SMALL RUMINANT CLINICAL DIAGNOSIS AND THERAPY

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Disclaimer: These formulary doses and withdrawal periods are derived from a number of literature sources. As such they represent a joint effort to reflect the most up to date pharmaceutical delivery. It is the authors' suggestion that the practioner refer to the approved labeling of the product for additional information. While this reference includes the use of non-approved (extra-label) drugs in food producing animals, this does not infer that the authors endorse the use of such drugs. The authors assume no responsibility for or make no warranty with respect to the treatment regimes noted here. The authors do not necessarily endorse such drug uses, procedures or dosages listed. Further, the authors shall not be held liable to any person whatsoever for any damages, equivalencies, or by reason of any misstatement or error, negligence or otherwise obtained in this text. Should the purchaser not wish to be bound by the above disclaimer, she/he may return this book to the distributor for a full refund. It is highly recommended that the veterinary practioner obtain a copy of the booklet: "FDA and the Veterinarian" <HHS (FDA) 89-6046>. This booklet discusses extra-label drug use. The web address is: http://www.fda.gov/cvm/.

Special thanks to the Class of 2002 small ruminant advanced tract students. This differential diagnosis/formulary grew out of both an industry need and the interest and dedication of these students. We hope this booklet is helpful to the small ruminant student as well as the veterinary practioner. All proceeds from the sale of this book will be donated to the University of MN, Small Ruminant Studies Student Scholarship.

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Bookstores and student groups please inquire about volume discounts!

This text grew out of a definitive need for a quick differential diagnosis and formulary text for small ruminant species. Judged by the number of phone calls from private practioners and student questions we developed this text divided by species. I would like to dedicate my portion of this text to my sister Parlin Gale for her loving support, kindness and wisdom.

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OVINE FORMULARY

Many of the following drugs are not approved for use in sheep. These drugs are marked ELU (Extra Label Use). In cases where withdrawal times are not determined for sheep, the withdrawal times for cattle are noted.

- SQ injections are preferred if possible (be careful not to inject into the wool)
- SQ / IM injection best made in the **NECK**, triceps, or caudal thighs
- Try to utilize body location with cleanest wool

Basic Sheep Reference Values:

T: 102°F (101°F – 103.5°F)
P: 70-80 bpm
R: 16-34 breaths per minute
PCV: 27% - 45%
Gestation Length : 144 – 147 days (meat breeds)
148 – 151 days (wool breeds)
Estrus Cycle Length: 16-17 days during the breeding season, determined by decreasing photoperiod

Drug	Dose	Withdrawal	Notes
Abomasal Tone Restoration / Emptying			
Metoclopramide HCl	0.5-1 mg/kg IV	ELU	Contraindicated with obstruction / perforations
Anaphylaxis			
Epinephrine	0.5-1cc/100# of 1:1000 dilution IM or SQ, 1:10,000 dilution IV, may be repeated at 15 minute intervals	None necessary	Can be added to local anesthetics to prolong effects
Dexamethasone	0.5-1 mg/kg IV with epinephrine	Cattle: none	
Diphenhydramine (Benadryl)	0.5-1 mg/kg IV with epinephrine	ELU	
Anesthesia			
Acepromazine	0.01-0.02 mg/kg slow IV 0.05-1.0 mg/kg IM	ELU FARAD: Milk: 48 hours Meat: 7 days	Causes hypotension; no analgesic effect
Alphaxolone / Alphadolone	3 mg/kg slowly IV		
Anesthesia Cocktail	Butorphanol 0.1 mg/kg + Xylazine 0.05 mg/kg + Diazepam 0.1 mg/kg		
Atipamezole (Antisedan)	125-175 µg/kg half IV, half IM	ELU	Reversal of Xylazine, Detomidine
Atropine	Preanesthetic: 0.15-0.3 mg/kg IM OP poisoning: 0.5 mg/kg (1/4 IV, rest SQ or IM), repeat q3-4 hours for 1-2 days	No information available for withdrawals	Not routinely used as preanesthetic

OVINE FORMULARY

Drug	Dose	Withdrawal	Notes
Anesthesia			
Buprenorphine	0.005 mg/kg IM every 12 hours, slow onset, lasts 4 hours	ELU	Good for visceral pain
Butorphanol (Torbugesic)	0.1-0.2 mg/kg IM or IV every 3 hours	ELU	Good for visceral pain
Chlorpromazine	0.55-4.4 mg/kg IV 2.2-6.6 mg/kg IM 2-3.5 mg/kg IV q5-6 hours	ELU	Causes contact dermatitis in humas
Detomidine (Dormosedan)	0.2-0.8 µg/kg IV 20-40 µg/kg IV or IM	ELU FARAD: Milk: 72 hours Meat: 3 days	
Diazepam	0.25-0.5 mg/kg slowly IV Tranquilization: 0.55-1.1 mg/kg IM Bermuda Grass toxicosis: 0.8 mg/kg IV Appetite Stimulant: 0.04 mg/kg IV	ELU	Also used to treat seizures
Doxapram (Dopram)	Stimulate respiration: 0.4 mg/kg IV Overdose of sedative: 0.5-1 mg/kg IV	ELU	
Guaifenesin	66-132 mg/kg IV 44-88 mg/kg IV + 0.66-1.1 mg/kg Ketamine	ELU FARAD: Up to 100 mg/kg Milk: 48 hours Meat: 3 days	For muscle relaxation
Ketamine	Premed atropine 0.4 mg/kg, then xylazine 0.22 mg/kg IM 20-25 mins later. 10 mins after xylazine, 11mg/kg ketamine IM Premed atropine 0.22 mg/kg + acepromazine 0.55 mg/kg then ketamine 22 mg/kg IM, then intermittent 2-4 mg/kg IV 2 mg/kg IV induction, then 4 ml/min constant infusion Extended anesthesia with ketamine 2-4 mg/kg IV (short term) or 6 mg/kg IV	ELU FARAD: Up to 2 mg/kg IV; 10 mg/kg IM Milk: 48 hours Meat: 3 days	Must be given following or with a sedative
Ketamine / Xylazine	X: 0.22 mg/kg IM then K: 11 mg/kg IM in 10 mins. OR X: 0.22 mg/kg + K: 11 mg/kg IM 5 mg/# increments, 3 mg/# if prolonged	ELU	
Lidocaine 2%	Toxic dose: 10 mg/kg IM / SQ 25cc SQ for 120# goat Lamb: dilute to 1%, no more than 4cc SQ	Milk and Meat: 48 hours	Also used for ventricular arrhythmias
Medetomidine	25-35 µg/kg IM	ELU	

OVINE FORMULARY

Drug	Dose	Withdrawal	Notes
Anesthesia			
Methohexital sodium	4 mg/kg as a 2.5% solution		
Morphine epidural	0.1 mg/kg (15 mg/ml morphine) Xylazine: 0.05 mg/kg	ELU	Class II controlled drug
Pentobarbital	Anesthesia: 20-30 mg/kg IV Lamb: 15-26 mg/kg IV	ELU	20 min duration of anesthesia
Propofol	3-4 mg/kg slowly IV	ELU	
Telazol	5.5 mg/kg IV 2.5 mg/# IV 5.7 mg/kg for prolonged procedure	ELU	
Thiopental	9.9-15 mg/kg IV 20-22 mg/kg IV (with atropine)	ELU	Good induction of general anesthesia
Tolazoline	Reverse xylazine: 2-4 mg/kg slow IV	ELU: Not for use in food animals New Zealand: Meat: 30 days	
Xylazine (Rompun)	Minor: 0.03-0.04 mg/kg IV / IM Standard: 0.05 mg/kg IV 0.10 mg/kg IM 0.02 mg/# IV or 0.1 mg/# IM 0.1-0.22 mg/kg IM 0.044-0.11 mg/kg IV FARAD: Up to 0.1 mg/kg IV, or 0.3 mg/kg IM: Milk: 72 hours, Meat: 5 days 0.3-2.0 mg/kg IM: Milk: 120 hours, Meat: 10 days	ELU FARAD See dose section	Use low dose and with caution
Xylazine epidural	0.05 mg/kg	Meat: 7 days	
Yohimbine	Reverse xylazine: 0.125 mg/kg IV 2.5 cc/100# IV	ELU FARAD: Milk: 72 hours Meat: 7 days	
Anthrax Treatment			
Oxytetracycline	4.4 mg/kg IM or IV daily	ELU Cattle: Meat: 15-28 days depending on brand used	Do not use in healthy animals recently vaccinated for anthrax
Antibiotics			
Amikacin	10 mg/kg IV	ELU	Gram negative aerobic, bactericidal
Amoxicillin	3-5 mg/# IM SID For footrot	Cattle: Milk: 96 hours Meat: 25 days	Gram +/- aerobes and anaerobes, bactericidal

OVINE FORMULARY

Drug	Dose	Withdrawal	Notes
Antibiotics			
Ampicillin (Polyflex 250 mg/ml)	2-5 ml/# IM SID 4 cc/100# SQ BID 14 days For pneumonia	Cattle: Milk: 48 hrs Meat: 6 days	Gram +/- aerobes and anaerobes, bactericidal Good after surgeries
Ceftiofur (Naxel)	0.5-1 mg/# injectable 2 cc/100# IV/ IM BID 7 days	Cattle: none	Gram +, mostly aerobes, bactericidal To treat respiratory and skin infections, mastitis, including Pasteurellosis
Chlortetracycline (Pennchlor, Aureomycin)	80 mg/head/day in feed		
Excenel	1-2 ml/100# SID Footrot and pneumonia	Cattle: Milk: none needed Meat: 2 days	
Florfenicol (Nuflor)	3 cc/100# (200 mg/kg) IM EOD x 2 6 cc/100# (400 mg/kg) SQ once	ELU Cattle: Meat: IM: 28 days SQ: 38 days	Gram +/- For respiratory infections: Pasteurellosis, Fusobacterium Not approved for use in lactating dairy cattle
Neomycin (Biosol, Neomix, Neosol)	10 mg/# for max. 14 days in water 70-140 g/ton of feed 11 mg/kg in water 200-400 mg/gallon in milk	Sheep: Meat: 20 days Cattle: Milk: 48 hours Meat: 30 days	
Oxytetracycline (LA - 200)	6-11 mg/kg IV / IM 10-20 mg/kg PO q6 hours 5 cc/100# IM/SQ EOD x 4 Anthrax: 4.4 mg/kg IM or IV daily	Cattle: Meat: 28 days	Footrot Pneumonia Abortion outbreaks
Procaine Penicillin G	6cc/100# IM SID 3-7 days 44,000 units/kg 3,000 IU/# 1 cc/30#	Sheep: Meat: 8 days Cattle: Milk: 48 hours Meat: 4 days **(per label dose)**	Gram + aerobes and anaerobes Treat clostridial diseases, especially tetanus, epididymitis and orchitis
Rifampin	10-20 mg/kg PO BID 4 weeks Johne's: 4 mg/# PO SID indefinitely	**No longer food animal**	Used in combo with other antibiotics to improve penetration

OVINE FORMULARY

Drug	Dose	Withdrawal	Notes
Antibiotics			
Sodium Iodide	Actinobacillus (Wooden Tongue): 70 mg/kg IV twice at 7-10 day interval Actinomycosis (Lumpy Jaw): 70 mg/kg IV	ELU	
Sulfadimethoxine (Albon)	25 mg/# initially IV SID, then 12.5 mg/# oral/IV	Cattle: Milk: 60 hours Meat: 5 days	Streps, respiratory, skin infections
Tetracycline	4.5 ml/100# IM or IV q2-4 days For pneumonia, footrot, scours	Sheep: 5 days Cattle: Milk: 4 days Meat: 28 days	
Tilmicosin (Micotil)	1.2 cc/100# SQ 1 dose	Cattle: Meat: 28 days	Not approved for use in dairy cattle
TMS / SMZ 960	22-30 mg/kg PO BID	ELU	
Tylosin (Tylan 200)	10 mg/kg SID not to exceed 5 days	Milk: 48 hours Meat: 21 days	
Anticonvulsants			
Diazepam (Valium)	0.05-0.5 mg/kg IV to effect. Repeat as necessary.	ELU	
Phenobarbitone (Sagatal)	0.44 ml/kg IV to effect then 0.22 ml/kg every 8 or 12 hours as required.	ELU	
Antifungal			
Clofazinim	2 mg/kg PO		
Copper napthenate			
Ehiliconazole	0.2% solution every 3 days for 4 applications topically		
Griseofulvin	7.5 mg/kg for 7 days PO	ELU	
Natamycin	0.01% solution locally repeat after 5 and 14 days		
Anti-inflammatories			
Aspirin	50-100 mg/kg PO every 12 hours	FARAD: Milk: 24 hours Meat: 1 day	
Betamethasone	0.04-0.08 mg/kg		
Carprofen	1.4 mg/kg SQ or IV every 36-48 hours or PO once daily	ELU	
Dexamethasone	0.1 mg/kg IV	Cattle: None necessary	
Flunixin meglumine (Banamine)	1 cc/100# SQ / IV/ IM 1.1-2.2 mg/kg IV / IM every 24 hours for 3-5 days	FARAD: Milk: 72 hours Meat: 10 days	

OVINE FORMULARY

Drug	Dose	Withdrawal	Notes
Anti-Inflammatories			
Ketoprofen (Ketofen)	1 cc/100# IM/IV/SQ as needed 3.3 mg/kg IV / IM every 24 hours for up to 3 days	ELU FARAD: Milk: 24 hours Meat: 7 days	
Meloxiram	0.5 mg/kg IV or SQ every 36-48 hours	ELU	
Methylprednisolone	10-30 mg/kg IV every 4-6 hours for 2-4 days	ELU	
Phenylbutazone	450 mg/100# PO SID 4 mg/kg IV or 10 mg/kg PO FARAD: Cattle 9 mg/kg IV or IM once Milk: 96 hours, Meat: 12 days 6-9 mg/kg IV or IM once followed by 3 mg/kg daily Milk: 120 hours, Meat: 21 days	ELU FARAD: See dose section	
Predef 2X	0.3-0.7 ml/100# IM, one-time dose!	Cattle: Milk: none needed Meat: 7 days	
Appetite Stimulation			
Chlorpromazine	0.5 mg/kg IV		
Diazepam	0.04 mg/kg IV		
Copper Poisoning			
Ammonium tetrathiomolybdate	Either 1.7 mg/kg IV or 3.4 mg/kg SQ in 3 doses on alternate days		
Grass Tetany (Hypomagnesemia)			
Calcium borogluconate 20% with magnesium and phosphorus	80-100 mL IV or SQ, plus 100 mL of magnesium sulfate 25% SQ		
Intestinal Motility Reduction			
Loperamide hydrochloride	100-200 µg/kg PO every 8-12 hours		
Johne's Treatment			
Clofazimin	2 mg/kg PO		
Levamisolee	1.5 mg/# PO SID with rifampin for 3 days	Sheep: Meat: 3 days	
Rifampin	4 mg/# PO SID indefinitely	**NO LONGER FOOD ANIMAL**	
Lead Poisoning			
Calcium disodium versenate 20%	75 mg/kg IV or SQ in divided doses every few hours for 3 or 4 days		
Milk Fever (Hypocalcemia)			
Calcium borogluconate 20%, with magnesium and phosphorus	80-100 mL, slowly IV, SQ or half by each route		

OVINE FORMULARY

Drug	Dose	Withdrawal	Notes
Myometrial Relaxants			
Clenbutarol hydrochloride	0.8 µg/kg slowly IV or IM		
Vetrabutine hydrochloride	2 mg/kg IM		
Ocular			
Atropine	TID-QID until pupil dilates then SID	ELU	
Forte topical	Topical, as needed	ELU	
Terramycin (oxytetracycline)	Topical, as needed	ELU	
Trioptic / Trioptic-S	Topical, as needed	ELU	
Opioid Analgesics			
Buprenorphine	0.005 mg/kg IM q12 hours	ELU	
Butorphanol (Torbugesic)	0.1-0.2 mg/kg IM/IV q3 hours	ELU	
Meperidine HCl (Demerol)	Up to 200 mg total dose IM	ELU	
Morphine sulfate	Up to 10 mg total dose IM	ELU	
Organophosphate Poisoning			
Atropine	1 mg/kg slowly IV 0.5 mg/kg (1/4 IV, rest SQ or IM), repeat q3-4 hours for 1-2 days		
Other			
Aluminum / Magnesium Hydroxide	1/8 to ¼ g/kg in 2-3 gallons water PO, repeat 6-12 hours	ELU	
Ammonium chloride	200 mg/kg PO 1-2 g PO		
CaEDTA	Cattle dose: 67 mg/kg slow IV BID for 2 days then withhold 2 days then dose another 2 days 73.3 mg/kg/day slow IV divided BID-TID 3-5 days, rest 2 days, then 5 days again		For lead toxicity
Calcium PMD	20 ml IV 50 ml SQ	ELU	
Fentanyl citrate / Droperidol (Transdermal)	Quantity of 2, 7.5 mg patches (release 75 µg/hr) per 150# sheep	ELU	Be sure to clip hair / wool and apply to skin
Kaolin / Pectin	3-4 oz PO	None	
Magnesium sulfate	25%: 50 ml SQ 20%: 50-100 ml (Ca/Mg solution)	ELU	
Mannitol	Cerebral edema: 1-3 g/kg IV Oliguric RF: 1-2 g/kg IV	ELU	
Mineral Oil	1-2 pints PO 100-500 ml PO	None	

OVINE FORMULARY

Drug	Dose	Withdrawal	Notes
Other			
Monensin (Rumensin)	20 g/ton of feed		
Neostigmine bromide	1.0-1.5 mg/100# SQ, repeat as indicated 0.01-0.02 mg/kg	ELU	
Phytonadione	Warfarin toxicity: 0.5-2.5 mg/kg IM Acute hypoprothrombinemia with hemorrhage: 0.5-2.5 mg/kg IV Non-acute hypoprothrombinemia: 0.5-2.5 mg/kg IM or SQ	None listed	
Sodium sulfate	Cathartic: 60 g PO (6% Solution)	ELU	
Stanazolol	Aflatoxicosis: 2 mg/kg IM Do not use with oxytetracycline	ELU	
Tripelennamine hydrochloride	0.5 ml/# (2.5 ml/100#) IM / IV	Cattle: Milk: 24 hours Meat: 4 days	Anti-histamine
Parasiticides			
Albendazole (Valbazen)	3 ml/100# PO 7.5 mg/kg PO 15 mg/kg PO, adult liver flukes **Do Not administer to females during first 30 days of gestation / 30 days post ram removal**	Sheep: 3 ml/100# Meat: 7 days Cattle: Meat: 27 days	Benzimidazole Used for nematodes, flukes
Albon (Sulfadimethoxine)	1 pkg/gal = mix, 1L of mix/5 gal water for 5 days, Injectable: 5 cc loading dose then 2.5 cc/day for 3 days for 100# goat	Cattle: Milk: 60 hours Meat: 5 days	
Amitraz (Mitaban)	10.6 ml of 19.9% Mitaban in 2 gallons of water, whole body dip, repeat every 10-14 days	Cattle: no withdrawal	
Decoquinate (Deccox)	0.5 mg/kg/day in feed		Coccidia preventative
Doramectin (Dectomax)	200 µg/kg PO 500 µg/kg topically	Cattle: Meat: 35 days	Avermectin
Eprinex	0.5 mg/kg		
Ivermectin	200 µg/kg SQ 1 ml/110# IM / SQ (1% solution) 3 ml/26# PO (0.8% solution)	Injectable: Meat: 35 days Oral: Meat: 11 days	Avermectin Used for nematodes, external parasites
Lasalocid (Bovatec)	15-70 mg/head/day in feed 20-30 g/ton of feed		
Levamisolee (Levasole, Tramisole, Prohibit)	0.184 g/50# 0.5 OZ/50# 7.5-8 mg/kg PO 2 ml/100#, repeat in 2-6 weeks	Sheep: 3 days	Used for nematodes
Malathion	1.5 oz/gal water, whole body spray until skin is wet		
Mebendazole	22.5 mg/kg orally		
Moxidectin	0.2-0.4 mg/kg SQ		Avermectin

OVINE FORMULARY

Drug	Dose	Withdrawal	Notes
Parasiticides			
Netobimin	11-25 mg/kg orally		
Nitrofurazone	Coccidiostat: 10 mg/kg PO 4 days		
Oxfendazole	5 mg/kg PO		Benzimidazole
Panacur (fenbendazole)	5 mg/kg PO SID for 3 days 9.5 mg/kg in feed for 3 days	Milk: 14 days Meat: 14 days	Benzimidazole Used for nematodes
Praziquantel (Droncit / Drontal)	10-15 mg/kg	ELU	Used for cestodes
Rumentel / Nematel (morantel tartrate)	10 mg/kg PO 0.44 g/100# in feed	14-160 days	Used for adult nematodes Don't use with Pyrantel or Levamisole
Salinomycin	Coccidiostat: 100ppm in concentrate		
Strongid (pyrantel tartrate / pamoate)	25 mg/kg PO	ELU	
Sulfadimethoxine	Coccidiostat: 75 mg/kg PO 4-5 days 250 mg/kg PO sustained release bolus		
Sulfamethazine	Coccidiostat: 50 g/ton of feed		
Thiabendazole	50-100 mg/kg PO, repeat in 2-4 weeks 44mg/kg PO Severe infection: 66 mg/kg PO	Milk: 96 hours Meat: 30 days	Benzimidizole
Thiophanate	9 kg/ton of feed or 2.8 kg/ton of feed daily for 5 days		
Flukes			
Albendazole	7.5 mg/kg orally		
Clorsulon	10 mg/kg orally		Fasciola hepatica
Netobimin	20 mg/kg orally		
Nitroxynil	10 mg/kg SQ		
Oxyclozanide	15 mg/kg orally		
Triclabendazole	10 mg/kg orally		
Cestodes			
Albendazole	10 mg/kg		
Febental	7.5 mg/kg	ELU	Metabolized to fenbendazole and oxfendazole
Fenbendazole	15 mg/kg		
Oxfendazole	10 mg/kg		
Coccidiosis			
Amprolium	5-10 mg/kg PO daily for 3-5 days	Calves: Meat: 24 hours	
Decoquinate	1 mg/kg or 100 g/ton feed for 28 days		
Diclazuril	1 mg/kg PO		
Sulphadimidine	200 mg/kg then 100 mg/kg SQ or IV daily for 5 days		

OVINE FORMULARY

Drug	Dose	Withdrawal	Notes
Coccidiosis			
Sulphamethoxy pridazine	20 mg/kg SQ daily for 3 days		
Toltrazuril	20 mg/kg PO once every 3-4 weeks		
External Parasites			
Amitraz	0.025 % solution by spray or wash		
Cypermethrin	1-2% solution pour on		
Eprinomectin	0.5 mg/kg		
Ivermectin	10 mg/50 kg SQ		
Moxidectin	10 mg/ 50 kg SQ		
Permethrin	4% solution pour on		
Reproductive			
Buserelin	2.5 mL IM, SQ, or IV (at time of breeding or to prevent luteolysis) 5 mL IM, SQ, or IV (cystic ovaries)		
Chorionic Gonadotropin	Cystic follicles: 250-1000 units IV or IM 500 units IM at time of breeding	Cattle: none	
Cloprostenol Na	Induce parturition: 62.5-125 µg IM at 144 days gestation	Cattle: none	
Dinoprost tromethamine (PGF2α, Lutalyse)	Estrus synchronization: 8 mg IM on day 5 of estrous, repeat in 11 days (start estrous in 2 days) Abortifacient: 10-15 mg IM (anytime during gestation) Chronic metritis / pyometra: 2.5-5 mg SQ	Cattle: none	
Folligun / Fostim	SQ or IM, Dose dependent on time or year, weight, and milk yield.		
Gonadorelin	Induce ovulation out of breeding season: 100 µg injected daily for 4-5 days	Cattle: none	
Oxytocin	10-20 IU or 1.5-2.5 ml IM/SQ 30-50 IU injection Retained placenta: 10-20 units Metritis: 5-10 units IM TID-QID, 2-3 days Bleeding: 10-20 units IV, may repeat SQ in 2 hours	none	
Reticular Groove closure (before giving oral meds)			
Copper sulfate	5 mL in 1 L of water PO		
Lysine-vasopressin	0.25 units/kg IV		
Spasmolytics			
Metanizole, hyoscine butybromide	0.505 mL IV		

OVINE FORMULARY

Drug	Dose	Withdrawal	Notes
Vaccines			
Cl. perfringens C, D, and tetanus	2 cc SQ, booster 21-28 days, biannual (R. axillary)	Meat: 21 days	
CLA	2 cc SQ, booster in 4 weeks, annual (L. axillary)	Meat: 21 days	
Pseudorabies	2 cc IM, annual		
Vitamins and Minerals			
Bo-Se (Selenium / Vitamin E)	Ewe: 2.5 ml/100# Lamb: 1 ml/40#	Meat: 14 days	
L-Se	Lamb: 1 ml	Meat: 14 days	
Thiamine	Polioencephalomalacia / thiamine deficiency: 10 mg/kg IV initially, then 10 mg/kg IM BID 2-3 days		
Vitamin A & D	1-2 cc SQ		
Vitamin B Complex	10 mg/kg IV then IM 3-4 days 4 cc IM or SQ		

OVINE DIFFERENTIAL LIST

ABDOMINAL PAIN / CONSTIPATION

- Bloat
- Fat necrosis (rectum or colon)
- Grain overload
- Hypocalcemia
- Intestinal obstruction
- Obesity
- Pelvic mass
- Peritonitis
- Pregnancy
- Ruptured bladder

ABORTIONS

- Border Disease (Bovine Viral Diarrhea—BVD)
- Brucellosis
- Campylobacter
- Chlamydia psittaci
- Leptospirosis
- Listeriosis
- Maternal stress
- Mycoplasma ovipneumonia
- Mycotic
- Nutritional deficiency / excess
- Parasitic
- Q Fever
- Salmonellosis
- Selenium toxicity
- Starvation
- Toxic plants
- Toxoplasmosis

AGALACTIA / HYPOGALACTIA

- Abscess
- Mammary aplasia, hypoplasia
- Mastitis

ALOPECIA

- Chorioptic mange
- Dermatophilosis
- Dermatophytosis
- Gastrointestinal parasites
- Iodine deficiency
- Lice
- Meningeal worm (Parelaphostrongylus tenuis)
- Sarcoptic mange
- Scrapie
- Staph Dermatitis
- Vitamin A deficiency
- Vitamin D deficiency
- Vitamin E deficiency
- Zinc deficiency

ANEMIA

- Anaplasmosis
- Babesia
- Clostridium
- Cobalt deficiency
- Copper toxicity
- Eperythrozoonosis
- Feeding cow colostrum
- Fleas
- Internal parasites
    - Haemonchus contortus
- Iron deficiency
- Johne's Disease
- Leptospira
- Lice
- Liver fluke infestation
- Moldy clover
- Plants
    - Garlic
    - Kale
    - Onions
- Swayback
- Toxins
- Zinc toxicity

ANESTRUS

- Heat stress
- Luteal cysts
- Malnutrition
- Nursing ewes
- Outside of normal breeding season
- Poor footing
- Post partum period
- Pregnancy
- Pseudohermaphrodite
- Pyometra

ANOREXIA

- Bloat
- Blue Tongue
- Grain engorgement / Acidosis
- Hypocalcemia / hypomagnesemia
- Mastitis
- Pasteurellosis
- Polioencephalomalacia / thiamine deficiency
- Pregnancy toxemia / Ketosis
- Sheep pox

ASCITES / PLEURAL EFFUSION / PERIPHERAL EDEMA

- Cor pulmonale
- Gastrointestinal malabsorption
- Heart problems
- Hemodilution
- High altitude disease
- Kidney disease
    - Amyloidosis
    - Glomerulonephritis
- Liver disease
- Lymphatic obstruction
- Monensin / Lasalocid toxicity
- Pleuritis
- Starvation
- Thrombophlebitis
- Urolithiasis—rupture

ATAXIA

- Border Disease abortion
- Clostridium perfringens
- Copper deficiency
- Hypocalcemia / Hypomagnesemia
- Listeria
- Parasitic migration
- Polioencephalomalacia / thiamine deficiency
- Scrapie
- Swayback
- Tetanus
- Vitamin D deficiency

ATYPICAL PNEUMONIA

- Chlamydia psittaci
- Mycoplasma ovipnemonia
- Selenium toxicity

BLINDNESS

- Brain abscess
- Brain edema
- Brain tumor
- Congenital
- Encephalitis
- Encephalomalacia
- Enterotoxemia
- Idiopathic hepatitis
- Inherited blindness
- Keratoconjunctivitis
- Ketosis
- Metaldehyde poisoning
- Morexella bovis
- Phenothiazine poisoning
- Poisonous plants
- Polioencephalomalacia / thiamine deficiency
- Pregnancy toxemia
- Salt poisoning
- Selenium

CARDIAC MURMUR

- Anemia
- Excitement
- Fever
- Heart problems
  - Bacterial endocarditis
  - Congenital defects
  - Degenerative valvular disease
- Pericarditis
- Young animal

CHRONIC PNEUMONIA

- Adenomatosis
- Caseous lymphadenitis
- Mycoplasma
- Ovine Progressive Pneumonia
- Pasteurella pneumonia

CIRCLING

- Brain abscess
- Brain neoplasia
- Brain trauma
- Cervical vertebral osteomyelitis
- Encephalitis
- Encephalomalacia
- Listeria
- Otitis media
- Polioencephalomalacia / thiamine deficiency
- Pseudorabies

COLIC

- Acidosis / Grain overload
- Bloat
- Constipation
- Diarrhea
- Foreign body
- Grain overload
- Hypocalcemia / hypomagnesemia
- Intestinal foreign body / obstruction
- Intussusception
- Labor

COLIC, Cont.

- Peritonitis
- Pregnancy
- Tetanus
- Urinary calculi
- Uterine torsion

CONJUNCTIVITIS

- Chlamydia psittaci
- Corneal ulcer
- Foreign body
- Moraxella bovis
- Mycoplasma ovipneumonia
- Sheep pox

CONVULSIONS

- Anthrax
- Brain tumor / abscess
- Developmental malformations
- Drugs
  - Intracarotid injection
  - Premature withdrawal of anti-convulsant medication
  - Theophylline
- Heat stroke
- Idiopathic epilepsy
- Infectious
  - Botulism
  - CNS parasite migration
  - Generalized sepsis
  - Meningitis / encephalitis
- Liver failure
- Metabolic
  - Hypernatremia
  - Hypocalcemia
  - Hypoglycemia
  - Hypomagnesemia
  - Hyponatremia
  - Metabolic acidosis
- Perinatal complications
  - Cerebral concussion
  - Hypoxic-ischemic brain injury
  - Intracranial hemorrhage

CONVULSIONS, Cont.

- Polioencephalomalacia / thiamine deficiency
- Rabies
- Tetanus
- Toxins
  - Cyanide
  - Lead
- Trauma

CORONITIS

- Blue Tongue
- Chemical exposure
- Foot and Mouth Disease
- Orf
- Toxic plants
- Vesicular Stomatitis

COUGH

- Abscesses
- Adenovirus
- Bacterial pneumonia
- Choke
- Chronic caseous lymphadenitis
- Parainfluenza virus Type 3
- Parasitic bronchitis
- Septicemia (neonate)
- Trauma
- White muscle disease

CRIMPLESS WOOL

- Border Disease
- Chronic disease
- Copper deficiency
- Pyrexia
- Swayback

CYANOSIS

- Anaphylaxis
- Bloat
- Heart defects
- Pneumonia
- Shock
- Toxic Methemoglobinemia

CYCLIC IRREGULARITIES—FEMALE

- Campylobacteriosis
- Cystic ovaries
- Early / late in breeding season
- Endometritis
- Heat stress
- Leptospirosis
- Poor body condition

DEFORMED HOOVES

- Acidosis / Grain overload
- Chronic foot rot
- Poor trimming
- Selenium toxicity
- Zinc deficiency

DERMATITIS

- Chemical burns
- Chorioptic mange
- Dermatophilosis
- Dermatophytosis
- Frost bite
- Lice
- Parelaphostrongylus migration
- Photosensitization
- Sarcoptic mange
- Staph Dermatitis
- Vitamin A deficiency
- Vitamin E deficiency
- Zinc deficiency

DIARRHEA

- Campylobacter
- Cathartics / laxatives
- Clostridium perfringens Type B
- Cobalt deficiency
- Coccidiosis
- Cryptosporidium
- E. coli
- Failure of passive transfer
- Grain overload / Acidosis
- Intussusception
- Listeria
- Molybdenosis / copper deficiency
- Nitrate poisoning
- Parasitic gastroenteritis
- Polioencephalomalacia / thiamine deficiency
- Rotavirus
- Salmonella
- Sepsis / toxemia / enterotoxemia
- Toxins / Poisonous plants
- Uremia / renal failure

DIARRHEA, NEONATAL

- Clostridium perfringens
- Coccidiosis
- Cryptosporidium
- E. coli
- Salmonella

DYSPHAGIA

- Actinobacillosis
- Actinomycosis
- Botulism
- Brain abscess
- Choke
- Cleft palate
- Diaphragmatic hernia
- Encephalitis
- Hypocalemia
- Listeriosis
- Locoweed
- Mandibular / maxillary fractures

DYSPHAGIA, Cont.

- Meningitis
- Oral vesicles, erosions, ulcers
- Orf
- Otitis media and interna
- Pharyngeal abscess / cellutitis
- Pseudorabies
- Rabies
- Ruptured / damaged esophagus
- Snake bite
- Teeth problems
    - Peridontal disease
    - Worn / missing teeth
    - Tooth root abscess
- Tetanus
- Tick paralysis
- White muscle disease

DYSPNEA

- Abscess
- Actinobacillus
- Acute viral infection
- Adenomatosis
- Anaphylaxis
- Bloat
- Caseous lymphadenitis (CLA)
- Chronic acidosis
- Foreign Body
- Migrating parasites
- Nasal myiosis
- Ovine Progressive Pneumonia (OPP)
- Pasteurellosis
- Selenium toxicity
- Sinusitis
- Sunburn / photosensitization

DYSRHYTHMIAS

- Brisket disease
- Cardiomyopathies
- Cor pulmonale
- Electrolyte abnormalities
- Excitement

DYSRHYTHMIAS, Cont.

- Fever
- Foot rot
- Gastrointestinal disease
- Myocarditis / myocardial disease
- Pericarditis
- Toxemia
- Valvular heart disease

DYSTOCIA

- Cervix undilated
- Fetopelvic disproportion
- Malposition
- Malposture
- Malpresentation
- Multiple feti
- Mummification / maceration
- Obesity
- Periparturient hypocalcemia
- Uterine torsion

DYSURIA

- Actinomyces
- Cystitis
- Mycoplasma
- Orf
- Photosensitivity
- Sacral fracture
- Spinal cord injury
- Trauma
- Ulcerative balantitis and vulvitis
- Urinary calculi

EAR

- Bacterial otitis
- Foreign body
- Fungal otitis
- Mycoplasma sp.
- Psoroptic mange

EDEMA

- Blue Tongue
- Clostridium
- Cobalt deficiency
- Iodine deficiency
- Johne's Disease
- Malignant edema
- Mastitis
- Pregnancy toxemia
- Snake bite
- Sunburn / photosensitization
- Trauma
- Ulcerative balantitis and vulvitis

FAILURE TO THRIVE

- Anemia
- Failure of passive transfer
- Genetic
- Immunodeficiency
- Johne's Disease
- Oral lesions
- Parasites
- Respiratory disease
- Vitamin / mineral imbalance

FEVER

- Acute viral infection
- Blue Tongue
- Failure of passive transfer
- Foreign body
- Malignant edema
- Mastitis
- Pasteurellosis
- Salmonella
- Sheep pox
- Traumatic reticulo-peritonitis

FRACTURES

- Breeding
- Calcium deficiency
- Copper deficiency

FRACTURES, Cont.

- Gun shot wound
- Osteoporosis
- Toxic ingestion
- Trauma
- Vitamin D deficiency

GESTATION, PROLONGED

- Fescue toxicity
- Fetal mummification
- High environmental temperature
- Hydrops amnii
- Hypothalamus-hypophyseal-adrenal axis disorders

GOITER

- Dietary iodine excess
- Goitrogenic substances
- Inherited enzyme excess
- Iodine deficiency

HEAD TILT

- Abscess
- Inner ear infection
- Listeria
- Mycoplasma sp.
- Otic foreign body
- Polioencephalomalacia / thiamine deficiency
- Tooth infection
- Trauma

HEART SOUNDS, MUFFLED

- Abscesses
- Congestive heart failure
- Emphysema
- Obesity
- Pericarditis
- Pleural effusion

HEMATURIA

- Bladder polyps
- Bracken fern toxicity
- Calculi
- Cystitis
- Infarction of kidney
- Papilloma
- Pyelonephritis
- Trauma
- Urethritis

HEPATITIS

- Flukes
- Hepatic abscesses
- Listeria
- Toxins

HYPOPROTEINEMIA

- Cobalt deficiency
- Johne's Disease
- Parasites

ICTERUS

- Hemolytic anemia
  - Anaplasmosis
  - Bacillary hemoglobinuria
  - Leptospirosis
- Liver
  - Aflatoxicosis
  - Fatty liver
  - Pyrrolizidine alkaloid

INFERTILITY—RAM

- Deficiencies
  - Iodine
  - Manganese
  - Vitamin A
  - Zinc
- Environmental
  - Cold weather infertility
  - Group housing of males
  - Heat stroke

INFERTILITY—RAM, Cont.

- Hereditary
  - Chromosomal abnormalities
  - Inbreeding
  - Segmental aplasia of reproductive tract
- Lameness
- Malnutrition
- Penis / Prepuce
  - Balanoposthitis
  - Cellulitis
  - Dermatophilosis
  - Foreign Body
  - Hematoma, hematocele
  - Herpes virus
  - Loss of penile sensation
  - Micropenis, hypoplasia
  - Orf
  - Paraphimosis
  - Penile deviation
  - Penile preputial adhesion
  - Persistant penile frenulum
  - Phimosis
  - Preputial stenosis
  - Prolapsed prepuce
  - Trauma, hematoma, abscesses
- Psychogenic impotency
- Scrotum
  - Abscess
  - Dermatophilosis
  - Frostbite
  - Inguinal scrotal hernia
- Seminal vesiculitis
- Sperm
  - Abnormalities of spermatogenesis
  - Hemospermia
  - Sperm granuloma
- Testicles / Spermatic cord
  - Actinomyces
  - Brucellosis
  - Cryptorchidism
  - Degeneration
  - Epididymitis
  - Hypoplasia / atrophy
  - Orchitis
  - Segmental aplasia
  - Spermatocele

INFERTILITY—RAM, Cont.

- Trauma
- Tumors

– Urethra and Erectile tissue
  - Corpus cavernosum vascular shunts
  - Ruptured urethra
  - Urethral fistula
  - Urolithiasis
– Varicocele
– Vertebral spondylosis

JUGULAR VENOUS DISTENTION / PULSATION

– Brisket disease
– Cardiomyopathy
– Congestive heart failure
– Cor pulmonale
– Heart base tumors / abscess
– Jugular venous phlebitis / thrombosis
– Monensin toxicity
– Pericarditis
– Right atrial-ventricular valve insufficiency
– Right sided heart failure
– White muscle disease

KERATOSIS

– Sarcoptic mange
– Vitamin A deficiency
– Zinc deficiency

KETOSIS

– Anorexia
– Mastitis
– Metritis
– Peritonitis
– Pregnancy toxemia

LAMENESS

– Bruised foot
– Chlamydia
– Erysipelas
– Foot abscess

LAMENESS, Cont.

- Foot and Mouth Disease
- Foot infection
- Foot Rot
- Foreign body
- Fractures
- Hoof defects
- Laminitis
- Malignant edema
- Muscle abscess
- Mycoplasma
- Osteomyelitis
- Over grown feet
- Previous acidosis
- Septic arthritis
- Sprain
- Tetanus
- Trauma / injury—laceration, puncture
- Vesicular Stomatitis
- Vitamin D deficiency
- White muscle disease
- Zinc deficiency

LIBIDO, POOR IN RAMS

- Epididymitis
- Group housing of males
- Lameness
- Malnutrition
- Orchitis
- Penis / Prepuce problems
    - Corpus cavernosum vascular shunts
    - Loss of penile sensation
    - Persistant penile frenulum
    - Posthitis
    - Prolapsed prepuce
    - Trauma, hematoma
- Psychogenic impotency
- Vertebral osteophytosis / spondylosis
- Zinc deficiency

LIMB SWELLING

- Hard tissue
  - Degenerative joint disease
  - Epiphysitis
  - Fracture
  - Molybdenosis / Copper deficiency
  - Osteomyelitis
  - Osteosarcoma
  - Septic arthritis
  - Sequestrum
  - Tumor calcinosis
- Soft tissue
  - Abscess
  - Bee sting / snake bite
  - Chronic tendonitis
  - Fescue foot
  - Foot rot
  - Gangrene of foot
  - Granulomas
  - Hematoma
  - Hygroma
  - Mycoplasma arthritis
  - Neoplasia
  - Ruptured tendon
  - Septic arthritis
  - Tenosynovitis

LYMPHADENOPATHY

- Caseous lymphadenitis
- Lymphosarcoma
- Nocardia
- Tuberculosis

MAMMARY DEVELOPMENT, PRECOCIOUS

- Abortion
- Ascending infection during pregnancy
- Ovarian tumors
- Pregnancy
- Spontaneous
- Zearalenone toxicity

MAMMARY GLAND, ENLARGED

- Abscesses
- Blind quarter
- Mastitis
- Pendulous udder
- Periparturient udder edema
- Trauma

MELENA

- Abomasal ulcer
- Coccidiosis
- Gastroenteritis with bleeding
- Internal parasites
- Intussusception
- Toxins
    - Arsenic
    - Non steroidal anti-inflammatory drugs (NSAIDS)
    - Oak toxicity
    - Sulfur
    - Warfarin

MUCOUS MEMBRANE PAPULES

- Orf
- Sheep pox
- Toxic ingestion
- Vesicular stomatitis

MUSCLE SPASM

- Hypomagnesemic tetany
- Grass tetany
- Hypocalcemia
- Tetanus

NASAL AND OCULAR DISCHARGE

- Abscesses
- Acute viral infection
- Bacterial pneumonia
- Chlamydia psittaci
- Choke
- Dusty environment
- Moldy feed

NASAL AND OCULAR DISCHARGE, Cont.

- Nasal myiosis
- Pasteurellosis
- Parainfluenza virus type 3 (PI_3)
- Septicemia (neonates)
- Trauma

NEONATAL DEATH

- Aspiration pneumonia
- Atresia ani or other congenital defects
- Cryptosporidia
- E. coli
- Lamb dysentery
- Orf
- Predation
- Rotavirus
- Salmonella
- Septicemia
- Starvation
- Trauma
- Vitamin E / Selenium deficiency

NEUROLOGICAL SIGNS

- Brain abscess (Caseous lymphadenitis—CLA / Actinobacillus)
- Clostridium perfringens type C
- Cobalt deficiency
- Copper deficiency
- Hypocalcemia
- Hypomagnesemia
- Inner ear infection
- Listeriosis
- Louping ill
- Mycotoxins
- Parelaphostrongylus (Meningeal worm migration)
- Polioencephalomalacia / thiamine deficiency
- Pregnancy toxemia
- Rabies
- Scrapie
- Swayback
- Tetanus
- Tick paralysis
- Uremia
- Vitamin A deficiency

OPHTHALMOLOGIC

- Cataracts
- Chlamydia
- Entropion
- Foreign body
- Hay or dust
- Moraxella bovis
- Mycoplasma
- Pasteurellosis
- Sheep pox
- Vitamin A deficiency

OPISTHOTONOS / HYPERETHESIA

- Clostridium perfringens Type D
- Listeria
- Menigeal worm migration
- Polioencephalomalacia / thiamine deficiency
- Scrapie
- ALSO SEE NEUROLOGICAL SECTION

ORAL LESIONS

- Abscesses
- Blue Tongue
- Broken or lost teeth
- Fungal and Bacterial gingivitis
- Lumpy jaw
- Malocclusion
- Neoplasia
- Vesicular Stomatitis
- Wooden tongue

PARALYSIS

- Hypocalcemia
- Meningeal worm
- Spinal abscess
- Swayback
- Trauma
- Vertebral fracture

PERIPHERAL PULSE, ABNORMALITIES

- Acid / Base disorders
- Cardiac dysrhythmias
- Congestive heart failure
- Dehydration
- Electrolyte imbalance
- Shock
- Toxemia

PHOTOSENSITIZATION

- Chronic fluke damage
- Congenital porphyria
- Liver disease
- Phenothiazines
- St. John's Wart
- Toxins

POLYARTHRITIS

- Chlamydia psittaci
- Failure of passive transfer
- Mycoplasma ovipneumonia
- Puncture wound
- Staphylococcus aureus

POLYURIA

- Diabetes mellitus / Diabetes insipidus
- Diuretics
- Fluid administration
- Hyperglycemia
- Renal failure acute and chronic
- Salt deficiency
- Salt toxicity
- Severe chloride, potassium, or urea deficiency
- Steroid administration

POSTURAL DEFORMITIES

- Chronic laminitis
- Congenital
    - Angular limb deformities
    - Contracted tendons
- Degenerative joint disease

POSTURAL DEFORMITIES, Cont.

- Fractures
- Hyperparathyroidism
- Hypertrophic osteopathy
- Infection of foot
- Luxation
- Muscle atrophy from denervation
- Osteomalacia
- Osteomyelitis
- Physitis
- Rickets
- Ruptured muscle
- Secondary contracted tendons
- Septic arthritis with ankylosis
- Septic tenosynovitis
- Severed tendons

PRURITIS

- Chemical toxins
- Chorioptic mange
- Cobalt deficiency
- Dermatophytosis
- Fleas, keds, ticks (ectoparasites)
- Lice
- Meningeal worm
- Plant toxins
- Pseudorabies
- Rabies
- Sarcoptic mange
- Scrapie
- Sunburn / photosensitization
- Zinc deficiency

REGURGITATION

- Choke
- Esophageal trauma
- Obstruction
- Salt toxicity
- Toxins / Poisonous plants

RENAL FAILURE, ACUTE

- Aminoglycoside administration
- Chemicals
- Hemodynamic causes
  - Heart failure
  - Renal vein thrombosis
  - Severe bloat
  - Shock
- Oak toxicity
- Septic causes
  - Mastitis
  - Metritis
  - Pyelonephritis
  - Renal necrosis

RENAL FAILURE, CHRONIC

- Amyloidosis
- Any cause of acute renal failure
- Chronic obstruction
- Chronic pyelonephritis

REPEAT BREEDING—FEMALE

- Campylobacteriosis
- Endometritis
- Follicular cysts
- Heat stress
- Inadequate number of rams
- Leptospirosis
- Malnutrition
- Poor semen quality

RESPIRATORY

- Adenovirus / adenomatosis
- Caseous lymphadenitis
- Chlamydia
- Chronic pulmonary adenomatosis
- Mycoplasma
- Nasal bot
- Nasal myosis
- Neoplasia
- Ovine Progressive Pneumonia (OPP)
- Parainfluenza type 3

RESPIRATORY, Cont.

- Parasitic bronchitis
- Pasteurellosis
- Selenium toxicity
- Tuberculosis

RESPIRATORY STRESS

- Acidosis
- Anaphylaxis / allergy
- Anaplasmosis
- Bloat
- Distended abdomen
- Enteritis
- Eperythrozoonsis
- Fluid and electrolyte loss
- Hyperthemia
- Hypocalcemia
- Hypomagnesemia
- Hypovolemic, cardiac, and septic shock
- Iron deficiency
- Metritis
- Neonatal septicemia
- Pain
- Pneumonia
- Salmonellosis
- Septicemia
- White muscle disease

RETAINED PLACENTA

- Abnormal gestation length
- Abortion
- Dystocia
- Hypocalcemia
- Induced parturition
- Placentitis
- Stillbirth
- Vitamin E deficiency

RETARDED GROWTH

- Failure of passive transfer
- Genetic
- Nutritional deficiency
- Parasitic gastroenteritis

ROUGH HAIR COAT

- Iodine deficiency
- Johne's Disease
- Parasites
- Vitamin A deficiency

SALIVATION, EXCESSIVE

- Blue Tongue
- Dental problems
- Foreign body
- Herpes virus
- Oral abscess
- Oral ulcers
- Organophosphate toxicity
- Tumor
- Vesicular Stomatitis
- Zinc Deficiency

SCABS / ULCERS ON SKIN / SCALING

- Chorioptic mange
- Contagious ecthyma (Orf)
- Dermatophilosis
- Fleas
- Lice
- Ringworm
- Sarcoptic mange
- Sheep pox
- Staphylococcal dermatitis
- Ulcerative balantitis and vulvitis
- Zinc deficiency

SEIZURES

- Anthrax
- Brain tumor / abscess
- Developmental malformations
- Drugs
  - Intracarotid injection
  - Premature withdrawal of anti-convulsant medication
  - Theophylline
- Heat stroke
- Idiopathic epilepsy
- Infectious
  - Botulism
  - CNS parasite migration
  - Generalized sepsis
  - Meningitis / encephalitis
- Liver failure
- Metabolic
  - Hypernatremia
  - Hypocalcemia
  - Hypoglycemia
  - Hypomagnesemia
  - Hyponatremia
  - Metabolic acidosis
- Perinatal complications
  - Cerebral concussion
  - Hypoxic-ischemic brain injury
  - Intracranial hemorrhage
- Polioencephalomalacia / thiamine deficiency
- Rabies
- Tetanus
- Toxins
  - Cyanide
  - Lead
- Trauma

SEPTICEMIA / ENLARGED JOINTS AND / OR UMBILICUS

- Actinomyces pyogenes
- Chlamydia
- E. coli
- Failure of passive transfer
- Fracture
- Hematogenous infection
- Joint-Ill
- Mycoplasma

SEPTICEMIA / ENLARGED JOINTS AND / OR UMBILICUS, Cont.

