- **Prevent early fetal death & resorption**
  - **High plane of nutrition 1st mo. of pregnancy**
- **Obese mares**
  - Diet in winter months to normal weight
  - Place on slowly rising plane of nutrition & positive energy balance
- **Racing mares** in training: give time to equilibrate



Poor heat detection, Unobserved estrus, Silent estrus

IM 1370; I2M 1527

- **#1 cause of infertility**
- **Management defect in detecting estrus**
  - Apathy or ignorance of signs by observers
  - Use of low libido stallion
  - Inappropriate teasing methods
- Mare problem
  - 10% reject 1st stallion, but display signs for 2nd stallion
  - Some mares are indifferent to teasing (covert estrus)
    . Know mare to tell when to artificially inseminate

- **Mares not pregnant**
- Unobserved same signs as silent or covert estrus

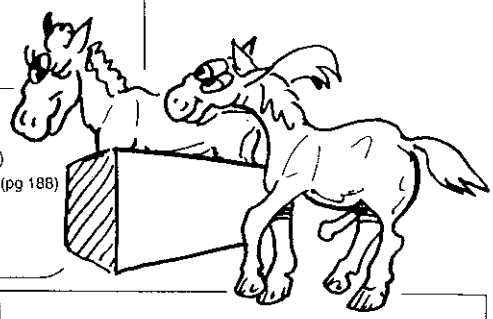
Signs of estrus
- **#1 standing quietly w/ tail raised** (to allow mounting)
- **"Winking"**
- **"Squatting"**
- Frequent urination
- Pressing against teasing bar

- **Signs of anestrus**
  - **Rejection**
  - Kicking & striking
  - Ears back
  - Squealing

- **Hx, CS: not pregnant**
- **Sequential palpation of ovaries**
  - **Look for follicles**
- **Progesterone levels**
  - ↑ 14 d of diestrus (normal due to secretion of CL)
  - Falls (< 1 ng/ml) 7 d surrounding estrus (normal)
  - If normal, indicate inadequate observation

- **Improve teasing management**
  - Review procedure & retrain observers
- **Check stallion's libido**
- **Tease w/ different stallion**
- Sequential palpation of ovaries
- Reproductive records
- PGF_{2alpha} occasionally to predict when in estrus

Prevention:
- Adequate management of teasing & observation



DDx:
- Silent or covert heat (pg 166)
- Prolonged diestrus/CL (pg 166)
- Granulosa-theca cell tumors (pg 188)
- Pyometra (pg 173)
- Undernutrition (pg 168)
- Gonadal dysgenesis (pg 190)

#1 cause of infertility, Management
CS: Not pregnant
Dx: Palpate for follicles, Progesterone
Tx: improve heat detection & teasing

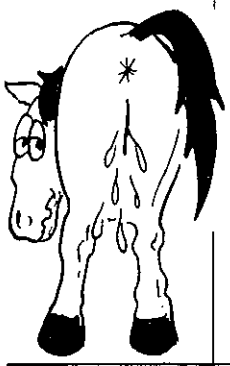
Teasing of mares:

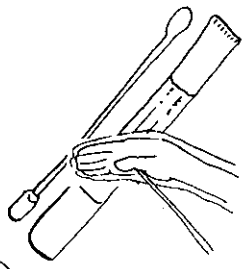
- **Maiden & barren mares**
  - Start teasing early in breeding season
  - Tease daily on alternate days until confirmed pregnancy
- **Foaling mares:**
  - Tease 4-6 d after foaling to detect 1st postpartum heat (**"foal heat"**)
- **Group teasing used**: timorous mares m/ not approach or m/ be driven away from stallion
  - Foaling mares - apprehensive for foals
- **Individual teasing**: good for shy mares
  - Teasing chute & foal box good for lactating mares
  - Good for close to individual breeding

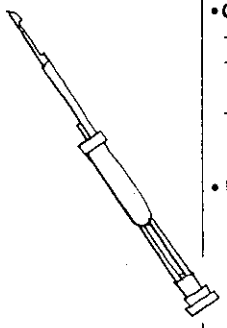
- **Procedure for teasing**
  - Solid barrier between mare & stallion (so mare doesn't kick stallion)
  - **Head to head** introduction (stimulates normal greeting behavior)
    . Stallion **"muzzles mare"** (discourage mare from biting)
    .. Observe mare's response, CS of heat
  - **Stallion approaches mare's perineum**

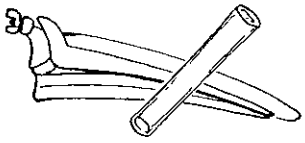
Infertility - Infections

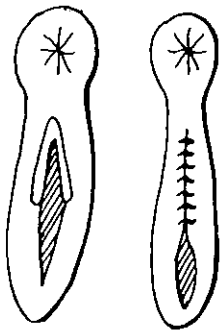
Condition	Facts/Cause	Presentation/CS	Diagnosis	Treatment
Genital infection R 599, 601; T 730; ER 381	• **Uterus normally sterile** • **Vagina, vestibule & vulva non-sterile** - Many organisms normal inhabitants of mares & stallions • **Positive cultures does't mean active infection unless clinical or histopathic signs of diz** • Positive cultures - 80-100% 1-2 days after service or few days after foaling . Usually clear by 6-10 days (± chronically infected, especially if pneumovagina) - Barren mares >>> foaling mares >>maiden mares (lowest)	• **Infertility** • **Discharge** from genital tract - Soiled perineum & tail - Matted hair • Vulva m/ gap exposing mucous membrane • Perineum m/b sunken	• **To establish Dx of infection** - Clinical signs of diz - Culture organisms - Inflammatory cytology - Uterine biopsy - Ultrasound (fluids during diestrus) • **Speculum exam** - Exudate - Mucosal color of vagina & cervix - Conformation of cervix • Routine culture & sensitivity of suspicious & infected mares & stallions • **Culture mare & stallion** - **Protected culture swab** (Tiegland®) . Smear a sterile glass slide . Amies transport medium - **Exudate in vagina to lab** - Pre-ejaculatory fluid to lab • **Cytological or biopsy & histo exam** - Endometritis - Organisms in lumen of vagina, endometrium or endometrial glands - If **+ culture & no** histological **evidence of diz, consider culture contaminated** • **Ultrasound** (fluids during diestrus)	• **Caslick's operation (#1) + Sexual rest m/b enough** • **± intrauterine infusion** (see box) • If mucopurulent material - Remove by douching & siphoning • ± Stilbesterol or estradiol (IM) • Mild exercise m/ help involution • Oxytocin • Parenteral ABs of little value **After treatment:** • **Bacteriological & cytological or histopathological exams to see when to breed** **Prevention:** • **Hygiene during breeding & foaling of major importance!!!**





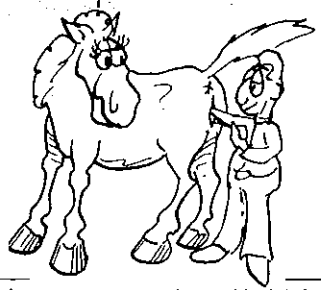






Causes - Genital infections
1. **#1 Pneumovagina**
2. Normal or pathological parturition
3. Copulation
4. Iatrogenic (hand & instruments)

 # 1 *S. zooepidemicus*, #1 "Windsuckers"
CS: Infertility, Genital discharge
Dx: CS, ?culture, biopsy, US
Tx: #1 Caslick's & rest; Px: good



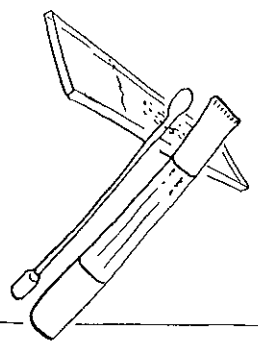
Infectious agents - endometritis & infertility
- ***#1 Strep. zooepidemicus*** *(genitalium)* (pg 180)
- *E. coli* (pg 181)
- *Klebsiella aerogenes (pneumoniae)* (pg 181)
- *Pseudomonas aeruginosa* (pg 181)
- *Staph. aureus*
- *Enterobacter agglomerans*
- *Taylorella equigenitalis* (CEM) (pg 179)
- Miscellaneous organisms: *Corynebacterium equi, Actinobacillus (Shigella) equuli, Aspergillus fumigatus, Candida albicans* (pg 181), Mucor spp., other Strep., Staph., Salmonella spp., Mycoplasm, etc.

Intrauterine infusion (lavage)
- Frequent douching w/
  - Mild antiseptic solution (weak Betadyne® or Novalsan®)
    . Avoid too irritating sol (10% Lugol's solution)
  - Mild chlorine sol. (50 ppm), warm physiological saline sol. alone
  - Physiological saline solution + ABs (pen., streptomycin, tetracycline, nitrofurazone, polymixin B &/or neomycin combo)
- After C&S (culture & sensitivity) use proper ABs in oil or saline
  - **Streptococcus or Gram + organsims**
    . Penicillin, nitrofurazone, broad spectrum ABs (terramycin, oxytetracycline, aureomycin, chlortetracycline, tetracycline & ampicillin)
  - **Klebsiella, *E. coli, Pseud. aeruginosa***
    . Streptomycin, neomycin, chloramphenicol, polymixin B sulfate, gentamicin & amikacin
  - **Pump or gravity feed 50-250 ml into uterine lumen**
  - **2-5 x at 24-48 hour intervals**
  - Preferred at estrus when natural uterine defence mechanisms working
- Clitoridectomy may be necessary for Klebsiella & CEM

#1 Strep. zooepidemicus

Prognosis:
- **Good: usually respond to Tx in 1-2 months**
- Acute infection usually spontaneously clears unless pneumovagina
- Sooner diagnosis & treated the better the prognosis
- Chronic severe cases m/ cause sterility
- *Pseud. aeroginosa, E. coli* & Klebsiella difficult to impossible to Tx
- Strep. & CEM easy to Tx
- Obstructive pyometra - poor or hopeless
- Urovagina: guarded to poor
- Older barren mares w/ Hx of abortions, pyometra & infertility: poor

Interpretation of smears & cultures
- Slide smears - Gram stain
  - Determine type of bacteria & numbers
  - Presence of PMNs (indication of degree of endometritis)
- C&S (culture & sensitivity) by vet gives quick information
- Culture by lab will be more accurate
- **Possible contamination always to be suspected**
  - **Pure colonies of 1 organism in large numbers w/ evidence of endometritis (PMNs)** more significant than:
  - Mixed cultures w/ no PMNs (insignificant)
  - If culture positive & no histological evidence of infection, consider swab contaminated
  - Often histologic evidence, but negative swab



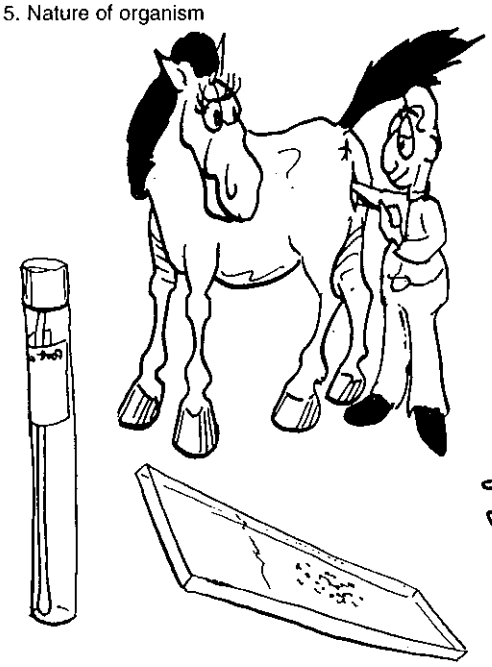
Uterine cultures & cytology

T 719; R-Y 87; E 1312, EM&S 957; M 257

- **Bacteria ≠ endometritis**: recovery of bacteria doesn't diagnose **endometritis** because organisms are mostly commensals & can easily contaminate culture
- Not an aid in diagnosing or confirming inflammation
- Used to suggest a cause of an already confirmed inflammation
- Maiden horses - culture?
- Post breeding - all mares showed positive cultures, so no use culturing then or after foaling, infection for 10 days
- **Technique:**
  - Culture endometrium not cervix which doesn't reflect uterus
  - Culture at anytime (estrus or diestrus), if affecting fertility, will be there whenever. Many people believe in culturing during estrus over diestrus as it easier at estrus because open, however also more resistent at this time due to estrogen
- Interpretation: must be significant (not if +1, occasional colony, to +4, look at cytology results). Type of organism also
  - Pathogenic organisms: *Strep. zooepidemicus* 65% *E. coli*, proteus (30%), *Pseudomonas aeruginosa, Klebsiella pneumoniae*
  - Documented inflammation: Staph. spp., Corynebacterium, Proteus spp. should be considered pathogens
  - **Contaminations**: alpha hemolytic Strep., Enterobacter spp & *Staph. epideridis*, rarely cause of inflammation
  - Repeated recovery to confirm role: Candida spp. & Aspergillus (fungus)
    . Often develop secondarily to antibiotic therapy
    . Potential for severe irreversible damage

Significance of culture

1. Greater than 48 hours post breeding
2. Repeat recovery during one estrus
3. Recovery during successive heats
4. Several organisms at one time, usually means contamination, coliforms from rectum (poor conformation)
5. Nature of organism

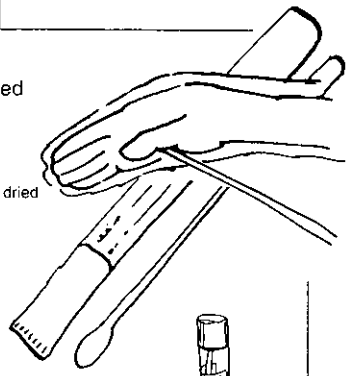


Uterine cytology

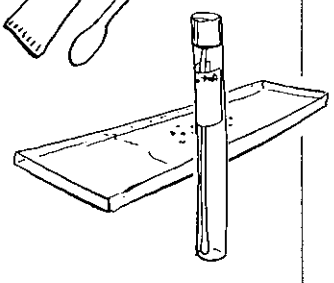
- Aids in interpretation of culture results
- Cell types
  - Mostly epithelial cells (tend to clump more as approach estrus)
  - Occasion PMN normal, < 1%
    . 69-70% = endometritis
  - Lymphocytes infrequent
  - RBCs if traumatic
  - Spermatozoa, usually degenerating
  - Mucous (diestrus stringy; estrus a lot more)

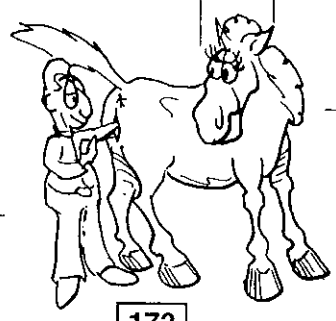
- 1 swab for culture (bacteriology)
- 1 swab for cytology (cell type present [scraping])
  - Normal < 1% inflammatory cells
  - If great # PMNs have a problem
- **Cytology over culture**
  - If culture positive & cytology negative, go with **cytology**
  - If culture negative & cytology full of inflammatory cells: have problem

Procedure: Culture of mare:



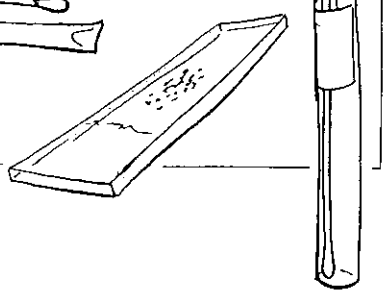
- Easiest during estrus when cervix relaxed & dilated
- Preparation
  - Well restrained & in clean envir.
  - Sterile gloves for each mare
  - Tail wrapped
  - Surgically scrub external genitalia (Nolvasan® or Betadyne®) & dried
- **Protected culture swab** (Tiegland®)
  - **Prepare all swabs in turn:**
    . Remove cap while still in plastic envelope
    . Pull swab back a little in tube
    . Pencil mark handle of swab next to end of tube so know when protected on removal from mare
- **Swab clitoral fossa**
  - Smear a sterile glass slide
  - Break tip of swab into Amies transport medium
- **Swab into cervix & uterus**
  - Put on a new plastic sleeve
  - Lubricate back of hand & arm, not palm
  - Place prepared swab in hand to protect
  - Insert hand into vagina to cervix
  - Direct tube through cervix & into uterine body w/ a finger
  - Push swab through tube onto the endometrium
    . Move swab back & forth & rotate on endometrium
  - Pull swab back to pencil mark
  - Protect tubed swab w/ palm as removed from mare
  - Smear slide & swab tip into transport medium
  - 2 sleeves or a sleeve & a sterile glove m/b used
    . Swab placed inside the outer sleeve & pushed through its index finger when cervix is reached
    . These techniques are preferred over vaginal speculum method
- **If abundant exudate in vagina**
  - Aspirate a sample w/ a sterile pipette & syringe
  - 5 ml in sterile vial & refrigerate until reaches lab for culture





Procedure - Culture stallion:

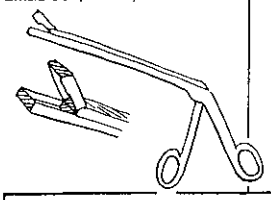
- Preparation
  - Adequate restraint (twitch, tranquilizer or sedation)
  - Teasing m/b necessary to extend penis
  - Approach on left side w/ handler on same side
  - Handler stand near shoulder & girth area
- Swab - urethra, may also swab inside preputial orifice (if extended penis on reflected prepuce), urethral fossa, urethral sinus
- Smear a slide & place tips in transport medium
- Pre-ejaculatory sample
  - Wash penis & prepuce w/ mild soap (Ivory®)
  - Rinse w/ clean water & dry
  - Tease stallion & collect pre-ejaculatory fluid in sterile disposable beaker
  - 5 ml in sterile vial & sent to lab



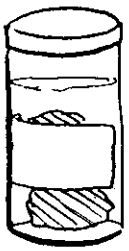
Bacteria ≠ endometritis
Cytology over culture

Uterine Biopsy

Condition	Facts/Cause	Presentation/CS	Diagnosis	Treatment
Severe Uterine fibrosis, Barren mares T 723, 656; ER 225; R-Y 89; E 1313; EM&S 960; M 253; S 751	• **Fibrosis:** when widespread becomes main limiting factor in carrying to term . **Endometrial categories 1-3:** - **Predicts ability to carry foal to term:** most valuable tool for predicting (especially in older mares) - Barren 1 year w/ moderate fibrosis twice as fertile as those barren for 2 or more years -Widespread changes much worse than scattered changes in ability to carry to term **Doesn't say if mare can get pregnant**	• **Infertility** • **Barren mares:** 3 or more good breedings • EED (early embryonic death) • Repeat breeders	• Hx, CS • Uterine biopsy - Fibrosis categories 1-3 . C1 is normal . **C3 is nearly hopeless** to carry to term	• **Don't buy Category 3**: recommend against for brood mare • **Category 3**: not sterile, so if valuable it m/b worth: - Breeding to get on an average one foal in 10 yrs - Minimum contamination of breeding, greatly improves foaling rate for mares w/ fibrosis



Foaling performance (produced foals)
Kenney catagories
Category 1 - 70-92%
Category 2 - 50-67%
Category 3 - 4-10%



Fibrosis related to carrying foal
CS: Barren
Dx: Biopsy: catogories 1-3
Tx: Don't buy C 3

Uterine biopsy

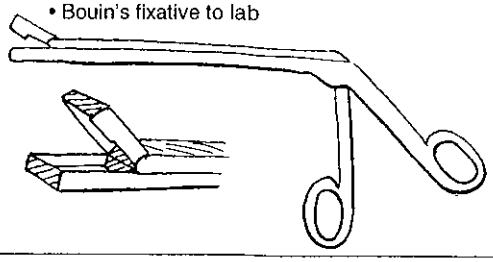
T 723, 656; ER 225; E 1313; EM&S 960; M 253; S 751

- **Uterine biopsy: valuable & easy**
  - **Predicts ability to carry foal to term**: most valuable tool for predicting (especially in older mares)
  . **Fibrosis:** when widespread becomes main limiting factor in carrying to term
  . **Categories 1-3 of fibrosis**: used to predict
  .. 1 is normal
  .. **3 is nearly hopeless** to carry to term
  - **Doesn't say if mare can get pregnant**

Indications for biopsy
1. Barren mares: 3 or more good breedings
2. Mares with EED (early embryonic death)
3. Repeat breeders
4. Clinical endometritis or pyometra
5. Behavioral anestrus in breeding season - June - July
6. Mares requiring genital Sx (prognostic indicator)
7. Fertility exam

Contraindication for biospy
1. **Pregnancy** (will abort due to dilation of cervix)

Procedure (see box below)
- Swab for culture before biopsy
- Biopsy uterine bifurcation
  - Don't do if pregnant because will abort
- Bouin's fixative to lab



Endometrial (Kenney) categories 1-3

Kenney: amount of fibrosis/scar tissue present determines scale, thus determines ability to carry to term
. Not a reversible condition; lining of uterus must have a lot of glandular tissue
- **Category 1: No detectable changes** or only slight inflammatory changes which are sparse & scattered, no hypoplasia, no atrophy
- **Category 2: Slight to moderate changes**
  - Diffuse & scattered changes, cellular infiltrates, scattered fibrotic foci w/ inflammation, scattered periglandular fibrosis, nest or clumping of glands 3- 5.5 mm in 4 or more fields, widespread lymphatic lacunae
  - Atrophy
- **Category 3: Widespread changes**
  - Widespread, diffuse, severe inflammatory changes
  - Deep atrophy in breeding season
  - Not sterile, but low foaling rate < 10%
  - Periglandular dilation, glands m/ have cells w/in them
  - Some places have no glandular tissue
  - Scar tissue isolates glands into clusters

Interpretations for categories
- Done by expert (lab)
- Parts of evaluation
  1. Adequate sample ≥ 1 linear cm
  2. Histological stage of estrus (endometrial epitheliumtype & condition)
  3. Inflammatory (cellular) response, type & no. of cells present
  4. Degree & extent of endometrial degeneration (fibrosis, lymphatic lacunae & cystic glands, size, # clumping of endometrial glands)

Normal endometrium & estrus cycle

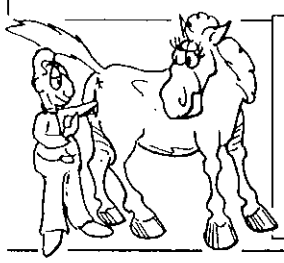
- Anestrus: cuboidal epithelium (atrophy) w/ straight glands
- Transitional period (in Spring & Fall) still atrophied though may have follicles that don't ovulate so biopsied for repeat breeder (need to wait until come into true breeding season)
- Estrus: columnar epithelium & torturous glands
  - Margination of PMNs in capillaries, but don't migrate through stroma

Pathological changes of endometrium

- **Inflammation**:
  - Acute: margination in capillaries & migrate through stroma
  - Chronic: mononuclear cells, plasma cells, eosinophils & mast cells
  - More common to get "**no growth swabs**" w/ indications of inflammation
- **Fibrosis**: permanent as apposed to inflammation
  - When widespread becomes main limiting factor in carrying to term
  - Glands tend to dilate w/ scar tissue, become occluded, get periglandular fibrosis
  - More widespread, regardless of severity, lower the chance to carry to term
- Lymphatic lacuna: dilated lymphatic vessels
  - Endometrial cysts: coalesced lymphatic lacunae
  - Reduce ability to carry to term
  - DDx from surgical edema
  - Lymphatic lacunae look like cracks in slide or lakes, no border
- Endometrial cysts: only small ones found w/ biopsy
  - M/b associated w/ EED (early embryonic death)
- Endometrial glands, size, #, clumping, activity - very important, support of early conceptus, endometrial milk. Arrangement of glands indicates amount of scar tissue present

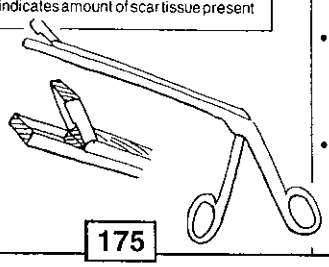
Uterine biopsy procedure (see box)

- **Preparation**: empty rectum, detailed rectal palpation of genital organs
  - Bandage tail & wash & dry vulva & perineum
- **Swab for culture before biopsy** (avoid contamination)
  - Because inflammatory changes most common pathology of endometrium
  - Interpret culture & biopsy together
  - Guarded swab (preferably double guarded to avoid contamination)
  . Use hand instead of speculum to open vagina (contamination)
  . See swab technique
- **1 site sufficient in absence of specific pathology**
  - Essentially representative of whole endometium
- **Biopsy uterine bifurcation**
  - Palpate entire uterus for uniformity (texture)
  - Abnormal areas also biopsied
  - Any stage of estrus because of ease of dilating cervix
  . **Don't do if pregnant because will abort**
  . Endometrial architecture varies w/ time of season
  .. Inexperienced vets - biopsy at diestrus when full luteal effect to avoid misinterpretation
  . Write down stage of estrus & physical findings at time
  - Introduce biopsy through cervix, into body of uterus as done for swab (guarded or double guarded w/ gloved hand & inside rectal sleeve)
  - Other hand in rectum to hold wall of uterine horn against jaws of forceps so can take adequate sample
  . Sharply pull to complete biospy
  . Don't take bite through entire wall, so be careful
  . No sensation in lining of uterus
  . Instruments - as long as possible in large mares
  . Forceps area large enough to get adequate sample, must go from mucosal surface through mucosa muscularis
- Tissue preparation
  - **Bouin's solution** 2-24 hr, 1 part tissue to 10 parts sol.: dislodge tissue from biopsy w/ fine hypodermic needle, Bouin's better than formalin.
  - 70% ethyl alcohol or 10% formalin
- Routine histopathologic procedure tained w/ hematoxylin-eosin



Biospy facts:

- Cost justified: mares often lose conceptus due to microscopic pathological changes in endometrium
- Valuable indicator of present & past diz conditions
- Safe & easy
- Performed w/ minimum equipment
- Never used alone, use w/ Hx, visual exam of external genitalia, internal exam of genitalia, uterine swab & vaginoscopy
- Results take time



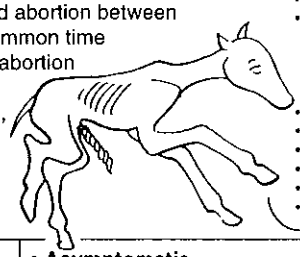
Infertility — REPRODUCTIVE SYSTEM

Condition	Facts/Cause	Presentation/CS	Diagnosis	Treatment

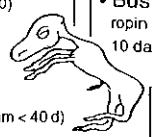
Early embryonic death, EED

Mk 1142; I2M 252; T 705; ER 517; EM&S 1063; E 1340; Pop 4/98

- **Abortion: expulsion of dead or nonviable fetus**
  - **EED: 50% up to mid-gestation**
  - **3-4% past mid-gestation**
- Called **infertility** when unnoticed abortion between 20-90 days of gestation, most common time
- **Lucky to Dx 1 in 10 causes** of abortion
  - Most are unknown causes
- If pregnancy lost before 60 days, rarely find any tissue
- Older mares (over 18 yrs), higher abortion



DDx:
- EHV-1 (Rhinopneumonitis) (pg 215)
- Eq. viral arteritis (pg 216)
- Uterine infections, Bacteria & mycotic (ascending) (pg 170, 182)
  - *Streptococcus zooepidemicus* (pg 180)
  - Salmonellosis, (pg 216)
  - CEM, Mycotic abortions (pg 178)
- Twinning (pg 220)
- Mares over 18 yr
- Malnourished mare (betw. 25-31 d)
- Management problem (rough, preg. exam < 40 d)
- Infertile mares
- Stress (transport, working)



Bacterial & mycotic
- **Good breeding hygiene**
- **Tx genital diz** before breeding
- **Caslick's** to prevent pneumovagina ("windsucking")
- Buserelin (Receptol®): gonadotropin releasing hormone agonist, given 10 days after ovulation

Lab - send in blood sample & chilled aborted fetus + placenta - Dx 50-60%

Twinning

M8k996; T651,705; EM&S 1059; E 129, 1319, 1349; M 267; ER 532; E 129; C3T 657

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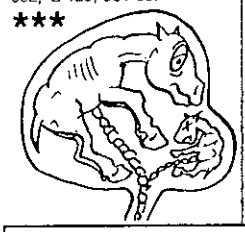
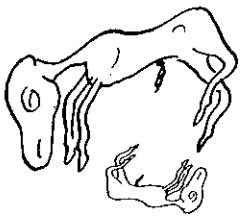
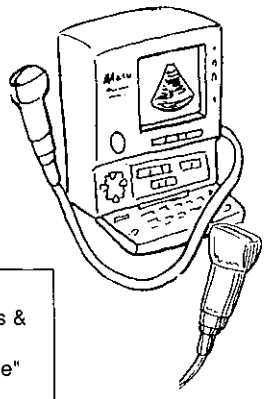


- **See pg 214**
- **Disastrous to pregnancy**
- **Occurs commonly, usually natural abortion**
  - Double ovulations average16%
  - 95% of twin ova or embryos lost early
  - 90% abortion of those surviving past 150 d
  - 20-30% of all abortions
  - Twins births rare (0.5% of births)
    - Usually 1 mummified & other weak
- If pregnancy lost before 60 days, rarely find any tissue

- **Asymptomatic**
- **EED or abortion**



- **Ultrasound**



No Tx highly satisfactory (see under abortion section)
- < 17 days: pinch, US aspiration
- < 35 days
  - **Terminate 1** & let other go to term, usually aborts both; or
  - **Terminate both** & rebreed next estrus
    - Cervical dilation & uterine douch
    - $PGF_{2\ alpha}$
- > 35 days, if terminated, doesn't come into estrus for several months
- Supplement w/ progesterone & let go to term

Disastrous to pregnancy
20-30% of all abortions
CS: Asymptomatic or EED or abortion
Dx: US
Tx: None highly sucessful

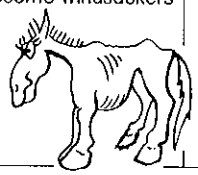
Prevention:
- Repeated rectals of "twin-prone" mares & breeding when only 1 mature follicle
- Consider embryo transfer in "twin-prone" mares

Windsucker, Pneumovagina

IM 1393; I2M 1546; C4T 514, 512; R 599, 610; R-Y 195; ER 418; M 265; S 734

- **#1 pathological infertility**
- **#1 cause of genital infections**
- Aspiration of air & contamination into vagina
  - Vaginitis, cervicitis & chronic endometritis
- Some only during estrus when area relaxes; others all the time
- Causes:
  - **Abnormal perineal conformation (older, thin mares)**
    - Normally 80% of vulvular opening below brim of pelvis, 20% above
    - Abnormal > 20% above brim
    - Anus pulled forward in old, thin mares
    - Vaginal opening normal 80-90° (nearly vertical)
  - Trauma to vestibule or vagina

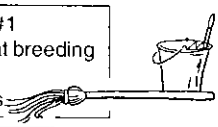
- Thin & atrophic vulvar lips
- **Abnormally apposed vulvar lips**
- **Windsuckers**: aspirate air into vagina during exercise or when lips of vulva separate
  - Gurgling, sucking sounds & explosive blowing sounds in severe cases
    - Especially when exercised, urination or defecation
  - Some only become windsuckers during estrus (estrogen relaxes area)



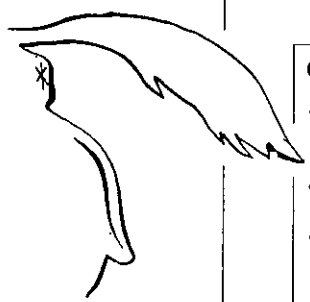
- **Hx: of infertility or FF**
- **PE: Conformation**
  - "Tipped vulva" - < 80°
- **"Windsucking"**
- Rectal palpation: air in vagina
- Speculum:
  - Inflammation & hyperemia of vagina & cervix
  - Pus in vagina

- **Caslick's surgery + sexual rest**
  2 estrous cycles after surgery
  - **Most cured in 1-6 months**
- Pneumovagina only at estrus or after parturition
  - Temporarily suture vagina closed until tone returns
    - Scarification of mucosa not necessary
- ± ABs locally & uterine infusion may shorten recovery
- Increase weight of thin mares

Prevention - preventive therapy & hygiene #1
- Proper hygienic handling of mare & stallion at breeding
- Care & hygiene at foaling
- Close observation, culture & treating mares



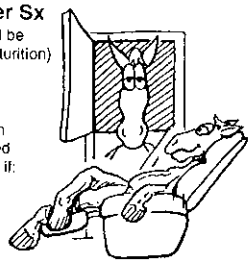
Prognosis:
- **Good** if endometrium OK & vulva kept closed, except during breeding & parturition

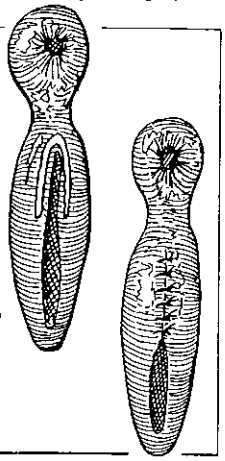


Caslick's operation - vulvar suturing R-Y 195; E 1367; M 265; S 734

- Prep: bandage tail, surgically scrub perineum, restrain mare w/ twitch & 1 leg raised (tranquilizer [xylazine or acepromazine] IV)
- **Local anesthetic** to mucocutaneous junction of labia
- **Remove a narrow strip of mucous membrane** (raised from anesthetic) of both labia from dorsal commissure to level of floor of pelvis
- **2 edges apposed** w/ single row of simple interrupted or continuous interlocking sutures
  - Leave a large enough opening to urinate
  - If bred by natural cover, leave opening large enough for intromission
- Single umbilical tape stitch at bottom for added strength
  - Remove stitches in 10 days

- **Tetanus antitoxin** to unvaccinated mares
- In well established pneumovagina - suture for life
- 7-14 d before parturition cut open vulva (anesthetize skin & cut)
  - Resuture right after parturition
- **+ Sexual rest very important after Sx**
- If infected only at foal heat & not bred most will be free of infection by 2nd heat (25-30 d after parturition)
- Don't breed on foal heat if:
  - Placenta weighs over 14 lbs
  - Foal weak, deformed, or dead
  - Abnormal discharge 1st week after parturition
  - Genital tract infected, inflamed, or traumatized
- 2-3 months sexual rest or breed following year if:
  - Dystocia
  - Severe infection & metritis



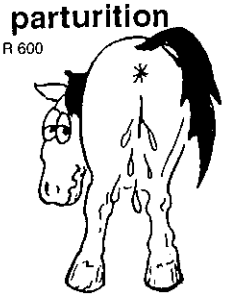


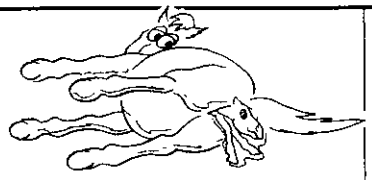
#1 Infertility
CS: Infertility
Dx: Hx, Tilted vulva
Tx: Caslick's + Rest

Infertility

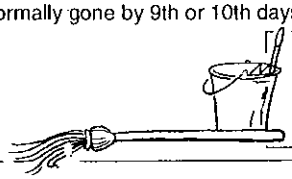
Infection from normal & pathological parturition

R 600

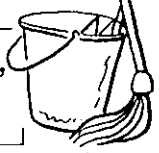




- Characterized
  - Dystocia
  - Dead or diseased foal
  - Retained placenta
  - Severe trauma
- Infertility due to:
  - Incomplete or delayed involution
  - Uterine inertia
- All mare's genital tracts infected during or just after foaling
  - Infections enters as mare rises & vagina & uterus balloons w/ air
  - Normally gone by 9th or 10th days

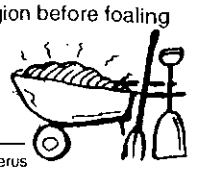


Hygiene, Hygiene, HYGEINE!!!



Prevention:

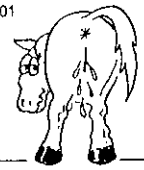
- ↓ incidence of infection
  - Careful washing & disinfecting perineal region before foaling
  - Sterile bandage on tail
  - Foal on sterile heavy rubber sheet
  - Temporarily closing vulva w/ skin clips after foaling



- Normal elimination & return to sterile uterus
  - "Leukocyte tide": massive invasion of WBCs in endometrium & lumen of uterus
  - Phagocytize infective organisms
  - ↑ Blood supply
  - ↑ Mucous production
  - Relaxation of cervix
- All of above happens any time in estrus w/ uterine infections
  - Results in release of prostaglandins, luteolysis of corpus luteum
  - Prompt onset of estrus
  - Shortened estrous cycle

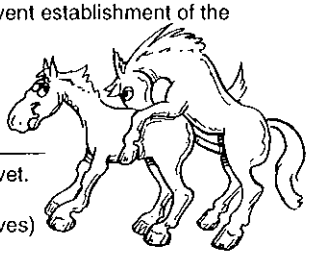
Infection from copulation

R 601



- Complication:
  - Pneumovagina which prevents normal elimination of infec. in vagina no matter what the hygiene (semen always has some organisms)
  - Normal protective mechanisms prevent establishment of the majority of these infections

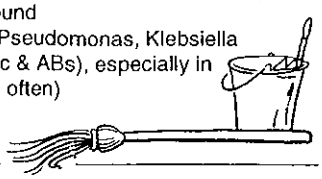
Hygiene, Hygiene, Hygiene!!!



Prevention:

- **Mare**
  - Tail wrap
  - Thorough cleaning of perineal region & buttocks (soap & water then wiped dry w/ cotton)

- **Stallion**
  - Wash penis & prepuce w/ soap & water & thoroughly rinse before & after service
- If mild antiseptic used, rinse w/ clear water & dry before service
  - Betadyne® (povidone iodine), Nolvasan® (chlorhexadine) or quaternary ammonium compound
  - Excessive frequency m/ incr. Pseudomonas, Klebsiella & *E. coli* (resistant to antiseptic & ABs), especially in stallion which is washed more often)
- **Breeding area clean, free of dust & protected from wind**



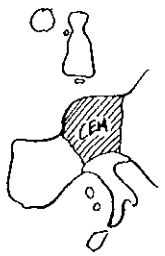
Iatrogenic infections

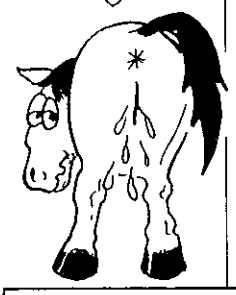
R 601

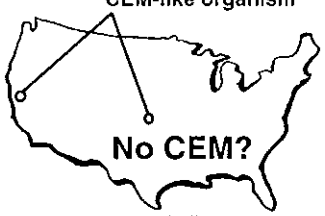
- Carelessness of owner, handlers or vet.
- Improperly sterilized instruments (speculum, douching equipment, gloves)
- Artificial insemination

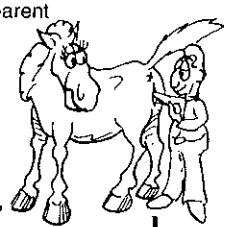
Hygiene, Hygiene, Hygiene!!!

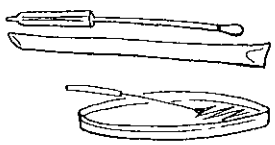
Condition	Facts/Cause	Presentation/CS	Diagnosis	Treatment
Contagious equine metritis, CEM Mk 693; IM 1397, 1414; I2M 1561; EM&S 1034; E 1338; R-Y 182; C3T 757; M 260; Pop 14-5/98, 15-4/98	• **Diz of infertility** • **No clinical CEM in USA** • Federal regulation restricts importation of horses 2 yrs old from countries w/ CEM (most of Europe & Japan) • 1975 1st case in France, 1977 to US; economic disaster • Highly contagious venereal diz • Reportable to state vet in most areas • ***Taylorella equigenitalis*** (originally *Haemophilus equigenitalis*) • Transmission: coitus, hygiene of breeding	• **Infertility, fail to conceive** • **Endometritis** - **Profuse, sticky, mucopurulent, vulvar discharge** - 2-6 d after breeding - M/b asymptomatic • **Conception rate low** (due to salpingitis, infection of mesosalpinx) (If get pregnant, very early abortions) • **Fertility regained** when subsides • **Abortion uncommon** • No CS of systemic diz • **Stallion carrier**, clinically inapparent	• **History (import, contact), CS** • **Bacterial culture** : - Mare, from clitoral sinuses & fossae, cervix if possible & any exudate - Stallion: swab of prepuce, penis, urethral fossa & sinus, distal urethra & pre-ejaculatory fluid - **Amies w/ charcoal** (or Stuart's media), refrigerated at 4° C, to lab in 24 hours • ± Blood tests in 20-30 d after breeding to allow antibodies to form • Passive hemagglutination & ELISA	• **Eradicated from USA but CEM-like organism & possibility to import** • **Report** CS of CEM or known exposure - quarantine diz • **Not difficult to treat**, susceptible to most antibiotics & disinfectants - Chlorhexidine (Nolvasan®) & nitrofurazone cream to mares & stallions - Systemic antibiotics unnecessary - **Uterine lavage** (weak Nolvasan®) - Some remove clitoris to eliminate nidus of infection (see box) - **Free carrier stallions of organism**, get rid of smegma ("bean" in urethral sinus) (regular cleaning w/ chlorhexidine [Nolvasan®] & nitrofurazone cream)

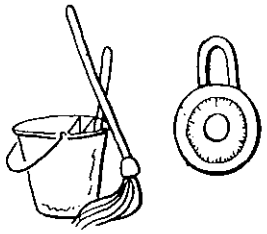












CEM like organism: found in a donkey jack in Ca. in 1997 & 1 in Ken. in 1998 & other horses on the farms of these Jacks since then.

- Considered a subspecies of CEM for now since little is known about it: cultures like CEM, contagious? can it produce diz? carrier mares & stallions?

Clitoridectomy: remove clitoris
- Xylazine sedation & restraint
- Local anesthetic around & under clitoris
- Sinusectomy & clitoridectomy
- Suture or leave open to heal
- Send tissue to lab for culture

Location of organisms
- Stallion: resides in smegma of prepuce, urethral fossa & surface of penis
- Mares: clitoral fossa
- Foals exposed at birth m/ retain infection until breeding age

Prevention of CEM & CEM-like:
- Isolate & test all horses that have been off the property
- 3 swabs > 6 d apart of breeding mares or stallion & 1st mare bred tested in 20-30 d
- Strict hygiene during breeding (disinfect equipment)
- Artificial insemination

Contagious, Eliminated in USA, New CEM type organism?
CS: Vulvar discharge, infertility (not abortion)
Dx: Culture clitoral fossa, prepuce, penis
Tx: Easily treated, Sinusectomy & clitoridectomy

Infectious Agents of Infertility

Condition	Facts/Cause	Presentation/CS	Diagnosis	Treatment
Streptococcus zooepidemicus IM 1382; I2M 1535; R 601; ER 382	• **#1 cause of infectious infertility** • **Common cause of abortion** & foal infections • **Common inhabitant** of external genitalia of mares & stallions - **Normally no diz unless resistance of mucosa lowered** • **100% of mares contaminated for 3-6 days following parturition** - Normally eliminated by 6-10 days - Others not cleared until 2nd estrus - Others chronically infected (especially if pneumovagina) • Conception possible in mild infections - But likely terminated by abortion, EED (early embryonic death), or a diseased foal • *Pseudomonas aeruginosa* infections m/ follow Factors lowering resistence • Parturition • Pneumovagina • Breeding • Old age • Lowered resistance • Wear & tear of endometrium	• **Infertility** • **Discharge from genital tract** - **Soiled perineum & tail** - **Matted hair** • Vulva m/ gap, exposing mucous membrane • Perineum m/b sunken • Thin, atrophic vulvar lips	• **CS of diz** • **Speculum** - Mucosa: congested & inflammed . Moist, blood vessels prominent & tortuous - Cervix: brick red instead of pink . Edematous, os relaxed & open - Cloudy mucopurulent exudate to yellow-white pus in vagina . M/b none or just thin exudate from cervix . Most evident at estrus due to hypersecretion of mucus • **C&S** (culture & sensitivity) • **Uterine biopsy** • DDx acute & chronic difficult - Breeding Hx - Older more likely chronic • Pyometra - uterus dilated • Mild or acute cases difficult because changes not pronounced	• **Caslick's if pneumovagina** • **Sexual rest** • ABs in oil or saline lavage - Penicillin, nitrofurazone, broad spectrum (terramycin, oxytetracycline, aureomycin, chlortetracycline, tetracycline & ampicillin) - 50-250 ml into uterine lumen - 2-5 x at 24-48 hr intervals - Preferred at estrus when natural uterine defence mechanical working **Prognosis: Usually respond to Tx in 1-2 mo** • Acute infection usually spontaneously clears unless pneumovagina • Sooner Dx & Tx'ed, better Px • Chronic severe cases m/ cause sterility • *Pseud. aeroginosa, E. coli* & Klebsiella difficult to impossible to Tx • Strep. & CEM easy to Tx • Obstructive pyometra: Poor or hopeless • Urovagina: Guarded to poor • Older barren mares w/ Hx of abortions, pyometra & infertility: Poor
#1 infectious infertility **Common cause of abortion** **Dx: CS, Speculum, C&S, biopsy** **Tx: Calsicks & rest, lavage**		**Prevention:** • Health certificate on mare required by some stallion owners - Cultural exam of cervix &/or uterus - Interpretation difficult • Clinical & histo exams m/b desirable		
***Klebsiella pneumoniae*, "Viscid rod" infection** IM 1382; I2M 1535; R 605; ER 382	• *Klebsiella pneumoniae* var genitalium (formerly Freidlander's bacillus, encapsulated genitalium, "Viscid rod" infection) • **Less common than *Strep. zooepidemicus*** • Gram negative encapsulated rod • Transmission by coitus, instruments, vet's hands • **More difficult to Tx** than Strep. or CEM • Sterility more severe than Strep. • ± **Carrier in clitoral fossa** (like CEM) • Common contamination of saw dust • Other infections ↑ inflam. response • Adhesions in cervix = pyometra	• **Infertility** • **Thick, viscid, tenacious, slimy exudate containing flocculi** - Dull-grey to yellowish-white - Estrus: profuse exudate - Soil perineum & tail, matted hair • Predisposing factors - Age of mare - Length of infection - Time of estrus cycle - Frequency of service	• **Speculum** - Vaginal & cervical mucosa - dull reddish-brown • Often 100's of ml of exudate in uterus • Rectal exam: uterus enlarged & walls thickened	• Caslick's if pneumovagina • Sexual rest • Uterine lavage: ABs in oil or saline - Streptomycin, neomycin, chloramphenicol, polymixin B sulfate, gentamicin & amikacin - 50-250 ml into uterine lumen - 2-5 x at 24-48 hr intervals - Preferred at estrum • **Clitoridectomy** **m/b necessary** **Px (prognosis)** • Chronic severe cases m/ cause sterility • *Pseudo. aeruginosa, E. coli* & Klebsiella difficult to impossible to Tx • Obstructive pyometra: poor or hopeless • Older barren mares w/ Hx of problems: poor
Pseudomonas infection IM 1382; I2M 1535; R 606	• *Pseudomonas aeruginosa* • Stallions to mares • Older mares more likely to have CS • Sporadic outbreaks by more pathogenic strains	• **Infertility** • Exudate	• Milky white exudate + flocculent material - Turns green, watery-grey or yellow-green on exposure to light	• Tx same as Klebsiella, except no clitoridectomy **Px**: Same as Klebsiella (see box)
E. coli IM 1382; I2M 1535; R 606	• M/b found on culture of cervix • Consider that m/b contaminant	• **Infertility**	• C&S (culture & sensitivity) - Consider possibility as contaminant	
Candida infection IM 1382; I2M 1535; R 606	• *Candida albicans, fungus* • Usually just contamination - Rapidly eliminated spontaneously • Serious infection following **prolonged ABs Tx** of vagina & uterus	• **Infertility** • Usually asymptomatic • M/b serious - endometritis	• Culture • Biopsy for serious endometritis - Organism w/in uterine lumen or endometrium or endometrial glands	• Nystatin (5 d) • Amphotericin B • Chlotrimazole uterine infusion every 3rd d for 3-4 treatments (human product - suppository inserted into uterus)

Infertility

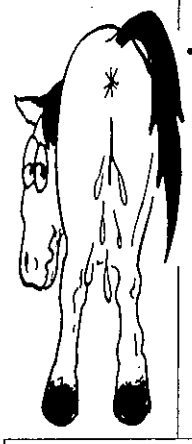
REPRODUCTIVE SYSTEM

Condition	Facts/Cause	Presentation/CS	Diagnosis	Treatment

Uterine infection

Endometritis, Metritis, Pyometra

IM 1382, I2M 1535; T 71, 718, 730; R 607; R-Y 161, 179; EM&S 1033; 1036,1065; E 1332, 1340; M 262; C4T 517

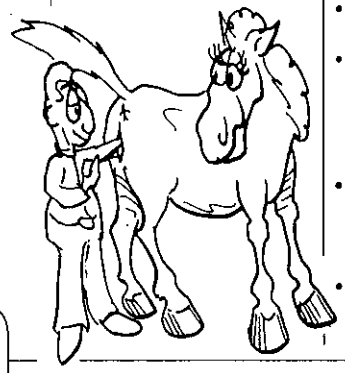


"Windsucking"

- Pathophysiology:
  - **Barriers** to infec. of endometrial cavity (uterus)
  - Vulva & vestibular sphincters **& cervix**
  - Parturition breaches all borders, also service, AI, examination, or defect in a barrier (pneumovagina)
  - **Bacteria usually transient & eliminated** during puerperium (period of confinement after labor)
  - **Estrogen** ↓ phagocytosis (PMNs & monocytes)
  - **Prostaglandins** cause luteolysis of CL
  - Prompt estrus w/ short estrous cycle
- **Involution of uterus**
  - Normally occurs by 10-15 d (before that can't be safely retracted)
  - **Fluid abnormal after 14-18 d**
  - Involution & repair in 40-50 d
- **Predisposing factors**
  - Abortion
  - Concurrent systemic diz
  - Malnutrition
  - Dystocia & manipulation

Causes:
- **"Windsucking"**
- **Abnormal parturition**
- **Service**
- **Gross contamination**

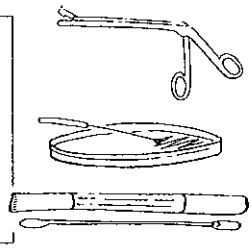
- **Infertility after mating**



- **To establish Dx of infection**
  1. Clinical signs or diz
  2. Culture organisms
  3. Uterine biopsy

- **Speculum exam**
  - Exudate
  - Mucosal color of vagina & cervix
  - Conformation of cervix
- Routine C&S (culture & sensitivity) of suspicious & infected mares & stallions
- **Culture mare**
  - **Protected culture swab** (Tiegland®)
  - Smear a sterile glass slide
  - . Amies transport medium
  - **Exudate in vagina to lab**
- **Cytology or biopsy & histology exam**
  - Endometritis
  - Organisms in lumen of vagina, endometrium or endometrial glands
- **If culture positive & no histo. evidence of diz, consider culture contaminated**

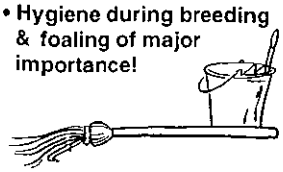
Organism
- **ß-hemolytic Streptococci** (*S. zooepidemicus* & *S. equisimilis*)
- *E. coli, Pseudomonas aeruginosa* & *Klebsiella pneumoniae*
- **CEM** - ***Taylorella equigenitalis***
- **Contaminants** - Alpha hemolytic Strep, Proteus, Citrobacter spp.



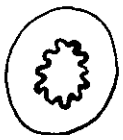
- **Caslick's operation (#1) + Sexual rest m/b enough**
- **Uterine lavage** (remove fluids & toxic products)
  - Physical removal of uterine contents m/b critical, douching & siphoning
- Stilbesterol or estradiol (IM m/b useful)
- Mild exercise m/ help involution
- Parenteral ABs of little value unless systemic diz

After Tx:
- Bacteriological & cytological or histopathological exams to see when to breed

Prevention:
- **Hygiene during breeding & foaling of major importance!**



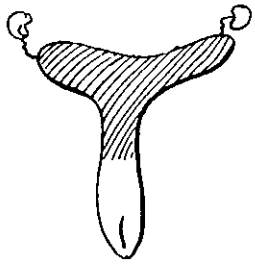
Endometritis



100% after service, Usually cleared

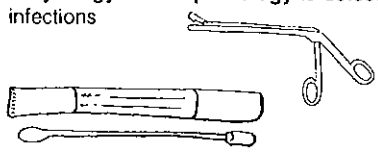
- **Inflammation of endometrium**
  - **Infertility due to hostile environment** to sperm & egg
- **100%** have some degree of inflammation after service or parturition
  - Mild/severe, acute/subacute/chronic
- **Normally healthy mare**
  - **Usually clears in 3 or 4-15 d**
  - If 2° infection (Pseudomonas) m/b several estrous cycles to clear
  - Cleared by defense mech. of uterus
- **Older barren mares**
  - Defense mechanism defective
    - . Few PMNs & phagocytosis of bact.
    - . M/ not clear - chronic infection

- Asymptomatic usually clears spontaneously
- **Infertility after mating** (temporary or chronic)
- Intermittent or continous vaginal discharge



- **Young healthy mare**
  - Speculum: edema & relaxation of cervix
  - . **Flocculent pus in cranial vagina**
  - Rectal exam: varying uterine distention & turgidity & edema

- Older barren mare
  - Speculum: no noticable changes in cervix
  - . Creamy colored exudate in uterine lumen
- Rectal palpation
  - No enlargement of uterus
- Culture less than 50% positive
- ± **Cytology & histopathology** to detect infections



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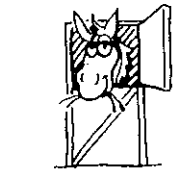
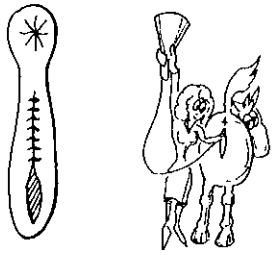




Metritis & Pyometra

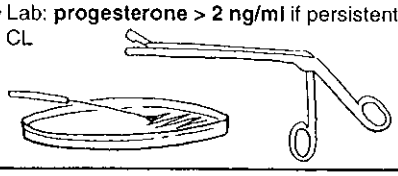
Infertility after mating

- **Metritis: inflamation of mucosa, muscularis & endometrium**
- **Pyometra**: accumulation of pus in uterus
- Pathophysiology:
  - Mild to severe metritis: permanent pathological changes to uterine wall (severe)
  - Pyometra - rare: fluid abnormal in uterus after 14-18 d
    - . Mucoid to inspissated or cheesy
    - . Opened or closed (cervical adhesions)
    - . M/b associated w/ persistent CL (endometrium doesn't release PGs)
  - **M/b incurably sterile**

- **Metritis**
  - **Discharge** from genital tract (several gallons m/b)
  - **Septic metritis**
    - . Fever, depression
    - . Anorexia
    - . Laminitis
- **Pyometra**
  - **Few clinical signs**
  - **Anestrus** main complaint (persistent CL)
  - ± Vaginal discharge
- Sequelae:
  - Peritonitis
  - Laminitis

- Speculum: m or m/not be pus in cranial vagina (closed or open)

- Rectal palpation
  - Palpate fluid (lochia or pus in uterus)
  - Friable & swollen uterus (be careful)
- Cultures: don't support or deny Dx (contamination problem)
- Biopsy: uterus
  - Degenerative & proliferative changes
  - Abscesses of uterine glands
  - Varying destruction of endometrium
- Lab: **progesterone > 2 ng/ml** if persistent CL



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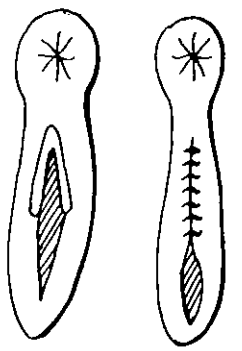


Infertility

REPRODUCTIVE SYSTEM

Condition	Facts/Cause	Presentation/CS	Diagnosis	Treatment
Cervicitis, **Cervical lacetations** I2M 1545; C4T 516, 515; R 609; ER 404; T 660	• Adhesions rarely close cervix - Pyometra & uterine abscesses m/ develop if they do • **Laceration & scarring of cervix** - Chronic cervicitis & patency (allows infection in) . Recurring infection & early embryonic death (EED) . Endometritis . Permanent sterility	• **Infertility** • Lacerations - Early embryonic death (EED) - Endometritis - Sterility	• **Speculum** - Mucosa of external os congested & dark red to purple - Edematous, pendulous & dilated - Rarely cystic glands & m/b abscesses - Fibrosis	• Laceration & patency - Sx repair a month after foaling in diestrus - Purse string suture to close cervix . Must be removed before foaling . Usually necessary to replace after foaling
Vaginitis & Vulvitis M8k 1034; Mk 701; IM 1394; I2M 1546; C4T 514, 516; EM&S 1057; E 1338; T 660 ***	• **Common** • **More resistant than cervix & uterus** • **Usually spontaneously clears** • **Endometritis usually accompanied by vaginitis** • Bacteria nonspecific (*A. pyogenes, E. coli*, Staphylococci & Streptococci) • **Fertility usually not compromised** as apposed to uterine infec.	• **Moderate discharge - mucopurulent** • **Congestion & edema of vagina** • Tenesmus • Anorexia **Causes:** • **Windsucking** • Breeding • Parturition • Exam • **Trauma** • **Rectovaginal fistula** • Relief of dystocia	• **PE (physical exam)** - **Congestion & edema of vagina** - **Mucopurulent discharge** **DDx:** • Vaginal discharge - Retained fetus - Rabies (pg 271)	• **Mild, spontaneously recover** • Lavage of vagina (dilute aqueous antiseptics) • Epidural (if tenesmus & aspiration of air) • **Caslick's** (prevent aspiration of air m/b)
Vaginal varicose veins C4T 514	• Frequently observed during vaginoscope exam of older mares • CS: vaginal bleeding • Tx: Usually none required			**Px** (prognosis) • **Good** - mild • Necrotic - m/b fatal
Coital exanthema, ** **Genital horse pox** M8k 1008; IM 1395; I2M 1547; C4T 513; R 618, 805; EM&S 1058; E 1339; M 273; Pop 39-9/97	• Acute mild disease • **Herpesvirus** (EHV-3) • Venereal contact (transm.) • Uncommon in USA • **No effect on fertility** • No abortion	• **Papules, pustules to ulcers** (crusts & scabs) - Vestibular mucosa, vulvar skin & perineum - Penis & prepuce of stallions - Occasionally lips, external nares, • **No systemic CS** (fever, anorexia) • M/ pass unnoticed • **Heals in 14-20 d** **- Depigmented spots** • 2° bacteria - mucopurulent discharge & systemic CS	• **Lesions** • **Depigmented spots** • **Intranuclear inclusion bodies** in cells from scrapings	• **Spontaneous recovery** • **No Tx required** • Astringent lotions & antiseptic creams • Sexual rest until resolved (3-4 weeks) • Mares usually bred next estrus Prevention: • No vaccine • Hygiene (stops spread)
Persistent hymen IM 1396; I2M 1548; ER 411	• **Imperforate or persistent hymen** (at vaginovestibular junction) • **Maiden mares**	• **Hemorrhage** from vulva following 1st mating • Seen on vaginal exam	• Speculum exam	• **Gentle manual rupture** (thin membrane) or incision (thick) Prognosis: • **Excellent** - no effect on reproduction
Clitoral hypertrophy IM 1396; I2M 1548	• Side effect of anabolic steroids (persists after Tx stopped) • Pseudohermaphrodites - clitoral enlargement			
Dourine, Trypanosomiasis M8k 35; Mk 81; IM 1420; I2M 1548; R 618; M 273 *	• *Trypanosoma equiperdum*, a protozoa • Transmitted by coitus, only in horses, so no reservoir of infection - IP 1-8 weeks - Infected horses are spreaders • **Eradicated in USA** • **Reportable disease** • Mortality 50-75% • Subtropical & tropical areas	• Early symptoms: - Female: . Swelling of vulva & vagina . Frequent urination & tail switching . Mucous discharge containing trypanosomes - Stallion: . Swelling & reddening of penis, prepuce & scrotum . Paraphimosis m/b (retracted swollen prepuce, causing swollen glans) . Mucopurulent urethral discharge • Followed by: - "Dollar" plaques in skin over body, appear suddenly & disappear in hrs-ds & replaced by others - Depigmentation of vulva, penis & prepuce • Irregular periods of fever • Paralysis of facial mm., limbs & penis gradually • Emaciation - death	• ID organisms in vaginal discharge • Serology (complement fixation)	• **Reportable diz** • **Euthanasia mandatory** • Medically: expensive & impractical as results are poor (quinapyramine sulfate) Prognosis: poor

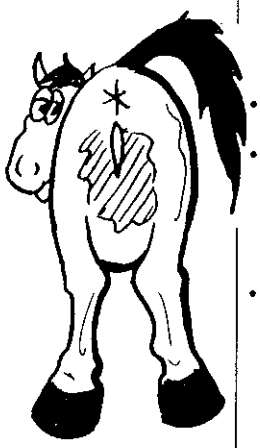
Pustules
No effect on fertility

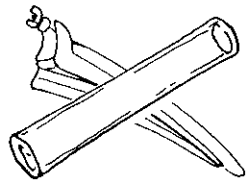
Fertility OK
CS: Discharge
Tx: Caslick's

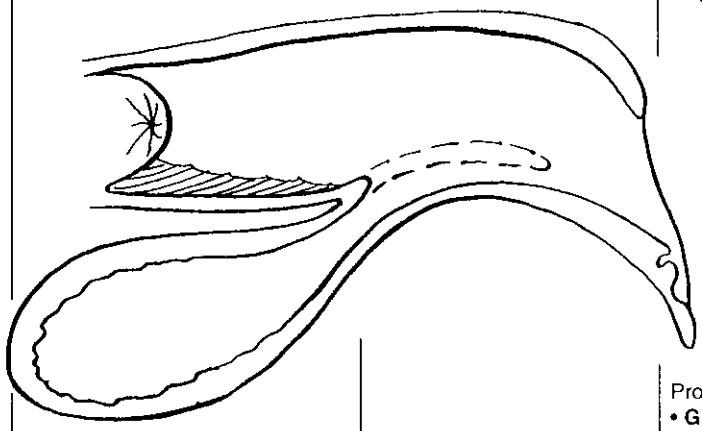
Eradicated in USA
Tx: Reportable, Euthanise

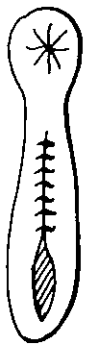
Infertility

Condition	Facts/Cause	Presentation/CS	Diagnosis	Treatment
Urine pooling, Urovagina IM 1393; I2M 1546; C4T 514; T 660; ER 420; R-Y 199; EM&S 1045; M 265; S 739; T&W 199; T&W-A 352	• **Urine accumulation in cranial vagina** • Irritates cervix & endometrium • **Abnormal cranioventral slope of vagina** (loss of normal caudoventral slope) - Urethral orifice at junction of vestibule & vagina - Urine refluxes from vestibule into cranial vagina where it pools - Leads to vaginitis, cervicitis, & endometritis - ↓ Conception • **Old, thin, multiparous mares** commonly • Abnormal perineal conformation due to stretching of ligaments & muscles - Also predisposes to windsucking . Caslick's correction of pneumovagina m/ contribute to urine pooling • M/b sequel to obstetric trauma	• **Urine dripping from vulva** - M/b intermittent or only during estrus • **Urine scalding on medial thighs** • **History of infertility**	• **CS** - urine dripping, thigh scald • **Sunken anus & dorsal vulva** • **Speculum** - urine in cranial vagina - Best done during estrus when more likely to pool - Repeat exam to see if chronic problem	• **Surgical correction** (see box) - Urethral extension . Pulling hymen caudally to make a separate channel for urine - 2 surgical procedures . Both pull transverse fold back to make a tunnel for urine to flow out - **Caslick's** • **Protectants** (zinc oxide ointment) for urine scalds









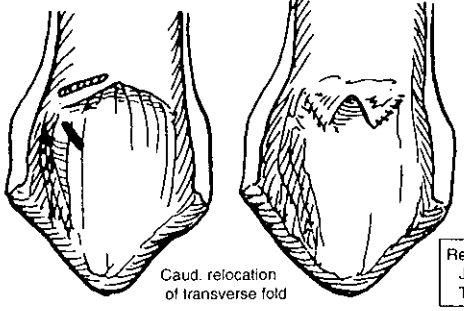
Old, thin mares; Slope of vagina
CS: Urine dripping, Infertility
Dx: CS, PE, Speculum
Tx: Sx, Protectants

Prognosis:
• **Guarded to fair** depending on damage & success of surgery

Two Surgical Procedures

Preop for both:
- Ace promazine (tranquilizer), Stocks
- Antibiotics, NSAIDs & tetanus immunization prior to Sx
- Epidural (xylazine (less hindlimb ataxia) or lidocaine)
- Wrap tail & tie overhead, evacuate rectum, scrub perineum (Novalsan®)
- If still sensitive after 20-30 min give systemic xylazine, butorphanol tartrate (Torbugesic®) & local
  - Local 50 ml of 2% lidocaine squirted into vestibule & manually distributed
- Balfour retractors or stay sutures to open vulva
- Catheter in urethra can be used as a guide; remove at end of Sx

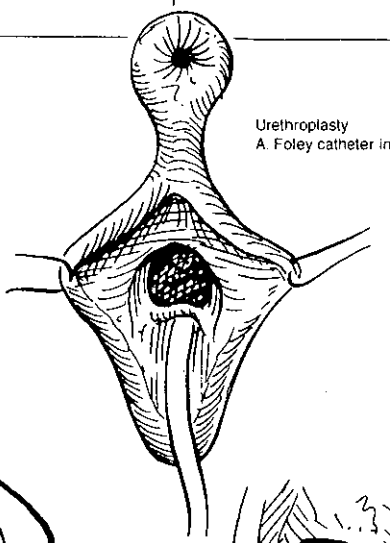
1 • Caudal relocation of transverse fold
(for mild cases) S 737; T&W 196
- Grab transverse fold, pull over urethral orifice
- Trim edge of transverse fold
- Match wounded edge to vestibular wall
- Incise into right & left vestibular wall to match incision on transverse fold
- Suture transverse incision to wall incisions
- Easier than urethral extension



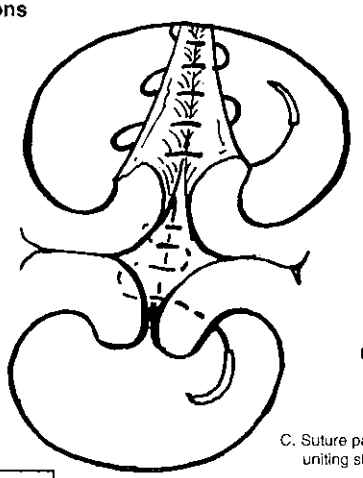
Caud. relocation of transverse fold

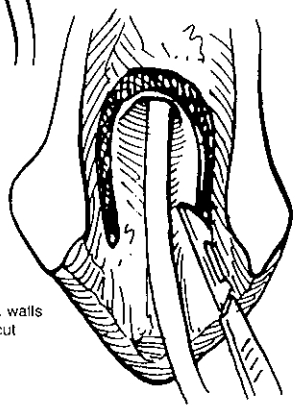
2 • Urethroplasty - Urethral extension Sx
E 1370; T&W-A 352; S 738
- Split transverse fold (hymen) horizontally into ventral & dorsal mucosal shelves
- Continued incision along right & left walls of vestibule to 1" from vulva (2/3rd way down)
- Dissect ventral & dorsal to make 4 mucosal shelves (sufficient so you can bring rt. & lt. shelves together)
- Make 2 cavities out of the vestibule (bottom one for urethra)
  - Suture together the 2 bottom mucosae
  . Continuous horizontal mattress suture from midpoint of transverse fold
  - Repeat for the 2 dorsal mucosae

Caslick's performed to close dorsal vulvar cleft in both operations



Urethroplasty
A. Foley catheter in urethra



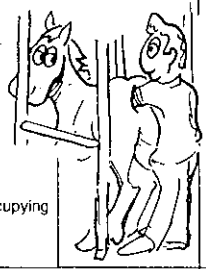
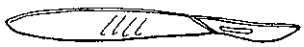
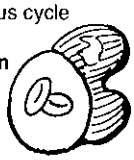
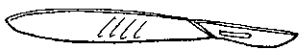


B. Hymen & lat. walls of vestibule cut

C. Suture patterns uniting shelves

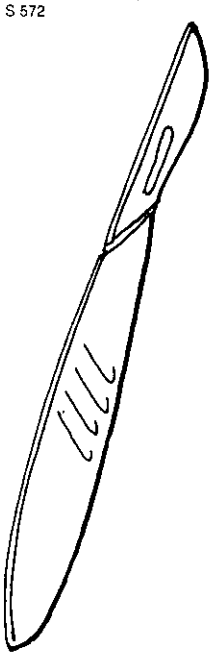
Redrawn from Tom McCracken's & John Daugherty's illustrations in Turner & McIlwraith's surgery books

Infertility — REPRODUCTIVE SYSTEM

Condition	Facts/Cause	Presentation/CS	Diagnosis	Treatment
Granulosa theca cell tumor, **Ovarian neoplasms** IM 1375; I2M 1531; R 620; R-Y 170; ER 399; EM&S 1025; E 1341; T 658, 769; M 264 *** 	• **#1 ovarian tumor**, commonly occurs • Unilateral & benign usually (m/b malignant) • **Adults >>> young** • Secretes steroids which suppress gonadotrophin secretion so follicles don't develop in norm. ovary, atrophies - **Won't cycle** until tumor removed • Originates from follicular cell type • M/ have foaled & mare doesn't cycle, anestrus • Causes endocrine disturbances, estrogen, progesterone, testosterone • Other ovarian tumors (see box)	• **Sexual behavioral changes** • **Anestrus or irregular/persistent estrus (nymphomania)** • **Virilism** (acts like stallion, heavy neck, mounts) • **Infertility until removed** • Abdominal discomfort 	• **Rectal palpation** - 1 large multicystic ovary - **Atrophy of other ovary** • History, CS • **Peripheral testosterone** usually > 50 pg/ml (normal in nonpregnant < 50). Pregnant mares also > 50, so not specific Dx - > 100 pg/ml assoc w/ virilism • **Ultrasound** 	• **Surgical removal TOC** for all ovarian tumors  Prognosis: • **Good**: most return to normal fertility by next breeding season after Sx. Some may take up to 1 year **DDx:** • Other ovarian neoplasms • Ovarian hematomas • Ovarian abscesses Stallion behavior • Excessive anabolic steroids • Testicular feminization • Normal pregnant mares • Pseudohemaphroditism
		Other ovarian neoplasms: • Arrhenoblastoma - originates from endothelial cell type - Endocrine disturbances (estrogen & testosterone produced) - Behavior: virilizing (stallion behavior) - infertility • Cystadenoma - From surface epithelium & primary sex cords - Nonsteroid secreting - Cycle normally w/ normal fertility, m/b pregnant, just space occupying - Ultrasound shows no stroma • Teratoma: uncommon & difficult to diagnose		
#1 Ovarian tumor **CS: Anestrus or nympho, Virilism, Infertile** **Dx: Rectal, > Testosterone** **Tx: Sx remove. Px: good**				
Ovarian hematoma IM 1376; I2M 1531; C4T 529; ER 401; R-Y 171; EM&S 1024; T 659; M 263; Pop 71-7/98	• **Excessive hemorrhage following ovulation** • May be up to 12" in diameter • No effect on reproduction • Hemorrhage confined because ovulation inside ovary	• **None**, normal estrous cycle - Continue to cycle • **Found on palpation** • **No behavioral changes** 	• **Rectal palpation** - **1 enlarged ovary, 1 norm.** - Feels similar to ovarian tumor - Regresses, tumor enlarges • Lab normal • **Ultrasound** 	• **None, slowly regresses** - Does not alter cyclic activity - No effect on reproduction **DDx:** Ovarian tumor
Cystic follicles * M8k 1005; C4T 531	• May occur more common in dairy cattle • Doesn't alter cyclic activity • M/ interfere w/ movement of ova into uterine tube	• **None**: doesn't effect estrus or fertility	• **Palpation** • **Ultrasound**	• Aspiration, surgical removal 
Ovaritis R 609 • Very rare in mare *				

Ovariectomy, Colpotomy

Eq S 707; T 773, 769; ER 450; EM&S 1-22; E 1372; T&W-A 346; S 572

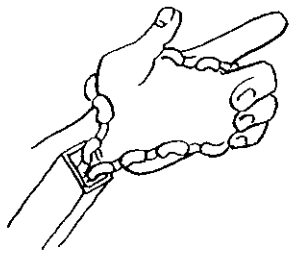


- Surgical procedure, not a disease
- Indications:
  - **Temperamental mares**, espesially in working horses, people prefer steady performance
  - . Elective ovariectomy
  - Pathology, granulosa cell tumor (nymphomania)
- **1) Ventral abdomen** approach
- **2) Flank** approach
- **3) Vagina** (colpotomy) approach
  - Standing (flank or vagina) requires a tractable mare because must remain still during procedure
  - Ecraseur also required as ligation very difficult to impossible in vaginal approach
  - Ovary must be < 4" for vaginal & 5" for flank
  - Cost of standing less than abdominal because of general anesthesia
  - Not if reproductive tract infection or introduce into the peritoneal cavity
  - Stocks almost essential
  - Recovery time
    - . Colpotomy - 2 wk
    - . Grid flank - 3 wk
    - . Incision flank - 4-6 wk
    - . Ventral midline - 6-12 wk
- Vaginal (colpotomy)

Temperamental mares
Through vagina, flank or ventral abdomen

Colpotomy most common method

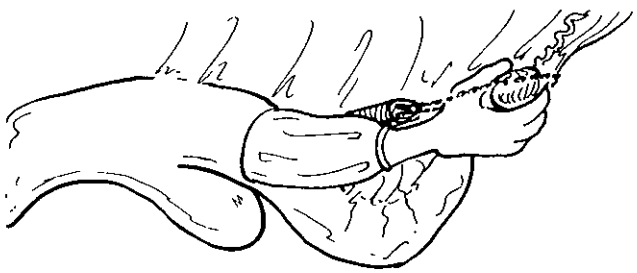
- Complication: ileus post op
- Colic secondary to ileus
- Mineral oil prior to surgery, to remove fecal balls which feel like ovaries
- Hold off feed 24-48 hours
- **Restrain in stocks** to minimize movement
  - Xylazine (0.8 - 1.0 mg/kg)
  - Caudal epidural- 5 ml mepivacaine (Carbocaine-V®)
  - Twitch before vaginal incision & maintain throughout surgery
- Clean out vagina w/ dilute Betadine®
- Pre-op antibiotics
- **Stab incise** through dorsal right or left hand wall of vagina, 1 inch from cervix
  - Bluntly open stab incision w/ fingers until hand in peritoneal cavity
- Locate ovaries by following uterine horns (prevents taking out a fecal ball, bad mistake!)
  - Infuse mepivacaine around ovary (sponge & polyethylene tube)



- **Ecraseur** over hand into abdomen (done completely blind)
  - Twitch horse
  - Grasp ovary & close chain over ovarian pedicle (mesovarium)
  - Controversy over slowly or quickly tightening chain to remove ovary
- **Don't suture vaginal incision** (heals by 2nd intention)
- **Postop care**:
  - Cross ties post surgery for 1 wk (controversial, but may prevent evisceration while getting up)
  - Stall rest for 5 days & m/b controlled walking
  - Feed 5 hr after surgery
  - Light riding in 7 days, full training 14 days

Standing flank approach:

- Stocks, xylazine, morphine & twitch used
- Grid incision or vertical incision approach used
- Ecraseur or ligation on ovarian pedicle



Infertility

Condition	Facts/Cause	Presentation/CS	Diagnosis	Treatment
Fossa cysts R 620	• **Germinal inclusion cysts** • Peritoneal fragments that become embedded in ovary following ovulation • May interfere with ovum transport in older mares, otherwise no effect on fertility			
Parovarian cysts R 621	• Common in mare • Fimbrial cysts (hydatids of Morgagni) too small to palpate • Larger cysts from remnants of the mesonephric or paramesonephric ducts in mesovarium near ovary • Epoophoron: cystic remnant of mesonephos (1/4-1") in ovarian capsule • **Cysts have no effect on fertility**			
Ovarian hypoplasia/gonadal dysgenesis w/ chromosomal abnormalities M8k 988; I2M 1529; R 621	• **Associated w/ infertility** • Chromosomal abnormalities - Most common 63, XO karyotype (similar to women w/ Turner's syndrome) . No germ cells in ovary, no sex chromation or Barr bodies • **Usually sterile**	• Phenotypic small to normal-sized mare • Absence of estrous cycle or occasional passive estrus	• Rectal palpation - Small to very small ovaries **(bilateral)** - Small flaccid uterus, flaccid cervix w/ open os • **Cytogenetic detection**	• **Cytogenetic detection to save expense since most sterile** **DDx:** • Granulosa-theca cell tumor (unilateral small ovary)
Salpingitis I2M 1532; R 609, 621, EM&S 1029 ★	• Inflammation of uterine tube • **Rare in mare** • Enlarged uterine tube never found on rectal exam			
Tumors of uterus, cervix, vagina IM 1390; I2M 1548; R 621 ★	• Uterine, cervical or vaginal tumors - Leiomyomas (usually small, 1-2") - Rare tumors - fibromas, rhabdomyosarcomas & carcinomas • Px - Poor generally			
Tumors of vulva IM 1396; I2M 1548; R 621	• **Black horse** **- Melanomas** • **White horses** **- Squamous cell carcinomas** • Perineum anus & vulva	• **Tumor on vulva**	• **Hx, CS, Hx** • **Biopsy**	• Surgical excision

Lymphangiectasis of uterus, Endometrial cysts
IM 1390; R 622; C4T 522

- Lymphangiectasis of myometrium or lymphatic lacunae
  - M/b cystic endometrial hyperplasia
- **Lymph stasis**
- **Older mares**
- Cause uncertain: cysts & lacunae arise following interference w/ lymph drainage

Lymph stasis, Older mares - normal
CS: Sterility
Dx: Rectal, US, biopsy
Tx: Massage, infusion & breed. Px: poor

- Cycle normally
- **Infertile/sterility**
- **May mimic pregnancy** (rectal exam & ultrasound)

- Rectal exam
  - **Uterus large & endematous**
  - Large fluid-filled cysts
- Biopsy: lymphatic lacunae
- **Ultrasound - transrectal: endometrial cysts**
- PM (postmortem):
  - "Jelly" uterus (flaccid, edematous, thick, doughy or spongy uterine wall)
  - Submucosal cyst m/ bulge into uterine lumen

DDx
- Pregnancy (remain static, amniotic vessel enlarges)

- **No Tx required unless suspect effect fertility**
- Uterine massage & hot saline infusion & breed
  - Present mares for service at earliest opportunity
- Prostaglandins if Hi progesterone from persistent CL

Prognosis: **poor**

Prevention: none since part of aging process

Segmental aplasia R 622 ★	• Rare (uterus)	
Cysts of Gartner's duct R 622 ★	• Cyst of remnant of mesonephric or Wolffian duct in floor of vagina • Rare	
Hermaphroditism R 623 ★	• Occasionally described • Mare w/ large protruding clitoris & irregular sexual symptoms	

Pseudo-hemaphroditism
IM 1391; I2M 1034t, 327; EM&S 1040

- **Male (XY) genotype**
- **Looks like female**
- **Acts like male**
- Androgen insensitivity (no androgen receptors) so male sexual organs don't develop

Male (XY) genotype, Female genitalia
Cs: Sterility
Dx: Cytogenetic detection
Tx: None. Px: hopeless for repro

- **Female external genitalia & mammary gland**
- **Displays stallion behavior**

- **Cytogenetic detection**
- Rectal palpation:
  - Only tubular organ: vagina, no cervix or uterine horns
  - Gonads in ovarian position, but are testicles
  - No male accessory sex glands

DDx:
- Stallion behavior, but mare genitalia
  - Prolonged Tx w/ anabolic steroids
  - Granulosa cell tumors

- **No Tx**
- Cytogenetic detection to save expense of trying to get pregnant, since sterile

No Tx

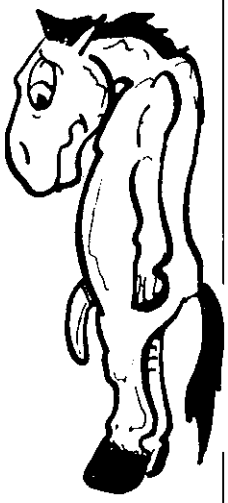
Prognosis:
- **Hopeless for repro** - sterile

Infertility in stallion

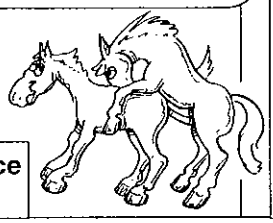
Condition	Facts/Cause	Presentation/CS	Diagnosis	Treatment
Stallion Nutritional infertility R 788, 782 R-Y 16	• **#1= underfeeding** • No specific nutrition for reproduction - If balanced ration (same as for nonpregnant mare) usually no problems - Special reproduction feeding rations of questionable value or necessity • Keep in good physical shape & not overweight • Vitamins seldom cause of infertility - Good quality roughage supplies vitamins - Vit. A deficiency m/ cause cessation of spermatogenesis • Mineral defc are rare **Underfeeding - ↓ Libido**	• Low plane of nutrition common - **Thin**, emaciated semistarved - **Reduced sex drive** - Atrophy of testes - Loss of sexual desire - Delayed puberty • High plane of nutrition - Obese & lazy - Doesn't affect spermatogenesis - Not proved to affect libido - M/b joint problems	• Low plane of nutrition - Thin, emaciated - ↓ in spermatozoa/ ejaculate • High plane of nutrition - Obese & lazy - Doesn't affect spermatogenesis	• **Good plane of nutrition** - Good quality roughage - Good pasture - Properly balanced for CHOs, protein, minerals & vitamins • Keep in good physical shape & not overweight • Exercise • Routine vaccinations • Sunlight • Parasite control
Stallion - Hormonal infertility R 784	• **No hormonal infertility responds uniformly to endocrine therapy** - Thus hormonal Tx seldom indicated for lowered fertility or impotency, usually disappointing or questionable - Do not just give testosterone or thyroid product or gonadotropin hormones w/o good Hx & clinical work up • Hypothyroidism: not proven, but obese, lethargic animals fed iodinated casein or thyroid hormone injection have lost weight & improved libido • Testosterone or anabolic steroids adversely effect reproduction (libido & spermatogenesis) in adult - M/ hasten sexual maturity & drive in young male			
Viciousness, Aggressive behavior R 777; EM&S 887	• Aggressive behavior normal • **Excessive aggression undesirable & dangerous** - Dominance aggression - Irritable aggression - Self mutilation • Confinement & ill treatment **Dangerous - Difficult to break**	• **Aggression towards mare & handler** • Self mutilation (boredom)	• Clinical signs, History **Prognosis:** • Once vicious difficult to break behavior (retrain) • **Short-term progestin Tx** (suppresses sexual aggression & antispermatogenic) - Use early in retraining of aggressive stallions	**Prevention:** • Proper handling from a young age - Regular daily handling, firm training & exercise • Do not tease confined animal
Stallion- Masturbation, Onanism R 776; ER 818	• Occurs in all species • Erection common, but masturbation w/ ejaculation not • **No effect on fertility or libido** • Declines if used for service frequently & regularly • Thought to have detrimental effect on performance of racing horses • Causes: **boredom & pleasure** - M/b accumulation of smegma causing irritation **No effect on fertility** **Boredom - So Exercise!** **Antimasturbation devices**	• **"Wack" penis repeatedly against ventral abdomen** • **Loss of libido rare**	• Visualization **Antimasturbation devices** • Stallion (Man-of-War) shield or wire brush suspended just in front of prepuce • "Bird cage" device over glans • Stallion rings: plastic or adhesive tape ring applied just behind glans to prevent erection - Remove & clean penis once a wk & before service or irritation - Cruel & unusual punishment - M/ cause urethral hemorrhoids & hemospermia	• Exercise • Provide company of pregnant mares • Devices (see box)
Systemic disease infertility R 788 **↓ Libido Tx cause**	• **Any chronic or acute severe debilitating diz m/ cause ↓ in libido** Causes: • Enteritis • Pneumonia • Advanced cancer • Peritonitis • Anaplasmosis • Parasitism, pediculosis, mange • Tuberculosis • Paratuberculosis	• **Rapid or prolonged loss of weight** • Anorexia • Depression • Weakness • **Decreased libido**	• Dx should be done early	• **Prompt Tx to reduce loss of reproductive ability**
Age infertility R 789	• Young & very old m/ have reduced libido due to complete lack of sexual drive			

Infertility - Stallion

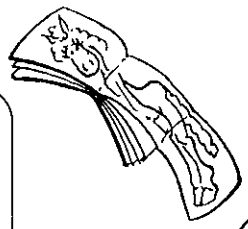
Condition	Facts/Cause	Presentation/CS	Diagnosis	Treatment
Impotency, Psychic, **Impotentia coeundi** IM 1432; I2M 1575; R 786-789; R-Y 20	• Lack of desire & inability to copulate • **Potency** (ability to erect, mount & ejaculate) • **Impotency**: - Seen in all species including man - Varies from complete dysfunction to slowness to exhibit libido, mount & ejaculate	• No intromission - **Indifference to mare,** or - **Excessive aggression to mare or handler**	• Breeding history • Thorough physical exam • Careful & repeated observation during coitus • Determine capacity of stallion	• **Patience & understanding** • **Long periods or sexual rest** (allow to forget) • Proper nutrition • Sufficient exercise • Tx chronic diz states (parasitism) • Don't overuse - Prolonged sexual rest if overused • **Make coitus a pleasurable experience** m/ help slow breeder (see box) • Hormonal Tx of questionable value (testosterone) - Iodinated casein feed to obese, lethargic males m/ help (if hypothyroid) • **Diazepam** (Valium®) 10 min before breeding m/b effective (↓ anxiety)

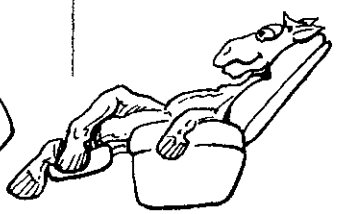


Causes of impotency
- Genetically lower sex drive
- **Traumatic/negative experience w/ copulation**
- **Excessive discipline** or chastisement during copulation
- **Excessive breeding**
- **Sexual inhibition (management)**
  - Inadequate socialization, isolation or
  - All male groups
    . Homosexual behavior common
    . Intimidated weak males
- Decrease confidence

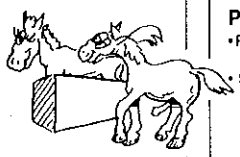


Negative sexual experience
Patience - Make sex fun!





