

Joint Theater Trauma System Clinical Practice Guideline

CLINICAL MANAGEMENT OF MILITARY WORKING DOGS

Original Release/Approval	15 Apr 2011	Note: This CPG requires an annual review.	
Reviewed:	Feb 2012	Approved:	19 Mar 2012
Supersedes:	Canine Resuscitation, 15 Apr 2011		
<input type="checkbox"/> Minor Changes (or)	<input checked="" type="checkbox"/> Changes are substantial and require a thorough reading of this CPG (or)		
<input type="checkbox"/> Significant Changes			

1. Goal. To 1) provide non-veterinary healthcare providers (HCPs) with general information concerning handling of military working dogs (MWDs), and 2) provide – as appendices to this base document – clinical medical guidance for management of seriously ill or injured MWDs to assist in recognition and initial resuscitation and stabilization of life- and limb-threatening conditions that warrant HCP intervention in the absence of veterinary personnel.

2. Appendices.

APPENDIX A	NORMAL CLINICAL PARAMETERS FOR MILITARY WORKING DOGS	9
APPENDIX B	EMERGENCY AIRWAY MANAGEMENT IN MILITARY WORKING DOGS	15
APPENDIX C	MANAGEMENT OF PENETRATING CHEST WOUNDS AND RESPIRATORY DISTRESS IN MILITARY WORKING DOGS	22
APPENDIX D	CARDIOPULMONARY RESUSCITATION (CPR) OF MILITARY WORKING DOGS	35
APPENDIX E	MANAGEMENT OF SHOCK IN MILITARY WORKING DOGS	39
APPENDIX F	MANAGEMENT OF ABDOMINAL TRAUMA IN MILITARY WORKING DOGS	43
APPENDIX G	MANAGEMENT OF GASTRIC DILATATION-VOLVULUS SYNDROME IN MILITARY WORKING DOGS	50
APPENDIX H	MANAGEMENT OF ENVIRONMENTAL INJURIES IN MILITARY WORKING DOGS	56
APPENDIX I	MANAGEMENT OF LONG BONE FRACTURES IN MILITARY WORKING DOGS	75
APPENDIX J	WOUND MANAGEMENT IN MILITARY WORKING DOGS	79
APPENDIX K	MANAGEMENT OF OCULAR INJURIES IN MILITARY WORKING DOGS	83
APPENDIX L	ANALGESIA AND ANESTHESIA FOR MILITARY WORKING DOGS	86
APPENDIX M	MANAGEMENT OF TRAUMATIC BRAIN INJURY (TBI) AND ACUTE SPINAL CORD INJURY (ASCI) IN MILITARY WORKING DOGS	90
APPENDIX N	MANAGEMENT OF CANINE POST TRAUMATIC STRESS DISORDER-LIKE SYNDROME	98
APPENDIX O	MANAGEMENT OF TRAINING AID TOXICOSES IN MILITARY WORKING DOGS	100
APPENDIX P	EUTHANASIA OF MILITARY WORKING DOGS	103
APPENDIX Q	AFTER-ACTION REVIEW OF MILITARY WORKING DOG EMERGENT CARE	105
APPENDIX R	ADDITIONAL INFORMATION REGARDING OFF-LABEL USES IN CPGs	106