- Physeal fracture
- Salmonella
- Staphylococcus sp
- Streptococcus sp
- Trauma

STIFF GAIT / SAWHORSE STANCE

- Clostridium
- Hypocalcemia / hypomagnesemia
- Polioencephalomalacia / thiamine deficiency
- Tetanus
- Vitamin D (deficiency or toxicity?)
- Zinc deficiency

STRANGE BEHAVIOR

- Hyperthermia
- Nasal myiosis
- Predators
- Pseudorabies
- Rabies

SUDDEN DEATH

- Infectious and Parasitic
  - Abscess rupture—liver
  - Anaplasmosis
  - Anthrax
  - Botulism
  - Clostridium species
  - Gangrenous mastitis
  - Haemonchus
  - Inhalation pneumonia
  - Leptospirosis
  - Liver flukes
  - Pseudorabies
  - Salmonellosis
  - Septic metritis
- Metabolic
  - Grain overload
  - Grass tetany
  - Hypocalcemia
  - Molybdenosis / copper deficiency

SUDDEN DEATH, Cont.

- Polioencephalomalacia / thiamine deficiency
- Pregnancy toxemia
- White muscle disease

– Miscellaneous
  - Anaphylaxis
  - Blood transfusion reaction
  - Dosing gun injury
  - Lightning strike

– Physical causes
  - Abomasal bloat (lambs)
  - Bloat
  - Choke
  - Gunshot
  - Heat stroke
  - Mesenteric torsion
  - Myocardial infarction
  - Ruptured uterine artery
  - Trauma
  - Ulcers perforating or bleeding
  - Urolithiasis

– Toxic
  - 4-aminopyridine
  - Anticoagulants
  - Arsenic
  - Botulism
  - Carbamates
  - Chlorinated hydrocarbons
  - Copper toxicity
  - Crude oil
  - Gossypol
  - Hydrogen sulfide gas
  - Lead toxicity
  - Metaldehyde
  - Monesin
  - Nicotine toxicity
  - Nitrogen dioxide gas
  - Organophosphates
  - Salt toxicity
  - Selenium toxicity
  - Urea toxicity

– Toxic plants
  - Bluegreen algae
  - Canary grass
  - Cocklebur
  - Cyanogenic plants

SUDDEN DEATH, Cont.

- Death camas
- Golden chain tree
- Greasewood
- Halogeton
- Ink weed
- Larkspur
- Laurels
- Lupine
- Milkweed
- Monkshood
- Night shades
- Nitrate accumulating plants
- Oleander
- Poison hemlock
- Tobacco
- Water hemlock

SWAYBACK

- Copper deficiency
- Genetic
- High molybdenum, sulfate, or cadmium
- Trauma

TACHYPNEA

- Acidosis
- Obesity
- Parasitic bronchitis
- Pneumonia
- Stress

TENESMUS

- Constipation
- Diarrhea
- Labor
- Parasites
- Rectal prolapse
- Rectovaginal fistula

UNTHRIFTINESS

- Copper toxicity
- Liver fluke infestation
- Parasitic gastroenteritis
- Swayback
- Vitamin D deficiency

WEAK LAMBS

- Anemia
- Bacterial infections
- Birth asphyxia
- Birth trauma
- Border Disease
- Brain / spinal cord disease
- Colibacillosis
- Cryptosporidiosis
- Diarrhea
- Drugs and toxins
- Failure of passive transfer
- Hypoglycemia
- Liver disease
- Malnutrition
- Parasitic infection
- Pneumonia
- Salmonellosis
- Septicemia
- Tetanus
- White muscle disease

WEAKNESS

- Abomasal ulcers
- Acidosis
- Anaplasmosis
- Cardiac arrhythmias
- Congenital heart defects
- Congestive heart failure
- Hypocalcemia
- Hypomagnesemic tetany
- Ketosis
- Malnutrition
- Myocardial disease
- Parasitism

WEAKNESS, Cont.

- Parturient paresis
- Peritonitis
- Pneumonia
- Polioencephalomalacia / thiamine deficiency
- Renal disease
- Salmonella
- Toxic blue bag
- Urolithiasis
- Vitamin deficiency

WEIGHT GAIN / GROWTH, DECREASED

- Cobalt deficiency
- Copper deficiency
- Cryptosporidium
- Diarrhea
- Lameness
- Malnutrition
- Parasites
    - Coccidiosis
    - Flukes
    - GI worms
    - Lice
    - Lung worms
    - Mange
- Pneumonia
- Selenium deficiency

WEIGHT LOSS

- Caseous lymphadenitis
- Copper toxicity
- Dental abnormalities
- Diarrhea
- Johne's Disease
- Lameness
- Malnutrition
- Ovine progressive pneumonia (OPP)
- Parasites
- Pneumonia

CAPRINE FORMULARY

Many of the following drugs are not approved for use in goats. These drugs are marked ELU (Extra Label Use). In cases where withdrawal times are not determined for goats, the withdrawal times for cattle or sheep are noted.

- IM injections are best made in the neck or triceps (longissimus muscles over back also acceptable if the hide will not be marketed)
- DO NOT use caudal thigh muscles for IM injections in goats (lameness, sciatic nerve damage)
- No more than 5ml injected into any one site

Basic Goat Reference Values:

T: 104°F (101.5°F - 105°F)
P: 70 – 80 bpm
R: 16 – 34 breaths per minute
PCV: 22% - 38%
Gestation Length: 145 – 155 days
Estrus Cycle Length: 21 days, does come into heat in the fall

Drug	Dose	Withdrawal	Notes
Abomasal Tone Restoration / Emptying			
Metoclopramide HCl	0.5-1 mg/kg IV	ELU	Contraindicated with obstruction / perforations
Anaphylaxis			
Epinephrine	0.5-1cc/100# of 1:1000 dilution IM or SQ, 1:10,000 dilution IV, may be repeated at 15 minute intervals	None necessary	Can be added to local anesthetics to prolong effects
Dexamethasone	0.5-1 mg/kg IV with epinephrine	Cattle: none	
Diphenhydramine (Benadryl)	0.5-1 mg/kg IV with epinephrine	ELU	
Anesthesia			
Acepromazine	0.01-0.02 mg/kg slow IV 0.05-1.0 mg/kg IM	ELU FARAD: Milk: 48 hours Meat: 7 days	Causes hypotension; no analgesic effect
Alphaxolone / Alphadolone	3 mg/kg slowly IV		
Anesthesia Cocktail	Butorphanol 0.1 mg/kg + Xylazine 0.05 mg/kg + Diazepam 0.1 mg/kg		
Atipamezole (Antisedan)	125-175 µg/kg half IV, half IM	ELU	Reversal of Xylazine, Detomidine
Atropine	Preanesthetic: 0.15-0.3 mg/kg IM OP poisoning: 0.5 mg/kg (1/4 IV, rest SQ or IM), repeat q3-4 hours for 1-2 days	No information available for withdrawals	Not routinely used as preanesthetic
Buprenorphine	0.005 mg/kg IM every 12 hours, slow onset, lasts 4 hours	ELU	Good for visceral pain
Butorphanol (Torbugesic)	0.1-0.2 mg/kg IM or IV every 3 hours	ELU	Good for visceral pain

CAPRINE FORMULARY

Drug	Dose	Withdrawal	Notes
Anesthesia			
Chlorpromazine	0.55-4.4 mg/kg IV 2.2-6.6 mg/kg IM 2-3.5 mg/kg IV q5-6 hours	ELU	Causes contact dermatitis in humas
Detomidine (Dormosedan)	0.2-0.8 µg/kg IV 20-40 µg/kg IV or IM	ELU FARAD: Milk: 72 hours Meat: 3 days	
Diazepam	0.25-0.5 mg/kg slowly IV Tranquilization: 0.55-1.1 mg/kg IM Bermuda Grass toxicosis: 0.8 mg/kg IV Appetite Stimulant: 0.04 mg/kg IV	ELU	Also used to treat seizures
Doxapram (Dopram)	Stimulate respiration: 0.4 mg/kg IV Overdose of sedative: 0.5-1 mg/kg IV	ELU	
Guaifenesin	66-132 mg/kg IV 44-88 mg/kg IV + 0.66-1.1 mg/kg Ketamine	ELU FARAD: Up to 100 mg/kg Milk: 48 hours Meat: 3 days	For muscle relaxation
Ketamine	Premed atropine 0.4 mg/kg, then xylazine 0.22 mg /kg IM 20-25 mins later. 10 mins after xylazine, 11mg/kg ketamine IM Premed atropine 0.22 mg/kg + acepromazine 0.55 mg/kg then ketamine 22 mg/kg IM, then intermittent 2-4 mg/kg IV 2 mg/kg IV induction, then 4 ml/min constant infusion Extended anesthesia with ketamine 2-4 mg/kg IV (short term) or 6 mg/kg IV	ELU FARAD: Up to 2 mg/kg IV; 10 mg/kg IM Milk: 48 hours Meat: 3 days	Must be given following or with a sedative
Ketamine / Xylazine	X: 0.22 mg/kg IM then K: 11 mg/kg IM in 10 mins. OR X: 0.22 mg/kg + K: 11 mg/kg IM 5 mg/# increments, 3 mg/# if prolonged	ELU	
Lidocaine 2%	Toxic dose: 10 mg/kg IM / SQ 25cc SQ for 120# goat Lamb: dilute to 1%, no more than 4cc SQ	Milk and Meat: 48 hours	Also used for ventricular arrhythmias
Medetomidine	25-35 µg/kg IM	ELU	
Methohexital sodium	4 mg/kg as a 2.5% solution		
Morphine epidural	0.1 mg/kg (15 mg/ml morphine) Xylazine: 0.05 mg/kg	ELU	Class II controlled drug
Pentobarbital	Anesthesia: 20-30 mg/kg IV Lamb: 15-26 mg/kg IV	ELU	20 min duration of anesthesia
Propofol	3-4 mg/kg slowly IV	ELU	

CAPRINE FORMULARY

Drug	Dose	Withdrawal	Notes
Anesthesia			
Telazol	5.5 mg/kg IV 2.5 mg/# IV 5.7 mg/kg for prolonged procedure	ELU	
Thiopental	9.9-15 mg/kg IV 20-22 mg/kg IV (with atropine)	ELU	Good induction of general anesthesia
Tolazoline	Reverse xylazine: 2-4 mg/kg slow IV	ELU: Not for use in food animals New Zealand: Meat: 30 days	
Xylazine (Rompun)	Minor: 0.03-0.04 mg/kg IV / IM Standard: 0.05 mg/kg IV 0.10 mg/kg IM 0.02 mg/# IV or 0.1 mg/# IM 0.1-0.22 mg/kg IM 0.044-0.11 mg/kg IV FARAD: Up to 0.1 mg/kg IV, or 0.3 mg/kg IM: Milk: 72 hours, Meat: 5 days 0.3-2.0 mg/kg IM: Milk: 120 hours, Meat: 10 days	ELU FARAD See dose section	Use low dose and with caution
Xylazine epidural	0.05 mg/kg	Meat: 7 days	
Yohimbine	Reverse xylazine: 0.125 mg/kg IV 2.5 cc/100# IV	ELU FARAD: Milk: 72 hours Meat: 7 days	
Anthrax Treatment			
Oxytetracycline	4.4 mg/kg IM or IV daily	ELU Cattle: Meat: 15-28 days depending on brand used	Do not use in healthy animals recently vaccinated for anthrax
Antibiotics			
Amikacin	10 mg/kg IV	ELU	Gram negative aerobic, bactericidal
Amoxicillin	3-5 mg/# IM SID For footrot	Cattle: Milk: 96 hours Meat: 25 days	Gram +/- aerobes and anaerobes, bactericidal
Ampicillin (Polyflex 250 mg/ml)	2-5 ml/# IM SID 4 cc/100# SQ BID 14 days For pneumonia	Cattle: Milk: 48 hrs Meat: 6 days	Gram +/- aerobes and anaerobes, bactericidal Good after surgeries

CAPRINE FORMULARY

Drug	Dose	Withdrawal	Notes
Antibiotics			
Ceftiofur (Naxel)	0.5-1 mg/# injectable 2 cc/100# IV/ IM BID 7 days	Cattle: none	Gram +, mostly aerobes, bactericidal To treat respiratory and skin infections, mastitis, including Pasteurellosis
Chlortetracycline (Pennchlor, Aureomycin)	80 mg/head/day in feed		
Excenel	1-2 ml/100# SID Footrot and pneumonia	Cattle: Milk: none needed Meat: 2 days	
Florfenicol (Nuflor)	3 cc/100# (200 mg/kg) IM EOD x 2 6 cc/100# (400 mg/kg) SQ once	ELU Cattle: Meat: IM: 28 days SQ: 38 days	Gram +/- For respiratory infections: Pasteurellosis, Fusobacterium Not approved for use in lactating dairy cattle
Neomycin (Biosol, Neomix, Neosol)	10 mg/# for max. 14 days in water 70-140 g/ton of feed 11 mg/kg in water 200-400 mg/gallon in milk	Sheep: Meat: 20 days Cattle: Milk: 48 hours Meat: 30 days	
Oxytetracycline (LA - 200)	6-11 mg/kg IV / IM 10-20 mg/kg PO q6 hours 5 cc/100# IM/SQ EOD x 4 Anthrax: 4.4 mg/kg IM or IV daily	Cattle: Meat: 28 days	Footrot Pneumonia Abortion outbreaks
Procaine Penicillin G	6cc/100# IM SID 3-7 days 44,000 units/kg 3,000 IU/# 1 cc/30#	Sheep: Meat: 8 days Cattle: Milk: 48 hours Meat: 4 days **(per label dose)**	Gram + aerobes and anaerobes Treat clostridial diseases, especially tetanus, epididymitis and orchitis
Rifampin	10-20 mg/kg PO BID 4 weeks Johne's: 4 mg/# PO SID indefinitely	**No longer food animal**	Used in combo with other antibiotics to improve penetration
Sodium Iodide	Actinobacillus (Wooden Tongue): 70 mg/kg IV twice at 7-10 day interval Actinomycosis (Lumpy Jaw): 70 mg/kg IV	ELU	
Sulfadimethoxine (Albon)	25 mg/# initially IV SID, then 12.5 mg/# oral/IV	Cattle: Milk: 60 hours Meat: 5 days	Streps, respiratory, skin infections

CAPRINE FORMULARY

Drug	Dose	Withdrawal	Notes
Antibiotics			
Tetracycline	4.5 ml/100# IM or IV q2-4 days For pneumonia, footrot, scours	Sheep: 5 days Cattle: Milk: 4 days Meat: 28 days	
Tilmicosin (Micotil)	1.2 cc/100# SQ 1 dose **TOXIC IN GOATS** **DO NOT USE**	Cattle: Meat: 28 days	May be toxic to goats Not approved for use in dairy cattle
TMS / SMZ 960	22-30 mg/kg PO BID	ELU	
Tylosin (Tylan 200)	10 mg/kg SID not to exceed 5 days	Milk: 48 hours Meat: 21 days	
Anticonvulsants			
Diazepam (Valium)	0.05-0.5 mg/kg IV to effect. Repeat as necessary.	ELU	
Phenobarbitone (Sagatal)	0.44 ml/kg IV to effect then 0.22 ml/kg every 8 or 12 hours as required.	ELU	
Antifungal			
Clofazinim	2 mg/kg PO		
Copper napthenate			
Ehiliconazole	0.2% solution every 3 days for 4 applications topically		
Griseofulvin	7.5 mg/kg for 7 days PO	ELU	
Natamycin	0.01% solution locally repeat after 5 and 14 days		
Anti-Inflammatories			
Aspirin	50-100 mg/kg PO every 12 hours	FARAD: Milk: 24 hours Meat: 1 day	
Betamethasone	0.04-0.08 mg/kg		
Carprofen	1.4 mg/kg SQ or IV every 36-48 hours or PO once daily	ELU	
Dexamethasone	0.1 mg/kg IV	Cattle: None necessary	
Flunixin meglumine (Banamine)	1 cc/100# SQ / IV/ IM 1.1-2.2 mg/kg IV / IM every 24 hours for 3-5 days	FARAD: Milk: 72 hours Meat: 10 days	
Ketoprofen (Ketofen)	1 cc/100# IM/IV/SQ as needed 3.3 mg/kg IV / IM every 24 hours for up to 3 days	ELU FARAD: Milk: 24 hours Meat: 7 days	
Meloxiram	0.5 mg/kg IV or SQ every 36-48 hours	ELU	
Methylprednisolone	10-30 mg/kg IV every 4-6 hours for 2-4 days	ELU	

CAPRINE FORMULARY

Drug	Dose	Withdrawal	Notes
Anti-Inflammatories			
Phenylbutazone	450 mg/100# PO SID 4 mg/kg IV or 10 mg/kg PO FARAD: Cattle 9 mg/kg IV or IM once Milk: 96 hours, Meat: 12 days 6-9 mg/kg IV or IM once followed by 3 mg/kg daily Milk: 120 hours, Meat: 21 days	ELU FARAD: See dose section	
Predef 2X	0.3-0.7 ml/100# IM, one-time dose!	Cattle: Milk: none needed Meat: 7 days	
Appetite Stimulation			
Chlorpromazine	0.5 mg/kg IV		
Diazepam	0.04 mg/kg IV		
Copper poisoning			
Ammonium tetrathiomolybdate	Either 1.7 mg/kg IV or 3.4 mg/kg SQ in 3 doses on alternate days		
Grass Tetany (Hypomagnesemia)			
Calcium borogluconate 20% with magnesium and phosphorus	80-100 mL IV or SQ, plus 100 mL of magnesium sulfate 25% SQ		
Intestinal Motility Reduction			
Loperamide hydrochloride	100-200 µg/kg PO every 8-12 hours		
Johne's Treatment			
Clofazimin	2 mg/kg PO		
Levamisolee	1.5 mg/# PO SID with rifampin for 3 days	Sheep: Meat: 3 days	
Rifampin	4 mg/# PO SID indefinitely	**NO LONGER FOOD ANIMAL**	
Lead Poisoning			
Calcium disodium versenate 20%	75 mg/kg IV or SQ in divided doses every few hours for 3 or 4 days		
Milk Fever (Hypocalcemia)			
Calcium borogluconate 20%, with magnesium and phosphorus	80-100 mL, slowly IV, SQ or half by each route		
Myometrial Relaxants			
Clenbutarol hydrochloride	0.8 µg/kg slowly IV or IM		
Vetrabutine hydrochloride	2 mg/kg IM		
Ocular			
Atropine	TID-QID until pupil dilates then SID	ELU	
Forte topical	Topical, as needed	ELU	
Terramycin (oxytetracycline)	Topical, as needed	ELU	
Trioptic / Trioptic-S	Topical, as needed	ELU	

CAPRINE FORMULARY

Drug	Dose	Withdrawal	Notes
Opioid Analgesics			
Buprenorphine	0.005 mg/kg IM q12 hours	ELU	
Butorphanol (Torbugesic)	0.1-0.2 mg/kg IM/IV q3 hours	ELU	
Meperidine HCl (Demerol)	Up to 200 mg total dose IM	ELU	
Morphine sulfate	Up to 10 mg total dose IM	ELU	
Organophosphate Poisoning			
Atropine	1 mg/kg slowly IV 0.5 mg/kg (1/4 IV, rest SQ or IM), repeat q3-4 hours for 1-2 days		
Other			
Aluminum / Magnesium Hydroxide	1/8 to ¼ g/kg in 2-3 gallons water PO, repeat 6-12 hours	ELU	
Ammonium chloride	200 mg/kg PO 1-2 g PO		
CaEDTA	Cattle dose: 67 mg/kg slow IV BID for 2 days then withhold 2 days then dose another 2 days 73.3 mg/kg/day slow IV divided BID-TID 3-5 days, rest 2 days, then 5 days again		For lead toxicity
Calcium PMD	20 ml IV 50 ml SQ	ELU	
Fentanyl citrate / Droperidol (Transdermal)	Quantity of 2, 7.5 mg patches (release 75 µg/hr) per 150# goat	ELU	Be sure to clip hair and apply to skin
Kaolin / Pectin	3-4 oz PO	None	
Magnesium sulfate	25%: 50 ml SQ 20%: 50-100 ml (Ca/Mg solution)	ELU	
Mannitol	Cerebral edema: 1-3 g/kg IV Oliguric RF: 1-2 g/kg IV	ELU	
Mineral Oil	1-2 pints PO 100-500 ml PO	None	
Monensin (Rumensin)	20 g/ton of feed		
Neostigmine bromide	1.0-1.5 mg/100# SQ, repeat as indicated 0.01-0.02 mg/kg	ELU	
Phytonadione	Warfarin toxicity: 0.5-2.5 mg/kg IM Acute hypoprothrombinemia with hemorrhage: 0.5-2.5 mg/kg IV Non-acute hypoprothrombinemia: 0.5-2.5 mg/kg IM or SQ	None listed	
Sodium sulfate	Cathartic: 60 g PO (6% Solution)	ELU	
Stanazolol	Aflatoxicosis: 2 mg/kg IM Do not use with oxytetracycline	ELU	
Tripelennamine hydrochloride	0.5 ml/# (2.5 ml/100#) IM / IV	Cattle: Milk: 24 hours Meat: 4 days	Anti-histamine

CAPRINE FORMULARY

Drug	Dose	Withdrawal	Notes
Parasiticides			
Albendazole (Valbazen)	7.5 mg/kg PO 15 mg/kg PO, adult liver flukes **Do Not administer to females during first 30 days of gestation / 30 days post buck removal**	Cattle: Meat: 27 days	Benzimidazole Used for nematodes, flukes
Albon (Sulfadimethoxine)	1 pkg/gal = mix, 1L of mix/5 gal water for 5 days, Injectable: 5 cc loading dose then 2.5 cc/day for 3 days for 100# goat	Cattle: Milk: 60 hours Meat: 5 days	
Amitraz (Mitaban)	10.6 ml of 19.9% Mitaban in 2 gallons of water, whole body dip, repeat every 10-14 days	Cattle: no withdrawal	
Decoquinate (Deccox)	0.5 mg/kg/day in feed		Coccidia preventative
Doramectin (Dectomax)	200 µg/kg PO 500 µg/kg topically	Cattle: Meat: 35 days	Avermectin
Eprinex	0.5 mg/kg		
Ivermectin	200 µg/kg SQ 1 ml/110# IM / SQ (1% solution) 3 ml/26# PO (0.8% solution)	Injectable: Meat: 35 days Oral: Meat: 11 days	Avermectin Used for nematodes, external parasites
Lasalocid (Bovatec)	15-70 mg/head/day in feed 20-30 g/ton of feed		
Levamisolee (Levasole, Tramisole, Prohibit)	0.184 g/50# 0.5 OZ/50# 7.5-8 mg/kg PO 2 ml/100#, repeat in 2-6 weeks	Sheep: 3 days	Used for nematodes
Malathion	1.5 oz/gal water, whole body spray until skin is wet		
Mebendazole	22.5 mg/kg orally		
Moxidectin	0.2-0.4 mg/kg SQ		Avermectin
Netobimin	11-25 mg/kg orally		
Nitrofurazone	Coccidiostat: 10 mg/kg PO 4 days		df
Oxfendazole	5 mg/kg PO		Benzimidazole
Panacur (fenbendazole)	5 mg/kg PO SID for 3 days 9.5 mg/kg in feed for 3 days	Milk: 14 days Meat: 14 days	Benzimidazole Used for nematodes
Praziquantel (Droncit / Drontal)	10-15 mg/kg	ELU	Used for cestodes
Rumentel / Nematel (morantel tartrate)	10 mg/kg PO 0.44 g/100# in feed	14-160 days	Used for adult nematodes Don't use with Pyrantel or Levamisole
Salinomycin	Coccidiostat: 100ppm in concentrate		
Strongid (pyrantel tartrate / pamoate)	25 mg/kg PO	ELU	
Sulfadimethoxine	Coccidiostat: 75 mg/kg PO 4-5 days 250 mg/kg PO sustained release bolus		

CAPRINE FORMULARY

Drug	Dose	Withdrawal	Notes
Parasiticides			
Sulfamethazine	Coccidiostat: 50 g/ton of feed		
Thiabendazole	50-100 mg/kg PO, repeat in 2-4 weeks 44mg/kg PO Severe infection: 66 mg/kg PO	Milk: 96 hours Meat: 30 days	Benzimidizole
Thiophanate	9 kg/ton of feed or 2.8 kg/ton of feed daily for 5 days		
Flukes			
Albendazole	7.5 mg/kg orally		
Clorsulon	10 mg/kg orally		Fasciola hepatica
Netobimin	20 mg/kg orally		
Nitroxynil	10 mg/kg SQ		
Oxyclozanide	15 mg/kg orally		
Triclabendazole	10 mg/kg orally		
Cestodes			
Albendazole	10 mg/kg		
Febental	7.5 mg/kg	ELU	Metabolized to fenbendazole and oxfendazole
Fenbendazole	15 mg/kg		
Oxfendazole	10 mg/kg		
Coccidiosis			
Amprolium	5-10 mg/kg PO daily for 3-5 days	Calves: Meat: 24 hours	
Decoquinate	1 mg/kg or 100 g/ton feed for 28 days		
Diclazuril	1 mg/kg PO		
Sulphadimidine	200 mg/kg then 100 mg/kg SQ or IV daily for 5 days		
Sulphamethoxy pridazine	20 mg/kg SQ daily for 3 days		
Toltrazuril	20 mg/kg PO once every 3-4 weeks		
External Parasites			
Amitraz	0.025 % solution by spray or wash		
Cypermethrin	1-2% solution pour on		
Eprinomectin	0.5 mg/kg		
Ivermectin	10 mg/50 kg SQ		
Moxidectin	10 mg/ 50 kg SQ		
Permethrin	4% solution pour on		
Reproductive			
Buserelin	2.5 mL IM, SQ, or IV (at time of breeding or to prevent luteolysis) 5 mL IM, SQ, or IV (cystic ovaries)		
Chorionic Gonadotropin	Cystic follicles: 250-1000 units IV or IM 500 units IM at time of breeding	Cattle: none	
Cloprostenol Na	Induce parturition: 62.5-125 µg IM at 144 days gestation	Cattle: none	

CAPRINE FORMULARY

Drug	Dose	Withdrawal	Notes
Reproductive			
Dinoprost tromethamine (PGF2α, Lutalyse)	Estrus synchronization: 8 mg IM on day 4 of estrous, repeat in 11 days (start estrous in 2 days) Abortifacient: 5-10 mg IM (anytime during gestation) Induce parturition: 2.5-5 mg IM on day 144 of gestation Chronic metritis / pyometra: 2.5-5 mg SQ	Cattle: none	
Folligun / Fostim	SQ or IM, Dose dependent on time or year, weight, and milk yield.		
Gonadorelin	Induce ovulation out of breeding season: 100 µg injected daily for 4-5 days	Cattle: none	
Oxytocin	10-20 IU or 1.5-2.5 ml IM/SQ 30-50 IU injection Retained placenta: 10-20 units Metritis: 5-10 units IM TID-QID, 2-3 days Bleeding: 10-20 units IV, may repeat SQ in 2 hours	none	
Reticular Groove Closure (before giving oral meds)			
Copper sulfate	5 mL in 1 L of water PO		
Lysine-vasopressin	0.25 units/kg IV		
Spasmolytics			
Metanizole, hyoscine butybromide	0.505 mL IV		
Vaccines			
Cl. perfringens C, D, and tetanus	2 cc SQ, booster 21-28 days, biannual (R. axillary)	Meat: 21 days	
CLA	2 cc SQ, booster in 4 weeks, annual (L. axillary)	Meat: 21 days	
Pseudorabies	2 cc IM, annual		
Vitamins and Minerals			
Bo-Se (Selenium / Vitamin E)	4 cc SQ 1x/month for >50# goat Kid: 2 cc SQ 1 ml/40#	Sheep: Meat: 14 days	
L-Se	Kid: 1 ml	Meat: 14 days	
Thiamine	Polioencephalomalacia / thiamine deficiency: 10 mg/kg IV initially, then 10 mg/kg IM BID 2-3 days		
Vitamin A & D	1-2 cc SQ		
Vitamin B Complex	10 mg/kg IV then IM 3-4 days 4 cc IM or SQ		

CAPRINE DIFFERENTIAL DIAGNOSIS

ABDOMINAL DISTENSION

- Bloat
- Fat necrosis (rectum or colon)
- Grain overload
- Hypocalcemia
- Intestinal obstruction
- Obesity
- Obstructive urolithiasis
- Pelvic mass
- Peritonitis
- Pregnancy
- Rupture of urinary bladder

ABORTION, EARLY

- Drugs (diazepam, xylazine, acepromazine)
- Nutrition
- Progesterone deficiency
- Toxoplasmosis

ABORTION, LATE

- Akabane
- Bovine viral diarrhea (BVD)
- Brucella
- Campylobacter
- Caprine herpesvirus
- Chlamydia
- Copper deficiency
- Corticosteroids
- Drugs
- Foot and mouth disease
- Leptospirosis
- Levamisolee
- Listeria
- Malnutrition
- Mycoplasma
- Phenothiazine
- Q fever
- Salmonella
- Selenium deficiency

ABORTION, LATE, Cont.

- Stress
- Toxic plants
- Toxoplasmosis
- Vitamin A deficiency
- Yersinia

AGALACTIA / HYPOGALACTIA

- Abscess
- Mammary aplasia, hypoplasia
- Mastitis

ALOPECIA

- Chorioptic mange
- Dermatophilosis
- Dermatophytosis
- Gastrointestinal parasites
- Iodine deficiency
- Lice
- Meningeal worm
- Parelaphostrongylus
- Sarcoptic mange
- Staphylococcus dermatitis
- Vitamin A deficiency
- Vitamin D deficiency
- Vitamin E deficiency
- Zinc deficiency

ANEMIA

- Anaplasmosis
- Babesia
- Blood cell parasites
- Chronic GI parasitism
- Clostridium perfringens
- Cobalt deficiency
- Coccidiosis
- Copper deficiency / toxicity
- Feeding colostrum from cows
- Fleas
- Hemolytic anemia
- Hemorrhage

ANEMIA, Cont.

- Iron deficiency
- Johne's Disease
- Leptospira
- Lice
- Liver flukes
- Pediculosis
- Schistosomiasis
- Toxic plants—kale, onions, garlic
- Toxins
- Trauma

ANESTRUS

- Heat stress
- Luteal cysts
- Malnutrition
- Heavily lactating does
- Outside of normal breeding season
- Poor footing
- Poor heat detection
- Post partum period
- Pregnancy
- Pseudohermaphrodite
- Pyometra

ANOREXIA

- Bloat
- Blue Tongue
- Grain engorgement / Acidosis
- Hypocalcemia / hypomagnesemia
- Mastitis
- Pasteurellosis
- Polioencephalomalacia / thiamine deficiency
- Pregnancy toxemia / Ketosis

ASCITES / PLEURAL EFFUSION / PERIPHERAL EDEMA

- Cor pulmonale
- Gastrointestinal malabsorption
- Heart problems
- Hemodilution
- High altitude disease

ASCITES / PLEURAL EFFUSION / PERIPHERAL EDEMA, Cont.

- Kidney disease
  - Amyloidosis
  - Glomerulonephritis
- Liver disease
- Lymphatic obstruction
- Monensin / Lasalocid toxicity
- Pleuritis
- Starvation
- Thrombophlebitis
- Urolithiasis—rupture

ARTHRITIS / JOINT SWELLING

- Caprine arthritis and encephalitis virus (CAE)
- Chlamydia
- Epiphysitis
- Joint ill
- Mycoplasma—polyarthritis
- Septicemia
- Traumatic arthritis
- Vitamin D deficiency

ATAXIA

- Bacterial meningoencephalitis
- Brain abscess
- Bromide
- Caprine arthritis and encephalitis virus (CAE)
- Caprine encephalomyelomalacia
- Clostridium perfringens
- Copper deficiency
- Cowdriosis / Heartwater
- Enzootic ataxia
- Hypocalcemia
- Hypomagnesemia
- Insecticides (levamisole)
- Lead toxicity
- Listeria
- Lumbosacral abscess
- Lymphosarcoma
- Milk fever
- Parasite migration

ATAXIA, Cont.

- Plant toxins (milkweed, larkspur, loco, selenium, rye grass, bermuda grass, palm, cyanide, nitrates, oxalates)
- Polioencephalomalacia / thiamine deficiency
- Polyradiculoneruitis
- Rabies
- Salt toxicity
- Scrapie
- Tetanus
- Tick paralysis
- Urea toxicity
- Vitamin D deficiency

BALANTITIS / VULVITIS

- Drug reaction
- Herpes virus—"pizzle rot"
- Orf
- Photosensitivity

BLEEDING DISORDERS

- Blood loss anemia
  - Coccidiosis
  - External parasites
  - Fasciola hepatica
  - Haemonchus
  - Trauma
- Cardiovascular
- Congential afibrinogenemia (saanens)
- Digestive
- Hemolytic anemia
  - Anaplasma
  - Babesia
  - Clostridum
  - Copper toxicity
  - Eperythrozoon
  - Kale
  - Leptospirosis
  - Oak
  - Theleria
- Impaired erythropoiesis
  - Chronic infection (paratuberculosis)
  - Nutritional (cobalt, copper, iron)
  - Toxic (fluorosis, bracken fern)

BLEEDING DISORDERS, Cont.

- Liver and pancreas
- Musculoskeletal
- Neurological ocular
- Pancytopenia (bracken fern)
- Reproductive
- Respiratory
- Sudden death
- Thrombocytopenia (trypanosomes)
- Urinary
- Wasting

BLINDNESS

- Blind staggers (selenium toxicity)
- Border disease
- Brain abscess
- Brain edema
- Brain tumor
- Bright blindness (bracken fern)
- Caprine arthritis and encephalitis virus (CAE)
- Congenital
- Encephalitis
- Enterotoxemia
- Hydrocephalus
- Idiopathic hepatits
- Keratoconjunctivitis
- Ketosis
- Poisonous plants
- Polioencephalomalacia / thiamine deficiency
- Pregnancy toxemia
- Scrapie
- Tapeworm larvae
- Vitamin A deficiency

BOWED LIMBS—VALGUS / VARUS

- Epiphysitis—excess calcium

CARDIAC MURMUR

- Anemia
- Excitement
- Fever

CARDIAC MURMUR, Cont.

- Heart problems
  - Bacterial endocarditis
  - Congenital defects
  - Degenerative valvular disease
- Pericarditis
- Young animal

CIRCLING

- Borna
- Brain abscess
- Brain neoplasia
- Brain tumor
- Caprine arthritis and encephalitis virus (CAE)
- Cervical vertebral osteomyelitis
- Cowdriosis / Heartwater
- Encephalitis
- Encephalomalacia
- Gid
- Insecticides
- Listeria
- Nitrofuran overdose
- Otitis
- Parasite migration
- Polioencephalomalacia / thiamine deficiency
- Pseudorabies
- Rabies
- Selenium

COLIC

- Acidosis
- Bloat
- Constipation
- Diarrhea
- Foreign body
- Hypocalcemia / hypomagnesemia
- Intussusception
- Labor
- Peritonitis
- Pregnancy
- Tetanus
- Urinary calculi
- Uterine torsion

COLIC, Cont.

- Coma
- Carbamate
- Chlorinated hydrocarbons
- Enterotoxemia
- Head trauma
- Hepatoencephalopathy
- Meningoencephalitis
- Milk fever
- Milkweed
- Organophosphate
- Oxalate
- Polioencephalomalacia / thiamine deficiency
- Pregnancy toxemia
- Pseudorabies
- Salt toxicity
- Uremia

CONVULSIONS

- Anthrax
- Bacterial meningoencephalitis
- Borna
- Brain neoplasia
- Brain tumor / abscess
- Cowdriosis / Heartwater
- Cyanide poisoning
- Enterotoxemia
- Gid
- Hepatoencephalopathy
- Hypocalcemia
- Hypoglycemia
- Hypomagnesemic tetany
- Insecticides
- Lead
- Lidocaine
- Polioencephalomalacia / thiamine deficiency
- Pregnancy toxemia
- Pseudorabies
- Rabies
- Salt toxicity
- Tetanus
- Trauma

COUGH

- Abscessed lymph node(s)
- Ammonia / other fumes
- Bacterial pneumonia
- Caprine arthritis and encephalitis virus (CAE)
- Caseous lymphadenitis (CLA)
- Choke
- Contagious caprine pleuropneumonia
- Cryptococcosis
- Dusty / moldy hay
- Dysphagia / neurological disease
- Heart failure
- Lungworms
- Parasitic bronchitis
- Pasteurellosis
- Parainfluenza virus type 3 (PI_3)
- Tracheal stenosis
- Trauma
- Tuberculosis

CYCLIC IRREGULARITIES—FEMALE

- Campylobacteriosis
- Cystic ovaries
- Early / late in breeding season
- Endometritis
- Heat stress
- Leptospirosis
- Poor body condition

DEFORMED HOOVES

- Chronic foot rot
- Laminitis
- Poor trimming
- Selenium toxicity
- Zinc deficiency

DERMATOLOGY DISEASES BY TYPE

- Bacterial
  - Actinobacillosis
  - Corynebacterium pseudotuberculosis
  - Dermatophilosis
  - Staphylococcal dermatitis
- Environmental
  - Frost bite
- Fungal
  - Dermatophytosis
  - Ringworm
  - Yeast
- Neoplasia
  - Melanoma
  - Papilloma
  - Squamous cell carcinoma (SCC)
- Nutritional
  - Copper deficiency
  - Iodine deficiency
  - Selenium toxicity
  - Vitamin A deficiency
  - Vitamin E / Selenium deficiency
  - Zinc deficiency
- Parasitic
  - Chorioptic mange
  - Cutaneous myasis
  - Demodectic mange
  - Fleas
  - Keds
  - Lice
  - Parelaphostrongylosis
  - Pelodera
  - Psoroptic mange
  - Sarcoptic mange
  - Ticks
  - Warbles
- Photosensitization
  - Chronic fluke damage
  - Congenital porphyria
  - Liver disease
  - Phenothiazines
  - St. John's wart
  - Toxins
- Toxic

DERMATOLOGY DISEASES BY TYPE, Cont.

- Viral
  - Bluetongue
  - Caprine herpesvirus
  - Capripox
  - Foot and mouth disease
  - Orf
  - Vescicular stomatitis

DERMATOLOGY LESIONS

- Feet
  - Chorioptes
  - Contact dermatitis
  - Dermatophilosis
  - Foot and mouth disease
  - Orf
  - Pelodera
  - Pemphigus
  - Sarcoptes
  - Staphylococcal folliculitis
  - Vesicular stomatitis
  - Zinc deficiency
- Lips, face, neck, ears
  - Capripox
  - Dermatophilosis
  - Dermatophyte
  - Ear mites (choropies)
  - Fly strike
  - Foreign body
  - Frost bite
  - Orf
  - Pemphigus foliaceous
  - Photodermatitis
  - Psoroptic mange
  - Sarcoptes
  - Staphylococcal folliculitis
  - Zinc deficiency
- Perineum
  - Ectopic mammary development
  - Herpes
  - Neoplasia
  - Orf
  - Staphylococcus
  - Ticks

DERMATOLOGY LESIONS, Cont.

- Udder
  - Contact dermatitis
  - Orf
  - Squamous cell carcinoma (SCC)
  - Staphylococcal dermatitis
  - Sunburn
  - Zinc deficiency

DIARRHEA

- Acidosis
- Campylobacter
- Chronic gastrointestinal parasitism
- Clostridia
- Cobalt deficiency
- Coccidiosis
- Cryptosporidiosis
- E. coli
- Enterotoxemia
- Grain overload
- Johne's disease
- Listeria
- Liver flukes
- Nitrate poisoning
- Parasites
- Rotavirus
- Rumenal atony
- Salmonella

DIARRHEA, NEONATAL

- Clostridium perfringens
- Coccidiosis
- Cryptosporidium
- E. coli
- Salmonella

DYSPHAGIA

- Actinobacillosis
- Actinomycosis
- Bacterial meningoencephalitis
- Botulism
- Brain abscess

DYSPHAGIA, Cont.

- Caprine arthritis and encephalitis virus (CAE)
- Choke
- Diaphragmatic hernia
- Listeria
- Locoweed
- Mandibular / maxillary fractures
- Oral vesicles, erosion, ulcers
- Otitis media and interna
- Pharyngeal abcess / cellulitis
- Pseudorabies
- Rabies
- Ruptured / damaged esophagus
- Snake bite
- Teeth problems
- Tetanus
- Tick paralysis

DYSPNEA / TACHYPNEA

- Acidosis
- Anemia
- Bloat
- Caprine arthritis encephaliti (CAE)
- Caseous lymphadenitis (CLA)
- Congestive heart failure
- Contagious caprine pleuropneumonia
- Cyanide poisoning
- Heartwater
- Heat stroke
- Inhalation pneumonia
- Lungworms
- Mycoplasma pneumonia
- Nasal obstruction / foreign body
- Nitrate poisoning
- Oestrus ovis—nasal bot
- Pasteurellosis
- Pregnancy toxemia, ketosis
- Schistosomiasis
- Septicemia
- Tuberculosis
- Urolithiasis
- Viral pneumonia

DYSRHYTHMIAS

- Brisket disease
- Cardiomyopathies
- Cor pulmonale
- Electrolyte abnormalities
- Excitement
- Fever
- Foot rot
- Gastrointestinal disease
- Myocarditis / myocardial disease
- Pericarditis
- Toxemia
- Valvular heart disease

DYSTOCIA

- Cervix undilated
- Fetopelvic disproportion
- Malposition
- Malposture
- Malpresentation
- Multiple feti
- Mummification / maceration
- Obesity
- Periparturient hypocalcemia
- Uterine torsion

DYSURIA / STRANGURIA

- Actinomyces
- Caprine herpes virus
- Cystitis
- Hair rings
- Mycoplasma
- Orchitis
- Photosensitivity
- Sacral fracture
- Trauma
- Ulcerative posthitis
- Urolithiasis
- Vaginal prolapse
- Vulvovaginitis

EDEMA

- Blue Tongue
- Clostridium
- Cobalt deficiency
- Iodine deficiency
- Johne's Disease
- Malignant edema
- Mastitis
- Pregnancy toxemia
- Snake bite
- Sunburn / photosensitization
- Trauma
- Ulcerative balantitis and vulvitis

EPIPHORA

- Chlamydia
- Entropion
- Foreign body
- Keratoconjuntivitis
- Mycoplasma

EXCITABILITY / MANIA

- Bacterial meningoencephalitis
- Borna
- Chlorinated hydrocarbons
- Cowdriosis / Heartwater
- Cyanide
- Gid
- Hepatoencephalopathy
- Hypomagnesemic tetany
- Larval migration
- Levamisole / Ivermectin injection
- Nitrates
- Nitrofurans
- Organophosphates
- Polioencephalomalacia / thiamine deficiency
- Pregnancy toxemia
- Pseudorabies
- Rabies
- Urea

FACIAL NERVE PARALYSIS

- Brain abscess
- Caprine arthritis and encephalitis virus (CAE)
- Ear mites
- Listeria
- Otitis media / interna

GESTATION, PROLONGED

- Fescue toxicity
- Fetal mummification
- High environmental temperature
- Hydrops amnii
- Hypothalamus-hypophyseal-adrenal axis disorders

GLAUCOMA

- Foreign body
- Genetic
- Lens luxation
- Mycoplasma
- Trauma

HEAD TILT

- Brain abscess
- Caprine arthritis and encephalitis virus (CAE)
- Foreign body
- Listeria
- Lymphosarcoma
- Nematodiasis
- Otitis media / interna
- Polioencephalomalacia / thiamine deficiency
- Tooth infection
- Trauma

HEART SOUNDS, MUFFLED

- Abscesses
- Congestive heart failure
- Emphysema
- Obesity
- Pericarditis
- Pleural effusion

HEMATURIA

- Bladder polyps
- Bracken fern toxicity
- Calculi
- Cystitis
- Infarction of kidney
- Papilloma
- Pyelonephritis
- Trauma
- Urethritis

HEPATITIS

- Flukes
- Hepatic abscesses
- Listeria
- Toxins

HYPERMETRIA

- Abscesses
- Enzootic ataxia
- Gid
- Nutritional
- Trauma

ICTERUS

- Hemolytic anemia
  - Anaplasmosis
  - Bacillary hemoglobinuria
  - Leptospirosis
- Liver
  - Aflatoxicosis
  - Fatty liver
  - Pyrrolizidine alkaloid

INFERTILITY—BUCK

- Deficiencies
  - Iodine
  - Manganese
  - Vitamin A
  - Zinc

INFERTILITY—BUCK, Cont.

- Environmental
  - Cold weather infertility
  - Group housing of males
  - Heat stroke
- Hereditary
  - Chromosomal abnormalities
  - Inbreeding
  - Segmental aplasia of reproductive tract
- Lameness
- Malnutrition
- Penis / Prepuce
  - Balanoposthitis
  - Cellulitis
  - Dermatophilosis
  - Foreign Body
  - Hematoma, hematocele
  - Herpes virus
  - Loss of penile sensation
  - Micropenis, hypoplasia
  - Orf
  - Paraphimosis
  - Penile deviation
  - Penile preputial adhesion
  - Persistant penile frenulum
  - Phimosis
  - Preputial stenosis
  - Prolapsed prepuce
  - Trauma, hematoma, abscesses
- Psychogenic impotency
- Scrotum
  - Abscess
  - Dermatophilosis
  - Frostbite
  - Inguinal scrotal hernia
- Seminal vesiculitis
- Sperm
  - Abnormalities of spermatogenesis
  - Hemospermia
  - Sperm granuloma

INFERTILITY—BUCK, Cont.

- Testicles / Spermatic cord
  - Actinomyces
  - Brucellosis
  - Cryptorchidism
  - Degeneration
  - Epididymitis
  - Hypoplasia / atrophy
  - Orchitis
  - Segmental aplasia
  - Spermatocele
  - Trauma
  - Tumors
- Urethra and Erectile tissue
  - Corpus cavernosum vascular shunts
  - Ruptured urethra
  - Urethral fistula
  - Urolithiasis
- Varicocele
- Vertebral spondylosis

JUGULAR VENOUS DISTENTION / PULSATION

- Brisket disease
- Cardiomyopathy
- Congestive heart failure
- Cor pulmonale
- Heart base tumors / abscess
- Jugular venous phlebitis / thrombosis
- Monensin toxicity
- Pericarditis
- Right atrial-ventricular valve insufficiency
- Right sided heart failure
- White muscle disease

KERATITIS

- Abrasion
- Borna
- Capripox
- Chlamydia
- Facial nerve paralysis
- Foreign body
- Hay or dust
- Infectious bovine rhinitis (IBR)

KERATITIS

- Mycoplasma
- Pasteurellosis
- Q fever
- Rinderpest
- Thelazia
- Vitamin A deficiency

LAMENESS / ABNORMAL GAIT

- Abscess
- Bluetongue
- Foot and mouth disease
- Foot rot
- Footscald
- Fractures
- Laminitis
- Over grown feet
- Previous acidosis
- Tetanus
- Trauma / injury—puncture, laceration
- Vesicular stomatitis
- Zinc deficiency

LIBIDO, POOR IN BUCKS

- Epididymitis
- Group housing males
- Lameness
- Malnutrition
- Orchitis
- Penis / Prepuce problems
    - Corpus Cavernosum vascular shunts
    - Loss of penile sensation
    - Persistant penile frenulum
    - Posthitis
    - Prolapsed prepuce
    - Trauma, hematoma
- Psychogenic impotency
- Vertebral osteophytosis / spondylosis
- Zinc deficiency

LIMB SWELLING

- Hard tissue
  - Degenerative joint disease
  - Epiphysitis
  - Fracture
  - Molybdenosis / Copper deficiency
  - Osteomyelitis
  - Osteosarcoma
  - Septic arthritis
  - Sequestrum
  - Tumor calcinosis
- Soft tissue
  - Abscess
  - Bee sting / snake bite
  - Chronic tendonitis
  - Fescue foot
  - Foot rot
  - Gangrene of foot
  - Granulomas
  - Hematoma
  - Hygroma
  - Mycoplasma arthritis
  - Neoplasia
  - Ruptured tendon
  - Septic arthritis
  - Tenosynovitis

LYMPHADENOPATHY

- Abscess
- Caseous lymphadenitis (CLA)
- Lymphosarcoma
- Mastitis
- Meliodosis
- Nocardia
- Staphylococcal pyoderma
- Theileria
- Trypanosomiasis
- Tuberculosis
- Vaccine reaction

MAMMARY DEVELOPMENT, PRECOCIOUS

- Abortion
- Ascending infection during pregnancy
- Idiopathic
- Ovarian tumors
- Pregnancy
- Zearalenone toxicity

MAMMARY GLAND, ENLARGED

- Abscesses
- Blind quarter
- Mastitis
- Pendulous udder
- Periparturient udder edema
- Trauma

MASTITIS

- Actinomyces pyogenes
- Bacterial
- Hard udder—Caprine arthritis and encephalitis virus (CAE)
- Mycoplasma
- Pasteurella
- Staphylococcus sp
- Streptococcus sp

MELENA

- Abomasal ulcer
- Coccidiosis
- Gastroenteritis with bleeding
- Internal parasites
- Intussusception
- Toxins
    - Arsenic
    - Non steroidal anti-inflammatory drugs (NSAIDS)
    - Oak toxicity
    - Sulfur
    - Warfarin

MUSCLE TREMORS

- Bacterial meningoencephalitis
- Border disease
- Borna
- Caprine arthritis and encephalitis virus (CAE)
- Cyanide
- Diesel fuel
- Enzootic ataxia
- Hepatoencephalopathy
- Hypoglycemia
- Hypomagnesemic tetany
- Insecticides
- Nitrate
- Oxalate
- Polioencephalomalacia / thiamine deficiency
- Rabies
- Scrapie
- Urea
- Visna

MUSCULOSKELETAL

- Bacterial
  - Abscess—non bacteroides infection
  - Bacterial polyarthritis
  - Clostridial myositis
  - Footscald—virulent, infectious
  - Lyme disease
  - Mycoplasma
  - Osteomyelitis
- Inherited / congenital
  - Akabane, lupine, positional
  - Myotonia
- Neoplasm
- Nutritional
  - Epiphysitis (excess calcium)
  - Laminitis (aseptic inflammation)
  - Nutritional muscular dystrophy (vitamin E / selenium)
  - Osteopetrosis (excess calcium)
  - Rickets (deficiency of vitamin D_3, calcium, or phosphorus)
  - Zinc deficiency
- Parasitic
  - Cestodes
  - Sarcocystis

MUSCULOSKELETAL, Cont.

