



Veterinary Assistant



Patient Restraint

Learning how to restrain dogs and cats properly is essential for safety



Taking a Thorough Medical History

- A good history can yield clues that often help lead to a diagnosis
- Listen closely to what clients tell you and take notes
- If the information is not readily offered by the client, be sure to find out:
 - Nature of current health challenge (symptoms noticed by client)
 - Onset and duration of current health challenge
 - Current vaccination and parasite control status
 - Past health issues (not already noted in medical record)
 - Recent changes in:
 - Behavior
 - Home environment
 - Husbandry practices
 - Elimination patterns
 - Eating and drinking patterns
 - Activity level
 - Weight status (loss or gain)

Maintaining Medical Records

- Whether handwritten or input electronically, medical records must thoroughly and accurately document each client and patient interaction
- Medical record form, style, and level of detail will vary with each individual practice
- Each time a pet is presented with a medical complaint, record the following on the medical record:
 - Patient history
 - Primary (and, if applicable, secondary) complaint(s)
 - General patient assessment
 - Physical exam findings, including vital signs
 - Diagnosis or differential diagnosis
 - Treatment protocols
 - Prognosis
 - Notes and observations pertaining to ongoing patient treatment and monitoring
 - Follow-up plan (diagnostic and treatment)
- Additional items to include in medical records:
 - Documentation of client conversations and interactions (phone, electronic, in person)
 - Patient and client information forms
 - Consent forms
 - Diagnostic results and reports
 - Anesthesia records
 - Discharge instructions
 - Patient reminders
 - Financial records

SOAP Approach to Medical Record Entry

Subjective: Hands-off assessment of patient, including history, attitude, temperament, obvious physical abnormalities, and other visual, olfactory, and auditory clues that could be pertinent to the patient's condition

Objective: Hands-on physical exam findings, including vital signs, as well as initial diagnostic steps and results

Assessment: Diagnosis (or differential diagnosis) and prognosis

Plan: Treatment plan, further diagnostics, and/or follow-ups

Performing a Physical Exam

Step 1: Assess General Appearance

- Mentation
 - Bright, alert, and responsive (BAR)
 - Depressed or uninterested
- Abnormal physical presence
 - Weakness
 - Panting
 - Ataxia
 - Coughing
 - Respiratory distress
 - Lameness
 - Other
- Body score
 - Normal, obese, malnourished, emaciated, or cachectic

Step 2: Obtain Vital Signs

	Temp. (°F)	Pulse	Respiration
Dog	99.5–102.2	70–140	10–30
Cat	99.5–102.2	110–140	20–40

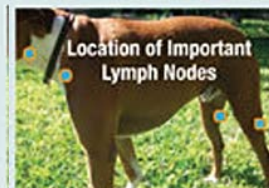
Step 3: Perform a Hands-On Exam

Choose your own systematic approach, and do it the same way every time; practice will improve your hands-on skills; abnormalities to note include:

- Eyes
 - Abnormal color of sclera
 - Abnormal or unequal pupil size
 - Discharge or squinting
 - Corneal cloudiness
 - Abnormal eye movement (nystagmus)
 - Eyelid mass
 - Entropion or ectropion
 - Nictitans (third-eyelid) protrusion
- Ears
 - Presence of odor or discharge
 - Excessive hair
 - Head tilt
 - Hair loss on pinnae
 - Parasites
- Nose
 - Discharge
 - Excessive respiratory "noise"
 - Ulcerations or masses
- Oral cavity
 - Slow capillary refill time (>2 sec)
 - Poor or abnormal mucous membrane color
 - Excessive mouth odor
 - Periodontal disease
 - Retained deciduous teeth
 - Foreign bodies, masses, or ulcers

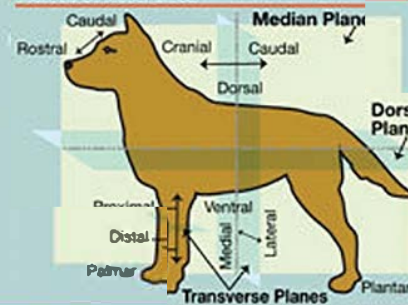
- Cardiovascular and pulmonary systems (auscultation of heart and lungs)
 - Heart murmur
 - Diminished heart sounds
 - Abnormal heart rate or rhythm
 - Harsh lung sounds
 - Weak femoral or jugular pulse

- Lymph nodes
 - Enlarged (symmetrical vs. asymmetrical)
 - Tender
- Abdominal palpation
 - Tense
 - Tender
 - Palpable mass



- Urogenital
 - Discharge or tenderness
 - Mass in mammary region
- Neurologic
 - Paralysis or partial paralysis
 - Toe drag
 - Slow proprioception
 - Exaggerated or diminished reflexes
- Musculoskeletal
 - Poor muscle tone
 - Muscle atrophy
 - Joint pain or inflexibility
- Skin and coat
 - Poor hair texture or hair loss
 - Lumps, bumps, or hernias
 - Scales, crusts, or infections
 - External parasites
 - Discoloration or rashes
 - Wounds

Planes of Reference



Robert Jones Bandage

- Useful for the temporary immobilization of long bone fractures below the elbow and stifle
- When using for immobilization, always remember the more padding, the better

Application

1. Place tape stirrups along the lateral and medial aspects of the lower limb; place a tongue depressor between the loose ends of tape that extend beyond the limbs to allow for easy separation later
2. Wrap the limb in roll cotton, starting from the paw and working up the leg; apply multiple layers; the toes should remain visible at all times
3. Starting from the paw and working up the leg, compress the roll cotton using a conforming gauze layer
4. Peel the ends of the tape stirrups from the tongue depressors and reflect them onto the gauze covering
5. Cover the bandage with a layer of stretch wrap and secure ends with white tape
6. Bandage must be kept dry and the toes inspected periodically for swelling (a sign that the bandage is too tight)

Recording an EKG (Lead II)

1. Patient can be standing or in lateral recumbancy
2. Attach clips in following locations:
 - a) Right arm (RA-White)/Left arm (LA-Black): On skin proximal to olecranon on caudal aspect of appropriate forelimb
 - b) Right leg (RL-Green)/Left leg (LL-Red): On skin over patellar ligament on anterior aspect of appropriate rear limb
3. Moisten clip sites with alcohol or conductive gel
4. To assess arrhythmias, record lead II at a paper speed of 25 mm/sec for 30 seconds (1 cm = 1 mV); if an arrhythmia is noted, record lead II for an additional 60 seconds
5. To get a good measurement of P-QRS-T waveforms, record lead II at a speed of 50 mm/sec for 10 seconds (1 cm = 1 mV)
6. If the QRS complexes extend beyond the paper margin, decrease sensitivity to 1/2 cm = 1 mV

