Veterinary Disaster Medicine

Working Animals

CHAPTER 1
FIRST AID FOR WORKING DOGS

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On deployment to a disaster scene that may include working dogs, it is important to obtain information relevant to potential hazards that the dogs may encounter. One hazard is the environmental temperature in which they may be working, so one must be prepared to treat hyperthermia or hypothermia. Another hazard is the chemicals present in a building that a dog may step through, breathe, or ingest during a search, so one must know how to counteract the chemicals. Drinking contaminated water during a search may also be a hazard. Knowledge of the hazards that may be faced will increase the handler's ability to avoid a problem and will prepare the veterinary unit to care for the dogs.

Veterinarians and veterinary technicians practice first aid daily. A review of first aid for dogs will be most useful for veterinarians and technicians who predominantly see large animals in their daily routine; for all other first responders, this chapter will provide information on the basics of canine first aid.

1. First Aid for Working Dogs

1.1. Presentation of a Sick or Injured Dog

1.1.1. *History:* When presented with a sick or injured animal, try to gain as much history and information from the handler as possible. Above and beyond an initial observation, find out the following information:
I. Where did the illness/injury occur? This is important so others can be warned of a potential hazard.
II. When did the illness/injury occur? The duration of an illness/injury often guides treatment by the veterinarian.
III. What happened to the dog? This may help guide others to the detection of unseen hazards.

1.1.2. Standard medical questions
I. Coughing, sneezing (Bloody? Purulent? Foreign debris? Productive? Nonproductive?)
II. Vomiting (Color? Frequency? Bloody? Coffee-grounds color? Foreign debris? Bile? Food?)

III. Diarrhea (Straining? Mucoid? Color? Foreign debris? Volume? Blood?)
IV. Lethargy? Anorexia? Depression?
V. Increased/decreased urination? (Normal urinary output for dogs is ≈0.5–1 ml/lb/hr body weight/hr [1.1–2.2 ml/kg/hr].)
VI. What is the dog's body weight? (Used for drug dosing and fluid administration.)
VII. Any abnormal behaviors noted?
VIII. Any abnormal bleeding noted?
IX. Did the dog ingest anything that might be toxic?

1.2. Handling

1.2.1. Safety is paramount. You must take into consideration your own safety, the safety of other people assisting, and the safety of the dog.

1.2.2. The three main risks of injury are being bitten, scratched, or hit in the face by the head of a thrashing dog. A normally gentle or well-trained dog may bite, paw, or thrash when injured due to pain and anxiety.

1.2.3. Muzzles (Figs. 1.1–1.2)
I. A muzzled dog should never be left unattended.
II. If a dog is in respiratory distress or heat stress, the ONLY type of muzzle that may be used is a wire-cage muzzle.

Figure 1.1. Leather muzzles for small- and medium-sized dogs.

Figure 1.2. Cloth muzzle on a large-breed dog.

III. Cloth muzzles are available; proper sizing is important. A "field" muzzle may be fashioned out of 2- to 4-inch roll gauze (Figs. 1.3–1.6) or with a quick-release knot (preferably two on big dogs).

Figure 1.3. Gauze being used to tie the muzzle of a dog. Notice one person is firmly holding the dog while a rescuer first wraps the gauze around the muzzle and then ties a half-hitch knot on top of the muzzle.

Figure 1.4. The gauze is next wrapped down and around the muzzle with a second half-hitch knot now tied underneath the muzzle.

Figure 1.5. The gauze is now secured behind the occipital protuberance of the skull and a bow-knot is tied in case the muzzle needs to be promptly removed should the dog begin to vomit.

Figure 1.6. Gauze muzzle is now securely in place.

IV. A cloth or "field" muzzle must be removed immediately if an animal vomits or develops signs of respiratory distress or heat stress.

1.2.4. Restraining methods

I. Restraint pole(s) may be used to gain control of a dog (Fig. 1.7).

Figure 1.7. Catch-pole applied around the neck of a dog. With this pole the dog can be controlled and kept away from the rescuer, thus preventing personal injury.

II. To control the head: Stand, facing the same direction as the dog and to the side and slightly behind the dog. Grasp the loose skin on either side of the neck (Fig. 1.8).

Figure 1.8.   Restraint of a dog is easily accomplished by grabbing the loose skin on either side of the neck and remaining behind the dog in order to prevent being bitten.

III.   To restrain a dog in lateral position: Position yourself on the dorsal (back) side of the dog. Place one arm over the neck of the dog and hold the forearm of the down leg. Place your other arm over the lumbar/abdominal region and hold the tibial region of the down leg (Fig. 1.9).

Figure 1.9.   In order to hold a dog in a recumbent position, the rescuer places him/herself over the back. The rescuer then grabs a downside forelimb and hind limb. The forearm and elbow are applied to the dog's neck to further control the dog's movement.

1.3.   Vital Signs (Table 1.1)

Table 1.1.   The Canine Physical Examination.