Turn stallion on to coitus
- Training, handling & management important to libido
  - Socialize young w/ mares
- Careful, patient, quiet training (artificial vagina)
  - Teach them to associate sex w/ pleasure not pain for better results
    . Proper restraint & handling of service so stallion has confidence
    . Proper footing & room
    . Encourage & compliment (feed the ego)
- Problem stallions:
  - Change breeding site m/b positive or negative
  - Sexually desirable mares in strong estrus
  - Allow stallion to pick mare of his fancy
  - Frequent changes of mounts
  - Longer periods of "teasing"
    . Some won't copulate w/ well scrubbed & tail bandaged mares
  - Artificial vagina In hands of experienced handler
    . Estrus mare standing next to phantom
  - Run in pasture w/ quiet nonpregnant female (sex therapist)



Prognosis:
- **Impotency guarded to poor**
- M/b permanent in young stallion
- Older usually respond to sexual rest

Psychic behavior:
- Female behavior is uncomplicated (willingness to be mounted)
- Stallion behavior more complicated (identification, courting, teasing, producing an erection & complicated mechanics of copulation)
  - Controlled by **CNS** & testosterone
    . Don't mess w/ minds, sensitive male sexual egos
  - Little correlation betw. blood levels or testosterone, libido & sperm quality or quantity

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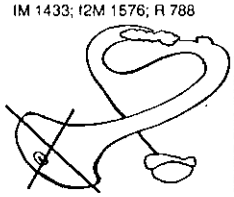
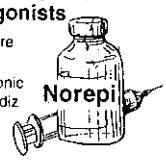
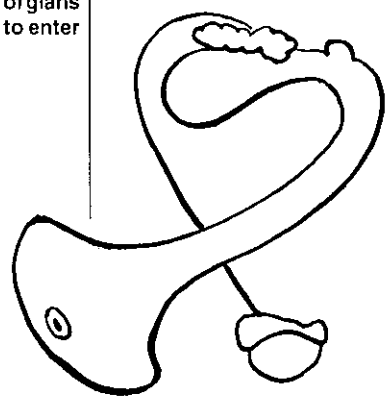
Ejaculatory dysfunction IM 1433; I2M 1576; R 788	• **Psychogenic disorders** - Environmental factors - Abusive handling - Breeding accidents - Sexual overuse • **Damage to dorsal nerve of penis** • **Insufficient penile friction**	• **Intromission w/o ejaculation** - Won't "flag" tail - No "pulsations" of penile urethra (palpate) - Not content & relaxed after service - No "belling" or "flowering" of glans following erection (necessary for ejaculation) • Frustration	• Intromission, but no ejaculation - No spermatozoa in "tail-end" sample of ejaculate collected as stallion dismounts	• **Provide ideal breeding environment** **- Patience & encouragement** • Drugs: **- Alpha-adrenergic agonists** **. L-Norepinephrine** 15 min before breeding (induce contraction of muscles around ductus deferens & accessory sex glands) **- ß adrenergic antagonists** **. Carzolol** 10 min before breeding .. Contraindicated in chronic obstructive pulmonary diz

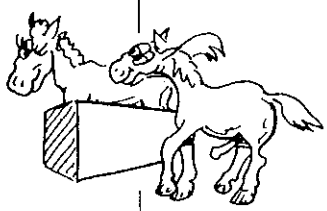


No "flowering" - Patience

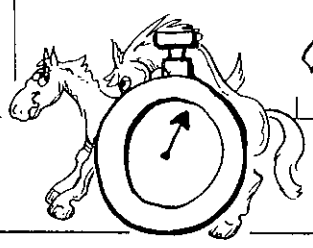


Premature erection R 807	• **Full erection before intromission** - **"Flowering" or "belling" of glans making penis too large to enter mare**	• **Inability to readily enter mare**	• Inability to enter mare • **"Flowering" or belling" of glans**	• **Help direct penis into vulva before "flowering"** • Lubricate vulva





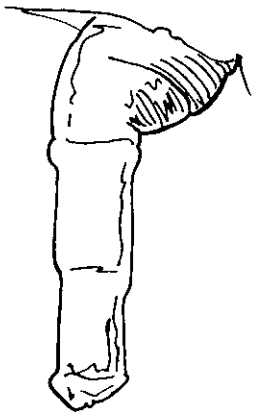
"Belling" before mounting
Help enter before "flowering"

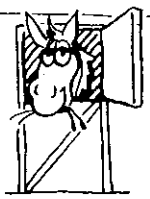


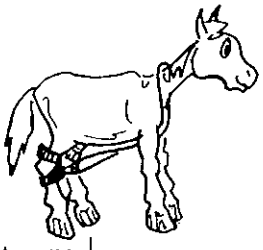
Slowness of breeding R 777	• Usually acquired vice - Improper training, rough treatment or accidents during service - Leads to impotency			

Stallion — REPRODUCTIVE SYSTEM

Condition	Facts/Cause	Presentation	Diagnosis	Treatment
Trauma to penis, "Broken" penis M 647, 740; R 775; R-Y 29; EM&S 929; ER 880, 887 *	• **Mare kicking erect penis during service** • Rare in stallion; common in bull • Results - Hematoma (bleeding outside tunica albuginea) - Swelling , Paraphimosis - Laceration - Rupture of penis	• **Hematoma** • **Swelling**	• History & CS	• **Reduce edema** - Hydrotherapy - Massage - Pressure wraps - Judicious use of diuretics - Sling close to body • Sexual rest







Mare's kick - Supervise
CS: Hematoma, swelling
Tx: Reduce edema

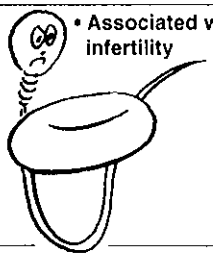
Prevention:
- Properly supervised service
- Make sure mare is in estrus, ready to receive
- Mare restrained properly (hobbles, etc.)
- Good footing for stallion & mare
- Breeding hobbles or AI in nervous &/or violent mares

Hemorrhage from prepuce & penis
R 775; S 709

• Rare • Causes: Tumors, Laceration, Bleeding from outside the tunica albuginea (unlike bull) • Most recover w/o Tx • Local Tx • Sexual rest • Remove tumors

Hemospermia
I2M 1570; R 776; R-Y 18, 33; EM&S 939; ER 864

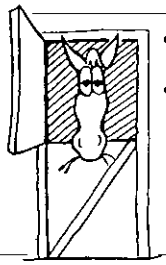
- **RBCs in ejaculate**
- Cause:
  - Penile lesions or fistulas
  - Urethritis
  - Urethral stricture
  - Vascular lesions in mucosa (stallion rings, lacerations or habronemiasis of urethral process, strongyle larvae or infection of accessory glands & urethral calculi)



• **Associated w/ infertility**

- **RBCs in ejaculate**
- Visual
- Endoscope
- Radiographs of genital organs

RBCs in ejaculate

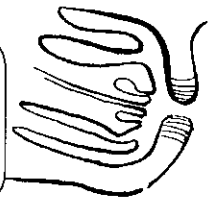


- Conservative or surgical Tx of problem
- Sexual rest

Phimosis
IM 1420; I2M 1566; R 793; R-Y 30; EM&S 935; ER 888

• **Inability to protrude the penis**

Causes - Phimosis
- Psychic impotency
- **#1 Small preputial orifice**
  - **Sequel to injury & scarring (cicatrix formation)**
  - Melanomas or Habronema granulomas
  - Rarely congenital



Can't protrude penis

- **Hygiene**, possibly pathological bacteria
  - Keep numbers down, do not sterilize or more pathological bacteria m/ take over
  - Clean w/ mild soap, not antiseptics
- Tx 1° cause
- Clean preputial cavity daily w/ hydrogen peroxide
- Oily AB preparations infused
- Broad spectrum ABs systemically
- Surgical correction

Paraphimosis
IM 1421; I2M 1566, 1688; M 740; R 802; R-Y 30; EM&S 920; ER 888

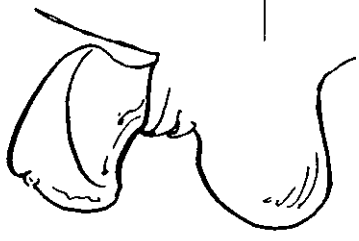
Acepromazine

- **Inability to withdraw penis into prepuce**
- Results in:
  - Edema, swelling &
  - Balanoposthitis
- **Phenothiazine-derived** tranquilizers: relaxation of smooth muscles & engorgement of corpus cavernosum w/ blood

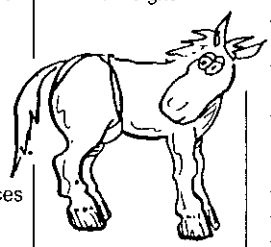
Causes - Paraphimosis
- **Trauma**, swelling of prepuce
- Stenotic preputial orifice
- Tumor
- **Paralysis or penis**
  - Spinal diz or trauma
  - Infec. diz (rhinopneumonitis, rabies, dourine)
  - **Phenothiazine-derived** tranquilizers

Can't withdraw penis
Phenothiazine tranquilizers
Tx: Return to prepuce

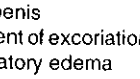
- **Traumatized penis**
  - **Swollen**, pendulous penis
  - Chronic ulcerative balanoposthitis develops if not relieved
  - Surface of penis dry, thickened & inelastic
- **Paralysis (tranquilizers)**
  - **Flaccid penis**
  - Blood m/coagulate in spaces of corpus cavernosum
  - Can't fully erect
  - Often doesn't recover



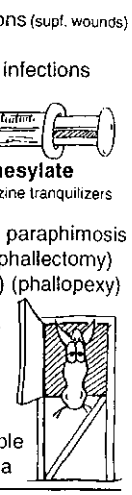
- History
- Clinical signs



- **Prompt Tx to reduce swelling & edema & return to prepuce**
  - **Purse string suture** in preputial orifice if penis can be withdrawn
  - Support penis in sheath w/in 2 hrs (stallion support)
  , Prevent gravitational edema & chronic prolapse
  - Cold packs & pressure to reduce swelling & allow replacement of penis
  - Emollient AB ointment of excoriations (supf. wounds)
  - Steroids if inflammatory edema
  - Systemic ABs to control bacterial infections
  - Exercise to reduce edema
  - Isolate from mares
- **Paralysis:**
  - Slow injection of **benzotropine mesylate** immediately after paralysis due to phenothiazine tranquilizers reported to cause detumescence (flaccidity)
  - If chronic then same treatment as paraphimosis
- **Amputation of paralyzed penis** (phallectomy)
- Surgical retraction (Bolz technique) (phallopexy)
- **Sexual rest**

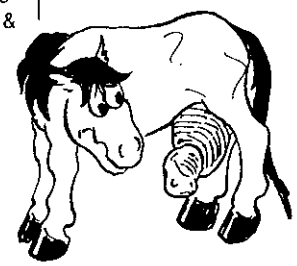
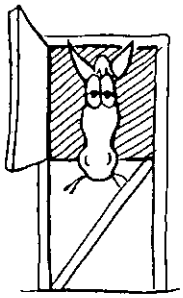
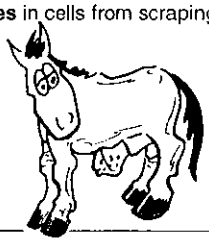
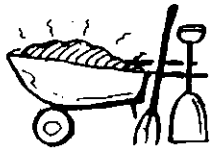
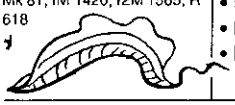
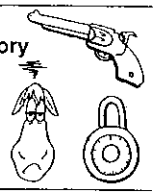


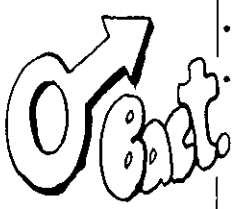
Prognosis:
- Good: if swelling & edema resolve rapidly & penis returns to prepuce in few days
- Guarded to grave: if chronic
- Stallion that can't fully erect, m/b able to ejaculate if penis placed in vagina

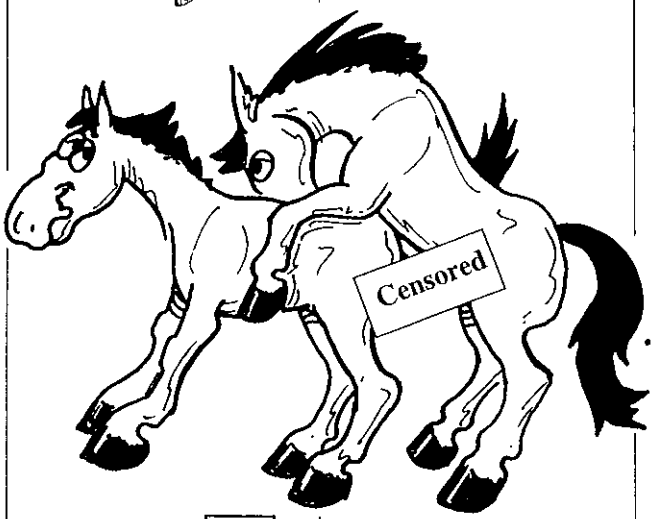


Priapism R-Y 32: persistent erection w/o sexual arousal

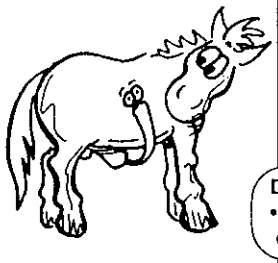
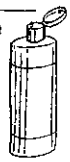
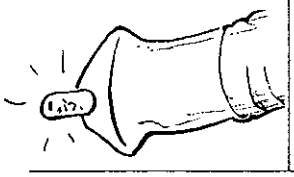
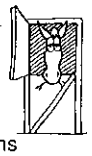
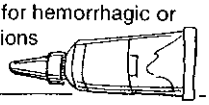
Stallion — REPRODUCTIVE SYSTEM

Condition	Facts/Cause	Presentation/CS	Diagnosis	Treatment
Balano-posthitis IM 1422; I2M 1568; R 803 **	• **Inflammation of the glans penis (balanitis) & prepuce (posthitis)** • Occasionally in stallion, commonly in bull, ram & dog • **Rarely due to bacteria** • Early symptom of Dourine (not seen in USA) • Herpes virus described (formerly horse pox)	• Stenosis of preputial orifice • Adhesions between penis & prepuce • Pain • Copulation avoided	• Clinical signs 	• **Sexual rest** 
Inflammation of glans & prepuce				
Coital exanthema, Genital horse pox IM 1395, I2M 1547; R 618, 805, M 648; Pop 31-9/97 **	• Acute mild diz • **Herpesvirus** (EHV-3) • Venereal contact (transm.) • Venereal balanitis & vulvitis • **Uncommon in USA** • **No effect on fertility** • No abortion 	• **Papules, pustules to ulcers** - Vestibular mucosa, vulvar skin - Balanoposthitis - Occas. lips, ext. nares • **No systemic CS** (no fever or anorexia) • **Depigmented spots** • 2° bacterial infection - Discharge & systemic CS	• **Lesions** • **Depigmented spots** • **Intranuclear inclusion bodies** in cells from scrapings 	• **Spontaneous recovery 10-14 d** • **No Tx required** • Astringent lotions & antiseptic creams • Sexual rest until resolved (3-4 wk) • Mares usually bred next estrus  **Prevention:** • No vaccine • **Hygiene** (stop spread)
Papules - Depigmentation Spontaneous recovery				
Dourine, Trypanosomiasis Mk 81; IM 1420; I2M 1565; R 618 !	• *Trypanosoma equipedum* • Transmitted by coitus - Only in horses, so no reservoir of infec. • **Eradicated in USA** • **Reportable diz.** • Mortality 50-75%  	• Swelling of penis, prepuce & scrotum • "Dollar" plaques • Emaciation - death 	• ID organisms in vaginal discharge • Serology (complement fixation)	• **Reportable** • **Euthanasia mandatory** • Medical Tx - Expensive & impractical as results are poor . Quinapyramine sulfate • Prognosis: Poor 
Stallion - Carrier of bacteria Mk 693; IM 1397, 1414, 1422; C4T 579; M 786; R-Y 21	• **Stallion's external genitalia harbor pathalogic bacteria, fungi & yeasts** - **Bacterial balanoposthitis uncommon** - May affect sperm motility • **#1 problem: passed to mare during coitus** - **Infertility of mare** • ***Strep zooepidemicus*** - #1 infectious infertility in mare - Abortion & foal infections • **CEM** (contagious eq. metritis) - Diz of infertility (fail to concieve) - No clinical CEM in USA - Reportable diz - quarantine - Not difficult to treat - *Taylorella equigenitalis* • ***Klebsiella pneumoniae*** - Less common than *Strep.* - More difficult to Tx than Strep or CEM - Sterility more severe than Strep. • **Pseudomonas aeruginosa** - Hard to Tx • *E. coli*, usually a contaminant if cultured • *Candida albicans* - Usually just contamination - Serious infection following **prolonged AB Tx** of vagina & uterus	• **Bacterial balanoposthitis rare** • **Clinically inapparent** in stallion usually • Mare vulvar discharge - Infertility 	• Culture prepuce, penis & urethral fossa & sinus - Single isolation of *Taylorella equigenitalis* Dx for CEM . **Amies w/ charcoal** - Others: serial isolation of large numbers in relatively pure cultures 	• **CEM & *Strep. zooepidemicus*** - **Free carrier stallions** . Get rid of smegma (bean in urethral sinus) - Regular cleaning w/ chlorhexidine (Novalsan®) & nitrofurazone cream - Strict hygiene during breeding - Artificial insemination less infections • ***Pseudomonas aeruginosa* & Klebsiella spp** - Thorough washing of penis & prepuce, including urethral fossa & sinuses . Iodine-based surgical scrub daily for 1-2 wks . Thoroughly rinse w/ tap water + dilute hydrochloric acid . Dry penis . 1% silver sulfadiazine cream - Breed mares artificially . Semen mixed w/ ABs containing semen extender (Polymyxin-B, [1000 U/ml], reagent grade gentamicin [100 mcg/ml], amikacin sulfate [100 mcg/ml]) . Buffer both gentamicin & amikacin w/ 8.4% Na bicarbonate before adding to extender - Natural service (Thoroughbreds) . Infuse AB extender into uterus immediately before service • Candida - Nystatin (500,000 IU/d for 5 d) - Amphotericin B - Clotrimazole uterine infusion (400-600 mg) every 3rd d for 3-4 treatments (human product - suppository inserted into uterus)
Strep. zooepidemicus & CEM **CS: Inaparent** **Dx: Culture** **Tx: Hygein, AI**				



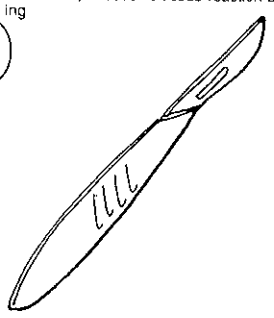
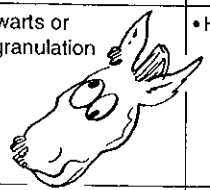
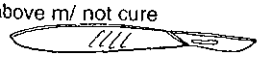


Stallion — REPRODUCTIVE SYSTEM

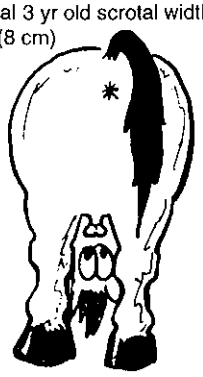
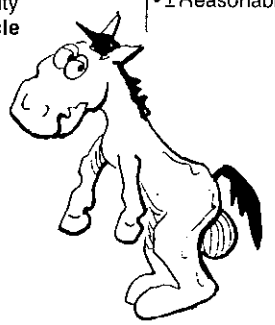
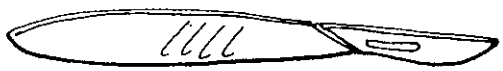
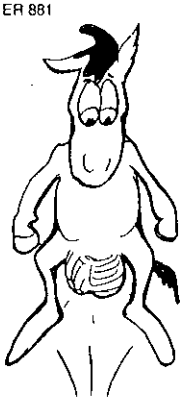
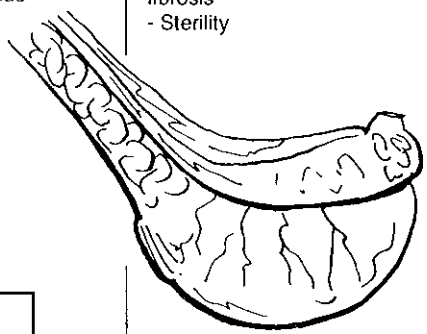
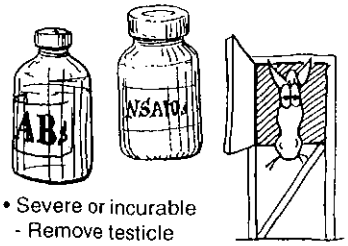
Condition	Facts/Cause	Presentation/CS	Diagnosis	Treatment
Summer sores, Cutaneous habronemiasis, Genital bursatti I2M 1570; R 805; R-Y 31; EM&S 934; ER 890; S 714; M 271 **Habronema larvae** **CS: "Kunkers"** **Tx: Ivermectin**	• *Habronema megastoma* larvae • May effect - Preputial orifice (preputial ring) - Urethral process - Glans penis - Not on mare's genitals 	• **Fungoid granulomatous growths** (1/4-1") - **"Kunkurs"** (firm necrotic, irregularly shaped masses in growths) • Bleed readily on manipulation • Pruritic • "Spraying" & frequently difficult urination if near urethral process • In cold north, lesions usually disappear in winter, but reappear & ↑ in size in warm weather	• Microscopic ID of larvae • Hemospermia 	• Topical organophosphates daily • Camphophenique in scarlet oil daily • **Ivermectin** • Ronnel® (systemic organic phosphate insecticide) 90 mg/kg by stomach tube (repeat in 2 wks) • Surgically remove in most cases • Amputation  **DDx:** • Smegma distended diverticulum (also spraying)
Smegma distention of diverticulum R 806; EM&S 930; M 308 *** **"Bean"**	• **Smegma**: debris in sheath & urethral fossa & sinus • Presses on urethral process • Occasionally Pseudomonas &/or proteus causing objectionable odor & excessive smegma • Smegma is foul, so wear gloves	• **"Spraying" & frequent difficult urination** 	• Evert urethral sinus - **"Bean"** inspissated smegma	• **Manual cleaning of sheath & urethral fossa & sinus** - Mild soap & water • Occasional application of neomycin in vegetable oil  Prevention: **routine cleaning of sinus**
Urethral injuries & urethritis IM 1421; I2M 1567; EM&S 918 	• **Trauma**: bruising, laceration & hemorrhage - **Urethral process** protrudes during erection . Laceration by mare's tail hairs or kicked . Parasitic granulomas - **Stricture** - occludes urethra - Stallion rings: pressure necrosis	• **Hemorrhage** • Habronema granulomas - Firm & friable • Occlusion of urethra - Urine retention - Bladder rupture	• Hemospermia • **Fiberoptic** exam length of urethra • **Ultrasound** • Fractionation of ejaculate (to eliminate involvement of accessory sex glands) • Contrast radiographs for strictures 	• Remove inciting factors • Sexual rest • Establish patency • Systemic ABs • Local oily ABs preparations • Insecticides or ivermectin (parasites) • Sx removal of granulomas • Silver nitrate for hemorrhagic or ulcerative lesions  

Tumors of penis & prepuce

IM 1423; I2M 1569; R 799; R-Y 31; EM&S 935; ER 871; E 1390; S 716; N 272

Squamous cell carcinomas  **# 1 SCC**	• **#1** tumor of penis & prepuce - Benign & usually doesn't metastasize • M/ cause phimosis or paraphimosis or prevent normal intromission • Uncommon in stallion • Preputial smegma m/b carcinogenic	• Tumors on glans penis usually - Also shaft of penis & prepuce • Fetid discharge • Lg. tumors m/ ulcerate & bleed • M/ metastasize to inguinal ln., abdomen or thorax • M/ extend into corpus cavernosum 	• Hemospermia if bleed • Histo. exam - Well differentiated & surrounded by eosinophils - No parasite larvae  **DDx:** • Granulomas of Habronema larvae	• **Hyperthermia** for small < 1" (2 cm) - 122° F [50° C] for 1-2 min. • **Cryosurgery** for larger superficial tumors - Debulk & control hemorrhage - Freeze remaining base - Repeated freezing m/b required • **Penile amputation** if Tx unsuccessful or tumor too big - Castration done before amputation, if both at same time, excessive tissue reaction & swelling 
Melanoma **Old gray horse**	• Common in **grey** horses - Occas.on penis & prepuce • **Old horses** • Remain benign for years • Rapidly fatal if vital organs involved • M/ metastasize to pelvic & iliac lymph nodes, spleen & other organs	• Firm or soft • Vary in size • Grow slowly	• Gross appearance • Histo. exam 	
Sarcoids **Wart-like**	• Skin of prepuce or scrotum • Cause unknown: virus or atypical response to injury	• Resemble warts or exuberant granulation tissue 	• Histo. exam of excised tissue  **DDx:** • Warts • Exuberant granulation tissue	• Tend to reappear after Tx or Sx
Genital papillomas	• Uncommon in stallions	• Papillomas on glans or shaft • Hemorrhage on erection & ejaculation • Friable		• Sx removal • Autogenous vaccine • Both above m/ not cure 

Testicle

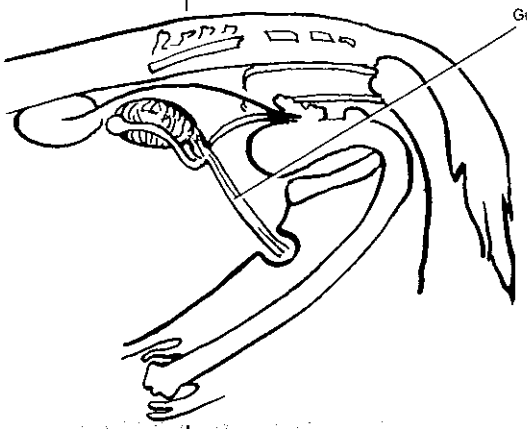
Condition	Facts/Cause	Presentation/CS	Diagnosis	Treatment
Testicular aplasia/ hypoplasia IM 1426; I2M 1571; EM&S 900, 905 **> 3" scrotum**	• Aplasia (complete absence of 1 or both testicles): Rare • **Hypoplasia** - Unilateral or bilateral - Both scrotal or abd. testicles • Cause of hypoplasia - Transplacental infection or intoxication - Hormonal insufficiency - Zinc defc - Impaired testicular descent - Vascular disturbances - Abnormal karyotype - **Adult: prolonged exogenous steroids**	• Hypoplastic: small testicle - Normal 3 yr old scrotal width > 3" (8 cm) 	• **Scrotal width < 3"** • Ejaculate - Azoospermia - Low concentration of sperm - Numerous morphological defects	• **No successful Tx** • Manage breeding stallion - Base number of mares bred on number of normal motile sperm in ejaculate **None** **Testicular agenesis, Anorchism** EM&S 894 • Rare in stallions
Testicular degeneration IM 1426; I2M 1571; R 826; EM&S 901, 906; ER 855; S 685 **Semen evaluation**	**Causes:** • ↑ Temperature . Cryptorchid, ectopic testes, inguinal hernias . Systemic dizs cause temporary infertility due to hi temp (EIA, Pneumonia, Strangles) . Prolonged hi environment temp + hi humidity • Torsion of testis • *Salmonella abortus equi* & "epizootic" cellulitis due to arteritis & influenza viruses • Ehrlichiosis • Piroplasmosis & Dourine	• Testicles: - Atrophic, softer & small - Chronic: **firm due to fibrosis**  **DDx:** • Testicular hypoplasia (hard to DDx)	• Physical exam (PE) • Semen evaluation (see box) - 50 to 60 days for sperm to reach ejaculate • Testicular biopsy only as final recourse - M/b hemorrhage, degeneration & necrosis **Semen evaluation:** • 50 to 60 d for sperm to reach ejaculate • Take repeated samples over long time • Sperm cell concentration 1/3-1/2 normal • Sperm cell motility: 1/3 - 1/2 • Sperm cell morphology - ↑ dead spermatozoa & abnormal heads, tails & middle pieces . Normal semen: 5-15% abnormal cells . Primitive cells (giant cells, pyknotic nuclei) sign of severe degeneration 	• Remove cause if 1 can be found • If temporary, improved semen in 4-5 months • Tx cause • Sexual rest • Balanced ration hi in Vit. A & protein • Good quality roughage & pasture • Hormones of no proven value
Testicular neoplasia IM 1427; I2M 1572; R 833; R-Y 28; EM&S 903; S 681 **May not affect semen**	• 1° uncommon in large animals - Seminoma #1 primary neoplasia (arise from germinal epithelium) • Dermoid cysts or teratomas (in cryptorchid testes) - Large cysts w/ hair, cartilage & bone • Sertoli cell or sustentacular cell tumors rare • Interstitial cell (Leydig cell) tumors occasionally (don't produce hormones usu.) - Extremely aggressive horses & vicious - Castration reverses behavior • Lipomas uncommon	• Fertility: only slight reduced conception rate to severe infertility & sterility • **Enlarged testicle** 	• **Semen evaluation** - **M/b w/in normal limits** • ± Reasonable pregnancy rates	• **Surgical removal** - Wait until end of breeding season if semen quality OK • Bilateral: wait until semen quality falls to negate use in breeding, then remove 
Acute orchitis IM 1427; I2M 1572; EM&S 902; ER 881  CS: "Hopping gait" Tx: Sexual rest	• Inflammation of testicles • Causes: - Infection - Trauma • *Strep. zooepidemicus* commonly	• **Hot, swollen, painful testicle** • **Refuse to mate** • **"Hopping gait"** • Chronic: testicular atrophy & fibrosis - Sterility 	• Hx, CS • Ejaculate - WBCs - ↓ Motility & - ↑ Morphlogical abnormalities	• **Sexual rest imperative** • Close confinement - physical rest • ABs IV (C&S) 1-2 wks past resolution of pain & swelling • Glucocorticoids & NSAIDs to reduce inflammation • Ice packs (sling under testes)  • Severe or incurable - Remove testicle - Culture for agent so precautions in future can be instituted

Stallion — REPRODUCTIVE SYSTEM

Condition	Facts/Cause	Presentation/CS	Diagnosis	Treatment
Torsion of spermatic cord IM 1428; I2M 1573; R 828; R-Y 26; EM&S 914; S 680	• Excessively long mesorchium predisposes • Twisting during a race	• Asymptomatic if < 180° • Severe torsion - Acute pain - **"Hopping" gait** - Abdominal discomfort - ↑ HR & RR - Unilateral swelling & edema of scrotum - ↑ Testicular temp - **Painful testicle** - Soft & friable testicle	• **Palpation of tail of epididymis out of place** - Should be caudal • **Hot testicle**	• Manual correction (not always possible) - Recurrence likely • Sx correction • NSAIDs • Analgesics
Inflammation of testicular artery R 828	• Causes: - Strongyle larvae - Eq. arteritis virus			
Varicocele IM 1429; I2M 1573; EM&S 915; S 681	• Abnormally distended & tortuous veins of pampiniform plexus - Backflow & stasis in veins • Causes disturbances in thermoregulatory mechanism (counter current heat exchange betw. hot artery & cool veins keeping testicle temp down)	• **Nonpainful "bag of worms"** w/in spermatic cord	• **"Bag of worms"** w/in spermatic cord	• Thrombosis: unilateral castration (transect spermatic cord proximal to thrombus)
Epididymitis IM 1429; I2M 1573R 841; EM&S 909	• Inflammation of epididymis • Cause: - Infection or trauma - 1° or - 2° to orchitis or infec. of accessory sex glands • **Tail** most commonly involved • ***Strep. zooepidemicus*** • Obstruction often develops	• **Infertility** (due to obstruction) • Pain • Enlargement of tail of epididymis • Adhesions to vaginal tunics • Chronic abscesses, periorchitis & fibrosis • Granulomas if sperm escape	• Palpate of epididymis esp.tail - Induration (process of hardening) - Spermatic granulomas, abscesses & enlargement • Culture • Ejaculate - abnormal sperm - Bilateral obstruction: azoospermia	• **ABs** (invitro sensitivity) - 1-2 wk after inflammatory cells gone from semen • No cure if obstructive • Unilat. to save valuable breeding animals - If vas deferens & seminal vesicles have no infection - Unilateral castration - Long recovery period - Repeated cultures of semen for elimination of infection
Tail of epididymis • Obstruction • Px: Poor		**Prognosis:** • Poor: obstruction usually occurs preventing sperm from leaving • Bilateral: hopeless • Unilateral: remove affected testicle & epididymis		
Infection of ductus deferens, Occluded ampulla M 649; C4T 580; R 845	• Associated w/ orchitis, epididymitis or seminal vesiculitis • ***Strep zooepidemicus*** • Usually unilateral • Ampullae • Blocking of ductus deferens	• **Low fertility** • **Failure to ejaculate**	• Rectal exam - **Enlarged ampullae** • Semen exam - Massage ampullae per rectum followed by prolonged sexual stimulation & semen collection m/ result in ejaculation - Hi concentration of semen, often in "strings" or plugs" - M/b WBCs & bacteria - M/b clots of pus & low motility	• Relieve blockage by massage of ampullae & sexual stimulation • Regular collection of semen m/ prevent recurrence • Empiracle blockade of ß receptors & stimulation of alpha receptorsm/cause ejaculation
Low fertility **Enlarged ampullae**				
Seminal vesiculitis IM 1430; I2M 1574; C4T 579; R 847; EM&S 916; ER 861; E 1389; S 724	• **Uncommon in stallion** • Bacterial infection including ***B. abortus***	• **Refusal to cover** • **M/b unable to ejaculate**	• Rectal palpation: normal to enlarged seminal vesicle - **Painful** • Semen: m/ contain PMNs & RBCs • Culture: - Sheath, penis, urethral fossa, preejaculatory fluid, urethra (before &after ejaculation) - Seminal vesicle effluent (manually expressed, sterile urethral catheter positioned at the colliculs seminalis)	• **Broad spectrum ABs** (culture invitro sensitivity) 2-4 weeks - Tx failures occur - Erythromycin, trimethoprim (both hi pKa & fat soluble) - Not aminoglycosides (low pKa & not fat soluble) **Prognosis:** • Mild case m/ spontaneously recover in 2-3 months • Fair to poor depending on causative agent
Uncommon **Painful, refuse to breed** **Tx: ABs. Px: M/ spontaneously recover**				
Prostatitis R 851	• Rare in all animals except dog			

Cryptorchid

Condition	Facts/Cause	Presentation/CS	Diagnosis	Treatment
Cryptorchid, High flankers M8K 986; I2M 1571; IM 1589,1426; EqS 722; M270; T 185, 748; T&W 185, S 677, 691	• **1 or both testicles missing from scrotum** • **Types of cryptorchids:** - **"High flanker"** or inguinal cryptorchid if testes through inguinal canal, but not in scrotum - **Descended epididymis** into inguinal canal but testes in abdomen - **Complete abdominal**: testes & epididymis inside abdomen • **Most unilateral, left > right** If right sided cryptorchid, 60% chance inguinal - 1 out of 10 abdominal cryptorchid • Normally readily palpated in scrotum by 30 days of birth • If in inguinal canal m/ descend up to 2 years old (4years?) • **Thought to be genetic**	• **Testicle missing from scrotum** • **Suspected only 1 testicle removed** - "Ridgeling" or "Rig"; hard to handle - Owner thinks its castrated	• **Testicle(s) not in scrotum** • **Deep palpation** over inguinal ring m/ or m/not reveal an inguinal cryptorchid, not abdominal. Stand by shoulder • **Rectal palpation** 80% effective - Ductus deferens into vaginal ring/ inguinal canal): inguinal cryptorchid - If ductus deferens not into wall then abdominal - **Rectals may be impossible** due to fractious horse • **Suspect malpractice** (crypt not removed) - **Look for scars on scrotum** - **Blood testosterone levels** . 5000 units of HCG, then 1 hr later take another sample . **Tremendous rise** if any testicular tissue present - **Estrogen levels** . Geldings < 50 picogr/ml . Cryptorchids > 400 picogr/ml . Stallions very high	• **Surgical removal indicated** - **Malpractice to remove just descended testicle** - Always remove retained 1 first - **5-6" skin incision over supf. ring** - **Bluntly dissect to supf. inguinal ring** • **Inguinal cryptorchid** at supf. inguinal ring - Open vaginal tunic & remove testicle • **"Superficial" inguinal cryptorchid** (inside canal) Forceps through inguinal canal, grasp & withdraw peritoneum & vaginal tunic - Open vaginal tunic - Grasp gubernaculum & pull tail of epididymis & then testicle out canal & remove testicle • **"Deep" abd. cryptorchid** (not inside canal) - Push hand through inguinal canal or internal abd. oblique muscle - Locate ampulla at dors. aspect of bladder & trace to tail of epididymis • **Suture supf. inguinal ring if damaged** • **Postop:** - Tetanus immunization - Examine internal vaginal ring in 24 hours, if no adhesions or viscera in ring discharge horse



Descent of testicle in fetus: migrates from kidneys via gubernaculum into scrotum
- **Gubernaculum** attached to tail of epididymis (future ligament of tail of epididymis) & by future proper ligament of testicle to testis
- **Inguinal canal**: passage through abdominal wall. Inguinal rings tighten up in first week of life.
  - **Deep inguinal ring**: bounded by internal abdominal oblique m., rectus abdominis m. & inguinal lig. (free edge of external abdominal oblique m.)
  - **Superficial inguinal ring**: slit in aponeurosis of external abdominal oblique m.
- **Vaginal ring**: opening where peritoneum evaginates through inguinal canal to become vaginal tunic.
- **Vaginal tunic**: evagination of peritoneum out inguinal canal around the spermatic cord & testicle; it consists of an outer parietal layer & a visceral layer adhering to structures of the spermatic cord and testicle/

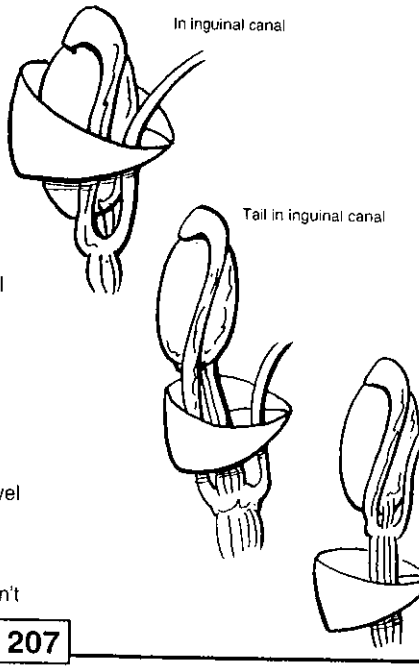
Surgery for cryptorchid, be prepared to go into abdomen, may still be at kidney
- Dorsal recumbency, tilted table w/ affected side little higher, encouraging bowel to fall away
- 5-6" skin incision made over superficial inguinal ring
- Bluntly dissect down to superficial inguinal ring w/ fingers
  . Large branches of external pudendal vein in region, avoid traumatizing them

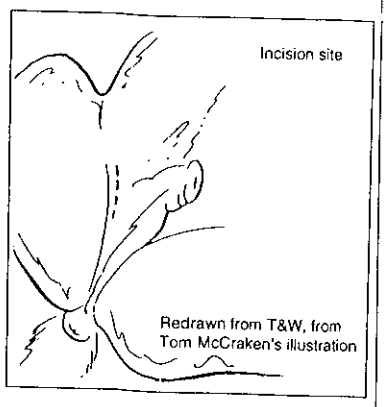
• **Inguinal cryptorchid** located in inguinal canal
- Open parietal vaginal tunic & remove testicle

• **Descended epididymis into canal**
- Hook epididymis, pull testicle out & remove

• **"Superficial" abdominal cryptorchid**: if not in inguinal canal
- **Push forceps through inguinal canal & grasp peritoneum & vaginal tunic under it**
- Withdraw forceps, holding peritoneum, vaginal tunic & gubernaculum inside vaginal tunic (excessive traction will rip vaginal tunic)
- Palpate cord-like gubernaculum w/in vaginal tunic by rolling between finger & thumb
- Nick vaginal tunic (parietal layer) w/ Metzenbaum scissors
- Grasp gubernaculum w/ Ochsner forceps
- Place traction on gubernaculum to pull tail of epididymis through canal
- Hook epididymis w/ finger & gently pull testicle through, manual dilation of inguinal canal m/b necessary
- Positively ID testicle, compare to tail of epididymis
- Emasculate testicle, if can't be retracted sufficiently to emasculate, ligate cord
- ± Pack w/ gauze bandage over ring if inguinal canal enlarged by surgery & fear of herniation to allow swelling time to obliterate inguinal canal
- Suture skin w/ heavy polymerized caprolactam (Vetafil®) in continuous pattern or w/ simple interrupted sutures w/ long ends
- Rectal palpation of vaginal ring (peritoneum over inguinal canal) next day for bowel or adhesions in ring
- Remove gauze packs & skin sutures & discharge horse

• **"Deep" abdominal cryptorchid** or if other reasons forceps retrieval doesn't work (accidental rupture of vaginal tunic, vaginal ring or medial wall of inguinal canal, loss of vital landmarks or previously unsuccessful Sx)
- Digital exploration inside of internal inguinal ring to locate gubernaculum, epididymis or testicle
- If fail to find, manual exploration of abd. w/ hand m/b necessary
  . Push hand through inguinal canal or internal abdominal oblique muscle (thin on medial wall of inguinal canal)
- **Locate ampulla of ductus deferens** at dors. aspect of bladder & trace it cranially to the tail of epididymis (if can't find then m/b no testicle)
• **Close external inguinal ring** if damaged, w/ interrupted structures (Dexon® [2 polyglycolic acid] or Vicryl®)

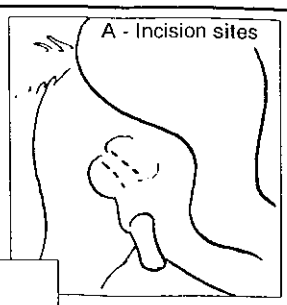




Castration, Orchiectomy

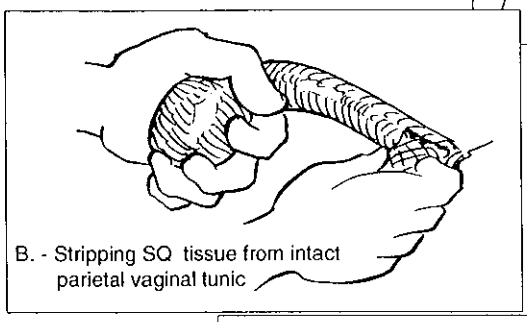
T&W 177; LAS 464; J 1092; E 1390; S 687; M 208; T 745

- **Purpose:**
  - Help manage a horse when in company of other horses
  - When undesirable to have a stallion
- Generally not done until **12-18 months** to allow development of some physical characteristics
  - Maybe done at a later age



Procedure:

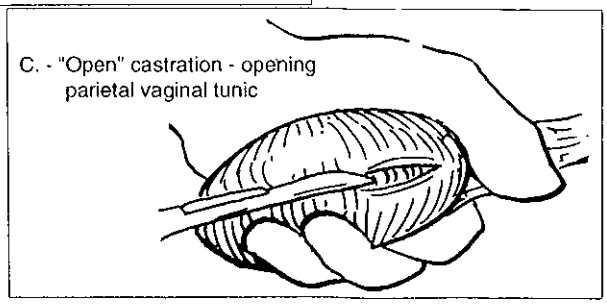
- **Recumbent under general anesthesia**
  - Anesthesia
    - . Guafenesin w/ thiamylal sodium, xylazine followed by ketamine
    - . Rapid induction w/ thiamylal sodium or thiopental sodium alone
  - Cast w/ left side down for right handed operator
  - Tie upper hind leg cranially
  - Prepare surgical site, clipping or shaving not necessary
- **Standing animal w/ local anesthetic**
  - Tranquilize or sedate
  - Stand on left hand side just behind the front limb, facing rear end (right handed operator)
  - Local infiltration of skin & SQ 1 cm from median raphe (10 mls)
  - Infiltrate spermatic cord w/ 18-20 gauge needle
  - Some owners demand a standing castration, sensible you m/ talk them out of it or send them to another veterinarian in the next county



B. - Stripping SQ tissue from intact parietal vaginal tunic

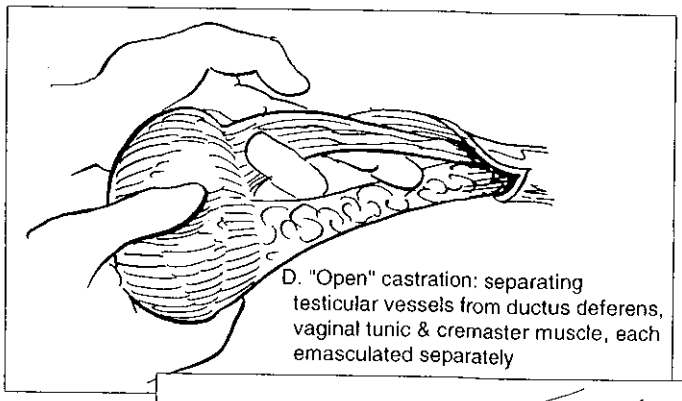
Redrawn from Tom McCracken's illustrations in Turner & McIlwraith's surgery book

- **"Open" castration** (cut parietal vaginal tunic before emasculator)
  - **Separate scrotal skin incisions** 1/3" (1 cm) on either side of median raphe
  - Incise through skin the length of the testicle, leaving parietal vaginal tunic intact
  - Squeeze testicle in vaginal tunic out incision
  - Grasp testicle in left hand & strip SQ tissue from vaginal tunic w/ a gauze sponge
  - **Cut through parietal vaginal tunic** (open castration) & hook finger in tunic to maintain tension & continue incision proximally
  - Digitally break through mesorchium (connecting vaginal tunic)



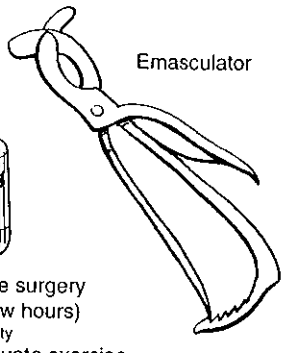
C. - "Open" castration - opening parietal vaginal tunic

- Separate testicular vessels from ductus deferens, vaginal tunic & cremaster muscle
- Cut ductus deferens, vaginal tunic & cremaster muscle (emasculator, for short period)
- **Then emasculate vessels**
  - . **"Nut to nut"** of emasculators, make sure cutting edge is distal to crushing edge
  - . Place forceps proximally on spermatic cord as a safeguard if problems develop
  - . **Maintain crush for 1-2 minutes**
- **Digitally enlarge skin incision for drainage**

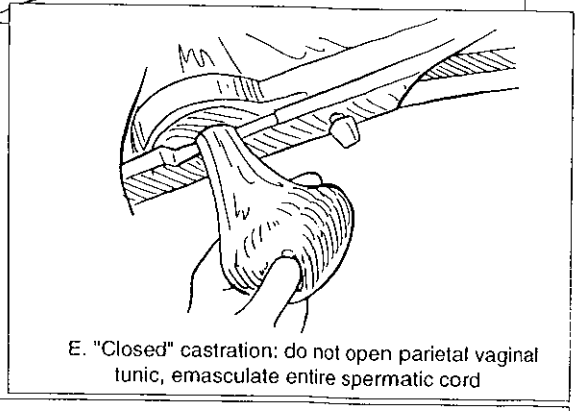


D. "Open" castration: separating testicular vessels from ductus deferens, vaginal tunic & cremaster muscle, each emasculated separately

- **"Closed" castration** (parietal vaginal tunic not cut before emasculator)
  - Parietal vaginal tunic dissected, but not opened
  - Emasculation of entire spermatic cord
  - Greater chance of inadequate crush of testicular artery bec. more structures between jaws of emasculators
    - . Restrict this technique to horses w/ small testicles

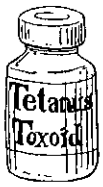


Emasculator



E. "Closed" castration: do not open parietal vaginal tunic, emasculate entire spermatic cord

- **Postoperative:**
  - Tetanus immunization
  - Antibiotics usually not needed
  - Close observation for several hours & limited exercise
  - Periodic observation during first week
  - Forcible exercise BID until healed
  - Separate from mares (1 wk) so no pregnancies



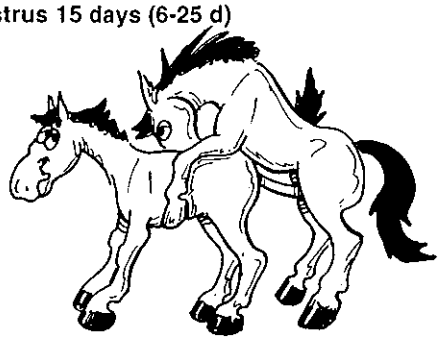
- **Complications - UNCOMMON** but may be life threatening
  - Hemorrhage, minor OK for several hours, if beyond 24 hrs m/ require surgery
  - Prolapse of abdominal contents through inguinal ring (usually first few hours)
    - . Replace bowel in scrotum, temporarily suture, fluids & ABs & refer to equine surgical facility
  - Edema of scrotum common third or fourth day, usually due to inadequate exercise
  - Adhesions
  - Acute wound infections & septicemia
  - Cirrhous cord: chronic infection due to poor technique, inadequate exercise, or poor drainage
  - Hydrocele in vaginal tunic due to inadequate resection
  - **"Proud cut"** (see box)

"Proud cut"

- Persistent masculine behavior after castration
  - "Proud cut": part of epididymis not removed during castration, also "cut proud"
  - **Maybe just a psychological problem**

Estrous cycle T 670; ER 473, 495; R-Y 64, 166; EM&S 982; E 1321; M 257; Pop 35-1/98

- **Seasonal polyestrous (polycyclic)**
  Jan/Feb-Aug/Sept. (occurs during particular season)
  - Depends on length of daylight
  - Begins when daylight +16 hr
    . Normally April or May
    . **Feb. 15th**, desirable start because want to birth on Jan 1st/artificial birthday (345 d gestation)
    . Artificial light started in mid Dec. to start cycling in Feb.
- Transitional anestrus at end & beginning of season w/ little follicular activity occurring
- **21-22 d cycle** (13-34 d) longer in early spring & late fall
  - Number of cycles ↑ in spring
  - Peak in May-June, shortest cycles
  - Minimum cycles in winter
- **Estrus, receptivity of 7 days (4-8 d)**
  - Very irregular, need close attention
  - Ovulation occurs 24-48 hours before end of estrus
- **Diestrus 15 days (6-25 d)**



- **When ovulation & breeding occurs**
  - Sperm leaves uterus in 15 min & into oviduct. Survives long time in oviduct, in uterus 1 hr survival rate
    . Once reach oviduct, propelled by swimming & contractions in oviduct
    . Go to site of fertilization within 6 hr (isthmus)
  - Sperm survive 2-4 day, so want sperm in oviduct when ovulates
  - Ova can be fertilized between 2-12 hours
- **Fertilization:**
  - Fertilized egg enters uterus 5-6th day
    . Lives off uterine milk (from uterine gland)
  - **Conceptus attaches on 14th day**
    . In 1 horn just to side of **bifurcation**, usually in horn that did not contain the last pregnancy
    .. Every other year mares - 1 horn normal & supports a pregnancy, other horn abnormal (scar tissue) & won't support
    . "Maternal recognition of pregnancy" caused by attachment
    .. Prevents normal involution of corpus luteum by preventing luteinizing prostaglandin from endometrium
- **Events of pregnancy**
  - **Initial corpus luteum** maintains preg. for 80-90 d
    . CL secretes progesterones to maintain pg
    .. At 40 d surge of 2° follicles ovulations that help CL maintain preg.
  - **Endometrial cups** (cells of fetal membranes invading the endometrium)
    . 40 d of gestation produce ECG (equine gonadotropin), formerly PMSG (pregnant mare serum gonadotrophin)
    . Production lasts 120 days
  - **After 120 d fetal progesterone** produced by fetal bone marrow (do not need ovaries to support preg.)
- **Hippomanes** or "colts tongues": semisolid, rubberlike, irregular, flattened masses commonly found floating in the allantoic cavity
- **Cervical star**: region of chorioallantois in region of the internal opening of the cervix, devoid of villi

"Artificial birth date": Jan. 1st for all foals born that year

- Want to foal New Year's Day
- Gestation 345 days, so breed 15th of Feb.
- Economics of vet practice: get in foal early
- Of all horses bred, 50% will have live foals

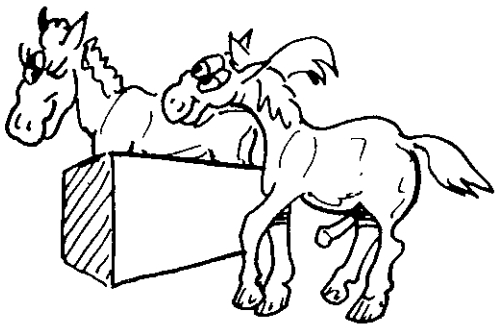
Gestation lengths

• Stallion to mare	340 d (foal)
- Thoroughbred	345 d (foal)
• Mare to Jack	355 d (mule)
• Stallion to Jennie	350 d (hennie)
• Jack to Jennie	365 d (foal)

Some have been recorded up to 375 d

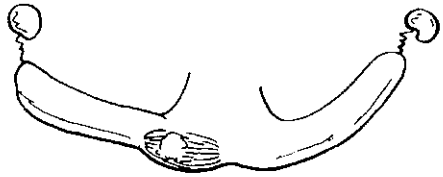
Pregnancy diagnosis

ER 501; T 675; E 1317; EM&S 979
- Early & accuracy important because of short breeding season



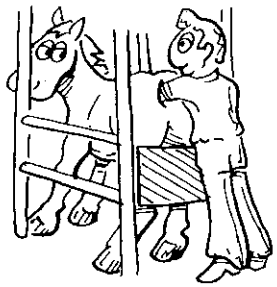
- **Presumptive Dx** of pregnancy
  1. **Absence of signs of estrum** 18-22d after service
  2. **Teasing 18-22 d following service** causes no visual signs of estrus
     - Some show no signs of estrum whether conceived or not
     - Tease regularly by stallion or aggressive or testosterone-primed gelding
     - Every 1-2 d to determine end of estrus
     - Tease for 18-21 d (m/b 40) to see if conception has occurred
     - 10-15% of mares will have signs of estrum 1st several months of pregnancy, usually weak & short, lasting a few days
       . Due to normal development of follicles for 1st 90 d of gestation

  NOTE: postestral bleeding not seen in mares as it is in cattle
  3. **Pear shape of abdomen > 5 mo. - unreliable**
  4. External signs at end of gestation
     - Distention of teats w/ colostrum: last 3-4 d of preg.
     - **"Waxing"**: 4-48 hr before foaling
     - Vulva enlarged, flaccid & edematous prior to foaling



Rectal exam (see pg 212)

- **Earliest & accurate Dx** (experienced vet)
- **Vesicle** 20-30 d - ventral bulge & thinning to side of uterine bifurcation
- **Palpation of fetus through rectal wall: 90-120 d**
- **Ovaries of little value in pregnancy diagnosis**



Biological tests for pregnancy

- **MIP** (Mare Immunological Pregnancy test) (pg 213)
  - **Accurate between 40-120 days of gestation**
  - Practical & almost as accurate as rectal exam
- **Plasma & milk progesterone values**

Ultrasound per rectum - diagnostic (see pg 213)

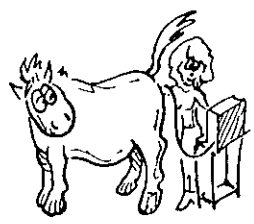
- **15-50 day diagnoses pregnancy, 95%** accuracy

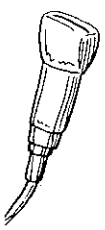
DDx - Pregnancy

- Endometrial cyst or lymph lacunae
- Distended bladder from 70-110 d
- Pneumovagina (pg 177)
- Enlarged or distended colon 90-120 d
- Pyometra assoc. w/ endometritis & focal cystic degeneration
- Tumors of uterus & ovaries: uncommon
- Fetal maceration: uncommon (pg 221)
- Twin pregnancy: common (pg 176, 214)

Pregnancy Diagnosis - Days

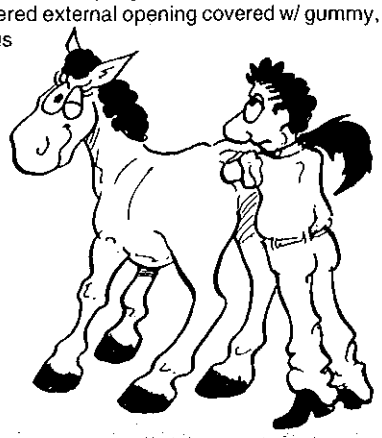
20-30 d	Rectal palpation of vesicle
90-120 d	Palpable fetus
> 7 mo.	Location of ovaries & enlarged uterine artery
40-120 d	MIP test (95%)
16-17 d	Plasma & milk progesterone values - 90%
15-50 d	Ultrasound per rectum (95%)





Rectal exam - Pregnancy Dx

- **Earliest & most accurate Dx** (experienced vet)
- **Chorionic or blastodermic vesicle** 20-30 d
  - Ventral bulge & thinning to side of uterine bifurcation
  - 60-90 d - water-filled balloon extending into body of uterus
  - Nonpregnant completely involuted horn
  - Pliable, soft, flat & flaccid
- **Palpation of fetus through rectal wall: 90-120 d**
  - **Ballot horn, difficult after 5-7 months**
  - Ballot horn & feel small, heavy, submerged, floating object
  - Deep bodied, older mares difficult to palpate after 5-7 months
- After 7 mo.: palpate enlarged, whirring uterine artery or note ovaries low (8-10" below lumbar vertebrae)
- **Ovaries of little value in pregnancy diagnosis**
  - Corpus luteum (CL) only palpable for few ds-wk after ovulation (deep in ovary then)
  - Follicles continue to develop for 40-150 d after conception
- **Speculum if pregnant**: cervix: small, w/ closed, puckered external opening covered w/ gummy, sticky mucus

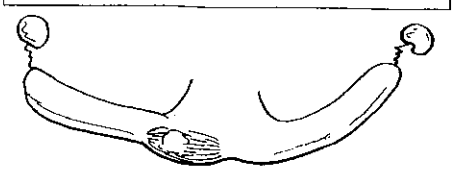


Rectal palpation - procedure

- **Restraint more important than in cow**
  (nose twitch, tail twitch [forced firmly dorsally & cranially], elevate foreleg, breeding hobbles)
  - Tranquilizers or sedation
  - Handler & vet on left (near side)
  - Stocks w/ rear rope low (mare m/ drop rear end)
  - Palpate around a stall partition
- **Bandage tail & hold out of way**
  (so tail hairs not dragged in)
- **Liberal lubrication of rectum & rectal sleeve**
  - Rectum tighter & drier than cow's, bucket of soapy water applied w/ sponge
  - K-Y jelly or cheap 500 gm of Na carboxymethyl cellulose (Hercules®) in 8 gal of water & 100 ml of Novalsan® (chlorhexidine)
- **Easy to fatally tear rectum** in horse (90% result in death): lawsuit
  - Remove hand when peristalsis occurs (peristalsis stronger than in cow)
- **Penetrate anus w/ a finger, then "cone" fingers**
  - Exert ventral pressure when removing manure to milk out urine & pus which m/ pool in vagina
  - Pass hand as far forward & pull rectum back
    . Gas distends rectum like drum, grab a peristaltic ring & pull back to release pressure at anus
- 1st locate bony pelvis
- **Locate cervix: sweep pelvic brim**
  - Pass arm forward to about the middle of your forearm
  - Sweep fingers over floor of pelvis near the pelvic brim to locate cervix (longitudinal lump on midline)
  - Option for inexperienced - locate ovary 1st and follow down horns to cervix
    . Fibrous bean-shaped 4-6" (10-20 cm) cranial to pubis 2-4" (5-10 cm) ventral to lumbar vertebrae in nonpregnant mare
    . Easier to reach left ovary w/ right hand & vice versa
    . Pass hand down proper ligament to horn of uterus & follow horn down to cervix
- **Palpate bifurcation of uterus for vesicle** (thinning of uterus)
  - Pass palm of hand foreword from cervix while exerting ventral pressure & side to side motion (get impression of size & content of uterus)
  - Cup uterine horns w/ fingers on ventral surface
  - Sweep hand across front of both uterine horns to detect ventral enlargement w/ thin wall at junction of 1 horn & body

Rectal findings - pregnancy Dx

- Cervix firm & contracted
- Pregnant horn - firm & tubular
  - **Thinning of uterine wall near bifurcation**
    . **Chorionic or blastodermic vesicle** can be palpated between 20-30 d
- Nonpregnant, completely involuted horn
  - Pliable, soft, flat & flaccid
- Horn changes
  - 3-4 mo: horn lies on abdominal floor
  - > 3 mo: impossible to retract heavy uterine horns
  - 5-6 mo: uterus well forward & tension on broad ligament
    . Ovary 8-10" (20-25 cm) below lumbar vertebrae



• Times to rectally palpate

- Experienced vet 30-40 ds of pregnancy
- Less experienced - 40-50 ds
- Highly skilled - 20-30 ds
- Easier in maiden mares or primgravidae & barren nonfoaling mares
- Harder in those conceiving on foal estrum when uterus not completely involuted
- Repeated early palpation didn't incr. abortion rate
- Do not directly palpate the amnionic vesicle or manually slip the membranes as in the cow

Biological Tests for Pregnancy

- **MIP** test (Mare Immunological Pregnancy test)
  - Gonadotrophic hormone (pregnant mare serum gonadotropin [PMSG] or equine chorionic gonadotropin [ECG] from endometrial cups)
  - **Accurate between 40-120 d of gestation**
  - Practical & almost as accurate as rectal exam
  - Indicated in nervous or vicious mares, small ponies (small rectum) or for inexperienced vets
  - False negatives if serum taken at < 38 d or > 120-150 d
  - False neg. if early embryonic death (EED) between 40-120 d (endometrial cups keep secreting)
  - **Procedure:** 10 ml blood from jugular vein into sterile tube, allow to clot at room temperature. Remove serum & refrigerate. Do not over heat sample.

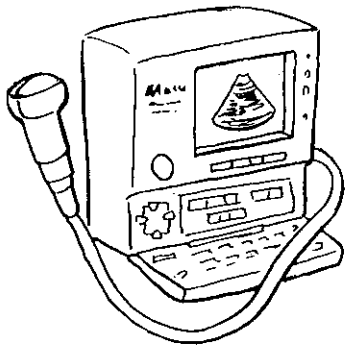
- Hemagglutination-inhibition test
  - Highly accurate - > 90%
  - PMS gonadotropins inhibit agglutination of horse RBCs coated w/ PMS gonadotropin in presence of PMS gonadotropin antiserum

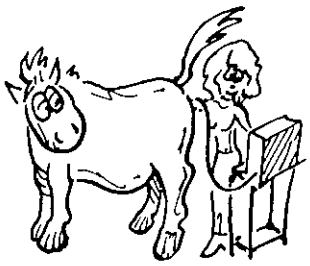
- **Plasma & milk progesterone values**
  - High levels of plasma progesterone 16-17 d after mare has gone out of estrus:
    . **90% accuracy to Dx pregnancy**
    . Persistent CL w/out pregnancy common & gives a false positive
  - Low levels or progesterone - nonpregnancy
  - Radioimmunoassay
  - Help determine stage of estrus & Dx early pregnacy
  - However several days required
  - Assess when out of estrus, good when no teaser stallion available or poor estrus behavior

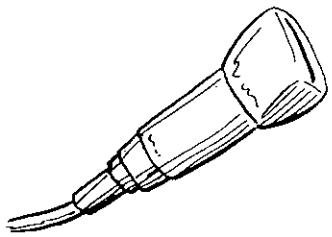
Early embryonic death (EED) common
- 2-20% between pregnancy diagnosis & 110 d
- Peaks at 25 & 30 d

Ultrasound, US T 679

- **Per rectum: diagnostic** - not harmful
  - Visualizing the uterus through the rectum
- **15-50 d - Dx pregnancy, 95%** accuracy
  - Repeat exam at 5-10 d intervals (reduces error, see vesicle grow)
  - Don't attempt before 14 days
- **21 d**: white echo of embryo in conceptus, migrates to more dors. position
- **At 30 d**: "blinking" heart beat = alive
- Diagnosis errors:
  - Ovarian follicle (too close to ends of uterine horns)
  - Endometrial cysts or lymphatic lacunae (older mare)
  - Cystic structures (re-examine in 5 days, cysts don't change)
- Fetal death in 15% between 15-50 days
- Twinning (disastrous), most end in abortion - US detects twinning very early





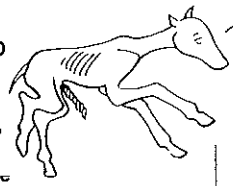


Abortion

Abortion

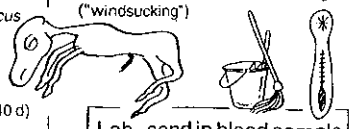
M8k 992; Mk 1142; I2M 252, 1549; T 705; R-Y 113; C4T 534; E 1347; EM&S 1066; M 26

- **Expulsion of dead or nonviable fetus**
  - **50% up to mid-gestation** (160 d), **EED** (early embryonic death) (see pg 276)
  - **3-4%(?) past mid-gestation**
- **Lucky to Dx 1 in 10 causes** of abortion, most causes unknown
- **Rhinopneumonitis (herpes-1) #1 cause**
- Called **infertility** (pg 176) when unnoticed abortion between 20-90 d of gestation, most common time
- Older mares (over 18), higher abortion rate
- If fetus retained - autolyses (opaque cornea, soft mushy organs, gelatinous blood-tinged SQ & placenta



DDx (see pg 342 for complete list)
- Twinning (pg 176)
- EHV-1 (Rhinopneumonitis)
- Uterine infec., Bact. or mycotic (ascending)
  - Salmonellosis, *Streptococcus zooepidemicus*
  - CEM, Mycotic abortions (*Aspergillosis*)
- Eq. viral arteritis (pg 216)
- Mares over 18 yr
- Malnourished mare (belw. 25-31 d)
- Management problem. (rough preg. exam < 40 d)
- Infertile mares
- Stress (transport, working)

Tx : Bacterial & mycotic
- **Good breeding hygiene**
- **Tx genital diz** before breeding
- **Caslick's** to prevent pneumovagina ("windsucking")



Lab - send in blood sample & chilled aborted fetus + placenta - Dx 50-60%

Condition	Facts/Cause	Presentation/CS	Diagnosis	Treatment

Twinning

M8k 996; T 651, 705; EM&S 1059; E 129, 1319, 1349; M 267; ER 532; R-Y 137; C4T 539, 545; C3T 657

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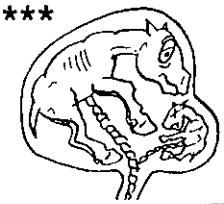

- **Disastrous to pregnancy**
- **Occurs commonly, usually natural abortion**
  - If not interrupted, 95% abort at 6-7 months of gestation
  - 20-30% of all abortions
  - Twins rarely produced alive
  - Usually 1 in each horn, 1 small & healthy, 1 mummified or blob of tissue

- **Asymptomatic**
- **EED** (early embryonic death) **or abortion**

- **Ultrasound**

DDx:
- EHV-1 (Rhinopneumonitis) (pg 216)
- EVA (Eq. viral arteritis) (pg 216)
- Bacterial & mycotic
  - Salmonellosis (pg 221)
  - *Strep. zooepidemicus* (pg 180)
  - CEM (contag. eq. metritis) (pg 179)
  - Mycotic abortions (pg 217)

Treatment expanded

< 35 days (golf ball-sized); once diagnosed, choices:
1• Do nothing & keep evaluating for 16-18 d (6 d intervals)
- If one does not grow, terminate it (don't allow it to reach 35-45 d when it is difficult to remove one w/out jeopardizing the other
. Squeeze manually or surgically (causes trauma to uterine lining so give antiprostaglandins [Bute or Banamine®] & progesterone for a few days to enhance pregnancy), Reexamine in a few days. Usually lose both, then re-breed next estrus

2• Dilate cervix & douche uterus to cause abortion; re-breed next estrus
3• PGF2 alpha IM for luteolysis & breed next estrus

> 35 days (baseball-sized): if aborted, mare doesn't cycle for several months (endometrial cups producing ECG prevent estrus)
- Allow to go to term
- Progesterone supplementation in last half of gestation m/ help

NO Tx satisfactory (see box)
- **< 35 d m/ terminate one & hope other goes to term** or
  - **Terminate both & re-breed** at next estrus (dilate & douche)
- **> 35 d if terminate doesn't cycle for months**
  - Supplement w/ progesterone & hope goes to term

Prevention:
- Repeat rectals of "twin-prone" mares & breed when only one mature follicle
- If two mature follicles:
  - Breed next estrus, or
  - Tap one follicle per vagina, or
  - Breed 12-18 hr after 1st follicle has ovulated
- Consider embryo transfer in "twin-prone" mares

Disastrous to pregnancy
20-30% of all abortions
CS: Asymptomatic or EED or abortion
Dx: US
Tx: None highly successful

"Snots", EHV-1, Rhinopneumonitis, Herpesvirus 1, Equine viral rhinopneumonitis, Equine abortion virus

M8k 996, 1081; Mk 734, 526; IM 1398; I2M 1549; C4T 536; T 703, 706, 711; R-Y 186; EM&S 1069; Pop 28-9/97

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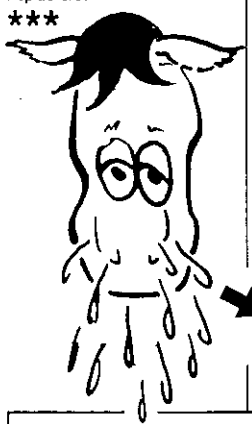
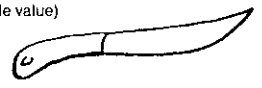


- **Respiratory virus - young & old**
- **#1 Diagnosed abortion in late pregnancy**
  - **Abortion storms** (last trimester)
  - Maiden mares, Sporadic
  - Economic importance of diz is abortion, not Respiratory or CNS
- **#1 infectious cause** of abortion (1/4 of all diag. abortions)
- Herpes virus similar to IBR in cattle
  - Persistent virus in environment
  - Contagious: annual outbreaks in foals (respiratory)
  - Herd immunity determines episodes
- **Transmission:**
  - Direct or indirect from nasal discharge, aborted fetuses, placenta or placental fluid
  - **Carrier animals** - always present
  - Intro. to farm by newly acquired
  - Fetal infection 4-5 mo IP (crosses placenta, fetus immuno-incompetent, dies)
- **Future breeding unaffected**
- Immunity on recovery not permanent

1° Respiratory virus - contagious
- **Foals** (annual outbreaks)
  - **"Snots"** - runny nose (copious)
  - Conjunctivitis
  - Malaise, inappetence, edematous mandibular &/or retropharyngeal lymph nodes, constipation followed by diarrhea
  - **Dry cough** in entire group
  - Self limiting, wk - 10 d
  - M/ have dry cough for longer period
  - 2° bacteria infections common - mucopurulent nasal discharge
- **Mares**: asymptomatic
  - Slight fever lasting a day ("didn't eat grain")
  - **Abortion storm 4-5 mo later . Last trimester** (7-11 mo)
- **Neonatal death** in a few d
  - M/b normal at birth then weak, respiratory distress, intractable diarrhea to death
- **CNS** (myeloencephalopathy) - some animals
  - Mild ataxia & posterior paresis to posterior paralysis & recumbency
  - **Most frequent in mares** shortly after foaling during an abortion outbreak (m/b also in barren mares, males, foals, etc.)