- Toxic
  - Hypervitaminosis D
  - Lupine
  - Selenium poisoning
- Trauma
  - Fractures
  - Predation
- Viral
  - Akabane
  - Caprine arthritis and encephalitis virus (CAE)
  - Foot and mouth disease

NASAL DISCHARGE

- Adenovirus
- Atrophic rhinitis
- Caprine arthritis and encephalitis virus (CAE)
- Caprine herpesvirus
- Cleft palate
- Cryptococcosis
- Dusty environment / feed
- Irritating fumes
- Moldy feed
- Mycoplasma
- Nasal bots
- Pasteurella pneumonia
- Parainfluenza virus type 3 (PI_3)
- Pulmonary adenomatosis
- Regurgitation
- Respiratory syncytial virus
- Trauma

NEONATAL DEATH

- Aspiration Pneumonia
- Atresia ani or other congenital defects
- Cryptosporidia
- E. coli
- Failure of passive transfer
- Orf
- Predation
- Rotavirus
- Salmonella
- Septicemia

NEONATAL DEATH, Cont.

- Starvation
- Trauma
- Vitamin E / Selenium deficiency

NEUROLOGICAL

- Bacterial
  - Botulism
  - Brain abscess
  - Inner ear infection
  - Listeria
  - Meningoencephalitis
  - Tetanus
- Congenital
  - Hydranencephaly
  - Hydrocephalus
  - Progressive paresis
- Nutritional / metabolic
  - Cobalt deficiency
  - Enzootic ataxia / swayback / copper deficiency
  - Hypovitaminosis A
  - Polioencephalomalacia / thiamine deficiency
  - Pregnancy toxemia
  - Uremia
- Parasitic
  - Parelaphostrongylus tenuis
  - Setaria
  - Tick paralysis
- Toxin
  - Bitterweed
  - Boron
  - Bromide
  - Calcium oxalate toxicity
  - Chlorinated hydrocarbons
  - Cycasin
  - Deathcamas
  - Heartwater
  - Lead
  - Locoweed
  - Lupine
  - Milkweed
  - Mycotoxins
  - Pyrethrin / organophosphates
  - Salt toxicity

NEUROLOGICAL, Cont.

- Trauma
- Viral / prion
  - Border disease
  - Borna disease
  - Caprine arthritis and encephalitis virus (CAE)
  - Louping-ill
  - Maedi-visna
  - Pseudorabies
  - Rabies
  - Scrapie

NYSTAGMUS

- Brain abscess
- Caprine arthritis and encephalitis (CAE)
- Gid
- Listeria
- Locoweed
- Nematodes
- Otitis
- Polioencephalomalacia / thiamine deficiency
- Rabies
- Salt toxicity
- Visna

OCULAR, CONGENITAL

- Cyclopia—veratrum
- Entropion (congenital or spastic)
- Microphthalmia—selenium

OPISTHOTONUS

- Bacterial meningoencephalitis
- Brain abscess
- Caprine arthritis and encephalitis virus (CAE)
- Chlorinated hydrocarbon
- Clostridium perfringens
- Enterotoxemia
- Hypomagnesemia
- Locoweed
- Polioencephalomalacia / thiamine deficiency
- Rabies
- Salt toxicity
- Tetanus

ORAL / MUCOSAL ULCERATIONS / LESIONS

- Abscesses
- Blister beetle ingestion
- Blue tongue
- Broken or lost teeth
- Capripox
- Contagious ecthyma—Orf
- Cutaneous neoplasms
- Foot and Mouth Disease
- Fungal or bacterial gingivitis
- Ingestion of caustic substances
- Lumpy jaw
- Malocclusion
- Neoplasia
- Pemphigus foliaceous
- Toxic ingestion
- Vesicular stomatitis
- Wooden tongue

PARALYSIS

- Borna
- Botulism
- Brain abscess
- Caprine arthritis and encephalitis virus (CAE)
- Enzootic ataxia
- Insecticides
- Listeria
- Milk fever
- Nematodes
- Polioencephalomalacia / thiamine deficiency
- Pseudorabies
- Rabies
- Spinal cord abscess
- Tick paralysis
- Trauma
- Visna

PERIPHERAL PULSE, ABNORMALITIES

- Acid / Base disorders
- Cardiac dysrhythmias
- Congestive heart failure
- Dehydration

PERIPHERAL PULSE, ABNORMALITIES, Cont.

- Electrolyte imbalance
- Shock
- Toxemia

PHOTOSENSITIZATION

- Chronic fluke damage
- Congenital Porphyria
- Liver disease
- Phenothiazines
- St. John's Wart
- Toxins

POSTURAL DEFORMITIES

- Chonic laminitis
- Congenital
  - Angular limb deformities
  - Contracted tendons
- Degenerative joint disease
- Fractures
- Hyperparathyroidism
- Hypertrophic osteopathy
- Infection of foot
- Luxation
- Muscle atrophy from denervation
- Osteomalacia
- Osteomyelitis
- Physitis
- Rickets
- Ruptured muscle
- Secondary contracted tendons
- Septic arthritis with ankylosis
- Septic tenosynovitis
- Severed tendons

PRURITIS

- Chemical toxins
- Chorioptic mange
- Meningeal worm (Parelaphostrongylus tenius)
- Pediculosis
- Pemphigus foliaceous

PRURITIS, Cont.

- Photosensitization
- Pseudorabies
- Psoroptic mange
- Rabies
- Sarcoptic manage
- Scrapie
- Spongiform encephalopathy
- Staphylococcal dermatitis
- Zinc deficiency

RESPIRATORY

- Viral
  - Goat pox
  - Progressive interstitial retroviral pneumonia
  - Sheep pulmonary adenomatosis
- Intracellular
  - Chlamydia
  - Contagious caprine pleuropneumonia
  - Mycoplasma pleuropneumonia
  - Q fever
- Bacterial
  - Caseous lymphadenitis (CLA)
  - Pasteurella pneumonia
  - Tuberculosis
- Fungal
  - Cryptococcosis
- Enzootic pneumonia—animals with stress
- Parasitic
  - Dictyocaulus pneumonia
  - Echinococcus
  - Eimeria
  - Liver flukes
- Inhalation pneumonia—foreign body
- Toxic
  - Cyanide
  - Nitrate

RETAINED PLACENTA

- Abnormal gestation length
- Abortion
- Dystocia
- Hypocalcemia

RETAINED PLACENTA, Cont.

- Induced parturition
- Placentitis
- Stillbirth
- Vitamin E deficiency

SCALING / ALOPECIA / ROUGH COAT

- Chorioptic mange
- Chronic gastrointestinal parasitism
- Demodecosis
- Dermatophilosis
- Dermatophytosis
- Fleas
- Frostbite
- Iodine deficiency
- Keds
- Parelaphostrongylus
- Parasites
- Pemphigus
- Photosensitization
- Psoroptic mange
- Sarcoptic mange
- Staphylococcal dermatitis
- Ticks
- Vitamin A deficiency
- Vitamin E deficiency
- Zinc deficiency

SEIZURES

- Anthrax
- Borna
- Brain tumor / abscess
- Cowdriosis / Heartwater
- Developmental malformations
- Drugs
    - Intracarotid injection
    - Premature withdrawl of anti-convulsant medication
    - Theophylline
- Enterotoxemia
- Gid
- Heat stroke
- Hepatoencephalopathy

SEIZURES, Cont.

- Idiopathic epilepsy
- Infectious
  - Botulism
  - CNS parasite migration
  - Generalized sepsis
  - Meningitis / encephalitis
- Lidocaine
- Liver failure
- Metabolic
  - Hypernatremia
  - Hypocalcemia
  - Hypoglycemia
  - Hypomagnesemia
  - Hyponatremia
  - Metabolic acidosis
- Perinatal complications
  - Cerebral concussion
  - Hypoxic-ischemic brain injury
  - Intracranial hemorrhage
- Polioencephalomalacia
- Pregnancy toxemia
- Pseudorabies
- Rabies
- Salt toxicity
- Tetanus
- Toxins
  - Cyanide
  - Insecticides
  - Lead
- Trauma

SEPTICEMIA / ENLARGED JOINTS AND / OR UMBILICUS

- Actinomyces pyogenes
- Chlamydia
- E. coli
- Failure of passive transfer
- Fracture
- Hematogenous infection
- Joint-Ill
- Mycoplasma
- Physeal fracture

SEPTICEMIA / ENLARGED JOINTS AND / OR UMBILICUS, Cont.

- Salmonella
- Staphylococcus sp
- Streptococcus sp
- Trauma

SUBCUTANEOUS SWELLING BY REGION

- Head and face swelling
  - Abscess
  - Blue tongue virus
  - Bottle jaw
  - Dental problem
  - Fibrotic ulcer
  - Food bolus
  - Foreign body
  - Hypoproteinemia
  - Malignant edema
  - Mucocele
  - Neoplasms
  - Swelled head in bucks
  - Tooth root abscess
  - Trauma in bucks
- Neck / chest swelling
  - Abscess
  - Bursitis
  - Foreign body
  - Hypoproteineima
  - Parasitic
  - Phlebitis
  - Tapeworm
  - Thyroid/goiter
  - Iodine deficiency
  - Trauma
  - Warbles
- Abdomen
  - Balanoposthitis
  - Congenital urethral diverticulum
  - Hypoproteinemia
  - Subcutaneous pooling of urine in perineal region
  - Ulcerative Posthitis

SUBCUTANEOUS SWELLING BY REGION, Cont.

- Other
  - Cellulitis
  - Edema
    - ? Blue tongue
    - ? Clostridium
    - ? Cobalt deficiency
    - ? Iodine deficiency
  - Foreign body
  - Hematoma
  - Seroma
  - Trauma

SUDDEN DEATH

- Anaphylaxis
- Anesthesia overdose
- Anthelminthics
- Bloat
- Cardiac glycoside containing plants
- Cecal / abomasal torsion
- Choke
- Dosing gun injury
- Enterotoxemia
- Exposure
- Heartwater
- Hypocalcemia
- Infectious
  - Anthrax
  - Clostridium sp
  - Encephalitis
  - Gangrenous / toxic mastitis
  - Listeria
  - Pasteurella pneumonia
  - Pseudorabies
  - Rabies
  - Yersiniosis
- Inhalation pneumonia
- Intestinal volvulus
- Lightning
- Listeria
- Mesenteric torsion
- Nutritional muscular dystrophy

SUDDEN DEATH, Cont.

- Parasitic
  - Haemonchus
  - Liver flukes (Fascioliasis)
- Poisonous plants
  - Cardiac glycosides
  - Oleander
- Polioencephalomalacia / thiamine deficiency
- Pregnancy toxemia
- Pulmonary edema
- Rumen acidosis
- Rumensin toxicity
- Ruptured aneurysm
- Ruptured uterine artery
- Ruptured uterus
- Snake bite
- Tetanus
- Toxins
  - Anthelmintics
  - Insecticides
  - Inonophore overdose
  - Oxalates
  - Urea
- Trauma
- Urolithiasis
- Vegetative endocarditis

SUDDEN DEATH MORE COMMON IN KIDS

- Aspiration pneumonia
- Atresia ani or other congenital defects
- Brain damage—disbudding
- Coccidia
- Congenital heart defect
- Cryptosporidium
- E. Coli
- Exposure
- Failure to thrive
  - Vitamin / mineral imbalance
  - Parasites
  - Oral lesions
  - Respiratory disease
  - Anemia
  - Immunodeficiency

SUDDEN DEATH MORE COMMON IN KIDS, Cont.

- Nutritional muscular dystrophy
- Orf
- Predation
- Rotavirus
- Ruptured abomasum
- Salmonella
- Septicemia
- Starvation
- Sucking lice anemia
- Trauma
- Vitamin E / Selenium deficiency

TENESMUS

- Constipation
- Diarrhea
- Labor
- Parasites
- Rectal prolapse
- Rectovaginal fistula

TEETH GRINDING

- Grain engorgement
- Oral neoplasms
- Pregnancy toxemia
- Rumen malfunction
- Stomatitis
- Tooth problems

UVEITIS, ANTERIOR

- Mycoplasma
- Retrovirus
- Septicemia
- Toxemia
- Toxoplasmosis
- Trauma

VULVITIS / BALANTITIS

- Drug reaction
- Herpes virus—"pizzle rot"
- Orf
- Photosensitivity

WASTING / INAPPETENCE

- Amyloidosis
- Bacterial infection
- Caprine arthritis and encephalitis (CAE)
- Chronic gastrointestinal parasitism
- Cobalt deficiency
- Johne's Disease
- Ketosis
- Malnutrition
- Milk fever
- Neoplasm
- Salmonella
- Teeth / mechanical
- Viral infection

WASTING DISEASES

- Amyloid
- Bacterial infection
- Behavioral—inadequate feed space
- Blindness
- Caprine arthritis and encephalitis (CAE)—interstitial pneumonia
- Cestodes
- Chronic mastitis
- Caseous lymphadenitis (CLA)
- Cobalt deficiency
- Coccidia
- Enterotoxemia
- External parasites
- Foreign bodies
- Infection
- Johne's Disease
- Locomotor problems—foot rot, foot scald, foot abscess, polyarthritis, fracture, nerve damage, rickets
- Lungworms
- Malnutrition
- Nematodes

WASTING DISEASES, Cont.

- Neoplasia
- Nutritional problems—(copper, cobalt, protein) vitamin A deficiency, carbohydrate deficiency
- Oral problems—tooth loss, disease
- Orf
- Pasteurella infection
- Peritonitis—rumenitis, liver flukes, internal abscess(es), intra peritoneal drugs
- Plant toxins
- Pulmonary adenomatosis
- Rinderpest
- Salmonella
- Scrapie
- Trematodes
- Tuberculosis
- Viral infections

WEAK KIDS

- Border disease (Bovine viral diarrhea—BVD)
- Failure of passive transfer
- White muscle disease

WEAKNESS / LAMENESS

- Arthritis
- Caprine arthritis and encephalitis virus (CAE)
- Chlamydia
- Clostridial myositis
- Cobalt deficiency
- Copper deficiency
- Foot and mouth disease
- Foot rot
- Foreign body
- Fractures
    - Copper deficiency
    - Trauma
    - Vitamin D deficiency
- Ketosis
- Laminitis
- Malignant edema
- Milk fever
- Mycoplasma
- Nutrition

WEAKNESS / LAMENESS, Cont.

- Plant toxin
- Previous acidosis
- Rickets
- Selenium toxicity
- Trauma
- Vesicular stomatitis
- Vitamin D deficiency
- White muscle disease
- Zinc deficiency

CAMELID FORMULARY

General notes about Llama and Alpaca drug therapy:

- Llama meat is not commonly eaten in the US; therefore there are no set withdrawal times.
- Sheep and cattle meat withdrawals are given where applicable to extrapolate for llamas.
- None of the following drugs are approved for llamas or alpacas.
- Doses given are for llamas, unless specified for alpacas.
- IM injections for llamas best into semimembranosus, semitendinosus, epaxials
- Maximum of 10ml per site in cervical musculature

Basic Llama Reference Values:

T: 99.5-102°F for adults; 102.2°F for juveniles; can be okay at 104°F in summer
P: 60-90 bpm resting
R: 10-30 breaths per minute
Gastric Motility: 3-4 per minute
Lifespan: 15-25 years
Gestation: 345 +/- 15 days for llamas
330 +/- 10 days for alpacas

Drug	Dose	Withdrawal	Notes
Emergency Drugs			
Atropine	0.04 mg/kg IV/ IM		Use for bradycardia
Calcium gluconate	0.7 mEq/kg IVslowly		Use for hypocalcemia
Dexamethasone	2 mg/kg IV/ IM 2-4 mg/kg SQ		Use for anaphylaxis, shock, heat Stress
Diazepam	0.1-0.5 mg/kg IV		Use for seizures
Diphenhydramine (Benadryl)	1 mg/kg IV (1:1000) Give slowly with epinephrine		Use for anaphylaxis, shock
Doxapram	0.1 mg/kg IV 1-5 mg/kg IV		Use for resp. depression
Epinephrine	0.01 mg/kg IV		Use for cardiac arrest
Lidocaine	0.5 mg/kg IV		Use for ventricular arrhythmias
Na Bicarbonate	0.5 mEq/kg IV		Use for metabolic acidosis
Na Dexamethasone Phosphate	1 mg/# IV Give slowly with epinephrine		Use for anaphylaxis, shock
Phenobarbital	0.1 mg/kg IM/ IV 2.25 mg/kg PO		Use for seizures

CAMELID FORMULARY

Drug	Dose	Withdrawal	Notes
Anesthesia			
Acepromazine	0.15 mg/kg IV, IM	FARAD: Cattle, Sheep, Goats: Milk: 48 hours Meat: 7 days	Use as sedative
Atipamezole	0.25 mg/kg IM		Use to antagonize Medetomidine
Atropine	0.02 mg/kg IV 0.04 mg/kg IM		
Butorphanol (Torbugesic)	0.05-0.1 mg/kg IV / IM		Provides analgesia
Detomidine HCl	0.02-0.04 mg/kg IM, IV	FARAD: Cattle, Sheep, and Goats: Milk: 72 hours Meat: 3 days	Use as sedative
Diazepam	0.2-0.5 mg/kg IV		
Guaifenesin	50-110 mg/kg IV only	FARAD: Cattle, Sheep, and Goats: Milk: 48 hours Meat: 3 days	Use for muscle relaxation in combo for induction
Ketamine	5-8 mg/kg IM 2-5 mg/kg IM, IV 1-2 ml/100# IV at 100 mg/ml	FARAD: Cattle, Sheep, and Goats: Milk: 48 hours Meat: 3 days	For general anesthesia
Llama Cocktail	Mix: Ketamine (one bottle of 100mg/ml) 10 mL Xylazine (100mg/ml, the large animal concentration) 1 mL butorphanol (10mg/ml) 1mL Dose: Llamas 1ml/60-70# Alpacas 1ml/50#		
Medetomidine	0.05 mg/kg IM		For immobilization, in combination with ketamine
Thiopental	8-11 mg/kg IV only		Not for debilitated animals, cardiac depressant
Tiletamine/Zolazepam (Telazol)	0.5-2 mg/kg IV to effect for induction 4-6 mg/kg IM to immobilize		
Tolazoline			**Can cause adverse reactions and sudden death in llamas**

CAMELID FORMULARY

Drug	Dose	Withdrawal	Notes
Anesthesia			
Xylazine (Rompun)	0.1-0.4 mg/kg IV 0.3-0.6 mg/kg IM Sedation for exam 0.1-0.2 mg/kg IV or IM Sternal recumbency 0.25 mg/kg IV 20 Minutes sedation 0.35-0.45 mg/kg IM Use the small animal concentration, 20mg/ml	FARAD: Cattle, Sheep, and Goats: 0.010-0.1 IV or 0.05-0.3 IM Milk: 72 hours Meat: 5 days 0.3-2.0 IM Milk: 120 hours Meat: 10 days	
Xylazine + butorphanol	Xylazine 0.1mg/kg IV, IM Butorphanol 0.05-0.1 mg/kg IV, IM		
Xylazine + Ketamine	Xylazine 0.25 mg/kg IV/ IM Ketamine 2-5 mg/kg IV/ IM		
Yohimbine	0.25 mg/kg IV	FARAD: Cattle, Sheep, and Goats: Milk: 72 hours Meat: 7days	For reversal of Xylazine
Local Anesthetics			
Lidocaine HCl 1-2%			onset 1 min duration 1hour
Mepivicaine 1-2%			onset 3-5 min duration 1.5 hours
Bupivicaine 0.25%			onset 5 min duration 2-4 hours
Epidurals			
Diazepam	0.25 mg/lb		
Lidocaine HCl 2%	1-3 ml Standing anesthesia for about an hour		Use for perineal surgeries, prolapse replacements, or to stop straining
Anthelmintics			
Albendazole (Valbazen)	Whips and nematodirus 5.5 mg/# PO repeat in 7 days flukes, cestodes, nematodes, lungworms 10 mg/kg PO Fascioloides magna (questionable efficacy) 15 mg/kg PO	Cattle: Meat: 27 days	Do not give to pregnant animals Benzimidazole
Amprolium (Corid)	Prophylaxis: 2.5 mg/# PO for 21 days Treatment: 20-25 mg/# PO for 5 days	Calves: Meat: 24 hours	
Clorsulon (Curatrem)	3.5 mg/# PO repeat in 60 days	Cattle: Meat: 8 days	Fasciola hepatica (questionable efficacy)

CAMELID FORMULARY

Drug	Dose	Withdrawal	Notes
Anthelmintics			
Decoquinate (Deccox)	0.5 mg/kg PO 28 days 0.5 mg/kg at 6% premix 28 days		coccidia prophylaxis
Doramectin (Dectomax)	0.2 mg/kg SQ 1 ml/110# at 10 mg/ml	Cattle: Meat: 35 days	Avermectin
Fenbendazole (Panacur)	Whips and Nematodirus 9 mg/# PO, 3 days Cestodes, nematodes, lungworms 10-15 mg/kg PO (paste or suspension) 5-10 mg/kg PO, 1-3 days Trichuris 15 mg/kg PO Parelaphostrongylus tenuis 30-50 mg/kg PO, BID, 3 days	Cattle: suspension, Meat: 8 days	Benzimidazole
Ivermectin (Ivomec)	Many dose 1 cc/75# OR, 0.2 mg/kg SQ / PO Nematodes, lungworms, sarcoptic mange, sucking lice 1ml/110# at 10mg/ml Trichuris, Cephenemyia 0.4-0.6 mg/kg SQ / PO Parelaphostrongylus tenuis preventative, spring-fall 1.5 ml/ 100#, at 10mg/ml monthly	Withdrawal varies with specific product	Avermectin
Levamisolee (Levasole)	Nematodes, lungworms 5-8 mg/kg PO 2 ml/100# SQ, repeat in 2-6wks	Sheep: Meat: 3 days	
Mebendazole (Telmin)	Whips and Nematodirus 10-12 mg/# PO, SID, 3 days		Benzimidazole
Oxfendazole (Benzelmin)	8.8 mg/# PO, repeat in 7 days Whips and Nematodirus (Synanthic22%) in UK, 6 ml/100#		Benzimidazole
Oxibendazole(Benzalmin)	6 mg/# PO, 3 days		Use for whips and nematodirus Benzimidazole
Praziquantel (Droncit)	5 mg/# SQ, PO 5 mg/kg PO 2-3 mg/kg SQ		Use for tapeworms
Pyrantel-Pamoate (Strongid-T)	Whips and Nematodirus 9 mg/# PO, 3 days Nematodes, cestodes 18 mg/kg PO, 1 day 18mg/kg PO, SID, 3days	Swine: Meat: 1 day	
Sulfadimethoxine (Albon)	25mg/# SQ, day 1 12.5mg/# SQ, days 2-5	Cattle: Meat: 5 days	Coccidia treatment

CAMELID FORMULARY

Drug	Dose	Withdrawal	Notes
Anthelmintics			
SulfaTrim (SMZ-TMP)	1 ml/5# suspension PO, BID, 7 days		Coccidia treatment
Thiabendazole (Equizole)	Nematodes 50-100 mg/kg PO, SID, 1-3days If severely parasitized 50-100 mg/kg repeat 2-4wks Routine dewormer 25-50 mg/kg SID, 3 days	Sheep: Meat: 30 days	Benzimidazole
Antibiotics			
Amikacin (Amiglyde-V)	2-3 mg/# IM, BID 1 cc/20# at 50mg/ml		Gram negative aerobic, bactericidal
Amoxicillin	5 mg/# SQ / IM, BID	Cattle: Meat: 25 days	Gram +/- aerobes and anaerobes, bactericidal
Ampicillin (Polyflex)	10 mg/# IM, BID	Cattle: Meat: 6 days	Gram +/- aerobes and anaerobes, bactericidal Good choice for antibiotics after surgeries
Ceftiofur (Naxcel)	2 ml/100# IM, BID, day 1 1 ml/100# IM, BID, day 2 2-4 ml/100# IM, SID	Cattle: No withdrawal time as used per label	Gram positive, mostly aerobes, bactericidal To treat respiratory and skin infections, mastitis, including Pasteurellosis
Cephalexin	5 mg/kg PO Treat osteomyelitis 10 mg/kg PO, BID, 2-4 weeks		Gram +/-, mostly aerobes, bactericidal
Chloramphenicol	15-20mg/# PO, BID	**NO LONGER FOOD ANIMAL**	Gram +/-, aerobic and anaerobic, bacteriostatic Not a good choice for llamas
Enrofloxacin (Baytril)	3-5mg/# injectable		Great for Gram neg, aerobic, bactericidal Works for Pseudomonas
Erythromycin	4 mg/kg PO, BID	Sheep: (Injectable) Meat: 3 days	Gram +, some anaerobes, bacteriostatic
Florfenicol (Nuflor)	20mg/kg, 3ml/100# IM, EOD 40mg/kg, 6ml/100# SQ, EOD	Cattle: Meat: IM dose = 28 days, SQ dose = 38 days	Gram +/- For respiratory infections: Pasteurellosis, Fusobacterium

CAMELID FORMULARY

Drug	Dose	Withdrawal	Notes
Antibiotics			
Gentamicin (Gentocin)	1 mg/# IM, BID 2 ml/100# IM, BID, day 1, then, 1 ml/100# IM, BID		Gram negative aerobes, bactericidal Cheaper than amikacin
Oxytetracycline (LA -200)	4.5 cc/100# SQ At 200 mg/ml	Cattle: Meat: 28 days	Chlamydia, Campylobacter, Salmonella, Q fever, Dermatophilus; For abortion outbreaks
Penicillin G	10,000 IU/# IM, BID = 3 cc/100# 20,000 IU/# IM, SID	Sheep: Meat: 8 days Cattle: Meat: 20 days	Gram + aerobes and anaerobes, bactericidal to treat Clostridial diseases, especially tetanus, epididymitis and orchitis
Rifampin	5 mg/kg PO, BID	**NO LONGER FOOD ANIMAL**	Used in combo with other antibiotics to improve penetration
Sulfa (SMZ-TMP)	Suspension: 1 cc/5# PO, BID Tablets: 45 mg/# PO, BID		Do not give if preexisting liver disease.
Sulfadimethoxine (Albon)	55 mg/kg PO / SQ, SID then 27.5 mg/kg PO / SQ, SID sustained release bolus 137.5mg/kg PO, every 4 days	Cattle: Meat: 7 days	Good for Streps, respiratory, skin infections
SulfaTrim	1 ml/5# suspension PO, BID 45 mg/# tabs PO, BID 30 mg/kg PO, SID		Gram +/- aerobes, bacteriostatic
Tilmicosin (Micotil)	1.2 ml/100# SQ once	Cattle: Meat: 28 days	**MAY BE TOXIC TO LLAMAS AND ALPACAS**
Anti-Inflammatory			
Adequan	1 mg/# IM, q4days x 5		For arthritis, lameness
Aspirin	5-100 mg/kg PO, BID	FARAD: All food animals: Milk: 24 hours Meat: 1 day	Exact dose never researched
DMSO	1g/kg IV over 45 minutes SID Comes as 90%, need to dilute down to 10% solution 32ml of 90% solution into 250ml sterile water or D_5W		Good for respiratory E. coli, central edema, meningeal worm

CAMELID FORMULARY

Drug	Dose	Withdrawal	Notes
Anti-Inflammatory			
Flunixin meglumine (Banamine)	1 ml/100# IV / IM / SQ, SID, at 50mg/ml 1.1 mg/kg IV, SID	Cattle: Meat: 4 days	Can cause GI ulcers, treat concurrently with omeprazole
Hyaluronic Acid (Legend)	1 ml or 10 mg IV, q7days x 4		
Ketoprofen (Ketofen)	1 ml/100# IV / IM as needed At 100mg/ml FARAD--Cattle, Sheep, Goats: 1.1-2.2 mg/kg IV or IM q24 hours for 3-5 days	FARAD: Cattle, Sheep, and Goats: (FARAD DOSE) Milk: 24 hours Meat: 7 days	
Phenylbutazone	2-4 mg/kg IV / PO, SID FARAD—Cattle: 9 mg/kg IV or IM Milk: 96 hours, Meat: 12 days 6-9 mg/kg IV or IM followed by 3 mg/kg daily Milk: 120 hours, Meat: 21 days	FARAD: Cattle, see left	Can cause GI ulcers, treat concurrently with omeprazole
Fluids			
LRS	10 ml/kg/hr during anesthesia 35-50 ml/#/day neonate maintenance 15-20ml/#/day adult maintenance		
GI drugs			
Cimetidine (Tagamet)	Prophylaxis while on bute, banamine 2.2 mg/kg SQ, SID Treatment for GI ulcers 2.2mg/kg SQ, BID		
Mineral Oil	1-2 Liters PO	No withdrawal time	For impactions and colic
Omeprazole (Prilosec)	1.2 mg/kg PO, TID 2 mg/kg PO, SID / BID 10 days 0.4 mg/kg IV, SID		Treat GI ulcers Gastrogard, horse paste form of omeprazole can be used
Pepto-Bismol	2-3 oz (60-90ml) PO, TID		For diarrhea, colic, ulcers, antiendotoxic
Sucralfate (Carafate)	1 g/50# PO, BID		Preventative for GI ulcers

CAMELID FORMULARY

Drug	Dose	Withdrawal	Notes
Miscellaneous			
Calcium EDTA	110 mg/kg slowly IV, for 5 days	No withdrawal time	For lead toxicity
Chlorhexidine Shampoo			Treat Staphylococcal dermatitis, Dermatophilus congolensis, Sarcoptic mange
CMPK (Calcium, Magnesium, Phosphorus, Potassium)	1 ml/# slowly IV / IP 2 oz/100# PO, 40% suspension	No Withdrawal times	
Furosemide (Lasix)	0.5 mg/kg IV/ IM	Cattle: Meat: 2 days	
Iron dextrans	150 mg/llama injectable		Treat anemia
Pralidoxime chloride (2-PAM)	20 mg/kg slowly IV may need to repeat Give atropine, diazepam as needed for symptoms		Treat organophosphate toxicity
Prednisone	0.5-1 mg/kg PO gradually taper		To treat munge (idiopathic nasal dermatitis)
Vitamin K_1	20-30 mg/llama PO, SID May need blood transfusion also, 20 ml/kg	No withdrawal time	To treat anticoagulant rodenticide toxicity
Ophthalmic Drugs			
Atropine	SID		Therapeutic
BNP (Bacitracin, Neomycin, Polymixin)	TID		Therapeutic
BNP + HC (plus hydrocortisone)	TID		Therapeutic (Check for ulcers)
Chloramphenicol	TID		Therapeutic
Ciprofloxacin	TID		Therapeutic
Gentamicin	TID		Therapeutic
Proparacaine HCl 0.5%	topical		Anesthetic
Terramycin (oxytetracycline)	TID	Cattle: Meat: 28 days	Therapeutic
Tetracaine HCl 0.5%	topical		Anesthetic
Reproductive Drugs			
Altrenogest (Regumate)	1.5-2.0 ml/100# PO, SID, 3-4months		To support pregnancy
Cloprostenol Na (Estrumate)	Luteolysis 0.75 ml/100# IM Induction of parturition, birth in 19-24 hours 40 ng/150# IM	No withdrawal time	

CAMELID FORMULARY

Drug	Dose	Withdrawal	Notes
Reproductive Drugs			
Dexamethasone	5 mg	No withdrawal time	Induce abortion in midgestation Not the best choice, should only be used in moribund llama
ECP (Estradiol cypionate)	1 mg/100# IM	No withdrawal times	Causes cervical dilation in 24-36 hours
FSH	4 mg/llama SQ, BID, 2 days	No withdrawal times	Follicular development, superovulation
HCG (Human Chorionic Gonadotropin)	333 IU/100# IM / IV	No withdrawal times	Used to induce ovulation
Oxytocin	Retained placenta, 6hr after parturition 20-30 units IM, Repeat every 30 minutes as needed For agalactia, repeat every 2 hours 20units/llama IM 10units/alpaca IM	No Withdrawal times	
$PGF_{2\alpha}$ (Lutalyse)	5-10 mg/llama SQ	No withdrawal times	To trigger cervical relaxation during dystocia, and to induce parturition To cause abortion Adverse reactions include dyspnea, colic, death….have oxygen ready
Synchromate B	1 Implant (6mg) SQ, 2x a month		To support pregnancy
Vaccines			
Clostridium 7-way	one week old: 2cc IM one month old: 2cc IM yearly: 3-4cc IM		Booster one month prior to parturition
Leptospirosis 5-way	2cc IM / SQ yearly		
Rabies	1cc IM yearly		
Tetanus toxoid	one month old: 1.5 cc IM yearly: 1 cc IM		
Alpacas should receive 1cc less than llamas for each dose of immunization			

CAMELID DIFFERENTIAL LIST

ADULTS

ABDOMINAL PAIN

- Acute renal failure
- Forestomach perforation (foreign body)
- Urolithiasis

ABORTION / STILLBIRTH /EMBRYONIC DEATH

- Brucellosis
- Chlamydiosis
- Heat stress
- Leptospirosis
- Listeria
- Maternal stress
- Pine needle toxicity
- Sarcocystiasis
- Stress
- Toxoplasmosis

AGGRESSIVE MALE

- Berserk male syndrome

ALOPECIA

- Chorioptic mange
- Psoroptic mange
- Ringworm
- Sarcoptic mange
- Zinc responsive dermatosis

ANEMIA

- Acute blood loss
- Anthrax
- Parasites
- Toxicity

ANESTRUS

- Heat stress
- Luteal cysts
- Malnutrition
- Heavily lactating
- Outside of normal breeding season
- Poor footing
- Poor heat detection
- Post partum period
- Pregnancy
- Pseudohermaphrodite
- Pyometra

ANGULAR LIMB DEFORMATIES

- Hypothyroidism
- Juvenile llama immunodeficiency syndrome (JLIDS)

ANOREXIA

- Alpaca fever
- Anthrax
- Foot and mouth disease
- Forestomach Perforation (foreign body)
- Gastrointestinal concretions
- Lymphosarcoma
- Malignant edema
- Mastitis
- Necrobacillosis
- Polioencephalomalacia / thiamine deficiency
- Rabies
- Renal failure
- Rinderpest
- Third compartment ulcer
- Vesicular stomatitis

ATAXIA

- Hepatic lipidosis
- Otitis media and interna
- Parelaphostrongylus tenuis
- Polioencephalomalacia / thiamine deficiency
- Rabies
- Vertebral abnormality (fracture, infection, slipped disc)

BLINDNESS

- Chorioretinitis
- Encephalitis
- Enterotoxemia
- Lead toxicity
- Optic neuritis
- Plant toxicity
- Polioencephalomalacia / thiamine deficiency
- Selenium toxicity
- Viral—Equine Herpes Virus-1

BLOAT

- Anaphylaxis
- Anthrax
- Choke
- Choke and aspiration
- Colibacillosis
- Compressive lesions
- Diaphragmatic hernia
- Indigestion
- Obstructive lesions
- Tetanus
- Toxicity (Solanine)
- Type C enterotoxemia

BRUXISM

- Psychogenic
- Third compartment ulcer

CHANGE IN PERSONALITY

- Berserk male syndrome
- Psychogenic
- Rabies

CHOKE / ASPIRATION

- Esophageal choke
- Foreign Body
- Genetic
- Megaesophagus
- Pharyngeal choke

CHOKE / ASPIRATION

- Retropharyngeal abscess
- Trauma

CIRCLING / HEAD PRESSING

- Brain abscess / tumor / trauma
- Listeria
- Otitis media and interna
- Parelaphostrongylus tenuis migration
- Polioencephalomalacia / thiamine deficiency
- Rabies
- Type D enterotoxemia

COAGULOPATHY

- Anthrax
- Clotting defect
- Toxicity

COLIC

- Alpaca fever
- Anthrax
- Dystocia—uterine torsion
- Endotoxemia
- Enteritis
- Gastrointestinal concretions
- Intestinal obstruction
- Intestinal perforation
- Intestinal volvulus / torsion / strangulation
- Pancreatitis
- Parturition
- Peritonitis
- Ruptured bladder
- Toxicity
- Traumatic reticuloperitonitis
- Type A enterotoxemia
- Type C enterotoxemia
- Ulcers of the third compartment
- Urethral obstruction

CONSTIPATION

- Alpaca fever
- Fascioliasis
- Gastrointestinal concretions
- Indigestion
- Type A enterotoxemia

CONVULSIONS / COMA

- Heat stress
- Hypoglycemia
- Lead consumption
- Polioencephalomalacia / thiamine deficiency
- Rabies
- Tetanus
- Toxin ingestion
- Trauma
- Type A enterotoxemia
- Type D enterotoxemia

COUGH

- Choke and aspiration
- Dictyocaulus
- Dusty feed
- Moldy feed
- Respiratory infection
- Trauma

CRUSTY LESIONS

- Camel pox

CYCLIC IRREGULARITIES—FEMALE

- Campylobacteriosis
- Cystic ovaries
- Early / late in breeding season
- Endometritis
- Heat stress
- Leptospirosis
- Poor body condition

DEFORMED HOOVES

- Acidosis / Grain overload
- Chronic foot rot
- Poor trimming
- Selenium toxicity
- Zinc deficiency

DERMATITIS

- Chemical burns
- Chorioptic mange
- Dermatophilosis
- Dermatophytosis
- Frost bite
- Lice
- Parelaphostrongylus migration
- Photosensitization
- Sarcoptic mange
- Staph Dermatitis
- Vitamin A deficiency
- Vitamin E deficiency
- Zinc deficiency

DIARRHEA

- Anthrax
- Clostridial toxemia
- Coccidiosis
- Colibacillosis
- Enterotoxemia
- Fascioliasis
- Hepatopathy
- Indigestion
- Johne's disease
- Over consumption of feed
- Parasites
- Polioencephalomalacia / thiamine deficiency
- Rinderpest
- Salmonellosis
- Stomach overload (C1 acidosis)
- Stress / excitement
- Sudden change in feed
- Toxins (organophosphates, arsenic, copper, lead, molybdenum)
- Tuberculosis

DYSPHAGIA

- Actinobacillosis
- Actinomycosis
- Bacterial meningoencephalitis
- Botulism
- Brain abscess
- Caprine arthritis and encephalitis virus (CAE)
- Choke
- Diaphragmatic hernia
- Listeria
- Locoweed
- Mandibular / maxillary fractures
- Oral vesicles, erosion, ulcers
- Otitis media and interna
- Pharyngeal abcess / cellulitis
- Pseudorabies
- Rabies
- Ruptured / damaged esophagus
- Snake bite
- Teeth problems
- Tetanus
- Tick paralysis

DYSPNEA

- Alpaca fever
- Choke and aspiration
- Chronic obstructive pulmonary disease (COPD)
- Dictyocaulus
- Necrobacillosis
- Tetanus
- Tuberculosis

DYSTOCIA

- Disproportion between fetus / maternal pelvis
- Fetal monster
- Malposition / malpresentation
- Obesity
- Poor cervical dilation
- Uterine torsion

EAR DISCHARGE

- Foreign body
- Otitis externa
- Spinous ear tick
- Trauma

FACIAL BULGE / SWELLING

- Abscess
- Actinobacillosis
- Foreign body
- Insect sting
- Lumpy jaw—actinomycosis
- Malocclusion
- Necrobacillosis
- Snake bite
- Stomatitis
- Tooth root abscess
- Toxic / caustic substance
- Trauma

FAILURE TO THRIVE

- Hypothyroidism
- Malnutrition
- Parasites

FIBER QUALITY, POOR

- Biting and sucking lice
- Internal parasites
- Johne's disease

FOOT ROT

- Actinomycosis
- Bacteroides fragilis
- Necrobacillosis

GESTATION, PROLONGED

- Fescue toxicity
- Fetal mummification
- High environmental temperature
- Hydrops amnii
- Hypothalamus-hypophyseal-adrenal axis disorders

HEAD TILT

- Abscess
- Inner ear infection
- Listeria
- Otic foreign body
- Polioencephalomalacia / thiamine deficiency
- Tooth infection
- Trauma

HEADSHAKING

- Bot flies (nasal flies)
- Foreign body
- Middle ear infection
- Otitis externa
- Spinose ear tick

HEAT STRESS

- Encephalitis
- Generalized neurological signs
- Meningitis
- Parelaphostrongylus tenius
- Polioencephalomalacia / thiamine deficiency
- Respiratory distress

HEMATURIA

- Anthrax
- Cystitis
- Urolithiasis

HORNER'S SYNDROME

- Otitis media and interna

HERNIA

- Abscess /neoplasia
- Inguinal hernia
- Surgical herniation
- Umbilical hernia

HYPERKERATOSIS

- Contagious ecthyma—Orf
- Idiopathic nasal dermatitis
- Ringworm
- Sarcoptic mange
- Zinc responsive dermatosis

HYPERNATREMIA, ESSENTIAL

- Central diabetes insipidus
- Primary hypodipsia

INFERTILITY (FEMALE)

- Congenital abnormalities
- Cystic endometrial glands
- Cystic ovaries
- Hormonal imbalance
- Malnutrition (too thin or fat)
- Metritis / pyometra
- Neoplasia—uterine adenocarcinoma

INFERTILITY (MALE)

- Bilateral testicular hypoplasia
- Congenital abnormalities
- Environmental—too hot
- Penile abnormalities
- Stud too young, obese

KERATOCONJUNCTIVITIS

- Foreign body
- Moraxella liquefacians
- Staphylococcus aureus

KETOSIS

- Anorexia
- Dietary-induced ketosis
- Late gestation / early lactation
- Mastitis
- Metritis
- Obesity
- Peritonitis
- Pregnancy toxemia
- Traumatic reticulo-peritonitis

LACRIMATION, EXCESSIVE

- Foreign body
- Mandibular trauma
- Oral abscess
- Thelazia californiensis
- Tooth fracture
- Toxic ingestion
- Trauma

LAMENESS

- Capture myopathy
- Heat stress
- Hypophosphatemia
- Juvenile llama immunodeficiency syndrome (JLIDS)
- Necrobacillosis
- Osteoarthritis
- Parelaphostrongylus tenuis
- Rabies

LUNG SOUNDS, INCREASED

- Choke and aspiration
- Chronic obstructive pulmonary disease (COPD)

LYMPH NODES, ENLARGED

- Contagious abscess of lymph node(s)—Caseous lymphadenitis (CLA)
- Mammary adenocarcinoma
- Neoplasia

MASTITIS

- Colibacillosis

MELENA

- Gastrointestinal foreign body
- Parasites
- Third compartment ulcer
- Toxic ingestion

MILK PRODUCTION, DECREASED

- Heat stress
- Mastitis

MOUTH, PROLIFERATIVE LESIONS / ULCERATIONS

- Contagious ecthyma—Orf
- Foot and Mouth Disease
- Necrotic stomatitis
- Squamous cell carcinoma
- Vesicular stomatitis

MUSCULAR DYSTROPHY

- Anthrax
- Black leg
- Botulism
- Malignant edema
- Selenium deficiency
- Snake bite
- Trauma / fracture
- Vitamin E deficiency

MUSCLE FASCICULATIONS

- Hypocalcemia
- Toxicity

NASAL DISCHARGE

- Allergic rhinitis
- Chronic obstructive pulmonary disease (COPD)
- Deviation of nasal septum
- Dictyocaulus
- Environmental—dust, cold
- Foreign body
- Nasal bot—Cephenemyia sp.
- Neoplasia
- Sinusitis
- Trauma / fracture
- Upper respiratory virus

NECROTIC LESIONS

- Necrobacillosis
- Sunburn

NEUROLOGICAL SIGNS

- Botulism
- Cervical spine deviation
- Coccidioidomycosis
- Copper deficiency
- Episodic myasthenia gravis
- Heat stress
- Listeria monocytogenesis
- Neoplasia
- Parelaphostrongylus tenius
- Plant toxicity (Cycas)
- Selenium deficiency
- Spondylosis
- Tick paralysis (Dermacentor)
- Toxicity—organophosphates
- Trauma / fracture
- Vertebral body abscess
- Virus—rabies, Equine Herpes Virus-1

NOT NURSING, CRIA

- Contagious ecthyma—Orf
- Enterotoxemia type C (cria)
- Mastitis

NYSTAGMUS

- Polioencephalomalacia / thiamine deficiency

OCULAR DISCHARGE, CHRONIC

- Conjunctivitis
- Foreign body
- Plugged nasolacrimal duct

OLIGURIA

- Acute renal failure

PARALYSIS / PARESIS

- Botulism
- Heat stress (facial)
- Parelaphostrongylus tenuis
- Rabies
- Tick paralysis
- Type D enterotoxemia
- Vertebral abnormality (fracture, infection, slipped disc)

POLLAKIURIA

- Cystitis

POLYURIA / POLYDIPSIA (PU / PD)

- Diabetes mellitus

PREMATURE CRIA

- Heat stress

PRURITIS

- Biting and sucking lice
- Chorioptic mange

PRURITIS, Cont.

- Fleas
- Mosquito and gnat bites
- Pemphigus foliaceous
- Psoroptic mange
- Sarcoptic mange
- Skrjabinemia ovis (sheep pinworm)
- Sunburn

PYODERMA

- Chorioptic mange
- Idiopathic nasal dermatitis
- Pemphigus foliaceous
- Psoroptic mange
- Sarcoptic mange
- Zinc responsive dermatosis

PYREXIA

- Alpaca fever
- Black leg
- Forestomach perforation (foreign body)
- Listeria
- Malignant edema
- Mastitis
- Necrobacillosis

RECUMBENCY, INTERMITTENT

- Enterocolitis
- Intestinal obstruction
- Parasites
- Urinary obstructions

RECUMBENCY, PREFERRED

- Enterocolitis
- Gastrointestinal necrosis—peritonitis
- Heart failure
- Intestinal obstruction
- Neoplasia—lymphoma, squamous cell carcinoma
- Parasites
- Pneumonia

RECUMBENCY, PREFERRED, Cont.

- Septicemia—endotoxemia
- Urinary obstructions

RECUMBENCY, CONSTANT

- Alpaca Fever
- Botulism
- Capture myopathy
- Foot and mouth disease
- Gastrointestinal perforation / ulcer / foreign body
- Heat stress
- Hepatic lipidosis
- Hyperlipemia
- Ketosis
- Listeriosis
- Nutritional muscular dystrophy
- Parelaphostrongylus tenuis
- Polioencephalomalacia / thiamine deficiency
- Tetanus
- Tick paralysis
- Trauma / fracture
- Type A enterotoxemia
- Vesicular stomatitis

RENAL DISEASE, CHRONIC

- Membranous glomerulitis
- Proliferative glomerulitis
- Renal amyloidosis

RENAL FAILURE, ACUTE

- Nephrotoxic drugs

RESPIRATORY DISTRESS (SNEEZE, COUGH, DYSPNEA)

- Coccidioidomycosis
- Chronic obstructive pulmonary disease (COPD)
- Foreign body
- Heart disease
- Heat stress
- Lungworms
- Neoplasia—lymphosarcoma
- Pneumonia

RETAINED PLACENTA

- Abnormal gestation length
- Abortion
- Dystocia
- Hypocalcemia
- Induced parturition
- Placentitis
- Stillbirth
- Vitamin E deficiency

SALIVATION / DROOLING

- Choke and aspiration
- Esophageal dilation
- Heat stress
- Ingestation of irritating substance
- Listeria
- Necrobacillosis
- Polioencephalomalacia / thiamine deficiency
- Rabies
- Tetanus

SCALING

- Amino acid deficiency
- Contact dermatitis
- Munge (hyperkeratotic dermatosis)
- Zinc responsive dermatosis

SEIZURES

- Cerebellar abiotrophy
- Heat stroke
- Hypoglycemia
- Meningitis / encephalitis
- Toxicities

SEPTICEMIA

- Alpaca fever (Strep. zoo)
- Colibacillosis
- Failure of passive transfer
- Salmonella

SKIN LESIONS, GENERALIZED

- Bacterial folliculitis / furunculosis
- Chorioptic mange
- Coccidioidomycosis (C. immitis=Valley Fever)
- Contagious ecthyma—Orf
- Demodicosis
- Dermatophilosis
- Idiopathic hyperkeratosis—Zinc responsive dermatosis
- Inhalant / food allergies
- Irritant dermatitis
- Neoplasia—papillomatosis
- Pediculosis
- Ringworm—Trichophyton verrucosum
- Sarcoptic mange (scabies)

STOMACH HYPOMOTILITY

- Anthrax
- Forestomach perforation (foreign body)
- Indigestion

STRAINING

- Cystitis
- Forestomach perforation (foreign body)
- Urolithiasis

STUNTED GROWTH / POOR BODY CONDITION SCORE

- Juvenile llama immunodeficiency syndrome (JLIDS)
- Malnutrition
- Parasites

SUDDEN DEATH

- Acidosis / grain overload
- Anthrax
- Gun shot
- Heat stroke
- Lightning strike
- Liver flukes
- Malignant edema
- Snake bite
- Trauma

SUDDEN DEATH, Cont.

