CLINICAL PRACTICE GUIDELINES FOR MILITARY WORKING DOGS

Military Working Dogs (MWDs) are critical assets for military police, special operations units, and others operating in today's combat environment. Expectations are that injured working dogs will receive the highest level of resuscitative care as far forward as possible, often in the absence of military veterinary personnel.

These guidelines are not a substitute for clinical judgments. (CPG ID: 16)

Photo credit: US Military Working Dog Teams National Monument, Lackland AFB, TX

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CHAPTER 1

Scope of Healthcare Provider Responsibilities

These clinical practice guidelines (CPGs) apply to deployed human healthcare providers (HCPs) in combat or austere areas of operations. Veterinary care is established at multiple locations throughout theater, and the veterinary health care team is the MWD's primary provider. However, HCPs are often the only medical personnel available to MWDs that are critically ill or injured. The reality is that HCPs will routinely manage working dogs in emergencies before they are ever seen by veterinary personnel.

Care by HCPs is limited to circumstances in which the dog is too unstable to transport to supporting veterinary facilities or medical evacuation is not possible due to weather or mission constraints; immediate care is necessary to preserve life, limb, or eyesight; and veterinary personnel are not available. HCPs should only perform medical or surgical procedures – within the scope of their training or experience – necessary to manage problems that immediately threaten life, limb, or eyesight, and to prepare the dog for evacuation to definitive veterinary care. Routine medical, dental, or surgical care is not to be provided by HCPs.

Emergent surgical management of injured MWDs may be necessary by HCPs to afford a chance at patient survival. This should be considered only if:

- The provider has the necessary advanced surgical training and experience.
- The provider feels there is a reasonable likelihood of success.
- The provider has the necessary support staff, facilities, and monitoring and intensive care facilities to manage the post-operative MWD without compromising human patient care.
- Emergent surgical management should be considered only in Role 2 or higher medical facilities and by trained surgical specialists with adequate staff. Direct communication with a US military veterinarian is essential before considering surgical management, and during and after surgery, to optimize outcome.

Considerations

Working dogs operated by allied military forces and DoD contractors may be presented for medical care by HCPs. Established agreements permit HCPs to provide necessary emergency care, just as if these dogs were MWDs.

The overarching goal when managing injured dogs is return to normal function and duty (RTD). Within reason, however, consider the adoption potential for dogs. Adoption of MWDs no longer fit for duty is authorized. Many MWDs with career-ending injuries have been successfully managed and ultimately adopted, some suffering these injuries while deployed. Consider emergency care, even if RTD is not likely but adoption is possible. HCPs should be reasonable, however, when considering the extent to which resources are allocated; dogs with multiple limb amputations or severe brain injury, for example, are not adoptable.

Information concerning MWDs (e.g., unit of assignment, operating location, illness or injury data, functional status) should be considered confidential and treated as such.

General Handling and Management of MWDs

MWDs are unpredictable and potentially dangerous animals, especially when ill, injured, or stressed, and especially when not under the control of a trained handler.

The dog handler is the best person to control the MWD; they have the most accurate information about past medical problems and the current situation, and they have first aid training and can assist in care. The MWD unit is responsible for providing a handler at all times.

Safety of HCPs and bystanders is paramount:

- Never examine a MWD without a handler present. Remove MWDs from areas where handlers are being treated; instances have occurred when MWDs aggressed on HCPs that the dog felt were threatening the handler.
- MWDs should be muzzled whenever being handled, unless medical issues prevent muzzling. Standard muzzles issued to handlers are ideal; however, roll gauze can be used for temporary control, looped tightly around the muzzle twice, and tied behind the head. Remove the muzzle when not actively handling the dog, if the dog is sedated or anesthetized, if the dog is having breathing difficulty, or if temperature extremes prevent cooling by panting.
- MWDs must be controlled and supervised at all times, especially if sedated or anesthetized. A handler must be immediately available 24 hours a day when MWDs are in a facility.
- MWDs must never be transported without a handler. If available, portable kennels are the best means of transport for stable MWDs. If a portable kennel is not available, MWDs transported in aircraft should be muzzled if their medical condition permits.

Evaluation and Treatment Tips

Note: Chapters 2-22 guide HCPs in management of specific scenarios involving life- or limb-threatening problems with MWDs.

Some supplies and equipment are unique to managing dogs, or differ from that used on people. Experience shows it is ideal to centrally locate these items in the area where injured dogs will be managed. Coordinate with supporting veterinary personnel for these items. Examples are dog hair clippers, dog muzzles, canine oxygen face masks, neonatal and pediatric blood pressure cuffs, and size 10mm and 11mm endotracheal and tracheostomy tubes. Durable medical equipment should be routinely disinfected for re-use, as is done after use on human patients.

MWDs with a catheter or bandage of any kind, or with wounds of any kind should be prevented from self-trauma and removal of devices. The simplest options for preventing self-trauma and device removal are either a loose-fitting muzzle (short-term use only) or application of a modified plastic bucket with the bottom cut off, secured around the neck using a collar (See Figures 21 and Figure 22).

Liberally clip hair at catheter sites, and around all wounds and over traumatized areas to reveal areas of "hidden" injury that might otherwise be missed.

Performance Improvement (PI) Monitoring

Intent (Expected Outcomes)

- HCPs manage MWDs safely in emergent situations to provide life-saving measures to resuscitate and stabilize injured dogs until evacuation is coordinated to a veterinary facility.
- HCPs do not perform medical or surgical procedures for non-emergent reasons or if veterinary personnel are available.
- HCPs promptly coordinate veterinary support and provide timely feedback in instances in which care is provided to MWDs.

Veterinary personnel will remain integrally involved in the decision chain for all MWD care issues. Current locations and contact information for theater veterinarians are found on the Veterinary Common Operating Picture or by contacting the TF MED/MED BDE TOC.

Performance/Adherence Measures

- Compliance review by supporting veterinary personnel of key data sources.
- Face-to-face discussions between supporting veterinary personnel and HCPs providing care.

Data Source

- Patient record generated by HCPs during care (Canine Resuscitation Record; See Chapter 22).
- Canine Tactical Combat Casualty Care card (See Chapter 22).

System Reporting and Frequency

The above constitutes the minimum criteria for PI monitoring of this CPG. System reporting will be performed biannually; additional PI monitoring and system reporting may be performed as needed.

The system review and data analysis will be performed by the JTS Director, JTS Program Manager, and the JTS PI Division.

Responsibilities

It is the trauma team leader's responsibility to ensure familiarity, appropriate compliance and PI monitoring at the local level with this CPG.

The Director, DoD Military Working Dog Veterinary Service is responsible to update the MWD CPG in coordination with the JTTS and JTS Directors and is the final veterinary approval authority.

HCPs will:

- Notify veterinary personnel immediately upon notification of an inbound MWD or on the arrival of a MWD in any medical facility, especially in emergent situations.
- Complete medical care documentation as detailed in Chapter 22 any time emergent care is provided.

Normal Clinical Parameters for MWDs

Table 1. Normal Vital Signs at Rest.

NORMAL VITALS AT REST	
Temperature (rectal)	101° to 103° F
Heart/Pulse rate	60 - 80 bpm
Respiratory rate	16 - 30 bpm *(note that controlled panting is common in MWDs)*
Blood pressure	Systolic 120 mmHg, Diastolic 80mmHg, Mean 90-100 mmHg

Table 2. Complete Blood Cell Count Parameters.

BLOOD CELL COUNT PARAMETERS	
WBC	6 - 17 X 10^3/µL
RBC	5.5 - 8.5 X 10^6/µL
Hgb	12 - 18 g/dL
Hct	35 - 45%
MCV	60 - 77 fl
MCH	19.5 - 24.5 pg
MCHC	32 - 36 g/dL
Platelet count	200 - 900 X 10^3/µL

Table 3. Blood Chemistry Parameters.

***NOTE**: Results from serum chemistry analyzers calibrated for human serum may be unreliable or misleading based on methodology for **albumin** and **total calcium** concentrations.*

BLOOD CHEMISTRY PARAMETERS				
Albumin	2.5 - 4.4 g/dL		GGT	0 - 7 U/L
ALP	20 - 150 U/L		Glucose	60 - 110 mg/dL
ALT	10 - 118 U/L		HCO_3	17 - 25 mmol/L
Amylase	200 - 1200 U/L		Lactate	1.5 - 2.0 mmol/L
AST	14 - 45 U/L		pCO_2	24 - 38 mmHg
Bicarbonate	12 - 27 mmol/L		pH	7.35 - 7.45
BUN/SUN	7 - 25 mg/dL		pO_2	85 - 100 mmHg
Calcium (total)	8.6 - 11.8 mg/dL		Potassium	3.7 - 5.8 mmol/L
Chloride	105 - 111 mmol/L		Sodium	138 - 160 mmol/L
Creatine kinase	20 - 200 U/L		Total bilirubin	0.1 - 0.6 mg/dL
Creatinine	0.3 - 1.5 mg/dL		Total protein	5.4 - 8.2 g/dL

Unique Clinical Anatomy and Venous Access

Dogs differ anatomically and physiologically in several key areas in comparison to people. Knowledge of these differences will assist HCPs when managing MWDs.

Most MWDs are German shepherd dogs, Belgian Malinois, and Labrador retrievers, with an weight of 50-80# (23-36 kg). Dose drugs based on actual body weight whenever possible.

Canine blood can be tested using analyzers designed for people, with generally reliable results. Interpretation of results may be unreliable or misleading for albumin and total calcium, however, due to species-specific methodology differences. For all other parameters, if the results appear reasonable, trust them for decision-making.

Venous blood sampling and IV catheterization sites:

Use the cephalic or lateral saphenous veins for routine blood sampling, drug administration, and routine intravenous fluid therapy. Use the external jugular vein for long-term fluid therapy, large volume fluid delivery, and repeated blood sampling.

- Cephalic vein on the cranial (superior) aspect of the forearm (See Figures 1, 2, and 3).
- Lateral saphenous vein on the lateral aspect of the hind limb at the distal tibial area (See Figure 4).
- External jugular vein in the jugular furrow of the neck (See Figures 5-16). Standard human central venous catheter kits can be used; the Seldinger technique is most reliable.

Figure 1. Cephalic Vein Location on Superior Aspect of Forearm.

Figure 1 shows cephalic vein location on the cranial (superior) aspect of the forearm.

The vein is best punctured toward the elbow, as the accessory cephalic vein and cephalic vein join in a Y-shaped configuration more distally (toward the carpus).

Figure 2. Occluding the Vein.

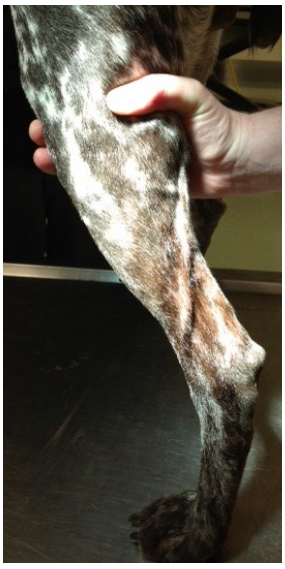
Figure 2 shows proper technique for an assistant to occlude the vein, while extending the elbow joint. The assistant's thumb occludes the vein while rolling the vein outward at the elbow.

Figure 3. IV Catheter in Cephalic Vein of Forelimb.

Figure 3 shows properly placed and secured IV catheter in the cephalic vein of the forelimb of a MWD.

Figure 4. Lateral Saphenous Vein Location.

Figure 4 shows location of the lateral saphenous vein on the hind limb of a MWD, located on the lateral aspect of the distal tibial area, coursing caudodorsally from the hock (ankle) and over the gastrocnemius tendon.



Figures 5 – 16: External Jugular Vein Location and Central Venous Catheterization.

Figure 5 shows the right external jugular vein (dotted lines) located in the right jugular furrow. The vein is best punctured distal to the junction of the more-proximal tributaries (the optimal insertion site is noted by the red oval). Hair should be clipped and a sterile preparation should be performed.

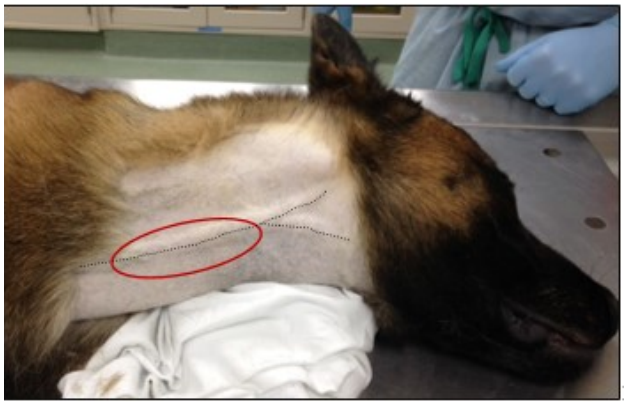


Figure 6 shows a small skin nick (noted in the red oval) created over the intended catheter insertion site to facilitate penetration of the thick skin of the dog. This nick can be made with the tip of a #11 scalpel blade or the bevel of an 18-gauge needle.

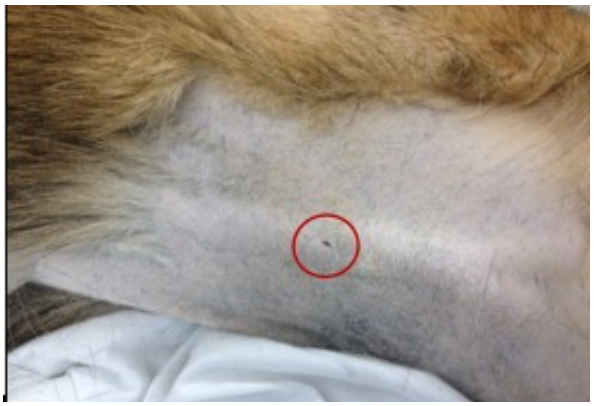
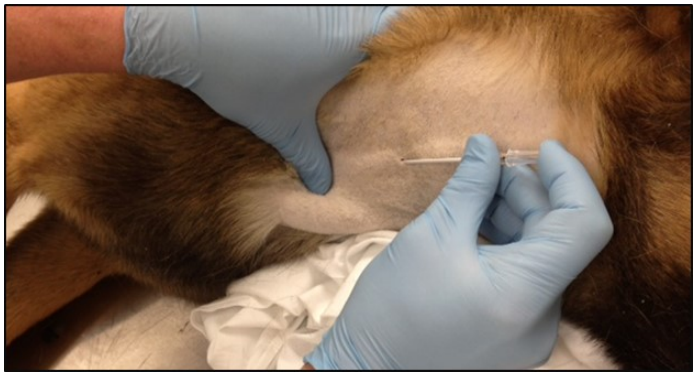


Figure 7 shows insertion of a large bore catheter-over-needle through the skin nick, penetrating the skin and entering the external jugular vein. Note the use of the thumb of the opposite hand to occlude the vein. ***In this figure, and in Figures 8-12, sterile draping is removed to provide better visualization; perform catheterization using sterile technique.***



Jugular Vein Location & Central Venous Catheterization

Figure 8 shows full insertion of the over-the-needle catheter into the external jugular vein, after removal of the needle.

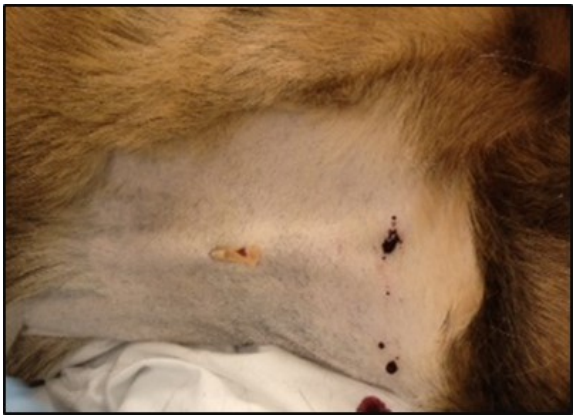


Figure 9 shows insertion of a Seldinger guide wire adapter into the hub of the catheter that has been placed into the external jugular vein.

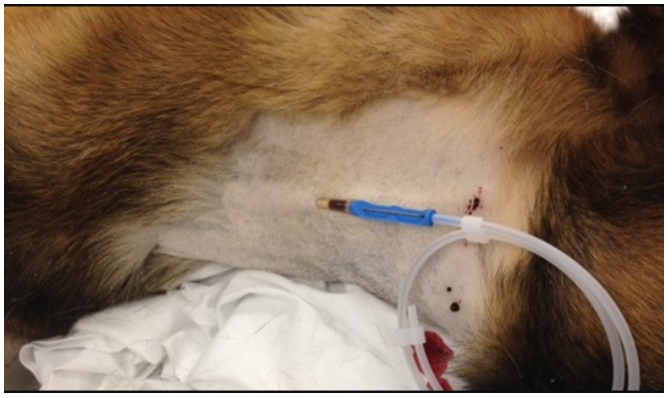


Figure 10 shows advancement of the Seldinger guide wire through the catheter and into the external jugular vein. Once the guidewire is advanced about two-thirds of its length into the vein, remove the catheter, leaving only the guidewire in place.

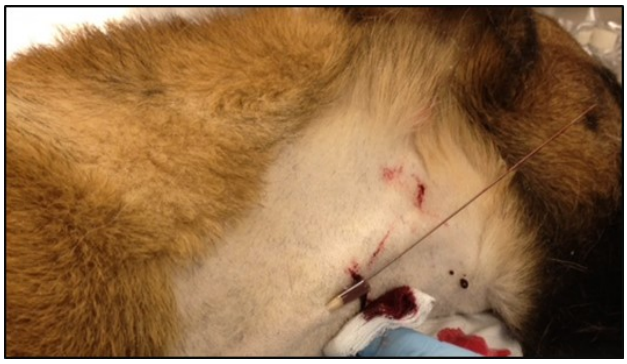


Figure 11 shows initial advancement of the multi-lumen central venous catheter over the guidewire. Use of a dilator (not shown) is often necessary before this step to enlarge the puncture site in the skin.

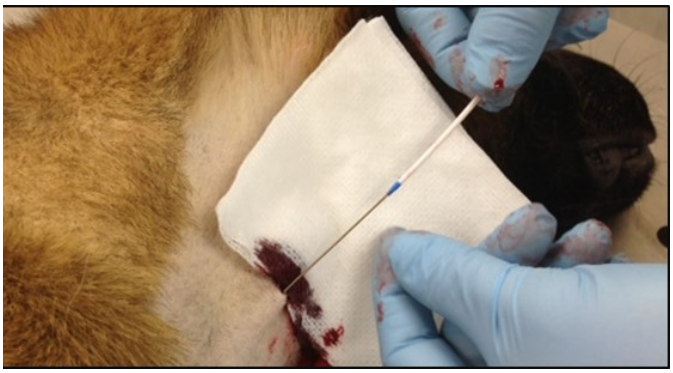


Figure 12 shows advancement of the catheter into the external jugular vein. Note extension of the guidewire from the proximal end of the catheter (red oval).

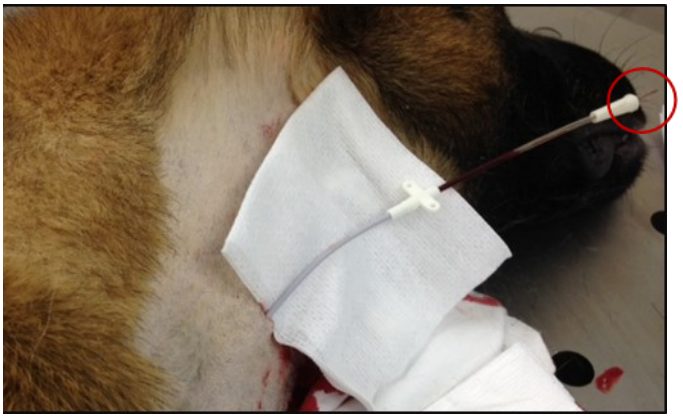
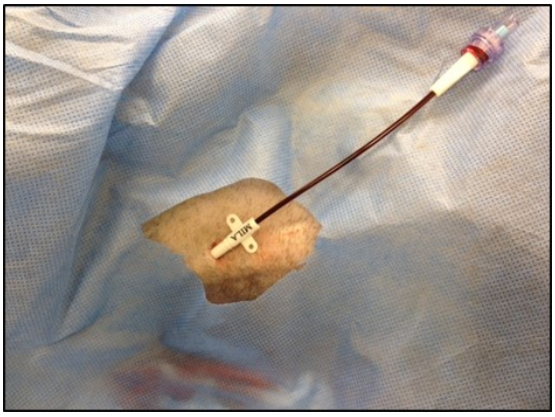


Figure 13 shows full insertion of the catheter into the external jugular vein, complete removal of the guidewire, and attachment of an injection port on the catheter hub.



Jugular Vein Location & Central Venous Catheterization

Figure 14 shows the optimal method to secure central venous catheters to the dog's skin using separate sutures at the wings of the catheter hub and circumferentially around the catheter base.

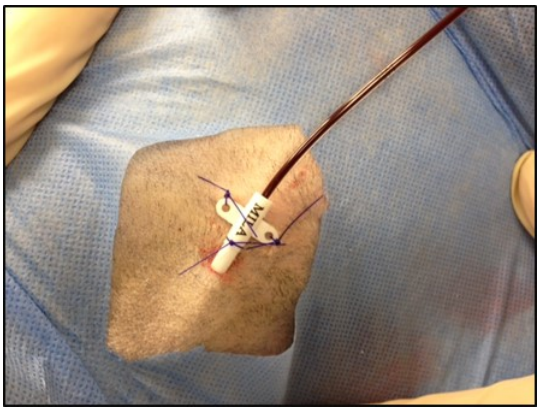


Figure 15 shows the optimal method to initially secure the central venous catheter using roll gauze or cast padding. Note that the catheter tubing (dotted line) is gently curved caudally and secured between snug layers of gauze/padding.

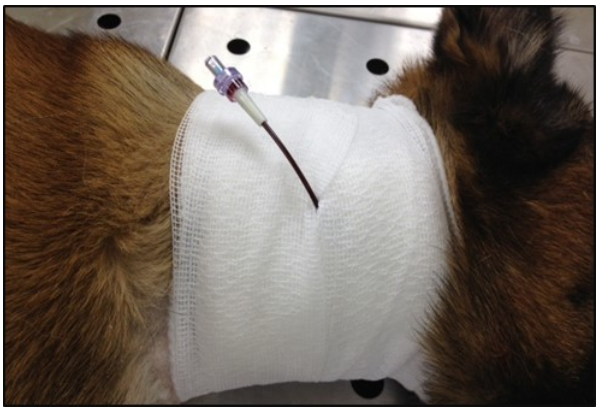
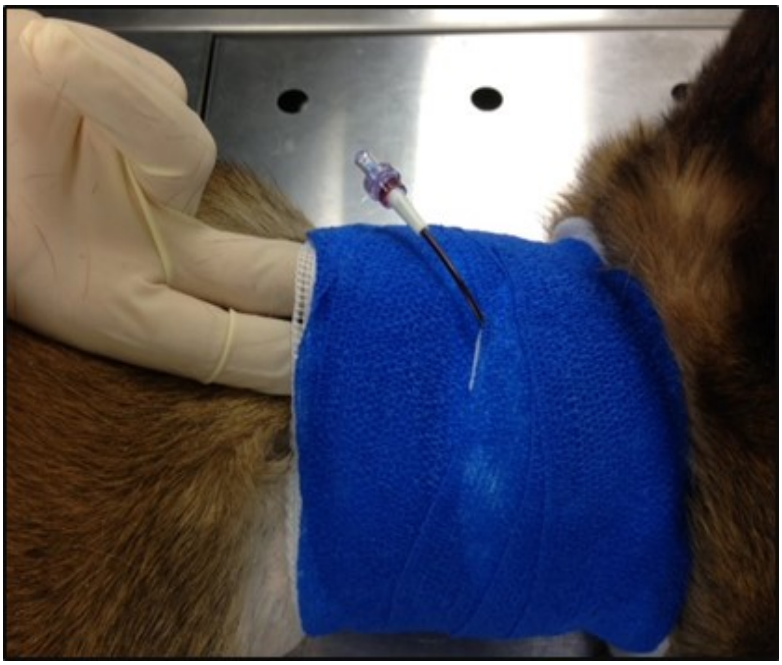


Figure 16 shows the optimal method to completely secure the central venous catheter using non-adherent bandage material placed over the underlying roll qauze/padding. Note: At least 2 fingers can be inserted beneath the bandage, ensuring the bandaging is not too tight.

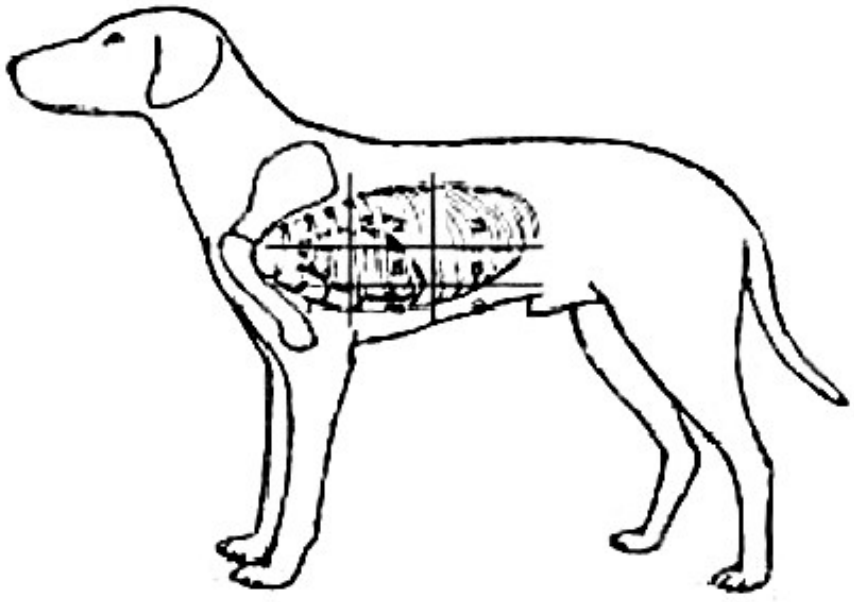


Routine Cardiovascular Monitoring

- Heart sounds are best auscultated over the lower lateral thoracic wall between the 4th-5th intercostal spaces, typically where the elbow crosses the chest wall when the forelimb is pulled caudally (See Figure 17).

Figure 17. Heart Sounds Location.

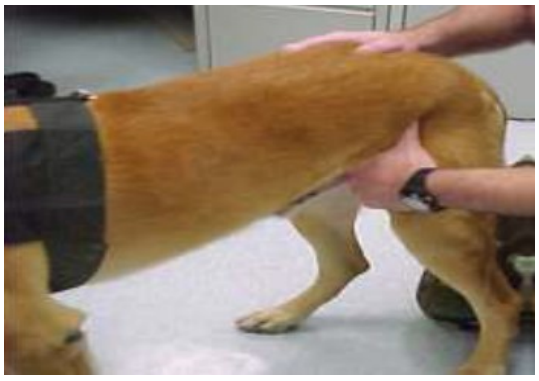
Figure 17 shows optimal location for auscultation of the heart sounds and palpation of the heartbeat, in the 4th-6th intercostal space just above the sternum and just caudal to the elbow.

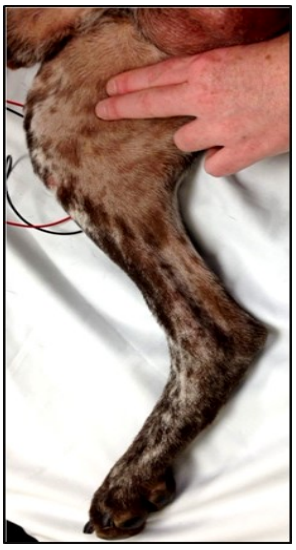


- The arterial pulse is best palpated at the femoral artery on the medial aspect of the proximal thigh in the inguinal area, or at the dorsal metatarsal artery on the dorsal aspect of the proximal hind paw. (Figure 18)
- Arterial blood pressure measurement is best measured non-invasively using the dorsal metatarsal artery, located on the dorsal aspect of the hind paw. Alternative sites are the lower forearm and tail base. Neonatal (size 4 or 5) or pediatric (size 6-8) human cuffs and an oscillometric technique work well. Use pediatric settings on the monitor.

Figure 18. Pulse location.

Figure 18 shows location for palpation of the femoral arterial pulse, in the inguinal region on the medial aspect of the proximal thigh.



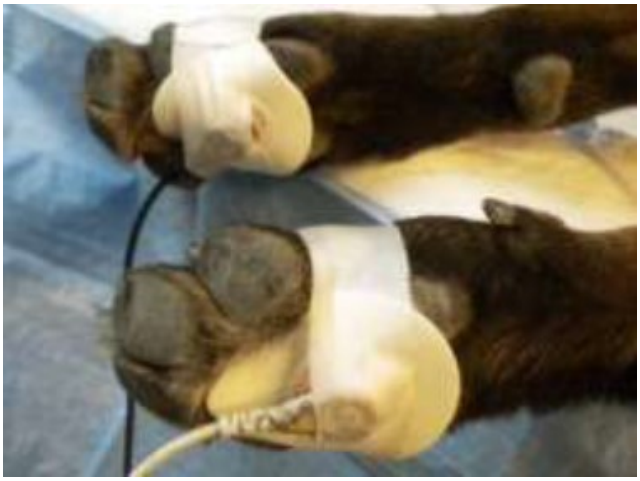


Routine Cardiovascular Monitoring

- ECG adhesive electrodes should be taped to the pads of the paws of the left forelimb (black lead), right forelimb (white lead), and left hind limb (red lead), as shown in Figure 19. 3-lead electrocardiograms are the norm and are sufficient. Canine ECG complexes resemble human complexes, with minor variations in key electrocardiographic intervals.

Figure 19. Placement of ECG Electrode Pads.

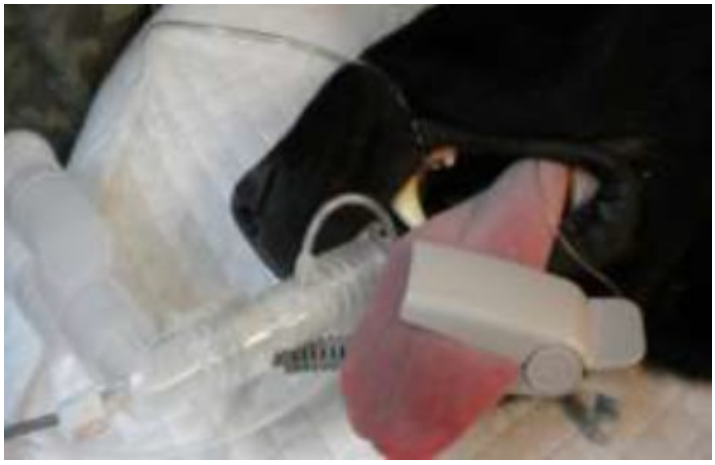
Figure 19 shows a technique for placement of adhesive ECG electrodes.



- Pulse oximetry probes used for people (typically finger probes) are best placed on the tongue for optimal reliability (See Figure 20) in unconscious, sedated or anesthetized dogs. In conscious dogs, use the ear pinna, lip fold, or flank skin fold; while not optimal for oximetry, these alternate sites generally yield reliable results in most instances.

Figure 20. Placement of Human Pulse Oximeter Finger Probe on Tongue.

Figure 20 shows a technique for placement of standard human pulse oximeter finger probe on the tongue of an anesthetized dog.



Prevention of Self-trauma & Removal of Devices

Military working dogs will chew at catheters, bandages, and monitoring devices, and will excessively lick and chew at wounds to the point of causing foreign body ingestion and self-trauma. Use muzzles in the immediate period of initial monitoring and care to prevent this.

Tape catheters around the entire circumference of the limb, including the hub and catheter adapter port to adequately secure the catheter. The tape should be snug, but caution used to prevent excessive tightness that will result in distal edema.

For long-term management, a simple option is to fashion a preventive device. The bottom of a standard bucket is removed, 4-5 holes are drilled in the base of the bucket, and cable ties are used through these holes to secure the bucket to the dog's leather collar. The bucket-collar combination is then applied. (See Figures 21 and 22). Supporting veterinary personnel or MWD handlers should provide these.

Figure 21 shows the technique to make a bucket to prevent self-trauma by MWDs.

The bottom of a standard plastic bucket is removed, 4-5 holes are drilled near the base, and cable ties are used to secure the bucket to the dog's leather collar.

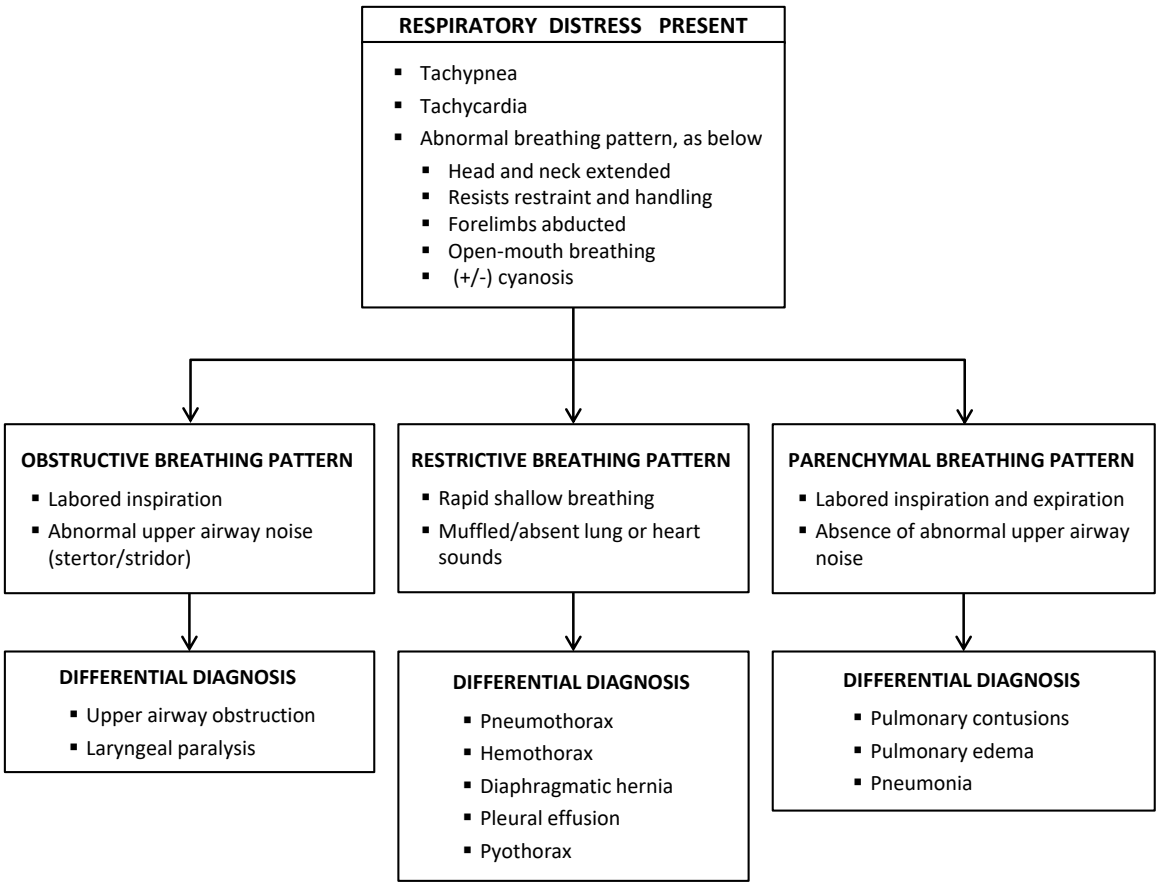
Figure 22 shows the bucket-collar device applied to a Military Working Dog.

Emergency Airway Management

Respiratory distress develops in deployed MWDs most commonly due to trauma. MWDs in respiratory distress are fighting to get oxygen: they are anxious, usually have obvious labored breathing, usually have their head and neck extended and elbows and upper legs held away from the chest, don't want to lie down, and fight restraint and handling. Cyanosis, if present, is a late finding. MWDs in respiratory distress typically have 1 of 3 characteristic breathing patterns that help localize the problem.

Figure 23 presents a clinical algorithm for differentiating the most likely cause of a patient's distress based on the pattern of breathing.

Figure 23. Clinical Algorithm for Differentiating Causes of Respiratory Arrest Based on Breathing Pattern.[1]



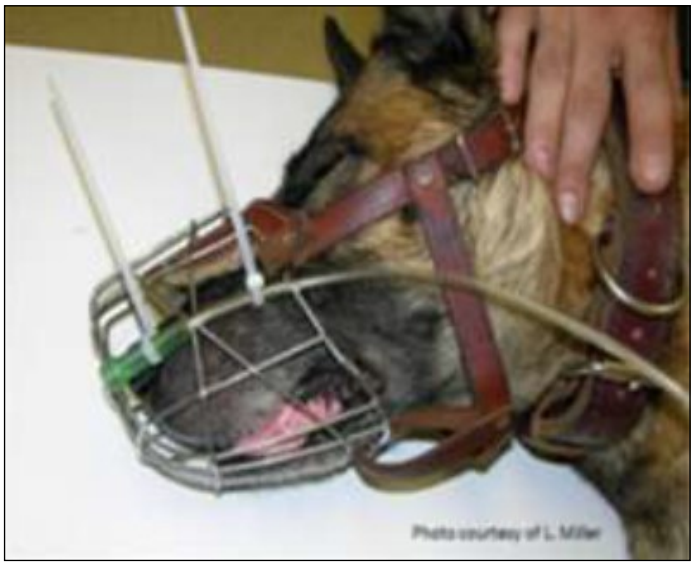
Oxygen Supplementation

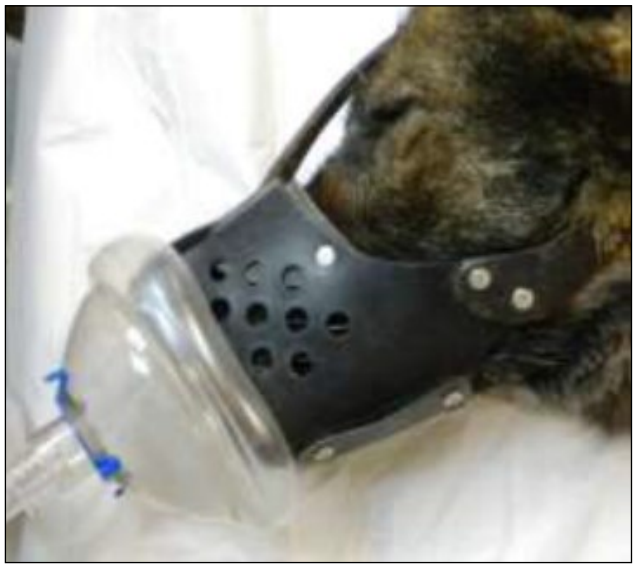
Oxygen supplementation is essential. Provide 100% oxygen to all trauma patients and any patient that is showing signs of respiratory distress, until proven unnecessary.[4] Oxygen cages (makeshift or manufactured) and oxygen tents are impractical or not available in the typical HCP situation, so evacuate the MWD to the supporting veterinary facility if long-term oxygen therapy is necessary.

Conscious MWDs: Use face mask or "blow by" technique (hold end of oxygen tubing or circuit as close to nose and mouth as possible or attach to muzzle) using high flow rates of 10-15 L/min.[5] Use caution; ensure handler has control of the MWD at all times. Agitated, distressed or dyspneic MWDs will bite and can cause serious injury to the HCP or MWD handler. Figure 24 shows simple yet effective techniques to safely provide "blow-by" oxygen supplementation to muzzled MWDs. While not the ideal method, acceptable inspired oxygen concentrations of 40-70% are achieved with this technique,[5] which may be life-saving.

Unconscious MWDs: Use tracheal insufflation, orotracheal intubation, or tracheostomy (see Table 4, Table 5, and Table 6 for techniques).

Figure 24. Administration of Supplemental Oxygen.[4]
Figure 24 shows techniques for safe administration of supplemental oxygen to conscious or fractious muzzled dogs.





Upper Airway Obstruction with Obstructive Breathing Pattern

A patient with an obstructive breathing pattern typically has respiratory distress characterized by labored inspiration and abnormal upper airway noise such as stridor or stertor (See Figure 23).

- Common causes in trauma patients are facial and oropharyngeal swelling (jaw fractures, facial trauma), cervical injury (tracheal compression by hemorrhage in neck area, muscle edema), direct tracheal injury, severe snake and insect envenomation, bite wounds, smoke inhalation, electrocution, and foreign objects.
- Diagnosis is usually obvious based on history of trauma and presenting signs. For every trauma patient, carefully ensure the airway is open by physically opening the mouth, examining the oral cavity, and watching the patient breath. Palpate and examine the face, muzzle, nose, mouth, external laryngeal area, and trachea for deformities, traumatic wounds, or other abnormalities
- If the airway is not patent, immediately takes steps to open the airway (See Figure 25 next page).

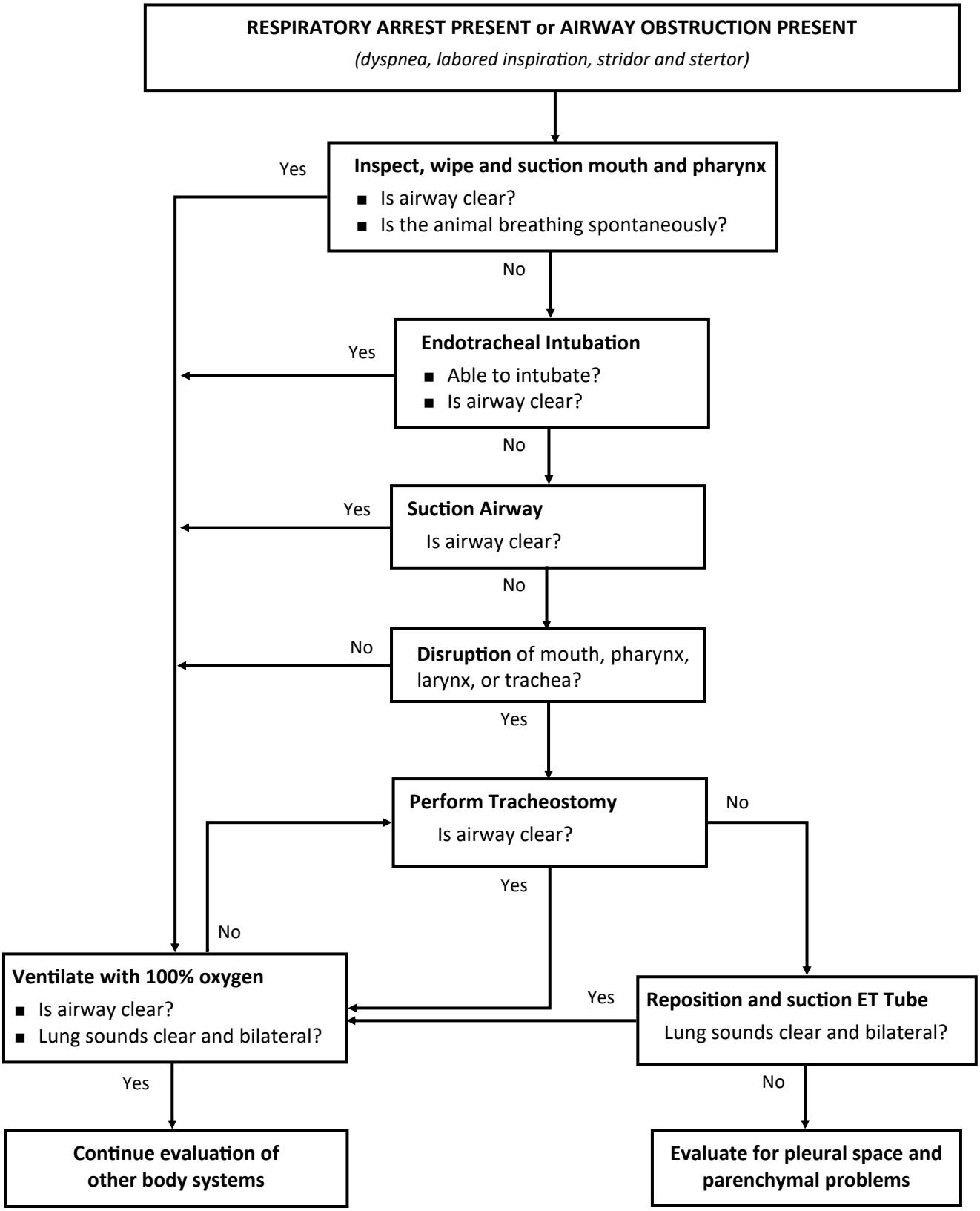
1. Provide oxygen therapy as above.
2. Bypass the obstruction until the patient is more stable:

    1) Attempt to remove the obstruction quickly by sweeping the mouth and pharyngeal area with a finger or gauze, suction the area, or use large forceps to remove objects that may be obstructing the passage.

    2) Do not attempt a Heimlich maneuver unless you know the object is smooth (e.g., ball); most trauma patients do not have a smooth foreign body obstruction, and the maneuver can cause significant patient distress and possibly further injury.

- If the obstruction cannot be removed in a few seconds, consider tracheal insufflation with oxygen for immediate oxygen delivery (See Table 4 for technique), and perform an emergency tracheostomy (See Table 5 for technique.
- Patient anxiety is frequently a compounding factor; tranquilize, sedate, or anesthetize if necessary.
- Management of patients with tracheostomy tubes requires 24-hour care and observation. Perform tracheal and pulmonary toilet as for human patients. Perform local wound care at least every 12 hours. Tube dislodgement is a potentially life-threatening complication that must be guarded against and monitored.

Figure 25. Airway Obstruction Management Algorithm for MWDs.