- **"Snots"**: can't be DDx from other viral diz by CS
  - Virus isolation - nasopharyngeal swabs & citrated blood
  - Serology of acute & convalescent sera
  - Leukopenia (neutropenia & lymphopenia)

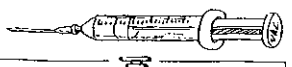
Abortion:
- **Hx of storm of "snots" on farm 4-5 months previously**
- **PM (postmortem) - Fetus**
  - Amnionic fluid opaque (normally clear)
  - Icteric
  - Thoracic cavity yellow fluid
  - Liver & lungs, white foci of necrosis
  - **Intranuclear inclusion bodies - diagnostic**
  - Pulmonary edema
  - **Histopathology**: liver, lung, adrenal & lymphoreticular tissue
- **Virus isolation** & viral antigens in fetal tissue (lung, liver, adrenal & lymphoreticular)
- **FA** (fluorescent antibodies)
- **Fetal serology** (serology of mare of little value)



"Snots":
- Self limiting (no economic advantage of treating all)
- Monitor: antibiotics for 2° bacteria, if temp. 102-3° F or mucopurulent discharge or pulmonary involvement

Abortion:
- Isolate
- Determine cause

Prevention
- **Isolate new horses** 3-4 wk
- **Reduce stress** (latent carriers)
- **Segregate** breeding & training horses
- Keep at farm for 3 weeks after resp. or abortion outbreak
- **Vaccine** see pg 12 (not 100%, almost mandatory due to constant movement of horses), give to all horses, not just mares
  - MLV for resp. form, only lessening CS
    . Foals 3, 4 & 12 mo
    . Adults every 2-3 mo for performance horses & biannually for pleasure horses
  - Brood mare, both KV & MLV approved for use in pregnant mares
    . **Vaccinate 5th, 7th & 9th** mo of gestation
    . **Vaccinate in abortion storm** (recommended)
  - Vaccine gives immunity for 2-4 months



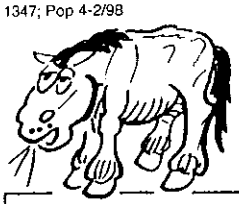
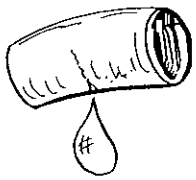
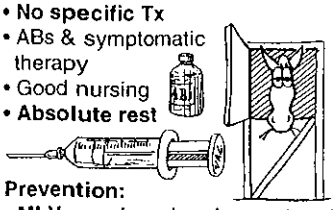
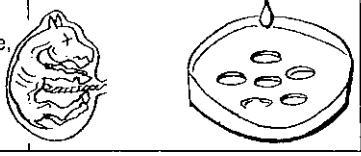
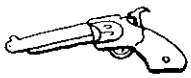
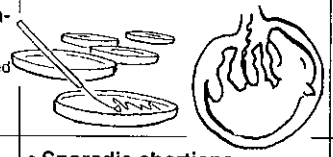
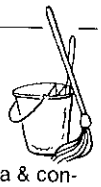
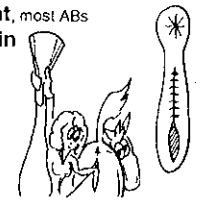
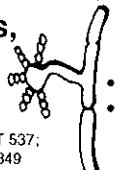
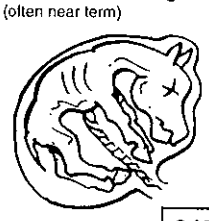
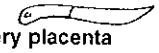
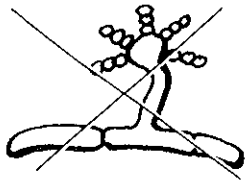
#1 Cause of Abortion, Last Trimester
CS: "Snots" then abortion storms
Dx: Hx
Tx: Time, Prevention Vaccination

DDx: Abortion
- EVA (Eq. viral arteritis) (pg 216)
- Bacterial & mycotic
  - Salmonellosis (pg 221)
  - *Strep. zooepidemicus* (pg 180)
  - CEM (contag. eq. metritis) (pg 179)
  - Mycotic abortions (pg 217)
- Twinning (pg 214)

DDx: "Snots"
- Other viral infec.
  - Eq. influenza
  - Eq viral arteritis
- *S. equi*

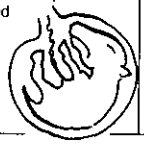
Px (prognosis)
- **"Snots" - self limiting**
  - Immunity last couple of years, not permanent
- Abortion: **Future breeding NOT affected**

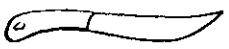
Abortion

Condition	Facts/Cause	Presentation/CS	Diagnosis	Treatment
Equine viral arteritis, EVA, Equine typhoid, Epizootic cellulitis M8k 997, 500; Mk 376, IM 527, 1401, 1397; I2M 1552; C4T 537; T 703, 706; R-Y 191; EM&S 1070; E 1347; Pop 4-2/98  **Nasal & Ocular discharge, edema** **Abortion during or following illness**	• **See CIRC pg 143** • Togaviridae - **Damages smaller arteries** - **Edema** due to leakage • Transm. - resp. or venereal - **Carrier stallion, NOT mares** • **Abortion rare** 	• **Most mild** • Fever & leukopenia • **Conjunctivitis** (pinkeye) **& Rhinitis** • **Very sick**, severe depression, quit eating • **Limb edema** (esp. hindlimbs) • ± Colic & diarrhea, photophobia, ventral edema, skin rash, pain in muscles joints, icterus • **Abortion**: of those aborting, over 1/2 abort during illness - **5-10 months of gestation**  **DDx:** • Rhino., EHV-1 (abortion months later; PM - inclusion bodies) (pg 215) • Eq. influenza (abortion rare) (pg 109) • EIA (pg 216) • Purpura hemorrhagica (pg 140)	• **CS to provisionally Dx** • **Virus isolation, serology, histopathology** (nasopharyngeal & conjunctival swabs, citrated blood samples & semen) **Abortion:** • **Abortion during or following illness** • **Virus isolation, serology, histopathology** (placental & fetal fluids & other tissues) - Few labs work w/ it, so ask about collection of specimens • **Postmortem** - Fetus: no specific signs - Myocardial arteritis - **No inclusion bodies**	• **No specific Tx** • ABs & symptomatic therapy • Good nursing • **Absolute rest**  **Prevention:** • **MLV vaccine closely regulated** - Economics, if no problem w/ EVA, don't vaccinate • **Seropositive stallions only bred to seropositive or vaccinated mares** - Don't ship mares to positive stallions - All positive stallions, semen culture for shedding (m/ shed for only a couple of months, then never again)
EIA, Equine infectious anemia, Swamp Fever M8k 499; Mk 27; IM 1074, 1401; I2M 1552; C4T 536; T 703, 707  **Rare cause controlled** **CS: Intermittent fever + Wt. loss** **Dx: Coggin's Test** **Yx: Euthanize of isolate for life**	• **See CIRC pg 136** • **Rarely see because controlled through testing, so:** - **Rare cause of abortions** - Infected mares generally abort • Transmission: Hematogenous, needles, bloodsucking flies - Intrauterо • **Retrovirus: lifetime infection** 	• **Intermittent fever** • Depression • Progressive weakness • **Weight loss** • Edema • **Progressive or transitory anemia** • Usually inapparent, but m/ cause death • **Abortions any stage of gestation**, especially during febrile episode - Don't abort unless very ill - May give birth to normal, live, free-of-infection foal 	• **History of wt. loss & periodic fever: suspect EIA** • **Coggin's test** (agar immunodiffusion) for serum antibodies - Foals nursing infected dams temporarily positive - Recently infected horses negative for 1 wk until antibodies develop • No lesions in fetus 	• **Euthanize positives or isolate for life**  • **No vaccination or specific Tx** - Stable fly control • **No Tx clears the carrier state** • **Isolate foals from infected mares** until Dx free of infec. by disappearance of maternal antibodies • **Once positive can't transport** - Tested every 6 mo; if positive, put in quarantine or euthanized • If aged, will be positive occasionally
Salmonella abortion M8k 997; Mk 184; IM 1413, 247, 819; I2M 1560; R-Y 183  **Late gestation, PH** **CS: Diarrhea, RP** **Hygiene**	• Turn of century *S. abortus-equi*, only 2 outbreaks since • Now associated w/ ***S. typhimurium*** or other nonhost specific spp. • **Contagious outbreaks** recognized in Wash., Ill. recently; not in other states • Similar to intestinal form of Salm. • **Carriers - feces, milk, or placental & uterine fluids** • **Public health/PH** (handle infected tissue w/ care) (zoonosis)	• **Abortions** - **Late in gestation** - **Retained placenta (RP)** • **Diarrhea** • Fever • **Vaginal discharge** (uterine infec.) • Metritis rare, fatal complication 	• **Retained placenta** • PM (postmortem) - **Autolyzed fetus** frequently - **Placentitis or inflamed fetal tissues** • **Culture & histopath.** of fetal tissues (especially abdominal contents) • FA of impression smears or sections of placental or fetal tissue • Serology, many labs don't do Salm. serology • Difficult to get titer from mare - no bacterial titer usually 	**Prevention:** • Carriers cultured • **Control w/ hygiene & avoid carrier animals** • **Isolate** aborting mares • **Remove** fetus, placenta & contaminated material from premises (handle carefully, zoonosis)  **Px** (Prognosis) • Future fertility m/b affected depending on bacteria, uterine infections also
Streptococcal abortion M8k 997; IM 1413; I2M 1560; T 701, 705; R-Y 183; E 1348 **#1 Abortion bacteria, normal flora** **Tx: Intrauterine Abs, Caslick's**	• ***Strep. zooepidemicus*** - **#1 bacterial abortion** • *E. coli* or Klebsiella • **Normal flora of genitalia** (tolerated in low numbers) • **Ascending infection up cervix** • **Vulvar abnormalities** predispose ("windsuckers")	• **Sporadic abortions** • Pyometra • Asymptomatic 	• **Postmortem:** - **Placentitis** (concentrated around cervical star) - Fetal inflammation • **Histopathology** • **Culture** from fetus • **Isolated from most parturient mares** (so not diagnostic) 	• **Easy to treat**, most ABs - **IM penicillin** • **Intrauterine infusions daily**  **Prevention:** • Mares w/ recurrent infections should be bred at first estrus after Tx • Artificial insemination safer • **Caslick's** for vulvar abnormalities
Mycotic abortions, Mycotic placentitis M8k 997; IM 1416, 1398; I2M 1563; C4T 537; T 701; R-Y 193; E 1349  **Late in gestation** **Leathery placenta**	• ***Aspergillus fumigatus*** - #1 fungal abortion in mare & COW (Mucor, Allescheria, Coccidioides, Histoplasma, Candida, Cryptococcus) • **Sporadic** • **Abortion in later 1/2 of preg.** (often near term) - 1 or 2 animals in herd - Winter more common - 5-30% of infectious abortions - Has recurred in subsequent preg. • Transmission through cervix usually	• **Abortion late in gestation** (often near term) 	• **Abortion late in gestation** • Postmortem:  - **Thick, leathery placenta (placentitis)**, especially chorio allantois (maternal side) - **Fetal bronchopneumonia** • **Fungal culture of placenta** • **Histopath.**, tissue smear or section (morphology or IF staining)	Control: • Reduce exposure to fungus 

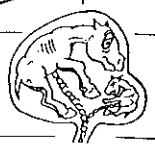
Abortion

Condition	Facts/Cause	Presentation/CS	Diagnosis	Treatment
Leptospirosis abortion M8k 997; Mk 352; IM 1410; I2M 1558; C4T 538	• **Rare** cause of abortion in mares; more common in cattle • *Leptospira pomona, L. icterohemorrhagiae* • Contaminated urine & poor hygiene - Moist environment (**likes water**) • If no immunity, get infected	• Asymptomatic, or • Fever • **Icterus** • **Hemoglobinuria** • **Abortion (mid- to last 1/3rd of gestation)** - Mare gets sick, then in couple of wks aborts • **"Moon blindness"**: periodic ophthalmia	• **PM** (postmortem) - **Autolyzed fetus** - All tissues brown to yellow & icteric • **Serology**: mare shows high titer; compare titer at abortion to that 3 wks later to see if dropping • Fetus culture usually unsuccessful	• **Isolate**: sheds organism for 2-3 months • **Vaccination available** - **During first trimester** - Repeat on yearly basis • No access to pond water

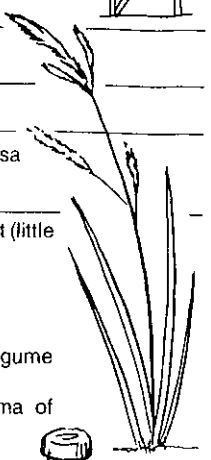





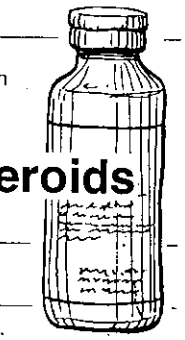

Non-Infectious causes of abortion (T 701; E 1350)

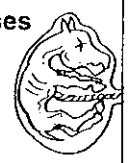
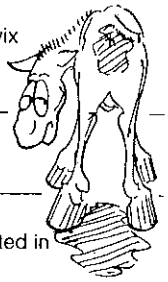


• **Twinning**	• See pg 214; 20-30% of all observed abortions, caused by lack of placental area (See pg. 214, 176)
• **Placental insufficiency**	• Caused by preexisting pathological lesions of uterus (chronic metritis w/ fibrosis, multiple cysts &/or atrophy of mucosa • Results in malnourished fetus that is aborted or born weak
• **Premature placental separation**	1• **Fescue grass toxicity**: prolonged gestation w/ separation of placenta before birth, little mammary gland development (little colostrum). - Edematous, thick & heavy chorioallantois & amnion. - Suffocate at birth or weak & frequently die from neonatal diz due to FPT (little colostrum) 2• **Stress** + excessive nutrition late in gestation: weather changes, transport, vaccination, worming, etc. + lush pastures, legume hays &/or excessive CHO or protein diets. -Fetus born premature, but normal mammary development. Cervical relaxation & separation of placenta (edema of chorioallantois because disconnected from dam)
• **Chemicals, drugs & poisonous plants**	• No hard evidence any cause abortion, it just happens & the substance recently used is blamed. • **Thiabendazole wormers** (scenario: used by millions w/ no problem, m/b just happened to be last Rx used) • **Arecholine & aloes** (purgatives) - used to stimulate bowel - smooth muscle stimulant for impaction colic • **Organophosphate** dewormers for bots (again millions Tx'd, some abort, Rx blamed) • **Sweet clover**: question if enough eaten to cause abortions

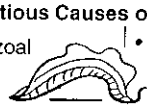

• **Hormones, Steroids, Oxytocin**	• Estrogens - not proven • **Steroids**: glucocorticoids (dexamethasone) 100 mg/d for 4 d during 10th mo of gestation hastens or induces parturition - **Stress** (transport, close housing, feed changes, debilitating diz) esp. from 3-5 mo of gestation will cause abortions . Decline of progesterone levels from CL at 3-5 mo . Mares w/ Hx of abortion: avoid stress, especially after 60 d • **Oxytocin**: induces parturition in late gestation w/in 1 hour - uterine contractions • **Prostaglandins**: cause abortion between 80-300 d of gestation • Deficiency of progesterone may cause abortion, especially w/ twins late in gestation
• **Chromosomal abnormalities**	• M/ cause abortion before 90 d, seldom causes abortion after 3 mo of gestation
• **Body pregnancy**	• Failure of horns to expand & chorioallantoic horns undeveloped. Retarded growth of fetus developing in body of uterus. • Abortion from 7-10 month of pregnancy. Cause unknown
• **Congenital malformations**	• 1% of all foals, many minor abnormalities • #1 contracted forelimbs, occasionally hindlimbs, cranial facial deformities, torticollis & scoliosis • Abnormalities of umbilical cord: - Excessive length, strangulation of fetus - Excessive torsion resulting in urachal obstruction & vascular occlusion (1% of fetal deaths, 5.5-7.5 mo of gestation) - Fluid filled sacculations & calcified cysts
• **Physical causes**	• Seldom cause abortions • **Trauma to mare or embryonic vesicle** (iatrogenic) • **Stress**: prolonged difficult transportation, excessive work, cast mare, struggling during surgery (release of steroids due to stress) • **Rough manipulation of embryonic vesicle** between 16-40 d of pregnancy (iatrogenic) • Natural service in first 3 mo of preg. (↑ estrogen levels cause follicles & ovulation), abortion rare bec. of constricted cervix • **Infusion of uterus** causes abortion in 3-10 days • **Manual dilation** of pregnant cervix
• **Fetal diarrhea**	• Defecate large amounts in late gestation; Aspiration of meconium - Abortion late in gestation or weak live foal with poor prognosis - Meconium stained foal (looks jaundiced); cause unknown - Fetal or maternal stress?



Rare Infectious Causes of Abortion

• Protozoal	• *Trypanosoma equiperdum* (dourine) & *Babesia equi* or *B. caballi* (piroplasmosis) rarely cause abortion. Dourine eradicated in USA; Piroplasmosis (or babesiosis) limited to Florida: CS similar to EIA; Treatable

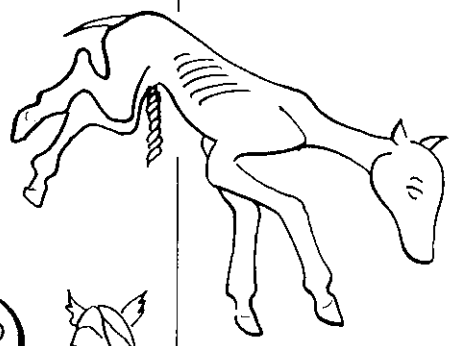


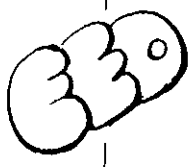
Abortion

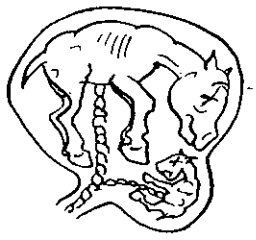
Condition	Facts/Cause	Presentation/CS	Diagnosis	Treatment
Early embryonic death, EED, Fetal loss Mk 1142; T 700, 705; R 175; R-Y 113; C3T 644; EM&S 1063; E 1340	• **EED: 50% of abortions up to mid-gestation (160 d)** **- 3-4% of abortions past mid-gestation** • Called **infertility** when unnoticed abortion between 20-90 d of gestation, EED, most common time • **Lucky to Dx 1 in 10 causes** of abortion • Variety of causes (see box) - Usually individual mare, problem mare, usually older, habitual aborter (early or late) - Nutrition: number of mares in herd, healthy mares . "Flushing" effect of going from dry winter or summer ration to lush spring or fall ration or "conditioned" for shows - relaxes cervix, ascending placentitis (bacteria &/or mycotic) - Transportation - stress - encourages onset of estrus & relaxation of cervix - tend to show signs of estrus a few days after hauling	• Infertility: Serviced - **Appeared pregnant** ("teasing" didn't produce signs of estrus) - Normal vaginal signs of pregnancy - Conceived, but fetus aborted • **Not pregnant on exam 20-60 d after service**	• History • No pregnancy 20- 60 d after being bred	• Eliminate stress, re-breed
Fetal mummification T 709; R-Y 119; EM&S 1071 **One of twins**	• **Rare in mare** - Only in one of twin fetuses - Single mummified fetus never reported • Fetal death 3-10 months of pregnancy - Absorption of fetal fluids			

Causes:
- Problem mares
  - Uterine infection (pg 170, 182)
  - Venereal diz (CEM) (pg 179)
  - Hormonal dysfunction
  - Genetic abnormalities
  - Cervical lesions
  - Pneumovagina (pg 177)
  - Poor conformation of vulva, vagina & cervix (pg 177)
  - Uterine pooling (pg 186)
  - Older mares
- Healthy mares
  - Nutritional flushing
  - Hauling
  - Stress - transportation
  - Twinning

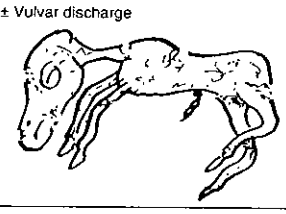
DDx:
- Persistent CL (pg 166)

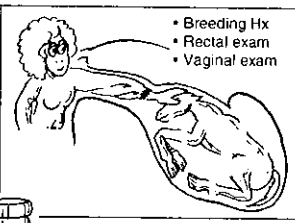




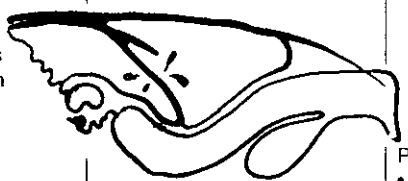


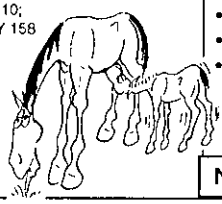
Fetal maceration T 709; E 1352; EM&S 1063 *	• Rare - From 2 mo to term • Fetal death, cervix fails to dilate - Autolysis of fetus - emphysema, & maceration, metritis & pyometra	• ± Vulvar discharge	• Breeding Hx • Rectal exam • Vaginal exam	• Gently dilate cervix w/ lots of lubricant - Remove fetus - Broad spectrum ABs in an oily base . Tx uterus & cervix - ± Systemic ABs - Prevention of laminitis
Rare - Vulvar discharge - Remove fetus				
Hydrops amnii & hydrops allantois, Fetal dropsy C4T 544; T 709; R-Y 124; E 1362; EM&S 1014	• Edema of chorioallantois, extremely rare in equine • Tx: Induce abortion - low IV infusion of oxytocin (m/b preceded by large dose of estradiol) - Laparotomy or cervical dilation & rupture of membranes			
Extremely rare - Induce abortion				
Hemorrhage of pregnancy - Uterine a. C4T 550; T 710; R-Y 121 **Serious**	• Internal hemorrhage of **uterine artery** ("middle uterine a.") - Violence or trauma - Happens occasionally - Large uterine vessel - Fatal intra-abdominal hemorrhage	• Marked ↑ HR & RR • Weakness, staggering • Sweating • Pale mucous membranes • Rapid onset of prostration • Shock & death	• History, clinical signs	• Large amounts of blood or blood substitutes Prognosis: • Poor if severe, hard to get volume in quickly enough
Postpartum hemorrhage T 710; R-Y 158 **Not serious**	• Bleeding from vulva after parturition • **Older mares** • Panics some owners • Usually not serious nor requiring Tx • Usually from ruptured "varicose" or surface vein in vagina or hymen area - Not usually from uterus	• **Occasional slight recurrent bleeding**	• History, • Clinical signs	• Usually heals spontaneously

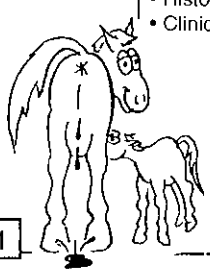


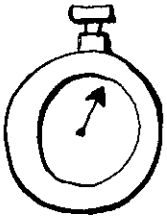


Oxytocin



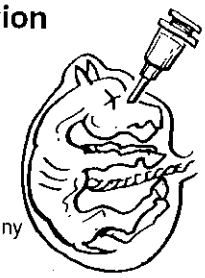






Pregnancy termination

T 715; R-Y 177; E 1351



- Indications
  - Mismating
  - Purchased pregnant mare w/ unwanted fetus
  - Dx of twin pregnancy
  - Research
- Can interrupt (terminate) at any stage, the earlier the better

Interruption Times & Methods	
1-3 d	Mega dose estradiol
6-45 d	Prostaglandins or flushing
35 - 80 d	Saline infusion
80 - 150 d	Cervical dilatation
< 4 mo	Ovariectomy
> 4 mo	Manual removal or induce
340 d	Oxytocin (for live foal)

- **1-3 days: Mega dose estradiol injections**
  - Breed w/in last 12-72 hr or still in estrus
  - **Repositol® (diethylstilbestrol)** (1 injection of 100-200 mg) or
  - **Estradiol** (several injections of 10-20 mg every 36-48 hrs)
  - Relaxes cervix
  - Probably will prevent pregnancy
  - Should come into estrus, if doesn't or is pregnant:
- **6-45 days: Prostaglandins or flushing after breeding or end of estrus**
  - Let mare go out of estrus for 6 days as need mature CL
  - **Interrupts corpus luteum,** stops progesterone production which terminates pregnancy
    - **Prostaglandins IM** (easiest), CL must be mature (6 d), PGF2 alpha (2.5-5.0 mg IM at 12 hr intervals) or Fluprostenol® (potent PgF2a analog, 2 mg IM)
    - **Infusion of uterus w/ 1 liter of saline:** irritates lining of uterus to release prostaglandins
  - 3-4 d return to estrus
    - Observe for next onset of estrus
    - Failure: if 10 -12 d not returned to estrus, uncommon to fail
      - Repeat treatment (14 d interval between Tx)

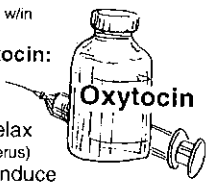
- **35 - 80 days: Saline infusion**
  - Equine fetus attached, endometrial cups forming after 35 days
  - No PGF2 alpha once endometrial cups formed because PMSG (pregnant mare serum gonadotropin) protects accessory corpus luteae formed
  - **Saline infusion,** 500-2000 ml (add 2 million IU of Na penicillin to flushing solution)
  - Pre-Tx w/ 10 mg of estradiol 24 hrs before flushing to cause cervical relaxation
    - Estradiol not necessary usually because cervix dilates spontaneously w/in 4 hrs of infusion
  - Expulsion usually w/in 24 hrs (m/ occur immediately)
  - If longer than 24 hrs, repeat flushing
    - Repeat every 24 hrs until terminated
- **80 - 150 d: Cervical dilation**
  - Penetrate cervical seal w/ 1 finger & gently dilate cervix for 10-20 min
  - Ruptures allantochorion
  - Gently remove fetus manually
  - Pre-Tx w/ estradiol 24 hrs earlier will facilitate by relaxation of cervix

  - **Saline not used after 90 days!** (kills, but fetus too large to pass easily)
  - If not manually removed after cervical dilation, abortion usually occurs in 2-7 d (more reliable to manually remove)
- **< 4 mo: Ovariectomy** will usually cause abortion in 4-6 days, but permanent sterility
- **> 4 mo: Manual removal** (if large) or induce labor w/ oxytocin

Induced parturition

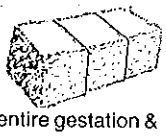
C4T 546, 548; R-Y 144; EM&S 997, E 1355

- **340 d: Induce parturition for live foal**
  - **Oxytocin** (60-100 IU)
  - Induces parturition in late pregnancy w/in 1 hr causes uterine contractions
  - **Strict criteria to give oxytocin:**
    1. At least 340 d gestation
    2. Need milk in udder
    3. Need cervix starting to relax (2 fingers easily introduced into uterus)
  - If have all 3, then safe to induce
    - Do NOT do this as a convenience
    - Don't need to prime mare with estrogen as in other species



- **Advise against very late abortions**
- Don't dilate if want to retain pregnancy - they will abort
  - **120 d before next estrus** once endometrial cups have formed (too late for early foal)

Late Gestation Care



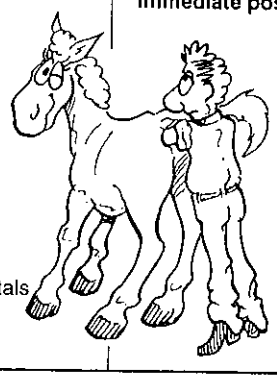
- **Nutrition** of mare during gestation
  - Hay usually fed free choice during entire gestation & supplemented as energy demands increase
  - Maintenance diet up to last third of gestation (so don't lose weight)
  - **Last 1/3rd of gestation: increase energy**
    - Sweet feeds of corn & molasses
    - Can't eat enough hay to maintain weight in this stage of gestation
  - Last 5-6 wk of gestation: greatest use of energy due to starting lactation
  - Observation a must
- **Dewormed 30 d prior to due date**
- **Vaccinations:**
  - Boosters, tetanus, influenza, encephalitis (up to you)
  - Rhinopneumonitis (2 forms: one resp., one abortion)
    - Pneumabort® a killed virus safe during preg.
    - Schedule on bottle, but 5th, 7th & 9th mos of gestation (period when virus can cross placenta & kill fetus)
- Hypocalcemia in only hard working horses, not so much in milk production, i.e., brood mares
  - Rare

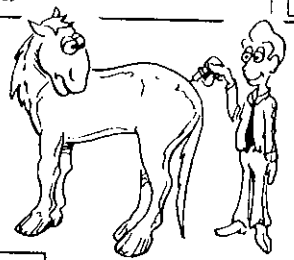
Exam of parturient mare

C4T 547; IM 253; T 694

- Proper restraint (see box)
  - Varies w/ temperament of mare
    - Twitch, sideline or hobbles m/ help
  - **No stocks!** Mares attempt to lay down when stimulated by manipulation of genitals
  - Chemical restraint m/b necessary
    - Acepromazine or **Xylazine/ketamine**
    - IV or general anesthesia for longer periods
    - **Epidural anesthesia** to relieve pain of dystocia & stop abdominal straining
      - Allows thorough exam, repulsion & mutation of fetus
- **Clean environment w/ good footing**
- **Bandage tail & tie to halter** (prevents injury to tail if mare lies down)
- **Sanitation, sanitation, sanitation!!!** when entering genital tract
  - Surgically scrub buttocks & perineal region & operator's hands
- **Adequate lubrication:**
  - Methylcellulose only lasts a short time
  - Petroleum preferred for mutation & fetotomy
  - Frequent reapplication necessary

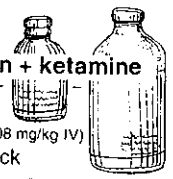
- **Examination of birth canal - thorough!**
  - Previous trauma
  - Adequacy of relaxation & size
  - Presentation, position & posture of fetus
  - Determine if fetus is alive
- **Form a plan for delivery & immediate postpartum care**





Foaling:

- **Clean quiet area** to which mare has adapted
- Pasture is better than stall, but usually can't observe in pasture
- Caslick's suture must be removed within week or two, but if necessary just before foaling to prevent tearing



Chemical restraint:

- Acepromazine maleate (0.04-0.08 mg/kg IV)
- Xylazine (Rompun®) m/ still kick
- **Xylazine/ketamine:** Xylazine (1.0 mg/kg IV) followed by ketamine (2.0 mg/kg IV) muscle relaxation & analgesia for short periods (10-20 min)
- IV or general anesthesia for longer periods
- Epidural (see box below)

Epidural anesthesia to relieve plain of dystocia & stop abdominal straining

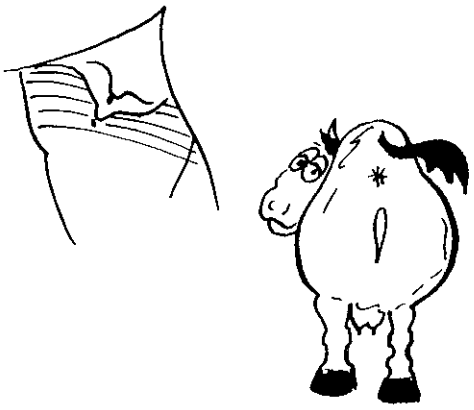
- Allows thorough exam & repulsion & mutation of fetus
  - 18 gauge, 3" spinal needle w/ stylet
  - Enter epidural space between 1st & 2nd caudal vertebrae
  - 2% lidocaine (6-8 ml for 1000# mare [450 kg]) will relieve straining w/out causing collapse of rear end

Foaling - Warning Signs

IM 253; Pop 45-2/98

1• Large bellies (DDx from those that had lot of babies or hay belly)
2• Fetal movement when drinking cold water or eating
3• Mammary gland development
- Fills 3 weeks before expected date (most noticeable for 2nd or more foals)
- Last day before foaling, udder tense, teats distended & leaky
- **Foaling day: "waxing"**: drying of milk secretion on udder (usually will foal that evening)

• **Night foaling**: most, usually between 7:00 PM - 1:00 AM, isolate themselves to foal (tremendous control over time of foaling)
- Put mare in foaling stall 2-3 wks prior (acclimatize)



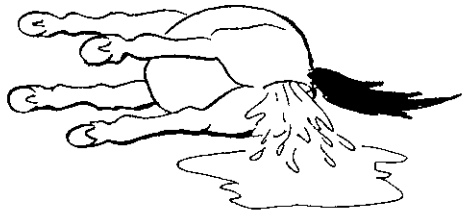
Three Stages of Parturition

C4T 547; R-Y 68, 141; EM&S 994, E 1352; T 693

Stage 1: Positioning of fetus, aligning it w/ birth canal
• Fetus extends head & forelimbs & rotates into dorso-sacral position
• CS: Vary from mild discomfort (restlessness, nervousness, uterine contractions) to sweating & marked colic
- **2-4 hr** for cervical dilation & end of 1st stage
. M/b delayed for hours to days
. Normal delivery m/b preceded by several bouts of false labor
. 80% foal in evening after dark to midnight

Stage 2: Delivery of foal
• **"Water breaks" to aid expulsion of foal**
- **Explosive in mare, usually 20 min to deliver**
- **Rupture of chorioallantois** as mare generally lays down, putting pressure on it, yellow to chocolate fluid
- Foal enters birth canal in slightly dorsoiliac position
. Shoulders enter successively so hoof of one forelimb at level of fetlock of other
. Head lies between carpal joints
- Amnionic membrane protrudes out vulva w/in 5 min of "water breaking"
- **Abdominal straining** begins shortly after 2nd stage starts, very strong contractions
- Placenta starts to separate
- **30-45 min maximum** time for foal to be born & breathing
- Placenta separates rapidly from endometrium, cutting off oxygen supply to foal
- If not delivered in 45 min, death of fetus from asphyxiation

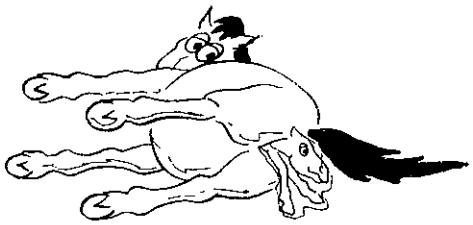
Stage 3: Expulsion of fetal membranes
• **30 min - 3 hours**
• Myometrium continues to contract to expel membranes & involute uterus
- Mare lies down & acts uneasy
• **Usually membranes pass easily**
• **> 3-6 hr** considered retained placenta (**RP**)
- RP starts to deteriorate & rot; m/ absorb breakdown products, develops toxic septicemia or circulation disturbances in feet due to histamine absorption
. **Postpartum laminitis**, most notably in draft horses
. Potentially a dangerous situation (more dangerous than in cow)
• **Normal vaginal discharge for about 7 days, usually dark chocolate**



Eutocia - Normal parturition

C4T 547; EM&S 994, E 1352

• **Good news!** Foaling generally normal in mare (as apposed to cow)
- Try to leave mare alone and let her give natural birth
• Foal born wrapped in amnion
• Then wiggles to rupture amnion
- Clear amnion from nostrils
• Foal born attached to umbilicus, pulsating to transfer blood to foal
- Don't try to remove umbilicus from foal
. Movement of foal will separate it normally
. Do NOT ligate cord in domestic animals due to contamination
. Umbilical cord will dry up
. If tears abruptly, then it is a problem to deal with
• **Dip naval in 2% tincture of iodine** to disinfect area
- **Naval ill**: ascending infection up umbilical cord
. 2-3 days after birth foal becomes very sick (systemic diz often settles in joints, hence name "joint ill"). Very enlarged, fluid-filled joints
- Relatively long cord, very twisted usually
. Occasional twisting to occlusion, but rare
. Blamed for stillborns



Dystocia C4T 552; R-Y 146; E 1356, EM&S 1015; M 261

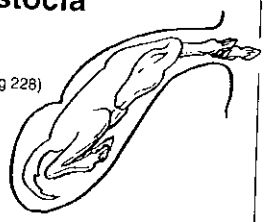
• TRUE EMERGENCY in MARE - 45 min

• Delivery in which something goes wrong
- When either of 1st or 2 stages of parturition are prolonged or not progressive
• Need veterinary assistance immediately if any abnormalities of parturition
- More urgent than other species because when foal breaks free, placenta does also, no air supply
• Examination of birth canal & fetus indicated
• **Most dystocias fetal in origin**
• Few maternal (herniated & no abdominal push, overwt. mare & no exercise, tendency to give up, exhaust early)
- Oversized fetus, rare in mare (big problem in cattle)
• **Cleanliness & lubrication - necessary**
- If contaminate uterus, may save foal, but destroy breeding possibility of dam
• **Need lots of lubrication**: if long time, lose all fluids, not unusual to put lots of lubrication back into uterus
- Methylcellulose in mare (cheap & water soluble)
• Treatment of dystocia
1• Mutation: reposition fetus
2• Traction: use to deliver, best for dam & foal

If can't mutate enough to use traction, can:

3• C-section: deliver live baby
4• Fetotomy: cut in pieces & deliver pieces

Causes of Dystocia



• **Common causes**
- **Malpresentation** (pg 228)
- **Malposition** (pg 228)
- **Malposture** (pg 228)
- **Torticollis**
- **Arthrogryposis**

• Less common causes
- Pre-term parturition
- Abortion (pg 214)
- Twinning (pg 214)
- Vaginal/vulvar obstruction (tumor, callus, hematoma, abscess)
- Pelvic deformities (fracture, injury)

• Uncommon causes
- Fetopelvic disproportion
- Uterine torsion (pg 232)
- Uterine dorsoretroflexion
- Uterine inertia
- Vaginal prolapse
- Ruptured prepubic tendon (pg 233)
- Abdominal ventr. hernias
- Prolonged gestation
- Induction of parturition (pg 222)
- Premature separation of chorioallantois from endometrium
- Congenital defects
- Hydrocephalus
- Hydrops of fetal membranes (pg 221)

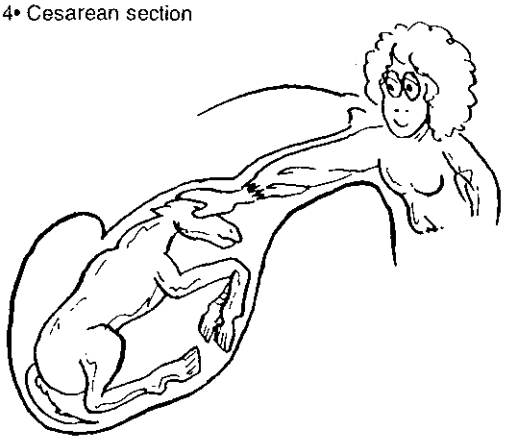
Most dystocias fetal in origin

Obstetric operations

C4T 555; T 693

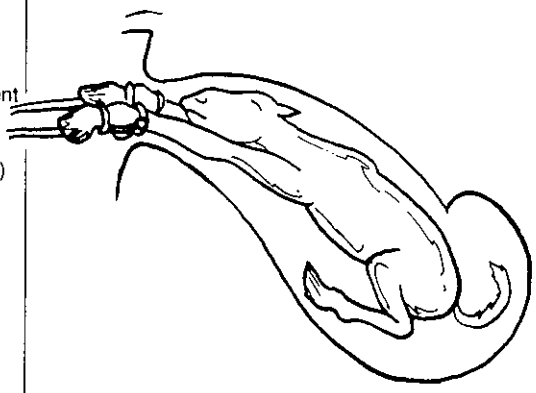
Obstetric operations for resolution of dystocia:

1• Mutation of abnormal presentation, position or posture
2• Forced extraction
3• Fetotomy (partial or complete)
4• Cesarean section



1 • Mutation T 694; R-Y 147

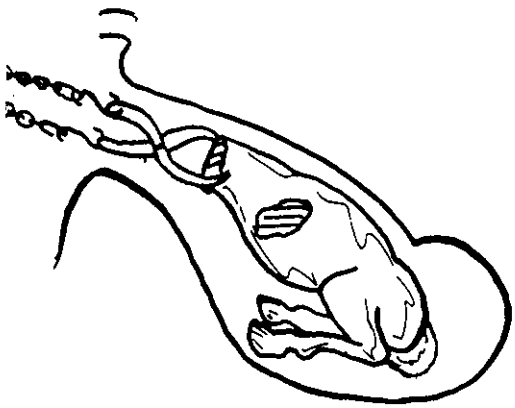
- **Normal presentation**: anterior presentation, dorsosacral or slightly dorsoilial position w/ head, neck & forelimbs extended
- Other presentations, positions & postures first corrected by mutation if possible
  - Obstruction of fetal head, thorax or pelvis less common than in cow
  - "Hip-lock" uncommon in equine so rotation while extracting not necessary
  - Oversized fetus uncommon
- **Do NOT get arm between fetus & pelvis** or m/break your arm
- **Preparation:**
  - Well lubricated birth canal & fetus
  - Epidural to stop straining
  - Mare standing preferable (unless long time)
    . Most not prone to kick when in foal, generally patient
    . Want to lay down
    . If fractious, be careful
    . Never get between horse & hard spot (wall, etc.)
  - Work in open area
  - Extreme care not to rupture uterus
  - Do NOT attempt if uterine wall tightly contracted around fetus
- **Procedure:**
  - 1st: repulse fetus out of mare's pelvis into uterine cavity (more room)
  - Attempt to rotate fetus into a dorsosacral position
  - Malposture of fetal extremities (most common cause of dystocia in mare)
    . Repulse as far cranially as possible
    . Flexion of extremity
    .. Repulse proximal end
    .. Rotate middle portion laterally
    .. Traction applied to distal end
    .. By operator if room for both hands, or
    .. By assistant pulling on obstetric chain or snare
    .. Protect birth canal from trauma
    ... Cup fetal hoof w/ hand
  - **If longer than 15 min use alternate form of delivery - cesarean section**

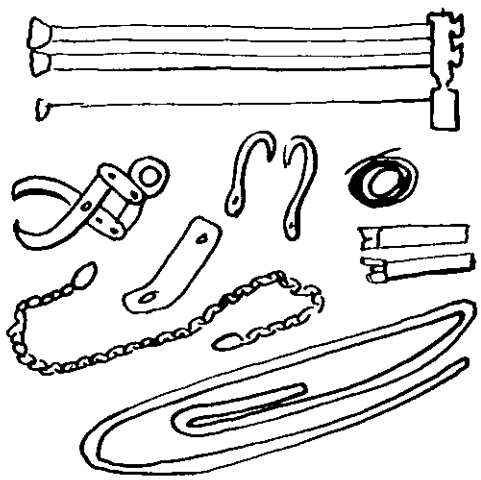


2 • Forced extraction (Traction)

C4T 559; R-Y 150; T 695

- Mutate fetus in dorsosacral position w/ head, neck & forelimbs extended
- Place traction snares or chains (OB)
  - Half hitch above & below fetlock so don't pull off distal epiphysis of cannon bone
  - Eye of snare on dorsal aspect
- Only direct head w/ traction devices, do not pull w/ them (head bones not as well developed as in the cow); don't use eye hooks
- **Moderated amount of traction** (only 2 or 3 people pulling)
  - Do not use mechanical aids!
  - Simultaneous traction w/ abdominal press of mare
  - Want foal to bend over pelvis
  - Should be easy
- If can't do rapidly, reexamine fetus & correct impediment; do a C-section



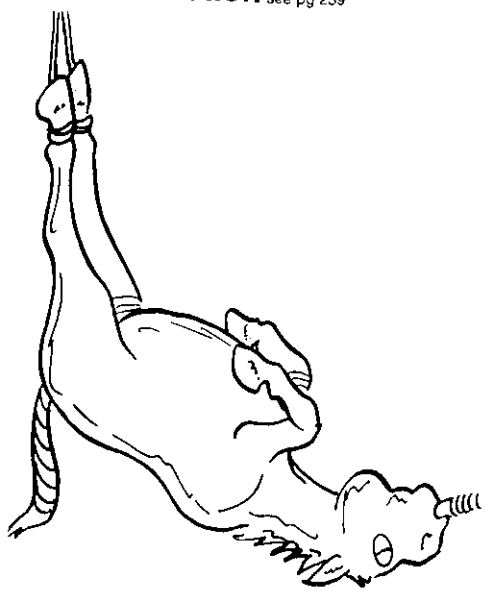


Fetotomy instruments

3 • Fetotomy T 695; R-Y 150; M 261

- **Reduction of fetal size by amputation, partial or complete**
- Requires expertise
- Partial fetotomy usually enough, followed by extraction of the remains of fetus
- Restraint: epidural anesthesia/general anesthesia
- Nonirritating lubricants
- If done w/in 12 hr of onset of labor, Px of mare's survival good

Cesarean section see pg 239



Sequelae to fetotomy

- Retained placenta
- Metritis
- Peritonitis
- Laminitis
- Vaginal & cervical laceration
- Delayed uterine involution
- Nerve paralysis (facial & radial)

Orientation of fetus: presentation, position & posture C4T 555

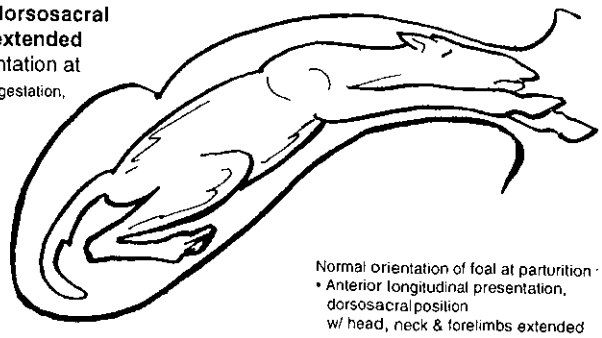
- **Presentation**: relationship of long axis of fetus to dam, & part of fetus approaching pelvis
  - Longitudinal presentation: fetal spine parallel to dam's spine
    . Anterior longitudinal: head at cervix, normal in mare, either way in cow
    . Posterior longitudinal: tail towards pelvis (breech)
  - **Transverse presentation**: fetal spine perpendicular to mare's spine
    . Ventral or dorsal: depends on side facing pelvis
- **Position**: relationship of dorsum of fetus to the four quadrants of mare's pelvis: sacrum, left or right, ileal or pubis
  - Dorsopubic (upside down)
  - Dorsoilial (left or right)
  - Dorsosacral (or slightly dorsoilial) preferred
- **Posture**: relationship of fetal extremities to its body
  - **Normal: both front feet at level of head w/ hind feet trailing behind**
  - Problem w/ abnormal posture: takes up more pelvic room in the dam

Hydrocephalus

- Dystocia due to fetal monsters
  - Not common in mare
- Correction
  - If bones soft - incise soft part of head & release fluid
  - If bones hard - partial fetotomy of enlarged part of head

Normal orientation of foal at parturition

- **Anterior longitudinal presentation, dorsosacral position w/ head, neck & forelimbs extended**
  - Only 1 in 500 foals in posterior presentation at delivery (50% in posterior presentation in early gestation, rotate by 6.5 months)

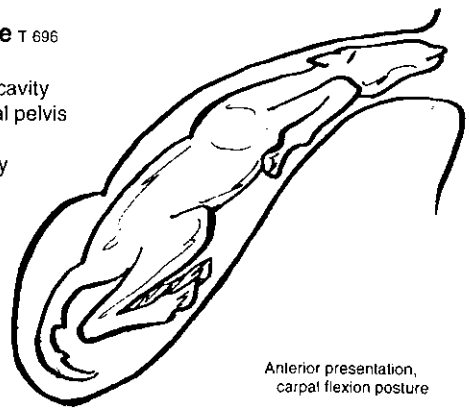


Normal orientation of foal at parturition
• Anterior longitudinal presentation, dorsosacral position w/ head, neck & forelimbs extended

Abnormal Orientations of Foal

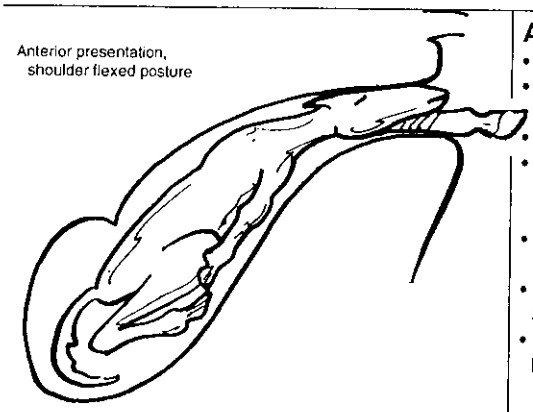
Anterior presentation, carpal flexion posture T 696

- Unilateral or bilateral
- "Engaged carpal flexion": head & flexed limb(s) in pelvic cavity
- Disengaged carpal flexion" - flexed limb cran. to maternal pelvis
- Correction:
  - Repulse affected limb & fetus cranially into uterine cavity
  - Grasp metacarpus just above the fetlock
  - Lift limb dorsally, flexing elbow & shoulder
  - Lift fetlock above the mare's pubis
  - Cup hoof & pull into pelvic inlet
  - Snare around fetlock m/ be useful, lift carpus & pull
- "Engaged" m/ deliver, if enough room, w/o repulsion
  - Traction on head, extended limb & flexed limb & repulsion of shoulder (extend it)
- Dead fetus: amputate just distal to carpus
- If not corrected rapidly & fetus alive: C-section indicated



Anterior presentation, carpal flexion posture

Anterior presentation, shoulder flexed posture

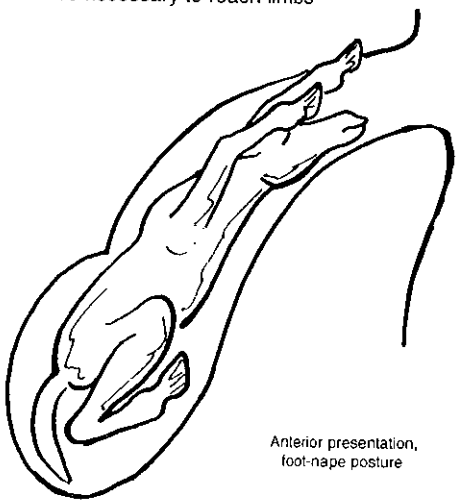


Anterior presentation, shoulder flexed posture

- Forelimb lies alongside or under fetal abdomen
- Unilateral or bilateral, engaged or disengaged
- Correction:
  - Attempt to turn into a carpal flexed posture
    . Grasp radius & pull toward pelvis
    . Difficult because of long limbs
    . Traction snare m/b helpful, but difficult to position
  - Once in carpal flexed posture, mutate
  - Forced extraction w/o correction only if fetus small or pelvis large (lubrication & forced extraction of extended limb & head), expect fetal trauma
- Fetotomy
  - Amputate head 1st
  - Incise over dorsal border of scapula
    . Place gigli wire in incision & around limb, between scapula & thorax
  - In bilateral cases m/ have to only remove 1 limb

Anterior presentation, foot-nape posture

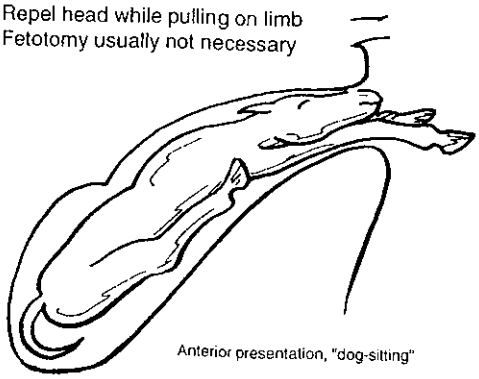
- 1 or both limbs lie on top of head
- Sequelae: rupture of vagina, rectovaginal fistula, 3rd degree perineal laceration
- Immediately correct this posture
- Correction: lift fetal head & repel, while assistant pulls downward & laterally on snares attached to fetlocks
  - Forced extraction
- If hooves penetrated vaginal or rectal walls, attempt to replace in vagina prior to correction of posture
- Rectovaginal fistula: incise mare's perineum to make 3rd degree perineal laceration
- Fetotomy of limbs in vagina or rectum; amputation of head m/b necessary to reach limbs



Anterior presentation, foot-nape posture

Anterior presentation, shoulder-elbow flexion posture

- Relatively rare
- Shoulder & elbow flexed, head lies next to fetlock instead of carpus
- Correction
  - Repel head while pulling on limb
  - Fetotomy usually not necessary



Anterior presentation, "dog-sitting"

Anterior presentation, "dog-sitting" posture

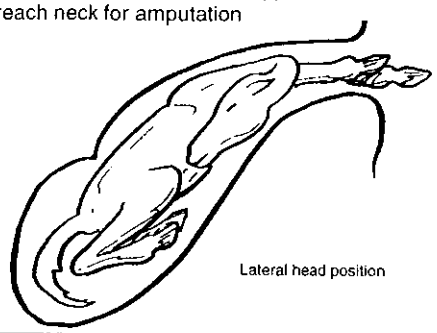
(ventrovertical presentation)

- Hip joints flexed
- Cranial part of fetus delivered OK, but stops after thorax emerges
- Forced extraction doesn't work & m/ drive hind hooves through uterus
- Correction difficult: rotate fetus to dislodge digits
  - Try to repel hindlimbs (long arm needed)
- Fetotomy:
  - Cut fetus transversely behind last rib
  - Deliver hindquarters or cut in half longitudinally

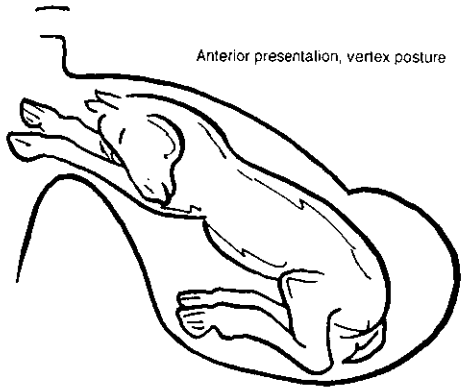
Abnormal Orientation of Fetus

Anterior presentation, lateral dead posture

- Common cause of dystocia in mare
- DDx from "wryneck" (congenital curvature of cervical vertebrae)
- Correction difficult because of long neck
  - If small m/ extract w/o correction, but unlikely
  - Repel into uterus
  - Lay mare on side w/ fetal head uppermost
  - Grasp fetal mouth, move head toward midline of mare
  - Grasp muzzle or lower jaw or orbital grooves w/ 1 hand & press on side of head w/ palm of other hand & pull head into pelvic cavity or
  - Mandibular snare (soft rope) pulled while pushing w/ other hand on head
  - Only use moderate traction
- Partial fetotomy
  - Indicated if "wryneck", fetal head beyond reach or can't be rapidly corrected
  - Amputate head & neck at point of deviation & remove
  - If small pelvis, amputate limb opposite neck flexure to reach neck for amputation



Lateral head position



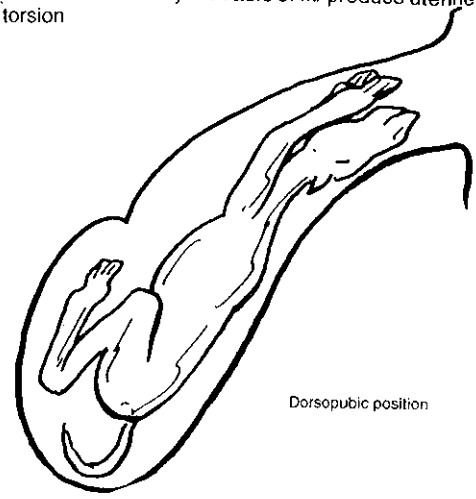
Anterior presentation, vertex posture

Anterior presentation, nape, vertex & breast-head posture

- Vertex posture: bridge of muzzle against mare's pubis w/ poll into pelvic cavity
- Nape posture: displaced further than vertex w/ nape of neck in pelvis
- Breast-head posture: muzzle against sternum
- Correction: traction on mandibular snare (soft rope) around lower jaw, while
  - Repel poll
  - Spontaneous delivery of nape posture possible if mare normal to large in size
- Fetotomy if fetus dead
- C-section if fetus living & can't rapidly reposition

Dorsoilial or dorsopubic position

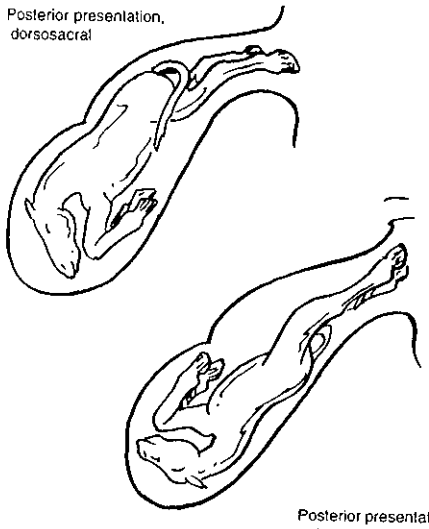
- Failure of normal rotation to dorsosacral position
- Unless small, must reposition before delivery
- Differentiate from uterine torsion
- Correction
  - Place obstetric chains on both fetal limbs
  - Secure head w/ mandibular snare or blunt eye hooks
  - Grasp humerus near shoulder & lift upward, while:
  - Assistant applies traction on dorsal limb downward & medially
  - Fetus must be freely movable or m/ produce uterine torsion



Dorsopubic position

Posterior presentation, dorsosacral

- OB chains half hitch above & below fetlock
- Forced extraction (worry about compression of umbilicus as goes through birth canal)
  - Little time to get out once compressed



Posterior presentation, dorsosacral

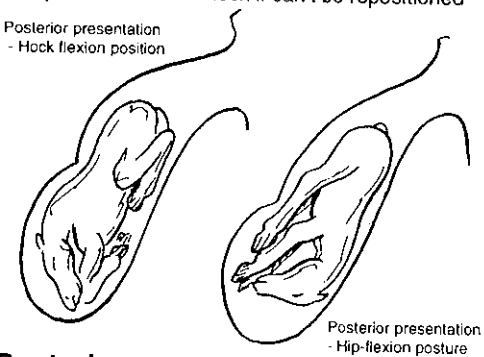
Posterior presentation, dorsopubic

Posterior presentation, dorsopubic

- Correction: rotated to dorsosacral presentation
  - . OB chains - half hitch above, half hitch below
  - Forced extraction

Posterior presentation, hock flexed posture

- Unilateral or bilateral, engaged or disengaged
- Posterior presentation w/ hindlimbs flexed at tarsus
- Correction: Grasp lateral aspect of metatarsus & displace hock upward & forward
  - Pull hoof into pelvis
  - Or snare on fetlock, pulling while operator repulses foal forward
- Amputation distal to hock if can't be repositioned



Posterior presentation - Hock flexion position

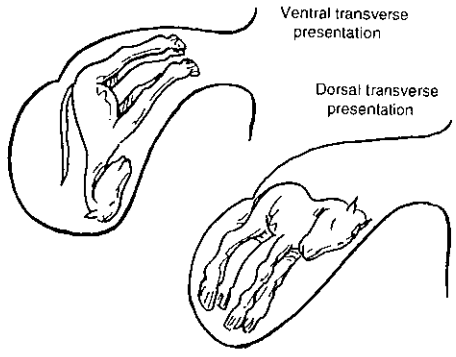
Posterior presentation - Hip-flexion posture

Posterior presentation, hip-flexed posture

- Posterior presentation w/ flexion of hip
- Rear limbs under body of fetus
- Correction difficult: mare in lateral recumbency, affected limb uppermost. Attempt to mutate hip-flexion to hock-flexion which is then further mutated as above
- Cesarean section
- Percutaneous amputation of affected limb(s)

Ventral transverse presentation

- Fetal spine perpendicular to dam's, 4 feet toward pelvis
- DDx from twin pregnancy
- M/b complicated by rotation of uterus
- Consider cesarean section as correction difficult
- Correction unlikely to be successful
  - Convert to posterior longitudinal presentation, dorsosacral position
  - Repulsion rotation
- Amputate forelimbs (m/b necessary to amputate hindlimb below hock to reach forelimbs)
  - Repel forepart of fetus & apply traction & rotation to hindlimbs



Ventral transverse presentation

Dorsal transverse presentation

Dorsal transverse presentation

- Less common than ventral transverse, either transverse presentation rare 0.1% of all pregnancies
- Fetal spine perpendicular to dam's spine, w/ legs toward dam's head
- Cesarean section best bet
- Mutate into posterior dorsosacral presentation
  - Repel forepart while hindparts extracted & rotated
- Mutation & fetotomy
  - Attempt to saw around lumbar areas & deliver cranial & caudal parts of fetus

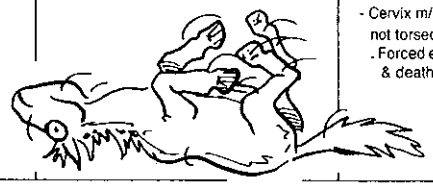
Condition	Facts/Cause	Presentation/CS	Diagnosis	Treatment

Maternal dystocia • Less common than fetal dystocia

Uterine torsion
C4T 543; R-Y 123; T 699, 771, 710; R 230, 337; E 1351, 1375; EM&S 1032; S 754

- Cause unknown
  - Rolling of mare
  - Excessively active fetus
- Less frequent in mare than cow due to:
  - Dorsal placement of broad ligament
  - Rarely more than 180°
- **More serious in mare** than cow
  - **Lower survival rate**
  - More difficult to correct
  - Foal usually dead
- **Doesn't** usually involve cranial vagina or cervix as in cow
- Most commonly turns to the left

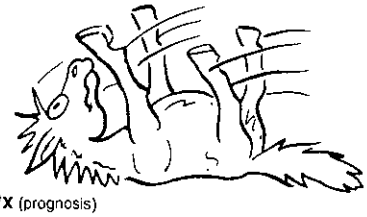
- **Severe colic** (8 mo to term)
- Anorexia
- Frequent attempts to urinate
- These prolonged signs resemble early stages of parturition

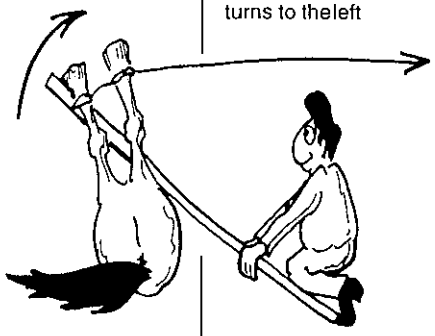


- **PE any colic in last trimester**
- **Rectal palpation** of displacement of broad ligament
  - 1 side pulled tight under uterus, while opposite side pulled tight over uterus
  - Left torsion: broad ligament over top from right to left
- Speculum exam m/not Dx (contorted folds m/not be seen because doesn't involve cervix as much as in cow)
  - Cervix m/b opened so vet m/ wrongly assume not torsed & elect forced extraction
    . Forced extraction will result in uterine rupture & death due to hemorrhage or peritonitis

DDx:
- Early parturition
- Colic
- Indigestion

- **Roll mare toward torsion** (see box)
- **Flank surgery** (see box)
  - Reposition manually
- Once corrected, if thrombosis & infarction = death
  - If near term, has milk & dilated, induce labor (oxytocin) & manually assist delivery
- Cesarean section if cannot correct
- If fetus dead, remove by hysterectomy (owner's permission, as mare will be sterile)

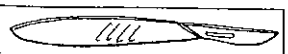




Roll mare (physical manipulation)
- Cast anesthetized mare on side towards torsion
  - Roll towards torsion (hopefully the gravid uterus will stay in place & body will rotate around it)
  - M/ grab part of fetus if cervix is open while rolling
  - Repeated rolling m/b necessary
  - Plank over abdomen as w/ cow also used
  - Little confidence in rolling mare
  - Complications include uterine rupture & abortion
  - Contraindicated if edematous or friable uterus, or thrombosis from 360° torsion

Px (prognosis)
- **Guarded**

- **Abdominal surgery**
  - Standing position preferred
  - Laparotomy incision in flank on side of torsion
  - Reposition uterus by lifting lower portion & pushing the upper portion (pushing better than pulling)
    . Careful not to tear friable uterus



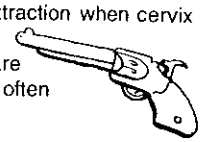
Rupture of prepubic tendon, Prepubic desmorrhexis
R 229; R-Y 122; T 709; E 1352; S 418

- **Draft mares**, idle & fat, rare in light mares
  - Less common in cow because of subpubic tendon which mare doesn't have
- Associated w/ excessive uterine weight or twinning or hydrops amnii
- **Last 2 months of gestation**
- M/b associated w/ trauma

- **Often preceded by ventral edema** (udder to xiphoid)
  - 4-6" thick, tense edema
  - Move slowly, refuse to lie down
- Rupture
  - Severe distress
  - Pain - sweating
  - ↑ RR, weak pulse, m/b internal hemorrhage
  - ± Shock
  - **Collapse & death m/b** w/in min to hours

- History
- Clinical signs (CS)

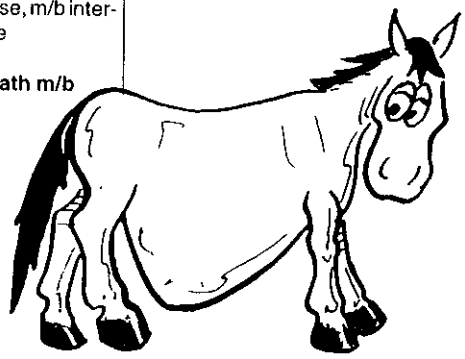
- **Rupture:**
  - Elective cesarean section near term
  - Repeated vaginal exam & induced parturition w/ extraction when cervix dilates
- Euthanasia of mare following delivery often indicated



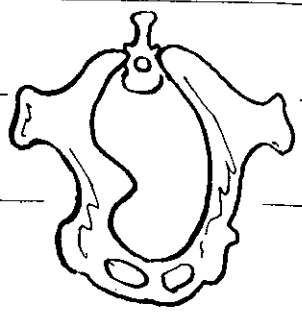
- **Prevention, if severe ventral edema before rupture**
  - Confine, limit exercise
  - Avoid bulky feed
  - Light, laxative concentrate feed
  - Canvas girdle w/ tightening straps
  - Watch closely for parturition to assist
  - Induce parturition late in gestation w/ oxytocin & assist delivery

Prognosis:
- Poor in all cases, can't apply abdominal pressure during 2nd stage of parturition
- If survive usually euthanized (usefulness gone & unsightly)

Draft mares last 2 mo of gestation
CS: Ventral edema then rupture
Dx: Hx, CS
Tx: Euthanize; Px: poor



Extensive unilateral ventral hernias C4T 543; R 229	• Rare in mare, rupture of abdominal tunic • Late in gestation • Treat like ruptured prepubic tendon
Abnormal pelvis C4T 543; T 699	• **Fractures or exostoses of pelvis** • Stenosis of birth canal, rare • Elective cesarean section if diagnosed before labor
Vaginal cystocele T 699	• Entrance of urinary bladder into uterus - Eversion through urethra or prolapse through rupture in vagina • Replace bladder & suture vaginal wound before extraction of fetus

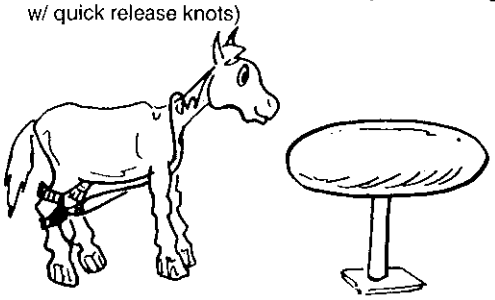


Artificial insemination

C4T 574; R-Y 36; T 652, 640; E 1393; Pop 19-2/98

Semen collection - jump mare or phantom

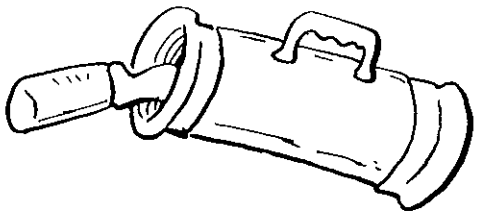
- **Use jump mare exhibiting estrus**
  - Small, stocky mare
  - Ovariectomized so they will allow covering at will
    . M/ show signs of estrus because of rise in production of adrenal estrogens
  - Wrap tail & clean perineal region
  - Adequately restrain mare (twitch, breeding harness or breeding chute, California hobbles [allow walking] w/ quick release knots)



- **Phantom mare or dummy**
  - Most stallions can be trained to mount a phantom mare
  - Texas phantoms: 2 oil drums welded together & mounted on steel pipe
    . Pad w/ several layers of plastic foam & covered w/ reinforced plastic, canvas or leather
  - Stand estrus mare next to phantom or cover its rear end w/ urine from an estrus mare
  - Let young stallion watch an expert stallion mount phantom

Artificial vagina (AV), Colorado model, Missouri model or Japanese model

- Ideal method for collecting
- All consist of hollow tube lined w/ rubber that can be filled w/ water
- Stallions show individual idiosyncrasies, some like one model better than another; some like them tight, some loose



Procedure: collection

- Fill artificial vagina w/ warm water
  - Proper temperature (same as mare's body temp.)
  - Penis should penetrate lubricated AV w/o excessive resistance
- Lubricate inside of AV w/ sterile nonspermicidal lubricant just prior to use
- Warm collection bottle to body temp. & attach to AV just before collection

Preparation of stallion

- Show collecting area, then bring in when shows some interest
- Expose stallion to jump mare or phantom until erection attained
- Wash penis of smegma (cotton or paper towels (water alone or w/ mild, nonirritating soap)
  - Rinse thoroughly if soap used (harmful to sperm)
  - Usually stallions permit this once accustomed & find it stimulating
- Collection area large enough & with good footing
- Restrain erect stallion for a short period prior to mounting (heighten excitement)
- Allow stallion w/ erection to mount phantom or estrus mare
- Stallion handler & collector on left side of stallion
- Direct penis gently to left side of mare's or phantom's buttocks & into artificial vagina (AV)
- Hold AV w/ distal end slightly elevated (like normal vagina)
- Once thrusting begins, palpate ventral base of penis to detect urethral pulsations that occur at ejaculation
- Lower AV during ejaculation so semen enters collection bottle
- Keep AV in place until stallion dismounts (ensure collection of complete ejaculate)
- Immediately drain water from AV to allow remaining semen into collecting bottle
- After dismount, rinse penis w/ warm water to remove lubricant
- Aspirate gel portion of semen, if unfiltered
  - If filtered, remove filter

- Maintain temperature of collection bottle
- Evaluate semen
- If stallion fails to ejaculate, lead him away from mare immediately after dismounting (so he doesn't kick her in frustration)
  - Encourage another erection & allow to approach mare or phantom & attempt another collection
  - If second collection fails, check temp. & pressure in AV (usually start w/ a slack AV & ↑ pressure w/ bicycle pump)
  - Several attempts m/b necessary to get ejaculation
  - If unsuccessful w/in 1 hr, postpone until later to avoid frustrating stallion
- Second collection
  - Give stallion time to recover (handler smoke a cigarette)
  - Wait 1 hour

Semen evaluation (E 1385)

- Maintain all supplies to evaluate semen at 37° C
- **Volume:** record total volume of gel-free semen
- **Concentration**
  - Hemocytometer or spectrophotometer (properly calibrated)
- **Motility**
  - Determine soon after collection
  - Place a drop of semen on a warm slide
  - Cover w/ warm cover slip
  - Estimate % of progressively motile spermatozoa (PMS) under a microscope
  - Dilute highly conc. samples w/ warm saline or extender to make a better estimate
- **Morphology**
  - Phase-contrast microscopy of semen fixed in buffered formal saline (preferred method, eliminates artifacts of stained smears)
  - Microscopy of stained smears
- **Total sperm output** =Volume x Concentration
- **Total number of progressively motile sperm** = Volume x Concentration x # PMS

Semen extender

- Antibiotic-treated extenders recommended
  - Semen normally contaminated w/ bacteria
- Extenders don't improve fertility
- Prepackaged dry powder mix or makeup your own

Semen Extender Preparation C4T 575

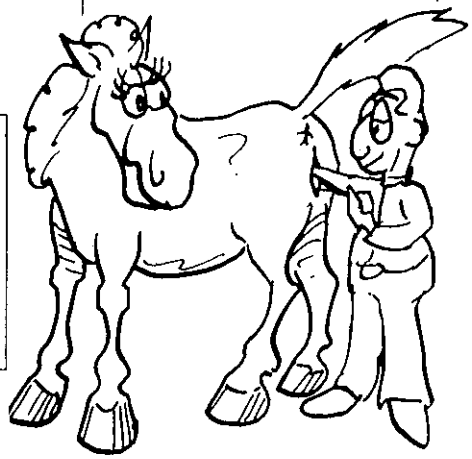
Powdered milk (Sanalac®)	2.4 gm
Glucose	4.9 gm
Sodium bicarbonate (7.5%)	2 ml
Gentamicin sulfate	100 mg
Distilled or deionized water	qs to 100 ml

- Maintain extender at 37° C
- Add semen to extender 1:1 - 1:3 ratio

Insemination

- Inseminate mares w/ minimum of 100 - 500 million progressively motile, morphologically normal spermatozoa
- Deposit semen into uterine body w/ clean plastic insemination pipette (disposable pipettes recommended)
- Inseminate at day 2 or 3 of estrus
- Inseminate every other day until ovulation occurs

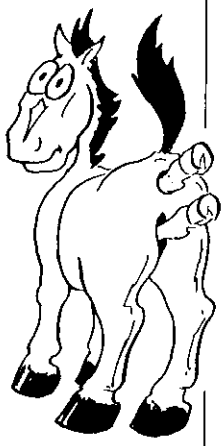
Most breed registries require freshly collected semen for artificial insemination
- Transport of semen is therefore limited
- Frozen semen thus is also limited, but good conception rates have been reported



Condition	Facts/Cause	Presentation/CS	Treatment

Rectovaginal tears, Perineal lacerations

C4T 512, 550; R-Y 199; T 760; E 1308; EM&S 1049; M 265; T&W-A 356; J 1125; S 739, 743



Facts/Cause

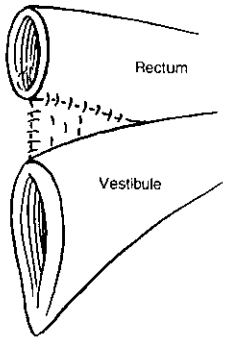
- Perineal trauma (of body wall at pelvic outlet)
  - Most wounds in vestibule wall
    - Most not deep, heal rapidly & don't cause problems (1st degree)
    - Deep wounds m/ lead to abscesses
- **Common in unattended foaling**
  - Leg of foal forced dorsally, generally into constricted area of hymen (slight constriction at vagina/vestibular junction)
  - Foal's hoof lacerates vestibular wall, or penetrates vestibular &/or rectal wall
    - If foal's foot pushed out of rectum & then back, get rectovaginal fistula
    - If foal foot in rectum as born, splits out perineum, ends up w/ **cloaca**
  - Generally caudal to peritoneal pouches so doesn't enter peritoneal cavity (no fatal peritonitis)

Classification of perineal lacerations

- **1st degree** - superficial, involving dors. mucosa of vestibule
- **2nd degree** - entire wall of vestibule & perineal body
- **3rd degree**: vestibule, perineal body, rectum & anal sphincter
- **Rectovestibular fistula**: hole betw. vestibule & rectum

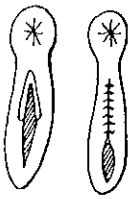
Presentation/CS

- **1st degree**: most common, usually heals rapidly w/o problems
- **2nd, 3rd & fistula**
  - **Acutely - hemorrhage**, have owner stuff a sheet into defect (hemostasis) until you arrive
  - **Mare straining**, due to irritation & trauma, causing damage; watch for this in first 48-96 hrs
- **2nd degree**: injures restrictor vestibuli muscle
  - Epithelialization instead of "bridge"; leaving a large defect in perineal body
  - Results in sunken appearance to dorsal vulva
  - Predisposes to pneumovagina & fecal material into vestibule
- **3rd degree:**
  - Mare hopelessly sterile until treated & repaired (feces in genital tract)
- **Rectovestibular fistula**: hole through vestibule, perineal body
  - As in 3rd degree, must be fixed



Treatment

- **Surgery**
  - **Usually wait - 4-6 week before Sx for inflammation to subside**
  - Epidural or NSAIDs to make more comfortable
  - Cover w/ antibiotics
  - ± Some debridement initially
  - 3rd & 4th degree: lose next breeding season, therefore most wait until foal is weaned to do Sx



1st degree laceration

- **Caslick's operation**
  (see pneumovagina pg 177)

2nd degree laceration Sx

- M/b repaired immediately or delayed
- Breed mare before elective Sx

- **Reconstruct perineal body**
  (restrictor vestibuli muscle)
  - Standing in stocks - Local anesthetic &/or epidural
  - Tail wrapped & tied overhead in case ataxia from epidural
  - Incise triangular area around laceration to vaginovestibular junction
  - Elevate mucous membrane
  - Suture triangular field from cranial to caudal
  - Oppose raw triangular suture dorsal to suture line w/ simple interrupted sutures
  - Skin closure: vertical mattress, interrupted pattern
  - Place deep mattress sutures across reconstructed perineal body

- Aftercare:
  - Tetanus immunization
  - Systemic ABs for 3 d
  - Remove sutures in 10 d

3rd degree laceration Sx (3rd & 4th degree Sx difficult to do or understand)

Reconstruct separation of vagina & rectum

- Preop:
  - Soften feces (pelleted feed, or grain, bran, alfalfa mixture for 5 d preceding operation)
  - Hold off feed 24 hr; Remove feces & clean out rectum & perineal area
  - Standing in stocks, tail wrapped & tied overhead in case ataxia from epidural
  - Epidural (xylazine 100 mg in saline, lasts long time, 4 hr) Tranquilize
  - Retractors (Balfours) or retention sutures used to open up vulva
- **First stage**: repair rectovaginal shelf
  - Remove scar tissue up to the intact rectovaginal shelf
    - This separates intact vestibular & rectal mucosa
  - Incise into intact rectovaginal shelf to connect wall defects
  - Dissect dorsally & ventrally along cut, separating rectal & vestibular mucosa & submucosa from walls
    - Results in 4 flaps of tissue (2 rectal & 2 vestibular) that can be opposed w/o tension
  - **6 bite suture pattern** (#4 Vetafil®) (see surgery texts for 4 bite pattern)
  - 2nd line of sutures (continuous) through inverted mucosal flap
- **2nd stage**: repair perineal defect between vulva & anus
  - Closes anal sphincter
  - Done at same time or **wait for shelf to heal (1 mo)**
  - Similar to repair of 2nd degree laceration (above)

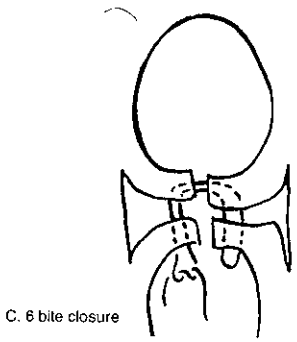
Rectovaginal fistula: 2 methods

- 1: Split perineal body transversely from perineum to 1-2" cranial to fistula
  - Suture the rectal defect w/o entering the lumen of the rectum
  - Then suture the vaginal defect in the same manner
  - Close space between rectal & vaginal tissue w/ simple-interrupted sutures
  - Close skin of perineum
- 2: Convert to 3rd degree tear by cutting out to perineum & repaired as a 3rd degree laceration
  - Lose support of perineal body & have to incise the anal sphincter, only advantage is good exposure

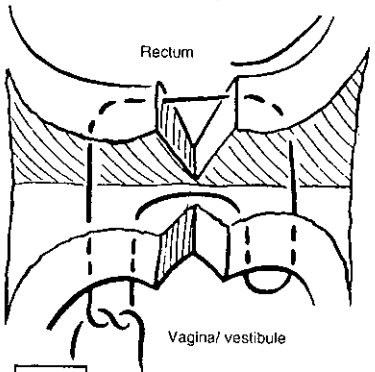
Postop

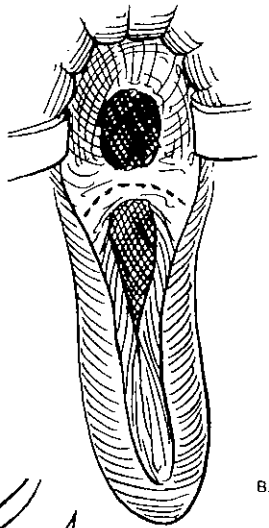
- **Keep loose feces w/ bran, grain, alfalfa diet & mineral oil**
  - Painful passing feces so resist as long as possible, constipated then strain (danger of tearing)
  - DSS to take in more water
  - NSAIDs, postop monitoring of feces coming through
  - If doesn't defecate, gentle enemas, don't want to palpate

- **Tetanus immunization**
- Systemic antibiotics for 3-5 d
- Remove sutures in 10-14 d
  - Difficult to manage
  - Tons of complications, mostly related to pain in mare not passing feces

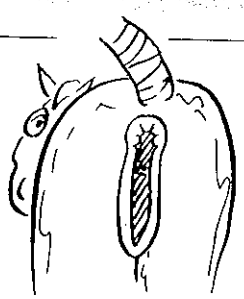


C. 6 bite closure





B. Incise through walls & transverse fold



A. Tail wrapped & in stocks

D. 6 bite suture pattern (#4 Vetafil®)

- 1. Through right vestibular flap from inside vestibule
- 2. Not full thickness of right rectal flap, then across
- 3. Into edge of left rectal flap & out ventrally
- 4. Through left vestibular flap
- 5. Back through left vestibular flap & across
- 6. Return to start, through right vestibular flap from opposite direction
  - Tie suture - everts vestibular mucosa
  - Check that rectal sutures do not penetrate rectum!

Retained Placenta

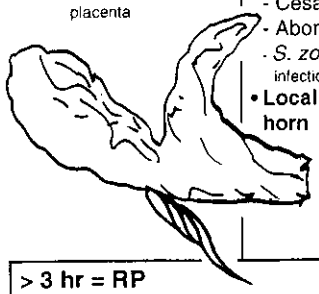
Condition	Facts/Cause	Presentation/CS	Diagnosis	Treatment

Retained placenta (RP)

M8K 1026; IM 255, 1378; I2M 264, 1523; C4T 560; R 256, 272, 382; R-Y 129; EM&S 1021; E 1360; M 266

- 1/2-3 hr: placental usually expelled
- **> 3 hr = Retained placenta**
  - **Must be treated**
- Prevalence from 2-10%
- Epitheliochorial placenta
  - Villi project into endometrial crypts to form microcotyledons
  - More villi in nongravid horn
  - Myometrial contraction, rupture of allantochorion at the cervical star
  - Delivery cuts off blood of umbilical vessel & villi shrink & separate from endometrium
- Impedance of delivery > 45 min. after start of 2nd stage of labor = fetal death
- Associated w/ **disturbance of myometrial contractions**
  - Dystocia
  - Cesarean section & fetotomy
  - Abortion after 7th mo of gestation
  - *S. zooepidemicus* most common infection
- **Localized retention - nongravid horn**

"Dutch britches" placenta



> 3 hr = RP
CS: Serious sequelae
Dx: Check "Dutch britches"
Tx: Oxytocin, infusion

Mares, as apposed to other species, don't eat fetal membranes

- **Partial RP not usually obvious**
- **Serious sequelae**
  - Severe metritis in hrs
  - Laminitis in hrs
  - Bacterial infections associated w/ RP > 6-8 hrs.
    - β-hemolytic Strep. & coliform
  - Endometrial fibrosis
  - Invagination of uterine horn
  - Uterine prolapse

- **Placenta obvious**
  - Partial or if falls over pelvis not obvious
- CS of metritis 1-2 d after foaling (fever, depression, colic &/or laminitis)
- **Spread out placenta**
  - **"Dutch britches"**, complete
  - Necrosis common near tips (incarcerated by contractions)
  - Areas devoid of microvilli
  - If part missing, do interdigital exam of endometrium

Oxytocin (bolus or slow IV infusion)

- **Bolus**: RP > 3 hr - 20 IU oxytocin IM
  - Many expel w/ 1 dose, if not give 20 IU oxytocin IM at 30-45 min intervals
  - RP after 4 injections of oxytocin
    - Probably have to manually remove
- **Slow IV infusion**
  - 30-100 IU in 500-1000 ml of saline over 30-60 min
    - Usually expels during infusion
    - If not, gentle manual removal attempted
- Bolus or IV drip; monitor for CS of abdominal pain, stop or reduce dose if present
- **Infusion into allantochorionic space** (stimulate uterine contractions)

10-12 L of dilute, warm Betadyne® (povidone-iodine)

- Restrain tail, presurgical scrub to vulva & perineum
- Arm in sterile, lubricated plastic sleeve into vagina
- Pull out allantochorion & ID cervical star
- Sterile tube into allantochorionic space & infuse
- Ligate opening in placenta
- Pressure causes contraction w/in 5-10 min.
- If not expelled, small (40 IU) oxytocin IM
- Contraction causes fluid to come into exposed placenta
- Squeeze fluid back into retained portion
- Usually expelled in 15-30 min

- **Sequela serious so initiate Tx early**
- **Oxytocin** (bolus or slow IV infusion) (see box)
  - **Infusion into allantochorionic space** (stimulate uterine contractions)
- **Tx w/in 6 hrs of foaling**
- Manual removal - not a preferred method of Tx because of thrombosis of uterine veins, pulmonary emboli, reduced fertility)
- **Adjunct therapy if 4 injections of oxytocin doesn't remove**
  - **Procaine pen G** (20,000 IU/kg BW (RP > 6-8 hr)
    - Ampicillin, gentamicin, kanamycin, penicillin, tricarcillin (w/ gentamicin for Pseudomonas) & trimethoprim-sulfamethazole
  - **1/2 gallon of mineral oil by nasogastric tube**
  - **Banamine®** (flunixin meglumine) NSAIDs, anti-inflammatory
  - Caslick's Sx, m/b to control aspiration of air
  - **Tetanus** toxoid (if vaccinated)
    T. antitoxin (unvaccinated)
- If no response to Tx for several ds
  - No aggressive manual removal
  - Oxytocin, ABs & NSAIDs until expelled & bacterial infection controlled

Prognosis:
- **Good,** but reduced if Tx delayed, or infection

Cesarean section, C-section

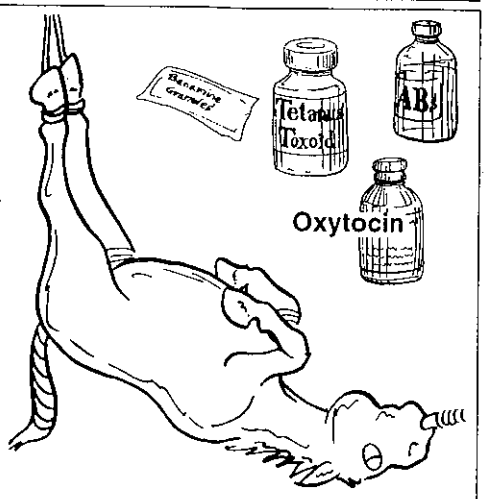
E 1373; T 695; S 756

Dystocia: prolonged 1st or 2nd stage of parturition

- **1st stage**: contraction of uterus
  - Normally only 1-4 hrs
  - Foal should rotate into dorsosacral position w/ head & front legs toward birth canal
  - Complete dilation at end of stage
  - Breech or transverse presentations m/ result in never reaching 2nd stage
- **2nd stage**: fetus enters birth canal & stim. forceful abdominal contractions, causing birth
  - **Normally last 20 min**
  - **Most dystocias occur in this stage**
- **3rd stage**: expulsion of fetal membranes & involution of uterus, very rapid usually
- **Indication for C-section**
  - Transverse presentation (especially draft horses, infrequent in light horses)
  - Large fetus
  - Small birth canal
  - Uncorrectable positions due to ankylosis of limbs or vertebrae
  - Neoplasia, masses, pelvic fxs
  - Hydrocephalus or other fetal deformities
- **Correction of dystocias**
  1. Mutation (moving foal into correct position)
  2. Fetotomy
  3. Cesarean section
  - **Rapid decision to do C-section** after evaluation under epidural anesthesia & tranquilization essential to Px
  - Fetotomies should only be performed on dead, emphysematous, or deformed foals
    - Avoid fetotomies requiring 2 or 3 cuts (mare less tolerant to long fetotomies than cow)

C-section procedure

- Anesthesia: keep as light as possible as all cross placenta
  - Some lay w/ GG, paralyzed & awake, then local
  - Must have facilities at stud farm
  - Properly pad, position & maintain blood pressure
- **Caudal ventral midline** approach most common
  - Dorsal recumbency w/ legs lifted upwards (well padded)
  - **Incise skin** from mammary gland to cranial to umbilicus
  - Linea alba incision
  - Pour sterile saline w/ **heparin** (20,000 - 50,000 IU) into abdominal cavity (prevent adhesions)
  - **Locate pregnant horn by finding feet** (hind feet if anterior presentation, forefeet if posterior presentation [caud])
  - **Pack off uterus** w/ wet towels or laparotomy pads (keep fetal debris or blood from abd.)
  - **Incise uterus over greater curvature** far from major blood vessels (long enough so doesn't tear as foal is removed)
  - **Exteriorize feet & put OB chains** above & below fetlock
  - Assistant pulls foal from uterus
  - Leave umbilical cord for several minutes before clamping & severing (pulsations sending blood to fetus)
  - Remove placenta if easy; if not leave in & just separate from edges of incision
  - **Oxytocin** (20-40 IU/mare IM) (involution)
  - **Run whip stitch** (simple continuous) along edge of incision, just binding edge to compress edges & shut down bleeding
  - **2nd layer, inverting** (Cushing's) w/ buried stitch
  - Lavage abdomen w/ saline & suction (remove blood & debris)
  - Antibiotics directly in abdomen unnecessary
  - **3rd layer abdominal closure** (linea alba, SQ & skin)



- **Postop:**
  - **Broad spectrum ABs** 5-7 d
  - **Banamine®** (flunixin meglumine) for endotoxemia given while placenta still retained
  - **Tetanus prophylaxis**
  - Heparin SQ 40 IU/kg TID
  - **Oxytocin** (20-40 IU) IM every 2 hrs
  - Controlled walking - 2 wk
  - 2 wk in small paddock
  - Not bred by natural cover for 8 wk

Prognosis:
- Depends on how soon done

Uterine Prolapse

Condition	Facts/Cause	Clinical Signs	Diagnosis	Treatment
Uterine prolapse M8k 1032; Mk 700; IM 1389; I2M 1542; C4T 549; E 1361; EM&S 1033; S 755	• **Rare in mare**, common in dairy cow & sow • **Invagination of the uterus & protrusion from the vulva** • Uterine eversion: invagination of uterine horn not protruding from vulva • Cause unknown - Associated w/ dystocia or retained placenta - M/ follow foaling - Partial eversion of a horn + pain & straining - Removal of RP (retained placenta)	• **Protrusion of uterus** from vulva • Edematous & enlarged tissue - in few hrs • Contaminated tissue (m/b lacerated & traumatized) • Straining, abdominal pain • Restlessness • Anorexia, ↑ pulse & RR • CS transient usually unless shock	• **Protruding uterus**	• Restrain animal (prevent trauma) • Clean & protect uterus • Stand mare w/ hindquarters higher than forequarters • **Replace uterus** (see box) • **Oxytocin** (stimulate myometrial contraction) after uterus replaced • **Antibiotics** • Amputation if severely traumatized or if impossible to replace
	Rare in mare **CS & Dx: Protrusion of uterus** **Tx: Replace - Oxytocin - ABs** **Px: Good**		**Replacing uterus** • Mild presurgical scrub of uterus • If fresh, easy; alternately massage dors. & ventr. aspect to move cervical end in, then invert prolapse • After time harder (if enlarged & edematous) - Vigorously & carefully massage emollient ointments into edematous tissue - Clenbuteros (reported to relax uterus)	Oxytocin Px (prognosis) • **Favorable** - generally, if no serious damage
Equine mastitis M8k 1032; IM 1064; R-Y 156	• **Much lower incidence than in cow for obvious reasons** • Most commonly a few weeks after foaling	• **Mammary swelling, heat, pain** • Ventral edema • Depression & anorexia • Mild hindlimb lameness	• **Culture & sensitivity (C&S)**	• **ABs** from culture & sensitivity - Before results - trimethoprim-sulfonamide (5 mg/kg orally bid) or penicillin (20,000 IU/kg IM bid) & gentamicin sulfate (2 mg/kg IV or IM tid) • Frequent milking • Hot packs
	Less than cow **CS: Swelling, heat, edema** **Dx: C&S** **Tx: ABs; Px: Good**			**Prognosis:** • **Good**: improve in 3-5 days, clinically normal in 1 week
Tumors of udder • Extremely rare in mare				
Postpartum colic E 1361; C4T 551	• **Common** • Normal postpartum pain caused by uterine contractions that persist past foaling • Inversion of tips of uterus : abnormal	• **Normal discomfort** • **Occasional rolling** • Inversion of tips of uterus - Severe pain	• Hx (pospartum), CS • Normal pospartum pain can be controlled - Differentiates it from more serious colic & inversion of	• **Normal, spontaneously recover**
	Normal after parturition **DDx from more serious colic**		**DDx**: Severe colic: • Inversion of tip of uterine horn • Rupture of vessel in broad lig. • Trauma to large colon • Uterine rupture	• **Inversion of tip, manually correct through uterine lumen**
Uterine rupture C4T 550; R-Y 159; E 1361; EM&S 1033; IM 253	• **Sequela to dystocia or uterine torsion** • Usually on dorsal aspect of body of uterus - Foal feet through wall • Partial or complete tears (peritonitis)	• M/b asymptomatic until peritonitis develops hours after parturition • **Postpartum colic** • M/b vaginal hemorrhage • Severe hemorrhagic shock & death	• **Suspect in any case of postpartum colic** • Rectal palpation • Uterine palpation • Abdominocentesis	• Repair uterine tear - Blind suturing through birth canal or **flank laparotomy** • Systemic ABs • NSAIDs • **Tx peritonitis** (pg 53) - Peritoneal lavage (lg. volumes of sterile saline & ABs) - Followed by drainage
	Dystocia - Uterine torsion **CS: Pospartum colic** **Dx: Hx, CS** **Tx: Repair & Tx peritonitis**			
"Summer syndrome", Fescue toxicity M8k 2086, 2083; C4T 571, 84, 670; IM 1660; I2M 257; CT 369; PP/O 19	• **Tall fescue** (*Festuca arundinacea*) - Usually good forage - Claviceps-like fungus m/b involved	• **"Summer syndrome"** - Pyrexia, inappetence - Loss of body condition - Poor hair quality - **Compromised repro function** **. Agalactia** **.Thickened placentae** **. Prolonged gestation** **. Weak foals at birth** • **Fescue foot** in cattle & sheep, occasionally horses	• Hx, CS • Hx of exposure	• No specific Tx • Remove source • Supportive care • Check hay for contamination
	Tall fescue **CS: Repro problems** **Dx: Hx, exposure** **Tx: Remove & support**		**Description** • Perennial grass • 3-4' tall • Broad leaves	

NERVOUS SYSTEM

Lesion localization - Spinal cord

I2M 165; C4T 314; S 538

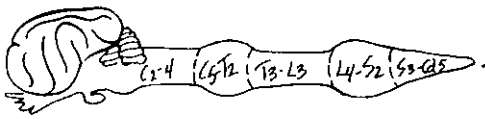
UMN & LMN CS: helps differentiate peripheral from central lesions; & if central, helps localize level of the lesion.