Physical Parameter	Technique	Expected Results
Temperature	Rectal	100°–102.5°F
Pulse rate	Femoral arterial pulse, inner thigh	60–160 bpm
Heart rate	Auscultate the heart over the left fourth intercostal space	60–160 bpm, synchronous with the heart
Respiration lungs	Auscultate both right and left side. Observe breathing pattern.	Clear lung sounds. 15–30 breaths/minute. Panting is likely normal. No respiratory effort or distress.
Hydration	Feel mucous membranes (gums); pinch skin over the thorax.	Moist mucous membranes; skin snaps back.
Mucous membranes	Check color and capillary refill time (CRT)	Pink and CRT <2 seconds
Eyes	Clear cornea and anterior chamber, pupillary light response (PLR), conjunctiva, nictitating membrane, ophthalmoscopic retinal exam.	Clear, no discharge. PLR present in both eyes; nictitating membrane is flat and nonbulging; conjunctiva should be white with no evidence of excessive redness.
Ears	Visual exam, odor? Otoscopic examination.	No discharge or malodor. Tympanic membrane is intact.
Nose	Visual inspection. Place feather or microscopic slide under each nostril.	Minimal serous (clear) discharge; symmetrical airflow from each nostril.
Oral cavity	Lift lips; check teeth/gums. Open mouth; check tongue.	No blood or pain. Gag reflex is present. Licks nose after open mouth is closed.
Peripheral lymph nodes	Palpate parotid, submandibular, prescapular, axillary, and popliteal lymph nodes.	Small, nonpainful, or nonpalpable.
Abdomen	Observe. Palpate spleen (left), intestines, and urinary bladder.	Symmetrical, not distended, no retching, nonpainful.
Urogenital	Female: Vulva, mammary glands Male: Prepuce, penis, scrotum. Lubricated, gloved finger, prostate.	No swelling, discharge, pain, wounds, or blood.
Rectal/perineum	Observe area. Lubricated, gloved finger.	No swelling, wounds, pain, or blood.
Musculoskeletal	Observe gait and posture. Palpate any abnormalities.	No lameness, swelling, or stiffness.
Neurological	Mental state, cranial nerves, spinal pain, limb reflexes? Observation. Handler's comments.	Bright, alert, responsive to commands, visual, no spinal pain, normal cranial peripheral nerve reflexes.

1.3.1. Temperature (T)

I.   101.5°F (38.6°C) is "textbook" normal. A normal temperature may be within the range of 100°–102.5°F (37.7°–39.1°C).

II. A rectal thermometer is most accurate, but an ear thermometer may be accurate as well if proper technique is used.

1.3.2. Pulse/heart rate (P/HR)—At rest

I.   Large- and giant-breed dogs: 60–100 bpm

II.   Medium-breed dogs: 90–110 bpm

III. Small-breed dogs: 100–120 bpm

IV.   Relatively accessible arteries to assess pulse rate and strength:

   A. Femoral artery—Generally easiest to find (Figs. 1.10 and 1.11).

   B. Dorsal pedal artery—May be difficult to palpate. Can be helpful in assessing perfusion of the distal limb.

1.3.3. Respiratory rate (R or RR)—At rest

I.   15–30 bpm

II. A normal, but significantly increased, resting respiratory rate (i.e., panting) may occur from anxiety or as a means of temperature control.

1.3.4. Mucous membrane (MM) color

I.   Normal: pink

II.   Subjective assessment of perfusion, oxygenation, shock, and homeostasis.

III. Animals with partial or complete gray or black pigmentation of their gums can confound assessment of MM color. Mucosa of vulvar lips or prepuce can also be checked.

1.3.5. Capillary refill time (CRT)

I.   Normal: <2 seconds

II. Press gum with finger and blanche to white. Remove finger and observe time for pink color to return (Fig. 1.12).

1.3.6. Blood pressure (BP)

I.   Hypotension: <90 mm Hg systolic (i.e., mean <60 mm Hg)

II.   Hypertension: currently defined as >180 mm Hg systolic; >100 mm Hg diastolic.

III. Measuring BP out in the field is more problematic in animals than in people. The compact, easily used sphygmomanometer cuff unit for humans does not work on dogs. Patient cooperation can also be an issue. In the field hospital setting, the use of noninvasive BP monitors using Doppler or oscillometric technology is very practical for animals. Invasive (direct) BP measurement is best reserved for use in a critical care unit or surgical setting.

Figure 1.10. Dr. John Anderson demonstrating the location of the femoral artery on a dog. This is the best place to obtain a pulse rate and pressure in the dog.

1.4. Antiseptics and Flushing Agents

1.4.1. Saline solution: physiologic saline solution (PSS), 0.9% NaCl
   I. Best choice if a joint or medullary cavity of bone is exposed.

Figure 1.11. One can easily palpate the apex beat of the heart on the left side and at approximately intercostal space 6–7 at the costochondral junction. If an arrhythmia is noted, simultaneously palpate the heart beat and femoral pulse. The heart and pulse rate should be the same.
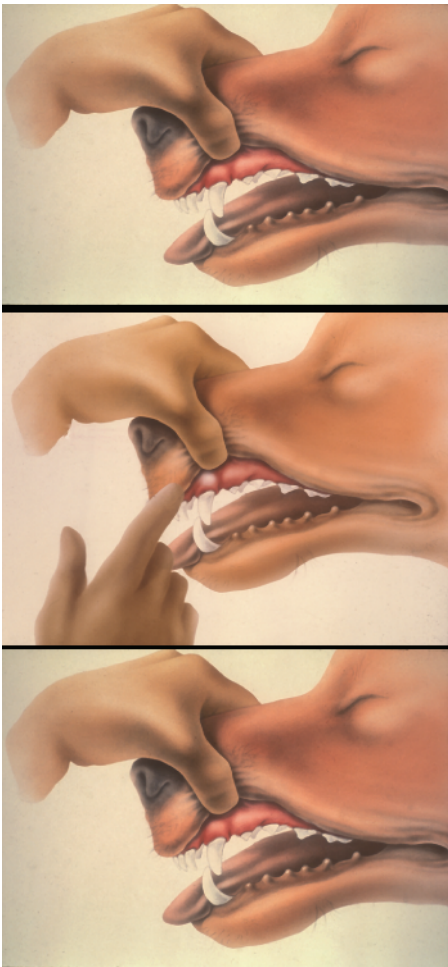

Figure 1.12. Capillary refill time in the dog is observed by gently lifting the lip; using an index finger, the gums are pressed to blanch out an area; and upon releasing the finger, begin counting the number of seconds it takes to reperfuse the area previously blanched by the index finger. A normal capillary refill time in a dog is less than 2 seconds.