Tracheal Insufflation with Oxygen

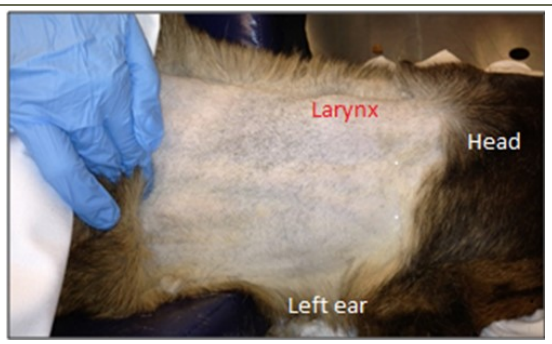
TABLE 4. TRACHEAL INSUFFLATION WITH OXYGEN FOR MWD TECHNIQUE[6]
1. Clip hair and surgically prepare a 6 inch X 6 inch area of the ventral neck area just distal to the larynx.
2. For conscious MWDs, sedate and use 20 mg lidocaine locally.
3. Attach a 10 mL syringe to the hub of a 14 or 16 gauge, 6 inch, over-the-needle catheter.
4. Stabilize the trachea with one hand.
5. While holding the catheter-syringe apparatus at a 45° angle, direct the catheter through the skin and annular ring between the 3rd and 4th or 4th and 5th tracheal cartilages, directed ventrally down the trachea. Do not pass through the cricothyroid membrane in dogs.
6. Begin to slowly aspirate with the syringe as you pass the catheter through skin.
7. Once the tip of the needle is through the skin, aspiration of air signifies successful entry into the tracheal lumen.
8. Once the catheter is successfully introduced into the tracheal lumen, stabilize the needle to prevent any further advancement of the needle into the trachea.
9. Advance the catheter OFF the needle, directed down the trachea, until the hub of the catheter is in contact with the skin.
10. Remove the needle from the catheter.
11. Attach oxygen tubing to hub of catheter and provide high-flow oxygen (10-15 L/min).
12. Do not use this method for more than 30-45 minutes, as hypercapnia will develop and lung barotrauma may occur due to high airway pressures. Use tracheal insufflations as a “bridge” to more practical methods (e.g., orotracheal intubation, tracheostomy).

Emergency Tracheostomy

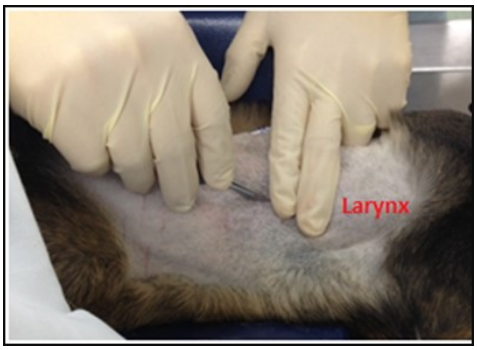
TABLE 5. EMERGENCY TRACHEOSTOMY OF MWD TECHNIQUE[6]

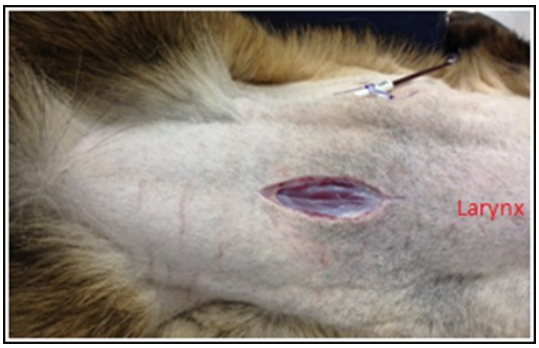
1. Position the animal in dorsal recumbency if unconscious, sedated, or anesthetized, extend the neck, and place a rolled towel or sandbag under the neck to force the trachea upwards. In conscious MWDs, position the MWD in sternal recumbency and extend the head upward to expose the ventral neck; sedate the dog and locally anesthetize the incision site with 20 mg lidocaine.

2. Clip the hair over the center of the ventral neck from the larynx to approximately the center of the neck, and prep the skin with surgical disinfectant.

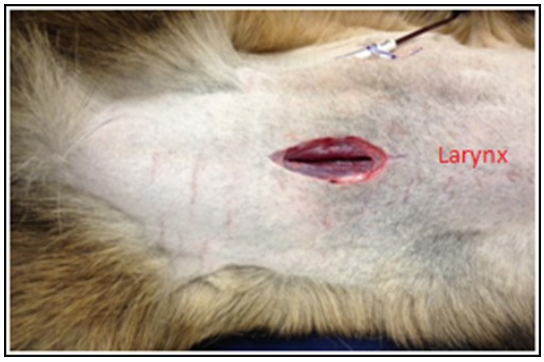


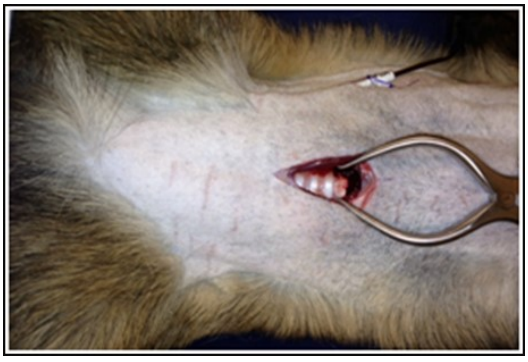
3. Make a full-thickness, ventral midline skin incision 2-3 finger widths below the larynx (ideally over the 3rd to 5th cartilage rings) parallel with the long axis of the trachea. Do NOT make a transverse skin incision (perpendicular to the long axis of the trachea), as this increases the risk of injury to adjacent vessels and nerves.





4. Separate the muscle bellies overlying the trachea using sharp or blunt dissection. Place a Gelpi or Weitlaner retractor to spread the muscle bellies and allow visualization of the trachea.

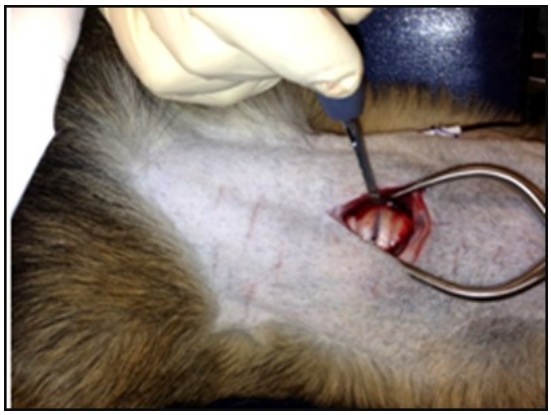




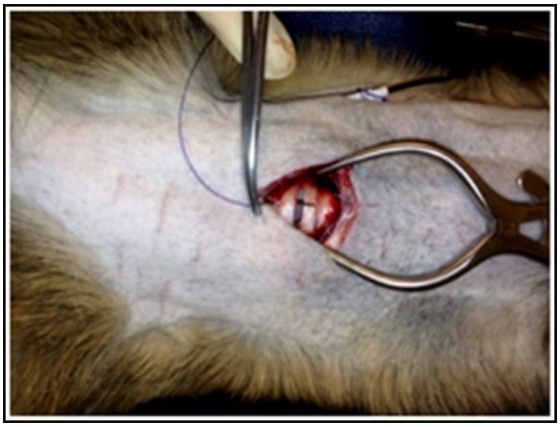
5. Stabilize the trachea with the non-dominant hand.

TABLE 5. EMERGENCY TRACHEOSTOMY (CONTINUED)

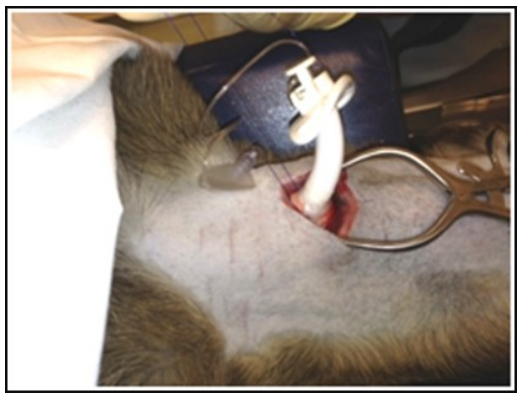
6. Make a transverse incision completely through the annular ligament between the 3rd and 4th or 4th and 5th tracheal cartilages to create the tracheostomy. Do NOT extend the incision more than one-half (50%) of the diameter of the trachea. Do NOT incise at the cricothyroid ligament, as is done in people.



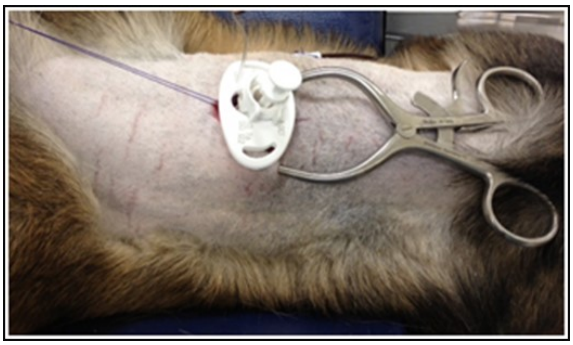
7. Using a cricothyroidotomy hook or stay sutures, retract the lower tracheal ring to open the tracheal lumen.



8. Insert a tracheostomy tube (ideal) or endotracheal tube through the incision and direct the distal opening down the trachea. Use the largest tube that will fit in the trachea; 7-11mm internal diameter tubes are typical.

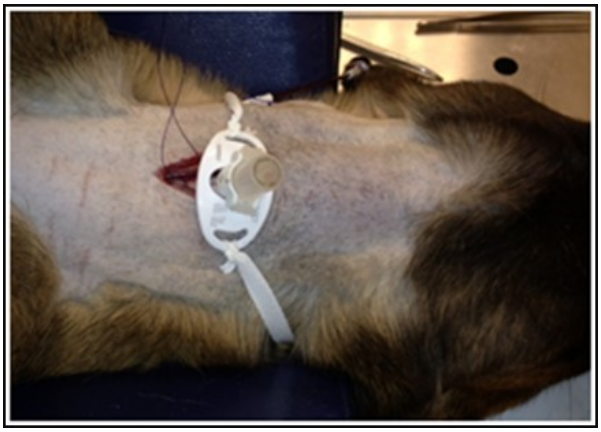


9. Once the tube has been inserted, place long stay sutures around the cartilage rings above and below the tracheostomy. These allow rapid control of the airway should the tube become dislodged, and facilitates tube maintenance.

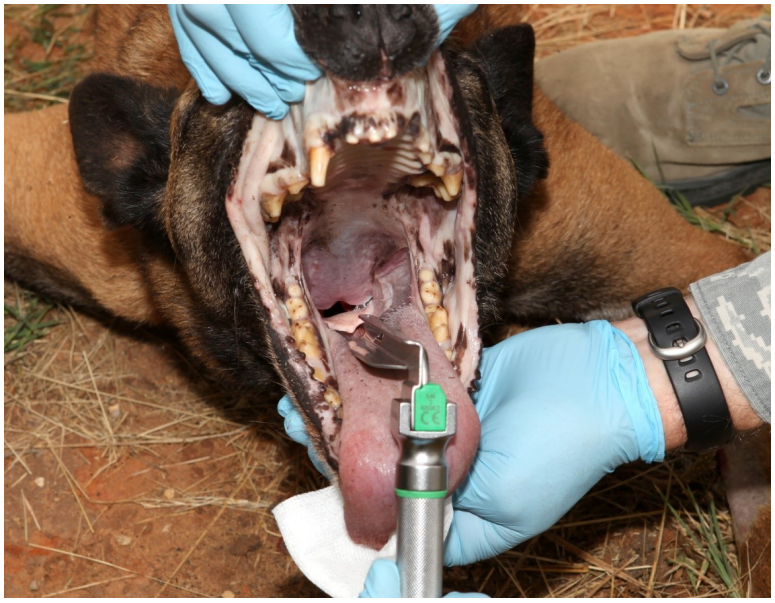


10. Secure the tracheostomy tube to the patient using umbilical tape, roll gauze, or similar material tied to the wings of the tube and passed around the neck and tied with a quick release knot. Do NOT suture the tube to the skin, as it cannot be removed rapidly if it obstructs.

11. Insert the inner cannula (if provided) in the tracheostomy tube (if used) and inflate the cuff of the tracheostomy tube.



Orotracheal Intubation

TABLE 6. OROTRACHEAL INTUBATION OF MWD TECHNIQUE[6]
1. Typical MWD needs a 9-11 mm internal diameter cuffed endotracheal tube.
2. Premeasure intended insertion length by placing the tube alongside the extended head and neck of the dog. Locate the larynx and position the cuff just below it. With the tube still lined up along side of the head and neck and the cuff positioned just below the larynx, apply a piece of tape to the tube opposite the lower canine teeth or incisors as a depth indicator when inserting the tube.
3. Cut and tie an 18 to 24 inch length of roll gauze to the end of the tube with the tape on it.
4. Lightly lubricate the cuffed end of the tube with sterile lubricant.
5. Place the MWD in sternal recumbency.
6. Have the handler lift and extend the dog's neck with one hand holding the upper jaw and the other hand holding the back of the head. Rolling the upper lips away improves visibility.
7. Grasp the animal's tongue with a dry 4X4 gauze sponge and gently pull the tongue out and down between the lower canine teeth.
8. Holding the laryngoscope in the other hand, place the tip of the blade on the base of the animal's tongue near the epiglottis and apply gentle downward pressure on the tip of the laryngoscope blade to visualize the opening to the trachea. 
9. Transfer the laryngoscope to the hand holding the animal's tongue.

10. With the free hand, using a slight rotating motion, guide the tube over the epiglottis, between the vocal cords, through the laryngeal opening, into to the trachea.

11. Advance the endotracheal tube into the trachea until the tape marker reaches the landmark.

12. Verify endotracheal tube placement.
    a. Palpate the dog's neck and feel for 1 tube. If 2 tubes are felt, the endotracheal tube is in the esophagus (1 "tube" is the trachea and the other is the endotracheal tube in the esophagus). Remove the tube and attempt intubation again if 2 tubes are felt.
    b. Place the base of the laryngoscope at a 90 degree angle next to the end of the endotracheal tube and look for fogging of the base caused by the animal exhaling air through the endotracheal tube. If fogging is noted, the tube is likely correctly placed.
    c. Attach a capnometer (if available) to the endotracheal tube and measure E_TCO_2. If E_TCO_2 is measured >10 mmHg, the tube is correctly positioned.

13. Inflate the cuff with the syringe until back pressure is noted in the syringe. Check for leaks and normal lung sounds during assisted ventilation.

14. Secure the tube into place by securing the attached roll gauze behind the canine teeth. Tie the gauze using a bow knot around the upper or lower jaw of the animal.

Emergency Airway Management References

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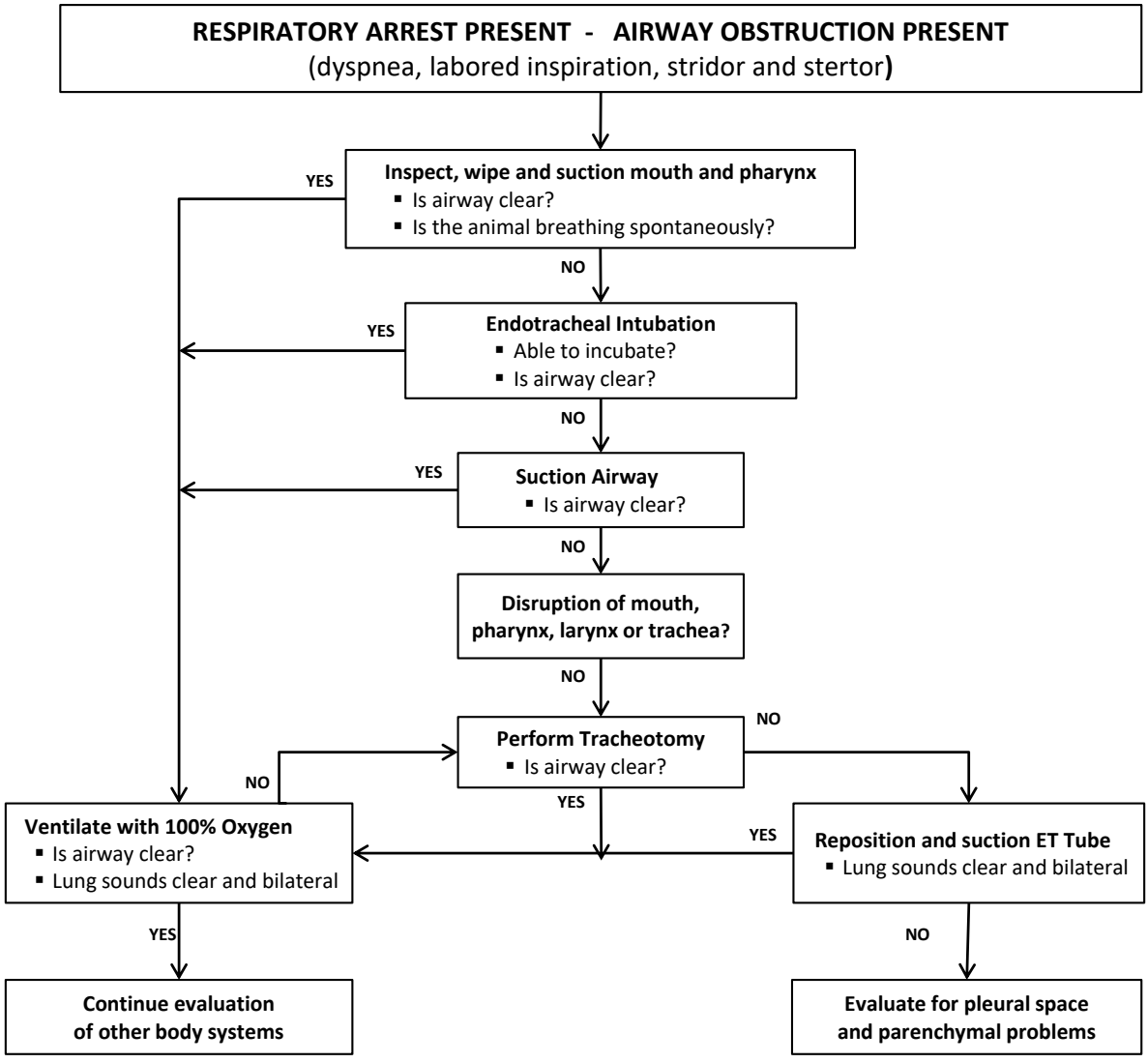
Penetrating Chest Wounds & Respiratory Distress

Respiratory distress develops in deployed MWDs most commonly due to trauma. MWDs in respiratory distress are fighting to get oxygen: they are anxious, usually have obvious problems breathing, usually have their head and neck extended, elbows and upper legs held out from the chest, don't want to lie down, and fight restraint and handling. Cyanosis, if present, is a late finding.

MWDs in respiratory distress typically have 1 of 3 characteristic breathing patterns that help localize the problem. A clinical algorithm for differentiating the most likely cause of a patient's distress based on the pattern of breathing is provided (See Figure 26).

Provide supplemental oxygen for any dog in respiratory distress (See Chapter 3).

Figure 26. Clinical Algorithm for Differentiating Cause of Distress Based on Breathing Pattern.[1]



Thoracic Radiography and Thoracic Focused Assessment with Sonography in Trauma (TFAST)

Thoracic radiography and TFAST exams are useful adjunct procedures, especially in the diagnosis and treatment of pneumothorax, hemothorax, pleural effusion, pulmonary contusions, or pulmonary edema. Radiography is also appropriate for documentation of correct thoracostomy tube placement.

Perform thoracic radiography on every traumatized MWD, if available, even if there is no clinical evidence of thoracic trauma. A significant number of trauma patients without outward evidence of chest trauma have hidden trauma that may manifest later, complicate management, or worsen with treatment of other conditions.

TFAST should be performed on every MWD that presents with a history of trauma, if the HCP has significant experience in its use; TFAST requires a high degree of experience to optimize diagnostic reliability. As with human casualties, TFAST is sensitive and specific for the diagnosis of pneumothorax and pulmonary parenchymal fluid, and for rapidly evaluating for pericardial and pleural effusions.[4] Figure 27 shows the imaging locations for TFAST in the dog. Figure 28 describes a clinical management algorithm for the use of TFAST in dogs.

Figure 27. Imaging Locations for TFAST.[4]
Figure 27 shows the ultrasound probe locations for TFAST in the dog.

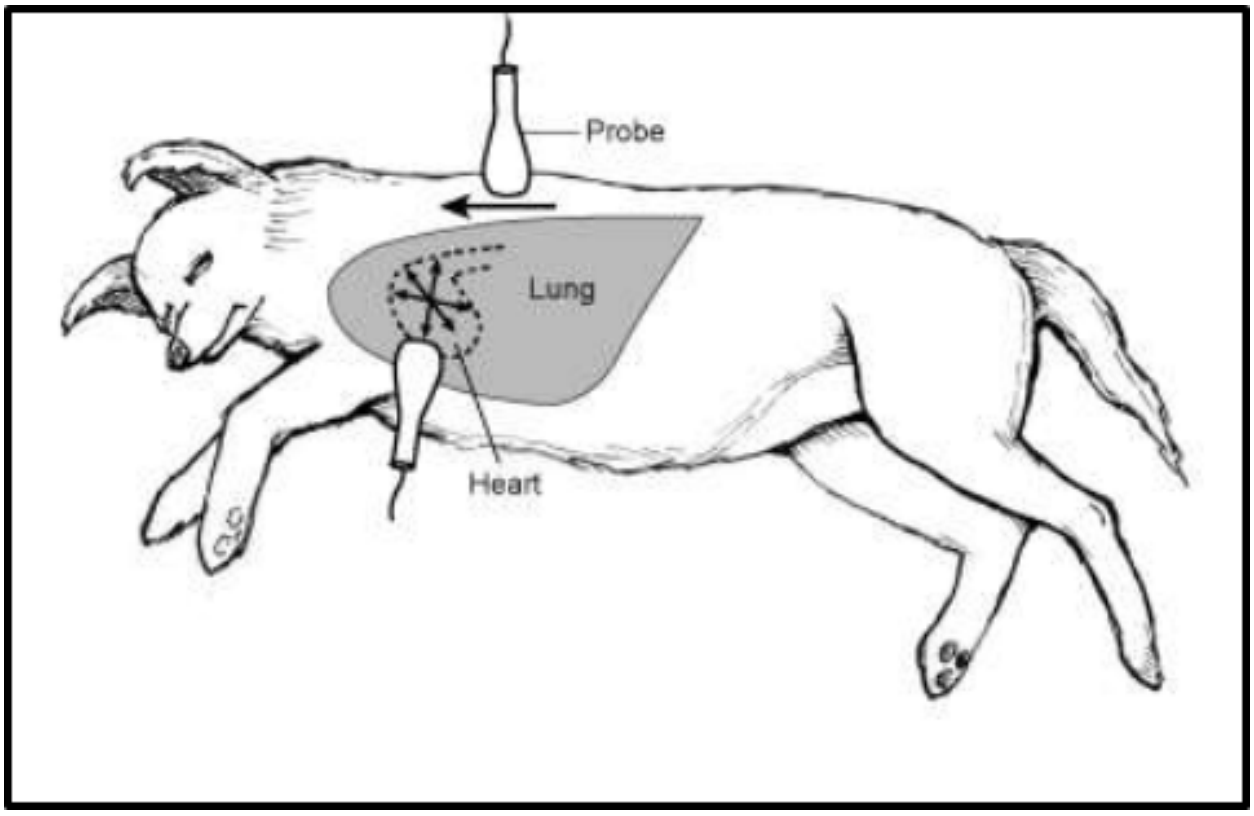
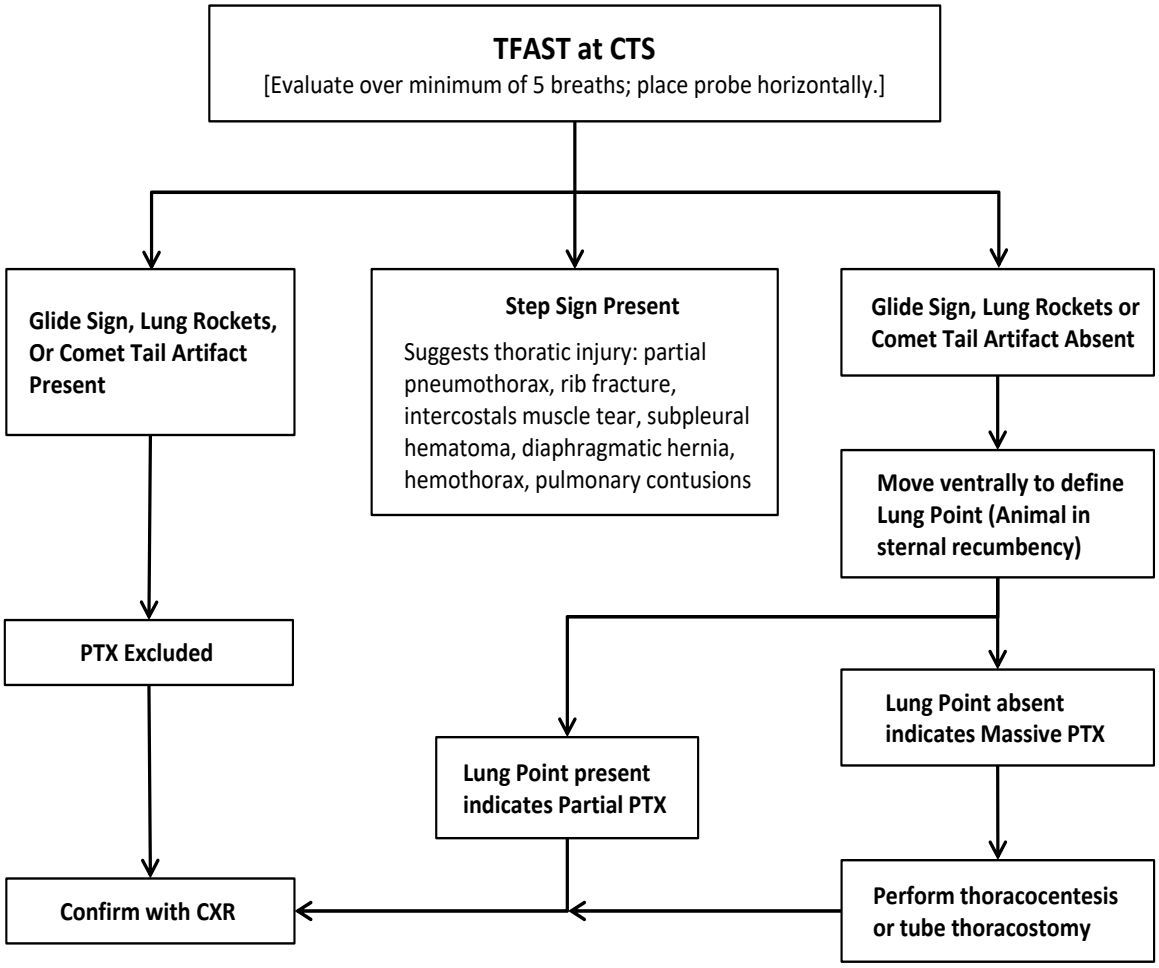


Figure 28. Clinical Management Algorithm for TFAST Use in Military Working Dogs.[4]



Note: CTS refers to probe imaging location at the conventional Chest Tube Site (8th-11th intercostal space). PTX refers to pneumothorax. CXR = thoracic radiography.

Thoracic Injury

Up to 50% of traumatized dogs have some form of thoracic injury.[5-12] Pneumothorax (PTX) and pulmonary contusions are very common. Dogs with thoracic injury typically have restrictive and parenchymal breathing patterns (See Figure 26).

Rib Cage Trauma

This includes flail chest, rib fractures, intercostal muscle rupture, and penetrating wounds. Signs mimic pleural space injury (restrictive breathing pattern). Usually the defect is obvious, especially if paradoxical chest wall motion is noted.

- Adequate management usually involves careful handling, laying the patient with affected side down, minimizing restrictive chest bandaging, and providing analgesia. External splinting or surgical management is usually not necessary unless injury is severe or extensive, or the chest wall is compromised and prolonged interference with gas exchange and ventilation is evident.
- Pain can substantially interfere with gas exchange and ventilation. Alleviate pain once the patient is stabilized to improve oxygenation and ventilation. Systemic or local analgesia are acceptable options (See Chapter 16). Local nerve/rib blocks and intrapleural analgesia administration work well and are readily accomplished.

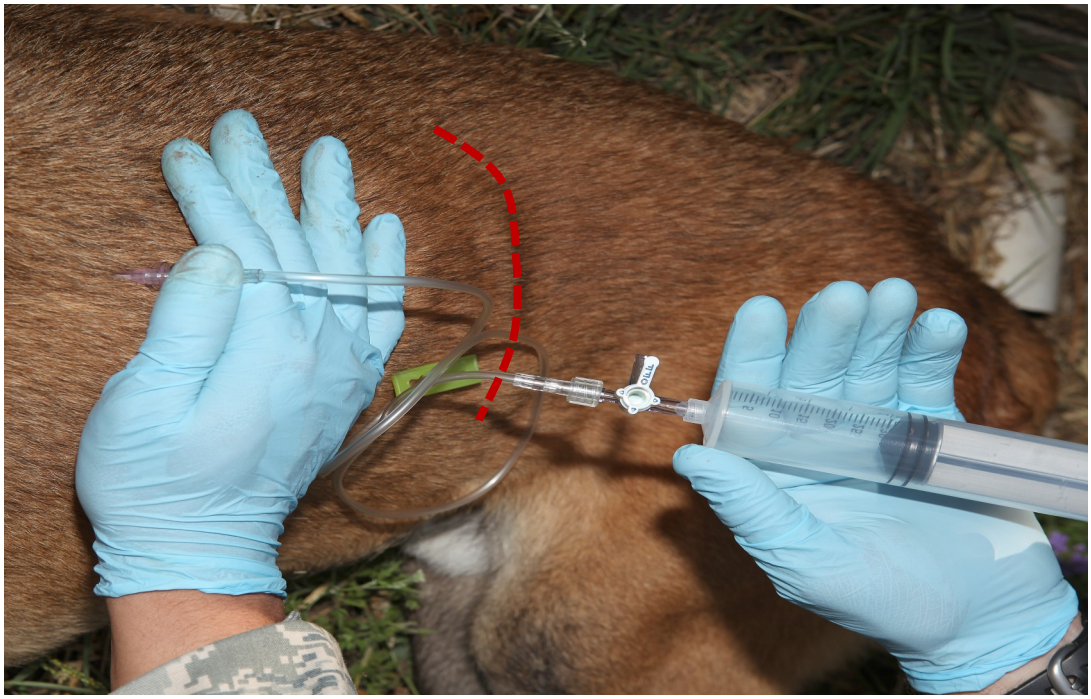
Pleural Space Trauma

This includes PTX (open, closed, tension), hemothorax (HTX), and diaphragmatic hernia. A restrictive breathing pattern is the classic presentation—shallow, rapid respiration with muffled lung and/or heart sounds. Auscult the chest for decreased lung sounds over most of the thorax, which suggests either fluid (blood) or air in the pleural space, pulmonary contusions, or diaphragmatic hernia.

- Open PTX requires immediate action. Rapidly clip hair from around the wound, and apply any occlusive seal over the wound. Apply a chest bandage to secure the material. Delay wound closure until the MWD is stable. Open PTX always requires chest decompression after closure of the wound.
- The presence of decreased lung sounds in a trauma patient with signs of respiratory distress, or rapid clinical deterioration in a MWD with respiratory distress is sufficient justification for needle thoracocentesis.
- Thoracocentesis is readily and rapidly accomplished, and safe when performed properly – "When in doubt, tap it!" Figure 29 on the next page shows the location for needle thoracocentesis in dogs.[13] See Table 8 for thoracocentesis technique in MWDs.
- The mediastinum in dogs is thin and typically ruptures; therefore, ***always tap both sides of the chest***, even if a positive tap is achieved on one side of the chest, as air will form pockets and will migrate.
- Repeated thoracenteses may be required to stabilize the patient. A negative chest tap doesn't always mean there's not an abnormal accumulation of air or fluid in the pleural space – it may mean you just couldn't find it! "When in doubt, tap it again!"
- In dogs, the intercostal artery, vein, and nerve run on the caudal aspect of each rib; thus, the best approach is by inserting the needle or catheter in the center of the intercostal space or at the cranial aspect of a rib.

Figure 29. Location for Needle Thoracocentesis.

Figure 29 shows anatomic location for needle thoracocentesis in dogs, with the dog in lateral or sternal recumbency, and the needle inserted generally on the mid-lateral thorax between the 6th to 8th intercostal space. Count forward from the last rib (#13; red dotted line) to find the insertion site.

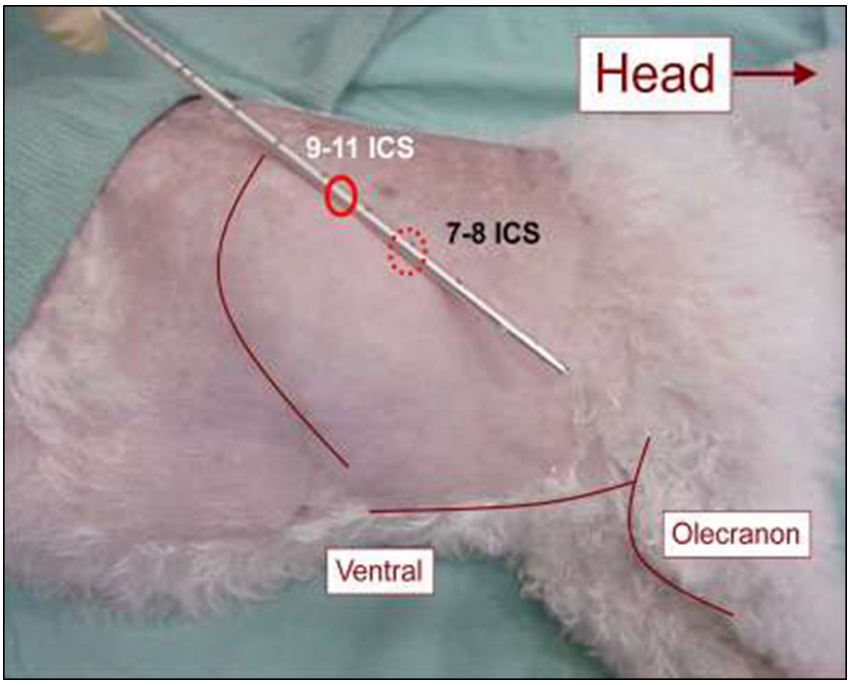


Immediate placement of a thoracostomy tube is indicated if negative pressure cannot be achieved with needle thoracocentesis, if large amounts of blood are aspirated, or if repeated thoracocenteses are required to maintain negative pleural pressure.

- A general rule of thumb for thoracostomy tube sizes is the chest tube should be the largest size that comfortably fits in the intercostal space. For most MWDs, use fenestrated tubes that are 24-36 Fr. Figure 30 shows the correct anatomic orientation for chest tubes placed in dogs. Table 9 describes techniques for chest tube placement in MWDs.
- Tube thoracostomy is a painful procedure. In emergent or critically ill patients, local analgesia may not be necessary. Consider local anesthesia, intercostal nerve blocks, and intrapleural analgesia in all other patients (See Chapter 16).
- Remove chest tubes when air or fluid accumulation is less than 2-4 mL/kg body weight per day.
- The chest tube will ideally lie in the pleural space, generally oriented cranioventrally to maximize removal of air and fluid. It is best to pre-measure the tube visually before placement to ensure proper depth of insertion. Be certain the last fenestration of the tube will be within the chest cavity.
    - Patients with chest tubes in place MUST be monitored continuously!
    - Some form of removal of air or fluid must be used. This can be continuous suction or intermittent aspiration by personnel.

Figure 30. Anatomic Orientation for Chest Tube Placement.

Figure 30 shows correct placement of a chest tube on the lateral aspect of the chest in a dog, with the tube penetrating the skin at the 9th to 11th intercostal space (ICS), tunneling cranioventrally to penetrate the chest wall at the 7th to 8th ICS, directed toward the olecranon of the elbow. Photo courtesy of Dr. Tim Hackett.



Resuscitative Thoracotomy

- Emergent thoracotomy may be indicated, keeping in mind caveats discussed previously.
- Thoracotomy in dogs is generally best done through a LEFT lateral thoracic wall approach, generally at the 4th to 5th or 5th to 6th intercostal space to afford optimal visualization. A median approach is not recommended in MWDs, given difficulties in post-operative management.
- Euthanasia should be considered for a MWD for which a resuscitative thoracotomy is deemed necessary but cannot be performed or has proven unsuccessful (See Chapter 21).

Parenchymal Trauma

Pulmonary contusions and intrabronchial hemorrhage are common. A restrictive breathing pattern may be noted in patients with mild and moderate parenchymal injury. Patients with severe parenchymal injury often have a parenchymal pattern, seen as respiratory distress with labored inspiration and expiration, with or without hemoptysis.

- Auscult the chest for decreased lung sounds, which suggest either fluid (blood) or air in the pleural space, or pulmonary contusions. A patchy distribution of altered lung sounds may be noted, which helps differentiate parenchymal injury from pleural space trauma.

- A negative thoracocentesis suggests the presence of pulmonary contusions in patients with these clinical signs. Note that radiographic signs (mixed interstitial-alveolar pattern) may lag 12-24 hours, and the stress of the process is usually not warranted.
- Hemoptysis, especially of arterialized (bright red) blood suggests significant large pulmonary vessel trauma that typically carries a very guarded prognosis.
- Most MWDs with pulmonary contusions do not require mechanical ventilation. Management of pulmonary contusions involves minimizing stress, providing oxygen supplementation, cautious intravenous fluid administration to prevent progression of contusions and/or development of pulmonary edema, and possible addition of colloids to the fluid therapy plan to decrease the amount of lung water that may accumulate during shock resuscitation. Diuretics and steroids are not indicated in treatment of pulmonary contusions, and may increase patient morbidity and mortality.
- Severe, life-threatening major pulmonary vessel hemorrhage may require resuscitative thoracotomy. Refer to the discussion of **Resuscitative Thoracotomy** in this chapter for guidance and technique.

Diaphragmatic Hernia

Auscultation of borborygma over the area of the lung field suggests the presence of a diaphragmatic hernia, but can be misleading. Standard radiography and ultrasonography procedures are diagnostic. Assume a hernia is present, and carefully manage the patient to minimize discomfort and further organ herniation until the patient is stable enough to allow definitive diagnosis of the hernia.

- ***Diaphragmatic hernia (DH) is usually not considered a surgical emergency unless the stomach is involved, or the patient's condition deteriorates or fails to respond to conservative management.*** In most cases, the patient should be stabilized for shock and other organ injury, with definitive repair of the hernia at a later time. Most patients suffering trauma severe enough to rupture the diaphragm have other pulmonary injuries that would preclude anesthesia and intermittent positive pressure ventilation (IPPV) (e.g., contusions, pneumothorax).
- Emergent repair of a DH may be indicated. Repair is performed via a cranial ventral midline laparotomy, with retraction of the liver and stomach caudally, to afford optimal visualization.
    - Some means of positive pressure ventilation is necessary intraoperatively.
    - At least 1 thoracostomy tube should be placed intraoperatively and maintained for at least 24 hours post-operatively to manage pneumothorax.
    - Generally, rents in the diaphragm due to trauma occur in the muscular portions of the diaphragm, and are readily repaired using a simple continuous suture closure.

Ventilatory Support

Ventilatory support (e.g., manual IPPV or mechanical ventilation) may be required for dogs that fail to respond to correction or stabilization of the primary respiratory problem and supplemental oxygen support.[15] Ventilatory support requires a heavily sedated or anesthetized patient, even if a tracheostomy tube is in place (See Chapter 16).

- Manual intermittent positive pressure ventilation (MIPPV) is feasible if personnel can be spared for this, and is ideal for short-term (i.e., <6 hours) of ventilator support.
- There may be instances in which mechanical ventilation (MV) is necessary to afford a chance for patient survival. MV may be necessary if MIPPV fails or duration of ventilator support is expected to be >6 hours. Providers must note that MV should be considered only if the provider has the necessary advanced MV training and experience, the provider feels there is a reasonable likelihood of success, and the provider has the necessary support staff, facilities, and monitoring and intensive care facilities to manage a MWD on MV without compromising human patient care. Thus, MV should be considered only in Level 2 or higher medical facilities and by trained specialists with adequate staff.
- Generally, it is best to induce general anesthesia and initially manage the ventilated dog using Controlled Ventilation or Assist-Control ventilator mode. Key ventilator settings are shown (See Table 7).

TABLE 7: MECHANICAL VENTILATOR SETTINGS & KEY PARAMETERS[13]

PARAMETER	NORMAL LUNGS	ABNORMAL LUNGS
F_IO_2	100%, then reduce to <60%	100%, then reduce to <60%
Tidal Volume (V_T)	5 – 15 mL/kg	5 – 15 mL/kg
Breathing Rate (f)	8 – 20 bpm	8 – 20 bpm
Minute Ventilation (V_E)	150 – 250 mL/kg/min	150 – 250 mL/kg/min
Peak Inspiratory Psi (PIP)	10 – 20 cmH_2O	15 – 25 cmH_2O
Positive End-Expiratory Psi (PEEP)	0 – 2 cmH_2O	2 – 8 cmH_2O
Trigger Sensitivity	-2 cmH_2O or 2 L/min	-2 cmH_2O or 2 L/min
Inspiratory: Expiratory Ratio (I:E)	1:2	1:2
Inspiratory Time	~ 1 sec	~ 1 sec

TABLE 8. NEEDLE THORACOCENTESIS OF MWDS[14]

1. Position the animal in sternal recumbency if conscious or lateral recumbency if unconscious, sedated, or anesthetized.
2. Clip the hair from and surgically prepare a 6 inch X 6 inch square area of skin on the mid-lateral aspect of the thorax centered between the 6th to 8th ribs.
   - If pneumothorax is suspected, prepare the thoracenteses sites at the junctions of the upper 1/3rd and lower 2/3rds of the thoracic wall.
   - If pleural effusion is suspected, prepare the thoracenteses sites at the costochondral junctions.
3. In conscious MWDs and if time, infiltrate 1 mL of local anesthetic (20 mg lidocaine or 5 mg bupivacaine) in the skin to the pleura.
4. Assemble an emergency thoracocentesis set. For a tension PTX, a 1-1.5 inch, 16-18 gauge over-the-needle catheter is sufficient to relieve tension. For other types of PTX, use a 1-1.5 inch, 18 gauge over-the-needle catheter, to which sterile extension tubing and a stopcock and 60 cc syringe are attached; this allows aspiration of air and fluid without iatrogenic PTX. ***Do NOT use the standard Needle Decompression Device (3.25 inch, 16 gauge), as risk of cardiac or pulmonary vessel trauma is high.***
5. Hold the needle with the thumb and index finger of one hand and brace the hand on the lateral aspect of the thorax by firmly resting the "knife" of the hand on the thorax near the proposed thoracocentesis site.
6. Hold the syringe in your dominant hand, or have an assistant manipulate the syringe and stopcock while you manipulate the needle. The syringe should be empty and the stopcock closed to room air.
7. While stabilizing the hand holding the needle, insert the needle at the proposed thoracocentesis site through the skin, intercostal muscles, and parietal pleura until ½ the length of the needle has been inserted.
8. While stabilizing the depth of the needle with your non-dominant hand, aspirate with the syringe plunger in an attempt to remove air or fluid.
9. If you are successful in removing air or fluid, close the stopcock to the patient and expel the contents from the syringe through the stopcock without removing the needle from the pleural space or breaking aseptic technique.
10. Repeat until no further air or fluid can be removed.
11. If you are not successful in removing air or fluid, insert the needle to the hub while aspirating with the syringe, or redirect the needle cranially, caudally, dorsally and ventrally, or do both in an attempt to tap a pocket of air or fluid.
12. If you are still unsuccessful in removing air or fluid, completely remove the needle from the thorax and attempt thoracocentesis in an intercostal space cranial or caudal to the initial site.

TABLE 9. TUBE THORACOSTOMY OF MILITARY WORKING DOGS[15]

1. Clip the hair from and surgically prepare an area of skin from the 4th to the 12th rib, and from the dorsal midline to the ventral midline.

2. Infiltrate local anesthetic (20 mg lidocaine +/- 10 mg bupivacaine) at the proposed skin incision site between the 9th and 11th intercostal space at the junction of the upper 1/3rd and the lower 2/3rds of the lateral thorax. Continue infiltration of the subcutaneous tissues cranioventrally to the intercostal space at the intended site of penetration of the thoracic wall between the 6th and 8th intercostal space. Infiltrate the intercostal muscles, down to the level of the parietal pleura.

3. Make a skin incision with a #10 scalpel blade that is the same diameter as the thoracostomy tube. Note that an incision that is too large increases the risk of iatrogenic PTX and fluid leakage.

4. Insert the thoracostomy tube using either a trocar or forceps through the skin incision and advance the tube cranioventrally toward the intercostal space where you intend to penetrate the thorax. This creates a subcutaneous tunnel and orients the tube to lie in the intended direction in the chest.

   Note: *The interval between the skin incision and the intercostals space where the tube penetrates the thorax must be at least 2 intercostal spaces in width to allow sufficient creation of a subcutaneous tunnel that is important in minimizing iatrogenic PTX and fluid leakage.*

   Note*: MWDs rarely develop pleural adhesions, so digital exploration before tube placement is not necessary.*

   Trocar Technique: (RECOMMENDED technique)

   1) Insert the tip of the tube through the skin incision and advance the tube subcutaneously cranioventrally at least 2 intercostal spaces. Be sure to hold the trocar firmly in the tube.
   2) Firmly drive the tip of the stylet into the intercostal musculature as you raise the thoracostomy tube vertically so that the tube is almost perpendicular to the thorax.
   3) This movement will cause the skin to bunch over the intercostal space and will expose the distal part of the tube that was in the skin tunnel.
   4) Firmly grasp the distal-most part of the thoracostomy tube with one hand approximately 2 cm from the tip to prevent inadvertent over insertion of the trocar when advancing the tube in the next step. Note that this step is vital, as this hand acts as a “brake” to prevent lung and heart trauma as the tube is inserted.
   5) Using either a single, sharp blow to the proximal blunt end of the stylet or firm continuous downward pressure on the proximal blunt end of the stylet, penetrate the intercostal muscles and pleura to advance the tube into the pleural space approximately 2 cm.
   6) Once the tip of the thoracostomy tube has been inserted approximately 2 cm into the pleural space, lay the tube flat against the body wall AS YOU BEGIN TO ADVANCE THE TUBE in the pleural space cranioventrally toward the point of the elbow.
   7) As the tube is advanced, begin to slide the stylet out of the tube.
   8) Clamp the thoracostomy tube using the box lock of the Rochester-Carmalt or similar forceps as the stylet is removed to prevent pneumothorax.
   9) Close the proximal (outer) opening of the thoracostomy tube using either a Heimlich valve or tubing adapter and stopcock so that air does not enter the pleural space.