Guideline Only/Not a Substitute for Clinical Judgment

March 2012

Joint Theater Trauma System Clinical Practice Guideline

3. Background.

- a. 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 a high level of resuscitative care as far forward as possible, often where the presence of trained Veterinarians or Animal Care Specialists is uncommon.
- b. The ideal medical providers for MWDs, especially during emergent situations, are military Veterinarians and Animal Care Specialists, supporting the assigned dog handler. However, HCPs may be the only medical personnel available to MWDs that are gravely ill or injured. Generally, provision of medical 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 necessary to manage problems that immediately threaten life, limb, or eyesight, and to prepare the dog for evacuation to definitive veterinary care.*** Under no circumstances should routine medical, dental, or surgical care be provided by non-veterinary personnel unless this care has been coordinated with and approved by supporting veterinary personnel.
- c. Veterinary care is established at multiple locations throughout theater. The veterinary health care team will remain the MWD's primary provider, and ***every effort should be made to contact the supporting veterinary team for guidance immediately upon presentation of an ill or injured MWD. Nothing in this CPG or its appendices authorize HCPs to provide medical care except as outlined above.***
- d. Information concerning MWDs (e.g., unit of assignment, operating location, illness or injury data, functional status) should be considered confidential and treated as such.
- e. Working dogs operated by government-contracted personnel may be presented for medical care by HCPs. These contract working dogs (CWDs) are authorized medical care on a reimbursable basis or as stipulated in contracts reviewed by the Theater MWD/CWD Program Manager; however, routine medical care will not be provided to these dogs by HCPs. In emergent situations and as outlined in this CPG for MWDs, HCPs are authorized to provide initial resuscitation and stabilization for these dogs as outlined for MWDs.
- f. Working dogs operated by allied military forces in theater may likewise be presented for emergent care. Established agreements permit US military HCPs to provide necessary emergency resuscitative and stabilization care for allied military dogs, just as if they were US MWDs.

4. General Handling and Management of MWDs.

- a. MWDs are often unpredictable and potentially dangerous animals, especially when ill, injured, or stressed, and especially when not under the control of their assigned handler.
- b. The dog handler is the best person to control the MWD. Handlers also have the most accurate information about past medical problems and current situation. All MWD handlers have received basic emergency first aid training and can assist in limited

Guideline Only/Not a Substitute for Clinical Judgment

March 2012

Joint Theater Trauma System Clinical Practice Guideline

emergent care; experience levels will vary. If the assigned handler is not present, other handlers are skilled at MWD restraint and handling and should be utilized if available.

- c. Safety of HCPs and bystanders is paramount.
 - 1) For safety reasons, ***never examine a MWD without a handler or knowledgeable person present, especially if the patient is conscious.***
 - 2) ***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.
 - 3) MWDs must be controlled and supervised at all times, especially if sedated or anesthetized; someone must be dedicated to this task if the handler is not available. A handler should be present or immediately (on site) available 24 hours a day during periods of MWD hospitalization or treatment.
 - 4) MWDs must never be transported by any means without a handler, or someone to control the dog if the handler is not available.
 - 5) 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.

5. Evaluation and Treatment.

- a. **Appendices A through P guide HCPs** in management of specific scenarios involving life- or limb-threatening problems with MWDs.
- b. As noted in specific appendices, there may be instances in which emergent surgical management of injured MWDs is necessary by HCPs to afford a chance at patient survival. ***Providers must note that emergent surgical management should be considered only if 1) the provider has the necessary advanced surgical training and experience, 2) the provider feels there is a reasonable likelihood of success, and 3) 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.*** Thus, emergent surgical management should be considered *only in Level 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.

6. Performance Improvement Monitoring.

- a. Intent (Expected Outcomes).
 - 1) 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.

Guideline Only/Not a Substitute for Clinical Judgment

March 2012

Joint Theater Trauma System Clinical Practice Guideline

- 2) HCPs do not perform medical procedures for non-emergent reasons or if veterinary personnel are available.
 - 3) HCPs promptly coordinate veterinary support and provide timely feedback in instances in which care is provided to MWDs.
- b. Performance/Adherence Measures.
 - 1) Compliance review by supporting veterinary personnel of key data sources.
 - 2) Face-to-face discussions between supporting veterinary personnel and HCPs providing care.
 - c. Data Source.
 - 1) Patient record generated by HCPs during care
 - 2) Appendix Q (After Action Report)
 - d. System Reporting & 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 Joint Theater Trauma System (JTTS) Director, JTTS Program Manager, and the Joint Trauma System (JTS) Performance Improvement Branch.