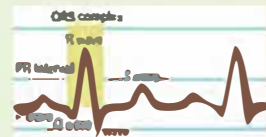


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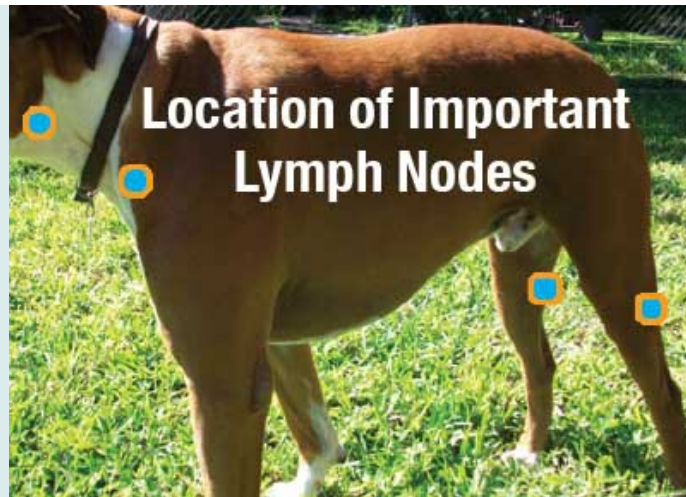
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Normal Values			
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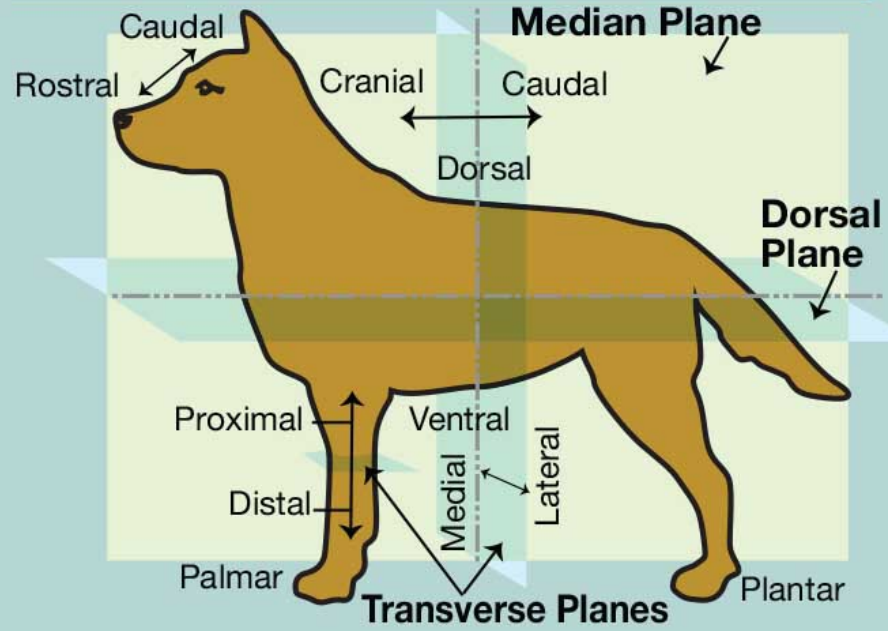
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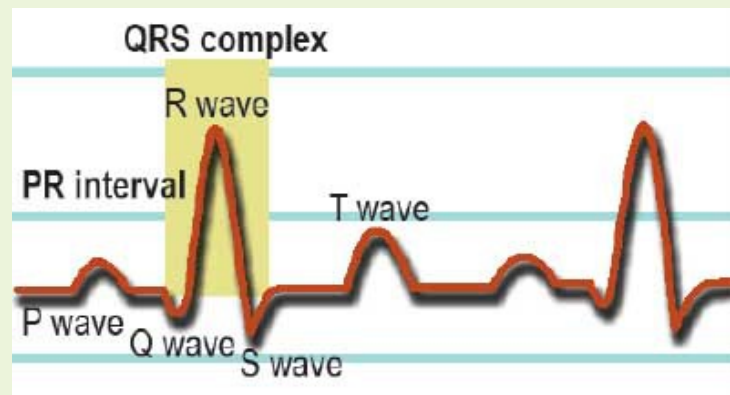
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Drawing Blood & Administering IV Injections (Cephalic Vein)

1. Ensure proper patient restraint
2. Moisten the venipuncture site with alcohol to better visualize the vein
3. Place a rubber tourniquet just above the elbow joint with the metal buckle positioned laterally on the leg and tighten
4. Evacuate all air from syringe and needle
5. Keeping in mind that the cephalic vein tends to roll medially, use a medial approach to the vein
6. Angle your needle slightly from medial to lateral, and insert the needle (bevel up) into the vein; approaching at an angle will ensure the needle “crosses” the vein and eliminates the chance of a miss
7. If drawing blood:
 - a. When you see a flash of blood in the hub of the needle, draw back on the syringe plunger (gently, not forcibly) to obtain your sample; if no blood flow is noted, move the needle slightly forward and back, maintaining a negative pressure with the syringe plunger until blood flows into the syringe
 - b. Release the tourniquet
 - c. Remove the needle from the leg, and apply pressure to the venipuncture site until bleeding has ceased
8. If injecting medications:
 - a. When you see a flash of blood in the hub of the needle, draw back on the syringe plunger (gently, not forcibly) and observe for backflow of blood into syringe; if observed, release the tourniquet and proceed to inject the drug

- b. If no blood flow is noted, move the needle slightly forward and back, maintaining a negative pressure with the syringe plunger until blood flows into the syringe; release the tourniquet and inject the drug
- c. *Always remember to release the tourniquet prior to injection*
- d. Remove the needle from the leg, and apply pressure to the venipuncture site until bleeding has ceased