TABLE 9. TUBE THORACOSTOMY OF MWDS[15] (CONTINUED)

Forceps Technique: (NOT ideal; more traumatic and technically demanding)

1) Create a subcutaneous tunnel by bluntly advancing a 7" curved Rochester-Carmalt forceps or similar forceps (without the tube) cranioventrally from the skin incision site to the proposed intercostal space where the thoracostomy tube will penetrate the thorax.
2) Forcefully drive the tip of the forceps through the intercostal muscles and parietal pleura using a firm, quick thrusting motion, to enter the chest cavity.
3) While the tips of the forceps are inserted through the intercostal muscles and pleura, firmly open the jaws of the forceps to dilate the penetration site in the thoracic wall.
4) Remove the forceps and grasp the distal end of the thoracostomy tube with the jaws of the forceps such that the length of the tube is lying over the handles of the forceps. Just a small part of the tip of the tube should extend beyond the tip of the forceps.
5) Attach a Heimlich valve or clamp the thoracostomy tube BEFORE placing the tube to prevent pneumothorax.
6) Insert the forceps holding the tube through the skin incision and advance the tube and forceps cranioventrally through the subcutaneous tunnel to and through the intercostal opening.
7) Without removing the forceps, open the jaws of the forceps to release the thoracostomy tube. Advance the thoracostomy tube into the pleural space in a cranioventral direction toward the point of the elbow.
8) As the thoracostomy tube is advanced into the pleural space, slowly remove the forceps completely.
9) Continue to advance the thoracostomy tube until you are absolutely certain the most proximal fenestration of the tube is well within the pleural space, and is not in the subcutaneous tunnel or outside the skin.

5. Secure the chest tube to the skin using a horizontal mattress suture through the skin ventral to the skin tunnel, a purse string suture at the skin incision site that surrounds the tube where it enters the skin, and a "finger trap" suture around the tube anchored to the skin. Incorporate the chest tube in a bandage applied around the thorax to protect the tube.

References for Penetrating Chest Wounds & Respiratory Distress

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CHAPTER 5

Cardiopulmonary Resuscitation (CPR)

Indications for CPR

HCPs should consider CPR of MWDs in cases of non-traumatic cardiopulmonary arrest (anesthesia-related, hypothermia, near drowning, electrocution). If the tactical situation and resources permit, HCPs may consider CPR in MWDs with CPA due to blast injury, blunt trauma, or penetrating trauma, although successful resuscitation in these cases is unlikely. Overall survival in dogs is approximately 5%.

Clinical Management Algorithm for CPR

In general, CPR is performed in much the same manner as for people.[1] Management guidelines for CPR in dogs are provided (See Figure 31 and Table 10).

Basic Life Support[2-4]

2-person, closed-chest CPR should be initiated as soon as CPA is declared.

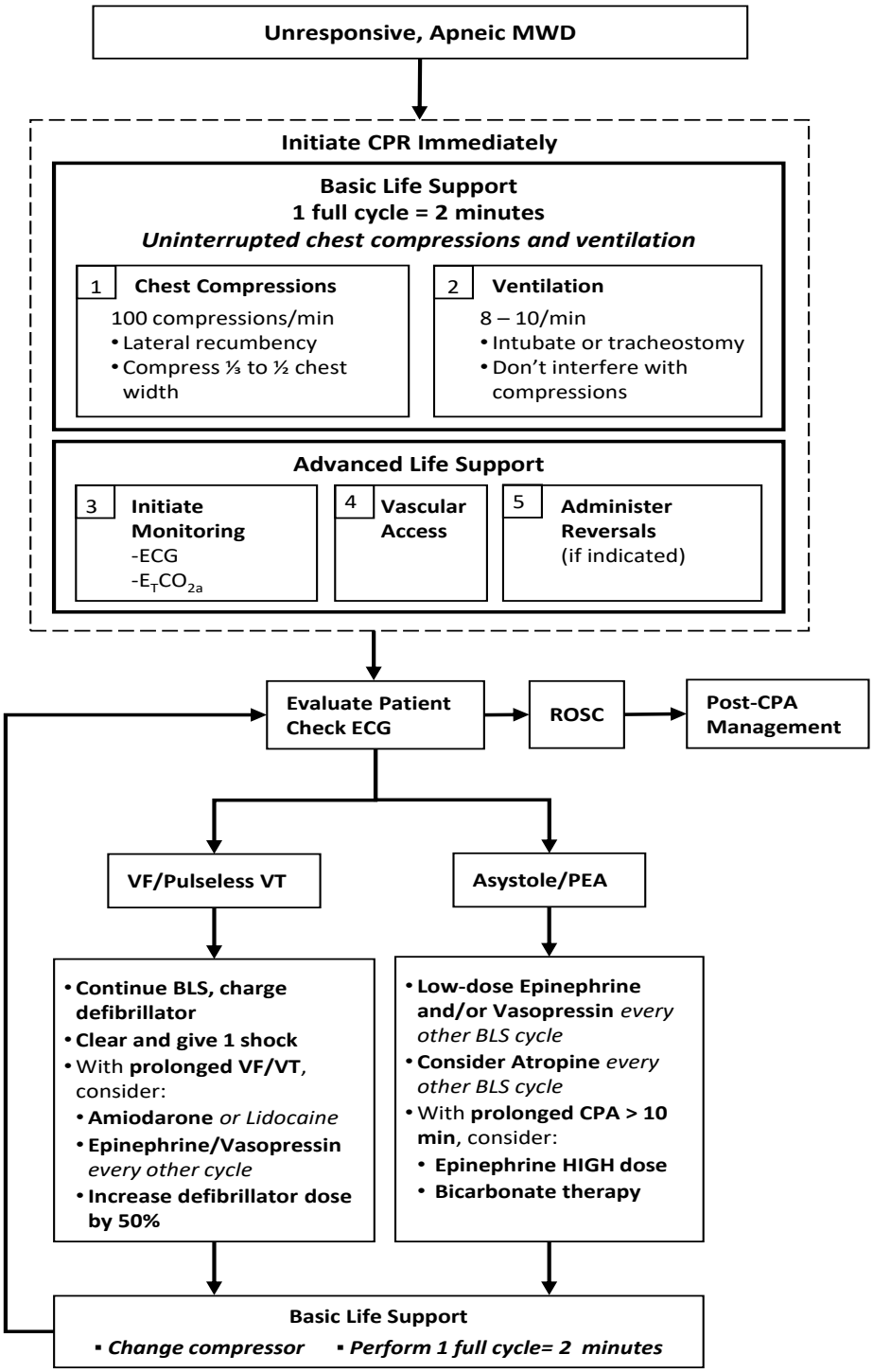
- Circulation – Immediately begin sustained, forceful chest compressions with the MWD in lateral recumbency (on either side) at a rate of 100 compressions per minute. Sustain compressions for at least 2-3 minutes per cycle. Hand placement can be directly over the heart (where the elbow crosses the chest above the sternum when the forearm is pulled caudally) or over the widest part of the chest (See Figure 32). Ensure adequate relief of downward pressure during the relaxation phase of the compressions. As for people, "PUSH HARD and PUSH FAST."[1]

- Airway – Establish an airway as rapidly as possible and as soon as possible after identifying a patient in CPA. However, start chest compressions first! Intubate the MWD if possible; if intubation is not possible, perform an emergent tracheostomy without delay (See Chapter 2).

- Breathing – Ventilate the patient at a rate of 8-10 breaths per minute. Avoid hyperventilation. Give oxygen if available; room air is acceptable if oxygen is not available.

Figure 32. Positioning for Canine CPR.

Figure 31. CPR Algorithm for Military Working Dogs.[2]



Clinical algorithm for canine cardiopulmonary resuscitation. Adapted from Cole SG, Otto CM, Hughes D. Cardiopulmonary-cerebral resuscitation in small animals–a clinical practice review, Part II. J Vet Emerg Crit Care 2003;13:1323. Used with permission

Advanced Life Support[5]

Initiate ALS as soon as feasible, with ECG monitoring to guide management. Figure 31[2] and Table 10 direct specific actions based on the arrest rhythm present. In contrast to people, the most common arrest rhythm in MWDs is pulseless electrical activity (PEA; 24%), followed by asystole (23%), and then ventricular fibrillation (VF; 20%). Sinus bradycardia commonly precedes arrest in many situations in dogs.[2,5]

- 70% of MWDs that arrest will have PEA, asystole, or sinus bradycardia as the initial arrest rhythm.[2,5] Epinephrine or vasopressin are best choices for these rhythms or for empiric use if ECG capability is not available. In the deployed setting, there is no role for transthoracic pacing in MWDs with PEA or asystole.
- Bradycardia due to a pronounced vagal response is very common in dogs, and use of atropine may prevent development of cardiopulmonary arrest.
- VF, while present initially in only 20% of MWDs with an arrest rhythm, often develops during resuscitation.[2] Perform external defibrillation if possible and as rapidly as possible if VF is noted; biphasic defibrillation is ideal.[5,7] Apply paddles to either side of the chest with the MWD in dorsal recumbency (on its back), or place a flat paddle under the MWD lying in lateral recumbency and a standard paddle on the upper chest wall. Defibrillate up to 3 times at each energy level if prior attempts are not successful, but perform aggressive chest compressions for at least 2 minutes before attempting each defibrillation.
- IV access is critical. Place multiple IV or IO catheters or perform venous cut-down (See Chapter 6, Figure 33). Follow all drugs with a 10 mL saline push. Do not give large volumes of fluids to MWDs during CPR, unless severe hypovolemia is thought present. Give fluids initially to facilitate drug delivery only.

Tips for Successful CPR in MWDS[2,3]

- Avoid interrupting chest compressions! The key to successful resuscitation is to SUSTAIN chest compressions aggressively for 2-3 minutes before stopping to check status.
- Most people apply too little force when performing chest compressions! Do not be concerned with breaking ribs or injuring the heart or chest with BLS. In contrast to CPR in people, the thorax of MWDs is more compliant and fractures are rare.
- Maintain a steady and continuous rate of chest compression and ventilation. Minimize the number of times you stop to check the patient. Most people stop too frequently, which makes BLS less successful.
- During CPR, consider sodium bicarbonate (1-2 mEq/kg IV, repeated every 10 minutes) if metabolic acidosis (pH <7.0) is present, or empirically if CPR is prolonged >10 minutes.
- During CPR, consider magnesium sulfate (30 mg/kg IV, once) in patients with refractory VT.

Single Person CPR

Single-person CPR on dogs is extremely challenging, with very poor success rates, and should be initiated only if other personnel are immediately nearby and can be mobilized to assist in 1-2 minutes. If single-person CPR is performed, the responder should only perform chest compressions, as this optimizes circulation.

Post-Resuscitation Care[6]

Resuscitated MWDs will require intensive care to optimize long-term outcome. Many MWDs will arrest again, and most do so in the first 4 hours after resuscitation.[2,3] Successful return of spontaneous circulation and resuscitation are unlikely if an MWD arrests again, and HCPs should balance resources against repeated attempts at resuscitation. Key management issues for MWDs in the post-resuscitation phase follow.

- Control seizures that develop with diazepam or midazolam (0.3 mg/kg; IV, IO, or intranasally), repeated every 15-30 minutes if necessary. If available, give phenobarbital (15 mg/kg IV or IO) loading dose, and 2.5 mg/kg IV every 12 hours thereafter if seizures persist or status epilepticus develops.
- Prevent and reduce cerebral edema. Use mannitol (1 gram/kg, IV, twice, 4-6 hrs apart), avoid hyperventilation, give a single dose of dexamethasone (0.5 mg/kg IV) or methylprednisolone sodium succinate (30 mg/kg, IV, once), avoid jugular vein compression, and maintain normoxemia and normotension.
- Maintain adequate ventilation, maintaining a patent airway and using manual IPPV at 8-10 breaths per minute, targeting an E_TCO_2 of 25-60 mmHg.
- Maintain adequate oxygenation, targeting a SpO_2 > 95% using supplemental oxygen for a minimum of 12 hours.
- Maintain normotension using IV fluids in bolus challenges, targeting a MAP > 65 mmHg or Sys > 90 mmHg. Isotonic crystalloids at 10-15 mL/kg over 15 minutes are usually effective.
- Use synthetic colloids if 2-3 bolus challenges do not achieve normotension. Give 2-3 bolus challenges of hydroxyethyl starch (HES) at 10 mL/kg over 15 minutes. Once normotension is achieved, give crystalloid IV fluids at 3-5 mL/kg/hour for maintenance. Given the dismal outcome in post-resuscitation MWDs that require vasopressor support, there is no role in the deployed setting for vasopressor therapy in MWDs in the post-resuscitation phase.
- Control pathologic ventricular arrhythmias with a lidocaine CRI (50-75 mcg/kg/min).
- Do not attempt tight control of blood glucose with insulin. Supplement IV fluids if hypoglycemia is present (5% dextrose), but avoid hyperglycemia.
- There is no role for therapeutic hypothermia in MWDs during the post-resuscitation period. Avoid hyperthermia; tolerate mild hypothermia (>92° F) if it develops.

Discontinuation of CPR

CPR should be discontinued 1) if the animal is successfully resuscitated, 2) if the senior HCP directs that efforts cease, or 3) if effective CPR has been attempted for at least 20 minutes without success.

Resuscitative Thoracostomy and Open-Chest CPR

There is no role for open-chest CPR by HCPs in MWDs. Euthanasia is indicated for any MWD for which a resuscitative thoracostomy is deemed necessary to manage CPR (See Chapter 21).

TABLE 10. MWD CPR PROTOCOL.[2-7]

BASIC LIFE SUPPORT		
Focus	**Actions**	**Comments**
CIRCULATION	IMMEDIATE chest compressions FAST and HARD -- 100/min	SUSTAIN for 2 minute cycles!
AIRWAY	Clear airway > Intubate or Tracheostomy	Don't interfere with compressions!
BREATHING	Manually ventilate (100% oxygen) 8-10 breaths/min	Don't hyperventilate!

ADVANCED LIFE SUPPORT

- ECG interpretation is essential
- Venous access is critical -- Place multiple peripheral lines and/or IO catheters -- Consider central line when able
- Follow all drugs with 10 mL saline push
- Do NOT give large volumes of fluids during CPR, unless the MWD is hypovolemic

ASYSTOLE, PEA, SINUS BRADYCARDIA		
Drugs	**Dose and Route**	**Comments**
VASOPRESSIN ***and*** EPINEPHRINE	0.8 U/kg -- IV or IO — ***ONCE!*** 0.01 mg/kg -- IV or IO	70% of arrests have these initial arrhythmias. These drugs are best for empiric use if ECG is not available, or if indicated by ECG.
…and…		
ATROPINE	0.04 mg/kg -- IV or IO ***only if bradycardia preceded arrest***	

VENTRICULAR FIBRILLATION or PULSELESS VENTRICULAR TACHYCARDIA		
ELECTRICAL DEFIBRILLATION	2 - 5 Joules/kg (biphasic) 4 – 6 J/kg (monophasic)	Only 20% of patients present initially with these arrhythmias. However, V Fib and pulseless V tach often develop during CPR.
	Immediately start compressions for 1 cycle after every defib attempt	
	Defibrillate TWICE more if needed at same energy level, BUT ***resume chest compressions for 1 cycle after each defib***	
…DRUG THERAPY if DEFIBRILLATION UNSUCCESSFUL…		
EPINEPHRINE	0.01 mg/kg -- IV or IO	Give SODIUM BICARBONATE every 10 minutes during CPR if pH is <7.0 or CPR is prolonged more than 10 minutes. **1-2 mEq/L, IV**
…or…		
VASOPRESSIN ***and*** LIDOCAINE	0.8 U/kg -- IV or IO -- ***ONCE!*** 2 mg/kg -- IV or IO	
…or…		Give MAGNESIUM SULFATE if patient has refractory VENTRICULAR TACHYCARDIA. **30 mg/kg, IV, once**
AMIODARONE	5 - 10 mg/kg -- IV or IO	
DEFIBRILLATE at 50% INCREASED energy if REFRACTORY		

TABLE 10. MWD CPR PROTOCOL.[2-7] (Continued)		
POST-RESUSCITATION MANAGEMENT		
▪ Maintain NORMOTENSION -- Target MAP of >65 mmHg or Systolic BP >90 mmHg ▪ Maintain VENTILATION -- Target RR of 8 - 10 bpm -- Target E_TCO_2 of 25 - 60 mmHg; consider IPPV/MV if needed ▪ Maintain OXYGENATION -- Target SpO_2 >95% with supplemental oxygen as needed		
CONTROL SEIZURES		
MIDAZOLAM or DIAZEPAM		0.3 mg/kg -- IV, IO, or INTRANASAL *prn*
MANAGE CEREBRAL EDEMA		
MANNITOL	1 - 2 grams/kg -- IV over 30 min	▪ Avoid HYPERVENTILATION ▪ Avoid JUGULAR VENOUS ▪ COMPRESSION ▪ Avoid HYPERTHERMIA ▪ Tolerate MILD HYPOTHERMIA
and		
DEXAMETHASONE	0.5 mg/kg -- IV -- ONCE	
…or…		
METHYLPREDNISOLONE	30 mg/kg -- IV -- ONCE	
CONTROL PATHOLOGIC VENTRICULAR ARRHYTHMIAS		
LIDOCAINE	CRI @ 50 - 75 mcg/kg/min	CORRECT H's and T's FIRST
CONTROL HYPOGLYCEMIA		
SUPPLEMENT IV fluids with 5% dextrose -- MONITOR blood glucose q4-6 -- AVOID intensive glucose titration		

CPR References

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CHAPTER 6

Shock Management

Shock in deployed MWDs will most likely be due to hemorrhage from trauma or hypovolemia due to heat injury or gastrointestinal losses. Control bleeding (if present) and then stabilize the patient using targeted fluid therapy. Figure 33 provides a clinical management algorithm for shock management in MWDs.

Immediate Hemorrhage Control

Treatment by handlers and combat medics may have been performed, with varying degrees of success.[1,2] Expect dogs to arrive with pressure dressings, hemostatic gauze packed into wounds, and improvised tourniquets. Expect untreated or inadequately treated extremity hemorrhage, and suspect "hidden" intracavitary hemorrhage in the chest and abdomen.

- Assess for unrecognized hemorrhage and control all sources of external bleeding. Use direct pressure initially, or rapidly clamp and ligate major vessels if traumatized. Dogs have excellent collateral circulation, and paired major vessels can be ligated without concern for tissue ischemia or edema, to include the femoral arteries and veins, external jugular veins, external carotid arteries, and brachial arteries and veins.[3,4]
- Tourniquets are unreliable on the limbs of dogs due to the anatomic shape of the leg. Conventional human tourniquets do not remain in place or effectively control hemorrhage. Some success is reported in use of improvised tourniquets, such as surgical rubber tubing or constrictive gauze bandage. If delay in definitive care of major extremity trauma is expected, use hemostatic agents, direct pressure, and compressive bandaging to assist with hemorrhage control.
- Use thoracic FAST (TFAST) and abdominal FAST (AFAST) to rapidly scan for intracavitary fluid (See Chapter 4 and Chapter 7).[5,6] Assume intracavitary fluid is due to bleeding until proven otherwise.

Clinical Signs of Shock in MWDs[7,8]

Dogs in shock are amazing in how stable they appear on initial presentation, due to compensatory mechanisms.

- MWDs in early (compensatory) shock may have tachycardia, tachypnea, alert mentation, rapid arterial pulses with a normal or increased pulse pressure, decreased capillary refill time (< 2 seconds), and normal or bright red mucous membranes. While this MWD seems normal, it is already in compensatory shock. Immediate treatment at this point may stop the progression of shock.
- As the early decompensatory phase of shock begins, tachycardia persists, pulse pressure and quality begins to drop or may be normal, capillary refill time becomes prolonged, mucous membranes appear pale or blanched, peripheral body temperature drops, and mental depression develops. Aggressive treatment must be provided to halt ongoing shock.
- As late decompensatory shock develops, the heart rate drops despite a decreased cardiac output, capillary refill time is very prolonged or absent, pulses are poor or absent, both peripheral and core temperature is very low, and marked mental depression (stupor) is present. Irreversible cellular injury may be present to such a severe degree that despite aggressive measures at this point, many patients will die.

Standard Shock Therapy

Provide immediate fluid therapy targeted to specific endpoints, provide supplemental oxygen, and identify and treat the cause for the shock. Tranexamic acid (TXA) or ε-aminocaproic acid (EACA) may be helpful in dogs with catastrophic hemorrhage.

1. Place multiple large-bore IV or IO catheters or perform venous cut-down.

   - Do not delay in placing catheters. *The IO route is rapid, reliable and safe — USE IT!* Place peripheral or central lines when feasible. If one percutaneous attempt is not successful in a shock patient, immediately choose an alternate percutaneous site and also begin an immediate venous cutdown or perform IO catheterization. The cephalic veins and external jugular veins are ideal for peripheral catheterization.

   - The proximal cranial medial tibia and the proximal lateral humerus are ideal for IO catheter placement, using the same technique as for people (See Figures 34-37). Most MWDs weigh >40#, so use adult (25mm X 15 gauge) IO catheters. Use pediatric (15mm X 15 gauge) IO catheters in dogs weighing less than 40#.

2. Give crystalloid fluids as the first-line treatment.[9-14]

   - Normosol-R® or Plasmalyte-A® are optimal for dogs; however, saline or LRS are acceptable in emergent cases.

   - Crystalloid fluid challenges, as needed based on response to therapy, are better than large volume fluid administration.[11-13] Be prepared to administer up to 90 mL/kg of crystalloids in the first hour (1 blood volume for the dog). Aggressive, but careful, fluid delivery, with frequent reassessment of the patient's status, is critical. Most MWDs can be resuscitated with much less than this calculated maximum volume.

   - For quick reference, ADD a ZERO to the dog's body weight (***in pounds***) to approximate a safe but effective bolus volume. For example, a 45# dog would need about a 450 mL bolus, and a 75# dog would need about 750 mL as a bolus.

3. Use synthetic colloids and hypertonic saline (HTS) in dogs with refractory shock. Very limited data in dogs suggest increased risks,[15-18] but dogs do not seem as sensitive to the adverse effects of these fluids as are people. Two recent studies in dogs showed no adverse side effects, specifically acute kidney injury, with tetrastarch use.[19,20] The benefits outweigh the risks, so be aggressive with synthetic colloid and HTS.[15-17]

   - Give hydroxyethyl starch (HES) as an IV or IO bolus of 10-20 mL/kg total over 5-10 minutes if clinical signs of shock do not abate after the first 30 minutes or the first 2 bolus crystalloid challenges), or response to crystalloid challenges is not sustained.[11-13,15,20,21] Repeat this bolus if no response to therapy.

   - Use HTS IV boluses, if 7.0 - 7.5% HTS is available, for MWDs that fail to respond to 2 or 3 boluses of crystalloids and/or 1 or 2 boluses of HES. Give 4 mL/kg over 5 minutes.[11-13,20] Do not administer HTS by the IO route.

Standard Shock Therapy (continued)

4. Human serum albumin (HSA) use. Do not give HSA or other synthetic colloids (e.g., dextrans) to MWDs, because severe allergic reactions are possible (HSA) and coagulopathies are common (dextrans). Some data suggest benefit in a very limited subset of patients with severe hypoalbuminemia,[22,23] but risks far outweigh potential benefit in dogs with shock.

5. Blood product use. Canine blood products are not available for immediate HCP use.[2] Dogs cannot be transfused with human blood products. HCPs will have to manage hemorrhagic shock with crystalloid and colloid therapy.

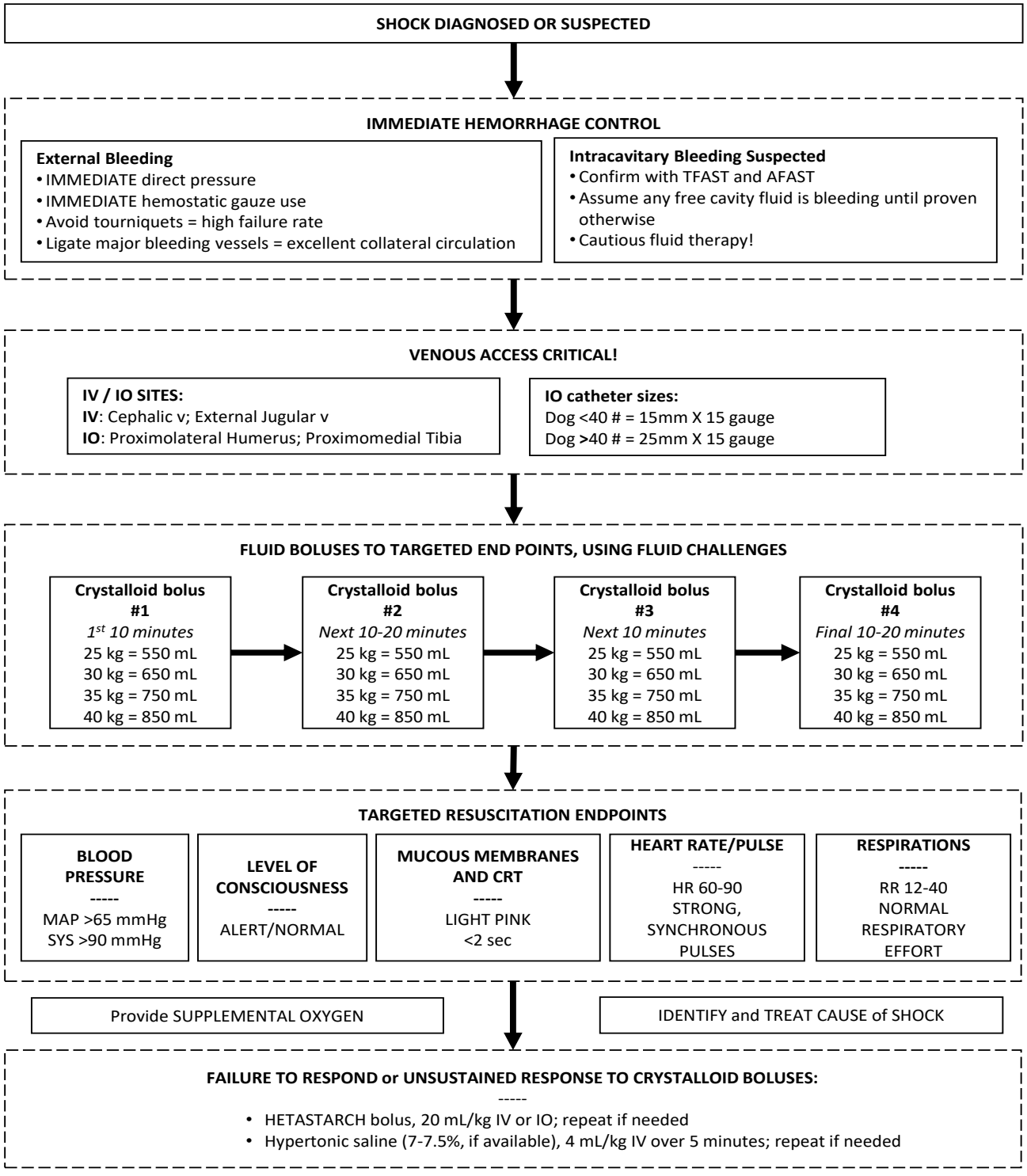
6. Tranexamic acid (TXA) and ε-aminocaproic acid (EACA) use. There is limited, but promising, data to guide use of TXA[24-27] and EACA[28] in dogs with hemorrhage. Dogs appear to be hyperfibrinolytic compared to humans, suggesting higher doses of TXA may be needed in dogs. Consider TXA or EACA if the dog is anticipated to need significant blood transfusion, such as severe hemorrhagic shock, limb amputation, penetrating torso trauma with severe non-compressible bleeding, because canine blood products are not available. Administer these drugs as soon as possible after trauma, but NO LATER THAN 3 HOURS post injury.
   - TXA: 10 mg/kg in 100 mL NS or LRS, IV over 15 min.
   - EACA: 150 mg/kg in 100 mL NS or LRS, IV over 15 min.
   - If bleeding continues, a CRI of additional TXA at 10 mg/kg/hour for 3 hours can be administered.

7. Targeted shock resuscitation end points that are practical for HCPs include systolic and mean arterial pressures, level of consciousness and mentation, mucous membrane color and capillary refill time, HR, RR, and pulse quality.
   - Target a MAP >65 mmHg or a Sys >90 mmHg. Note that neonatal or pediatric blood pressure cuffs must be used (See Chapter 2).
   - Target normal level of consciousness (LOC) and an alert mentation.
   - Target light pink-to-salmon pink MM and a CRT <2 seconds.
   - Target a HR that is 60-90 beats per minute at rest with a strong, synchronous pulse quality.
   - Target a respiratory rate at rest of 12-40 breaths per minute with normal effort.
   - Once shock has abated, continue IV crystalloid fluids at 3-5 mL/kg/hour for 12-24 hours to maintain adequate intravascular volume.

8. Provide supplemental oxygen therapy. Oxygen supplementation is critical. Every shock patient should receive supplemental oxygen therapy until stable (See Chapter 3).

9. Identify and treat the cause of shock. The cause of shock must be corrected, if possible.
   - Patients with massive intra-abdominal or intrathoracic bleeding need surgery to find the site of bleeding and surgically correct the loss of blood, with the caveats in mind as discussed previously.
   - Chapter 4 addresses emergent resuscitative thoracotomy. Chapter 7 addresses emergent abdominal laparotomy.
   - Euthanasia should be considered to prevent undue suffering for a MWD for which emergent surgery is deemed necessary but cannot be performed or has proven unsuccessful (See Chapter 21).

Figure 33. Clinical Management Algorithm for Shock Resuscitation in MWDs.



Figures 34-37. Intra-osseous Catheter Placement (Tibia) in a MWD.
Note: Sterile draping is removed to provide better visualization; perform catheterization using sterile technique.

Figure 34 shows the general landmark for IO catheterization on the upper medial aspect of the hind leg of the dog.

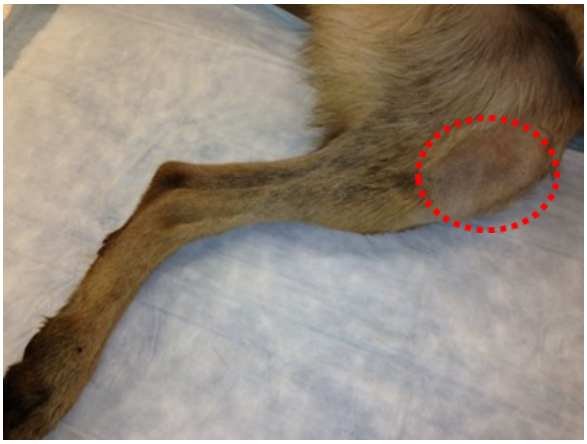


Figure 35 shows the intended insertion site (red oval) on the proximal medial tibial crest, just distal to the knee joint. The area should be clipped of hair and prepared for aseptic catheter placement.

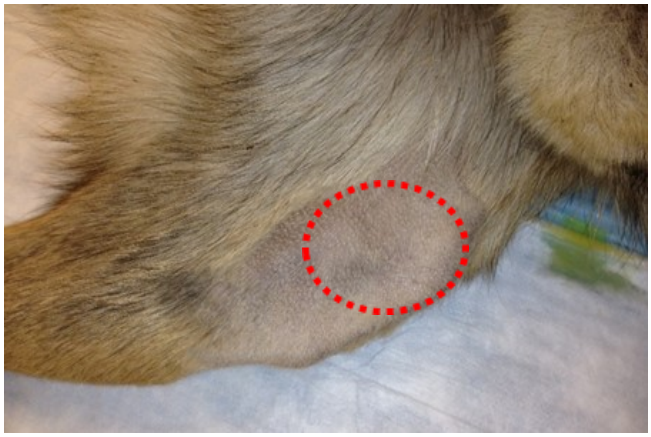


Figure 36 shows insertion of a pediatric IO catheter in the proximomedial tibia using the EZ-IO® device.

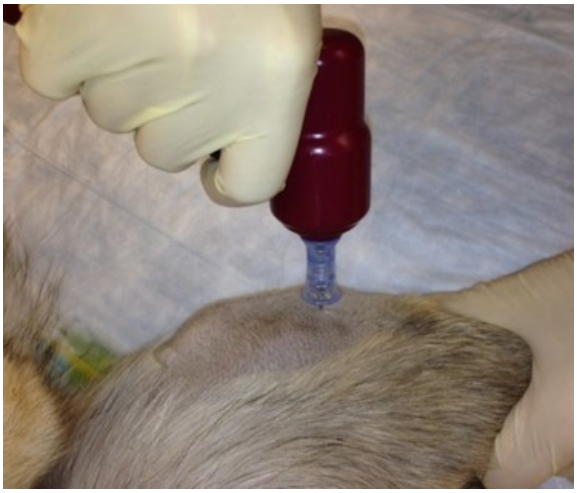
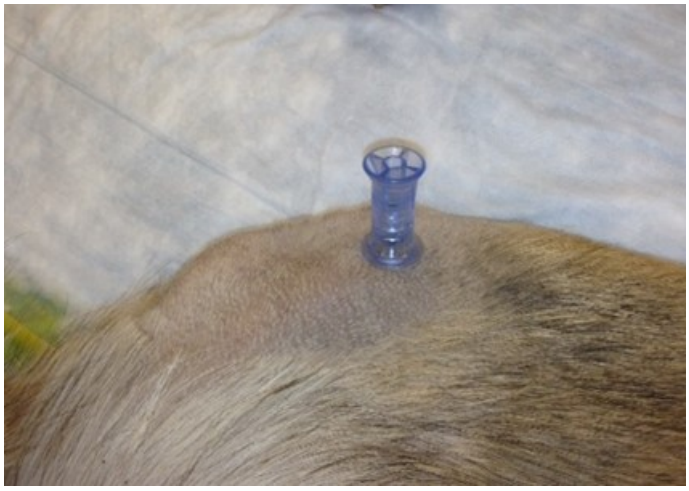


Figure 37 shows full insertion of the IO catheter, after removal of the stylet.



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Abdominal Trauma

Abdominal Injuries in Deployed MWDs

These injuries are the result of either blunt abdominal trauma (BAT) or penetrating abdominal trauma (PAT).[1-7] Management of these types of injuries differs markedly. Conservative medical management is usually indicated for MWDs with blunt abdominal trauma; whereas, urgent exploratory surgery is generally recommended for MWDs with penetrating injuries. A clinical management algorithm for MWDs with abdominal trauma is provided. (See Figure 38).

Physical Exam Finding Supporting Abdominal Trauma

Suspect significant intra-abdominal injury in any MWD that presents with abdominal rigidity or sensitivity to palpation, increasing abdominal size over time, visible bruising of the abdominal wall, or failure to respond to or deterioration in face of aggressive trauma resuscitation. Wounds involving more than the skin and superficial subcutaneous tissues dictate detailed examination to determine if the body wall was penetrated, and may require surgical exploration.

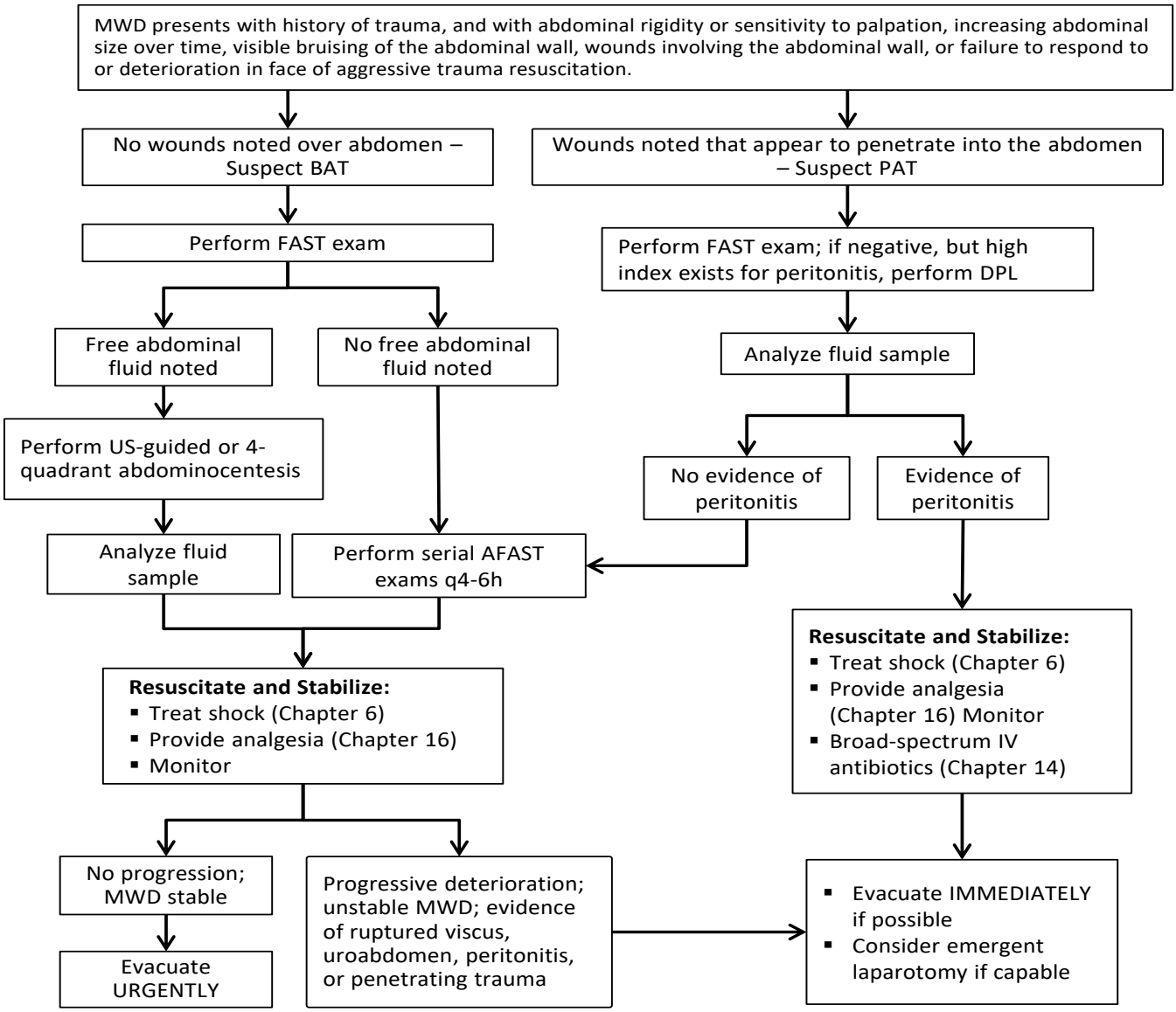
Diagnosis of Abdominal Trauma

The diagnostic method of choice for evaluating patients with suspected blunt abdominal trauma is the abdominal FAST (AFAST) exam, with ultrasound-guided or 4-quadrant needle abdominocentesis if free abdominal fluid is noted. Consider CT if advanced imaging is available.

Perform an AFAST exam during the initial evaluation phase of every MWD with a history of trauma, acute collapse, or weakness. FAST is proven in dogs to be extremely reliable in detecting free abdominal fluid and can be performed rapidly during resuscitation.[8]

- Examine 4 quadrants. Probe placement for dogs includes the diaphragmatic-hepatic site (DH) caudal to the liver, the splenorenal site (SR) around the left kidney, the cystocolic site (CC) cranial to the urinary bladder, and the hepatorenal site (HR) around the right kidney.[8] Figure 39 on page 51 provides a schematic showing probe placement in dogs. Fan the probe in the cranial-caudal and lateral-medial planes.

Figure 38. Clinical Management Algorithm for MWDs with Abdominal Trauma.



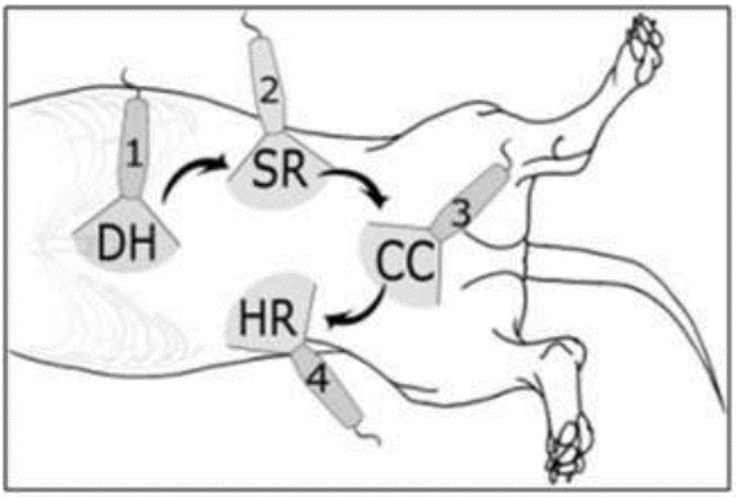


Figure 39. Imaging Locations for AFAST.

Figure 39 shows ultrasound probe placement sites for AFAST scanning of dogs. The dog's head is to the left; the dog is in right lateral recumbency.

DH = diaphragmatic-hepatic

SR = splenorenal

CC = cystocolic

HR = hepatorenal

- Score the AFAST exam, with 1 point for each quadrant that has free fluid identified. Perform serial FAST exams every 4-6 hours and compare scores. MWDs with increasing scores should be monitored closely and prepared for URGENT evacuation or surgery, as exploratory surgery may be necessary for MWDs with scores of 3/4 or 4/4[8] or with clinical deterioration.

Perform a 4-quadrant abdominocentesis in any patient with free fluid in the abdomen.[9] This technique is quick and easy to perform, and usually differentiates abdominal hemorrhage or biliary or urinary tract injury. The general rule of thumb is that a positive peritoneal tap is a reliable indicator that some hemorrhage has occurred or that free urine or bile is in the abdominal cavity, but that a negative tap does not rule these out.

- Place the dog in lateral recumbency. Clip the abdomen of hair and prepare for aseptic procedure.
- "Divide" the abdomen into 4 quadrants, and tap each quadrant sequentially, unless a positive yield is obtained in a quadrant. Perform abdominocentesis on the "down" quadrants, rolling the dog over for the opposite quadrants.
- A large bore needle (18 or 20 gauge) is quickly inserted perpendicular to and through the body wall approximately 2 inches off the midline in each quadrant. Alternatively, a large bore over-the-needle catheter can be aseptically fenestrated and inserted into the abdomen. This increases the likelihood for higher yield because the fenestrations are less likely to occlude.
- The presence of blood suggests intra-abdominal hemorrhage, and the presence of clear or yellowish fluid suggests urine.
- As much sample is collected by gravity drip or slight suction with a 3 cc syringe and saved in serum tubes and EDTA tube. The fluid is analyzed cytologically, and for glucose, lactate, hematocrit, total protein concentration, BUN or creatinine, bilirubin, amylase or lipase, ALT, and ALKP.
  - Assess cytology for the presence of bacteria or other organisms, or fecal or food material that would suggest gastrointestinal rupture and contamination.
  - The peritoneal fluid glucose and lactate concentrations can be measured and compared to serum levels to aid in differentiating possible septic peritonitis in the absence of cytological evidence. An increased abdominal fluid lactate >2.5 mmol/L or an abdominal fluid-to-peripheral blood lactate

difference of >2 mmol/L strongly suggests a septic peritonitis.[10,11] An abdominal fluid glucose concentration that is >20 mg/dL lower than peripheral blood glucose concentration strongly suggests a septic peritonitis.[10,11]

- The hematocrit and total protein concentration are compared to a simultaneously collected peripheral blood sample. If the hematocrit and total protein concentration are similar, significant hemorrhage into the abdomen is probable, and surgical intervention may be necessary, but base this decision on the patient's status more than the actual number. If the hematocrit and total protein concentration of the abdominal fluid are very low, minor hemorrhage is more likely, and a more conservative approach – based on the patient's status – is recommended.

- The presence of bilirubin suggests gall bladder injury, although this may not be present for several days after trauma.[9] Amylase or lipase with values higher than systemic circulation suggests pancreatic trauma. A ratio of 1.4:1 in comparing abdominal fluid potassium with peripheral blood potassium concentrations has 100% sensitivity and specificity for uroperitoneum.[12] Comparison of abdominal fluid creatinine to peripheral blood creatinine concentrations shows 86% sensitivity and 100% specificity for ratios >2:1.[12] Elevated ALT suggests direct liver injury, and elevated ALKP suggests bowel injury or ischemia, but these are non-specific and can rarely be used to guide management decisions.

Consider diagnostic peritoneal lavage (DPL) in any MWD in which major abdominal trauma is suspected, but AFAST and abdominocentesis are unrewarding.[9] If available, CT or MRI may be better modalities.

- Use a specialized DPL catheter or aseptically fenestrate a large bore over-the-needle (OTN) catheter.
- Sedate the patient if necessary and locally anesthetize the site of catheter insertion using 20 mg lidocaine.
- Percutaneously insert the catheter; a small stab incision may be needed if a larger catheter is used.
- Immediately after entering the abdominal cavity, remove the needle and advance the catheter in a caudodorsal direction to avoid the omentum and cranial abdominal organs.
- Infuse 20 mL/kg warmed, sterile saline aseptically over 5-10 minutes.
- Aseptically plug the catheter and gently roll the MWD from side to side for several minutes to allow the infusate to mix.
- Either aspirate effluent or allow gravity-dependent drainage to collect a sample for analysis.
- Analyze the sample for the same parameters described for abdominocentesis.