- 7. Responsibilities.** It is the trauma team leader's responsibility to ensure familiarity, appropriate compliance and PI monitoring at the local level with this CPG.
- a. 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. HCPs will complete [APPENDIX Q](#) any time emergent care is provided and forward to the supporting veterinary facility, in an effort to evaluate the utility of this and other MWD-related CPGs and to improve allocation of veterinary resources.
 - b. Veterinary personnel will remain integrally involved in the decision chain for all MWD care issues.
 - c. The process for updating CPGs is described in the *CENTCOM JTTS CPG Development, Approval, Implementation, and Monitoring Process* document posted to the JTS website (<http://usaisr.amedd.army.mil/cpgs.html>). The Directors determined that one MWD CPG containing multiple appendices was the best way to ensure that the MWD CPG will not be confused with or lost within the human medical CPGs also posted on the JTS website. The in-theater proponents for updates are the JTTS Director and the TF MED/MED BDE Staff Veterinarian or a Medical Detachment (Veterinary Service Support) Commander. Theater recommendations are presented to JTTS POCs, reviewed and passed to the JTS Directorate POCs for final review and approval. The Director, DoD Military Working Dog Veterinary Service has the responsibility to update the MWD CPG in coordination with the JTTS and JTS Directors and is the final veterinary approval authority as the MWD representative of the DOD Executive Agent for Veterinary Services, IAW DODD

Guideline Only/Not a Substitute for Clinical Judgment

March 2012

Joint Theater Trauma System Clinical Practice Guideline

5101.1, DoD Executive Agent, November 21, 2003; DODD 5200.31E, DoD Military Working Dog (MWD) Program, August 10, 2011; DODD 6400.4, DoD Veterinary Services Program, November 24, 2003; and, Memorandum, Surgeon General, 9 December 2008, Subject: Delegating Roles and Responsibilities for the DoD Veterinary Service Activity (DODVSA).

- d. 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.

8. References.

1. Bernhard M, Gries A, Kremer P, et al. Spinal cord injury (SCI)—prehospital management. *Resuscitation* 2005;66:127-139.
2. Bouchama A, Dehbi M, Chaves-Carballo E. Cooling and hemodynamic management in heatstroke: practical recommendations. *Critical Care* [serial online]. 05/12/07;11 (issue 3):R54. Available at: www.ccforum.com/content/11/3/R54. Accessed May 15, 2010.
3. 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.
4. Bruchim Y, Klement E, Saragusty J, et al. Heat stroke in dogs: a retrospective study of 54 cases (1999–2004) and analysis of risk factors for death. *J Vet Intern Med* 2008;1:38-46.
5. Bonczynski JJ, Ludwig LL, Barton LJ, et al. Comparison of peritoneal fluid and peripheral blood pH, bicarbonate, glucose, and lactate concentrations as a diagnostic tool for septic peritonitis in dogs and cats. *Vet Surg* 2003;32:161-166.
6. Casa DJ. Exercise in heat. I. Fundamentals of thermal physiology, performance implications, and dehydration. *J Athlet Train* 1999;34:246-252.
7. Centers for Disease Control and Prevention. After an earthquake: management of crush injury and crush syndrome. Accessed online 12 April 2011: <http://www.bt.cdc.gov/disasters/earthquakes/crush.asp>.
8. Centers for Disease Control and Prevention. Explosions and blast injuries: a primer for clinicians. Accessed online 01 April 2011: <http://www.bt.cdc.gov/masscasualties/explosions.asp>.
9. 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.
10. Crowe DT, Jr., Devey JJ. Assessment and management of the hemorrhaging patient. *Vet Clin N Am (Sm Anim Pract)*, 1994;24:1095-1122.
11. Dewey CW. Brain Trauma. In: *The Veterinary ICU Book*. Teton NewMedia, Jackson, WY, 2003.
12. Drobatz K. Triage and initial assessment. In: *Manual of Canine and Feline Emergency and Critical Care*. King L and Hammond R, eds. British Small Animal Veterinary Association, 1999, pp 1-7.
13. Drobatz KJ. Heat stroke. In: Silverstein DC, Hopper K, eds. *Small Animal Critical Care Medicine*. St. Louis: Saunders/Elsevier, 2009;723-726.