LOWER MOTOR NEURON (LMN): motor part of reflex arc to muscles or glands (peripheral nerves). LMN are spontaneously active w/out input of UMN

- **LMN CS** to area innervated by damaged peripheral n. or its cell body in CNS (not UMN CS because UMN requires intact LMNs)
  - **Flaccid paresis or paralysis** ("limp as a dish rag")
  - **Tone: ↓ to absent** (hypotonia - atonia)
  - **Reflexes: ↓ to absent** (hyporeflexia - areflexia)
  - **Fast atrophy** (neurogenic atrophy) w/in 1 week

UPPER MOTOR NEURON (UMN): CNS neuron that affects LMNs (peripheral or cranial nn.). Initiates & maintains conscious movements & provides tone to extensor muscles (posture). Excitatory UMNs (inactive until needed) & inhibitory UMNs (constantly keep LMN under control)

- **UMN CS** caudal to damage in CNS, degree of signs depends on amount of damage to spinal cord (white &/or gray matter). Loss of the ability to initiate voluntary motor activity, & possibly uncontrolled hyperactivity of LMNs due to ↓ inhibition
  - **Tone - normal to ↑**
  - **Reflexes - normal or ↑** (normo- or hyperreflexia)
  - **Spastic paresis or paralysis**
  - **Slow disuse atrophy**
  - **Extensors facilitated** (extended limb [s])



SHIFF-SHERRINGTON SYNDROME: hyperextension of the forelimbs with lesions to the thoracic spinal cord (removal of ascending inhibition) (bad prognostic sign, serious spinal cord lesion). Rare in large animals.

Proprioception damage: usually 1st CS in spinal cord damage compression. For localization, interpreted the same as LMN/UMN

- **Ataxia**
- Postural deficits (wide base stance, knuckle over)
- Delayed initiation of movement

Superficial pain loss: lost at the same time as motor function loss. If superficial pain perceived, so will be deep pain. (A withdrawal reflex, DOES NOT require perception)

Deep pain: first to show pain & last to disappear (**first to show, last to go**). Loss of deep pain is a bad prognostic sign. Evaluated only when superficial pain is absent

Cutaneous trunci reflex or panniculus reflex: a normal twitching of the cutaneous trunci muscle to stimuli. Sensory fibers from lateral wall dermatomes pass craniodorsally to thoracolumbar spinal cord segments (1 or 2 vertebrae cranially). Ascending sensory tracts extend up the spinal cord to **lateral thoracic nerve (C8)** innervating the cutaneous trunci muscle

- **Panniculus absent 1 - 2 vertebrae caudal to spinal cord lesion**

Hyperesthesia: abnormal increase in sensitivity. Spinal cord segment lesions cause a focal hyperesthesia to the dermatome supplied.

Diffuse or multifocal pain: often due to inflammation

Focal pain: often due to compression of the spinal cord or nerve roots

CS & spinal cord region damaged

C1-5: Cervical region
- No LMN to all limbs
- UMN CS, proprioc. & pain defc.- all limbs

C6-T2: Cervicothoracic region
- LMN - thoracic limb
- UMN, propriocep. & pain defc.- p. limbs

T3-L3: Thoracic & thoracolumbar region*
- Normal thoracic limb (+/- Shiff-Sherrington)
- UMN CS, proprioc. & pain defc.- p. limbs
- Cutaneous trunci absent 1-2 vert. caudal

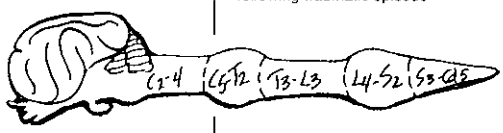
L4-S2: Lumbosacral region
- Normal thoracic limbs
- LMN signs pelvic limbs

S3-Cd5: Sacral region (cauda equina)
- UMN signs - bladder, anus & urethra (flaccid paralysis of anus, no defecation)
- Loss of sensation to tail, penis, vulva & perineum
- Distended, flaccid bladder, incontinence

Horner's Syndrome - possible in lesions of C1-T3 (see box below)

*** Lesions between C1-S2**
- UMN - pelvic region
  - Anal & tail tone normal
  - Bladder m/b distended, urethralis m. normal

Condition	Facts/Cause	Presentation/CS	Dx	Treatment
Spinal trauma M8k 928; IM 1004; I2M 165, 1130; EM&S 799; C4T 10, 304; C3T 535; E 1176, 1233; M 371; J 1021; S 549, 573	• **Common sites: C1, T12, L5** • CS depend on site of trauma - Foals: cervical vertebral Fx & trauma • Adults: fractures, thoracolumbar area • "Wobblers" often fall & must be Ddx following traumatic episode	**C2-4** • **Noncompressive** - stiff neck • **Mild compression** - ataxia (proprioception - 1st to go) • **Severe** - Recumbent - BAR (bright, alert & responsive) to depressed - ± **Phrenic n.**, paralysis of diaphragm - death - **UMNs all 4 limbs** (spastic) - UMN - pelvic region . Anal & tail tone normal . Bladder m/b distended, urethralis m. normal **C5-T2** (see above) • LMN thoracic limb (flaccid) • UMN pelvic limb (spastic) • UMN - pelvic region - Anal & tail tone normal - Bladder m/b distended, urethralis m. normal **T3- L3, Thoracic & thoracolumbar spine** • Dog sitting posture • Sternal recumbency - pelvic limbs extended, not tucked up • Normal thoracic limbs • LMN signs pelvic limbs • UMN - pelvic region - Anal & tail tone normal - Bladder m/b distended, urethralis m. normal **L4-S2 Lumbosacral region** • LMN signs pelvic limbs • UMN - pelvic region - Anal & tail tone normal - Bladder m/b distended, urethralis m. normal **S3- Cd5** • Normal limbs • ↓ to absent anal tone • Distended & flaccid bladder • Incontinence (atonia of urethral sphincter)	• Hx, CS • Rads	• **Evaluate suffering** (manage or euthanize from this) • **Manage pain:** severe: Demerol® or morphine • **Evaluate repeatedly over 1st hrs for Px** • **Euthanize** if unable to rise after several days or if suffering • If bladder problem: empty distended bladder, culture urine repeatedly & Tx any infection • If paralyzed rectum: empty rectum manually • **Most recover spontaneously**, not influenced by drugs • IV DMSO, in acutely affected, same dosage, every 12-24 hr (antiinflammatory, scavenges free radicals) • Steroids: dexamethasone IM or IV - Worry about laminitis, give early - Hydrocortisone, expensive, advantage is its short life • ±Mannitol if sure of no hemorrhage, mixed in lactated Ringer's, saline or 5% dextrose, given slowly; expensive to manage these animals • **Slings**: if fx stable & animal stands w/ assistance **Demerol** Steroid **DMSO** **Prognosis** figured from: • **Repeated neurological exams (1st several hours)** - not from radiographs, because pieces of fx likely to be in different position than at time of injury • Longer recumbent & neurologically impaired, poorer prognosis **Horner's Syndrome:** see pg 255 - spinal cord lesions in C1-T3 area & sympathetic ANS lesion between T1-3 gray matter & eye • In all species - Miosis (loss of sympathetic to iris) - Enophthalmos - Ptosis • Excessive sweating on affected side (horse)



DDx:
- OAAM (pg 247)
- Herpes myeloencephalopathy (pg 254)
- Degen. myeloencephalopathy (pg 249)
- Protozoal myeloencephalopathy
- Verminous myelopathy
- Cauda equina neuritis (pg 248)
- Wobbler (pg 247)
- Rabies (pg 271)
- Congenital abnormalities
- Spinal tumors (pg 246)
- Sorghum cystitis/ataxia (pg 157)

Stiff neck
- Meningitis (pg 268)

Recumbent animal
- Obturator n. paralysis (rare, pg 257)

LMN CS: level of lesion
UMN CS: behind level of lesion

Wobbler

Condition	Facts/Cause	Presentation/CS	Diagnosis	Treatment
Vertebral body abscess, Osteomyelitis M8k 923; IM 1009; I2M 1134; C4T 3; EM&S 804; M 372; J 1013; E 1230	**Hematogenous infection** • Neonates - septicemia - Salmonella, *Actinobacillus equuli, E. coli,* Strep., *Rhodococcus equi* & *Klebsiella pneumoniae* • Adult w/ bacteremia - *Brucella abortus* & *Mycobacterium tuberculosis* - Brucella, m/b extension from wounds in horses in same environment as cattle - *Mycobacterium tuberculosis* extension from granulomas present in lungs • **Lumbar vertebrae** commonly involved • Sequelae: - **Compresses spinal cord** - **Erodes through meninges** (pachymeningitis) - Meningitis - **Pathological fractures** - **Fistulous withers**, draining tract from vertebral bodies externally	**Localized to vertebrae** • **Occlusion of spinal cord** - **Mimics spinal trauma** (see pg 245) - **↑ Temperature** (helpful in Ddx) - **Sick**, bacteremia, septicemia - **Pain**, heat, swelling over site gen. - Standing or recumbent - If standing often reluctant to move due to pain - **Neurological signs** (acute or chronic) . **UMN &/or LMN** signs . **Paresis & ataxia** . All 4 limbs or just hindlimbs, depending on vertebrae affected **Pachymeningitis:** • Meningeal inflammation CS • Hyperesthesia • Intermittent spastic muscle contractions • Recurrent profuse sweating • **"Weather vane"** (head stiffly extended)	• **CS of spinal cord problems** **- LMN & UMN CS** • **Sick animal - fever** • CBC: chronic inflammation - Hyperfibrinogenemia, neutrophilia, monocytosis, anemia - Globulin ↑ in adults, but ↑ or ↓ in neonates, depending on colostrum • CSF: - Epidural abscess most common, CSF normal - Inside dura: CSF > 100 PMNs/dl, Protien > 200 mg/dl - Bacteria m/b on gram stain smear - Xanthrochromia • Brucellosis titer: rising or > 1:160 if spinal brucellosis • Intradermal skin test for spinal tuberculosis • **Radiographs** - plain films - **Osteomyelitis** (random hypolucency & sclerosis) - Diskospondylitis (osteolysis in intervertebral joint) - Myelogram (to locate site of compression) • **PM** (postmortem) - Uneven, deformed, soft vertebrae - Sequestration of necrotic bone - Fistulous tract from abscess to subarachnoid space occasionally **DDx:** (no fever) • See Ddx for spinal trauma pg 245	• **Long term ABs for 2-3 mo** - Generally effective if early - Culture & sensitivity - Broad spectrum ABs if culture inconclusive or no culture . Amikacin or gentamicin + Potassium pen. G IV 1-2 wk . Followed by trimethoprim-sulfonamide combination - for 2-3 mo • Sx curetlage of necrotic bone & drainage of abscess recommended by some, but difficult because of inaccessibility of large animal spine Px (Prognosis): • **Poor**

Hematogenous, lumbar
CS: UMN/LMN, sick, fever
Dx: CS, Rads
Tx: Long term ABs

Pathophysiology:
- Hematogenous septic thrombi into metaphyseal arteries that enter the physes of vertebrae
- Metaphyseal aa. & vv. communicate w/ ventral vertebral plexus
- Ventral vertebral plexus drains into caud. vena cava & portal vein
- Ventral plexus has no valves so blood w/ bacteria m/ backup w/ ↑ abdominal or pleural pressure

Spinal tumors
IM 1010; I2M 1136

- Rare - no treatment
- CS indistinguishable from spinal fractures, m/b insidious onset leading to paraplegia or tetraplegia

Wobbler syndrome, Equine sensory ataxia, Cervical malformation-malarticulation, Cervical stenotic myelopathy M8k 919, 902; Mk 593; IM 997, 1580; I2M 1121, 1127; EM&S 807; E 1214; C4T 306; C3T 532; C2T 355; M 365; S 551; J 1023	• **Stenosis of cervical vertebral canal** • Heredity not established • Young horses • 2 types of stenosis **1. Static stenosis - C5-7** **2. Dynamic stenosis - C3-5** • **Pathophysiology:** - **Focal compression of dorsal spinal cord** (white matter diz) - Demyelination myelopathy - Proprioceptive loss (sensory ataxia) - Motor generally normal; but m/b spastic or weak (compression of spinocerebellar tracts - UMN) - Pain & spinal reflexes generally unaffected	• **Pronounced hindlimb ataxia & paresis** • ± **Forelimbs spastic** • **"Clumbsy" ("Tin soldier"** walk) hypometric (proprioception) - **"Knuckling"**, spasticity, stumbling, scuffing of toes, incomplete limb protraction, circumduction, crossing over, interference, excessive sway of pelvis • Rarely - cutaneous desensitization & atrophy of neck • Horner's syndrome & sweating of neck if severe • OCD in some animals **DDx:** • See DDx for spinal trauma pg 245	• **History & CS "clumbsy"** • PE (physical exam): - **Pull tail** laterally while walking (horse unable to compensate) - **Turn sharply** while trotting, exacerbates proprioceptive deficit - **Placing tests**: pull limbs away from midline, failure to replace limbs spontaneously - Reluctance to move backwards - Up or down slope: exaggerated ataxia • **Radiographs:** - Neck: plain films nonflexed & flexed - **Static compression** . **Measure diameter** of spinal canal & compare to normal horses . Chronic cases, remodeling m/ give normal measurements w/ CS - **Dynamic compression** . **Subluxation on flexion** of vertebral junctions .. Sometimes can't see w/o contrast material • **Myelography** for subtle lesions - General anesthesia & lateral recumbency - **Metrizamide**	• **No universally successful treatment** • Rare recovery w/ short term corticosteroids & 6 mo rest • Surgical arthrodesis m/b successful (for breeding animals) - Fusion of intervertebral joint (bone graft or decompression & immobilization) • Dorsal decompressive laminectomies: poor success & high complication probability **Prognosis:** • **Guarded** • In some, diz does not progress, some appear to improve, learn how to compensate for neurologic deficits

Stenosis - white matter - proprioceptive loss
CS: Clumbsy, knuckling
Dx: PE, Rads, Myelograph
Tx: ? Px: Guarded

1. Static stenosis: cervical vertebral stenosis - C5-7
- Narrowing of lumen due to excessive bone production (osteopetrosis)
- Compression not relieved by extending head
- Older: 1-3 yr-olds (6 mo - 10 yr)

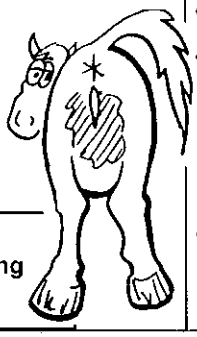
2. Dynamic stenosis: cervical vertebral instability - C3-5
- Flex head - compresses vertebral canal
  - When extended, no radiographic sign of compression
- **Younger** horses 6 mo - 2 yr

OAAM, **Occipito-atlanto-axial malformation** M8k 920, 902; Mk 593; IM 1016; I2M 1142; EM&S 797; E 1231; C4T 2; C3T 531; M 370; S 566	• Developmental defect • **Arabian foals - inherited** - Symmetric occipito-atlantal, atlanto-occipital fusion & other malformations - Quarter horses - nonfamilial - Morgans & Standardbreds • **Spinal cord compression** **- Lesion to UMN & conscious proprioceptive pathways**	• ± Dead at birth • **Ataxic at birth** or in few wks • Difficulty bending head to suckle • **"Weather vane" stance** - neck extended if symmetrical lesion • Torticollis ("wryneck", twisted neck) • **Symmetric UMN CS** (Cervical region) **- #1 tetraplegia or tetraparesis** **- Proprioceptive deficits** (ataxia) **- Hyperreflexia & hypertonia**	• Hx, CS: Arabian • **Clicking noises** when flexing neck • ± Palpate malformation of atlas, axis • **Radiology - definitive Dx**	• **No Tx for Arabians because hereditary** **None** **DDx:** • Normal awkwardness at birth • See DDx for spinal trauma pg 245

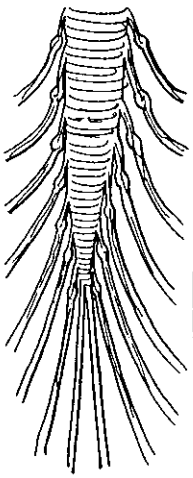
C_1 - Occipital - Arabians

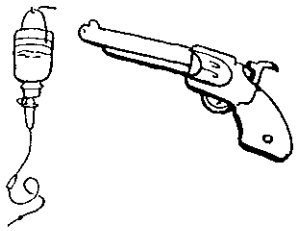
Spinal Cord

Condition	Facts/Cause	Presentation/CS	Diagnosis	Treatment
Cauda equina neuritis, Equine polyneuritis M8k 915; Mk 594; IM 1037; I2M 1163; EM&S 824; C4T 311; C3T 579; M 349	• **Inflammation of nerve roots** - **Cauda equina** particularly & cranial nerves - **LMNs** (lower motor neurons) flaccid paresis or paralysis • Adult horses • Cause unknown (idiopathic) - Maybe autoimmune (resembles Coonhound paralysis) - Maybe hypersensitivity	• **Initially: rub & chew tail head** (alopecia of tail head) - hyperesthesia • Then **hypoesthesia** or anesthesia of effected area • **Progressive paresis, m/ terminate in paralysis** of tail, bladder, rectum, anal sphincter • **Weak or paralyzed tail** • **Anus hypotonic** or atonic & distended • **Fecal retention** or incontinence • **Urinary incontinence** (parasympathetic fibers in sacral nerves [pelvic n.], LMN type [atonic bladder, distended & easily expressed]) - **Scalding of thighs** due to dribbling • Protruded, relaxed penis • ↓ Sensation to perineum • Prepuce usually still sensitive (L2-4 roots) • If lumbrosacral involvement - **Hindlimb flaccid, weak & ataxic** (denervation atrophy m/ develop) • All 4 limbs m/ be affected • **Cranial nerve involvement** - Asymmetrical (different than cauda equina) - Depends on nerves involved - Atrophy of temporal & masseter muscles (motor branch of CrN 5) - Facial paralysis (CrN 7/Facial n.) - Keratitis & corneal ulcers (CrN 7/Facial) • Head tilt & other CN deficits possible **Sequela: Urinary infections** (due to incontinence)	• **CS: loss of sensation to perineum, urinary incontinence** • EMG abnormalities (due to denervation) • PM (postmortem): - **Cauda equina thickened, discolored** & covered w/ fibrous tissue - Granulomatous inflam. of nerve roots - Axonal degeneration & demyelination - Wallerian degen. in spinal cord • CSF tap shows ↑ mononuclear cells, protein, xanthrochromia	• **No therapy** consistently effective • **Steroids** at inflammatory doses • **Supportive care** - Fluid therapy - Manual evacuation of bladder & rectum • **Euthanasia** (severity gradually progressive) Prognosis: **Grave - eventually euthanized** • Can support for a long time because of slow progression



Inflammation of nerve roots
CS: LMNs, Numb rump, Dribbling
Tx: Euthanasia. Px: grave

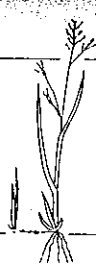


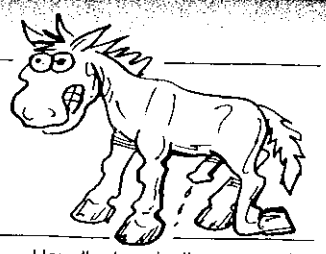


DDx as for spinal trauma pg 245
- Instabilities of caudal spine
- Luxations & fractures of caudal spine
- Equine herpes virus myelitis (pg 254)
- Sorghum toxicity (lathyrism) (pg 249, 154)
- Spinal nematodiasis (pg 250)
- Protozoal neuritis (pg 249)
- Rabies (pg 271)

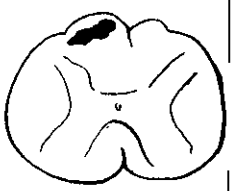
Rubbing tail head
- Vices
- Pin worms (*Oxyuris equi*) (pg 288)
- Food allergies

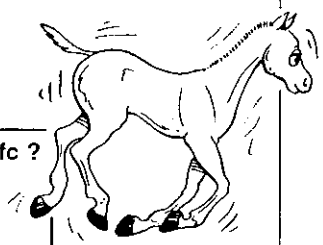
Lathyrism, Equine sorghum cystitis/ataxia syndrome	• **See URIN pg 156; Usually valuable forage, Grazing *Sorghum*** spp. & Sudan grasses • Myelomalacia of lower spinal cord • **CS:** Toxic to CNS: **Posterior incoordination, "Dribbling"** (urinary incontinence) **Cystitis 2°** to urine retention • **Tx:** Withdraw Sorghum, ABs (cystitis) • **Px:** Recovery rare	



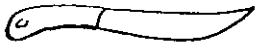


Equine degenerative myeloencephalopathy, EDM M8k 921, 902; Mk 593; IM 1002; I2M 1128; EM&S 757; C4T 319; C3T 559; C2T 353; M 366	• **Common cause of ataxia in young horses** - Foals 6-8 mo (m/b born w/ it) • **Degenerative, noncompressive spinal cord diz** - Demyelination of dorsal funiculi of cervical spinal cord & brain stem - **Loss of conscious proprioception** (don't know where limbs are) • Cause: unknown, implicated: - **Vit. E deficit suggested** - Confinement on dirt paddock - Insecticides & wood preservatives - Processed or pelleted feeds • Arabians, now in all breeds • Familial predisposition reported	• **Symmetrical ataxia** - **Proprioceptive (sensory)** - **Knuckling, stumbling**, stabbing as limbs placed on ground, circumduction, abduction, interference, **spasticity**, abnormal limb protraction, hypermetria - All 4 limbs; hindlimbs m/b more affected	• **History, CS** • **Postural placement tests** - Pull tail to side or push withers or tuber coxae (m/ stumble or fall) • Turn sharply (stumble & can't lift inside forefoot) • **Laryngeal test** - Endoscope larynx & slap saddle area - Normal contralateral arytenoid closes • Radiographs, plain & contrast - **Spinal canal normal diameter** • CSF normal • **Vit. E levels** of feed & individuals • PM (postmortem) - Fiber degeneration of ascending & descending spinal cord funiculi - Large eosinophilic "spheroids" in gray matter	• Usually chronically progressive • **Signs are irreversible** • **Euthanasia,** usually when become dangerous to self or others • **Supplement Vit. E** if not severely affected & < 12 months - Supplement for life - Sprinkle on conc. mixed w/ vegetable oil - Maintenance 6,600-10,000 IU/kg/day orally - Up to year to be neurologically normal **Prevention:** • On farms w/ problem - Mares supplemented w/ Vit. E/Selenium to increased Vit. E in milk • Mare w/ normal Vit. E status, will not show deficiency • Check all animals on farm (subclinical) • Change to hay w/ adequate Vit. E

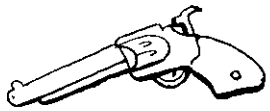




Compression - Vit. E defc ?
CS: Ataxia, knuckling
Dx: Hx, CS
Tx: Euthanasia

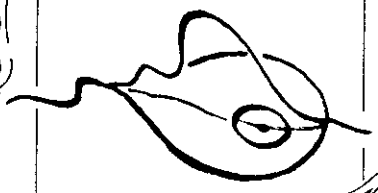


DDx as for spinal trauma
- **Cervical stenotic myelopathy** (spinal canal stenotic)

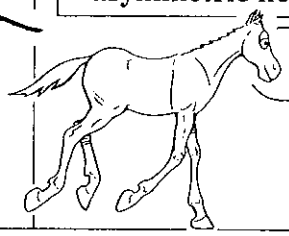


Spinal Cord

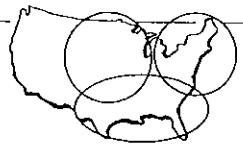
Condition	Facts/Cause	Presentation/CS	Diagnosis	Treatment
Equine protozoal myeloencephalitis, EPM M8k 934, 926; Mk 594; IM 939; I2M 1046; M 368; EM&S 757; E 1225; C4T 329; C3T 554; C2T 359; POP 43-1/98; 12-4/98, 9-5/98, 12-5/98	• **#1 cause of multifocal, asymmetric, progressive CNS diz** • **Can mimic any neurologic diz** • *Sarcocystis neurona* - Lesion in brain & spinal cord - **Asymmetric** loss of LMN (lower motor neurons) &/or UMN • Infectious, but not contagious diz • **Route of infection unknown** - Organism randomly **migrates** through spinal cord & brain - White & gray matter damage • 1-6 yr (not foals) • Standardbreds (most common) & Thoroughbreds • Midwest, NE & S USA	• **Gait abnormality** (peracute or acute) - 1or all 4 limbs depending on where it migrates - **Asymmetrical** (because multifocal) - **Ataxia, paresis & spasticity** . Knuckling, circumduction, crossing over, tetraparesis - areflexia, hyporeflexia (LMN) or hyperreflexia (UMN) depending on site of lesion • **Muscle atrophy** of individual muscle groups • Localized areas of sensory deficits • **"Strip sweating"** localized areas (dermatomes, sympathetic white matter tracts) • Cerebellar, brain stem (less common) or cerebral signs, cranial nerves - Head tilt, facial paralysis, circling, nystagmus, dysphagia, blindness w/ or w/o abnormal pupillary reflexes • **Untreated progressive to recumbency in 14 day- 6 months**	• Hx (age), CS (asymmetric, multifocal ataxia & weakness) • **CNS CS + pos. Western blot of CSF** highly suggestive • **Presumptive: treat & R/O** (rule out) others • **Western blot serological test** for CSF & serum, 50% of horses positive serum • CSF taps: normal or m/b ↑ protein & ↑ monocytes (pleocytosis) • **Post** multiple sections of spinal cord - **Multifocal & asymmetric** - Gross: gray-brown discoloration, w/ hemorrhage, swelling, & liquefaction - Histo: nonsuppurative inflammatory focal malacia & hemorrhage, perivascular cuffing, gliosis, astrocytosis, neuronal necrosis & gitter cell proliferation . **Multinucleated giant cells** - **Parasite in CNS definitive Dx**, schizonts & merozoites at periphery of lesions, but m/not be demonstrated	• **COMBO of antifoliate drugs** - **Trimethoprimsulfa** (PO q12h 4-8 wk) + - **Pyrimethamine** (Daraprem®, malaria drug) (PO q12h 3 d, then PO q24h 4-8 wk) - Blood count every 2 wk during therapy because m/ cause foliate defc. (leukopenia, thrombocytopenia & anemia; rare) . Discontinue & give foliate • Foliate supplement ?$: potential toxicity in pregnant mares • **NSAIDs** • No steroids (because of need for cell mediated immunity to control parasites) • DMSO IV to ↓ inflammation in 5% dextrose - given without difficulty, but causes intravascular hemolysis so hemoglobinuria or hematuria • Variable positive or neg. response time - Insurance require 6 wk before euthanize - Monitor CBC every 10-14 d, folate inhibitors, can get pancytopenia - Marked platelet drop, cut back dose • Multiple B vitamin complex supplement • **Stall rest** • Diclazuril & Toltrazuril: antiprotozoal diz, need testing • **Euthanize** those that don't respond



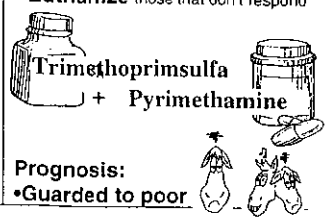
#1 DDx for multifocal, asymmetric neuro diz



DDx • SEE DDx for spinal trauma pg 245



#1 multifocal, asymmetric neurological diz
CS: Ataxia, atrophy, down
Dx: CNS CS + Western blot (CSF)
Tx: Timethoprimsulfa + Pyrimethamine

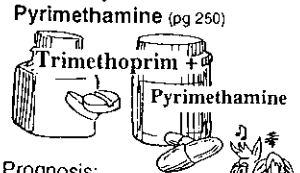


Prognosis:
•Guarded to poor

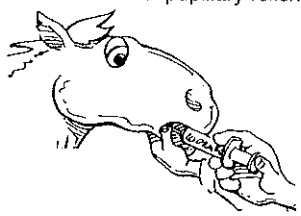
Cerebrospinal nematodiasis, Verminous myelitis/ myeloencephalitis

M8k 926, 940; Mk 594; IM 1011; I2M 1137; EM&S 751; E 1190, 1231; C3T 556; M 372

• **Occasional aberrant migration of parasites through CNS** • **Multifocal, asymmetrical progressive diz** of CNS • CS can mimic any neurologic diz • *Strongylus vulgaris*, Micronema, Setaria, less commonly Habronema • **Similar to protozoal migration, but much less common** - Inflammation & necrosis of caudal brainstem & spinal cord - Asymmetric loss of LMN (lower motor neurons) &/or UMN • **Pathophysiology:** - Organism randomly migrates through spinal cord & brain - White & gray matter damage - **Multifocal & asymmetric**	• **Mimics protozoal myelitis** • **Gait abnormality** (peracute or acute) - 1or all 4 limbs depending on migration - **Asymmetrical** - **Ataxia, paresis & spasticity** . Knuckling, circumduction, crossing over, tetraparesis - areflexia, hyporeflexia (LMN) or hyperreflexia (UMN), depending on site of lesion • Muscle atrophy of individual m. groups • Localized areas of sensory deficits • Cerebellar, brain stem, cerebral, or cranial nerves CS - Head tilt, facial paralysis, circling, nystagmus, dysphagia, blindness w/ or w/o abnormal pupillary reflexes	• **Presumptive: 1° treat animal & rule out (R/O) others** • Serologic tests not available • CSF taps - Xanthrochromia - If recent migration . ↑ RBCs, mononuclear inflammatory cells . Eosinophils (highly suggestive of aberrant migration) • **PM** multiple sections of spinal cord - **Multifocal & asymmetric** - Gross: gray-brown discoloration, w/ hemorrhage, swelling, & liquefaction - Histo: nonsuppurative inflam., focal malacia & hemorrhage, perivascular cuffing, gliosis, astrocytosis, neuronal necrosis & gitter cell proliferation . Multinucleated giant cells - **Parasite in CNS - definitive Dx**	• **Ivermectin** (PO once), repeat in 10-14 d m/b, more clinical studies on ivermectin needed? • **Thiabendazole**, (10 x normal dose) SID for 2 d • Fenbendazole (Panacur®) at hi doses 3-5 d in a row • Setaria organophosphates &/or diethylcarbamazine • **NSAIDs**: Banamine®, bute, aspirin or naproxen to ↓ inflammation around parasite when it dies • No corticosteroids • **Tx for EPM/Protozoal also Trimethoprimsulfa + Pyrimethamine** (pg 250)



Prognosis:
• **Guarded**: some respond to Tx w/ anthelmintics
- Some may improve & maintain some neurologic deficits



DDx
• SEE DDx for spinal trauma pg 245

Similar, but less common than EPM
Tx: Ivermectin + EPM Tx

Setaria spp.

- Common filarid parasite of cattle
- **Aberrant migrations in horse**
  - Predilection for spinal cord
- **Tx: Diethylcarbamazine** (single dose m/b effective) or organophosphates

Strongylus vulgaris

- CS normal infestation
  - Colic
  - Gangrenous enteritis
  - **Acute or chronic diarrhea**

Micronema deletrix

- Free living rhabditid nematode
- Penetrates skin of face, lips, gums & tongue
  - Migrates through vascular system to CNS

Habronema infections

- ***Draschia (H.) megastoma*** (most severe)
  - Tumorlike enlargements in stomach wall
  - Other habronema spp. asymptomatic
  - **CNS migration** of *Draschia*
- **Pour-on insecticide** before migration into CNS
  - Warm climates USA - by Aug.-Sept.
  - Cold climates - by Oct.

Condition	Facts/Cause	Presentation/CS	Diagnosis	Treatment - Prognosis
Botulism, "Shaker foals", "Forage poisoning" M8k 916; Mk 328, IM 1033; I2M 1159; EM&S 759; E 1242; C4T 327, 157; C3T 370, 542; M 374; Pic 26	• *Clostridium botulinum* type B & C - Gram positive, anaerobic, spore-forming - Ubiquitous in soil • **Toxin** - Alkaline or neutral soil, decomposing tissue - Prevents synthesis or release of **ACh at NMJ (LMN)** . Loss of muscle tone - **No proprioceptive deficits** - **Rapid & fatal** (respiratory paralysis) • Horses > susceptible > cattle 1) **"Forage poisoning"** ingestion of preformed toxin, occurring 1° in adults 2) **"Shaker foal diz"** ingestion of spores, grow in GI (toxicoinfectious botulism) - 2 wk - 8 mo-old - **Mid-Atlantic states**, exclusively • Individual sporadic cases more common than herd outbreaks	• **Progressive muscle weakness** • **"Forage poisoning"** - Gradual or rapid onset - Dyspnea - Diffuse paresis - weak & trembling - Recumbency • **"Shaker foals"** - Paresis (stiff, stilted gait) - **"Shaking"** (generalized m. tremors) - **Drool**: difficulty chewing & swallowing - **Tongue hanging out**, not retractable - cardinal & early sign - **↓ Muscle tone** ."**Sleepy look**", pytosis, loss of tone to eyelids, ↓ in tail tone • Mydriasis (para-ANS), slow pupillary response, ileus, constipation & urine retention • **Inability to stand** once down • **Dyspnea** • **Death - respiratory paralysis** or pneumonia w/in 24-72 hrs	• **Difficult to Dx**, because small amounts cause diz, improbable to demonstrate toxin in tissue or feed - Tongue paralysis - early • **Inject mice** ("wasp-waisted" death) - False negatives • **Presumptive Dx**: motor paralysis, if sus-pected, eliminate other causes - Cl. organism in hay **DDx:** • Rabies (pg 271) • Septicemia • Trauma • Nutritional myonecrosis • Hypoglycemia • Esophageal obstruction	• Antitoxin available, usually too late • **Hyperimmune serum**, from horses vaccinated for Botulism - Given before recumbent can reverse CS - Very expensive $1500 per 500 mls for foal **Control:** • Proper disposal of carcasses • Vermin control **Prognosis:** • **"Shaker foals" mortality > 90%: grave** • "Forage poisoning" - Slow onset better than rapid - If recover, takes weeks to months
Tick paralysis M8k 972, 917; I2M 1167; EM&S 764	• *Ixodes holocyclus* • **Foals** & most other domestic species, most common in dog, sheep & cattle	• Generalized flaccid paralysis (resembles botulism)	• Flaccid paralysis • ID tick	• **Remove tick, recover quickly** Prognosis: • **Good after removal of tick**

C. botulism **toxins**
CS: Rapidly fatal paralysis
Dx: Difficult
Tx: ?

Hypomagnesemia, Grass tetany: Affects only ruminants; tetanic spasms, convulsions

Tetanus, Lockjaw M8k 447, 929; Mk 330; IM 1023,1479; I2M 1150; EM&S 785; E 1209; C3T 540; M 385	• *Clostridium tetani* - **Spore** in soil/feces - World wide distribution - **Deep puncture wounds** (anaerobic environment needed) - Necrotic tissue, cells lyse, releasing toxin - **Neurotoxin** picked up by nerves to spinal cord (ascending tetanus) - Excess toxin travels by lymph & blood to brain (ascending tetanus) • All species susceptible (horse & man most sensitive) - IP 10 -14 days (week - weeks) **Toxin** ascends nerves to spinal cord, causing ascending paralysis, if excess toxin in blood to brain, ascending tetanus • Tetanospasmin, tentanolysin & nonspasmogenic • Blocks post synaptic inhibition to motor nerves, causing hypertonia & spasms	• **Initially intractable colic & vague stiffness** • **Muscle spasms** (masseter, neck, hindlimb & wound location) • Then spasticity, general stiffness, & hyperasthesia • **Sound & tactile stimuli** (elicit muscular spasms) • **"Lockjaw"** (masseter m.) • **Prolapse of 3rd eyelid** • **Erect ears, flare nostrils** • **"Sneering"** expression due to contraction of facial mm., retracted eyelids • **"Pump handle" tail** (stiff & extended) • Excess salivation, quidding (drop food), dribble water (can't swallow) • **"Saw horse" stance** (extensor rigidity) • Sweat profusely (horse only) • Difficult walking, turning & backing up • Recumbency, legs extended, ears parallel to back, unable to rise • **Dyspnea** (m/b aspiration pneumonia) • Lose consciousness & convulse • Death due to respiratory paralysis or convulsions • Survivors begin to show improvement in 2 wk, CS m/ persist for 1 month **2° Complications:** • Laminitis • Aspiration pneumonia, 2° to laryngeal & pharyngeal paralysis • Tremendous myositis due to thrashing around if recover	• **Usually presumptive Dx** • History • CS muscular rigidity & hyperesthesia - **"Pump handle" tail** - **"Saw horse" stance** - Erect ears • No reliable clinical test for Dx (try to culture) **DDx:** • Laminitis • Hypocalcemia • Exertional rhabdomyolysis • Heat stroke • Pleuropneumonia **Vaccination:** • **Pregnant mares** - Annual toxoid booster 1-2 mo prior to foaling • **Foals from vaccinated dam** - Toxoid to foals at 3, 4 & 12 mo • **Foals from unvaccinated dam** - Tetanus antitoxin (1500 IU) day 1 + T. toxoid, then T. toxoid 4 wk, 4 & 12 mo • Annual revaccination for all horses **Tetanus prone wounds or surgery** • **Unvaccinated horses or unsure** - Tetanus antitoxin + tetanus toxoid (mixed together) - 2nd toxoid 1 mo later • **Vaccinated horse** - Toxoid booster (not antitoxin because of serum hepatitis pg 88)	• **Debridement of area, lavage & inject penicillin in wound area** • **Muscle relaxation** to control m. spasms acetylpromazine + 5% pentobarbital (cheap), or diazepam ($) repeat multiple times • **Quiet, dark stall,** pack ears w/ cotton • **Good footing**, deep bedding, m/b sling • **High levels of systemic penicillin** - Minimum of 7 d IV 2-3 X normal dose • **Antitoxin** (binds loose toxin to prevent binding to nerves, once bound can't unbind) - IM, hi dosage, minimum 100 IU/kg, repeated every 3-5 d (IM doesn't cross BBB) - **Endothecal antitoxin** (into cisterna magnum [subarachnoid space], under anesthesia) . Remove 30 ml of CSF slowly, inject 50 ml (1000 IU/ml) toxoid. Success variable & many complications • **Good nutrition**: alfalfa pellets soaked in water containing electrolyte solution **Prognosis** • If survive 7 days: fair to good Antitoxin Toxoid **Antitoxin? Serum hepatitis**

Clostridium tetani
CS: "Saw horse", Dyspnea
Dx: Presumptive - Hx, CS
Tx: Wounds - Antitoxin + Toxoid
Vaccinate - Vaccinate - Vaccinate

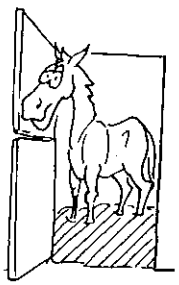
Spinal Cord

Condition	Facts/Cause	Presentation/CS	Diagnosis	Treatment
"Snots", Rhinopneumonitis, EHV-1, Myeloencephalopathy. **Herpesvirus 1, Viral rhinopneumonitis, Abortion virus** M8k 924; Mk 593; IM 526; I2M 1015; EM&S 751; E 1228; C4T 333; C3T 556; M 367; Pop 3-9/97	• **See RESP pg 111** • **Herpes virus** • **Transmission:** - Direct or indirect from nasal discharge, aborted fet, placenta or placental fluid - Carrier animals - always present - Introduced to farm by newly acquired • Persistent virus in environment • Annual outbreaks in foals in horse areas • **Separate syndromes: Respiratory problem in foals, Abortion storms, Neonatal death** or **Myeloencephalopathy** - M/ have had resp. diz in the past **- CNS least common syndrome** - Vasculitis of arterioles, w/ 2° ischemic necrosis of spinal cord - Affects white matter (almost exclusively) - Lumbosacral area **- Unknown mechanism** - Arthrus hypersensitivity reaction Type 3 due to vasculitis (m/b) - Neurotropic herpes strains (m/b) - Most frequent in mares shortly after foaling during an abortion outbreak (m/b also in barren mares, males, foals, etc.)	1° **Resp. virus** (pg 111) • **Foals - "Snots"** - runny (copious) nose • **Mares** - asymptomatic - **Abortion 4-5 mo later** • **Neonatal death** in a few days • **Myeloencephalopathy** - some **- Incoordination & weakness in hind limbs**, mild ataxia & posterior paresis to posterior paralysis & recumbency - Rarely are forelimbs affected - Usually remains standing **- ± Recumbency (bad sign)**, need help to get up, crawl around stalls due to not affecting front limbs **- Urinary bladder incontinence** & distension **- Hypotonic tail** - M/ or m/n be pyrexic which m/ or m/not be associated w/ respiratory signs - No marked ↑ temperature **- BAR**, w/ good appetite **- No progression after 24 hrs**	• **Hx of resp. diz, or abortion** • CS symmetrical ↓ incoordination w/ incontinence • Lab: lymphopenia early due to viral infection, but short lived • CSF: Xanthrochromia - ↑ Protein - Normal cell count (> 8/ml) • To confirm Dx: herpes virus titer, though generally not done, CS & CSF enough	• **Steroids: Dexamethasone** (hypersensitivity reaction) once w/in 24 hrs (IM or IV), Can give after 24 hrs, but doesn't help & m/ cause laminitis **- Stabilizes after 24-48 hrs** • **Broad spectrum ABs** to offset dexamethasone& catherization of bladder • **Catheterize urinary bladder** 2-4 x/ d • **Keep on feet or myositis** - If recumbent, assist to feet - Slings used to get them off muscles • Deep bedding if recumbent also helpful, ideally pack stall w/ shavings, wet down, then straw to give mat • Feed & water placed in front of them

CNS least common syndrome
CS: Ataxia (rear), incontinence, BAR
Dx: Hx, CSF
Tx: Steroid, Catheterize
Vaccination

DDx:
• See DDx for spinal trauma pg 245

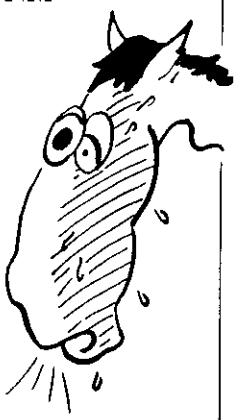
Prevention
• **Management** (see pg. 111)
• **Vaccine** see pg 12 (almost mandatory)
- Foals 3, 4 12 months-old
- Vaccinate 5th, 7th & 9th mo. of gestation
- Booster all horses every 2-3 months
• Vaccine gives immunity for 2-4 months



Prognosis:
• **Good if remain standing**
• **Guarded if recumbent > 2 d**
• Quite a while to completely resolve
• Able to compensate for neurological deficits (ridden at low grade performance levels)

Horner's syndrome

IM 169, 980; I2M 1100, 169; E 1212



• **A syndrome, not a disease**
• **Disruption of sympathetic pathways** to head (see box)
• **Horse** most susceptible of all livestock

Causes: Horner's -many
• Avulsion of brachial plexus
• Injection in neck hitting vagosympathetic trunk
• Infections of guttural pouch
• Cervical abscesses
• Cervical tumors
• Space occupying lesions of cranial thorax
• Esophageal rupture
• Retrobulbar abscess
• Retrobulbar tumor

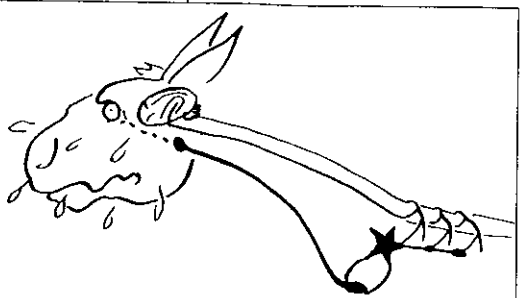
• **Miosis** (small pupil, same side, due to loss of sympathetic innervation)
• **Enophthalmos** (sinking of eyeball)
• **Ptosis** (drooping of upper eyelid)
• **Excessive sweating** on ipsilateral head & neck (seen only in horses)
• Regional hyperthermia

• Find location of damage
- Physical exam
- Endoscopic exam of guttural pouch
- Palpate jugular groove for swelling
- X-ray cervical vertebrae
- Check chest (auscultation, x-ray)
- Gait & proprioceptive responses

• **Tx depends on cause**
- Injection damage: quickly infiltrate (inject) saline (perivascular) to dilute out & NSAIDs
- Tx mycotic infections

Prognosis:
• Neurological signs often irreversible

Sympathetic pathway:
• Descend from brainstem down neck to synapse in T_1-T_3 segments of spinal cord
• Preganglionic fibers pass over T_1-T_3 spinal nerves to sympathetic trunk in dorsal thorax
• Pass through stellate (cervicothoracic) & middle cervical ganglia to pass up neck in vagosympathetic trunk to synapse in the cranial cervical ganglion
• Postganglionic fibers pass to sweat glands of head, dilator muscles of the iris, periorbital smooth muscles & periarteriolar musculature



Sympathetic disruption to head
Miosis, Enophthalmos, Ptosis, Sweating

Guttural pouch mycosis, Damage to CrNs 9, 10, 11 & 12

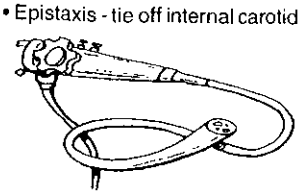
IM 981; I2M 1101; EM&S 788, E 1206; J 1035

• **See RESPIRATORY** pg 100
• Mycotic infection of guttural pouch
- Grows on dorsomedial aspect of pouch over internal carotid a., CrNs 9, 10, 11 & 12 & vagosympathetic trunk
- Eats through to artery & nerves & cause epistaxis & nerve dysfunction
• Extension of infection to parotid lymph node m/ cause facial nerve damage (CrN 7)

• **Epistaxis**
• **Nasal discharge**
• **Dysphagia** (CN IX & X)
• Parotid pain (head extended & held close to ground)
• Horner's syndrome (sympathetic)
• Facial paralysis (VII)
• Sequelae:
- Aspiration pneumonia
- Extension - vestibular diz

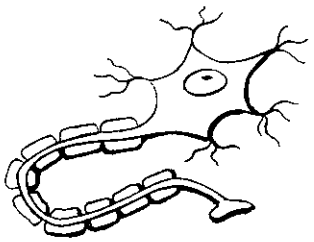
• Hx, CS
• **Endoscopic exam of guttural pouch**

• NO specific Tx of neurologic disorders
• Euthanasia
• Epistaxis - tie off internal carotid a.

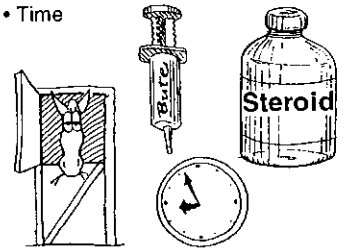


Peripheral Nerve Damage

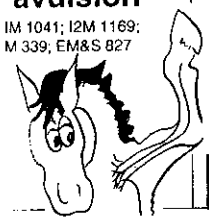
Condition	Facts/Cause	Presentation/CS	Diagnosis	Treatment
Peripheral nerve damage IM 1041; E 1176; EM&S 826; M 389; C3T 577; S 539	• **Problems localized to only 1 limb** (monoparesis) by **LMN** signs • Problem in specific nerve roots, nerve or group of nerves or muscles they innervate	• **Gait & posture abnormalities** • **Loss of cutaneous sensation**	• Hx (history) • CS (clinical signs)	• **Reduction of inflammation** - **Dexamethasone** daily 3-5 d - **Phenylbutazone** (bute) IV 1st 24 hr - **Cold packs** 1st 24 hr • **Relief of pain** - **NSAIDs**: Banamine®, Bute - **Narcotic analgesics** (Demerol®, 1-2 mg/kg, or morphine 0.07-0.14 mg/kg) • Stall w/ good footing • Recumbent animals turned 6-8/d • Time



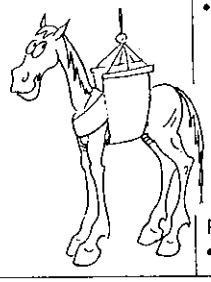
Brachial plexus	C6-T1	
• Subscapular	C6-7	Supraspinatus & infraspinatus mm.
• Musculocutaneous	C6-8	Biceps brachii, coracobrachialis, brachialis mm.
• Radial	C6-T2	All extensors of arm & forearm
• Median	C8-T2	Most of flexors mm. of forearm
• Ulnar	C8-T2	Some of flexors mm. of forearm
Lumbosacral plexus	L4-S2	
• Obturator	L4-6	Adductor mm. of limb
• Femoral	L3-6	Extensors mm. of stifle (quadriceps)
• Ischiatic	L5-S2	Caudolat. mm. of thigh & flexors & extensors of leg
• Peroneal	L5-S2	Extensors mm. of leg
• Tibial	L5-S2	Flexors mm. of leg

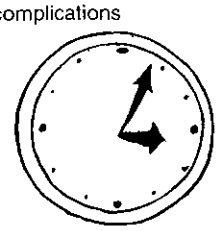


Brachial plexus avulsion IM 1041; I2M 1169; M 339; EM&S 827	• **Avulsion of brachial plexus** - Trauma to shoulder - Deep penetration wounds of axilla - Dystocia manipulation	• **Motor deficits** - **Complete flaccidity of forelimb** - **Unable to bear weight** (radial n.) - Abduction (pectoral nerves) - Dropped shoulder (subscapular n.) - Hyperextension of elbow (musculocutaneous n.) - **Knuckling over** (radial n.) • **Desensitization distal to elbow**	• Hx (history) • CS	• Tx: time • Prevent 2° complications Prognosis: • **Poor** if no improvement in 2 wk

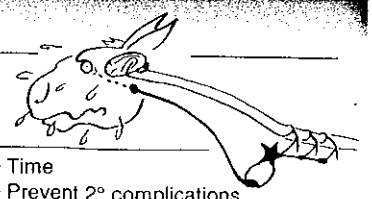


Trauma
CS: Flaccid forelimb, no sensation
Tx: Time

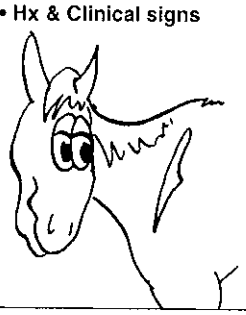


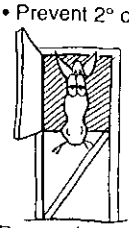


Horner's syndrome	**SEE pg 255; Sympathetic nerve damage**: although not part of brachial plexus, their preganglionic fibers travel over the roots of the brachial plexus & can be damaged w/ brachial plexus nerves • CS: miosis, ptosis, enophthalmia & sweating on head & neck (same side as lesion)			
"Sweeney", Suprascapular paralysis M8k 917; IM 1041; I2M 1169; E 1238; EM&S 826; M 389; C3T 578; J 1019	• **Suprascapular n.** crosses cranial border of scapula • Common injury when yokes used to pull farm machinery, now w/ horse pulling contests • Trauma where nerve crosses scapula	• **Acutely: lateral slipping of shoulder** • **Chronic: prominent scapular spine due to marked atrophy** of shoulder **muscles** (supraspinatus & infraspinatus mm.)	• **Hx & Clinical signs**	• Time • Prevent 2° complications Prognosis: • **Poor** if no improvement in 2 weeks

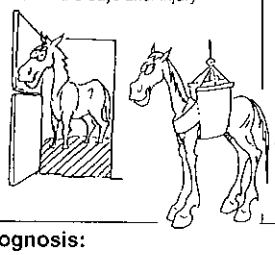


Trauma to suprascapular n.
CS: Lateral slipping, prominent spine
Tx: time

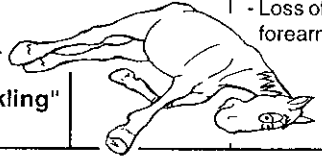




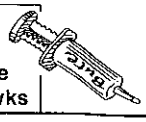
Radial n. paralysis IM 1041; I2M 1169; E 1239; EM&S 828; M 389; AL 678; LAS 678	• **Radial nerve**: crosses axilla to dive into triceps brachii muscle & passes superficially on **lateral side** of arm under lateral head of triceps brachii m. (common injury site) • **Innervates all extensor mm.** of limb • Causes: - Direct trauma: kick, laceration, humeral fxs - **Lateral recumbency w/o padding** on lateral side of arm & shoulder (where it emerges under lateral head of triceps) . Question if due to radial n. paralysis or compression of vasculature & ischemia to muscles . Danger of further injuries as horse recovers - Overstretching of nerve during hyperextension	• **"High radial nerve paralysis"** injury above entrance into the triceps - **"Dropped elbow"** - **Unable to bear weight** on limb - Neurogenic atrophy of extensor mm. of limb - **CS of lower radial nerve injury** - Limb appears longer than opposite forelimb • **"Lower radial n. paralysis"** injury near lateral elbow - **"Knuckling over"** (carpus, fetlock & pastern joint) . Dragging foot = dorsal fetlock trauma - **Can bear weight on limb** - Loss of sensation to craniolateral forearm above the carpus	• **Hx, CS (clinical signs)** - **"Dropped elbow"** - **"Knuckling over"** • Palpate for fxs of humerus • Radiology of humeral fxs • EMG (electromyography) of extensor mm. 5 days after injury	• **Conservative** - **Time & TLC** to see if function returns - Horse can learn to "**flip**" distal limb so foot lands correctly ("lower radial n. paralysis") - Reduce inflam.: Dexamethasone 3-5 days - Phenylbutazone IV & ice packs first 24 hours - NSAIDs (Banamine®, bute) or Demerol® for pain - Deep bedding, slings - Recumbent animal turned 6-8 X/day to prevent decubital ulcers - ± Light cast or bandage to prevent contracture of flexors & to protect dorsal fetlock • Surgery: - Humeral fxs m/b, remove bone chips & free up nerve done 6-10 weeks after fracture - End-to-end anastomoses of severed nerve



Extensor muscles
CS: "Dropped elbow", "knuckling"
Tx: Time



Prognosis:
• **Guarded in mild cases**
• **Unfavorable if severed nerve**
• **Poor** if dysfunction lasts > 2 wks



Facial Nerve & Spinal Cord — NERVOUS SYSTEM

Condition	Facts/Cause	Presentation/CS	Diagnosis	Treatment
Peroneal n. paralysis M8k 917; IM 1042; I2M 1170; E 1241; EM&S 829; M 390	• **Peroneal n.: innervates extensors of digits & flexors of tarsus** - Superficial as crosses lateral surface of gastrocs • **Injured:** horses postanesthetic myopathy **Extensors** **CS: "Knuckling over"** **Tx: Time**	• **Knuckling at fetlock & pastern**, wear on dorsal surface • Hyperextension of hock • Desensitization of craniolateral limb from stifle to hoof • **Trip** • **Usually temporary**	• **Hx, CS** • **Hindlimb lameness w/ fetlock & pastern flexed**	• **Time, usually recovers** • Plaster cast to keep joints extended • Reduce inflammation - Dexamethasone 3-5 d - Phenylbutazone IV & ice packs first 24 hr • NSAIDs (Banamine®, bute) or Demerol® for pain • Deep bedding, slings • Recumbent animal turned 6-8 X/d to prevent decubital ulcers
Obturator n. paresis IM 1043; I2M 1172; EM&S 830 *	• **Obturator nerve**: passes down shaft of ilium (pelvic inlet) through obturator foramen - **Supplies adductors** of rearlimb • Causes: - **Dystocia** (foal damaging obturator & ischiatic nerves on way through canal) - Coxofemoral luxation or **femoral neck fxs** sequelae • **Rare in horse**, common in cow **Rare - Adductors** **"Splits" on slippery surface**	• Nonslip surfaces - minimum deficit • **Splay leggedness** (severe abduction) - **"Splits"** to sides on slippery surfaces (can't adduct limbs) • Hopping gait • Recumbency w/ hind legs to each side • No cutaneous loss	• **Hx, CS** • **Do splits**	• **Time; hope function returns** • Keep on firm ground, no slippery surfaces • Tie hocks together just proximal to the calcaneus • Reduce inflammation - Dexamethasone 3-5 d - Phenylbutazone IV & ice packs first 24 hr • NSAIDs (Banamine®, bute) or Demerol® for pain • Deep bedding, slings • Recumbent animal turned 6-8 X/d to prevent decubital ulcers

Median, musculocutaneous, ulnar, median, femoral, ischiatic & tibial nerves
Mk 917: rarely traumatized individually & if they are, there is very little gait abnormalities.

Facial nerve trauma M8K 936, 918; I2M 1172, 153; EM&S 784, E 1202; C3T 578; M 376; J 1010, LAS 374, 386	• **Facial paralysis common** • Signs depend on where injured • **Brain stem or middle ear** - Fxs of petrous temporal bone - Fx of stylohyoid bone - Fx of ramus of mandible - Midbrain lesions - Polyneuritis equi - Idiopathic facial n. paralysis • **Buccal branch:** Recumbency under general anesthesia . "**Buccal on buckle**" (halter) **Common** **CS: Facial paralysis, dry eye** **Dx: Hx, Schirmer tear test** **Tx: Time** **Prevent: Pad head when anesthetize**	• **Buccal: Facial paralysis** - Deviation of nose away from lesion - Drooping of lip, ear & eyelid (side of lesion) - Flaring of nostril on inspiration (side of lesion) • **Proximal to ramus of mandible** - **Facial paralysis** - **Exposure keratitis** (eye) . Inability to close eyelids . ↓ Lacrimal secretion - ± **Vestibular n. signs** if near inner ear (head tilt, nystagmus & circling)	• HX, CS • **Stimulation of face** doesn't result in muscle contraction (CrN 5-CrN 7 reflex, trigeminal provides sensory component) • **Schirmer tear test** (for lacrimal gland) • Atrophy not apparent because muscles thin as apposed to muscles of mastication - Atrophy does cause distortion of face	• **Time** • **Banamine®** (flunixin meglumine) IV 5 d, a NSAIDs • Surgical repair if severed • **Protect eye if affected** **Prognosis:** • Depends on site of lesion • Peripheral nerve damage - good **Prevention:** • **Pad side of face** when under general anesthesia

Facial nerve (Cranial nerve 7)
- **Innervates muscles or facial expression & lacrimal gland**
- Arises from midbrain
- Passes in relation to the middle ear
  - Branches to lacrimal gland
- Crosses the guttural pouch under parotid salivary gland
  - Branches to ear muscles & eyelid
- Crosses over cheek (masseter muscle)
  - Branches to cheek, nose & lips

Trigeminal nerve trauma, Dropped Jaw, Trigeminal neuropathy
I2M 153; C4T 157; M 377

- 5th cranial nerve
- Caused by trauma, protozoal migration or cauda equina neuritis
- **CS: Dropped jaw**, food falling out of mouth; marked atrophy of thick muscles of mastication
- **Tx:** No specific Tx; Banamine® (anti-inflammatory)

Brain stem lesions

IM 159; I2M 160; E 1176, 1205; C3T 522

Brain stem (midbrain, pons & medulla)
- **RAS**, reticular activating system: concerned w/ conscious level
- **Proprioceptive fibers** pass through
- **Cranial nerves** associated w/ brainstem
- **UMN, sensory & proprioceptor fibers** pass through brain stem
- **Walking motion reflexes**
  - Generated in centers caudal to the midbrain
  - Initiated rostral to midbrain (higher centers)

- **↓ Consciousness** (depression, stupor, coma)
  - Profound depression (RAS)
- **Deficits in CrN 3-12**
- **Proprioceptive (Proprcpt) deficit & gait**
  - Proprcpt. defc w/ normal gait - midbrain or rostral
  - Proprcpt. defc w/ abnormal gait - caudal to midbrain
- **UMN & proprioceptive deficits all limbs**

Causes - Brain stem lesion:
- Verminous migration (pg 251)
- Protozoal myeloencephalopathy (pg 250)
- Brain abscess or brain tumor (pg 269, 262)
- Cauda equina neuritis (pg 248)
- Horner's syndrome (pg 255)
- Eq Rhinopneumonitis (pg 254)

Proprioceptive (proprcpt.) deficit & gait
- Proprioceptive defc w/ normal gait - midbrain or rostral
- Proprioceptive defc w/ abnormal gait - caudal to midbrain
- Rostral lesions (cerebro-diencephalic) - contralateral (opposite) proprioceptive defc, normal gait
- Caudal to the midbrain (brain stem & spinal cord) - ipsilateral (same side) proprioceptive deficit, abnormal gait
- Midbrain lesions - normal gait & proprioceptive deficit on both sides

Vestibular system lesion

IM 159; I2M 154; EM&S 792; E 1203; C3T 575; S 538

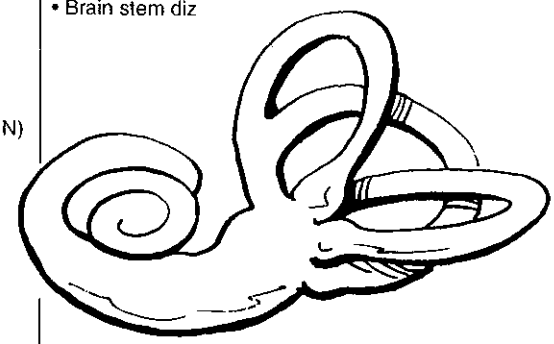
- **Control posture in relationship to gravity; & eye movements in relationship to head movements**
- **Peripheral vestibular centers**: inner ear (labyrinth, receptors, & vestibular n., not proprioceptive fibers)
- **Central vestibular** (vestibular nuclei in brain stem & centers in cerebellum) motor, sensory & proprioceptive centers [brain stem] located in area

- **Head tilt**
- **Nystagmus**
- **Ataxia**
- **Possibly circling & falling towards the lesion**
- **Strabismus**

Central vestibular diz (brain stem) also shows:
- Postural deficits (proprioception) & paresis (UMN)
- Depression (RAS in area of vestibular nuclei)
- Recumbency, lesion side down
- Lean against wall
- Loss of perception of sensation

Peripheral vestibular diz also shows:
- No UMN signs (paresis)
- Ataxia because of loss of balance, not due to proprioception
- Not decr. sensorium or depression

Causes:
- Otitis media/interna (pg 263)
- Brain stem diz



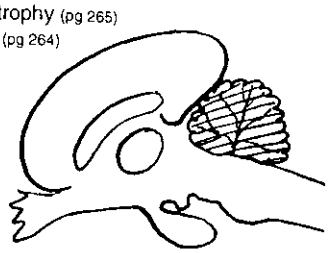
Cerebellar lesions

IM 159; I2M 164; EM&S 793; E 1176, 1208; C3T 524; S 538

- **Coordinating movements**, but does not initiate them
- **Vestibular system connections** to help coordinate balance & posture
- Proprioceptive fibers don't pass through cerebellum
- **Menace response**, cerebellum plays an unknown role in the menace response

- **Incoordination (ataxia)** (excessive range, rate & force of movement) (base-wide stance from balance deficits, not proprioception)
- **Tremors**
- **Abnormal movements of the head**
- Vestibular diz signs, including:
  - Head tilt
  - Nystagmus
- **Loss of menace response, but not blind**
- **BAR** (bright, alert & responsive) bec. RAS not affected
- **No proprioceptive deficits**

Causes:
- Cerebellar abiotrophy (pg 265)
- Grass staggers (pg 264)
- Locoism (pg 265)



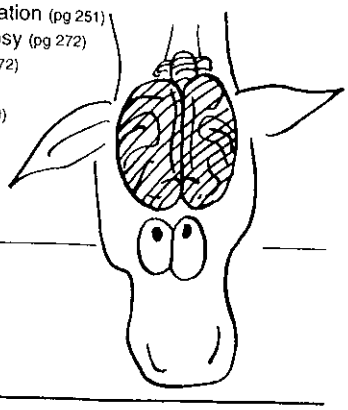
Cerebral lesions

IM 159; I2M 156; E 1175; C3T 523; S 537

- Cerebral hemispheres & basal nuclei
- **Voluntary motor control, behavior, & mental status**
- **Interprets vision & audition, proprioception, & general sensations**
- **Thalamus**: functionally, it is closely related to the cerebrum to which it relays information

- **Mild to marked depression** (less than brain stem lesion)
- **Alterations in behavior** (aggression, rage, hypersexuality)
  - Seizures
  - Propulsive circling (wide)
  - Head pressing, continual chewing (odontoprisis)
  - Normal gait in straight line w/ abnormal postural reactions (proprioception loss, stumbling, knuckling over at fetlock)
  - **Blindness** (occipital lobe) w/ normal pupillary responses

Causes - Cerebral lesions
- Protozoal myeloencephalopathy (pg 250)
- Hepatoencephalopathy (pg 268)
- Viral encephalomyelitis (pg 266)
- Rabies (pg 271)
- Leukoencephalomalacia (pg 267)
- Trauma/hematoma (pg 262)
- Hydrocephalus (pg 263)
- Verminous migration (pg 251)
- Idiopathic epilepsy (pg 272)
- Narcolepsy (pg 272)
- Brain abscess/ meningitis (pg 269)

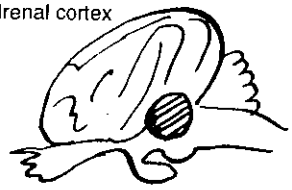
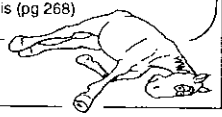
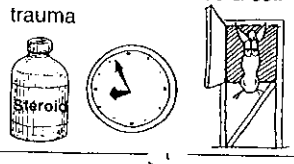
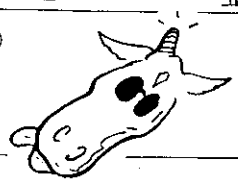
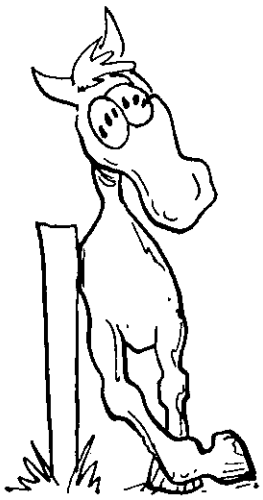
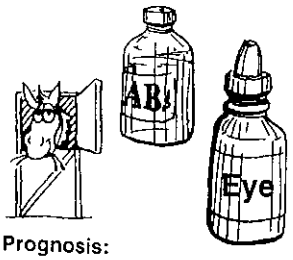


Hypothalamus

- **Controls the autonomic nervous system (ANS) & the endocrine system**

Autonomic & endocrine abnormalities
- Polyuria/Polydipsia
- Altered sleep patterns
- Rage to affectionate behavior
- Abnormal appetite

Brain Stem Lesions

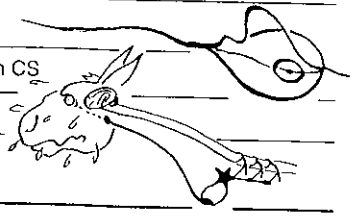
Condition	Facts/Cause	Presentation/CS	Diagnosis	Treatment
Brain tumors M&k 951; IM 966, I2M 1083; EM&S 778 **Compression** **No Tx**	• Cause compression of brain stem - Cranial nerves 5, 7 & 8 • Pituitary tumors of old horses rarely produce CNS CS, but stimulate adrenal cortex 	• Hypermetric gait, ataxia • Depression • Facial paralysis • Facial anesthesia or analgesia • Head tilt, strabismus & nystagmus • Exophthalmos (if facial tumor [SCC]) migrates through foraminae into cranium • Horner's syndrome	• CS • **CNS tumors** - Pituitary adenomas, microgliomas, medulloepithelioma, choroid plexus papillomas, ependymoma, neurofibromas, meningiomas, meningeal carcinoma • **2° tumors** - Melanoma, lymphosarcoma, adenocarcinoma, squamous cell carcinoma, hemangioma & osteoma - Metastasize via vascular channels or extension along peripheral nerves	• **None**
Brain trauma IM 932; I2M 1037; C4T 301; EM&S 782; E 1199; M 378; S 543  **Poll**	• **Poll (top of head) trauma common** - Fxs of basisphenoid, petrosal bones, occipital bones - Disrupt foramen lacerum & jugular foramen . Dysfunction of CrN 9, 10 & 12 - **Midbrain**: swelling - compression (herniation through foramen magnum) • Medullary/inner ear syndrome	• CS depend on part of brain • **Extreme swelling** - midbrain - Cran. nn. dysfunction (see optic below) - Disturbances of consciousness - Abnormal respiration - Decerebrate rigidity - Vestibular disturbances (nystagmus, ventrolateral strabismus, head tilt, blindness, circle) - **Ataxia, recumbency, depression & coma** (struggle violently) • Vestibular CS - Head tilt, nystagmus, circling, facial paralysis	• Hx (History) • CS **DDx:** • Herpes myeloencephalopathy (pg 254) • Degen. myeloencephalopathy (pg 249) • Protozoal myeloencephalitis (pg 250) • Verminous myelopathy (pg 251) • Rabies (pg 271) • Botulism (pg 252) • Tetanus (pg 253) • Congenital abnormalities • Meningitis (pg 268) 	• Early recognition • **Control ↑ CSF pressure** - Steroids - Mannitol $ (not if active hemorrhage) - IV DMSO • **Control seizures**: Valium®, phenobarbital or pentobarbital • Protect from decubitus & self trauma 
Traumatic optic nerve blindness IM 935, EM&S 782	• Severe, blunt, head trauma - pushes brain back & stretches optic nerve in young, as in poll trauma (see above) • CS: **Blindness**, loss of pupillary reflexes, pupillary dilation • Tx: **None** • Px: **Permanent condition**			
Vestibular diz, Otitis media/ interna IM 976; I2M 1096; E 1202; EM&S 791, 794; C4T 323; C3T 575  **Peripheral - CrN 7 & 8** • **Dry eye, Head tilt - BAR** **Central - 7, 8 & Brain stem** • **Depressed, Ataxia**	• ß-hemolytic Strep., Staph., *Aspergillus versicolor* • 2 types: - **Peripheral otitis media/interna**: localized in temporal bone (less severe) - **Central**: extends to tympanohyoid joint & stylohyoid bone (severe) . Fuses the joint between temporal bone & stylohyoid bone . Fusion fractures w/ extension into brain case . Results in hematoma w/in CNS .. Septic meningitis **Causes:** • Extension of pyogenic bacterial infection from guttural pouch • Polyneuritis equi • Viral labyrinthitis • Traumatic fractures	• **Peripheral** - localized in temporal bone - **Dysfunction of CrN 7** (facial) & **8** (vestibulocochlear) . Mild proprioceptive deficit (side of lesion), **Ataxia** . **Head tilt** . **↓ Lacrimation** (CrN 7) . Facial paralysis (drooped ear & lip, drooling, ptosis) (CrN 7) - **Exposure keratitis** (can't close eyes) - Nystagmus (not changed by head movement, rapid phase toward lesion) . ± Ventrolateral strabismus (side of lesion) . **Lean against wall** (or circle) . **BAR** (bright, alert & responsive) • **Central** w/ fx - **Above signs** - Fall & become recumbent - **Depressed**, febrile & anorexic - If 2° septic meningitis . Rapid deterioration of mental status . **Stiff neck** . **Ataxia (proprioceptive)** . Hyperesthesia, fever, dysphagia . Otorrhea (discharge from ear)	• Hx, CS • **Skull radiographs** for fxs • Schirmer tear test (lacrimation VII) - Defc flow < 17 mm/min 	• Peripheral - **ABs**: hi dose penicillin (IV qid) . 3rd generation cephalosporins . Trimethoprim-sulfonamide - NSAIDs in early stages - Corticosteroids m/b early (problem w/ immunosuppression) - Quiet, heavily-bedded stall on good footing • **Exposure keratitis** - Tarsorrhaphy, or - Ophthalmic ointments, pilocarpine eye drops qid  **Prognosis:** • Seemingly recovered horses used carefully because subtle neurological deficits m/ result in catastrophic accidents

Hydrocephalus C3T 530: Dome shaped to cranium, Neurologic deficits

Verminous or protozoal migrations (see pg. 251, 252): aberrant migration through brain stem results in midbrain CS

Brain abscesses or **brain tumors** (see pg. 278): in midbrain cause midbrain CS

Horner's syndrome (see pg 255): fibers pass through midbrain, lesions to midbrain m/ result in Horner's syndrome



Cerebellar Lesions

Condition	Facts/Cause	Presentation/CS	Diagnosis	Treatment
Grass staggers, **Ryegrass staggers, Bermuda staggers, Dallis grass staggers,** Paspalum staggers, **Tremogenic toxins, Nervous ergotism** Mk 1689, 1724; IM 986; I2M 1115, 1892; EM&S 795; E 1212; C3T 377; Tox 428, 435; PP/O 19	• Horses occasionally (also sheep, commonly in cattle) • Dallis grass, other Paspalum grasses, Rye grass, Bermuda grasses • **Ergot**, *Aspergillus, Penicillium* & *Claviceps paspali*, Tremogenic alkaloids - Contaminate grasses	• **Staggers** • Muscle tremors to marked ataxia • "Goose stepping" (overstepping) & falling - Exaggerated hypermetric gait, • Ataxia, exacerbated w/ exercise or excitement • Paralysis • Belligerent • ± Nystagmus & salivation	• CS + • Hx of exposure to contaminated grass	• Remove from grass, spontaneously recover • Supplemental nutrition **Prognosis:** CS regress in 2-4 d - Occasional persistent locomotor disturbances
Bracken staggers Mk 1641; IM 1648; I2M 1062, 1893; EM&S 805	• **See TOX pg 322; Bracken fern** & horsetail toxicosis - **Thiaminase** causes Vit. B1 (thiamine) deficiency • **CS:** Anorexia, incoordination (staggering), crouching stance, death preceded by convulsions & opisthotonus • **Dx: Bracken fern** or **horsetail area**, Lab: ↓ **Blood thiamine** to 2.5 • DDx: Plants, Horsetail, Turnip (*Beta vulgaris*), *Crotalaria* spp. Ragwort (*Senecio jacobea*), Other neurological disorders, Rabies • **Tx:** Vit. B1 highly effective if early, Remove from bracken fern area • **Prognosis:** Vitamin therapy usually effective if early			

Ergot
CS: "Goose stepping"
Dx: CS + Hx
Tx: Remove grass = recovery

Dallis grass
• Perennial grass, 2-5'

Locoweed poisoning, Locoism Mk 332; IM 995; I2M 1877; EM&S 1784; E 1194, 211; C4T 651; C3T 376; C2T 674	• **See TOX pg 328** • **Astragalus & Oxytropis** not all are toxic, Specklepod loco (*A. lentiginosus*), Pursh loco (*A. purshii*) • Toxic principle: Unknown (m/b barium, selenium, locaine alkaloid or larhyrogen) - 1st vegetation available in spring, overgrazing & drought, remains green in late fall & winter • **Horses** > cattle > sheep - Continuous ingestion, Horses that consume 30% of weight over 6-7 weeks • **Addictive (horses)** • **Diffuse CNS disorder** • **Western USA**	• **Incoordination** (proprioceptive deficits, ataxia) • **"Stringhalt-like" gait** • **Frenzied or maniacal** activity alternating w/ depression • Wander in circles, or straight, Jumping imaginary objects, shying at familiar objects (poor judgement), Violent action, Depressed, Convulsions & falling, Bump into objects, Head press • Head tremors (intention), visual impairments, dysphagia • Emaciation - death • Abortion & limb deformities in foals	• History of ingestion • CS • Tranquilization ineffective in controlling behavior • Lab: vacuolation of cytoplasm of lymphocytes	• **No Tx** Prognosis: • **Poor:** horse remains affected long after removal from plants • **Altered behavior & extremely unpredictable**
Cerebellar abiotrophy IM 984; I2M 1105; EM&S 793; E 1209	• Degenerative diz in postnatal horse (abiotrophy) • **Arabians** & Arabian crosses - M/b born w/ it - Develops CS after 6 mo • Cause: Unknown, **possible familial** relationship • **Cerebellar** neurologic diz - Slow progression, some no progression - **Conscious proprioceptive deficits**	• **CS suddenly after 6 mo** of age • Slight ataxia to complete diffuse cerebellar dysfunction - **BAR,** No weakness, Hypertonia - **Stiff, hypermetric gait** - Rear & fall over backwards - Accentuation of CS by stimuli - **Intention head tremors** - Truncal ataxia - Hyperreflexia of all limbs - No menace response, not blind	• **Arabian - cerebellar diz** • Turn animal sharply or blindfold & obstacle course (exaggerates ataxia) - Circling, hypermetric, especially in hind-limbs, outside limb circumducts widely • Menace response absent (but can see) • CSF ↑ protein • PM (postmortem) ↓ **number of Purkinje cells**	• **NO Tx** - outcome euthanasia • Council owners on heredity & suggest don't breed

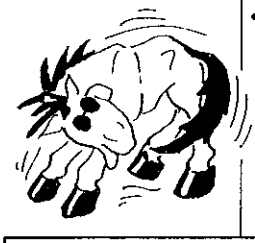
Astralgalus - W. USA - Addictive - Maniacal - No Tx

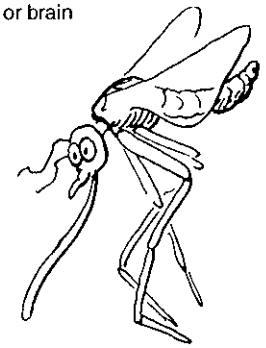
Arabians - BAR - Ataxia - Euthanasia

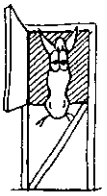
DDx:
• OAAM (pg 247), rads R/O
• Neonatal maladjustment syndrome (NMS) (pg 270)
• Septicemia w/ 2° meningitis

Cerebral Lesions

Condition	Facts/Cause	Presentation/CS	Diagnosis	Treatment
Equine encephalomyelitis, EEE, WEE, VEE, Viral encephalomyelitides M8k 931; Mk 599; IM 917; I2M 1018; EM&E 744; E 1184; C3T 547; C2T 345; Pop 8-9/97	• Eastern (EEE), Western (WEE), or Venezuelan (VEE) equine encephalomyelitis: 3 primary types - Less virulent: Snowshoe hare, St. Louis, Japanese B encephalitis, etc. • Clinical similar syndromes **- CS of CNS dysfunction** **- Moderate to high mortality** • All togaviruses (formerly arbovirus) - EEE - E & SE USA - WEE - W & MidW US - VEE - S & Cen. Amer. & W. Indies, not common in USA (Texas in 1971) • **Birds - mosquito - horse cycle** - Birds & rodents no CS - Vector - mosquito - Horse - dead end host (WEE), low level viremia usually - VEE viremia, so horse also reservoir • **Mid/late summer** (mosquito season) • IP 1-3 days	• **Deaths 2-3 d after CS start** • **Fever (101- 106°F),** biphasic (EEE & WEE), anorexia & stiffness • **Cerebral, brain stem & spinal cord** CS in 4 d **- Demented**: behavior changes, despondent & depressed to hyperexcitable & demented, ± Crash through stall if stimulus **- Seizures** **- Blindness** **- Circling** (either direction), Head pressing - Pendulous lower lip (CrN 7), inability to swallow, photophobia - Nystagmus (rotatory, vertical or horizontal), head tilt, dysphagic - Yawning, Grinding of teeth, Drowsiness • **Spinal cord CS** **- Weak & ataxic,** Irregular gait, Wandering, Reduced reflexes - Inability to rise, **Paralysis** - Twitching of muscles • ± Extremely pruritic, DDx rabies • **Occasional convulsions & death** • **"Dummies"**: if recover (neurologic deficits) some m/ recover completely	• **Presumptive - CS, History, Seasonal occurrence** • Histo lesions of viral encephalitis • Lab: Virus neutralization - Hemagglutination inhibition or complement fixation tests during acute or convalescent phase - Hi mortality & rapid death make paired sera hard to get . Serologic titers, 4x increase • **Isolation of virus** from blood or brain	• **No specific antiviral agents** • Supportive: Anti-inflammatory • **Control seizures**: Diazapam (short term), pentobarbital IV (longer) • **Intensive nursing** **Valium** **Px** (Prognosis) • Mortality rates: EEE > WEE (EEE: 75-90% , WEE: 20-50%, VEE: 40-90%) **Prevention:** • **Control mosquitoes** (drain swamps, insect repellents) • **Stable animals** during mosquito season • **Vaccine** (see pg 12) - bivalent (EEE + WEE) & trivalent (EEE + WEE +VEE) - ↓ # of new cases not effective when CS present - Effective 1 mo before mosquito season • **Quarantine** (zoonotic)