Blunt Abdominal Trauma (BAT)

The usual organs in MWDs subjected to blunt trauma are the spleen, liver, and urinary bladder, in this order of frequency. Splenic and hepatic injuries are usually fractures of the organ; major vessel trauma is uncommon.[1-7]

- Intra-abdominal hemorrhage. Most hemoperitoneum cases in MWDs are due to splenic and hepatic frac-

tures, which can vary markedly in size, with a significant difference in quantity of blood lost into the abdomen.

- The majority of MWDs with BAT and intra-abdominal hemorrhage that survive to admission can be successfully managed conservatively, since most of the time the source of hemorrhage is small liver and splenic fractures. These usually will spontaneously cease bleeding given time and conservative fluid therapy. Monitor the MWD closely, as some will require exploratory laparotomy and surgical correction of hemorrhage, especially those that do not respond or deteriorate.
- Given the difficulty in maintaining an abdominal counterpressure bandage, and the risk of respiratory compromise, do not apply an abdominal counterpressure bandage on a MWD.
- Patients with massive intra-abdominal bleeding need surgery to find the site of bleeding and surgically correct the loss of blood. There may be instances in which emergent laparatomy is necessary by HCPs to afford a chance at patient survival. See **Emergent Abdominal Laparotomy** in this chapter for guidance.

- Urinary tract trauma. Urinary bladder rupture, with uroperitoneum, is fairly common, especially if the animal had not voided before the trauma.
  - MWDs with acute urologic trauma and uroperitoneum should be stabilized for other injuries, and aggressively managed for shock. Primary repair of a ruptured urinary bladder or other urologic injury must wait until the patient stabilizes to minimize the risk of complications associated with taking an unstable patient to surgery.
  - In many cases, urologic injury is not apparent for several days after trauma, so a high index of suspicion must be maintained. Special studies (ultrasound, excretory urography, contrast urethrocystography) may need to be performed to rule out urologic trauma.
  - In patients with known urologic tears and urine leakage, abdominal drains may be indicated if surgery is delayed for several days while the patient stabilizes. This will allow removal of urine, which will minimize chemical peritonitis and electrolyte and acid-base imbalances (metabolic acidosis, hyperkalemia). Intensive fluid therapy to correct or prevent electrolyte and acid-base imbalances is often necessary, especially if several days have passed since traumatic injury.
  - Surgical repair must only be performed after the patient is stabilized. Patients with severe uroabdomen need surgery to define the extent of injury and correct the problem. There may be instances in which emergent laparatomy is necessary by HCPs to afford a chance at patient survival. See **Emergent Abdominal Laparotomy** in this chapter.
- Ruptured abdominal viscus. Patients with a ruptured gastrointestinal viscus are candidates for emergent exploratory surgery to identify the part of the tract that is injured and allow primary repair. Delay in repairing bowel perforation can rapidly lead to septic peritonitis, septic shock, and rapid patient deterioration.[13]

TABLE 11. ANTIBIOTIC SELECTION AND DOSING FOR MWDS			
ANTIBIOTIC	**DOSE FOR MWD**	**ROUTE**	**FREQUENCY**
Amoxicillin-Clavulanic Acid	13.75 mg/kg	PO	q 12 h
Ampicillin Sulbactam	20 – 30 mg/kg	IV q	8 h
Cefazolin	20 -30 mg/kg	IV q	8 h
Cefotaxime	22 mg/kg	IV q	8 h
Ceftriaxone	25 mg/kg	IV q	8-12 h
Cephalexin	20 – 30 mg/kg	PO q	12 h

- Broad-spectrum antibiotic therapy is vital, especially against anaerobic and gram negative bacteria. Table 11 lists antibiotic options for initial use in MWDs with ruptured viscus or septic peritonitis.
- Shock management is of special importance. Every attempt must be made to stabilize the patient as much as possible, with URGENT evacuation to a veterinary facility for definitive repair.
- Patients with ruptured abdominal viscus need surgery to define the extent of injury and correct the problem. There may be instances in which emergent laparatomy is necessary by HCPs to afford a chance at patient survival. See **Emergent Abdominal Laparotomy** in this chapter for guidance.

Penetrating Abdominal Trauma

Exploratory laparotomy as a diagnostic and therapeutic modality is clearly indicated in trauma patients if penetrating trauma is highly suspected or known, or if the patient's status deteriorates despite aggressive resuscitation attempts and major organ hemorrhage or injury is suspected or known.[13]

- Non-invasive diagnostic imaging is recommended in an attempt to confirm a suspicion of major internal organ injury. Perform AFAST, abdominocentesis, and/or DPL as necessary, and advanced imaging if available.
- Patients with penetrating abdominal injuries and a high index of suspicion for peritonitis, bowel injury, ruptured viscus, major hemorrhage, or other life-threatening problem need emergent surgery to further define the extent of injury and provide corrective surgery. There may be instances in which emergent laparatomy is necessary by HCPs to afford a chance at patient survival. See **Emergent Abdominal Laparotomy** in this chapter for guidance. Empiric antibiotic therapy is critical (See Table 11).

Emergent Abdominal Laparotomy

Some patients with severe abdominal trauma require surgery to define the extent of injury and attempt repair of the problem, remembering the caveats discussed previously.[13]

- Surgical management includes an approach through the ventral midline under general anesthesia with the dog in dorsal recumbency, to expose the abdominal cavity.

- A complete abdominal exploratory is necessary to define all injuries. Routine exploratory techniques used for people are appropriate for dogs.
- Surgical management will depend on the injuries noted. Expect hemoabdomen, liver and spleen trauma with hemorrhage, major vessel injuries with hemorrhage, bowel perforation, hollow viscus injuries, urinary tract injuries, and abdominal wall injuries. Repair of injuries in the dog is essentially the same as repair in human casualties.
- Abdominal wall closure is in 3 layers: 0 non-absorbable simple interrupted linea alba closure; 2-0 absorbable simple continuous subcutaneous closure; routine skin closure.

Abdominal Trauma References

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CHAPTER 8

Gastrointestinal Emergencies

Among other gastrointestinal emergencies, MWDs are at increased risk for development of two life-threatening gastrointestinal emergencies: Gastric Dilatation-Volvulus Syndrome, and mesenteric volvulus.[1-3]

Gastric Dilation-Volvulus Syndrome (GDV or "bloat")

GDV is a multifactorial, rapidly progressing, life-threatening surgical emergency common in large-breed dogs, to include MWDs.[4] In GDV, the stomach rapidly dilates (gastric dilation) with fluid, food, and air, and then rotates along the long axis (volvulus). When volvulus develops, the esophagus and duodenum become twisted, preventing passage of stomach contents. The amount of air, food, and fluid that accumulates is dramatic and progressively worsens – typically over 30 minutes to 4 hours – and causes shock by interfering with venous return from the abdomen and pelvic limbs. Death in cases of GDV in the short-term is due to shock. Death in the long-term is due to gastric wall necrosis and rupture with secondary sepsis, DIC, or cardiac arrhythmias.[4-5]

Most MWDs have had a prophylactic gastropexy performed before deployment. This elective surgical procedure creates a surgical adhesion between the stomach and the inner abdominal wall that is very effective at preventing volvulus. While gastric dilation (GD) can still occur, this in and of itself is seldom severe enough to cause shock, since accumulated gas and stomach contents can be vomited or passed into the bowel. However, HCPs should recognize that many deployed working dogs operated by Allied military forces and DoD contractors likely have not been gastropexied, and – in rare cases – a gastropexy can fail, and GDV must be a differential in dogs with typical signs.

Clinical Signs of GDV

GDV patients classically present with a constellation of clinical signs that should prompt immediate evaluation. MWD handlers are trained to recognize these signs, and handlers may have performed emergency care before the dog is presented to a MTF, to include gastric decompression.

Early signs of GDV include varying degrees of abdominal distention (tympany) from stomach filling with air, food, and fluid; nonproductive retching, attempted vomiting without result, or retching a small amount of saliva ("dry heaves"); signs of pain (grunting, especially when the stomach or abdomen is palpated); signs of anxiety, which is commonly noted as pacing, anxious stares, and inability to get comfortable when lying down; and signs of compensatory shock (tachycardia, tachypnea).

As GDV progresses, clinical signs of advancing shock ensue. MWDs may present at any time in the continuum of the syndrome, and often present *in extremis* if recognition or care has been delayed.

HCPs should assume GDV is present and take immediate action if an MWD presents with signs of shock, abdominal distension, non-productive vomiting or retching, and signs of anxiety or pain.

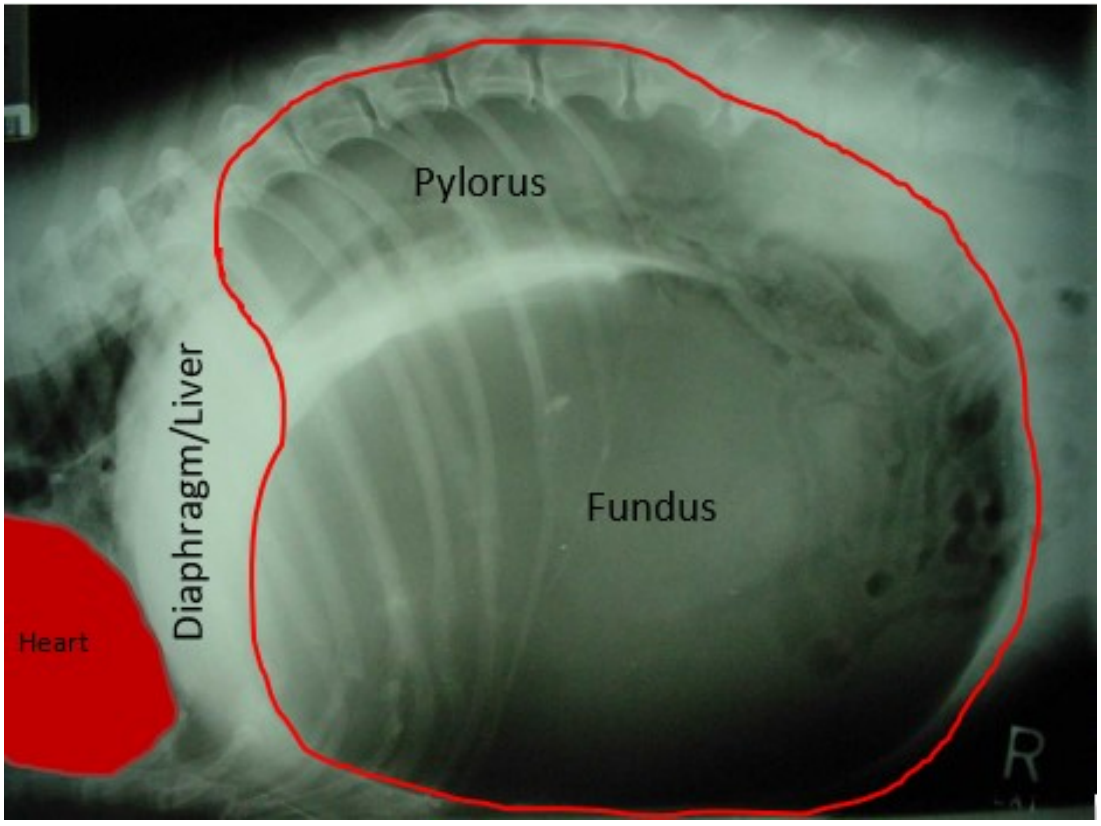
Definitive Diagnosis of GDV

Confirmation of GDV is based on abdominal radiographs that demonstrate marked gastric dilation with air (See Figure 40). Radiography, if available, is recommended if there is doubt about the diagnosis, as other conditions (e.g., hemoperitoneum, abdominal neoplasia, ascites) mimic some of the signs of GDV. Generally, a single right lateral radiograph is sufficient.

Management of GDV

A management algorithm is provided (See Figure 41). The hallmark immediate treatment of GDV includes rapid decompression of gas from the dilated stomach, shock therapy, monitoring for complications, repeated decompression if dilation recurs, and rapid evacuation to veterinary facilities for definitive surgery. GDV is a surgical emergency; surgery is required to derotate the stomach and perform gastropexy, and to perform partial gastric resection or splenectomy if warranted, with extended monitoring for common life-threatening sequellae in the post-operative period.

Figure 40. Radiograph with Gastric Dilation Volvulus.
Figure 40 shows a right lateral radiograph of a dog with marked gastric dilation due to GDV. Head is to left. Red line depicts general outline of the massively distended stomach, with the pylorus malpositioned dorsal to the fundus.



GDV Management Summary

- **Treat shock.** Provide 100% oxygen (See Chapter 4). Administer intravenous fluids to targeted end-points (See Chapter 6, Figure 33).
- **Decompress the stomach by percutaneous trocarization of the stomach:**
- Position yourself on the left side of the patient, or lay the dog with its left side down (left lateral recumbency).
- **Locate the insertion point:**
  - Palpate the last rib.
  - Move the hand 2 inches caudal to the last rib, midway between the spine and the ventral border of the abdomen on the right side.
  - Auscult the lateral abdominal wall at the most distended area while percussing (flicking) the abdominal wall firmly with a finger. This percussion will elicit a "pinging" sound, and the site of insertion of the trocar should be at the point of loudest "pinging."
- Clip the hair over a 6-inch X 6-inch area over this area. Prepare the area using surgical scrub.
- Forcefully insert a 10-14 gauge trocar or 14-18 gauge IV over-the-needle catheter through the skin, abdominal wall, and stomach wall. Note gas or air escaping through the trocar/needle from the stomach to signify a successful trocarization.
- Note: If no air or gas is coming from the trocar, attempt gastric trocarization one more time. If still unsuccessful, do not attempt any further trocarizations. Emergent surgery is indicated if trocarisation is not possible.
- Gently apply external pressure to the abdominal wall to assist in decompressing air from the stomach.
- Once the majority of the air is evacuated, remove the trocar/needle, because leaving it inserted may cause trauma to internal organs.

Common Complications Associated with GDV

Monitor for the most common complications seen in MWDs with GDV, to include ventricular arrhythmias, persistent shock, recurrent gastric dilation, nausea and vomiting, ileus, electrolyte abnormalities (especially potassium), and metabolic acidosis. Multi-organ failure may develop, depending on the degree and duration of shock.

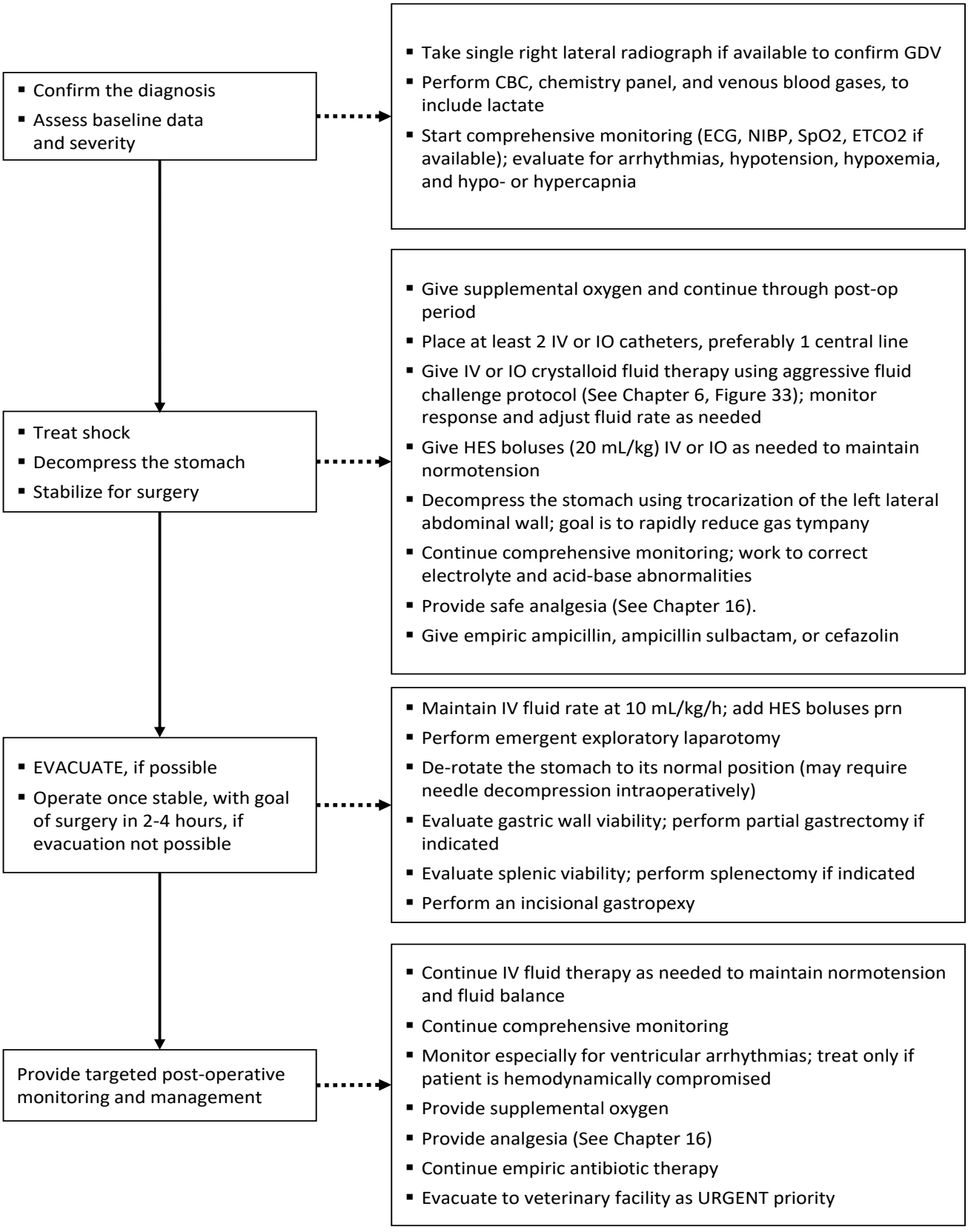
Definitive Surgical Management of GDV

Evacuate the MWD to a veterinary facility as soon as it is stabilized. Any MWD with GDV should be considered an URGENT casualty. Definitive surgical management – consisting of exploratory laparotomy, derotation of the stomach, gastropexy, and possible partial gastric resection and/or splenectomy – requires trained personnel intimate with the anatomy and physiology of the dog.

Emergency surgical exploration of the abdomen and attempted surgical management of GDV by HCPs in the deployed setting may be necessary if evacuation will be delayed more than 4-6 hours.

- It is essential to counter shock and stabilize the dog before considering operative management.
- Surgical management includes an approach through the ventral midline under general anesthesia, with the dog in dorsal recumbency, to expose the abdominal cavity (See Chapter 16.)
- GDV is confirmed once the abdomen is open by identifying a dilated stomach covered by omentum.
- The stomach is de-rotated to its normal position by grasping the stomach on both extreme lateral aspects simultaneously, and rotating the stomach counterclockwise (when viewed from the dog's right side in dorsal recumbency).
- A markedly tympanic stomach may need to be further decompressed by intraoperative needle decompression with suction to allow adequate manipulation.
- Typically, the gastric wall has variable degrees of bruising, especially at the cardia, and may have developed partial- or full-thickness necrosis. If bruising persists or worsens intraoperatively, or if gastric wall necrosis is suspected, perform a partial gastrectomy of suspect gastric wall. Gastrectomy is ideally performed using TA or GIA surgical stapling equipment or an inverting double-layer gastric wall suture pattern of non-absorbable suture. Note that postoperative mortality in dogs that require gastrectomy is approximately 25 -35%, compared to mortality <10% in dogs that do not require gastrectomy.
- Typically, intra-abdominal bleeding is encountered due to rupture of the short gastric arteries and/or splenic injury. Assess the viability of the spleen and perform splenectomy if splenic thrombosis, marked splenic vessel injury and bleeding, or splenic lacerations are noted. Arcade ligation, with special attention to the major splenic vessels, is optimal, and is best done with LDS stapling equipment (for vessels <4 mm diameter) and suture ligation (for vessels >4 mm diameter) using transfixation sutures.
- Perform an incisional gastropexy (to prevent future GDV). Create a 3-4 cm incision in the seromuscular layer of the right pyloric area of the stomach wall. Create a similarly-sized incision in the right ventrolateral abdominal wall musculature. Appose the margins of the gastric wall incision against the margins of the incision in the abdominal wall musculature and create a gastropexy by suturing each margin using 0 or 2-0 non-absorbable suture.
- Abdominal wall closure is in 3 layers: 0 non-absorbable simple interrupted linea alba closure; 2-0 absorbable simple continuous subcutaneous closure; routine skin closure.

Figure 41. Clinical Management Algorithm for Gastric Dilatation-Volvulus (GDV) in Military Working Dogs.



Mesenteric Volvulus

Mesenteric volvulus (MV) is a rapidly progressive and often fatal condition in which intestinal rotation develops around the root of the mesentery. Although rare, it appears to be increasing in frequency in MWDs.[3] The case fatality rate was 92% in a recent report of 54 MWDs with MV; of these 24% were found dead and 76% were identified antemortem, and only 14% of the 126 reported cases have survived.[3] Rapid recognition is necessary to afford MWDs a chance at survival.

- In MV, the cranial mesenteric blood vessels and branches obstruct due to rotation, causing ischemic necrosis of the aborad duodenum, all the jejunum, ileum and cecum, ascending and transverse colon, and orad descending colon.
- Death is due to rapidly progressive vascular obstruction, intestinal anoxia, shock, endotoxemia, and cardiovascular failure.[3]
- Statistical analysis of MV in 54 MWDs[3] suggests key risk factors include German shepherd breed, age, prophylactic gastropexy or other abdominal surgery, history of gastrointestinal disease, use of nonsteroidal anti-inflammatory drugs, and increased humidity on the day of occurrence.

Clinical Signs and Imaging Findings Suggesting MV

- Peracute-to-acute onset of vomiting, mild abdominal distension, and shock.
- Hemorrhagic diarrhea with or without tenesmus.
- Intense abdominal pain on palpation.
- Rapidly progressive deterioration in clinical presentation.
- Extreme gas distension of the majority of the small and large bowel (See Figure 42 below).

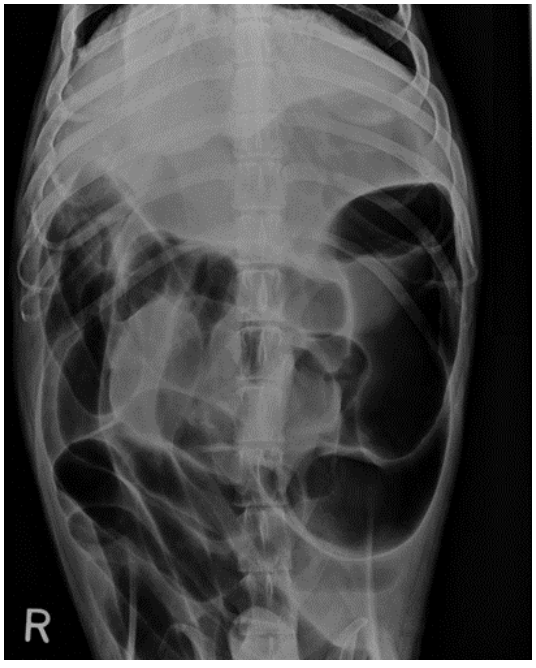
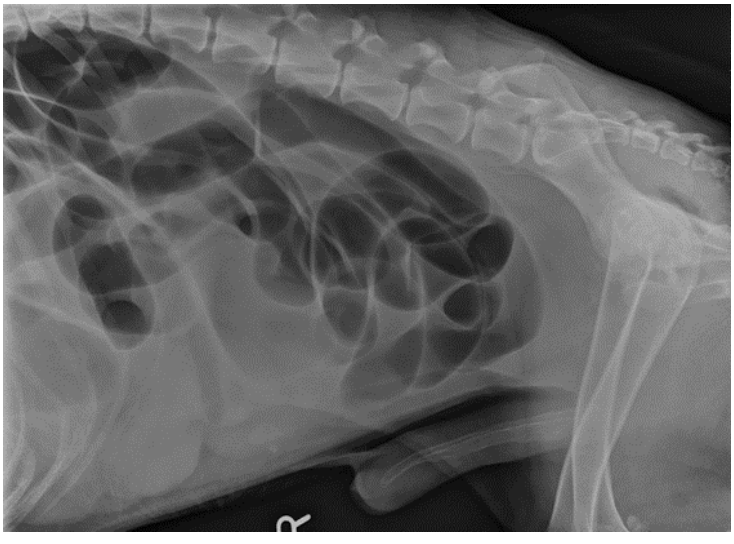


Figure 42. Lateral and ventrodorsal abdominal radiographs of a dog with MV, demonstrating near complete and severe gas distension of the entire bowel.



Emergent Management of MV

MV is a true surgical emergency. The hallmark immediate treatment of MV includes rapid assessment and determination of the need for emergent abdominal surgery, and aggressive shock therapy – err on the side of emergent abdominal laparotomy if clinical signs and imaging suggest MV. It is unlikely the dog can be evacuated soon enough to veterinary facilities, so be prepared to operate in the MTF. Extended monitoring for common life-threatening sequellae is required in the post-operative period.

Treat shock:

- Provide 100% oxygen (See Chapter 4).
- Administer intravenous fluids to targeted endpoints (See Chapter 6, Figure 33).

Perform emergent exploratory laparotomy:

- It is essential to begin to counter shock as you prepare for surgery.
- Surgical goals are to confirm the diagnosis, determine surgical options, and assess prognosis.
- Surgical management includes an approach through the ventral midline under general anesthesia (See Chapter 16), with the dog in dorsal recumbency, to expose the abdominal cavity.
- Operative management by resection and anastomosis should only be considered if the following conditions are met:
  - The duodenum is intact in its entirety;
  - At least 2cm of healthy ileum is present;
  - At least 50% of the jejunum is assessed to be viable;
  - No large bowel is affected.
- Abdominal wall closure is in 3 layers: 0 non-absorbable simple interrupted linea alba closure; 2-0 absorbable simple continuous subcutaneous closure; routine skin closure.

Euthanasia should be considered for an MWD presenting in extremis, or in dogs that fail to respond to therapy, that deteriorate despite care, or in which operative management is not feasible (See Chapter 21).

Common Complications Associated with MV

Monitor for the most common complications seen in MWDs with MV, to include ventricular arrhythmias, persistent shock, septic peritonitis, nausea and vomiting, ileus, and metabolic acidosis. Multi-organ failure may develop, depending on the degree and duration of shock.

Gastrointestinal Emergencies References

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CHAPTER 9

Heat Injury

Heat loss in dogs is via convection, conduction, and evaporative loss, contrasted to radiant heat loss of humans.[1] Panting is the only significant cooling mechanism for dogs. A recent study[2] in exercising MWDs demonstrates that temperatures up to 106^0 F are not uncommon in healthy MWDs during work, and that body temperature continues to increase over the course of 15 minutes after exercise; dogs not affected with heat injury rapidly normalized their temperatures within 15-20 minutes.

In MWDs, heat-induced injury usually develops due to heavy exertion in environments with high temperatures, compounded by high humidity and/or inadequate acclimation. Rarely, MWDs may develop heat-induced injury if left in or trapped in closed vehicles or containers in high-heat environment, or due to partial airway obstruction of any cause. The subsequent hyperthermia exceeds the capability of the MWD to compensate.

There are three types of heat-induced injury in veterinary patients, based on the severity of the resulting injury: mild ("heat stress"), moderate ("heat exhaustion"), or severe ("heat stroke"). Severe heat injury is associated with a mortality rate of 50-64%.[3-5]

Mild Heat Injury[6-9]

- Mild heat injury is characterized clinically by development of excessive thirst, discomfort associated with physical activity, but with controlled panting (i.e., the patient can control or reduce panting when exposed to a noxious inhalant such as alcohol).
- Treatment of mild heat injury involves removing the patient from the source of heat, stopping exercise, cooling by use of fans or movement to an air-conditioned area, and offering cold water for the dog to drink.
- Close monitoring for several hours is necessary to ensure heat stress does not progress, or rebound hypothermia does not develop.
- Key parameters to monitor, in addition to frequent body temperature measurement, include changes in mentation, development of petecchiae or ecchymoses, hematuria, weakness or collapse, clinical signs of shock (e.g., tachypnea, tachycardia, weak pulse quality, pale mucous membranes), and anxiety or restlessness.

Moderate Heat Injury[6-9]

- Moderate heat injury is present when the signs of heat stress are present, as well as weakness, anxiety, and uncontrolled panting (i.e., the patient cannot reduce or stop panting when exposed to a noxious inhalant), but CNS abnormalities are not present.
- Treatment of moderate heat injury is the same as for heat stress, but more aggressive measures at cooling are often necessary.
- The patient must be removed from the source of heat and all activity must be stopped.
- Cooling by use of fans or movement to an air-conditioned area should be done if possible. The hallmark treatment for moderate and severe heat injuries is to thoroughly soak the hair coat to the skin with tepid water to reduce core body temperature.
- Close monitoring for several hours as stated for heat stress is necessary to ensure heat exhaustion does not progress, or rebound hypothermia does not develop.

Severe Heat Injury[3-9]

- Severe heat injury is present when signs of heat exhaustion are present, coupled with varying degrees of central nervous system (CNS) abnormalities (encephalopathy). The most common CNS abnormalities include changes in mentation and level of consciousness (e.g., obtunded, stupor, coma), seizures, abnormal pupil size, cortical blindness, head tremors, and ataxia. Heat stroke is a life-threatening condition.
- It is characterized by a severe increase in core temperature and widespread, multiple organ injury with risk of progression to multi-organ failure.
- No specific body temperature defines heat stroke in MWDs; however, temperatures as low as 105.8°F have been associated with pathology. Most commonly, heat stroke is seen in MWDs with rectal temperatures >107°. Studies report multiple serious complications and high fatality rates in heat stroke patients despite proper treatment.[3-5] Table 12 describes the management of MWDs with heat-induced injury.

Initial Management Considerations for Heat-injured MWDs[7,10]

- Triage of the MWD with heat injury is similar for other types of injury or illness, but with emphasis on assessing mentation, airway and breathing, circulation, and body temperature. MWDs typically present with obtundation or stupor; however, heat stroke patients can be alert and responsive, stuporous, or comatose. MWDs presenting in stupor or coma are in imminent danger of death. Some heat stroke patients present actively seizuring.
- Anticipate that in a state of hyperthermia, the patient's initial physiological response will be to move blood to the surface vessels to maximize conductive cooling. The initial phase will generally include renal and

splanchnic vasoconstriction, peripheral vasodilatation, and increased cardiac output. Over time, if the body temperature remains high, splanchnic and renal vasoconstriction will eventually fail, creating conditions favorable for venous pooling and hypovolemia or distributive shock. Monitor continuous ECG, blood pressure, mucus membrane color, and capillary refill time.

- Rectal temperature may lag behind core body temperature by up to 15 minutes.[3] Heat stroke patients may therefore be hypothermic, hyperthermic, or normothermic upon presentation, based on cooling measures initiated by the handler and length of time since onset of heat stroke.

Emergency Management of Heat Injury[7,10,11]

- Intubate MWDs if apneic or not breathing adequately; maintain IPPV at 8-12 breaths/minute. Protect the airway if intubated while cooling with water, to reduce chances of aspiration of running water. Provide supplemental oxygen until normoxemia is confirmed with the MWD breathing room air. Use "blow by" technique if not intubated (See Chapter 3), as oxygen masks can increase humidity and prevent maximal heat dissipation.

- MWDs with a rectal temperature > 105° F require emergency cooling measures. Use a combination of cooling methods! The rate of cooling should be as rapidly as possible until the body temperature is 105° F. The most practical, most expedient, and most rapid method to reduce body temperature is to soak the patient thoroughly to the skin with room-temperature water. The patient can be placed under running tepid water in a well-drained tub or submerged partially in a tub of tepid water. The key is to soak the entire MWD as rapidly as possible, and to soak through the hair coat to soak the skin thoroughly.

- The value of intravenous fluids in patient cooling and support cannot be overstated. Unless there are specific contraindications, intravenous fluid therapy using room-temperature fluids should be initiated for any MWD with heat stroke. Adequate circulating blood and plasma volume are required for conduction to maximize heat dissipation, and IV room-temperature fluids reduces core body temperature.

- Use additional cooling methods! Direct fans on the MWD to facilitate surface cooling. If possible, move MWD to a cool room or reduce the ambient temperature of the treatment room.

- Use of cold intravenous fluids, ice-water baths, and surface cooling with ice water or ice packs are contraindicated because they cause peripheral vasoconstriction with sustained increase in core temperature, cause shivering which generates more internal heat, and promote capillary sludging which contributes to coagulopathy. Placing isopropyl alcohol on the footpads is commonly done, but is ineffective because the paw pads have such a small surface area.

- Once the patient's body temperature is <105°, the rate of cooling can be reduced to avoid rebound hypothermia. Discontinue ancillary cooling measures (e.g., remove fans, return room temperature to normal), and dry the MWD's skin.

- Once the MWD's body temperature is <103°, provide supportive warming, cease all cooling efforts, monitor temperature continuously, and be prepared to actively warm the patient to prevent an excessive drop in body temperature (rebound hypothermia). Although warming a patient with a temperature of 103° F may

seem counterintuitive, HCPs should anticipate a period of rebound hypothermia, and understand that the delay between rectal temperature and true core temperature likely means that the true core temperature may be lower.

- HCPs should evacuate any MWD heat stroke casualty to veterinary facilities on an URGENT basis if feasible.

Monitor and Treat Concurrent or Developing Problems[7,10,11]

- Shock is common in MWDs with heat stroke. Manage shock (See Chapter 6, Figure 33). Monitor blood pressure, lactate clearance, clinical assessment of perfusion, and assessment of volume status until the MWD is evacuated.

- Glucose, acid-base, and electrolyte abnormalities are common. If able, monitor blood glucose and venous blood gas analyses every 6-12 hours. If concurrent pulmonary abnormalities are present, monitor arterial blood gas analysis (or surrogates such as pulse oximetry and capnography). Supplement maintenaced IV fluids with dextrose to 5% and with KCl at 20 mEq/L routinely to maintain normoglycemia and normokalemia.

- Hypercoagulable and consumptive coagulopathic states (e.g., DIC) are common. Gastrointestinal hemorrhage is common during recovery, and may be present on admission. FFP or canine serum albumin may be necessary; however, these are not available to HCPs, and HCPs must not give human FFP or human serum albumin to dogs. Coagulation testing for MWDs will be problematic for HCPs, as analyzers for human blood will not provide accurate results for canine blood. HCPs should monitor the MWD and CBCs (if available) for evidence of thrombocytopenia (petecchiae, ecchymoses, low platelet count). HCPs should monitor for signs of clotting abnormalities (e.g., hematoma formation, intracavitary bleeding, epistaxis, hematuria). MWDs rarely require whole blood or pRBCs to treat complications of heat-induced illness; frozen plasma or fresh frozen plasma may be necessary in severe cases. HCPs must never give human blood to dogs. URGENT evacuation to veterinary facilities is critical to survival of MWDs that develop bleeding disorders, as veterinary personnel can facilitate canine blood product collection and administration.

- Cardiac arrhythmias, especially ventricular arrhythmias, are common, but rarely require intervention. Perform continuous or intermittent ECG monitoring. Treat ventricular arrhythmias only if causing hemodynamic compromise, using lidocaine (2 mg/kg IV bolus, then 50-75 mcg/kg/min CRI).

- Vomiting and diarrhea are typical. Diarrhea is often hemorrhagic. Start systemic antibiotic therapy (See Chapter 14) for any MWD with hemorrhagic diarrhea. Start famotidine therapy (1 mg/kg IV, IM, or PO q12h) for any MWD with heat stroke. Treat nausea and vomiting with ondansetron (1 mg/kg, IV or PO, q12-24h). Add sucralfate (1 gram PO q8h) for any MWD with hematemesis. Allow food and water once vomiting has resolved. Hygiene is critical, and bedding should be changed as needed; shave long tail hair and wrap tails to minimize soiling.

- Renal insufficiency is uncommon, but possible. Maintain urine production at 1-2 ml/kg/hour. Monitoring urine output in males will be difficult without canine-specific urethral catheters; use estimates of voiding or weigh absorbent pads or blankets to estimate urine output. Alternatively, in male dogs, adapt a 10- or 12-Fr

suction catheter (ubiquitous in trauma bays) by removing the control valve end, aseptically inserting the remaining catheter into the urethra to the level of the urinary bladder, and connecting the distal end to a sterile empty IV bag or closed collection system by way of an adapter.

- Treat seizures with a benzodiazepine (diazepam or midazolam, 0.3 mg/kg; IV, IN, rectally) as needed, up to 3 doses over 2 hours. If seizures continue, give phenobarbital (15-20 mg/kg total dose, divided into 4 doses and given IV every 30-60 minutes as needed to control seizures) and start oral phenobarbital (2.5 mg/kg PO q12h) 12 hours after last IV dose. Treat any MWD with stupor or coma with mannitol on admission (1.5 grams/kg, IV, over 30 minutes) and repeat every 4-6 hours for up to 2 additional doses). CNS abnormalities typically resolve with mild or moderate cases of heat stroke. Cortical blindness is common and usually resolves over a period of several days.

Prognosis: Nucleated Red Blood Cells, Heat Injury Severity Scoring System

- A study in 40 dogs[12] demonstrated that 90% of dogs presenting with heatstroke had increased peripheral nucleated red blood cells (nRBC) at presentation, with a cut-off point of 18 nRBC/100 leukocytes corresponding to a sensitivity and specificity of 91 and 88%, respectively, for death. Dogs with nRBC above this cut-off were significantly more likely to have life-threatening complications such as kidney failure and disseminated intravascular coagulopathy, as well. Thus, rapidly screening for the presence of nRBC may be useful to confirm clinical suspicion of heatstroke, and guide aggressiveness of therapy and monitoring.

- A severity scoring system[10] has been validated in dogs with clinical heat stroke that may prove useful to gauge severity of injury and prognosis based on key clinical and laboratory parameters noted within the first 24 hours of admission. Parameters useful to measure include heart rate, blood glucose, and coagulation tests. Clinically, the presence of obesity, acute collapse, shock, seizures, altered mental status, coagulopathy, acute kidney injury, and acute lung injury are documented risk factors for death. While calculating this score is beyond the scope of practice for HCPs, it is key to recognize those parameters and conditions that are significantly associated with outcome and complications, and to document these results, as this guides the aggressiveness of therapy and monitoring.

TABLE 12. MWD HEAT INJURY PROTOCOL[5-10]

PHASE	CLINICAL SIGNS	
MILD (Stress)	Controlled panting, excessive thirst, discomfort	Dehydration typically accompanies heat injury --> treat dehydration and monitor for shock
MODERATE (Exhaustion)	**UN**controlled panting, weakness, ataxia, anxiety, petecchiae/ecchymoses	
SEVERE (Stroke)	Moderate signs, ***PLUS*** CNS signs, collapse, shock	

TREATMENT OF MILD HEAT INJURY

1. Cease work
2. Remove from source of heat (move to shade or air-conditioned area if possible, use fans if available)
3. Offer cool water in small increments frequently
4. Monitor temperature q 15-30 min to ensure mild injury doesn't progress; perform serial physical exams

TREATMENT OF MODERATE AND SEVERE HEAT INJURY -- ANY DOG WITH TEMPERATURE >105^0 F

1. Immediately soak the dog's skin with water – Saturate to the skin!!
2. Continue soaking until body temperature is reduced to <105^0 F.
3. Start IV fluid therapy
4. Follow SHOCK RESUSCITATION PROTOCOL if dog is in shock (See Chapter 6, Figure 33)
5. Give IV fluids at 3-5 mL/kg/hr if not in shock
6. Triage the patient based on severity of injury
7. Protect the airway (intubate or tracheostomy *prn*), treat dehydration or shock, support ventilation *prn*
8. Be prepared to support/correct REBOUND HYPOTHERMIA
9. Dog may be hypothermic on arrival or develop hypothermia during treatment
10. DO NOT USE cold or iced IV fluids, surface cooling with ice, or ice water immersion

REDUCE cooling efforts once the body temperature is <105^0 F. Dry the hair, stop fans, increase room temperature, etc.

CEASE cooling efforts once the body temperature is <103^0 F to prevent rebound hypothermia. Actively warm the dog if temperature is <100^0 F

PROVIDE INTENSIVE MONITORING AND MANAGEMENT

Maintain NORMOTENSION -- Target MAP of >65 mmHg or Systolic BP >90 mmHg

Maintain VENTILATION -- Target RR of 8 - 10 bpm -- Target E_TCO_2 25 - 60 mmHg

Maintain OXYGENATION -- Target SpO_2 >95% with supplemental oxygen *prn*

CONTROL SEIZURES

MIDAZOLAM or DIAZEPAM	0.3 mg/kg -- IV, IO, or INTRANASAL *prn*

TABLE 12: MWD HEAT INJURY PROTOCOL[5-10] (continued)	
MANAGE CEREBRAL EDEMA	
MANNITOL	1 - 2 grams/kg -- IV over 30 min
and	
DEXAMETHASONE	0.5 mg/kg IV ONCE
…or…	
METHYLPREDNISOLONE	30 mg/kg -- IV -- ONCE
CONTROL PATHOLOGIC VENTRICULAR ARRHYTHMIAS	
LIDOCAINE CRI @ 50 - 75 mcg/kg/min	CORRECT H's and T's FIRST

CONTROL HYPOGLYCEMIA	MANAGE ANCILLARY PROBLEMS
▪ SUPPLEMENT IV fluids with 5% dextrose ▪ MONITOR blood glucose q4-6h ▪ AVOID intensive glucose titration	▪ Anti-emetics + gastrointestinal protectants ▪ Potassium Supplementation ▪ Mobility

Heat Injury References

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Hypothermia and Cold Injuries

Hypothermia in MWDs may be caused by exposure to low environmental temperatures (primary hypothermia), or low body temperature due to trauma, toxicity, underling illness, or anesthesia and surgery (secondary hypothermia).[1] Most commonly, HCPs will be presented with dogs suffering secondary hypothermia.

Classification of Hypothermia

MWDs with primary hypothermia can apparently tolerate much more severe hypothermia than MWDs with secondary hypothermia, and adverse effects due to hypothermia have been reported in dogs with secondary hypothermia at significantly closer-to-normal temperatures than patients with primary hypothermia.[1]

- Primary hypothermia is classified as mild (90-99° F), moderate (82-90° F), severe (68-82° F), or profound (less than 68° F).
- Secondary hypothermia is classified as mild (98-99.9° F), moderate (96-98° F), severe (92-96° F), or profound (less than 92° F).

Management of Hypothermia

- Warm hypothermic MWDs rapidly but carefully. Anticipate possible complications. Cardiovascular support (principally IV fluid therapy), management of co-existing problems, and prevention of rewarming complications are necessary (See Table 13).
- Rewarm MWDs at a target rate of increase of 2-4° F per hour.
- Use a combination of methods based on the severity of hypothermia and the MWD's status.
- Rewarm MWDs with mild hypothermia and normovolemia using passive surface warming. Apply external blankets, towels, or other devices to prevent heat loss while the animal 'self-generates' heat. These measures will not be effective as sole measures if shivering is absent.[1]
- Rewarm MWDs with moderate hypothermia using active surface warming.
  - Use externally-applied heat sources such as forced-air devices, warm water bottles, or warm-water circulating heating pads to provide heat to offset the patient's inability to generate heat.
  - Provide IV fluid volume support to maintain normotension and prevent rewarming shock (See Chapter 6, Figure 33).

- Apply heat to the thorax and abdomen, and not the extremities, as this avoids peripheral vasodilatation and prevents the decreased thermoregulatory response seen when extremities are warmed, both of which contribute to persistent hypothermia and "afterdrop."[1,5]

- Rewarm MWDs with severe or profound hypothermia using active core warming.
  - Always use active surface warming concurrently with active core warming.[1]
  - Use warmed IV fluids. The temperature of intravenous fluids should not exceed 108° F to avoid injury to cellular components of the peripheral blood.[1,5]
  - If the MWD is intubated and warming humidifiers are available on anesthesia circuits, use warmed inhaled air.
  - Given potential complications with use, HCPs should not use warm peritoneal or pleural lavage or urinary bladder or rectal lavage with warmed fluids.
  - Warm hypothermic MWDs to a temperature of 98.5° F, and then cease use of all warming methods except passive warming, while providing blood volume support (i.e., IV fluids) at relatively moderate rates to avoid volume overload (10-15 mL/kg/h) that is possible due to earlier cold diuresis [1,5] in hypothermic MWDs being rewarmed.

Complications Related to Hypothermia

- It is most important for the HCPs to recognize potential problems rather than specific temperatures at which to expect these problems.
- Hyperglycemia is common in mild and moderate hypothermia; specific measures to reduce blood sugar are seldom necessary. Hypoglycemia can develop in severely hypothermic patients, and dextrose supplementation (5% in IV fluids) is recommended empirically.
- Hypokalemia is common in mild-to-moderate hypothermia, and supplementation is necessary (KCl in IV fluids, 20 mEq/L) empirically. Hyperkalemia is reported in severe hypothermia; specific measures (e.g., insulin-dextrose administration, bicarbonate administration) may be necessary if potassium is >7-8 mmol/L. Check electrolytes, if able.
- Metabolic and respiratory acidosis are reported in most types and degrees of hypothermia; these typically correct with fluid therapy and patient warming.
- Hemostatic defects are common. MWDs are commonly in a hypocoagulable state with prolonged clotting times, and platelet abnormalities are also noted. Monitor for bleeding diasthesis. Given the inability to correct coagulopathies and thrombocytopenias in MWDs in the deployed setting, any MWD with evidence of bleeding should be evacuated URGENTLY to a veterinary facility.
- Tachycardia and hypertension are common in mild-to-moderate hypothermia. As hypothermia worsens,

bradycardia and hypotension develop, and other cardiac arrhythmias may develop. Monitor continuous ECG and blood pressure. Avoid giving drugs, to include anti-arrhythmic agents, until the body temperature is >90°, as drugs are believed ineffective at temperatures below this.[1,5]

- ***HCPs must be aware that measures to correct hypothermia can actually cause complications to develop, such as "afterdrop" and "rewarming shock;" thus, careful warming and close monitoring are essential when managing hypothermic patients.***[3,5]
  - "Afterdrop" is the continued decrease in core temperature as warming is provided, due to the return of cold peripheral blood to the central circulation. To prevent "afterdrop," it is important to warm the patient's trunk (chest and abdomen), not the extremities.
  - "Rewarming shock" develops with excessively rapid warming and is due to the sudden development of systemic vasodilatation. This vasodilatation causes hypotension at a time when the circulatory system may not be able to react. The systemic hypotension is aggravated by the increased metabolic demand that develops as hypothermic patients are rewarmed, which increases the demand for perfusion. To prevent or reduce "rewarming shock," IV fluid therapy must be provided and assessment of volume status (e.g., serial body weight measurement, clinical signs of hydration), systemic blood pressure, and tissue perfusion (e.g., evaluation of CRT, lactate clearance, change in mentation, urine output) must be monitored carefully.