1.4.2. Chlorhexidine solution 2%
   I. Must be diluted with water. (Dilute to pale-blue color.)

1.4.3. Povidone-iodine (Betadine) solution
   I. Must be diluted with water. (Dilute to iced tea color.)

1.4.4. Hydrogen peroxide (H_2O_2)
   I. Best choice for puncture wounds
   II. Should not be used repeatedly as an antiseptic as it is damaging to healthy tissue.

1.4.5. Do NOT use scrub agents (i.e., chlorhexidine scrub or Betadine scrub) on wounds as these are detergents.

1.5. Antimicrobial Ointments (e.g., Neosporin, Triple Antibiotic, Novalsan Ointment)

1.5.1. Antimicrobial ointments may be applied to wounds initially to decrease bacterial contamination or control infection, but once a wound is considered clean, ointments should no longer be used.

1.5.2. Antimicrobial ointments should not be used if the wound will be sutured or if a wound will require more definitive treatment imminently.

1.5.3. Antimicrobial ointments should not be used if a joint or medullary bone is exposed.

1.6. Bandaging Principles

1.6.1. In terms of first aid, the purpose of a bandage is to control hemorrhage, prevent further contamination of the wound, and provide comfort in stabilizing the wound until definitive medical treatment can be obtained.

1.6.2. First-aid bandage components
   I. Stirrups (1-inch white tape)
   II. Telfa (± sterile) no-stick pad
   III. Cast padding, Soft Kling, roll cotton
   IV. Roll gauze–conforming (2- to 4-inch)
   V. Vet Wrap (2- or 4-inch)
   VI. Elastikon (2- to 4-inch)

1.6.3. Wrap each layer of a bandage in the same direction (Figs. 1.13–1.17).

1.6.4. Bandages on limbs should not be placed so as to create a tourniquet effect.

1.6.5. Body-wrap bandages should not restrict the dog's ability to breathe, and the caregiver should recognize temperature and humidity considerations and the increased risk of heat stroke.

Figure 1.13. Application of a bandage on the distal forelimb begins with placement of two tape strips applied on the medial and lateral sides of the limb. A gauze pad is being applied over the wound.

Figure 1.14. Kling gauze is best for wrapping the limb.

Figure 1.15. Once the gauze is applied, an elasticized product like VetWrap is used to secure the gauze.

Figure 1.16. It is important to leave the digits out of the bandage. This not only provides the dog better traction but also allows examination of the toes to note if the bandage might be too tight. If the two middle digits are spread apart under a bandage, it is very likely the bandage is too tight and should be loosened immediately.

Figure 1.17. Adhesive tape is wrapped around the VetWrap in order to further secure the bandage.

1.6.6. Unless a bandage is being applied specifically for a wound to digit 3 or 4, these digit nails should be visible when bandaging a limb. This allows assessment of swelling and perfusion of the bandaged limb (Figs. 1.18–1.20).

Figure 1.18. Notice how the middle digits are outside the bandage and are in apposition to each other. This is how the toes should look if the bandage is not too tight.

Figure 1.19. Should the bandage be applied too tightly, the middle two digits will separate and should be promptly removed and then reapplied.

Figure 1.20. If the pads are injured, it is sometimes necessary to cover the entire extremity with a bandage.

1.6.7.   When applying a bandage to a limb, the use of stirrups will help keep the bandage in place (Figs. 1.21).

Figure 1.21.   The final step in applying a bandage is to take the tape stirrups and extend them up over the bandage. This will help secure the bandage and prevent the dog from easily removing it.

1.6.8.   The carpal pad/accessory carpal bone is a potential pressure point. First-aid bandages do not have to be too concerned with this point, but "definitive" bandages should be modified with "donut hole" padding to protect against pressure necrosis (Fig. 1.22).
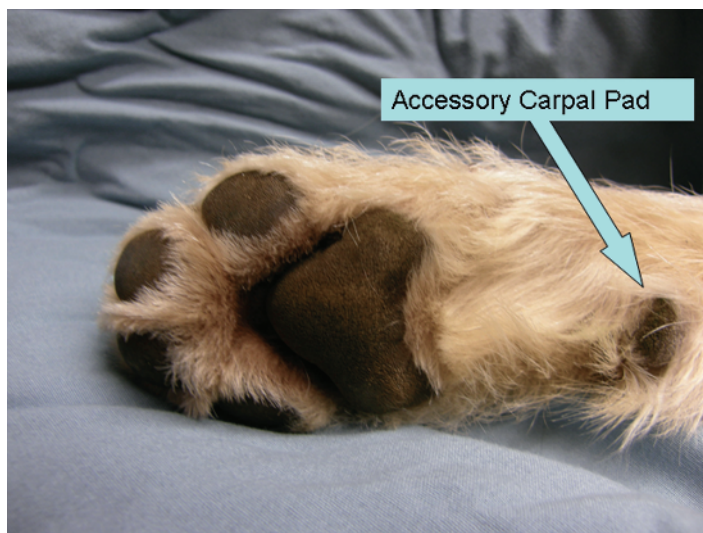

Figure 1.22.   When applying a bandage to the distal forelimb, be aware of the location of the accessory carpal pad (*blue arrow*). It is located on the caudal aspect of the lower limb.