- Type A enterotoxemia
- Type C enterotoxemia
- Type D enterotoxemia

SWELLINGS

- Black leg
- Mosquito and gnat bites
- Tabanid / fly bites
- Trauma

TACHYPNEA

- Acidosis
- Choke and aspiration
- Chronic obstructive pulmonary disease (COPD)
- Heat stress
- Obesity
- Pneumonia
- Stress

URETHRAL OBSTRUCTION

- Rupture of bladder / urethra
- SEE COLIC DIFFERENTIALS
- Urolithiasis

VESICLES

- Foot and mouth disease
- Pemphigus foliaceous
- Vesicular stomatitis

WEIGHT LOSS

- Chronic obstructive pulmonary disease (COPD)
- Foot and mouth disease
- Forestomach perforation (foreign body)
- Johne's disease
- Lymphosarcoma
- Malnutrition
- Parasitic infection
- Pneumonia
- Renal failure

WEIGHT LOSS, Cont.

- Tuberculosis
- Vesicular stomatitis

NEONATES AND JUVENILES

ALIMENTARY ABNORMALITIES, CONGENITAL

- Atresia ani
- Atresia coli
- Megaesophagus
- Pyloric stenosis

CONSTIPATION

- Colon impaction
- Endotoxemia
- Enteritis
- Enterotoxemia
- Intestinal obstruction
- Intestinal perforation
- Intestinal volvulus / torsion / strangulation
- Pancreatitis
- Peritonitis
- Ruptured bladder
- Toxicity
- Traumatic reticuloperitonitis
- Type C enterotoxemia
- Ulcers of the third compartment
- Urethral obstruction

DIARRHEA

- Coccidiosis
- Colibacillosis
- Corona virus
- Dietary upset
- First compartment stagnation
- Overfeeding
- Rota virus
- Septicemia

EYE ABNORMALITIES, CONGENITAL

- Cataract
- Distichiasis
- Ectropion
- Entropion
- Eyelid hypogenesis
- Iridal heterochromia
- Microphthalmia
- Persistent hyperplastic vitreous

FACIAL ABNORMALITIES, CONGENITAL

- Choanal atresia
- Cleft palate
- Facial bone dysgenesis
- Mandible / Maxilla dysgenesis
- Nasal stenosis
- Synophthalmia (Cyclops)

FAILURE TO THRIVE / ILL THRIFT

- Dental problems
- Eperythrozoonosis
- Failure of passive transfer
- Hypophosphatemia
- Hypothyroid
- Intestinal parasites
- Iron deficiency
- Juvenile llama immunodeficiency syndrome (JLIDS)
- Malnutrition

FIRST COMPARTMENT STAGNATION

- Acidosis
- Dehydration
- Esophageal groove dysfunction
- Septicemia

HEART ABNORMALITIES, CONGENITAL

- Atrial septal defect
- Patent ductus arteriosus
- Patent foramen ovale
- Persistent right aortic arch

HEART ABNORMALITIES, CONGENITAL, Cont.

- Tetralogy of Fallot
- Transposition of great vessels
- Ventricular septal defect

HERNIA

- Diaphragmatic hernia
- Inguinal hernia
- Umbilical hernia

LIMB ABNORMALITIES, CONGENITAL

- Angular limb deformity
- Arthrogryposis
- Dwarfism
- Patella luxation
- Polydactyly
- Syndactyly
- Tendon contracture
- Vertical talus
- Weak flexor tendons

NEURAL ABNORMALITIES, CONGENITAL

- Cerebellar hypoplasia
- Encephalomeningocele
- Hydrocephalus

POOR GROWTH

- Hypophosphatemia
- Hypothyroidism

RECUMBENCY

- Failure of passive transfer
- Juvenile llama immunodeficiency syndrome (JLIDS)
- Limb deformities

REPRODUCTIVE ABNORMALITIES, CONGENITAL

- Agenesis of teat
- Cryptorchidism
- Double cervix

REPRODUCTIVE ABNORMALITIES, CONGENITAL, Cont.

- Gonad hypoplasia / aplasia
- Hypoplasia of vulva
- Persistent frenulum
- Phallocampsis (corkscrew)
- Pseudohermaphrodite
- Segmental aplasia—M. ducts
- Supernumery teats

SPINAL ABNORMALITIES, CONGENITAL

- Anury
- Hemivertebra
- Scoliosis

URINARY TRACT ABNORMALITIES, CONGENITAL

- Persistent urachus
- Renal aplasia

CERVIDAE FORMULARY

Drug	Dose	Withdrawal	Notes
Anesthesia			
Atropine	0.03-0.06 mg/kg SQ		
Ketamine	Up to 10mg/kg IM for deer	FARAD: Cattle, Sheep, Goats: Milk: 48 hours Meat: 3 days	
Xylazine	Up to 2 mg/kg Small animal concentration (20mg/ml)	Deer: 14 days FARAD: Cattle, Sheep, Goats: Milk: 120 hous Meat: 10 days	
Yohimbine (Antagonil)	0.2-0.3 mg/kg IV	Deer in New Zealand: 1 day FARAD: Cattle, Sheep, Goats: Milk: 72 hours Meat: 7 days	To reverse xylazine Approved for use in deer
Anesthetic Protocol by Species			
Caribou	Ketamine 1mg/kg IM Medetomidine 0.07 mg/kg IM Reverse with 0.35 mg/kg atipamezole ½ IV, ½ IM		
Fallow Deer	Ketamine 2.5 mg/kg Medetomidine 0.1mg/kg Reverse with 0.5 mg/kg atipamezole ½ IV, ½ IM		
Moose	Carfentanil 0.01 mg/kg Xylazine 0.1 mg/kg If not down in 20minutes, repeat entire dose Reverse with 100mg naltrexone or naloxone per mg carfentanil plus 0.1mg/kg yohimbine IV		
North American Elk	Xylazine 0.1 mg/kg IM Carfentanil 0.01 mg/kg IM Repeat entire dose in 20 minutes if animal not down Reverse with 100 mg naltrexone or naloxone per mg Carfentanil and 0.125 mg/kg yohimbine IV		Monitor carefully for overheating and bloat
White Tailed Deer	Telazol 4.4 mg/kg Xylazine 2.2 mg/kg Reverse with 0.125 mg/kg yohimbine		

CERVIDAE FORMULARY

Drug	Dose	Withdrawal	Notes
Anthelmintics			
Albendazole (Valbazen)	Elk: 10 mg/kg PO, suspension Intestinal, stomach parasites, lungworms, tapeworms, liver flukes Deer: 7.5 mg/kg PO Roundworms, tapeworms 10 mg/kg PO Flukes	Deer: New Zealand: 7 Days	
Amitraz (Taktic)	760 ml in 100gallons water 2 gallons spray for each elk	Dairy Cattle: no withdrawal needed	Ticks, mange mites, lice Toxic to fish and horses
Doramectin (Dectomax)	500 ug/kg pour-on 200 ug/kg, SQ or IM	Cattle: 35 days	Great for L4 ostertagia larvae
Eprinomectin	500ug/kg in deer as pour-on	Deer: New Zealand: 14 days	
Febantel (Rintal)	Deer: 7.5 mg/kg PO	Deer: New Zealand: 21 days	Mature lungworms
Fenbendazole (Panacur)	Red deer: 10 mg/kg, in feed pellets, 3 days Treat Parelaphostrongylus tenuis: 15 mg/kg for 3-5 days	Deer: New Zealand: 14 days	
Ivermectin (Ivomec 1%)	Deer: 500-1000 ug/kg pour-on Good for nematodes, may work for ostertagia Deer: 200 ug/kg SQ For lungworm, adult abomasal parasites Deer: 400 ug/kg SQ For immature abomasal parasites 1.5 cc/100# at 10mg/ml, PO monthly Spring-Fall Prevent Parelaphostrongylus tenuis	Reindeer and Bison: 56 days	Mild SQ reaction is common day after
Levamisolee (Levasole)	Deer: 7.5 mg/kg PO / SQ 10 mg/kg pour-on	Deer in Austrailia: 3 days	
Moxidectin (Cydecin)	Elk: 0.5 mg/kg pour-on 5 mg/ml Deer: 500 ug/kg pour-on	Deer in New Zealand: 21 Days	Nematodes, lungworms, cattle grubs, mites, lice, horn flies D.viviparous, haemonchus, ostertagia, trichostrongylus, oesophagostomum Longer action than ivermectin vs lungworm

CERVIDAE FORMULARY

Drug	Dose	Withdrawal	Notes
Anthelmintics			
Oxfendazole (Benzelmin)	4.5 mg/kg PO single dose for deer	Deer in New Zealand: 14 days	
Permethrin (Atroban)	0.5 fluid oz/100#, max 5 fluid oz for elk		Flies and lice Very toxic to fish
Antibiotics			
Chlortetracycline (Aureomycin)	feed additive/ water mix		Treat foot rot in deer
Florfenicol (Nuflor)	20 mg/kg = 3 ml/100# IM 40 mg/kg = 6 ml/100# SQ	Cattle: Meat: SQ: 38 days IM: 28 days	Good for treating respiratory diseases of deer and elk Pasteurella, E. coli, blue tongue, Anaplasma
Penicillin G Procaine	3 cc/100#	Cattle: Meat: 20 days	Gram + aerobes and anaerobes, bactericidial to treat Clostridial diseases, especially tetanus, epididymitis and orchitis
Sulfadimethoxine (Albon)	Long acting boluses		
Tetracycline	20 mg/kg IM	Red Deer in UK: Meat: 28 days	
Tilmicosin (Micotil)	10 mg/kg 1.5 ml/100#	Cattle: Meat: 28 days	Good for treating respiratory diseases of deer and elk Pasteurella, E. coli, blue tongue, Anaplasma
Vaccines	8-way Clostridium yearly 5-way Leptospirosis yearly tetanus toxoid yearly		

CERVIDAE DIFFERENTIAL LIST

ABDOMINAL PAIN

- Grain engorgement
- Oak poisoning
- Obstruction / Impaction
- Salmonellosis
- Trauma (antler trauma)
- Urea poisoning / toxicity

ABORTION

- Infectious
  - Blue tongue
  - Brucellosis
  - Bovine Viral Diarrhea (BVD)
  - Campylobacter (Vibriosis)
  - Leptospirosis
  - Listeriosis
  - Louping ill
  - Mycoses
  - Neospora
  - Q-Fever (Coxiella burnetti)
  - Salmonella
  - Sarcosporidiosis
  - Toxoplasmosis
- Nutritional
  - Copper deficiency
  - Iodine deficiency
- Toxic
  - Akabane
  - Selenium toxicity
  - Sorghum toxicity

ABSCESSES

- Injection site abscess
- Lymphosarcoma
- Trauma
- Tuberculosis

ALOPECIA

- Blue Tongue
- Dermatophilosis
- Parelaphostrongylus tenius
- Ringworm (Trichophyton, Microsporum)
- Sarcoptic mange
- Sorghum toxicity
- Staphyloccocal dermatitis
- Vitamin A deficiency

ANEMIA

- Blood loss (hemorrhage, trauma)
- Leptospirosis
- Nutritional
    - Cobalt deficiency
    - Copper deficiency
    - Iron deficiency
- Parasites
    - Anaplasmosis
    - Babesiosis
    - Coccidiosis
    - Eperythrozoonosis
    - Haemonchus contortus
    - Hookworm
    - Liver flukes (Faciola, Facioloides)
    - Sarcosporidiosis
    - Thelariosis
    - Winter ticks
- Toxins
    - Bracken fern
    - Coumarol toxicity
    - Mold / fungal
    - Toxic plants (Rape, Kale)

ANESTRUS

- Heat stress
- Luteal cysts
- Malnutrition
- Heavily lactating
- Outside of normal breeding season
- Poor footing
- Poor heat detection
- Post partum period

ANESTRUS, Cont.

- Pregnancy
- Pseudohermaphrodite
- Pyometra

ANOREXIA

- Babesiosis
- Blue Tongue
- Borreliosis
- Copper deficiency
- Ehrlichiosis
- Foot and Mouth Disease
- Iron deficiency
- Polioencephalomalacia / thiamine deficiency
- Rinderpest
- Sarcosporidiosis
- Tetanus
- Tooth abscess

ATAXIA

- Botulism
- Capture Myopathy
- Chronic Wasting Disease
- Elaphora Schneideri
- Encephalomyelitis
- Epizoonotic Hemorrhagic Disease
- Lead poisoning
- Listeriosis
- Louping Ill
- Malignant Catarrhal Fever
- Meningeal Worm (Parelaphostrongylus)
- Meningitis
- Perennial ryegrass staggers
- Polioencephalomalacia / thiamine deficiency
- Rabies
- Selenium toxicity
- Sorghum toxicity
- Spinal Cord disease / trauma / abscess
- Tetanus
- Vitamin A deficiency

BLINDNESS

- Brain abscess
- Brain edema
- Brain tumor
- Conjunctivitis
- Elaphora Schneideri
- Lead poisoning
- Malignant Catarrhal Fever
- Meningeal Worm (Parelaphostrongylus)
- Neoplasia
- Polioencephalomalacia / thiamine deficiency
- Rinderpest
- Trauma
- Vitamin A deficiency

BLOAT

- Abrupt Dietary Change
- Esophageal Obstruction
- Grain / Carbohydrate Engorgement
- Prolonged Recumbency

BRUXISM

- Anthrax
- Chronic Wasting Disease
- Louping Ill

CHANGE IN BEHAVIOR

- Arboviruses
- Chronic Wasting Disease
- Meningeal Worm (Parelaphostrongylus)
- Rabies

CIRCLING

- Arboviruses
- Brain abscess
- Brain tumor
- Encephalitis
- Elaphora Schniederi
- Listeriosis
- Meningeal Worm (Parelaphostrongylus)

CIRCLING, Cont.

- Otitis media
- Rabies

CONJUNCTIVITIS

- Ant Attack
- Blue Tongue
- Chylamydia
- Foreign Body
- Herpes Virus Conjunctivitis
- Infectious bovine rhinitis (IBR)
- Listeriosis
- Malignant Catarrhal Fever
- Moraxella bovis
- Mycoplasma conjunctivae
- Thelazia
- Trauma

CONVULSIONS

- Chlorinated Hydrocarbon poisoning
- Enterotoxemia
- Ergotism
- Hypoglycemia
- Hypomagnesemia
- Lead poisoning
- Listeriosis
- Malignant Catarrhal Fever
- Nitrate poisoning
- Perennial ryegrass staggers
- Polioencephalomalacia / thiamine deficiency
- Stress
- Strychnine poisoning
- Tetanus
- Trauma

COUGH

- Aspiration
- Bacterial pneumonia
- Choke
- Lung Worm (Dictyocaulus filaria)
- Pasteurella pneumonia

COUGH, Cont.

- Parainfluenza virus type 3 (PI_3)
- Tissue worm migration
- Tuberculosis
- Viral pneumonia

CYCLIC IRREGULARITIES—FEMALE

- Campylobacteriosis
- Cystic ovaries
- Early / late in breeding season
- Endometritis
- Heat stress
- Leptospirosis
- Poor body condition

DEFORMED HOOVES

- Acidosis / Grain overload
- Chronic foot rot
- Poor trimming
- Selenium toxicity
- Zinc deficiency

DERMATITIS

- Chemical burns
- Chorioptic mange
- Dermatophilosis
- Dermatophytosis
- Frost bite
- Lice
- Parelaphostrongylus migration
- Photosensitization
- Sarcoptic mange
- Staph Dermatitis
- Vitamin A deficiency
- Vitamin E deficiency
- Zinc deficiency

DIARRHEA

- Abrupt feed change
- Anthrax
- Besnotiosis
- Bovine viral diarrhea (BVD)
- Campylobacter
- Clostridial disease (types A, B, C, and D)
- Coccidiosis
- Cryptosporidium
- E. coli
- Epizootic hemorrhagic disease
- Grain engorgement
- Intestinal parasites
- Johne's disease
- Malignant Catarrhal Fever
- Polioencephalomalacia / thiamine deficiency
- Rinderpest
- Rotavirus
- Salmonella (typhimurium, dublin)
- Sarcosporidiosis
- Stress
- Thelariosis
- Toxins
    - Aflatoxin
    - Arsenic
    - Bracken fern
- Tularemia
- Winter dysentery (Coronavirus)
- Yersinia enterocolitica

DYSPHAGIA

- Actinobacillosis
- Actinomycosis
- Bacterial meningoencephalitis
- Botulism
- Brain abscess
- Caprine arthritis and encephalitis virus (CAE)
- Choke
- Diaphragmatic hernia
- Listeria
- Locoweed
- Mandibular / maxillary fractures
- Oral vesicles, erosion, ulcers

DYSPHAGIA, Cont.

- Otitis media and interna
- Pharyngeal abcess / cellulitis
- Pseudorabies
- Rabies
- Ruptured / damaged esophagus
- Snake bite
- Teeth problems
- Tetanus
- Tick paralysis

DYSPNEA

- Anemia
- Anthrax
- Aspergillosis
- Aspiration pneumonia
- Blue bonnets
- Cyanide poisoning
- Epizootic hemorrhagic disease
- Foreign body
- Heat stroke
- Infectious bovine rhinitis (IBR)
- Lung Worm (Dictylocaulus filaria)
- Malignant Edema (clostridial)
- Mycobacterium Infection
- Nitrate / Nitrite poisoning
- Pasteurella pneumonia
- Parainfluenza virus type 3 (PI_3)
- Prussic Acid poisoning
- Rinderpest
- Selenium toxicity
- Trauma
- Yersinia pseudotuberculosis
- Yew toxicity

DYSTOCIA

- Disproportion between fetus / maternal pelvis
- Fetal monster
- Malposition / malpresentation
- Obesity
- Poor cervical dilation
- Uterine torsion

ENCEPHALITIS

- Chronic Wasting Disease
- Infectious Bovine Rhinotracheitis
- Listeriosis
- Malignant Catarrhal Fever
- Rhinotracheitis

FEVER

- Anaplasmosis
- Anthrax
- Babesiosis
- Blue Tongue
- Borreliosis
- Bovine viral diarrhea (BVD)
- Clostridial diseases
- Deer Herpes Virus
- Ehlichiosis
- Epizootic Hemorrhagic Disease
- Foot and Mouth Disease
- Generalized septicemia
- Infectious bovine rhinitis (IBR)
- Leptospirosis
- Listeriosis
- Louping Ill
- Malignant Catarrhal Fever
- Malignant Edema (clostridial)
- Meningoencephalitis (bacterial and fungal)
- Pasteurellosis
- Pesti des petits ruminants
- Parainfluenza virus type 3 (PI_3)
- Pseudorabies
- Rinderpest
- Salmonella
- Sarcosporidiosis
- Theleriosis
- Tularemia
- Yersiniosis

GESTATION, PROLONGED

- Fescue toxicity
- Fetal mummification
- High environmental temperature
- Hydrops amnii
- Hypothalamus-hypophyseal-adrenal axis disorders

HEAD TILT

- Abscess
- Inner ear infection
- Listeria
- Otic foreign body
- Polioencephalomalacia / thiamine deficiency
- Tooth infection
- Trauma

HEMOGLOBINURIA

- Bacillary Hemoglobinuria
- Clostridium
- Copper poisoning
- Kale or Rape toxicity
- Leptospirosis
- Red clover ingestion

HEMORRHAGE

- Aflatoxin
- Bracken fern toxicity
- Coumarol toxicity
- Mold poisoning
- Trauma

HOOF SLOUGHING

- Dry gangrene
- Ergotism
- Grain engorgement

HYPOTHERMIA

- Failure of passive transfer
- Malnutrition
- Winter death syndrome

HYPERTHERMIA

- Heat stroke
- Malignant Catarrhal Fever
- Septicemia (Pasteurella, Salmonella, Yersinia)
- Toxemia

HYPERKERATOSIS

- Sarcoptic mange
- Vitamin A deficiency
- Vitamin E deficiency
- Zincdeficiency

ILL-THRIFT

- Chronic Wasting Disease
- Cobalt deficiency
- Helminthosis
- Johne's Disease
- Mycobacterium infection
- Nutritional insufficiency
- Phosphorus deficiency
- Selenium deficiency

INABILITY TO EAT

- Actinobacillosis (Wooden Tongue)
- Actinomycosis (Lumpy Jaw)
- Botulism
- Foreign body
- Teeth excessive wear
- Tetanus

JAUNDICE / ICTERUS

- Facial eczema
- Hepatitis
- Lantana poisoning
- Pyrrolizidine Alkaloid toxicity

LAMENESS

- Clostridial disease
- Foot abscess
- Foreign body
- Fracture
- Interdigital necrobacillosis
- Malignant Edema
- Overgrown feet
- Previous acidosis (laminitis)
- Puncture
- Traumatic injury
- Vitamin D deficiency
- White Muscle disease

LYMPHADENOPATHY

- Borreliosis
- Ehrlichiosis
- Generalized infection
- Malignant Catarrhal Fever
- Melidiosis
- Mycobacterium infection
- Necrobacillosis
- Nocardia
- Thelariosis
- Tuberculosis

MUCOSAL LESIONS

- Bovine viral diarrhea (BVD)
- Foot and Mouth Disease
- Malignant Catarrhal Fever
- Necrobacillosis
- Orf
- Vesicular Stomatitis

NASAL DISCHARGE

- Aspergillosis
- Blue Tongue
- Bovine viral diarrhea (BVD)
- Deer Herpes Virus
- Foot and Mouth Disease
- Foreign body

NASAL DISCHARGE, Cont.

- Malignant Catarrhal Fever
- Nasal Bots
- Neoplasia
- Pneumonia
- Trauma

NEUROLOGICAL

- Bacterial meningitis
- Brain abscess
- Haemophilus somnus
- Inner ear infection
- Ketosis
- Lead toxicity
- Listeria
- Polioencephalomalacia / thiamine deficiency
- Pseudorabies
- Rabies

NYSTAGMUS

- Encephalomyelitis
- Listeriosis
- Polioencephalomalacia / thiamine deficiency
- Trauma

PARESIS OR PARALYSIS

- Botulism
- Capture Myopathy
- Hypocalcemia
- Listeriosis
- Louping Ill
- Oxalate poisoning
- Rabies
- Selenium deficiency
- Tetanus
- Tick paralysis
- Trauma

PHOTOSENSITIZATION

- Drug reaction
- Hepatitis
- Lantana toxicity
- Liver damage
- Lupinosis
- Phenothiazine toxicity
- Lily toxicity

PRURITIS

- Bacterial Skin infections
- Dermatophylosis
- Dermatophytosis
- Keds
- Lice
- Mange
- Photosensitization
- Ticks

RECUMBENCY

- Calving paralysis
- Hypothermia
- Rinderpest
- Stress ataxia
- Trauma

RESPIRATORY STRESS

- Acidosis
- Anaphylaxis / allergy
- Anaplasmosis
- Bloat
- Distended abdomen
- Enteritis
- Eperythrozoonsis
- Fluid and electrolyte loss
- Hyperthemia
- Hypocalcemia
- Hypomagnesemia
- Hypovolemic, cardiac, and septic shock
- Iron deficiency
- Metritis

RESPIRATORY STRESS, Cont.

- Neonatal septicemia
- Pain
- Pneumonia
- Salmonellosis
- Septicemia
- White muscle disease

RETAINED PLACENTA

- Abnormal gestation length
- Abortion
- Dystocia
- Hypocalcemia
- Induced parturition
- Placentitis
- Stillbirth
- Vitamin E deficiency

ROUGH HAIR COAT

- Copper deficiency
- Internal parasites
- Iodine deficiency
- Vitamin A deficiency
- Vitamin E deficiency

SALIVATION

- Bovine viral diarrhea (BVD)
- Choke
- Chronic Wasting Disease
- Cyanide poisoning
- Foot and Mouth Disease
- Ingestation of irritating substance
- Larkspur
- Listeriosis
- Rabies
- Tetanus
- Vesicular Stomatitis
- Zinc deficiency

SCALING AND CRUSTING / SKIN LESIONS

- Dermatophilosis
- Ectoparasites (lice, keds)
- Fibroma
- Lymphosarcoma
- Parapox Virus Disease
- Photosensitization
- Ringworm
- Selenium deficiency
- Skin Tuberculosis
- Staph Dermatitis
- Warbles

STRAINING

- Constipation
- Cystitis
- Dystocia
- Normal labor
- Tenesmus

SUDDEN DEATH

- Anthrax
- Bluebonnet toxicity
- Botulism
- Capture myopathy / Stress
- Clostridial disease (types A, B, C, and D)
- Cyanide Accumulating plants
- Epizootic hemorrhagic disease
- Exposure (Winter Death syndome) / Hypothermia
- Failure of passive transfer
- Grain engorement
- Hemorrhagic enteritis
- Hypomagnesium
- Larkspur intoxication
- Lightning
- Louping Ill
- Malignant Catarrhal Fever
- Malignant Edema
- Mycobacteria infection
- Pasteurella pneumonia
- Plant or Chemical toxins (nitrate, prussic acid, oxalate, lead, urea, white cedar)
- Poison Hemlock

SUDDEN DEATH, Cont.

- Rinderpest
- Salmonellosis
- Selenium toxicity
- Tetanus
- Trauma (antler trauma, dog attacks, etc)
- Tularemia
- Yersiniosis

ULCERATIVE LESIONS

- Besnotiosis
- Blue Tongue
- Contagious Ecthyma (Orf)
- Foot and Mouth Disease
- Malignant Catarrhal Fever
- Pesti des petits ruminants
- Rinderpest
- Vesicular stomatitis

WEIGHT LOSS

- Besnotiosis
- Chronic Wasting Disease
- Cobalt deficiency
- Coccidiosis
- Copper deficiency
- External parasites
- Internal parasites
- Johne's (paratuberculosis)
- Liver flukes
- Lungworms (Dictyocaulus filaria)
- Phosphorus deficiency
- Poor nutrition
- Pseudorabies
- Selenium deficiency
- Thelariosis
- Tooth abscess
- Tuberculosis

SMALL RUMINANT LABORATORY RESULT DIFFERENTIALS

ANEMIA

- Blood loss
  - Abomasal ulcer
  - Moldy sweet clover toxicity
  - Parasites (Internal and External)
- Hemolysis
  - Anaplasmosis
  - Bacillary hemoglobinuria
  - Brassica toxicity
  - Copper toxicosis
  - Leptospirosis
  - Onion toxicosis
- Inadequate RBC production
  - Bracken fern toxicosis
  - Chronic abscess
  - Chronic pneumonia
  - Johne's disease
  - Liver abscess

ANTI-THROMBIN III, REDUCED

- Disseminated intravascular coagulation
- Johne's disease
- Renal amyloidosis

APTT, PROLONGED

- Disseminated intravascular coagulation
- Moldy sweet clover (coumarin toxicity)

BILIRUBIN (SERUM), ELEVATED

- Fasting / anorexia
- Hemolytic anemia
- Liver failure
- Systemic disease

BLOOD UREA NITROGEN (BUN), DECREASED

- Liver failure
- Low-protein diet
- Normally low in neonates

BLOOD UREA NITROGEN (BUN), INCREASED

- Postrenal azotemia
  - Ruptured bladder
  - Urolithiasis
- Prerenal azotemia
  - Congestive heart failure
  - Dehydration
  - Hypovolemia
  - Reduced renal perfusion
- Renal azotemia
  - Acute renal failure
  - Chronic renal failure

CREATININE, ELEVATED

- Postrenal azotemia
  - Ruptured bladder
  - Urolithiasis
- Prerenal azotemia
  - Congestive heart failure
  - Dehydration
  - Hypovolemia
  - Reduced renal perfusion
- Renal azotemia
  - Acute renal failure
  - Chronic renal failure

ENZYME ELEVATIONS

- Alkaline phosphatase (AP)
  - **NOT A GOOD RUMINANT TEST!**
- Creatine phosphokinase (CPK)
  - Alert down animal
  - Nutritional myodegeneration
- Gamma-glutamyl transferase (GGT)
  - Acute liver failure
  - Aflatoxicosis
  - Chronic liver failure
  - Normally elevated in young animals
  - Pyrrolizidine alkaloid toxicity

ENZYME ELEVATIONS

- Lactate dehydrogenase (LDH)
  - Hemolysis
  - Liver disease
    - Acute liver failure
    - Chronic liver failure
    - Liver flukes
  - Muscle disease
- Sorbitol dehydrogenase (SDH)
  - Acute liver failure
  - Liver abscess
  - Damaged bowel
    - Strangulation
    - Acute toxic enteritis

EOSINOPHILIA

- Allergies
- Migrating parasites
- Sarcocystosis
- Toxoplasmosis

FIBRIN / FIBRINOGEN DEGRADATION PRODUCTS, ELEVATED

- Disseminated intravascular coagulation
- Immune-mediated thrombocytopenia
- Postoperative states
- Severe inflammatory disorders
- Thrombophlebitis

HYPERCALCEMIA

- Excessive, rapid IV calcium
- Hyperparathyroidism
- Hypervitaminosis D
- Neoplasia parathyroid gland

HYPERCHLOREMIA

- Salt poisoning
- Water deprivation
- **Hyperchloremia without hypernatremia**
  - Hyperchloremic metabolic acidosis
  - Renal tubular necrosis

HYPERFIBRINOGENEMIA

- Acute inflammatory disease
- Acute mastitis
- Pleuritis
- Pneumonia
- Umbilical infection

HYPERGLOBINEMIA

- Abdominal abscess
- Chronic inflammatory disease
- Chronic pneumonia
- Umbilical abscess

HYPERGLYCEMIA

- Excitement and stress
- Glucocorticoid administration
- Xylazine administration

HYPERKALEMIA

- False hyperkalemia (In vitro hemolysis, prolonged storage)
- Hypovolemia with renal shutdowm
- Metabolic acidosis

HYPERNATREMIA

- Sodium excess
- Water deprivation
- Water loss

HYPERPHOSPHATEMIA

- Acute renal failure
- Endurance exercise
- Excessive phosphate intake
- Hi-normal range in neonate

HYPERPROTEINEMIA

- Coccidiosis
- Diarrhea
- Panhyperproteinemia—dehydration
- Peritonitis
- Ruminal acidosis
- Salmonellosis
- Salt toxicity
- Sepsis toxemia (Mastitis / Metritis)
- Toxins

HYPOCALCEMIA

- Acute renal failure
- Anorexia in lactating animal
- Blister beetle toxicosis
- Fat necrosis
- Grass tetany
- Pariparturient paresis

HYPOCHLOREMIA

- Ascites
- Blood loss
- Diarrhea
- Fluid drainage
- Gastric reflux
- Intestinal block
- Peritonitis
- Ruptured bladder
- **False hypochloremia**
  - Hyperglycemia
  - Hyperlipidemia
  - Hyperproteinemia
- **Hypochloremia without hyponatremia**
  - Metabolic alkalosis

HYPOGLYCEMIA

- Anorexia in newborns
- Late endotoxic shock
- Pregnancy toxemia

HYPOKALEMIA

- Diarrhea
- Dietary deficiencies
- Gut torsion / volvulus
- Metabolic alkalosis
- Peritonitis
- Prolonged anorexia
- Vomition

HYPOMAGNESEMIA

- Grass tetany
- Magnesium deficient diet (milk only)

HYPONATREMIA

- Blood loss
- Diarrhea
- Excessive 5% dextrose to renal disease patient
- Excessive sweating
- Fluid drainage
- Hyperglycemia
- Sequestration of fluid in third space
    - Ascites
    - Peritonitis
    - Ruptured bladder
    - Torsion or volvulus of gut

HYPOPHOSPHATEMIA

- Hyperparathyroidism
- Pariparturient paresis
- Starvation

HYPOPROTEINEMIA

- Hypoalbuminemia
    - Amyloidosis
    - Glomerulonephritis
    - Johne's Disease
    - Pyelonephritis
    - Salmonellosis

HYPOPROTEINEMIA

- Panhypoproteinemia
  - Acute blood loss
  - Excessive IV fluid or water intake
  - Gastrointestinal ulceration
  - Parasites, internal and external

LYMPHOPENIA

- Acute pneumonia
- Diffuse peritonitis
- Gram negative septicemia / endotoxemia
- Steroid administration
- Stress

METABOLIC ACIDOSIS

- Acute diarrhea
- Ketosis
- Peritonitis
- Pregnancy toxemia
- Rumen overload
- Ruptured bladder
- Strangulated bowel

METABOLIC ALKALOSIS

- Abomasal sequestration of fluid
- Chloride and/or potassium depletion
- Diuretic

MONOCYTOSIS

- Chronic bacterial infections
- Granulomatous disease

NEUTROPENIA

- Acute pneumonia
- Acute salmonellosis
- Clostridial infection
- Gram negative septicemia / endotoxemia
- Peritonitis
- Septic mastitis
- Septic metritis
- Toxic, bone marrow suppression

NEUTROPHILIA

- Chronic metritis
- Chronic pyelonephritis
- Corticosteroid administration
- Enteritis
- Internal abscess
- Liver abscess
- Neonatal septicemia
- Peritonitis
- Septic arthritis
- Stress
- Toxins
- Umbilical abscess

PCV, INCREASED

- Absolute erythrocytosis
  - Chronic hepatic disease
  - Congenital cardiovascular disease
  - Hemangioblastoma
  - Hepatoma
  - Residence in high altitudes
- Relative erythrocytosis
  - Dehydration
  - Endotoxic shock
    - Intestinal strangulation / obstruction
    - Salmonellosis
    - Septic mastitis
    - Septic metritis

PROTHROMBIN TIME, PROLONGED

- Disseminated intravascular coagulation
- Moldy sweet clover (coumarin toxicity)

RESPIRATORY ACIDOSIS

- Depression of respiratory center of CNS
  - CNS disease
  - Drugs
  - General anesthesia
- Laryngeal edema
- Obstruction of upper respiratory tract
- Pneumonia
- Pneumothorax

RESPIRATORY ALKALOSIS

- Hypoxemia
  - Congestive heart failure
  - Pulmonary disease
  - Severe anemia
- Stimulation of CNS respiratory center
  - Neurological disorders
  - Psychogenic hyperventilation
  - Septicemia
  - Transport, pain, fear, excitement

THROMBOCYTOPENIA

- Bracken fern toxicity
- Disseminated intravascular coagulation
- Septic mastitis
- Septic metritis

SMALL RUMINANT TOXINS

CARDIOPULMONARY

- Black locust
- Cardiac glycoside-containing plants
  - Azalea
  - Foxglove
  - Laurel
  - Lily-of-the-valley
  - Milkweed
  - Oleander
- Castor beans
- Deathcamas
- Ergot
- False hellebore
- Fluoride
- Ionophore poisoning
- Tall Fescue
- Western sneezeweed
- Yew

DERMAL

- Iodine
- Primary Photosensitizing Agents
  - Bishop's weed
  - Buckwheat
  - Dutchman's Breeches
  - Rain lily
  - Spring Parsley
  - St. John's Wart
- Secondary Photosensitizing Agents
  - Cultivated Rape
  - Lantana
- Selenium toxicity
- Snake bites
- Stinging insects
- Stinging nettle (Urtica dioicia)

GASTROINTESTINAL

- Arsenic
- Black Locust
- Blister Beetles (Cantharidae)

GASTROINTESTINAL, Cont.

- Buttercups (Ranunculaccae)
- Castor beans
- Caustic agents
- Copper
- Corn Cockle (Agrostemma githago)
- Crude oil
- Deathcamas (Zigasenus nuttallii)
- False hellebore
- Fertilizer
- Fluoride
- Labrador tea
- Lead
- Milkweed (Asclepias sp)
- Molybdenum
- Mountain and brown laurel
- Mustards (Brassica sp)
- Nightshade (Solanum sp)
- Non-Protein Nitrogen toxicity (Urea poisoning)
- Oleander
- Organophosphates
- Purple foxglove
- Rhododendron
- Slobber factor (Slaframine)
- Spurges (Euphorbia sp)
- Sulfates / Total dissolved solids in water supply
- Western azalea
- Western snakeweed
- Yew

HEMATOPOIETIC

- Anticoagulants (rodenticides)
- Bracken fern
- Choke cherry
- Copper
- Moldy sweet clover (Melilotus sp)
- Molybdenum
- Onions and garlic
- Rape, kale, brussel sprouts

HEPATIC

- Aflatoxin
- Blue-green algae poisoning
- Cocklebur (Xanthium strumarium)
- Copper
- Kleingrass (Panicum coloradatum)
- Lantana
- Pyrrolizidine Alkaloid-Containing Plants

MUSCULOSKELETAL

- Arrowgrass
- Labrador tea
- Mountain and brown laurel
- Organochlorides
- Organophosphates
- Rhododendron
- Strychnine
- Tobacco
- Western azalea
- White snakeroot and Rayless goldenrod

NEUROLOGICAL

- Arrowgrass
- Bermuda grass
- Bluebonnet (Lupine sp)
- Choke cherry
- Deathcamas (Zigadenus nuttallii)
- Dutchman's Breeches (Dicentra sp)
- False hellebore
- Fluoride
- Jimsonweed (Datura sp)
- Labrador tea
- Larkspur or Delphinium (Delphinium sp)
- Lead
- Locoweed (Astragalus sp. or Oxytropis sp)
- Marijuana or Hemp (Cannabis sativa)
- Milkweed (Asclepias sp)
- Morning Glory (Ipomoea violacea)
- Mountain and brown laurel
- Organochlorides
- Organophosphates and Carbamates
- Poison Hemlock (Conium maculatum)

NEUROLOGICAL, Cont.

- Rhododendron
- Salt toxicity (water deprivation)
- Strychnine
- Tobacco
- Water hemlock (Cicuta maculata)
- Western azalea

RENAL

- Arrowgrass
- Copper
- Oak (Quercus sp)
- Soluble Oxalate-Containing Plants
    - Beets
    - Dock
    - Halogeton
    - Pig weed

REPRODUCTIVE

- Molybdenum
- Phytoestrogen-containing plants
- Plants which cause teratogenesis
    - Bluebonnet
    - Locoweed
    - Poison hemlock
    - Potatoes
    - Skunk cabbage
    - Tobacco
- Selenium
- Western yellow pine (Pinus ponderosa)

RESPIRATORY

- Arrowgrass
- Choke cherry
- Crude oil and Petroleum distillates
- Cyanide-accumulating plants
- Nitrate-accumulating plants
- Organophosphates
- Paraquat
- Toxic gases
- Western sneezeweed
- Yew

SMALL RUMINANT NUTRIENT IMBALANCES

CARDIOPULMONARY

- Selenium ↓
- Vitamin E ↓

DERMAL

- Cobalt ↓
- Copper ↓
- Vitamin A ↓
- Zinc ↓

GASTROINTESTINAL

- Cobalt ↓
- Copper ↓
- Selenium ↓
- Vitamin E ↓

HEMATOPOIETIC

- Cobalt ↓
- Copper ↓ or ↑
- Iron ↓
- Vitamin K ↑

HEPATIC

- Copper ↑
- Selenium ↓
- Vitamin E ↓

MUSCULOSKELETAL

- Calcium ↓
- Copper ↓
- Iodine ↓
- Phosphorus ↑
- Selenium ↓
- Vitamin A ↓
- Vitamin D ↓
- Vitamin E ↓

NEUROLOGICAL

- Copper ↓
- Iodine ↓
- Selenium ↓
- Vitamin A ↓
- Vitamin E ↓

REPRODUCTIVE

- Cobalt ↓
- Copper ↓
- Iodine ↓
- Selenium ↓
- Vitamin A ↓
- Vitamin E ↓

RESPIRATORY

- Selenium ↓
- Vitamin E ↓

SHEEP HEALTH AND MANAGEMENT FACT SHEETS

THERESA ANTTILA

Included is a short list of fact sheets covering various aspects of sheep health and management. This is not a comprehensive group, but just a beginning. The purpose of these sheets is to provide a single sheet that could be copied and given to clients to give them a short description about a specific management technique or health matter. These sheets could be easily adapted to an individual's wants and needs (including for other species). I hope they are useful and encourage the development of additional sheets. I hope to one day have a complete set of fact sheets, but I know there will always be one more topic that could be covered.

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Castration

Is it necessary?

YES IF

- Lamb during spring, wean in fall
- Feed all lambs in same feedlot
- Want to sell club lambs
- Market rams > 6 months of age

MAYBE NOT IF

- Early wean (60 days of age)
- Feed ram lambs separate from ewe lambs
- Raise own replacement ram lambs
- Sell breeding stock
- Market rams at 3-6 months of age

Castration is the process of removing testicles from male lambs. An open castration involves cutting into the scrotum to remove the testicles while a closed castration does not open to scrotum.

Advantages:

- Don't have to worry about unplanned breeding.
- Don't have to deal with "ram attitude" and fighting amongst ram lambs.
- Male lambs marketed intact may get discounted price.

Disadvantages:

- Wethers (castrated males) grow slower and put on less muscle and more fat than uncastrated male lambs.

How to do it:

When:

Lambs less than 30 days of age is most common, best done when still small.

With what: Discuss each with your veterinarian and choose the one that works best for you.

Before any castration method is used, the scrotum must be checked to ensure both testicles and no intestines are present! If both testicles are not present, castration should NOT be performed at this time—CONSULT WITH VETERINARIAN!

Closed castration methods

1. Elastrator—applies an elastrator band (small tight rubber band) on scrotum with testicles inside. Care must be taken to ensure both testicles are down inside the scrotum before the band is released. The band constricts the blood supply to the scrotum and it will shrivel up and fall off in 20-30 days depending on size of lamb. This method is bloodless and requires low labor needs. With dry weather conditions, it is the least likely method to result in an infection. The main disadvantage is increased tetanus risk and fly strike due to extended length of time the dead scrotum remains with the lamb. This is the method of choice for club lamb producers/showers since the entire scrotum is removed leaving a nice clean look to the underline of the belly.
2. Burdizzo—a steel castration tool that crushes the spermatic cord without breaking the skin of the scrotum. The scrotum remains intact because its blood supply is not completely damaged. The burdizzo is clamped onto the scrotum where it connects to the body and crushes each spermatic cord individually. The burdizzo must not close across the entire scrotum at one time. The testicles will shrivel up in 30-40 days. The advantage of this method is that it is a closed method of castration so infections should not occur. However, the disadvantages are need for more expensive equipment (that must be properly adjusted) and increased labor skill.

Open castration method

(For open castration, the bottom third of the scrotum must first be cut off. A sharp clean knife or scalpel can be used. If done when less than 2 weeks of age the testicles can be grabbed and pulled until the spermatic cord rips. Do not stick hands and fingers up and into scrotum as this will increase the risk of infection. Use pressure on the outside of the top of the scrotum and push down to get the testicles out.)

1. Emasculator—Once the scrotum is cut the testicles are grasped and stretched downward to expose the spermatic cord. The emasculator is placed on the spermatic cord with the nut facing the testicle. The emasculator will crush and cut the spermatic cord. The advantage of this method is that the castration procedure is done and over and guaranteed successful. The disadvantages are increased training is needed and increased infection risk. It is a bloody procedure, and proper restraint is critical.

Tail Docking

Tail docking is removal of the tail.

Advantages:

- Keeps hind end cleaner reducing chances of fly strike (maggot infestation).
- Natural length tails could interfere with lambing, shearing, and breeding.

Disadvantages:

- Tails docked excessively short can lead to increased risk of rectal prolapse.

How to do it:

When:

Lambs 2-3 days of age is most common, best done when still small.

Where:

Depends on future purpose of lamb

Club lamb—as short as possible

Purebred show lamb—usually one joint or less is left

Commercial lambs—the third joint is the best, usually about the distance where the two skin flaps on the underside of the tail end, or about 1 ½ inches from the body.

With what: Discuss each with your veterinarian and choose the one that works best for you.

1. Elastrator—applies an elastrator band (small tight rubber band) on tail. The band constricts the blood supply to the tail after the band and it will shrivel up and fall off in 10-14 days depending on size of lamb. This method is bloodless and requires low labor needs. With dry weather conditions, it is the least likely method to result in an infection. This method is the method of choice for short docked lambs. The main disadvantage is increased tetanus risk and fly strike due to extended length of time the dead tail remains with the lamb.
2. Emasculator/Burdizzo—both of these tools crush the tail at the desired docking location. The emasculator will also cut off the remaining portion of the tail, while use of the Burdizzo would require the tail to be cut off using a sharp knife or scalpel just below where it was crushed. The advantage of this method is it is done and over with—the tail is gone. However, the disadvantages are increased bleeding, need for more expensive equipment, and increased labor skill.
3. Hot docking iron—heated by electricity, propane, or fire, these tools burn through the tail. Used properly, they cauterize the tail's blood supply thus preventing bleeding. Therefore there is little chance for blood loss and infection. However, if the iron is left on for too long or too short a time period, excessive amount or not enough tissue will be cauterized and infection is likely. The wound from hot docking may take longer to heal compared to docking with an elastrator band.

Coccidiosis

A parasitic infection most often in feeder lambs characterized by diarrhea, dehydration, loss of weight, and weakness.

Cause:

Protozoan parasite

Factors affecting outbreak:

- Rapid feed change
- Chilling
- Shipping fatigue
- Interruption of feeding during shipping time
- Survives best in wet warm environment

Treatment:

All lambs must be treated even if not showing clinical signs. If lambs are in the same group, they are most likely affected.

- Medicate feed or water
- Amprolium (1.25% crumbles) fed for 21 days or used in water
- Sulfamethiazine
- Electrolytes and vitamins can be added to water to replace those lost due to diarrhea

Prevention:

- Lasalocid (Bovatec) included in ration
- Deccox included in ration or loose salt mix
- Proper design of facilities to prevent fecal contamination of feed and water

Rectal Prolapse

A rectal prolapse occurs when the rectum protrudes from the anal opening. They are most prevalent among feedlot lambs 6-12 months of age.

Possible Causes:

- Genetic (hereditary weakness)
- Continuous coughing (pneumonia or dusty environment)
- Overly short tail docking
- High concentrate feeding leading to excessive fat deposition in pelvic canal
- Repeated growth implantation
- Straining from other diseases such as coccidiosis or urinary calculi (stones)

Treatment:

Depends on severity: (Ask your veterinarian for assistance the first time treatment is desired).

If goes in and out of anal opening:

- Clean off prolapsed portion (mild soap/disinfectant and water).
- Reinsert into anal opening.
- Use a 2" 18 gauge needle to inject 7% iodine (or other veterinary recommended solution) at 12, 3, 6, and 9 o'clock around the anus.
- Insert the needle its entire length keeping it parallel to the rectum. Inject 1 mL of recommended solution at each site.

If remains outside of anal opening:

- Use a rectal ring or 12 cc syringe case to tie off prolapsed tissue.
- Clean off prolapsed portion.
- Insert ring or tube into rectum—where grooved section is equal with anal opening.
- Tie off with umbilical tape (tightening enough to cut off circulation) or use an elastorator ring.
- Prolapsed tissue will slough off in about 4-5 days.

If animal is close to market weight, slaughter would be the best option.

Prevention:

Do not keep any male or female lamb that has prolapsed for future breeding as their offspring may also prolapse. Culling of mature ewes that have had multiple lambs prolapse should also be considered. The best prevention is to decrease the primary conditions that can lead to rectal prolapses: pneumonia cases/dusty environments to prevent the continuous coughing; coccidiosis; urinary calculi; and too short tail docking. Be sure to keep lambs at proper condition (see body condition scoring fact sheet) not allowing them to become excessively fat (especially important for replacement ewe lambs).

Sore Mouth

"ORF" "Contagious Pustular Dermatitis" "Contagious Ecthyma" "Scabby Mouth"

CONTAGIOUS TO HUMANS

A highly contagious viral infection that causes scabs around the mouth, nostrils, eyes, and may infect udders of lactating ewes.

Causes:

Virus—Family Poxivirdae, Genus Parapoxvirus
The virus penetrates through small abrasions in the skin. Generally affects mouth, udder, and feet.

Treatment:

- Particularly unrewarding because it is a virus
  - Within a few weeks, the disease will clear up on its own
- Ewes with affected teats / udders:
  - Need to be watched carefully since ewe will be more prone to mastitis infection. In a worst-case scenario, the lambs should be removed from the dam and raised artificially! (Do NOT foster lambs onto another ewe as she may become infected.)