Cold-induced Injury

Cold-induced injuries include non-freezing and freezing injuries, typically to an extremity, and tend to be related to geographic location (i.e., freezing climates) and use of the animal (e.g., search dogs).

Non-freezing Injury

Non-freezing injuries typically involve the extremities, occur despite the tissue not actually freezing, and are commonly due to prolonged cold exposure. In humans, common terms to describe these types of injuries are "chilblains" and "immersion foot" or "trench foot;" similar terms are not used in veterinary medicine.

With non-freezing injuries, extremities (ear pinnae, paws, tail tip, scrotum) are exposed to cold temperatures above freezing for prolonged periods (>12 hours), causing intense erythema of the skin, pain, and pruritus. If skin is exposed to damp conditions or submerged and exposed to cold, tissue edema and maceration may also develop.

Treatment of non-freezing cold injuries involves removing the MWD from the cold environment and passively warming the affected tissues slowly. Passive warming of non-freezing injuries can be accomplished by moving the MWD to a warm room (e.g., hospitalize, indoor facility) and gently wrapping the patient or affected body part in warm blankets or towels.

TABLE 13. MANAGEMENT OF HYPOTHERMIA IN MWDS

1. Warm rapidly but carefully.
   a. Increase the body temperature by 2-4° F per hour.
   b. Warm to a temperature of 98.5^0 F, and then cease use of all warming methods except passive warming.
2. **Mild hypothermia, adequate blood volume** – Warm using passive surface warming (wrap MWD in blankets or towels; hospitalize in warm environment).
3. **Moderate-to-severe hypothermia;** mild hypothermia with inadequate blood volume.
   a. Warm using active surface warming (use of externally-applied heat sources such as forced-air devices, warm water bottles, non-electric heating pads, or dryers)
   b. Apply heat to the thorax and abdomen, and not the extremities.
   c. Perform passive warming as above.
4. **Severe-to-profound hypothermia**
   a. Warm using active core warming (heat inhaled air provided by endotracheal tube, warm intravenous fluids).
   b. Perform active and passive warming as above.
5. Provide cardiovascular support.
   a. Provide intravenous fluids at relatively moderate rates (2-3 times maintenance rates, or 2-10 mL/kg/h) until normothermic.
   b. Once resuscitated and stabilized, provide continued intravenous fluids.
   c. Provide oxygen supplementation for severe-to-profound hypothermia to reduce risk of cardiac arrhythmias.
6. Anticipate and manage complications.
   a. Perform continuous ECG monitoring, and treat malignant arrhythmias using lidocaine 2 mg/kg IV bolus followed by lidocaine CRI 50-75 mcg/kg/min as needed. ***Do not treat arrhythmias until body temperature >90°.***
   b. Monitor for glucose, electrolyte, and acid-base abnormalities every 6-12 hours.
   c. Monitor platelet count and coagulation parameters every 6-12 hours.
   d. Provide analgesia as needed (See Chapter 16).
   e. Perform continuous or intermittent blood pressure monitoring, lactate clearance, changes in mentation, and urine output to monitor for "rewarming shock."
   f. Perform continuous temperature measurement, to monitor for correction of hypothermia and "afterdrop."

Freezing Injury

Freezing injury, or "frostbite," is the development of cold injury in which tissues actually become frozen, with crystallization (ice formation) of tissue and cell water. Frostbite is seen at environmental temperatures below 32° F and primarily affects the distal extremities, ears, nose, scrotum, and tail. Frostbite varies in severity from superficial (1st degree frostbite) to deep injury (4th degree frostbite).

Clinical signs of superficial frostbite (1st and 2nd degree frostbite) include a grey-to-white, waxy appearance of affected skin; blistering of affected skin may be present with 2nd degree frostbite. Clinical signs of deep frostbite (3rd and 4th degree frostbite) include involvement of the entire epidermis, but no subcutaneous tissues (3rd degree) to involvement of subcutaneous tissues, to possibly include muscle and bone (4th degree frostbite). Tissues affected with deep frostbite may be black and friable. In all cases of frostbite, pain may be intense, especially during rewarming of tissues.

Management of MWDs with freezing injury is summarized in Table 14 on the next page. Treatment of frostbite involves rapid warming of affected tissues, overall patient management (e.g., treatment of whole-body hypothermia,
trauma, or shock as appropriate), analgesia, and protection of affected tissues.

- Affected tissues may be warmed by immersion in a water bath that is 104-108° F for at least 20 minutes or until thawing has occurred, or by wrapping the affected tissue with warm, wet towels for 15 to 20 minutes, changing the towels every 5 minutes.
- Do not use dry heat to warm tissues, and never rub or massage the tissues, as further injury may occur.
- Provide systemic analgesia (See Chapter 16), as frostbite is extremely painful.
- Protect the affected tissues by applying loose protective bandages, minimizing movement (confine to a cage), and attaching a bucket-collar device (See Figure 21 and Figure 22) to prevent self-trauma.
- Antibiotic use is not recommended.
- Aseptically aspirate large blisters that develop.

TABLE 14. MANAGEMENT OF FREEZING INJURY (FROSTBITE) IN MWDS
1. Treat whole-body hypothermia, trauma, or shock as directed in supporting chapters. 2. Provide systemic analgesia (See Chapter 16). 3. Warm frozen tissues gently and slowly, using 1 of 2 methods: a. Immerse in a water bath that is 104° to 108° F for at least 20 minutes or until thawing has occurred. b. Wrap with warm, wet towels for 15 to 20 minutes, changing the towels every 5 minutes. ***NOTE: Do not use dry heat or rub or massage tissues to warm tissues.*** 6. Apply loose protective bandages. 7. Minimize movement (confine to a cage). 8. Apply a bucket to the collar to prevent self-trauma. 9. Aseptically aspirate large blisters that develop. Do not use empiric antibiotics. 10. Manage open, infected, or necrotic wounds (See Chapter 14).

Cold Injury References

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Snake and Insect Envenomation

Insect and snake envenomation of dogs is possible in deployed settings (See Table 15). This chapter focuses on the CENTCOM AOR exclusively. Refer to local guidance for other geographic areas.

- Specific treatment with geographic area-specific antivenin is optimal for patients with moderate-to-severe clinical signs.
- Although data are limited, antivenin decreases morbidity and may reduce mortality (especially for bites to the trunk and upper limbs, which have the highest mortality rates).[1-3]
- Antivenin is typically only available in select Role 2 and Role 3 facilities because antivenin use – for humans and dogs – is highly regulated and governed by theater policy. The CENTCOM Policy for Snake and Scorpion Antivenins, which provides regulatory guidance for antivenin management, use, and reporting, is the primary reference to guide use of snake and scorpion antivenin in dogs.[4]
- Antivenins, especially those that contain whole immunoglobulin components, must be used with caution, due to the potential to induce allergic reactions.[1-3,5,6] Although dosing in dogs is empiric, if used, antivenins should be given to effect to control clinical signs.

Insect Envenomation

Insect envenomation typically causes local pain, erythema, and swelling (angioedema or urticaria). Some insect venoms cause a locally extensive wound that often take several days to manifest, while others may cause systemic anaphylaxis.

Venomous Scorpions

Venomous scorpions that typically induce severe clinical signs include the Arabian or Asian Fat-Tailed Scorpion (*Androctonus amoreuxi*), the African Ground Scorpion (*Hottentotta alticola*), and *Hemiscorpius lepturus* (no common name).

Venomous Spiders

Venomous spiders that typically induce severe clinical signs include the Mediterranean Black Widow (*Latrodectus tredecimguttatus/lugubris*) and the Tarantula or Wolf spider (*Lycosa signoriensis*). Note that sopulgids (Camel spiders) are NOT venomous, but may cause a painful bite.

Supportive Care for Scorpion Stings and Spider Bites

- Coordinate MEDEVAC (Urgent) directly to appropriate medical facilities where antivenin is stored. Remote sites should request overfly (bypass the local MTF/VTF) directly to appropriate facilities.
- Ensure a patent airway and provide supplemental oxygen and ventilation, as needed.
- Place an IV catheter and obtain a CBC, blood chemistry panel, and urinalysis.
- Start crystalloid fluids IV to maintain hydration and perfusion and to facilitate diuresis of toxin. Fluid rate should be 3 mL/kg/hr for 12 hours, then reduce to 2 mL/kg/hr for another 12 hours, pending patient improvement.
- Administer 50 mg diphenhydramine IM and wait 30 minutes after initial dose before administering antivenin. Repeat diphenhydramine every 8 hours for a total of 3 doses.

  NOTE: MWD handlers may have been issued diphenhydramine and may have initiated therapy before presentation. Do not give diphenhydramine IV because it can cause severe hypotension in dogs.

- Manage any open wounds that develop (See Chapter 14).
- Treat pain if noted (See Chapter 16). NOTE: Do not treat with NSAIDs, given the propensity for envenomated dogs to develop coagulopathies and thrombocytopenia and thromobocytopathia.
- If systemic anaphylaxis is suspected based on the history and clinical signs (weakness, peracute vomiting or diarrhea, collapse, or hypotension), treat the MWD as above, and treat with IV fluid therapy as for shock (See Chapter 6, Figure 33) and give epinephrine (0.5-1 mg per dog, IM or IV; repeat if necessary every 20-30 minutes).
- Hospitalize the patient and provide supportive care until resolved or evacuated.

Antivenom Use for Scorpion Stings and Spider Bites

Scorpion Stings

Administer Saudi Polyvalent Scorpion (Equine) $F(ab)_2$ if the specific scorpion is identified as one of those listed above and if systemic clinical signs of evenomation are present. Dosing is empiric: Initially, dilute 5 of the 1 mL ampules in 100 mL 0.45% saline and infuse IV over 60 minutes.

Spider Bites

Antivenin is only available for Black Widow spider bites. Administer Antivenin Latrodectus mactans for witnessed Black Widow spider (*Latrodectus tredecimguttatus/lugubris*) bites and with systemic evenomation clinical signs. Dosing is empiric: Reconstitute 1 vial, dilute in 100 mL 0.45% saline, and infuse IV over 60 minutes.

Snake Envenomation

- Clinical signs of bites by venomous snakes can vary tremendously, principally depending on the type of snake involved, location and number of bites, and the amount of venom injected. HCPs should become familiar with indigenous snakes in deployed areas and seek guidance on specific management recommendations in preparation for deployments. Information on indigenous venomous snakes in each AO can be found in the Veterinary Medical Threat Brief from the MD(VSS) or Medical Brigade Staff Veterinarian.
- Vipers and elapids are the most common venomous snakes of concern in the CENTCOM theater (See Table 15).
- In general, snakebites by most venomous vipers cause severe pain, variable degrees of local swelling that may spread, and varying degrees of local tissue necrosis. Many MWDs will also develop systemic signs of pain. Some dogs will develop life-threatening complications of envenomation, but this is uncommon. Generally, clinical experience shows that most MWDs bitten by vipers on the face or lower leg will survive, with or without antivenin treatment. Dogs bitten on the upper limb or torso, however, have markedly increased mortality rates. It is prudent to recommend that any MWD bitten by a venomous snake be evacuated URGENTLY for optimal management. Follow guidelines below while coordinating evacuation.
- Unwitnessed envenomation is common. The presence of fang marks does not necessarily mean that envenomation has occurred – "dry bites" are common. Conversely, envenomation may have occurred without obvious puncture wounds evident.
- Injection of venom typically causes marked localized swelling and edema, intense local pain, and discoloration of the surrounding tissues due to necrosis, with oozing of venous blood.
- Systemic signs frequently observed include pain, lethargy, vomiting, and weakness. Many MWDs will develop laboratory evidence of thrombocytopenia and coagulopathy (decreased platelet count, prolonged coagulation times) but true spontaneous hemorrhage is rare.

Supportive Care for Venomous Snake Bites

- Coordinate MEDEVAC (Urgent) directly to appropriate medical facilities where antivenin is stored. Remote sites should request overfly (bypass the local MTF/VTF) directly to appropriate facilities.
- Hospitalize any MWD with history of or signs suggesting envenomation for at least 12 hours to monitor progression.
- Ensure patent airway, provide supplemental oxygen, and ventilation, as needed.
- Place an IV catheter and obtain a CBC, blood chemistry panel, and urinalysis.
- Start crystalloid fluids IV to maintain hydration and perfusion and to facilitate diuresis of toxin. Fluid rate should be 3 mL/kg/hr for 12 hours, then reduce to 2 mL/kg/hr for another 12 hours, pending patient improvement.

- Administer 50 mg diphenhydramine IM initially, and then once every 8 hours for a total of 3 doses. Wait 30 minutes after initial dose before administering any antivenin.

  NOTE: MWD handlers may have been issued diphenhydramine and may have initiated therapy before presentation. Do NOT give diphenhydramine IV; it can cause severe hypotension in dogs by this route.

- Manage any open wounds that develop (See Chapter 14).
- Treat pain if noted (See Chapter 16). NOTE: Do not treat with NSAIDs, given the propensity for envenomated dogs to develop coagulopathies.
- ***Do NOT use tourniquets, ice packs, heating, or local vasoconstriction (***e.g., injection of epinephrine locally) in an attempt to slow venom spread.
- Confine MWDs to minimize venom distribution.
- If systemic anaphylaxis is suspected based on the history and clinical signs (weakness, peracute vomiting or diarrhea, collapse, or hypotension), treat the MWD as above and also, treat with IV fluid therapy as for shock (See Chapter 6, Figure 33), and give epinephrine (0.5-1 mg per dog, IM or IV; repeat if necessary every 20-30 minutes).
- Treat mild envenomations (signs localized to face or lower limb that do not progress or progress slowly) with analgesics (See Chapter 16), diphenhydramine (2-4 mg/kg IM q8h), and IV fluid therapy (3-5 mL/kg/h for at least 12 hours, then reduce to 2-3 mL/kg/h for another 12 hours). See recommendations for antivenin use.

Antivenom Use for Viper and Elapid Envenomation

- Treat moderate-to-severe envenomation (rapidly progressive signs originating on the lower limb or face, any MWD with systemic signs, and any MWD with upper limb or torso bites) with analgesics (See Chapter 16), diphenhydramine (2-4 mg/kg, IM, q8h), IV fluid therapy using the guidelines recommended for shock therapy initially (See Chapter 6, Figure 33), and antivenin (if available) following the recommendations that follow. Monitor closely for progression.
- For suspected or unwitnessed envenomation by an unknown species of snakes, use the Razi Polyvalent Snake Antivenin, as it has the broadest spectrum of antivenin activity for the majority of venomous snakes in theater. Intradermal testing for potential allergic reaction is unreliable in clinical cases; do not delay antivenin administration to perform this testing. Emergency interventions should be initiated as needed to treat anaphylaxis.
  - Dilute 2 ampules of Razi Polyvalent Snake Antivenin in 100 mL 0.45% saline and infuse IV over 60 minutes.
  - Dose “to effect” with dosing targeted to visible reduction in severity and progression of swelling and pain locally at the site of envenomation, and to improve the dog’s comfort.
  - Be prepared to administer 1-2 additional ampules over an hour if swelling continues to increase or spread, pain locally and systemically is not abated, or the patient’s overall condition deteriorates. Additional antivenin may be needed if clinical signs persist, worsen, or recur. Antivenin is effective up to 24 hours after envenomation; consider use even if there was delay in evacuation to the facility for care.

- For witnessed envenomation by vipers or elapids for which $F(ab)_2$ antivenin is available, use Saudi Polyvalent Antivenin monotherapy, or a combination of Saudi FAVIREPT Polyvalent Antivenin and the Haffkine/ Vinsbio (Indian) Antivenin.
  - Dilute 4 of the 10 mL ampules of Saudi Polyvalent Snake Antivenin $F(ab)_2$ in 350 mL of 0.45 % saline and infuse IV over 60 minutes.
  - Alternatively, dilute 2 of the 10 mL ampules of Saudi FAVIREPT Polyvalent $F(ab)_2$ in 250 mL 0.45% saline and infuse IV over 60 minutes, PLUS give 1 of the 10 mL ampules of Haffkine/Vinsbio (Indian) in 500 mL 0.45% saline infused IV over 60 minutes.
- Treat presumed adverse effects of antivenin (increased temperature, restlessness, panting, vomiting, urticaria or angioedema, weakness, collapse, hypotension) by temporarily slowing or stopping the antivenin infusion and giving diphenhydramine (2-4 mg/kg, IM). Consider epinephrine (0.5-1.0 mg per dog, IM or IV) if signs of shock develop.

NOTE: Use of fresh frozen plasma (FFP) is controversial for snake envenomation. Currently canine FFP, if available, should only be considered in cases of severe systemic coagulopathy with active bleeding.

TABLE 15. VENOMOUS SNAKES, CENTCOM AOR

Location	Type	Common Name	Scientific Name	1st Choice Antivenin	2nd Choice Antivenin
Afghanistan	Viper	Puff adder	*Bitis arietans*	Saudi	FAVIREPET
Afghanistan	Viper	Saw-scaled vipers	*Echis spp*	Razi	Saudi, FAVIREPT, Haffekine/Vinsbio
Afghanistan	Viper	MacMahon's viper, Asian sand viper	*Eristocophis macmahoni*	Razi	Saudi, FAVIREPT
Afghanistan	Viper	Haly's pit viper	*Gloydius spp*	Razi	None
Afghanistan	Viper	Levantine vipers	*Macrovipera lebetina subspp*	Razi	None
Afghanistan	Viper	Persian horned viper	*Pseudocerastes persiscus*	Razi	None
Afghanistan	Elapid	Indian krait	*Bungarus caeruleus*	FAVIREPT	Razi, Saudi, Haffekine/Vinsbio
Afghanistan	Elapid	Desert Cobra/ Desert Black Snake	*Walterinnesia aegyptia*	Saudi	Razi
Afghanistan	Elapid	Egyptian cobra	*Naja haje*	FAVIREPT	Saudi, Razi
Afghanistan	Elapid	Indian cobra, Caspian or Central Asian cobra, Oxus cobra	*Naja naja, Naja oxiana*	Razi	FAVIREPT, Saudi
Iraq	Viper	Horned vipers	*Cerastes spp*	Saudi	FAVIREPT
Iraq	Viper	Levantine vipers	*Macrovipera lebetina subspp*	Razi	None
Iraq	Viper	Persian horned viper	*Pseudocerastes persiscus*	Razi	None
Iraq	Elapid	Desert Cobra/ Desert Black Snake	*Walterinnesia aegyptia*	Saudi	Razi

TABLE 16. SCORPION, SPIDER, AND SNAKE ANTIVENIN SELECTION			
Antivenin	**Covered Scorpions**	**Dosing**	**Administration**
Saudi Polyvalent Scorpion (Equine) F(ab)$_2$ NSN: 6505-08-140-1520	Yellow Scorpion, Death Stalker Scorpion *(Leiurus spp),* Black Scorpion and Fat-Tailed Scorpion *(Androctonus spp), Buthus spp* (no common name)	Five 1 mL ampules initially. Further dosing usually not needed, but dose to effect.	Dilute in 100 mL of 0.45% saline. Infuse IV over 60 min.
Antivenin	**Covered Spider**	**Dosing**	**Administration**
Antivenin Latrodectus Mactans NDC: 0006-4084-00	Black Widow Spider *(Latrodectus spp)*	1 vial	Dilute in 100 mL of 0.45% saline. Infuse IV over 60 min.
Antivenin	**Covered Snakes**	**Dosing**	**Administration**
Razi Polyvalent Snake Antivenin, IgG NSN: 6505-08-139-1454	**ANY UNWITNESSED SNAKE BITE**, *Echis carinatus,* *Vipera lebetina,* *Vipera albicornuta,* *Pseudocerastes persicus*, *Naja spp*, *Agkistrodon halys*	2 ampules initially. Repeat dosing as needed to effect to control signs.	Premedicate with diphenhydramine 50 mg IM at least 30 min before use. Dilute antivenin in 100 mL 0.45% saline and infuse IV over 60 min.
Saudi Polyvalent Snake Antivenin, F(ab)$_2$ NSN: 6505-08-139-1452	*Echis carinatus,* *Vipera lebetina,* *Vipera albicornuta,* *Pseudocerastes persicus*, *Naja spp,* *Agkistrodon halys*	2 ampules initially. Repeat dosing as needed to effect to control signs.	Premedicate with diphenhydramine 50 mg IM at least 30 min before use. Dilute antivenin in 100 mL 0.45% saline and infuse IV over 60 min.

Snake & Insect Envenomation References

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Blast, Burn and Crush Injuries

With the increased use of improvised explosive devices, blast injury is not uncommon in MWDs. However, there is little definitive clinical information available for managing blast injury in dogs, so recommendations are similar to management for human patients. Burn and crush injuries are less common, but may be encountered.

Blast Injury

Be prepared to provide care for MWDs exposed to bomb blasts and other explosions. Recognize that blast injuries may be subtle or occult for days, with MWDs appearing stable on initial evaluation. Figure 43 (next page) provides the recommended general approach to assessing MWDs exposed to blast.

Blast Injury Mechanisms[1-3]

Blasts produce injury through primary effects of the blast overpressure wave, secondary injury due to penetrating objects displaced by the explosion impacting victims, tertiary injury due to victims physically being displaced into objects, and quaternary injury due to complications resulting from any combination of injury from primary, secondary, or tertiary injuries or unrelated to these mechanisms.

Initial Management of Blast Injuries

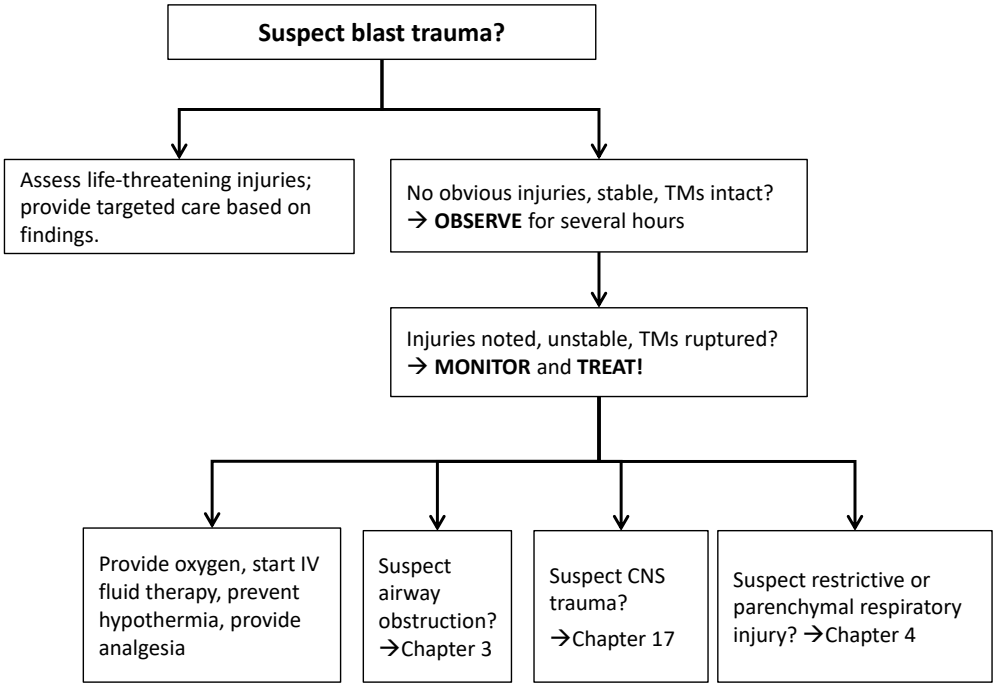
Generally, the approach to blast-injured MWDs is the same as for any other type of trauma – FOCUS on life-threatening problems first, followed by targeted support based on findings, with emphasis on a detailed secondary evaluation and care as needed once the patient is stabilized.

During initial care, focus on those types of life-threatening injuries commonly seen with blasts, especially respiratory distress due to airway obstruction or trauma, pneumothorax, pulmonary contusions, and hemothorax; traumatic amputations or serious bleeding; hemoperitoneum; CNS trauma; air embolism; and shock.

While tympanic membrane (TM) rupture in and of itself is a minor injury, experience suggests that it is a marker of more severe systemic injury, and patients with TM rupture should be observed carefully for signs suggesting the development of other injuries.[2-3] The absence of TM rupture, however, does not exclude potentially life-threatening internal injuries, based on recent data from humans exposed to blasts.[3]

Recognize delayed onset of clinical signs. Many injuries from blasts may not manifest for many hours, to include pulmonary contusions, “blast lung,” concussions and mild TBI, and bowel hemorrhage with perforation and peritonitis. Serial monitoring is critical to detect early signs of impending decompensation due to these delayed problems. Any MWD exposed to blast should be evacuated to a veterinary facility as soon as possible for detailed evaluation and observation. If evacuation is not possible or is delayed, hospitalize in the MTF for 12-24 hours for close observation.

Figure 43. General Approach to Military Working Dogs Exposed to Blasts.



Burn Injury

Burn injuries in MWDs are typically caused by fires, motor vehicle mufflers, stoves, caustic chemicals, or explosions. While uncommon, these injuries can cause not only severe pain and complicated local wounds, but also result in serious metabolic abnormalities and systemic infection that can lead to life-threatening compromise.

Burn Classification in MWDs[4-6]

Burns affecting dogs are physically similar to those in humans. Hair may need to be carefully clipped over burned areas for adequate assessment. Superficial burns are red and painful, similar to sunburn, involving the outer layer of the epidermis. Superficial partial-thickness burns are red or mottled, with epidermal sloughing, fluid leakage, swelling, and extreme hypersensitivity (pain), involving the epidermis and variable amounts of dermis. Hair should not easily pull out. Deep partial-thickness burns are black or yellow-white and hair follicles are
destroyed, and the skin surface is dry. These burns are generally less painful, as nerve endings are destroyed. If any hair remains, it will pull out easily. Full-thickness burns are black, dry, and leathery. These burns have destroyed the epidermis and dermis and expose underlying connective tissue, muscle, and bone. Any eschar that forms is painless.

Inhalation Injury

Burn patients may have significant inhalation injury. Clinical signs of inhalation and pulmonary injuries may not manifest for several hours. Clinical signs of inhalation injury include stertor or stridor, harsh cough or upper airway sounds, coughing, production of dark sputum, tachypnea, and respiratory distress. MWDs with inhalation injury should be observed closely for need for orotracheal intubation or (uncommonly) tracheostomy to manage the airway. Intubate or perform tracheostomy for any MWD with observed respiratory distress or if in doubt about the patency of the airway (See Chapter 3).

Estimation of Total Body Surface Area (TBSA) Burn Extent in Dogs

Determine the severity of the burn once the MWD has been resuscitated and stabilized. General characteristics of the wound that are important to examine include color, texture, presence or absence of pain, moistness, and extent of swelling, if present.

Estimate the percent of the total body surface area (TBSA) that is burned by using a modification of the "Rule of 9s" used for humans:[4]

ADD the estimated percent of burn from EACH of the following body areas:

- Head and neck (H/N) – 9%
- Chest (C) – 18%
- Abdomen (A) – 18%
- Each forelimb (L FL, R FL) – 9%
- Each hindlimb (L HL, R HL) – 18%

TBSA = H/N + C + A + L FL + R FL + L HL + R HL. For example, the estimated TBSA burn for a dog with burns to the chest and abdomen and left forelimb would be 18% (chest) + 18% (abdomen) + 9% (L FL) = 45%.

The percent TBSA is important in assessing severity, anticipating problems, and determining prognosis. Patients with TBSA >20% often have severe metabolic problems (e.g., hypovolemic shock, albumin and electrolyte losses, acidoses, renal failure); patients with TBSA >50% have a poor prognosis.[4] Any discussion of prognosis must take into consideration not only the TBSA but also the severity of burn. Note that initial evaluation of severity of burn wound may be inaccurate, as wounds often progress over a period of 3-7 days before completely manifesting ultimate severity.[4-5]

General Patient Management Recommendations[4-6]

- Monitor and treat for complications related to burn injury, to include shock, fluid losses, respiratory problems, and electrolyte abnormalities, see appropriate chapters. Stabilize the patient first. Manage pain using appropriate analgesics (See Chapter 16 and Table 17).
- Cool the burned skin using cool water (45-65° F) by immersion, application of compresses, or gentle spray for at least 30 minutes. Do not apply ice to any burned skin, as the vasoconstriction it causes may impede wound healing and may worsen the extent of tissue damage. Measure the patient's rectal or esophageal temperature frequently to monitor for and prevent hypothermia.

- Minimize potential contamination of burned skin. Wash hands thoroughly before handling patients; wear clean exam gloves (superficial burns, superficial partial-thickness burns) or sterile surgical gloves (deep partial-thickness burns, full-thickness burns); do not contact wounds with things such as personal clothing, stethoscopes, or other instruments or monitors; wear barrier protection when handling deep partial-thickness burns and full-thickness burns; change gloves and wash hands before handling other burn wounds and invasive devices on the same patient.
- Follow strict aseptic technique when placing invasive devices and use clean examination gloves whenever handling catheters, adapters, fluid lines, etc. Unless absolutely necessary, do not place invasive devices through burned skin. Provide antibiotic coverage using the guidelines in Chapter 14 only for MWDs presumed to be immunocompromised, with pneumonia or acute lung injury, or with sepsis or suspected sepsis.
- Provide excellent nursing care. Turn or rotate the MWD every 4 hours if recumbent, and perform Passive Range of Motion (PROM) exercises of all limbs except burned limbs every 4 hours. Provide soft, padded bedding. Prevent urine scalding and fecal soiling. Allow MWDs to eat and drink if able.

Specific Burn Wound Management Recommendations[4-6]

- Depending on severity and extent of burn, the patient may require daily heavy sedation or general anesthesia to allow debridement and management. Extreme care must be taken to monitor burn patients adequately during sedation or anesthesia (See Table 17).
- Superficial or superficial partial-thickness burns are generally managed with daily cool water lavage, followed by topical silver sulfadiazine cream application until healed or the wound worsens.
- Deep partial-thickness and full-thickness burns need varying degrees of daily wound debridement. This may be accomplished by use of conservative debridement, chemical debridement, or surgical debridement.
    - Conservative debridement of deep partial-thickness and full-thickness burns involves hydrotherapy using sterile saline lavage under light pressure or application of a wet-to-dry saline dressing under a light bandage for several hours, followed by removal of obvious necrotic or dead tissue using aseptic technique. Surgical debridement may be necessary in very deep or widespread wounds to more aggressively remove necrotic tissue; however, HCPs should not routinely perform surgical debridement – MWDs should be evacuated to veterinary facilities for this level of care.
    - Following debridement, apply silver sulfadiazine (SSD) cream, petrolatum, or hydrogel dressings in a thin layer directly on the wound and cover the burn with a non-adherent dressing (if the wound area is bandaged) or leave the burn uncovered (if bandaging is not permissible due to wound size or location).
- Bandage burn wounds if the burn area is amendable to application (i.e., the bandage can be placed without increasing patient discomfort, the burn area is relatively small, and the bandage will not increase the potential for wound injury). If there is any doubt about whether to bandage a burn wound or not, it is better to leave the wound unbandaged. In most cases, a wet-to-wet bandage is recommended to keep wounds moist and improve comfort. Change bandages at least daily or more often if wound exudate is excessive or the bandage becomes soiled.

TABLE 17. MANAGEMENT OF BURN WOUNDS IN MILITARY WORKING DOGS
Provide heavy sedation or general anesthesia to allow debridement and management, as necessary.
Superficial or superficial partial-thickness burns: ▪ Perform daily cool water lavage. ▪ Apply topical silver sulfadiazine cream after cool lavage.
Deep partial-thickness and full-thickness burns: ▪ Perform daily wound debridement as necessary: ▪ Perform hydrotherapy using sterile saline lavage under light pressure, or, ▪ Apply a wet-to-dry saline dressing under a light bandage for several hours, followed by removal of obvious necrotic or dead tissue using aseptic technique.
Protect burn wounds: ▪ Apply silver sulfadiazine cream in a thin layer directly on the wound. ▪ Apply a light protective bandage, if the burn area is amendable to application.

Crush Injury and Crush Syndrome

- Crush injury is defined as injury due to compression of extremities or other parts of the body that causes muscle swelling or trauma, with or without neurological or orthopedic problems in the body parts. Body areas most commonly involved are the limbs and torso.
- Crush syndrome develops when crush injury is extensive and prolonged, causing systemic manifestations. These systemic effects are due to traumatic rhabdomyolysis (muscle breakdown) and reperfusion syndrome (release of potentially toxic muscle cell components and electrolytes into the circulatory system) after sudden release of pressure over the crushed limb or torso. Acute hypovolemia and metabolic abnormalities are common and can be severe (even fatal), and myoglobinuria from trauma to muscles frequently may cause or exacerbate renal failure if untreated.
- Crush injuries and crush syndrome in MWDs are expected after building collapses, most frequently after natural disasters or explosions. In humans, the incidence of crush syndrome is 2-15% with approximately 50% of those with crush syndrome developing acute renal failure. Of those with renal failure, 50% need dialysis. Crush syndrome is rarely reported in animals.[7,8]

Pathophysiology

- Crush injury develops after muscle injury and muscle cell death. Three mechanisms are responsible for the death of muscle cells, to include direct cell lysis by the force of the crush; direct pressure on muscle cells causing muscle ischemia, development of anaerobic metabolism and lactic acidosis, and cell membrane disruption and leakage; and vascular compression or disruption, with loss of blood supply to muscle tissue.
- These mechanisms cause the injured muscle tissue to generate and release a number of substances that may be toxic in the general circulation. The crushing force actually serves as a protective mechanism, preventing these toxins from reaching the central circulation. Once the patient is extricated and the force is

released, reperfusion injury is prevalent due to release of toxic compounds and reactive oxygen species. Reperfusion injury may continue for as long as 60 hours after release of the crush injury.

- Other consequences of reperfusion include massive third spacing of fluids in crushed tissues, leading to hypovolemia and shock and exacerbating renal injury, and leading to compartment syndrome.

Clinical Presentation

Clinical signs of crush injury/crush syndrome include some or all of the following:

- Skin injury of the affected body part (may be subtle and less impressive than other signs)
- Limb swelling (may be delayed)
- Paresis or paralysis (may be mistaken as spinal cord injury)
- Loss of sensation (may mask the severity of underlying injury)
- Pain (typically becomes severe with reperfusion)
- Absent or weak extremity pulses
- Discolored urine due to myoglobinuria or hematuria or both
- Hypotension due to hypovolemia (dehydration, hemorrhage, third spacing of fluids) is commonly present and may be severe
- Massive third spacing (often causes or exacerbates compartment syndrome and renal failure)
- Metabolic abnormalities (hypocalcemia, hyperkalemia, and lactic acidosis)
- Clinical signs of compartment syndrome (severe pain in the involved extremity, pain on passive stretching of the involved muscles, decreased sensation to the affected limb)
- Renal failure (due to rhabdomyolysis and secondary myoglobinuric acute tubular necrosis).

Patient Management

- Treat MWDs, if possible, before and during extrication.
- Maintain a high index of suspicion, as MWDs with crush injury may present initially with few signs or symptoms. Delayed treatment leads to poor outcome.
- Most crush syndrome patients have an extensive area of involvement such as a lower extremity and/or the pelvis. It requires more involvement than just one paw. Also, the crushing force must be present for some time before crush injury syndrome can occur.
- The syndrome may develop in <1 hour in a severe crush situation, but usually it takes 4 to 6 hours of compression for the processes that cause crush injury syndrome to take place.
- The hallmark initial treatment for crush syndrome is IV fluid therapy before release of pressure and contin-

ued during extrication and evacuation. Place multiple IV lines, because the MWD will require large fluid volumes and there is a risk of catheter dislodgement during extrication. Normal saline is the initial fluid of choice. Avoid fluids with potassium.

- Once compression is removed, maintain aggressive fluid therapy. Specific guidelines for fluid volumes to administer are difficult to provide. As a starting point, use a rate of 3-5 mL/kg/hr to improve pulse quality, blood pressure (if possible to measure), CRT, and mentation. Try to estimate urine output – the goal is to maintain urine output >1-2 mL/kg/h.
- Alkalinization of the blood with bicarbonate (as is done for humans) is likely not going to be feasible. Thus, HCPs should focus on aggressive IV fluid therapy to correct dehydration and promote diuresis pending extrication and evacuation.
- Anticipate secondary complications. MWDs with crush injury should be treated initially as any other multiple trauma victim.
- Compartment syndrome is rare in dogs; this seems to be a much more common and more severe problem in humans, so extreme measures to control intracompartmental pressures like fasciotomy are unwarranted.
- Wounds should be cleaned and covered with sterile dressings in the usual fashion. Splint fractures if possible.
- Provide analgesia to any MWD with crush injury or crush syndrome (See Chapter 16).

Blast, Burn and Crush Injury References

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CHAPTER 13

Long Bone Fractures

General Considerations

- Recognize and manage life-threatening problems FIRST. Fractures and muscle, tendon, or ligament injuries are rarely life threatening. Resuscitate and stabilize life-threatening problems first. Provide treatment to prevent further compromise to the fracture site and neurovascular structures and minimize infection risk.
- Recognize long bone fractures. MWDs with fractures will have varying degrees of lameness and will likely have limb deformity, swelling, pain, and loss of function. Open fractures are generally obvious, but pose greater risk of local and systemic infection and loss of function. See **Management of Open Fractures** in this chapter for specific guidance.
- Provide analgesia and confine the MWD. Any MWD with possible fractures or joint injury should initially be given parenteral analgesia, continued orally once stabilized (See Chapter 16). Any MWD with possible fractures should be confined to its kennel or small space at all times, with limited opportunities to go outside to urinate and defecate (three times daily as a minimum). Use a make-shift sling placed under the abdomen while walking patients outside. Analgesia and confinement may be the only treatment necessary or feasible, as noted below.

Long Bone Fractures and Joint Abnormalities of the Lower Limbs

HCPs should stabilize any suspected fracture or joint abnormality of the long bones distal to the elbow and knee (radius/ulna, tibia/fibula).

- Manage wounds as per Chapter 14 and then apply splints (e.g., SAM splints) to immobilize the fracture site, ensuring the joints above and below the fracture site are immobilized. Apply buttresses made of layers of cast padding or non-adherent dressing around footpads and any wounds. Apply about twice as much cast padding as is used for people. Generally, it is best to leave the nails of the middle two toes exposed, to allow monitoring for swelling.
- Cast application is not recommended, as cast pressure or friction sores are extremely common with MWDs and complicate recovery. MWDs tolerate splints and bandages poorly, so any MWD with a bandage or splint applied must wear a device to prevent self-mutilation or bandage removal (See Figure 21 and Figure 22).
- Splints and bandages generally need to be changed at least every other day. Change more frequently if soiled, wet, or loose.

Long Bone Fractures and Joint Abnormalities of the Upper Limbs

In MWDs, fractures of these bones are very difficult to immobilize, splints and bandages are poorly tolerated, and splints and bandages can actually increase fracture displacement, worsen fractures, and jeopardize neurovascular bundles. Key management principles are to provide adequate analgesia (See Chapter 16) and minimize movement to the maximal extent (kennel confinement except for limited leashed walks, using ancillary support).

- **HCPs without advanced orthopedic training and experience** generally should not attempt to immobilize fractures of the humerus, scapula, or femur.[1,2]
- **HCPs with advanced training and experience in orthopedics** (typically orthopedic surgeons, orthopedic PAs, splint technicians in Level 2 or higher facilities) may be capable, with written and/or verbal guidance from supporting veterinarians in constructing an appropriate Spica splint for humerus and femur fractures. In these instances, appropriate coaptation is safe, makes the patient more comfortable and consequently makes it easier and safer to transport a wounded MWD. With appropriate coaptation, the MWD is less likely to become agitated or aggressive every time it is bumped, moved, or moves about during manipulation and transport.

Open Fractures

Proper management of open fractures is essential. Open fractures should be treated as a medical emergency, once more pressing problems are addressed (See Table 18).[1,2]

Initial management of open fractures during resuscitation. While evaluating the entire patient and initiating life-saving therapy, take measures to protect the open fracture site:

- Do not attempt to reduce bone(s) protruding at fracture sites, as this drags contamination to the fracture site and may cause injury to the neurovascular bundle.
- Quickly remove any large gross contaminants from the wound (e.g., leaves, rocks, stick fragments), but do not attempt to clip the hair or cleanse the wound at this point.
- Cover the fracture and wound with sterile non-adherent dressing and apply a light bandage. This bandage should not be placed in an attempt to stabilize or immobilize the fracture at this time; it is simply to protect the open wounds and exposed bone from further contamination during initial patient resuscitation.

Specific management recommendations for open fractures. MWDs with open fractures generally will require surgical correction of the fracture once evacuated to veterinary facilities. The overriding aims are to prevent bacterial infection and promote normal healing.

- Culture open fracture sites as soon as possible after presentation and before antibiotic use if possible.
- Administer antibiotics as per Table 20 in Chapter 14, focusing on use of intravenous antibiotics based on

(Continued on page 93)

likely contaminants. Never withhold antibiotic therapy in any patient with an open fracture.

- Address pain with appropriate analgesic therapy (See Chapter 16). Reassess pain every 4-6 hours.
- Manage soft tissue injuries over the fracture site appropriately, as proper management of the wound postures the patient for successful outcome. See Chapter 14 for wound management recommendations.
- After appropriate wound care, apply a sterile moisture-retentive bandage over open fractures, as it is important to keep soft tissues and bone moist for optimal healing. Change bandages at least once daily, based on degree of strike-through, soiling, or loosening.

TABLE 18. MANAGEMENT OF LONG BONE FRACTURES IN MWDS[1,2]

1. Address life-threatening problems first!

During resuscitation, protect any open fractures.

- Do not attempt to reduce bones protruding at the fracture site.
- Remove any large gross contaminants from the wound, such as leaves, rocks, or stick fragments, but do not clip hair or cleanse the wound at this point.
- Cover the fracture and wound with sterile non-adherent dressing and apply a light protective bandage.

2. LOWER LIMB FRACTURES -- After resuscitation, immobilize fractures or joint abnormalities involving the limbs below the elbow or knee, prevent bacterial infection, provide analgesia, and promote normal healing until definitive surgical repair.

- Culture any open fracture sites as soon as possible, and before antibiotic use if possible.
- Administer antibiotics as directed in Chapter 14 for open fractures.
- Manage any open wounds over the fracture site as per Chapter 14.
- Provide analgesia as directed in Chapter 16. Reassess pain every 4-6 hours.
- Apply splints or heavy bandages to immobilize the fracture site, ensuring the joints above and below the fracture site are immobilized.

3. UPPER LIMB FRACTURES – After resuscitation, minimize further injury to fractures of the limbs above the elbow or knee.

- Culture any open fracture sites as soon as possible, and before antibiotic use if possible.
- Administer antibiotics as directed in Chapter 14 for open fractures.
- Manage any open wounds over the fracture site as per Chapter 14.
- Provide analgesia as directed in Chapter 16. Reassess pain every 4-6 hours.
- Unless experienced in external coaptation, DO NOT apply splints or heavy bandages, as these are poorly tolerated by MWDs and will increase the risk of displacement and further injury to the neurovascular bundle.
- Confine the MWD to a kennel or small space; limit walks; and support as needed when walked.

4. Monitor MWDs with fractures.

- Ensure a device is used to prevent self-trauma (See Chapter 2).
- Assess pain frequently and ensure adequate analgesia.
- Change splints or bandages daily (open fractures, wounds, soiled or wet) or every other day (clean and dry splints or bandages that do not cover open fractures or wounds).

- Apply splints and bandages as described previously for open fractures of the radius/ulna or tibia, or lower aspects of the limbs. Confine MWDs with any fracture, but especially with upper limb fractures that cannot be immobilized.

Definitive Long Bone Fracture Repair

Definitive repair should be delayed until the patient can safely undergo anesthesia and surgery performed by veterinary personnel best equipped to manage MWD's post-operatively. There is no role for HCPs to attempt definitive repair of long bone fractures in MWDs. Standard practice human fracture management is to span the fracture with external fixation to stabilize during transport, with definitive repair at a later date. Spanning the fracture is not considered definitive repair, but is not appropriate for MWDs as they will be ambulatory and break the construct. Thus, temporary external skeletal fixation is not indicated in MWD long bone fractures. The goals for HCP care of MWDs are initial management, stabilization, and evacuation to veterinary medical personnel for definitive care.

Pelvic Fractures

Pelvic fractures in MWDs in deployed settings will most likely be due to crush or blast injury (See Chapter 12). Evaluate the pelvis for external evidence of trauma or deformity.

The major joints involving the pelvis are the coxofemoral (hip) and sacroiliac (lower back) joints. Fractures or dislocations of these bones and joints are fairly common. A tip off for joint dislocation is asymmetry. Carefully palpate the hip joints and lower back for swelling, pain, or deformity that suggests joint injury. Move the limbs carefully through their range of motion while palpating the hip area and lower back to evaluate hip luxation.