1.6.9. Except for initial hemorrhage control, puncture wounds should not be bandaged.

1.6.10. Wet bandages should be changed as soon as possible.

1.7. Emergency Conditions Affecting Working Dogs

1.7.1. Shock

I.   *Shock* is defined as abnormal tissue perfusion leading to abnormal cellular metabolism. There are many causes of shock which have led to the following etiological classification:

  A.   Hypovolemic shock (dehydration)
  B.   Cardiogenic shock (heart diseases and arrhythmias)
  C.   Traumatic shock (hit by a car, kicked by a horse)
  D.   Septic shock (parvovirus enteritis, pyometritis, gastric dilatation–volvulus)

II.   The classic signs of an animal in shock include the presence of a weak pulse; pale MM (gums); increased heart, pulse, and RR; and cold extremities (feet and ears) (Fig. 1.23).
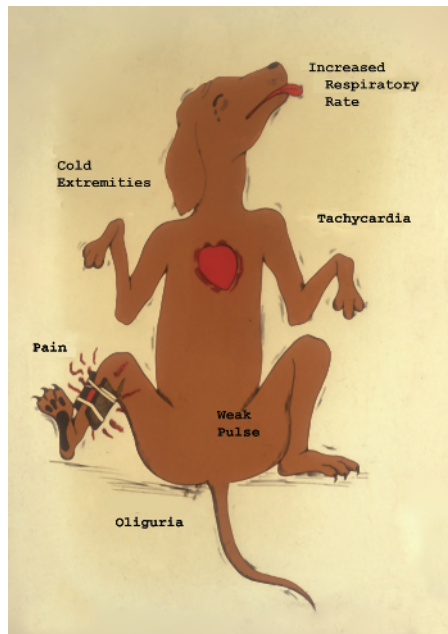

Figure 1.23. Common clinical findings in a dog suffering from shock include weak pulse, pain, tachycardia, cold extremities, oliguria, and an increase in respiratory rate.

A. Tachycardia—heart rate >160 bpm

B. Hypotension—pallor, CRT >3 seconds, weak pulses

C. Tachypnea—>30 bpm

D. Hypothermia—temperature <98°F

E. Weakness, restlessness, depression, mental confusion

F. Reduced urinary output—<0.5–1 ml/lb/hr

G. Coma, dilation of pupils

III. First aid management of shock involves the following actions:

A. Be careful!! The pet is often in pain, possibly excited, and may bite or claw you.

B. Check the airway and be sure the animal is breathing.

C. Apply a pressure bandage to any obvious hemorrhage

D. Keep the animal warm and try to calm the animal.

E. If there is evidence of a central neurological injury, immobilize the pet on a solid surface such as a piece of plywood. Be very careful when moving the animal!

F. If a fracture involves a lower part of the extremity, apply a temporary splint.

IV. Transport the animal to a veterinarian's hospital as soon and quickly as possible.

A. Treatment will begin with the use of crystalloid fluids (Normosol-R, Ringer's lactate, 0.9% sodium chloride).

    1. The initial dosage one should be prepared to administer intravenously (IV) is calculated using the following formula: ml = BW (lb) × 40 ml/hr (≈90 ml/kg/hr).

B. Corticosteroids continue to be controversial but are often administered IV after at least 25% of the crystalloids have been given.

    1. Dexamethasone sodium phosphate: 1–4 mg/kg IV one time.

C. Sodium bicarbonate is rarely required in the treatment of shock in the dog unless the cause of the shock is associated with ingestion of agents such as ethylene glycol (antifreeze), raisins, or wood alcohol.

D. Depending on the amount of blood lost, it is sometimes useful to administer either whole blood or blood substitute products.

    1. The amount of blood to be administered is usually based upon the following formula: for each 1% rise in packed cell volume (hematocrit) you want to achieve, it will require 1 ml/lb body weight of whole blood.

        a. Sample calculation: If the 75-pound dog's packed cell volume is currently 15% and you want to raise that value to 30%, it will require 1 ml/1 lb to raise the PCV by 1%. To raise the PCV 15%, it will require 15 ml/lb. The dog weighs 75 pounds, and therefore it will require a transfusion of 1125 ml of whole blood.

1.7.2. Neurological Injuries

I. Neurological injuries to a working dog most commonly affect either the spinal cord or the brain.

II. Clues to the presence of such injuries are often seen by observing the appearance of the dog.

A. The three motor postures of most significant concern are as follows (Fig. 1.24):

   1. Shiff-Sherrington posture: Severe spinal cord injury located between the second thoracic and third lumbar vertebra.

      a. Extensor rigidity in the front limbs and flaccid paralysis of the rear limbs (Fig. 1.24A).
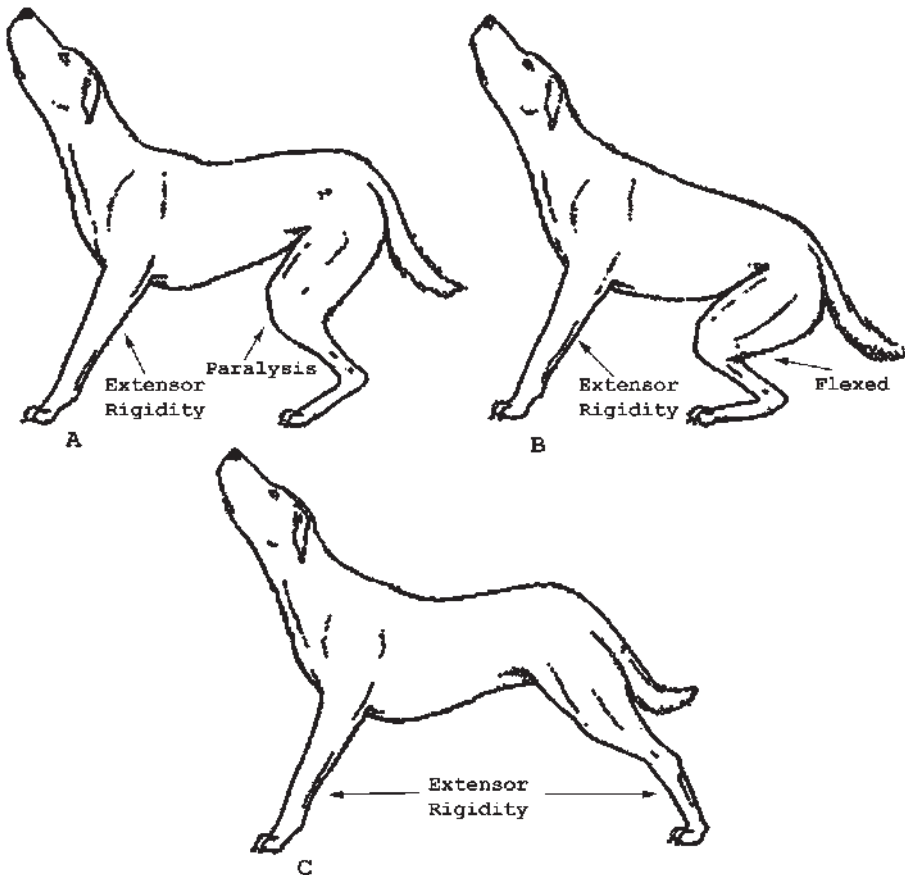