Prevention and Control:

- Prevention can only be successful by maintaining a closed flock
- Vaccination is available—However, the vaccine should NEVER be used in a flock that has never had the disease, as it will introduce the disease onto the farm. The vaccine does not prevent sheep from becoming infected with the natural virus, but it should reduce the degree of damage and shorten the course of the infection both in individual animals and in the flock as a whole.
- Proper disinfection of premises where outbreaks have occurred is important, but complete disinfection is often very difficult.

Tetanus

Causes:

Most often invades tail docking and castration wounds / areas. The use of elastorator bands, leaving a dead anaerobic environment may increase the risk of tetanus infection. Also invades deep puncture wounds.

Treatment:

Often NOT effective unless very early detection of disease.
PREVENTION IS KEY!

- Clean any noticeable wounds—cut open to allow air to penetrate wound. Rinse with hydrogen peroxide
- Penicillin to kill Clostridium tetani bacteria
- Tranquilizers to reduce frequency of convulsions
- Good supportive care will be required as lamb is unable to eat or drink

Prevention:

- Proper vaccination—vaccinate ewes 2-6 weeks prior to lambing to protect lambs through colostrum (provides protection for 12-16 weeks of life).
- If NOT vaccinated. Give 300 to 500 units of tetanus antitoxin at time of docking and / or castration (protects the animal for 10-14 days).

Urinary Calculi

A metabolic disease in which stones are formed in the urinary tract. Blockage of the urinary tract may result in retention of urine, abdominal pain, distention and rupture of the urethra, loss of appetite, a humped up appearance, edema under the belly, urine dribbling, kicking at the belly, and frequent attempts to urinate. If untreated, it will lead to DEATH.

Causes:

- Low water intake due to cold weather or unpalatable water
- Ration incorrectly high in Phosphorus and Potassium and low in Vitamin A
- "Hard" water
- More prevalent when only pelleted feed is fed
- Castration < 4 weeks of age can lead to decreased urethral diameter
- Sorghum-based rations and cottonseed meal and milo feed ingredients

Treatment:

- If bladder has ruptured—no treatment is possible—euthanasia
- Surgical treatment (by veterinarian)
  - Amputate tip of penis—urethral process
  - Divert penis so ram urinates from a position similar to females
- Muscle relaxants—may or may not improve condition

Prevention:

Correct underlying problems—clean water offered at all times; warmed water in winter.

- Proper ration formulation
  - 2:1 calcium-to-phosphorus ratio in the total ration
  - Common salt can be added to ration—1-4% usually adequate
  - Ammonium chloride—2% of concentrate ration
  - Adequate vitamin A levels

Body Condition Scoring
(BCS)

A system used to estimate muscle and fat coverage on sheep. A scale of 1-5 (thin to fat) is used.

Advantages:

- Allows optimal management for ewes and rams throughout the year to maximize productivity.
- Important ram times:
  1. Prebreeding—want him in BCS of 3.5-4.0, he won't be eating a lot during mating season.
  2. Postbreeding—need to assess how much condition needs to be put back on for next breeding season.
- Important ewe times:
  1. Prebreeding—certainly greater than 2.0, 3.0-3.5 best.
  2. Midgestation—if you do it now, you have time to make adjustments before lambing time
  3. Late gestation—best to maintain around 3.0-4.0, need adequate body condition to support lamb growth and lactation, but not too much to cause excessively large lambs and lambing problems.
  4. Weaning—useful to divide ewes into groups to insure proper BCS for next breeding

Disadvantages:

- NONE! Get out there and do it.

How to do it:

Body condition is estimated by feeling for the bones of the sheep's spine. Slight pressure is used to feel the muscle, fat, and bones along the top of the sheep back (spinous processes) and on the side behind the ribs and in front of the pelvis (transverse processes). The amount of bone, muscle, and fat that is felt is graded on a scale of 1-5.

	Score	Spinous Processes	Transverse Processes	Loin Muscle and Fat
Thin	**1**	Sharp and stick up	Sharp and finger easily pushes under ends	Loin muscle concave, no fat
Okay	**2**	Less sharp	Fingers can push under with little pressure	Loin muscle moderate depth, no fat
Ideal	**3**	Stick up slightly, smooth and rounded, firm pressure needed to detect each one separately	Smooth and covered, firm pressure required to push fingers under ends	Loin muscle full and some fat cover
Okay	**4**	Can be just felt and level with flesh on either side	Ends cannot be felt	Loin muscle full and thick fat cover
Fat	**5**	Cannot be felt at all, hollows in back	Cannot be felt	Loin muscle fully developed, thick fat cover

Flushing

Flushing is a management practice of improving ewe's plane of nutrition just prior to breeding to attempt to increase the ovulation rate and thus the number of lambs born per ewe.

Advantages:

- Ewes are in better physical condition for breeding.
- Synchronizes ewes bringing them into heat at about the same time.
- Estimate increase of 18-25 percent in number of lambs born.
- Flushing rams may also help with libido and sperm production.

Disadvantages:

- Flushing is not effective if ewes are over or severely under conditioned prior to breeding (see body condition scoring fact sheet).
- Adequate nutrition must be available to ewes late in gestation and lactation to support increased number of lambs.

How to do it:

- Corn, alfalfa hay, or improved pasture can be used as nutritional source.
- Start flushing 2 weeks before introducing ram into breeding group.
- Increase amount fed per head starting with ¼ pound each day, increasing that amount ¼ pound/head/day.
- Finish by feeding ½ pound/head am and pm.
- Discuss with your veterinarian the proper length of time to feed ewes. Depending on body condition, times will vary.

Hoof Trimming

Advantages:

- Prevent lameness
- Provide good footing on all toes

Disadvantages:

- None, get out there and do it.

How to do it:

- First, proper restraint is needed. Sheep can be flipped and held in the "dog sitting" position or sheep cradles/turn tables could be used.
- Equipment:
  1. Hoof pruning shears are the most common.
  2. Pneumatic shears are also available but more expensive.
- Scrape away all dirt from bottom of hoof.
- Trim the hoof wall back to the level of the foot pad.
- Trim off excess growth on the tip of the toe as well.
- Stop trimming when level or the hoof looks pink. A pink color means you are getting close to the blood supply to the foot.
- If bleeding occurs cover wound with Kopertox®.
- If trimming a lame sheep look for any signs of infection, a lump of mud, a stone, or other sharp object that could be lodged into hoof.
- The number of times per year the hooves need to be trimmed depends on the surface they are housed on and how fast the hooves grow. Ask your veterinarian for his/her suggestion on frequency.

Acidosis

"Grain Engorgement" "Acute Ingestion" "Founder"

A metabolic disease characterized by depression, loss of appetite, recumbency, loss of consciousness, and death. Diagnosis can be confirmed through necropsy by examining the rumen contents for concentrates and testing the contents for an acid pH.

Causes:

Excessive production of lactic acid in the rumen due to a sudden engorgement of grain or other high-carbohydrate content feeds, or in feedlot lambs fed high grain / low roughage diets that the rumen is not properly adjusted to.

Treatment:

Rarely possible as progression of disease is very fast.

- Early suspected cases:
  - Drench with antacid; Magnesium hydroxide in water including 1,000,000 units of penicillin orally.
  - Place on roughage diet
  - Observe closely
- If down or comatose
  - Drench as above
  - Intravenous therapy of bicarbonate
- If grain engorgement is seen in a valuable animal an emergency rumenotomy (by your veterinarian) to remove all rumen contents may be indicated

Prevention:

Ensure all feed storage supply is located out of sheep access. Make all diet changes including increased concentrates gradually.

Caseous Lymphadenitis
CLA

A bacterial infection characterized by abscessation of lymph nodes and internal organs. It is a chronic and recurring disease. Economic losses occur due to reduced weight gain, reproductive efficiency, and wool and milk production. Condemnation of carcasses and devaluation of pelts can also occur.

Causes:
- A bacterial infection caused by Corynebacterium pseudotuberculosis
- Infection most often occurs through superficial skin wounds that are contaminated with material from ruptured abscesses from other sheep
- The bacteria are able to penetrate unbroken skin and the mucous membranes
- Ruptured superficial and lung abscesses are the primary sources of environmental contamination
- Contaminated dipping vats and shearing, handling, and feeding equipment are responsible for the spreading of the organism
- The bacteria can survive for months in hay, shavings, and soil

Treatment:
- The formation of thick walled abscesses limits the penetration and effectiveness of antibiotic treatment
- Standard treatment includes draining of abscesses and thorough cleaning with antibiotics placed directly in the abscess
- Surgical resection is also possible
- There is a high rate of recurrence
- Emaciated animals and those with recurrent abscesses should be culled

Prevention:
- Young lambs should be raised isolated from infected older animals
- Older animals and those with abscesses should be sheared last
- Disinfect equipment whenever it is contaminated with infected material
- Skin wounds should be treated topically with proper disinfectant and sutured if necessary
- Vaccination is available—However it only reduces the incidence and prevalence of disease. Vaccination does not prevent all new infections, nor will it cure animals already infected
- All incoming animals should be tested before admittance into flock

Eradication:
- The current status of the flock can be determined by blood test (once vaccinated, they will test positive!)
- The cost effectiveness of culling all infected sheep must be determined
- For complete eradication—all positive animals need to be culled, and maintain a closed flock (or test all incoming animals before arrival)
- Selective culling may be used if the economic losses caused by caseous lymphadenitis may not be sufficient to justify removal of all infected sheep

Hypocalcemia

"Milk Fever" "Calcium Deficiency" "Lambing Sickness" "Parturient Paresis"

Calcium demands of the ewe are high during late gestation for fetal bone development and early lactation for milk production. During these high demand times, high enough levels of calcium cannot be obtained from the diet alone. If the ewe is unable to move calcium from her own bones in great enough amount to maintain normal blood levels, hypocalcemia results.

Clinical signs usually appear suddenly. The earliest signs are slight hyperexcitability, muscle tremors, and a stilted gait. Progression leads to the ewe losing the ability to stand. She is often found lying on her brisket with her hind legs extended backwards and her head, either turned into the flank, or stretched out forward. The rumen muscles are also affected. Therefore, bloat may also occur. If untreated, death usually occurs within six to 48 hours.

Causes:

- Improperly formulated late gestation rations—especially calcium, phosphorous, and magnesium levels
- Abrupt feed changes
- A time period without feed
- Increased risk in older ewes—older ewes can not release calcium from their bones as fast as younger ewes

Treatment:

A MEDICAL EMERGENCY

- Intravenous injection gives the fastest response to treatment but is also the most dangerous treatment due to calcium's effect on the heart
  - 50-100 ml of 20% Calcium gluconate intravenously
- Subcutaneous injections can be done by the less experienced shepherd, but the response time to the treatment will be longer
  - 100 ml of 20% solution Calcium borogluconate with added magnesium and phosphorus given subcutaneously over 2 to 3 sites

Prevention:

- Need to provide ewes with adequate, although not excessive, amount of calcium. Recommended levels of 5-10 g/day.
- Calcium to phosphorus ratio between 1:1 and 2:1
- Sufficient Vitamin D in diet (allows absorption of calcium)
- Good-quality protein (allows proper absorption of calcium and phosphorus)
- Gradually introduce ewes to concentrates at least 6 weeks prior to lambing

Johne's Disease

A chronic, progressive, contagious infection characterized by muscle wasting, ill-thrift, emaciation, and weakness. Unlike in cattle, diarrhea is usually not seen due to this disease. Sheep are infected as lambs, but due to long incubation period may not show signs for years.

Causes:

- A bacterial infection caused by Mycobacterium paratuberculosis
- Transmitted from infected older animals to young
- Transmitted through ingestion of infected feces by lambs either from nursing dirty ewes or eating/drinking contaminated feed/water

Treatment:

- No treatment is available

Prevention:

- Must prevent exposure of healthy sheep to infected animals
- Any purchased animal should be tested before addition into the new flock
- It is critical to prevent the contamination of feed and water with feces

Eradication:

- The current status of the flock can be determined by blood test
- The cost effectiveness of culling all infected sheep must be determined
- For complete eradication—all positive animals need to be culled; maintain a closed flock (or test all incoming animals before arrival); and only retain replacement ewe lambs from negative females
- Selective culling may be used if the economic losses caused by Johne's disease may not be sufficient to justify removal of all infected sheep

Ketosis

"Pregnancy Disease" "Pregnancy Toxemia" "Twin Lamb Disease"

A metabolic disease characterized by numerous signs depending on severity. Ewes with early pregnancy toxemia are dull and lag behind the flock. Additional signs may include grinding of teeth, labored breathing, frequent urination, a general unsteadiness, walking in circles, or pushing against solid objects. In later stages, the animals are unable to stand. Animals that progress to recumbency usually die within a few days.

Cause:

A disease of inadequate caloric intake. The energy demands put on the ewe late in pregnancy by the growing fetus(es) is great. At the same time, the ewe's rumen capacity decreases as the fetus(es) take up more of the abdominal cavity. When the ewe cannot eat enough calories to support her and the lambs, she breaks down her stored body fat supply, which leads to ketone production. Excessive fat metabolism leads to too high ketone levels = ketosis.

Treatment:

- Propylene glycol or corn syrup—2 ounces given orally twice a day for at least 4 days
- Electrolytes to combat dehydration
- Advanced cases:
  - Intravenous treatment with 250-500 ml of 10-20% glucose
- If no improvement is seen, termination of pregnancy may be necessary

Prevention:

- BODY CONDITION SCORE ALL EWES AT CRITICAL TIME PERIODS THROUGHOUT YEAR
- Avoid overly fat ewes early in pregnancy (leads to decreased feed intake)
- Encourage ewes to exercise daily
- Provide increasing level of nutrition in last 4-5 weeks of pregnancy
- Supply a constant source of palatable water (encourage feed intake)
- Feed regular amounts at regular times
- Give molasses in ration or drinking water (quick energy source)
- Make no sudden change in type of grain offered (decreases feed intake, upsets rumen digestion)
- Pay special attention to older sheep with poor teeth late in pregnancy
- Treat the feet of any lame ewe; she may not move around well enough to get adequate nutrition.

Ovine Progressive Pneumonia

OPP, Maedi-visna

A slowly progressive virus characterized by pneumonia, arthritis, meningitis, and mastitis. The most common clinical signs are non-responsive pneumonia, physical weakness, dyspnea, and emaciation. Early on, the only signs may be a bilaterally hard udder upon lambing that usually resolves in a few days and falling behind when the herd is moving. Sheep are usually infected as lambs (but adult-to-adult transmission can occur), but due to long incubation period may not show signs for years.

Causes:

- Retrovirus—Lentivirus
- Transmitted mainly through colostrum from dam to offspring
- Also passed through respiratory secretions

Treatment:

- No treatment is curative
- Can only reduce clinical signs
- Culling infected animals is the best treatment

Prevention:

- Must prevent exposure of healthy sheep to infected animals
- Infected adult sheep must be isolated from the uninfected members of the flock
- Lambs from infected ewes must NOT be allowed to nurse from their infected mothers. They should be pulled immediately after birth and raised on a non-infected ewe or artificially
- Any purchased animal should be tested before addition into the new flock

Eradication:

- The current status of the flock can be determined by blood test
- The cost effectiveness of culling all infected sheep must be determined
- For complete eradication—all positive animals need to be culled; maintain a closed flock (or test all incoming animals before arrival); and only retain replacement ewe lambs from negative females
- Selective culling may be used if the economic losses caused by OPP may not be sufficient to justify removal of all infected sheep

Polioencephalomalacia

"Cerebral-Cortical Necrosis"

A metabolic disease characterized by loss of appetite, where the sheep is often found down on one side and paddling its feet, with its head thrown back.

Causes:

- Acute thiamine (Vitamin B-12) deficiency due to increased bacterial growth in rumen that produce thiaminase (the enzyme that destroys thiamine)
- Most often caused by a sudden change in diet which results in change in rumen bacterial growth, examples—flushing, feedlot

Treatment:

- Thiamine supplementation—10 mg/kg Thiamine hydrochloride twice daily for 2-3 days
- Dexamethasone—1-2 mg/kg for an anti-inflammatory
- Supportive care including feeding / fluids may be necessary
- Antibiotics may be beneficial in severely depressed recumbent animals

Prevention:

Polioencephalomalacia is a sporadic disease. The most effective preventative would be gradual feed changes to allow proper adaptation of the rumen microbes to the new feed supply. Careful monitoring of sheep during feed changes and early detection of signs increase treatment success.

Retained Placenta

A condition in which the placenta is not expelled normally after birth. Usually the placenta is expelled with hours after the last lamb is born. Even if a placenta "tag" cannot be seen coming from the vulva, a partial retained placenta can occur.

Possible Causes:

- Hormone imbalance
- Vitamin E / Selenium deficiency
- Premature birth
- Infection
- Dead/Putrefying lambs in uterus
- Prolonged lambing which exhausts the ewe
- Inadequate relaxation of the birth canal
- Low blood calcium levels
- Magnesium deficiency

Treatment:

Treat underlying cause if possible.

Infection—antibiotics (Penicillin or Oxytetracycline)
Swelling / Inflammation—anti-inflammatories (Banamine or Aspirin)
Low blood calcium levels—calcium supplementation
Selenium / Vitamin E deficiency—Selenium / Vitamin E supplementation

DO NOT FORCIBLY REMOVE PLACENTA!
It will eventually decompose and is usually voided within a week or ten days. Attempting to remove the placenta could cause it to rip leaving smaller pieces in the uterus / vagina.

Prevention:

Not all causes of retained placentas can be prevented. However, if a significant proportion of ewes in the flocks retain the afterbirth, then further investigation should be done. Increased calcium or vitamin E supplementation before the lambing season may be beneficial.

Uterine Prolapse

A uterine prolapse occurs only after lambing. The uterus is seen as a large red mass protruding from the vulva. A uterine prolapse must be considered a MEDICAL EMERGENCY!

Possible causes:

- Difficult birth
- Delivery of large lamb(s)
- Low calcium levels

Treatment:

Veterinary assistance may be necessary to provide pain relief so ewe does not continue to strain during and after replacement of prolapsed uterus.

Getting ewe ready for replacement by a veterinarian:

- The uterus must be protected from heat loss, injury, and infection.
- Wrap ewe in old bed sheet—take one end of the sheet between the ewe's legs and under her belly tying the ends over her spine. Then take the other end back between her hind legs, enveloping the uterus, and tie the two corners to the knot over her spine.

Replacing the uterus:

- Professional instruction by your veterinarian is advised before attempting to place your first uterine prolapse.
- Place the ewe with her hind end elevated—hanging ewe over two bales works well.
- Using large quantities of warm water with very mild soap or diluted disinfectant, rinse the uterus removing as much dirt as possible.
- A lubricant may be beneficial when attempting replacement.
- Use both hands to cup the uterus, gently push back into ewe.
- Once uterus is replaced, the organ must be felt inside the ewe to ensure that it is properly placed back inside the ewe. If any portion of the uterus is still turned inside out, the ewe will continue to strain and will prolapse again.
- Keep uterus in place by using a Bearing retainer (prolapse retainer) tied to wool or attached to a harness, or sutures. Ask veterinarian for assistance the first time treatment is needed.
- Systemic antibiotics are recommended: consult your veterinarian on choice of antibiotic and dosage. Your veterinarian may also recommend an injection of calcium.

Prevention:

Prevention of uterine prolapses may not always be possible. Body condition scoring to ensure that ewes do not become overly fat late in gestation is beneficial. Ram selection could also play a role with certain sires leading to larger offspring. Careful monitoring of ewes and quick treatment is the key to successful repair. Consult with your veterinarian about calcium levels in your late gestation ewe ration.

Vaginal Prolapse

A vaginal prolapse occurs when the vagina protrudes through the vulva in ewes. They occur most often during late pregnancy. Early detection is key as this condition usually worsens as time goes on if not treated.

Possible causes:

- Genetic (hereditary weakness)
- Increased abdominal pressure during late pregnancy
- Feeding too much roughage (increases abdominal size and pressure)
- Over conditioned ewes with lots of fat in abdominal cavity/pelvis
- Continuous coughing due to pneumonia/dusty environment
- Deficiency of vitamin A
- Overly short tail docking

Treatment:

Veterinary assistance may be necessary to provide pain relief so ewe does not continue to strain during and after replacement of prolapsed vagina.

- Clean off prolapsed portion (mild soap/disinfectant and water).
- Elevate hind end of ewe to allow easier replacement of vagina (hanging ewe over 2 stacked bales of straw or hay is usually very effective).
- Reinsert into vulva opening. Be careful for urine output if urinary opening was previously blocked. Lubrication may be necessary.
- Keep vagina in place by using a Bearing retainer (prolapse retainer) tied to wool or attached to a harness, or sutures. Ask veterinarian for assistance the first time treatment is needed.
- Careful monitoring of ewe is needed as retainer may need to be removed before lambing can occur (sutures MUST be removed to allow lambing to occur).

Prevention:

Do not keep any female that has prolapsed for future breeding as her offspring may also prolapse. Culling of mature ewes that have had multiple lambs prolapse should also be considered. The best prevention is to decrease the primary conditions that can lead to vaginal prolapses: pneumonia cases/dusty environments to prevent the continuous coughing, and too short tail docking. Be sure to keep ewes at proper condition (see body condition scoring fact sheet) not allowing them to become excessively fat. Proper nutrition during late gestation (decreased roughage) would also benefit the ewes.

Diseases of Nursing Lambs

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1. Colibacillosis (E. coli scours, watery mouth)
   - Economic importance
   - Crowding and unsanitary facilities
   - Habitually used lambing sheds without cleaning
   - Lambs 2-3 days of age affected with diarrhea, 2-6 weeks of age septicemia
   - More common in lambs born from late winter to early spring
   - Spread from feces, contaminated water and feed supplies
   - Feces is semifluid and yellow to gray in color, occasional blood and mucus, abdominal pain, hunched up

2. Colostrum Deficiency
   - Functions: contains nutrients for fuel, prevents hypothermia; contains growth factors which promote gut growth and differentiation; contains immunoglobulins, some line the gut and some are absorbed into the blood stream
   - How much does a lamb need: 210 ml/kg of body weight in field conditions during the first 18 hours; 180ml/kg in housed animals
   - Milking donor ewes
   - Freeze storage: oxytocin use; milking the first day three times should yield 850 ml to 2400 ml of colostrum
   - Feeding goat colostrums: similar composition as sheep
   - Use only CAE negative colostrums; CAE is similar to OPP in sheep
   - Cow colostrums: increase the volume by 40%; feed only the first day or two or hemolytic disease can occur

3. Enterotoxemia (overeating, pulpy kidney)
   - Clostridium perfringens type D is the causative agent
   - Sudden death, convulsions and hyperglycemia
   - Occurs more commonly in ewe than in wether lambs and in singles rather than in twins
   - Young sheep suckling, eating concentrate and succulent forage feed are especially susceptible
   - More common in spring and early summer
   - Prevented by vaccination and management
   - Vaccinate pregnant ewes
   - Protection extends between birth and 5 weeks of age

4. Coccidiosis
   - Hemorrhagic diarrhea, depression, weakness, weight loss
   - Common disease in feedlot lambs but also affects nursing lambs 1-3 months of age
   - Eimeria species
   - Transmitted through consumption of feed and water contaminated with sporulated oocysts
   - All adult sheep and most pasture lambs are carriers
   - Diarrhea, dehydration and rectal prolapses are common
   - Control: management
   - Prevention with: amprolium, monensin, lasalocid, decoquinate
   - Treatment with: sulfa drugs, amprolium, dapsone, toltrazuril

5. Parasitic Gastroenteritis
   - Animals 2-24 months of age are highly susceptible
   - Nematode gastroenteritis: caused by ten major parasites
   - Ingest infective larvae on contaminated forage
   - Most common in late spring, summer and fall
   - Fecal diagnosis with sugar float method by a veterinarian or diagnostic lab; cheap assurance that deworming is needed
   - Prevention: management- pasture rotation, avoid overstocking and insure adequate nutrition
   - Anthelmintics: levamisole, Ivermectins, fenbendazole, albendazole

6. Hypothermia/Starvation
   - Exposure to adverse weather conditions
   - Balance between heat loss by the lamb and that metabolically produced
   - Causes: combination of wet birth coat, climatic conditions, ewe that is slow to lick and dry the lamb; starvation or lack of colostral absorption (hypoglycemia)
   - Lambs affected in the first 5 hours of life have a heat loss problem; those after 5 hours have a heat production problem
   - Prevention: management

7. Border Disease (hairy shaker disease, BVD)
   - Birth of weak lambs, trembling, hairy lambs, poor thriving lambs
   - Caused by border disease virus (BDV)
   - Disease related to BVD in cattle
   - Isolate lambs and ewes from rest of flock
   - Separate sheep from cattle
   - BVD vaccines???

8. Tetanus (lockjaw)
    - Clostridium tetani
    - Incubation 3-10 days
    - Injury: shearing cuts, castration, docking, punctures, cuts
    - Stiff gait later progressing to rigidity; can't eat, many times looks like pneumonia in the early stages; clap test
    - Vaccination: toxoid vs antitoxin
    - Vaccinate dams for colostral passage; passive protection lasts 12-16 weeks
    - Clean wounds
    - Elastrator band?

9. White Muscle Disease (stiff lamb disease)
    - Affected from birth to six months of age
    - Those born of severely deficient ewes may abort
    - Lambs are stiff and are commonly confused with joint ill
    - Common when feeding silage or old hay
    - Inhalation pneumonia can occur from weak muscles
    - Adults commonly retain placentas
    - Supplemental feeding of vitamin E/selenium
    - Treatment of ewes twice yearly in deficient areas, one treatment is given to ewes 4-6 weeks prior to lambing

10. Pneumonia
    - Inhalation of milk, medicines
    - Overcrowding
    - Inadequate ventilation
    - Vitamin E/selenium deficiency in ewe in late gestation
    - Prevention: management

11. Lamb dysentery/diarrhea
    - K99 E. coli
    - Salmonella species
    - Clostridium perfringens type C
    - Rotavirus
    - Cryptosporidum species
    - Coccidia species
        - Lamb dysentery: affects strong lambs under 2 weeks of age
        - Clostridium perfringens type B
    - Abdominal pain, lacks suckling response, semi fluid blood stained feces
    - Prevention: management, vaccination

12. Miscellaneous
    - Eye infections secondary to entropion
    - Joint ill
    - Naval ill
    - Fractures
    - Fractured ribs
    - Umbilical hernia
    - Incorrect castration

Small Ruminant Reproduction—Sheep Reproduction

Department: Clinical and Population Sciences
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Managing the Reproductive Flock

BCS as will be discussed later is a tool of extreme importance in the management of the reproduction of a flock's reproductive performance.

- Subjective scoring; importance in maintaining consistency
- Palpate over the spinous and transverse processes, over the cranial ribs and twist
- Evaluate all animals including rams
- Evaluate feet and legs
- Bag out or evaluate ewe's mammary glands

Ram-to-Ewe Ratio

Mature Ram in Rough Terrain: 1:20-30 ewes
Mature Ram in Small pasture: 1:40-75
Mature Ram in Synchronized flock 1:10-12
Immature Ram in Small Pasture: 1:20-25
Immature Ram in Rough Terrain: 1:10-12

- Estimates as to the number of breeding rams necessary to cover ewes within a breeding flock
- Ranch/farm terrain needs to be taken into account
- Animal breeding experience
- Estrous synchronization techniques utilized?
- Pasture size, water sources, and shade

Sheep Abortive Diseases

- Abortion rate should not exceed 5% of the lambing flock to be considered normal
- What is the stage of gestation?
- Primiparous or multiparous
- Nutrition program
- Weather conditions
- Secondary diseases evident
- New animal introductions
- Toxins potential ingested

Enzootic Abortion of Ewes (EAE)

- Chlamydia psittaci immunotype 1
- Elementary body formation
- Post infection abortion 50-80 days
- Late term abortion
- Animals post abortion are immune for 3-4 years; however, these may become carriers
- Oral and conjuctival contamination is the most common form of infection
- It is not a venereal disease
- Abortion is the primary sign; prior to day 105 of gestation fetal resorption can occur.

This would reflect in an increase in infertility within the flock

- Weak still born lambs as well as near term abortions and mummies

Dx

- Severe placentitis with a thickened tissue structure, cotyledons are gray to red in color with inflammation in the intercotyledonary areas as well. This is diagnostic for the disease in sheep.
- Ziehl-Neelson staining of impression smears for diagnosis; organism isolation via cell culture
- Paired serum titers 3-4 fold greater.
- DDx Brucella and Tick borne disease (Coxiella burnetii)
- Treatment/prevention: tetracycline fed at from day 50 on of gestation or long acting tetracycline injections
- Separate pregnant and aborted ewes

Bluetongue Virus

- Orbivirus that is arthropod borne
- Endemic in the south and western portions of the US
- Serotypes 10, 11, 13, 17
- Virus is transmitted by the Culicoides gnat
- Seasonal occurrence associated with the occurrence of the gnat

Signs
- Fever, swollen face and tongue
- Ulcers of the face, lips and feet
- Can infect feti with deformities and hydranencephaly

Dx
- Virus isolation
- Serology
- Vaccine available

Salmonella
- S. abortus ovis, S. Dublin, S. arizonae, S. typhimurium,
- S. abortus ovis is the most common isolate
- Persistent infection is common with flock carriers evident; fomites and birds also act as carriers
- Weather stress conditions and poor nutrition can commonly precipitate the disease
- Incubation is 2-3 weeks
- Feti are aborted, born weak or stillborn in late gestation with a high rate of abortion of up to 80% of the exposed animals
- Fever, diarrhea
- Common to see post-lambing metritis and retained placenta
- Culture the placenta and the lambs stomach contents
- Treat flock with appropriate antibiotics

Border Disease (BDV)
- "Hairy shaker" lambs
- Border disease virus is a pestivirus
- Very similar to BVD
- Viremia for about a week
- Fetuses infected prior to day 85 commonly are resorbed, aborted or mummies occur
- Teratogenisis is common

Dx
- Virus isolation from buffy coat or infected lambs
- Persistent carriers
- Paired serum titers
- Separate pregnant sheep from cattle
- Vaccinate cattle

Campylobacter (Vibriosis)
- C. jejuni and C. fetus subspecies fetus
- Gram-negative rods
- Generally associated with large abortion storm disasters
- Carrier sheep seem to be the most prevalent cause
- Incubation up to 80 days
- Placentitis
- Aborting ewes are protected for up to 3 years post infection

Signs
- Abortion usually in mid to late gestation
- Ewes not ill
- Placenta is edematous, cotyledons are swollen
- Fetus is emphysematous
- Feti with peritonitis, pleuritis and hepatitis

Campylobacter (Vibriosis), Cont.

Dx
- Cotyledon impression smears
- Submit fetal stomach contents

Tx
- As with all outbreaks it is wise to put all animals on tetracycline as a preventive; cultures and sensitivities should be performed to insure resistance has not developed within the flock

Leptospirosis

- Leptospira interrogans serotype hardjo
- Usually spread from cattle or wildlife
- A rare cause of abortion unless in intensive operations
- Ewe's abort, stillborns and weak lambs
- Pyrexic
- Diagnose with paired serum titers
- Tetracycline is the treatment of choice

Toxoplasma

- T. gondii
- Protozoa
- A very common cause of abortion in sheep and goats
- Usually seen with large numbers of cats
- Abortions at all stages of pregnancy usually 14 days post ingestion of the organism
- Infection prior to day 40: resorption and apparent infertility
- Infection from day 40-120: mummies, abortion and maceration
- Infection from day 120 on: stillbirths or weak lambs

Dx
- Placenta!!!!!!!!!
- Cotyledons are red to tan in color; white pinpoint calcified foci
- Intercotyledonary areas are free from infection
- Rising titer

Tx
- Feeding monensin or decoquinate

Copper Deficiency

- Common with excess Mo in diet
- Wwayback in newborn lambs
- Late term abortions

Brucella ovis

- Gram negative
- Common cause of epididymitis is rams
- Venereal disease
- Abortion in ewes that are not sick
- Stillbirths and weak lambs are common
- Placentitis is very common; thickened necrotic placenta commonly confused with EAE

Dx
- Blood titers are not always definitive
- Culture is the key to diagnosis- placenta as well as fetal stomach contents
- Ram serology is another good tool
- Vaccination coverage is poor

Listeria

- Listeria monocytogenes
- Two sub species: sensu stricto and ivanovii
- Contaminated silage
- Incubation of 7 days
- Silage feeding
- Abortion followed with metritis
- Autolyzed feti
- Microabscesses in the fetal liver
- Treatment/prevention: tetracycline

Tick Borne Abortion (Coxiella burnetii)

- Rickettsia
- Oral and respiratory spread
- Placentitis is common thickened intercotyledonary areas
  - Yellow cotyledons
- Stillbirths, weak lambs and abortion
- Ewes usually become immune for life post abortion

Dx
- Ziehl-Neelson staining
- Paired serum titers
- Organism isolation

Treatment/Control
- Tetracycline

Diseases of Rams

Epididymitis

- Very common in rams
- B. ovis, Histophilus spp.
- Actinobacillus spp
- Corynebacterium pseudotuberculosis
- Normally palpated in epididymitus along the median raphe
- Swelling, atrophy, enlargement, fibrosis

Orchitis

- Corynebacteria pseudotuberculosis
- Coliforms
- Pseudomonas
- Brucella ovis

Scrotal hernia

- Genetic
- Distension and freely moveable bowel loop

Ulcerative Posthitis

- Infectious and inflammatory condition of prepuce and penis of the ram
- Sheath rot/pizzle rot
- Gram-positive organism Corynebacterium renale
- Animal kicks at abdomen with stiff gate
- Failure to urinate or extend penis
- Scabs and ulcers
- Prepucial orifice is reduced in size or completely occluded with scabs
- Many times the sheath is urine filled
- Treatment with “petercillin”
- Decrease protein level in feed

Varicocele

- Dilation and tortuosity of the vasculature of the pampiniform plexus and cremaster veins
- Associated with testicular atrophy
- Decreased semen quality
- Heat exchange problems
- Ultrasound diagnosis

Cryptorchid

- Not uncommon
- Genetic
- Cull

Management

BCS

- Range from 0-5
- Most breeding animals are considered in good flesh between 2.5 and 3.5
- Be sure not to forget to BCS the rams
- The most over looked theriogenology tool

BSE

- Brucella ovis titers ELISA
- Feet and legs/ body conformation/libido/structural soundness
- Check feet for foot rot, skin for external parasites/fungal lesions
- Check penis for pizzle rot; extend to check penis and prepuce for adhesions
- Palpate testicles and epididymitis: note tone and firmness, swelling (hernia) atrophy
- Measure testicular circumference at the widest point
- The circumference can vary by season, especially if the ram has been exposed to a breeding ewe
- We generally electroejaculate the ram

Evaluate

- Progressive motility
- WBC's
- Morphology for defects (100 count)
  - Head defects
  - Detached heads
  - Tail defects
  - Artifacts
  - Acrosomal defects
  - Cytoplasmic droplets

BSE Classifications				
Age	**Excellent**	**Satisfactory**	**Questionable**	**Unsatisfactory**
6-12 months	SC>33 cm Mot>50% >90% Norm	SC>30 cm Mot>50% >70% Norm	SC<30 cm Mot<70% <70% Norm	SC<30 cm Mot<30% <50% Norm
12-18 months	SC>35 cm Mot>50% >90% Norm	SC>33 cm Mot>30% >70% Norm	SC<33 cm Mot<30% <70% Norm	SC<33 cm Mot<30% <50% Norm

Artificial Insemination/Embryo Transfer Techniques

Artificial insemination and embryo transfer has limited use within the sheep breeding community. Economics of sheep breeding preclude its use to a large degree. Most sheep are of a limited value: ewes ($150-1500) and rams ($200-1500). Secondarily the ewe's anatomy precludes the easy passage for trans-cervical techniques.

ET Program

- Superovulation
  - Follicle Stimulating Hormone (FSH)
  - PMSG
  - PMSG and FSH
  - PG-600
- Surgical embryo collection
- Laprascopic embryo collection
- Transfer of embryos-surgical vs. Laprascopic

Artificial Insemination

- Vaginal insemination: must utilize large volumes of fresh or chilled semen
- Transcervical insemination: poor success rates
- Transcervical Intrauterine Insemination
- Laprascopic Intrauterine Insemination: high success rates

Synchronization of ewes for A.I.

Day 1	Progestin started
Day 12	Progestin removed
	Inject PG-600
Day 13	Tease with vasectomized ram
Day 14	AI
	6-8 hours later second AI

Breeding Management Programs

Hormone programs of estrus synchronization

- Pros: more efficient breeding season, more uniform lamb crop, off-season breeding
- Cons: cost, more ram concentration, impaired fertility, hydrometria, and maternal rejection problems
- These should be explained to the client prior to implementing the program

Hormonal Programs

- Uses: summer breeding programs, synchronize breeding during the normal breeding season, breed during the winter and spring months
- Teaser rams are necessary for the success of the program. The number of ewes cycling normally must be determined
- Pregnancy check the ewes prior to initiating this program, This will help ensure that mistakes are not made

Programs Available

- Oral Progestin agents: MGA (melengesterol acetate) is fed to the breeding ewes daily at a rate of 0.125 mg BID for 12-14 days
- Progesterone injections 10-25 mg SID IM
- Regumate (altrenogest) orally 1 ml/110 pounds of body weight SID for 14 days
- CIDR's (controlled Intravaginal drug releasing device): progesterone in silicone intravaginal implant 12 days followed upon removal with PG600 or lutalyse
- Progesterone vagnal pessary- common problems with application as well as loss
- Syncro-Mate-B (norgestomet) implants: subQ implant in the ear for 10 to 14 days. Usually use ½ of the bovine implant.
- Synchronization in cycling ewes: prostaglandin f2a will work on in ewes with a CL. After one injection in cycling 60+% of ewes will be in estrus within 48 hours. The second synchronization program utilizes two injections between 9-11 days apart.
- Anestrous breeding: progesterone treatment followed by gonadatropin treatment. Most of these programs vary their progesterone use of between 8-14 days. At the time of progesterone removal a gonadatropin (PMSG or PG 600) is given within 48 hours of removal. PG600 is a combination of PMSG and HCG. FSH products are also used. PMSG 400 IU during ancestral season and 200 IU during breeding season/ PG-600 400 IU.
- Early Spring and Summer programs: Progestin and gonadotropins. Progesterone for 8-14 days. Introduce teaser ram. Sixteen days after introduction PGF2a can be given to bring synchrony to the breeding females.
- Melatonin has been used to increase ovulation rates.

Parturition and Dystocia

- Ewes should be brought up close for observation one week prior to the proposed lambing period; 24-48 hours prior to parturition they should be placed in Jugs.
- Normal parturition should not be interrupted but allowed to go through the three stages of labor
- Crutching is recommended prior to lambing
- Booster vaccines and Deworm 30 days prior to lambing
- For diagnostics sample 2-5 % of the flock for serum Ca, P, Mg and Se. Body condition score 4 weeks prior to delivery
- Have cow or goat Colostrum frozen available
- Start coccidiostat 14 days prior to lambing

Dystocia

- Malposition of head (head back)
- Head only
- Elbow lock
- Foreleg malposition (leg back)
- Large single lamb
- Breech
- Transverse

Cesarean Section

- Sheep are of limited value
- Ventral approach is best but paralumbar is also acceptable
- Indications: torsion, vaginal prolapse, fetal monsters, ring womb, large fetus, unable to extract the big sucker.
- Anesthesia and restraint are the keys to success; watch your back, tables and hay bales can be helpful

Pregnancy Diagnosis and Ultra-Sound

- Estrus detection by ram; crayon marking system
- Serum progesterone 19-24 days
- Ballottement: after 100 days
- Radiography: after 70-90 days
- Real-time ultrasound >25 transrectal
  >35 transabdominal
  - Usually use between 3.5 and 7.5 MHz transducer
  - The lower the frequency the deeper the penetration, I prefer the 3. MHz
  - Sector transducer is preferred for transabdominal scanning
    - Normally scan between day 45-90 days
    - > range is 30-120
    - After day 90 it is hard to view the entire fetus
    - After day 110 it is impossible to do fetal counts
    - 80 days is the optimal time to scan
- Pregnancy diagnosis is based on several criteria: uterine distension, fluid, caruncles and fetal structures

Peripartorient Ewe Diseases

Hypocalcemia

- Lambing sickness, lambing ill
- 1-4 weeks pre-lambing
- Calcium, phosphorus and magnesium imbalance
- Down ewe, poor papillary light response
- Common confused with hypoglycemia by the farmer
- Blinded, head back to shoulder, bloat, death
- Calcium, phosphorus and magnesium levels decreased
- Vaginal prolapses are not uncommon in subclinical cases
- Pregnancy toxemia may go hand in hand

Dx

-Check urine ketones of flock, serum calcium on down animals, on post mortum animals cardiac blood clots can be spun and the calcium evaluated. This will reflect the true antemortem Ca levels.

Tx

- IV calcium SLOWLY, monitor heartbeat; usually 50 ml of the stock solution of calcium borogluconate (1000 mg calcium) IV. Many practioners also give 50 ml SQ as well
- Generally the subclinical flock is also treated with the SQ injection only

Management

- BCS the flock in the last 6 weeks of pregnancy anything under a 2.5 should be suspect
- Avoid low calcium diets in the last 4-6 weeks of gestation

Pregnancy Toxemia

- Also called twin lamb disease
- Usually in the last 4-6 weeks of gestation
- Fat ewes/thin ewes
- Poorly balanced ration; twins require 1.9 times the DMI of a normal single lamb, triplets require 2.3 times the amount
- Poor feed intake due to increased uterine size
- Changing weather patterns
- Check for dental disease, parasites
- Foot rot/lameness

Dx
- Slow progression
- Decreased food intake
- Separate from the flock when being moved or driven
- Depression, blindness, CNS signs
- Inability to rise
- Hypoglycemia, ketonuria
- Increased BUN poor prognosis with renal shut down

Tx
- Initially dose all animals off feed with 60 ml propylene glycol BID q 3 days
- Down ewes: propylene glycol, 100 ml 50% glucose one time IV, IV D5W may be helpful on more expensive ewes, 50 ml of calcium borogluconate IV SLOWLY,
- Induced abortion 20 mg Dexamethasone (abort in 24-48 hours)
- Correct ketoacidosis with bicarbonate
- Prevention of management factors is helpful; feeding Monensin in the last 6 weeks of pregnancy seems to be helpful 40mg/head/day

Uterine Prolapse

- Common post lambing
- Manage as in the bovine
- Epidural, elevate the hind end
- Clean well, lubricate
- Purse string sutures

Vaginal Prolapse

- Should not exceed 2-5% of the flock
- I have seen flocks as high as 8-10%
- Usually seen in the last 2-3 weeks of gestation, more common in older ewes than primiparous animals
- Stillbirths are common
- C section requirements are higher

Dx
- Low BCS (thin ewes), high BCS (fat ewes) 2.0< X>3.5
- Previous vaginal prolapse (cull ewes)
  - hypocalcemia
- Ketosis
- Previous dystocia
- Chronic respiratory disease/cough
- Diarrhea/straining (tenesmus)
- Abdominal pressure
- Feeding up hill
- Crowding

- Short tail docks
- Within certain family lines
- High fiber diets with increased rumen fill
- Phytoestrogens from alfalfa hay

Tx
- Correct previously mentioned management problems
- Purse string sutures of vagina/lacing patterns
- Plastic prolapse retaining insert
- Epidural to facilitate procedure
- Harness technique
- Induced parturition with dexamethasone

Ringwomb

This is a genetic predisposition towards poor dilation of the cervix at parturition. At parturition the cervix fails to dilate. Generally intravaginal palpation will alert the owner or veterinarian to failure to dilate. Manual dilation can be helpful though scarring is a common sequella. ECP generally is too slow for the needed response. Other treatments have been tried but with poor response. Culling is suggested. It is more common in maiden ewes. C-section is indicated in more expensive animals. Some practitioners have used estrogen and oxytocin combinations.

Induced Lambing
- Glucocorticoids after day 137 of gestation
- Dexamethasone at 15-20 mg IM at day 142-144. Parturition will commonly occur 36-48 hours later. Retained placenta is usually not a problem
- Ewes need to be one week or less away from lambing for lamb survival success

CAPRINE THERIOGENOLOGY FACT SHEET

ANNE M. TRAAS, DVM

CYCLE:

Type: Seasonally polyestrous, begins when day length is decreasing (August until March). Can be off-season bred by several methods.

Cycle Length: 21 days (pygmy goats 18-24 days)

Ovulation occurs: 30-36 hours after heat begins

Estrous Signs: Flagging, increased alertness and vocalization, will search for a buck

Gestation: 150 days, kid January through March if bred in normal season

PREGNANCY:

Placentation: Caruncles and cotyledons

Pregnancy diagnosis: Can be scanned by ultrasound trans-abdominally after 35 days or trans-rectally after 25 days. Radiographs can be taken after 90 days looking for fetal skeletons. Serum progesterone at 19-24 days is 97% accurate in diagnosing non-pregnant animals.

Drugs not to use during pregnancy: diazepam, xylazine, acepromazine, parabendazole, cambendazole, phenylbutazone, chlorpromazine, phenothiazines, levamisole, corticosteroids (last month).

Causes of Early Abortions: It is often very difficult to distinguish early abortions from failure to conceive. False pregnancy may also play a role in misdiagnosis.

- Malformations
- Toxoplasmosis
- Nutritional

Causes of Late Abortions—Infectious:

- Salmonellosis
- Chlamydiosis
- Listeriosis
- Toxoplasmosis
- Leptospirosis
- Q Fever
- Brucellosis
- Campylobacteriosis—rare in goats, common in sheep
- Akabane virus—exotic to USA

Other systemic infections: Any infection that causes the doe to become febrile or generally ill may also cause her to abort. Some examples are: Bluetongue, Border Disease, Caprine Herpes virus, Nairobi sheep disease, Peste des petits ruminants, Rift Valley Fever, Wesselsbron disease, Mycoplasmosis, Yersiniosis, Tick borne fevers, Anaplasmosis, Sarcocystosis, etc.

Causes of Late Abortions—Non-infectious:

- Malnutrition
- Stress
- Inherited abortion of Angoras
- Vitamin or Mineral Imbalances: Vitamin A, Selenium, Copper, Manganese or Iron deficiency. Molybdenum or Sulfur excess
- Toxic Plants
- Drugs

PARTURITION:

Normal:

- 1st stage: up to 12 hours, multiparous does are usually faster
- 2nd stage: straining typically lasts 2 hours or less and is completed by expulsion of last kid
- 3rd stage: expulsion of the placenta usually within 4 hours
- Lochia is normal for up to 3 weeks and should not have a foul odor.
- Uterine involution macroscopically complete by 4 weeks post kidding.

Dystocia: Rare, 95% of kiddings need no assistance

When to worry:

- If hard labor produces no kids or placenta has been showing for greater than 30 minutes to 1 hour.
- If the sacrotuberous ligaments have been softened to the point of disappearing for greater than 12-16 hours.

Retained Placenta: Considered retained after 12 hours. Do not remove manually.

- Administer oxytocin (5 IU SQ or IM) several times a day. May lead to metritis.
- Check tetanus booster, administer antibiotics.

LACTATION:

Usually lasts about 305 days but can be very variable.

OTHER FACTS:

Sheep goat hybrids are possible but almost always die before birth. Does must be bred by a ram and they will not allow this if a buck is present.

CAPRINE AND CERVIDAE REPRODUCTION

Scott R.R. Haskell, DVM, MPVM

Terms:
"buck jar"
"flagging"
"buck effect"

Goats are Seasonally Polyestrus

- August to March is the normal breeding season
- September to December is the breeding season in the northern hemisphere
- Many tropical breeds cycle all year
- Photoperiod tends to be the primary determinant
- Melatonin secretion is also important

Transition periods occur at both ends of the breeding spectrum, these are generally not as fertile as central portions of the breeding season. During these time periods the cycle lengths vary considerably.