Cephalic Catheter Placement

1. Ensure proper patient restraint
2. Clip and disinfect intended site; be sure to start “low” (closer to the paw) on the vein when attempting an initial catheter placement; if the first attempt is unsuccessful, you’ll be able to move up the leg to a different location without having to contend with a “blown” vein
3. Place a rubber tourniquet just above the elbow joint with the metal buckle positioned laterally on the leg and tighten
4. Insert the catheter needle (bevel up) through the skin and into the vein
5. Once you see a flash of blood in the catheter hub, advance the needle another several millimeters to ensure the catheter itself (not just the end of the catheter needle) has entered the vein
6. Keeping the stylet held in place with one hand, advance the catheter over the stylet and into the vein using your other hand
7. Release the tourniquet, remove the stylet, and plug the open end of the catheter to staunch blood flow
8. Secure the catheter to the skin with tape

Over-the-Needle Catheter Selection for Cephalic Vein Placement

Size of Pet (lbs)	Catheter Gauge
1–7	24
8–25	22
26–75	20

>75

18



Preventive Health Care

Determining Age

- Determining age can be challenging if presented with a stray pet or a pet with an unknown history
- With puppies and kittens, it's important to verify the age (even if the owner claims to know the age) for the purpose of preventive health-care schedules
- Determining age is not an exact science (unless, of course, you definitively know the date of birth)
- For both puppies and kittens, determine if the animal is still nursing; if not, consider it *at least* 4 weeks of age
- Ask the owner how long he/she has had the puppy/ kitten in his/her possession, and add 4 weeks to this figure; this gives you a baseline from which to work
- **Puppies:** Examine the teeth
 - If deciduous incisors and canines have not yet erupted, then the puppy is less than 6 weeks of age
 - If deciduous incisors and canines are in place yet no permanent teeth are showing, the puppy is 6–11 weeks of age
 - Permanent incisors erupt at 12–16 weeks of age
 - Permanent canines erupt at 16–20 weeks of age
 - A puppy with a full complement of permanent teeth can be considered at least 6 months of age
- **Kittens:** Examine the teeth or determine body weight:
 - Using teeth
 - If the deciduous incisors and canines have not yet erupted, then the kitten is 5 weeks of age or less
 - If deciduous incisors and canines are in place yet no permanent teeth are showing, the kitten is 6–12 weeks

of age

- Permanent front incisors erupt at 12–16 weeks of age
- Permanent canine teeth erupt at 16–20 weeks of age
- A kitten with a full complement of permanent teeth can be considered at least 6 months of age

NOTE: For both puppies and kittens, these are approximate eruption timelines; variations can occur

- Using body weight
 - As a general rule, 1 pound of body weight should equal approx. 1 month of age (**EX:** a 3-pound kitten is 3 months of age)
 - This correlation remains valid up to around 5 months of age
 - Keep in mind that parasitism or malnourishment can cause a kitten to weigh less than it should for its true age

Vaccinations

- Dog and cat vaccines are classified as either “core” or “noncore”
- Core vaccines should be given to every pet
- Noncore vaccines are considered optional, and the decision whether to use them should take into account a pet’s breed, geographic location, age, lifestyle, and risk of exposure to the disease agent
- Bacterins (**EX:** leptospirosis, Lyme) and adjuvanted, killed viral vaccines (**EX:** rabies, FeLV) pose the greatest risk for vaccine reactions

Dog Vaccines

- Core
 - Rabies
 - Distemper
 - Adenovirus type 2
 - Parvovirus

- Noncore
 - Leptospirosis
 - Bordetella
 - Lyme
 - Parainfluenza
 - Other

Cat Vaccines

- Core
 - Rabies
 - Viral rhinotracheitis
 - Panleukopenia
 - Calicivirus
- Noncore
 - FeLV/FIV
 - *Chlamydophila* (*Chlamydia*)
 - Other

	Sample Puppy/Kitten Vaccination Series*			Sample Adult Dog/Cat Vaccination Schedule*		
Vaccine Type	6–8 wks	10–12 wks	13–16 wks	15–16 mos	Annually	Every 3 Years
Core						
Distemper/ Viral rhinotracheitis	1st	2nd	3rd	4th	—	Yes
Adenovirus type 2/ Panleukopenia	1st	2nd	3rd	4th	—	Yes
Parvovirus/ Calicivirus	1st	2nd	3rd	4th	—	Yes

Rabies (dogs and cats)	—	—	1st	2nd	If 1-year licensed vaccine is used	If 3-year licensed vaccine is used
Noncore						
Leptospirosis (4-way)	—	1st (12 wks)	2nd	3rd	Yes	—
Bordetella and parainfluenza (intranasal)	—	1st (12 wks)	2nd	3rd	Annually or semiannually	—
FeLV	—	1st (12 wks)	2nd (16 wks)	3rd	Up to 2 years of age	—

Preventive Deworming

Puppies & Kittens

- All puppies and kittens should be dewormed every month starting at 2–4 weeks of age and finishing at about 16 weeks of age
- A fecal exam should be performed prior to 12 weeks of age to check for coccidia infestation
- Heartworm prevention can be started as early as 8 weeks of age Adult Dogs & Cats
- A negative fecal examination does not necessarily mean a pet is free of intestinal parasites
- Adult dogs should be given heartworm-preventive medication year-round to assist in nematode control
- Adult cats that are allowed to roam and hunt should be dewormed empirically at least twice yearly for nematodes *and* cestodes and be screened for coccidia (toxoplasmosis) at least once a year

Popular Intestinal Dewormers

Generic	Effective Against	Precautions
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(Trade)		
Fenbendazole (Panacur, Safe-Guard)	Roundworms, hookworms, whipworms, tapeworms (<i>Taenia pisiformis</i>), lung flukes, lungworms, <i>Giardia</i>	May cause vomiting; minimum 3-day treatment needed (5 days for <i>Giardia</i>); safe for pregnant pets
Pyrantel pamoate (Strongid T, Nemex)	Roundworms, hookworms	Do not give to severely debilitated pets; may cause vomiting; safe for pregnant pets
Praziquantel (Droncit, Drontal)	Tapeworms	Do not use in puppies less than 4 weeks of age or in kittens less than 6 weeks of age; safe for pregnant pets
Sulfadimethoxine (Albon)	Coccidia	Use with caution in dehydrated pets or pets with liver or kidney disease; do not use in pregnant pets



Oncology

Classifying & Naming Tumors

- Typically combines both **character** (benign or malignant) and **tissue of origin**
- **Benign tumors:**
 - Prefix: Tissue of origin; Suffix: Typically *-oma*

EX: lipoma (benign tumor of fatty tissue); mammary adenoma (benign tumor of mammary tissue)
- **Malignant tumors:**
 - Prefix: Tissue of origin; Suffix: *-carcinoma* (epithelial, glandular, or organ tissue) or
 - *sarcoma* (connective tissue, including bone and blood)