Figure 1.24. Neurological postures seen in the injured dog. **A,** Schiff-Sherrington motor posture suggesting a severe spinal cord injury located between T2 and L5 vertebrae. The dog will show upper motor neuron signs, with extensor rigidity of the forelimbs and flaccid paralysis of the rear limbs, and usually there is no sensation of pain when squeezing the toes of the rear limb. Generally, this has a grave prognosis. **B,** Decerebellate motor posture with the front limbs extended, the head thrown back (opisthotonus), and the rear limbs flexed. This usually suggests an injury to the cerebellum and carries a fair prognosis for recovery. **C,** Decerebrate motor posture with extensor rigidity in the forelimb and hind limb and opisthotonus. This posture generally carries a grave prognosis.

    2. Decerebrate rigidity: Head injury but usually has a favorable
outcome.
        a. Extensor rigidity in the front limbs and rear limbs are flexed (Fig.
1.24B).
    3. Decerebellate rigidity: Severe brain injury with a very grave prognosis.
        a. Extensor rigidity in the front and rear limbs (Fig. 1.24C).
  III. First aid care would involve the following:
    A. Carefully transport the dog to a veterinary hospital as quickly as possible.
    B. With a spinal cord injury, place the animal on a back board, sheet
of plywood, or other mobile solid surface (i.e., door). Tape the animal to the
surface so it is unable to move and transport to the nearest veterinary
hospital.

1.7.3.   Hypoglycemia

  I. Hypoglycemia may result when the blood glucose is abnormally low.
    A. Normal blood glucose for a dog = 70–140 mg/dl.
    B. Hypoglycemia results when the blood glucose is <60 mg/dl.
  II. Clinical signs of hypoglycemia
    A. Weakness, incoordination, confusion, collapse
    B. Muscle tremors
    C. Seizures
    D. Hyperthermia or hypothermia
  III. Treatment
    A. 50% dextrose given at a dosage of 0.5–1.0 ml/lb slowly IV. If possible,
dilute the 50% solution to at least a 10% solution to avoid phlebitis following
administration of a hypertonic solution (50% dextrose).
    B. Intravenous fluids: 5% dextrose in water or Normosol-R + 5% dextrose or
Ringer's lactate + 5% dextrose.
      1. Calculate the volume required by using the following formula:
ml = $(BW_{kg} \times 30) + 70$.
        a. Sample calculation: How much fluid should a 75-pound (34-kg) dog
receive? ml = $(34 \times 30) + 70$ or ≈1093 ml over 24 hours.
    C. Diazepam may be needed to control seizures.
      1. Intravenous dosage: 1 mg/kg to effect.
      2. Per rectum dosage: 1–2 mg/kg to effect and a maximum dosage of 40 mg.
  IV. Control body temperature with cooling or warming as needed.
  IV. Beware of cerebral edema with seizures.
    A. Dexamethasone sodium phosphate: 1–4 mg/lb IV.
    B. Mannitol: 0.25 g/kg IV.

1.7.4.   Gastric dilatation-volvulus (canine bloat)

  I. Gastric dilatation-volvulus (GDV) is a peracute condition predominantly
affecting large-breed, deep-chested dogs. It results from an abnormal, acute
accumulation of air in the dog's stomach. The source of this air is believed to be
from abnormal swallowing of air (aerophagia) (Fig. 1.25).
    A. Diet has been implicated in the etiology of canine bloat but thus far there is
no evidence to support this theory.
    B. Most clinically affected GDV dogs have gas-filled stomachs, and analysis of
the gas has shown it to be consistent with room air.
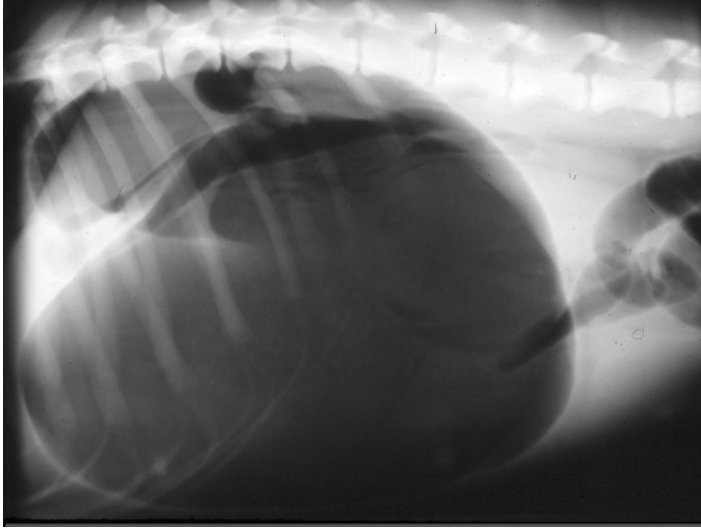   **C.** GDV appears most commonly in the nervous and hyperactive dogs.