Estrous cycle length:
Normal dairy goats: 20-21 days
Pygmy goat is from 18 to 24 days
Estrus length is between 12-36 hours

- The placenta is cotyledonary/synepitheliochorial
- Gestation length is 147-155 days; most owners consider it to be 150 days
- Births are most common at midday; they are much less common at night

- Estrus detection is best done with a teaser buck
- Vaginal smears have a poor success rate
- Buck jar technique is fair
- Drop in milk production is a good sign
- Vaginal speculum exam: when cervical mucus is cloudy with cervical dilation is the most common determinant for breeding estrus; cheesy white to yellow mucus signals the end of estrus

Chemical Control of Goat Breeding

- The key factor is what phase of the reproductive cycle you may be in: transition, breeding or non-breeding seasons
- **"Buck effect":** used to induce estrus in non-cycling/ancestral does
- Out of sight/out of mind for 3 weeks
- LH surge in 48 to 72 hours

Prostaglandins

- Most effective in cycling does
- Between day 4 and 16 of the cycle
- Most producers use 2-3 cc's but 1 cc will work fine
- Estrus in 36-60 hours post injection for those in the luteal phase
- Normal program consists of 2 injections 11 days apart
- Shortened estrus periods can result from the use of prostaglandins
- This can be from a phenomena in goats known as ELR or early lacteal regression

Photoperiod Manipulation

- During late January the photoperiod is increased to 18-20 hours over a 70-day time frame. The lights are then brought back down to seasonal normal between 50-80% of does will cycle
- The buck effect can also be important

Progesterone

- Progestin use
- CIDR: Controlled Internal Drug Releasing Device contains 330 mg of progesterone breed at 45 hours post removal
- Vaginal sponges with 45 mg fluorogestrone breed at 55 hours post removal
- Synchro-Mate B (use ½ bovine implant): implanted in dorsal pinnae or ventral tail
- MGA: melengestrol acetate
- Most people use the progestins for variable time lengths: 9-21 days seem to be the most common
- Treat goats with PGF2a 24-48 hours prior to removal of the progesterone source

Progestins with Gonadotropins

- Usually used at the removal of the progesterone regime
- FSH, eCG, hCG

PG 600 is commonly used: it is a mixture of eCG and hCG and used primarily in swine

- It is an extra label product in small ruminants
- Use one porcine dose of 5 ml IU
- Does cycle in 12-36 hours
- Breed them twice at hours 30 and 50

Artificial Insemination

- Vaginal insemination
- Cervical insemination
- Intrauterine insemination via transcervical
- Intrauterine insemination via laprascopic approach

Pregnancy Diagnosis

- Think **HYDROMETRIA** during the transition periods, off-season breeding, artificial insemination and chemical manipulation of estrus
- Greatly distended uterus with out caruncles or feti present
- Usually the uterus is saculated

Types of Diagnosis Methods
- Radiology
- Estrone sulfate/progesterone levels
- Ultrasound
- PSPB test (pregnancy specific protein B)
- Ballottement
- Abdominal/rectal probe palpation

Radiology
- Is not recommended
- Used after day 65
- Day 90 post breeding is best
- Too expensive
- Field units will not penetrate
- False negatives are common

Hormonal Assays
- Estrone sulfate is used after day 50
  - Positive is a live fetus, this is a very specific test
  - Negative is less exact; this will show either an open animal of one that has aborted
- progesterone
- 1 ng/ml is a common cut off point
- < 1.0 ng/ml is not pregnant
- Elevated progesterone can still be seen in hydrometrias, pyometrias, mummies and stillbirths
- 21-24 days post breeding
- Farm side ELISA test for cows work well for goats

Ultrasound
- Transrectal: day 20-50
- Transabdominal: day 35 to term

PSPB

- Used after day 24 post breeding
  - < 1.0 ng/ml not pregnant
  - Hydrometria will show no level
  - Viable feti produce
  - Can be elevated for a substantial time period post abortion, should be used in conjunction with ultrasound if an abortion is suspected

DYSTOCIA

Posture
Presentation
Position

- Cranial with a longitudinal presentation, dorsosacral position with an extremity extended posture
  - Dystocia is uncommon in goats, between 3-5%
  - Limb flexed
  - Head back
  - Caudal presentation
  - Multiple feti entering the birth canal
  - Ringwomb
  - Fetomaternal disproportion
  - Uterine torsion
  - Uterine/rectal prolapse
  - Mummies
  - Uterine inertia
  - Pyometria
  - Hydrometria
- Most common in Nubians with multiple births
- Second most common in pygmy goats bred too small or to a larger buck
- Third would be primiparous Alpine does with a large single kid

REPELL REPELL REPELL

How to manage the case

- Preparation, examination and hygiene
- Repelling and reposition J-LUBE!!!!!!!!
- Fetal extraction
- Post-parturient case management

Fetotomy- *DON'T GO THERE*

Cesarean Section

- Post-parturient problems
  - Middle uterine artery rupture
  - Retained placenta
  - Metritis
  - Prolapsed uterus
  - Vulvovaginitis

Abortion in Goats

- Collect paired sera samples, placenta and aborted feti
- In the face of an "abortion storm" place the entire herd on tetracycline unless a definitive diagnosis can be made

Note: See the sheep section as well

Chlamydiosis

- Also referred to as enzootic abortion
- One of the most common causes of abortion
- Chlamydia psittaci
- Arthritis, respiratory disease, pink eye, coughing
- The placenta and uterine discharges are very infective to other does
- Late term abortion
- Placenta with thickened intercotyledonary regions; necrosis; brownish discharge
- Q fever appears similar
- Rreatment tetracycline
- Zoonotic

Toxoplasma

- One of the most important causes of abortion
- Early and late term abortions
- Toxoplasma gondii
- Abortion, stillbirth, weak kids and mummies
- Cats are the definitive host
- Placenta with small white foci of calcification in the cotyledons, the rest is normal

Campylobacter

- C. fetus ss fetus
- Late term abortion
- Placenta with edema and cotyledon necrosis
- Treat with tetracycline

Nutritional

- Early and late term abortion
- Deficiencies and excess
- BCS
- Copper, iodine, selenium
- Protein
- Energy

Salmonella

- S. typhimurium and S. Dublin
- Dehydration, profuse diarrhea
- Not common
- Any stage of pregnancy

Listeria

- L. monocytogenes
- Gram positive
- Poor silage
- Septicemia
- Doe may die
- Thickened necrotic cotyledons
- Not common in goats

Leptospirosis

- Not common
- L. interrogans
- Late term abortion
- Anorexia, hemaglobinuria, abortion, septicemia, death
- Vaccination at least every 6 months

Drug Induced

- Corticosteroids
- Prostaglandins
- Estrogens
- Cambendazole
- Albendazole
- Coxiella burnetii (Q fever)
- Both cotyledon and intercotyledon necrosis; mineralization

Brucellosis

- Brucella melitensis and B. abortus
- Gram negative
- Late term abortion
- Placental edema and cotyledon necrosis
- More common in developing countries
- Spread as a sexually transmitted disease
- Vaccinate for the disease
- Treat with tetracycline
- Zoonotic

Induced Abortion in Goats

- Prostaglandin- PGF2a: 5-10 mg IM abort 30+ hours later; can induce retained placenta
- Corticosteroids: 20 mg IM (induces placental estrogen production) given after day 141 of pregnancy
  - Approximately 48 hours post injection
- Estrogens- not recommended

Breeding Soundness Examination:

Male

- Physical examination
- Libido evaluation
- Penile examination- extrude penis: 5 mg diazepam IV, sit on rump, extrude penis
  - Balanopoposthitis
  - Paraphimosis: hydrotherapy, Naquazone, diruretics, topical ointment to prevent dissecation
  - Phimosis: adhesions
  - Pizzle rot/posthitis: C. renale
  - Hypospadia
  - Partial patency to urethra
  - Urinary calculi
  - Ulceration
  - Foreign bodies

Venereal Disease

- Bluetongue virus
- Toxoplasma
- Mycoplasma
- FMD
- Leptospirosis
- Brucella melitensis
- Trichomoniasis

Palpate Testicles
- Orchitis
- Epididymitis
- Varecocele/sperm granulomas
- Cryptorchid
- Unilateral/bilateral hypoplasia
- Inguinal/scrotal hernia
- Intersex/freemartin

Scrotal Circumference
- Semen collection and evaluation: motility and morphology
  - Normal volume 1.0 ml (0.5-1.5 ml)
  - AV collection
  - Electroejaculate: be careful!!!!!!! Goats are extremely pain sensitive

Reproductive Surgery in the Caprine

- Goats need to be monitored closely under general anesthesia
- Goats are susceptible to lidocaine toxicity

Cesarean Section

Episiotomy

Ovariectomy

Vasectomy

Epididymectomy

Penile translocation

Urolithiasis
- Uretheral process amputation
- Tube cystotomy
- Urethrostomy

Castration
- Immature- local anesthesia; if wait until more mature (6 months) less likely to develop urolithiasis
- Mature-local and general anesthesia; FLY CONTROL
  - Elastrator
  - Burdizzo
  - Emasculator
  - Chemical castration: ChemCast injectible lactic acid

DAIRY GOAT BIOSECURITY CANNOT BE IGNORED

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Biosecurity is an extremely important component of disease control on the dairy farm. The importance of preventing the spread of disease in today's global agriculture is paramount to successful animal management and production. Recent Foot and Mouth Disease (FMD) in England is a timely example where biosecurity measures could have at least diminished many of the disease consequences.

What is biosecurity? Biosecurity is a program designed by the owner with the help of animal health care professionals that both prevents the introduction of new disease(s) onto a farm from outside sources and helps prevent the transfer of infectious disease in the farm environment. Biosecurity should be a top priority when formulating management decisions. Individual farm Risk assessment is the key to developing a successful Biosecurity program. What factors constitute disease exposure? New animals (goats, embryos, semen), feed, water, direct animal contacts (fence line, shows/fairs, different age group intermixing), wildlife (including insects), vaccination/treatment of many animals with the same needle, transport vehicles, rendering vehicles and visitors are but a few high exposure examples.

BIOSECURITY AND ANIMAL PRODUCTION

1. Open versus closed farm system: The first step in managing and preventing disease is in deciding on wether the farm will maintain an open or a closed farm operating program. This will be the first phase in directing the farm risk assessment program.
2. Will the farm totally exclude visitors (closed), allow visitors only in specific areas (modified closed) or an open production system with out controls.
3. Farm priority plans need to be developed allowing each farm enterprise to evaluate and determine which specific target disease(s) the owner wishes to exclude from the premises (risk assessment) (i.e. Johne's disease, CAE, caseous lymphadenitis, Brucellosis, parasites)
4. Methods of animal selection need to be determined. Will a dairy select to have a closed herd (i.e. produce all of its own replacement stock without buying out side animals. Should the producer select to purchase outside animals, were they purchased from a known certified or specific pathogen free herd?).
5. Quarantine programs should be in place for all new stock or those animals which have left the premises (i.e. show animals). Sufficient time and distance from other stock needs to be determined on a per farm basis. This data should be determined by developing a farm priority plan for the exclusion of specific diseases.
6. All new animals should have a through physical evaluation to exclude those potentially carrying specific diseases. Risk assessment would include serologic/fecal testing for specific diseases. Examples would be CLA,

7. Johne's and persistent CAE animals. Should an open or modified closed system be in place, how will disease transfer be contained off the farm?
    - Scrub brushes to scrub all organic debris from boots prior to entering and exit.
    - Plastic booties for use on feet as well as bath
    - Paper coveralls provided
    - Shower in shower out (an extreme step)
    - Foot baths: One Stroke Environ or Roccal
    - Change foot bath according to use, depth or organic matter content
    - Some farms maintain wheel baths for vehicles entering the premises
    - Total exclusion of off farm vehicles
8. All farms should maintain a visitors log. Name, date and time of visit should be logged to determine potential for where a point epidemic originated.
9. Some farms have gone to a locked gate with an entrance bell. Only those with immediate business or "need to enter" are allowed on the premises.
10. On those farms who want to maintain a modified closed operation restriction zones can be a good deterrent to disease transmission.
11. Posted rules and regulations are imperative to notify all those concerned as to what precautions need to be in place to improve biosecurity on an operation? These should be posted at all entrances.
12. Milk pickup may become a large issue. Should the trucks wheels be made to travel through a dip tank? Should the milk truck technician be required to wear booties? Should on farm sales be stopped?
13. At some point many larger farms have decided to move the bulk tank/milk house outside the farms "safe perimeter". This does not allow the potential contamination of the farm premises by the milk hauler.
14. Biosecurity also allows for containment plan needs to be developed. Should an outbreak occur, how will the management contain and prevent the spread of this disease on the premises?
15. Fences or barriers are installed to discourage wildlife (including birds and insects)
16. All individuals who work directly with the dairy goats should practice clean sanitary hygienic practices.

Though this list is far from complete a basic understanding of what biosecurity is and its importance to the dairy goat farmer is what is essential. Farm risk assessment should stress what target disease(s) are important for the exclusion of the farm and wether an open or closed security system is to be maintained. It should be stressed that the dairy goat farmer should consult as many individuals as possible (i.e. local extension staff, university animal scientists, local veterinary practioners and the public health department).

Heat Stress in Llamas

Christina Larson

The native habitat of the llama is the altiplano of South America, a region that, while between 12,000 and 14,000 feet, stays within a temperature range of 20 - 60°F for the most part. With a thick coat of fiber covering much of the torso, neck, and upper limbs, llamas are well-equipped to withstand cool temperatures. Temperatures above the accustomed range, especially when combined with high humidity, can be lethal.

How can you determine if the weather is too hot for your llama? The very first signs may be a llama that just isn't acting 'normal.' You, as owner, are the best person to notice when your llama is 'off', and if the weather is hot, heat stress may be a reason. There are a number of behaviors a llama will display when it is too warm (see Figure One).

Figure One: Cooling-off Behaviors
- seeking shade
- lying down
- standing in water
- open-mouthed panting
- minimizing amount of body exposed to sunlight
- sweating (check fiberless areas)

Table One: Normal Body Temperatures

Adult Llama	99 – 101.8°F
Adult Alpaca	99.5 – 101.5°F
Babies of either species	100-102.2°F

Note: May vary with environment. When in doubt, compare with others in the herd.

DANGER ZONE:
Anything above 103°F is questionable, but temperatures above 106°F are too high.

Check your animal's rectal body temperature with a thermometer. Is it normal? (See Table One). Some llamas may be capable of maintaining their daytime temperature at 104 °F, while others may begin to show heat stress at 103°F. Temperatures of 106°F or higher are a sign of heat stress, and you must do something to get the llama out of the heat or cool it off.

Get to know your individual llama, because abnormal behavior may be a better and more reliable sign than the thermometer reading., especially when you cannot obtain a temperature. Signs of heat stress (Figure Two) appear when the llama can no longer keep its body temperature stable, and death will occur when body temperature reaches ten degrees above normal.

Figure Two
Signs of Heat Stress
- Body temperature > 106°F
- Behavior changes
- Dehydration
- Signs of brain damage

Call your veterinarian if you see any of these signs on a hot day.

Figure Three
Signs of Dehydration
- dry mouth
- sunken eyes
- no urination
- prolonged skin tent
- slow capillary refill time
- lack of sweating

Other signs of heat stress include open-mouthed panting, rapid breathing, and sweating in the fiberless areas. If you cannot, for whatever reason, obtain a temperature on a llama, look for signs of dehydration (Figure Three). If your llama actually stops sweating, it is dehydrated by the heat stress. A dehydrated llama that will not drink water needs to be seen by a veterinarian. A dry mouth, sunken eyes, lack of sweating, and no urination are all signs that your llama is dehydrated.

Figure Four: Skin Tent

a. Choose an area of skin that is loose over the underlying muscle and doesn't have too much fatty thickness. A good area to try is a fold of eyelid.
b. Gently pick up a fold of skin between your thumb and forefinger.
c. Let go. The skin tent should fall back into place quickly and easily if your llama is not dehydrated.

You can also check a skin tent (see Figure Four) or a capillary refill time (Figure Five). Both are good signs of your llama's hydration status. A skin tent that is slow to fall back into place is a sure sign of dehydration. A capillary refill time that is longer than two seconds is very suspicious of dehydration. If there are any signs of dehydration, offer your llama plenty of cool (not cold) fresh water, and call your vet.

Figure Five: Capillary Refill Time (CRT)

a. Open your llama's mouth enough to see the gums.
b. Press the ball of your thumb into the gums hard enough to whiten the skin around your thumbnail, and let go.
c. The llama's gums should show a pale spot where you just pressed your thumbpad. If your llama is normal, that spot will disappear in less than two seconds.

Figure Six:
Signs of Brain Damage

- Staggering, stumbling, or otherwise uncoordinated gait
- Seizures
- Down llama

Call your veterinarian immediately! Chances for recovery are poor.

When the llama starts to stagger or stumble, as if it cannot coordinate its walking, then it is showing signs of brain damage (Figure Six). Seizures are another sign of brain damage, as is a llama that cannot stand up. If the llama is displaying behavior like this, call your veterinarian and be aware that even if your llama recovers, some brain damage is likely to be permanent.

Figure Seven:
First Aid for Heat Stress

- Move animal into shade
- Offer fresh cool water
- Turn fans on
- Wet down fiberless areas
- Dunk baby in cool water
- Cool water enema (tell vet!)

What can you do to stop heat stress? Early recognition of the problem is the key. The sooner you act to help your llama cool down, the more damage you can prevent (Figure Seven). Take the llama's temperature, and call your veterinarian if the llama's temperature is 106°F or higher. Offering plenty of fresh cool water will help, as will moving your llama into a shady place. Turn on fans, and direct the air flow toward the belly, where it will do the most good. Wet down the fiberless areas (belly, lower legs, behind front legs, groin) with cool water or rubbing alcohol, but avoid wetting the fiber because it won't help cool the llama down. Baby llamas can be immersed in cool (not cold!) water, but don't put the baby's head under water. Always check the body temperature to see if it's falling. You can even gently insert a trickling garden hose into the llama's anus and give it a cold water enema, but the downside is that you will not be able to get an accurate body temperature reading from the llama. Call your veterinarian if you cannot cool the llama off, and be sure to inform the vet if you have done a cold water enema.

Once your llama's temperature has fallen to normal and it shows no signs of distress, keep it out of the situation that caused the problem or the llama will relapse. Even when the llama is back to normal, you will always have to observe the animal a little more carefully, because one episode of heat stress will make it much more likely to happen again to that animal.

Heat stress is best prevented (Figure Eight). Minimize your risk factors (Figure Nine). Keep fresh clean water always available in the pen or pasture. Provide shade for all animals, especially during the hottest part of the day (usually ten am to two pm). Fans help keep barns and other closed areas from turning into ovens. Sprinklers (aimed up at the llama's belly, not down onto the back) or children's wading pools will provide ways for the llama to cool itself. Keep animals in good body condition (Fowler's Medicine book is a good reference); you want them neither fat nor thin. Schedule stressful events (travel, deworming, training, vaccination, etc.) for cooler times of the year, or try to do them in the evening or very early morning. If travel in hot weather is a must, provide plenty of cool water and soak the underbelly when possible. Avoid buying new animals in the summer, so that the animals have time to adjust to the climate and their new surroundings. Plan the gestation of your breeding herd so that babies arrive in spring rather than mid-summer. Prior to hot weather, shear part or all of the llama's fiber down to two inches. Shorter than two inches will remove the llama's protection from the direct heat of the sun.

Figure Eight:
Prevention of Heat Stress

- Shade
- Fans
- Sprinklers
- Wading pools
- Fresh water always available
- Avoid travel or other stress
- Plan births for springtime
- Buy animals in cooler seasons
- Prevent obesity
- Shear fiber
- Avoid handling animals during the heat of the day

Figure Nine:
Factors placing Llamas at risk for heat stress

- obesity
- pregnancy
- older animals
- stagnant, still air
- fighting
- handling
- travel
- high humidity
- dirty, matted, wet fiber coat
- excessively long fiber coat
- illness (with or without fever)
- immaturity (babies are naïve and often don't know to get out of the sun and into shade)
- strenuous exercise (ex. males pacing fences)
- animal down for a long time
- length of exposure to heat

Other diseases (Figure Ten) can be confused with heat stress, so if you have an animal that is feverish, dehydrated, or behaving strangely, always call your veterinarian.

Figure Ten:
Other diseases that can be confused with heat stress

- infection causing a fever
- colic
- polioencephalomalacia
- gastric ulcers
- tick paralysis
- meningeal worm

Sources:

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Fowler, Murray, DVM. Medicine and Surgery of South American Camelids. 1998. Iowa State Univ. Press, Ames, IA. pp 234-235.

CAMELID THERIOGENOLOGY

Scott R.R. Haskell, DVM, MPVM

Camelids: llamas (also called lama), alpaca, vicuna, guanacos

Gestation of camelids: 345 days range is 335 to 355 days (can be greater than 375 days)

PREMATURE AND POSTMATURE DELIVERIES SHOULD BE CONSIDERED A MEDICAL EMERGENCY AND TREATED ACCORDINGLY

Breeding ages:

In general when breeding any animal for the first time they should approach 60-70% of their adult weight

Llamas 15-18 months
Greater than 200 pounds

Alpacas 15-18 months of age
Greater than 90 pounds

Peruvian researchers have shown that alpacas are non-receptive to males before 12 months of age

Terms:

"Spit off"
"Kush"
"Cria"
"Orgling"

Sexual Behavior

- Camelids are induced ovulators
- Ovulation is depended on follicular activity at the time of mating; to a degree receptivity is also dependent; the female is continually receptive while the follicle is present. The decline in estrogen following follicular rupture and the increase of progesterone secondary to CL formation controls receptivity.
- LH release in the post-coital female is dependent on cervical stimulation by the penis and activity and semen factors stimulating the release
- Ovulation is generally 24 hours post mating
- FOLLICULAR WAVE formation is important in camelid sexual behavior
- Fertilization occurs at 24-36 hours post coitus in the uterine horn; it will move to the body of the uterusm5-7 days post mating

OVULATION RATE FROM EACH OVARY IS 50:50

- **95% OF ALL PREGNANCYS ARE IN THE LEFT HORN**
- Twin pregnancy is very rare and they will usually abort between months 5 and 7 of gestation
- Non-breeding season April-May
- Camelids have the normal three-layer placentation found in other species placentas plus a fourth epithelium layer surrounding the crias mouth, nostrils and eyes; it is also found around the feet.

CAMELID PLACENTATION DOES NOT CONTAIN CARUNCLES/COTELYDONS

Breeding

Most breeders breed every other days for 2-3 breedings, they are then teased between 15-21 days post breeding to evaluate this breeding

- 10-21 days post parturition llamas are usually rebred
- Post dystocia, the female should be given 3-4 weeks to allow healing
- Breed every 21 days for three consecutive breeding. If still not pregnant reevaluate.
- Induced ovulators
- Females do not have an estrous period; females are receptive until bred or pregnant
- Fowler estimate that early embryonic death occurs as high as 30-50% prior to 90 days
- Camelid feti develop an extra membrane of fetal epidermal origin called the epidermal membrane (EM
- The presence of the embryonic vesicle as a nonechogenic circular structure within the uterus as early as 12-14 days post-copulation is a positive indicator of pregnancy
- Llamas copulate for 13-35 minutes
- Male llamas do not choose between receptive and non-receptive females

Males

Breeding Soundness Exam (BSE)

- Vaginal collection of semen
- Artificial vaginal collection
- Intravaginal condom
- **DONOT ATTEMPT ELECTROEJACULATION WITHOUT CONSULTING A THERIOGENOLOGY PROFESSIONAL**
- Semen characteristics:
  - 1.5 cc average ejaculate
  - Motility: should expect greater than 80-85%
  - Morphology as in other species
  - Testicular size: measured with calipers
  - 12 months: llama 3.4x2.3 cm---alpaca 2.3x1.5 cm
  - 18 months: llama 3.5x2.6 cm---alpaca 2.8x1.9 cm
  - 24 months: llama 3.9x2.3 cm alpaca 3.3x2.2 cm

Testicular Degeneration is not uncommon in camelids. Both trauma as well as hypo/hyperthermic changes can precipitate disease.

- Age does not appear to be a problem
- Heat stress is a common cause of testicular degeneration; scrotal hydrocele and edema are common sequella
- Starvation, transportation, environmental stress, iatrogenic steroid use, disease, potentially vitamin E/Se deficiency, toxic ingestion and heavy metals

Most breeding soundness examinations also take into account libido as measured by testosterone in pg/ml; normal should be in the 5 range.

- 70 % of sperm should be progressively motile
- Concentration varies tremendously

Castration-common procedure

- Monitor for hemorrhage

Vasectomy- production of teaser males

Cryptorchid- less than 10%

- Most are left side
- Cystic structures are not uncommon

Fighting teeth

Prepucial adhesions

Pregnancy Diagnosis

- See attached notes
- A well-designed reproductive management program should emphasize monitoring through out pregnancies. Many pregnancies (up to 25%) are lost after day 30
- Transrectal vs. transabdominal ultrasounding
- 95% of pregnancies are in the left horn but generally lays on the right side

<u>Methods of Pregnancy Diagnosis:</u>

- Teasing with a male 15-21 days post breeding; "spitting off", if the female kushes then she is probably not bred; sometime though she will just not be receptive to that male; this method is approximately 80% accurate; it is considered most accurate after 21 days.

<u>Blood Progesterone</u>

- Elevated progesterone of >1.0 ng/ml is consistent with pregnancy
- If the female aborts during her pregnancy her CL will regress and the serum progesterone level will fall back to normal. Thus this is a good tool to check for the normal pregnancy levels of progesterone for maintenance. However, <5% of animals will not have a CL regression thus a false pregnancy is detected.
- Persistent CL is treated in camelids with PGF2a (lutalyse 2 ml IM)
- Most accurate after 21 days

- Progesterone levels vary within a given llama through out pregnancy
- Llama normal pregnant range is 3-8 ng/ml
- Alpaca levels are generally 1.5-5.0 ng/ml
- This test is 95% accurate

RESTRAINT-RESTRAINT-RESTRAINT
- Llama schute
- Chemical .3 mg/kg xylazine IM in llama double this for alpacas; butorphanol 0.1 mg/kg for llamas 0.4 mg/kg alpacas

Rectal Palpation

I DO NOT RECOMMEND THIS TECHNIQUE FOR MOST PEOPLE WITH LARGE FORE ARMS. Check with the owners first, trust me ☺

- generally done 30 days post copulation
- rectal tears

Tear Management/Diagnosis
- Lymphosarcoma and adenocarcinoma can be diagnosed via uterine palpation
- Ovaries are ovoid 2 cm in length
- Ultrasound: see attached notes!
- Tectal is usually done with a transducer extension probe
- Transrectal scanning is done 28-90 days of gestation; day 30-60 is ideal
- Evacuate bowel
- Transabdominal post 90 days pregnant

Ballottement as a means of Pregnancy Diagnosis
- Best if used in conjunction with ultra sound
- Usually used after day 120-150

Parturition
- Stage one: 1-6 hours this is the preparation/nesting phase of delivery
- Stage two: one to two hours, the normal is around 30 minutes; this is the fetal delivery phase of parturition
- Stage three: four to six hours; this is the placental delivery phase of parturition

REMEMBER: PRESENTATION
POSITION
POSTURE

Normal Presentation, position and posture defined: anterior presentation, dorsosacral position and normal birth posture

- >90% of camelid births occur between 0700 and 1300 hours
- Camelid females do not lick their crias at birth
- Females do not abandon their young

Criteria for Evaluating Premature Crias in Llamas and Alpacas

- Low birth weight: < 4.5 kg in alpacas and <9.0 kg in llamas
- Flexor tendon laxity
- Floppy ears
- < 4 erupted incisors

Cria Problems

- Failure of Passive Transfer (FPT)
- Choanal atresiae
- Agalactia
- Wry face
- Umbilical hernia
- Constipation
- Septicemia

Induced Parturition

- PGF2a
- Oxytocin and dexamethasone are not very effective

Induction of Lactation

- Domperidone (Equidone) oral jel
- Three times the equine dose orally
- 5cc orally for a mature llama for 7-10 days
- Should see improvement by the second week

Periparturition Difficulties

- Abortion
- Resorbed feti
- Hydrometria
- Pregnancy toxemia
- Hypocalcemia

Uterine Torsion: Malposition of the dam's reproductive tract

- Almost always torsed to the right
- Usually found in the last 2 months of gestation
- Mimic camelid colic: rise and kush repeatedly, roll violently they act like a horse with colic
- Stretched broad ligament
- Most are in the clockwise direction when viewed from the rear

Approach

- Sedate with butorphanol at 0.1 mg/kg IM
- Rectal palpation to determine right or left hand torsion.
- Attempt rolling to detorse. Make three attempts checking the cervix each time. If after three attempts have been made surgical intervention is required
- Surgical detorsion with local sedation

Dystocia: 4-5% of births
- Dam fatigue
- Abnormal presentation, position and/or posture
- Extended labor
- Poor progress over 15 minutes
- Many camelid birth in the morning hours. If a camelid starts delivery after 5-6 PM that animal is more at risk to dystocia than others

Llama dystocia should be managed professionally!!!

- Use warm soap and water to disinfect both your arm and the vagina/perineum
- Use a disinfectant like dilute Betadyne
- Lubricant like methylcellulose, K-Y or J lube, NOT mineral oil, it is a tissue irritant
- Tail wrap with Vetwrap
- Adequate animal restraint and facilities; adequate lighting
- Proper owner communication
- Vaginal/cervical examination- be gentle
- Repel! Repel! Repel!
    - If a decision is made to "pull" feti protect feet with your hands to insure that a uterine tear does not occur
    - Pull with contractions, use the animals strength to help you
    - Don't be too traumatic
    - Remember the 45 degree manipulation technique to reduce width of shoulders in the pelvic opening

Dystocia in Camelids
- Upside-down
- Head back
- Breech
- Leg back
- Leg over neck
- Elbow lock
- Twins
- Front and rear leg presented
- Hip lock

ABORTIONS

Chlamydial Abortions
- Late term abortions
- Weak and stillborn feti
- Paired serum samples
- Submit placenta; impression smears and staining
- Tetracycline to remaining pregnant females

Toxoplasma Abortions

- Toxoplasma gondii
- Cat feces
- Tetracycline to remaining pregnant females

Brucellosis

- B. mellentensis, B. abortus, B. ovis
- Not found in US
- Common in South America
- Usually found in animals grazed in sheep and goats; may become a problem with guard llamas here

Leptospirosis

- Potential for abortion, not common
- Would suspect multiple grazing species

Toxic Ingestion
- Copper and selenium
- Plants
- Sprays
- Valbazen dewormer
- Pine needle consumption

Other
- Twins
- One uterine horn
- Low progesterone production
- Stress
- Trauma
- Poor nutrition
- Drug induced

Postpartum Complications
- Uterine prolapse
- Uterine infection/metritis
- Postpartum hemorrhage
- Uterine tear
- Rectal tear
- Agalactia
- Maternal rejection
- Bottle babies- aggressive llama syndrome

Camelid Reproductive Management

BCS!! I use 0-5. Many use a 0-10. Be consistent and ask the owner which she or he prefers. Once again you want a 2.5-3.5 for good breeding condition. The score of 3 is optimal

Feeding during pregnancy: the last trimester is the most important to both the developing fetus and the pregnant dam

- Many producers in this area feed the Norm Evans Mix or the Mizzuri Llama Mix
- Feed requirements of the last trimester of pregnancy and first quarter of lactation: 14% crude protein and 65% TDN for llamas and 16% CP and 70% TDN for alpacas. Have the hay tested for CP, TDN, Ca, P, Mo, Zn, Se. The supplement will have a "guaranteed analysis" listing these components
- The first 2 trimesters require 2% less protein for each species and 10% less TDN.
- Camelids eat between 1-2% of their body weight per day of hay or grass
- It is suggested that all females get a prebreeding physical exam to insure their ability to maintain a pregnancy-see attachment sheet; especially check teeth
- Try to reduce all possible stressors
- All drugs in camelids are EXTRA-LABEL
- Booster vaccines 2 months prior to delivery with killed products only
- Use only killed rabies if this is a part of your vaccination program
- Do not use Valbazen (albendazole) in pregnant llamas
- It should be noted that catching and treating less user-friendly camelids could stress animals
- Be careful with drugs used in pregnant animals: glucocorticoids, prostaglandins and oxytocin can cause abortion
- Colostrum should be available. It is worthwhile maintaining either sheep or goat Colostrum in the freezer for emergencies. I freeze in an ice cube tray for individual use.

Problem Breeders/Infertility

- Ovarian hypoplasia
- Follicular cysts
- Luteal cyst
- Endometritis
- Ovarian tumors

Case Presentation/Problem

Female camelid aborts or resorbs post 45-60 days

- Poor nutrition/ BCS
- Twins
- Implantation difficulties
- Low progesterone production: measure the levels, Regumate
- False pregnancy/hydrometria
- Metritis/vaginitis

Infertile Cycles

- Correct age?
- Nutritional/BCS
- Male unable to copulate: large male small female, small male large female
- Female does not like male
- Poor libido
- Male previously used as a teaser and has lost interest
- Poor semen quality (BSE)
- Follicular cysts (GnRH and HCG) PG-600
- Obesity
- Lactation
- Underlying disease

Female Found to Ovulate but not Pregnant

- Check male (BSE); hot weather with poor semen quality?
- Use another male
- Metritis is common in camelids; discharge is not always common
    - Sedate
    - Speculum exam
    - Uterine culture
    - Uterine biopsy
    - Culture and sensitivity
    - CBC/panel
    - Rectal exam and ultrasound- rectal exam is done with 180 cc's of methyl cellulose and lidocaine as an enema, then wait 5 minutes
- Abnormal cervix
- Abnormal ovaries or one ovary
- Only one uterine horn; two horns are required for full development of the fetus in camelids
- Persistent hymen (speculum exam)
- Ovarian cysts (check progesterone)

Other Infertility Problems

- Endometritis- generally in multiparous females
- Common secondary to dystocia; cultures: Strep, Staph, E. coli, Pseudomonas, Proteus, Actinmyces pyogenes
- Pyometria- very rare in llamas
- Cystic ovaries
- Early/middle and late embryonic loss
- Placental insufficiency-absence of villi in the chorionic surface of the placenta
- Hormonal- insufficient progesterone; 2.2 mg/45 kg BW/day
- Twinning- mummification and still birth

Chemical Control of Ovulation

- Superovulation
  - eCG of FSH given at 12 hour intervals in decreasing doses
  - 25 mg FSH over 4 days followed by GNRH
  - progesterone for 3 days followed by PGF2a
- Synchronization
  - Seasonal effect
  - Non-breeding season April-May
  - Best to use chemotherapeutics with a breedable follicle
  - hCG 750 IU IV in alpacas
  - 1000 IU hCG in llamas
  - Progesterone followed by PGF2a
  - CIDR followed by PG600 should work well

CHRONIC WASTING DISEASE IN DEER AND ELK

LISA NASHOLD

Chronic Wasting Disease (CWD) is a neurodegenerative disease of deer and elk. The signs of disease can vary between species. Common signs include weight loss, emaciation, drinking large quantities of water and frequent urination, and behavioral changes such as walking in fixed patterns and staring with a blank facial expression. Elk can show signs of ataxia and increased excitability and increased reactions to stimuli. Deer may have difficulty swallowing due to dilated esophagus with an associated increased salivation.[i] The disease signs may be mild initially, but they always become progressively worse. Once an animal shows signs of illness, it is invariably fatal.

CWD was first described in captive mule deer in a wildlife facility in Colorado in 1967.[ii] In the United States, it is endemic to Colorado and Wyoming. It was first noted in captive-bred herds, but is now found in wild populations in these areas. Based on surveillance and epidemic modeling, it is estimated that in wild populations in these areas 2.1% of white-tailed deer, 4.9% of mule deer and 0.5% of elk are infected.[iii] There have been two isolated cases in captive-raised herds in South Dakota.

What is the cause of the disease?

CWD is related to a group of diseases known as transmissible spongiform encephalopathies (TSE). TSEs can present as infectious or sporadic disorders with a genetic component. Evidence of the genetic component of TSEs is the apparent "species barrier." The CWD strain is a sporadic disease that is infectious to the related species of black-tailed deer, elk, and mule deer. Other animals such as cattle, sheep, bighorn sheep, antelope, moose, and white-tailed deer have been in direct or indirect contact with CWD cases but none have become infected with the disease.[iv]

Other TSEs include scrapie, which affects sheep and goats, bovine spongiform encephalopathy (BSE) of cattle, and Cruetzfeld Jacob disease (CJD) of humans, which has the new variant form which is associated with BSE and the non-variant form that is a sporadic disease with a genetic predisposition. Scrapie was first described in 1730; however, the BSE epidemic in the United Kingdom appears to be a result of a mutation of the scrapie prion due to improper rendering of sheep that were later fed to cattle. This mutant strain has then been linked to the variant form of Cruetzfeld-Jacob Disease in humans. So understanding prion strains and the "species barrier" is a vital goal of research.[v]

The agent that causes scrapie was described as a "slow virus" in 1954 by Bjorn Sigurdsson. There is a long period between inoculation with an infective dose and the onset of disease. Like viruses, prions are infectious because they stimulate a process by which more of the pathogen is produced. As their numbers increase to a sufficient level, disease results.[vi] The scrapie agent and the agent for other TSEs are now generally referred to as a "prion" which is derived from "proteinaceous, infectious" particle.[vii]

How does this agent make treatment difficult?

Although once thought to be a virus, the prion is different from viruses in many more ways than it is similar. Prions do not contain any RNA or DNA as viruses and other infectious agents do. Instead, they are composed of only an abnormal form of a cellular protein.

Prions are very difficult to inactivate once they are incorporated in a cell. It was found when trying to prepare a killed vaccine for another disease of sheep that the scrapie agent was not inactivated by formalin as viruses are.[viii] They are also extremely resistant to ionizing and ultraviolent irradiation.[ix]

Also unique is the fact that the body does not exhibit any host defenses to prions. Although the immune system is intact, there is no fever, no antibody production, and no increase in white blood cell count or change in blood cell morphology.[x]

How are TSEs transmitted?

The exact routes of transmission of CWD have not yet been shown conclusively, but maternal and lateral transmission seem to be likely methods.[xi] Scrapie has been proven to have lateral transmission to goats in close contact with affected sheep. It is suspected to be transmitted to lambs or kids in contact with placenta, birth fluids or contaminated enclosures. Scrapie has been experimentally transmitted to sheep via ingestion of placenta.[xii]

The oral transmissibilility of TSEs varies due to differences of concentration of the prion in different tissues. There is experimental evidence that BSE from brain tissue of affected animals can be orally transmitted to calves, cattle, sheep, goats, mice, macaque, and mink.[xiii]

There are differences in infectivity between strains. Also significant is a level of genetic susceptibility, not only on a species level, but also on an individual level. Genetic susceptibility specific to infecting strain type has been described in scrapie.[xiv]

Based on the theory of oral transmission, the feeding of ruminant-derived protein to ruminants was banned in the United Kingdom in 1988. Consistent with the 4 to 5 year incubation period, confirmed cases of BSE began to decline in 1993.[xv] In order to prevent the establishment of BSE in the United States, the Food and Drug Administration banned the use of most mammaliam proteins in ruminant feed.[xvi]

Diagnosis and disease control

CWD and other TSEs are characterized by neurologic tissue lesions found at necropsy including neuronal vacuolization and cell death, abnormal glial cells, and accumulation of transformed prion protein.[xvii] The CWD diagnostic work to determine prevalence was based on surveillance and epidemic modeling, as well as, immunohistochemistry among 5,513 deer and elk sampled in random surveys in endemic areas.[xviii]

Eradication of CWD in captive herds has been attempted unsuccessfully. Efforts included killing and burying all animals on a farm, turning the soil, and repeated spraying of structures and pastures with hypochlorite, followed by a 12-month period during

which no related species were raised. Failure may have been due to incomplete disinfection of buildings or pasture or possible reintroduction by wild animals.[xix]

Prions are resistant to inactivation by many methods and there may be differences in sensitivity to disinfection from one strain to another. However, the World Health Organization (WHO) recommends the following methods of inactivation: autoclaving at 134 to 136 degrees Celsius, using sodium hypochlorite (2.5% available chlorine) or 1M sodium hydroxide for 1 hour at 20 degrees Celsius for inactivation of scrapie agent in the absence of organic matter.[xx]

Conclusion

How should CWD be prevented from spreading further? There seems to be no useful control other than humane slaughter of affected animals and an embargo on the movement of animals from affected facilities to other facilities or the wild.[xxi] The debates on how aggressively to attempt to control this disease are complicated on several levels. Clearly, the highly publicized disease outbreak of BSE and the related variant form of CJD in the U.K. and Europe have a profound effect on public sentiment. However, it has not been proven conclusively that CWD can cause a similar public health concern, for example, scrapie was first described in 1730 and it was only recently found to have made the mutation to BSE and CJD. The ongoing efforts to control this disease will be followed with great interest.

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Parasites of Small Ruminants: Practical Considerations

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Overview

Parasites live on or in all animal species. They may or may not cause clinical disease, and may or may not cause economic losses for the producer. These effects depend partially on the evolutionary adaptation of parasite to host and vice versa. Also, they depend on the immunological, nutritional, and physiological characteristics of the individual host animal. Other effects of parasites can include disease transmission and zoonotic infection. Parasites are continually changing, especially in response to various pharmacological therapies, and thus their study is a continually evolving science.

Signs of Parasitism

Signs of parasitism in small ruminants vary from overt clinical disease to subclinical production losses to asymptomatic infections. In general, the various classes of parasites cause similar signs. Parasites should always be considered in herd health evaluations for small ruminants, especially when considering herds with production losses (poor wool/fiber quality, decreased rate of gain, decreased reproductive performance).

External parasites, including flies, lice, ticks, and mites, cause skin lesions and wool or fiber loss. Some of these are blood suckers, and as such can potentially cause anemia, weight loss, poor growth, and decreased production.

Internal parasites, including nematodes, trematodes, cestodes, and coccidia, can cause many varied clinical signs. Diarrhea, weight loss, anemia, poor wool/fiber quality, ventral edema, pneumonia, neurological signs, and abortion can all be caused by internal parasites.

External Parasites

Flies

Flies can cause myiasis, or "fly strike," when open wounds are infected with fly larvae. The most important of these is the screw worm, *Cochliomyia hominivorax*, currently eradicated in the United States. Treatment of myiasis consists of removing larvae from the wound, debriding necrotic tissue, applying topical antibiotics, and preventing reinfestation via wound dressings and topical insecticides. Prevention is the key, especially during lambing/kidding, castration, dehorning, and shearing. It is best to schedule these activities outside of fly season, if possible.

The nasal bot fly, *Oestrus ovis*, deposits its larvae near the nose, where they ascend to the sinuses. The larvae consume blood and mucus, causing annoyance, but no production losses. The prevalence among sheep is nearly 100%.

Lice

Lice are host specific, and are spread via direct contact. Prevalence and density of infection increases in the winter months, as animals are often confined to small spaces. Reservoirs of infection are the older animals in the herd. All life stages of the parasite are found on the host.

Biting lice, in the suborder Mallophaga, eat skin debris by scraping the skin surface with their mandibles. Their heads are rounded. *Bovicola ovis* infects sheep, and *B. caprae* infects goats. The major implication of biting lice infestations is poor wool quality due to pruritis and excessive self-grooming/rubbing leading to wool loss.

Sucking lice, in the suborder Anoplura, pierce the skin and suck blood from capillaries. As such, they are exposed to systemic treatments, unlike the biting lice. *Linognathus ovillus* is the sheep species.

Mites

Sarcoptes scabiei is a common mite in all domestic mammals. It causes intense pruritis leading to hair loss. Pruritis is due to a hypersensitivity reaction of the host to the eggs, saliva, and feces present in the burrows left by female mites.

Psoroptes ovis (sheep) and *P. cuniculi* (goats) is a non-burrowing mite. It infects wooly areas and leads to wool loss. It can be found at the edges of the skin lesions. It is a reportable disease in the United States for which an infected herd will be quarantined. The last reported case was in New Jersey in 1972.

Chorioptes bovis causes pruritis on the tail base and legs (non-wooly areas) of sheep and goats. It is not very pathogenic and can be controlled with routine measures.

Demodex mites are host specific, and can be found on all mammals. The mites are cigar shaped and are found in hair follicles. Goats can exhibit a papular form of demodectic mange, but most animals show localized pruritis.

Ticks

Ticks mainly cause problems via disease transmission and damage at feeding sites. Anemia and tick paralysis also may occur. Diseases transmitted via ticks include Babesiosis, Ehrlichiosis, and Q fever. Damage at feeding sites can lead to myiasis. Many species of ticks, both hard- and soft- bodied, infect small ruminants. Specific species of ticks vary by area of the country.

Internal Parasites

The internal parasites of small ruminants can be divided into four major categories: Nematodes (round worms), Cestodes (tape worms), Trematodes (flukes), and Coccidia.

Nematodes

Trichostrongyles

Trichostrongyles as a group are the most important parasites of ruminants. The important species within the group vary by area of the country, with *Haemonchus*, *Ostertagia*, and *Trichostrongylus* the most important to small ruminants in the northern USA. Pasture-managed small ruminants are almost invariably infected with one or more species within the trichostrongyles group, while confinement-managed small ruminants are less likely to be infected.

Haemonchus Contortus

Haemonchus contortus is the most important parasite in sheep. It is called the barberpole worm, and is found in the abomasum. It sucks blood, causing anemia, ventral edema (bottle jaw), weight loss, and death in some cases. The disease can present acutely, subacutely, or chronically. Acute infection, usually in young or debilitated animals, is rare and is characterized by severe anemia, generalized edema, and death within one week. Chronic infection is most common, and shows a more moderate anemia, localized edema to the intramandibular space, and weight loss.

Ostertagia Ostertagi (Teladorsagia circumcincta)

Ostertagia ostertagi, the cattle species, is known as the brown stomach worm, and is the name normally used for small ruminant infections as well. It is found in the abomasum, where emerging larvae cause extensive damage to the gastric mucosa. The resulting infection disrupts the normal architecture and cellular function of the mucosa, leading to pepsinogen leakage into the bloodstream and plasma leakage into the abomasum. Additionally, HCl production is decreased and mucus production is increased. The gastric pH rises, allowing bacterial overgrowth and preventing conversion of pepsinogen to pepsin. Malabsorption results, leading to diarrhea and weight loss. Anorexia can also be seen. Cattle are more susceptible to Ostertagia than small ruminants.

Trichostrongylus axei

Trichostrongylus, called the bankrupt worm or small stomach worm, lives in both the abomasum and the small intestine. In the abomasum, it causes a syndrome similar to that described above for Ostertagia. In the small intestine, it causes separation of the epithelium from the underlying tissue, leading to inflammation and an increased rate of epithelial cell turnover. Villus atrophy results, leading to intense diarrhea. Anorexia accompanies this infection, and in combination with the diarrhea leads to weight loss and poor wool growth. This is the second most important parasite in small ruminants.

Nematodirus

Nematodirus species, called the thin-necked intestinal worm, lives in the small intestine. The three sheep species are *N. filicolis, N. battus*, and *N. spathiger*. They cause severe diarrhea, especially in young animals, and can result in death.

Cooperia

Cooperia species, called the cattle bankrupt worm, are found in the small intestine. Small ruminant species are *C. punctata* and *C. pectinata.* Major clinical signs are as with the other trichostrongyloides, mainly anorexia, diarrhea, weight loss, and rarely death. Hemoconcentration may also occur.

Strongyloides

Strongyloides species, called threadworms, are common in the small intestine of lambs. Natural infections usually resolve by one year of age as the host acquires immunity to the worms. Strongyloides can be acquired via transcutaneous and transmammary transmission; the source of infection is the ewes. Infrequently, infection can cause pneumonia due to parasite migration through the lungs or diarrhea due to intestinal inflammation. More commonly, strongyloides infection causes foot rot-like lesions on the feet, and can predispose to a secondary foot rot infection. Thiabendazole is the drug of choice.

Oesophagostomum

Oesophagostomum species, called nodular worms, are found in the large intestine. They can cause diarrhea in sheep, which may lead to fly strike in the perineal region.

Chabertia ovina

Chabertia ovina, called the large mouth bowel worm, is found in the large intestine of sheep. It may cause a bloody or mucous diarrhea. Occasionally, it may cause severe anemia, usually in otherwise compromised hosts. Eggs of this species are not found in fecal samples taken during acute disease.

Bunostomum

Bunostomum species, the hookworms, are found in the small intestine. In young animals, bloody diarrhea, anemia, anorexia, and ventral edema (bottle jaw) may be seen. Death can occur. Skin penetration can cause dermatitis, and the larvae cause cutaneous larval migrans in humans. This parasite is most common in southern states.

Parelaphostrongylus tenuis

Parelaphostrongylus tenuis, or the meningeal worm, is a parasite of white tailed deer. It is highly pathogenic for llamas, frequently causing death. The llama acquires the infection via ingestion of a larvae-infected snail from pasture contaminated by deer. The parasite migrates through the spinal cord to the brain, causing ascending incoordination and paralysis due to inflammation in the CNS. A CSF tap will reveal eosinophilia. Treatment consists of ivermectin prophylatically. Once lesions are present, recovery is unlikely. Flunixin meglumine, DMSO, and intravenous fluids can be given in conjunction with ivermectin if treatment is attempted.

Trematodes

Trematodes, or flukes, are acquired via ingestion of infected snails. *Fasciola hepatica* is the most common liver fluke, found in bile ducts. An acute syndrome during parasite migration can cause hepatitis and death. The chronic syndrome ensues when parasite migration leaves fibrotic tracts through the liver. This can lead to liver condemnation at slaughter and potentially weight loss and decreased reproductive performance. Fluke infection can also predispose the host to Clostridia infections.

Cestodes

Cestodes, or tape worms, are important mainly for the human health risk and tissue condemnation at slaughter. *Echinococcus granulosus* causes hydatid cysts in the liver and/or lungs, and is zoonotic. Many other species exist in various tissues; carnivores are an important part of the tape worms' life cycle. This is a common secondary invader with shepherds in the western range flocks.

Coccidia

There are many species of coccidia which may infect small ruminants. The most important is *Eimeria*, found in the small intestine. In young animals, bloody diarrhea, decreased weight gain, and death may occur with some pathogenic species. Adults may also exhibit diarrhea and decreased production. Commonly adults remain chronic infected carriers infecting young stock.

Eperythrozoon llamis

This protozoa is secondary to immunosuppression in llamas. It is diagnosed on a blood smear, as an extracellular red blood cell parasite. It can be treated with penicillin or chlorotetracycline, but is best prevented via good management. Good nutrition and a low stress environment are the best prophylaxis.