Guideline Only/Not a Substitute for Clinical Judgment

March 2012

Joint Theater Trauma System Clinical Practice Guideline

14. *Emergency War Surgery*, 3rd US revision. US Government Printing Office, Washington, DC, 2004.
15. Fletcher DJ, Syring R. Traumatic Brain Injury. In: *Small Animal Critical Care Medicine*, Silverstein DC and Hopper K, eds. Saunders/Elsevier, St Louis, MO, 2009.
16. Flournoy WS, Macintire DK, Wohl JS. Heat stroke in dogs: clinical signs, treatment, prognosis, and prevention. *Comp Cont Edu Pract Vet* 2003;25:422-431.
17. Gall TT and Monnet E. Evaluation of fluid pressures of common wound-flushing techniques. *Am J Vet Res* 2010;71:1384-1386.
18. Garzotto CK. Thermal burn injuries. In: Silverstein DC, Hopper K, eds. *Small Animal Critical Care Medicine*. St. Louis: Saunders/Elsevier, 2009;683-686.
19. Garzotto CK. Wound management. In: Silverstein DC, Hopper K, eds. *Small Animal Critical Care Medicine*. St. Louis: Saunders/Elsevier, 2009;676-682.
20. Gonzalez D. Crush syndrome. *Crit Care Med*, 2005;33(Suppl 1):S34-S41.
21. Halling K. Wounds and open fractures. In: Mathews K, ed. *Veterinary Emergency and Critical Care Manual*. Guelph, Ontario, Canada: Lifelearn, Inc., 2006;702-708.
22. Harker J, Gibson P. Heat-stroke: a review of rapid cooling techniques. *Intensive Crit Care Nursing* 1995;11:198-202.
23. Hoedemaekers CW, Ezzahti M, Gerritsen M, et al. Comparison of cooling methods to induce and maintain normo- and hypothermia in intensive care unit patients: a prospective intervention study. *Critical Care* [serial online]. 08/24/07;11 (issue 4):R91. Available at: www.ccforum.com/content/11/R91. Accessed May 15, 2010.
24. Levin GM, Bonczynski JJ, Ludwig LL, et al. Lactate as a diagnostic test for septic peritoneal effusions in dogs and cats. *J Am Anim Hosp Assoc* 2004;40:364-371.
25. Kovacic JP. Management of life-threatening trauma. *Vet Clin N Am (Sm Anim Pract)* 1994;24:1057-1094.
26. Lisciandro GR, Lagutchik MS, Mann KA, et al. Evaluation of an abdominal fluid scoring (AFS) system determined using abdominal focused assessment with sonography for trauma (AFAST) in 101 dogs with motor vehicle trauma. *J Vet Emerg Crit Care*, 2009;19:426-437.
27. Lisciandro GR, Lagutchik MS, Mann KA, et al. Evaluation of a thoracic focused assessment with sonography for trauma (TFAST) protocol to detect pneumothorax and concurrent thoracic injury in 145 traumatized dogs. *J Vet Emerg Crit Care* 2008;18:258-269.
28. Mathews K. Accidental hypothermia. In: Mathews K, ed. *Veterinary Emergency and Critical Care Manual*. Guelph, Ontario, Canada: Lifelearn, Inc., 2006;291-296.
29. Mathews K. Burn injury and smoke inhalation. In: Mathews K, ed. *Veterinary Emergency and Critical Care Manual*. Guelph, Ontario, Canada: Lifelearn, Inc., 2006;682-689.
30. Mathews K. Hyperthermia, heat stroke, malignant hyperthermia. In: Mathews K, ed. *Veterinary Emergency and Critical Care Manual*. Guelph, Ontario, Canada: Lifelearn, Inc., 2006;297-303.