EX: liposarcoma (malignant tumor of fatty tissue [connective tissue]); mammary adenocarcinoma (malignant tumor of mammary gland [glandular tissue])
- Exceptions do exist;

EX: melanoma (malignant); insulinoma (malignant); lymphoma (malignant)

Tumor Metastasis

- Presence or absence can help determine prognosis
- **Carcinomas** spread through lymphatic system and bloodstream; lymph nodes and lungs are primary sites of metastasis
- **Sarcomas** spread primarily through bloodstream; lungs are main site of metastasis

Grading & Staging Tumors

- Based on histological features
- **Low grade:** Well-differentiated cell population; few mitotic figures (cell division); minimal invasion into surrounding tissue
- **High grade:** Poorly differentiated cell population; abundant mitotic figures; aggressive invasion into surrounding tissue



Nutrition

Determining Caloric Requirements

- Each food will differ in regard to its caloric content and caloric density
- Don't always rely on label recommendations for feeding amounts; instead, focus on calories per serving
- Many formulas exist for determining daily caloric needs for dogs and cats; unfortunately, caloric requirements can fluctuate widely based on individual metabolism, activity, breed, size, coat length, health status, reproductive status, stage of life, and environmental temperature; as a result, daily caloric intake for adult pets should be based on **body score** and *not* solely on a particular formula

Daily Caloric Intake for Adult Cats*

Active	35 kcal/lb
Sedentary	32 kcal/lb

Daily Caloric Intake for Adult Dogs with Normal Activity Levels*

Small breeds (<20 lbs)	39 kcal/lb
Medium breeds (20–75 lbs)	30 kcal/lb
Large breeds (>75 lbs)	25 kcal/lb

* These are approximate feeding amounts only; neutered pets may require up to 25% fewer calories per day than their intact peers; active dogs will need their daily caloric intake increased by a factor of two or more (depending on activity); growing puppies and kittens (up to 6 months of age) generally require twice as many kcal/day than adults

Daily Water Requirements for Healthy Dogs & Cats**

Cats and small breeds	30 ml/lb**
Medium breeds	25 ml/lb**
Large breeds	20 ml/lb**

** approximates



Dental Care

Using an Ultrasonic Dental Scaler

- Ultrasonic scalers work by converting sound waves into mechanical vibrations
- Prior to scaling, rinse mouth with 0.2% chlorhexidine to reduce amount of aerosolized bacteria and to reduce chances of bacteremia
- Be sure patient's eyes are lubricated and shielded
- Ensure the endotracheal tube is of proper size and the cuff is inflated
- Place a gauze sponge in back of mouth to absorb fluid (remember to remove!)
- Keep patient's head positioned at a downward angle to help drain water and debris
- Ensure adequate water flow to tip of scaler before beginning
- Use the correct scaler tip for the job: broad "standard" tips are for removing medium to heavy deposits; precision "slim" tips allow for improved access to subgingival and furcation areas



- Use the back surface and sides (not the point) of the tip to scale the tooth surface; the front surface (concave surface) of the tip can be used to dislodge tough deposits

- At least 30% of the tip surface should be kept in contact with the tooth surface
- Keep the tip at an angle no greater than 45° to the surface of the tooth
- Move tip over the enamel as you would a pencil eraser (vertically, horizontally, and obliquely); don't scrape the tooth; allow the vibrations to break up the deposits

Using a Dental Polisher

- Polishing teeth after scaling is essential to smooth grooves and scratches caused by scaling; failure to do so will hasten the return of plaque and calculus
- When using the polisher, apply enough pressure (for just 1 or 2 seconds) to flare the edge of the polishing cup against the tooth, then release slightly while still maintaining contact with the tooth; repeat this cycle using a continuous motion as you move over the tooth surface (do not "bounce" the cup)
- Pause often to refill the polishing cup with pumice or polishing paste



Occupational Safety

Read and become familiar with Occupational Safety and Health Administration (OSHA) guidelines regarding workplace safety, as well as the Material Safety Data Sheets for potentially hazardous agents used in your practice; these should be readily available from your employer

Hazards & Methods for Reducing or Eliminating Risk

Radiation

- Always wear a dosimeter, lead apron, lead gloves, and a thyroid shield whenever taking radiographs
- Ensure proper collimation and keep milliamperes-seconds (mAs) as low as possible
- Perform routine X-ray equipment maintenance and check for scatter radiation at least quarterly
- Minimize retakes (get it right the first time!)
- Stay as far away from X-ray beam as possible; an anesthetized patient is ideal so that patient will remain calm and images will not be blurred by motion

Routine Dentistry

- Wear mask and eye protection when scaling teeth to prevent exposure to aerosolized bacteria

Chemotherapy Drugs

- Always wear gloves and, if available, a low-permeability gown when preparing or administering chemotherapeutic agents

- Keep in mind that feces, urine, or vomit from a pet that has received certain types of chemotherapy can be a source of exposure

Anesthetic Gases

- Ensure proper maintenance of all anesthetic machines
- Be sure waste anesthetic gas–elimination systems are working correctly
- Use correct-size endotracheal tube for the patient and properly inflate the cuff

Antibiotics & Antimicrobials

- Avoid handling penicillin or derivative products if you have a known sensitivity to penicillin
- Wear gloves when handling sulfa drugs or products containing chloramphenicol

Bite & Scratch Wounds

- Use proper patient restraint
- Trim nails of cats prior to performing uncomfortable procedures

Zoonotic Diseases

- If in doubt, wear gloves
- Use proper patient restraint
- Never handle or remove ticks with bare hands
- Wash hands frequently
- Consider routine rabies prophylaxis
- Leptospirosis must be ruled out whenever a pet is presented with kidney or liver disease

Harmful Chemicals & Disinfectants

- Ensure proper ventilation in work area

- Avoid direct contact with skin
- Avoid splashing when mixing or diluting



Diagnostic Imaging

Radiographic Exposure Factors & Settings

Milliamperage (mA)

- Increase in mA will increase radiographic density
- Decrease in mA will decrease radiographic density

Exposure Time (seconds)

- Exposure time of less than 1/30 second (1/120 second is preferred) is desirable in veterinary medicine (due to potential patient motion)
- Rare earth screens allow for much shorter exposure time as compared to standard screens

Milliampere-second (mAs)