Hi mortality, mosquitoes
CS: Fever, Seizure, "Dummies"
Tx: Control seizures
Vaccinate - Reportable

Public Health
- **VEE reportable in USA**
- CS in people include pyrexia, muscle pain, mild to severe encephalitis
- Handling tissue & mosquitoes

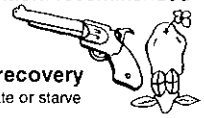
Vaccination schedule - all horses
- **Foals: 3, 4 & 12 mo**
- **All horses annual booster in spring**

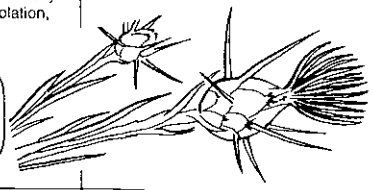
DDx:
- Liver diz (pg 84) (Hepatoencephalopathy)
- Rabies (pg 271)
- Protozoal myeloencephalitis (pg 250)
- Verminous encephalitis (pg 251)
- Leukoencephalomalacia (pg 267)

Nigropallidal encephalomalacia, Yellow star thistle poisoning, Chewing diz Mk 1707; IM 978; I2M 1098, 1889; E 1207, 209; EM&S 789; C4T 157; C2T 675; M 381; NS-hb 237	• ***Centauria solstitialis*** **(yellow star thistle)** - Russian knapweed (*C. repens*) • **Western US** • **Summertime,** Centuria remains green as rest of plants die, drought • **Long term ingestion** • Adult horses - Addiction to plant in some • **Liquefactive necrosis of substantia nigra & globus pallidus** - Slight motor & sensory deficits of limbs • Not progressive, but no recovery	• **Fixed facial expression** **- Hypotonic facial nerve** • **Weight loss** • **Depression** • Yawning, Lowered head • ± Protruding tongue • **Mouth held open** (lips pulled back) • **Lips don't work** (prehension, mastication & deglutition inefficient) **- "Chewing diz"**, muscle fasciculations - Scoop food w/ teeth, food retained in mouth • **Muzzle deep into H_2O bucket** to drink • **Motor & sensory deficits of limbs** - Ataxia, tetraparesis, hypertonicity, conscious proprioceptive deficits, m/b hypermetria, walk propulsively or circle • **Die of starvation or dehydration**	• **CS & exposure to plant** • Neuro exam: mental status, gait, proprioception • CSF - ↑ WBCs (75/dl) - CBC & chem normal • PM (postmortem) **- Bilateral softening & necrosis extrapyramidal system** (substantia nigra & globus pallidus) pathognomonic . Sharply demarcated & m/b cavitary - Histo - neural necrosis, vacuolation, gliosis, liquefactive necrosis	• **None** • **Euthanasia** recommended **Px: No recovery** - Aspirate or starve **Prevention:** • Supplement if on arid field (10-15 # of alfalfa hay) • Don't pasture w/ thistle

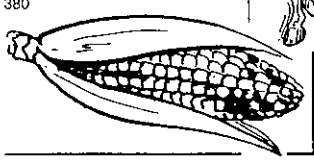
W. USA, "Eats" brain
CS: Lips don't work
Tx: Euthanasia

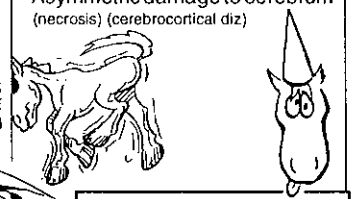
DDx:
- **Rabies**
- Brainstem abscess
- Hematoma



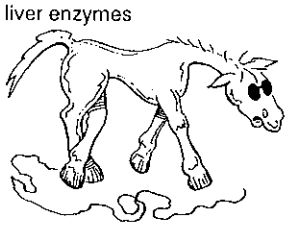


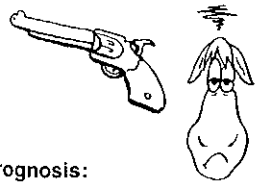
Leukoencephalomalacia, Moldy corn poisoning, Blind staggers, Mycotic encephalomalacia M8k 2087, 2079; Mk 1684, 1680; IM 961; I2M 1077; EM&S 789; E 1194, 198; C4T 157; C3T 377; M 380	• **Moldy corn** • ***Fusarium moniliforme*** - fungus • Horses fed moldy corn, outbreaks - Over a period of several weeks - Winter when fed moldy corn • Asymmetric damage to cerebrum (necrosis) (cerebrocortical diz)	• ± **Die acutely** • Initially inappetence • **Sensory/motor** abnormalities **- Wildly thrash around** - severely depressed or highly excitable **- Head press, circle** randomly, or wander aimlessly, walk into objects **- Centrally blind,** lack of menace response 1 eye - Loss of facial sensation - Generally asymmetric • Generally progresses to pharyngeal paralysis • Recumbent • General muscle fasciculation • Progresses; die while convulsing • **Death w/in 1 wk of CS** • Hepatic failure & m/ die of liver diz • **Recovery gives "Dummies"**	• **Hx of eating moldy corn** • Asymmetric, coagulative necrosis of white matter of cerebrum **- Holes in cerebrum** • **Liver**: congestion, centrilobular necrosis • Lab: look at blood chem. for liver enzymes	• **None when CS** • **Euthanasia** • If catch getting into corn - Cathartics to remove or clear gut if inadvertently into moldy corn - Activated charcoal to decr. absorption - Mineral oil **Prognosis:** • **Poor/grave: usually euthanasia** • Long term if not showing CS, worry about damage to liver





Holes in cerebrum
CS: Thrash, Dummies
Tx: Euthanasia

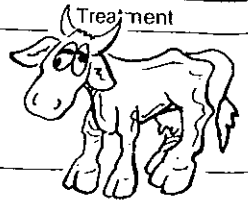


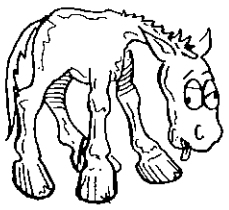


Cerebral Lesions

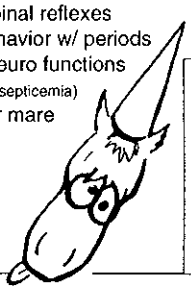
Condition	Facts/Cause	Presentation/CS	Diagnosis	Treatment
Meningitis M8k 946; IM 342, 926, 972; I2M 1030; EM&S 754; E 1188; C3T 552; M 373	• **Gram neg.** organisms predominantly - ***Actinomyces* spp.** • **Neonatal foals common** due to not enough colostrum• **Cause:** - Direct extension into calvarium or hematogenous - Surgical removal of ethmoidal hematomas - Migration of *Cryptococcus neoformans* along peripheral nn. • Sequelae: phalophlebitis, septic arthritis, anterior uveitis, panophthalmitis	• **Fever**, anorexia • **Stiff neck**, Hyperesthesia • **Tonic clonic convulsions** • Behavior: depression to mania • Tetraparesis, hyperreflexia, circling & falling to one side • Subtle intention tremors of foals • **Cranial nerve dysfunction** (facial tremors, nystagmus, facial palsy, blindness, anisocoria, strabismus) • Propulsive walking, coma & status epilepticus • Recumbency, convulse repeatedly, rigidity, hyperreflexia & tetany • **Fungal meningitis: granulomatous lesions** of lips, nasal mucosa & peripheral nerves	• Hx, CS • PM (postmortem) - Swollen meninges - Cloudy CSF **DDx:** • Metabolic encephalopathies • Hypoglycemia • Septicemia • Neonatal maladjustment syndrome (pg 270) • Seizure syndrome • Hepatoencephalopathy (pg 268) • Trauma	• **Early recognition & Tx** • **ABs: 10-30 x** minimum inhibitory concentration - Culture & sensitivity - High IV penicillin - Cephalosporins, 3rd generation (bid or qid $) - Trimethoprim-sulfonamide (TMS) combo - NOT chloramphenicol • **Cryptococcal meningitis** - **Amphotericin B** (in 5% glucose) • Supportive therapy: - **Fluids** - **Sedation** (Valium® IV; phenobarbital IV) . **Long term control of convulsions** .. Diphenylhydantoin (PO) or phenobarbital (IV sid) - Analgesics (Banamine® & bute)
CS: Fever, Stiff neck, CrNs, convulsions **Tx: ABs**				
Hepatoencephalopathy, Walking diz, Walkabout, Sleepy staggers	• **See GI pg 84** • Severe hepatic insufficiency due to liver diz or portosytemic shunts • **Result in abnormal mentation** • Pathophysiology: accumulation of ammonia, mercaptans, etc. to brain • **Poisonous plants** Color me Yellow	• **Diffuse cerebral impairment** - Depression & anorexia - Stand w/ head hanging, jerking it up occasionally - Yawning, grimacing, twitching of muzzle & lips - **Head pressing** - **Compulsive, oblivious walking** - Aggressive or maniacal - Blindness w/ time - **Seizures & coma terminally** (w/in hours or months dep. on cause)	• Hx, CS • Lab: liver failure - Ammonia tolerance test	• **Empirical & supportive** - IV glucose (correct hypoglycemia) - Nutrition: low protein, high CHO diet (grass hay/citrus or beet pulp) - Mineral oil (slow absorption of toxic products) Prognosis: **Grave, hopeless**, but occasional recoveries recorded
Liver failure **CS: Compulsive walking** **Tx & Px: Hopeless**				
Abscesses in brain IM 931; I2M 1036; EM&S 774; E 1189; M 376	• **Bastard strangles, *Strep. equi*** • **Horse >>> cattle** • Brain dysfunction slower onset than meningitis	• CNS CS vary, depending on location • Compression of cerebrum - Blindness - Mania - Circling, head tilt (toward lesion) - **Propulsive walking, coma** • Brain stem - **Cran. nn. dysfunction** (facial tremors, nystagmus, facial palsy, blindness, anisocoria, strabismus) • Late in diz: recumbency, convulse repeatedly, rigid, hyperreflexic & tetanic	• Presumptive - prior strangles & CS • ↑ WBC & fibrinogen • CSF: xanthochromia & elev. protein • Abscesses in other parts of body or chronic infect. • ↑ # of neutrophils in CSF (usually not done) **DDx** • Meningitis (pg 268) • Parasite migration (pg 250) • Trauma (pg 262)	• **Penicillin is DOC** (drug of choice) - Potassium or Na pen. 100,000-400,000 IU/kg qid 1-2 wk, IM procaine pen. 22,0000 IU/kg bid 4 wk • Corticosteroids if brain edema Prognosis: • **Poor** Penicillin
Bastard strangles **CS: Propulsive walking** **Tx: Penicillin**				
Lead toxicity M8k 2072; Mk 1674, IM 956; I2M 1071; Tox 107; EM&S 790; E 1207; C3T 363	• **1° cattle**, horses more sensitive but more discriminate eaters • Ingestion >>> through skin - Cows - drinking crankcase oil, eating paint off fences - Horses: contaminated pastures from lead smelters - **Cumulative** over time • Pathophysiology: - Deposited in bone, **"sink organ"** - Interferes w/ -SH enzymes, inhibits cellular respiration - Shortens RBCs life & basophilic stippling - Rapidly enters brain - Acute cerebellar hemorrhage & edema (capillary dysfunction)	• Polyneuritis - GI • Chronic syndrome • **Emaciation**, anorexia, weight loss • Depression • Weakness, stiffness, ataxia (conscious proprioceptive defc.) • Colic • Diarrhea • **"Roaring", laryngeal paralysis** (CrN 9 & 10) • Difficult eating - emaciation • Frequently die in psychomotor seizures • Sequela: 2° aspiration pneumonia	• Hx (smelter), CS • **Concentration whole blood (> 0.3 ppm)** diagnostic • **Admin. Ca Na2 EDTA** & measure rise in Pb in plasma (solubilizes bone stores) • Measure lead in environment • Postmortem: - Edema & congestion of cerebral cortex (occipital lobe) **DDx** • Inorganic Arsenic • Moldy feeds (pg 267) • Vitamin A deficiency	• **Ca^{++}EDTA** (chelating agent, mobilizes lead from tissue = ↑ urinary excretion) supplement Zn - Not Na EDTA (binds Ca) - D-penicillamine (oral chelating agent) given to dogs, **not to** horses or ruminants • Oral MgSO4 (magnesium laxative) purge & limit absorption • Good nursing • Supportive care: Water Ca^{++} EDTA
1° cattle **CS: Emaciation, "Roaring"** **Tx: Ca^{++} EDTA**				

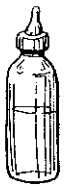
Cerebral Diseases

Condition	Facts/Cause	Presentation/CS	Diagnosis	Treatment
Listeriosis, Circling Diz M8k 479; Mk 382; IM 969; EM&S 754; E 1246 *	• **Very rare in horses, mainly a DDx for encephalopathies,** Neonatal foals - meningoencephalitis, ***Listeria monocytogenes;*** Common in **ruminants** & humans • **CS: Encephalitis,** depressed, ↑ temperature, anorexia, weakness, difficulty feeding, ↑ RR & HR, **death in 2-10 d,** Abortion reported • **Dx:** Isolation & ID organism (difficult, brain, liver, spleen & lymph nodes), seldom done before death • **DDx:** Rabies, Encephalitis, Lead poisoning • **Tx: ABs considered ineffective,** probably administered too late in diz; Vaccines have given poor results			
Vitamin A defc	• Not in horses, mainly feedlot ruminants w/o access to succulent plants			
"Dummies", Neonatal maladjustment syndrome, NMS, "Barkers", "Wanderers", "Convulsants" M8k 966, 925; Mk 610; IM 341; EM&S 764; E 1197; C4T 589; C3T 432; C2T 219; M 290; Pop 35-1/98	• **Cause: unknown,** m/be multiple; possible asphyxia during difficult birth, but some have normal births • **Abnormal behavior at birth** or w/in 24 hr • **Deranged cerebral,** cerebellar function or spinal cord CS • Foals if force fed colostrum, will not be depressed & sick as w/ septicemia, just dumb • **Sequelae** - **Gastric ulcers** - Entropion & corneal ulcers - **FPT** (failure of passive transfer)	• **"Dummies"** • **Cerebral CS (diffuse, most common)** - Loss of suckle reflex - **Aimless wandering** - Apparent central blindness - Hyperexcitability or depression - Extensor spasms or convulsions - Seizure in severely affected - Excessive chewing or salivation - **"Barking"** abnormal vocalization - Abnorm respiration • Spinal cord CS - **Weakness** in front, hind, or all limbs - **Ataxia** - Depressed spinal reflexes • M/b normal behavior w/ periods of worsening neuro functions • **BAR** (opposite of septicemia) • Lack affinity for mare	• CS (Rule out other causes of CS) • History of hypoxia m/b • Lab: Normal WBC, fibrinogen & electrolytes (opposite of septicemia) • Postmortem: pathologic lesions associated w/ spinal cord - Scattered foci thru/o brain, ischemic necrosis & cerebral edema • No way to definitely Dx • CSF tap, m/ be normal or evidence of xanthrochromia **DDx:** • Septicemia • Meningitis (pg 268) • Metabolic disturbances Prognosis (Px): • **Good:** for those managed intensively & not septicemic - **Complete recovery w/ no neuro deficits** in wk • Best Px associated w/ normal IgG levels at 18 hrs • Bad Px if 2° infections due to FTP or if never stood or suckled • Recovering foals, plateau of CS at 24 or 48 hrs, improve after 3 d • Guarded if no improvement in 4 d	• **Can be Tx successfully - Labor intensive** • **Control seizuring** & aimless thrashing, diazepam, then maintenance w/ barbiturates, pentobarb TID then wean down to lowest level to control seizures - Corticosteroids not helpful - Manual restraint on padded surface when down • **Once coherent** - **Relearn to walk, nurse & follow its mother** • **Colostrum** 1st 6 hrs of life - 1 L of colostrum (Sp gr. > 1.06) - If FPT give plasma & ABs - Monitor for infections • **Anti-ulcer Rx** empirically, monitor for gastric ulcers • DMSO m/ b benefit for cerebral edema

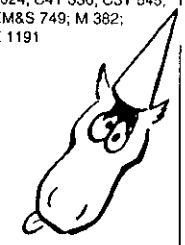


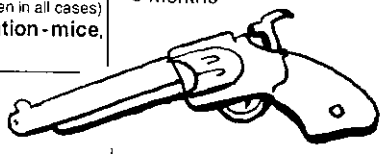
CS: Day old Dummies
Tx = OK



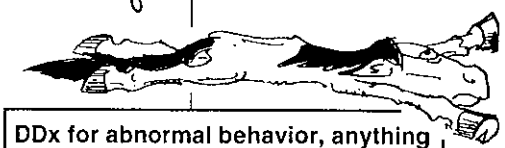


Rabies M8k 966, 925; Mk 575, 604, 1608; IM 922; I2M 1024; C4T 336; C3T 545; EM&S 749; M 382; E 1191	• Rhabdovirus (*Lyssavirus*) - Worldwide, except some free islands • **Progressive, fatal neurological diz** of warm blooded animals • Reservoirs: skunks & raccoons, bats, foxes; less dogs & cats because of vaccinations - Impossible to eliminate in endemic areas - Asymptomatic carriers • **Pathophysiology** - Transmission: bites (in saliva) - Migrates to CNS over peripheral nerves - Then antigrade over nerves to salivary glands - Shed in saliva (dies in dried saliva) • IP 3 wk - 3 mo (m/b > 6 mo)	**CS highly variable** • **Dysfunction of nerves & brain** - **Behavioral changes** (1st) - ± Excess **"salivate"** - **Progressive lameness, ataxia & posterior paresis** - Prodromal, excitative & paralytic phases • **FURIOUS FORM** - Muscle tremors, tenesmus - **Aggression,** attack, pursue & bite (as progresses, less belligerent) - Crash frantically through fences, etc. - **Hypersexuality,** mounting inanimate objects - **Pruritic,** regional - Ataxia: proprioceptive deficits - Recumbent, convulse & die w/in 2-4 d • **DUMB FORM:** - **Severely depressed** - **Frothy salivation,** inability to swallow (pharyngeal paralysis), "hydrophobia" (inability to drink) - Inappetent, temp > 103° F, drooped head - Flaccid paralysis, wide base stance, difficulty rising - Hypersexuality, paraphimosis - Flaccid facial mm., tail, tongue, bladder (dribbling) - Grinding teeth (odontoprisis), head pressing, circling, blindness & nystagmus - **Die: laryngeal paralysis** • **PARALYTIC FORM** (common in cattle): - Flaccid tetraparesis or paraparesis, hyporeflexia, recumbency • Comatose or convulse, thrash wildly before death in 10 d • **Forms can overlap** • **All forms rapidly fatal**	• **Notify authorities** • PM done by state officials • **FA staining tech.** (Ag/Ab reaction) • **Negri bodies** (microscopic brain sections [hippocampus], not seen in all cases) • **Intercerebral inoculation - mice,** examine brain in 5 d **DDx - anything** **Abnormal behavior** • Digestive disorders • Injury • FB in mouth • Poisoning (Lead) (pg 269) • Early infectious disease **Inability to swallow** • Choke (pg 23) • FB lodged between teeth • Ingestion of irritating substances • Obstruction **CNS** • Hepatoencephalopathy (pg 258, 84) • Leukoencephalomalacia (pg 267) • Togavirus encephalitis • EHV-1 myeloencephalitis (pg 254) • Space occupying masses • Meningitis (pg 268) • Protozoal myeloencephalitis (pg 249) • Toxicity **Lameness** • Musculoskeletal problems	• **Euthanize & notify authorities** • Valuable animal, isolate for 6 months **Control:** • Unlikely to eradicate from endemic areas • Mass vaccination of dogs & cats • **Approved vaccines**: safe & effective in horses (see pg 12) - 3 & 4 mo-old • Revaccinate annually recommended in endemic areas were horses have contact w/ wild animals • Islands remain free because of 6 mo quarantine of entering dogs & cats





Human immunization strongly recommended for veterinarians
• If unvaccinated & then exposed - Tx is no fun



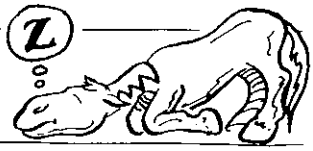
DDx for abnormal behavior, anything
Progressively fatal neurologic diz
CS: Furious, dumb & paralytic forms
Dx: Authorities
Tx: Euthanize & report

Horses & humans resistant to pseudorabies

Condition	Facts/Cause	Presentation/CS	Diagnosis	Treatment

Epilepsy *
IM 966; I2M 1084, 386; C3T 561; E 1198; EM&S 779

- **Poorly documented in horse**, but possibly occurs in some ponies & Arabians. So rare no specific Tx regime, phenobarbital or Dilantin®



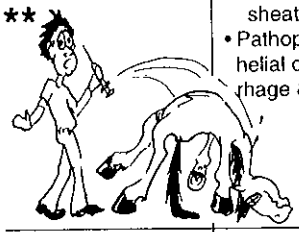
Narcolepsy/ Cataplexy *
IM 968; I2M 1086; C3T 56, E 1201; EM&S 791; M 381

- **Rare in horse**; sleep episodes at inappropriate times, stimulation (restraint, feeding, change in environment) cause animal to fall down & appear comatose; animal appears normal between episodes
- **Tx:** Imipramine a tricyclic antidepressant or amphetamine sulfate m/ prevent narcoleptic attacks

Cholesteatomas
I2M 1083; E 1192

- Common lesions in brains of older horses, caused by chronic vascular inflammation or 1° tumor. Usually located in lateral ventricles.
- Cause CS when block CSF flow or affect brain directly. No specific Tx

Intracarotid drug injection
IM 964; I2M 1080; E 1195; EM&S 774
**

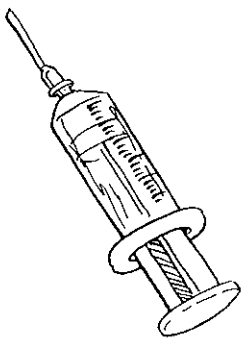


- **Occurs in horses**
- Jugular injection in caudal 1/3 of neck where jugular & common carotid artery anatomically close
  - Also vagosympathetic trunk attached to carotid in the carotid sheath
- Pathophysiology: vascular endothelial damage = edema, hemorrhage & thrombosis

During jugular ijections Usually recover - M/die

- **Lunge back from injection**, strike or rear violently, run wildly, fall down comatose
- **May die, usually recover**
- Residual neurological deficits
  - Contralateral blindness, facial hypalgesia (↓ sensation), head tilt (towards side of lesion)
- Contralateral conscious proprioceptive deficit
- Vagosympathetic damage
  - Horner's syndrome - ptosis (drooping eyelid), miosis, enophthalmos, sweat profusely over head & neck on same side (ipsilat.)

- Hx: CS after injection



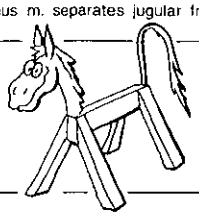
- **NO specific Tx**
  - Padded stall
  - Diazepam (Valium®)
  - Dexamethasone (0.4-1 mg/lb)
- No mannitol or osmotic diuretics in 1st 24 hr (bleeding in CNS)

Prognosis:
- **Most recover**, but some have died

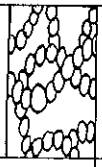
Prevention:
- Insert needle (unattached to syringe) in toward heart (if enter common carotid will spurt towards ceiling)
- Jugular sticks in cranial 1/3 of neck (omohyoideus m. separates jugular from carotid)

Strychnine
Mk 1732; IM 1635; I2M 1912; C3T 1346

- **To kill burrowing rodents & coyotes, no rationale for its use! stimulates CNS**, interferes w/ inhibitory neurons of spinal cord, **loss of "damping" of spinal reflexes**
- **CS: Uncontrolled reflex activity**: generalized extensor rigidity, **"saw horse"** stance, **easily induced convulsions**/tonic seizures, death due to exhaustion or hypoxia
- **Dx:** CS, Check for strychnine: stomach contents, liver, kidney, CNS & urine
- **Tx: Control seizures** (Diazepam), Muscular relaxation (GGE, Robaxin®), Maintain oxygenation, Quiet, darkened environment, Activated charcoal orally, Diuresis, Laxative



Algae
poisoning; Algal poisoning, Toxic blue-green algae



- **See TOX pg 324**: toxic dead algae in bodies of fresh water, foul fish smell, ruminants > monogastrics drink
- CS: **Acute prostration & death w/in minutes**, nausea, colic, bloody diarrhea, prostration, muscle tremors, dyspnea, cyanosis, general paralysis, ± **CNS** (seizures, prostration), hepatic diz
- Dx: Very difficult - exposure
- Tx: **No specific antidote, often animal dead or dying before Tx**
- Px: **Poor, die in 24 hrs**
- Prevention: Organic herbicides or copper sulfate (bluestone) Tx of water

Sodium fluoroacetate (1080)

- **See TOX pg 315; highly toxic** for rodents & coyotes in W USA, controversial
- CS: **Cardiac CS**, pain, hyperexcitability, profuse sweating, ataxia, terminal convulsions to sudden death
- Dx: Hx, CS, Hyperglycemia, rapid rigor mortis (**extensor rigidity**), 1080 in tissue difficult, ↑ kidney citrate levels suggestive
- Tx: No specific antidote, Calcium gluconate or calcium chloride if hypocalcemia, Glycerol monoacetate (Monacetin®) IM before onset of CS
- Px: Grave - once CS

Chlorinated hydrocarbons

- **See TOX pg 312; Use curtailed** (DDT [prototype]), Only **few (lindane)** approved for use around livestock
- CS: **Stimulation or depression CNS**, intermittent colic, **convulsive seizures (unlike OPs)**, **death**
- Dx: **Exposure, CS, Levels**
- Tx: **No antidote, Symptomatic Tx; sedate, remove stress**, IV fluids or gastric tube

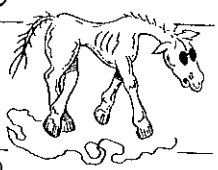
Organophosphates, OPs

- **See TOX pg 312; Major cause of poisonings**, pesticides & anthelmintics, **irreversible inhibition of AChE, overstimulation of p-ANS, skeletal mm. & CNS**
- CS: **Acute, colic, diarrhea, "slobbering", dyspnea, CNS CS:** tetany, excitable or depressed, no seizure
- Dx: Hx w/in 48 hrs + parasympathetic signs tentative, **response to atropine therapy**
- Tx: **Emergency: Atropine, ASAP: 2 PAM**, activated charcoal & osmotic laxatives

Carbamate

- **See TOX pg 312**; like OPs except **reversible**
- CS & Dx: **Similar to OPs**
- Tx: **Atropine** as in OPs, No need for 2-PAM, but it doesn't hurt

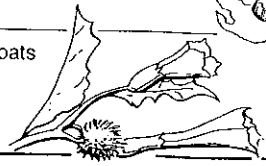
Selenium toxicity



- **See TOX pg 321; Plants in W. USA**, **Chronic "alkali diz", Chronic "blind staggers",**
- CS: **Aimless wandering or circling,** incoordination, forelimb weakness, dyspnea, blindness
- Dx: **Exposure, blood levels**
- Tx: Chronic: ruminants: **arsenic**, dangerous in equine because live so long

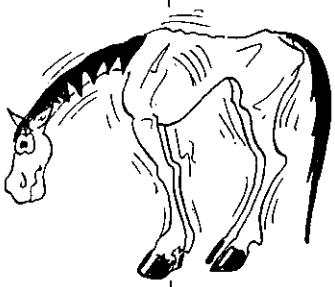
Jimsonweed

- **See TOX pg 326**; Atropine-like alkaloid (scopolamine), Distasteful, **Horse** > cattle, sheep & goats
- **CS: Depression & parasympatholytic nervous system,** irritability, delirium, convulsions
- Dx: Urine in eye = dilation
- **Tx:** Symptomatic, physotigmine, charcoal, valium



Equine Motor Neuron Diz

Condition	Facts/Cause	Presentation/CS	Diagnosis	Treatment
Equine motor neuron diz, EMND C4T 321, 314 *	• **New diz**, first reported in 1990, rare • Progressive muscle atrophy, weakness & debilitation • NE & NC USA (most cases) • Adults: 2-25 years • Individual horses housed at riding stables - Absence of grazing for 1 year, poor quality hay - Quarter horses over represented (boarded more?) • **Cause: unknown** - Resembles Lou Gehrig's diz (amyotrophic lateral sclerosis/ALS) - Oxidative diz? Preference for Type 1 muscle fibers, deficiency in dietary antioxidants • Pathophysiology: motor denervation atrophy - Particularly of type 1 muscle fibers	• **Muscle fasciculation**: more pronounced if forced to stand for long periods (stocks, trailer) - May disappear later • **Marked weight loss** w/in 2 months - **Muscle atrophy - symmetrical**: scapular, triceps, quadriceps, lumbar & neck muscles • Ravenous appetites, coprophagia • **Muscle weakness: sternal recumbency**, frequently (head on ground), inability to hold head & neck up • Hyperesthesia (increased sensitivity) of muscles • Stand w/ limbs close together under body • Constantly shift weight on hindlimbs (unable to lock stifles), buckling of carpus • **Ataxia rare**, no proprioceptive loss, normal tail & anal tone • Walk better than stand • Short strided gait, especially in tight circle • **Respiratory distress** • Signs may stabilize & even improve for a few months - None return to effective use, euthanized	• No definitive antemortem Dx • **Hx** (stabled horses), **CS** • Laboratory: - **Mild ↑ in serum muscle enzymes**, CK (creatine kinase, normal 90-350 IU/l) & AST (aspartate transaminase, normal 150-550 IU/l) - Low plasma Vit E - CSF: ↑ protein & creatine kinase • EMG (electromyography): frequently denervation (positive sharp waves, fibrillation, Pseudomyotonic bursts) • Necropsy: - Degeneration of peripheral motor nerves - Neurons swollen, chromatolytic & ghostlike - Aggregates of glial cells in ventral horn	• **None - Euthanasia** • Access to pasture • Vitamin E supplementation



NE & NCentr USA, Motor neuron degeneration, Cause?
CS: Weakness, fasciculations & muscle atrophy
Dx: Hx, CS, Muscle enzymes
Tx: None, euthanasia
Px: Grave

DDx:
- Botulism (decreased tail tone)
- Laminitis
- Myositis/rhabdomyolysis
- White muscle diz
- Spinal cord dizs (ataxia)
  - Cervical stenosis
  - Degenerative myelopathy
  - Protozoal myelitis (asymmetry)
- Lyme diz
- Iliac thrombosis
- Other causes of neuromuscular diz

Prognosis:
- **Grave**: none return to effective use, euthanized

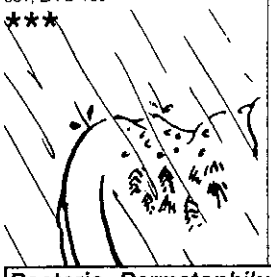
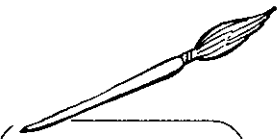
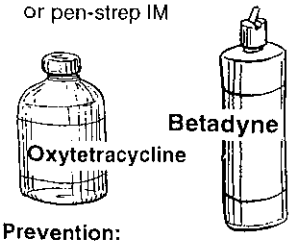
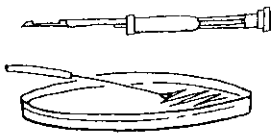
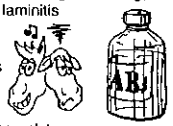
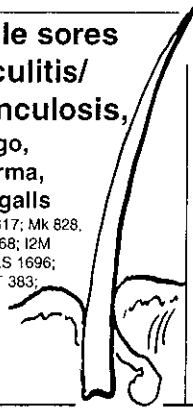
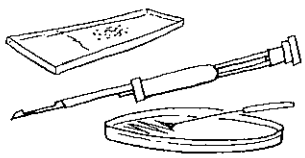
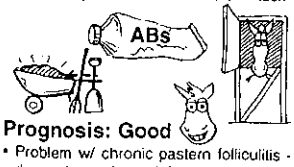
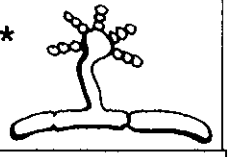
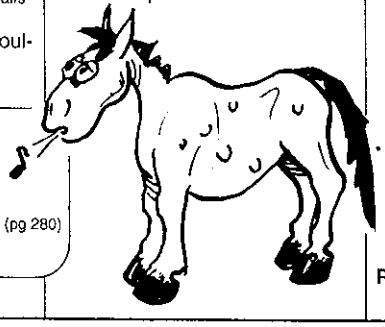
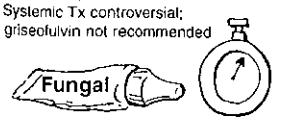
References:

- Divers TJ et al. Eq motor neuron diz. Proc 13th ACVIM Forum, p918, 1995
- Divers TJ et al, Eq Motor neuron diz. Cont. Ed 14(9)1222, 1992
- Cummings JF et al. EMND; a preliminary report
- Diver TJ et al. EMND: 28, proposed mechanism. Eq Vet J 26(5) 409, 1994
- Hahn CN et al. Does EMND exist in UK. Vet Rec 132 p133, 1993

INTEGUMENT & EYE

Skin

INTEGUMENT

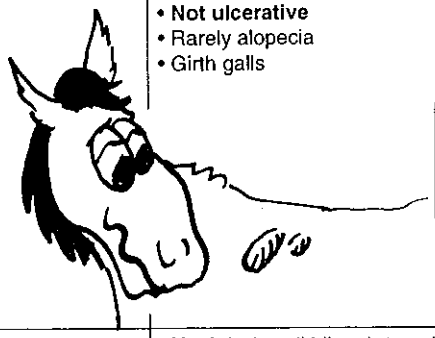
Condition	Facts/Cause	Presentation/CS	Diagnosis	Treatment
Dermatophilosis, "Rain scald" **Streptothricosis** M8k 613; Mk 787, C4T 382, 368; I2M 1411; IM 1266, E 827; EM&S 1694; M 351; LA-D 136 *** 	• **Superficial bacterial infection** • ***Dermatophilus congolensis*** (gram pos., branching aerobic organism) - **Zoospores** germinate in **moist, damaged** skin to form mycelium - **Mycelium** proliferate in living layers of skin - Suspected in soil, but can't be isolated • **Enter through damaged skin** - **Macerated or traumatized** - **Rainy season** (constant wetness damages skin) - External parasites - Non-hygienic conditions • Ruminants, **horses** • Transmission: **direct contact** w/ reservoir host, fomites or insects, crusts - **Crusts contain organisms** up to 42 months (accounts for repeated outbreaks in contaminated areas) **Bacteria *Dermatophilus*** **Damaged skin + Zoospores** **CS: "Paintbrush" crusts** **Dx: Hx, CS -"Railroad tracks"** **Tx: Bath, Keep dry** 	• **Suppurative crusts** (proliferative) • **Pus** under yellow crusts • **"Paintbrush"** appearance (pus sticking to matted hair) • **Painful, not pruritic** • Hair breaks & falls off • Back, rump, head, muzzle, neck, lower hindlimbs • **If untreated, can generalize**  **DDx** • Mange (pg 283) • Saddle sores (pg 277) • Ringworm (pg 277) • Pemphigus foliaceus (pg 280) • Seborrhea (pg 279)	• **Hx, CS** • **Direct smear of pus** • Minced preps of crust, on slide (microscope) • Stain w/ Diff-Quik® -**"Railroad track"**, long chains of cocci, branching, filamentous - If negative submit crusts or punch biopsy to microbiologist before ruling out (R/O) 	• **Self limiting** • **Remove crusts** w/ brush & mild soap • **Dispose of infective crusts** • **Betadyne®** (povidone-iodine) shampoo or chlorhexidine daily for 7 d, then weekly until resolved • Severe or generalized infections - **Oxytetracycline** or penicillin or pen-strep IM  **Oxytetracycline** **Betadyne** **Prevention:** • Remove underlying factors: moist conditions, parasites (damage superficial layers of skin) • Keep dry
Equine staphylococcal cellulitis * IM 1269; I2M 1413; EM&S 1696 ***Staph. aureus*** **CS: Dissects, sloughing skin** **Tx: Aggressive ABs *C&S)**	• **Rare** • **Severe, deep suppurative process, infection dissects through tissue planes** • Cause unknown (handlers & grooming equip.?) • ***Staph. aureus, S. intermedius*** • Thoroughbred racehorses 	• Initially: **Acute swelling & lameness** • **Rapidly dissects along fascial planes** • Overlying skin devitalized - **Frequent sloughs** • Sequelae: - Laminitis (same or opposite limb) - Bacteremia - Osteomyelitis 	• CS (clinical signs) • Bacterial culture & biopsy 	• **Aggressive & early** • **Broad spectrum ABs** (pen G & gentamicin sulfate or trimethoprim-sulfamethoxazole) until Culture & Sensitivity • ↓ Edema, promote weight bearing, reduce chance of laminitis - NSAIDs - Hydrotherapy - Support wraps  Px: Guarded for complete recovery
Saddle sores **Folliculitis/ Furunculosis,** **Impetigo, Pyoderma, Collar galls** M8k 718, 617; Mk 828, 829; IM 1268; I2M 1413; EM&S 1696; E 813; C4T 383; C3T 700; M 344; LA-D 134  **Hair follicles, tack** **CS: Papules, scabs, alopecia** **Tx: Hygiene, time**	**Inflammation of hair follicles** Folliculitis & furunculosis common in horse & goat • Impetigo common in cattle & goats • **Cause: #1 Staph.** - *D. congolensis, Corynebacterium pseudotuberculosis, C. equi* • Predisposing factors - **Trauma to skin from tack** . **Points**: contact points of saddles on trunk & withers - Insect bites • **Pastern folliculitis** (special form) - Staphylococcus spp. or ß-hemolytic strep. - **Limited to palmar/plantar pastern or fetlock of 1 or more limbs** 	• **Papules** - Multiple 3 mm foci of erect hairs - Each hair projects from center of a papule • Papules m/ regress, or • Enlarge, exude serum & **scab** • Alopecia (denuded areas common) • **Painful, not pruritic** **Pastern folliculitis** (special form) • Papules • Ulceration & suppuration if left untreated • **Folliculitis** = inflammation of hair follicles 2° to bacterial infection • **Impetigo** = superficial inflam. not involving hair follicles • **Furunculosis** = Inflammation rupturing hair follicle & extending into surrounding dermis & subcutis • **Carbuncle or boil** = coalescing areas of furunculosis forming fistulous tracts	• **Hx, CS** • **Gram stain pus** • Culture & sensitivity for Tx • Biopsy • Gram positive cocci  **DDx:** • Rain scald (pg 276) • Ringworm (pg 277) • Pemphigus foliaceus (pg 280) • Mosquito bites (pg 288)	• **Tack & hygiene**: eliminate predisposing factors • **Time**: mild cases m/ resolve w/o Tx • **Severe cases** - **Clipping areas & cleaning** w/ Betadyne® or peroxide solution - Sedate because painful - **ABs ointments** w/ no steroid - Topical Tx m/not cause resolution • Furunculosis or unresponsive folliculitis: **Systemic ABs**, Trimethoprim Sulfa, orally by owner • Rested, no contact w/ saddle or tack  **Prognosis: Good** • Problem w/ chronic pastern folliculitis - deep w/ scar tissue & fissures
Ringworm, Dermatophytosis, Girth itch M8k 628; Mk 791; IM 1272; I2M 1419; E 823; EM&S 1698; C4T 384, 368; C3T 698; M 353; LA-D 171; POP 18-7/98 ***  **Fungus, Trichophyton** **CS: Alopecia, crusting** **Tx: Self limiting**	• **Mycotic - fungal** • ***Trichophyton equinum,*** *Microsporum equinum, T. mentagrophytes, M. canis, M. gypseum* - Gram +, branching, aerobic organism - Generally invades nonliving layer of skin • Saprophyte in soil • Young >> adults (lack of exposure & immunity) • **Horse** & cattle >> sheep & goats • Predisposing factors - ↓ Resistant to infections (diz, poor nutrition, crowding, immunosuppressive drugs) - Environment: hot, humid weather - Winter stabled animals, anytime • Transmission: contaminated grooming equipment, saddle blankets & harnesses	• **Multifocal lesions** • **Alopecia** (hair breaks & falls off) • **Crusting** (not wartlike as in cattle) • **Early looks like urticaria** (hairs stand erect) then crusting (horse) • Head, around eyes, neck, shoulders & sides of thorax • Pruritus mild or absent **DDx:** • Mange (pg 283) • Folliculitis (pg 277) • Rain scald (pg 276) • Ringworm (pg 277) • Pemphigus foliaceus (pg 280) • Flat sarcoid (pg 290) • Hives (pg 281)	• **CS: alopecia & crusts** • Fungal cultures (of broken hairs at periphery, not crusts) • Microscopic exam 	• **Self limiting** (1-4 months) - Betadyne (povidone iodine) & crust removal + time • Fungal products (topical) to ↓ spread (lime sulfur, Chlorox, tamed iodine shampoos, thiabendazole (Tresaderm®), miconazole (Conofite®), Na tolnaftate (Tinactin®), chlorhexidine, fulvacin in feed - Orthocide® (captan) plant fungicide from nurseries, not recommended • Systemic Tx controversial; griseofulvin not recommended  **Prevention:** disinfect grooming equipment & tack frequently

Skin — INTEGUMENT

Condition	Facts/Cause	Presentation/CS	Diagnosis	Treatment
Arabian fading syndrome, **Arabian leukoderma, Pinky syndrome, Hereditary vitiligo** M8k 604; C4T 391; IM 1291; I2M 1439; E 833; EM&S 1716; LA-D 353	• Leukoderma (acroderm, hypomelanosis) • **Loss of melanin from skin** (depigmentation) • **Arabians** • 6 months - 2 years old • Probably hereditary	• **Depigmentation** - Periocular, muzzle, genitalia, anus, perineum, inguinal region, & underside of tail • Not seen at birth **DDx:** Copper defc.	• **White areas of skin**	• None None
Depigmentation (White), Arabians; No Tx				
Reticulated leukotrichia IM 1291; C4T 392; I2M 1439; E 834; EM&S 1716	• **Quarterhorses, yearling** • Cause unknown - Probably hereditary • Can't be registered or, if registered, registration taken away	• **Linear crusts on dorsal midline** - Crosshatched pattern • Crusts shed, alopecia occurs • **White hairs grow in permanently** • It may persist, repigment or wax & wane	• **Linear crust** • **White hairs on dorsum**	• **No effective Tx** None
Quarterhorse, yearlings **CS: Linear crust, white regrowth** **Tx: None**				
Vitiligo IM 1291; C4T 391; I2M 1439; EM&S 1716	• Acquired loss of skin & hair pigment • **Traumatic wounds** • **Saddle sores**	• **Scar devoid of pigment**	• **White scar**	• **Irreversible** None
Contact dermatitis IM 1266; I2M 1411; E 836; M 348; LA-D 68, 300	• **Irritant & allergic forms** • Muzzle, extremities & areas in contact w/ tack	• **Erythema, edema & vesicles** • **Erosion, ulceration & crusting** • **Lichenification & hyperpigmentation**	• Patch testing usually impractical • **Provocative exposure test** - Remove from all possible sources for 7-10 days, clears up - Expose to suspected agent & look for dermatitis - Repeat for positive ID	• **Eliminate possible exposure** • **Wash gently** w/ water until clears up
Vesicles - Ulcerations - Lichenification - Hyperpigmentation				
Seborrhea, "Stud crud" M8k 719; C4T 385; IM 1291; I2M 1438; E 831; EM&S 1715; M 354	• **Abnormal keratinization** • Mane & tail, or cannon • **"Stud crud"** or cannon keratosis - Dorsal aspect of hind cannon areas (incorrectly thought to be predilection for intact males)	• **Scaling & crusting** - **Mane, tail or dorsal cannon** • Little or no pruritus • Variable alopecia • M/b generalized over body	• CS • Biopsy	• **Frequent antiseborrheic shampoos** 2x weekly initially TOC (Tx of choice) - Contains tar sulfur - As control, less frequently • **Not cured, just managed**
Keratinization - Dors. cannon **Tx: Antiseborrheic shampoos**				
Scratches, Grease heel, **Pastern dermatitis, Mud fever, Cracked heels, Dew poisoning** EM&S 1711; E 829; M 75; C4T 368; POP 67-6/98	• **Crusting & seborrheic dermatitis** • **Palmar heel & pastern area** • Not a Dx, but a clinical description • Hind limb, common in breeds w/ long fetlock hairs • **Multifactorial:** - Muddy paddocks, stubbled pastures (trauma) - Choriptic mites, chiggers (Trombiculid mites) - Staph. dermatophilosis, ringworm infections - Photosensitization - Fungus? • If severe, lesions may extend up leg	• **Pain, swelling palmar pastern** • Alopecia • **Exudation & ulceration - crusts** • Matted hair on heel & pastern • ± Lame • Foul odor & fissures • **"Grapes"**: granulomatous growths occasionally	• Dermatologic workup - Skin scraping - Biopsy - Bacterial (aerobic & anaerobic) & fungal cultures - Remove suspected cause of contact dermatitis **DDx:** • Folliculitis (pg 277) • "Rain scald" (pg 276) • Ringworm (pg 277) • Chorioptic mange (pg 283) • Pelodera dermatitis (pg 282) • Trombiculiasis • Contact dermatitis (pg 278) • Horse pox (pg 185) • Vasculitis • Pemphigus foliaceus (pg 280) • Photosensitization (pg 323, 289)	• **Early diagnosis & Tx** prevent severe chronic lesions • **Clip & clean area** (soak to remove crusts) • **Astringents if exudative,** aluminum acetate, White lotion (zinc & lead acetate) or Calamine lotion • **Combo topicals:** Panalog® (triamcinolone/nystatin/neomycin/thiostrepton); Forte topical® (penicillin/neomycin/polymyxin/hydrocortisone • AB-steroid creams if lichenification & fissuring (Bag Balm®) • **Systemic ABs if cellulitis** (staph, dermtophilosis): trimethoprim/sulfa or penicillin • Dry, clean quarters • Sx removal of "grapes" Panalog Calamine
Pastern, Mud **CS: Exudation, ulceration, pain & "grapes"** **Tx: Astringents (Calamine)**				
Glanders, Farcy M8k 502, 2164; Mk 377; LA-D 158	• **Not seen in USA**, *Pseudomonas mallei*, ingestion, invades GI wall, bacteremia, localizes in lungs & skin • CS: Pulmonary form (chronic pneumonia & loss of condition); Nasal form (unilat. discharge & greyish nodule & ulcerations); Cutaneous form (nodules, thick cords & ulcerations along lymphatics) • Dx: CS, culture organism from nodules, serology, Mallein test • Tx: Not advisable; REPORTABLE disease			**Prevent:** • Keep fetlock hair short • Clean, dry environment • Udder ointments (Bag Balm®) to scarred area
Epizootic lymphangitis E 813	• **Not in USA**; *Histoplasma farciminosum*, 3-4 mo, then spontaneous recovery & immunity			Not in USA

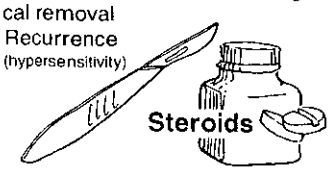
Skin

Condition	Facts/Cause	Presentation/CS	Diagnosis	Treatment
Nodular necrobiosis, Collagen granulomas, Eosinophilic, collagenolytic granuloma M8k 713; Mk 792; IM 1293; I2M 1440; EM&S 1651; M 346; C2T 634; S 277; POP 18-7/98 ★★★	• **Common condition** • Cause unproven - Hypersensitivity (m/b to insect bites) • **Summer** • **Saddle area**	• **Nodules** (single to multiple, 0.2- 2") • Neck, withers & back • **Not pruritic nor painful** • **Not ulcerative** • Rarely alopecia • Girth galls	• Hx, CS • **Foci of collagen** degeneration surrounded by granulomatous reaction containing **eosinophils** (m/b mineralized if chronic)	• **Few lesions - surgically remove & sublesional steroids** - Triamcinolone acetonide (3-5 mg/lesion) & methylprednisolone acetate (3-10 mg/lesion) • **Multiple lesions** - **Systemic steroids** (oral prednisone or prednisolone (2-3 wk, then alternate day therapy & gradual reduction of dose • M/ resolve spontaneously • Calcified, chronic m/ need surgical removal • Recurrence (hypersensitivity)

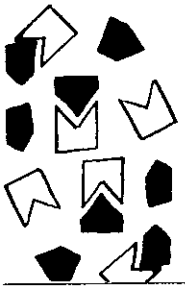


Common - Hypersensitivity?
CS: Nodules
Tx: Sx, Steroids

DDx:
- Infectious granulomas
- Chronic urticaria (pg 281)
- Erythema multiforme (pg 281)
- Neoplasia
- Amyloidosis (pg 289)
- Cysts (pg 292)
- Rain scald (pg 276)
- Panniculitis (pg 289)
- Calcinosis circumscripta (pg 289)
- Foreign body granulomas



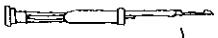
Pemphigus foliaceus Mk 430; IM 1258; I2M 1403; EM&S 1701; E 832; M 352	• Dogs > cats & horses (Appaloosas predisposed) • **Autoimmune skin diz**: autoantibodies present in epidermis of skin - Destroy intracellular cementing substance (acantholysis) - Detachment of epidermal cells (intraepidermal vesicles, separation of cornified from noncornified epidermal cell layers)	• **Vesicle** (small blister), transient • **Erosions** • **Ulcerations** • **Scales & crusts** • Thick encrustations of skin & mucocutaneous junctions • Head, ear, ventrum & lower limbs - Spreads to entire body • Develop dependent edema • Some febrile • Pruritic in some cases	• Hx, CS • Biopsy (m/b repealed biopsy) (crusts) - Histopathology • Indirect or direct immunofluorescence	• **Hi dose corticosteroids initially** (immunosuppressive dose) • Once controlled, reduce gradually to low dose alternate day Tx w/ • Cyclophosphamide or azathioprine w/ steroids if unresponsive to steroids • Gold salts w/ steroids in cases for which steroids alone are not enough • **Often relapse**, respond to Tx & then don't after a period of time



Autoimmune
CS: Blisters to crusts
Dx: Hx, CS, Biopsy
Tx: Steroids

Vesicle -> Erosions -> Scales & Crusts

DDx:
- Ringworm (pg 277)
- Rain scald (pg 276)
- Onchocerciasis (pg 285)
- Saddle sores (pg 277)
- Insect hypersensitivity (pg 288)



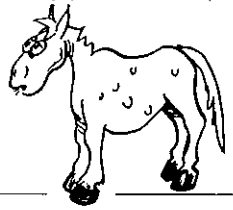
Prognosis:
- **Good: yearlings** or younger, remission & stay there
- Guarded: older, tend to relapse
- Good if controlled
- Poor long term, if respond poorly to initial Tx, or require hi doses to control

Purpura hemorrhagica

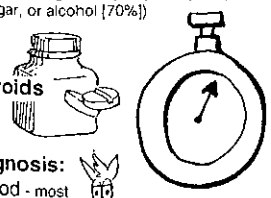
See CIRC, pg 138; Sequel to other diz, #1 Strangles, Arthrus Type 3 hypersensitivity, vascular damage, Ag/Ab complexes
- **CS:** 2-4 wk after resp. infec., **pitting edema** of head, belly & limbs, **wheals**, petechiation, dyspnea, diarrhea, anemia
- **Dx:** Hx, PE, skin biopsy (vasculitis), mild anemia, normal platelets
- **Tx: Aggressive**: ABs (2 x), NSAIDs, steroids, tracheotomy; some refractory to Tx

Hives, Urticaria, Nettle rash M8k 612; Mk 867; IM 1260; I2M 1405; EM&S 1651; M 350	• **Wheals or plaques**: localized edema in dermis • **#1 horse,** but in all domestic species • **Type 1 hypersensitivity** • **Precipitating** or intensifying factors - Pressure, sunlight, heat, exercise, psychologic stress, genetic abnorm.	• **Wheals** or plaques: transient swellings in skin appear few min or hrw/in exposure to agent - Elevated, rounded, flat-topped, 0.5-5 inches in diameter, m/b depressed in center - Anywhere: back, flanks, neck, eyelids & limbs • Severe m/b preceded by fever, anorexia or dullness • **Excitation & restlessness** • Advanced: plaques on mucous membranes of mouth, nose, conjunctiva, rectum & vagina • **Develop & suddenly disappear generally** (w/in few hours)	• **Hx, CS: wheals** • **Pit w/ pressure** • Intradermal skin testing	• **Spontaneously recover w/o Tx** • Avoid allergen - Change feed & see if better • Short acting corticosteroids - Prednisone or prednisolone (gradually ↓ dose & give every other morning) - Dexamethasone (long acting) causes laminitis • Hyposensitization when from inhaled allergens • Antihistamine questionable, m/ cause urticaria if type 4 • Epinephrine if life threatening • Local Tx not generally required (cold packs, vinegar, or alcohol [70%])

Cause: Hives
- **Drugs**: ABs (pen, & sulfonamides) NSAIDs (bute), lidocaine
- **Ingestion** (feeds)
- Inhaled antigens (pollens, molds, & dust)
- Insect bites blamed, but rarely cause
- Stinging nettle
- Chemicals - carbolic acid, turpentine, carbon disulfide or crude oil



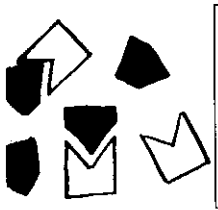
DDx:
- Other nodular diz (they don't pit on pressure)
- Infec. granulomas
- Chronic urticaria (pg 281)
- Neoplasia
- Amyloidosis (pg 289)
- Erythema multiforme (pg 281)
- Cysts (pg 292)
- Rain scald (pg 276)
- Panniculitis (pg 289)
- Foreign body granulomas
- Purpura hemorrhagica (pg 144)
- Calcinosis circumscripta (pg 289)



Prognosis:
- Good - most spontaneously recover

Horse #1, Type 1 hypersensitivity
CS: Wheals, edema
Dx: Hx, CS
Tx: Spontaneously recover

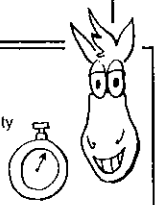
- **Pathophysiology - Hives:**
- Wheals result from vasodilation & leakage of fluids from small vessels
- Immunological & non-immunological factors trigger release of mediators from mast cells & basophils that cause wheals
- Immunological Type I hypersensitivity (IgE) most common immunological cause



- **Dermographism** (some purebred horses)
- Scratches causing local swelling (urticaria-like skin lesions)
- No clinical significance
- **Angioneurotic edema**: life threatening variation of urticaria
- Diffuse SQ edema often localized to head limbs & perineum

Erythema multiforme ★

IM 1264; EM&S 1653
- **Rare** in horse, Benign, Self limiting, M/b hypersensitivity reaction, 50% of time cause never found
- CS: Urticaria-like lesions which **tend to persist**
- Tx: Remove cause
- Px: Spontaneous resolution w/in 3 months



Dermatology

INTEGUMENT

Condition	Facts/Cause	Presentation/CS	Diagnosis	Treatment
Lice, Pediculosis, Lousiness M8k 663; Mk 794; IM 1274; I2M 1422; E 820; EM&S 1692; M 349; POP 18-7/98 ***	• **Winter** - N. USA > Summer • Transmission: - Direct contact - Ova on floor m/ hatch in 2 weeks in warm weather • Species specific, live on host	• **Pruritus** (scratching, rubbing & biting) • Roughened hair coat, unthrifty • Restless • Irritable • **Lose weight** - less eating, only scratch • **Anemia** (w/ large # of sucking lice)	• **Seeing them** (part hairs on head, face, ears, neck, back topline, escutcheon, tail base & tail switch) • **Nits** (louse eggs attached to hair)	• **Topical insecticides** (pour on, sprays, powders, dips) - 2-3 treatments 2 weeks apart will cure - Retreat for eggs • Ivermectin for sucking lice, less effective against biting lice
Rhabditic dermatitis, *Pelodera strongyloides* M8K 662; Mk 810; E 821; EM&S 1696	• ***Pelodera (Rhabditis) strongyloides*** (free living nematode, 2° parasite) • Wet, decaying bedding • Contact w/ infested bedding	• **Pruritus** (less than mites) • **Pustules** - hair follicles • **Contact areas** (extremities, ventral abdomen & thorax, perineum) • **Scratching** • Alopecia - 2° areas	• Nematode larvae - **Skin scrapings** - Bedding • 2° bacterial infection • Flies & screw worms may infest lesions	• **Eliminate bedding** • **Spontaneous recovery** usually • **Dip or spray w/ insecticides** 2x (at least) 1 wk apart • Corticosteroids if severe pruritus
Mange, Ascariasis M8k 667; Mk 816; IM 1275; I2M 1422; E 821; EM&S 1681, 1693, 1692; M 349	• **Sarcoptic reportable** • **Uncommon** in horses • Damages skin • Hypersensitivity • 2° bacterial infection	• **Pruritus**, most severe w/ Sarcoptes • **Self trauma** - Focal areas of alopecia - Erythematous, crusting lesions - 2° bacterial infections	• **Multiple skin scraping,** especially w/ Sarcoptes (deep) - Psoroptes & Sarcoptes (few in #, so difficult)	• **Sarcoptic: Reportable to Federal agents**
Chorioptic mange, "Leg or foot mange" **	• ***Chorioptes equi*** - round bodies, long legs, short unsegmented pedicles	• Lower rear limbs - M/ move up limb to abdomen	• Skin scrapping	• Tx Chorioptes & Psoroptes - Topical insecticides - 5-7 d intervals for at least 2 Txs - Lindane, diazinon, malathion, toxaphene & lime sulfur - Treat infected environment also
Psoroptic mange, Common scabies *	• ***Psoroptes equi*** - round bodies & segmented pedicles • **Eradication from horses & sheep in USA**	• Papules at base of hair • Mane & tail & under forelock		
Scabies, Sarcoptic mange *	• ***Sarcoptes scabeii*** var. equi - Round bodies, terminal anus, short legs & long unsegmented pedicles • **Reportable** • **Rare in Eq but most severe** • Can be transmitted to man (PH) • Transmission direct contact (m/b fomites) **PH**	• **Severe itching** • **Head, ears & neck** • Squamous, crusted skin • Skin thickens & forms large folds	• Negative skin scrapings do not rule out (R/O) • Dx by clinical suspicion & response to therapy • ± Biopsy	• **Report sarcoptes to Feds** - **Quarantine, isolate** - Insecticides 12- 14- d intervals at least 3-4 x 10 d intervals: Organophosphates or lime sulfur: spray, dip or sponge - Ivermectin: several x every 2-3 wks
Demodex *	• **Rare disorder** • ***Demodex* spp.** - cigar shape w/ short stubby legs • Transmission from mother to foal nursing • Not contagious between horses	• **Pruritus absent** • Head, neck & withers • Rarely spreads over entire body	• Skin scrapping	• **No satisfactory Tx** • **NO Amitraz** (used in dogs) as causes severe colic & death in horses

Topical insecticides

DDx
- Mange (pg 283)
- Pelodera dermatitis (pg 282)
- Ringworm (pg 277)
- Rain scald (pg 276)

Winter
CS: Pruritus - Wt. loss
Dx: PE
Tx: Topical insecticides

- **Damalinia** (order Mallophaga) biting louse (chewing mandible)
- **Haematopinus**, Solenopotes, Linognathus (order Anoplura) sucking louse (retractable stylet mouth parts)
- **Louse eggs** (nits) on hairs (transparent & oval)
- **Nymphs**: smaller, but identical to adults

DDx:
- Mange (pg 283)
- Pelodera dermatitis (pg 282)
- Ringworm (pg 277)
- Dermatophilosis (pg 276)

Reportable - Uncommon in horses
Psoroptes eradicated
Sarcoptes: Burrow, hard to Dx & Tx
Chorioptes: "Leg mange"
Demodex: Rare

Location:
- Chorioptes: on surface of skin
- Psoroptes: on surface of skin
- Sarcoptes: burrow in epidermis
- Demodex: in hair follicle & sebaceous glands

Psoroptes
Sarcoptes
Chorioptes

DDx:
- Lice (pg 282)
- Pelodera dermatitis (pg 282)
- Ringworm (pg 277)
- Dermatophilus congolensis (pg 276)

Condition	Facts/Cause	Presentation/CS	Diagnosis	Treatment
Summer sores, Cutaneous habronemiasis, Jack sores, Bursatti M8k 658; Mk 806, 201; E 798; IM 1283; I2M 1431; EM&S 1673; M 342; S 274; POP 18-7/98 ★★★	• *Habronema muscae, H. microstoma & Drashia (Habronema) megastoma* • **Larvae of stomach worm** - Emerge from flies feeding on wounds or eye or genital excretions - Migrate & irritate tissue - **Granulomatous** reaction . Hypersensitivity to dead/dying larvae • Develops in same horse year after year • Springtime (fly season) - Recurs in subsequent years	• **Granulomatous** skin reaction • Ulcerative, nodular & tumorous masses • Chronic slow healing lesion • Locations - Medial canthus of eye - **Male genitalia** (sheath, urethral process) - Lower extremities	• Nonhealing, reddish-brown greasy skin granulomas - **Contain rice-sized, yellow, calcified, dead larvae** • Scraping: rarely larvae found (spiny knobs on tail) • Biopsy - granulation tissue, eosinophilic infiltrate, larvae	• **Most give poor results,** difficult to eliminate due to locations • **Insect repellents** • **Organophosphates** topically • **Surgical removal** or cauterization or cryosurgery & hope doesn't granulate in • **Ivermectin** eliminate adult in stomach, slows down progression of diz • Steroids, systemically & intralesionly - Prednisone or prednisolone (10-14 d) • If conjunctiva involved - Frequent steroid ophthalmic sol. • Topical DMSO-corticosteroids
	Stomach worm, Migrates **CS: Granulomas: eye, penis, legs** **Tx: Difficult**	**Life cycle:** • Adults in stomach: normally little problem in stomach, except Drashia • Eggs passed in feces • House or stable fly intermediate host • Normally horses ingest fly • Larvae m/ emerge from flies feeding on wounds or from eye or genital excretions - Can't penetrate normal healthy skin	**DDx:** • Nonhealing ulcerative lesions • SCC (pg 291) • Sarcoids (pg 290) • Proud flesh (pg 292) • Rain scald (pg 276) • Ringworm (pg 277)	**Prevention**: Fly control • Regular removal of manure • Regular anthelmintic Tx
Sweet itch, Queensland itch, Culicoides hypersensitivity Mk 804; IM 1277; I2M 1424; E 814; C3T 693	• **Recurring, seasonal itching** • **Allergic reaction - Type 1** • **Culicoides gnats** (midge, no-see-ums, punkies, sandflies) - Small, blood sucking flying insects - Breed in stagnant water - Can only fly 1/4-1/2 mile from water - Only warm weather (April - Nov.) - Before or during dusk • **Small % allergic** to saliva - Immature horses rarely affected - Recurs seasonally - CS worsen w/ age	• **Pruritic** • Dorsally: **poll, mane & tail** (rarely belly), Forehead, neck, withers, shoulder, rump • **Self trauma** • Crusting alopecia (excoriation) - Hair & mane broken & matted • Severe chronic cases - Lichenification (thickening of skin due to rubbing) & scarring	• Hx of midge exposure • Pruritic, crusting alopecia of dorsum (mane & tail region) • Warmer months • **Positive response to Tx**	• **↓ Exposure to midges** - Move 1/2 mile from midge habitat - Stable before & during dusk, midges stay out of barns - Fan on horses (fly poorly) - Insect repellent • **Steroids**: prednisolone (PO BID) - Dexamethasone (PO, BID) for severe cases - ↓ Dose gradually after 5 ds to lowest alternate daily dose • **Antihistamines ineffective** in most cutaneous hypersensitivity dizs of horses
	Allergy, seasonal **CS: Dorsal itching** **Dx: Hx, CS, Tx** **Tx: Steroids**		**DDx:** • Onchocerciasis (nonseasonal, less pruritic, head, neck & belly) (pg 285) • *Haematobia irritans* (horn fly) ventr. midline (pg 286) • *Stomoxys calcitrans* (stable fly) back, chest, neck & legs (pg 287)	Steroids
Cutaneous onchocerciasis; Diffuse midline dermatitis, M8k 659; Mk 808; IM 1279; I2M 1427; EM&S 1687; E 816; M 350	• ***Onchocerca cervicalis*** - Adults - coiled in funicular part of ligamentum nuchae . Produce calcified nodules - Microfilaria . Migrate through connective tissue to dermis . Ventral midline, lower eyelid & lateral limbus of eye • ***Culicoides*** intermediate host - L3 (3rd stage larvae) enter host through lesions by feeding vector • **Hypersensitivity** to dying microfilaria (not all infected horses show CS, severity not proportional to # of organisms & Tx temporarily exacerbates CS • Adult horses	• **Most asymptomatic** (up to 90% infected w/o CS) • **Ocular & cutaneous** - Ocular . Uveitis, conjunctivitis, keratitis, depigmentation of lateral limbus - **Cutaneous lesions** . Diffuse/patchy alopecia, erythema & scaling . Ventral midline, face, base of mane, craniomedial forearm, cranial pectoral . **"Bull's eye"** lesion in center of forehead . Nonseasonal & nonpruritic - ± Edema on ventral midline & face	• History, CS • Exclusion of DDx • **#1 Response to therapy** • Microfilaria preparation - Not diagnostic because many have no CS - Lack of microfilaria doesn't definitely exclude	• **Ivermectin TOC** (orally) - Most improve in 2-3 wks - Minor adverse reactions in 25% of horses (fever & swelling) - Ineffective against adults so recurrence possible in 2 mo, but most free for 6-12 months - Retreatment at 4-mo intervals • Banamine® for ventral edema • Corticosteroids for severe reactions (usually unnecessary because most resolve in 1-3 days)
	Onchocerca worm, Culicoides Hypersensitivity **CS: Ocular & Cutan. ("Bull's eye")** **Dx & Tx: Ivermectin**		**DDx:** • Ventral midline dermatitis (horn fly) (pg 286) • Sweet itch (no improvement w/ ivermectin) (pg 284) • Ringworm (pg 277) • Mange mites (pg 283)	Ivermec **Microfilarial preparation** • Punch biopsy (6 mm) - Half preserved in buffered formalin - histopath. . Eosinophilic & lymphocytic perivascular dermatitis (nonspecific & common in other parasitic dermatoses) - Half on dampened sponge in closed container . Mince w/ razor blade on slide, add few drops of nonbacteriostatic saline . Incubate for 15 min at room temperature . Scan at 4x objective for slender, delicate microfilaria . If negative, incubate overnight & reexamine
Warbles, Hypoderma Mk 781; IM 1281; I2M 1429; E 809	• Larvae (grub) of *Hypoderma bovis* & *H. lineatum* • Common & serious problem in cattle • Sporadically in horses pastured near cattle • Adults bee-like, spring & early summer, deposit eggs on legs or lower body, rump • Migrate through body, see **NEURO pg 251**	• Usually only 1 or 2 grubs • **Small nodular** lesions on withers or back • **Breathing pore on nodule** • Posterior paresis, neuro pg 251	• Nodule w/ breathing hole • Season	• **Enlarge breathing hole & extract grub**
	Pastured near cattle		**DDx:** • Nodular necrobiosis • Mastocytoma • Sterile nodular panniculitis • Amyloidosis	

Flies

Condition	Facts/Cause	Presentation/CS	Diagnosis	Treatment
Horn flies, Ventral midline dermatitis M8k 643; Mk 801; I2M 1425; EM&S 1690; C3T 688	• *Haemotobia irritans* • Major cattle pest - Reproduce only in bovine feces - Will feed on horses, sheep & goats • **Ventral abdomen because shade & thin skin**	• Pierce skin to suck blood - Pain, annoyance & blood • **Ventral midline dermatitis** (w/ onchocerciasis & Culicoides also) - Papules & wheal **w/ central crust** - Progresses to alopecia, ulceration & lichenification - Excoriation if pruritic	• *Haemotobia irritans* - 1/2 size of stable flies, otherwise look like stable flies - Bayonet-type, piercing, sucking mouth parts • Biopsy	• **Relatively easy to control** because stay on Eq all the time - Insecticide & repellents usually suffice - Antibiotic-steroid ointment in severe cases • **Separate from cattle**
	Biting **CS: Ventral midline crusts** **Control: easy as always on host**	**Life cycle:** • **Entirely on host, except when depositing eggs in feces** • Emerged flies can fly 7-10 miles • In South fly population m/ reach thousands on single animal		**DDx:** • Cutan. onchocerciasis • Culicoides hypersensitivity
Horse flies Mk 802; I2M 1426; EM&S 1649 ***	• Tabanidae family **(biting)** • Tabanus & Hybomitra (horse flies), Chrysops (deer fly) - Intermediate feeders - Need blood meal for female to reproduce • **Transmits EIA** & *Trypansoma evansi* (tropical diz - *T. surra*)	• **Painful wounds**, papules & wheals w/ central ulcers & crusts - Ventrum, legs, neck & withers - 2° feeders around wounds (house flies, gnats) **Biting** **CS: Wounds, EIA** **Control: Difficult**	• Up to 1" long • Blade-like mouth parts of females	• **Most difficult to control** of all bloodsucking flies, intermittent feeders, takes longer to kill them • Stable Eq during day • Keep away from forested areas • Daily repellent insecticides (pyrethroids & synthetic pyrethroids)
Stable flies Mk803, I2M 1426; EM&S 1649; E 807, 820; C3T 690	• *Stomoxys calcitrans* • Feed on most warm blooded animals • Develop in decaying organic matter (grass clippings, seaweed) • Intermediate host of *Habronema microstoma* (stomach worm of horse) • Swarm in wet Summers **Biting, Habronema host** **Control: Difficult**	• **Irritation, painful bite** - Papules & wheals w/ small central crusts • Neck, back, chest, groin & legs • **Hypersensitivity reaction m/b** **- Pruritus or nodules**	• *Stomoxys calcitrans* - Looks like house fly - Outer of 4 thoracic stripes is broken & checkered abdomen - Prefer bright light, usually not seen in dark stables	• **Difficult** because only feed once or twice a day • Spray area w/ insecticides • #1 sanitation, clean up decaying matter • Feed additives w/ organophosphate larvicides available • Daily insecticide/ repellent sprays or wipes
Face flies M8k 646; Mk 800; I2M 1426; EM&S 1722; C3T 690 ***	• ***Musca autumnalis*** • **Range cattle 1°** host (also horse) • 2° feeders from open wounds of other insect bites & on lacrimal & nasal secretions • **Do not bite, but delay healing** • **Vector of habronemiasis & eyeworm, *Thelazia californiensis*** • Deposit eggs in manure & rotting vegetable matter **1° Cattle** **Nonbiting - Delay healing**	• Irritation & mechanical damage to eye tissue • Delay healing of insect wounds **Sequelae:** • **Transmit habronemiasis** • **Vector for *Thelazia* spp.** Life cycle: • Breed only in fresh feces • Eggs hatch in feces & mature in soil • Egg to adult 12-20 d • Overwinter in buildings • Females feed on facial secretions (tear fluids, nasal mucus & saliva). Also blood from wounds & milk from calf's face	• *Mucosa autumnalis* - 4 longitudinal stripes on abd. - Mouth parts sponging labellae	• **Difficult to control** • Spray area w/ insecticides • Sanitation, clean up decaying matter • Feed additives w/ organophosphate larvicides available • Daily insecticide/repellent sprays or wipes
House flies Mk 802; I2M 1426; E 807; C3T 690 ***	• ***Musca domestica*** - Breeds in manure - Sponge-like nonbiting mouthparts • 2° feeders from open wounds of other insect bites & on lacrimal & nasal secretions • Do not bite, but delay healing **Nonbiting - Delay healing**	• Annoyance even though don't bite • **Do not bite, but delay healing**	• ***Musca domestica*** - Sponge-like nonbiting mouth parts	• **Difficult to control** • Spray area w/ insecticides • Sanitation, no decaying matter • Daily insecticide/repellent sprays or wipes
Black flies, Buffalo gnat M8k 644; Mk 797; EM&S 1690; E 818; C3T 688	• *Similium* spp, buffalo gnats • Annoying pest • Breed along swift streams • Do not enter buildings • Late spring, early summer • **During day** • **South** • **Dark colored** animals most affected • Aural plaques m/b caused by chronic irritation of ears **South, ± Death - Stable in day**	• **Ears**, head, neck, pectorals, ventrum • **Papules, wheals** - Vesicle, hemorrhage & necrosis - Alopecia, excoriation & lichenification (chronic) • M/b hypersensitivity-related dermatoses • **Death** if large numbers attack (toxin in saliva - cardioresp. dysfunction & ↑ capillary permeability = shock)	• **Black fly** - Thorax humped over head - Short, piercing snout - Long antennae (like cow horns) • **Stable during day dramatic** • Intradermal skin testing w/ commercial black fly extract for hypersensitivity	• **Stable during day** • Systemic steroids for relief • Fly repellents • Control difficult because can fly long distances **Prevention:** • **Stable during day**

Parasites — INTEGUMENT

Condition	Facts/Cause	Presentation/CS	Diagnosis	Treatment
Mosquito bites Mk 805; EM&S 1649; M 345	• Aedes, Anopheles & Culex • **#1 transmit 3 encephalomyelitis viruses (EEE, WEE, VEE)** • Deposit eggs in water • Warm rainy weather ↑ numbers	• Bites like flies, but no central crusts - Usu. subside in 3-4 days w/o Tx • M/ cause insect bite dermatitis	• CS & mosquito	• Eliminate breeding water • Spray stagnant water w/ larvicides (pyrethrins or organophosphates) • Insect repellents on horse (Deet® & Avon's Skin-So-Soft®)
Tick bites M8k 670; Mk 837; E 835; C3T 691	• Number of ticks - Most are hard ticks - Soft tick: spinous ear tick - Seed ticks: 6-legged larvae • Transmit eq. babesiosis, m/b *Ehrlichia equi* & m/ cause tick paralysis	• **Papules, pustules,** wheals & m/b nodules, m/ crust or ulcerate, foci of alopecia • Heavy infestation: poor condition, anemia & lowered resistance • Allergies to cattle tick, *Boophilus microplus*, wheals & pruritus	• **ID tick**	• **Organophosphates** • **Pyrethrin**/pyrethroid compounds • Ivermectin - variable efficacy **Prevention:** • Acaricides & repellents when exposure likely • Mowing pastures
Pinworms, Oxyuriasis M8k 202; Mk 202; IM 218; I2M 212t; EM&S 1691; E 70	• **Pruritus in stabled horses** • Spreads between stabled horses	• **Pruritus** due to irritating substance of egg • Severe rubbing limited to tail & perineum • **"Rat tail"**: broken hair, matting & excoriation	• CS • **Microscope exam for eggs** - Clear tape to perineal region	• **Ivermectin**, benzimidazole or pyrantel pamoate • Stable management - prevent contamination of water & feed

CS: Pruritus, "Rat tail"
Dx: CS, Eggs
Tx: Ivermectin

DDx:
- Insect hypersensitivity (pg 284)
- Lice (pg 282)
- Mange (pg 283)
- Hives (Food allergy) (pg 281)
- Behavioral vice (pg 306)

Life cycle
- Adults inhabit cecum & colon
  - Females migrate out anus to deposit eggs on perineum
  - Eggs fall to ground, contaminate feed
  - Hatch to larvae & ingested by horse

Eosinophilic dermatitis, Eosinophilic granulomatosis: **Rare**; **See GI pg 28**; hypersensitivity reaction?
- **CS: GI & skin, granulomatous** enteritis, malabsorption; diarrhea, crusting, alopecia, skin nodules, pruritus uncommon, wt. loss, depression
- **Dx:** D-glucose test, skin biopsy (eosinophilic infiltrate, collagen degeneration) • **Tx:** Most horses don't recover, steroids

Calcinosis circumscripta EM&S 1664; E 811; S 278: • Cause unknown • **CS:** Large (1-5") dense **SQ nodule** on lat. leg near stifle
• **Dx:** Biopsy mineral deposits • **Tx:** Leave alone unless causes lameness or cosmetic concern. Sx removal m/b difficult because m/ be assoc. w/ joint capsule

Panniculitis EM&S 1677; C3T 636
- **Uncommon in horse**; inflammation of SQ fat, Insults liberate lipids (potent inflammatory agents); Se/Vit. E deficiency
- **CS:** Deep, cutan., firm or soft **nodules** or plaques, single or multiple, ± systemic CS (depression, anorexia, fever, lethargy)
- **Dx:** Cytology, biopsy, culture, suppurative to pyogranulomatous inflammation
- **Tx:** Large doses of glucocorticoids, supplement Se/Vit. E

Cutaneous amyloidosis Mk 319; IM 1293; I2M 1440; EM&S 1663; E 812; C3T 636
- **Rare nodular diz of skin &/or upper resp. tract,** cause unknown, fibrillar protein derived from immunoglobulins
- **CS:** Respiratory - dyspnea; Cutaneous form - firm, painless nodules, head, neck & pectoral regions
- **Dx:** Histopath - amyloid stains, multinucleated giant cells
- **Tx:** **No Tx**, progressive diz, horse useful until severe respiratory embarrassment

Generalized granulomatous diz IM 1294; I2M 1441
- **Rare diz** - skin lesions & widespread systemic involvement
- **CS: Skin: scaling, crusting, alopecia, nodules or large tumorlike masses**; Systemic: weight loss, anorexia, low grade fever, exercise intolerance, dyspnea, lymphadenitis, diarrhea & icterus
- **Dx:** granulomas or epithelioid cells & multinucleated giant cells in skin & internal organs
- **Tx:** Prednisone or prednisolone (600-700 mg P.O./d, 6 mo; once regression alternate day therapy for at least 6 mo)

Photosensitization (IM 1294; M 353) • **See TOX pg 323**, Pathological sunburn, 1° photosensitizing or 2° hepatotoxic substances

Frostbite (Mk 627; IM 1290; I2M 1438; S 291) • **Rare** in healthy animal, Ears, tail, teats & scrotum affected
- **Tx:** Thaw tissue **rapidly** in warm water (100-111° F), analgesics & massage, supportive care

Sporotrichosis IM 1274; I2M 1421; E 810
- **Yeastlike fungus** (*Sporotrichium schenckii*), skin & lymphatics, enters through wounds, common in warm moist climates
- **CS:** hard nodules (1/3-2"), often in lines along lymphatics, m/ ulcerate & encrust
- **Dx:** Culture in Sabouraud's dextrose agar
- **Tx:** Sodium iodide, organic iodides, potassium iodide

Bullous pemphigoid Mk 430; IM 1260; I2M 1405
- **Rare in horse**, autoimmune, vesicolobullous & ulcerative disorder
- **CS:** Painful, ulcerative lesions of face & axillae, mucous membranes
- **Tx:** too few cases

Epizootic cellulitis, EVA, Equine viral arteritis (Mk 379) • **See CIRC. pg 143**; damages small arteries - edema
- **CS:** fever, nasal & ocular discharge, edema, abortion, edema & petechiae in subcutis of skin of limbs and abdomen

Pseudorabies, "Mad itch" (IM 915; I2M 1017): Horses & man resistant, disease of pigs & ruminants

Skin Growths

Condition	Facts/Cause	Presentation/CS	Diagnosis	Treatment
Sarcoids M8k 700; Mk 857, IM 1284; I2M 1432; EM&S 1657; M 343; E 795; S 276 ***	• **#1 neoplasm of horses** • Cause: unknown - M/b papillomavirus (distinct from cattle) - Familial predisposition - May occur at site of previous trauma • Transmission: - Direct contact - Arthropod vector or fomites • Horses, donkeys & mules • < 4 years old • **Complication:** - Bacterial infections - Fungal infections - Habronemiasis • **Intermediate malignancy** - Doesn't metastasize - Commonly recurs - Partial biopsy is contraindicated	• May occur anywhere on body - Head, limbs & ventral abdomen - Most multiple sites • **Variable appearance** **1. Verrucose** (warty, rough) **2. Fibroblastic** (proud flesh) 3. Sessile (attached by base) or flat 4. Mixed verrucose & fibroblastic • Verrucose sarcoids can be transformed to fibroblastic by trauma	• Appearance • Partial biopsy is contraindicated	• **Cryosurgery TOC** (see box) • Surgical incision: 50% recurrence reported - Usually combined w/ cryosurgery • Large % regress spontaneously - M/ take years • Cisplatin (Plantinol®) alkylating agent • BCG (bacillus Calmette-Guerin) - Attenuated strain of *Mycobacterium bovis* - Nonspecific immunostimulant to induce regression of tumors - < 5 cm - Foreign protein so premedicate w/ Banamine® & antihistamine + tetanus prophylaxis • **Radiation** (^{222}Rn implants) - TOC for recurrent sarcoids

#1 tumor
DDx for bumps & tumors
Warty or Proud flesh-like
Cryosurgery - Depigmentation

DDx for all nodular or tumorous lesions of skin
- Neoplastic growth, SCC (pg 291), Warts (pg 292), Fibromas (pg 290), Neurofibromas
- Rain scald (pg 276)
- SQ or deep fungal infections
- Cutan. habronemiasis (pg 284)
- Proud flesh (pg 292)
- Ringworm (DDx from sessile [flat]) (pg 277)

Cryosurgery TOC
- Surgically debulk large sarcoids 1st
- Liquid nitrogen (cryoprobe or spray)
- Protect adjacent skin from freezing w/ styrafoam or petrolatum-coated gauze
- **2 rapid freezes from - 68° to -86°F w/ slow thaw**
- Monitor w/ thermocouple needles 1/2 cm from margin & below base
- Tissue becomes endematous, necrotic & sloughs
- 2nd intention healing in several wks
- Depigmentation expected

Basal cell tumors Mk 848; EM&S 1661: • Rare in horse • **CS:** Ulcerative nodules • **Tx:** Excision TOC (Tx of choice) *

Tumors of adnexa Mk 850; EM&S 1661: • < 1% of equine tumors; tumors of sweat glands, sebaceous glands or hair follicles • **Tx:** Excision TOC *

Mast cell tumors Mk 862; IM 1287; I2M 1435; EM&S 1662; E 809; S 272: • **Rare in horse**; Mastocytomas
*
- **CS:** Single 1-8" cutan./SQ nodule on neck, head or dist. limb, Diffuse swelling below hock or carpus
- **Dx:** Biopsy: mast cells & eosinophils
- **Tx:** Surgical excision • Px: Recurrence rare after removal

Fibroma Mk 856; EM&S 1663; E 601: • **Uncommon** • **CS:** Growths on nictitating membrane, conjunctiva, cornea, neck, flank & legs • **Tx:** Surgical excision **