Guideline Only/Not a Substitute for Clinical Judgment

March 2012

Joint Theater Trauma System Clinical Practice Guideline

31. McCurnin DM, Bassert JM, eds. *McCurnin's Clinical Textbook for Veterinary Technicians*, 7th ed. Saunders, St. Louis, MO, 2009.
32. McMichael M. Heatstroke. In: Cann CC, Hunsberger S, eds. *Handbook of Veterinary Emergency Protocols: Dog and Cat*. Jackson, WY: Teton NewMedia, 2008;228-230.
33. NATO STANAG 2534 MED (Edition 1). Welfare, Care and Veterinary Support for Deployed Military Working Animals. NATO Standardization Agency, 02 Dec 2005.
34. NATO STANAG 2538. Animal Care and Welfare and Veterinary Support During All Phases of Military Deployments. NATO Standardization Agency, 19 Nov 2009.
35. Oncken AK, Kirby R, Rudloff E. Hypothermia in critically ill dogs and cats. *Comp Cont Edu Pract Vet* 2001;23:506-521.
36. Pennardt A. Blast injuries, updated 28 May 2010. Accessed online 01 April 2010: <http://emedicine.medscape.com/article/822587>.
37. Platt SR. Coma Scales. In: *Small Animal Critical Care Medicine*, Silverstein DC and Hopper K, eds. Saunders/Elsevier, St Louis, MO, 2009.
38. Shawver D, Battaglia A. Mechanical ventilation. In: Battaglia A, ed. *Small Animal Emergency and Critical Care: A Manual for the Veterinary Technician*. Ithaca, NY: WB Saunders Co, 2000;100-107.
39. Simpson SA, Syring RS, Otto CM. Severe blunt trauma in dogs: 235 cases (1997-2003). *J Vet Emerg Crit Care* 2009;19:588-602.
40. Smarick SD. Heatstroke: keeping them alive. In: *Proceedings 14th Int Vet Emerg Crit Care Symp*. Chicago, IL. 2009;167-170.
41. *Soldier's Manual and Trainer's Guide*, MOS 68T Animal Care Specialist, STP 8-91T14-SM-TG. Headquarters, Department of the Army, 20 Aug 2002.
42. Tabor B. Heatstroke in dogs. *Vet Tech* 2007;28. Available at: www.vettechjournal.com. Accessed May 31, 2010.
43. TB MED 283. *Veterinary Necropsy Protocol for Military Working Dogs and Pathology Specimen Submission Guidelines*. Headquarters, Department of the Army, 24 May 2001.
44. *The Handbook of Veterinary Care and Management of the Military Working Dog*. DoD Military Working Dog Veterinary Services, Lackland AFB, TX, 2004.
45. Thulesius O. Thermal reactions of blood vessels in vascular stroke and heatstroke. *Med Principles Practice* 2006;15:316-321.
46. Tillson MD. Open fracture management. *Vet Clin North Am Small Anim Pract* 1995;1093-1110.
47. Todd J, Powell LL. Hypothermia. In: Silverstein DC, Hopper K, eds. *Small Animal Critical Care Medicine*. St. Louis: Saunders/Elsevier, 2009;720-722.
48. Vogelsang R. Care of the Military Working Dog by Medical Providers. *J Special Operations Med* 2007;7:33-47.
49. Wingfield WE, Palmer SB. In: *Veterinary Disaster Response*. Wiley-Blackwell, Ames, IA, 2009.
50. Wingfield WE, Nash SL, Palmer SB, et al. In: *Veterinary Disaster Medicine: Working Animals*. Wiley-Blackwell, Ames, IA, 2009.

Guideline Only/Not a Substitute for Clinical Judgment

March 2012

Joint Theater Trauma System Clinical Practice Guideline

- ⁵¹. Wingfield WE, Raffe MR, eds. *The Veterinary ICU Book*. Teton NewMedia, Jackson, WY, 2003.

Approved by CENTCOM JTTS Director,
JTS Director and CENTCOM SG

Opinions, interpretations, conclusions, and recommendations are those of the authors
and are not necessarily endorsed by the Services or DoD.

Guideline Only/Not a Substitute for Clinical Judgment

March 2012

Joint Theater Trauma System Clinical Practice Guideline

APPENDIX A NORMAL CLINICAL PARAMETERS FOR MILITARY WORKING DOGS

1. Normal Vital Signs at Rest.

Table 1, Normal Vital Signs at Rest

Temperature (rectal)	99.0° to 102.5° F
Heart rate/Pulse rate	60 - 80 bpm
Respiratory rate	16 - 30 bpm <i>(note that controlled panting is common in MWDs)</i>
Blood pressure	Systolic 120 mmHg, Diastolic 80 mmHg, Mean 90-100 mmHg

2. Complete Blood Cell Count Parameters. (Note that results from analyzers calibrated for human blood cell sizes may be unreliable or misleading based on methodology for each test parameter.)