- Expressed as the product of milliamperage $\times$ time
- The higher the mA, the less exposure time needed for proper density
- The lower the mA, the longer the exposure time needed for proper density
- Always use the highest mA setting and lowest time setting when setting for desired mAs to reduce motion-induced blurring

Kilovoltage (kV)

- Increase in kV results in increased density and contrast (more tones of gray that represent varying tissue densities on radiograph)

- High kV (with lower mAs setting) is useful for soft tissue evaluation
- Lower kV (with higher mAs setting) is useful for bone evaluation

Focal-Film Distance

- To prevent unwanted image magnification and lack of margin distinction, this distance should be kept as long as possible without having to significantly reduce the X-ray beam intensity
- Most veterinary hospital technique charts use a focal film distance of 80–110 cm

Grids

- Used to control scatter radiation
- Should be used when portion of body being radiographed is greater than 10 cm thick

Ultrasound Principles

- Transducer sends out sound waves, which reflect back to transducer at varying speeds from tissue surfaces and are displayed as an image on the computer screen
- White dots on image = strong reflections (echoes)
- Black dots on image = weak reflections (echoes)

Acoustic Impedance

- Equals velocity (v) $\times$ tissue density (ρ)
- Measures the compressibility of a tissue
- Differences in acoustic impedance between tissues allow for image interpretations
- Bone has highest acoustic impedance (less compressible); air has lowest acoustic impedance (more compressible)

Angle of Incidence

- The angle at which the sound strikes the surface of the tissue
- Perpendicular beams yield the greatest percentage of reflected sound waves
- Optimizing the angle of incidence will improve image quality

Attenuation

- The deeper sound waves penetrate into tissue, the more energy they lose due to absorption, scattering, and reflection; attenuation refers to this gradual loss of energy and intensity
- Dark areas (shadows) appear distal to tissues with high sound attenuation; light areas (enhancements) appear distal to tissues with low sound attenuation



Parasitology

Quick Facts – Heartworms

- Canine heartworm disease is caused by the parasite *Dirofilaria immitis*
- Adult worms reside in the right ventricle, pulmonary arteries, and vena cava
- Occult infections (absence of microfilaria within the bloodstream) result from prepatent infections, destruction of microfilaria by the host immune system, unisex infections, and consistent administration of heartworm-preventive medication
- Severity of heartworm disease is subdivided into three classes:
 - **Class I:** Mild worm burden with absent or mild clinical signs, including occasional cough
 - **Class II:** Moderate worm burden with moderate clinical signs, including sporadic cough, mild exercise intolerance, and mild cachexia
 - **Class III:** Severe worm burden with persistent cough, exercise intolerance, marked cachexia, and labored breathing
- Cats can contract canine heartworms from the bite of an infected mosquito, although only 10% will end up with actual worms in the heart
- Feline heartworm disease is characterized by a low worm burden within the heart (usually fewer than 5); however, due to the small size of the feline heart, even one worm can have devastating consequences
- There is no approved or safe treatment for feline heartworm disease; worms that inhabit the hearts of cats have a much shorter life span than those found in dogs; as a result, a spontaneous “cure” may occur due to natural heartworm die-off

- Potential causes of false negative heartworm antigen tests are a low worm burden, immature female worms, male unisexual infection, or a cold test kit

Quick Facts – External Parasites

Fleas

- Most common external parasite in dogs and cats
- Carriers of the tapeworm *Dipylidium caninum*; dogs and cats that consume a flea when chewing on themselves can develop a tapeworm infestation
- Fleas have a four-stage life cycle; successful flea control requires elimination of all stages (eggs, larvae, pupae, adults); in other words, you must treat both pet *and* its environment
- Rate of development is temperature dependent; adults must find a host within 2 weeks of emerging from pupal stage or they will die
- The female flea can lay over 2,000 eggs over a 3-week period
- 85% of the flea population lives in the yard and in the home in the form of eggs and pupae
- One square foot of carpet can produce over 200 fleas per day
- Flea saliva contains histamine-like compounds that irritate the skin; in some pets, the saliva from just one bite can cause a generalized allergic reaction (flea allergy dermatitis)

Prepatent Periods of Intestinal Worms

Worm	Species	Time from Ingestion or Exposure to Appearance of Eggs in Stool
Roundworms*	<i>Toxocara canis</i> (dogs)	3–5 wks
	<i>Toxocara cati</i> (cats)	6–8 wks
	<i>Toxascaris leonina</i> (dogs and cats)	10 wks
Hookworms*	<i>Ancylostoma caninum</i>	2 wks

	(dogs)	
	<i>Ancylostoma tubaeforme</i> (cats)	3 wks
Whipworms	<i>Trichuris vulpis</i> (dogs)	12 wks
Tapeworms	<i>Dipylidium caninum</i> (dogs and cats)	2–3 wks
	<i>Taenia pisiformis</i> (dogs)	6–8 wks
	<i>Taenia taeniaeformis</i> (cats)	6–10 wks
	<i>Echinococcus multilocularis</i> (dogs and cats)	4–5 wks

* Puppies exposed in utero or from nursing may begin to shed hookworm eggs as early as 2 weeks of age and roundworm eggs as early as 3 weeks of age

- Year-round warm climates require year-round flea control; in seasonally warm climates, begin flea control in late spring
- Excessive licking and chewing in cats caused by fleas can lead to secondary hairball complications

Ticks

- Larva, nymphs, and adults all feed on blood from host
- A female can lay thousands of eggs in a single reproductive burst
- Can transmit serious zoonotic diseases, including Lyme disease
- An attached tick will feed for up to 1 week if not removed
- Transmission of pathogens and diseases from the tick to the host often requires hours to days of feeding before it will occur; as a result, prompt removal can prevent transmission of disease
- The salivary secretions of ticks contain neurotoxins that can cause actual paralysis in some dogs (tick paralysis)
- Remove ticks by grasping the tick close to point of attachment with tweezers and gently pulling free

- Tough to control in environment; therefore, on-pet control year-round is important

Demodectic Mange

- Noncontagious disease (demodicosis) caused by the *Demodex* sp. mange mite, which is found normally in small numbers within hair follicles and sebaceous glands of the skin
- Disease caused when mites proliferate in great numbers due to genetic predisposition or immunosuppression; most commonly seen in dogs; rare in cats
- Mites cause inflammation within the hair follicles, which leads to secondary bacterial infections
- In severe cases, mites can spread systemically
- Itching is caused by secondary bacterial infection and inflammation
- Localized demodicosis occurs in young pets under 1 year of age; often resolves spontaneously
- Generalized demodicosis occurs in both young and old pets
- Easily diagnosed with skin scrape
- Treatments include amitraz, ivermectin, or milbemycin