Trauma to adjacent structures such as the rectum, descending colon, urinary bladder, urethra, and reproductive organs is a concern. Evaluate the inguinal area and external genitalia for evidence of trauma or herniation. Fractures of the pelvic floor commonly cause asymmetry, swelling, and bruising in the inguinal region. Hidden internal injury due to fractures (e.g., urethra, urinary bladder, prostate, vagina) is difficult to detect. Assess neurologic input to the anus by pinching the skin around the anus with hemostatic forceps—the expected response is sudden tightening of the anal sphincter.

Examine external genitalia for trauma. Carefully perform a digital rectal exam with a well-lubricated finger to assess for bleeding and injury to the urogenital structures in the pelvic canal, and to palpate for pelvic fractures.

Manage pelvic fractures by confining the MWD to its kennel or to a small space, limiting movement to short, frequent, handler-controlled leash walks using a towel or other material passed beneath the abdomen to provide support when walking, and adequate analgesia (See Chapter 16).

Long Bone Fracture References

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CHAPTER 14

Wound Management

Open Wounds and Necrotic Tissue

MWDs with wounds are frequently presented for care. Wounds commonly result from ballistic injuries, bites, motor vehicle trauma, or other trauma. In most cases, traumatic wounds can be classified as contaminated or dirty/infected wounds; the difference is based on how long the wound existed before presentation. Contaminated wounds generally are considered those less than 6 hours old, and dirty/infected wounds are considered those greater than 6 hours old and generally with obvious exudates or infection. Wounds are often noted in conjunction with potentially life-threatening injuries; thus, in all MWDs presenting with wounds, a detailed systematic triage examination and a careful search for – and management of – more severe concurrent injuries must take precedent over management of wounds. In all instances, wound care follows resuscitation and stabilization of the patient.

Considerations in Wound Management

The primary goal in wound management is to create a healthy wound bed, one that has adequate blood supply to support repair, and without contamination or necrotic tissue that will impede healing and increase the risk of infection. Unless simple and small, many wounds will require frequent evaluation, generally at least once daily, based on location, extent, severity, and other factors. Many wounds will need to be managed as open wounds (although protected by bandages until smaller) before definitive surgical repair. The steps in daily wound evaluation are to assess the response to or need for antibiotics, debride dying or necrotic tissues and lavage the wound, assess for surgical closure, and protect the wound.

Initial Wound Management Recommendations

Provide effective analgesia or anesthesia based on wound severity, location, and other factors (See Chapter 16 and Table 19).[1-6]

1. Apply sterile water-soluble lubricant liberally to the wound bed and then clip the hair generously around the wound. Gently cleanse the skin around the wound, but not the wound bed, with surgical scrub. Gently lavage the lubricant and gross contaminants from the wound using sterile saline or lactated Ringer's solution (LRS); do not use tap water except in very grossly contaminated wounds with large amounts of debris, in which case it may be more expedient to flush the wound with warm water under gentle pressure initially. The goal of initial lavage is to remove gross contaminants and reduce the bacterial burden.

2. Debride grossly necrotic tissues and non-viable tissue carefully using aseptic technique and sharp dissection. Do not mass ligate tissues or use cautery excessively, as this usually leads to necrosis of these tissues

and serves as a bed for infection. Use caution not to damage, transect, or ligate major blood vessels (unless actively hemorrhaging) or nerves, as these are crucial to maintain effective blood flow and innervation distally.

3. Lavage of the wound is necessary to remove particulate debris and reduce bacterial contamination – remember the adage, ***"The solution to pollution is dilution."***

   - There are several devices acceptable and available for adjunctive wound irrigation. Simple bulb irrigation and gravity irrigation have been the preferred method of wound irrigation. The bulb and syringe method has been more widely accepted and is significantly less expensive. Large bore gravity-run tubing has been favored for quick irrigations. Pulsatile jet lavage irrigation using a battery powered system is another method of adjunctive irrigation in the overall management of contaminated crushed wounds. It must be emphasized that all methods of wound irrigation, including pulsatile lavage, are adjuncts to sharp, surgical debridement and not a substitute for surgical debridement.

   - Normal saline, sterile water and potable tap water all have documented similar usefulness, efficacy and safety. Sterile isotonic solutions are readily available and remain the fluid of choice for irrigation. If unavailable, sterile water or potable tap water can be used.

   - Bacterial loads drop logarithmically with increasing volumes of 1, 3, 6, and 9 liters of irrigation. The current recommendations are as follows: 1-3 liters for small volume wounds, 4-8 liters for moderate wounds, and 9 or more liters for large wounds or wounds with evidence of heavy contamination.[3]

4. Generally, contaminated and dirty/infected wounds should not be sutured until healthy granulation tissue is established, which generally occurs in 3-5 days. This is especially true for bite wounds.

Bandaging Recommendations

- In nearly all cases, open wounds should be bandaged to protect the wound from contamination and support the wound while it heals. In most cases, mechanical debridement is desired (i.e., in most wounds after initial management has been performed, with varying degrees of contamination or infection), so use an adherent dressing. Once a healthy granulation bed has formed, convert to a non-adherent dressing.

- The most common adherent dressing is a wet-to-dry bandage, consisting of sterile gauze sponges that are saturated with sterile saline, gently wrung to eliminate excessive moisture, and the applied directly to the wound. Over the wet dressing, several dry gauze sponges are applied. In large wounds, laparotomy sponges may be optimal to cover more wound bed.

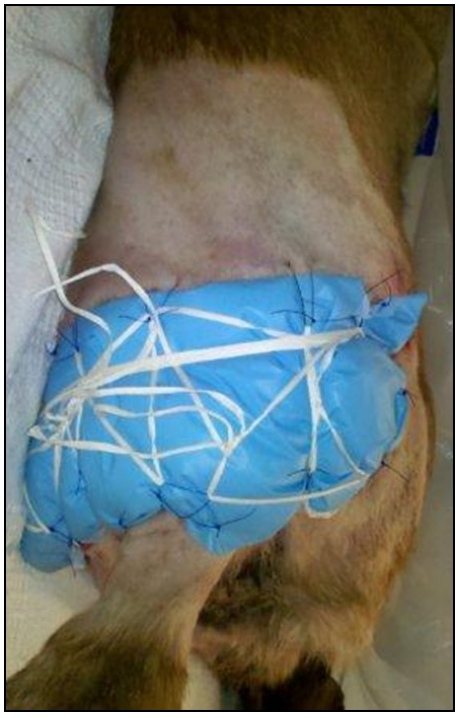
- The most common non-adherent dressing is a semi-occlusive cotton pad (e.g., Telfa®) that retains moisture against the wound bed and 'wicks' exudate from the surface of the wound.

- Use topical silver sulfadiazine ointment or triple-antibiotic ointment on most wounds.

- Apply a secondary layer over the primary layer. Most commonly, rolled cast padding or roll cotton is used to provide support. Splints can be included in the secondary layer, if used.

- Apply a tertiary layer, typically consisting of non-adherent conforming bandage, adhesive bandage, or both. This layer holds the dressing and secondary layer in place, provides additional support, and provides more durable protection of the underlying layers. In most cases, the tertiary layer is applied just tight enough to hold the bandage in place, and without compression.
- Change bandages at least once daily. More frequent bandage changes may be necessary if the wound has a heavy discharge or the bandage becomes soiled or partially removed by the MWD. Once wound discharge is reduced and a healthy granulation bed has formed, bandage changes become less frequent, generally every 2-3 days.
- Any MWD with a bandage applied must be prevented from chewing at the bandage. A plastic bucket with the bottom cut out can be used to prevent self-trauma can be attached to the dog's collar as an effective prevention practice (See Figure 21 and Figure 22).
- Negative pressure wound therapy (NPWT; e.g., WoundVac®) has proven a viable treatment modality for wounds in dogs, but requires proper training to apply properly to dogs and frequently heavy sedation of the MWD to prevent disruption of the dressing. HCPs with experience with NPWT are encouraged to consult with supporting veterinary personnel if this treatment modality is considered necessary before the MWD is evacuated to a veterinary facility. In most cases, application of NPWT can be delayed until the MWD is evacuated to a veterinary facility for long-term care.
- A "tie-over" bandage should be used in locations that are difficult to place a bandage, such as the inguinal area, dorsum, hip, and flank. Routine bandages placed in these areas typically slip off, and fail to protect the wound. A tie-over bandage consists of the same layers of bandage material, whether adherent or non-adherent, placed within and over the wound in a packing fashion. Multiple suture loops are placed around the periphery of the wound in the skin, evenly spaced around the wound, using large (2-0 or larger) monofilament suture material. The wound is then covered with a portion of impermeable drape or similar material. The bandage is then secured using umbilical tape or similar material laced through the suture loops (see Figure 44). Ties of surgical masks are a good substitute if umbilical tape is not available. The ties should be sufficiently tight to hold the bandage in place, with mild tension on the suture loops. The covering layer should be snug over the top of the underlying layers. A tie-over bandage will not have a compression layer.

Figure 44. Tie-Over Bandage.



Antibiotic Use with Open or Necrotic Wounds

Systemic antibiotics are indicated for any MWD with moderate or severe wounds. Wound cultures are indicated at admission if the patient presents with a dirty/infected wound, if obvious infection develops during any phase of wound management, if the wound fails to heal normally, or if systemic signs of infection develop. Continue antibiotics for a minimum of 7 days (See Table 20).

TABLE 19. MANAGEMENT OF OPEN OR NECROTIC WOUNDS IN MWDS[1-6]

1. Manage potential local and systemic infection.

a. Collect samples for microbial culture and sensitivity testing, preferably before antibiotic therapy is started. Transfer samples to supporting veterinary personnel for submission.

b. Initiate antibiotic therapy within the first 6 hours of the wound's development, or as soon as possible thereafter (See Table 20 for antibiotic selection and dosing).

c. Culture the wound if obvious infection develops during any phase of wound management, if the wound fails to heal normally, or if systemic signs of infection develop.

2. Provide initial wound management.

a. Provide effective analgesia or anesthesia based on wound severity, location, and other factors (See Chapter 16).

b. Apply sterile water-soluble lubricant to the wound bed and then clip the hair generously around the wound.

c. Gently cleanse the skin around the wound, but not the wound bed, with surgical scrub.

d. Gently lavage the lubricant and gross contaminants from the wound using sterile saline or lactated Ringer's solution (LRS).

e. Debride grossly necrotic tissues and non-viable tissue carefully using aseptic technique and sharp dissection.
   1) Do not mass ligate tissues or use cautery excessively.
   2) Do not damage, transect, or ligate major blood vessels (unless actively hemorrhaging) or nerves, as these are crucial to maintain effective blood flow and innervation distally.

f. Lavage the wound to remove particulate debris and reduce bacterial contamination.
   1) Thoroughly lavage the wound bed.
   2) Lavage under pressure.
   3) Sterile isotonic solutions are the fluid of choice.

g. Bandage the wound.
   1) Apply a primary layer to provide mechanical debridement initially, using a wet-to-dry bandage, consisting of sterile gauze sponges saturated with sterile saline, gently wrung to eliminate excessive moisture, and applied directly to the wound.
   2) Apply several dry gauze sponges over the primary layer.
   3) Apply a secondary layer over the primary layer, using cast padding or roll cotton +/- splints to provide support.
   4) Apply a tertiary layer of non-adherent conforming bandage, adhesive bandage, or both, using light compression.
   5) Apply a "tie-over" bandage in areas that are not amenable to routine bandaging.

3. Provide daily wound care until evacuation, using appropriate analgesia, sedation, or anesthesia. Change bandages at least once daily, but more frequently if heavy discharge is present or the bandage is soiled or partially removed by the patient. Lavage the wound as above at every bandage change. Debride the wound as above at every bandage change. Apply a new bandage as above; however, change the primary layer to a non-adherent dressing once a healthy granulation bed is formed.

TABLE 20. ANTIBIOTIC SELECTION AND DOSING FOR MWDS			
Antibiotic	**Dose for MWD**	**Route**	**Frequency**
Amoxicillin	20 – 30 mg/kg	PO	q 12 h
Amoxicillin-Clavulanic Acid	13.75 mg/kg	PO	q 12 h
Ampicillin	20 – 30 mg/kg	IV	q 8 h
Ampicillin Sulbactam	20 – 30 mg/kg	IV	q 8 h
Cefazolin	20 -30 mg/kg	IV	q 8 h
Cefotaxime	22 mg/kg	IV	q 8 h
Ceftriaxone	25 mg/kg	IV	q 8-12 h
Cephalexin	30 mg/kg	PO	q 12 h
Ciprofloxacin	35 mg/kg	PO	q 24 h

Wound Management References

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Ocular Injuries

Ocular injuries in MWDs in deployed settings will likely include irritant conjunctivitis, corneal ulceration, eyelid lacerations, and penetrating foreign objects. Clinical signs of ocular and periocular injury include eyelid lacerations, swelling of the periorbital tissues or conjunctiva, exudate in the conjunctival sac or on the eyelids, blepharospasm, intense redness of the conjunctiva, epiphora, photophobia, and rubbing the eye. Penetrating foreign objects may be present.

Evaluations of Ocular Injuries

1. Sedate the MWD as needed to allow detailed but safe examination of the affected eye (See Chapter 16).
2. Flush the affected eye and adjacent tissues with copious amounts of sterile saline or ophthalmic rinse.
3. Topically anesthetize the affected eye to facilitate examination, using 3-4 drops of topical ophthalmic anesthetic solution (e.g., proparacaine) on the cornea.
4. Remove exudate from the affected eye, if present, using saline-soaked cotton balls.
5. Examine the conjunctival area for foreign objects (e.g., particles, grass, plant seeds, thorns).
6. Stain the cornea of any affected eye using fluorescein stain to evaluate for ulceration.
7. Apply stain to the cornea, allow stain to dwell for at least 1 minute, and then rinse copiously with sterile saline or ophthalmic rinse.
8. Examine the eyes for symmetry, anisocoria, abnormal PLRs, or lens abnormalities.
9. While specific treatment of these problems is beyond the scope of practice for HCPs, the presence of these findings may suggest additional injury (e.g., TBI), that may need to be managed by the HCP.
10. Apply a bucket to the dog's collar to prevent self-trauma in ALL cases of ocular or periocular injuries in MWDs until the problem has resolved (See Figure 21 and Figure 22).

Treatment of Ocular Injuries

1. Irritant conjunctivitis

- Noted by varying degrees of conjunctival hyperemia, mild-to-moderate chemosis, and absence of other ocular signs.
- Flush eye and adjacent tissues with sterile saline/ophthalmic rinse 1-2 times daily.

- Apply bland ophthalmic antibiotic ointment (preferable) or solution (e.g., bacitracin-neomycin-polymyxin), q8h for 5 days.
- If corneal ulceration is present, DO NOT USE topical corticosteroids, as the risk of worsening the ulcer is high.
- If corneal ulceration is not present, the ophthalmic ointment can include topical corticosteroids. The eye MUST BE examined daily and fluorescein stain applied daily to ensure ulceration has not developed. Discontinue use of topical ophthalmic corticosteroids if any evidence of corneal ulceration is noted.

2. Corneal ulceration

- Noted by varying degrees of conjunctival hyperemia, mild-to-moderate chemosis, and presence of fluorescein dye uptake on the affected cornea.
- Flush eye and adjacent tissues with sterile saline/ophthalmic rinse 1-2 times daily.
- Apply bland ophthalmic antibiotic ointment (preferable) or solution (e.g., bacitracin-neomycin-polymyxin), q8h for 5 days.
- DO NOT USE topical corticosteroids, as the risk of worsening the ulcer is high.

3. Penetrating or embedded foreign object.

- Noted by the presence of a foreign object on the surface of or embedded in or through the cornea, with varying degrees of corneal edema. If the injury is chronic, neovascularization of the cornea may be present.
- Flush the eye and adjacent tissues with copious amounts of sterile saline/ophthalmic rinse 1-2 times daily.
- If the object is on the surface of or embedded on the outer cornea, attempt cautious removal after topically anesthetizing the eye.
    - If the object is removed, apply topical bland ophthalmic antibiotic ointment (preferable) or solution (e.g., bacitracin-neomycin-polymyxin) to the affected eye, q8h for 5 days.
    - DO NOT USE topical corticosteroids, as the risk of worsening the injury is high.
- If the object cannot be removed from the surface of the cornea, or appears to penetrate the cornea or globe, do not attempt to remove the object.
    - Apply topical bland ophthalmic antibiotic ointment (preferable) or solution (e.g., bacitracin-neomycin-polymyxin) to the affected eye, q8h for 5 days.

- DO NOT USE topical corticosteroids, as the risk of worsening the injury is high.
- Do not attempt to bandage the eye/head. The anatomy of the canine head is such that attempts to bandage the eye generally are unsuccessful and bandages tend to worsen ocular injuries. Although it is counterintuitive, leave the affected eye unbandaged.
- Evacuate the MWD to a veterinary facility on an URGENT basis once feasible.

4. Eyelid and peri-orbital lacerations.

- Noted by the presence of lacerations or abrasions affecting the peri-orbital tissues.
- Deeply sedate or anesthetize the MWD (See Chapter 16).
- Close subcutaneous tissues in 1 or 2 layers, using absorbable 3-0 or 4-0 monofilament simple interrupted sutures.
- Close the skin using nonabsorbable 3-0 nylon.
- Apply topical bland ophthalmic antibiotic ointment (preferable) or solution (e.g., bacitracin-neomycin-polymyxin) to the affected eye, q8h for 5 days.

Ocular Injury References

Hollingsworth, SR and Holmberg, BJ. Ocular disease in the intensive care unit. In: Small Animal Critical Care Medicine, Silverstein DC and Hopper K, eds. Saunders/Elsevier, St Louis, MO, 2015;815-820.

CHAPTER 16

Analgesia and Anesthesia

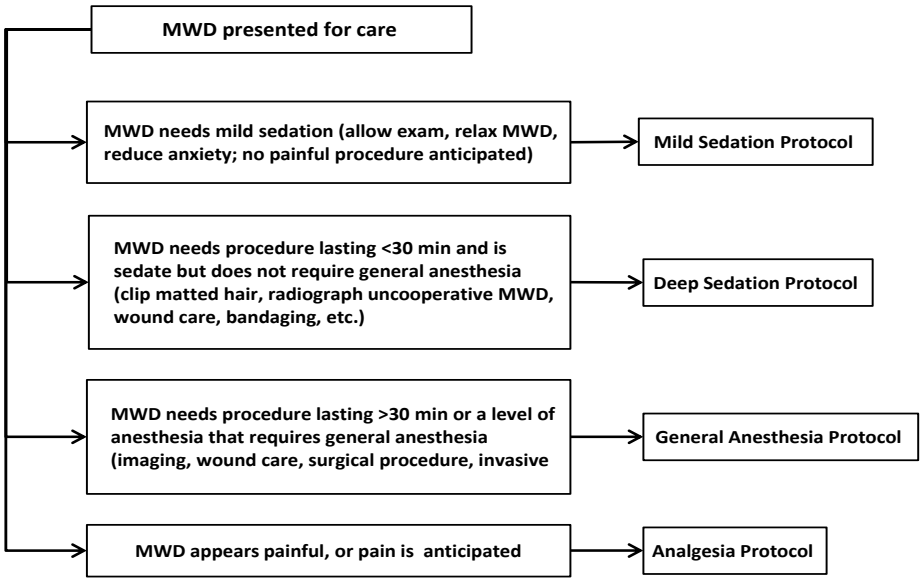
This chapter provides succinct, quick reference protocols for analgesia and anesthesia of emergently ill or injured MWDs, using simple combinations of drugs readily available to most HCPs.[1] A decision-making algorithm is provided below (Figure 45) to determine which analgesia or anesthesia protocol is recommended, based on specific need. Before any use of analgesia or anesthesia, a full physical exam must be performed.

MWDs can be fractious and difficult to manage, and often require heavy sedation for relatively simple procedures. Tailored protocols are provided, based on the level of sedation or anesthesia required – mild or deep sedation, or general anesthesia.[1]

Prehospital Analgesia

MWD handlers or combat medics may have given morphine, fentanyl, or ketamine before arrival, so inquire about drug use before transport, which may affect assessment of the patient's mentation and analgesia.

Figure 45. Decision-making Algorithm for Analgesia or Anesthesia.



Protocol Guidance

All drug combinations use the intramuscular (IM) route for ease and safety. If used within 5 minutes, all drugs can be combined in the same syringe to simplify administration. ***Wait at least 20 minutes after administration before attempting any procedure, to allow maximal drug effect***. Ideally, an IV catheter should be placed once feasible (See Chapter 2).

Drug Dosing in Dogs

Dosages for many analgesics in dogs are significantly higher than for people. Trust the doses provided in this chapter, and dose as directed to prevent inadequate analgesia or sedation and 'wind up' pain.

Gastrointestinal Side Effects of Opioids

Protocols include opioids, which in dogs typically causes emesis, often within 5 minutes of administration. Use caution and have the handler prepared to remove the muzzle to minimize aspiration risk.

Mild Sedation Protocol

- Use to relax MWDs for examination, handling, or short minor procedures that will not cause pain. Use to reduce anxiety.
- **Protocol:** MIDAZOLAM 0.3 mg/kg IM and HYDROMORPHONE 0.2 mg/kg IM.
- **Expectations:** The MWD will be calm, but reactive and noise sensitive.

Deep Sedation Protocol

- Use for procedures that can be completed in <30 minutes and do not require general anesthesia, such as clipping of hair, wound cleansing, minor wound debridement, splinting of lower limb fractures, bandage application or removal, ear cleaning, or radiography. First-line protocol for fractious MWDs.
- **Protocol:** MIDAZOLAM 0.3 mg/kg IM and KETAMINE 5 mg/kg IM and HYDROMORPHONE 0.1 mg/kg IM.
- If deeper sedation or light anesthesia is necessary, or to allow general anesthesia induction, use PROPOFOL in 1 mg/kg boluses IV as needed.
- **Expectations:** The MWD will not be able to walk, cannot be intubated, can be aroused with stimulation, and maintains laryngeal and palpebral reflexes.

General Anesthesia Protocol

- Use to facilitate imaging, allow management of fractures, perform surgical procedures, and perform invasive diagnostic procedures.
- Preoxygenate for 5 minutes using oxygen mask.

- Premedicate using the Deep Sedation Protocol, and place an IV catheter.
- Induce using PROPOFOL 1 mg/kg IV boluses to effect.
- Intubate with an appropriate endotracheal tube. Most MWDs require a 9-11 mm ID endotracheal tube. Use a cuffed tube.
- Maintain anesthesia using ISOFLURANE 0.5-1.5% titrated to effect in 100% oxygen or SEVOFLURANE 2.0-2.5% titrated to effect in 100% oxygen or PROPOFOL CRI 100-300 mcg/kg/min.
- Manage pain with HYDROMORPHONE 0.1 mg/kg IV boluses, not to exceed 0.2 mg/kg per hour.
- Monitor appropriately, give IV fluids, and keep the MWD warm (See **Ancillary Support** in this chapter, and Table 21 on the next page).

Effective Analgesia Protocols for MWDs

Assessment of pain in dogs is difficult. Dogs are generally very stoic and often hide or fail to show outward signs of pain. HCPs should err on side of providing analgesia – if performed properly, it is safe and effective, and analgesia is critically important for safe handling and alleviation of pain.

- Note that all protocols have analgesia incorporated into them. Additional analgesia can be provided by the IV, IM, or PO route, as necessary.
- ***Scheduled administration of analgesics in the post-procedure period is preferred*** to as needed administration in dogs, because pain can be difficult to assess and to avert the 'roller coaster' effect of unmanaged pain.
- For intermittent IV or IM supplementary analgesia, use one of the following drugs:
  - HYDROMORPHONE 0.1-0.2 mg/kg q2-4h.
  - MORPHINE 0.2-0.5 mg/kg q4-6h
- For CRI supplementary analgesia, use one of the following drugs:
  - FENTANYL 2-10 mcg/kg/h.
  - MORPHINE 0.1-0.25 mg/kg/h.
  - HYDROMORPHONE 0.02-0.05 mg/kg/h.
- For PO supplementary analgesia, use TRAMADOL 5-10 mg/kg PO q8-12h for up to 5 days.

Caution: Do NOT use acetaminophen or ibuprofen in MWDs, as these drugs can cause liver toxicity. AVOID use of NSAIDs such as naproxen, meloxicam, and aspirin in emergently ill or injured MWDs.

Opioid Reversal

At appropriate doses, dogs appear less susceptible to opioid-induced respiratory depression and excessive sedation. However, opioid side effects can be reversed in the dog using NALOXONE 0.01-0.02 mg/kg slow IV to effect if needed. Note that this will reverse analgesia as well as sedation!

Ancillary Support

- Any MWD that is deeply sedated or under general anesthesia should be given IV crystalloid fluid therapy at 10 mL/kg/h to offset anesthesia-induced hypotension. Additional fluid volumes may be necessary based on the underlying problem (e.g., shock should be given IV fluids to targeted endpoints, as per Chapter 6, Figure 33).
- Active warming should be provided for any MWD that is deeply sedated or under general anesthesia. Use forced-air warmers, warm water circulating blankets, heat-retaining covers, and warming tables to target a body temperature of 100-101° F. Monitor temperature post-procedure until sustained >100^0 F.
- Basic and advanced monitoring of the MWD at a level considered appropriate for a human patient for the respective level of analgesia or anesthesia must be provided. Table 21 lists key monitoring parameters and goals for anesthetized MWDs, and common anesthesia machine settings.

TABLE 21. KEY MONITORING PARAMETERS & ANESTHESIA MACHINE SETTINGS

Parameter	Normal Values	Notes
Heart rate	60-100 bpm	See Chapter 2 for placement of ECG electrodes
Heart rhythm	Normal sinus	
Blood pressure	MAP >60 mmHg	Non-invasive technique
Pulse oximetry	97 ± 2%	See Chapter 2 for placement
Capnography	E_TCO_2: 35 – 45 mmHg	Up to 60 mmHg is permissible in a normoten-sive, spontaneously ventilating patient
Temperature	99 - 102.5 ^{0} F	Continuous recording probes can be inserted into the esophagus or rectum
Fresh gas flow	1 – 2 L/min	
F_IO_2	0.3 – 1.0 %	
Inhalant agent	Isoflurane: 0.5 – 1.5% Sevoflurane: 1.0 – 3.0 %	
Ventilation modes	Spontaneous (preferred) Volume controlled: TV=10-20 mL/kg Pressure controlled: PIP=1-25 cmH_2O BPM = 6-12 PEEP: 0 – 5 cmH_2O	

Analgesia and Anesthesia Reference

US Army Public Health Command, Veterinary Medical Standardization Board, Anesthesia and Pain Management Standards, 10 October 2013.

CHAPTER 17

Traumatic Brain Injury and Acute Spinal Cord Injury

Traumatic brain injury (TBI) and acute spinal cord injury (ASCI) are uncommon in MWDs. These injuries are often catastrophic, with poor long-term outcome. Caring for affected MWDs is daunting and can tax resources. However, some CNS injuries are recoverable, so efforts to evaluate MWDs with TBI and ASCI should be made to determine the severity of injury and potential for successful outcome. Anticipate these injuries in MWDs exposed to building collapses, blast, and ballistics injuries.

Acute Spinal Cord Injury

Assume ASCI is present in every MWD trauma patient until proven it is not present. Maintain a high index of suspicion! 40-50% of MWDs with ASCI have concurrent injury elsewhere that may be more life-threatening.[1] Focus on initial resuscitation and stabilization, but constantly consider potential neurological injuries. Excessive movement can cause a partial injury to become a permanent injury. Limit movement during the initial exam and treatment period to that which is absolutely necessary until a detailed neurological exam is performed.

Clinical Signs Suggesting ASCI

Clinical findings of bruising over any part of the spine; spinal instability, misalignment, crepitus or pain along the spine; presence of head injury or altered mentation or level of consciousness; or major trauma to other body systems are early tips that ASCI may be present.

Specific neurological signs that strongly suggest ASCI include loss of conscious proprioception, loss of superficial and deep pain, and loss of function (paresis or paralysis).

Lesion Localization

It is ideal to localize the segment of the cord affected. Determine if upper motor neuron (UMN) or lower motor neuron (LMN) signs are present.

- **UMN signs** are characterized by increased motor tone causing normal or exaggerated limb reflexes, normal to increased muscle tone, and decreased proprioception and decreased superficial and deep pain sensation in areas caudal to the lesion.
- **LMN signs** are characterized by flaccid or weak motor tone causing depressed limb reflexes and decreased muscle tone in areas caudal to the lesion.

With both UMN and LMN involvement, paresis or paralysis are possible.

- C1-C5 – UMN signs to all 4 limbs, possibly abnormal respiration (shallow or absent).
- C6-T2 – UMN signs to the hind limbs and LMN signs to the forelimbs.
- T3-L3 – UMN signs to the hind limbs with normal forelimbs.
- L4-S2 – LMN signs to the hind limbs with normal forelimbs.

Diagnostic Imaging

Radiographs, CT, or MRI are often necessary for definitive diagnosis in patients with fractures or dislocations to determine the site of injury. If these imaging modalities are available and the MWD can be managed without worsening possible injury, attempt imaging (See Chapter 20). Heavy sedation or anesthesia will be necessary (See Chapter 16).

General Management Considerations for Patients with ASCI

Goals are to reduce neurological deficit and prevent further loss of neurological function (See Figure 46).

- Follow guidance in this CPG for management of shock, hypotension, hypovolemia, hemorrhage control, and respiratory dysfunction. Be prepared to intubate patients that are not breathing or have depressed ventilation. Careful intubation using manual in-line stabilization (MILS) is essential to minimize further injury.
- If signs suggest ASCI are present and the MWD is NOT ambulatory, immobilize the MWD using a backboard (plywood sheet, plastic board, EMS backboard, etc.) to which the animal is taped, and sedate with or without analgesia as often as necessary to prevent unwanted patient movement due to anxiety and pain.
- If signs suggest ASCI is present and the MWD IS ambulatory or adequate immobilization is not possible (due to lack of sedative/analgesia or support devices or patient temperament), confine the MWD to a small area or kennel and prevent excessive movement until evacuated.
- Do NOT use nonsteroidal anti-inflammatory drugs (NSAIDs).
- Do NOT give corticosteroids to MWDs with ASCI, UNLESS the animal has no deep or superficial pain, is paralyzed, or the neurological condition deteriorates. If corticosteroids are given, use ONLY a SINGLE dose of methylprednisolone sodium succinate, IV, 30 mg/kg over 15 minutes.

Conservative Management of ASCI

Indications for conservative (non-surgical) treatment include patients that are ambulatory or paraparetic, and patients that have strong voluntary movement and peripheral pain sensation.

- Maintain enforced confinement, analgesia, and sedation as needed to minimize movement.
- Evacuate URGENTLY if feasible.

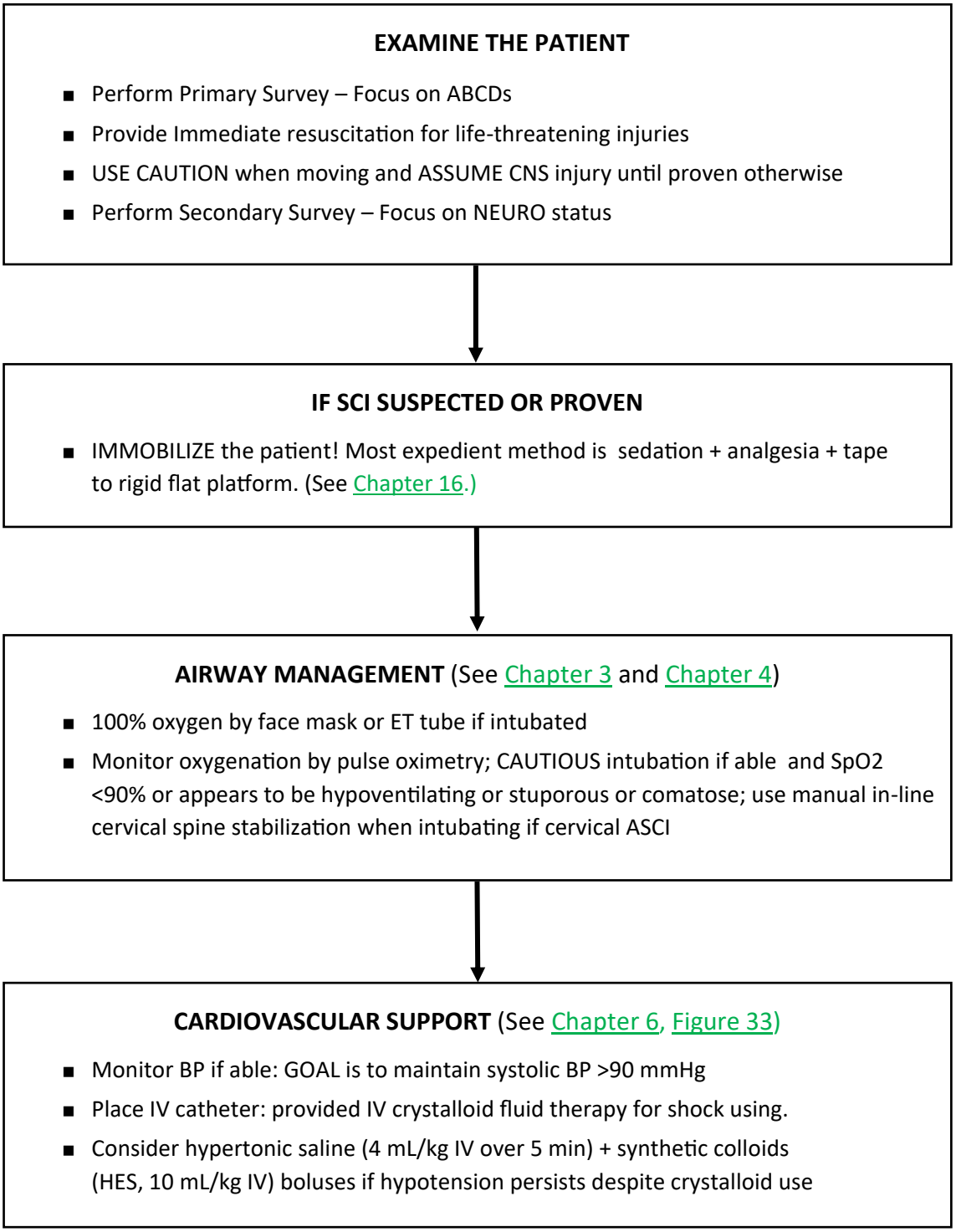
Surgical Management of ASCI

Early definitive surgical correction is indicated in non-ambulatory patients, patients with palpably unstable or displaced injuries, patients that deteriorate with conservative therapy, patients with peripheral pain sensation but no voluntary movements, and patients requiring decompressive surgery to correct displaced or fractured

spinal segments or bone fragments. Surgical management is likely not be feasible in a deployed setting.

- Definitive surgical repair of ASCI in MWDs should only be performed by qualified veterinary personnel.
- Evacuate as soon as feasible, or consider euthanasia (Chapter 21) if severe ASCI is present based on physical exam, diagnostic imaging results, lack of deep or superficial pain, or paralysis is present at any time.

Figure 46. Clinical Management Algorithm for Acute Spinal Cord Injury in MWDs.



Traumatic Brain Injury

There is limited data on TBI in animals. Anticipate TBI in MWDs after trauma in 25-40% of cases.[2-6] TBI carries an extremely high mortality; assume a prehospital mortality of >40% in severe TBI cases. Management of MWDs is largely based on recommendations for treating people. Care by HCPs should be directed at efforts to mitigate secondary injury from hypotension, hyperthermia, hyper- and hypoglycemia, hypoxia, hyper-and hypocapnia, acid-base imbalances, electrolyte imbalances, SIRS, MODS, and ARDS. Thus, HCP care should be directed at maintenance of blood pressure, normoxemia, normal ventilation, and normal body temperature.

Clinical Signs Suggesting TBI

Brain injury should be suspected in any trauma patient with altered mentation (coma, stupor, depression, lethargy, inappropriate behavior or responses) or with physical evidence of head trauma (e.g., lacerations, abrasions, bruising, swelling, pain, bleeding from the nose or ears).

- Pay special attention to the patient's level of consciousness (LOC), overall pain response, pupillary light responses, cardiac and respiratory changes, motor activity and reflexes, and body temperature.
- The external ear canals and nasal openings should be examined for evidence of blood or CSF.
- The presence of lateralizing neurologic signs in a patient with brain injury suggests underlying intracranial hemorrhage; whereas patients with diffuse CNS deficits more probably have significant intracranial edema as a cause or contributor to their neurologic dysfunction.[2-5] These findings will affect treatment options.
- MWD posture on presentation may allow injury localization and estimation of prognosis. While these classic postures are not always noted, their presence can be used by first responders to identify severe TBI with poor-to-grave prognoses.
  - Patients with injury to the T2-L2 thoracic spine often display the Schiff-Sherrington syndrome (Figure 47, inset A), typically with normal mentation, forelimbs in extensor rigidity, and hind limbs that are flaccid. The prognosis for these patients is usually grave due to severe spinal cord trauma.
  - Patients with decerebellate rigidity (Figure 47, inset B) typically are obtunded or depressed, have

Figure 47. Characteristic Neurologic Postures on Presentation.

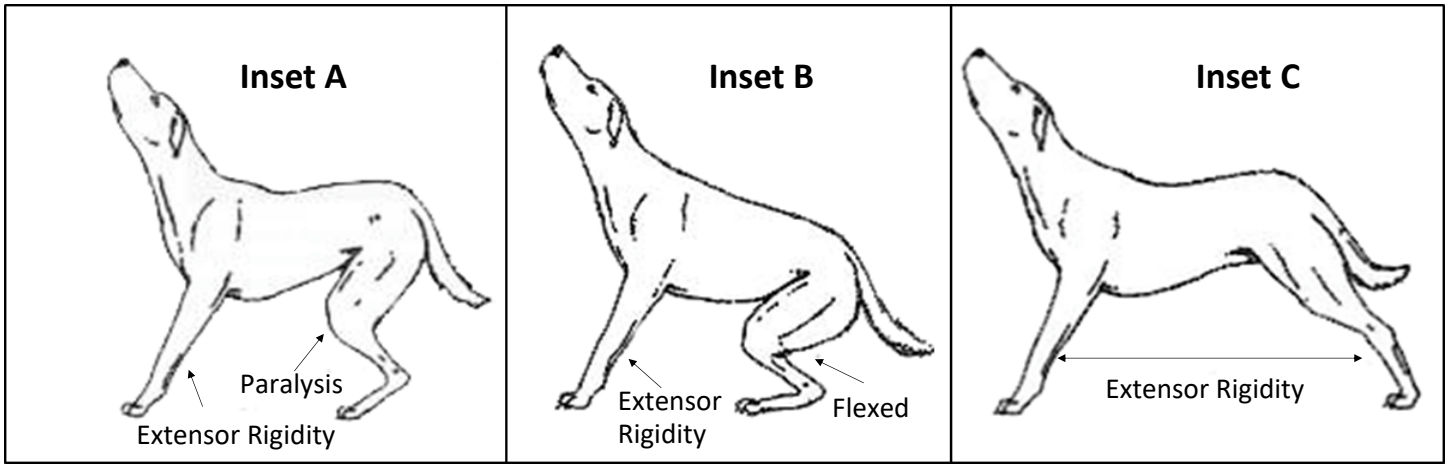


TABLE 22. MODIFIED VETERINARY GLASGOW COMA SCALE[7]	
Level of Consciousness	**Score**
Occasional periods of alertness and responsive to environment	6
Depression or delirium, capable of responding but response may be inappropriate	5
Stupor – semi comatose, responsive to visual stimuli	4
Stupor – semi comatose, responsive to auditory stimuli	3
Stupor – semi comatose, responsive only to repeated noxious stimuli	2
Comatose – unresponsive to repeated noxious stimuli	1
Motor Activity	
Normal gait, normal spinal reflexes	6
Hemiparesis, tetraparesis, or decerebrate activity	5
Recumbent, intermittent extensor rigidity	4
Recumbent, constant extensor rigidity	3
Recumbent, constant extensor rigidity with opisthotonus	2
Recumbent, hypotonia of muscles, depressed or absent spinal reflexes	1
Brainstem Reflexes	
Normal PLRs and oculocephalic reflexes	6
Slow PLRs, normal to reduced oculocephalic reflexes	5
Bilateral unresponsive miosis, normal to reduced oculocephalic reflexes	4
Pinpoint pupils, reduced to absent oculocephalic reflexes	3
Unilateral unresponsive mydriasis, reduced to absent oculocephalic reflexes	2
Bilateral unresponsive mydriasis, reduced to absent oculocephalic reflexes	1

opisthotonus, have fore limbs in extensor rigidity, and hind limbs in active flexion. These patients have a guarded prognosis due to severe injury to the cerebellum.

- Patients with decerebrate rigidity (Figure 47, inset C) typically are obtunded, have opisthotonus, and the fore limbs and hind limbs are in extensor rigidity. The prognosis for these patients is grave due to severe injury to the cerebrum.

Assessing Severity of TBI in MWDs

A modified veterinary Glasgow Coma Scale (Table 22 above) is validated for use in dogs.[7] Data is limited, however, correlating long-term outcome (i.e. prognostication) with initial or serial assessment of GCS in dogs.

- As with people, the lower the total GCS, the worse the TBI and the lower the expected survival with neurological function intact.
- Limited use in veterinary trauma patients has allowed development of suggested prognoses based on the MVGCS (See Table 23). HCPs should use this guidance when assessing severity of TBI and resource allocation.

TABLE 23. SUGGESTED PROGNOSES BASED ON MODIFIED VETERINARY GLASGOW COMA SCALE[7]	
MVGCS Score	**Suggested Prognosis**
3-8	Grave
9-14	Guarded
15-18	Good

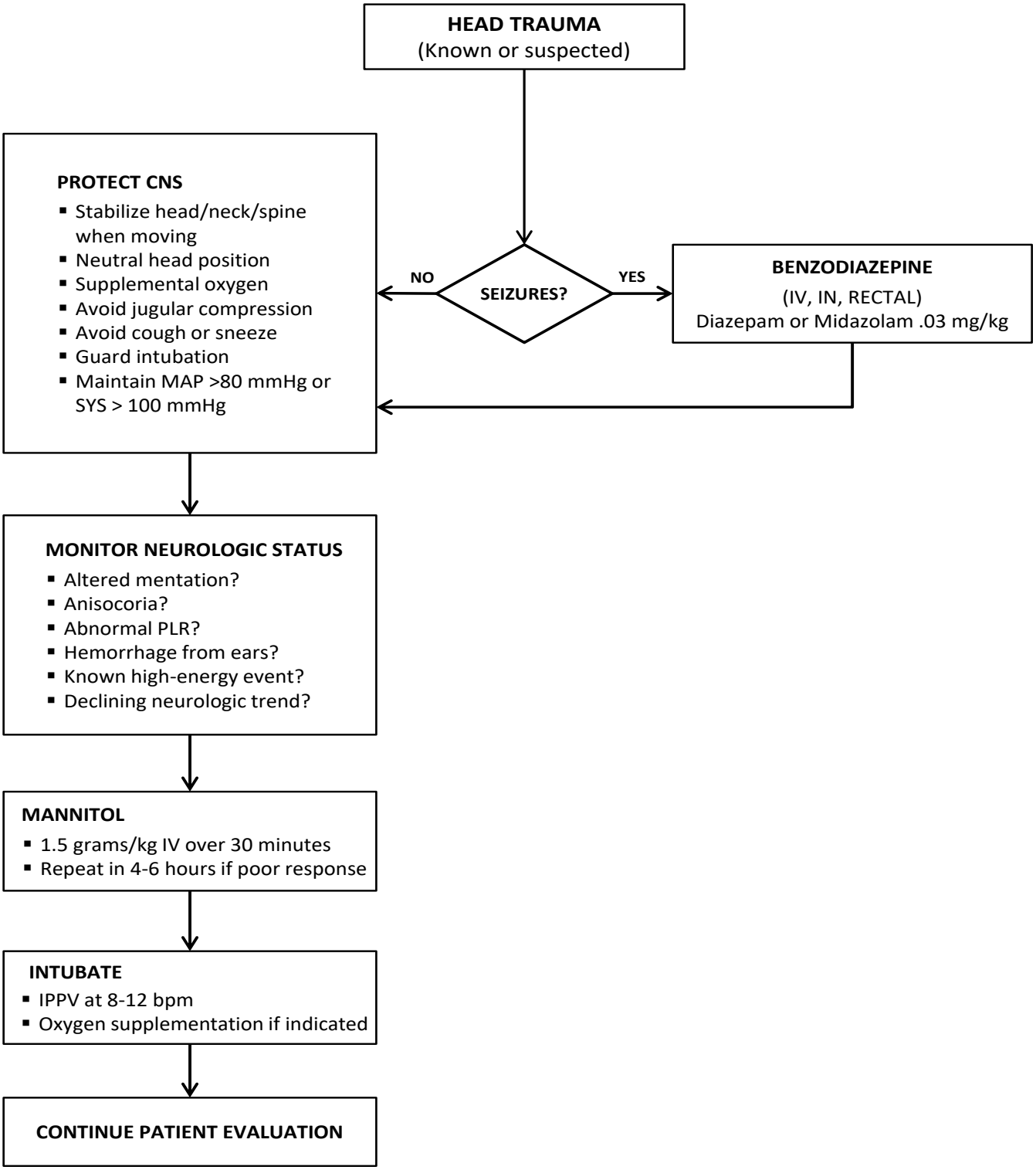
General Management Considerations for MWDs with TBI

It is critical to ensure adequate resuscitation and management of cardiovascular and respiratory problems, as hypotension, poor tissue perfusion, and hypoxia lead to progressive brain injury due to the adverse effects of secondary neurological injury due to ischemia, cerebral edema, reperfusion injury, and so forth. (See Figure 48 on the next page.)