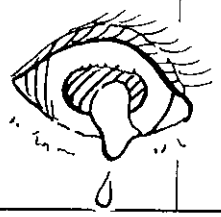
Squamous cell carcinoma, SCC M8k 689; Mk 849; IM 1284; I2M 1432; EM&S 1659; E 802; M 344; S 274; POP, 18-7/98 ***	• Tumors of squamous epithelial cells • All domestic species, but rare in pig • **#2 tumor of horse** • Rare in skin not adjacent to mucous membranes • Chronic sunlight • Malignant, rapidly, locally invasive, rarely metastasizes, if does to lymph nodes, rarely to lungs	• **Nonpigmented skin at mucocutaneous junctions** - **Penis & sheath** of aged geldings & stallions - **Eyelids**, lips, nose, vulva & ears • Initially: papillomatous or nonhealing ulcer • **Then granulomatous - crusty** • Bleed easily & ulcerative surface	• **Biopsy/histology** - Cords &/or islands of polyhedral cells w/ intercellular bridges, lack of basal laminae, keratin "pearls", mitotic figures **DDx:** • Proud flesh (pg 292) • Habronemiasis (pg 284) • Sarcoid (pg 290) • Bact. & fungal granulomas • Other neoplastic conditions	• **Radical excision** • Radiation therapy • **Cryosurgery** w/ or w/o cesium-37 needle implants • **Cisplatin** (Plantinol®) • Hyperthermia Prognosis: recurrence common
Melanoma M8k 710, 608; Mk 865; IM 1288; I2M 1436; E 808; M 346; S 273; LAS 192; POP 18-7/98 ***	• Most significant in horses • **Gray or white** horses usually; rare in colored horses • **Older horses** ("gray horse will get if live long enough") • Epidermal or dermal in location • Type: - **Benign: most**, slow growing - Benign for yrs, then malignant - Malignant melanomas . Grow rapidly . Metastasize to regional lymph nodes, lungs, spleen, & liver, also hematogenous spread	• **Firm, dome-shaped, hairless** • Usually multiple • **Gray or black** • Anywhere: **muzzle, under tail head, underlines**, head, udder, scrotum, prepuce & limbs • Complication: enlargement m/ cause interference w/ urination or defecation **Old gray horses, benign** **Tx: Remove**	• Hx, CS • Cytologic & histological - Melanin pigmentation - Benign or malignant - Mitotic figures: malignant	• **Surgical excision** • **Cryosurgery** • Perineal region: no Tx because surgery difficult & low metastatic rate - Tx if interfere w/ urination or defecation • Cimetidine: variable results(?)
Cutaneous lympho-sarcoma M8k 705; Mk 861; IM 1112; I2M 1437; EM&S 1662; E 810	• Infrequent in horse (but #1 hematopoietic neoplasm of horse) • CS vary depending on organs affected • Frank leukemia rare • 6-10 years (range birth-20 years) • **Horses live w/ them** **SQ nodules - Horses live**	• **SQ nodules**, discrete masses or multiple bumps resembling urticaria • Bridge of nose, neck, shoulder, forelegs & perineum • Ulceration of vulva & cervix • Acutely appear, regress & reappear • Internal organs seldom involved	• Biopsy: diffuse dermal & SQ infiltration of malignant lymphocytes • Hemogram: usually normal	• **Usually left alone** because horse usually does fine w/ them • Dexamethasone (20 mg/d), many regress in 1-2 weeks. Gradually taper dose for longer periods or reappear more vigorously (why they are usually left alone) **Prognosis:** • Horse m/ live & function normally for years w/ lesions

Skin

INTEGUMENT

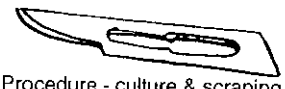
Condition	Facts/Cause	Presentation/CS	Diagnosis	Treatment
Viral papillomatosis **Warts, Papilloma,** M8k 682; Mk 854; IM 1269; I2M 1417; EM&S 1656; M 347; E 838; S 279 **Self limiting**	• **Younger (6-12 mo) > older** • **Cattle > horses** > goats > sheep (not cat) • Viruses - Papovaviridae • Infectious, **Papillomatosis** • Transmission: - Direct contact, fomites & possibly insects - Colts muzzle each other (abrasions)	• **Warts** (small, scattered) • Cosmetic problem: **Muzzle** (nose & lips), eye, forelimbs, genitalia • If irritating m/ rub, causing ulceration for 2° bacteria	• **Warts** • Biopsy (epidermal hypoplasia, papillomatosis, basophilic intranuclear inclusion bodies) **DDx:** • Sarcoids (pg 290)	• **Tx usually not necessary** • **Self limiting** - regress in a few mo - **Immunity,** but recurrence if immunity lost • Cosmetic surgical removal (before sale) - When maximum size so doesn't stimulate recurrence & growth - Cryosurgery (3-cycle freeze-thaw-freeze) - Chemical cautery (trifluoroacetic acid) to affected tissue only, protect adjacent tissue w/ petrolatum - Remove few warts m/ speed disappearance of remaining **Prevention:** • **Autogenous vaccines** - moderate to highly effective - Cattle wart vaccine not effective
Aural plaques, **"Ear fungus"** **Papillary acanthoma** Mk 854; IM 1271; I2M 1418; EM&S 1720; E 834 **Persist for life**	• **Aural plaques** (thought to be type of papilloma) • Inner surface of pinnae - Anus, mammary glands & vulva • May be due to chronic irritation from **fly bites** • Lesions persist for life	• Small, smooth, raised, depigmented **plaques**; or • Large, confluent, hyperkeratotic **plaques** • Inner surface of pinna, anus & vulva • Not painful • **Persist for life** (irritate owners) **DDx:** • Sarcoids (pg 290)	• CS • Histology/biopsy: wart like, epithelial proliferation & epidermal hypomelanosis	• **No specific Tx** Prevention: • **Apply repellents** during fly season **Prognosis: Persists for life**
Keloid EM&S 1661; E 834	• **Hypertrophic scars** • Distal limbs, flexor surfaces of joints	• **Hard, raised lesions** • **Distal limbs, flexor surface**	• CS	• **Leave alone** because tend to recur following surgical removal • Cryosurgery or radiation suggested
Cysts IM 1289; I2M 1437	• Benign lesions, epithelial wall w/ keratinous contents, Types: epidermal, dermoid & dentigerous • **Tx:** Surgical excision			
Proud flesh, **Granulation tissue** E 795; M 341; EM&S 1594, 1604, 1676; S 278 *** **Distal limbs** **CS: Healing out of control** **Tx controversial, excise & pressure**	• **Exuberant granulation tissue in wound healing by 2nd intention** • More common on distal limbs - Minimal skin, constant motion • Impedes epithelialization • **Cause unknown**	• **Exuberant granulation tissue** • **Distal limbs** • Lateral metacarpus of large horses **DDx:** • Cutan. habronemiasis (pg 284) • Phycomycosis • Sarcoid (pg 290) • Squamous cell carcinoma (pg 291)	• Hx (wound healing) • CS (granulation tissue) • Biopsy, repeated occurrences	• **Tx controversial** • Excision to below skin level - Pressure bandage - Whites lotion - Consider skin grafts in 3 months • Other reported treatments - Topical chemical debridement - Cryosurgery - Irradiation
Ulcerative lymphangitis, "Pigeon fever", "Dryland distemper" M8k 56; IM 1120; I2M 210t, 216l; M 347; E 812, 839 *	• **Sporadic** • *Corynebacterium pseudotuberculosis* • **2 forms** - **Ulcerative lymphangitis** . Endemic on some farms - hygiene - **Abscess formation** . Dermatitis & large (3-12") pectoral, abdomen & inguinal abscesses . Insect vectors suspected . West USA, esp. Calif. . Late Summer to Winter	• **Ulcerative lymphangitis** - Principally the hindlimbs - Severe cellulitis of one or more limbs - Multiple small nodules . Tend to ulcerate w/ purulent discharge - Lameness • **"Pigeon breast"**, pectoral abscesses - Insidious wasting - Low-grade fever - Sequelae . **Internal abscesses** . Recurrent abscesses **DDx:** • Nonspecific lymphangitis • Sporotrichosis • Histoplasmosis • Phycomycosis (pg 293)	• Hx, CS • **Thick walled abscesses** • **Difficult to Dx** • SHI test **Prevention** • Insect vector control difficult • Clean bedding	• **Ulcerative lymphangitis** - Hygiene - clean bedding & feet - ABs: useful in early stages . May be useless in well established cases . IM procaine penicillin, trimethoprim-sulfa, oxytet. IV • **Abscesses - Pigeon breast** - **Allow maturation of abscesses** - **Lance, lavage & drain** abscesses: usually resolves - **ABs controversial** (1st abscesses mature?) - Internal abscesses - procaine penicillin, trimethoprim-sulfa, Rifampin/penicillin, - **NSAIDs** for pain & edema **Prognosis:** • **Ulcerative lymphangitis: Guarded** • Typical ventral abscesses - Good • Internal, deep abscesses & ulcerative lymphangitis - Guarded
Phycomycosis, Pythiosis, "Swamp cancer" M 343; EM&S 394, 1613; C3T 162; POP 18-7/98 *	• Fungal infection - Pythium, *Hyphomyces* sp • Wet Gulf Coast states • Cause: prolonged contact w/ water + fungus, - Usually associated w/ previous wound **DDx:** • Sarcoid • Excessive granulation tissue • Habronemiasis • Squamous cell carcinoma	• **Large pale granulation lesion** - **Foot & pastern, single** usually, - Proliferative, ulcerative, sinuses - **Pruritus** often - Lymphangitis or limb edema if large lesion - **Lameness** • Sequela: **lameness** - Osteomyelitis - Loss of hoof, bone & soft tissue	• Hx (wet Gulf Coast states) • CS, Biopsy (Histo: fungal hyphae, Inflammation & eosinophils) - "Leeches" or "kunkers" (cores of necrotic tissue & Pythium organisms) in sinus tracts	• **Surgical excision** necessary for large proliferative lesions - Radically trim excess tissue to below skin surface - Repeated excisions common - Topical amphotericin B - Vaccine reported to be successful in some cases, weekly for 3 weeks • "Pycofixer": antifungal mixture Prognosis: **Guarded**

Condition	Facts/Cause	Presentation/CS	Diagnosis	Treatment
Bacterial keratitis IM 1227; I2M 1371; E 1282; EM&S 1113; S 643; M 323; C2T 451; S 643	• **Infection of corneal ulcer** • ***Pseudomonas*** spp. common & most devastating - **Proteoglycanolytic enzymes - corneal melting**, ± perforation • Enterobacter, Acinetobacter, Strep., Staph. spp., etc.	• **Ulcer** - **Pain** (infected or not) (blepharospasm, lacrimation & photophobia) • Infected ulcer - White/yellowish opacity (PMNs & bact) - **"Melting ulcer"** (keratomalacia, widening & deepening) - M/b perforation in 24-48 hr (Pseudomonas) • Stromal abscess (rarely, under healed ulcer, do not stain w/ fluorescein)	• **Clinical signs** • **Fluorescein stain of ulcer** • **Gram stained corneal scraping** (bacteria & PMNs) - C&S (culture & sensitivity) • Melting ulcers" suspect Pseudomonas - gram-negative rods	• **Gram negative** - Subpalpebral lavage - Immediately: gentamicin sol. every hr - If worsens - change ABs (C&S [culture & sensitivity]) . Tobramycin (another aminoglycoside) . Chloramphenicol ineffective against pseudomonas • **Gram positive** - Cefazolin (Ancef®) • **Attempt to stop "melting"** - **Acetylcysteine** 5-10%, Na EDTA or serum (collagenase & protease inhibitors), every hour - Conjunctival flap (brings blood, allows observation) - Nictitans flap contraindicated (can't observe) • Descemetoceles & perforations - Corneoscleral transposition (microsurgery) • ↓ Reflex uveitis - **Atropine** (cycloplegic) **& Banamine®** Prognosis: **Grave** - rapidly progressing / or "melting", m/ lose eye or m/be able to save visual eye w/ scarring



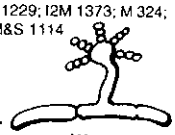
Infected ulcer - Pseudomonas
CS: "Melting ulcer"
Dx: Stain, Scraping
Tx: ABs, Acetylcysteine, Atropine

DDx:
• Fungal keratitis (similar appearance, slower & less acute)



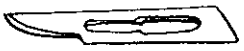
Procedure - culture & scraping
• Palpebral nerve block
• Moistened swab on cornea for culture
• Topical anesthesia
- Scrape corneal margin

Fungal keratitis IM 1229; I2M 1373; M 324; EM&S 1114	• **Mycotic infection of ulcer** • **#1 Aspergillus**, Phycomyces, Penicillin, Paecilomyces, Candida, Fusarium, Mucor, Altenaria spp. • **Hx of chronic steroid or AB Tx**	• **Corneal ulcer: grey/yellowish haze around ulcer** • Pain (blepharospasm, lacrimation & photophobia) • Hyperemic conjunctiva • Corneal neovascularization **Sequelae:** • Perforation & loss of eye • Superinfection w/ bacteria • Phthisis bulbi (wasting of eyeball)	• Fluorescein stain ulcer - Epithelium m/ heat over fungus & not stain • **Hx: chronic steroid or AB Tx** • **Corneal scraping or biopsies** **- Fungal hyphae or yeasts**	• **Need definitive Dx because Tx expensive & prolonged** • **Topical antifungal agents** frequently - several wks - Heals when neovascularization reaches infected area - Natacyn® (natamycin) ophthalmic sol - Monistat® (miconazole) - Amphotericin B very irritating • **Atropine** (for uveitis) • Topical ABs for bacterial infections



DDx:
• Corneal foreign body
• Trauma
• Bacterial keratitis

Aspergillus, Chronic steroid or ABs Tx
CS: Corneal ulcer
Tx: $ & long - antifungal, atropine, ABs



Prognosis: Guarded to poor
Hope for visual eye w/ residual scarring

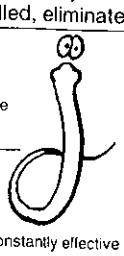
Equine Recurrent uveitis, ERU Periodic ophthalmia, **Moon blindness** M8k 360; IM 1239; I2M 1383; M 324; EM&S 1114; S 670; C3T 592; C2T 445; POP 51-7/98 ***	• **Uveitis**: inflammation of uvea (iris, ciliary body& choroid) • **Recurrence & periods of quiescence** • **#1 cause of blindness in horses** • Damages cornea, lens, vitreous, retina & optic nerve • Cause? **Hypersensitivity to antigens** - immune-mediated? - Trauma - Leptospira & Onchocerca - Also: Brucella, Strep. Influenza, adenovirus & Toxoplasma - Cowboys blamed it on phase of the moon • Varying lesions - severity & duration	• **Blepharospasms**: acute - pain • **"Ciliary flush"**: hyperemia of limbus (corneal scleral junction) • **Cloudy eye** (corneal edema) • **Aqueous flare**: anterior chamber • **Pupillary constriction** (miosis) • **Synechiae** (adhesions), between iris & lens & iris & cornea (distorts pupil) • **"Butterfly" lesion**: depigmentation near optic disc (blind spots) • ± Ulcer - cornea • **Chronic**: synechiae, iris depigmentation & atrophy - **Iris bombe**: forward ballooning - **Cataracts** (long standing cases) - **Phthisis bulbi** (shrinkage of globe)	• **Digital palpation of eyeball** for ↓ intraocular pressure • Paired serum (leptospira, brucella or toxoplasma) • Conjunctival biopsy (Onchocerca microfilariae) • Most cases cause can't be determined, but responds to symptomatic Tx	• **Reduce intraocular inflammation** - **Steroids** (**not if ulcers** - fluorescein stain 1st) . Pred-Forte® (prednisolone acetate) topical, 10-14 days to reduce recurrence . Depo-Medrol (methylprednisolone) subconjunctival - **NSAIDs** - Banamine®, Bute, or Aspirin • **Atropine**: mydriatics (cycloplegics) - Pupillary dilation for pain & to prevent synechiae formation (2-4 hour intervals until dilation, watch for development of colic) once dilated SID 3-5 days • Warn of recurrence & start antiinflammatory Tx once CS • ± TPA (tissue plasminogen activator) $ dissolve fibrin • **Remove eye** if blind & painful

Hypersensitivity
CS: Pain
Tx: Steroid, atropine

DDx:
• Blepharitis
• Conjunctivitis
• Corneal ulcers
• Keratitis
• Septic or traumatic uveitis

Neoplasia M8k 367; IM 255; I2M 1392; C3T 605; C2T 441; S 609 • Sarcoids most common neoplasia, possible to optimistically treat • Lymphosarcoma • Px: Guarded

Ocular onchocerciasis M8k 364; IM 1244; I2M 1388; E 292; EM&S 1107, 1102	• **Aberrant migration** of *O. cervicalis* microfilaria, seen in 50% of horses w/ cutaneous onchocerciasis, adult horses • **CS:** Conjunctivitis & keratoconjunctivitis, lacrimation, blepharospasm, sm. nodules & corneal opacities, depigmentation (vitiligo) bulbar conjunctivitis, Uveitis, Chorioretinitis, "butterfly-shaped" pattern around optic disc, cutaneous ventral thorax d • **Dx:** CS; Corneal or conjunctival biopsy: microfilaria rarely found • **DDx:** Squamous cell carcinoma, habronemiasis, mycotic infection • **Tx: Steroids** (Pred-Forte® [prednisolone acetate] & dexamethasone): to control inflammation - 4-6 x/d, once inflam. controlled, eliminate microfilaria
Ocular habronemiasis M8k 364; IM 1245; I2M 1389; E 1276; EM&S 1101; M 321; C2T 440; S 608	• Larvae of *Habronema muscae*, *H. microstoma* or *Draschia*, deposited on ocular tissue by **flies** • **CS:** Raised proliferating wounds on med. canthus, contain sulfur granules • **Dx:** Biopsy - larvae • **DDx:** Neoplasia (SCC), sarcoids, phycomycosis, Onchocerciasis, foreign body reaction, exuberant granulation tissue • **Tx:** Oral **ivermectin**, fly control
Thelaziasis M8k 363; I2M 1390; EM&S 1107	• **Thelazias worm commensal** in conjunctival sac, 15-38% of horses affected • **CS: usually asymptomatic**, m/b conjunctivitis, superficial keratitis, neovascularization, edema & ulceration • **Dx:** Direct visualization of adult worm in conjunctival sac (8-18 mm long) • **Tx:** Manual removal (saline flush or forceps after topical anesthetic); topical organophosphates, Ivermectin not constantly effective
Intraocular parasites IM 1247; I2M 1391	• **Setaria** most common; aberrant migration; into **aqueous humor**; also *Dirofilaria immitis* & *Onchocerca cervicalis* • **CS: Serious intraocular inflammation** • Dx: Visualize worm in aqueous humor • Tx: Symptomatic anti-inflam, Tx & surgical removal



EYE

INTEGUMENT

Condition	Facts/Cause	Presentation/CS	Diagnosis	Treatment
Entropion M 320; C2T 440; EM&S 1097; S 602	• **Self correcting condition in foals** • Relatively common • Bilateral or unilateral • Within few days of birth - CS	• Eye irritation a few days after birth - Excessive lacrimation - Blepharospasm - Photophobia • Sequelae - Corneal ulcer	• History, CS • See inversion of lower eyelid margin **DDx:** • Keratitis • Conjunctivitis • Trauma	• **Most spontaneously resolve** - Manual eversion of lower eyelid . Antibacterial eye ointment if corneal ulceration - Mechanical eversion of eyelid margin . Procaine penicillin, saline or local anesthetic SQ injection, or . Skin staples • Surgery seldom required **Prognosis: Good:** most spontaneously resolve
Eye laceration M 320; C3T 588; C2T 460; EM&S 1099, 1112	• Very common • Cause: rubbing eyes on fences & other objects	• **Eyelid laceration** **DDx:** • Corneal trauma	• History • CS: **eye laceration** • Assess extent of laceration - Profound sedation required . Xylazine (Rompun®) & butorphanol (Torbugesic®) . Xylazine + ketamine or triple-drip anesthesia	• **Surgical repair** - Saline lavage, dilute Betadine® (povidone iodine) if infected - Freshen edges only (preserve all vital tissue, minimal wound debridement to prevent distortion of eyelid) - Precise closure (at least 2 layers) - PBZ (phenylbutazone) to prevent swelling - Systemic ABs over topical to avoid injury to repair - **Tetanus prophylaxis**
Cataracts M 326; C3T 601; C2T 456; S 649	• **Congenital > acquired**, focal or diffuse, Hereditary? In Quarterhorse & Appaloosa • CS: Visual defects, cloudy lens • Dx: Visualize, absence of menace response if severe, Ophthalmoscope • DDx: Synechiae, Lens luxation, Uveitis • Tx: Cataract surgery in foals at a few months of age has good results; Acquired: surgery only if bilateral; difficult & often unsatisfactory			

Retinal diseases & Optic nerve M 327; C2T 458: Rare, normal appearing eye; CS: blindness, night vision problems; Dx: Ophthalmoscope; No treatment

GENERAL

Endocrine Diseases

Condition	Facts/Cause	Presentation/CS	Diagnosis	Treatment
"Cushing's diz", Hirsutism, Pituitary adenomas, Hypertrichosis, Cushing-like diz M8k 403; IM 1297; I2M 1445; E 903; M 395; EM&S 839; C4T 487, 499; C2T 182	• **#1 endocrine diz** • Common in **old horses** & ponies, average age 19 yr, ponies >> horses because they live longer, Mares • **Cushing's-like diz in horses** - **Excess ACTH from pituitary gland** - Adenoma of pars intermedia - **Excessive circulating glucocorticoids** from hyperplastic **adrenals** - Positive regulatory - serotonin - Inhibited by dopamine - Not sensitive to negative feedback by glucocorticoids • Additionally hyperinsulinemia	• **Hirsutism** (long hair) 85% of cases - **Classic: thick, long, wavy, matted coat** - Sometimes no shedding, or - Shedding & growing winter coat later or earlier than normal - Transient patchy shedding - **M/b only "guard hair"**, chin or jugular grooves • **Chronic or recurrent laminitis** • **Sole abscesses** most common cause of euthanasia in "Cushing's" • **PU/PD** (polyuria/polydipsia), may drink up to 80 liters per day, normal 10-45 l/d • **Excessive sweating** (hyperhydrosis) • **Wt. loss w/ voracious appetite** • ↑ RR • **Skin diz** (rain scald/dermatophilus) - ± Supf. skin erosions under long hair coat • Potbellied • ± Delayed wound healing • Abnormal estrous cycle • Rarely blind - compressed optic nerve • **Chronic respiratory diz**	• **Hx of chronic diz, laminitis, skin diz, Hirsutism, old** • Lab: frequently normal CBC & chem panel - Stress leukogram - ± Hyperglycemic > 150 mg/dl • Urine analysis: glucosuria, ↓ specific gravity, m/b ketonuria • **Dexamethasone suppression test** (see box) • PM (postmortem) - Mostly seen at this time - Sharply delineated tumor on pituitary gland m/ extend into hypothalamus & posterior pituitary - Both adrenals abnormal, evident in cortex	• **Few horses treated successfully** • Excellent husbandry & feeding • Manage 2° complications - Least expensive - 10 yrs of life • **Cyproheptidine** HCL (Periactin®) PO 3 mo - Inexpensive, antiseritonin effects - Limited success - 6-8 wks before clinical improvement, 8-12 wks to lower cortisol to normal - Some do not respond • **Pergolide**, a dopamine agonist only in experimental stages, so very $$$ - Must show horse nonresponsive to cyproheptidine for the drug company to release it

DDx:
- Hyperlipemia
- Hypothyroidism
- Laminitis
- Hypoadrenocorticism
- Diabetes mellitus
- Pheochromocytoma

Cyproheptidine

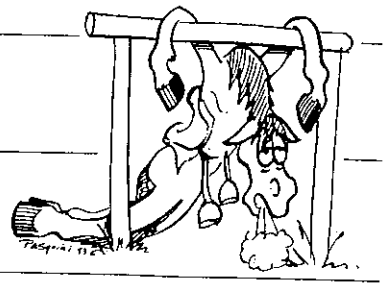
Prognosis: Poor w/ CS

Pituitary tumor
CS: Hirsutism, PU/PD, lameness, sweating
Dx: Dex suppression
Tx: Poor Px, Cyproheptadine

Endocrine tests:
- **Resting cortisol levels**
  - Adenoma: high cortisol in morning & afternoon
  - Other cases, normal in morning w/ no change in afternoon or evening
- **Dexamethasone suppression test**
  - Procedure - baseline cortisol taken before 8:00 a.m.
    . IM (try to stay at low end) Sample 4, 12, 24 hrs
  - Normal: great ↓↓↓ in cortisol
  - Functional adenomas: **not** a great ↓ in cortisol
    . Abnormal back to baseline sooner than normals
- Insulin tolerance test
  - Only in horses w/ hyperglycemia
  - Use if suspect cause of hyperglycemia pancreatic diz & not Cushing's
  - 95% of adenoma patients resistant to this test
- ACTH stimulation test
  - Used to DDx adrenal exhaustion from pituitary adenomas

Adrenal exhaustion * IM 1301; I2M 1449; E 1404; EM&S 1748; M 393

- **Hypoadrenocorticism: "turn out" or "let-down" syndrome, rare disorder**, much talked about, poorly documented, blamed on racehorse's **poor performance**; may be due to long term administration of **corticosteroids**
- CS: depression, anorexia, weight loss, **exercise intolerance**
- Dx: **Hx of corticosteroid admin., ACTH stim. test** (blunted cortisol response), low plasma cortisol & leukopenia
- Tx: Reduce stress, stop training, rest



Diabetes insipidus * IM 1300; I2M 1448; E 888; M 394

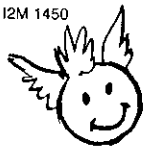
- **Pancreatic disorders extremely rare** • **release of ADH** (antidiuretic hormone) **from posterior pituitary**
- Cause: 2° to pars intermedia enlargement or idiopathic
- **CS: PU/PD** (polyuria/polydipsia); otherwise normal animal, hypoglycemia (from anterior pituitary involvement)
- Dx: Urine specific gravity < 1,010; failure to concentrate on water deprivation test
- DDx: 1° renal diz, "Cushing's diz", Psychogenic polydipsia syndrome

Diabetes mellitus IM 1306; I2M 1454; EM&S 1749; E 899; C2T 181 • **1° diz rare in horse**; due to chronic pancrealitis ("bastard" strangles, strongyle migration)

* • Most cases actually 2° to equine Cushing's diz (uncontrolled secretion of ACTH & cortisol, resulting in insulin-resistant hyperglycemia)

Psychogenic polydipsia syndrome IM 1300, C4T 488 • Relatively rare • CS: PU/PD • Dx: Water deprivation test; concentrate up to 1.025

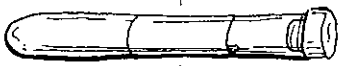
Pheochromocytoma IM 1302; I2M 1450 *



- **Adrenal medulla tumor**
  - Chromaffin cells
  - Secretes catecholamines
- **Usually benign**; incidental finding at necropsy
- Older horses; no sex predilection

- Generally asymptomatic (find on PM)
- Hyperhydrosis (sweat a lot)
- Recurrent colic, apprehension
- PU/PD
- ↑ HR, RR
- Appear painful (mis-Dx for colic)
- Muscle tremors often generalized

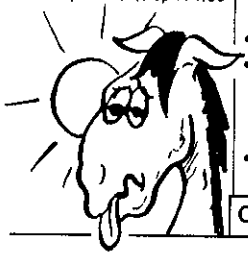
- Hypoglycemia
- ↑ neutrophils
- ↑ PCV & TPP due to splenic contraction (from catecholamines
- **Measure norepinephrine levels** (not done in many labs, Michigan does)



DDx:
- Colic
- Pituitary adenomas (sweating also)

- Potentially to remove affected adrenal
- Hard to do in reality due to anatomical location

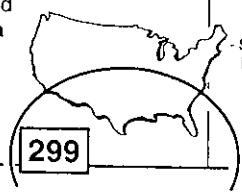
Anhydrosis, Nonsweater IM 36, 1302; I2M 1451; E 837; C3T 703; C2T 187; Pop 44-7/98



- **Inability to sweat** in hot climates
  - "Drycoat", "nonsweater"
  - Gradual onset
  - Some can't sweat in summer, but can in winter
- 1° in SE & SW USA & tropical areas
- **Cause unknown**
  - Neurotransmitter control of sweat glands implicated
  - Theory: lack of adrenergic receptors in skin
- Any age, related to heat stress

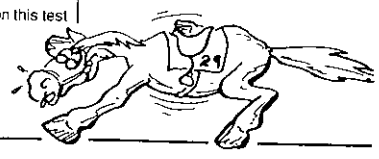
Can in winter not in summer

- **Anhydrosis** (inability to sweat) in hot weather at first
  - Progresses - don't sweat any time
  - Total body or limited to focal areas
- ↑ RR to dissipate heat
- **Exercise intolerant**
- Febrile, especially when exercised
- Alopecia on face

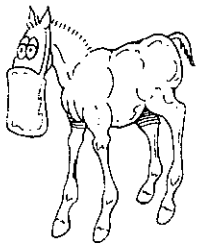


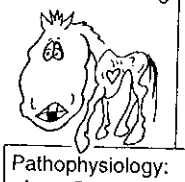
- Hx, CS: Inability to sweat
- Lab: Stress leukogram
- Intradermal epinephrine test in neck region
  - Use control of sterile saline
  - 0.5 ml of 1/1000 & 1/10,000 + control
  - Normals will sweat w/n 1 hr
  - Abnormal - totally or partially anhydrotic
    . No response or delayed response of 4-5 hrs
  - Some in early diz will sweat on this test in winter, not in summer

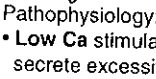
- Minimize concentrates in diet
- Electrolyte solution in drinking water
- Misting fine, rest until winter
- Move to cool environment

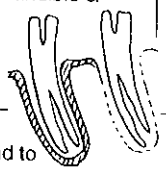


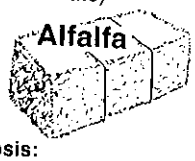
Condition	Facts/Cause	Presentation/CS	Diagnosis	Treatment
Nutritional secondary hyperparathyroidism, Big head diz, Bran diz IM 1305; I2M 1454, 1469; E 895; C3T 119, 207; M 128; Pic 24	• **Young, growing horses** & ponies (also pigs and ruminants) • **Problem of past**, less prevalent now due to understanding nutrition • **Absolute Ca deficiency** • **Cause: diet - excessive P over Ca** - **"Pampered" horse diets** . Too high in grains (especially bran, low in Ca) & low in roughage (high in Ca) - Vit. D toxicosis . Overzealous supplementation . Plants high in Vit. D activity (*Cestrum diurnum* [wild jasmine, day cestrum]) - Pasture high in oxalate plants (unavailable Ca) (*Setaria sphacelata, Cenchuris ciliaris, Panicum maximum*) • Chronic diz	• **Lameness** - Early stiff gait, shifting leg lameness - Enlarged painful joints (bilateral) • **Teeth fall out** & difficult mastication - Lamina dura: resorbed, causing teeth to fall out • **"Big head"**: fibro-osteodystrophy of facial bones, 1° maxilla & mandible (symmetrically) - Harder than soft tissue swelling • **Weight loss**	• **CS: "Big head"**, lameness, teeth • Analysis of feed for Ca, P & Vit D content • Lab: ↑ **Serum Ca** - Normal serum PO_4 . ↑ Renal secretion of phosphorus & ↓ Ca excretion • ↑ ALP w/ overt bone diz (young naturally have higher ALP) • **Rads support Dx**, done in field - Loss of lamina dura - Delineation of mandible & maxilla	• **Correct diet** (take off bran) - Alfalfa roughage w/ high Ca content - Supplement w/ limestone (Ca^+ carbonate) **Prognosis:** • **Good** if lame, not "big head" - Resolution in 1-2 mos w/ proper diet • **Poor if "big head"**, will never resolve due to bony changes & teeth loss



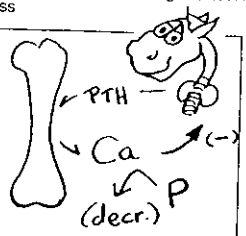








Pathophysiology:
- **Low Ca** stimulates parathyroid gland to secrete excessive PTH
- PTH pulls Ca from bone
- High phosphorus indirectly affects by lowering blood Ca
- **Parathyroid hyperplasia & metabolic bone diz**
  - Osteoclastic activity (eats bone) leads to lameness
  - Osteoblastic activity (builds bone) leads to fibrohyperplasia which leads to osteoid formation (bone substance that doesn't calcify)
- **Results in osteodystrophy** due to more osteoblasts than osteoclasts
  - Widespread pathological calcification of soft tissue (arteries, tendons & ligg.)
- **Obscure lameness**
  - Microfracture of subchondral bone & resulting degeneration of articular cartilage
  - Ligament tearing from periosteal attachments
  - Folding fxs of long bones



Growing foals, ↓ Ca
CS: Big Head, lameness, teeth loss, wt. loss
Dx: Hx, SC, Lab
Tx: Change diet

Neonatal hypothyroidism

IM 1303, 1579t; I2M 1451; E 892; M 394; EM&S 1747; C4T 502; C2T 185; Tox 456, M8k 2128; Mk 283

- **Hyperplastic goiter in neonates**
- **#1 thyroid disorder** in horse & small ruminants
- **Young foals**
- Adult not documented
- Dam usually asymptomatic
- Association between myopathies & hypothyroidism

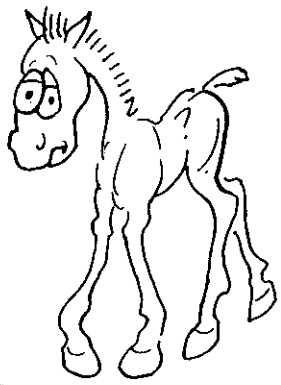
Cause:
- **Dam - excessive intake of iodine** (in kelp feed) or plant goitrogens; See TOX pg 320
  . Thiocyanates (SCN) contained in plant
  . Infect foal *in utero*

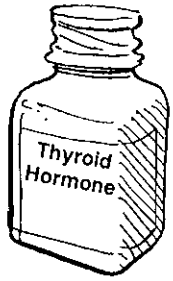
Pathophysiology:
- Low thyroid hormones cause TSH (thyroid stimulating hormone) stimulation of pituitary gland
- Leads to thyroid enlargement

Hypothyroidism
- **Goiter**, m/ or m/not be seen
- **Poor performance**
- Weak, lethargic
- **Incoordination**
- **Poor suckle reflex**
- **Poor righting reflex**
- **Hypothermia** (low metabolic rate)
- **Angular limb deformities**, tarsal & carpal bones - 2° to delayed ossification
- **Tendon contraction** &/or rupture
- Retarded bone development
- M/b born asymptomatic, but at 2 weeks skeletal lesions (particularly tarsus)

- **History, Clinical signs**
- **PE: Grossly enlarged thyroid**
- **↓ Thyroid hormones**
  - Bute will give false positive (↓ protein carrier so total thyroid hormone less)
  - T3/T4 levels & check against age-matched controls
  - Free T3 is physiologic component of this
  - T3 has diurnal variation
  - Drugs such as Lasix® interfere w/ binding of T3/T4
  - Horses w/ systemic illness will have lower than normal values
- **1° TSH stimulation response test** (1 day old foal)
- TRH response test (rare)

- **Thyroid hormone supplementation (iodine)** if hormone level is low, if CS & normal levels then deficiency occurred during critical developmental period
  - Therapy only effective during low hormone levels
  - Developmental lesions can't be reversed

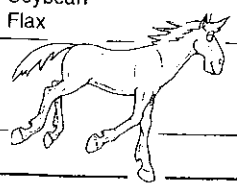




Plants w/ goitrogenic compounds
Mustard family (*Cruciferae*)
- *Brassica* spp — Rape seed, Mustard, Kale, Broccoli, Cabbage & Turnip
- *Glycine max* — Soybean
- *Linum usitatissimum* — Flax

Neonatal goiters
CS: Weak, angular limbs
Dx: TSH stim. test
Tx: T4, No reversal

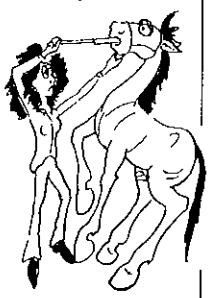
Adult hypothyroidism IM 1304; C4T 502: not documented in horses, but probably occurs (Standardbreds & Thoroughbreds)
- Tx: Adult horse generally 20 mg thyroxin/d in 1000 lb horse - 2 wks to see change (and lots of little pills to grind & put inmolasses)
  - Alternatively iodinated casein which contains 5 grams thyroxin, sprinkled on feed, also takes time to respond



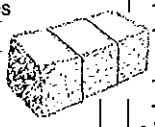
Hyperthyroidism IM 1304; E 894: not documented in horses

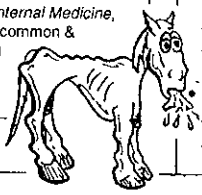
Condition	Facts/Cause	Presentation/CS	Diagnosis	Treatment
Anthrax **Splenic fever, Charbon, Milzbrand** M8k 432; Mk 359; IM 1118; E 365; EM&S 532	• **Infectious disease** • Cattle & sheep > **horse** & goat > pig & man • **Septicemia** & highly fatal - Horse m/ localize in tonsils & intestines & m/ recover • ***Bacillus anthracis*** - Normal flora of **alkaline soils** • **Spore forming**: persists in contaminated environment Transmission: ingestion of spore-containing forage • **Reticuloendothelial system & vasculature destruction** • Usually Summer • Isolated areas in USA **DO NOT Necropsy in field** **CS: Edema, bleeding, necrosis, Sudden death** **Report**	• Classical: **edema, hemorrhage & necrosis** - Pyrexia [fever], colic, enteritis - Dyspnea - SQ edema of ventrum (painful) - **Death** in 2-4 days • **Chronic form** **DDx:** • Colic - Intestinal torsion (pg 69) • Sudden death - Lead poisoning (pg 269) - Sunstroke - Malignant edema (pg 303) - Purpura hemorrhagica (pg 140) - Equine infectious anemia (pg 136) - Colic (pg 54-81) - Lightening strike	• **DO NOT necropsy in field** • **Sudden death, CS**, anthrax area • **Blood exuding from orifices** - Failure of blood to clot • **Incomplete rigor mortis** • Rectal - enlarged spleen • Lab: -Blood smear, cotton swab, blood from jugular, ear or piece of spleen - ELISA, string of pearls test, FA, animal inoculation • PM: for 1st animal, in area that can be disinfected	• **Rapid onset & death - often no time for Tx** • Segregate animal immediately • **Report** • Penicillin to other members of herd w/ temperature 1° above normal • Vaccinate afebril horses at risk in outbreak **Prognosis: Guarded** **Prevention** • Vaccines in problem areas • Hygiene & quarantine • Reportable diz in most states • Annual vaccination in enzootic areas • Bury carcasses
Tularemia M8k 494; Mk 371; IM 1119	• Infectious diz of man & animals • *Pasteurella (Francisella) tularensis* (gram negative rod) • Natural host - **rabbits** & rodents • Transmission: ticks, fleas, deerflies • **Sheep** most commonly affected, documented in horse **Sheep >>> horse** **Septicemia**	• **Acute septicemia** - Nonspecific signs: fever, anorexia, depression, cough, ↑ RR, diarrhea, stiffness & edema of limbs • Localized granulomatous lesions of organs	• Culture organism • **Ticks on carcass**	• Early Tx effective • Aminoglycosides, cephalosporins • Remove insects • Fresh water
Lyme diz, Borreliosis M8k 436; Mk 359; IM 1118	• Infectious diz of horses & man & other animals • **Tick** transmitted (*Ixodes* spp.) • Spirochetes - *Borrelia burgdorferi* **Humans - Tick**	• **Arthritis & uveitis** in a pony • **Encephalitis** in an adult horse	• IFA & ELISA for antibodies to *B. burgdorferi* • Can't culture to Dx	• No controlled studies in horse • Humans antibiotic early helps - Chronic cases less responsive - over 2 years of Tx
Brucellosis M8k 998,1001; Mk 469, 667, 670; IM 1180, 1233, 1008	• *Brucella abortus* - **Fistulous withers** (inflammation of supraspinous bursa betw. supraspinous lig. & spines of thoracic vertebrae 2-5) . M/ extend to osteomyelitis of vertebrae - **Poll evil** (inflammation of atlantal bursa under ligamentum nuchae) - Occasional abortions - Joint & tendon sheath infection • *Actinomyces bovis* also often isolated • *Onchocerca* spp (worms) implicated • Brucella can pass through unbroken skin • **Infected cattle** & contaminated milk source of infection	• **Fistulous withers** • **Poll evil** • **Heat, pain & swelling** • **Fistula**: open, purulent, draining lesions • Lethargy, fever & generalized stiffness **Contact w/ cattle** **CS: Fistulous withers & Poll evil** **Tx: Vaccine - Flush - Sx excision**	• CS • **Contact w/ infected cattle** • Agglutination test • Often can't be isolated	• Killed Brucella vaccine injections • Fistula: flush w/ dilute Betadyne® + ABs • Surgical excision & drainage **Prevention:** • **Public health - infects man** • Remove from Brucella + cattle • Fly control • Correctly fitting saddles & harnesses
Malignant edema, Clostridial myonecrosis * M8k 441; Mk 327; IM 1358; E 296	• **Rare in horse** • **Ruminants**, horse, man • Acute diz of **skeletal muscles** • *Clostridium septicum* in horse usually • Infectious, but not contagious • Transmission - Lacerations, injections, castrations, parturition	• Site of organism entrance - **Soft, pitting edema** w/ little gas formation - Spreads rapidly - gelatinous exudate - M/ become emphysematous • **Toxemia** (lameness, fever, ↑ HR, congestion of mucosa)	• CS & Hx of injury **DDx:** • Limb trauma • Punctures • Staphylococcal cellulitis • Other abscesses - *Strep. actinomyces*, Staph, *Corynebacterium pyogenes*	• Surgical drainage • ABs, penicillin or penicillin-streplomycin • Fluids for shock
Malignant hyperthermia M8k 738; Mk 438; IM 1346	• **Fever** & muscular rigidity associated w/ **anesthetics &/or muscle relaxants** - **Halothane & succinylcholine**	• Muscular stiffness, cramping or fasciculations • **↑ Body temp** • ↑ or irregular HR • Irregular breathing pattern • Variable blood pressure	• CS & Hx of anesthesia or muscular relaxants • **Monitor temp during anesthesia**	• Remove stimulus • **Cool animal** w/ alcohol or cold water baths
Fever - Anesthetics or muscle relaxants				
CID, Combined immunodeficiency M8k 584; Mk 435; IM 1592; E 420; C4T 585; C2T 217; Pop 36-7/97	• **Fatal diz of Arabian foals** • **Combined (B & T-lymphocyte) immunodeficiency** • Probably inherited	• **Adenovirus pneumonia or other 2° infections** - ± Death at 2 month old **Refractory to treatment**	• **Arabian foal with CS** • Lab: - Lymphopenia (1000/mm) - Intradermal PHA test (T response) - Immunodiffusion for IgM, no IgM • Postmortem: thymus difficult to ID & has abnormal architecture	• **Refractory to Tx**

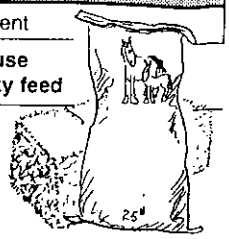
Condition	Facts/Cause	Presentation/CS	Diagnosis	Treatment
Weight loss I2M 181, 905; IM 181	• Associated with: **1. Anorexia - usually 2° to a 1° disease condition** - Loss of appetite (desire to eat) . Complete or partial . Usually 2° to 1° disease - Differentiate from dysphagia (difficult swallowing) by observation **2. ↑ Nutrient demands** - Physiologic (colds, weather, growth, exercise, pregnancy & lactation) - **Pathologic** (sepsis, parasitism, burns, peritonitis, surgery or trauma) - **Parasitism** . Common cause of weight loss . Competition for nutrients .. Inflammation (↑ requirements) .. Malassimilation, malabsorption .. Migration damage to organs or vasculature .. Anorexia in advanced stages **3. Malnutrition** - Poor quality feed - Deficient micronutrients (copper, cobalt [Vit B12] or Vit A) • Stress of disease increases sympathetic activity - ↑ Epinephrine release, impaired insulin release & enhanced glucagon secretion - Hyperglycemia (↓ insulin release, enhanced glycogenolysis & gluconeogenesis) • **Granulomatous enteritis** - Associated w/ malabsorption or malassimilation syndromes - Anorexia absent, good appetite w/ wt. loss	• **Weight loss** - short or intermediate duration • **Dehydration** • **Electrolyte imbalances** &/or acid-base imbalances **Weight loss** (pg 348) **Common causes** • **Parasitism** (pg 24, 35) • **Malnutrition** • **Teeth** & jaw problems (pg 18-22) • COPD (chronic obstr. pulm. diz) (pg 121) • Strangles • Pneumonia (pg 111-116) • Lung abscesses (pg 113) • *Rhodococcus equi* (pg 113) • Pleuritis (pg 118) • Sand colic/impaction (pg 78) • Cribbing, Wind sucking (pg 307) • Pyrrolizidine alkaloid toxicity (pg 89) • *S vulgaris* thromboembolism (pg 75) • SCC of stomach (pg 26) • Gastroduodenal ulcers (pg 26) • Neoplasia • Obstruction of small colon (pg 77) • Peritonitis (pg 53) • Abdominal abscesses (pg 65) • Wound myiasis • Infectious arthritis *From Large Animal Internal Medicine*, Smith (see for less common & uncommon causes)	• **Note other CS**: diarrhea, dysphagia, coughing & polyuria • **History (Hx)** - Amount of weight loss - Dietary Hx, quality of feed, feeding practices, esp. if fed in groups - Deworming Hx - Environmental toxic substances • **Physical exam (PE)**: CS of concurrent disease (diarrhea) fever, dysphagia [difficult swallowing], dentition, melena, icterus, dyspnea, tachycardia - Can animal eat? - Weigh horse • **Analyze diet** - Adequate intake - Inadequate intake . Adequate feed available .. Anorexia due to 1° disease . Inadequate feed available .. Malnutrition • **Fecal exam** - Microscopic - parasite ova - Fecal occult blood for melena - Diarrhea • Lab - CBC, PP (plasma proteins) & fibrinogen - Inflammatory process (↑ WBCs, ↑ PMNs, ↑ fibrinogen, ↓ PP: fibrinogen ratio [<10]) - If anemia, calculate RBC indexes - Chemistry: Hypoalbuminemia assoc. w/ internal abscessation, malnutrition, liver, renal, granulomatous bowel diz • Function tests: - Oral glucose & D-xylose absorption tests to access carbohydrate absorption - Direct (conjugated) bilirubin to access fat absorption	• **Treat 1° cause** • **Good quality feed**

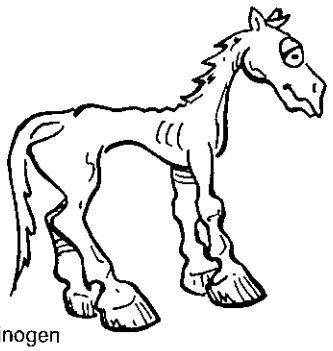


#1 parasitism
Malnutrition
Teeth

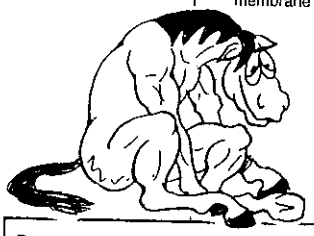








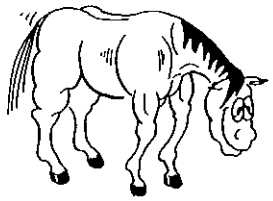
Hyperkalemic periodic paralysis, HYPP M8k 767, 904; IM 1340, 397; C3T 117; M387; Pop 137, 246	• **"Impressive" syndrome - inheritable**: autosomal dominant trait in offspring of Impressive. They do better in halter classes (heavily muscled). - **Pure & part quarterhorses**, thus in Appys & Paints • **Evident by 2-3 yr-old** • Cause: Mutation of Na^+ channels - ↑ K^+ (potassium) during episode . Not hi between episodes - **Temporary loss of muscle function** due to persistent depolarization of muscle cell membrane	• **Variable**: from no episodes to severe • **15-90 min. episodes** (variable) • ± Prolapse of 3rd eyelid, Sardonic grin • Sweating (hyperhydrosis) • **Muscular fasciculations** (myotonia) (starts in front then generalizes, "rippling") • **Muscle weakness**, stagger & sway in rear end, bulking, inability to raise head • **Foal: stridor, laryngospasms** • **"Collapse"/recumbency, dog sitting, inability to rise** (severe) • **BAR**, fully conscious, show no pain, anxious • ± Loose feces • **CS resolve spontaneously w/o therapy, or may die** (cardiac standstill) • **Normal between episodes**	• **Hx: 1/4 from Impressive** • **Muscle weakness episodes** • **During episodes** collect blood - ↑ K^+ > 5 mEq/L (normal 3-5) usually but not always, life threatening - Bradycardia - cardiac standstill - ↑ Temp. usually, Hemoconcentration - Normal CPK (not altered unless muscle damage from recumbency) • After episode: K^+ returns to normal (all lab parameters normal) • **DNA test**: accurate, whole blood EDTA to U of Cal, Davis, takes 3 wks • KCl provocation test: risky & replaced w/ DNA test • EMGs (electromyography): quick screening test for DNA: ↑ activity, doublets	• **Emergency during episode** - **5% Na bicarbonate** (1-2 mEq/kg) drives K^+ into cells by pulling H^+ out of cells - **Ca gluconate** IV beneficial 23% sol) - Dextrose (6 ml/kg - 5% sol.) diuresis - Potassium-free fluids - Possibly insulin (hypoglycemia) • **Foals: ± tracheotomy** **Prevention:** • ↑ Renal excretion of K^+ - **Acetylzolamide** PO for life (a carbonic anhydrase) (induce kaluresis by proximal tubules) - Phenytoin, hydrochlorthiazide • Diet: low potassium (K) - **Timothy or Bermuda grass hay** - ↓ Alfalfa & brome (Hi in K) • Regular exercise or access to pasture



DNA test

Quarterhorse - Inheritable
CS: Episodes of weakness
Dx: DNA probe
Tx: Bicarb,
Prevent: Acetylzolamide, Timothy hay

DDx:
- Colic (pg 54-81)
- Hypocalcemia
- Exercise myopathy
- Tetanus (pg 253)
- Chronic renal failure (pg 150)

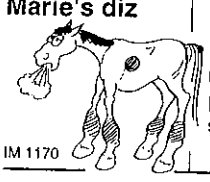


Bicarb

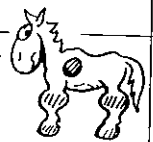
Acetylzolamide

Timothy hay

HPO, Hypotrophic (pulmonary) osteopathy, HO, Marie's diz	• **Associated w/ pulmonary diz** (most commonly, but not always) - Pulmonary abscesses or neoplasia, rib fx w/ pleural adhesions - 1° Abd. disorders (ovarian tumors) **Formation of subperiosteal new bone growth of distal diaphyses of long bones, axial** skeleton & facial bones	• **Nonedematous swelling of extremities** (over distal diaphyses) - Warm & throbbing, Asymmetrical • **Taut skin** over dorsal cannon bone • Swelling & pain of joints, **Stiff gait** • Pain on manipulation, reluctance to move • **± Pulmonary signs** if associated - **Cough** - **Nasal discharge**	• **CS: swelling + pulmonary** • Radiographs: - **Periostitis** of proximal & distal long bones - Generalized soft tissue swelling - **Chest films** for 1° pulmonary lesion - Abd. films for 1° abd. lesion • **Ultrasound of abdomen & thorax** for 1° lesion	• **Tx & cure 1° problem & HO will disappear** **Prognosis:** Depends on cause & its treatment **DDx:** • Pulmonary lesions • Intra-abdominal mass • Fluorosis



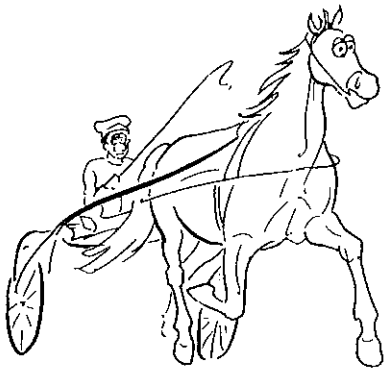
IM 1170



Behavior - Anomalies

Condition	Facts/Cause	Presentation/CS	Clinical Sequelae	Treatment
Weaving M8k 1165; Mk 920	• **Chronic stall confinement** • **Boredom**	• Weave from side to side while standing in same position	• Condition loss • Sore back	• **Cross tie head** • Hobbles on front limbs • **Exercise critical** - Riding, lunging or mech. walker
Pawing Mk 920, EM&S 766	• Cause unknown - Confined & isolated	• Pawing		• Put out to pasture • Hobbles & kick chains - limited success
Stall walking, Stereotypic pacing M8k 1165; EM&S 766	• Stall confinement of horses, zoo & circus animals & dogs	• Pacing back & forth continuously	• Condition loss	• **Turn out to pasture**
Head nodding, Shaking M8k 1165; Mk 920, EM&S 767	• Stereotypic behavior • Boredom • Teeth problems	• Head nodding or shaking	None	• Control difficult once established • Heavy fringe on brow band to distract from behavior • Check teeth & bit
Self mutilation M8k 1166; Mk 921	• **Confinement & isolation**	• **Self mutilation**	• **Injuries**	• ↑ Exercise & minimize stress
Mobile alarm Mk 922	• Hyperactive	• Tendency to sudden flight • Lose riders	• **Injury to thrown rider**	• Limit likely stimuli • ↑ Exercise to dissipate excess energy
Threatening behavior M8k 1163; Mk 922; EM&S 887	• Bad disposition	• Flatten ears • Bare teeth • Rush at people	• **Injury to people**	• **Restraint** • Punishment & reward to adjust • **Use caution**
Biting Mk 922; EM&S 766	• Bad disposition or playful	• Nip w/ incisors • Ears laid back, lips retracted & teeth bared • Sudden bite w/o signs • Others playful	• **Injury to people**	• Muzzling • Punishment
Shying Mk 922	• Fast moving object around horses head	• Overreacting to stimuli		• Companion animal to keep company • Blinkers, especially when riding

Kicking, Striking M8k 1165; Mk 922	• **Hyperactive temperament** • **Stallion & light horses**	• Striking w/ both front feet while rearing • Striking w/ one front foot while standing • Kicking w/ both or one rear limb at a target or just kicking	• Injury to people	• **Difficult to control** • **Caution** • **Punishment** • **Hobbles or kick chains**
Aerophagia • **Crib biting** M8k 1165; Mk 923; EM&S 766; C2T 125	• "Cribber" or "Crib-biter" • "Cribbing" • Stall confinement • Boredom	• **Grasps edge of manger** ("crib") or other object w/ incisors • Push down w/ incisors & raise soft palate • Wind swallowing or gulping • Gastric distention	• **Loss of condition** • **Occasional colic**	• **Adequate exercise** • **Put out to pasture** • **Windsucking strap**" around cranial throat (tight to make arching neck uncomfortable, pointed piece towards pharynx) - "Gullet-piece" that has a depression for trachea so doesn't interfere w/ resp. - Remove strap for eating • Remove crib after feeding • If cure m/ substitute other stereotypic behavior • Surgical sectioning of throat muscles (last resort)
• **"Wind sucking"** M8k 1165; Mk 924		**Repeated forceful swallowing of air** - Nods head & neck several times - Jerks head upwards, sucks air by contracting larynx w/ neck flexed - Gastric distention		
Tongue dragging Mk 923	• Boredom	• **Hangs tongue out** (often folded longitudinally) • M/ suck on tongue • Foamy mouth		• Pain (pinch) to extruded tongue • Restrain tongue w/ net or spoon bit • Amputate tip of tongue (unethical)
Licking, Crib-whetting Mk 923		• Repeatedly running tongue over part of stall		• Salt lick (salt defc?)
Pica Geophagia, Soil eating, Wood chewing M8k 1164; Mk 927; C2T 125	• **Depraved appetite** • Nutritional deficiencies • Boredom	• Eat abnormal things - Chew wood - Eat sand or soil - Litter	• **GI problems**	• Check nutritional defc.; iron or phosphorus • Check for parasites • Enforce exercise



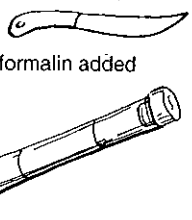
TOXICOLOGY

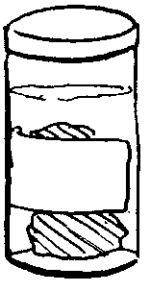
Poisonous Plants

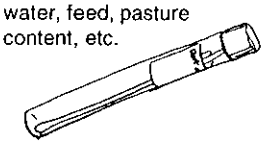
Diagnosing poisonings

M8k 2018; IM 1626, C4T 652; C3T 337, Tox 44

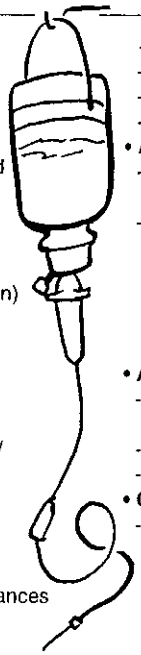
- **Sudden death**
- **History** of circumstances & sequence of events & progression of signs
- **PM** (postmortem)
  - Always performed
  - Presence or absence of lesions, both important
- **Chemical analysis - Lab**
  - Tissues usually frozen
  - No preservatives such as formalin added
  - Live animal
    . 10 ml of whole blood
    . 50 ml of urine
    . 200 g of feces
  - Dead animal
    . 5 ml of serum
    . 10 ml of whole blood
    . 50 ml of urine
    . 100 g of liver, kidney, spleen & body fat
    . Half the brain
    . 500 g of stomach contents
  - If in doubt about tissue, call lab 1st before collecting
  - Environmental samples: water, feed, pasture content, etc.



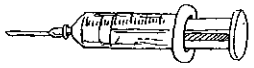




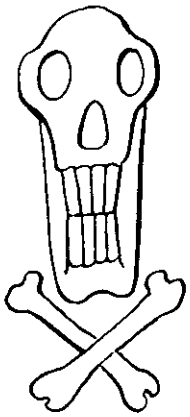
Treatment of poisonings:



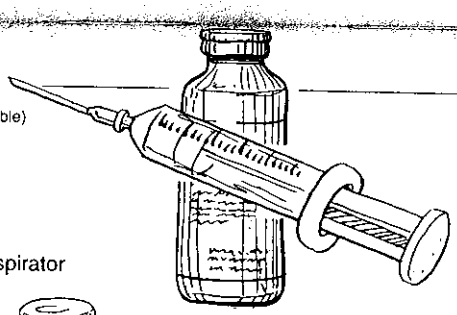
- **Prevent continued absorption & assist elimination**
  - **Lavage & laxatives** (removes unabsorbed material & limits absorption)
- **Antidotes**: some have, others don't
- Detoxifying agents (assist metabolism & protect organs)
- Fluids (maintain kidney perfusion & excretion)
- **Skin:** Bath w/ large volumes of water
- **Oral route**: Activated charcoal
- **Toxins in small intestine**
  - Laxatives (sodium sulfate or magnesium sulfate)
  - Mineral oil (mild laxative & protectorant)
  - Gastrointestinal binding agents (milk & raw eggs, prevent absorption)
- **Fluids** (Calcium, 5% dextrose & large volumes of electrolyte solution)
  - Provide energy & conjugation material
  - General nonspecific detoxification
  - Maintain cell membrane & intracellular balances
  - IV use maintains adequate urine flow
- Colonic lavage
- Hemodialysis
- **Symptomatic & supportive Tx**
  - Positive respiratory assistance (give time to Tx & recover)
  - Control body temperature (blankets or ice baths)
- **Detoxification**
  - Antidotes if agent known

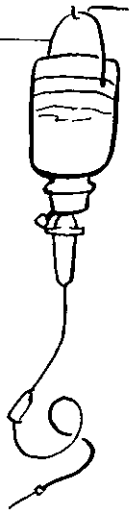


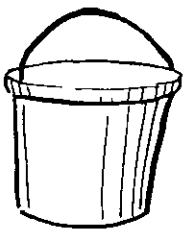
  - Rumenotomy to remove toxins
  - Diuretic to ↑ secretion, Lasix® (furosemide)
  - Corticosteroids (dexamethasone)
  - Lactated Ringer's Na containing polyionic fluids
- **Acid base disturbances**
  - Lactated Ringer's safest if acid-base status unknown
  - Measure w/ CO_2 apparatus or blood gas machine
    . Metabolic acidosis most common in toxicity
    .. Sodium bicarbonate (1.3%) administered slowly over hours (Dose: kg BW x 0.6 x base deficit)
    . Alkalosis - sodium chloride (0.9%, 10 ml/kg/hr) usually sufficient
- **Analeptic agents** for respiratory depression
  - Short lived, monitor patient continuously
    . Doxapram (5-10 mg/kg) pentyenetetrazol (6-10 mg/kg)
  - M/ induce convulsions
  - Respiratory support preferred in CNS depression
- **Convulsions:**
  - Diazepam (Valium® IV or IM), phenobarbital, pentobarbital sodium

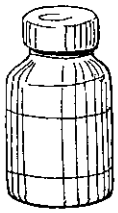


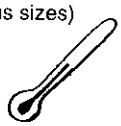
Emergency kit (keep stocked & readily available)

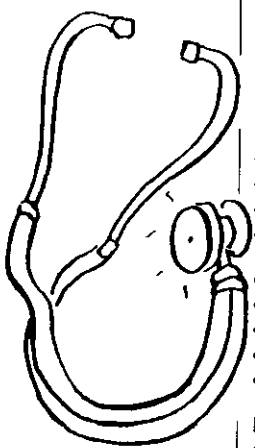


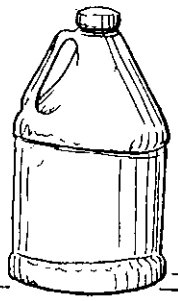


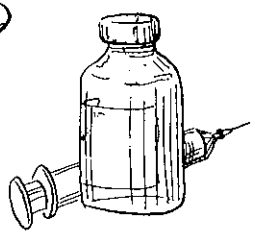


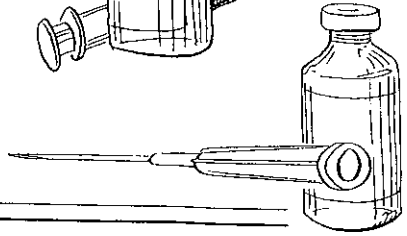












Equipment
- Endotracheal tubes (several sizes)
- Gauze & rolls of tape
- IV catheters & stylets
- Compression bag (AMBU bag) or mech. respirator
- Hypodermic needles
- Syringes
- Stethoscope
- Stomach tubes (several sizes)
- Thermometers
- Urinary catheters (various sizes)
- Venostomy kit

Parenteral medications
- Amphetamines
- Atropine sulfate
- Barbiturates (phenobarbital, pentobarbital)
- Calcium borogluconate
- 5% dextrose
- Diazepam
- Lactated Ringer's
- Normal saline
- 2-PAM (protapam chloride, pralidoxime)
- 5% sodium bicarbonate

Oral medications
- Activated charcoal
- 5% Dioctyl sodium sulfosuccinate (1/2 L/450 kg)
- 20% Magnesium sulfate sol.
- Mineral oil

Miscellaneous
- Oxygen

INSECTICIDES

Chlorinated hydrocarbons, CHC, Organochlorine insecticides

M8k 2063; Mk 1666; IM 1630; EM&S 762; C2T 657; Tox 286

- **Use curtailed because of persistence in environment** (DDT [prototype]; **Only lindane, methoxychlor & toxaphene** approved for use around livestock, **Recommended levels of spraying usually safe, absorbed all routes, accumulate in tissue** (fat soluble)
- **CS: Stimulation or depression of CNS, depression alternates w/ muscle activity** (head press, fasciculations of face & cervical mm.), Hypersensitive, **Convulsive seizures (unlike OPs)**, Continual chewing motions, Frenzied, Agitated, Ataxic, Abnormal postures (on sternum & hind feet), Comatose, **Death during severe seizure** or complete recovery, Thick saliva, Fever, Dehydration, Anorexia
- **Dx:** Exposure, **Convulsive seizures & neuromuscular involvement**, Levels in blood, serum or urine • **DDx:** Encephalitis, Meningitis
- **Tx: No specific antidote, Symptomatic Tx**, Dermal exposure: wash in soap & cold water, Oral: lavage & purgative, heavy mineral oil, Activated charcoal, **Sedate to effect** (Barbiturate, chloral hydrate or valium), **Remove stress from environment**, IV fluids or gastric tube

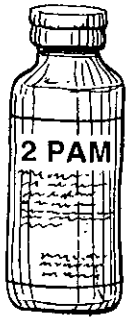
DDT/Lindane (persists) - CNS/Seizures - No antidote

Organophosphates, OPs

Organophosphorus insecticides

M8k 2066; Mk 1669; IM 1630; M 384; E 195; EM&S 762; C3T 338, C2T 658; Tox 298

- **Major cause of poisonings now,** ↑ use because reduced half life, **Pesticides & anthelmintics,** Contaminated feed or water, Trichlorfon, parathion, dichlorvos, malathion, ronnel, ruelene, chloryrifos, trichlorofon (for ascarids & Bots), Interaction w/ phenothiazine tranquilizers, succinylcholine, physostigmine, neostigmine, carbamates, **Similar CS & mech. to carbamate** poisonings, except **irreversible inhibition of acetylcholinesterase (AChE), Overstimulation of parasympathetic ANS, skeletal mm. & CNS**
- **CS: Acute (w/in an hour), Colic, Tucked abd.**, Patchy sweating, **Diarrhea, "Slobbering", lacrimation, Dyspnea**, Muscle tremors & contraction, ataxia & collapse, Tetany (saw horse stance), **Hyperexcitability or depression** (CNS), **Usually no convulsive seizure,** Miosis, Bronchoconstriction, Pulmonary edema, **Death from respiratory failure**
- **Dx:** Hx w/in 48 hrs + parasympathetic signs tentative Dx of OPs or carbamate poisoning, **Response to atropine therapy**
- **Tx: Emergency** (rapid progression), **Atropine** (0.1 mg/kg IV) to effect (mydriasis & absence of salivations), **Repeat** SQ every 2 hr m/b necessary (irreversible action of OPs), **ASAP: 2 PAM** (protopam chloride) IV every 4-6 hours; Dermal route bath w/ soap & water, Oral route - **Activated charcoal & osmotic laxatives** (MgSO4, magnesium sulfate), IV Fluids, ± respiratory support, **Contraindicated:** morphine, succinylcholine & tranquilizers



Major poisoning; CNS, Slobbering; Atropine, 2 PAM

Carbamate

M8k 2062; Mk 1665; IM 1603; E 195; C3T 338; Tox 298

- **Insecticides** (carbaryl), Not toxic w/ normal use, Inhibit acetylcholinesterase like OPs, **Reversible unlike OPs, Overstimulation of parasympathetic ANS same as OPs**
- **CS & Dx:** CS & diagnosis similar as organophosphate toxicity
- **Tx: Like OPs,** Atropine as in OPs, 1 Tx usually enough (because reversible), No need for 2-PAM, but it doesn't hurt (especially if can't DDx)

Facts, CS, Dx & Tx like OPs, except reversible

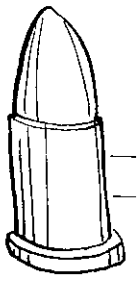
METALS & METALLOIDS (EM&S 1553)

Arsenic poisoning, Arsenicals

M8k 2024; Mk 163, IM 1633; C2T 662, 668; Tox 72, 80; EM&S 1714; E 189

- **Pesticides:** main source, **use greatly** ↓ because of livestock losses & environmental persistence, **Hazardous** when used as recommended Binds to **-SH enzymes & disturbs cellular respiration**
- **CS: Sudden death, severe colic, weakness, trembling, ataxia, salivation, diarrhea, paraparesis, stupor, death**
- Dx: **Hx** of exposure, CS (no other heavy metal has this rapid of GI signs), Feed, GI, liver, kidney, urine levels > 10 ppm
- Tx: Remove source, Mineral oil & saline purgatives, **Na thiosulfate**, Antidote: **BAL** (British Anti-Lewisite, Dimercaprol) IM ; Symptomatic (fluids, epinephrine, antihistamines, glucocorticoids)
- Prognosis: **Grave**

Sudden death • Tx: BAL • Px: Grave



Lead

- **See NEURO** pg 269, 1° cattle, CS: CNS/GI - "Roaring" • Tx: Ca EDTA, Supportive

Mercury, Hg

M8k 2073; Mk 1676; IM 1638; C4T 661; C3T 359; Tox 121 *

- **Rare,** Horses - Inorganic Hg containing **blistering agents,** If horse licks or used w/ DMSO (solvent action), Mercuric fungicide treated grains historically, Banned for years
- CS: Severe diarrhea (hemorrhagic), Vomiting, Ulcerative stomatitis, Acute toxic nephrosis
- Dx: Hx: Exposure, Kidney levels
- Tx: Symptomatic, Sodium thiosulfate IV or w/ BAL ($), Meat danger to humans, report to Feds

Rare, Blisters, Nephrotoxic, report

FEED ADDITIVES

Urea toxicity, Ammonia toxicosis, NPN

M8k 094; IM 1634, Mk 1693, Tox 160; EM&S 762

- Urea OK, **Ammonium (NH3) toxic** (cleaved from urea by microorg. in cecum of horse), **horse unlikely to consume enough,** NPN Feed additive (1-3%) for cattle
- CS: **CNS,** muscle tremors, aimless wandering, ataxia, colic, pulmonary edema, terminal convulsions to death, 3-12 hr in horse
- Dx: **CS, Hx, dietary exposure,** smell ammonia m/b, **Lab analysis** for NH3-N in ante- & postmortem specimens & feed
- Tx: **Fluid therapy**

Cattle - Unlikely in horse

Iodine, Iodidism

M8k 419; Mk 1472; IM 1629; Tox 145; EM&S 1683

- **Essential element,** present in thyroid hormone, GRAS, **Uses:** antiseptic, antifungal, antibacterial, expectorant, Watch for CS & stop
- CS: Lacrimation, Seromucoid nasal discharge w/ nonproductive cough, Scaly skin, Anorexia, Sweating, Joint pain, Reproductive problems
- Dx: CS, Continuous exposure at hi levels
- Tx: Remove source, rapid recovery • **Px: Good**

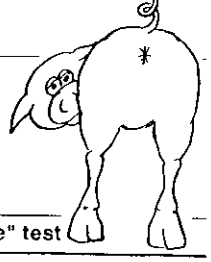
GRAS - Resp./Skin/Lameness/Repro

Salt poisoning,

M8k 2149; Mk 1358, 1726; IM 948; Tox 167

- **Mostly in swine & poultry,** occasionally in ruminants or horse when water consumption low, "Salt poisoning" misnomer because water deprivation required
- **CS: Thirst,** dry mucous membranes, constipation, hyperpyrexia (↑ temperature), **CNS abnormalities,** convulsions, death
- **Dx:** Hx: limited water intake (caretaker rarely admits), CS & course of events, Na concentration in plasma & CSF >160 mEq/L
- **Tx: Nonspecific & m/b futile, most die:** frequent, small amounts of water, fluids (brain edema), Induce diuresis - Lasix® (furosemide, 1.0 mg/kg)

Swine - Thirst/CNS - Most die



Monensin

- **See CIRC** pg 129, coccidiostat, Horse into or

fed cattle feed, dilated cardiomyopathy, "Horse-side" test

MOLLUSKICIDE

Metaldehyde
M8K 2074, 2145; Mk 1676; IM 1637; EM&S 777; Tox 325

- **Molluskicide**: slug & snail bait, Snarol®: looks & tastes like dog food, palatable, reported in dog, cat, sheep & children
- **CS: Acute** w/in 3 hrs, vomiting, colic, diarrhea, dyspnea, tachycardia, frothing, CNS (tremors, hyperesthesia, spasms, convulsions), death: resp. failure
- **Dx**: Lab: stomach contents for acetaldehyde (break down product of metaldehyde), PM : **formaldehyde odor**
- **Tx**: No specific antidote, symptomatic, sedate: diazepam, emetic or gastric lavage, fluids (Na lactate)

CNS/GI - No antidote

WOOD PRESERVATIVE, FUNGICIDE

PCP, penta,
Pentachlorophenol
M8K 2097; Mk 1696; IM 1631; EM&S 1708; C4T 663; C3T 362; Tox 239

Lick "leaky" wood

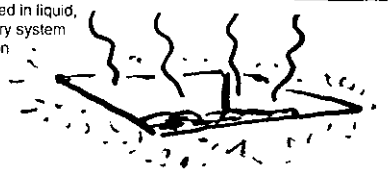
- **Pressure wood treatment** (soil fungi & insects), **Horses like to lick "leaky" wood, Not street drug called PCP** (angel dust), ↑ **O2 demand** by blocking oxidative phosphorylation & ATP formation, Irritating to skin & respiratory tract
- **CS: Acute**: muscular weakness, anorexia, lethargy, fever, **gasping,** dehydration, sweating, salivation, lethal: cardiac & muscular collapse & death • **Chronic: anemia, weight loss**
- **Dx**: Treated wood in environment, ↑ BUN, proteinuria, **Blood: 40-80 ppm PCP, Rapid rigor mortis**
- **Tx**: No specific therapy, Fluids to flush kidney • Control: prevent use of oily, freshly treated wood where contact can occur

TOXIC GASES

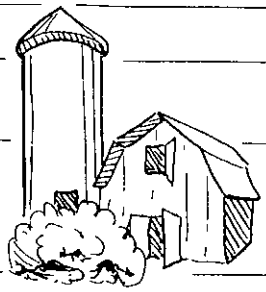
Hydrogen sulfide, H_2S
IM 1643; C3T 315; Tox 372

- Colorless, heavier than air, toxic gas, **"Rotten egg" smell, Liquid manure holding pits** underneath animal housing, H2S retained in liquid, when liquid agitated prior to pumping out released (m/b 1000 ppm), > 500 ppm imminent threat to life, Irritant to eyes & respiratory system
- **CS:** Pulmonary edema, hyperpnea (↑ respiration initially followed by apnea); asphyxia follows if not immediate artificial respiration
- **Dx:** Smell in air at low levels, Hi levels can't smell (olfactory paralysis)
- **Tx: Fresh air**, artificial respiration • **Prevention:** Remove animals & humans before agitating manure pit, Ventilate area • Public Health: Asphyxiation to humans, Don't enter manure pit

"Rotten egg" - Manure pit - Respiratory • Tx: Fresh air



Ammonium C3T 315
• Ammonia most common noxious gas found in stables



Smog, SO_2, Sulfur oxide Tox 376

- **Smog**, Sulfur oxides + H2SO4 smog major factor in air pollutants; deaths of man & animals
- **CS:** Eye irritation & salivation, emphysema, respiratory distress; cattle & horses in urban environments
- **Tx:** None, supportive

Eyes - Respiratory

Smoke inhalants
IM 602, 1643; C4T 460; EM&S 431

- **Barn fires, Alveolar damage**, interstitial edema, hypoxia & 2° bronchopneumonia
- **CS:** Oral burns, Conjunctivitis, Laryngospasms, **Respiratory problems** (cough, stridor, tachypnea)
- **Dx:** Hx, CS, Bronchoscopy, Transtracheal wash
- **Tx:** Patent airway (intubation, tracheostomy), O2 therapy (up to 100%) (Careful bec. O2 m/ cause lung damage) IV fluids (monitor for pulmonary edema), ABs for 2° pneumonia, Bronchodilators (aminophylline) (relieve soot-induced bronchospasms)

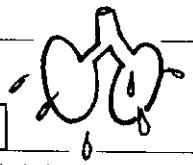
Respiratory - O_2

RODENTICIDES

ANTU *
M8k 2143; Mk 1721; IM 1635, E 196; C2T 661; Tox 332

- **Rare:** dogs, cats & swine, *Alpha-naphthyl thiourea*, Use declining because of more effective rodenticides, ↑ permeability of pulmonary capillaries, Strong emetic (protects some animals that vomit), rodents unable to vomit
- CS: Pulmonary edema "drowns in own fluid", Death w/o convulsions
- **Tx:** No specific Tx, emetics early before edema

Rare - Respiratory



Strychnine
M8k 2156; Mk 1732; IM 1635; C3T 1346

- **See Neuro pg 272**; Used for burrowing rodents & coyote, **No rationale for its use!** Stimulates CNS, **loss of "damping" of spinal reflexes**
- CS: **Uncontrolled reflex activity, extensor rigidity, easily induced convulsions, tonic seizures**
- Dx: CS, Strychnine tissue & urine levels
- Tx: **Control seizures, muscular relaxation**, Oxygenation, Quiet environment, **charcoal, Diuresis**

No rational fore use - CNS/Seizures

Sodium fluoroacetate, 1080 *
M8k 2146; Mk 1723; IM 1635; C2T 661; Tox 340

- **Highly toxic, used to control rodents & coyotes** in West USA, Blocks Kreb's cycle: ↓ ATP, loss of cellular respiration
- **CS: Cardiac CS**, pain, anxious, hyperexcitability, profuse sweating, trembling, ataxia, **terminal convulsions**, sudden death m/b only CS
- **Dx:** Hyperglycemia, Rapid course, **Rapid rigor mortis** (extensor rigidity), Detection of 1080 in tissue difficult, Elev. kidney citrate levels suggestive
- **Tx**: No specific antidote, calcium gluconate or calcium chloride if hypocalcemia, glycerol monacetate (Monacetin®) IM before CS
- **Px: Grave once CS**

To kill coyotes - Rapid death - No antidote • Px: Grave

Zinc phosphide, * ZN_3P_2
Mk 1724; IM 1636; C2T 662; Tox 353

- **Kilrat®**, Goph-rid®, Release of **phosphine gas** on contact w/ water (more rapid at low pH), Odor of rotten fish, Emetic properties: rodents can't "barf"
- **CS:** Rapid, **Die w/in 2 d**, Anorexia, lethargy, **Rapid deep breathing, Colic**, Ataxia, weakness, prostration, **convulsions, Garlic-breath**
- Dx: **Exposure, Rapid death, Dyspnea**, PM - **Garlic smell** to stomach, Histo: kidney & liver damage
- Tx: **NO specific Tx**, Gastric lavage w/ 5% Na bicarbonate (raise pH to delay formation of gas), Symptomatic

Phosphine gas in stomach

Phosphorus
M8k 2145; Mk 1722; IM 1636, C2T 663; Tox 358, 49, 54
*

- **Garlic odor**, Corrosive & hepatotoxic, Protoplasmic poison, rare, infrequently used as a rodenticide today, dogs may get phosphorus in fireworks
- **CS: Biphasic**, GI irritation (Colic, Hemorrhagic diarrhea) M/b coma & death before 2nd phase, Latent phase - apparent recover, **2nd phase**, 2-4 d after start of CS, Depression, **Hepatic & renal failure - death**, Colic m/ recur, oliguria, icterus & bleeding tendencies
- Dx: **Biphasic CS**, elev. liver enzymes, ↑ BUN, PM: enlarged liver, icterus, GI irritation, hemorrhage & necrosis, Histo: liver & renal lesions
- Tx: **Emergency, Symptomatic Tx, Mineral oil, activated charcoal, No fat in diet for 3-4 d** (absorbs phosphorus)
- **Px: Grave**

Garlic - Biphasic

Pyrimilin, "Vacor"
IM 1637; E 196; C2T 662; Tox 357
*

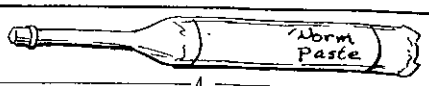
- **Not currently available**, but m/ be on premises, Mech.: **Vit. B antagonism**, destroys pancreatic cells & depresses glucose uptake by cells
- CS: Apprehension, Mental confusion, Visual disturbances, Colic, ↑ peristalsis, Dilated pupils, Weak pupillary response, ↑ HR, Dehydration, Muscle fasciculations & profuse sweating, Hindlimb weakness, Ataxia
- **Tx:** Many recover **spontaneously** if protect from self trauma & give supportive care, Nicotinamide reported as specific antidote (disappointing in human poisonings)

ANTHELMINTIC & OTHER DRUGS

Piperazine
IM 1629

- **Toxicity rare**, Accidental overdose in horses, Worm medicine
- **CS:** depression & incoordination
- **Tx:** No specific Tx

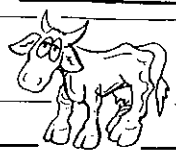
Rare - Accidental overdose - CNS



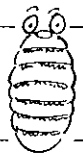
Levamisole
IM 1629

- **Not approved for horses**, used in cattle for filarids, narrow margin of safety in horses (20 mg/kg m/b fatal) (15 mg/kg is anthelmintic dose)
- **CS** in horse: sweating, colic, sound sensitivity & head pressing

For cattle, Not horses



Carbon disulfide
IM 1629



- **Fumigant for grains**, combo w/ carbon tetrachloride insecticide to kill bots in horses, Hepatotoxin & nerve poison, contraindicated in last trimester of pregnancy (horses)
- **CS:** Spasmodic tremor, dyspnea, cyanosis, convulsions, prostration, coma & death
- **Tx:** remove toxin (oral activated charcoal) & symptomatic Tx

Kills bots, not in pregnant
Liver & nerve toxin

Carbon tetrachloride
IM 1629

- CCl4 used as a fumigant, accidentally used as an anthelmintic in horses because of confusion w/ carbon disulfide, hepatic & renal toxin
- **CS:** anorexia, depression, muscle weakness, ataxia initially, bloody diarrhea, collapse & death w/in 24 hrs
- **Dx:** PM: gastroenteritis, necrosis of liver & kidney, centrilobular necrosis of liver

Confused w/ Carbon disulfide

Lincomycin

- **See GI pg 43**, Antibiotic **CONTRAINDICATED in horse**
- **CS:** Colic, **Loose, watery diarrhea, Dehydration**, Laminitis if survive acute episode
- **Tx:** Symptomatic Tx for diarrhea, dehydration & shock

Lincomycin contraindicated in horse

Phenylbutazone toxicity, NSAIDS toxicity
IM 665; C3T 355; EM&S 1554

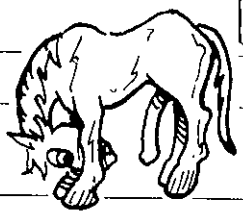
- **See GI pg 27; NSAIDs, Phenylbutazone ("Bute"), Banamine®**, Widely misused in horse practices, safe at recommended doses
- **CS: GI & kidney**, GI signs, Laminitis sequela, **Renal damage**
- **Tx: Stop NSAIDs,** Symptomatic (Plasma, Fluid, Broad spec. ABs, narcotic agonists, Gastric protectants)
- **Px**: Guarded in severe cases

GI - Renal - Laminitis

Aminoglycosides

- **See URIN pg 156**; Common cause of tubular nephrosis

Gentamicin



Phenothiazine tranquilizers

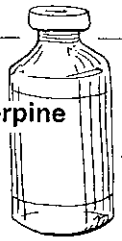
- **See REPRO pg 197**; Uncommonly cause paraphimosis (paralysis of penis)

Acepromazine

Reserpine
IM 1628

- **Used to alter behavior of horse**, cause sudden release of norepinephrine followed by depletion
- **CS:** Colic, depression, bradycardia, miosis, ptosis & paraphimosis
- **Tx:** Supportive therapy;
- **Px: Recovery**