Toxoplasma gondii

This feline parasite can cause abortion and neonatal death in small ruminants. Fetal resorption or mummification results if infection occurs early in gestation; abortion results from late gestation infection. Toxoplasmal placentitis causes cotelydonary lesions. Ewes, does, and llamas do not show clinical signs of infection and develop lifelong immunity after one infection. Controlling the cat population on the farm and exposing naïve, unbred animals to toxoplasma-induced aborting females may help prevent the disease. Toxoplasmosis is zoonotic.

Lungworms

There are several species of lungworms that infect small ruminants, including *Dictyocaulus filaria, Muellerius capillaris,* and *Protostrongylus rufescens*. All of these can predispose the infected host to pneumonia, but are not very pathogenic on their own. *D. filaria* can cause chronic infections in adult ruminants, characterized by lethargy, cough, and dyspnea. *M. capillaris* is most common in goats. *P. rufescens* is a problem in big horn sheep.

Diagnostic Considerations

Diagnosis of parasite infections varies by the parasite. For intestinal parasites, fecal sample analysis is the preferred antemortem test. External parasites are diagnosed via skin scrapings (mites), visual exam (ticks), or microscopic exam of hairs (lice). Blood parasites are found on blood smear examination.

Fecal sample analysis is by far the most common method to evaluate parasitism. In general, fecal samples should be gathered from a representative sample (usually 5% to 10%) of the herd or flock. It is best to obtain fresh feces directly from the rectum, and each sample should be approximately 10 grams. Refrigerate any samples that won't be analyzed within two hours of collection.

There are five major techniques for fecal analysis:

1) Fecal Flotation – this is the most commonly performed test. Eggs and oocysts can be detected with this technique. Various solutions are used in this method, including sugar, magnesium sulfate, zinc sulfate, and sodium nitrate.
2) Fecal Sedimentation – this technique will concentrate fluke eggs.
3) Baermann Technique – this method is used to find larval stages, usually of lungworms. It takes at least 8 hours to allow the larvae to migrate out of the feces into water, where they can be collected and identified microscopically.
4) McMaster Technique – this is a quantitative method for estimating the number of eggs present in a fecal sample
5) Direct Smear – this is the best technique to find Giardia (infrequently found in small ruminants)

Pharmacological Parasite Control

"Deworming" is the traditional method of parasite control. This usually consists of injectable or oral parasiticides administered to all animals in the herd/flock at specified times of the year. Many of the drugs introduced over the years are now ineffective due to drug resistance in the parasite population. This is a major concern for the future of parasite control in veterinary medicine

Research is ongoing to promote alternate substances and management techniques to control parasites. Some of the newest possibilities include vaccines (currently possibilities for *Haemonchus* and *Fasciola*) and predacious fungi (a species called *Duddingtonia flagrans* preys upon larval stages of *Trichostrongylus, Nematodirus,* and *Dictyocaulus*). The general recommendations at the current time are targeted used of effective parasiticides in combination with effective environmental management. Targeted use means utilizing drugs when they are most likely to be needed and effective, such as at weaning in combination with moving the weanlings to fresh pasture.

Environmental Parasite Control

Environmental parasite control consists of pasture management, intermediate host control, insect avoidance techniques, and sanitation. Pasture management includes spreading feces out to promote drying, mowing pastures to increase sunlight penetration, alternating species of grazers that do not share parasites, and rotational grazing. Rotational grazing is best accomplished when the grazing period per allotment is less than the prepatent period of the parasite of interest and the resting period per allotment is long enough to allow all the eggs and larvae deposited during grazing to die. This is difficult to do in temperate climates due to the longevity of larval stages in mild weather. Tropical climates lend themselves well to rotational grazing because the larval stages use up their energy reserves faster in hot, humid conditions where their metabolism will be quicker, thus the length of time required for a pasture allotment to rest is reduced.

Intermediate host control consists of physically and chemically preventing contact between livestock and the intermediate host. For example, *Fasciola magna* is carried by a snail. If livestock and snails do not come in contact, parasite transmission is not possible.

Similarly, insect avoidance techniques are utilized for prevention of external parasites. Dips, sprays, and powders can be applied to individual animals as repellants, indoor areas can be screened, and animals can be grazed during times of the day when the insect pest is less active, such as at night to avoid horse flies.

Sanitation is an important aspect of parasite control in both indoor and outdoor management areas. Bleach is effective at killing larvae and can be used to disinfect many areas, especially those prone to fecal buildup. It has even been suggested that applying a weak bleach solution to pasture may be effective at reducing larval loads, although the

effects on the plants and the grazers have not been determined. Also, nitrogenous fertilizer in liquid form shows larvacidial properties on pasture. It is recommended that pastures be sprayed in late spring or early summer, and whenever conditions are extremely warm and humid.

Example Parasite Control Programs

All parasite control programs should be based on quantitative egg counts for that flock/herd. Ideally, these counts would be performed before deworming to assess worm burden and after deworming to assess efficacy.

Rotation of anthelmintics is recommended. Two idealogies exist to achieve rotation : 1) rotate between classess of drugs at each deworming or 2) rotate between classess of drugs each year. Rotation by year seems to be the least likely to promote parasite resistance. The most important aspect of rotating anthelmintics is to rotate *classes* of drugs, not drugs within one class. For example, use an avermectin (Ivermectin) one year and switch to a benzimidazole (Fenbendazole) the next year.

Effective parasite control programs must also include utilization of clean pastures. This can be accomplished by either rotating cattle and sheep, or simply resting one grazing area between groups of the same species. For instance, pasture designated for weaning lambs should not be grazed by any other sheep that year.

Finally, treatment must be accurately dosed by body weight, or the heaviest animal in the group used to determine dose. Feed- or water-distributed drugs are least effective because the dose per animal is not controlled. All animals in a given group must be treated at the same time, and all incoming animals to a group must be treated before introduction.

If these tenents are used for the development of specialized parasite control programs for each farm, the parasite burden will decrease, production will increase, and parasite resistance to current anthelmintics will be kept to a minimum.

Sheep

Midwestern Farm Flock

- Deworm ewes and rams in fall before breeding
- Deworm ewes 2 to 6 weeks before lambing
- Provide coccidiostat in creep feed for lambs
- Deworm lambs at weaning AND move to clean pasture
    - Fecal test flock to assess parasite status
    - Note drug withdrawal times

Large Flock in Arid Area

- foci of parasite infection will exist at water sources or especially lush grazing areas
- Deworm ewes during the last 3rd of pregnancy and again when the lambs are gathered
- Lambs should be dewormed at gathering
- Fecal test flock to determine parasite levels
- Note drug withdrawal times

Goats

Milking Herd

- Deworm does 2 to 4 weeks before kidding during the dry period
    - +/- deworm does mid-lactation dependent on egg counts note withdrawal times for milk, test milk before sale
    - Fecal test herds to assess parasite numbers

Meat Herd

- Deworm does 2 to 4 weeks before kidding
- Deworm all goats midsummer and move to new pasture
- If clean pasture is not available, deworm all goats every 4 to 6 weeks from spring to fall
- Fecal test herd to assess parasite levels
    - Note drug withdrawal times

Llamas/Alpacas

Meningeal Worm

- Keep llamas away from white-tailed deer
- Administer ivermectin once a month preventatively
- Snail/slug control, clean dry environment

Small Hobby Herd

- Deworm all animals in the spring before moving to clean pasture
- Deworm all animals in the fall after a hard frost, preferably with ivermectin
- Administer clorsulon at the end of grazing and 8 weeks later if grazing swampy fluke endemic areas
- Coccidiostat may be used for crias and/or weanlings
- Fecal test herd to assess parasite levels

Cervidae

Zoo Herd

- fenbendazole is approved for use in captive wild cervidae
- seasonally deworm all animals at a time when the climate will help destroy many of the larvae in the enclosure (i.e. after frost in northern USA) or when moving animals to a new enclosure
- minimum deworming spring and fall
- increase access to medicated feed for all animals in enclosure to ensure all animals are treated
- fecal test the herd to assess parasite levels

Farmed Herd

- As with other small ruminants, deworm adult females before parturition and all animals before moving to clean pasture
- January-February and September-October is most common
- Fecal test the herd to assess herd for parasite levels
    - Note any drug withdrawal times

Conclusion

Parasitism in small ruminants is a major problem worldwide, as much of the developing world relies on small ruminants in their agricultural systems. Although parasitism rarely causes death by itself, it commonly leads to significant production losses. Parasitism will continue to be a problem for livestock producers in the future, and the continued prospects for drug therapy as the sole technique in parasite management are grim. Alternative methods of controlling or eliminating parasites must be investigated and improved upon, including genetic enhancement of breeds for parasite resistance and/or tolerance.

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Applications of Small Ruminant Diagnostic Ultrasound

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Diagnostic ultrasound has increasingly become an important adjunctive tool in diagnostic veterinary medicine and surgery in many veterinary practices. Many brands are available, however most veterinary clinics today utilize a **5 MHz transducer** with their ultrasound unit. A higher frequency transducer produces an image with better resolution than a lower frequency transducer but the sound beam cannot penetrate tissue as deeply. When selecting a transducer, the transducer with the highest frequency that can provide adequate depth of penetration for the procedure is chosen. The 7.5 MHz linear array transducer is the best selection for the visualization of the nongravid reproductive tract when used transrectal. The 3.5 MHz sector scanner also can be a helpful tool for evaluation of the reproductive tract transabdominally due to the smaller animal size of the small ruminant. Irrespective of the transducer selected, once the sound waves are emitted from the transducer, the wave passes through the tissues and eventually is reabsorbed back by the probe. The transducer acts as a receiver 99% of the time and a transmitter 1% of the time. **Acoustic impedance** can be a problem in quality of the ultrasound. The final image quality is determined by the number, strength and time delay of sound waves returning from the tissues. Brightness is dependent on the difference in acoustic impedance (density and stiffness) of the tissue interfaces. Dense tissues such as bone produce high intensity images and are called **hyperechoic** and appear white. Low-density tissues and fluid (commonly urine) produce little intensity in their signals (**anechoic**) and appear black. **Hypoechoic** densities reflect cellular fluids. Variations of shades appear dependent on thickness of tissues examined. The key to success in small ruminant diagnosis where hair and wool cannot always be clipped from the patient is to reduce the air interface by using large quantities of ultrasound gel.

Ultrasound pregnancy diagnosis in sheep and goats was initially a common procedure done with "lay" staff using an A-mode Doppler measuring fetal pulses or placental fluids. The average range of accuracy was 80-90% in sheep and goats. This technique is most accurate between 40-60 days of gestation. One of the problems with this measure of pregnancy diagnosis is that later in gestation this technique can become extremely inaccurate (20-40%). Both lack of placental fluid and fetal maturity precludes its use. The accuracy of the A-mode transabdominal procedure in llamas and alpacas is extremely low. Currently many veterinary clinics utilize ultrasound diagnostics for other species (equine and small animal). This equipment is generally B-mode real time ultrasound with almost 100% accuracy. The sensitivity of the technique depends primarily on the skill of the investigator.

Sensitivity: number of animals diagnosed as not pregnant/ number actually not pregnant

Specificity: number of animals diagnosed as pregnant/numbers that are pregnant

Evaluation of fluids, uterine contents, pathology, embryo, fetus, and placentomes are all-important parameters for making the final diagnosis. Each carries its own weight and importance. Linear-array versus sector scanning transducer probes is also an issue in transducer selection and use. The sector scanner has an image or beam, which is pie or wedge shaped. These transducers are commonly employed for transabdominal scanning. The linear-array scanner gives a more wide-angle view in a rectangular shape. Linear-array transducers are also much cheaper than their sector scanner counter parts and are found more commonly in veterinary clinics.

Handling of animals is also of importance while ultrasounding. The techniques described here are all done with the animals manually restrained in normal standing position. The ultrasound unit should be kept "out of harms way" as animals improperly restrained can do many thousands of dollars of damage to a unit.

Method of viewing the small ruminant reproductive tract: transabdominal vs. transrectal.

Transrectal imaging – restraint is important: standing vs. dorsal recumbency

Sheep:

- Using a 7.5 MHz transrectal probe the clinician can detect pregnancy in sheep at day 15 or greater of gestation.
- Using the 7.5 MHz probe fetal heart beat detected at day 18-23
- Using the 5 MHz probe fetal heart beats are detected at day 28
- Using the 7.5 MHz probe number of embryos at day 25
- Using 5 MHz probe pregnancy diagnosis at day 25
- Using the 7.5 MHz probe embryonic vesicles can be detected at day 16-17 transabdominal approach after day 35

In sheep the transrectal probe is inserted using 60 ml of lubricating gel with 6 cc lidocaine premix.

- 5.0 or 7.5 MHz transducer guided transrectally with a PVC pipe adapter

Goats:

- Heart beat day 23-25 with the 7.5 MHz probe
- Fetal count by day 25 with the 7.5 MHz probe
- Embryo detected at day 25 with the 5 MHz probe
- Embryonic vesicles are detected at 16-17 at 7.5 MHz
- Day 35 it is best to use the transabdominal approach
- Sector scanning transducer improves accuracy in counting fetal numbers

Llamas:

- 7.5 MHz linear array transducer in llamas can detect pregnancy at day 11-12;
- Embryos are very obvious by day 17-18 with the 7.5 MHz probe
- Llama heart beat begins at day 21 with the 7.5 MHz probe
- Day 21 embryo detection with the 5.0 MHz probe
- Day 28 very obvious heart beat with the 5.0 MHz probe
- Pregnancy in 98% left horn in camelids, however fluid and membranes occur in the right horn so both horns should be scanned; early on twins may be noted. However normal attrition occurs commonly and twinning is a rare event.
- Camelid transrectal u/s tends to be ineffective after day 75-90

<u>Transabdominal Imaging</u>

- 35 days and over in sheep and goats
- 24 hour fast facilitates transabdominal u/s
- After day 40 caruncles are visualized with the 5.0 MHz probe
- Day 40 and before only see fluid and embryo no caruncles
- After day 110 visualization is more difficult, fluid and fetal position shift cranially
- Fetal counts done at 60 days of gestation
- **Placentomes at 35-40 days, these become "c" shaped between 40-50 days**
- Fetal numbers are best assessed between 40-70 days of gestation
- Right side wool/hair free area dorsal to the mammary
- **Caruncles, fluid levels and feti need to be evaluated to make a proper diagnosis**
- **The 5.0 or 3.5 MHz linear-array or a sector scanning probe are best for transabdominal scanning**

- Sector scanning probes tend to be more accurate for counting fetal numbers
- Determining the length of gestation comes with practice utilizing placetomes, fetal size, and placental fluids.
- Abortions- placentomes evident upon ultrasound but they are found close together lacking fluid volume.

In evaluating pregnancy fluid only as a diagnostic tool is a mistake. Placentomes are a minimum requirement after day 40 in the sheep and goat**. Llama placentation does not contain placentomes. Hydrometria** (pseudopregnancy)/mucometria is common in goats at the beginning and the last portions of the breeding season. Hydrometria is also common with out-of-season-breeding programs and when reproductive management

drugs are used. Hydrometrias are visualized on ultrasound as a large sacculated organ which is fluid filled (hypoechoic) lacking placentomes and feti. Thin tissue walls separate the uterus into compartments. These walls will undulate when balloting. White flecks are common in the fluid compartments.

- Linear array probe diagnosis is effective in goats from 25 to 100 days of gestation
- Sector scanner will increase the diagnostician's accuracy as well as improve fetal number evaluation
- In goats estimation of gestation stage is best done in the early stages, day 45-60 of gestation

Means of measuring fetal age:
- Crown rump length
- Biparietal diameter
- Chest diameter

In goats the practitioner is often asked to determine age of gestation. In Saanen and Alpine dairy goats, the fetal length appears to correlate with age (Smith and Sherman 1994).

The length of the fetus is 40 mm at 45 days, 100 mm at 60 days and 250 mm at 90 days of gestation. Biparietal diameter also correlates approximately with age in goats. Between 40 to 100 days of gestation a close correlation is evident. Caruncular size can also be used early on for age determination.

Camelids

- Transabdominal 5 or 3.5 MHz linear or sector scanning probe works best
    - Left side 35-55 days of gestation
    - Right side 75+ days
- During late gestation a lack of fluid and a fetal shift cranially allows for missed diagnosis.
    - Scan both horns
- Ideal camelid program:
- Transrectal: 28-45 days of gestation early evaluation; note to owners that absorption/resorption is common in the first 60-90 days of gestation
- Secondary follow up transabdominal: 75+ days
- Tertiary follow up progesterone analysis if questions arise
- Determination of fetal age and a close proximity of due date: the transabdominal assessment of the biparietal distance. The equation to determine age in crias is:
- **GA= 18.8 + 3.79 BPD**, where GA is the gestational age and BPD is the biparietal distance (Fowler 1998).
    - Amniotic sac in camelids can be visualized between days 15-21 with the 7.5 MHz probe
    - Transrectal evaluation day 15-50
    - Transrectal analysis sensitivity low after 75-90 days
    - Transabdominal approach after day 40-45

Cervids (elk, red deer, fallow deer, mule deer, antelope, reindeer and moose)

- Restraint, restraint, restraint!!!!!!!!
- Transrectal day 14 uterine fluid in horns with 7.5 MHz probe
- Day 24 fetus
- Heart beat at day 28
- Day 31-42 is the most accurate time to ultrasound with 5.0 MHz probe
- Transrectal generally done in a drop floor chute
- Transabdominal done with manual restraint or sedation
- Transrectal can be dangerous if restraint is poor

Positioning

Transrectal ultrasound can be most readily utilized by first clearing or evacuating the bowel of fecal material. Once this has been accomplished, large volumes (60-180 ml) of lubricating gel should be injected into the lumen of the colon. It may be helpful to add lidocaine to the gel at 9cc/60ml lubricant. An important note is that goats tend to be very sensitive to the effects of lidocaine. The transducer should either be introduced by glove-covered hand or with the use of a P.V.C. pipe extension. This is usually done while the female is standing. The important geographic element is to first note the urinary bladder as a reference point. From here position the probe cranially to sweep the caudal abdomen for evaluation of pregnancy. It should be noted that many camelid owners do not favor the placement of a transrectal probe for ultrasound diagnosis. The practitioner should always ask the owner first if they object to this approach. Blame may wrongly be placed later on as to abortion/ resorption of the fetus due to this procedure.

Transabdominal ultrasound is generally done in the standing restrained small ruminant from the right side. Generally in most species there is a hairless/wooless area just cranial and dorsal to the mammary gland. The area should be as clean as possible and large amounts of ultrasounding gel should be applied to both the skin and the transducer. In sheep gel is useful as well as ob lubricant, alcohol, water or mineral oil. During early pregnancy < 60 days in most species the probe is aimed at the opposite brim of the pelvis in a doro-caudal direction (directed towards the pelvic inlet). The 5.0 MHz probe works well during early pregnancy while the 3.5 MHz probe would be the preferred transducer after 90 days of gestation. In camelids the left inguinal area is scanned between days 28-90 of pregnancy in alpacas and between 35-90 in llamas. After the ninetieth day of pregnancy the best approach is to switch to the right side or the ventral midline in camelids. With sheep, goats and cervids, the right side is routinely utilized to minimize contact with the rumen and bowel contents.

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SMALL RUMINANT NUTRITION SIMPLIFIED
-or-

A GUIDE FOR THE NUTRITIONALLY CHALLENGED

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Many veterinarians as well as animal scientists learn up front that the majority of first time small ruminant owners have never owned livestock before. The owners understanding of nutrition is basically limited to anecdotal as well as pet nutrition insight. The other extreme would be owners who carefully calculate the feed rations of large sheep feeding operations and commercial dairy goat herds. The span of knowledge is great. Many producers become enmeshed in feeding a "least cost" ration to their flock or herd. I would like to start this treatise with the statement that **THE CHEAPEST OR LEAST COST RATION IS NOT NECESSARILY THE MOST EFFICIENT RATION**. With this in place a better understanding of feed utilization needs to be formed. Producers as well as specialists need to understand the balance between the rumen (or compartmental) microbes and the nutritional capacity of the animal.

Type of Feed
- Pellets
- Hay
- Grass
- Grazing pasture
- Grain
- Cubes
- Ground feeds
- Water

Types of Feeders
- Bunk feeders
- Free choice troughs or bins
- Key hole feeders
- Pasture
- Forest/ rough land

Other Factors of Importance
- Feeding hierarchy/psychology
- Bunk space
- Feed utilization
- Spoilage (mold)
- Poisonous plants
- Particle size/ feed related factors

Feeding hierarchy is extremely important in the nutrition of small ruminants. Social structure of small ruminants is key to feeding these species successfully. It is extremely important to body condition score the herd on a regular basis. Wether the body condition score is from 1-5 or 1-10, I personally allow the owners to make this decision. However, it is important that all animals with a thick coat (wool or hair) be monitored carefully. It is very common that many animals low in the social hierarchy are too thin, and body condition score can be over looked with a full fleece.

Sub-clinical acidosis is a common problem in the feeding of all livestock. Too "hot" of a ration with inadequate long stem roughage is generally to key to this problem. Many first time small ruminant owners feed excessive concentrate levels to animals. Also with social eating schemes, one animal may gorge on all of the concentrate. This may be due to inadequate feed bunk space.

Treatment

- Limit or discontinue concentrate feeding
- Buffering agents may be helpful (baking soda)
- Free choice excellent long stem hay or grass pasture
- Transfaunation
- Probiotics

Feeding Success

- Appropriately process feed according to type and need for the given species
- Appropriate storage of feed in dry well ventilated areas
- Adequate amounts of feed available (a minimum approach is the 1.5% of body weight on an as fed basis)
- Available to all members of the herd or flock
- Proper bunk space requirements per animal unit

Assessment of a Successful Feeding Program:

- Annually feed analysis: grass, hay, silage, mineral mix, supplements
- Water analysis
- Blood mineral analysis
- Liver biopsy/analysis: males and non-pregnant females over six months of age at the end of the winter feeding season before being placed on pasture
- Animals of all species eat in a wave like structure: first wave- dominant animals will eat the highest quality feed stuffs; second wave- the middle class group will eat most if not all of the higher quality feedstuffs; third wave- the least aggressive group will eat the "fines" and stem components left in the feed bunk. These animals will be the young, old, infirm and the more timid stock. Also males fed with females may keep others away from the feed bunks.
- BCS is the key to success to diagnosis of nutrition problems.

- Llama and alpaca nutrition is unique in the small ruminant pattern. They maintain a low dry matter intake of 1.8-2.0% of body weight. Their ideal ration will contain 12% protein, 55% TDN, 0.7% calcium and 0.4% phosphorus and 2 mg selenium per head per day would be a good mix. The norm would be to feed good quality of alfalfa, alfalfa/grass hay or plain grass hay along with a small amount of pelleted supplement per day. Grass hays are deficient in Ca and P so these are compensated for by the pelleted feed. It should be noted that at least 25% CF or greater should be include to insure normal compartment function. During the last trimester of pregnancy the caloric density on an as fed basis needs to be increased.

Rumen Microbiology

There have been well over 150 different species of microorganisms (yeast, bacteria, protozoa, viruses and fungi) isolated from the rumen fluid. It is important from the start to understand that fiber breakdown and fermentation with subsequent absorption and utilization of nutrients occurs only at higher pHs. Rumen acidosis will allow this balance to be broken and shut down will occur. Levels of microbial organisms are pH dependent and as such population shifts are common and easy to manipulate.

Sheep Nutrition

REMEMBER: ANIMALS PERFORM TO THE LEVEL OF THE FIRST LIMITING NUTRIENT!

Sheep feeding habits:
- the sheep's muzzle is divided by a vertical cleft
- sheep tend to be less selective feeders than other small ruminants
- sheep utilize "selective consumption". Sheep consume diets much higher in nutritive value than the average of the forage provided to them. They select out the more nutritional components.
- mobile upper lips and prehensile tongue

Essential Nutrients

- Water requirements- lactating ewe: 6 liters per day average; fattening lamb: 4 liters in temperate climates
- 4-5 pounds of water are required for every pound of DM consumed; when water intake drops, feed intake drops
- Water intake must exceed expected levels of milk production. Under temperate conditions 3.5 pounds of water must be consumed for every pound of milk produced
- With snow, sheep do not need water when out on range; they consume snow
- Water consumption is also directly related to the crude protein (CP) consumption.
- Water acts to flush nitrogen from the system

- Water sources: tanks, streams, reservoirs, succulent feeds; beware of earthen tanks, they can bog down and trap sheep
- When formulating mineral mix requirements, levels of mineral in the water supply should be considered. Many water sources contain high levels of minerals
- When grazing semiarid pastures the crude protein levels often fall below 4%
- Below 7% CP rumen microbial activity is depressed by lack of nitrogen. A level of 8.5% crude protein should be considered a minimal level to sustain normal rumen function.
- Stage of plant growth needs to be assessed when determining CP
- In rangeland agriculture the most important factor affecting productivity is vegetation/plant management

Weight Gains Can be Increased By

- Control of pasture pests
- Lambing season manipulation to fit the productive unit
- Over sowing legumes into natural grass lands
- Range and pasture testing and fertilization when necessary
- Genetically selecting animals for specific environments

NATURAL RESOURCE MANAGEMENT TOOLS

1. Livestock management
   - Mixtures of livestock species
   - Seasonal grazing
   - Adequate stocking rates for the environment

2. Vegetation replacement
   - Reseeding
   - Deferred grazing
   - Want high leaf to stem ratios
   - Rapid recovery ability is desirable
   - High tolerance to grazing
   - Ability to regenerate from seed

3. Supplemental feeding during critical periods to remove pressure from range/pasture

4. Water development

5. Salt/mineral distribution

6. Plant monitoring

7. Nutritional laboratory assessment of native plant species

8. Soil testing to determine deficiencies/toxicities
    - Nitrogen fertilization increases the yield and protein content of range and pasture plants
    - Fertilization does not improve forage digestibility

Energy

- Insufficient energy levels are the primary limiting factor/nutrient deficiency
- Inadequate amounts of feed
- Poor quality feeds
- Symptoms: slow weight gains, weight loss, reproductive failure, decreased milk production, reduced wool yield, animal mortality and lowered immune function
- No production occurs until the maintenance requirement has been satisfied

RULE OF THUMB: Sheep consume 2 ½ to 3% of their body weight in DM per day

Nutritional wool quality factors:
- Requires energy and protein for production
- Poor nutrition=poor fiber quality
    - Fleece fibers break easily
    - Angora goats- fiber yield improves as protein level increases

Flushing
- Elevated plane of nutrition allowing thinner ewes to increase ovulatory capacity just prior to breeding
- Moving to lush pasture or providing ½ pound per head per day of concentrate
- Ewe with a BCS of 3.5 or higher should not be flushed; works best with BCS 2.0 to 3.0
- May increase lamb crop by 15-20% ? ?

NPN (nonprotein nitrogen)
- Urea + keto acids from rumen flora= amino acids
- These amino acids + rumen flora= microbial protein

Ammonia toxicity secondary to massive urea consumption is common
- Lipid layer of the rumen layer is permeable to ammonia
- Rumen has a poor buffering ability to buffer ammonia
- Ammonia levels may overwhelm the liver's ability to convert it to urea=toxicity
- Problems with urea feeding: lack of adaptation, fasting prior to feeding, feeding urea in diets of poor quality roughages, low water intake, improper formulation of ration

Treatment: Instill 5-40 liters of cold water to rumen before seizures occur; cold water lowers ureolysis

FEEDING PREGNANT EWES:

Management of the pregnant ewe is critical to the reproductive and economic success of the sheep producer. It has been estimated that 60-80% of sheep production cost is in the feeding program. It should be noted when evaluating a ration that BCS must be practiced.

Fetal Development

- Substantial increase in the requirements of the pregnant and lactating ewe over the dry unbred animal
- 1.5 to 2.0 times greater dietary requirements for the pregnant (third trimester) ewe for crude protein (CP), digestible energy (DE), calcium (Ca) and phosphorus (P)
- The transition ewe is an important aspect of the sheep producers feeding program

Transition Ewe Program

- Maximize dry matter intake
- Minimize the animals' ability to create a negative protein and energy imbalance
- Insure adequate levels of calcium and the maintenance of a proper Ca: P ratio
- Adequate nutritional stimulation of rumen papillae
- Maximize immune system health and function
- Decrease metabolic disease
- Increase lamb viability, 60% of fetal growth occurs in the last month of pregnancy
- Acclimate the rumen microbe slowly to prevent the potential for acidosis and the animals going off feed
- Maternal protein deficiency is more important than energy deficiency
- NRC recommends 11.3% CP however 15-16% is really required on an as fed basis, this is especially important after day 130.
- Soybean meal and blood meal prepartum is a good source of protein above the requirements necessary to meet microbial feed requirements
- Bypass proteins can be helpful

Increasing the dry matter consumption is critical in a time period when the abdominal distension of the uterus will preclude adequate fill. Therefore the quality of the feed is extremely important to the success of the program.

Common Transition Ewe Problems

- Hepatic lipidosis
- Metabolic ketosis
- Milk fever
- Hypomagnesaemia/grass tetany
- Trace mineral levels are decreased in the dam from the fetus. Fetal hepatic micro and macronutrient levels are developed by in utero absorption of minerals and the absorption of high concentrated Colostrum

    Vitamins A and E as well as other fat soluble vitamins do not cross the placenta, the total fetal absorptive source is the Colostrum

FLOCK BASED DIAGNOSTIC MONITORING

It is important when evaluating individual animals' nutrient status that a flock "mean" and "median" level be arrived at for the population assessed. This is the process of developing a flock normal.

- Cost benefit
- Pooling of samples where ever possible
- Hepatic biopsies
- Blood samples- not as exact as hepatic sampling; collect from animals over 6 months of age. Most labs do not have normals set for younger animals. Whole blood for selenium and plasma for copper and zinc
- Feed samples
- Water samples
- Draw samples from all representative groups: age, sex, feed type, transitional, physiologic state and disease categories. This does not allow for an evaluation of population variance, however it does give us an idea of normals for the herd or flock

<u>Parameters Which Need Assessing from the Herd</u>

- Body condition scores (BCS)
- Energy balance
- Liver function
- Kidney function
- Micronutrients
- Macronutrients
- Protein status- measured by blood urea nitrogen (BUN), total protein, albumin and muscle enzyme activity.

These will all give an understanding of protein status and metabolism in the body.

- Vitamins
- NEFA assessments- reflect an increase of liver and lipid metabolism. This can lead to hepatic lipidosis with secondary ketosis. NEFA's are a very sensitive measure of energy balance.
- Serum samples are best assessed when the animals are in a physiologically challenged state

ARTIFICIAL REARING OF LAMBS

- Reasons: multiple births, bummer lambs, intensive management
- Colostrum: laxative, protective, nutritive
- Cow Colostrum can be used, make sure it is from the first two milkings, double the volume you would normally feed of ewes milk, freeze in 4-6 ounce servings, do not microwave to thaw it will denature proteins
- Recommend 3-4 feedings of 4 to 6 ounces each at 2-4 hour intervals
- Feed lamb standing, this conditions them to "milk bar" feeding
- Milk replacer after the colostrum feeding
- Higher quality lamb milk is worth the money= you get what you pay for
- Sanitation needs to be strict; clean all feeders daily with bleach; disassemble feeder tubes, clean and air dry
- Feed milk replacer at a temperature below 40 degrees F. This limits consumption, teaches more frequent nursing and reduces digestive problems
- Wean at 4-5 weeks of age; feed solid feed initially with milk replacer
- Abrupt weaning is preferred over gradual weaning; gradual weaning stimulates bloat
- For the first 2 weeks after weaning the diet should contain a minimum of 24% crude protein

LLAMA NUTRITION

It is important to remember that the camelid has a stomach divided into three compartments and is not technically a ruminant. These compartments are referred to as the first (C1), second (C2) and third compartment (C3). C1 and C2 are the compartments comparable to the rumen with approximately 90% of the total volume. These like the rumen are located on the animals left side in the paralumbar fossa.

- C1 and C2 are lined with both stratified squamous cells as well as glandular mucous secretion cells
- The glandular cells may secrete bicarbonate to buffer the fluids found in the compartments

- Cells of the C1 and C2 absorb VFA and digest from both salivary breakdown as well as microbial fermentation
- Saccules occur in the first two compartments to increase fermentative capacity
- C1 contractions average 4-6 per minute in the normally fermenting animal, but can increase in animals recently post-pyrandial. These contractions progress from caudal to dorsal. They are much weaker in intensity than those of the cow.
- C3 represents 10% of the gastric volume or ability
- With C3, the distal 20% is glandular and acts as the abomasum does in ruminants; 80% is non-glandular
- Camelids do not have a gall bladder, bile flows on a continuous basis
- Camelids have a spiral colon which commonly impacts; colic is common in camelid
- Camelids can more readily utilize poor quality feeds due to a slowed nutrient transit time allowing for better breakdown and absorption
- Camelids are 10-25% more efficient in the digestion of feed stuffs over sheep and goats
- Camelids are both grazers and browsers; llamas are primarily browsers while alpacas are primarily grazers
- Nutrient requirements: CP 8-10%, CF 25%, TDN 55%
- Calcium 0.6-0.8% and 0.3-0.5% phosphorous
- Lactating and growing animals require an increase in protein to 12-14%
- Alterations of the diet should be made during the winter, for pack animals and those animals which are used as jogging partners
- Supplementing for energy should be done slowly; fat can be increased; in the Midwest where corn is readily available. Up to 20% of the total dry matter content can be corn. Camelids are not as susceptible to grain overload as other animals are.
- Mineral needs are met with a multitude of commercially available camelid supplements; these contain needed micro minerals. Feed as to labeled instructions
- With selenium deficient areas supplementation is necessary. It should be emphasized that a presumptive diagnosis needs to be made. Supplements should contain 90 ppm Se or as a added supplement 1-3 mg/100 pounds of body weight on a daily basis
- Zinc deficiencies are common in animals fed high levels of calcium such as free choice alfalfa hay
- During the last trimester llamas should be BCS weekly and may require grain at 1-2 pounds per head per day
- Llamas gain 45-60 pounds during pregnancy/ alpacas gain 20-30 pounds
- Lactation requirements may increase by 50% over maintenance; TDN at 60-65% and CP at 12-14%

- Diets severely restricted in energy and protein can lead to ketosis, hepatic lipidosis, poor quality Colostrum
- Males should be kept at a BCS of 5-6/10 heat stressed animals require more mineral and energy to maintain thermoregulation

Example:

Johnsonm Camelid Supplement Formula

Dry molasses 50 pounds
Bone meal or Dicalcium Phosphate 25 pounds
Monosodium Phosphate 25 pounds (if alfalfa is fed replaces bone meal)
Trace mineral salt with selenium 50 pounds
Zin Pro 100 10 pounds (Zin Pro Corp Edina, MN 55439-2441)
Fed on a 1.0 oz/animal/day basis

LLAMA NUTRITION PROBLEM ISSUES

Feeding Crias
- Crias will gain 1 pound during the first 2-4 days of life
- Crias average ½ to 1 pound of gain per day
- Minimize contact with the cria as much as possible. Imprinting is a common sequella and as such can lead to Berserk Llama Syndrome
- Crias consume 10% of their body weight per day in 6-10 feedings; sheep's milk is best (dilute by 25%) followed by goats milk if sheep milk is not available
- Lambs milk replacer is the best replacer (though a much poorer selection than whole milk). The replacer should be diluted by 25%.

Heat Stress
- Very important in hot humid climates
- Avoid obesity
- Avoid the over consumption of protein
- Poor quality roughage gives off more heat during digestion
- Panting increases energy requirements
- Slowed gut movement of ingesta, colic is more common

Selenium Deficiency
- Selenium is absorbed with less efficiency than in other small ruminants
- C 1 microflora convert the absorptive capacity of selenium diminishing its ability for assimilation
- Vitamin A and E enhance uptake of selenium
- Vitamin C, calcium, Sulfur, Cu and arsenic diminish selenium absorption
- Rain, pasture irrigation and acidic soils can decrease selenium levels
- Legumes are higher than grasses in selenium/ concentrates are the lowest
- Processing of feeds can decrease the level of selenium in a feed

- Best way to evaluate selenium is to have the diet analyzed by a commercial nutrient analysis laboratory; whole blood can also be used to evaluate the levels and is resistant to short term discrepancies (serum is not a good test) collect in lavender or green top tubes
- Diet levels should be around 1 to 1.5 ppm over this can be a toxic level
- Salt blocks for sheep, injectable Vit E/Se, mineral supplementation diets
- Symptoms: colic, muscle weakness, lameness, arched back abortions/stillbirth, infertility, poor growth of crias
- Most commonly seen in young rapid growing animals

Zinc Deficiency – Very Common
- Zinc is better absorbed from legumes than grasses or grains
- Zinc absorption is inhibited by calcium, Fe, cadmium, oxalates, organophosphates
- Vit C, lactose and citrate enhance absorption
- Skin lesions are the most common sequella to zinc deficiency
- Symptoms: skin crusting and scaling, poor quality fiber, infertility, decreased food intake, hoof abnormalities, poor immune function
- Skin lesions include: alopecia, papules, plaques, thickened scaling-ventral abdomen, escutcheon, bridge of nose, inguinal region, inner thighs; parakeratosis on biopsy, inflammatory highlights; usually in animals older than 1 ½ years of age
- Treatment: 1 gram of zinc sulfate daily; if severe and non responsive 2-4 gm of zinc methionine daily; inform owner that it may take 2-4 months for success; decrease the calcium level in diet if the nutritional evaluation is high
- Diagnosis: biopsies, plasma zinc concentration, scrapping, impression smears, fungal and bacterial culture
- RBC's have a high zinc concentrations

GOAT NUTRITION

The number one nutrition problem in small ruminants in the world today is starvation. Though this is problematic in many areas of the world, it also can be common in the USA, Canada, and other "developed" nations. Nutrient understanding is key to a healthy nutrition program.

Goat Feeding Habits
- Mobile upper lips and prehensile tongue
- Browse and short forage feeders; normally browse contributes 50% of the diet
- Energetic feeders; randomly consume feed stuffs in a highly inquisitive manner
- Relish aromatic herbs in areas of sparse feed supply
- Tend to wander and graze widely
- Meticulous feeders
- Retain feed for shorter time frames (22.0 hours/ sheep 32.7 hours)

RULE OF THUMB: Goats consume from 5 ½ to 10% of their body weight in DM per day

Feeding Characteristics

- Water consumption: goats drink 3-5 times per day
- Goat water consumption depends on ambient temperature; 0 degrees C= 2.3 liters per day; 35 degrees C = 6.6 liters; 40 degrees C = 4.0 liters per day consumed. At forty degrees there is a failure of the heat regulatory mechanism.
- Water consumption increases with salt intake in the diet
- Goats should be provided with a clean water source at all times; they will not drink readily from foul or polluted water sources
- Unpalatable or extremely cold water sources can also precipitate urolithiasis secondary to poor water consumption
- Goats can go for 3-4 days without water due to rumen water contents
- Utilize BCS to evaluate a herds nutrition program initially
- With chronic low BCS in animals on an excellent diet the animals should be checked for: dental/oral disease, parasites, chronic wasting diseases (Johne's disease, CLA, CAE), blindness, foot and leg problems, low level acidosis
- Goats ruminate 8 hours a day
- Dry matter intake is the primary nutrient limitation in goats; this can be a decisive factor in nutrient absorption
- Monitor silage if fed, goats are extremely susceptible to listeria
- Molasses improves palatability of processed feeds. Feeding over 5% molasses can adversely affect rumen function leading to low level acidosis.
- Over feeding of grain by owners is the number one cause of clinical acidosis
- When the doe is dried off, feeding of woody browse can be of importance to restore rumen capacity. Goats as browsers have an extreme change in rumen function with fine particle, high energy rations. Rumen tone is lost and there is a marked decrease in rumen contractions
- Goats will refuse dusty or moldy hay
- Dry matter intake of hay can be increased with the addition of supplemental green forage daily; goats will waste up to 40-50% of hay fed in a manger; most producers try to have a 20% waste loss
- Hay intake as a rough estimate is 2.5 pound of hay per 100 pounds of body weight as a rough rule of thumb; maximum DM intake is 5 to 6 kg/100 kg of body weight
- During lactation goats fed high quality alfalfa hay plus concentrates will consume 2.8 to 4.2 Kg DM/ 100 kg body weight. This range will depend on the stage of lactation (DIM)
- Lactational consumption may reach 3.5% of the live body weight
- **Early lactation feeding: free choice hay plus one pound of concentrate (14-18% protein, 75% TDN, low dry matter) for each 2 pounds of milk produced daily; the feeding of concentrates is dependent on milk production**

Dry Matter Intake (Adapted from Smith and Sherman, 1994)

	Animal Weight		
	50 kg	60 kg	70 kg
Maintenance	1.20	1.33	1.47
Last month of gestation	1.09	1.21	1.23

- Gestational dry matter consumption is depressed
- DM consumption ranges from 2.2 to 2.8 kg/100 kg of live body weight during the last trimester of pregnancy
- Hay intake ranges from 1.5 to 2.5 kg/100 kg of body weight during the pregnant dry period or transition doe period.
- When feeding alfalfa hay and concentrates a 2:1 H:C ratio is a good rule of thumb
- When feeding poorer quality hay a 1:1 or 1:2 ratio can be utilized. It should be noted that as the % of concentrates in a lactational diet increase, the % butterfat decreases
- Early lactation does require 17-18% crude protein
- Midlactation does require 13-16% crude protein
- **Zero-grazing versus grazing programs** need to be considered in formulating a diet.
- Palatability is of extreme importance to goats. Coarse textured feeds are preferred over finely milled feeds. Smell and taste are also key issues. Dusty or moldy hays are not well tolerated.
- When purchasing hay it should be green not yellow or brown. Break open a bale and determine its dust and mold content. Smell the hay for freshness. Look for toxic plants or trash in the hay. Forage testing on a regular basis should be recommended where it is economically feasible. The stage of maturity is paramount in the selection of hay. If the hay has too much stem the animals will waste a large proportion of the feed.
- Stored brownish hays have a decreased vitamin A, D and E level. This should be considered when determining the mineral mix or supplement feeds.
- Angora goats have a decidedly higher protein and energy requirement. Critical time periods are: early stock growth, reproduction, mid through late gestation and during lactation.

Problems Associated with a Poor Nutrition Program

- Ketosis (pregnancy toxemia)
- Parturient Paresis (milk fever)
- Acidosis/indigestion
- Enterotoxemia
- Abortion
- Diarrhea/constipation
- Starvation
- Lameness
- Weak kids at delivery
- Poor colostral quality/quantity
- Urolithiasis (see below)
- Posthitis (pizzle rot): excess protein fed to males
- Arthritis: hypercalcemic diets
- Vitamin/mineral imbalance

UROLITHIASIS

Urolithiasis is a common problem in sheep and goat medicine. Uretheral obstruction due to stone formation is common in both males as well as females, however castrated males pose the greatest risk. Nutrition plays the biggest part in urolithiasis. This is a substantial problem in "pet" food animal medicine (hobby farm animals); requires a more long-term approach to the control of this disease. In production animal medicine the treatment protocol is for salvage not long term survival.

Urinary stone formation

The composition of uroliths in sheep and goats is primarily dependent on the feeds and soil conditions within a specific geophysical location. Researchers at the University of Minnesota College of Veterinary Medicine have done studies on goat uroliths and found them to be of two common types: calcium apatite and phosphatic calculi. The phosphatic calculi can be further broken down to calcium hydrogen phosphate dihydrate and magnesium ammonium phosphate. Silicate and calcium carbonate uroliths can also be seen, though less commonly.

Phosphatic Uroliths

- Low roughage
- High concentrate
- Low Ca: P ratio; high phosphorus levels in grains
- Increased magnesium
- Alkaline urine
- Decreased saliva formation due to high levels of phosphorus. Normally phosphorus is excreted via feces in small ruminants, but the lowered saliva levels allow the concentration of phosphorus in the urine
- Several breeds of sheep are predisposed: Texel and Scottish Blackface
- Pygmy goats are much more predisposed to the disease

Disease Diagnosis

- Early signs: hematuria, dysuria, tail flagging, vocalization, depression, off feed, colic, chewing at tail head, urine dribbling
- Late signs: recumbency, depression, change in appetite, prepucial swelling, severe straining, severe vocalization, abdominal distension, increased TPR
- Tachycardia, tachypnea and increased or decreased core body temperature
- Ultrasound revels a distended bladder with or without stones
- Increased BUN, creatinine, AST, CPK, hyponatremia and hypochloremia
- Ultrasound of the penis revels a distended urethra; stones lodge most commonly at the urethral process. Many times just amputating this process will help alleviate many of the symptoms. Another common site for blockage is the distal sigmoid flexure

Prevention

- Pet sheep and goats should be castrated at an older age (6-12 months)
- Increase water consumption through the use of salt, more water sources
- Acidify urine with ammonium chloride at a rate of 0.5 to 1% of the total ration
- **Do not feed equine diet mixes to sheep and goats**. These diets are higher in phosphorus and add the problem. This is commonly seen with back yard hobbyists
- Show animals and feedlot animals fed high levels of grain should have salt mixed in at 2-5% to increase water consumption and there by flush the system
- Ca:P 2:1 or 2.5:1
- Grass hay is lower in Ca and higher in P
- Calculi in younger goats on milk replacer: cheaper milk replacers have a 1:1 Ca: P ration and will require Ca supplementation

Treatment

- $$$$
- Reeducate owner to improved dietary program
- Prognosis poor to grave
- Owner should be educated to the high incidence of recurrence
- First approach remove/amputate urethral process- temporary approach, recurrence is likely; to extrude penis the animal is usually placed in a sitting position on its rump. 10-15 mg of Diazepam is given IV, the penis is extended with a gauze sponge; proprynylpromazine at 1.0 mg/kg IM can also be used
- Tranquilizers and antispasmodics can be used: acepromazine at 0.1 mg/kg IV, diazepam at .5 mg/kg IV, aminopromazine at 2.0 mg/kg IM
- Perineal urethrostomy- salvage procedure of feeder animals, poor prognosis for pet animals
- Urethral translocation
- Ischial urethrostomy- exteriorize the urethra at a larger diameter
- Permanent cystotomy

CERVIDAE NUTRITION:

Deer and elk nutrition is very similar to sheep nutrition. The importance of feeding varies with the productive cycle of cervidae. However, deer and elk appetites fluctuate seasonally. Understanding the annual appetite cycle is extremely important in nutritional management of the herd.

- Fetal growth and lactation can increase maintenance nutrient requirements by 70% for energy and 85% for protein during the last trimester of pregnancy and a 45% greater energy and 75% protein requirement during lactation
- Elk and deer give birth from late May to July; they consume less feed during the winter months and time their increase in nutrients to correlate with the grazing of forage pastures
- Seasonal growth and reproduction of cervidae requires changing nutritional programs
- Stags need maximum nutrients in the winter; stags having lost condition in their rut gain increase in body condition and appetite in the spring and summer
- Hinds need maximum nutrition in the summer
- Hinds nutritional demands are greatest in the spring and summer. During the fall breeding season they must regain condition. Though the hind has a decreased appetite in the winter, it is imperative that they do not loose condition
- For calves the first winter, the seasonal depression is less than for adult deer; growth becomes limited with rapid weight gains in the spring and summer.
- With calves it is important that dry matter consumption be monitored so that during winter feeding the animals can eat enough to maintain their weight.
- Winter is the period where higher energy feed stuffs need to be supplemented
- Concentrate or pelleted supplements should be fed but not to exceed 50% of the ration

Feeding Ratios

- Weanlings and stags: hay 6: corn 3: supplement 1
- Pregnant females: hay 8: Corn 1.5: supplement 0.5

- Most feeding programs emphasize the feeding of good legume hay or pasture with grain (oats, corn, barley, or a mix) as a supplemental energy source
- Grass hay feeding programs require additional protein, minerals and vitamins; pellet supplements supply this

Example:

Jordan Deer Pellet Formulation	
Ingredients	**Percent of Diet (%)**
Ground Alfalfa	31
Soybean Meal	31
Corn	30
Molasses	4
Limestone	1
Dicalcium phosphate	2
Trace Mineral Salt (with selenium and copper)	1
TOTAL	100%

- Fall feeding of fawns and calves is imperative to prepare them for the winter-feeding pattern. Needed body weights and gain are important early on
- Flushing hinds in September increases the ovulation rate
- Summer pastures should contain grasses as well as legumes
- Deer and elk rarely bloat!