Sarcoptic Mange

- Caused by the mite *Sarcoptes scabiei*
- Intensely pruritic and highly contagious skin disease
- Commonly affects ear margins, elbows, hocks, abdomen, and chest
- Often difficult to diagnose with skin scrape
- In 80% of cases, positive pinna-pedal reflex can be used to confirm diagnosis (rubbing the affected ear margin between thumb and forefinger will induce the dog to scratch with its back legs)
- Treatments include selamectin, ivermectin, milbemycin, amitraz, and lime-sulfur dips
- Mites can survive up to 3 weeks in environment
- Considered a zoonotic disease

***Cheyletiella* Mange**

- Caused by the mite *Cheyletiella*
- Pruritic, highly contagious skin disease
- Hallmark clinical sign is intense scaling of the skin
- Known as “walking dandruff”; can see mites moving on skin due to large size and excessive scaling; mites can be identified with handheld magnifying lens
- Occurs in dogs, cats, and rabbits
- Treatments include lime-sulfur dips and pyrethrin dips
- Considered a zoonotic disease

Ear Mites

- Caused by the mite *Otodectes cynotis*
- Intense irritation of the external ear canal due to hypersensitivity reaction
- Hallmark presentation is itchy ears accompanied by dry, thick, black or red-brown crusts in external ear canals
- Easily diagnosed with otoscope or ear swab
- To treat, clean debris from canals first using commercial ear cleaner, then apply appropriate otic parasiticide for minimum of 10 days; selamectin and ivermectin are also effective treatments
- Topical flea medications are helpful to eliminate residual ear mites on the pet’s skin and hair coat



Laboratory

Biochemical Profile Interpretation

- **Blood urea nitrogen (BUN):** By-product of protein metabolism within the body; increases in BUN can be caused by dehydration, kidney disease, cardiovascular disease, and shock; decreases in BUN can be seen in liver disease
- **Serum creatinine:** Amino acid compound closely regulated by the kidneys; abnormal elevations are indicative of kidney disease; decreases seen with decreased muscle mass
- **Glucose:** Marked increases in blood glucose can occur with diabetes mellitus, Cushing's disease, stress, drug therapy, convulsions, and excitement; decreases seen with liver disease, advanced seizure activity, Addison's disease, gastrointestinal disease, parasitism, starvation, and neoplasia
- **Sodium:** Serum electrolyte vital to fluid balance within the body; increases caused by dehydration and high fever; decreases seen in Addison's disease, vomiting, diarrhea, starvation, kidney disease, diabetes mellitus, and bladder disease
- **Potassium:** Intracellular cation important for cardiac and neuromuscular membrane excitability; serum electrolyte increases in potassium electrolyte levels are seen with Addison's disease, tissue damage, dehydration, and oversupplementation; diminished amounts of potassium in the blood occur secondarily to vomiting, diarrhea, stress, drug therapy (**EX:** insulin, diuretics), malnutrition, and kidney disease
- **Chloride:** Serum electrolyte vital to fluid balance within the body; increases can be caused by diarrhea, kidney disease,

diabetes mellitus, and shock; decreases in chloride levels occur secondarily to vomiting, diarrhea, and malnutrition

- **Calcium:** Most abundant mineral within the body; important for muscle function, heart function, blood clotting, nerve conduction, and integrity of the teeth and bones; tumors, hyperparathyroidism, Addison's disease, bone infections, and kidney failure can increase blood calcium levels; decreases seen with pancreatitis and low blood protein levels
- **Phosphorus:** Important to many metabolic processes throughout the body; contributes to structural integrity of bone; elevations seen with bone tumors, kidney disease, and hypoparathyroidism; decreases seen with hyperparathyroidism, tumors, and poor nutrition
- **Total serum protein:** Serum proteins include albumin (transport protein) and globulins (transport and immunity protein); increases in total serum protein levels result from dehydration and immune responses to infection; decreases in serum protein are seen with immunodeficiency disease, gastrointestinal disease, parasitism, pancreatic disease, liver disease, kidney disease, blood loss, Addison's disease, and severe skin disease
- **Creatinine phosphokinase (CPK):** Not to be confused with serum creatinine, it is an enzyme located primarily in muscle and brain tissue; elevations found typically with muscle disease, trauma, and heart disease
- **Lactate:** Produced by anaerobic metabolism; increases seen with tissue necrosis and/or sepsis; hypoxia will lead to increase; used as marker for treatment of shock
- **Aspartate aminotransferase (AST, SGOT):** Enzyme found in tissues throughout the body, including the heart, liver, muscles, and blood; increases in AST seen with liver and muscle disease, along with red blood cell damage
- **Alanine aminotransferase (ALT, SGPT):** Liver-specific enzyme; elevations indicative of liver damage

- **Alkaline phosphatase (ALP, SAP):** Enzyme found on cell membranes throughout the body; elevations occur with cholestasis, liver disease, Cushing's disease, steroid drug therapy, hyperparathyroidism, and neoplasia
- **Gamma-glutamyltransferase (GGT):** Enzyme found in the liver, kidney, and pancreas; elevations occur with cholestasis, liver disease, steroid drug therapy, or treatment with certain anticonvulsant medications
- **Bilirubin:** Pigment found in blood and bile; produced by the liver and originates from breakdown of oxygen-carrying molecules found in red blood cells (hemoglobin) and muscle tissue (myoglobin); increases seen with liver disease, red blood cell destruction, muscle disease, and trauma
- **Bile acids:** Compounds derived from cholesterol and produced in the liver; responsible for absorption of fat from the small intestine; abnormalities in bile acids indicative of liver disease
- **Cholesterol:** Steroid compound produced primarily by the liver; vital to normal cellular structure and function; increases occur with kidney disease, liver disease, Cushing's disease, gastrointestinal disease, diabetes mellitus, and pancreatitis; decreases in normal levels due to improper fat digestion
- **Amylase:** Digestive enzyme produced in the pancreas; also found in liver and intestinal lining; elevations are seen with pancreatic disease, kidney failure, Cushing's disease, liver disease, and gastrointestinal disease
- **Lipase:** Digestive enzyme produced by the pancreas and stomach lining; increases seen with pancreatic disease, kidney failure, Cushing's disease, liver disease, and gastrointestinal disease