Alter behavior
• Px: Good



DSS
IM 1628

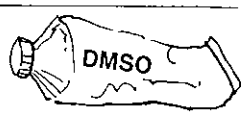
- Dioctyl sodium sulfosuccinate; **surface active substance**
- **Treatment for intestinal impaction**, 7.5-30 ml/1000 lbs of 5% DSS
- CS: **Overdose** (3-5 times) ↑ HR, RR & intestinal sounds, restlessness, watery diarrhea, dehydration, recumbency & death in 14-72 hrs

Softening agent
Overdose m/ kill

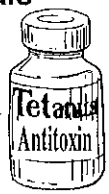
DMSO,
Dimethyl sulfoxide
IM 1628

- **Great membrane permeability**, transports other substances mixed w/ it across membranes; m/ ↑ toxicity of substances mixed w/ it
- Mercurial intoxication possible when mixed w/ mercury & applied topically
- IV administration ≥ 50% DMSO m/ cause severe **hemolysis**

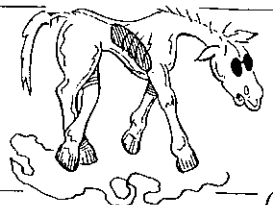
Carrying others through skin



Equine origin biologicals



- **See GI pg 88; adult, acute hepatitis** (serum hepatitis (Theiler's diz), **Equine origin biologicals (Tetanus antitoxin)**
- CS: Wt. loss, **Hepatoencephalopathy** (CNS), Icterus, photodermatitis, Die
- Dx: Hx, CS, Lab (**↑ liver enzymes**), PM ("disrag liver")
- **Tx: Tx liver failure**: xylazine, 10% glucose IV, Slow 5-10% dextrose drip, Diet, Vit. B1, folic acid & Vit. K1 weekly



Ethylene glycol, Antifreeze poisoning
Mk 1648; IM 960; Tox 398

- **1° dogs & cats**, though all are susceptible, 1° large animal is ruminants, not mentioned in horses; **Antifreeze** (Ethylene Glycol): sweet tasting alcohol, metabolized to oxalic acid which combines w/ calcium in kidney to form insoluble calcium oxalate in renal tubules
- **CS:** Same as oxalate poisoning, **hind limb ataxia, salivation, depressed sensorium, loss of menace response**, nystagmus, tonic clonic **seizures, status epilepticus**, acidosis, dehydration
- Dx: **Same as in oxalate poisoning,** azotemia, ↑ creatinine, ↓ K, Ca, acidosis, hyperosmolality, ↑ GGT, Isolate ethylene glycol w/in 1st hr in GI; PM: slight swelling of kidney, **oxalate crystals** in kidney, microscope using polarized light
- **Tx**: Early w/in 12 hr of exposure, **20% ethanol** (50 ml/hr), Activated charcoal, NaHCO3 IV, Replace fluids

1° Dog & Cat,
Oxalate crystals - Kidney
CS: CNS
Tx: 20% ethanol

Fluoride, Fluorosis
Mk 1651; IM 1169; E 199; EM&S 1293; C4T 661; C3T 358; Tox 183

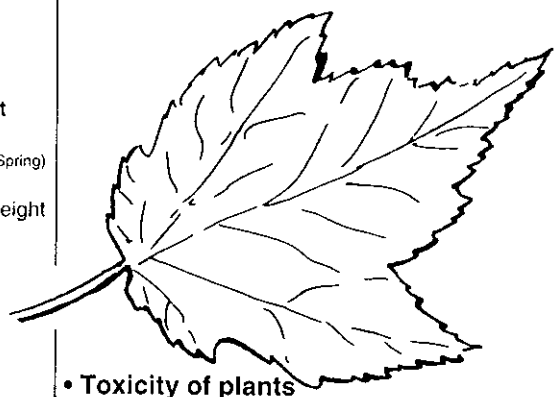
- **1° dairy cattle** (most sensitive), horses, sheep & swine all susceptible. Fe & Al smelters & fertilizer plants, rodenticides (Na fluoroacetate [1080]), stored in bone & teeth (calcified tissue). Affects formation & remodeling of bone, young most susceptible due to developing bone & teeth
- **CS: Acute/rare (resp./cardiac failure - CNS/clonic convulsions); Chronic/Teeth & bone** (more common), exostosis, sclerosis & osteoporosis, 1st on medial side of prox. metatarsal bone, then mandible, metacarpals & ribs, **intermittent lameness**, fractures, **mottled teeth**: discolored, **unthrifty appearance, rough hair, lose winter coat slowly**, wt. loss
- **Dx: Exposure, teeth, bone, lameness**, urinalysis > 2-6 ppm, bone (biopsy, PM) cannon, rib, pelvis & mandible > 1,200 ppm, Feed (> 60 ppm) & water; **Rads**: porosis, sclerosis, hyperostosis, osteophytosis, osteomalacia or combinations
- **Tx: No specific Tx**, remove animals from source
- **Px**: Poor for intermittent lameness, teeth damage irreversible

1° Dairy cattle
Bone & teeth

Poisonous plants E 205; PP/Mt 3

Facts:

- **Rule of thumb: poisonous plants usually not palatable**
  - Usually eat only when nothing else (drought, early Spring)
  - Or when mixed w/ hay or grain
    . Fortunately horses need to eat 1-3% of body weight to be poisoned
- **Economics:**
  - Western USA 3-5% annual deaths for cattle, horses & sheep
  - Poor weight gain & poor reproduction
- **Variables:**
  - Plants vary in toxicity
  - Animals affected (some OK for cattle & horses, but kill sheep)
  - Conditions of poisonings:
    . Some nutritious, except during certain seasons when they are poisonous
    . Some nutritious unless only thing eaten (choke cherry for cattle)
- **Poisonous substances:**
  - Poisonous substances themselves to livestock (Alkaloids & oxalates)
  - Harmless substances transformed by decomposition or ingestion (choke cherry nontoxic amygdalin changed to toxic prussic acid)
  - Substances absorbed from soil into plant (ex. milkvetch accumulates selenium)
  - Substances making animal hypersensitive (e.g., St. John's wort causes photosensitization)
  - Miscellaneous substances (toxic metals: fluorine, arsenic)



• Toxicity of plants

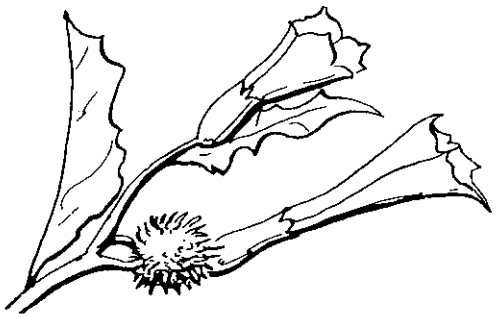
- Palatability (influences how much eaten, herbicide or fertilizers m/ make more palatable)
- Available nonpoisonous forage: will eat instead of nonpalatable toxic plants usually
- Stage of development: usually more toxic when immature, some when mature
- Drought or freezing (stress) commonly ↑ toxicity
- Soil (e.g., some toxic on selenium soil, but good on other soils)
- Moisture contents: drying m/ ↑, ↓ or leave toxicity the same
- Parts of plants: some more toxic than others (seeds, leaves, stems or root)
- Toxic substances: some lethal in small amounts, others require large amounts
  . Some accumulate in animal while others don't

• Animal factors

- Some toxic to certain species, others toxic to all
- Young usually more susceptible than adults
- White animals: photosensitization
- Variability of susceptibility of individual animals
- Stressed animals more susceptible (temperature, exertion)
- Fasted animals more susceptible
- Horses are more selective grazers than cattle

• Management factors

- **Overgrazing** most common cause of poisonings, have to eat poisonous plants
- Turning hungry animals into new pasture, eat first thing they see
- Early turn out onto range, toxic plants often 1st to "green up" (low larkspur, lupine, death camas)
- Crowding animals, let spread out
- Inadequate nutrients (salt defc eat greasewood or arrowgrass)
- Feeding contaminated hay (Blister beetle)
- Grazing during dangerous seasons
- Spraying or fertilizing pasture may ↑ palatability of toxic plants
- Grazing snow covered fields, taller toxic plants m/b only available feed (tall larkspur or lupine)
- Grazing after heavy rainstorm, some more toxic after rain, some more palatable, easier to pull up toxic roots
- Grazing during drought, some toxic plants remain green, while good forage is gone



Clinical signs m/b confusing

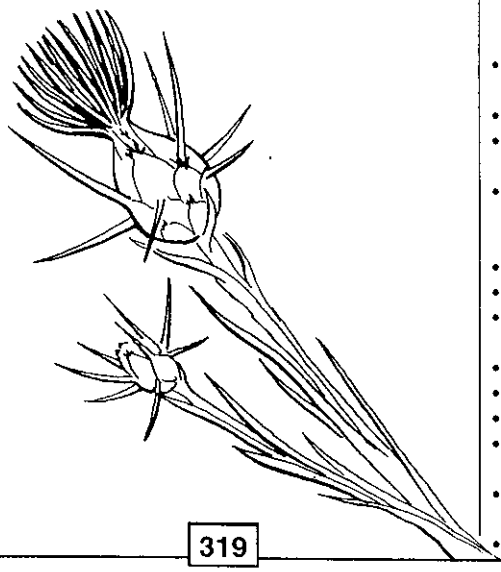
- Similar signs for different plants
- Incomplete or nontypical CS of poisonings by usually nontoxic plants

Diagnosis:

- Hx: of injestion (requires more than just identification of plant, need proof of ingestion also)
- Clinical signs: confusing
- Suspected plant poisonings:
  - Sudden onset of illness w/ no apparent cause (after turned out into new pasture)
- **ID plant**
  - Check pasture, especially fence rows, ditches & springs for poisonous plants
  - Check GI for plant material in those that die
  - Collect plants & send to local county agent for ID
    . Press & dry between 2 pieces of paper
    . Send between 2 pieces of stiff cardboard
- Detailed record of events
  - If alive: observe & record CS

Treatment

- Tx less satisfactory then for chemical poisonings
  - Therefore prevention is key to control
- **Usually symptomatic** because few antidotes
- Absorbents: activated charcoal
- Astringents (bismuth subnitrate) constrict intestinal capillaries (prevent further absorption)
- Stimulate elimination:
  - Stomach pump - Emetics - Purgatives - Diuretics
- Treat symptoms
  - Cramps & convulsions: sedative & depressants
  - Depression & paralysis: stimulants



Prevention key to controlling

- **DON'T OVERGRAZE**
- Remove plants
- Remove animal from pasture during poisonous season for certain plants (e.g., late summer & fall for yellow star thistle, because horses like to eat it)
- Put on range when sufficient growth of desirable forage
- Spread out herd & move slowly, so they can be selective
- Supplement forage or extra hay during poisonous seasons (prefer over nonpalatable poisonous plants)
- Mineral supplements, mineral deficiencies m/ stimulate to eat poisonous plants (e.g., hi nitrate have salty taste)
- Check hay for too many weeds (e.g., oleander)
- No hungry animals into new pastures, will eat anything
- Don't throw lawn clippings where animals can eat (e.g., oleander)
- Salt & phosphorus blocks (supplement & spread livestock out)
- Adequate water supply
- Keep off sprayed or fertilized land for 2 weeks
- Feed supplements when snow covers forage except tall toxic plants
- Supplement during drought or reduce number of animals
- Fence uncontrollable areas

Cyanide, HCN, Hydrocyanic acid, Prussic acid

M8k 2154; Mk 1647; IM 1649; E 214; C2T 678; Tox 455

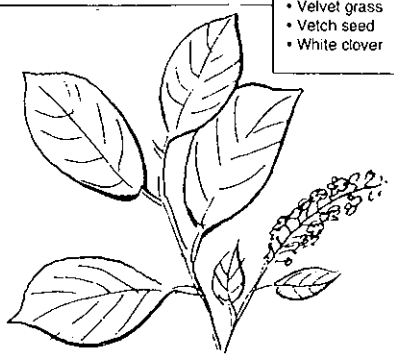
- **Cyanogenic glycosides - hydrolyzed to release hydrocyanic acid (prussic acid, HCN), Cattle** > sheep/goats > equine > swine
  Sources: Rodenticides, Plants 1° (see box), damage (wilted, trampled, drought) cause glycoside to change to HCN, Not cumulative (must eat a lot in short time, 1 hr), **cellular hypoxia**, hemoglobin (Hb) can't release oxygen (**bright red blood**)
- **CS: Found dead** (rapidly acting); excitement & muscle tremors; **dyspnea**; salivation; lacrimation; voiding of feces; goes down, gasps for breath, m/b clonic convulsions due to anoxia; dilated pupils; mucous membranes **bright red**; If survives longer than 2 hours usually recover
- **Dx: Exposure - resp. distress, cherry red blood**, red mucous membranes, **odor of bitter almond** to GI; GI & lung hemorrhage
- **Tx: Na nitrate IV** (Breaks HCN bonds & is excreted), **Na thiosulfate IV** (HCN to thiocyanate & excretion), Rare toxicity because it can be treated specifically & effectively
- **Px: Poor, so rapid, usually too late to Tx**

Cherry Red Blood

Hb can't release O_2
CS: Found dead
Dx: Cherry red blood, Almond smell
Tx: Na nitrate - Na thiosulfate
Px: Poor

Cyanide plants

- **Apple** — *Pyrus malus*
- **Arrow grass** — *Triglochin maritima*
  - Birdsfoot trefoil — *Lotus corniculatus*
- **Cherries, choke cherries,** apricot, peach — *Prunus* spp.
- Corn, maize — *Zea mays*
- Elderberry — *Sambucus canadensis*
- Flax — *Linum* spp.
- Hydrangea — *Hydrangea* spp.
- Lima bean — *Phaseolus lunatus*
- Poison suckleya — *Suckleya suckleyana*
- **Sudan grass, Johnson grass Sorghum grass hybrids** — ***Sorghum* spp.**
- Velvet grass — *Hoecus lunatus*
- Vetch seed — *Vicia sativa*
- White clover — *Trifolium repens*



Chokecherry

M8k 2136, Mk 1647; IM 1649, C2T 678; Tox 455; PP/US/C 366; PP/Mt 44

- *Prunus virginiana*, Cattle & sheep, all susceptible
- **Description:**
  - Large shrub or tree
  - Leaves: dark green, 2-4" long oval w/ pointed tip, saw-toothed margins
  - Flowers: small, yellow-white, dense clusters
  - Fruit: dark red to black (3/8")

Thiocyanates, SCN, Goiter

- **SEE ENDO** pg 301; **Goitrogenic plants** or excess iodine (kelp) eaten by pregnant mare; most common thyroid disorder in neonates, inhibit thyroid hormone production
- **CS: Goiter, hypothyroidism** (incoordination, poor suckle response, poor righting reflex, hypothermia, tendon contracture, retarded bone development, born normal - skeletal lesion in wks
- **Dx:** Thyroid stimulation hormone response test
- **Tx: Thyroid hormone supplementation (iodine)**; No way to reverse lesions

Plants w/ goitrogenic compounds
Mustard family (*Cruciferae*)

- *Brassica* spp — Rape seed, Mustard, Kale, Broccoli, Cabbage & Turnip
- *Glycine max* — Soybean
- *Lineum usitatissimum* — Flax

Selenium toxicity, Alkali diz, Bob-tailed diz, Blind staggers

M8k 2150; Mk 1727; IM 1653; E 192; EM&S 1681; C4T 667; C3T 125; C2T 670; Tox 132; PP/US/C 305

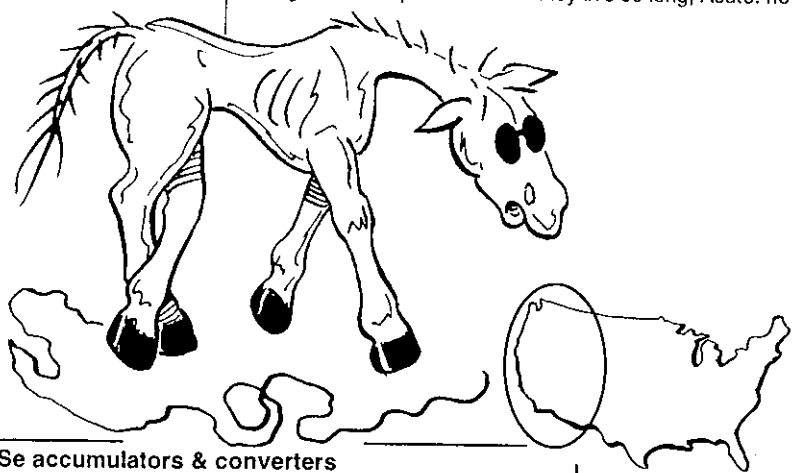
- Cattle, sheep & horses, **arid & semiarid areas**, **"accumulator"** plants require Se & m/ contain > 1000 ppm, Fortunately only eaten if starving, **"converter"** plants don't require Se, but absorb it (commonly grazed & cause poisoning), **western 1/3 of USA. Se supplementation may result in toxicosis**
- **CS:** Acute (rare, because avoid plants) dyspnea, frothy nasal discharge, recumbency, diarrhea, polyuria, death
  - **Chronic "alkali diz"**, weight loss, depression, lameness, abnormal hoof conformation
  - Coronary band inflam. & break, grows down & sloughs
  - **"Bob-tailed" diz**, hair loss from mane & tail, reproductive compromise (soft testicles)
  - **Chronic "blind staggers"**, aimless wandering or circling, incoordination, forelimb weakness, dyspnea, blindness
- **Dx:** Exposure & CS, Se blood levels 1-2 ppm "alkali" diz; 1.5-4 ppm in "blind staggers"
- **Tx: Chronic**: Ruminants: **arsenic** application to feed reduces sorption; arsenic orally dangerous in equine because they live so long; Acute: no treatment

Se Plants
Obligate Se-indicator plants (often >1000 ppm)

- **Goldenweed** — ***Oonopsis***
- **Milk vetch** — ***Astragalus bisulcatus***
- **Poison vetch** — ***Astragalus pectinatus***
- **Prince's plume** — ***Stanleya pinnata***
- Woody aster — *Xylorrhiza*

Facultative Se-indicator plants

- Broom snakeweed — Gutierrezia sarothrae
- Groundsel varieties — *Senecio* spp.
- Gumweed — *Grindelia*
- Aster

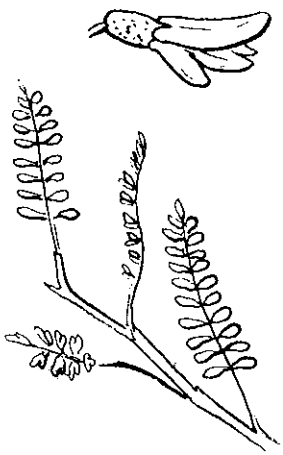


Se accumulators & converters
CS: "Alkali diz", "Bob-tailed diz", "Blind staggers"
Dx: Exposure, Levels
Tx: Arsenic for cattle

Astragalus spp., Milkvetch, Poison vetch

M8k 2128; Mk 1727; IM 1653; Tox 132; PP/Mt 36

- *Astragalus* spp. (over 300 species), largest genus of legume family
- Cattle, sheep, horse, all species
- Difficult to ID species of astragalus
- Oxytropis, point locoweed, pointvetch so closely resemble astragalus that some botanist treat as the same
- Unpalatable, garlic odor



- **Description**
  - Low growing perennial
  - Woody tap root
  - Leaves pinnately compound
  - Flowers: white to purple, rounded keel petal (lowermost petal)

Thiamine Deficiency

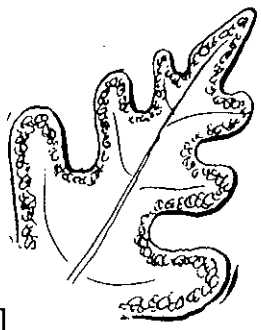
Thiamine defc, Bracken fern toxicosis, Bracken staggers

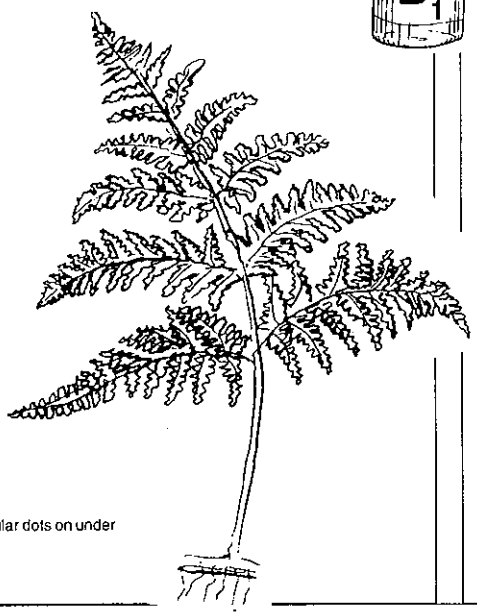
M8k 2140, 2136; Mk 1641; IM 1648; E 208; EM&S 805; C3T 676; PP/US/C 114; 105

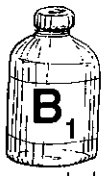
- **See NEURO** pg 264, **Bracken fern & Horsetail** Western USA; **Thiaminase** leading to thiamine defc (B_1) in monogastric animals, Not in ruminants (bone marrow depletion - aplastic anemia) - Accumulates over 1-3 months, **Palatable**
- **CS: Bracken staggers**, anorexia, weight loss, incoordination, crouched stance, arched neck & feet wide apart, convulsion, clonic spasms & opisthotonus, death
- **Dx: CS, Bracken fern or horsetail area,** ↓ blood thiamine levels
- **Tx: B_1, thiamine** (IV qid, then IM for several days)
- **Prevention**: Remove bracken fern

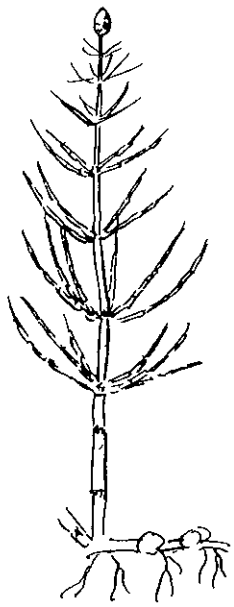
Thiaminase producing plants

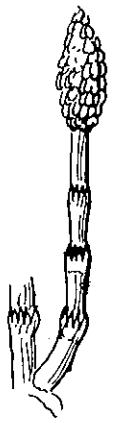
• Bracken fern, w. bracken	*Pteridium apuilinum*
• Crotalaria	
• Horsetail	*Equisetum arvense*
• Perennial ryegrass	
• *Pteris aquilina*	
• Ragwort	*Senecio jacobea*



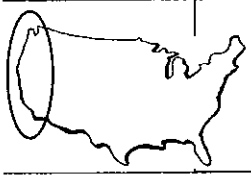








Thiaminase
CS: Staggers
Dx: Exposure, Levels
Tx: B1

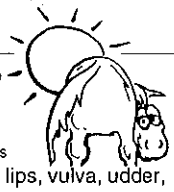


Bracken fern
- Description
  - Fernlike
  - Broad, triangular fronds
  - Fruiting bodies: small circular dots on under side of leaves

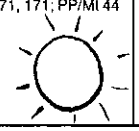
Horsetail, Scouring rush, Jointfir
- Horses most common, all susceptible
- Description
  - Long rush-like, green stems, jointed, hollow
  - Cone-like fruiting bodies on top of stems

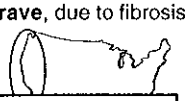
Photosensitizing plants, Pyrrolizidine alkaloid toxicity, Trefoil dermatitis, Rape scald

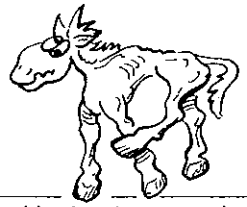
M8k 2132, 2138, 2114; Mk 820, 1698; IM 850; 1652; E 205; EM&S 1555, 1652; C2T 672; C4T 76, 650; C3T 680, PP/US/C 271, 171; PP/MI 44

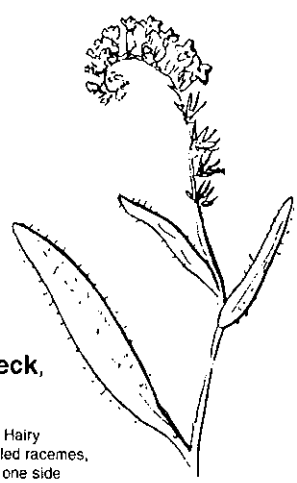


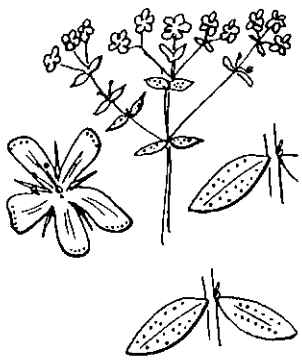
- **See GI** pg 89; Not common sunburn, exposure to sunlight plus chemical deposited in dermal tissue
- Western USA
- **1° photosensitizing plants** - photodynamic substances
  - **CS: Sun burn of light colored skin** (ears, nose, lips, vulva, udder, coronary band), **erythema, edema, blister & serum exudate**
  - **Tx: No specific Tx, Avoid sunlight & plants**
- **2° Photosensitizing plants: Pyrrolizidine alkaloid** (more common)
  - **Cause hepatic damage, cumulative & progressive**, prevenling clearance of normal chlorophyll breakdown products which are photodynamic & deposited in dermis, 1-5 mo later
  - **CS: Weight loss, liver failure: hepatoencephalopathy** (ataxia, wandering), **Icterus, photosensitization** (white areas)
  - **Tx: Euthanasia**, remove plant source, **Tx for liver failure**
  - **Px: Poor to grave**, due to fibrosis of liver











Fiddleneck, Amsinckia
- Description
  - Erect, 1-3', Hairy
  - Flower: coiled racemes, flowers on one side ("fiddleneck")
- 2° photosensitization

St. John's Wort
- Cattle > sheep > horse
- Description
  - Stiff, erect, 1-3' tall
  - Leaves in pairs covered w/ small clear to black dots
  - Flowers: numerous, bright yellow
- **1° photosensitization**

2° > 1°, Pyrrolizidine alkaloid
CS: Wt. loss, Liver Failure (CNS, icterus, photo)
Dx: Exposure
Tx: Euthanasia, Px: poor

1° Photosensitizing plants

• Bishop's weed	*Ammi majus*
• Buckwheat	*Fagopyrum esculemtum*
• Castor bean	*Ricinus communis*
• Clover	*Trifolium*
	Cooperia pedunculata
• Oat grass	*Avena fatua*
• Perennial rye grass	
• Rape	*Brassica*
• Rutaceae	
• Spring parsley	*Cymopterus watsoni*
• **St. John's Wort, Klamathweed**	*Hypericum perforatum*
• Trefoil	*Erodium*
	Umbelliferae

2° photosensitization: hepatogenic plants

- Blue green algae
- Bog asaphodel — *Narthecium ossifragum*
- Brassica — *B. napus, B. hyssopifolia, B. brizantha*
- Broomcorn millet — *Lantana camara*
- Bunch grass, texas sacahuiste — *Nolina texana*
- Common heliotrope — *Heliotrophium europeaum*
- **Fiddleneck** — ***Amsinckia intermedia***
- Groundsels — *Senecio redellii, S. longilobus*
- **Horsebrush** (gray) — *Holocalys glaziovii*
- Kleingrass — *Tetradymia canescens*
- Mycotic agents — *Panicum coloratum*
- Panic grass, witch grass — *Lippia rehmanni*
- *Pithomyces chartarum & P. minutissima*
- Panicum spp.
- Puncture vine, caltrop — *Tribulus terrestris*
- **Ragwort** — **Senecio**
- Rattlebox — Crotalaria
- **Tansy ragwort** — ***Senecia jacobea***
- Viper's bugloss — *Echium plantagineum*

Unclassified photosensitizing plants

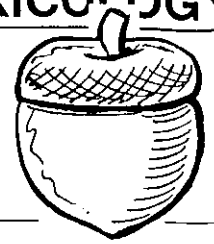
• Alfalfa	Medicago
• Clover species	*Trifolium* spp.
• Fireweed, summer cyprus	*Kochia scoparia*
• Milk purslane	*Euphorbia maculata*
• Oats	Avena
• Smartweed	Polygonium
• Sudan grass	*Sorghum* var. *sudanense*
• Velches	Vicia spp.

Oak Poisoning

Oak poisoning,

M8k 2142, 2110; Mk 1720; IM 814; C2T 673; Tox 468

- ***Quercus* spp., SW USA** associated w/ browsing of buds, new leaves in spring, **midwest & NE**; associated w/ eating acorns in fall, Windstorms drop acorns, Hi rainfall softens acorns (more palatable), **Rarely in horses**, #1 Cattle (less selective eating)
- **CS**: Peracute or acute, sudden death, **colic**, tenesmus, hemorrhagic **diarrhea, not urinary problem seen in cattle**
- **Dx**: Consuming oak buds or acorns, acorn husks or shells in feces, Urinary phenolic content to DDx from other colics
- **Tx**: as all colics, fluids IV, analgesics, oral laxatives, diuresis, acid base balance & serum calcium levels
- **Description**: Trees to shrubs, Acorns, 60 spp. in USA & Canada

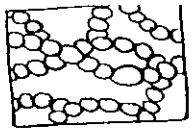


Rare in horse, GI; not urinary

Toxic blue-green algae,

Algae poisoning; Algal poisoning,

Mk 1638; IM 962; Tox 451



- Common in fresh water, N. plain states, **summer** when bloom (green scum) of algae, algae dies, toxin in water - foul fish smell, Wind blows to shore, Animals drink water - die, **ruminants more sensitive than monogastrics**
- **CS**: Acute death w/in minutes, rapid onset (15-45 min), rapidly progresses to prostration & death; nausea, **colic**, bloody **diarrhea**, prostration, muscle tremors, **dyspnea**, cyanosis, ± **CNS (general paralysis**, seizures, prostration & death), chronic (depression, anorexia, hemorrhagic gastroenteritis, photosensitization, **hepatic diz**
- **Dx: Very difficult**, exposure, no practical way to isolate & identify toxins, PM: gastroenteritis, **degenerative changes of liver** (centrolobular necrosis) & kidney
- **Tx**: No specific antidote, **often animal dead or dying before Tx**, supportive care, activated charcoal & oil
- **Px**: Poor, die in 24 hrs
- **Prevention**: Organic herbicides or copper sulfate (bluestone) Tx of water, follow label direction to avoid toxicity, fence off water when bloom of algae on water

Ruminants> Horse, CS: Acute death, Dx: difficult; Tx: prevention; Px: poor die in 24 hrs

Trauma plants,

Mechanical trauma-producing plants

IM 1659; PP/US/C 487

- **Bristle grass, Yellow bristle grass, Foxtail, Cheatgrass, Needle grass**, Povert grass, Crimson clover, Cocklebur (*Xanthium strumarium*)
- Common in hay, **mechanical injury**
- **CS: Mouth ulcers**, trauma to skin around mouth & eyes (horse), lodge alongside mouth (salivation)
- **Tx:** Removal of source, remove from animal, Antibiotics - heal rapidly
- **Description: Short, sharp, straight awns**

American black walnut shavings

M8k 2124; IM 1656; C3T 374

- Toxic principle: Jugulone (anaphthoquinone), Horses bedded on black walnut shavings
- **CS:** Signs in 12-24 hr, laminitis, weight on rear limbs, limb edema, blackish/brown staining to mouth & teeth if eat walnut hulls
- **Tx:** Remove bedding, treat laminitis
- **Prevention:** Don't use black walnut bedding

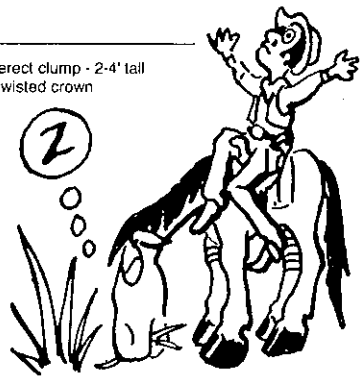
Bad horse bedding

Sleepy grass

IM 1658; C2T 681; PP/US/C 494

- **Description**: Grass: erect clump - 2-4' tall - Tipped w/ long dry twisted crown
- Stipa spp.; Sierra Blanca Mountains of N. Mex.
- **CS**: Profound stuporous sleep (comatose), lasts only a few days
- **Tx**: Avoid further ingestion - complete recovery

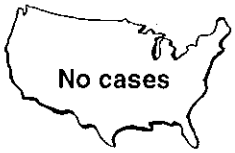
Horses fall asleep
Tough on cowboys of yesteryear



Grass sickness, Equine dysautomia

C4T 203:

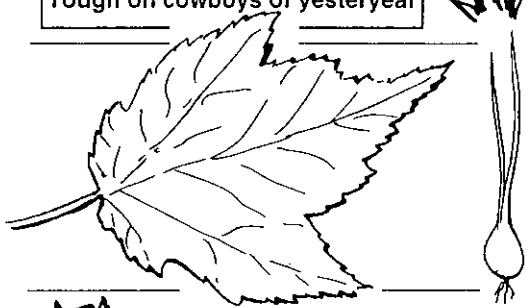
- Unknown cause
- High mortality rate
- No histologically confirmed cases in N. Amer.



Milkvetch, Vetch toxicosis, Timber milkvetch

IM 1658

- *Astragalus miser* var. (wasatch, Columbia & yellowtone milkvetch)
- **1° Cattle**, all species
- Toxic principle: Glucosides
- **CS:** CNS & respiratory
- **Tx:** Symptomatic & supportive



Red maple leaf toxicity,

Heinz body hemolytic anemia

Hemolytic anemia
Heinz bodies

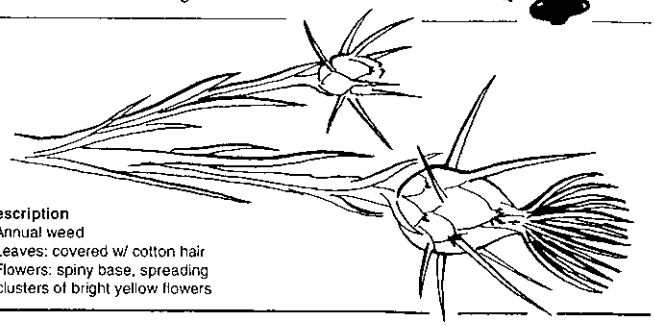
- **See CARDIO pg. 139,** *Acer rubrum*; Oxidizing agents causing acute **hemolytic anemia** & **Methemoglobin**, also Phenothiazine, **onions & Brassica plants**
- **CS:** Weakness, exercise intolerance, **brownish mucosa**, No fever
- **Dx:** CS, anemia, **Heinz bodies** (crystal violet)
- **Tx:** Remove source, supportive
- **Px:** Good if modest anemia, unfavorable if renal damage

Nigropallidal encephalomalacia

Yellow Star Thistle poisoning, "Chewing diz"

Lips don't work
Euthanasia

- **See NEURO pg 267,** ***Centauria solstitialis*** , *Centauria repens* (Russian knapwéed)
- **Western US, Summertime, Long term ingestion** - addiction
- **CS: "Chewing diz", Lips don't work, Die of starvation/dehydration**
- **Dx:** PM: **necrosis of** substantia nigra & globus pallidus - pathognomonic
- **Tx: Euthanasia** recommended
- **Px**: No recovery



Description
- Annual weed
- Leaves: covered w/ cotton hair
- Flowers: spiny base, spreading clusters of bright yellow flowers

Jimsonweed, Datura, Stramonium, Thornapple

- **Description**
  - 4-5' tall
  - Leaves: long petioled (stalk attaching leaves), alternate
  - Flowers: solitary, showy, large, **tubular**, born at fork of stem & branches
  - Fruit: spiny capsule

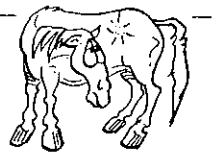
- Toxin: *Datura stramonium*; **Atropine-like alkaloid** (scopolamine), distasteful
- **Horse** > cattle, sheep & goats
- **CS: Depression & parasympatholytic nervous system**, restlessness, irritability, weakness, mydriasis, photophobia, constipation, thirst, incoordination & paresis, respiratory failure, delirium, convulsions
- **Dx:** Drop of urine in lab animal's eye = mydriasis
- **Tx: Symptomatic,** parasympathomimetic (physostigmine), activated charcoal, laxatives; **Convulsions: diazepam** (not phenothiazine), anticholinergics

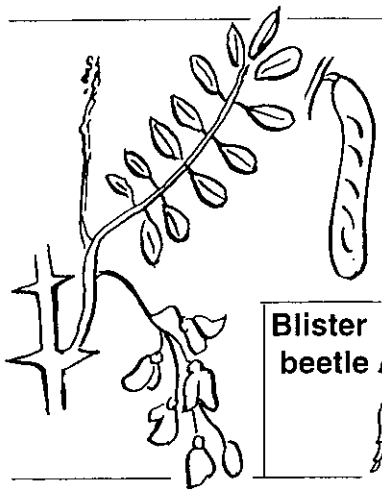
Atropine-like
CS: P-ANS
Valium

Black locust

IM 1657; C3T 678; PP/A 43

Pica - Bark
CS: Colic, diarrhea
Tx: Symptomatic, fatalities rare





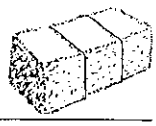
- **Description**
  - Shrub or tree - 40' tall
  - Rough deeply furrowed bark
  - **Paired spines** at base of each leaf
  - Leaves odd pinnate - 12" long
  - Flowers: white, drooping racemes

- *Robinia pseudocacia*, Horses, cattle & sheep, Toxin: Lectins in tree bark, Not palatable, **Pica or cribbing** (horse), Only small amount for CS
- **CS: Colic, diarrhea,** weakness, posterior paralysis, mental depression, **fatal cases rare**
- **Dx:** Exposure, Irregular HR
- **Tx:** Symptomatic & supportive, digitalis in severely affected, Avoid exercise (heart)

Blister beetle

- **See GI** pg 45; **Horses** > cattle, **swarm in alfalfa** during harvest, **Cantharidin**: potent irritant & vesicant, **SW**
- **CS: Endotoxic shock & renal failure, Found dead peracute,** GI irritation
- **Dx: CS, beetle in alfalfa, cantharidin** in urine or stomach, BUN & creatinine
- **Tx: No antidote, Supportive: IV fluids**: protectants, mineral oil, charcoal, diuretics, analgesics
- **Prevention:** Hay not from Southwest, ID feed source
- **Px:** Guarded if obvious CS & a lot of blood in feces & urine

Alfalfa



Dogbane, Indian hemp

M8k 2116; IM 1656; PP/US/C 263

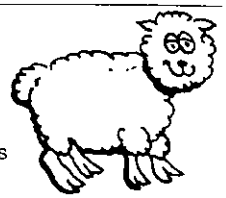
- *Apocynum cannabinium* (Indian hemp, dogbane), *A. androsaemifolium* (Spreading dogbane)
- Cattle, horse & sheep
- **CS: Urinary system**
- **Dx:** Urinalysis, crystals in urine
- **Tx:** Dilute toxins (diuretic)

- **Description**
  - Erect herb
  - Woody stem - milky sap
  - Leaves: opposite pairs
  - Pods hanging in pairs

CS: Urinary system
Dx: Crystals in urine
Tx: Diuretic

Bitter rubberweed, Bitterweed, Hymenoxys

M8k 2108; IM 1655



- *Hymenoxys odorata*
- Sheep in SW USA, also cattle & horses

Hairy vetch, Fava bean

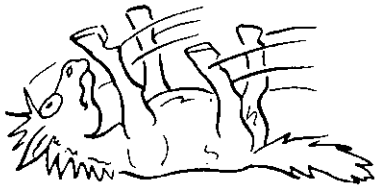
IM 1659, EM&S 1680; PP/US/C 362

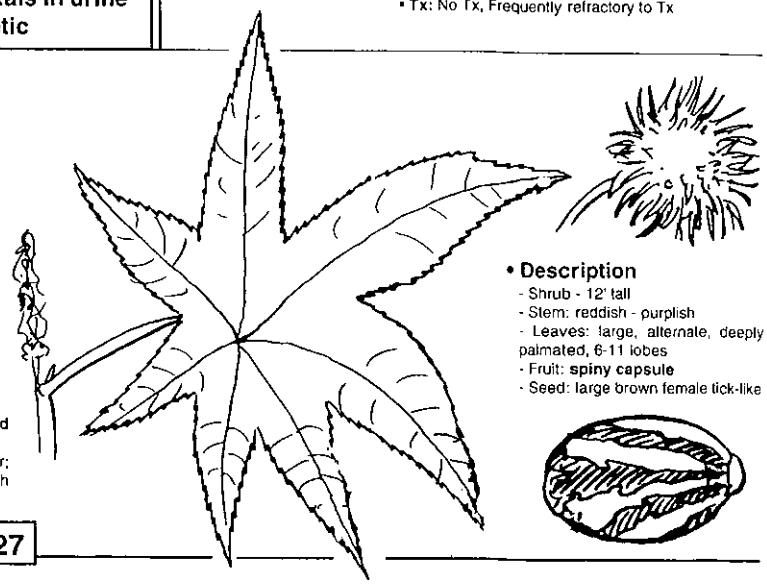
- *Vicia billosa*, Horse & cattle
- Toxic principle: unknown
- Horse - infrequently reported
- **CS:** Pyrexia, Progressive SQ edema of lip, spreads to rest of body, Marked wt. loss, Corneal ulcers; SQ papules & plaques, pruritus & alopecia
- **Tx:** No Tx, Frequently refractory to Tx

Castor bean (ricin) toxicity

M8k 2138; IM 1653; E 207; C2T 673; PP/US/C 194

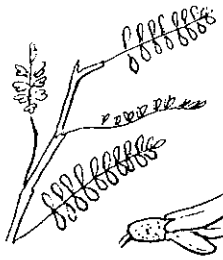
Seed in feed
CS: GI irritation, convulsions, death
Dx: Exposure, Levels
Tx: Sedate & Tx shock





- **Description**
  - Shrub - 12' tall
  - Stem: reddish - purplish
  - Leaves: large, alternate, deeply palmated, 6-11 lobes
  - Fruit: **spiny capsule**
  - Seed: large brown female tick-like

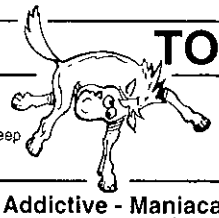
- ***Ricinus communis***, Toxin: **Ricin** - seed-borne protein phytotoxin, plant not usually ingested, but **seeds in feed** as an oil by-product (2 soldiers chewed the seeds as a laxative and died)
- **CS: Gastric irritation** - colic; profuse, watery diarrhea; anaphylactic shock if enough eaten; Hi fever; depression; incoordination; profuse sweating; muscle twitching; pounding heart beat; convulsion before death
- **Dx:** Hx of ingestion, seed in feed material, RBC agglutination or precipitation test for ricin
- **Tx:** Sedation & Tx shock initially, keep warm, antihistamines, IV fluid, prevent further absorption (Oral laxatives, intestinal protectants & activated charcoal)



Locoweed poisoning

"Locoweed diz", Texas loco

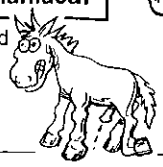
- **See NEURO** pg 265; **West**, Astragalus spp. & Oxytropis; Toxin: unknown, unpalatable, starvation, **Addictive m/b, Horses** > cattle > sheep
- **CS: Stagger, loco**, Wander in circles, convulsions & falling, death
- **Tx:** None
- **Px: Bad** - remains effected long, extremely unpredictable

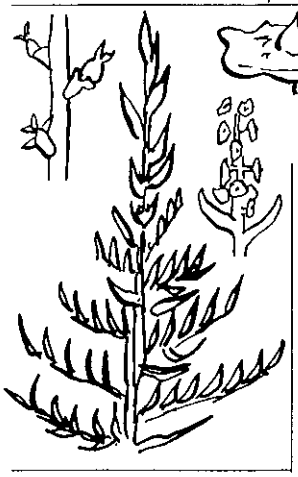


Addictive - Maniacal

Sorghum cystitis/ataxia syndrome

- **See URIN** pg 156; **Usually valuable forage,** Myelomalacia of lower spinal cord
- **CS: CNS: Posterior incoordination, "dribbling", cystitis**
- **Dx:** Hx & CS, no specific tests, urinalysis for cystitis
- **Tx:** Withdraw Sorghum, No specific Tx, ABs for urinary tract infections
- **Px:** Recovery rare • **Control:** diversify diet (Sorghum not complete diet)





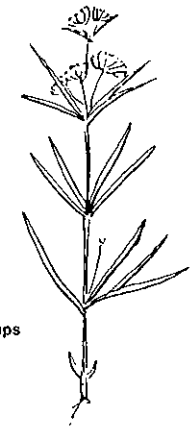
Description - Greasewood
- Erect, woody, spiny shrub, 3-5'
- Leaves: **fleshy**, 1/4-1 1/2" long
- Flowers: sexes separate, small flowers

1° in cattle - rare in horses - West
Crystals - Renal • Px: Grave

Oxalate

M8k 2110, 2122; Mk 1709, IM 1651; Tox 471; PP/US/C 235, 240

- **Halogeton, Greasewood**, 1° in cattle, **Rare in horse**, West USA
- Insoluble pcpt. w/ Ca, Vascular necrosis & renal tubular blockage,
- **CS:** Colic, Weakness, Frequent urination, **Crystals in urine**
- **Tx:** Hopeless once CS; Fluids, Ca gluconate



Halogeton - description
- Annual herb
- Leaves: **fleshy**
- Flowers: "microscopic"

Milkweed, Asclepias

M8k 2126; IM 1656; C3T 374; PP/Mt 36; PP/US/C 267

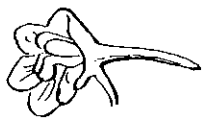
Description
- Perennial w/ milk juice, erect
- Flowers: umbrellas
  - **Narrow & broad leaved groups**

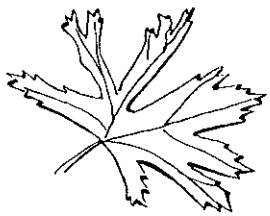
- ***Asclepias*, 1° sheep, all species affected,** broad & narrow leaved species
- **CS: cardiac & neurological, Colic**, incoordination, Weak rear end, Anxiety (markedsweating & trembling), Tetanic convulsions (falls w/ neck bowed **& forelegs flexed),** Paddling, Resp. failure, Death
- **Tx:** No specific antidote, Supportive & symptomatic in mild cases, Sedation for convulsions, Antiarrhythmic Rx: atropine &/or diphenylhydantoin
- **Prevention:** Keep out of hay

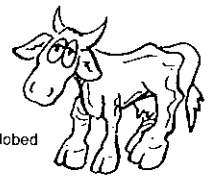
Larkspur toxicosis, Delphinium

M8k 2112; IM 1647, PP/Mt. 14, 15; PP/US/C 25

- Toxic principle - Delphinine alkaloids (similar to substance isolated from Aconitum)
- Horses: don't eat enough to show CS, sheep resistant
- #1 poisonous plant of cattle in Western USA







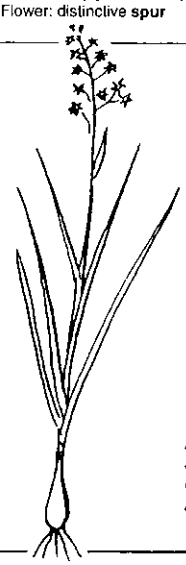
Description
- Tall & low larkspurs
  - Tall at high altitude - 3-6';
  - Low at low altitude - < 3'
- Perennial
- Leaves deeply divided to palmately lobed
- Flower: distinctive **spur**

Solanum toxicosis, Nightshade, Deadly nightshade

M8k 2120; IM 1646, CT 376; C2T 677; PP/O 13; PP/US/C 290

- Minor importance of intoxication of horses
- **CS: CNS & GI**

Description:
- Annual, 6"-3'
- Berry black when ripe



Oleander toxicosis

M8k 2136; IM 1649; E 208; C2T 674; PP/US/C 264

- *Nerium oleander* • Ornamental hedge W & S USA
- Toxin - Cardiac glycoside similar to digoxin
- Bitter taste (infrequent ingested, clippings mixed in grass)
- CS: Cardiac, "thumps" (↑HR), diarrhea, sweating, muscle twitching, death

Description:
- Shrub or bush up to 20'
- Leaves: leathery, lanceolate
- Flowers: showy clusters

Death Camus, Zygadenus

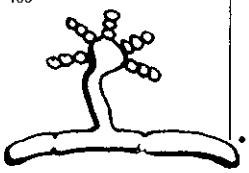
M8k 2110; IM 1646; PP/Mt 28; C2T 677; PP/O 14

Description:
- Perennial, single stem, **bulb**
- Flower: terminal racemes

- **Sheep**, all classes susceptible, **W USA**, very early spring; Distasteful, **onion-like bulb**
- **CS: Cardiac & respiratory**: salivation, dyspnea, weakness & staggering, coma, death
- **DDx:** Onion (has onion odor)
- **Tx:** No specific Tx, Symptomatic & supportive

Mycotoxicosis

M8k 2076, 232, 2078; Mk 1678; C4T 83, 668; EM&S 1708; Tox 409



CS: Vague, chronic
Dx: difficult
Tx: ABs not effective

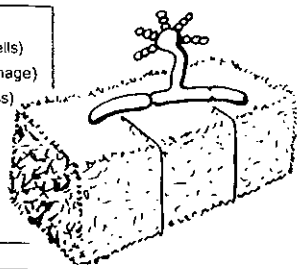
- **Mycotoxin**: 2° toxic metabolite produced by mold, Not from growth of mold in animal
- Characteristics:
  - **Cause of problems not readily identifiable**
  - **Tx by drugs or ABs not effective**
  - Not contagious or infectious
  - Often seasonal outbreaks (climate dependent)
- Conditions needed
  - Substrate carbohydrates of feedstuff
  - Moisture of grain (10-18%) or 70% humidity
- **SE USA** - warm humid conditions
- SW USA - irrigated cotton production
- Grains shipped long distances
- Rarely responsible for acute diz or large death loss

- **Vague chronic conditions** (poor performance, ill thrift or ↑ susceptibility to infect. dizs)
  - Reduced growth
  - Hepatic fatty infiltration: aflatoxins

- Vague chronic conditions
- Confirmation - ID toxin
  - Feed analysis 10 lbs (4.5 kg), many individual samples mixed together
    - Dry samples preferred, shipped in paper or cloth, not plastic

- **No known Tx**
- Remove source of toxin (moldy feedstuff)

- Clinical effects:
  - Hepatotoxins (degeneration, fatty changes, hemorrhage, necrosis of hepatic cells)
  - Nephrotoxins (oxalic acids by Aspergillus & Penicillium spp. - renal tubular damage)
  - Hematopoietic & coagulation changes (hemorrhage, anemia, weakness)
  - Direct irritation (oral ulcers, gastroenteritis)
  - Reproductive &/or endocrine disturbances
  - Feed refusal m/b only CS
  - CNS (tremogens from ergot & Penicillium spp.)
  - Immune system (↑ susceptibility to infectious dizs)



• Aflatoxicosis

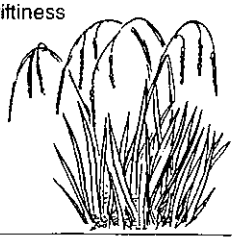
M8k 2077; C4T 669; C3T 369; Tox 415

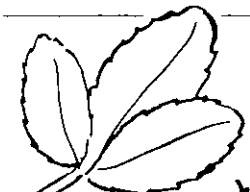
- Poultry > dogs > swine > **horse** > calves > cattle > sheep, *Aspergillus flavus*, Aflatoxin; Hepatic necrosis & fatty changes, Immunosuppressive
- **CS:** Anorexia, fever, tachycardia, ataxia, colic, icterus, bloody feces, abdominal straining, reduced weight gain
- **Dx:** Hepatotoxic diz - depression, icterus, hemorrhages; anemia, ↓ BSP secretion, icterus, ↑ serum transferase, ALP, aflatoxin in feed, UV light: greenish-yellow "firefly"-like glow
- **Tx:** Methionine or methionine + cysteine & Na thiosulfate, ↑ protein in diet, Vit. supplementation (A, D, E, K, B complex), aggressively Tx infections (since immune system is compromised)

• Ergotism, Ergot

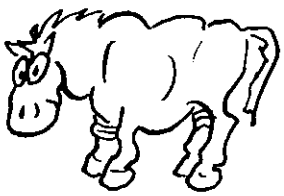
M8k 2083, 2078; Mk 1684; C4T 83; Tox 428

- **Parasitic fungi, *Claviceps purpura*** (rye, oats, wheat & Kentucky blue grass), *Claviceps paspali* (Paspalum or Dallis grass); swine, sheep, horses & poultry; warm moist conditions; Toxicity: alkaloids: ergotamine, ergotoxine & ergometrine; ↑ muscle motor activity of uterus, arterial & venous constriction, vascular stasis, thrombosis, gangrene
- **CS: Gangrenous: gangrene** of extremities (limbs, nose, ears, tail), depression, anorexia, rapid RR, general unthriftiness
  - **GI**: vomiting, colic & constipation or diarrhea;
  - **Lameness,** swelling & tenderness of fetlock, then darkening & discoloration below fetlock, Sloughing of hoof
  - **Convulsive**: hyperexcitability, belligerence, ataxia, limb flexure, recumbency, convulsion & opisthotonus (dorsal recumbency & arched back)
- **Dx:** Ergot ID on grain (rye, wheat or barley), **dark purple to black banana-shaped body** > grain itself, chromatographic analysis of feed
- **DDx:** Foot rot, Chronic selenium toxicosis, Laminitis, Frostbite, Fescue toxicosis
- **Tx: Remove contaminated grain, supportive Tx**, supplemental feeding, antibiotics, Pain control





Description
- Leaves: 3 oval
- Flowers: racemes

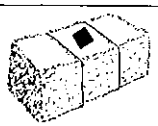


• Moldy sweat clover

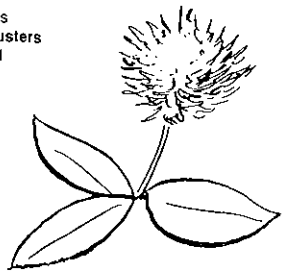
See CIRC pg 141; Melilotus spp., mold on plant synthesizes dicoumerol
- **#1 cattle,** all susceptible
- **CS:** Swelling & hemorrhages
- **Dx:** Exposure, hemorrhages, prolonged PT time, no other clotting abnormalities, anemia
- **Tx:** Remove source, Vit K1, Fresh plasma
- **Px:** Good if early Tx

• Black patch diz, Moldy red clover, Slaframine

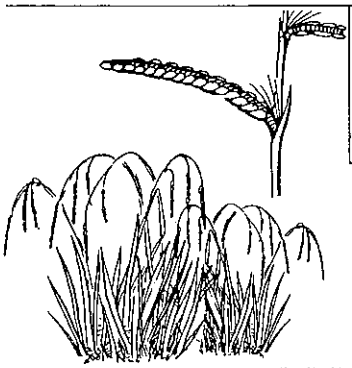
M8k 192, 2089, 2080; C4T 668; Tox 436; PP/US/C 360; PP/O 18



Description:
- Leaves: in 3 leaflets
- Flowers: **round clusters**
  - Red to purple red

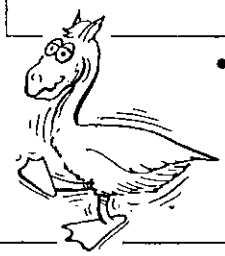


- **Molded red clover** (*Trifoleum pratense*) or other legumes, Fungus: *Rhizoctonia leguminicola*, Piperidine alkaloid (slaframine), Wet weather or high humidity
- Horse, Cattle, sheep & goats; Eastern & central USA
- **CS: "Slobbers"**, salivation (copious), anorexia, frequent urination, m/b watery diarrhea
- **Dx:** ID fungus w/ dissecting scope, Chem. ID of Slaframine in hay
- **Tx:** Remove from toxic forage, atropine
- **Px:** Recovery usually after forage removed, fatalities rare



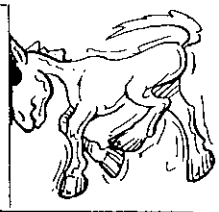
• Moldy corn poisoning, Blind staggers

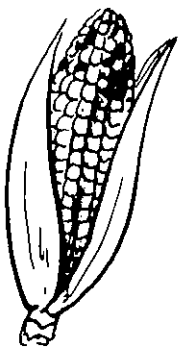
- See **NEURO** pg 267, ***Fusarium moniliforme*** - fungus, Winter
- Asymmetric damage to cerebrum
- **CS: CNS to "Dummies"**
- **Tx: None when CS, Euthanize**



• Staggers: Dallis grass, Paspalum, Ryegrass, Bermuda

- **SEE NEURO** pg 264; 1° Cattle
- Paspalum grasses + **Ergot**
- **CS: Staggers**, "Goose stepping",
- **Px:** CS regress in 2-4 d



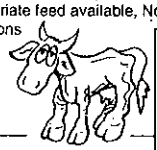


PP - Snake Bite

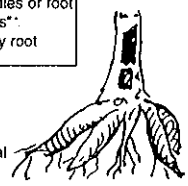
Water hemlock, Cicuta, Poison parsnip, Wild parsley, Snakeroot

Mk2 2108; IM 1646, C2T 675; PP/MI 17; PP/US/C 373

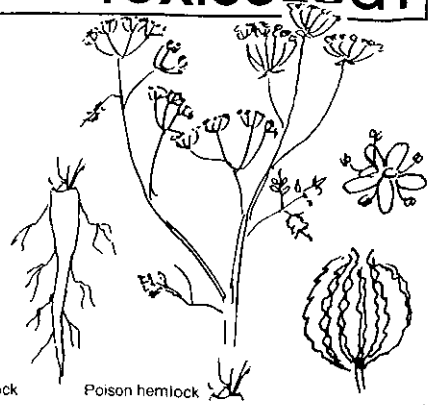
- 1° **Cattle**, all susceptible, *Cicuta douglasii*
  - Early Spring if low forage, watery environment
- **CS:** Death - resp. paralysis, muscle twitches, tremors, violent **convulsions** (not w/ poisonous hemlock), salivation, frothing at mouth
- **Tx:** Seldom eaten if appropriate feed available, No specific Tx, Sedate to control convulsions



Description
- Both similar: erect 4-8'
- Flowers: "umbrellas"
- Root
  - Water H. - bundles or root w/ "air chambers"
  - Poison H.: fleshy root



Water hemlock



Poison hemlock

Poison hemlock

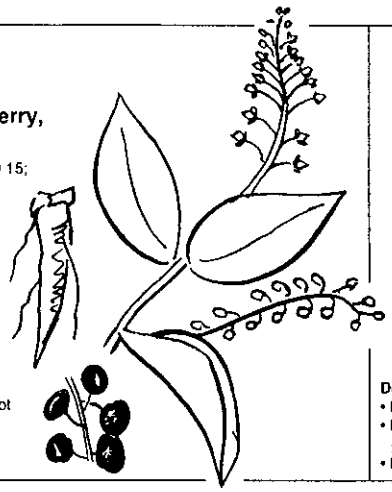
Mk2 2130; IM 1646; C2T 677; PP/ MI 17; PP/US/C 379

- **Cattle & pig**; sheep & horse less susceptible
  - *Conium maculatum*, alkaloid, extremely toxic - CNS
  - Confused w/ Water hemlock found in aquatic areas
  - Spring w/ no other forage - **nauseating taste**
- **CS: Similar to water hemlock, except absence of convulsions**
- **Tx:** Seldom eaten if appropriate feed available, Stimulants, Charcoal

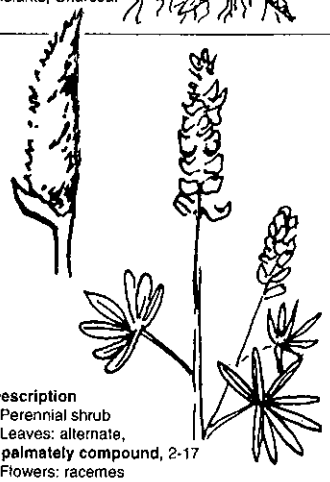
Pokeweed toxicosis, Inkberry, Pigeon berry, Garget

Mk2 2108; IM 1657, PP/O 15; PP/US/C 225

- *Phytolacca americana*
- Cattle & sheep, occasionally horse & pig
- CS: GI irritation, chemical oral burns, hemolytic crisis



Description
- Perennial, 9', fleshy taproot
- Leaves: alternate, ovate
- Flowers: racemes
- Fruit: purple berry



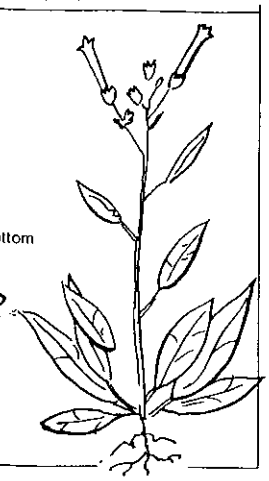
Description
- Perennial shrub
- Leaves: alternate, **palmately compound**, 2-17
- Flowers: racemes

Nicotine poisoning

IM 1647; E 194

- *Nicotiana tabaccum*, wild tobacco
  Nicotine alkaloids
- **CS:** Stimulation of ANS, Paralysis, Death
- **Dx:** Exposure CS
- **Tx:** None

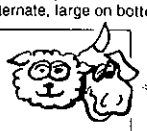
Description
- Annual, 1-3', sticky
- Leaves alternate, large on bottom



Lupine toxicity, Lupinosis

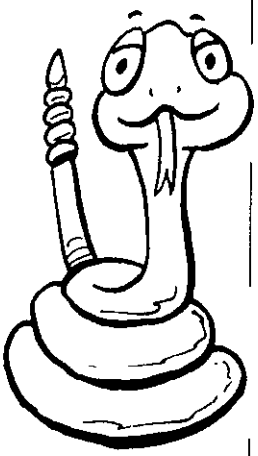
Mk2 2078, 2088, 2134; IM 1647, PP/MI 33

- 1° Sheep, Cattle common
- **Horses infrequent** (discriminating eaters)
- CS: agitation, depression



Venomous snake bites

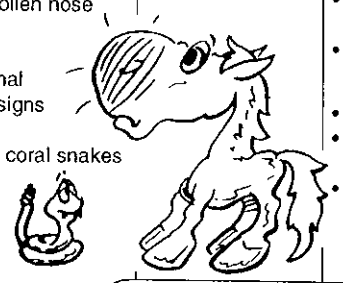
M8k 2152; Mk 1729; IM 1662; E 215; EM&S 764; C2T 663; LA-D 86; Pop 72-7/98



- **Pit vipers**
  - Copperhead (*Agkistrodon*)
  - Cottonmouth (*Agkistrodon pescivorus*)
  - Rattlesnake (Crotalarus)
  - Massasauga or pygmy rattlesnake (*Sistrurus*)
- **Coral snakes - Elapines**
  - Eastern or Texas coral snakes (*Micrurus*)
  - Arizona or Sonoran coral snake (*Micruroides*)
- **Toxic principles**
  - Coral snakes: neurotoxic - respiratory paralysis
  - Pit vipers: hemotoxic, necrotizing & anticoagulant (some neurotoxin)
- **Identification**
  - Pit vipers: pit organ on sides of nose . Rattlesnakes easy: rattle; broad, flat head
  - Coral snakes: bands of yellow, red & black (yellow bands in contact w/ red bands in USA), short fangs
  - "Pseudo" coral snakes - black bands bordering yellow bands on both sides
- **Horse: bitten on nose** or face (curiosity)
- **Rarely fatal** in adult equid or bovid

- **Pit vipers**
  - Distinct teeth marks on muzzle
  - Marked warm edema of lips
  - Skin discoloration common w/ rattle snakes, infreq. w/ copperheads
- Swollen nasal passages
  - **Dyspnea**
- Local tissue necrosis
  - 2° clostridial infections
- Cardiac, neurologic & resp. CS rare in adult equid, except swollen nose

- **Coral snakes**
  - Pain & swelling minimal
  - Systemic neurologic signs predominate
  - CS delay of hours for coral snakes



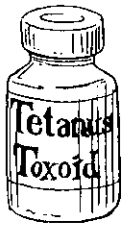
- CS, bite wounds

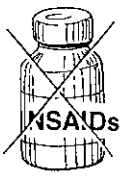
- **Rarely fatal, not emergency**
- Keep calm
- Thorough cleaning, disinfection & irrigation

- 1/2" incise & suck venom for 30 min (do under 30 min. of bite)
- **Antivenin** (Micrurus) w/in 2 hr of bite
  - Probably unnecessary in adult horse because of large body wt. & low fatality
  - Foal may be helpful
  - Have epinephrine for anaphylactic shock ready
- Tracheostomy if dyspnea from swollen nose

- No NSAIDs early (aggravate possible thrombocytopenia) OK in later stages for pain & edema
- **Antibiotics**
- **Tetanus toxoid** (+ antitoxin in unvaccinated horses)
- Foals w/ hypotension, cardiac dysrhythmias, CNS signs
  - IV fluids (careful for pulmonary edema)
  - Neostigmine for CNS signs (rare)

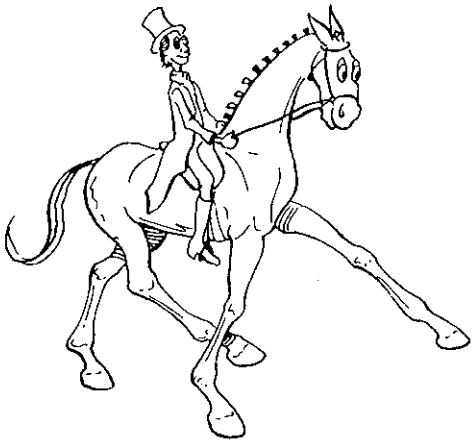
DDx
- Abscesses
- Spider bites
- Allergic reaction to insect bites or stings





Pit viper - Coral snakes
Curiosity bit the horse, Rarely fatal
CS: Swelling, dyspnea
Dx: Hx, Cs, bite
Tx: Cleaning, T. toxoid, Abs

"Red on yellow
- Kill a fellow.
Red on black
- Friend of Jack"
Good for USA Not for Mexico



DIFFERENTIAL DIAGNOSIS

Colic, Abdominal pain

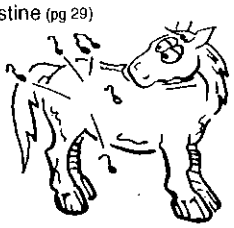
IM 128, 127; I2M 30, 125; M 25

COMMON CAUSES

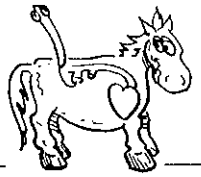
- **GI - common causes**
  - **Gas distention of intest., cecum or colon**
  - **Hypermotility & intestinal spasms**
  - **Feed impaction, constipation** (pg 77, 78)
  - **Meconium impaction** (pg 83)
  - **Gastroduodenal ulcers** (pg 26)
  - **Anterior enteritis** (pg 67)
- **Extra - GI**
  - **Mesenteric abscess** (pg 65)
  - **Ovarian tumor, abscess, or hematoma** (pg 188)
  - **Parturition** (pg 224)
  - **Acute hepatitis** (pg 88)
  - **Hepatic lipidosis** (pg 91)
  - **Diaphragmatic hernia** (pg 71)
  - **Ruptured bladder (foal)** (pg 155)
  - **Urinary tract or renal diz** (pg 152)
  - **Urolithiasis** (pg 155)
  - **Uterine torsions** (pg 232)

LESS COMMON CAUSES

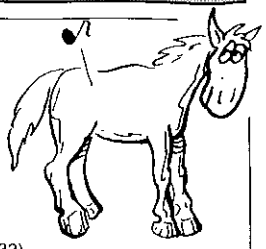
- **GI - less common**
  - Thromboembolism (cr. mesenteric a.) (pg 75)
  - Intest. FB (sand, enterolith, phytobezoar) (pg 79)
  - Volvulus of small intestine (pg 69)
  - Volvulus or displacement of bowel (pg 29)
  - Sand colic (pg 78)
  - Pedunculated lipoma w/ bowel strangulation (pg 67)
  - Hernia (inguinal, epiploic, umbilical, diaphragmatic) (pg 72, 73)
  - Nephrosplenic lig. entrapment (pg 81)
  - Ascarid impaction (pg 65)
  - Massive strongyle infection (pg 47, 75)
  - Gastric dilation (pg 29)
  - Peritonitis (pg 53)
  - Parasympathomimetic drugs
  - Irritant cathartics
  - Necrotizing enterocolitis (pg 34)
  - Psychogenic colic
  - Rectal tears (pg 82)
  - Rupture of stomach or intestine (pg 29)
  - Ileus (pg 66)
  - Intussusception (pg 72)
  - Cecal dilation (pg 76)
  - Enteroliths (pg 79)
  - Strangulating lipoma (pg 69)



- **Extra - GI less common**
  - Rabies (pg 271)
  - Pleuritis or pericarditis (referred pain) (pg 118)
  - Retained placenta (pg 238)
  - Uterine rupture or retroflexion
  - Spermatic cord thrombosis or torsion (pg 204)
  - Rupture of prepubic tendon (pg 233)
  - Splenitis
  - Splenic abscess
  - Splenomegaly
  - Cauda equina neuritis (w/ retention of feces or urine) (pg 284)

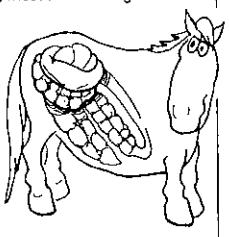


- **TOXIC CAUSES**
  - Cantharidin toxicity (pg 45)
  - Warfarin (pg 143)
  - Herbicides
  - Lead (pg 269)
  - Vacor (pg 315)
  - Phenylbutazone or other NSAIDs (pg 27)
  - Poisonous plants (pg 313-332)



UNCOMMON CAUSES

- **GI - Uncommon causes**
  - Abdominal adhesions (pg 66)
  - Intramural hematomas of stomach or intest.
  - Stenosis or stricture of bowel lumen
  - Botulism (pg 252)
  - Tetanus (pg 253)
  - Potomac fever (pg 43)
  - Exhaustion
  - Anaphylaxis (pg 117)
  - *Rhodococcus equi* - gut abscesses (pg 35)
  - Cribbing or wind sucking (pg 307)
  - Abdominal fibroma
  - Segmental ischemic necrosis following mesocolic tearing
  - Eq. viral arteritis (EVA) (pg 143)
  - Anthrax (pg 302)
  - Displaced colon (pg 80)
  - Malignant mesothelioma
  - Gastric or intestinal tumor (pg 28, 51)
  - Atropine
  - Moldy sweet clover (pg 141)

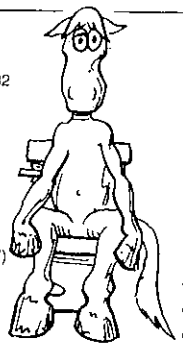


- **Extra-GI - uncommon causes**
  - Perirectal abscess
  - Pheochromocytoma (pg 299)
  - Purpura hemorrhagica (pg 140)
  - Biliary atresia
  - Vaginal or vulvar tear
  - Cholelithiasis (pg 91)
  - White muscle diz (pg 128)

Colic - Neonate
I2M 129

Diarrhea

IM xx; ; I2M xxi, xxii, 121, 122; M 32



Common cause:

- **Idiopathic** (pg 40, 46)
- **Salmonellosis** (pg 42)
- **Colitis** (pg 44)
- **Potomac fever** (pg 43)
- **Endotoxemia** (pg 52)
- **Sm. strongyles** (pg 36, 47)
- **Stress induced** (pg 40)
- **Nutritional** (pg 40)

Less common causes:

- Gastroduodenal ulcers (pg 26)
- Clostridiosis (pg 44)
- Chronic liver diz (pg 84)
- Peritonitis (pg 53)
- Eosinophilic gastroenteritis (pg 28)
- Chronic granulomatous bowel diz (pg 50)
- Enterotoxemia (pg 52)
- Intestinal lymphosarcoma (pg 30, 51)
- Proximal enteritis (pg 67)
- Necrotizing enterocolitis (clostridium) (pg 34)
- Intussusception (pg 72)
- Sand (pg 79)
- Enteroliths (pg 79)
- Gut stenosis (pg 66)
- Antibiotic use (lincomycin, tetracycline)
- *Rhodococcus equi* (pg 35, 48)
- Cryptosporidiosis (pg 37)
- Giardiasis
- Parasympathomimetics
- Cathartics, laxatives

- *Campylobacter jejuni*
- Heart failure (pg 125)
- Large strongyles (pg 47)

Toxicity:

- Phenylbutazone toxicity (pg 27)
- Blister beetle toxicity (pg 45)
- Selenium toxicity (pg 321)
- Monensin toxicity (pg 129)
- Organophosphate toxicity (pg 312)
- Arsenic toxicity (pg 313)
- Mercury toxicity (pg 313)
- Sulfur toxicity
- Phosphorus toxicity (pg 315)
- Slaframine toxicity (pg 332)
- Nicotine toxicity (pg 329)

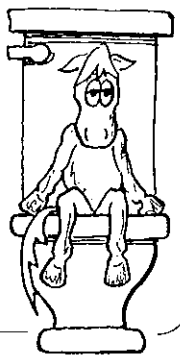
Poisonous plants:

- Jimson weed (pg 326)
- Algae poisoning (pg 324)
- Oleander poisoning (pg 329)
- Acorn or oak poisoning (pg 324)
- St John's wort (pg 323)
- Mycotoxicosis (pg 330)
- Castor bean poisoning (pg 327)
- Avocado poisoning
- Potato poisoning
- Japanese Yew poisoning

Diarrhea in foals

I2M 391; IM 347

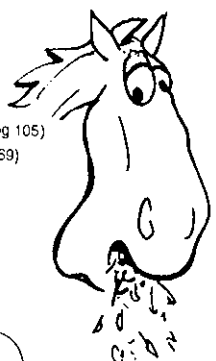
- Idiopathic
- Foal heat (pg 35)
- Failure of passive transfer (pg 39)
- Drug induced (ABs, phenobutazone) (pg 43, 27)
- Foal heat (pg 35)
- Bacterial septicemia (pg 38)
- Salmonellosis (pg 38)
- *Rhodococcus equi* (pg 35)
- *Clostridium perfringens* (pg 34)
- Rota virus (pg 38)
- Corona virus
- Nutritional (pg 38)
- *Parascaris equorum* (pg 37)
- Cyathostomes (pg36)
- *S. westerii* (pg 36)
- *S. vulgaris* (pg 36)
- Cryptosporidia (pg 37)
- *C. difficile*
- Campylobacter
- *B. fragilis*



Dysphagia

I2M 135; C4T 141; M 33

- Teeth problems (pg 18-20)
- Choke (pg 23)
- Pharyngeal paralysis
- Strangles (pg 96)
- Hepatoencephalopathy (pg 84)
- Guttural pouch diz (pg 98)
- Esophageal stricture (pg 22)
- Yellow star thistle (pg 267)
- Equine protozoal myeloencephalitis (pg 249)
- EEE, WEE (pg 266)
- Botulism (pg 252)
- Rabies (pg 271)
- Trauma (pg 262)
- Laryngeal surgery (pg 105)
- Lead poisoning (pg 269)



Melena
I2M 129

Peritonitis (pg 53) I2M 861; IM 674

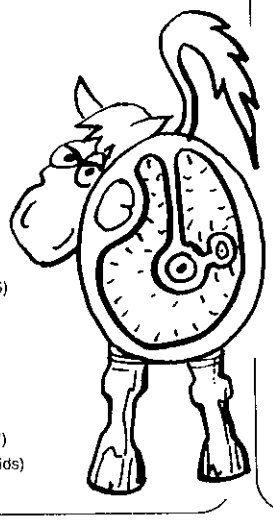
Infectious:
- Perforation of abdomen or intestine w/ migration of bacteria
- Septicemia
- Enteritis
- Abdominal abscesses (pg 65)
- Surgical complications
  - Anastomoses
  - Asepsis
  - Dead tissue
  - Gut trauma
  - Wound dehiscence
- Metritis (pg 183)
- Uterine rupture (pg 240)
- Ascending urinary tract infections (pg 152)
- Castration (pg 208)
- Equine influenza (pg 109)
- Equine infectious anemia (pg 136)
- Bastard strangles (pg 96)
- Chemical irritants + 2° infection

Noninfectious
- Gastric rupture (pg 29)
- Hepatitis (pg 88)
- Cholelithiasis (pg 91)
- Pancreatitis (pg 91)
- Splenitis
- Ruptured bladder (pg 154)
- Urinary tract obstruction (pg 155)
- Urolithiasis (pg 155)
- Ovarian tumor (pg 188)
- Hemoperitoneum
- Drugs
- Foreign bodies (drain, sponge)
- Chem (bile, gastric or pancreatic juice, barium, talc, chyle)

Traumatic:
- Perforation of abdominal wall
- Blunt abdominal trauma
- Ruptured diaphragm
- Bleeding accidents
- Foaling accident
- Rupture of esophagus

Iatrogenic:
- Rectal tear (pg 82)
- Intraperitoneal injection
- Uterine perforation
- Liver biopsy
- Cecal trocharization (pg 76)
- Enterocentesis
- Peritoneal dialysis

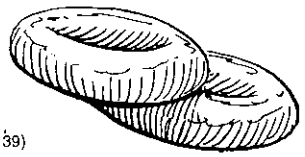
Parasitic:
- Larval migration
- Verminous arteritis (pg 127)
- Perforation (tapeworm, ascarids)

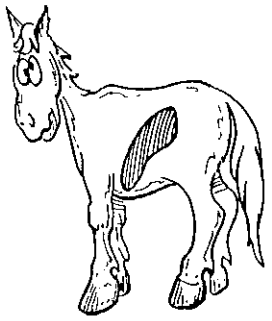


Icterus, Jaundice

I2M 139; IM 117, 142; Pic 79; Pop 90-2/98

- **Hemolytic anemia**
  - **Common causes**
    - **Immune-mediated hemolytic anemia** (pg 141)
    - **Ehrlichiosis** (pg 142)
    - **Neonatal isoerythrolysis** (pg 137)
  - Less common causes
    - Babesiosis (pg 144)
    - Equine infectious anemia (pg 136)
    - Transfusion reaction (pg 145)
    - Snake bite (pg 332)
    - Cold isoagglutinins
    - Erythrocytosis
  - Toxins
    - Phenothiazine poisonings (pg 139)
    - Red maple toxicity (pg 139)
    - Onion toxicity (pg 139)
- **Hepatic diseases**
  - **Common causes**
    - **Serum hepatitis (Theiler's)** (pg 88)
    - **Equine infectious anemia** (pg 136)
    - **Acute hepatitis** (pg 88)
    - **Chronic active hepatitis** (pg 90)
    - **Cholangitis** (pg 91)
    - **Bile stones** (pg 91)
    - **Fasting (hyperbilirubinemia)**
    - **Poisonous plants**
      - **Pyrrolizidine alkaloid** (pg 89)
  - Less common causes
    - Mycotoxicosis (pg 330)
    - Lupinosis (pg 329)
    - Tyzzer's disease (pg 87)
    - Hepatic abscess (pg 87)
    - Hepatic hyperlipemia (pg 91)
    - Drug toxicity
    - Phenol toxicity

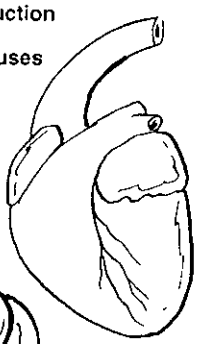


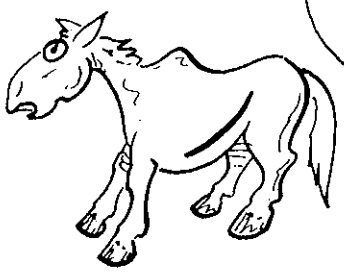


Dyspnea (respiratory distress) I2M 70, 73; IM 76; M 34

Common respiratory causes
- **Pneumonia** (bacterial, viral) (pg 111-116)
- **Pleuritis** (pg 118)
- **Pulmonary abscessation** (pg 113)
- **COPD** (Chronic obstructive pulmonary diz) (pg 121)
- **Strangles** (pg 96)
- **Prematurity (RDS - foals)** (pg 121)
- **Neonatal septicemia** (foals) (pg 35)
- **Pharyngeal/retropharyngeal abscesses or trauma** (pg 97)
- **Partial upper airway obstruction**

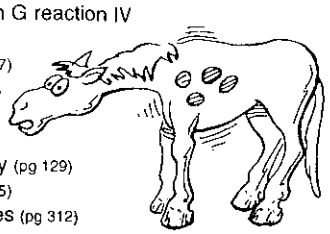
Common nonrespiratory causes
- **Cardiac diz - CHF** (pg 125)
- **Endotoxemia/Shock**
- **Anemia** (pg 134)
- **Pain**
- **Hyperthermia** (pg 303)





Less common respiratory causes
- Fungal rhinitis (pg 94)
- Nasal polyps
- Ethmoid hematoma (pg 94)
- Nasal trauma/neoplasia (pg 94)
- Cleft palate (pg 22)
- Epiglottic entrapment + infection (pg 107)
- Arytenoid chondritis (pg 104)
- Paranasal sinusitis (pg 102)
- Guttural pouch empyema, tympany (pg 99)
- Guttural pouch mycosis (pg 99, 100)
- Foreign bodies anywhere in resp. tract
- Exercise induced pulmonary hemorrhage (pg 101)
- Lung worms (pg 116)
- Inhalation pneumonia (pg 116)
- Neonatal maladjustment syndrome (pg 270)
- Pneumothorax (pg 121)
- Mediastinal abscess
- Diaphragmatic hernia (pg 71)
- Thoracic trauma (rib fxs, etc.)
- Coccidioidomycosis, cryptococcosis
- Bronchospasm

Less common nonrespiratory causes
- Gastric distention (pg 29)
  - Small intestinal obstruction (pg 64)
- Pulmonary edema (pg 117)
- Fluid therapy
- Pericarditis (pg 124)
- Cardiovascular defects (pg 130)
- Endocarditis (pg 132)
- Atrial fibrillation (pg 133)
- Left AV valve problems
- Purpura hemorrhagica (pg 270)
- Blood or plasma transfusions
- Acidosis
- Intracarotid injection (pg 272)
- Tetanus (pg 253)
- Malignant edema (pg 303)
- Injection abscess (Clostridium)
- Procaine penicillin G reaction IV
- Liver failure (pg 84)
- Anaphylaxis (pg 117)
- Tooth root tumors



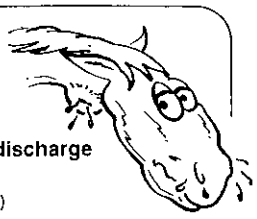
Toxic cause
- Red maple toxicity (pg 129)
- Blister beetle (pg 45)
- Organophosphates (pg 312)
- Lead (pg 269)
- Selenium (pg 321)
- Strychnine (pg 273)
- Ryegrass (pg 264)
- Pyrrolizidine alkaloids (pg 89)
- Locoweed (pg 265)
- Monensin (pg 129)
- Iron (pg 86)
- Sodium fluoroacetate (1080) (pg 315)
- Larkspur (pg 329)
- Oleander (pg 329)
- Water hemlock (pg 329)
- ANTU (pg 315)
- Vit. D

From *Large Animal Internal Medicine*, Smith; **I2M 70, 73; IM 76; M 34** for less common causes & more toxic causes