Table 2, 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

3. Blood Chemistry Parameters. (Note that results from serum chemistry analyzers calibrated for human serum may be unreliable or misleading based on methodology for each test parameter.)

Table 3, 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	Lactate	1.5 - 2.0 mmol/L
Amylase	200 - 1200 U/L	Potassium	3.7 - 5.8 mmol/L
AST	14 - 45 U/L	Sodium	138 - 160 mmol/L
Bicarbonate	12 - 27 mmol/L	Total bilirubin	0.1 - 0.6 mg/dL
BUN/SUN	7 - 25 mg/dL	Total protein	5.4 - 8.2 g/dL

Guideline Only/Not a Substitute for Clinical Judgment

March 2012

Table 3, Blood Chemistry Parameters

Calcium (total)	8.6 - 11.8 mg/dL	pH	7.35 - 7.45
Chloride	105 - 111 mmol/L	pCO ₂	24 - 38 mmHg
Creatine Kinase	20 - 200 U/L	pO ₂	85 - 100 mmHg
Creatinine	0.3 - 1.5 mg/dL	HCO ₃	17 - 25 mmol/L

- 4. Clinical Comparative Anatomy for MWDs.** Dogs differ anatomically and physiologically in several key areas in comparison to people. Knowledge of these differences will assist HCPs in resuscitating and stabilizing injured MWDs.
- The **average MWD weighs 25-40 kg** (German shepherd dogs, Belgian Malinois, Labrador retrievers). Actual body weight should be obtained if possible, but this range can be used when calculating drug dosages if actual weight is unknown. ***All drug dosages should be calculated based on measured or estimated body weight.***
 - Laboratory parameters are general ranges** and will vary depending on the analyzer used. Interpretation of results from analyzers calibrated for human blood cells and serum chemistries may be unreliable or misleading (e.g., analyzers designed for human blood albumin measurement use species-specific methodology making canine blood albumin determination impossible.)
 - Venous blood sampling and IV catheterization** are through
 - the cephalic vein on the cranial (superior) aspect of the forearm (as shown in [Figure 1](#), [Figure 2](#), and [Figure 3](#)),
 - the lateral saphenous vein on the lateral aspect of the hind limb at the distal tibial area (as shown in [Figure 4](#)), or
 - the external jugular veins in either jugular furrow of the neck.

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 [wrist]).

Figure 2, Occluding the Vein



Figure 2 shows proper technique for an assistant to occlude the vein, while extending the elbow joint.

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, Location of Lateral Saphenous Vein on Hind Limb



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 (Achilles tendon).

- d. The **arterial pulse** is best palpated at the femoral artery on the medial aspect of the proximal thigh in the inguinal area as shown in [Figure 5](#), or at the dorsal metatarsal artery on the dorsal aspect of the proximal hind paw.

Figure 5, Location for Palpation of Femoral Arterial Pulse

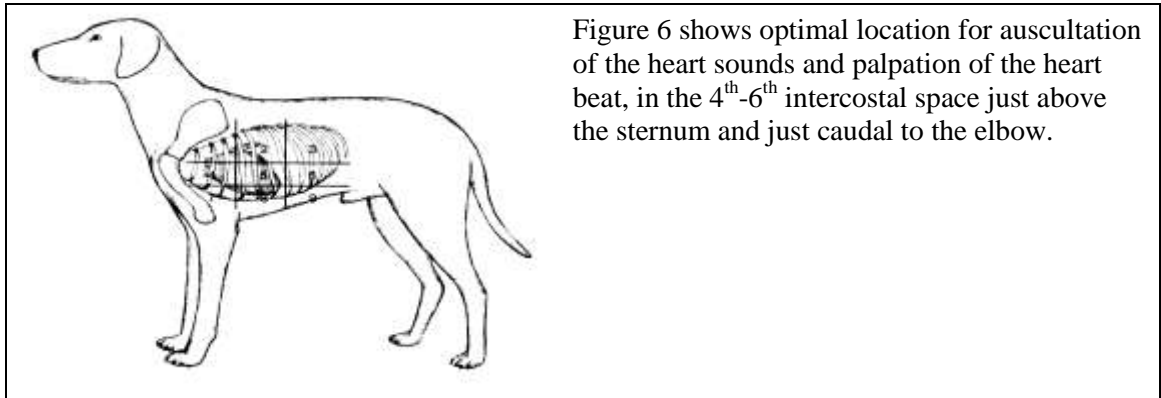


Figure 5 shows location for palpation of the femoral arterial pulse, in the inguinal region on the medial aspect of the proximal thigh.