Figure 1.25. Lateral radiograph of a dog with acute gastric dilatation-volvulus. The air-filled stomach now fills most of the abdominal cavity. Notice the twisting of the stomach whereby the pylorus is now dorsal to its normal ventral position within the abdomen. The rotated stomach impinges on both the caudal vena cava and portal vein, leading to severe shock.

II.   Clinical signs of GDV in the working dog.
    A.   The classic picture of a GDV dog is described with the following three characteristics:
        1.   Retching with the inability to vomit ("dry-heaves").
        2.   Abdominal distention with tympany.
          a.   Using one's index finger and thumping on the right side near the last rib will result in a very tympanic (drum-like) sound.
        3.   The inability to pass an orogastric tube.
          a.   Passing an orogastric tube relieves the gaseous accumulations, but failure to pass a stomach tube does not rule out the presence of gastric volvulus (twisting of the esophagus and stomach).
    B.   The GDV dog will exhibit abdominal discomfort, will often pace about, and will whine due to pain.
    C.   There are usually clinical signs of shock with the HR and P being elevated and pulse pressure being decreased.
    D.   The CRT is quite variable. If the dog is in the hyperdynamic phase of shock, the CRT will be accelerated or normal. If the shock is hypodynamic, the CRT will be prolonged or normal.
    E.   When viewed over the dog's back looking forward, the abdomen tends to protrude unevenly to the right.
III.   Treatment of GDV
    A.   Emergency treatment involves the following:
        1.   Gastric decompression
          a.   Most commonly involves the passage of a large bore (colt-sized) orogastric tube.

- Measure the length of the tube by measuring from the tip of the dog's nose to the last rib. Make a mark on the tube to alert you when the stomach has been reached.
  - Use a roll of 2-inch tape inserted behind the canine teeth to pass the tube and prevent the dog from biting down.
- As the tube is passed, never push the tube too vigorously as this might result in a ruptured esophagus.
- If obstruction is encountered, stop and either let a more experienced person pass the tube or, as an alternative, you may need to trocarize the stomach through the abdominal wall.
  - Using a 10- to 14-gauge, 1.5-inch, sterile hypodermic needle, first percuss the abdomen on the right side. You are seeking an area that is quite resonant. If you do not have a resonant sound, it may be due to the fact the spleen has also rotated with the stomach. Do NOT trocarize through the spleen!
  - Once you have found that resonant area (usually located on the right and at the lower half of the abdomen), quickly insert the needle all the way to the hub. Foul-smelling gas will escape the needle. Leave the needle in place, and as the stomach decompresses, gently press upon the cranial abdomen to release even more gas.
  - Once you have trocarized the stomach, it is usually possible to now pass the orogastric tube.

B. Shock therapy is begun by inserting a large-bore (16- to 18-gauge) catheter in either the cephalic or lateral saphenous vein.
  1. Begin crystalloid administration at a rate of 40 ml/lb/hr (≈90 ml/kg/hr).
C. Transport the dog quickly to a veterinary hospital.
D. Do not think the stomach has rotated back to its normal position even though you were able to pass the stomach tube.
E. Definitive treatment for GDV requires a veterinary surgeon.
  1. Treatment of shock
  2. Surgical replacement of the stomach to its normal position.
  3. Surgical prevention of future rotation of the stomach.

1.7.5. Heat stroke/hyperthermia

I. This refers to an extremely high core body temperature >105°F/40.6°C that occurs when excess heat, generated by body metabolism, exercise, and/or environmental conditions, exceeds the body's ability to dissipate that heat.

II. Heat loss can occur by convection (air currents), conduction, radiation, or evaporation.

III. Dogs do not sweat (except through their pads) so this method of evaporative cooling is not available to them. Dogs pant and drool to cool themselves by evaporation, and vessels on the skin and periphery dilate to cool by radiation and convection.

IV. Core temperatures >106°F are harmful to cellular metabolism. At core temperatures above 109°F, things fall apart biochemically: oxidative phosphorylation is uncoupled, cell membrane function is impaired, and critical enzymes are denatured. Organ failure may occur (because of this cell death) even after the core temperature has returned to normal.

    A.   Early signs of hyperthermia
       1.   Rapid panting
       2.   Rapid HR
       3.   Bounding P
       4.   Bright-red and dry MM (gums)
       5.   CRT <0.5 second
    B.   Later signs
       1.   Profound depression
       2.   Unable to stand
       3.   Weak pulse
       4.   Pale/ashen MM
       5.   Vomiting/diarrhea
    C.   Terminal signs
       1.   Shallow respirations
       2.   Seizures
       3.   Coma
       4.   Death
V.   First aid treatment for hyperthermia
    A.   Transport to or create a cooler environment (e.g., shade, air-conditioned car, etc.)
    B.   Ideally, soak hair coat with COOL water (55°–65°F), or place in COOL water (55°–65°F) bath.
       1.   Do NOT use ice baths or cold (35°–40°F) water baths as this promotes skin vessel constriction, which impairs heat loss and induces shivering, which increases heat production.
    C.   Any water (e.g., water bottle, etc.) cooler than ≈90°F can be used, with fanning, to aid in cooling.
    D.   Moving air over the dog will help with evaporative and convection cooling (e.g., fanning).
    E.   Cool packs applied to large vessel areas (inguinal, axillary, and jugular) will cool blood returning to the body core. Towels soaked in cool/cold water and changed frequently can be used.
    F.   An extreme measure is to use a syringe to give a cool (65°–75°F) water enema (20–40 ml). This must be done with care, so as not to damage the rectum.
    G.   When body temperature drops to 103°F, stop active cooling. Continue to monitor core body temperature as it may continue to decline and warming procedures may be indicated.
    H.   The goal is to reduce the core body temperature to approximately 102°F in 30–60 minutes.
    I.   Transport to definitive medical care ASAP.