Growth Requirements

- Red deer require 4.0 Mcals of ME/lb of gain
- This would be the equivalent of 4.9 Mcals of DE or 2.5 pounds of TDN
- On a grain supplement basis this would require 3.1 pounds of corn per pound of weight gain

Lactation Requirements

- Red deer require 9.43 Mcals ME/day
- This would equal 11.5 Mcals DE or 5.75 lbs TDN
- 7.19 lbs of corn or 10.8 lbs of 53% TDN hay

Maintenance Requirements

- Mature hind will consume 4.5 to 6 pounds of dry matter per day in the winter.
- This diet should consist of a good quality forage fed free choice plus 2 to 3 pounds of concentrate
- Stags and calves should be fed a ration higher in concentrates since they have a marginal dry matter intake during this period
- The best way of assessing a nutrition management program is by regular live weight monitoring; setting target weights allows program evaluation; target weights should be set on conditions particular to a given farm
- General purpose mineral and trace element supplement should be available at all times
- Stags lose weight during the breeding period; dominant stags in multiple sire herds will loose more weight than subordinate stags
- Stag weight loss is directly related to the amount of energy required for sexual and antagonistic behavior
- Stag weight loss is inversely related to the amount of feeding done by stags
- BCS on a regular basis

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NEONATOLOGY OF CAMELIDS AND SMALL RUMINANTS

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Neonate: Less than Three Weeks of Age

- Camelid problems are far more commonly related to the foal than the bovine or other small ruminants

Problems Encountered

- Failure of passive transfer (FPT) of immunoglobulins
- Premature delivery (floppy ears, persistent hoof coverings), hypoglycemic, bradypnea
- Redelivery bacterial infections
- Hypoxia
- Hypothermia
- Growth retardation
- Severe maternal illness
- Colostral loss through premature development of the mammary or precocious lactation
- Prolonged gestation event
- Premature placental separation
- Agalactia
- Induced parturition
- Cesarean section
- Postpartum: failure to stand, angular limb deformities

- Aspiration distress
- Meconium impaction
- Choanal atresia
- Wry face/parrot jaw

Cria Concerns Within the First 24 Hours

- Passage of meconium: may require enema, digital palpation
- Urination: has the owner seen urine flow
- Oral/nasal/respiratory complications sedate with IV butorphanol at 0.05 mg/kg, manual examination
- Contracted tendons: llama dose of ketamine/xylazine/butorphanol IM: splint legs, hot packs prior to splinting
- Persistent urachus: cauterize with silver nitrate sticks; Naxcel for 5 days
- Floppy or limp ears: frost bite, cartilage; tape ears erect
- Blind with FPT: 250mg thiamine; dexamethasone at .05 mg/kg one time; check for cataracts
- Persistent intention tremor related to dystocia/anoxia; cbc and panel need to be run to rule out hypoglycemia; give it time
- Umbilical hernia- allow adaptation to dam before consider surgery; if smaller give them time

Concerns Post 24 Hours

- FPT see elsewhere
- Diarrhea- is the cria still gaining
    - Heavy milking dam
    - Coliforms, salmonella, cryptosporidia, rota virus
    - Supportive care, fluids, assess acid/base, kaolin products
- Neonatal diseases are many times multisystemic in nature
- Crias with acute metabolic disease commonly have secondary bacterial involvement

Immediate Care

- Shock
- Hypothermia (temp < 90 degrees F)
- Hyperthermia of dam: factor in humidity
- Respiratory distress
- Hypotension
- Cyanosis
- Blood loss
- Blunt trauma to skull

Success in survival of the neonatal compromised patient is dependent on prepartum care and feeding of the dam, BCS (1-5), capable diagnostics and acute care.

Physical Examination of the compromised neonate
- Assessment of the dam should be the first phase
- Assessment of the neonate

Systems approach to evaluating the neonate (normal temperature is 99-101 for cria)
- Behavioral signs- slumping, inactive, weak, recumbent, sleepiness
- Neurologic exam- most crias will stand within 30 minutes post delivery and walk within one hour; **droopy ears are a sign of prematurity**
- Ophthalmic exam: can the cria see, cataracts, hyphemia
- Cardiovascular- murmurs are common and generally of little significance in the new born 60-90 beats per minute
- Respiratory- normal 20-40 breaths per minute
    - Open mouthed breathing, dilated nares, gulping air, cyanosis
    - Crias have a special membrane that covers the face of the newborn (epidermal membrane), suffocation can occur
    - Aspiration of fetal fluids
    - Pneumonia
    - Mechanical blockage/ choanal atresia- mouth breathing (atypical for the camelid), severe dyspnea when nursing
- Abdomen- colic, distension, gaunt
    - Ascult, percuss
    - Ultrasound, radiology
- Umbilicus
    - Common problem
    - Common in the first two weeks
        - Abscess
        - Patent urachus
    - Omphalitis/omphalophlebitis
    - Septicemia
    - Hernia
    - Ultrasound evaluation of the umbilicus
- Urogenital: ability to urinate, color of urine; dip sick exam
- Hematologic database
    - CBC
    - Serum chemistry
    - Blood cultures (aerobic and anaerobic): septicemia is common; in referral cases to the VTH these are done even if chemotherapeutic agents have already been utilized
        - Gram negative and mixed bag infections are most common
        - Arterial blood gas analysis can help rule out cardiopulmonary dysfunction; acid base function is easily estimated here; best drawn from the medial saphenous vein

Important Criteria

- Alpaca breeding age 15-18 months > 90 pounds
- Llama breeding age 15-18 months > 200 pounds
- Gestation is 335 to 355 days
- Average is 342 days

All premature camelids should be considered neonatal emergencies!!!!!!!!

Feeding Llamas for Adequate Cria Development

Pregnancy Diet: Last trimester of pregnancy to 3-4 months of lactation

- Llama 14% crude protein and 65% TDN
- Alpaca 16% crude protein and 70% TDN
- Maintenance through mid gestation diet (through 8-9 months of gestation):

- Llama 12% crude protein and 55% TDN
- Alpaca 14% crude protein and 60% TDN

- Fed 1.5% of body weight daily

Dystocia

Uterine torsion

Weighing the cria is extremely important to monitor development
- Llama > 20 pounds will expect 0.5 to 1.0 pound/ day weight gain
- Alpaca > 12 pounds will expect 0.25-0.5 pound/day weight gain
- Llamas less than 16 pounds of weight at birth and alpacas less than 10 pounds should be considered premature and treated as critical

Constipation: check for atresia ani

IgG levels

- Best-evaluated > 15 hours post delivery
  - Measurement of TSS (total serum solids with refractometer is a good initial test for the practitioner in the field. It is fairly non-specific
    - TSS of < 4.5 g/dl is evidence of FPT, 5-6 some transfer, > 6 adequate
  - Cbc- measure plasma fibrinogen and total white count is a second method
  - Total globulin levels at a commercial laboratory
  - Llama specific radial immunoglobulin assay

Failure of Passive Transfer (reflect most current laboratory levels)

- Inadequate < 400 mg/dl
- Suspect 400-800 mg/dl

- Adequate > 800 mg/dl

Inadequate IgG

- <24 hours alternate Colostrum source
- Hard to find
- Best if from the farm
- Goat or sheep Colostrum second best source, cow would be my third choice although much easier to obtain
- Johne's disease is of concern
- Oral plasma (last resort)
- Requires 10% of the body weight fed over 24 hours (divided into 5-7 feedings)

- >24 hours transfusion
- IV into jugular or cephalic vein or intra peritoneal
- Triple the dose of plasma in the IP route
- 25 ml/pound of body weight (most practitioners give 1 U of llama plasma 350 ml)
- Remeasure IgG in 12-24 hours; increase of IgG or 150-700 mg/dl are common with one treatments

- Whole blood transfusions (if plasma is not available)
- >500 ml in acid-citrate-dextrose administered over 2 hours

Milk Replacer

- 6-8 ounces of goat milk replacer (land of lakes is best) plus 2-3 ounces of live culture
- Yogurt or goats milk plus yogurt
    - Make sure the milk replacer does not contain antibiotics, scours result

Lactational Problems

Mother
- Mastitis
- Metritis
- Agalactia
- Ketosis
- Udder edema
- Behavioral

Cria
- Premature
- Hypothermia
- Developmental defects
- Cleft palate
- Choanal atresia

Behavioral Problems

- "WALL BABY" – unable to discern mother from physical environment
- "DUMMIES"- neonatal maladjustment syndrome; may be due to hypoxia
    - Can respond positively within 4-7 days with supportive care

Camelid Diseases

Infectious Disease
- Bacteremia: gram negative and mixed bag
- Clostridial entertoxemia (C. perfringens type A and C)

Treatment: supportive care, penicillin, antitoxin, nutritional support

Hypoxemia/Ischemia
- Acidosis impairs cellular function
- Asphyxia is a common sequella
    - Mechanical, cardiopulmonary disease, premature delivery, dystocia, umbilical cord occlusion

Treatment: supportive care, blood gas monitoring, oxygen therapy

Premature Delivery is Common!!!!!
- Unknown breeding dates
- Hypothermic
- Acidotic
- Hypoglycemic
- Hypoxic

Treatment: Temperature stabilization, correct acid/base imbalance, correct hypoglycemia, oxygen therapy if indicated

With all treatments in camelids the cria and dam should not be separated. It may also be indicated to bring in yet another herd mate to prevent stress to the dam. Third compartment ulcers are a common sequella to separation anxiety in the llama

- Cria's separated from their dam or other llamas can be quite aggressive to humans later on in life.
- While in house or in the field avoid bottle-feeding as this allows human bonding
- Orogastric tube feeding
- Feed small amounts every 1-2 hours if indicated
- It should be noted that as the cria is supplement fed the dam will diminish milk production
- Stallion catheters at 18-22 French are about the right size for smaller cria's
- 24-30 French tubes should be used for larger sized cria's < 40 pounds

Hypoxemia is common: 100%-humidified oxygen should be used intranasal; 5 L/minute is the most common starting rate; this is adjusted according to the pO2
- Oxygen tension should be at 80 mm Hg

Catheter Placement
- 16 or 18 gauge catheter in jugular or cephalic vein.
- Jugular vein at the C4 or C6 level
- My favorite choice of fluids is 2.5% dextrose in saline.

SUPPORTIVE CARE IN THE NEWBORN CRIA

Fluid Care and Maintenance
- Replacement fluid deficit in liters = % dehydration x weight in kg
  - Maintenance 4-6 ml/kg/hr
  - Bicarb deficit (mEq)= 0.6 x BW (kg) x base deficit (mEq)
  - Usually only treated with diarrhea or if severe, mild acidosis many times rectifies with rehydration
  - Hypoglycemia most common neonate disease

Nutritional Support
- To tube or bottle-feed
- Parenteral nutrition: chronic diarrhea, third compartment ulcers, post surgery
- Monitor blood and urine glucose

Respiratory Support
- Arterial blood gas taken from medial saphenous artery
- Thoracic radiographs may be indicated with compromised patients

Thermal Support
- Adult camelids do not lick or groom their young post delivery
- Cria's unlike foals maintain sternal recumbency at all costs
- Heating lamps and blankets work well, commercial llama coats are available

Chemotherapy:
- Antibiotic use should reflect culture
- A good initial choice in the cria is Naxcel

GLOSSARY OF DISEASES

Akabane

History: Exotic to the U.S. Arthropod borne virus
Signs: Stillborn or die shortly after birth. Birth defects may include microencephaly, hydrocephalus, and arthrogryposis.
Diagnosis: Clinical presentation, virus isolation from placenta

Anaplasmosis, Babesiosis, Eperythrozoonosis

Signs: Anemia, weakness, jaundice
Diagnosis: Identification of organism in blood smears
Treatment: As indicated for the specific parasite

Anthrax

Bacillus Anthracis
Signs: Recumbency, moribund, hypersalivation, sudden death
Diagnosis: Signs, blood does not coagulate, carcass hemorrhages
Treatment: Do not do post mortem exam, **REPORTABLE, ZOONOTIC**, vaccinate in endemic areas

Bloat

History: Many possible etiologies, predispositions: may be associated with high grain diets, leguminous diets and lush pastures, Free Gas and Frothy bloat
Signs: Colic, kick at side, abdominal distention, dyspnea
Treatment: Pass stomach tube, administer mineral oil, treat frothy bloat with poloxalene, trocarize critical animals,
Prevention: Management changes, rumensin

Blue-Tongue Disease Virus

History: Arthropod (Culicoides) borne disease
Signs: Facial edema, depression, loss of appetite, pyrexia, hyperemia of oral mucosa, oral mucosal ulceration and necrosis, coronitis, abortions
Diagnosis: Paired sera titers, virus isolation, post-mortem exam
Treatment: Supportive care, avoid sunlight, quarantine, **REPORTABLE**
Differentials: Foot and mouth disease, goat pox, Orf, photosensivitity

Border Disease

BVD-like Abortion
History: May be associated with bovine virus diarrhea. Infection in uterus remains for life.
Signs: Ataxic hairy shaker lambs, weak born offspring, failure to thrive, altered conformation, abortion at any stage of gestation may occur,
Diagnosis: Pinpoint foci of necrosis in cotyledons, paired serum titers.

Brucellosis

Brucella melitensis

Brucella abortis

History:	**ZOONOTIC AND REPORTABLE**
Signs:	Mid to late gestation abortions
Diagnosis:	Culture from placenta, fetus, or vaginal discharge.
Treatment/Control:	Test and slaughter. Vaccination in endemic areas.

Campylobacteriosis

Campylobacter Fetus ss Fetus, Campylobacter Jejuni (vibrosis)

Signs:	Abortion, 30% of fetuses have liver necrosis, endematous placenta
Diagnosis:	Isolation of organism
Treatment:	Tetracycline, vaccination

Caprine Arthritis Encephalitis (CAE)

History:	Neurological form in kids 2-6 months of age, arthritis and CNS form in adults
Signs:	Weakness, encephalitis, arthritis, depression, head tilt, blindness,
Diagnosis:	Serology, clinical signs, joint tap, post mortem exam yields emaciation, enlarged bursae and tendons, hyperplastic synovial membranes, CNS lesions include cloudiness of meninges, and brownish discoloration of the white matter
Treatment/Control:	No treatments are available
Differentials:	Young—enzootic ataxia, spinal abscess, trauma, migrating parasites, muscular dystrophy, tick paralysis, organophosphate toxicity, scrapie, listeria. Adults—traumatic arthritis, mycoplasma, chlamydia bacterial polyarthritis, nutritional

Capripox

History:	Skin lesions and scabs, virus resists dessication
Signs:	Rhinitis, conjuctivitis, pyrexia, humped, anorexia, cutaneous macules and pustules on lips, nares, ears, high morbidity and mortality, benign form in USA
Differentials:	Orf
Control:	Management, vaccination—MLV

Caseous Lymphadenitis

Corynebacterium Pseudotuberculosis

History:	**ZOONOTIC** Number one sheep and goat disease, most common 3-7 years of age
Signs:	Lymphadenopathy, may see rupture of lymph node—green / yellow pus, chronic pneumonia, dyspnea, exercise intolerance, weight loss,
Diagnosis:	History of CLA in the herd, clinical signs, culture of sample obtained from lymph node, gram stain, blood test—UC Davis
Treatment:	Isolate affected individuals, surgical drainage of lesion or surgical removal of lymph node, antibiotic selection—penicillin, tetracycline, erythromycin

+ rifampin, inject abcess with formaldehyde (questionable withdrawal period, therefore not recommended in food animals)

Chlamydiosis

Chlaymdia Psittaci

History: **ZOONOTIC, REPORTABLE.** Gram negative intracellular bacteria, number one cause of late term abortions

Signs: Abortion in last 2 weeks of pregnancy—often primiparous females, arthritis, keratoconjunctivitis, respiratory infection, pneumonia

Diagnosis: Clinical presentation. Impression smears of exudates yield elementary bodies. Culture and identification of organism from placenta, fetal stomach.

Treatment: Tetracycline, or tylosin for all animals. Vaccinate

Differentials: Q fever

Chorioptic Mange

History: Affects goats and llamas, lives on skin surface. Usually seen in winter.

Signs: May be subclinical, crusts, alopecia, erythema and ulceration of lower limbs, udder, scrotum, and perineum may be present. Pruritus may be observed.

Diagnosis: Skin scraping, flea comb

Treatment: Long term treatment is usually required. Ivermectin every 10 days, or amitraz dips every 10 days, antihistamines can be given to try to relieve pruritis, treat any secondary bacterial infections with antibiotics.

Chronic Wasting Disease (CWD)

History: Found in Canada and USA, spongiform encephalopathy. Submit deer heads to state diagnostic lab

Signs: Wasting

Treatment: None

Cobalt deficiency

White Liver Disease

History: grazing of cobalt deficient soils, this mineral is used in the rumen to make B vitamins

Signs: Signs are similar to B vitamin deficiency, anemia, hypoproteinemia, thin, weak, listless, pale mucous membranes, submandibular edema, diarrhea, Polioencephalomalacia / thiamine deficiency, progressive emaciation, and hepatic lipodystrophy

Diagnosis: Clinical signs, response to treatment

Treatment: Ensure cobalt in ration at 1 mg/head/day, Vitamin B12 injections, cobalt pellets

Coccidiosis

History: Eimeria sp. Usually affects nursing and feeding stock of 3-5 months of age

Signs:	Poor growth, weight loss, diarrhea (may be hemorrhagic), abdominal discomfort, depression, weakness, dehydration, acidosis, anemia
Diagnosis:	Fecal flotation
Treatment:	Supportive care, coccidiostats, sulfonamides, Amprolium
Prevention:	Monensin, Lasalocid, Decoquinate
Control:	Good hygiene / management, low stress, no feeding on ground, small group housing

Congestive heart failure

History:	May be associated with pulmonary disease
Signs:	jugular pulse, jugular distension, moist cough, tachycardia, ascites, exercise intolerance
Diagnosis/Pathology:	Clinical signs, pleural effusion, pericardial effusion, ascites, pulmonary edema, enlarged heart, ventricular dilation
Treatment:	Therapy can include diuretics, lidocaine, digoxin as in small animals

Copper / Molybdenum

History:	Mo excess presents as copper deficiency Copper toxicosis is associated with Mo deficiency
Signs:	Copper deficiency presents as inappetence, poor growth, weight loss, anemia, bone fractures, enzootic ataxia, swayback, cardiac insufficiency
Copper Toxicosis:	usually diagnosed in kids / lambs on a calf milk replacer
Diagnosis:	Clinical signs
Treatment:	Balance the Cu: Mo ratio in feed (> 2:1, < 10:1)

Cryptosporidium

Signs:	White to yellow watery diarrhea of young usually less than 2 weeks old, depression, inappetence, rough hair coat
Diagnosis:	Fecal flotation, direct fecal smear, gross lesions at necropsy are unspecific and may be limited to mild to moderate enteritis.
Treatment:	Supportive care, no pharmacologic intervention has been shown to be effective

Cutaneous Myiasis

Fly Strike

History:	Associated with fly season, and activities which promote formation of open wounds (shearing, dehorning, castration)
Signs:	Foul smelling lesions, presence of maggots in lesions
Diagnosis:	Clinical signs
Treatment:	Clean and debride wounds, insecticides and antibiotics as needed

Screw worms are reportable, (exotic disease)

Cutaneous Neoplasia

Papilloma, squamous cell carcinoma, melanoma

Signs: Masses often on the perineum, vulva, ear, mammary glands, and planum nasale

Diagnosis: Clinical signs, definitive diagnosis of tumor type is by biopsy.

Treatment: Resection if possible for valuable animals, or cull

Demodectic Mange

History: Associated with high stocking densities and stress

Signs: Pruritis if present is mild, alopecia, crusting and scaling of neck face, shoulders, and sides.

Diagnosis: Examination of caseous fluid expressed from hair follicles, skin scrapings, bacterial and fungal culture, biopsy

Treatment: Amitraz, ivermectin, or mitaban, keratolytic shampoo

Dermatophilosis

Dermatophilus congolensis

History: Gram positive, anaerobic bacteria. Prefers wet and humid weather. **ZOONOTIC,** younger animals more affected

Signs: Tiny wart-like scabs appear on pinna of the ears; lesions are generally non-pruritic; other areas of the body may be affected including nose, muzzle, feet, scrotum, under tail; dry crust scales and alopecia of healing lesions may be seen

Diagnosis: Gram stain of impression smear, skin biopsy, culture of organism,

Treatment: Penicillin-streptomycin, tetracycline, naxcel, chlorhexidine, remove crusts, external parasite control

Dermatophytosis / Ringworm

Trichophyton mentagrophytes, T. verrucosum, Microsporum, Epidermophyton

Signs: Alopecia, scaling, erythema, and crusts of face external ears, neck or limbs, leather-like appearance. Not usually pruritic.

Diagnosis: Skin scraping, trichogram, fungal culture, microscopic examination of hair shafts for fungal hyphae

Treatment: May regress spontaneously in 1-4 months. **ZOONOTIC**. Lime sulfur dips, thiabendazole paste, betadine, topical preparations. Cleaning pens with bleach helps controls spread to other animals.

Enteritis / colibacillosis

Affects young stock.

E. Coli: < 1 week, dirty environment, fluid diarrhea, dehydration, weakness, mortality 75%

Salmonella: 3-4 weeks, fever, abortion, diarrhea, high mortality, sudden death, yellow staining of perineum

Campylobacter (vibrio): Unthrifty young, acute diarrhea

Rota virus:	Destroys villous epithelial cells, malabsorption diarrhea
Cryptosporidium:	Fecal transmission, severe ileum damage, tucked up
Treatment:	Supportive care

Enterotoxemia

Clostridium perfringens types A, B, C, D, and E

Signs:	sudden death, sudden loss of appetite (young stop nursing), depression, abdominal distention, colic, recumbency, vocalization, weight loss, diarrhea
Diagnosis:	neutrophilic leukocytosis is suggestive, necropsy reveals:type B—semifluid blood stained feces, ulcerated mucosa; type C—straw colored peritoneal fluid, resembles Blackleg; type D—usually lambs 4-10 weeks of age, pulpy kidneys, ataxia, opisthotonos. Anaerobic culture of lesions.
Treatment:	Guarded prognosis, supportive care, fluids, electrolytes, NSAIDS, prevent by vaccination

Epididymitis / orchitis

Orchitis:	Inflammation secondary to archanobacter pyogenes, trauma
Epididymitis:	Brucella ovis, actinobacillus, others
Treatment:	Cull

False Pregnancy / Persistent Corpus Luteum (CL)

History:	Failure to cycle. May or may not have been exposed to a male
Signs:	Failure to cycle.
Diagnosis:	Ultrasound yields hydrometra with absence of fetus or caruncles.
Treatment:	Administer prostaglandins to lyse CL and oxytocin to evacuate fluid from uterus

Foot and Mouth Disease

History:	**Exotic**, **REPORTABLE** disease
Signs:	Subclinical infection, young may show sudden death from myocarditis, abortion may occur in pregnant females, vesicles along coronary band, interdigital space and heels, ulceration of ruptured vesicles and oral mucosa
Diagnosis:	Virus isolation
Treatment:	No treatment, cull, contact regulatory agencies

Foot Rot

History:	Associated with interdigital dermatitis, infection with Fusobacterium necrophorum, Bacteroides nodosus. Contagious, most often spread in summer months.
Signs:	Lameness, walking on knees, recumbency, hoof cracks and deformities, purulent necrotic debris
Diagnosis:	Clinical signs
Treatment:	Trim feet and treat with foot baths, place in a clean, dry stall, iodine supplementation, penicillin, tetracycline, or sulfa drugs

Heartwater, Cowdria ruminantium

History:	Tick vector, **Exotic** animal disease of sub-Saharan Africa
Signs:	fever, increased respiratory rate, coughing, dyspnea, head pressing, torticollis, bruxism, recumbency, paddling
Diagnosis/Pathology:	Giemsa stain of cerebrocortical gray matter yields C. ruminantium organism in vascular endothelium. Pleural effusion, pericardial edema, pulmonary edema, mild cerebral edema.
Differentials:	Tetanus, rabies, organophosphate toxicity, peste des petits, rinderpest
Treatment:	Oxytetracycline for 4-5 days at the onset of fever to control disease.

Hypocalcemia / Hypomagnesemia

History:	Milk fever, grass tetany. 4-6 weeks post lambing
Signs:	Decreased appetite, bloat, constipation, weak contractions, stiff gait, spasms, sawhorse, rapid death
Treatment:	Calcium borogluconate, oral paste, forage:concentrate 2:1, calcium borogluconate and MgSO4

Iodine Deficiency

History:	Common in iodine deficient regions, plants that interfere with iodine uptake
Signs:	Goiter, rough hair coat, subcutaneous edema
Diagnosis:	History, clinical signs, geographic region, ration analysis
Treatment:	Iodine supplement

Iron Deficiency

History:	Deficiency is associated with chronic disease, bleeding, parasitism, feeding onions.
Signs:	Anemia, pale mucous memebranes, decreased appetite
Diagnosis:	Clinical signs, history
Treatment:	Eliminate underlying cause of blood loss (deworming), 150mg iron dextran per youngstock.

Johne's Disease

Mycobacterium paratuberculosis

History:	Gram positive, acid fast bacteria. Affects all ruminants. Associated with stress, commonly occurs after 2 years of age
Signs:	Progressive weight loss, lethargic, rough hair coat, flaky skin, watery diarrhea (some species), anemia
Diagnosis:	Clinical presentation, culture of feces (20 weeks), serologic AGID, ELISA, focal thickening of mucosa of ileum, cecum or spiral colon, enlarged lymph nodes, granulomatous lesions of GI tract on histopath exam

Treatment: No known effective treatment, cull affected animals, do not feed affected Johne's positive colostrum to neonates

Leptospirosis

Leptospira interrogans

History: Infection is due to exposure to urine from infected animals.
Signs: Anorexia, jaundice, hemoglobinuria, abortion
Diagnosis: Paired sera, dark field microscopy, IFA, or silver stains of fetal tissues.
Treatment/Control: Control by vaccination in endemic areas. Separate different species.

Listeriosis

Listeria monocytogenes

History: Gram positive bacteria. Acute and noncontagious. Associated with feeding silage
Signs: Circling, head tilt, facial paralysis, head pressing, encephalitis, placentitis with late term abortion, gastrointestinal septicemia, hepatitis, splenitis, depression, disorientation,
Diagnosis: Clinical signs
Treatment: Penicillin, tetracycline, nuflor, dexamethasone
Differentials: Polioencephalomalacia / thiamine deficiency, brain abscess, inner ear infection

Liver Fluke

F. hepatica, F. magna

History: 2 clinical forms: Acute—traumatic liver parenchyma damage; chronic—biliary fibrosis from chronic infection. Snails are intermediate host.
Signs: Depression, poor appetite, lethargy, weight loss, diarrhea, anemia, edema, eosinophilia
Diagnosis: ELISA, necropsy may reveal biliary fibrosis in chronic forms, and parenchymal damage in acute forms, slaughter checks
Treatment: Pharmacologic intervention is not very effective. Try albendazole, and clorsulon.

Louping-ill

History: Similar to scrapie—CNS signs
Signs: Pyrexia, incoordination, trembing, salivation, coma, death

Lymphosarcoma

Signs: Peripheral lymphadenopathy, wasting
Diagnosis: Clinical signs, CBC, lymph node aspirate
Treatment: Rapidly progressive, untreatable, cull

Malignant Edema

Clostridial myositis

History: associated with a penetrating wound, anaerobic clostridial species are involved. All ruminant species are susceptible.

Signs: malodorous necrotic tissue at site of open wound, fever, depression, lameness, edema, crepitance, death in 12-24 hours

Treatment / Prevention: Proper post operative care of animals, move animals to a clean pen, penicillin, sulfas, surgical debridement, poor prognosis

Mastitis

Signs: Inflammation of the mammary gland, decreased milk production, many bacterial agents can cause mastitis, pyrexia, off feed, gaunt, painful, unilateral or bilateral udder swelling / hardness / heat (cold if gangrenous)

Diagnosis: Culture of milk sample, Gram stain

Treatment: Mycoplasmal mastitis: cull of affected animals is recommended as treatment is generally ineffective

Bacterial mastitis: Treat as indicated by sensitivity tests—penicillin, sulfas, naxcel, erythromycin, milk out 6-10 times per day.

Viral Mastitis "hard udder": No treatment, culling recommended

Advise on management changes to prevent bacterial mastitis

Meningeal worm

Parelaphostronglus tenuis

History: white tail deer is definitive host, transmitted through consumption of snail or slug, the intermediate hosts

Signs: hypermetria, posterior paresis, paralysis, head tilt, circling, blindness, may show linear vertical alopecia lesions of neck, thorax, abdomen, flank and tail head, can be highly pruritic, eosiniphilia in CSF.

Diagnosis: clinical signs, CSF eosinophilia, ELISA

Treatment: Ivermectin to treat larvae, Fenbendazole, phenylbutazone, banamine, dexamethasone, dimethyl sulfoxide (DMSO)

Mycoplasma pneumonia

History: Several mycoplasma species can cause pneumonia.

Signs: Fibrinous pleuritis and pneumonia. May be associated with other clinical signs depending on the species involved (mastitis, polyarthritis, keratoconjunctivitis, abortions)

Diagnosis: Thoracocentesis / TTW and culture, necropsy: consolidation and atelectasis of lungs.

Treatment: Tetracycline, Tylosin, NSAIDS, supportive care

Nasal Myiosis

Oestrus ovis, nasal bot

History: Seasonal correlation with presence of fly

Signs: Rhinitis, sinusitis, mucopurulent discharge, shaking of head, dyspnea, oviposition causes extreme distress

Diagnosis: Clinical presentation, nasal discharge

Treatment: Treat when larvae are small in fall with ivermectin or doramectin

Orf, Contagious Ecthyma, Sore mouth

History: **ZOONOTIC**, High morbidity, low mortality (from anorexia), scabs are contagious in environment for years

Signs: Papules, vesicles, pustules and scabs around the face, lips, ears, coronary bands, scrotum, teats, or vulva. Regress in 3-4 weeks.

Diagnosis: Clinical signs

Treatment: Zoonotic, treatment may include systemic antibiotics, debridement, vaccination (DO NOT VACCINATE A NEGATIVE HERD)

Oxalate Toxicity

Calcium oxalate containing plants

Ethylene Glycol

History: History of exposure to calcium oxalate containing plants or anti-freeze, evidence of ingestion

Signs: Incoordination, weakness, muscular trembling, hyperexcitability, recumbency, torticollis, PU/PD, clonic-tonic seizures, blindness, death

Diagnosis/Pathology: Azotemia, proteinuria, crystalluria, edematous and swollen kidneys at necropsy, presence of plant parts in rumen.

Treatment: Prognosis is poor and treatment is symptomatic. Give charcoal if ingestion is recent, administer IV fluids and calcium borogluconate to combat hypocalcemia. Control by feeding high quality hays and avoiding pastures with oxalate containing plants.

Parasitic Bronchitis

History: Correlates with seasonality of parasites

Signs: Cough, tachypnea, weight loss

Diagnosis: Clinical signs, fecal flotation, necropsy may yield parasites in the lungs

Treatment: Levamisole, albendazole, fenbendazole

Parasitic Gastroenteritis

Many parasites are capable of infecting all species. Clinical signs may vary depending on which part of the GI tract is infected. Mixed infections are common.

History:	Grazing disease, all ages, subacute, acute, chronic, worse in warm wet pastures
Signs:	Anemia, pot-bellied appearance, rough-dry hair coat, poor growth, depression, decreased feed intake, colic, bottle-jaw, unthrifty, diarrhea
Diagnosis:	Clinical signs, anemia, edema, fecal flotation
Treatment/Control:	Benzimidazole, avermectins, rotational grazing
Differentials:	Coccida, pneumonia, salmonella, poison, acidosis

Parturient Paresis

Milk fever-hypocalcemia

History:	High-producing dairy goats are more susceptible to alterations in calcium regulation. Can occur in all lactating females, most often during the first 6 weeks post parturition.
Signs:	Weakness, decreased appetite, mild bloat, constipation, weak intestinal contractions, rapid death
Diagnosis:	History, clinical signs, serum calcium
Treatment/Control:	Improve nutrition, IV calcium borogluconate

Pasteurella Pneumonia

Pasteurella haemolytica, Pasteurella multocida

History:	Associated with stress/shipping/crowding/weaning. Gram negative, aerobic bacteria. Part of normal flora in upper respiratory tract.
Signs:	Fever usually >104 F, mucopurulent nasal discharge, lethargy, anorexia, dyspnea, found dead
Diagnosis:	Clinical signs/history. Crackles, and consolidation on auscultation, pleuritis. Culture of TTW. Necropsy reveals bilateral cranioventral involvement of the lungs. Consolidation, fibrinous pleuritis, hemorrhage and necrosis. Concurrent viral and bacterial infections are common. Paired titers are helpful.
Treatment:	Penicillin, tetracycline, tylosin. Supportive care for dyspnea. Control by management changes, autogenous vaccines.

Pediculosis

Lice

History:	Lice are usually species specific however the sheep louse can also infect goats
Signs:	Moderate pruritis, severe infestations in kids may cause anemia and death
Diagnosis:	Clinical signs, visualization of lice or nits on the hair
Treatment:	Coumaphos or dichlorvos, treatment must be repeated at 10-14 day intervals because nits are not killed.

Pemphigus Foliaceous

History: Auto immune disorder
Signs: Vesicles, blisters, pustules, crusts, pruritus, lesions may be localized or generalized at mucocutaneous junctions—often seen on perineal area, ventral abdomen, groin
Diagnosis: Skin biopsies—histopathology
Treatment: Usually not attempted, High dose corticosteroids.

Photosensitization / Sunburn

History: Skin tumors seen in white sheep, goats, and camelids. Effects areas of thin hair / wool coat including face, legs, and teats. Photosensitization can occur by ingestion of photodynamic agents or hepatotoxic plants, liver disease, and congenital porphyria.
Signs: Edema, pruritis, erythema, photophobia, icterus, necrosis and sloughing of skin, dyspnea
Diagnosis: Clinical signs, feed/pasture/hay examination for hepatotoxic plants
Treatment: Avoid sunlight, supportive care for liver disease, antihistamines, laxatives

Polioencephalomalacia

History: **Cerebrocorticonecrosis** All ruminants can be affected. Thiamine deficiency caused by sudden feed change, increasing concentrate in feed, feeding equine diets, may follow rumenal acidosis, thiabendazole or levamisolee administration.
Signs: Non-motile, splashy rumen, opisthotonos, depression, anorexia, diarrhea, star gazing, circling, ataxia, blind, nystagmus, strabismus
Diagnosis: History, clinical signs, response to treatment
Treatment: Thiamine supplementation 10mg/kg QID for first 24 hours with first dose IV, transfaunation, brewers yeast, dexamethasone, mannitol or furosemide for edema

Psoroptic Mange

Psoroptes cuniculi

History: Affects youngstock, can be as early as 10 days of life, most are affected by 3rd week of life.
Signs: Head shaking, ear scratching, flaky or scabby lesions of the ears with yellowish white debris.
Diagnosis: Clinical signs, ear swabs will reveal mites
Treatment: Small animal ear mite medications applied topically

Pregnancy Toxemia

Ketosis, Twin Lamb Disease

History:	Poor or excessive body condition in late gestation. Associated with multi feti pregnancies, anorexia, or malnutrition. Occurs both in late gestation and early lactation.
Signs:	Ketonuria, ketones on breath, depression, bruxism, limb edema, rapid breathing, off feed, small dry feces, blind, nystagmus, pneumonia, recumbency, death
Diagnosis:	History, clinical signs, ketonemia/ketonuria, acidosis. Lesions at necropsy may include fatty liver, emaciation, dehydrated carcass.
Treatment/Control:	Oral Propylene Glycol or corn syrup, IV dextrose, B-vitamins. Improve quality of roughage, abortion if severe. Diagnose triplets early and maintain these does on a higher plane of nutrition. Maintain ideal body condition.

Progressive Retroviral Pneumonia (CAEV)

Signs:	Dyspnea post kidding or mastitis, wasting, secondary bacterial infection
Diagnosis:	Interstitial pneumonia, bullous emphysema, lung biopsy
Epidemiology:	Spread through milk

Q Fever

Coxiella burnetti

History:	**ZOONOTIC.** Acid fast, gram negative bacteria. Shed in placenta, fluids, colostrum, and milk. May be associated with stress, crowding or poor nutrition
Signs:	Late term abortions, Highly exudative, necrosis of cotyledons, and intercodyledonary placentas.
Diagnosis:	Giemsa stain of smear of placental lesions yields acid-fast rods Acute and convalescent sera.
Treatment:	Tetracycline, reduce crowding/stress
Differentials:	Chlamydiosis

Rectal Prolapse

History:	Most common in lambs and kids 6-12 months of age. Occurs usually in summer concurrently with pneumonia, cystitis, a weak anal sphincter, uphill feeding, overconditioning, diarrhea, pregnancy and prolonged recumbency. In adults it most commonly occurs peripartum, or when animal is straining for any reason, possibly associated with short tail docks in sheep.
Signs:	Tissue protruding from rectum, tenesmus, anorexia
Treatment:	Slaughter, or treat concurrent disease, clean prolapse, reduce the size of prolapse with salt or topical lasix to allow replacement, administer epidural anesthesia and local lidocaine infusions, place sutures to retain tissue in anus

Rumen Malfunction / Grain Overload

History: Associated with grain overload / engorgement, acidosis, bloat

Signs: Bruxism, constipation followed by diarrhea, splashy rumen sounds, dehydration, acidosis, off feed, bloat, increased respiratory and heart rates, laminitis is common as a sequelae

Diagnosis: Rumenal fluid pH<5.0, milky gray in color. History. Gram positive overgrowth in rumenal fluid with no protozoa, grain found in rumenal fluid.

Treatment: Antacids, rumenotomy, transfaunation, supportive care, tetracycline, fluids, probiotics, thiamine

Salmonella

Signs: Septicemia in neonates, pre-weaning enteritis, enteritis/septicemia in adults, depression, anorexia, profuse watery foul-smelling diarrhea, fever, abortion

Diagnosis: Leukopenia is suggestive, anemia, hypoproteinemia, clinical signs, repeated fecal cultures

Treatment: Supportive care, fluids, electrolytes, Tetracycline, NSAIDS, prevent introduction of salmonella via management.

Sarcoptic Mange

History: **ZOONOTIC** and **REPORTABLE**

Signs: Pruritis is usually severe. Hyperkeratosis, alopecia, wrinkled skin, and self mutilation may occur. Affected areas include head, shoulders, ears, thorax, inner thighs, and udder.

Diagnosis: Clinical signs, skin scrapings may reveal the presence of the mites, skin biopsy with eosinophilic dermatitis and tunnels are suggestive of sarcoptic mange.

Treatment: Long term treatment is usually required. Ivermectin every 10 days, or amitraz dips every 10 days, antihistamines can be given to try to relieve pruritis, treat any secondary bacterial infections with antibiotics.

Schistosomiasis

History: All ages, sex, breeds are affected. **Exotic.** Disease in Africa, South and Central America, Mediterranean. Proximity to natural water sources where the snail host lives.

Signs: Diarrhea, anemia, emaciation, anorexia, dehydration, and edema in the intestinal form. Snorting, sneezing, purulent nasal discharge, dyspnea in the nasal form

Diagnosis/Pathology: Hypoproteinemia, Identification of eggs in nasal swabs. Post-mortem findings include emaciated carcass, schistosomes can be found in mesenteric vessels, catarrhal enteritis with petechial and ecchymotic hemorrhages.

Treatment: Praziquantel

Scrapie

Mad Itch, Spongiform encephalopathy

Hitory:	**REPORTABLE** Suspected etiologic agent is a prion, vertical and horizontal transmission occurs. Usually infects animals 30-60 months of age with a 2-5 year incubation period
Signs:	Hopping gait, ataxia, pruritis, hair / wool loss, apprehension, tremors, impaired vision, isolation, excitable
Diagnosis:	Third eyelid biopsy, submit thalamus and medulla for analysis, vacuolated brain tissue on histopath, clinical signs
Treatment:	No effective treatment, cull
Differentials:	Listeriosis; rabies; Polioencephalomalacia / thiamine deficiency; bacterial, fungal, or parasitic dermatoses; encephalopathy; enzootic ataxia

Selenium Deficiency

Muscular dystrophy, young with deficient mothers < 5 µg sel/dl blood

Signs:	Decreased reproductive rate & lactation, abortion
Diagnosis:	Liver biopsy, heparinized or EDTA blood sample. Increased supply of vitamin E masks a mild selenium deficiency
Treatment:	BO-SE, MU-SE, E-SE injection

Selenium Toxicity

History:	Associated with geographic regions with seleniferous soil and plants (>50ppm), over-supplementation
Signs:	Depression, dyspnea, pulmonary edema, myocardial necrosis, abortion, death
Diagnosis:	History, geographic region
Treatment:	None

Staphylococcal Dermatitis

History:	S. intermedius and S. aureus. Common in goats and camelids. **ZOONOTIC**.
Signs:	Papule that develops into a pustule, coalescing lesions that may become purulent or have a serosanguinous exudate, lesions may become generalized. Often affects inner thighs, axilla, abdomen, neck, and tail
Diagnosis:	Clinical signs, gram stain of impression smear, culture
Treatment:	Wash localized lesions with an antiseptic, apply antibiotic ointment Systemic antibiotics may be needed in generalized cases

Swayback

History:	**Enzootic ataxia**. copper deficiency or molybdenum excess, nutritional deficiency of dam. Usually affects young from 0-3 months of age with progressive incoordination of hind limbs

Signs: Flaccid paralysis, incoordination, brittle bones, abnormal ambulation, unthrift, anemia, crimpless wool in lambs
Diagnosis: Clinical signs, liver copper levels
Prevention: Adequate copper levels in diet for pregnant females

Tetanus

Clostridium tetani

History: Gram positive, anaerobic bacteria, spore producer.
Signs: anxious, stiff gait, muscle rigidity, hyperreactive to stimulus, sawhorse stance, prolapsed third eyelid, convulsions, bloat
Diagnosis: Clinical signs, clap test
Treatment: Poor prognosis, penicillin, tetanus anti-toxin, diazepam, methocarbamol, supportive care, prevent by vaccination
Differentials: Polioencephalomalacia / thiamine deficiency, strychnine, hypomagnesmic tetany

Toxoplasmosis

Toxoplasma gondii

History: Exposure to feces of definitive host—cats.
Signs: Early embryonic death if the pregnant female is infected early in gestation. Late abortion, mummification or stillbirth / weakborn offspring if infected in second half of gestation.
Diagnosis: Fetal serology, lack of titer rules out disease
Treatment/Control: Prevent exposure to cat feces. Expose females prior to breeding.

Tuberculosis

Mycobacterium tuberculosis, M. Bovis, M. Avium

History: **ZOONOTIC,** Gram positive, acid fast bacteria.
Signs: Dyspnea, cough, lymphadenopathy
Diagnosis: Caudal fold tuberculin test, post-mortem exam reveals tubercles in the dorsal lung.
Treatment: Test and slaughter, avoid exposure to poultry
Differentials: Caseous lymphadenitis, neoplasms, chronic infections

Ulcerative Posthitis

Corynebacterium renale

History: More common in castrated males than in intact males.
Signs: dysuria, painful penis, urine pooling in the prepuce, kicking at the abdomen
Diagnosis/Pathology: Clinical signs. Culture of preputial swab yields Corynebacterium renale.
Treatment: Clip preputial hair, re-establish patency of urethral orifice, debride lesions and apply topical antibiotics (penicillins, ampicillins, or cephalosporins)
Differentials: Urolithiasis, colic

Urolithiasis, Obstructive

History: More common in young, castrated males on a diet consisting of excessive grain.

Signs: dysuria, stranguria, colic, tail twitching, distended bladder, distended abdomen, anorexia, weakness, depression

Diagnosis/Pathology: Radiographs, pain elicited on palpation of penis and urethral process, elevated blood urea nitrogen (BUN), creatinine if bladder has ruptured, crystalluria. Necropsy may reveal bladder rupture, and calculi.

Treatment: Treatment depends on the level of obstruction, and stage of disease. Conservative treatment may consist of passing a catheter to relieve the obstruction, surgical intervention may involve removal of the urethral process, urethrostomy can be performed in valuable animals. Prognosis for reproductive soundness is poor with most treatments. Control or prevent urolithiasis by feed management. Feed an appropriate calcium: phosphorus ratio.

Vaginal / Uterine Prolapse

History: Vaginal eversion occurs prepartum due to straining or discomfort. Uterine prolapse occurs after parturition.

Signs: Straining, tissue prolapsed from vulva

Diagnostics: Evaluate severity and duration of prolapse by palpation and physical exam to formulate a treatment plan.

Treatment/Control: If vaginal prolapse is intermittent administer epidural anesthesia to reduce straining and this may prevent continued prolapse. If severe and not intermittent, then clean and lavage prolapse. Carefully replace vagina or uterus. Vulvar sutures may need to be placed to retain the tissues within the vulva. If uterine prolapse is severe amputation may be warranted.

Ventricular Septal Defects

History: Rarely diagnosed but when it is, it occurs in young animals

Signs: Grade IV or V out of VI holosystolic murmur over right and left heart base.

Diagnosis/Pathology: Clinical signs, auscultation. VSD detected at necropsy.

Treatment: None

Differentials: Although rare, rule outs include valvular disorders, and endocarditis

Vesicular Stomatitis

History: Mainly in the west; **REPORTABLE**

Signs: Oral vesicles and ulcers, salivation, coronitis. Goats possibly resistant, seen in sheep, deer, elk

Viral Pneumonia, Acute

Parainfluenza and adenoviruses

Signs: Afebrile cough, tachypnea, dyspnea, serous nasal discharge, high morbidity and mortality

Diagnosis: Necropsy reveals linear/patchy areas of consolidation in the apical lung lobes, bronchiolar epithelial hyperplasia. Virus isolation from swabs, demonstrate rising titers.

Treat: Supportive care, management changes, antibiotics if concurrent bacterial pneumonia.

Viral Pneumonia, Chronic

History: Possibly linked to herpes virus or retro virus, more commonly diagnosed in sheep but may occur in goats

Signs: Chronic pulmonary disease, pulmonary adenomatosis

Diagnosis: Necropsy reveals grayish nodules or extensive tumors in the lungs

Treatment: This is a chronic and progressive disease. Isolation and culling is recommended.

Vitamin A Deficiency

History: Deficiency is associated with poor quality bleached hay, grains other than corn, failure to consume colostrum

Signs: Neurologic signs, rough dry hair coat, patchy alopecia, hyperkeratosis

Diagnosis: Clinical signs, history

Treatment: Dietary supplement, leafy alfalfa or alfalfa meal

Vitamin B Deficiency

Severe neurological signs seen with cobalt deficiency, see also Polioencephalomalacia / thiamine deficiency

Vitamin D Deficiency

Signs: Bowed limbs, enlarged joints, stiffness, osteomalacia of adults, rickets of youngstock

Diagnosis: Clinical signs

Treatment: Expose to sunlight, feed supplement, injectable Vitamin D

Vitamin E deficiency

White muscle disease in lambs and kids

Signs: Dry thin hair coat, periorbital alopecia, hyperkeratosis

Treatment: Injectable or oral vitamin E

Vulvovaginitis and Balanoposthitis

Caprine Herpesvirus, "Pizzle Rot"

History: Goats of breeding age, venereal and insect transmission

Signs:	Pain, dysuria, swelling, straining, scabs, ulcers, ulvar edema, and hyperemia with blood tinged discharge. Lesions in males are uncommon but may include penile hyperemia and punctate epithelial erosions.
Diagnosis/Pathology:	Virus isolation from lesions, rising titers to CHV
Treatment:	No specific treatment—clip hair, decrease protein level of feed, topical antibiotics to prevent secondary bacterial infections (penicillin, ampicillin, cephalosporin). Control by using seronegative bucks, or teasers. Test and remove positive animals from the herd.
Differentials:	Orf, photosensitivity, drug reaction

White Muscle Disease

Vitamin E / Selenium Deficiency

History:	Associated with feeding poor quality hays, silage
Signs:	Young are too weak to nurse, aspiration pneumonia due to weak diaphragm muscles, sudden death, Zenker's necrosis of heart muscle or diaphragm
Diagnosis:	White or pale muscles are seen on necropsy, plasma vitamin E <1.5 umol/L in preparturient females and <1.0 umol/L in suckling young.
Treatment/Control:	Treat lactating females early in season, feed supplementation, Vitamin E and Selenium injections

Yersiniosis

Signs:	Sudden death, diarrhea of young 1-6 mos of age, abortion, mastitis
Diagnosis:	Emaciation, large multiple abscesses are noted at necropsy, microabscesses of small and large intestine, hemorrhagic or pus filled uterus in abortion form. Culture of abscesses.
Treatment:	Tetracycline, supportive care.

Zinc deficiency

History:	Proposed level 45-75 ppm, associated with calcium excess
Signs:	hyperkeratosis, hyperemia, pruritis, crusts, of skin rear legs, perineum, joint stiffness, hypersalivation, swelling of feet and deformed hooves, low libido (small testicles)
Diagnosis:	Skin biopsy, response to treatment, serum levels of less than 0.8 ppm
Treatment:	Supplement, improve nutrition

Abbreviations

#	pound
µg	microgram
AGID	agar gel immunodefusion test
BCS	body condition score
BID	two times a day
CBC	complete blood cell count
cc	cubic centimeter
CF	crude fiber
CNS	central nervous system
CP	crude protein
CSF	cerebral spinal fluid
DE	digestible energy
DIM	days in milk
dl	deciliter
DM	dry matter
ELISA	enzyme-linked immunosorbent assay
ELU	extra-label use
EOD	every other day
FARAD	Food Animal Residue Avoidance Databank
g	gram
gal	gallon
GI	gastrointestinal system
IFA	immunoflorescent antibodies
IM	intra-muscular
IP	intra-peritoneal
IU	international units
IV	intra-venous
kg	kilogram
lb	pound
Mcals	megacalories
ME	metabolizable energy
mEq	milliequivalent
mg	milligram
MHz	megahertz
ml	milliliter
MLV	modified live vaccine
NEFA	non-esterified fatty acids
ng	nanogram
NRC	National Research Council
NSAIDS	non-steroidal anti-inflammatory drugs
PCV	packed cell volume
PO	per oral, by mouth
ppm	parts per million
PU / PD	polyuria / polydipsia
q	every
QID	four times a day
RBC	red blood cell
SID	one time a day
SQ	subcutaneous
TDN	total dietary nutrients
TID	three times a day
TTW	trans-tracheal wash
WBC	white blood cell

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