- Follow guidance in this CPG for management of shock, hypotension, hypovolemia, hemorrhage control, and respiratory dysfunction.
- Be prepared to intubate patients that are not breathing or have depressed ventilation; careful intubation using manual in-line stabilization (MILS) is essential to minimize further injury.
- Focus care on preventing hypoxemia, maintaining cerebral perfusion pressure and systemic arterial pressure in the normal ranges, and preventing secondary ischemic cerebral injury.
  - Provide 100% oxygen by facemask. Monitor respiratory rate and effort. Be prepared to intubate and provide supplemental oxygen by ET tube. Maintain arterial carbon dioxide content in the normal range using assisted manual ventilation. Avoid hyperventilation!
  - Maintain normotension (MAP 70-80 mmHg or systolic BP >90 mmHg). Start IV crystalloid fluid therapy to correct shock and provide ongoing volume support (See Chapter 6, Figure 33). Measure blood pressure if possible; otherwise, guide fluid therapy based on presence or absence of distal pulses. Consider hypertonic saline (4 mL/kg IV over 5 min) or hyperoncotic fluid (HES, 10 mL/kg IV) boluses if hypotension persists despite crystalloid use.
  - Nurse with head elevated 30^0 with neutral neck position, avoid external jugular vein compression and catheters, avoid procedures that stimulate coughing or sneezing.
  - If evacuation will be prolonged and the patient is recumbent, rotate lateral recumbency and lubricate the eyes with ophthalmic ointment every 4 hours and maintain in a well-padded area.
  - If the MWD is conscious, restrict activity and movement (e.g., portable kennel), which may require sedation and analgesia (See Chapter 16).

(Continued on page 113)

Figure 48. Management Algorithm for TBI for MWDs.



- Give mannitol, 1.5 grams/kg, IV, over 30 min for MWDs with a MVGCS score of ≤ 8. Repeat this dose once more 4-6 hours after the first dose.
  Note that dogs are less likely to suffer subdural or intracranial hemorrhage; thus, mannitol should be used early in any MWD with moderate-to-severe TBI (MVGCS ≤ 8).
- ***Do NOT use corticosteroids to treat MWDs with TBI.***

Prognosis

HCPs must be realistic when treating MWDs with ASCI and TBI. While efforts and resources should be extended for MWDs with mild-to-moderate ASCI and TBI, HCPs should consider the likelihood of return to function. Consider euthanasia (See Chapter 21) for MWDs with catastrophic neurological injuries, or dogs with paralysis and that fail to respond to therapy or deteriorate despite care.

TBI and ASCI References

1. Park EH, White GA, Tieber LM. Mechanisms of injury and emergency care of acute spinal cord injury in dogs and cats. J Vet Emerg Crit Care 2012;22:160-178.
2. Dewey CW. Brain trauma. In: The Veterinary ICU Book. Teton NewMedia, Jackson, WY, 2003;910-920.
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5. Sande A, West C. Traumatic brain injury: a review of pathophysiology and management. J Vet Emerg Crit Care 2010;20:177-190.
6. Sharma D, Holowaychuk MK. Retrospective evaluation of prognostic indicators in dogs with head trauma: 72 cases (January-March 2011). J Vet Emerg Crit Care 2015;25:631-639.
7. Platt SR. Coma scales. In: Small Animal Critical Care Medicine, Silverstein DC and Hopper K, eds. Saunders/Elsevier, St Louis, MO, 2015;422-425.

CHAPTER 18

Canine Post Traumatic Stress Disorder (C-PTSD)

Background

MWDs exposed to different types of intense external stimuli, such as explosions and gunfire, experience a syndrome that is similar to PTSD in people. While much remains unknown about this syndrome, most of the affected MWDs to date have been exposed to these stimuli in combat scenarios. Thus, it is reasonable that MWD handlers will seek medical guidance for acutely affected dogs from HCPs. It is essential to be aware of this syndrome and to effectively guide handlers in immediate care while working to evacuate affected dogs to veterinary facilities. Veterinary Corps Officers are the best resource for current diagnostic and therapeutic recommendations and will facilitate telemedicine consultation with experts at the DoD Military Working Dog Veterinary Service.

High Index of Suspicion

Maintain high index of suspicion based on antecedent events. HCPs should maintain a high index of suspicion for C-PTSD so as to identify potential MWDs for further evaluation. Inclusionary criteria in the immediate period include antecedent events, specifically any combination of the following:

- Concussive event (with or without physical injury)
- Exposure to a combat environment, and
- Prolonged or repeated deployment to combat zone.

Key Behavioral Signs Characteristic for C-PTSD

Specific behavioral signs are tip-offs that C-PTSD may be present. HCPs will need to rely on the MWD handler for information about these signs.

Signs include any combination of the following: escape or avoidance from work-related environments, increased or decreased reactivity to environmental or social stimuli, positive or negative changes in rapport with the handler, or interference with critical tasks (detection, controlled aggression, and obedience).
NOTE: Possible delayed onset or delayed reporting of clinical signs supporting C-PTSD is common.

Although MWD handlers will most likely seek guidance after acute onset of signs, HCPs should be aware some MWDs may not manifest obvious signs for some time, or handlers may not seek guidance until the syndrome is advanced. Additionally, some dogs will have been evaluated, with treatment initiated by veterinary personnel, with handlers seeking guidance some time later. Thus, other keys to C-PTSD for HCPs to be aware of are the continuance of behavioral signs for more than 30 days and failure to improve with time or treatment.

Rule Out Problems Mimicking C-PTSD

Some medical problems cause signs that mimic C-PTSD. HCPs should carefully evaluate dogs for exclusionary criteria, such as traumatic brain injury (See Chapter 17). A key tip-off that C-PTSD is likely not present is development of behavioral signs before the antecedent events noted previously. Veterinary personnel must rule out anecdotal reports and other appropriate behavioral diagnoses in order to validate a C-PTSD diagnosis.

Management Guidance for HCPS

Listen to the MWD handler! If a handler seeks guidance for his or her working dog due to abnormal behavior in the first 30 days after a traumatic event or combat action, HCPs should do the following:

1. Record the interaction and forward to supporting veterinary personnel (See Chapter 22).
2. Direct the handler immediately remove the dog from the situation, if not already done.
3. Upon approval from the supporting veterinary officer, provide an anxiolytic for dogs that have demonstrated a moderate-to-severe response, using one of the following agents, given PO (preferable), IV, or IM:
   - Clorazepate (TRANXENE®), 12.5 mg per dog PO q12h (moderate response)
   - Buspirone (BUSPAR®), 10-20 mg per dog PO q8-12h (moderate to severe response)
   - Alprazolam (XANAX®), 1-2 mg per dog PO q12h (moderate to severe response)
4. Direct the handler to provide support for the dog with social activity and play.
5. Direct the handler to provide work therapy by performing critical tasks in safe area, free from distress.
6. Recommend to the handler and the commander that the MWD not be used in the tactical environment until the dog has been evaluated by veterinary personnel.
7. Coordinate soonest evacuation to veterinary personnel for further evaluation and care, base on the tactical situation and resource availability. MWDs with C-PTSD should be classified as ROUTINE for evacuation planning purposes.

Long-term Management

There is no role for HCPs to attempt long-term or delayed management of presumed C-PTSD. Misdiagnosis and/or delay of appropriate treatment will equally jeopardize the affected MWD's proper therapy and potential of return to duty. Affected dogs should be evaluated under the supervision of Veterinary Corps Officers and through consultation with the DODMWDVS board-certified animal behaviorist. On-going research suggests a positive association with early diagnosis, +/- medication and focused desensitization/ counterconditioning performed by the MWD handler in the first 60-90 days of case management. Every attempt is made to return the MWD to duty and avoid unnecessary STRATEVAC/redeployment, which can result in security and readiness issues.

C-PTSD References

1. Overall KL, Burghardt, WF. Report of the Blue Ribbon Panel on Post-Traumatic Stress Disorder in Military Working Dogs. Department of Defense Military Working Dog Veterinary Service, Lackland Air Force Base TX, 2011.

2. Burghardt WF, Broach, DR. Canine Post-Traumatic Stress Disorder (C-PTSD) in Military Working Dogs. American Veterinary Medical Association, San Antonio TX, 2016.

Training and Toxicoses in MWDs

MWDs are exposed to small quantities of select drugs and explosives, contained in specially-constructed containers called training aids. Training aid ingestion and toxicity are events unique to MWDs and working dogs employed by law enforcement agencies.

- Training aids that are of concern when ingested include nitrate-based explosives (TNT, water gel, dynamite, RDX , detonation cords, and C-4), smokeless powder, sodium and potassium chlorates, and drugs (marijuana, heroin, cocaine, and amphetamines).[1]
- Potential toxicity is a concern and it is plausible that HCPs will be presented with an MWD that has ingested a training aid and is or may become toxic.

Clinical Signs of Intoxication (by Agent)

MWD handlers will have critical knowledge of the agent to which an MWD was exposed, for training aid ingestion. Common agents used and associated clinical signs follow.

- **Nitrate/nitroglycerin-based explosives.** Ingestion may result in hypersalivation, severe CNS abnormalities (ataxia, incoordination, seizures, tremors), gastrointestinal irritation (nausea, vomiting), and methemoglobinemia (cyanosis, weakness, syncope, respiratory distress).
- **Smokeless powder explosive.** Ingestion may result in hypotension, CNS depression (ataxia, depressed mentation, incoordination), and methemoglobinemia (cyanosis, weakness, syncope, respiratory distress).
- **Potassium and sodium chlorate explosives.** Ingestion may result in methemoglobinemia (cyanosis, weakness, syncope, and respiratory distress), CNS abnormalities (ataxia, incoordination, and depressed mentation), gastrointestinal irritation (nausea, vomiting, abdominal cramping and pain, hemorrhagic diarrhea with melena or hematochezia), hematuria, hemoglobinuria, and renal and liver failure.
- **Marijuana/hashish.** Ingestion may result in altered mentation (disorientation), hallucinations (in the dog, typically manifested as vocalizing, useless scratching, hyperexcitability), nausea and vomiting, and respiratory distress.
- **Heroin.** Ingestion may result in bradycardia, respiratory distress, miosis, coma, and sudden death.
- **Cocaine and amphetamines.** Ingestion may result in restlessness, tachycardia, hyperexcitability, vocalization, excessive or unprovoked aggression, seizures, and mydriasis.

Treatment of Training Aid Toxicity[1]

If ingestion occurred ≤ 4 hours before presentation and the MWD is conscious and has normal CNS responses, induce vomiting.

- Apomorphine is the drug of choice to induce vomiting in the dog. MWD handlers are issued apomorphine in tablet form, which is generally available in 6 mg tablets. If available, place ¼ to ½ tablet into either conjunctival sac. Vomiting typically occurs in 5-10 minutes. Once vomiting has occurred, rinse residual apomorphine from the conjunctival sac.
- Apomorphine may be available in the HCP drug inventory as an injectable agent (10 mg/mL). If the injectable form is available, give 0.03-0.04 mg/kg IV. Emesis is typically evident within 5 minutes in most MWDs.
- An alternative is to give hydrogen peroxide orally if apomorphine is not successful or available. Give 1 mL per kilogram body weight of hydrogen peroxide 3% orally. Note that hydrogen peroxide is less successful than apomorphine.
- Do NOT use Syrup of Ipecac or salt, or try to induce vomiting manually. These methods are ineffective in the dog and risk intense gastrointestinal irritation in the dog, and bite wounds to the HCP.

If ingestion occurred >4 hours before presentation, or if the dog has abnormal mentation or is unconscious or seizuring, do not induce vomiting. In these cases, balance the benefit of gastric decontamination by orogastric lavage against the very real risk of aspiration pneumonia. If gastric lavage is elected, induce general anesthesia (See Chapter 16) and ensure a cuffed endotracheal tube is used. Lavage the stomach using repeated instillations of water at a dose of 10-20 mL/kg. Maintain the cuffed endotracheal tube until the MWD has regained a swallowing reflex.

The next critical step in management of any training aid toxicity is to administer activated charcoal.

- The dose for activated charcoal is 1.5 grams/kg PO. Most MWDs will ingest activated charcoal if the charcoal is mixed with canned food. If the MWD will not ingest the charcoal voluntarily, either have the handler syringe the slurry slowly orally or (if the MWD is anesthetized) give the slurry by orogastric tube. MWD handlers are issued Toxiban® with sorbitol and may have initiated therapy prior to presentation.
- Activated charcoal WITH sorbitol as a cathartic is preferred as the initial dose.
- Repeat activated charcoal once in 4-6 hours. This dose should not include sorbitol.

If seizures are present or develop, treat the MWD with a benzodiazepine.

- Give midazolam (0.3 mg/kg IV or IN) or give diazepam (0.3 mg/kg IV, IN, or per rectum).
- Repeat in 10-15 minutes if seizures persist or recur.

If methemoglobinemia is suspected or confirmed and deemed causing significant respiratory distress, treat with methylene blue (if available).

- The dose for methylene blue 1% in the dog is 1-2 mg/kg IV slow bolus.
- This dose can be repeated once or twice if respiratory distress persists.
- Methylene blue can cause severe Heinz body anemia in the dog, so monitor an HCT q6-8h if this drug is used.

Toxicoses in MWDs Reference

Bright PA. Military working dog training aids: toxicity and treatment. Air Force Occupational and Environmental Health Laboratory (AFSC), Human Systems Division, Brooks Air Force Base, TX, 1989;1-32.

Diagnostic Imaging

Diagnostic imaging of injured or ills dogs is frequently required for comprehensive patient evaluation. Veterinary facilities may not be equipped for imaging, or may be limited to plain radiography. Advanced imaging (e.g., MRI, CT) is often ideal, and veterinary facilities do not have these capabilities. This chapter provides guidance for HCPs with extensive training in the use of CT and MRI, when considering advanced imaging requirements, highlighting unique aspects when imaging dogs.

Computed Tomography vs Magnetic Resonance Imaging

CT is often superior to MRI and used for assessment of margins of osseous or mineralized structures compared to MRI. CT can assess soft tissue changes and differences fairly well by narrowing windows and levels under standard algorithms to see differences of attenuation of the x-rays, but cannot manipulate the soft tissues due to their molecular structure as MRI can in order to enhance or null their differences. Therefore, MRI is often far superior to CT at assessing for subtle changes within soft tissues due to the dramatic contrast enhancement. MRI is most often utilized in veterinary medicine and is the modality of choice when you are trying to assess soft tissue structures not easily accessed by an ultrasound probe or are looking for diseases that may not be appreciated via any other modality. MRI is used primarily for neurologic (brain and spine) imaging and joint imaging concerning cartilage, ligaments, and/or menisci. Keeping those general statements in mind, depending on the type of disease you are assessing for you may be able to appreciate the abnormalities on both modalities, so either study may be adequate for diagnosis. References are provided with specific imaging protocols for MWDs.[1-5]

Computed Tomography[3,4]

Sedation/Anesthesia

The patient must be either heavily sedated or anesthetized while the study is taking place. CT studies of the thorax and abdomen require general anesthesia and intubation of the patient, with closure of the pop-off valve on the anesthetic machine during image acquisition. Depending on how advanced the CT machine is and slice thicknesses needed, this may or may not be a problem for the patient, as the breath hold may have to last for several seconds. ***Always ensure anesthesia pop-off valves are not left closed, to avoid pneumothorax.***

Contrast Administration

Intravenous iodinated contrast may be used during a CT study in order to further enhance margins of soft tissue structures. If a CT is being conducted to assess an abnormal soft tissue mass or structure, intravenous iodinated contrast should be administered after acquisition of routine images prior to contrast administration for comparison purposes. This contrast administration allows for further characterization of the abnormal soft

tissue as only the vascular portions of the structure will enhance.

- The current standard for use of contrast during CT is non-ionic iodinated contrast media, with the two most common types being iohexol and iopamidol. Iohexol is most commonly used in MWDs. For a vial of iohexol at a concentration of 240mg/mL, the intravenous contrast dose is 400 mg/kg (rule of thumb is 1 mL of contrast agent per pound of body weight, not to exceed 60 mL).
- IV catheterization of the patient is required for contrast administration, and the contrast is a thick, sticky solution which needs to be bolused to the patient, so use 18 gauge catheters and syringe needles.
- After bolusing the contrast to the patient, only the study in the standard algorithm needs to be repeated.
- If the patient is dehydrated, the patient should be rehydrated prior to the CT study if possible or at least on IV fluids to correct the problem if unavoidable.
- Adverse side effects are rare with non-ionic contrast media in correctly hydrated patients.

CT Protocols

CT protocols will vary per region you are attempting to image, patient positioning, slice thickness, algorithms, and whether or not contrast will be used. Each of these factors is critical, but the most commonly overlooked factor is patient positioning. Ensure the region of the patient you are imaging is straight and symmetrically positioned on midline of the CT table, as subtle changes in obliquity may make structures appear abnormal when they are not. Use positional aids, sponges, or troughs if needed, and ensure that all metallic or other unnecessary objects are removed. Place the patient either head-first or hindlimb-first into the gantry, depending on which will be closest to the region for imaging. The following are recommended protocols for different body regions based on common problems seen in MWDs.

CT Skull

Patient positioning should be in ventral recumbency, with the hard palate parallel to the CT table. Studies should extend from the tip of the nose to the 2nd to 3rd cervical vertebra. Bone, standard, and bone algorithms with slice thicknesses of 2.5 mm, 1.25 mm, and 0.625 (if available) should be performed, respectively. Sagittal and dorsal reconstructions should be made as needed.

CT Nasal

Patient positioning should be in ventral recumbency, with the hard palate parallel to the CT table. Studies should extend from the tip of the nose to the larynx. A bone algorithm with slice thicknesses of 2.5 mm and 0.625 mm (or equivalent) and a standard algorithm with slice thickness of 1.25 mm should be performed. Intravenous contrast should be administered, and the standard algorithm with 1.25 mm thick slices repeated. Dorsal reconstructions are required. Sagittal reconstructions should be made as needed.

CT Brain

Patient positioning should be in ventral recumbency, with the hard palate parallel to the CT table. Studies

should extend from mid-muzzle to the 2nd to 3rd cervical vertebra. Bone, standard, and brain algorithms with slice thicknesses of 2.5 mm, 1.25 mm, and 1.25 mm should be performed, respectively. IV contrast should be administered and brain and standard algorithms repeated. Sagittal and dorsal reconstructions of the standard algorithms are required.

CT Tympanic Bullae

Patient positioning should be in ventral recumbency, with the hard palate parallel to the CT table. Studies should extend from the orbits to the 2nd or 3rd cervical vertebra. Bone and standard algorithms with slice thicknesses of 0.625 - 1.25 mm and 1.25 mm should be performed, respectively. Sagittal and dorsal reconstructions should be made as needed.

CT Spine

Patient should be positioned in dorsal recumbency, with the hind limbs maximally extended caudally (like for a hip-extended VD pelvic view in radiography). Study should extend through necessary vertebral regions based on pain and/or neurolocalization. More specifically for the hind limbs, if UMN signs are present, extend from T8-T9 through sacrum, and if LMN signs present, from T12-T13 through sacrum. CT slices should be acquired perpendicular to vertebral canal (may require gantry rotation). A bone algorithm with 2.5 mm and 1.25 mm slice thicknesses and a standard algorithm with 1.25 mm slice thickness should be performed. For suspect lumbosacral disease, the bone algorithm of 1.25 mm slice thickness should be replaced with 0.625 mm (or equivalent) slice thickness to better visualize the neuroforamina at the lumbosacral junction. Sagittal and dorsal reconstructions of bone and standard algorithms are required.

CT Thorax

Anesthesia and breath holds are required. Patient should be positioned in ventral recumbency. Study should extend from thoracic inlet through caudal aspect of liver (ensure extent of all lungs imaged). Bone, standard, and lung algorithms should be performed with slice thicknesses at 5.0 mm, 2.5 mm, and 1.25-2.5 mm, respectively. Sagittal and dorsal reconstructions of lung and standard algorithms are required.

CT Abdomen

Anesthesia and breath holds are required. Patient should be positioned in dorsal recumbency. Study should extend from caudal margin of cardiac silhouette through pelvic canal (or prostate if male). Bone and standard algorithms should be performed with slice thicknesses at 5.0 mm and 2.5 mm, respectively. Sagittal and dorsal reconstructions of bone and standard algorithms are required.

CT of Extremity or Joint

Patient positioning depends on whether imaging forelimbs or hindlimbs. For forelimbs, the patient is in ventral recumbency. The forelimbs should be extended cranially, resting the forearms and paws on the table with the elbows and shoulders bent at a normal resting position. If the hindlimbs are the focus of the study, the patient is usually placed in dorsal recumbency. The hindlimbs should be placed in maximal caudal extension, keeping both limbs symmetric and including both in the study for comparison purposes (use tape, sponges, or other

positional aids). CT slices should be acquired perpendicular to joint spaces, which may require gantry rotation if the joint is the focus of the study. Bone and standard algorithms should be performed along the affected region with slice thicknesses of 1.25 mm. If a joint the focus of the study, conducting an additional bone algorithm sequence with a slice thickness of 0.625 mm is required (if available). Sagittal and dorsal reconstructions of the affected limb only are required.

Magnetic Resonance Imaging[5]

Magnetic resonance imaging protocols used in veterinary medicine are more simplified compared to human medicine. However, current protocols are adequate in assessing for the majority of diseases of concern.

Anesthesia

Use either an MRI-safe anesthetic machine or constant rate IV anesthesia protocols (See Chapter 16). Patient monitoring presents challenges in the MR gantry due to increased noise, greater chance of hypothermia, and overall decreased patient accessibility.

MRI Technician Assistance

It is very important for the Veterinary Corps Officer to be present during image acquisition (if available) to help determine the beginning and end points (range) of the study in each plane, due to anatomic differences between humans and dogs (humans have five lumbar vertebrae compared to seven in dogs, for instance). Beginning and end points for the study should be based on neurolocalization.

MRI Contrast Administration

Paramagnetic contrast agents are commonly used during MRI. Contrast agent administration is always required when imaging the brain, and may be necessary for other exams dependent on the case. For example, if neoplasia or diskospondylitis of the spine is suspected, then administration of contrast during a spinal exam is warranted. All pre-contrast sequences must be performed prior to contrast bolus administration. The contrast agent most often used in MWDs for MRI is gadolinium-based, and the dose for IV bolus use in the dog is 0.1 mmol/kg (0.2mL/kg). As a quick rule of thumb, 1 mL per 10 pounds body weight is the appropriate dose.

MRI Protocols

MRI Brain

The patient should be positioned in ventral recumbency with the head encased within an effective coil (often head or cardiac types). Studies should extend from the most cranial limit of the orbits/eyes to the level of the 2nd or 3rd cervical vertebra. Slice thicknesses of 3-5 mm should be used; dependent on how many sequences you have time to perform. The following sequences in each respective plane should be performed:

- Axial/Transverse Plane. T1-weighted, T2-weighted, FLAIR, T1-weighted with contrast.
- Sagittal Plane. T1-weighted, T2-weighted, T1-weighted with contrast.
- Coronal/Dorsoventral Plane. T2-weighted, T1-weighted with contrast (T1-weighted pre-contrast also if time allows).

MRI Spine

The patient should be positioned in dorsal recumbency, and the coil within the table will likely be used. Study should extend through necessary vertebral regions based on pain and/or neurolocalization. More specifically for the hindlimbs, if UMN signs are present extend from the 8th or 9th thoracic vertebra through the sacrum, and if LMN signs are present, from the 12th or 13th thoracic vertebra through sacrum. Slice thicknesses of 2-4 mm should be used; dependent on how many sequences you have time to perform. The following sequences within each respective plane should be performed:

- Axial/Transverse Plane. T1-weighted, T2-weighted (T1-weighted with contrast if indicated).
- Sagittal Plane. T1-weighted, T2-weighted, STIR (T1-weighted with contrast if indicated).
- Coronal/Dorsoventral Plane. T2-weighted (T1-weighted pre and post- contrast administration if indicated).

MRI Stifle/Joint Imaging

The patient should be placed in lateral recumbency, with the affected limb up, with the stifle placed in neutral to moderate extension. Study should at least extend from distal femoral diaphysis to the proximal tibial diaphysis, distal to the tibial crest. A wrist coil is preferable, however if the joint/region to be imaged is too large, then cardiac or other similar coils may be used. Slice thicknesses of 2-3 mm should be used; dependent on how much time you have to complete the study. The following sequences within each respective plane should be performed:

- Axial/Transverse Plane. Proton Density (PD)-weighted (+/- fat sat).
- Sagittal Plane. PD-weighted (+/- fat sat), T1-weighted, T2-weighted (+/- fat sat).
- Coronal/Dorsoventral Plane. PD-weighted (+/- fat sat), T2-weighted (+/- fat sat).

Diagnostic Imaging References

1. American Association of Veterinary Radiologists. MRI protocols for dogs. www.aavr.org
2. Department of Defense Veterinary Service Activity. Handbook of Veterinary Care and Management of the Military Working Dog, 2017. In press.
3. Drees R, Dennison SE, Keuler NS, Schwarz T. Computed tomographic imaging protocol for the canine cervical and lumbar spine. Veterinary Radiology & Ultrasound, 2009;50:74-79.
4. Schwarz T and Saunders J (eds). Veterinary Computed Tomography. Danvers, MA: Wiley-Blackwell, 2011.
5. Gavin PR and Bagley R (eds). Practical Small Animal MRI. Danvers, MA: Wiley-Blackwell, 2009.

CHAPTER 21

Euthanasia

MWDs may present with illnesses or injuries so severe that the only humane option is euthanasia. MWDs may be euthanized in the case of catastrophic wounding with poor prognosis for recovery and in order to relieve the MWD from undue suffering. Examples include catastrophic TBI, traumatic limb amputations, decompensatory refractory shock, and major abdominal evisceration injury, in addition to failure to respond to resuscitation, or rapid clinical deterioration with poor prognosis for recovery.

HCPs must recognize the need for euthanasia and perform euthanasia in a humane manner. Normally euthanasia requests must be authorized by either the first field grade officer in the MWD unit supervisory chain of command or a veterinarian. If possible, contact a veterinarian and receive verbal agreement to perform euthanasia. When in doubt, consider the best interest of the MWD, and perform euthanasia if felt necessary to relieve suffering.

All euthanasia procedures will be performed humanely and in accordance with the American Veterinary Medical Association Guidelines on Euthanasia.[1] Note that neuromuscular blocking agents are NOT an acceptable euthanasia agent, even when combined with other drugs.

In the deployed HCP setting, the following 3 options are recommended for canine euthanasia:

1. Commercial veterinary euthanasia solution. Several veterinary euthanasia products are available and include a barbituric acid derivative (usually sodium pentobarbital at ~400 mg/mL), often with local anesthetic agents or agents that metabolize to pentobarbital. Ideally, veterinary personnel will coordinate with adjacent or supporting HCP units to arrange access to these drugs in emergencies. Controlled substances management regulations apply.
    - These products should be given by the IV route.
    - The standard dose of these products is 1 mL per 10 pounds of body weight.
2. Barbiturate overdose. All barbituric acid derivatives used for anesthesia are acceptable for euthanasia when administered intravenously. There is a rapid onset of action, and loss of consciousness induced by barbiturates results in minimal or transient pain associated with venipuncture. Desirable barbiturates are those that are potent, long-acting, stable in solution, and inexpensive.
    - Sodium pentobarbital best fits these criteria and is most widely used.
    - The lethal pentobarbital dose for dogs is 40-60 mg/kg IV.

3. Potassium chloride (KCl). The use of a supersaturated solution of potassium chloride injected is an acceptable method to produce cardiac arrest and death. When using KCl, the MWD MUST BE anesthetized deeply before administration of KCl. It is unethical and unacceptable to use KCl in un-anesthetized animals.
    - Anesthetize the MWD (See Chapter 16).
    - Once anesthetized, rapid IV or IC administration of 1-2 mEq/kg KCl will cause cardiac arrest.
    - A typical dose for an average-sized MWD would be 30-40 mL of 2 mEq/mL KCl.
    - Bolus administration through IV catheter is the preferred route.

It is critical to ensure the death of the MWD after agents have been given for euthanasia. Ensure absence of a heart beat and pulse, absence of voluntary respirations, and absence of electrical activity on an ECG tracing (if available) for at least 5 minutes after presumed death. Agonal respiratory efforts are common and should cease before death is declared.

Whenever possible, a gross necropsy is recommended.

Collect blood and urine samples (one red top and one EDTA tube of blood and urine in a specimen cup or capped syringe) before euthanasia.

The MWD's body (ideally refrigerated, not frozen), all health records, and samples must be sent to the supporting veterinary facility for complete necropsy and final disposition paperwork.

If necropsy by veterinary personnel will be delayed, it is ideal to collect gross samples of major organs and tissues that are obviously abnormal or traumatized, and preserve with 10% buffered formalin. TB MED 283 (Veterinary Necropsy Protocol for Military Working Dogs) is an excellent reference.[2]

If possible and deemed appropriate by the senior HCP present, MWD handlers should be permitted to be present for euthanasia. The bond between handler and MWD cannot be overemphasized, and many handlers will want to be present. Note that the MWD handler as well as providers may require behavioral health care or grief counseling.

Euthanasia References

1. American Veterinary Medical Association. AVMA guidelines for the euthanasia of animals: 2013 edition. Available at: www.avma.org/KB/documents/guidleines_for_the_euthanasia_of_animals_2013.aspx. Accessed 01 November 2016.
2. TB MED 283. Veterinary Necropsy Protocol for Military Working Dogs and Pathology Specimen Submission Guidelines. Headquarters, Department of the Army, 24 May 2001.

CHAPTER 22

Documentation—Medical Records

Canine Tactical Combat Casualty Care (cTCCC) Card

To document care at the point of injury, a canine Tactical Combat Casualty Care card (cTCCC card) has been approved for use, and is included in this chapter. This form should be used to document trauma or Disease, Non-Battle Injury at the point of injury anywhere an MWD is deployed, by the handler or provider who first provides care. Once care has been transferred to a medical facility, the form should be submitted to veterinary personnel for submission, or scanned and emailed by HCPs to dog.consult@us.af.mil.

The fillable electronic cTCCC care and instructions are available at:

https://jts.health.mil/assets/docs/forms/DD_3073_Canine_Tactical_Combat_Casualty_Care_Card.pdf

https://jts.health.mil/assets/docs/forms/DD_3073_Instructions_Canine_Trauma_Combat_Casualty_Card.pdf

Canine Resuscitation Record Worksheet

To document medical care of MWDs by HCPs, all medical care provided in military medical facilities should be documented on the Canine Resuscitation Record. This new worksheet is included in this chapter. Input all relevant information to the best of your ability, recognizing the form has been revised for canine-specific information, and thus is significantly different from the DD Form 3019 used for human patients. Use a new worksheet each day the dog is an inpatient in the facility. Maintain the worksheets throughout the patient's care. Once care has been transferred to supporting veterinary personnel, either provide the worksheet to them, or scan and email it to dog.consult@us.af.mil.

The fillable electronic worksheet and instructions are available at:

https://jts.health.mil/assets/docs/forms/DD_3074_Canine_Treatment_and_Resuscitation_Record.pdf

https://jts.health.mil/assets/docs/forms/DD_3074_Canine_Treatment_and_Resuscitation_Record_Instructions.pdf

Figure 49. Canine Tactical Combat Casualty Care Card (CTCCC), Page 1 of 2

CANINE-TACTICAL COMBAT CASUALTY CARE CARD (cTCCC)

EVAC CAT: ☐Urgent ☐Priority ☐Routine ☐MEDEVAC ☐CASEVAC

EVAC TYPE: ☐Fixed ☐Rotary ☐Ground

UNIT: _____ **NAME:** _____ **TATTOO:** _____ **BREED:** _____

DATE (DD-MM-YY): _____ **TIME:** _____

GENDER: ☐M ☐F **CASTRATION/SPAY:** ☐Y ☐N

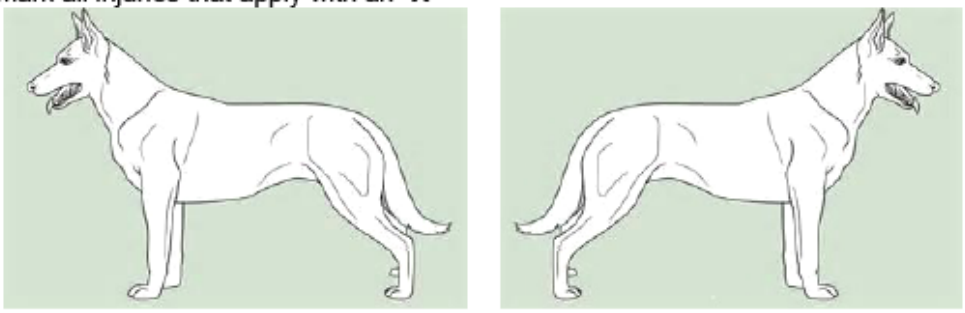
BLOOD: DEA 1.1 ☐POS ☐NEG

Mechanism of Injury: (X all that apply)

☐IED ☐GSW ☐MINE ☐BURN ☐GRENADE ☐ARTILLERY ☐MORTAR ☐FALL

☐OTHER: _____

Injury: (Mark all injuries that apply with an **X**



VITAL SIGNS

Time					
Acute Pain Score (≤1)					
Temperature (99-102)					
Pulse Rate (60-80)					
Respiratory Rate (16-30)					
Blood Pressure (120/80)					
Pulse Ox% > 95%					
Capillary Refill (< 2 sec)					

CANINE ACUTE PAIN SCALE

SCORE	BEHAVIORAL	PALPATION	BODY TENSION
0	Comfortable when resting	Nontender to wound palpation	Minimal
1	Slightly unsettled or restless	Reacts to palpation of wound	Mild
2	Uncomfortable at rest, whimpers, lick s wound	Flinches, whimpers, cries	Mild to Moderate (reassess analgesic plan)
3	Unsettled, crying, groaning, biting, chewing wound	Increased respiratory rate, sharp cry, growl, bite	Moderate (reassess analgesic plan)
4	Constantly groaning or screaming when unattended, may bite wound	Cries at non - painful palpation, may react aggressively	Moderate to severe (reassess analgesic plan)

FIRST RESPONDERS:

RANK	LAST, FIRST	DUTY AOC/MOS	DATE

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CANINE-TACTICAL COMBAT CASUALTY CARE CARD (cTCCC)

Treatments: (X all that apply)

C: ☐ Extremity-TQ ☐ Junctional-TQ ☐ Pressure-Dressing ☐ Hemostatic-Dressing

Type/Other: _____

A: ☐ Intact ☐ ET-Tube with bite guard ☐ Tracheostomy ☐ Tracheal Insufflation (Muzzle: ☐ Y ☐ N)

B: ☐ O^2 ☐ Needle-D ☐ Chest-Tub ☐ Chest-Seal Type: _____

(75% of K9s have fenestrated mediastinums)

FLUIDS: **(Trauma MAP target 65mmHg; Hemorrhage MAP 40mmHg; TBI MAP 80mmHg)**

Total Crystalloid Shock Volume of fluids is 90 mls/kg: Give ¼ of the Total Shock Fluid Volume IV/IO in 10 - 20 min. then reassess; repeat another ¼ of the calculated "shock" volume if necessary every 10 min. until targeted endpoints			
CRYSTALLOID	**VOLUME**	**ROUTE**	**TIME**
HYDROXYETHYL STARCH (HES) 10 - 20mls/kg over 5 - 10 min. (after ½ shock crystalloid not effective)			
HYPERTONIC SALINE 4mls/kg (If two or three ¼ shock boluses and one or two boluses of HES not effective)			
MWD Blood /Plasma (no human) 2.5 - 10mls/kg			

(First blood transfusion can be done without blood typing)

MEDS:

	NAME	DOSE	ROUTE	TIME
ANALGESIC				
ANTIBIOTIC				
TXA 10 mg/kg in 100ml NaCl or LRS followed by 10 mg/kg/h CRI over 3 hours)				

OTHER: ☐ Gastric Trocarization ☐ External Cooling (tap water) ☐ Splint ☐ Hypothermia-Prevention ☐ Muzzle ☐ Other:

DRUG (conc.)	DOSE	RTE	60lb/ 27.3kg	70lb/32kg	80lb/36.4kg
Ketamine (100mg/ml)	2-5mg/kg	IV/IM	1 ml	1.5 mls	2 mls
Midazolam (2mg/ml)	0.1-0.3mg/kg	IV/IM	3 mls	4 mls	5 mls
Hydromorphone (2mg/ml)	0.1-0.2mg/kg	IV/IM	1.5 mls	1.75 mls	2 mls
Ketorolac (30mg/ml)	0.5mg/kg	IV/IM /PO	0.5 mls	0.55 mls	0.6 mls
Ertapenem (100mg/ml)	15mg/kg	IV/SQ	4 mls	5 mls	6 mls
Morphine (10mg auto inj.)	0.2-0.5 mg/kg	IM	1 *auto*	1 *auto*	2 *auto*
Diphenhydramine	1-2 mg/kg	IV/IM/PO	50 *mg*	75 *mg*	100 *mg*
Meloxicam	0.1-0.2mg/kg	IV/SQ/PO	5 *mg*	6 *mg*	7 *mg*
Amoxicillin Clavulanic Acid	- 13.75mg/kg	PO	375 *mg*	440 *mg*	500 *mg*
Cefazolin	20-30mg/kg	IV/IM	600 *mg*	650 *mg*	700 *mg*
Cefotaxime	22 mg/kg	IV/IM/SQ	600 *mg*	700 *mg*	800 *mg*
Ceftriaxone	25 mg/kg	IV/IM	700 *mg*	800 *mg*	900 *mg*

NOTES: _____

_____

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General Instructions for Canine Trauma Combat Casualty Care Card

PURPOSE: The Canine Tactical Combat Casualty Care (cTCCC) card is for documenting a trauma or disease non-battle injury (DNBI) at the point of injury anywhere a canine is deployed in support of DoD operations. The cTCCC card will be filled out by the handler or provider who attends to the canine's trauma or DNBI. After medical treatment and resuscitation care is provided, the cTCCC card can be handed off to the nearest veterinary treatment facility or supporting veterinary unit to be scanned, uploaded and emailed to dog.consult@us.af.mil or the unit providing care can email directly. Once the MWD Trauma Registry is online, the first veterinary unit will input the information into the registry and scan the cTCCC card to upload into ROVR. The cTCCC card becomes part of the canine's permanent DoD medical record. For US Special Operations Command (SOCOM) canines, the cTCCC card will be filled out and returned to the handler or operator. The handler or operator will route the card to their respective veterinarian to be inputted into the MWD Trauma Registry and the canine's record.

PAGE 1:

GENERAL INSTRUCTIONS

- To be completed by the handler, human medical provider, veterinary technician or veterinarian fulfilling the role at the point of injury.
- Time Zones: Record all time local 24 hour military format, hh:mm
- A+ (plus sign) means positive test result; a - (minus sign) means negative test result.

EVACUATION CATEGORY (mark as appropriate)

URGENT – Patient who should be evacuated as soon as possible and within **two** hours to save life, limb or eyesight

PRIORITY – Patient who should be moved within **four** hours or their condition will deteriorate to such a degree that will be urgent

ROUTINE – Patient whose condition is not expected to worsen significantly and who will require evacuation in the next **24** hours

EVACUATION MODE & TYPE (mark as appropriate)

PATIENT IDENTIFICATION

UNIT. Record the unit the canine is assigned

ANIMAL NAME. (self-explanatory)

TATTOO. (self-explanatory)

BREED. (self-explanatory)

DATE. (DD-MM-YY)

TIME. Record all time local 24 hour military format, hh:mm

BLOOD. DEA 1.1 (mark as appropriate if known)

GENDER. (mark as appropriate)

MECHANISM OF INJURY (mark as appropriate – use other for DNBI or if unknown – describe)

INJURY (mark the diagram where the trauma/injury or disease is located – if there are more than one injury, identify each with the mechanism of injury)

General Instructions for Canine Trauma Combat Casualty Care Card

VITAL SIGNS (input vital signs at least hourly)

FIRST RESPONDERS (self-explanatory)

PAGE 2:

TREATMENTS (mark as appropriate)

C (circulation): self-explanatory

A (airway): self-explanatory

B (breathing): self-explanatory

FLUIDS (fill out as appropriate and complete as possible)

MEDICATIONS (MEDS) (fill out as appropriate and complete as possible – if other medications are given that aren't mentioned on the form, please include whether they are an analgesic, antibiotic or TXA. Be as thorough as possible)

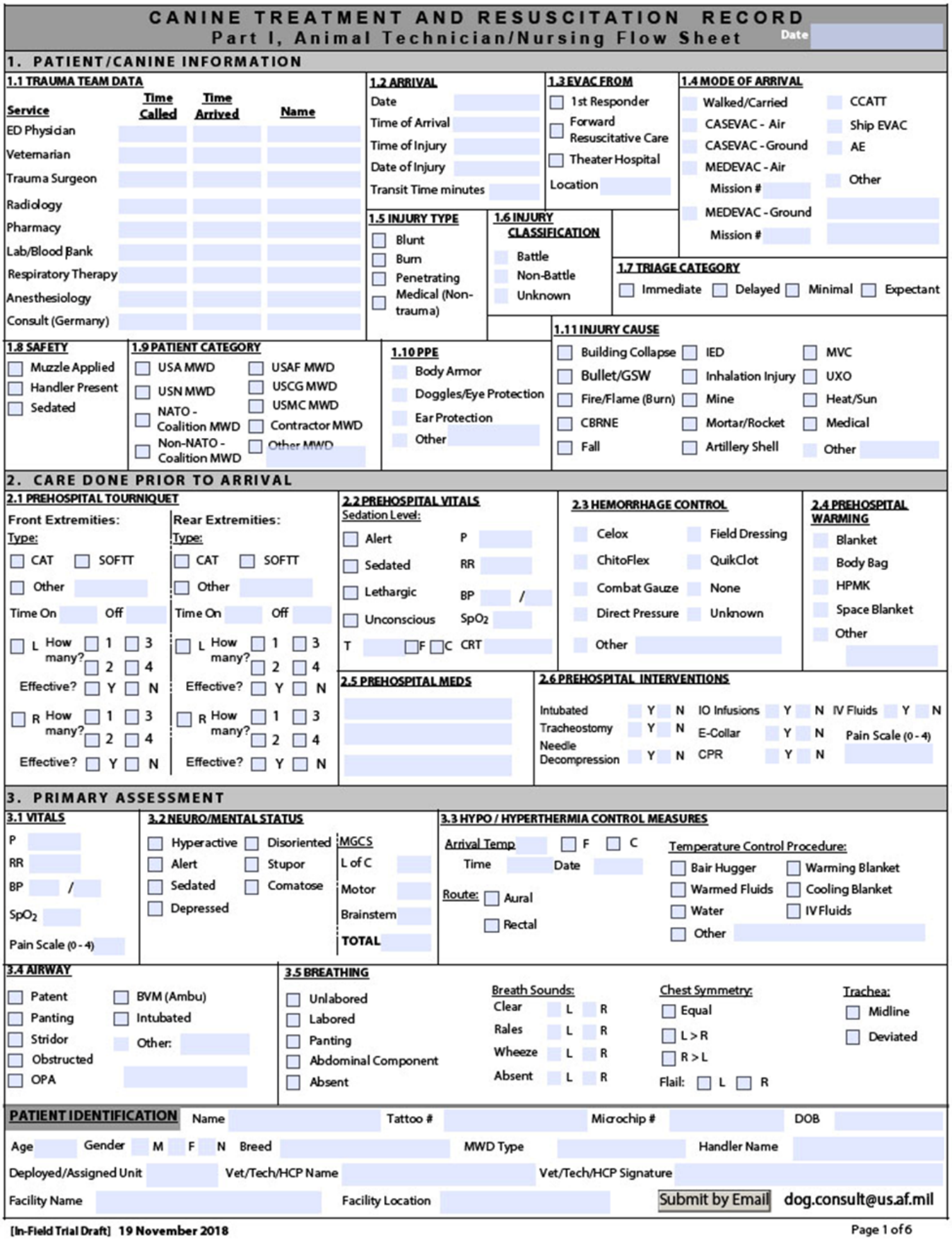
OTHER (Include other lifesaving techniques or treatments)

NOTES (Include any additional information (location/country, euthanized/KIA, treatment regiments that were used to the treat the patient, etc.)

DISPOSITION OF THE FORM – (The form is to be kept with the patient until it can be put into the patient's record.) Pass the card to the next treatment facility. 1) Scan and email the card to dog.consult@us.af.mil . 2) Put the card into the patient's hard copy record. CAVEAT: For US Special Operations Command (SOCOM) canines, the cTCCC card will be filled out and returned to the handler or operator. The handler or operator will route the card to their respective veterinarian to be inputted into the MWD Trauma Registry and the canine's record.