IV Fluid Rate Calculations

Microdrip (60 drops/ml): $\text{ml/hr} \times 60 \text{ drops/min} \times \text{hr}/60 \text{ min}$

EX: 40 ml/hr = 40 drops/min

Macrodrop (15 drops/ml): $\text{ml/hr} \times 15 \text{ drops/min} \times \text{hr}/60 \text{ min}$

EX: 40 ml/hr = 10 drops/min

Macrodrop (10 drops/ml): $\text{ml/hr} \times 10 \text{ drops/min} \times \text{hr}/60 \text{ min}$

EX: 60 ml/hr = 10 drops/min

NOTE: See more in the **QuickStudy®** *Medical Math* and *Nursing Math* guides



Pharmacology

The 6 Cs of Safe & Effective Drug Administration

1. Correct patient
2. Correct drug
3. Correct dose
4. Correct route or location
5. Correct speed of administration (IV drugs)
6. Correct dosage interval

Drug Precautions & Interactions

Class	Drug Examples	Precautions & Potential Interactions
Antimicrobials		
Aminoglycosides	Gentamicin (Gentocin); amikacin (Amiglyde-V)	Use with caution in the presence of dehydration, kidney disease, and neuromuscular diseases; can be ototoxic; do not administer to rabbits
Penicillins, aminopenicillins, and cephalosporins	Penicillin G; amoxicillin (Amoxi-Tabs); ampicillin; cephalexin (Keflex)	Can cause hypersensitivity reactions and gastrointestinal upset; do not administer to rabbits and rodents
Tetracyclines	Tetracycline; doxycycline (Vibramycin);	Have been known to cause birth defects when given to pregnant pets; can discolor deciduous teeth; use with

	oxytetracycline (Terramycin)	caution in the presence of liver and kidney disease; doxycycline can cause esophageal ulcers if pet fails to fully swallow pill
Metronidazole	Flagyl	Do not use in pregnant animals; seizures and neurologic disorders can occur at high dosages
Fluoroquinolones	Enrofloxacin (Baytril); marbofloxacin (Zeniquin); orbifloxacin (Orbax)	Use with caution in seizure patients; can cause cartilage abnormalities when used in growing puppies; use with caution if pet is dehydrated or has kidney disease; parenteral administration in cats could cause blindness
Sulfas	Trimethoprim-sulfa (Tribrissen, Bactrim); ormetoprim-sulfa (Primor)	Use with caution in dehydrated pets, kidney patients, and liver patients; hypersensitivity reactions can occur; can cause keratoconjunctivitis sicca (dry eye); avoid use in cocker spaniels and Dobermans
Macrolides and lincosamides	Clindamycin; lincomycin	Use with caution in presence of liver or kidney disease; may cause gastrointestinal upset; do not use in rabbits and rodents
Chloramphenicol	Duricol; Viceton	Use with extreme caution in pets with liver or kidney disease; long-term use in cats can lead to bone marrow toxicity; do not use in pregnant pets; potentially toxic to owners and hospital personnel

		administering the drug to pets, so avoid direct contact!
Griseofulvin	Fulvicin; Gris-PEG	Do not use in pregnant pets or cats with FeLV or FIV; use with caution in pets with liver disease

Anti-inflammatories

Nonsteroidal antiinflammatories (NSAIDs)	Deracoxib (Deramaxx); carprofen (Rimadyl); etodolac (EtoGesic); firocoxib (Previcox)	Do not use in pets with bleeding disorders; use with caution in presence of kidney and liver disease; do not use in conjunction with other NSAID or steroid anti-inflammatories; may cause GI upset
Steroid anti-inflammatories	Prednisone; prednisolone; dexamethasone (Dexasone); triamcinolone (Vetalog)	Dose-dependent immunosuppression; do not use in presence of fungal infections; use with caution in presence of bacterial infections, corneal ulcers, diabetes, heart disease, and kidney disease; long-term use can cause iatrogenic Cushing's disease

Anti-parasitics

Avermectins	Ivermectin (Heartgard); selamectin (Revolution); moxidectin (Advantage Multi)	At dosages above those used for heartworm prevention, can cause neurologic toxicity in breeds susceptible to MDR1-allele mutation (collies, Australian shepherds, shelties, long-haired whippets, and other dogs with "white feet"); can cause shock-like reaction if
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		administered to heartworm-positive pets
Macrolides	Milbemycin oxime (Interceptor)	Can cause severe shock-like reaction if administered to heartworm-positive pets; neurologic toxicity at higher dosages
Spinosad	Comfortis; Trifexis	Do not use in conjunction with high-dose avermectins
Miscellaneous		
Tramadol	Ultram	Do not use in pets prone to seizures; avoid use with antidepressant medications and MAO inhibitors (amitraz, selegiline)
Antihistamines	Diphenhydramine (Benadryl); hydroxyzine (Atarax)	Use with caution in pets with glaucoma, seizures, heart disease, or urine-outflow obstructions
Acepromazine	AceproTabs; PromAce	Use with caution in pets prone to seizures; avoid use in boxers, sight hounds, and giant breeds; reduce dosages for collies, shelties, and Australian shepherds; may adversely affect a pet's ability to thermoregulate, increasing susceptibility to hypo- or hyperthermia
Tricyclic antidepressants	Clomipramine (Clomicalm); amitriptyline	Use with caution in pets with seizures, liver disease, and heart disease; may cause GI upset and dry mouth
SSRI antidepressants	Fluoxetine (Prozac);	Use with caution in pets with liver disease; may cause GI

	sertraline (Zoloft)	upset; do not combine with other SSRI medications or MAO inhibitors (amitraz, selegiline)
Sucralfate	Carafate	Will impair absorption of most drugs if administered within 2 hours of those drugs
Theophylline	Theochron; Theo-Dur	Use with caution in pets with seizures, liver disease, kidney disease, heart disease, and gastric ulcers; can cause GI upset



Anesthesia

Selection & Use of Endotracheal Tubes

- Tube diameter and length must be taken into account when selecting an endotracheal tube for a patient
 - Reductions in tube diameter increase airway resistance and work needed for breathing
 - Increases in length increase airway resistance and work needed for breathing
 - Choose the largest possible diameter that can be safely passed (not forced) into the larynx and trachea
- When placing an endotracheal tube, never rely on “blind” placement; you *must* see the tube pass into and through the laryngeal opening before you can confirm that the tube has been properly placed
- Endotracheal tube cuffs should be inflated just enough to prevent leakage when a breath is administered at a peak airway pressure of 25 cm H₂O