Tachypnea

I2M 70, 73; IM 76; M 34 78

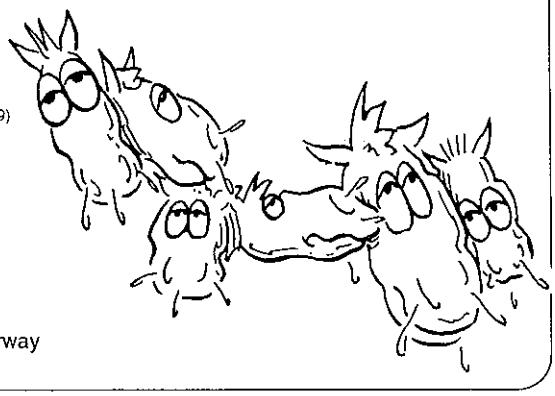
Nasal discharge I2M 56, 60; IM 60- 64; M 42



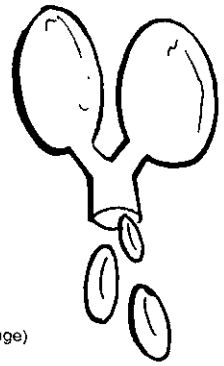
Serous discharge
- Influenza (pg 109)
- EHV-1 (pg 143)
- Rhinovirus (pg 110)
- Other viruses
- Pharyngitis/hyperplasia (pg 95)
- Nasal/sinus infections, cysts, polyps, tumors
- Early bacterial pneumonia/pleuritis (pg 111-116)
- Early strangles (pg 96)
- Guttural pouch infections/mycosis (pg 100)
- Overflow of nasolacrimal ducts
- COPD (pg 121)

Ingesta in nasal discharge
- Choke (pg 23)
- Cleft palate (pg 22)
- Pharyngitis (pg 95)
- Strangles (pg 96)
- Dorsal displacement of soft palate (pg 106)
- Guttural pouch infection, mycosis, neoplasia (pg 100)
- Glossopharyngeal nerve damage
- Botulism (pg 252)
- Retropharyngeal abscess (pg 97)

Mucopurulent
- 2° bacterial infections (postviral) (pg 111-116)
- Strangles (pg 96)
- Bacterial rhinitis
- Pharyngitis (pg 95)
- Pneumonia (pg 111-116)
- Guttural pouch empyema (pg 99)
- Lung abscess (pg 113)
- Pharyngeal abscess (pg 97)
- Paranasal infections (pg 103)
- Fungal rhinitis (pg 94)
- Nasal foreign body
- Conchal necrosis
- Ethmoid hematoma (pg 95)
- Nasal tumors, polyp, cyst
- Trauma: nasal, skull, upper airway



Epistaxis I2M 68; IM 67)



Common Cause
- Ethmoid hematoma (pg 95)
- Nasal polyps
- Fungal granulomas (pg 94)
- Tumors of nasal cavity
- Trauma from nasogastric tube or endoscope
- Guttural pouch mycosis (pg 100)
- Thrombocytopenia (pg 142)
- Purpura hemorrhagica (pg 140)
- EIPH (exercise induced pulmonary hemorrhage) (rarely see epistaxis) (pg 101)

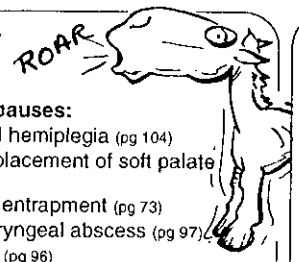
Less common causes
- Toxic hepatic failure (pg 86)
- Pharyngeal lymphoid hyperplasia (pg 95)
- Cryptococcal rhinitis (pg 94)
- Coccidiomycosis
- Fungal granuloma (pg 94)
- Guttural pouch empyema, neoplasia, or FB

Toxicity
- Arsenic (pg 313)
- Warfarin/dicoumerol (pg 143)
- Moldy sweet clover (pg 141)
- Pyrrolizidine alkaloids (pg 89)

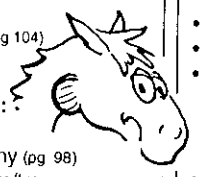
Uncommon causes see I2M 68, IM 67

Stridor

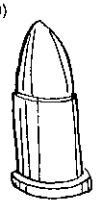
I2M 85, 90; IM 90; M 44)



Common causes:
- Laryngeal hemiplegia (pg 104)
- Dors. displacement of soft palate (pg 106)
- Epiglottal entrapment (pg 73)
- Retropharyngeal abscess (pg 97)
- Strangles (pg 96)
- Guttural pouch empyema/ mycosis (pg 99, 100)
- Pharyngitis (pg 95)
- Arytenoid chondritis (pg 104)
- Laxity of alar cartilage



Less common causes:
- Botulism (pg 252)
- Guttural pouch tympany (pg 98)
- Nasal polyps/neoplasm/trauma (pg 94)
- Ethmoid hematoma (pg 95)
- Sinusitis/tumors (pg 103)
- Tracheal problems/stenosis (pg 95)
- Purpura hemorrhagica (pg 140)
- Anaphylaxis (pg 117)
- Equine influenza (pg 109)
- EIPH (Ex. ind. pulm. hem.) (pg 101)
- Subepiglottic cyst (pg 107)
- Rostral displacement of palatopharyngeal arch

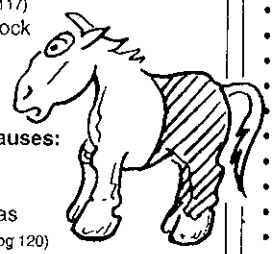


Toxic causes:
- Lead (pg 269)
- OPs (pg 312)
- Reserpine (pg 317)

From Large Animal Internal Medicine, Smith for uncommon causes

Cyanosis I2M 80, 425; IM 83)

Common causes:
- Bacterial/viral pneumonia (pg 111-116)
- Pleuritis (pg 118)
- Pulmonary abscesses (pg 113, 114)
  - *Rhodococcus equi*, Strep.
- COPD (Chronic obstructive pulmonary diz) (pg 121)
- Aspiration pneumonia (pg 116)
- Prematurity (RDS - foals) (pg 121)
- VSD/ tetralogy of Fallot, ASD (pg 130)
- Toxic methemoglobinemia
- Anaphylaxis (pg 117)
- Hypovolemic shock



Less common causes:
- Stenotic nares
- Neoplasia
- Nasal granulomas
- Pneumothorax (pg 120)
- Pulmonary edema (pg 117)
- Smoke inhalation (pg 314)

Toxic causes:
- Sulfur/hydrogen sulfide (pg 314)
- ANTU (pg 315)
- Chlorinated hydrocarbons (pg 312)
- OPs (Organophosp./carbamate) (pg 312)
- Red maple (pg 139)

From *Large Animal Internal Medicine*, Smith for uncommon causes

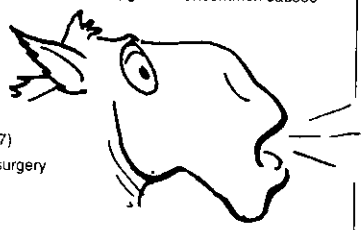
Coughing 341 I2M 46, 54; IM 54; M 30

Common causes:
- **Equine influenza** (pg 109)
- **Equine herpesvirus-1** (pg 111)
- **Rhinovirus, Reovirus** (pg 110)
- **Bact./aspiration pneumonia** (pg 116)
- **Bacterial pleuritis** (pg 118)
- **COPD** (C. obstr. pulm. diz)(pg 120)
- **Mechanical (dust)**
- **Pharyngitis** (pg 95)

Less common causes:
- Strangles (pg 96)
- Retropharyngeal abscess (pg 97)
- Pharyngeal/laryngeal trauma or surgery
- Pharyngeal paresis
- Inhalation pneumonia (pg 116)
- Lung worms (pg 116)
- Tracheal collapse/stenosis (pg 107)
- Chondritis of arytenoid cartilages (pg 104)
- Choke (pg 23)
- Guttural pouch empyema (pg 99)
- Guttural pouch mycosis (pg 100)
- Parascaris migration (pg 117)
- Pulmonary abscessation (pg 113)
- Epiglottic entrapment (pg 107)
- Subepiglottic cyst or abscess (pg 107)
- EIPH (Exercise induced pulm. hem.) (pg 101)
- Neonatal septicemia (pg 35)
- Left heart failure (pg 125)
- Congestive heart failure (pg 125)
- Equine viral arteritis (pg 111)
- Laryngeal surgery (pg 105)

Toxic causes:
- ANTU (pg 315)
- Pentachlorophenol (pg 314)
- Organophosphate (pg 312)
- Carbamate (pg 312)

From *Large Animal Internal Medicine*, Smith; pg 54 for uncommon causes



Chest pain

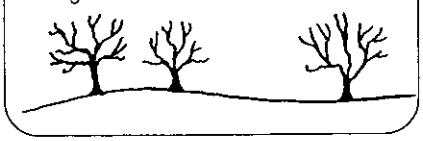
I2M 32; IM 30

Common cause
- **Lung abscess** (pg 133)
- **Pneumonia** (pg 111-116)
- **Pleuritis** (pg 118)
- **Pleuropneumonia** (pg 118)

Less common
- Choke (pg 23)
- Ruptured esophagus (pg 72)
- Mediastinal masses (pg
- Fractured ribs
- Osteomyelitis (pg 246)
- Tying up syndrome

Anestrus I2M 247; IM 243, 1367

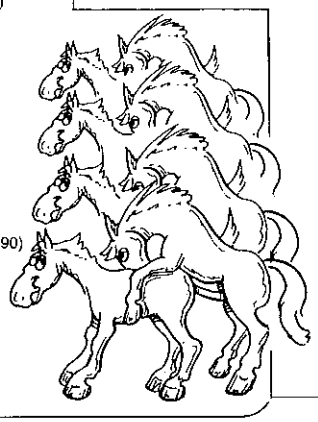
- **Pregnancy**
- **Seasonal anestrus** (pg 164)
- Transitional (pg 164)
- Prolonged estrus ("split estrus") (pg 165)
- Persistent corpus luteum (pg 166)
- Unobserved estrus (pg 169)
- Silent heat (pg 166)
- Nymphomania (pg 168)
- Nutritional infertility (pg 168)
- Twinning (pg 176)
- EED/Early embryonic death (pg 176)
- Genital infections (pg 169)
  - Endometritis (pg 183)
  - Metritis (pg 183)
  - Pyometra (pg 183)
  - Cervicitis (pg 184)
  - Vaginitis (pg 184)
- "Windsucker" (pg 177)
- Urine pooling (pg 186)
- Granulosa theca cell tumor (pg 188)
- Ovarian hypoplasia/dysgenesis (pg 190)
- Lymphangectasis of uterus (pg 191)
- Chronic diz
- Pituitary tumors
- Weight loss



Repeat Breeding (RB)

I2M 249; IM 246; M 37

- **Common causes**
  - **Transitional season** (pg 164)
  - **Windsucker** (pg 177)
  - **Endometritis/fibrosis** (pg 183)
  - **Twins** (pg 176)
  - **Poor AI timing**
  - **Poor heat detection** (pg 169)
  - **EED** (early embryonic death) (pg 176)
  - **Uterine lymphagectasis** (pg 191)
- Less common causes
  - Uterine pooling (pg 186)
  - Rectovaginal fistula (pg 236)
  - Malnutrition (pg 168)
  - Metritis (pg 183)
  - Pyometra (pg 183)
  - Heat stress
  - Poor semen quality
- Uncommon causes:
  - CEM (contagious equine metritis) (pg 179)
  - Gonadal dysgenesis (pg 190)
  - Neoplasia, uterine or cervical (pg 190)
  - Ovarian neoplasia (pg 188)
  - Parovarian cyst (pg 190)
  - Oophoritis
  - Salpingitis (pg 190)
  - Iodine deficiency
  - Phosphorus deficiency
  - Zearalenone toxicity
  - Intersexuality



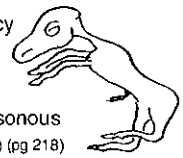
Abortion I2M 252; IM 1397; C4T 532

Common causes:

- **Twinning** (pg 220)
- **Early embryonic death** (pg 220)
- **Herpesvirus-1** (pg 215)
- **Streptococcal** (pg 217)

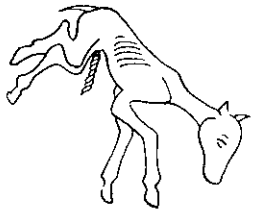
Less common causes:

- Malnutrition (pg 168)
- Equine viral arteritis (EVA) (pg 216)
- EIA (equine infectious anemia) (pg 216)
- Salmonella (pg 217)
- Leptospira (pg 218)
- Mycotic (pg 217)
- Placental insufficiency (pg 218)
- Premature placental separation (pg 218)
- Body pregnancy (pg 218)
- Congenital malformations (pg 219)
- Chromosomal abnormalities (pg 219)
- Fetal diarrhea (pg 219)
- Oxytocin (pg 219)
- Prostaglandins (pg 219)
- Glucocorticoids/severe stress (pg 219)
- Uterine torsion (pg 232)
- Uterine body pregnancy
- Ehrlichia abortion
- Endotoxemia



Chemicals, drugs & poisonous plants (implicated, not proven) (pg 218)

- Ryegrass (pg 264)
- Locoweed (pg 265)
- Sorghum (pg 156)
- Death camus (pg 329)
- Slaframine (pg 332)



Altered sexual function in stallions

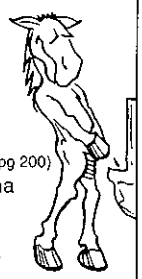
I2M 242

Dysuria/stranguria

I2M 34, 196, 426; IM 195; C4T 432

1° causes:

- Urethral calculi (pg 154)
- Cystic calculi (pg 154)
- Cystitis (pg 152)
- Sorghum cystitis (pg 259)
- Habronemiasis (pg 200)
- Smegma accumulation (pg 200)
- Penile or preputial trauma (pg 196)
- Urethritis (pg 200)
- Ruptured bladder (pg 155)
- Rabies (pg 271)
- Herpes myeloencephalopathy (pg 254)
- Estrogen-responsive dysuria

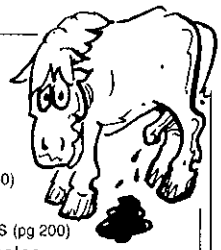


2° causes:

- Severe spinal cord diz (pg 245)
- Vertebral body infection or fxs (pg 246)
- Laminitis
- Recumbency
- Myositis
- Peritonitis (pg 53)
- Colic (pg 54-81)

Hematuria

I2M 199; IM 198; C4T 489



- Urethra:
  - Urethritis (pg 200)
  - Calculi (pg 155)
  - Habronemiasis (pg 200)
  - Idiopathic in males
- Urinary bladder:
  - Cystitis (pg 152)
  - Calculi (pg 155)
  - Tumors
  - Debris
  - Warfarin/dicoumerol (pg 143)
- Kidney:
  - Trauma
  - Calculi (pg 155)
  - Nephritis (pg 153)
  - Glomerulopathy (pg 149)
  - Vascular anomaly
  - Parasitic migration (pg 151)
  - Papillary necrosis (rarely hematuria)

Polyuria

I2M 206; IM 202; M 46; C4T 486

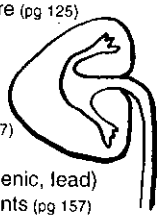
- Chronic renal failure (pg 150)
- Acute renal failure (pg 148)
- Psychogenic water intoxication (pg 297)
- Steroid administration
- Diuretic administration
- Fluid administration
- Cushing's syndrome (pg 296)
- Hyperglycemia
- Diabetes mellitus (pg 297)
- Diabetes insipidus (pg 297)
- Salt toxicity or deficiency (pg 313)
- Cl, K or urea deficiencies
- Blister beetle (pg 45)

Acute renal failure

I2M 204; IM 200

Vasomotor nephropathy:

- Hemorrhagic shock (pg 145)
- Septic shock
- Sepsis
- Congestive heart failure (pg 125)
- Dehydration
- Thromboembolism



Toxic:

- Aminoglycosides (pg 157)
- NSAIDs (pg 27)
- Heavy metals (Hg, arsenic, lead)
- Oxalate containing plants (pg 157)
- Vit D
- Pigment nephropathy (pg 149)

Immunologic:

- Glomerulopathy (rare) (pg 149)
- Drug-induced nephritis
- Acute interstitial nephritis (sporadic) (pg 149)

Pain on urination

IM 33

Common causes:

- Bladder calculus (pg 155)
- Rupture of bladder (pg 154)

Less common causes:

- Cystitis (pg 152)
- Urethritis (pg 152)
- Urethral calculi (pg 155)
- Neoplasia
- Vaginitis (pg 184)

Uncommon causes

- Pelvic fractures
- Urethral strictures

Chronic renal failure I2M 205; IM 201

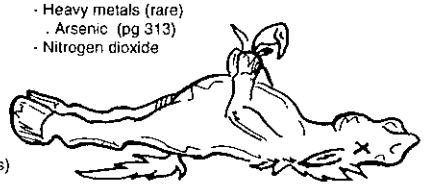
- Proliferative glomerulonephritis (immunological) (pg 150)
- Acute renal failure (septic, toxic or vascular causes) (pg 148)
- Obstruction (chronic or intermittent) (pg 155)
- Granulomatous infiltration
- Amyloidosis (rare) (pg 151)
- Idiopathic glomerulosclerosis (pg 151)
- Renal hypoplasia (pg 150)
- Neoplasia
- Chronic pyelonephritis (rare) (pg 151)
- Parasite migration (pg 151)

Oliguria I2M 426; M 46

- Chronic renal failure (pg 150)
- Acute renal failure (pg 148)
- Shock
- Dehydration (severe)
- Ruptured urinary bladder (pg 155)
- Urolithiasis (pg 154)
- Eq. herpes virus myelitis (pg 156)

Sudden death I2M 288; IM 283-290; M 45; C4T 651

- **Noninfectious**
  - **Lightning**
  - **Electrocution**
  - **Gun shot**
  - **Ruptured aorta**
  - **Ruptured heart**
  - **Anaphylaxis** (drug reactions) (pg 117)
  - **Trauma**
  - **GI torsion & rupture** (pg 69)
  - **Heat stroke** (rare)
  - **CNS embolism**
  - **Myocarditis** (pg 125)
  - **Uterine arterial rupture** (pg 221)
  - **Splenic rupture**
  - **Thrombi (verminous)** (pg 127)
  - **Uterine torsion** (pg 232)
  - **Skull fractures**
  - **Diaphragmatic hernia** (pg 71)
  - **Birth trauma**
- **Infectious**
  - **Malignant edema** (pg 303)
  - ***Cl. perfringens* endotoxemia** (pg 34)
  - **Endotoxins** (pg 52)
  - **Botulism (usually slower)** (pg 252)
  - **Babesiosis** (pg 144)
  - **Potomac fever** (pg 43)
  - **Salmonellosis** (pg 34, 42)
  - **Tyzzer's disease** (pg 87)
  - **Hemorrhagic enterotoxemia** (foals)
  - **Colitis-X** (pg 44)
  - Anthrax (rare) (pg 302)
- **Metabolic/Nutritional**
  - **White muscle disease** (pg 128)
  - **Transit tetany** (hypocalcemia, eclampsia)
- **Toxic**
  - **Monensin** (pg 129)
  - **Mycotoxins** (pg 330)
  - **Blister beetle** (cantharidin) (pg 45)
  - **Organophosphates/carbamate** (pg 312)
  - **Serum sickness** (pg 88)
  - **Black flies** (pg 287)
  - **Snake bite** (pg 333)
  - **Poisonous plants**
    - **Sweet clover** (pg 141)
    - Cyanogenic plants (pg 320)
    - Blue-green algae (pg 324)
    - Castor bean (ricinus) (pg 327)
    - Poison hemlock (pg 329)
    - Water hemlock (pg 329)
    - Oleander (pg 329)
    - Tobacco (pg 329)
    - Yew
  - Heavy metals (rare)
    - Arsenic (pg 313)
  - Nitrogen dioxide



Peripheral edema/Pleural effusion/Ascites

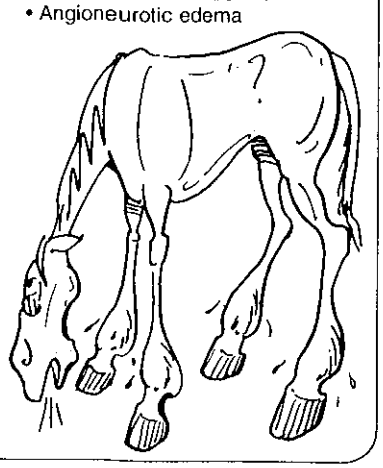
I2M 101; IM 101; M 35; C4T 269

Common causes:

- Pericarditis (pg 124)
- Heart problems:
  - Congestive heart failure (pg 125)
  - Vegetative endocarditis (pg 132)
  - Cardiomyopathy (pg 126)
  - Lt. or rt. AV valve regurgitation
  - Aortic valve insufficiency
  - Chronic atrial fibrillation (pg 133)
  - Congenital heart defects (pg 130)
  - Infectious myocarditis (pg 154)
- Heart base tumor
- Monensin toxicity (pg 129)
- Pleuritis (pg 118)
- Liver disease (pg 85)
- Kidney disease (pg 150)
- Equine viral arteritis (pg 143)
- Vasculitis (pg 127)
- Purpura hemorrhagica (pg 138)
- Equine ehrlichiosis (pg 142)
- Equine infectious anemia (pg 136)
- Thrombophlebitis (pg 127)
- Starvation
- Hypoproteinemia:
  - GI malabsorption (pg 50)
  - Peritoneal or pleural effusions
  - Ulcerative lymphangitis (pg 293)
  - Lymphatic obstruction/ lymphadenitis
  - Trauma
  - Tumor
  - Cellulitis
  - Parasitism
  - Drug reactions
  - Phenobutazone toxicity (pg 27)
  - Confinement
  - Rhodococcus infection (foal) (pg 35)

Uncommon causes:

- Pregnancy
- Ruptured bladder (pg 154)
- Angioneurotic edema



Fever I2M 37-45; IM 37-42

Infectious causes:

- **Common causes**
  - **Strangles** (pg 96)
  - **Pneumonia - bacteria/viral** (pg 111-116)
  - **Upper respiratory viral infections** (pg 94-107)
  - **GI parasite infection** (pg 36)
  - **Enteritis**
  - **Salmonellosis** (pg 34, 42)
  - **Potomac fever** (pg 43)
  - **Septicemia** (pg 35)
  - **Endotoxemia** (pg 52)
  - **DPJ** (duodenitis prox. jejunitis) (pg 67)
  - **Rotavirus diarrhea** (foals) (pg 38)
  - **Peritonitis** (pg 53)
  - **Localized abscesses**
  - **Tumors**
  - **Tetanus** (pg 253)
  - **Tenosynovitis, Cellulitis** (pg 143)
  - **Metritis** (pg 183)
- **Less common causes:**
  - EEE/WEE (pg 267)
  - EIA (pg 136)
  - EVA (pg 143)
  - Tyzzer's diz (foals) (pg 87)
  - Osteomyelitis (adults)
  - Bacterial endocarditis (pg 132)
  - Mastitis (pg 241)
  - Pyelonephritis (pg 151, 153)
  - Otitis media/interna (pg 263)
  - Vesicular stomatitis
  - Malignant edema (pg 303)

Fever - Neonate

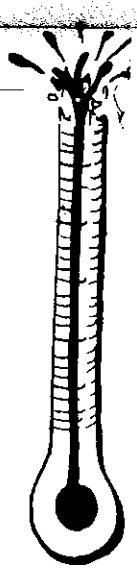
I2M 424

Neoplastic:

- **Common causes:**
  - **Squamous cell carcinoma** (pg 294)
  - **Metastatic melanoma** (pg 291)
  - **Lymphosarcoma** (pg 30)
  - **Fibrosarcoma** (pg 291)
- **Less common cause:**
  - Granulosa cell tumors (mares) (pg 188)
  - Reticuloendothelial cell sarcoma
  - Adenocarcinomas
  - Myeloproliferative diz (pg 144)

Immunologic causes of fever:

- **Common cause:**
  - **Urticaria** (pg 281)
  - **Purpura hemorrhagica** (pg 140)
  - **Drug induced fever**
- **Less common causes:**
  - CID (Combined immunodefc. diz) (pg 303)
  - IgM deficiency
  - Pemphigus foliaceus (pg 280)
  - Neonatal isoerythrolysis (pg 137)
  - Immune mediated hemolytic anemia (pg 141)
  - Thrombocytopenia (pg 142)
  - Chronic necrotizing vasculitis



Drugs

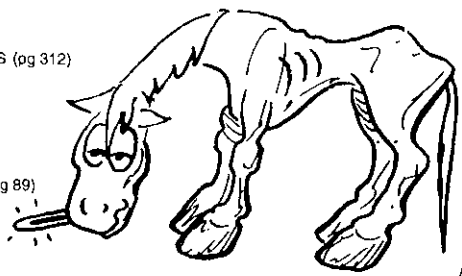
- **Common:**
  - **Penicillins**
  - **Sulfonamides**
  - **Procainamide**
  - **Quinidine**
  - **Amphotericin B**
  - **Antihistamines**
- **Less common:**
  - Levamisole
  - Cephalosporins
  - Iodides
  - Rifampin
  - Furazolidone
  - Cimetidine

Toxins:

- Blister beetle (pg 45)
- Mercury (pg 313)
- Propylene glycol
- Dinitrophenol
- Arsenic (pg 313)
- Selenium (pg 321)
- Chlorinated hydrocarbons (pg 312)
- Trichloroethylene
- Plant toxins:
  - Algae (pg 324)
  - Castor bean (pg 327)
  - Pyrrolizidine alkaloids (pg 89)
  - Jimson weed (pg 326)
  - Water hemlock (pg 329)
  - Mycotoxicosis (pg 330)

Miscellaneous - noninfectious:

- Acute renal failure (pg 157)
- Hepatic problems
  - Acute hepatitis (pg 88)
  - Chronic active hepatitis (pg 90)
  - Hyperlipidemia (pg 91)
  - Chlolelithiasis (pg 91)
- Foreign bodies (nasal, oral, pharyngeal, tracheal, bronchial)
- Thrombophlebitis (pg 127)
- Ocular trauma/recurrent uveitis (pg 295)
- Snake bite (pg 332)
- Burns
- Smoke inhalation (pg 314)



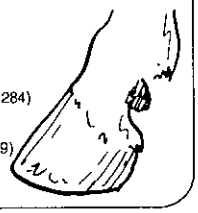
Pruritus I2M 226; IM 221; M 43

- Boredom
- Pemphigus foliaceous (immune mediated)
- Infectious diseases (bacteria, viral, parasites, chemical & photoactive dermatitis)
- Contact dermitis (Allergens: seasonal, pollen, parasite) (pg 278)
- Culicoides hypersensitivity (pg 284)
- Hypersensitivity reaction (food, drugs or inhalants)
- Rain scald (pg 276)
- Ringworm (pg 277)
- Ectoparasites
  - Lice (winter) (pg 282)
  - Mange (pg 283)
  - Mosquito bites (pg 288)
  - Pinworms (pg 288)
  - Biting files (pg 286)
- Early anaphylaxis (pg 117)
- Sweet itch (pg 284)
- Eosinophilic dermatitis (pg 280)
- Photosensitization (pg 89)
- Neurological dizs (Rabies, Polyneuritis equi, self mutilation syndrome)

Nodules/Tumors/Swellings

I2M 228; IM 223

- Cutaneous & SQ neoplasms (pg 290)
- Hives, urticaria (pg 281)
- Erythema multiforme (rare) (pg 281)
- Cutaneous cysts
- Abscess
- Hypersensitivity reaction
  - Insect, spider bite (pg 288)
  - Food or inhalant allergies
- Infectious disease
- Cutaneous lymphosarcoma (pg 291)
- Melanoma (pg 291)
- Sarcoids (pg 290)
- Nodular necrobiosis (pg 280)
- Amyloidosis (pg 289)
- Anaphylaxis (pg 117)
- Cutaneous habronemiasis (pg 284)
- Panniculitis (pg 289)
- Calcinosis circumscripta (pg 289)



Ulceration & Erosions

I2M 228; IM 224

- 2° to:
  - Nodules (see nodular diseases)
  - Tumors
  - Cysts
  - Hypersensitivity
  - Contact dermatitis (pg 278)
- Pruritus (see pruritic diseases)
- External trauma
- Hypersensitivity

Papule (small nodule) I2M 230; IM 225

- See nodular diseases DDx this page
- Hypersensitivity
  - Culicoides (pg 284)
  - Food & drug
- Parasites
  - Biting files (pg 286)
- Infectious diz (bacterial, viral, fungal)
- Neoplasia
  - Papillomas (pg 292)
  - Sarcoids (pg 290)
- Pemphigus foliaceus (pg 280)
- Generalized granulomatous diz

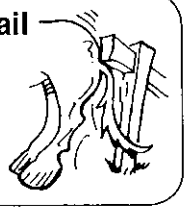
Pustules (accumulation of pus)

I2M 226230; IM 225, 226

- Bacterial infections
- Demodex (pg 283)
- Drug eruptions
- Rain scald (pg 276)
- Pemphigus foliaceous (pg 280)

Pruritus at head of tail

- Vice
- Food allergies
- Culicoides hypersensitivity
- Pin worms



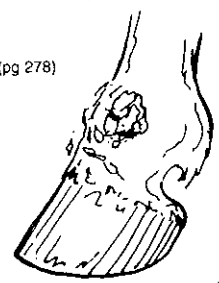
Vesicles/Bulla (accumulation of fluid)

I2M 230; IM 225

- Contact dermatitis (pg 278)
- Burns
- Autoimmune diseases
  - Pemphigus foliaceus (pg 280)

Scaling/Crusting I2M 231; IM 227

- Self trauma from pruritus (see pruritic diz)
- Rain scald (pg 276)
- Ringworm (pg 277)
- Pemphigus foliaceous (pg 280)
- Cushing's diz (pg 298)
- Cutaneous filariasis (pg 286)
- Photosensitization (pg 289, 328)
- Contact irritation (pg 278)
- Generalized granulomatous diz (pg 289)
- Anhydrosis (pg 298)
- Aural plaques (pg 292)
- Reticulated leukotrichia (pg 278)
- Seborrhea (pg 279)
- Lice (pg 282)
- Folliculitis (pg 277)



Hives, Uticaria

pg 281; I2M 1407; IM 1261

Allergic urticaria:

- Ingestants
  - Food or beverages
    - . Citrus fruits
    - . Strawberries
    - . Some fish
    - . Food additives
  - Drugs

Inhalants:

- Pollens
- Dander
- Smoke
- Dust
- Volatile chemicals
- Feather down
- Mold spores

Infections:

- Foci of bacteria, viral, fungal or parasitic

Contactants:

- Animal products
- Cosmetics
- Plastic
- Plant material
- Many chemicals

- **Drugs:**
  - Penicillin
  - Quinine
  - Sulfonamides
  - Aspirin
  - Insulin
  - Cocaine
  - Morphine
  - Codeine
  - Atropine
  - Polymyxin B

Injectants:

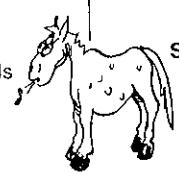
- Drugs
- Insect bites/stings
- Serums
- Blood
- Diagnostic agents

Toxins:

- Cobra venoms
- Plant toxins
- Jellyfish toxin
- Insects

Physical:

- Heat
- Cold
- Light
- Dermographic

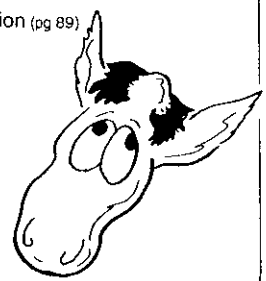


Secondary:

- Infections
- Neoplasia
- Psychogenic
- Collagen vascular disease

Alopecia I2M 2331; IM 228; M 26

- Self trauma (pruritus or ulceration)
- Trauma to skin
- Stress from high fever or severe illness & parturition
- Congenital alopecia
- Contact dermatitis (pg 278)
- Rain scald (pg 276)
- Ringworm (pg 277)
- Dietary deficiencies
- Drug hypersensitivity
- Black hair follicle dystrophy of Appaloosas
- Ectoparasites
  - Lice (pg 282)
  - Mange (pg 283)
  - Biting flies (pg 286)
  - Mosquitoes (pg 288)
- Grease heel (pg 279)
- Anhydrosis (pg 299)
- Sarcoids (pg 290)
- Mercury blister
- Photosensitization (pg 89)



Exercise intolerance I2M 92, 98, 111; IM 97; M 36

Respiratory:
- Roaring (pg 104)
- Displacement of soft palate (pg 106)
- Epiglottic entrapment (pg 73)
- Arytenoid chondritis/chondroma
- Pharyngeal lymphoid hyperplasia (pg 95)
- Guttural pouch infections (pg 99)
- Stenotic nares/enlarged alar fold/ nasal polyps
- Tracheal problems (pg 95)
- Ethmoid hematoma (pg 95)
- Paranasal sinus empyema (pg 103)
- EIPH (Exercise induced pulmonary hemorrhage)(pg 101)
- Pneumonia - viral/bact (pg 111-116)
- Pleuritis (pg 118)
- Pulmonary abscessation (pg 113)
- Diaphragmatic hernia (pg 71)

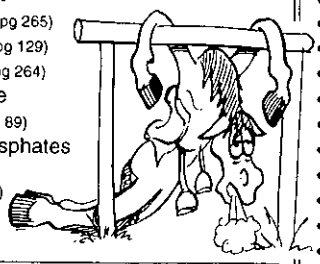
Cardiovascular causes:
- Atrial fibrillation (pg 133)
- Heart block
- CHF (pg 125)
- Valvular insufficiency or stenosis
- VSD/ASD/ Tetralogy of Fallot (pg 130)
- Endocarditis/myocarditis (pg 132)
- Pericarditis (pg 124)
- Thrombosis (pg 127)

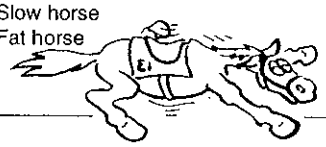
Musculoskeletal causes:
- Tying up syndrome
- Degenerative joint disease
- Back problems
- Tendonitis/desmitis
- Fractures
- Chronic sarcocystosis
- Sacroiliac problems
- Osteochondrosis
- Hoof imbalance

Metabolic/Systemic causes:
- Fluid & electrolyte imbalances
- Heat exhaustion
- Diarrhea diseases (pg 32-49)
- Liver diseases (pg 84)
- Skin diseases - generalized
- Anemia (pg 134)
- Anhydrosis (pg 298)
- Febrile diseases
- Myeloproliferative disease
- Thyroid tumors

General causes:
- Unconditioned
- Poorly trained
- Slow horse
- Fat horse

Toxic cause:
- Locoweed (pg 265)
- Monensin (pg 129)
- Ryegrass (pg 264)
- Pyrrolizidine alkaloids (pg 89)
- Organophosphates (pg 312)
- Lead (pg 269)
- Vit. D

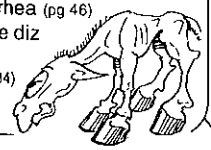




Weight loss - Foals M 47

Common causes:
- Septicemia (pg 38)
- Malnutrition
- Failure of passive transfer (pg 39)

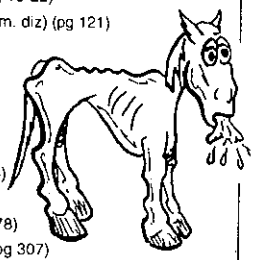
Less common causes:
- *Parascaris equorum* (pg 37)
- *Strongyloides westerii* (pg 36)
- *Rhodococcus equi* (pg 35)
- Bacterial GI infections (Salmonella, *E. coli*, Clostridium, Rhodococcus) (pg 35)
- Small intes. intussusception (pg 72)
- Chronic diarrhea (pg 46)
- White muscle diz (pg 128)
- Liver diz (pg 84)
- Idiopathic

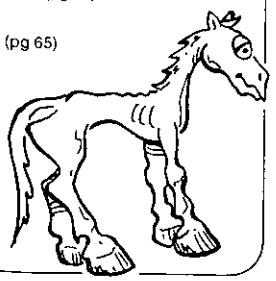


Weight loss I2M 171, 180, 189; IM 188; M 46)

Common causes
- Parasitism (pg 24, 35)
- Malnutrition
- Teeth & jaw problems (pg 18-22)
- COPD (chronic obstructive pulm. diz) (pg 121)
- Strangles
- Chronic infections
- Liver diz (pg 84)
- Pneumonia (pg 111-116)
- Lung abscesses (pg 113)
- *Rhodococcus equi* (pg 113)
- Pleuritis (pg 118)
- Sand colic/impaction (pg 78)
- Cribbing, Wind sucking (pg 307)
- Pyrrolizidine alkaloid toxicity (pg 89)
- *S. vulgaris* thromboembolism (pg 75)
- SCC of stomach (pg 26)
- Gastroduodenal ulcers (pg 26)
- Neoplasia
- Obstruction of small colon (pg 77)
- Peritonitis (pg 53)
- Abdominal abscesses (pg 65)
- Wound myiasis
- Infectious arthritis
- Heart failure
- Renal diz (pg 150)
- Idiopathic

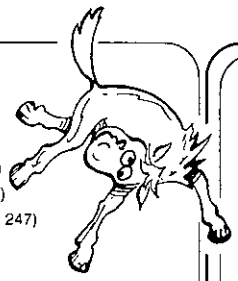
See *Large Animal Internal Medicine*, Smith, for less common & uncommon causes



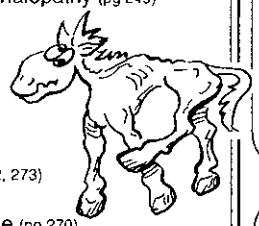


Ataxia M 29; C4T 651

Common causes:
- **Head/spinal cord trauma** (pg 245, 262)
- **Protozoal myeloencephalitis** (pg 250)
- **Cervical vertebral malformation** (pg 247)
- **Herpes myeloencephalitis** (pg 254)



Less common causes:
- Equine degenerative myeloencephalopathy (pg 249)
- Viral encephalomyelitides (pg 266)
- Hepatoencephalopathy (pg 268)
- Lead poisoning (pg 269)
- Vestibular syndrome (pg 263)
- Botulism (pg 252)
- Locoweed toxicosis (pg 265)
- Organophosphate toxicosis (pg 312, 273)
- Cauda equina neuritis (pg 248)
- Neonatal maladjustment syndrome (pg 270)
- Vertebral osteomyelitis (pg 246)
- Septicemia (pg 38)
- Otitis media/interna (pg 263)
- Rabies (pg 271)
- Narcolepsy/epilepsy (pg 272)
- Idiopathic epilepsy (Arabians)
- Verminous myeloencephalitis (pg 251)

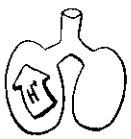


Metabolic acidosis I2M 457; IM 402

Common causes:
- Acute diarrhea (pg 32-49)
- Colic w/ strangulate bowel (pg 54-81)
- Peritonitis (pg 53)
- Ruptured bladder (pg 155)
- Excess exercise

Respiratory acidosis I2M 458; IM 404

Common cause:
- Obstruction of upper respiratory tract
- Laryngeal edema
- Pneumonia (pg 111-116)
- Pneumothorax (pg 121)
- Chronic obstructive pulmonary disease (pg 120)
- Depression of respiratory center of CNS
  - General anesthesia
  - Drugs (opiates, anesthetics & tranquilizers)
  - CNS disease



Metabolic alkalosis I2M 457; IM 404

- Gastric reflux w/ ileus (pg 67, 66)
- Excessive sweating in endurance horses
- Salivary loss w/ esophagostomy
- Diuretic
- Chloride &/or potassium depletion

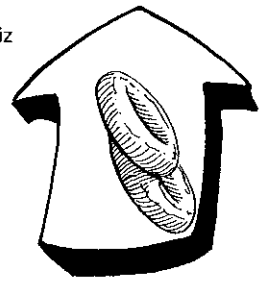
Respiratory alkalosis I2M 458; IM 405

Common causes:
- Hypoxemia
  - Pulmonary disease (pg 93)
  - Severe anemia (pg 134)
  - Congestive heart failure (pg 125)
- Stimulation of CNS respiratory center
  - Neurologic disorders
  - Psychogenic hyperventilation
  - Septicemia (pg 35)
  - Transport, pain, fear, excitement

↑ PCV I2M 478; IM 424

- Relative erythrocytosis:
  - Dehydration
  - Endotoxic shock
    - . Strangulating intest. obstruction (pg 66)
    - . Salmonellosis (pg 34, 42)
    - . Colitis -X (pg 44)
    - . Septic metritis (pg 183)
  - Splenic contraction
- Absolute erythrocytosis:
  - Common causes
    - . COPD (Chronic obstr. pulm. diz) (pg 121)
    - . Residence in high latitudes
    - . Congenital cardiovascular diz
  - Less common cause
    - . Hepatoma (pg 87)
    - . Pheochromocytoma (pg 288)
    - . Myeloproliferative diz (pg 144)
    - . Chronic hepatic diz (pg 90)
    - . Hemangioblastoma

From *Large Animal Internal Medicine*, Smith pg 424 for uncommon causes

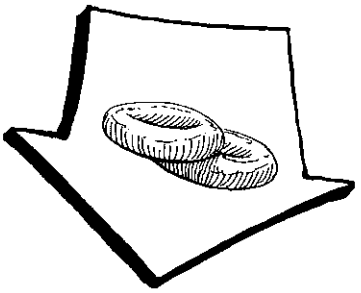


Anemia I2M 476; IM 423; M 27

Blood loss:
- Common causes:
  - Intestinal parasites (strongylosis) (pg 36)
  - Ectoparasites (lice [pg 272], ticks)
  - Gastric ulcers (pg 26)
  - Immune-mediated thrombocytopenia
  - Gastric SCC (squamous cell carcinoma) (pg 28)
  - Equine purpura hemorrhagica (pg 140)
- Less common causes:
  - DIC (disseminated intravascular coagulation) (pg 142)
  - Moldy sweet clover toxicosis (pg 143)
  - Warfarin poisoning (pg 143)
  - Hemophilia A or other congenital factor deficiency
  - Guttural pouch mycosis (pg 100)

Hemolysis:
- Common causes:
  - Neonatal isoerythrolysis (pg 139)
  - EIA (equine infectious anemia) (pg 138)
  - Red maple leaf toxicosis (pg 141)
  - Equine ehrlichiosis (pg 135)
- Less common causes:
  - Onion poisoning (pg 141)
  - Autoimmune hemolytic anemia
  - Babesiosis (piroplasmosis) (pg 144)
  - Clostridial infection
  - Incomplete blood transfusion

Inadequate RBC production
- Common causes:
  - Chronic inflammatory dizs
  - Abdominal abscess or other chronic abscessation (pg 143)
  - Chronic pneumonia/pleuritis (pg 118, 143)
  - Equine purpura hemorrhagica (pg 140)
  - Equine ehrlichiosis (pg 135)
  - Lymphosarcoma (pg 30)
  - Chronic liver diz (pg 143)
- Less common causes:
  - Myelogenous leukemia
  - Equine viral arteritis/EVA (pg 134)
  - Chronic renal failure (pg 148)
  - Radiation toxicosis
  - Idiopathic aplastic anemia



Cardiac murmur I2M 108

Muffled heart sounds I2M 108

Jugular venous distention I2M 112

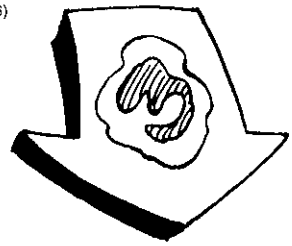
Enlarged lymph nodes I2M 115

Neutrophilia (↑ PMNs)

I2M 483; IM 429

Common causes:
- **Exercise/excitement**
- **Stress/corticosteroid administration**
- **Chronic salmonellosis or colitis** (pg 46)
- **Chronic peritonitis** (pg 53)
- **Abdominal/internal abscesses** (pg 65)
- **Strangles** (pg 96)
- **Chronic pneumonia** (pg 118)
- **Chronic pleuritis** (pg 118)
- **Purpura hemorrhagica (vasculitis)** (pg 138)
- **Thrombophlebitis** (pg 127)

Less common:
- Chronic hepatitis (pg 90)
- Cholelithiasis (pg 91)
- Lymphosarcoma/internal neoplasia (pg 31)
- Bacterial endocarditis (pg 132)
- Autoimmune hemolytic anemia (pg 141)
- Granulocytic leukemia
- Pyelonephritis (pg 151, 153)
- Cellulitis (pg 276)



Neutropenia (↓ PMNs)

I2M 484; IM 430

Common causes:
- **Acute peritonitis** (pg 46)
- **Septicemia/endotoxemia** (pg 52)
- **Neonatal septicemia** (pg 35)
- **Acute salmonellosis** (pg 42)
- **Acute toxic colitis**
- **Proximal enteritis (DPJ)** (pg 67)
- **Acute pleuritis** (pg 118)
- **Equine influenza** (pg 109)
- **Snotts (EHV-1)** (pg 111)
- **Acute metritis** (pg 183)

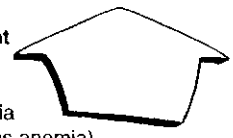
Less common causes:
- Potomac fever (pg 43)
- Ehrlichiosis
- Equine viral arteritis (pg 143)
- Idiopathic aplastic anemia
- Radiation therapy

Lymphocytosis (↑ lymphocytes)

I2M 485; IM 431

Common causes:
- **Exercise/excitement**

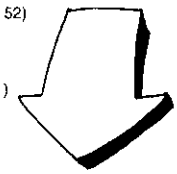
Uncommon causes:
- Lymphocytic leukemia
- EIA (equine infectious anemia)



Lymphopenia (↓ lymphocytes)

I2M 485; IM 431

Common causes:
- **Stress/corticosteroid administration**
- **Endotoxemia/septicemia** (pg 52)
- **Acute peritonitis** (pg 46)
- **Influenza** (pg 109)
- **Equine herpes virus-1** (pg 111)



Less common causes:
- Starvation/malnutrition
- CID (combined immunodeficiency) (pg 303)
- EVA (equine viral arteritis) (pg 143)
- Pyometra (pg 183)

Monocytosis (↑ monocytes)

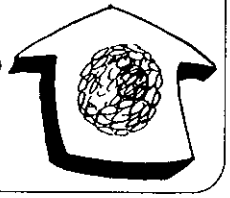
I2M 486; IM 432

Uncommon causes:
- Chronic bacterial infections
- Granulomatous disease

Eosinophilia (↑ eosinophils)

I2M 486; IM 432

Uncommon cause:
- Cutaneous habronemiasis (pg 284)
- Internal parasites
- Lymphosarcoma (pg 31)
- Eosinophilic leukemia
- Systemic hypersensitivity reaction



Hyperproteinemia I2M 492; IM 439

Panhyperproteinemia - dehydration

Common cause:
- **Salmonellosis** (pg 34, 42, 48)
- **Acute toxic colitis**
- **Intestinal clostridiosis** (pg 44)
- **Potomac fever** (pg 43)
- **Proximal enteritis** (pg 67)
- **Sepsis/endotoxemia** (pg 52)
- **Intestinal strangulation** (pg 66, 79)
- **Choke** (pg 23)
- **Botulism** (pg 252)

Prot.

Less common causes:
- Chronic hepatic disease (pg 90)
- Guttural pouch mycosis w/ dysphagia (pg 100)
- Chronic renal failure (pg 150)
- Protozoal myelitis
- Salt toxicosis (pg 313)
- Toxins/poisonous plants
  - Lead toxicity (pg 269)
  - Yellow star thistle poisoning (pg 267)
- Idiopathic dysphagia

Hyperglobulinemia

Common cause:
- **Abdominal abscesses** (pg 65)
  - **Bastard strangles** (pg 96)
- **Chronic pleuritis** (pg 118)
- **Pulmonary abscess** (pg 96)
- **EIA** (equine infectious anemia) (pg 136)
- **Purpura hemorrhagica** (pg 140)

Less common causes:
- Lymphosarcoma (pg 30)
- Strongyloides (pg 36)
- Chronic hepatic disease (pg 90)

Hypoproteinemia (↓ protein) I2M 494; IM 442

Hypoalbuminemia

Common causes:
- **Parasitism**
- **Protein losing enteropathy** (pg 50)
- **Idiopathic granulomatous enteritis** (pg 50)
- **Intestinal lymphosarcoma** (pg 30, 51)
- **Salmonellosis** (pg 34, 42, 48)
- **Potomac fever** (pg 43)
- **Colitis X** (pg 44)
- **Clostridiosis** (pg 44)
- **Chronic hepatic fibrosis** (pg 90)
  - **Pyrrolizidine alkaloid toxicity** (pg 89)
- **NSAIDs** (nonsteroidal antiinflammatory drugs)
- **Glomerulonephritis** (pg 148)
- **Pyelonephritis** (pg 151, 153)

Less common causes:
- Starvation
- Chronic eosinophilic gastroenteritis (pg 28)
- Chronic hepatitis (pg 90)
- Hepatic neoplasia (pg 87)
- Amyloidosis (pg 149)
- Tuberculosis
- Histoplasmosis

Prot.

Panhypoproteinemia

Common causes:
- **Excessive fluids or water intake**
- **Gastrointestinal ulceration** (pg 26)
- **Strangulation - GI obstr./infarction** (pg 66, 75, 79)
- **Protein-losing enteropathy** (granulomatous) (pg 50)
- **Acute peritonitis** (pg 53)
- **Acute blood loss** (pg 145)
- **Glomerulonephritis** (pg 148)
- **NSAIDs** (nonsteroidal anti-inflammatory drugs) (pg 27, 43)

Less common causes:
- Parasites - blood sucking internal or external
- Intestinal lymphosarcoma (pg 30, 51)
- Congestive heart failure (pg 125)
- DIC (disseminated intravascular coagulopathy) (pg 140)
- Immune-mediated thrombocytopenia (pg 142)
- Urinary blood loss:
  - Congenital vascular disorders, renal trauma, renal calculi (pg 155), pyelonephritis (pg 151, 153), neoplasia, cystic calculi (pg 155)

Hyperfibrinogenemia I2M 496; IM 443

Common causes:
- Abscessation
- GI inflammation
- Salmonellosis (pg 34, 42, 48)
- Chlolelithiasis (pg 91)
- Peritonitis/abscesses (pg 53)
- Pneumonia (pg 111-116)
- Pleuritis (pg 118)
- Purpura hemorrhagica (pg 140)
- Osteomyelitis
- Septic arthritis
- Cellulitis (pg 143)

Fibrin

Hypofibrinogenemia I2M 503; IM 450

Uncommon causes:
- Acute severe DIC
- Acute hepatic necrosis
- Severe hepatic fibrosis

Thrombocytopenia (↓ platelets)

I2M 499; IM 446

Common causes:
- **DIC** (disseminated intravascular coagulation) (pg 140)
- **Immune-med. thrombocytopenia** (INTP) (pg 142)
- **Endotoxemia/septicemia** (pg 52)
  - **Acute toxic colitis**
  - **Intest. strangulating obstruction** (pg 68, 80)
  - **Neonatal septicemia** (pg 35)
- **Lymphosarcoma** (pg 30, 51)
- **Ehrlichiosis** (pg 43)
- **EIA** (equine infectious anemia) (pg 136)

Less common cause:
- Salmonellosis (pg 34, 42, 48)
- Influenza (pg 109)
- EVA (equine viral arteritis) (pg 143)
- Aplastic anemia
- Stachybotryotoxicosis
- Plasma cell myeloma
- Myeloproliferative disease (pg 144)

Prolonged APTT

(Activated partial prothrombin time) I2M 501; IM 448

Common causes:
- **DIC** (Disseminated intravascular coagulation) (pg 140)
- **Acute hepatic necrosis**
- **Warfarin toxicosis** (pg 141)

Less common causes:
- Moldy sweet clover toxicosis (pg 141)
- Hepatotoxins
  - Pyrrolizidine alkaloids (pg 89)
  - Rubratoxins, aflatoxins (pg 330)
  - Bitterweed (pg 327)
- Hemophilia A
- Congenital deficient factors IX, XI, hi-molecular weight kininogen or prekallikrein

APTT

Elevated FDPs (Fibrogen degradation products) I2M 502; IM 449

Common causes:
- DIC (Disseminated intravascular coagulation) (pg 140)
- Thrombophlebitis (pg 127)
- Severe inflammatory disorders
- Postoperative states
- IMTP (Immune-mediated thrombocytopenia) (pg 142)

FDPs

Uncommon causes:
- Massive internal hemorrhage
- Primary hyperfibrinolysis

Prolonged PT (prothrombin time)

I2M 500; IM 447

Common cause:
- **DIC** (disseminated intravascular coagulation) (pg 140)
- **Warfarin toxicosis** (pg 143)
- **Acute hepatic necrosis** (pg 148)
- **Chronic hepatic fibrosis** (pg 150)
- **Pyrrolizidine alkaloid toxicosis** (pg 89)
- **Aflatoxicosis** (pg 330)

Less common causes:
- Moldy sweet clover (pg 141)

PT

Reduced antithrombin III

I2M 502; IM 450

Common cause:
- **DIC** (Disseminated intravascular coagulation) (pg 140)
- **Chronic glomerulonephritis**
- **Protein losing enteropathy**
  - **Intestinal lymphosarcoma**
  - **Granulomatous enteritis**
  - **Phenylbutazone toxicosis**
- **Starvation**

Less common causes:
- Acute hepatic necrosis
- Venous thrombosis
- Acute toxic enteritis

Antithrombin 3

Serum enzyme elevation I2M xxv, 461; IM xxii

SDH ↑

(sorbitol dehydrogenase)

- **Common causes:**
  - **Acute liver failure** (pg 88)
  - **Liver abscess** (pg 87)
  - **Damaged bowel**
    - **Strangulation** (pg 66)
    - **Acute toxic enteritis**
- Less common cause:
  - Chronic liver failure (pg 90)
  - Acute & severe anemia (pg 134)
  - General anesthesia
  - Anorexia

GGT ↑

(gamma-glutamyl transferase)

- **Common causes:**
  - **Acute liver failure** (pg 88)
  - **Chronic liver failure** (pg 90)
  - **Pyrrolizidine alkaloid toxicity** (pg 89)
  - **Aflatoxicosis** (pg 330)
  - **Cholangiohepatitis** (pg 91)
  - **Cholelithiasis** (pg 91)
  - **Normal range in young**

AP ↑

(alkaline phosphatase)

Common cause:
- **Acute liver failure** (pg 88)
- **Chronic liver failure** (pg 90)
- **Cholangiohepatitis** (pg 91)
- **Cholelithiasis** (pg 91)
- **Hi normal range in young**

CPK ↑

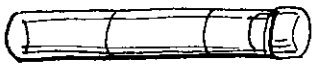
(creatine phosphokinase)

Common cause:
- **Tying up (muscle damage)**
- **Nutritional myodegeneration (Se/Vit E defc)** (pg 128)
- **Malignant hyperthermia** (pg 303)
- **After endurance rides**

Uncommon cause:
- Post exercise increase
- Equine influenza
- Cardiomyopathy
- IM injection
- Purpura hemorrhagica

LDH ↑

(lactate dehydrogenase)



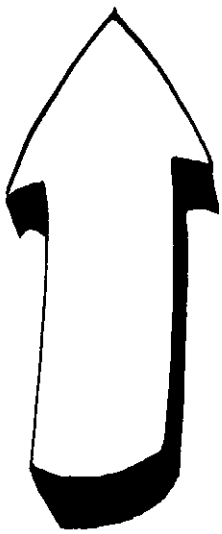
Common cause
- **Muscle disease**
  - **Tying up (muscle damage)**
  - **Nutritional myodegeneration** (Se/vit E defc) (pg 128)
  - **Malignant hyperthermia** (pg 303)
  - **After endurance rides**
- **Liver disease**
  - **Acute liver failure** (pg 88)
  - **Chronic liver failure** (pg 90)
  - **Cholangiohepatitis** (pg 91)
  - **Cholelithiasis** (pg 91)
- **Hemolysis** (pg139-143)

Uncommon cause:
- Acute cardiomyopathy (pg 126)
- Hemolytic anemia (pg 141)
- Equine influenza (pg 109)
- Purpura hemorrhagica (pg 140)
- IM injection

AST, GOT ↑

(aspartate aminotransferase)

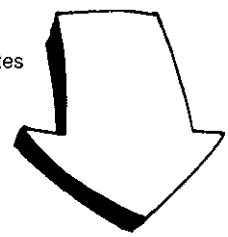
- **Same as for LDH**



BUN ↓ ↑

↓ BUN (blood urea nitrogen) I2M 466; IM 411

Common causes:
- Liver failure (pg 84-91)
- Normally lower in neonates



↑ BUN (blood urea nitrogen) I2M 466; IM 411

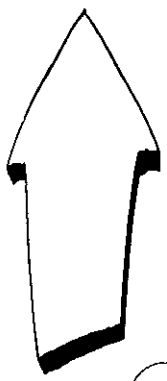
Common causes:
- Prerenal azotemia
  - Hypovolemia
  - Congestive heart failure (pg 125)
  - Reduced renal perfusion
  - Dehydration - endurance exercise
- Renal azotemia
  - Acute renal failure (pg 148)
  - Chronic renal failure (pg 150)
- Postrenal azotemia
  - Urolithiasis (renal, ureteral, urethral calculi) (pg 155)
  - Ruptured bladder (pg 155)

Bilirubin ↑

↑ Serum bilirubin

I2M 464; IM 408

Common causes:
- Hemolytic anemia (pg 134)
- Liver failure (pg 84-91)
- Systemic disease
- Fasting/anorexia

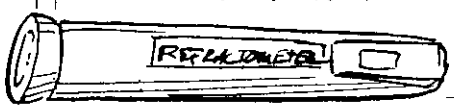


• ↑ Indirect bilirubin

Common causes:
- Hemolytic anemia (pg 134)
- Liver failure (pg 84-91)
- Systemic disease
- Fasting/anorexia

• ↑ Direct bilirubin

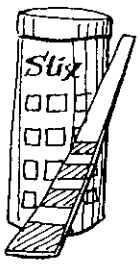
Common cause:
- Liver failure (pg 84-91)
- Cholelithiasis (pg 91)
- Cholangiohepatitis (pg 91)
- Neonatal isoerythrolysis (pg 137)



Glycemia ↓ ↑

↓ Hypoglycemia I2M 464; IM 409

Common cause:
- Anorexia in newborn
- Late endotoxic shock



↑ Hyperglycemia

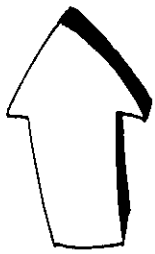
I2M 464; IM 409

Common cause:
- Excitement & stress
- Acute colic (pg 54-81)
- Cushing's syndrome (pg 296)
- Xylazine administration
- Glucocorticoid administration

Creatinine ↑

I2M 465; IM 410

Common cause:
- Prerenal azotemia
  - Hypovolemia
  - Congestive heart failure (pg 125)
  - Reduced renal perfusion
  - Dehydration - endurance exercise
- Renal azotemia
  - Acute renal failure (pg 148)
  - Chronic renal failure (pg 150)
- Postrenal azotemia
  - Urolithiasis (renal, ureteral, urethral calculi) (pg 155)
  - Ruptured bladder (pg 155)



Hyponatremia (↓ Na) I2M 450; IM 395

Common causes:

- **Decreased fluid volume**
  - **Diarrhea** (pg 32-49)
  - **Blood loss** (pg 145)
  - **Excessive sweating**
  - **Fluid drainage**
    - **Pleural drainage**
    - **Gastric reflux** (pg 67)
  - **Sequestration of fluid in 3rd space**
    - **Ascites**
    - **Peritonitis** (pg 53)
    - **Ruptured bladder** (pg 155)
    - **Torsion or volvulus or gut** (pg 69, 80)
  - **Adrenal insufficiency** (pg 297)
  - **Hyperlipidemia** (pg 91)
  - **Hyperglycemia**
    - Excitement & stress, Cushing's diz, Acute colic, Steroid administration, xylazine administration
  - **Excessive 5% dextrose to renal diz patient**

Uncommon causes:

- Water retention (normal circulatory volume)
  - Renal disease (pg 148)
  - Excess ADH (antidiuretic hormone) (pg 296)
  - Psychogenic polydipsia

Hypernatremia (↑ Na) I2M 450; IM 396

Common causes:

- **Water loss**
  - **Water deprivation** (pg 313)
- **Sodium excess** (water restriction/salt poisoning) (pg 313)

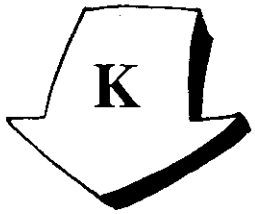
Uncommon causes:

- Water loss >> electrolyte loss
  - Diarrhea (pg 32-49)
  - Vomition
  - Burns
  - Intrinsic renal diz
  - Diabetes insipidus (pg 297)
  - Hypertonic saline or NaCO3 administration
  - Mineralocorticoid excess (pg 296)

Hypokalemia (↓ potassium) I2M 451; IM 396

Common causes:

- **Diarrhea** (pg 32-49)
- **Gut torsion/volvulus** (pg 69, 80)
- **Peritonitis** (pg 53)
- **Metabolic acidosis**
- **Dietary deficiencies**
- **Prolonged anorexia**
- **Vomition**



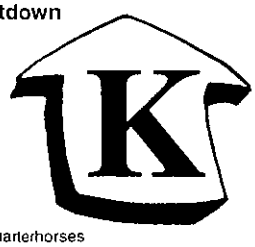
Uncommon causes:

- Mineralocorticoid excess
- Renal tubular acidosis
- Diuretics
- Postobstructive diuresis
- Excessive NaCO2 administration
- Excess catecholamines
- Insulin or glucose administration

Hyperkalemia (↑ potassium) I2M 451; IM 397

Common causes

- **Hypovolemia w/ renal shutdown**
- **Metabolic acidosis**
- **Excessive exercise**
- **False hyperkalemia**
  - **In vitro hemolysis**
  - **Prolonged storage**



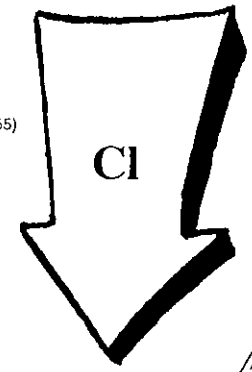
Uncommon causes

- Renal disease (pg 148)
- Addison's disease
- Hyperkalemic periodic paralysis in Quarterhorses
- Tissue necrosis
- Diabetes mellitus (pg 297)

Hypochloremia (↓ cloride) I2M 452; IM 398

Common causes:

- Diarrhea (pg 32-49)
- Blood loss (pg 145)
- Fluid drainage
- Peritonitis (pg 53)
- Ruptured bladder (pg 155)
- Ascites
- Excessive sweating
- Gastric reflux (pg 66, 67)



False hypochloremia

- Hyperglycemia
- Hyperproteinemia
- Hyperlipidemia (pg 91)

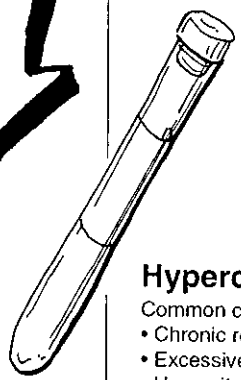
Uncommon causes:

- Psychogenic polydipsia (pg 297)

Hypochloremia w/o hyponatremia

Common causes:

- Metabolic alkalosis
- Lasix (furosemide) response in horses



Hyperchloremia (↑ Cl) I2M 452; IM 398

Common causes:

- Water deprivation (pg 313)
- Salt poisoning (pg 313)

Hyperchloremia w/o hypernatremia

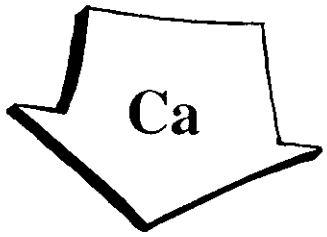
Common causes:

- Hyperchloremic metabolic acidosis
- Renal tubular necrosis (pg 148)

Hypocalcemia (↓ calcium) I2M 454; IM 399

Common causes:

- Lactation tetany
- Hypoalbuminemia
- Transport tetany
- Blister beetle toxicosis (pg 45)
- Diaphragmatic flutter
- Acute renal failure (pg 148)



Hypercalcemia (↑ Ca) I2M 454; IM 400

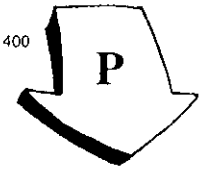
Common causes:

- Chronic renal failure (pg 150)
- Excessive, rapid IV calcium
- Hypervitaminosis D
  - Excessive supplementation

Hypophophatemia (↓ phosphorus) I2M 455; IM 400

Common causes:

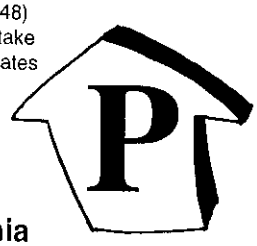
- Chronic renal failure (pg 150)



Hyperphosphatemia (↑ phosphorus) I2M 455; IM 401

Common cause:

- Acute renal failure (pg 148)
- Excessive phosphate intake
- Hi normal range in neonates
- Endurance exercise



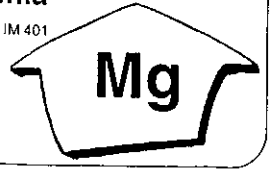
Hypomagnesemia (↓ magnesium) I2M 455; IM 401

Common cause:

- **Endurance exercise**

Hypermagnesemia (↑ magnesium) I2M 455, IM 401

No common cause



Index of Conditions

AAAAAA

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EEEEEEEEE

FFFFFF

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IIIIIII

JJJJJJ

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MMMMMM

NNNNNN

OOOOOO

PPPPPP

P - Poisonous plants

P - Poisonous plants

P - Poisonous plants

P - Poisonous plants

P - Poisonous plants

QQQQQQQQ

RRRRRRRRR

SSSSSSSS

TTTTTTT

T - Toxins

T - Tumors

UUUUUU

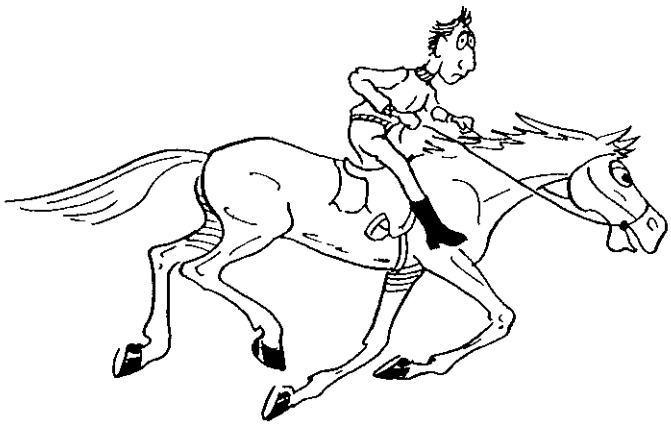
VVVVVV

WWWWWW

XXXXXXX

YYYYYYY

ZZZZZZZ



Help make this Guide yours

This is meant for the veterinary student, as you go through your senior year using this guide note how it can be improved to better meet the students needs. Write down your thoughts on this page please. At the end of the year send them to Susan Pasquini. We will try to incorporate them into the next guide and acknowledge your contribution.

Things you would like to see

Remove more typos

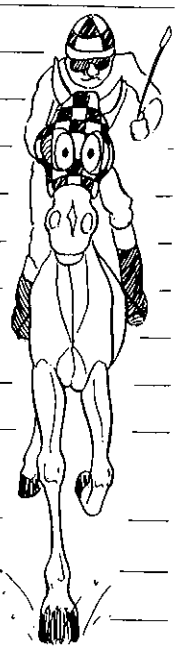
Eye information

Idiot page, anything you or a classmate did that warning may have prevented

Index entries, write down how you looked up a condition that you didn't find in the index

Corrections, spelling, punctuation, wrong information

Pg number, condition, heading (facts, CS, Dx, DDx, Tx mistake)



Other suggestions

Cartoon for a specific condition which will make it stick in student's mind

Sudz - Books Available

Anatomy of Domestic Animals – 10th ed.

By Chris Pasquini, Tom Spurgeon & Susan Pasquini

Over 700 illustrations, 443 pages, in a soft perfect bound format.

A fully illustrated guide to the anatomy of the important domestic species: dog, cat, horse, cattle, sheep, goat and pig. The Anatomy of the Domestic Animals makes learning anatomy more pleasant and longer lasting for animal science majors, wildlife majors, zoology majors, veterinary technician students and veterinary students.

This system-oriented book is a heavily illustrated summary of essential anatomical facts in a comparative format, making information readily accessible.

Atlas of Equine Anatomy

By Chris Pasquini D.V.M., M.S..

Over 650 illustrations, 335 pages, perfect bound

A fully illustrated guide to the anatomy of the horse. Used by veterinary students in Veterinary Medical Schools throughout the United States and Canada, it is clear enough for the general horse public. It will help anyone understand the anatomy of the horse. The appendix has 23 illustrated pages (over 70 illustrations) with text explaining nerve and joint blocks, of interest to any performance horse person.

Atlas of Bovine Anatomy

By Chris Pasquini D.V.M., M.S., B.S., B.A.

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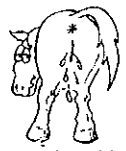
A fully illustrated guide to the anatomy of cattle. Used by veterinary students in Veterinary Medical Schools throughout the United States and Canada. It has over 650 illustrations on 339 pages.



Guide to

Equine Clinics, Volume 1

By Chris Pasquini & Susan Pasquini

357 pages, Perfect bound

This booklet is a quick reference guide for common problems encountered in Equine clinics. These problems are outlined in table form for quick reference. This is a must for senior students in their senior year during Equine clinics; and will help the horse owner understand his horse & veterinarian

Guide to Equine Clinics

Lameness, Volume 2-2nd Edition

By Chris Pasquini, Hank Jann & Susan Pasquini

Perfect bound over 460 pages

This booklet is a quick reference guide for common problems encountered in Equine lameness clinics. These problems are outlined in table form for quick reference. This is a must for horse owners, veterinarians and veterinarian students. It is keyed to commonly used text books and to popular horse books, veterinary journal articles and popular horse magazines.

Guide to Equine Clinics

Lameness Diagnosis, Volume 3

By Chris Pasquini, Robert Bahr, Hank Jann & Susan Pasquini

150 pages, Perfect bound

This booklet outlines the steps in diagnosing lameness in horses and is a companion book to Guide to Equine Clinics - Lameness Vol. 2. The first chapter deals with history, including conformation, work use and age. The palpation chapter outlines the systematic manipulation of the limbs and back. Exam at motion follows. Nerve blocks and joint blocks chapters are heavily illustrated, detailed explanations of blocking. The radiology chapter explains the common views used in radiology with a clinical check list for each. Thermography, scintigraphy and gait analysis are briefly dealt with.

Tschauner's Guide to

Small Animal Clinics

By Chris Pasquini & Susan Pasquini

799 pages, in a soft bound foremat.

This booklet is a quick reference guide for common problems encountered in small animal clinics. These problems are outlined in table form for quick reference. This is a must for senior students in their senior year during small animal clinics.

Guide to

Bovine Clinics – 4th Edition

By Chris Pasquini & Susan Pasquini

302 pages, Perfect bound

This booklet is a quick reference guide for common problems encountered in Bovine clinics. These problems are outlined in table form for quick reference. This is a must for senior students in their senior year during Bovine clinics.

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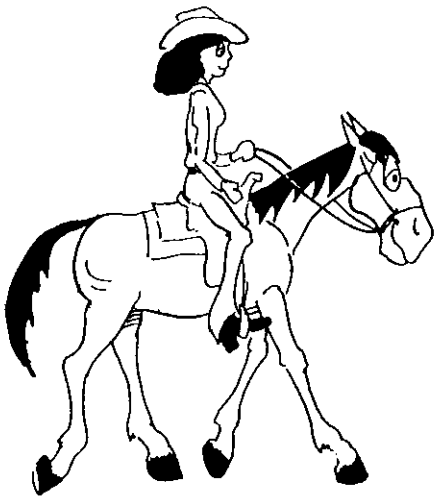
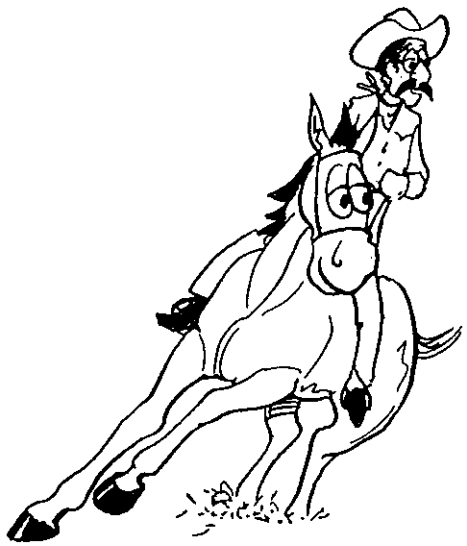
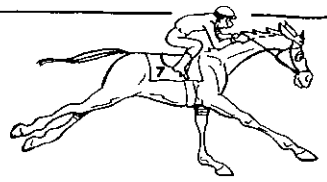




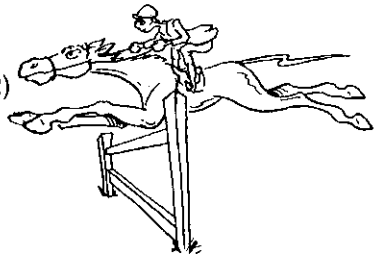
Weights & Measurements

- equivalents & conversions M8k 2196; Mk 972; POP 36-8/98



Fluids

1 L (liter)	= 1000 ml (10^3 ml)	≈ 1 qt (1.0567 L)
1 dl (deciliter)	= 100 ml (10^2 ml)	
1 ml (milliliter)	= 0.001 L (10^{-3} L)	= 15 minims (16.23)
	= 1 cc (cubic centimeter)	
1 µL (microliter)	= 0.000001 L (10^{-6})	
1 fl oz (fluid oz)	≈ 30 ml (29.57)	
1 pt (pint)	≈ 500 ml (473.2)	= 16 fl oz
	≈ 1/2 L (473.2 ml)	= 2 cups
1 qt (quart)	≈ 1 L (946.4 ml)	= 1.136 imperial L
1 gal (gallon)	≈ 4000 ml (3785.6)	≈ 4 L
	= 4 quarts	= 4.55 imperial L
	= 0.833 imperial gal	
1 cup	≈ 250 ml	= 8 fl oz
1 drop	= 1/20 ml	
1 tsp (teaspoon)	= 5 ml	
1 tbsp (tablespoon)	= 15 ml	
1 minim	≈ 0.06 ml (0.062)	



Length

1 yd (yard)	= 91.44 cm	≈ 1 m
1' (ft/foot)	≈ 30 cm (30.48)	
1" (in/inch)	= 2.54 cm	
1 m (meter)	≈ 40 " (39.37)	≈ 1 yd
	= 100 cm	
1 cm (centimeter)	≈ 0.4" (0.39)	= 10 mm
1 mm (millimeter)	≈ 0.04" (0.039)	

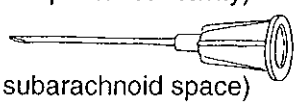
Weights

1 kg (kilogram)	≈ 2.2 lb (2.205)	= 1000 g
1 mg (milligram)	= 0.1 g (10^{-3} kg)	= 1/65 (0.015) gr
1 g (gram)	≈ 15 grains (15.43)	= 10 mg
	= 0.035 oz	
1 µg (microgram)	= 0.000001 g (10^{-6})	
1 ng (nanogram)	= (10^{-9})	
1 pg (picogram)	= (10^{-12})	
1 gr (grain)	≈ 65 mg (64.8)	≈ 0.065 g
1 oz (ounce)	≈ 30 g (28.35)	
1 lb (pound)	≈ 1/2 kg (0.454)	= 16 oz
1µg/gm	= 1 part per million	= 1 mg/kg
1 ton	= 2,000 lb	
1 metric ton	= 1,000 kg	= 2,205 lb

Drug abbreviations

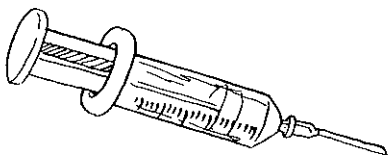
Routes of administration

PO	per os, by mouth or orally
SQ	subcutaneous injection
IM	intramuscular injection
IV	intravenous injection
IP	intraperitoneal (into peritoneal cavity)
IN	intranasal
IC	intracardiac
IT	intrathecal (into subarachnoid space)

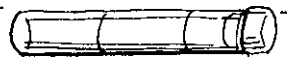


Dosage schedules/Timing

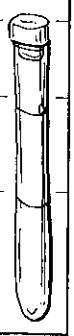
q	every (e.g.; q4h = every 4 hours)
SID	every day, q day or every 24 hours
BID	twice a day, q 12 hours
TID	three times a day or q 8 hours
QID	four times a day or q 6 hours
QOD	once every other day, q 48 hours
PRN	as needed, as in "1 tablet PRN for pain
hs	at night



Blood Tube "Run Down"



Color (ingredients)	**Uses**	**Comments** [Resulting testing solution]
Red (nothing)	Common chemistries Serology Occult heartworm	[Serum]
Red & black (None, separator)	Common chemistries Serology Occult heartworm	[Serum]
Green (lithium heparin)	"Stat" chemistries Hormone tests Ammonia	"Stat" = Don't have to wait for clotting [Heparin plasma]
Black (Batroxobin enzyme + soybean trypsin inhibitor)	Fibrin degradation products (FDP)	Used for DIC dogs [serum]
Gray (NaFl)	Glucose	[Plasma]
Gray (Diatomaceous earth)	Activated clotting time	[Whole blood clot]
Gray w/ bright yellow label (nutrients)	Urine culture	[Urine]
Blue (Na Citrate)	PT & PTT Von Willebrand's diz (hereditary coagulopathy, Dobies)	Must fill tube completely
Purple (EDTA)	CBC Fibrinogen Microfilariae heartworm Hormone tests Serology	[EDTA plasma]



From Anja's Nerd book

Abbreviations

a, aa	artery (ies)	ext	external	m/b	maybe	R/O	Rule out
abd	abdomen	FB	foreign bodies	med	medial	RR	respiratory rate
abnorm	abnormal	Feds	Federal agents	membr	membrane	rt	right
ABs	antibiotics	fx, fxs	fracture (s)	metab	metabolic	Rx	drug (s)
bact	bacterial, bacteria	gen	general	min	minute	SID	once a day
BID	twice/day	hi	high	MLV	modified live virus	sm	small
bilat	bilateral	hr(s)	hour(s)	mo (s)	month, months	spec	spectrum
C&S	Culture & Sensitivity	HR	heart rate	n, nn	nerve (s)	SQ	subcutaneous
caud	caudal	hs	at night	neg	negative	supf	superficial
CrN	cranial nerve	Hx	history	norm	normal	Sx	surgery
conc	concentrate	IM	intramuscular	p-ANS	parasympathetic	thru	through
cran	cranial	IN	intranasal	PCV	packed cell volume	TID	three times/day
CS	clinical signs	incr	increase	perf	perforating	TP	total protein
d(s)	day, days	infec	infection	PM	postmortem	Tx	treatment
decr	decrease	inflam	inflammation	PMNs	neutrophils	UMNs	upper motor neurons
DDx	differential Dx	int	internal	PO	per os/orally	usu	usually
defc	deficiency	IP	intraperitoneal	pos	positive	unilat	unilateral
degen	degenerative	IV	intravascular	ppt	precipitate	vac	vaccination
dist	distal	jt	joint	PRN	as needed	ventr	ventral
diz	disease	lat	lateral	preg	pregnancy	v, vv	vein (s)
DJD	degenerative joint diz	lb	pound	prblm	problem	w/	with
DOC	Drug of Choice	lg	large	prox	proximal	w/i	within
dors	dorsal	lig (ligg)	ligament (s)	Px	prognosis	w/o	without
Dx	diagnosis	LMNs	lower motor neurons	q	every (as in q 12 hrs)	wk(s)	week, weeks
elev	elevated	ln, lnn	lymph node (s)	QID	four times/day	wt.	weight
envir	environment	lt	left	repro	reproduction	yr(s)	year, years
esp	especially	m/	may	resp	respiratory	$	expensive

Equine Clinical Chemistry:

Normal ranges

Total bilirubin	< 2.5 mg/dl
Direct reacting	< 0.8
Indirect reacting	0.1-2.0 mg/dl
Cholesterol	75-200 mg/dl
Creatinine	1-2 mg/dl
Glucose	50-115 mg/dl
Fibrinogen	100-500 mg/dl
Total Protein	5.4-7.9 g/dl
Albumin	2.3-3.9 g/dl
A/G ratio	0.6-1.5
BUN (Urea nitrogen)	10-25 mg/dl

Enzyme

ALP (Alkaline phosphatase)	149-395 IU/L
AST, SGOT (Aspartate aminotransferase)	150-550 IU/L
CPK (Creatine phosphokinase)	90-350 IU/L
GGT (Gamma-glutamyl transferase)	11-40 IU/L
LDH (Lactate dehydrogenase)	160-490 IU/L
SDH (Sorbitol dehydrogenase)	3-14 IU/L

Electrolyte

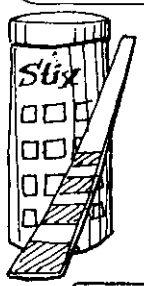
Na (Sodium)	132-147 mEq/L
K (Potassium)	2.4-4.7 mEq/L
Cl (Chloride)	95-110 mEq/L
Ca (Calcium)	9.1-13.4 mg/dl
P (Phosphorus)	2.9-4.9 mg/dl
Mg (Magnesium)	1.3-3.2 mg/dl

Normal values - RBCs & WBCs

PCV (%)(hematocrit)	32-48%
RBCs (Erythrocytes)	6-12 x 10^6/µl
Hgb (Hemoglobin)	10-18 g/dl
MCV (mean corpuscular vol.)	34-58 fL
MCH (mean corpuscular Hgb)	13-19 pg
MCHC (mean corpuscular Hgb conc.)	31-37 g/dl
Reticulocytes (%)	0%
Thrombocytes	100,000-600,000 µl

WBC		6-12 x 10^3/µl
PMNs (Neutrophils)	30-75%	(3-6 x 10^3/µl)
Bands	0-1%	(0-0.1 x 10^3/µl)
Lymphocytes	25-60%	(1.5-5x 10^3/µl)
Monocytes	1-8%	(0-0.6 x 10^3/µl)
Eosinophils	1-10%	(0-1 x 10^3/µl)
Basophils	0-3%	(0-0.3 x 10^3/µl)
N/L(Neutrophil:lymphocyte) ratio	0.8-2.8	

Rectal temp	
Stallion	99.7°F (37.6°C)
Mare	100°F (37.8°C)
Heart rate (HR)	40 (26-50) beats/min
Respiratory rate	12 (10-14) breaths/min
Urine volume	3-18 ml/kg body wt./d
& specific gravity	1.025-1.060



All Labs vary widely!!!

These are only general guidlines for interpreting laboratory data
M8k 2188-2194; C4T 761; I2M 474, 481, 491, 498; IM 103

Acid-base (venous blood)	
pH	7.32-7 .44
PCO_2	38-46 mm Hg
HCO_3 (Bicarbonate)	**20.7-28.9 mEq/L**
Total CO_2	24-32 mEq/L

Inside back cover