DEFINITIONS
IED – Improvised explosive device
GSW – Gunshot wound
TQ – Tourniquet
ET – Endotracheal tube
TXA – Tranexamic acid

Figure 50. Canine Treatment and Resuscitation Record Worksheet, Page 1 of 6



CANINE TREATMENT AND RESUSCITATION RECORD
Part I, Animal Technician/Nursing Flow Sheet Date

1. PATIENT/CANINE INFORMATION

1.1 TRAUMA TEAM DATA

Service	Time Called	Time Arrived	Name
ED Physician			
Veterinarian			
Trauma Surgeon			
Radiology			
Pharmacy			
Lab/Blood Bank			
Respiratory Therapy			
Anesthesiology			
Consult (Germany)			

1.2 ARRIVAL
Date
Time of Arrival
Time of Injury
Date of Injury
Transit Time minutes

1.3 EVAC FROM
☐ 1st Responder
☐ Forward Resuscitative Care
☐ Theater Hospital
Location

1.4 MODE OF ARRIVAL
Walked/Carried
CASEVAC - Air
CASEVAC - Ground
MEDEVAC - Air
Mission #
MEDEVAC - Ground
Mission #
CCATT
Ship EVAC
AE
Other

1.5 INJURY TYPE
☐ Blunt
☐ Burn
☐ Penetrating
☐ Medical (Non-trauma)

1.6 INJURY CLASSIFICATION
Battle
Non-Battle
Unknown

1.7 TRIAGE CATEGORY
☐ Immediate ☐ Delayed ☐ Minimal ☐ Expectant

1.8 SAFETY
☐ Muzzle Applied
☐ Handler Present
☐ Sedated

1.9 PATIENT CATEGORY
☐ USA MWD ☐ USAF MWD
☐ USN MWD ☐ USCG MWD
☐ NATO - Coalition MWD ☐ USMC MWD
☐ Non-NATO - Coalition MWD ☐ Contractor MWD
☐ Other MWD

1.10 PPE
Body Armor
Doggles/Eye Protection
Ear Protection
Other

1.11 INJURY CAUSE
☐ Building Collapse ☐ IED ☐ MVC
☐ Bullet/GSW ☐ Inhalation Injury ☐ UXO
☐ Fire/Flame (Burn) ☐ Mine ☐ Heat/Sun
☐ CBRNE ☐ Mortar/Rocket ☐ Medical
☐ Fall ☐ Artillery Shell ☐ Other

2. CARE DONE PRIOR TO ARRIVAL

2.1 PREHOSPITAL TOURNIQUET

Front Extremities:
Type:
☐ CAT ☐ SOFTT
☐ Other
Time On Off
☐ L How many? ☐ 1 ☐ 2 ☐ 3 ☐ 4
Effective? ☐ Y ☐ N
☐ R How many? ☐ 1 ☐ 2 ☐ 3 ☐ 4
Effective? ☐ Y ☐ N

Rear Extremities:
Type:
☐ CAT ☐ SOFTT
☐ Other
Time On Off
☐ L How many? ☐ 1 ☐ 2 ☐ 3 ☐ 4
Effective? ☐ Y ☐ N
☐ R How many? ☐ 1 ☐ 2 ☐ 3 ☐ 4
Effective? ☐ Y ☐ N

2.2 PREHOSPITAL VITALS
Sedation Level:
☐ Alert
☐ Sedated
☐ Lethargic
☐ Unconscious
T ☐F ☐C
P
RR
BP /
SpO_2
CRT

2.3 HEMORRHAGE CONTROL
Celox
ChitoFlex
Combat Gauze
Direct Pressure
Other
Field Dressing
QuikClot
None
Unknown

2.4 PREHOSPITAL WARMING
Blanket
Body Bag
HPMK
Space Blanket
Other

2.5 PREHOSPITAL MEDS

2.6 PREHOSPITAL INTERVENTIONS
Intubated Y N
Tracheostomy Y N
Needle Decompression Y N
IO Infusions Y N
E-Collar Y N
CPR Y N
IV Fluids Y N
Pain Scale (0 - 4)

3. PRIMARY ASSESSMENT

3.1 VITALS
P
RR
BP /
SpO_2
Pain Scale (0 - 4)

3.2 NEURO/MENTAL STATUS
☐ Hyperactive ☐ Disoriented
☐ Alert ☐ Stupor
☐ Sedated ☐ Comatose
☐ Depressed
MGCS
L of C
Motor
Brainstem
TOTAL

3.3 HYPO / HYPERTHERMIA CONTROL MEASURES
Arrival Temp ☐ F ☐ C
Time Date
Route: ☐ Aural ☐ Rectal
Temperature Control Procedure:
☐ Bair Hugger ☐ Warming Blanket
☐ Warmed Fluids ☐ Cooling Blanket
☐ Water ☐ IV Fluids
☐ Other

3.4 AIRWAY
☐ Patent ☐ BVM (Ambu)
☐ Panting ☐ Intubated
☐ Stridor ☐ Other:
☐ Obstructed
☐ OPA

3.5 BREATHING
☐ Unlabored
☐ Labored
☐ Panting
☐ Abdominal Component
☐ Absent

Breath Sounds:
Clear L R
Rales L R
Wheeze L R
Absent L R

Chest Symmetry:
☐ Equal
☐ L > R
☐ R > L
Flail: ☐ L ☐ R

Trachea:
☐ Midline
☐ Deviated

PATIENT IDENTIFICATION
Name Tattoo # Microchip # DOB
Age Gender M F N Breed MWD Type Handler Name
Deployed/Assigned Unit Vet/Tech/HCP Name Vet/Tech/HCP Signature
Facility Name Facility Location Submit by Email dog.consult@us.af.mil

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TOC

CANINE TREATMENT AND RESUSCITATION RECORD
Part I, Animal Technician/Nursing Flow Sheet

Date

3. PRIMARY ASSESSMENT (CONT.)

3.6 NOTES

3.7 CIRCULATION

Mucus Membrane: ☐ Hot ☐ Warm ☐ Cool; ☐ Pink ☐ Pale; ☐ Moist ☐ Dry; ☐ Cyanotic ☐ Brick Red

Heart Sounds: ☐ Clear ☐ Muffled

CRT: ☐ < 2 s ☐ ≥ 2 s

4. SECONDARY SURVEY

4.1 HEAD / NECK ENT

Drainage:
☐ Nasal (Color)
☐ Ear (Color)

Dental Injury ☐ Y ☐ N

JVD ☐ Y ☐ N

Reactive Pupils

Right:	Left:
☐ Y ☐ N	☐ Y ☐ N
Brisk	Brisk
Sluggish	Sluggish
NR	NR

4.2 HEART

Rhythm
☐ NSR ☐ PEA
☐ Tachy ☐ Brady
☐ V-fib ☐ V-tach
☐ Asystole
☐ Normal Sinus Arrhythmia
☐ Other

Pulses
S = Strong **W** = Weak
D = Doppler **A** = Absent

Femoral L R

Dorsal Metatarsal L R

4.3 ABDOMINAL

☐ Open Wound
☐ Flat
☐ Distended
☐ Rigid
☐ Bruising
☐ Soft
☐ Pain

FAST + / -

Site ☐ DH ☐ CC ☐ SR ☐ HR

4.4 EXTREMITIES

Deformities	Pulses Present	Motor	Sensory
LF		☐ Y ☐ N	☐ Y ☐ N
RF		☐ Y ☐ N	☐ Y ☐ N
LR		☐ Y ☐ N	☐ Y ☐ N
RR		☐ Y ☐ N	☐ Y ☐ N

Pulses Present: indicate **S**=Strong **W**=Weak **D**=Doppler **A**=Absent

4.5 ALLERGIES

☐ Unknown
☐ NKDA
Other

4.6 CURRENT MEDICATIONS

☐ Unknown ☐ None
☐ Current Meds: (List med, dose, & route)

4.7 MEDICAL HISTORY

4.8 PROCEDURES

Procedure	Time	Size/Type	Site	Performed By	Results/Notes
O_2 Therapy Lpm %	On / Off	☐ Low Flow Blow By ☐ High Flow Blow By	☐ OPA ☐ Nasal Cannula ☐ BVM/(Ambu)		
ET Intubation	Time	Trach Tube mm	Oral / Tracheostomy		$ETCO_2$ Change / BBS Post Intubation
Chest Tube #1	Time		☐ L ☐ R		☐ Air Blood (ml)
Chest Tube #2	Time		☐ L ☐ R		☐ Air Blood (ml)
Needle Decompression	Time		☐ L ☐ R		☐ Air Blood (ml)
Tourniquet	Time	Types	LF RF LR RR		
Urinary	Time	Amount Color Foley Size			
Other Procedure	Time	Describe			
Other Procedure	Time	Describe			
Other Procedure	Time	Describe			

Hemorrhage Control: Celox, Combat Gauze, Field Dressing, QuikClot, ChitoFlex, Direct Pressure, HemCon, None, Unknown, Other

PATIENT IDENTIFICATION

Name Tattoo # Microchip # DOB

Age Gender M F N Breed MWD Type Handler Name

Deployed/Assigned Unit Vet/Tech/HCP Name Vet/Tech/HCP Signature

Facility Name Facility Location Submit by Email dog.consult@us.af.mil

CANINE TREATMENT AND RESUSCITATION RECORD
Part I, Animal Technician/Nursing Flow Sheet

Date

4. SECONDARY SURVEY, continued

4.9 VENT SETTINGS

Time
Mode:
FiO2:
Rate:
PEEP:
TV:
Notes:

4.10 INTRAVENOUS/INTRAOSSEOUS ACCESS AND FLUIDS/BLOOD PRODUCTS

Start Time	Rate	Type	Gauge	Site	IVF Type	Amount Up	Amount In	Stop Time	Initials
		☐ IV ☐ IO							
		☐ IV ☐ IO							
		☐ IV ☐ IO							
		☐ IV ☐ IO							
		☐ IV ☐ IO							

4.11 MEDICATIONS

Start Time	Drug	Dose	Site	Route	Stop Time	Initials

4.12 LABS

Time	Test	Time	Test
	CBC		INR
	Chem7		Lactate
	Chem12		U/A
	H&H		☐ Other, specify:
	ABG/Serial		
	VBG		
	PT/PTT		

4.13 CT

Type	Time
☐ Head	
☐ Spine	
☐ Chest	
☐ Abd/Pelvis	
☐ Pan Scan	

4.14 X-RAY

Type	Time
☐ Head	
☐ Spine	
☐ Chest	
☐ Abd	
☐ Pelvis	

☐ Extremity
☐ LF
☐ RF
☐ LR
☐ RR
Time

4.15 Pending Studies

4.16 Results

4.17 VITAL SIGNS

Time	BP	P	RR	Temp	SpO2	Other (ICP)	Initials

4.18 DISPOSITION

Date: Time: Handler Present: ☐ Y ☐ N

RTD ☐ Full ☐ Light Work ☐ No Work for Days

Admit ☐ OR ☐ ICU ☐ ICW ☐ Vet Clinic

Evac to ☐ VTF Role 2 ☐ VTF Role 3 ☐ VMCE Facility Name:

Evac Priority ☐ Routine ☐ Priority ☐ Urgent

Evac Mode ☐ Ambulatory ☐ Gurney/Litter ☐ Crate/Kennel

Evac Transport Vehicle
MEDEVAC: ☐ Rotary Wing ☐ Fixed Wing ☐ CCATT
Ground: ☐ Ambulance ☐ Non-Medical

4.19 NOTES

PATIENT IDENTIFICATION Name Tattoo # Microchip # DOB

Age Gender M F N Breed MWD Type Handler Name

Deployed/Assigned Unit Vet/Tech/HCP Name Vet/Tech/HCP Signature

Facility Name Facility Location Submit by Email dog.consult@us.af.mil

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CANINE TREATMENT AND RESUSCITATION RECORD
Part II, Veterinarian/Physician

Date

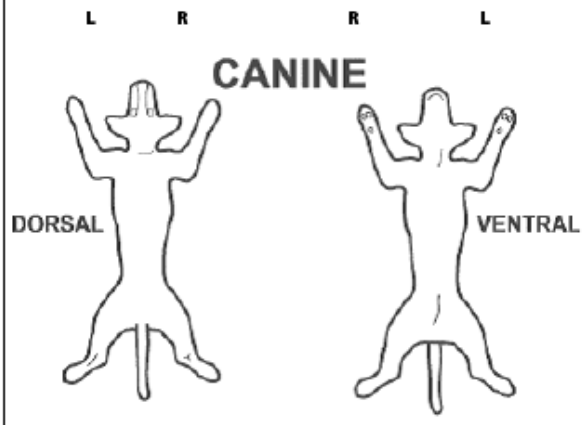
1. HISTORY & PHYSICAL - INJURY DESCRIPTION

1.1 ARRIVAL
Date
Time of Arrival

1.2 TRIAGE CATEGORY
- ☐ Immediate
- ☐ Delayed
- ☐ Minimal
- ☐ Expectant

1.3 CHIEF COMPLAINT, HISTORY AND PRESENTING ILLNESS

1.4 INJURY DESCRIPTION
(AB)rasion
(AMP)utation
(AV)ulsion
(BL)eeding
(B)urn %TBSA_____
(C)repitus
(D)eformity
(DG)Degloving
(E)cchymosis
(FX)Fracture
(F)oreign Body
(GSW)Gun Shot Wound
(H)ematoma
(I)llness (not trauma)
(LAC)eration
(PW)Puncture Wound
(SW)Stab Wound
(P)ain
(PP)Peppering



Pulses Present
S= Strong W= Weak D= Doppler A=Absent

1.5 HISTORY AND PHYSICAL

Head & Neck:

Chest:

Abdomen/Back and Spine:

Pelvis: ☐ Stable ☐ Unstable

Front Extremities:

Rear Extremities:

Interventions Prior to Arrival:

1.6 PRE / INITIAL PROCEDURES / DIAGNOSTICS

Pre / Initial
- ☐ ☐ Trach
- ☐ ☐ ICP Monitor
- ☐ ☐ Eye Injury ☐ L ☐ R
- ☐ Fluorescein - / +

Pre / Initial
- ☐ ☐ Cantholysis & Canthotomy ☐ L ☐ R
- ☐ ☐ Tympanic Membranes Rupture ☐ L ☐ R
- Blood ☐ L ☐ R

Needle Decompression ☐ R ☐ L Pericardial FAST - / +

Output
- ☐ Air
- ☐ Blood (ml)
- ☐ Pericardiocentesis

Describe

Thoracic FAST - / +

Site ☐ L CTS ☐ R CTS

DPL ☐ Gross Blood: - / + Describe

Serial AFAST - / + Site ☐ DH ☐ CC ☐ SR ☐ HR

Rectal Exam ☐ WNL ☐ Weak/Absent Tone Gross Blood: - / +

Front Extremities:
- ☐ Closed Reduction ☐ EXT Fixation ☐ Splint ☐ Wound Washout
- ☐ Tourniquet ☐ L # ☐ R #

Rear Extremities:
- ☐ Closed Reduction ☐ EXT Fixation ☐ Splint ☐ Wound Washout
- ☐ Tourniquet ☐ L # ☐ R #

Interventions Prior to Arrival:
- ☐ Sedated ☐ Hypertonic Saline ☐ Mannitol ☐ Seizure Protocol
- ☐ Central Line Loc Site
- ☐ IO/IV Loc Site

PATIENT IDENTIFICATION Name Tattoo # Microchip # DOB

Age Gender M F N Breed MWD Type Handler Name

Deployed/Assigned Unit Vet/Tech/HCP Name Vet/Tech/HCP Signature

Facility Name Facility Location Submit by Email dog.consult@us.af.mil

[In-Field Trial Draft] 19 November 2018

CANINE TREATMENT AND RESUSCITATION RECORD
Part II, Veterinarian/Physician

Date

1.7 PUPILS / VISION

Brisk L R Sluggish L R NR L R Hand Motion L R
Light Perception L R No Light Perception L R
Aniscoria L > R R > L

1.8 BURN

Super Deep PT %TBSA Cause
Super PT Full

1.9 EXTREMITIES

	Motor	Sensory	ROM
LF	+ / -	+ / -	+ / -
RF	+ / -	+ / -	+ / -
LR	+ / -	+ / -	+ / -
RR	+ / -	+ / -	+ / -

2. LABORATORY RESULTS

2.1 CBC

WBC
RBC
HGB
HCT
PLT

2.2 CHEMISTRY 7/12

Na	Gluc	TProtein
K	BUN	ALT
Cl	Crea	AST
Ca	Albumin	ALP
CO2	TBili	Lactate

2.3 COAG

PT
PTT
INR

2.4 Blood Type

2.5 VBG/ABG

VBG		ABG
	pH	
	PaO2	
	PaCO2	
	HCO3	
	SaO2	

2.6 URINALYSIS

SpGr
pH
LEU
PRO
GLU
KET
UBG
BIL
HGB

2.7 OTHER LABS

3. X-RAYS and CT

3.1 CT OBTAINED

Head
Spine
Chest
Abd/Pelvis
Pan Scan*
* Select Pan Scan only if all of the above requested

3.2 X-RAYS OBTAINED

Head
Spine
Chest
Abd
Pelvis
Extremity
LF
RF
LR
RR
Other
Other
Other

3.3 Foreign Body

Projectile Shrapnel Debris
Incendiary Device Bones
Other:

3.4 PENDING STUDIES

3.5 RESULTS (include TEG/Rotem results)

4. IMPRESSION/ASSESSMENT

4.1 Severity

Critical
Severe
Moderate
Mild

4.2 Impression/Assessment Comments

5. DIAGNOSES

1.
2.
3.
4.
5.
6.
7.
8.
9.
10.
11.
12.

PATIENT IDENTIFICATION Name Tattoo # Microchip # DOB

Age Gender M F N Breed MWD Type Handler Name

Deployed/Assigned Unit Vet/Tech/HCP Name Vet/Tech/HCP Signature

Facility Name Facility Location Submit by Email dog.consult@us.af.mil

CANINE TREATMENT AND RESUSCITATION RECORD
Part II, Veterinarian/Physician

Date

6. PLAN

6.1 PLAN

7. DNBI / NBI CATEGORY

☐ Injury, MVC ☐ Surgical ☐ Other
☐ Injury, Work/Training ☐ Disease ☐ Describe

8. CAUSE OF DEATH

8.1 ANATOMIC

☐ Airway ☐ Neck ☐ Abdomen
☐ Head ☐ Chest ☐ Pelvis
☐ Extremity ☐ LF ☐ RF ☐ LR ☐ RR
☐ Other, Specify

8.2 PHYSIOLOGIC

☐ MOF ☐ Sepsis ☐ CNS ☐ Hemorrhage ☐ Breathing
☐ Heart Failure ☐ Total Body Disruption
☐ Other, Specify

8.3 DEATH INFORMATION

Date of Death Time of Death Mortuary Affairs Notified? ☐ N/A ☐ Y ☐ N
Euthanized ☐ Y ☐ N Method
Gross Necropsy by DVM ☐ Y ☐ N Necropsy Date Necropsy Time
Time between death and necropsy Gross Pathology Report: ☐ Y ☐ N ☐ Unknown
Samples Shipped to JPC ☐ Y ☐ N ☐ N/A ☐ Unknown
Death Remarks

PATIENT IDENTIFICATION Name Tattoo # Microchip # DOB
Age Gender ☐ M ☐ F ☐ N Breed MWD Type Handler Name
Deployed/Assigned Unit Vet/Tech/HCP Name Vet/Tech/HCP Signature
Facility Name Facility Location Submit by Email dog.consult@us.af.mil

(In-Field Trial Draft) 19 November 2018

General Instructions for Canine Treatment and Resuscitation Record

PURPOSE: The Canine Treatment and Resuscitation Record is for documenting a canine's illness or traumatic injuries and related medical treatment and resuscitation care provided at DOD veterinary medical treatment facility (VTFs) or medical treatment facilities (MTFs). It is to be used at all DoD VTFs & MTFs which have a surgical capability or emergency department (ED). It is also to be used to document all instances of Disease Non-Battle Injury (DNBI) seen at Role II VTFs. In cases of DNBI, complete only the applicable sections. A canine trauma patient is defined as a canine who has an injury or illness with the potential of requiring a surgical intervention. The form is comprised of two parts. Part I, Nursing Flow Sheet is completed by the veterinary technician or nurse fulfilling the role as a scriber or the nurse providing bed side care. Part II, Physician H&P (History and Physical) is completed by the trauma veterinarian or physician providing care for the patient. The Canine Treatment and Resuscitation Record becomes part of the patient's permanent DOD medical record. For US Special Operations Command canines, the Canine Treatment and Resuscitation Record will be filled out and returned to the handler or operator. The handler or operator will route the record(s) to their respective veterinarian to be inputted into the MWD Trauma Registry and the canine's record.

PART I: ANIMAL TECHNICIAN / NURSING FLOW SHEET

GENERAL INSTRUCTIONS

- To be completed by the technician / nurse fulfilling the role as a scriber or the technician / nurse providing care.
- Time Zones: Record all time local 24 hour military format, hh:mm
- A + (plus sign) means positive test result; a - (minus sign) means negative test result.
- Record date on top of each page. The date should be the day when care is initiated. If the dog receives multiple days of care, use a new, correctly dated form each day.

PATIENT IDENTIFICATION (at bottom of each page). As stated.

NAME. Name of the Military Working Dog (MWD)

TATTOO. Tattoo identifier (located on the inner surface of the MWD's left ear)

MICROCHIP #. Nine, 12 or 15 digit number specific to the MWD. Record if known or scan if available.

DOB. Date of Birth as listed on the record or in the Remote Online Veterinary Record (ROVR)

AGE. Dog's age in years

GENDER. Male, Female, Neutered (used for both genders)

BREED. Dog's breed as listed on the record or in ROVR. Recognized abbreviations are acceptable (e.g. German Shepherd Dog – GSD, Dutch Shepherd – DS, Belgian Malinois – B Mal, Labrador Retriever – Lab)

MWD TYPE. MWD's type of service, e.g. PEDD, SSD, MPC, IEDD

HANDLER NAME. Name of the person accompanying MWD

DEPLOYED / ASSIGNED UNIT. MWD's owning unit

VET / TECH / HCP NAME. Name of the person responsible for the care of the MWD.

VET / TECH / HCP SIGNATURE. Signature of the responsible provider completed after reviewing the form for accuracy and completeness.

FACILITY NAME. Record your VTF or MTF unit identifier

FACILITY LOCATION. Record FOB, COB, or geographic site

1.0 PATIENT / CANINE INFORMATION

1.1 TRAUMA TEAM DATA. As stated. Record all time local 24 hour military format, hh:mm

General Instructions for Canine Treatment and Resuscitation Record

1.2 ARRIVAL. As stated.

1.3 EVAC FROM. Check all that apply. Location is the facility name.

1.4 MODE OF ARRIVAL. Check one.

WALKED/CARRIED. As stated.

CASEVAC – Air. Casualty Evacuation via non-medical rotary wing aircraft.

CASEVAC – Ground. Casualty Evacuation via non-medical ground transport vehicle.

MEDEVAC - Air includes DUSTOFF. Medical Evacuation via helicopter. Record mission number when known.

MEDEVAC – Ground. Medical Evacuation via ambulance. Record mission number when known.

CCATT. Critical Care Air Transport Team.

SHIP EVAC. Evacuation via US Navy vessel.

AE. Aeromedical Evacuation. Casualty Evacuation via USAF fixed-wing aircraft.

If Other, describe the method by which the patient arrived, such as USAF Pararescue (PJ or Pedro) or United Kingdom Medical Emergency Response Team (MERT), but not DUSTOFF.

1.5 INJURY TYPE. Check all that apply.

1.6 INJURY CLASSIFICATION. Check one.

1.7 TRIAGE CATEGORY. Check one.

Immediate - Patients who require rapid, immediate intervention in order to preserve life and/or limb AND are likely to survive because of the intervention--damage control surgery (e.g.: respiratory obstruction, unstable casualty with chest or abdominal injuries, uncontrolled hemorrhage, hypovolemic shock, emergency amputation).

Delayed - Patients who require surgery or other specific therapeutic intervention, but who will not be severely compromised if the intervention is delayed to a later time (e.g. closed fracture without neurovascular compromise, moderate burns of < 50% TBSA, large muscle wounds, intra-abdominal and/or thoracic wounds).

Minimal - Non-Urgent: Minor Injuries; MWD can be safely cared for by veterinary staff or be monitored by handler. (e.g. Minor lacerations, abrasions, fractures of digits/distal tail, and minor burns). Can safely wait 12-24 hours or longer for care.

Expectant - Patients whose injuries are so severe that even with the benefit of optimal medical resources, their survival would be unlikely (e.g. massive open head injury with brain matter present, high spinal cord injuries, mutilating explosive wounds involving multiple anatomical sites and organs, second/third degree burns in excess of 60% TBSA, profound shock with multiple injuries and agonal respirations).

1.8 SAFETY. Check all that apply.

1.9 PATIENT CATEGORY. Check one.

USA MWD. United States Army-owned MWD

USAF MWD. United States Air Force-owned MWD

USMC MWD. United States Marine Corps-owned MWD

USN MWD. United States Navy-owned MWD

USCG MWD. United States Coast Guard-owned MWD

Contractor MWD. Specify Contractor Company

NATO-Coalition MWD. NATO country military forces-owned MWD. Specify country.

Non-NATO Coalition MWD. Non-NATO military forces-owned MWD. Specify country.

Other. If Other, describe the patient's classification as it relates to military, government or civilian organizations.

1.10 PERSONAL PROTECTIVE EQUIPMENT (PPE). Check all that apply. Collect the PPE and ensure it is transported with the canine.

1.11 INJURY CAUSE. Check all that apply. If Other, describe cause of the injury.

IED. Improvised Explosive Device

MVC. Motor Vehicle Crash

GSW. Gunshot Wound

UXO. Unexploded Ordinance

CBRNE. Chemical, Biological, Radiological, Nuclear and Explosives. Specify

Mortar/Rocket/Artillery Shell. Includes Indirect and Direct Fire

2.0 CARE DONE PRIOR TO ARRIVAL

GENERAL INSTRUCTIONS

- Information for this section should be taken from any medical records that accompany the MWD. This may include a Canine - Tactical Combat Casualty Card (cTCCC), SF 600 notes, ROVR digital medical records (eNOTE), or handler recollection. Complete as thoroughly and with as much detail as possible.
- Time Zones: Record all time local 24 hour military format, hh:mm
- A + (plus sign) means positive test result; a - (minus sign) means negative test result.

2.1 PREHOSPITAL TOURNIQUET. Check all that apply.

CAT. Combat Application Tourniquet.

SOFFT. Combat Application Tourniquet

Other. If other, describe the type of tourniquet.

Effective. An effective tourniquet controls active hemorrhage. May be combined with a dressing.

2.2 PREHOSPITAL VITALS. As stated.

SpO2. Do not attempt to obtain an O2 saturation measurement from the lip or tongue of an unsedated MWD. Use the prepuce, vulva, toe webbing or ear pinna as an alternate location.

2.3 HEMORRHAGE CONTROL. Check all that apply.

Celox. Granules, applicator or gauze. Stops bleeding by bonding with red blood cells and gelling with fluids to produce a sticky pseudo clot. This clot sticks to moist tissue to plug the bleeding site. Celox is made with chitosan, a natural polysaccharide.

ChitoFlex. A stuffable wound dressing conducive to narrow wound tracks.

Combat Gauze. Combat Gauze™ is a 3-inch x 4-yard roll of sterile gauze. The gauze is impregnated with kaolin, a material that causes the blood to clot.

Direct Pressure. Pressure applied directly to a wound, usually with sterile, low-adherent gauze between the wound and source of bleeding.

Field Dressing. A casualty's dressing applied to a wound to control hemorrhaging.

QuikClot. Emergency dressing, combat gauze, interventional bandage, QuikClot ACS+™, QuikClot 1st Response™. When QuikClot® comes into contact with blood in and around a wound, it takes in the

smaller water molecules from the blood. The larger platelet and clotting factor molecules remain in the wound in a concentrated form. This promotes rapid natural clotting and prevents severe blood loss.

None. Check if no hemorrhage control measures.

Unknown. Check if hemorrhage control measures are unknown.

Other. Describe the not otherwise specified hemorrhage control measure.

2.4 PREHOSPITAL WARMING. Check all that apply.

HPMK. Hypothermia Prevention and Management Kit. Check only if all three components were used: Hat/Hood, Activated Liner, and Outer Shell.

If Other. Describe the not otherwise specified warming device.

2.5 PREHOSPITAL MEDS. Enter medication, dose and route.

2.6 PREHOSPITAL INTERVENTIONS. As stated.

IO Infusions. Intra-osseous administration of fluids

IV Fluids. Intravenous administration of fluids

E-Collar. Elizabethan collar. One of a number of devices placed around the neck of a MWD to prevent licking or chewing at a wound or device. May be a commercial product or a bucket with the bottom removed.

Pain Scale. See Table 1 for the explanation of how to determine pain in a MWD

CPR. Cardiopulmonary resuscitation

3.0 PRIMARY ASSESSMENT

3.1 VITALS. As stated. For Pain Scale, enter level that you estimate the dog to be experiencing. Zero indicates the least pain; four is the most severe pain. See Table 1.

TABLE 1. CANINE PAIN SCALE

Score	Behavioral	Palpation	Body Tension
0	Comfortable when resting	Nontender to wound palpation	Minimal
1	Slightly unsettled or restless	Reacts to wound palpation	Mild
2	Uncomfortable at rest, whimpers, licks at wound	Flinches, whimpers, cries	Mild to Moderate
3	Unsettled, crying, groaning, biting, chewing wound	Increased respiratory rate, sharp cry, growl	Moderate
4	Constantly groaning or screaming when unattended, may bite wound	Cries at non-painful palpation, may react aggressively	Moderate to Severe

3.2 NEURO / MENTAL STATUS. As stated. If Other, describe the not otherwise specified.

HYPERACTIVE. Stressed, overly-excited MWD that is alert and conscious but will not follow commands due to repeated panting, pacing and/or aggression. MWD may exhibit frantic searching behavior or excessive, unfocused aggression. Special care should be taken when handling a hyperactive MWD to avoid being bitten.

ALERT. Characterized by a normal level of consciousness. The MWD responds to external stimuli and is able to follow commands when asked.

SEDATED. As stated. The MWD has been administered sedative medication but was alert or hyperactive

before administration.

DEPRESSED. Characterized by a conscious but lethargic state. The MWD is relatively unresponsive to the environment and tends to sleep when undisturbed. Often caused by systemic problems like fever, anemia or metabolic disease. When associated with a primary brain problem, indicates diffuse cerebral cortex disease.

DISORIENTED. The MWD can respond to its environment but does so in an inappropriate manner. Special care should be taken when handling a disoriented MWD to avoid being bitten.

STUPOR. Characterized by an animal that tends to sleep when undisturbed, and that is not arousable with gentle stimuli like sound or touch. The MWD will respond slightly to painful stimuli and have some voluntary movements.

COMATOSE. Characterized by a state of deep unconsciousness, where the MWD cannot be aroused even with significant painful stimuli. Simple reflexes may still be intact and their presence should not be confused with level of consciousness.

MGCS. Modified Glasgow Coma Scale. See Table 2. Score interpretation: 3 – 8 Grave; 9 – 14 Guarded; 15 – 18 Good.

TABLE 2. CANINE MODIFIED GLASGOW COMA SCALE

Level of Consciousness	**Score**	**Pt Score**
Occasional periods of alertness and responsive to environment	6	
Depression or delirium, capable of responding to environment but response may be inappropriate	5	
Stupor, responsive to visual stimuli	4	
Stupor, responsive to auditory stimuli	3	
Stupor, responsive only to repeated noxious stimuli	2	
Coma, unresponsive to repeated noxious stimuli	1	
Motor Activity		
Normal Gait, normal spinal reflexes	6	
Hemiparesis, tetraparesis, or decerebrate activity	5	
Recumbent, intermittent extensor rigidity	4	
Recumbent, intermittent extensor rigidity with opisthotonus	3	
Recumbent, constant extensor rigidity with opisthotonus	2	
Recumbent, hypotonia of muscles, depressed or absent spinal reflexes	1	
Brainstem Reflexes		
Normal pupillary light reflexes and oculocephalic reflexes	6	
Slow pupillary light reflexes and normal to reduced oculocephalic reflexes	5	
Bilateral unresponsive miosis with normal to reduced oculocephalic reflexes	4	
Pinpoint pupils with reduced or absent oculocephalic reflexes	3	
Unilateral, unresponsive mydriasis with reduced or absent oculocephalic reflexes	2	
Bilateral, unresponsive mydriasis with reduced or absent oculocephalic reflexes	1	

3.3 HYPO / HYPERTHERMIA CONTROL MEASURES. As stated. Other includes Body Bag.

3.4 AIRWAY. As stated.

OPA. Oral Pharyngeal Airway

BVM. Bag-Valve-Mask (Ambu bag)

General Instructions for Canine Treatment and Resuscitation Record

3.5 BREATHING. As stated.

3.6 NOTES. As stated.

3.7 CIRCULATION. As stated. Use caution when assessing the mucous membranes of a MWD. If unsedated or variably conscious, ask the handler to show you the mucous membrane color and perform the CRT evaluation. Also consider using an alternate location to approximate CRT. The mucosa of the conjunctiva, prepuce or vulva are acceptable alternative locations to evaluate CRT.

4.0 SECONDARY SURVEY

4.1 HEAD / NECK ENT. As stated.

JVD. Jugular Venous Distention

NR. Non-Reactive

4.2 HEART.

Rhythm. As stated. If Other, describe not otherwise specified rhythm.

NSR. Normal Sinus Rhythm

PEA. Pulseless Electrical Activity

V-Fib. Ventricular Fibrillation

V-Tach. Ventricular Tachycardia

Pulses. Enter S, W, D, A as appropriate. Doppler includes non-palpable, but detected with Doppler. Absent means no pulse, non-palpable and not detected with Doppler.

4.3 ABDOMINAL. As stated.

FAST. Focused Assessment with Sonography for Trauma. Check + (plus) if fluid present.

Check – (minus) if no fluid present. Check in the appropriate block if fluid is identified in

the evaluated quadrant. Leave blank if not performed.

DH. Diaphragmatic-Hepatic

CC. Cysto-Colic

SR. Spleno-Renal

HR. Hepato-Renal

4.4 EXTREMITIES. Check all that apply. To evaluate for Motor in an extremity: once the MWD has been cleared for spinal fracture, then assist to stand if necessary and evaluate each leg for motor as the dog is walked. If the MWD cannot be walked, then touch each paw and evaluate the response. While testing a recumbent dog, do not confuse the withdrawal reflex with motor function. To evaluate for Sensation in a MWD: superficial pain can be elicited by gently pinching between the toes and watching for a head turn or growl; deep pain is assessed by clamping a digit firmly with hemostats until a response is seen. For Pulses Present (positive) enter S, W, D, or A. Doppler includesnon- palpable, but detected with Doppler. Absent means no pulse, non-palpable and not detected with Doppler.

4.5 ALLERGIES. Check one. NKDA is No Known Drug Allergies. If Other, describe not otherwise specified allergy.

4.6 CURRENT MEDICATIONS. As stated. Current Meds: List medication, dose and route.

4.7 MEDICAL HISTORY. As stated.

4.8 PROCEDURES. As stated. Hemorrhage Control Measures. Refer to Prehospital Hemorrhage Control Measures.

NOTE: In the 'performed by' block, in addition to name, record the Title / AOC / MOS / Rate of the person performing each intervention.

ET Intubation. Endotracheal Intubation. List endotracheal tube size if used. List tracheostomy tube size if used. Check block if End Tidal CO2 (ETCO2) changes post-intubation. Check block if patient has bilateral breath sounds (BBS) post-intubation.

General Instructions for Canine Treatment and Resuscitation Record

Chest Tube. 75% of MWDs have a fenestrated mediastinum so both sides of the chest should be tapped if there is significant pneumothorax.

4.9 VENT SETTINGS.

MODE. Manual or Mechanical

FiO2. Fraction of inspired O2. Start at 100% then reduce to <60%

Rate. Number of breaths delivered per minute. For MWDs, set between 8 – 20 bpm to maintain end tidal CO2 between 35 – 45 mmHg

PEEP. Positive End-Expiratory Pressure. For normal lungs 0 -2 cmH2O; for abnormal lungs 2 – 8 cmH2O

TV. Tidal Volume. To calculate tidal volume in a MWD: 15 x BW (kg) = mL TV

Notes. As stated

4.10 INTRAVENOUS / INTRAOSSEOUS ACCESS AND FLUIDS / BLOOD PRODUCTS. As stated. Initials: Legible initials of person who performed task. Enter time as stated.

4.11 MEDICATIONS. As stated. Initials: Legible initials of person who performed task.

4.12 LABS. As stated. Enter time as stated.

CBC. Complete Blood Count

Chem 7. Actual test will vary based on location and available equipment. Typically includes Sodium (Na), Potassium (K), Chloride (Cl), Bicarbonate (HCO3), Blood Urea Nitrogen (BUN), Creatinine (Cr), and Glucose

Chem 12. Actual test will vary based on location and available equipment. Typically includes the tests in a CHEM 7 plus Alkaline Phosphatase (ALP), Alanine aminotransferase (ALT), Aspartate aminotransferase (AST), Bilirubin, Total Protein, Albumin and Calcium (Ca).

H&H. Hematocrit and Hemoglobin

ABG. Arterial Blood Gas

VBG. Venous Blood Gas

PT / PTT. Prothrombin Time / Partial Thromboplastin Time

INR. International Normalized Ratio

U/A. Urinalysis

4.13 CT. As stated. Enter time as stated.

4.14 X-RAY. Enter time as stated.

4.15 PENDING STUDIES. Record any additional tests that have been ordered or completed if there is not adequate space in 4.12 LABS, 4.13 CT or 4.14 X-RAY.

4.16 RESULTS. As stated. Excludes results for labs, CT and X-Ray that should be recorded in Part II, Section 2 Laboratory Results and Section 3 X-RAYS and CT

4.17 VITAL SIGNS. As stated.

ICP. Intracranial Pressure Measurement

4.18 DISPOSITION. Describe patient disposition. If death, complete Part II, section 8.3 Death Information. For mode of transport, refer to section 1.4 Mode of Arrival. If no additional information will be completed on this form, refer to the Completion Instructions on Page 10 for instructions on how to finalize and submit this form.

VMCE. Veterinary Medical Center Europe

4.19 NOTES. Enter additional information relevant to the patient's nursing care.

PART II: VETERINARIAN / PHYSICIAN H&P

GENERAL INSTRUCTIONS:

- To be completed by the veterinarian / trauma physician providing care for the patient.
- Time Zones: Record all time local 24 hour military format, hh:mm

General Instructions for Canine Treatment and Resuscitation Record

- A + (plus sign) means positive test result; a - (minus sign) means negative test result.
- Record date on top of each page. The date should be the day when care is initiated. If the dog receives multiple days of care, use a new, correctly dated form each day.

PATIENT IDENTIFICATION (at bottom of each page). As stated.

NAME. Name of the Military Working Dog (MWD)

TATTOO. Tattoo identifier (located on the inner surface of the MWD's left ear)

MICROCHIP #. Nine, 12 or 15 digit number specific to the MWD. Record if known or scanner available

DOB. Date of Birth as listed on the record or in the Remote Online Veterinary Record (ROVR)

AGE. Dog's age in years

GENDER. Male, Female, Neutered (used for both genders)

BREED. Dog's breed as listed on the record or in ROVR. Recognized abbreviations are acceptable (e.g. German Shepherd Dog – GSD, Dutch Shepherd – DS, Belgian Malinois – B Mal, Labrador Retriever – Lab)

MWD TYPE. MWD's type of service, e.g. PEDD, SSD, MPC, IEDD

HANDLER NAME. Name of the person accompanying MWD

DEPLOYED / ASSIGNED UNIT. MWD's owning unit

VET / TECH / HCP NAME. Name of the person responsible for the care of the MWD.

VET / TECH / HCP SIGNATURE. Signature of the responsible provider completed after reviewing the form for accuracy and completeness.

FACILITY NAME. Record your VTF or MTF unit identifier

FACILITY LOCATION. Record FOB, COB, or geographic site

1.0 HISTORY & PHYSICAL – INJURY DESCRIPTION

1.1 ARRIVAL. As stated.

1.2 TRIAGE CATEGORY. Check one. Refer to 1.7 for definitions from Part I Animal Care Technician / Nursing Flow Sheet.

1.3 CHIEF COMPLAINT, HISTORY AND PRESENTING ILLNESS. As stated.

1.4 INJURY DESCRIPTION. As stated. Annotate on the diagram using the appropriate injury abbreviation. Doppler includes non-palpable, but detected with Doppler. Absent means no pulse, non-palpable and not detected with Doppler. Calculate %TBSA using the guide in section 1.8.

1.5 HISTORY AND PHYSICAL. As stated. Interventions Prior to Arrival is any intervention performed in a prehospital or transferring facility.

1.6 PRE / INITIAL PROCEDURES / DIAGNOSTICS. As stated. Pre means prior to arrival.

Pericardial FAST. Check if presence of fluid or free air. Describe findings as needed.

Thoracic FAST. Check if presence of fluid or free air at Left or Right Chest Tube Site (CTS).

Pericardiocentesis. Check block if performed and record volume of fluid obtained in the space below to distinguish from fluid or blood obtained from the thorax.

DPL. Diagnostic Peritoneal Lavage. Describe technique, locations attempted / performed and findings.

Serial AFAST. Refer to Part I, section 4.3 Abdominal for location definitions.

Front / Rear Extremities. As stated. Also record and describe if other type of bandage is placed.

Seizure Protocol. Control seizures that develop with diazepam or midazolam (0.3 mg/kg; IV, IO, or intranasally), repeated every 15-30 minutes if necessary. If available, give phenobarbital (15 mg/kg IV or IO) loading dose, and 2.5 mg/kg IV every 12 hours thereafter if seizures persist or status epilepticus develops.

Central Line. Describe location, catheter size and number of ports.

Intraosseous / Intravenous Catheter. Describe location and catheter size.

General Instructions for Canine Treatment and Resuscitation Record

1.7 PUPILS / VISION. As stated.

1.8 BURN. As stated. Describe the cause of burn.

% TBSA. Percent of Total Body Surface Area affected. Head: 9%; Thorax: 18%; Abdomen: 18%; Forelimb: 9% each; Hindlimb: 18% each.

Super. Superficial – First Degree.

Super PT. Superficial Partial Thickness – Second Degree.

Deep PT. Deep Partial Thickness – severe Second Degree.

Full. Full Thickness – Third Degree if injury limited to the skin and subcutaneous tissues. Fourth Degree if the burn involves muscle and bone.

1.9 EXTREMITIES. As stated. Evaluate and record Motor, Sensory and Range of Motion (ROM) for each extremity.

2.0 LABORATORY RESULTS

2.1 CBC. As stated.

2.2 CHEMISTRY 7/12 (14). As stated. Refer to Part I, Section 4.12 for abbreviation descriptions.

2.3 PT / PTT / INR. Prothrombin Time / Partial Thromboplastin Time / International Normalized Ratio. As stated.

2.4 BLOOD TYPE. Record if patient is DEA 1.1 positive or negative. Record full blood type if known.

2.5 VBG / ABG. Venous Blood Gas / Arterial Blood Gas. As stated.

2.6 URINALYSIS. As stated.

SpGr. Urine Specific Gravity. Canine USG should be measured on a refractometer, as urine test strips are not always accurate.

LEU. Leukocytes

PRO. Protein

GLU. Glucose

KET. Ketones

UBG. Urobilinogen

BIL. Bilirubin

HGB. Hemoglobin

2.7 OTHER LABS. Record any additional labs performed and appropriate results.

3.0 X-RAY AND CT

3.1 CT OBTAINED. As stated.

3.2 X-RAYS OBTAINED. As stated.

3.3 FOREIGN BODY. Check all that apply. Collect the foreign body and save. More guidance will be forthcoming on where to send.

3.4 PENDING STUDIES. As stated.

3.5 RESULTS. As stated. Include TEG / Rotem results if performed. Refer to the CPG to evaluate canine TEG results.

4.0 IMPRESSION / ASSESSMENT

Enter impressions and findings.

4.1 SEVERITY. (mark the most appropriate)

4.2. IMPRESSION/ASSESSMENT COMMENTS (fill in as appropriate)

5.0 DIAGNOSES

Enter diagnoses and findings, up to 12. If more than 12, record the most life-threatening findings.

General Instructions for Canine Treatment and Resuscitation Record

6.0 PLAN

6.1 PLAN. Enter the treatment plan and any additional procedures that were or will be performed.

7.0 DNBI / NBI CATEGORY

Check all Disease Non Battle Injuries/Non Battle Injuries that apply. Describe any injury not otherwise specified.

8.0 CAUSE OF DEATH

If death, complete all appropriate sections. Leave blank if patient is alive.

8.1 ANATOMIC. As stated. If Other, describe not otherwise specified anatomy.

8.2 PHYSIOLOGIC. As stated. If Other, Specify, describe not otherwise specified physiology.

MOF. Multi Organ Failure

CNS. Central Nervous System Failure

8.3 DEATH INFORMATION.

Euthanized. Record medication(s) used, volume administered and route. Compete Canine Death Certificate (DD Form 1743).

Necropsy by DVM. Record necropsy date and time (local). Record time between death and start of necropsy if known. Estimate time if unknown.

Gross Pathology Report. Annotate if a gross necropsy was performed, and gross pathology report (DD Form 1626) was completed, and if samples were submitted to the Joint Pathology Center (JPC) or other pathology center. Record where the tissue samples were submitted and date of submission if known.

Death Remarks. Annotate any other information that may be pertinent to the patient's case.

CANINE TREATMENT AND RESUSCITATION RECORD COMPLETION AND SUBMISSION

- After the form has been completed, it should be reviewed by the responsible HCP listed in the Patient Identification block for completeness and detail. The responsible HCP should then sign each page.
- The signed form needs to be submitted to the DOD Military Working Dog Veterinary Services DAILY by clicking on one of the 'Submit by Email' buttons located on the bottom of each page. If the button does not work, then submit the form to dog.consult@us.af.mil. The subject line should include the MWD Name, Tattoo and Date, i.e. 'Canine Treatment and Resuscitation Record MWD Ayaks L332 16 August 2018'. For US Special Operations Command canines, the Canine Treatment and Resuscitation Record(s) will be filled out and returned to the handler or operator. The handler or operator will route the record(s) to their respective veterinarian to be inputted into the MWD Trauma Registry and the canine's record.
- A printed copy of each signed form MUST be included in the MWD's paper record to ensure continuity of care, especially if the dog will be transferred to another level of care.
- A completed copy of the record will be uploaded into the MWD's ROVR record when access is available. This should happen in theater if possible, but if ROVR access is not available, then all records need to be uploaded at the first Role III facility or at the MWD's home station veterinary clinic.
- To upload a form in ROVR:
    - Open the MWD's record, select Imported Files from the Patient Tools menu on the right
    - Select the Upload File button in the upper left hand corner of the screen
    - Find the appropriate file by selecting the browse button, then complete each field. Document date is the date listed on the Treatment and Resuscitation Record. Document Type should be 'Other' and Specialty should be 'Emergency Care.' In the Comments, record as 'Canine Treatment and Resuscitation Record'. Select Upload to finish.
    - Repeat as necessary for each completed record.