1.7.6.   Hypothermia and frostbite

 I.   Degrees of hypothermia
    A.   Mild is 86°–90°F and can be withstood for 24–36 hours
    B.   Moderate is 72°–77°F, and animal may survive for 4–24 hours
    C.   Severe is <60°F with a maximum survival of 5–6 hours.
    D.   Frostbite when body temperature is <93°F.

II.   Clinical signs
   A.   Diminished consciousness
   B.   Low BP (weak/absent pulses)
   C.   Bradycardia
   D.   Shallow, infrequent respirations
   E.   Dilated pupils
   F.   Delayed, diminished reflexes
   G.   Shivering
   H.   Increased muscle tone without shivering (T < 90°F)
   I.   Cyanotic/pale body part
   J.   Anesthesia (no pain sensation) of frozen body part

III. Treatment
   A.   Airway, oxygen
   B.   Warm IV solutions to 104°–109°F.
      1.   Use extreme caution in delivering IV fluids while the animal is hypothermic.
      2.   Most commonly, the volume to be administered starts at a rate of 10 ml/lb/hr.
   C.   Active/passive rewarming
      1.   Mild hypothermia: Remove from cold, wrap with blankets, warm water bottles.
      2.   Moderate: Warm water bottles, heating pads, ± warm water immersion (careful not to burn skin).
      3.   Severe: Use active rewarming techniques.
         a.   Continuous warm IV fluids.
         b.   Warm peritoneal dialysis.
         c.   Warm water enema.
         d.   Warm water gastric lavage.
      4.   Frostbitten areas: Remove from the cold, provide rapid rewarming with immersion in warm water (102°–104°F), apply warm compresses, prevent refreezing, do not rub affected digits.
   D.   Supportive care
      1.   Analgesics (morphine, oxymorphone, butorphanol [Torbugesic], buprenorphine [Buprenex])
      2.   Antibiotics—penicillin, cephalexin
      3.   Local injury wound care
   E.   Patient monitoring
      1.   Body temperature (avoid hyperthermia).
      2.   Urine output (maintain >1 ml/lb/hr).
      3.   Blood chemistry values may be useful.
      4.   Pneumonia is a common complication.

1.8.   Common Injuries

1.8.1.   Lacerations

I.   First aid principles
   A.   Quickly assess the wound for depth, severity, and structures (i.e., tendons, joints, nerves, vessels) involved.
   B.   Control hemorrhage with direct pressure or pressure bandage. (If unable to achieve some degree of hemostasis, continue direct pressure or apply

pressure bandage, if possible, and seek definitive medical treatment as soon as possible.)

C.   Clean and flush the wound with PSS, dilute chlorhexidine solution, dilute Betadine solution, or hydrogen peroxide.

D.   Blot dry

E.   Apply an antimicrobial ointment if definitive assessment and treatment will be delayed.

F.   Apply a bandage.

G.   Obtain definitive medical assessment and treatment.

H.   Antibiotics and/or anti-inflammatory drugs may be indicated.

II.   Lacerations may involve major arteries, veins, nerves, tendons, etc. If these structures are involved, the primary concern will be to control hemorrhage (via direct pressure or pressure bandage) and seek definitive medical treatment as soon as possible.

1.8.2.   Pad lacerations

I.   Normal appearance of dog pads (Fig. 1.26).

Figure 1.26.   Normal pads in the dog's foot.

II.   Most pad lacerations are best managed by bandaging and second-intention healing (granulation).

III.   If a digit or metacarpal/metatarsal pad laceration requires sutures, a splint will also have to be applied. However, these lacerations should be bandaged until definitive suturing can be done.

IV.   First aid for pad lacerations

A.   Remove gross contamination (glass, metal, gravel)

B.   Flush with PSS, dilute chlorhexidine solution, dilute betadine solution, or hydrogen peroxide.

C.   Blot dry.

D.   Apply antimicrobial ointment.

E.   Apply bandage covering the entire foot: stirrups, Telfa, Soft Kling or cast padding, gauze, Vet Wrap, Elastikon (Fig. 1.27).

Figure 1.27. Bandaging a foot pad injury requires that the entire foot be covered by the bandage.

F.   Bandages should be changed daily initially, and then may be changed every 2–4 days.

1.8.3. Limb lacerations
I.   First aid for limb lacerations:
A.   Many of these lacerations are best managed definitively by suturing, so field first aid is primarily to control hemorrhage, decrease contamination, and approximate tissue edges.
B.   Flush with PSS, dilute chlorhexidine solution, dilute Betadine solution, or hydrogen peroxide. If a joint is exposed, PSS should be used.
C.   Blot dry.
D.   If a wound is heavily contaminated, and definitive treatment will be delayed, apply an antimicrobial ointment. Do NOT apply if joint is exposed.
E.   Generally, lacerations distal to the elbow and stifle (knee) are amenable to bandaging.
F.   Apply bandage: stirrups, Telfa, Soft Kling or cast padding, gauze, Vet Wrap, Elastikon top and foot.
G.   Apply bandage from toes (leaving nails of digits 3 and 4 visible) to ≈2 inches above the laceration (Fig. 1.28).