Anesthesia Machine & Circle Breathing System Check

Perform checks each day prior to anesthetizing the first pet and familiarize yourself with the machine’s operation manual for specific guidelines

1. Check oxygen supply source to ensure adequate quantities and flow

Oxygen Flow Rates & System Parameters

Weight	Flow Rate	Bag Size	Bain Non-Rebreathing
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(lbs)	(L/min)	(L)	System
<3	1.0	1	Yes
4-6	1.50	1	Yes
7-15	2.0	1	Yes
16-20	0.75	1	No
21-25	1.0	2	No
26-30	1.0	3	No
31-40	1.25	5	No
41-50	1.50	5	No
51-60	1.75	5	No
61-70	2.0	5	No
71-80	2.25	5	No
81-90	2.50	5	No

2. Connect machine to oxygen source via machine's oxygen hose
3. Attach appropriately sized rebreathing bag and all tubing to machine
4. Inspect gauges, vaporizer, bag, and all hoses for defects
5. Check vaporizer level of liquid inhalant anesthesia, and fill if needed; be sure control dial is off and filler cap is sealed
6. Ensure the connections to the scavenging system are intact and secure (also check that all scavenger exhaust fans in the room are functioning properly)
7. With the vaporizer control dial still in its off position, turn on the oxygen flowmeter and check (via smell) for a vaporizer leak
8. Turn off the oxygen flowmeter and close the pop-off valve
9. Occlude the opening of the tubing's Y-piece
10. Turn the oxygen flowmeter back on to 5 L/min to begin filling the bag with oxygen
11. When the pressure manometer reaches 20 cm H₂O, reduce the flow of oxygen until the pressure no longer rises
12. The pressure in the system should remain at 20 cm H₂O for approximately 30 seconds; if the pressure falls, there is a leak in the system

13. Open the pop-off valve slowly and observe the bag deflate, then release the Y-piece
14. Press the flush valve and be sure the pop-off valve allows system pressure to be properly relieved



Surgery

Surgical Scrub

1. Ensure cap and mask are in place
2. Keep hands and forearms positioned above waist at all times
3. Divide each finger into 4 sections and scrub each section for a minimum of 5 seconds (including interdigital webbing) with surgical scrub
4. Divide forearm into 4 sections and scrub each section for a minimum of 5 seconds
5. Rinse well, allowing water to flow from fingertips to elbows

Prepping the Patient

1. Start with gauze or sponge containing surgical scrub at proposed incision site (usually at center of clipped area)
2. Scrub site in a circular motion, moving from the center to periphery (discard the gauze or sponge when periphery is reached)
3. Repeat this process a minimum of three times
4. Rinse site thoroughly with 70% isopropyl alcohol or other antiseptic solution

Guidelines of Aseptic Surgical Technique

- Never reach over a sterile field if you have not scrubbed
- Once you have scrubbed and entered a sterile area, do not leave sterile area until the surgery is finished
- Confirm that all equipment to be used during surgery has been sterilized; if there is doubt, consider that equipment contaminated

- Sterile items are handled only by those who have scrubbed and are wearing appropriate sterile attire
- If a sterile object touches anything with questionable sterility, it should be considered contaminated
- A sterile item that touches the sealed edge of the open pouch that holds it should be considered contaminated
- Sterile items covered in damaged or moist wrapping are considered contaminated
- Sterile tables are to be considered sterile only at table height; anything below this height and out of the surgeon's field of vision should be considered contaminated
- Sterilized gowns should be considered sterile only from the neck to the waist and from the gloved hand to the elbow
- Since the back of the surgical gown is not sterile, surgical assistants in the operating room should always stay facing each other or the sterile surgical field
- When not in use, gloved hands should be held in front of the gown and never allowed to drop below the waist
- Talking within the surgical prep area and operating room should be kept to a minimum; talking releases moisture from the mouth that is laden with bacteria
- Keep movement within the surgical prep area and operating room to a minimum, as movement can stir up potential sources of contamination within the area



CODE BLUE – Emergencies

The ABCs of Emergencies

A = Airway

- Sweep mouth and ensure patent airway
- Intubate if indicated

B = Breathing & Bleeding

- Control hemorrhage with direct compression
- **Positive pressure ventilation:** Minimum 30 breaths/minute (1 every 2 seconds) at peak pressure of 20 cm H₂O
- Goal: PaO₂ > 90 mmHg

C = Circulation

- Cardiac massage if no heartbeat or pulse
 - Right lateral recumbency
 - Place hands at the intercostal space between the 5th and 6th ribs
 - 100–120 compressions/minute (2 per second)
 - Each compression should decrease thoracic diameter by a third
 - Compression–relaxation ratio = 1:1
- Place intravenous catheter
- Fluids (shock rate)

Management of the Poisoned Pet

1. Induce vomiting
 - a. If within 3 hours of ingestion
 - b. Do not induce vomiting if caustic substance or petroleum-based product was ingested (if in doubt, check product label if available)
 - c. Apomorphine (intravenous or directly into conjunctival sac) is an effective emetic for dogs; for cats, xylazine (Rompun) is an effective emetic when administered subcutaneously
2. Neutralize the toxin
 - a. Activated charcoal can be used to adsorb toxins and facilitate their excretion from the intestinal tract
 - b. Do not administer activated charcoal if a caustic substance was ingested; caustic substances should be diluted with a generous amount of water administered by mouth
3. Eliminate the toxin
 - a. A cathartic should be used to help expel toxin-laden activated charcoal (if not expelled, the charcoal will eventually release the toxin back into the intestines)
 - b. Most veterinary formulations of activated charcoal contain a built-in cathartic (sorbitol)
 - c. Use cathartics with caution in dehydrated pets
 - d. DSS enemas can also be used to eliminate toxins from the large intestine; do not use human enemas in dogs or cats, as these can cause severe electrolyte and acid-base imbalances

NOTE TO STUDENT: The US is guide is intended for informational purposes only. Due to its condensed format, this guide cannot cover every aspect of the subject; it should be used in conjunction with course work and texts. US is guide is not intended for the diagnosis, treatment, or cure of any medical condition or illness and should not be used as a substitute for professional veterinary medical care. BarCharts, Inc., its writers, editors, and design stars are not responsible or liable for the use or misuse of the information contained in this guide.

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