Joint Theater Trauma System Clinical Practice Guideline

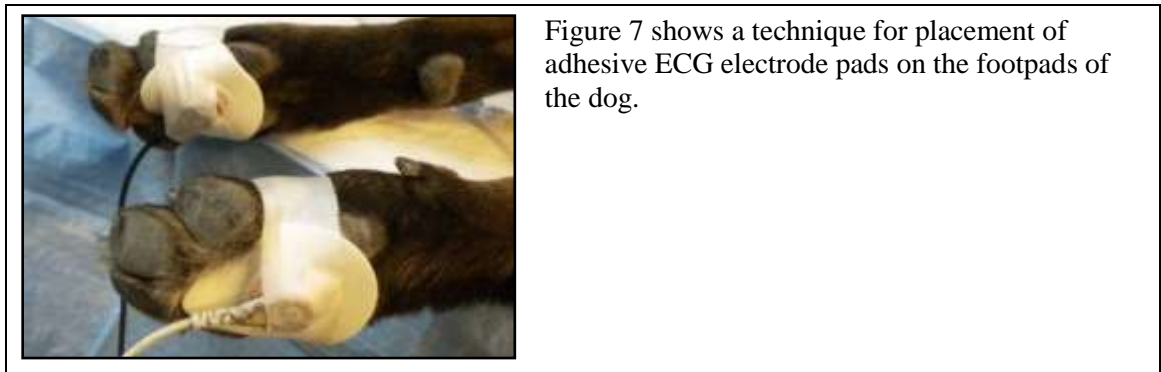
- e. **Heart sounds** are best auscultated over the lower lateral thoracic wall between the 4th-5th intercostals spaces, typically where the elbow crosses the chest wall when the forelimb is pulled caudally, as shown in [Figure 6](#).

Figure 6, Heart Sounds



- f. **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. Pediatric settings should be used on the monitor.
- g. **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 7](#). 3-lead electrocardiograms are the norm and are sufficient. Canine ECG complexes resemble human complexes, with minor variations in key electrocardiographic intervals.

Figure 7, Placement of ECG Electrode Pads



Joint Theater Trauma System Clinical Practice Guideline

- h. **Pulse oximetry** probes used for people (typically finger probes) are best placed on the tongue for optimal reliability, as shown in [Figure 8](#). Note that this can only be done in unconscious or sedated/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 8, Placement of Human Pulse Oximeter Finger Probe on Tongue