1.8.4. Head and face lacerations
I.   First aid for head and face lacerations:
A.   Many of these lacerations are best managed definitively by suturing, so field first aid is primarily to control hemorrhage and decrease contamination.
B.   Hemorrhage is often best controlled with direct pressure using 4×4 gauze sponges, pads, towels, etc. and hand pressure, as applying an effective pressure bandage in this region can be difficult.
C.   Flush with PSS, dilute chlorhexidine solution, dilute betadine solution, or hydrogen peroxide. Use caution with solutions around eyes.

Figure 1.28. If possible, keep the toes free to provide the dog better traction and to provide you the opportunity to observe the toes to detect swelling when an excessively tight bandage is applied.

> **D.** If a wound is heavily contaminated and definitive treatment will be delayed, apply an antimicrobial ointment.
> **E.** Bandage if possible.
> **F.** If the ears are not wounded, they should be free of the bandages (Figs. 1.29–1.32).

Figure 1.29. Wounds on the dog's head are covered with a gauze/Telfa bandage.

Figure 1.30. Kling™ gauze is wrapped around the head to hold the gauze/telfa pad in place.

Figure 1.31. Wrapping the head in a crisscross fashion will allow the ear flaps to be free. Following the application of the Kling bandage, VetWrap is used to hold it in place.

Figure 1.32. Final appearance of a head wound bandage.

1.8.5. Neck and trunk lacerations
   I. First aid for neck and trunk lacerations:
      A. Many of these lacerations are best managed definitively by suturing, so field first aid is primarily to control hemorrhage and decrease contamination.
      B. Flush with PSS, dilute chlorhexidine solution, dilute betadine solution, or hydrogen peroxide.
      C. If a wound is heavily contaminated, and definitive treatment will be delayed, apply an antimicrobial ointment.
      D. Bandages must be applied with attention to airway, swallowing, venous return, breathing, and heat stress.

1.8.6. Puncture wounds
   I. There are two primary considerations in the assessment of puncture wounds. The first addresses immediate, life-threatening hemodynamic issues (bleeding, cardiac tamponade, tension pneumothorax). The second, and more common, relates to potential morbidity associated with bacterial infection, both anaerobic and aerobic.
   II. If one suspects a puncture wound has penetrated into the chest cavity, abdominal cavity, or pelvic canal, definitive medical care should be obtained immediately.
   III. If the wound can be addressed in the field, clip the hair from the site of the wound, if possible. This will facilitate future wound site identification for definitive treatment.
   IV. Gently probe a puncture wound with a sterile blunt instrument or moistened sterile cotton swab to assess depth, direction of track, and presence of foreign body.
   V. Use a syringe (NO needle) or apply antiseptic solution to a sterile cotton swab to flush and cleanse wound.

VI.   Hydrogen peroxide is the best initial flushing/cleansing agent for puncture wounds. Subsequent flushing should be done with dilute chlorhexidine solution or dilute Betadine solution.

VII.   The goal of treatment is to promote drainage, decrease the risk of developing an anaerobic environment, and encourage second-intention healing from the deep tissues outward. To this end:

   A.   Antimicrobial ointments should NOT be applied to puncture wounds.

   B.   Puncture wounds should NOT be bandaged.

   C.   Puncture wounds should NOT be sutured.

   D.   Surface crusts should be removed and the track flushed.

VIII.   Obtain definitive medical care as antibiotics and anti-inflammatory agents are indicated.

1.8.7.   Torn nails

I.   Torn nails are very painful and will continue to be painful until the torn horn is removed.

II.   First aid for a torn nail:

   A.   Flush with or soak in antiseptic solution. Dilute chlorhexidine solution or dilute Betadine solution is best.

   B.   Reduce torn horn to normal anatomic position if possible.

   C.   Bandage paw.

   D.   Obtain definitive medical treatment for debridement of nail.

   E.   Antibiotics and anti-inflammatory agents may be indicated.

1.8.8.   Broken toes

I.   Broken toes are extremely painful. Definitive treatment options include coaptation, internal fixation, or amputation.

II.   First aid for a broken toe is primarily to prevent unnecessary motion in the area and obtain definitive treatment as soon as possible. In terms of first aid, generally speaking, this means doing nothing.

   A.   Applying a splint or bandage to the paw area will often cause more pain and discomfort for the dog.

   B.   Dogs are able to ambulate on three legs and this effectively protects the affected paw.

   C.   If it is not possible for the dog to ambulate on three legs (e.g., through building rubble, across water, other injuries present), it is best to carry the dog.

1.8.9.   Eye injuries

I.   All eye injuries should have definitive medical evaluation and treatment as soon as possible. (Irritation or foreign body removal that resolves 100% with PSS flushing may be the exception to this rule.)

II.   When examining eyes, avoid facing the dog into direct sunlight.

III.   There are various eye ointments available.

   A.   Ointments should NOT be used until a dog is through working.

   B.   Ointments containing steroids should NOT be used until a definitive ophthalmic evaluation has been done.

1.8.10. Eye Irritation and conjunctivitis

I. The most common eye problem is irritation and conjunctivitis.

II. Eye irritation can be minimized by periodic flushing across the eye and under the eyelids with PSS.

1.8.11. Ocular foreign bodies

I. Foreign bodies trapped under the eyelids are treated by flushing with PSS in combination with judicious use of a moistened cotton swab/gauze sponge.

II. Dogs have a third eyelid (the nictitating membrane) that comes "up" from the ventral medial canthus to cover the eye and offer another layer of protection. Topical anesthetic is required to examine under and clear foreign bodies from behind the nictitating membrane.

Suggested Reading

Wingfield, W. E. *Veterinary Emergency Medicine Secrets*. Philadelphia, Hanley and Belfus, 2001.

Wingfield, W. E., M. R. Raffe. *The Veterinary ICU Book*. Jackson Hole, WY, Teton New Media, 2002.