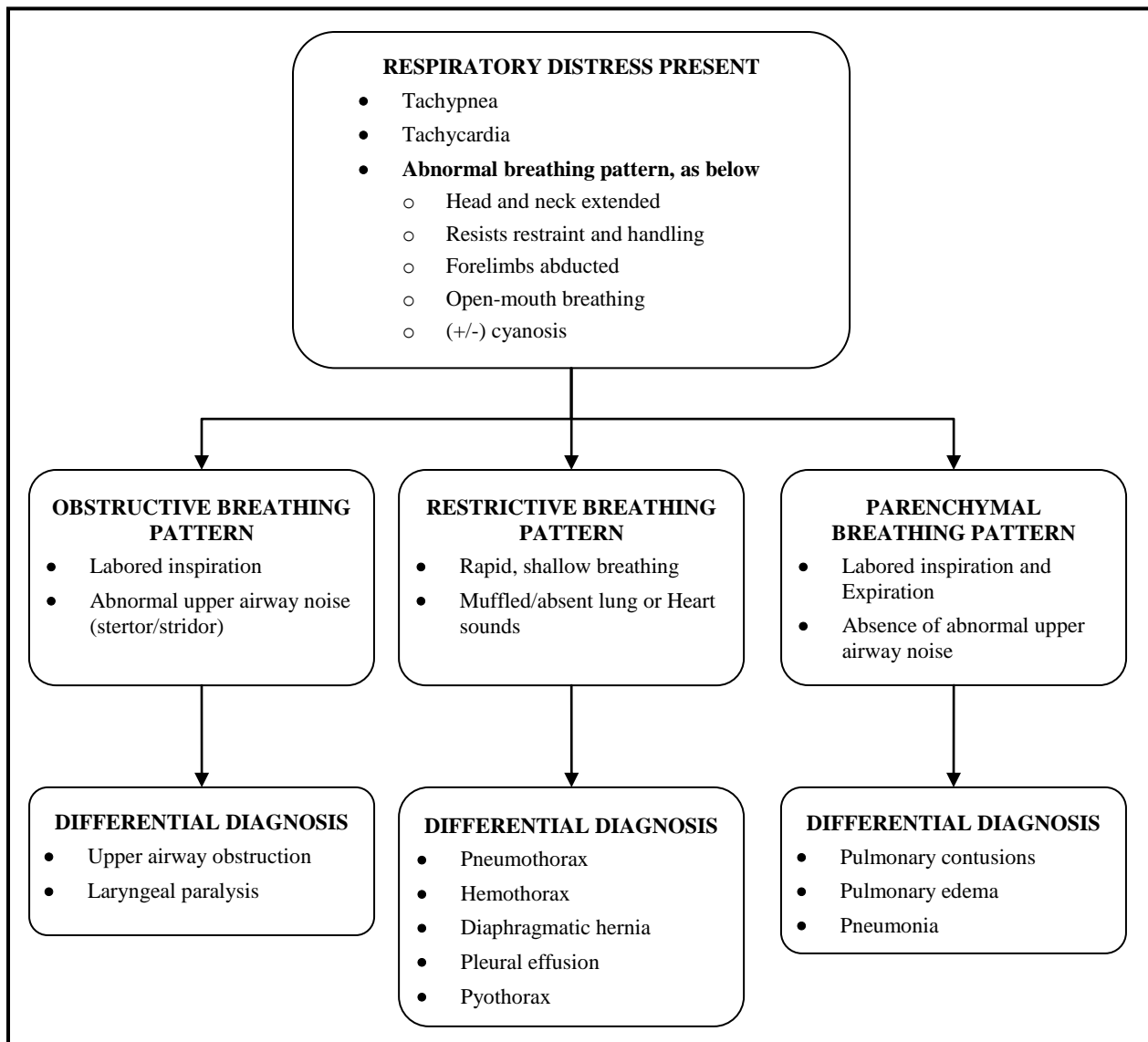


Figure 8 shows a technique for placement of standard human pulse oximeter finger probe on the tongue of an anesthetized dog.

APPENDIX B EMERGENCY AIRWAY MANAGEMENT IN MILITARY WORKING DOGS

1. Respiratory distress develops in 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.
2. MWDs in respiratory distress typically have 1 of 3 characteristic breathing patterns that help localize the problem. [Figure 9](#) presents a clinical algorithm for differentiating the most likely cause of a patient's distress based on the pattern of breathing.

Figure 9, Clinical Algorithm for Differentiating Cause of Distress Based on Breathing Pattern



Joint Theater Trauma System Clinical Practice Guideline

- 3. Oxygen supplementation is essential.** Provide 100% oxygen to all trauma patients and any patient that is showing signs of respiratory distress, until proven unnecessary. 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.
- a. 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. **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 10](#) shows simple yet effective techniques to safely provide “blow by” oxygen supplementation to muzzled MWDs.

Figure 10, Administration of Supplemental Oxygen



- b. Unconscious MWDs: Use tracheal insufflation, orotracheal intubation, or tracheostomy (see [Table 4](#), [Table 5](#), and [Table 6](#) for techniques).
- 4. Upper airway obstruction with an obstructive breathing pattern.** A patient with an obstructive breathing pattern typically has respiratory distress characterized by labored inspiration and abnormal upper airway noise (stridor and stertor). See [Figure 9](#).
- a. 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.
- b. 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.

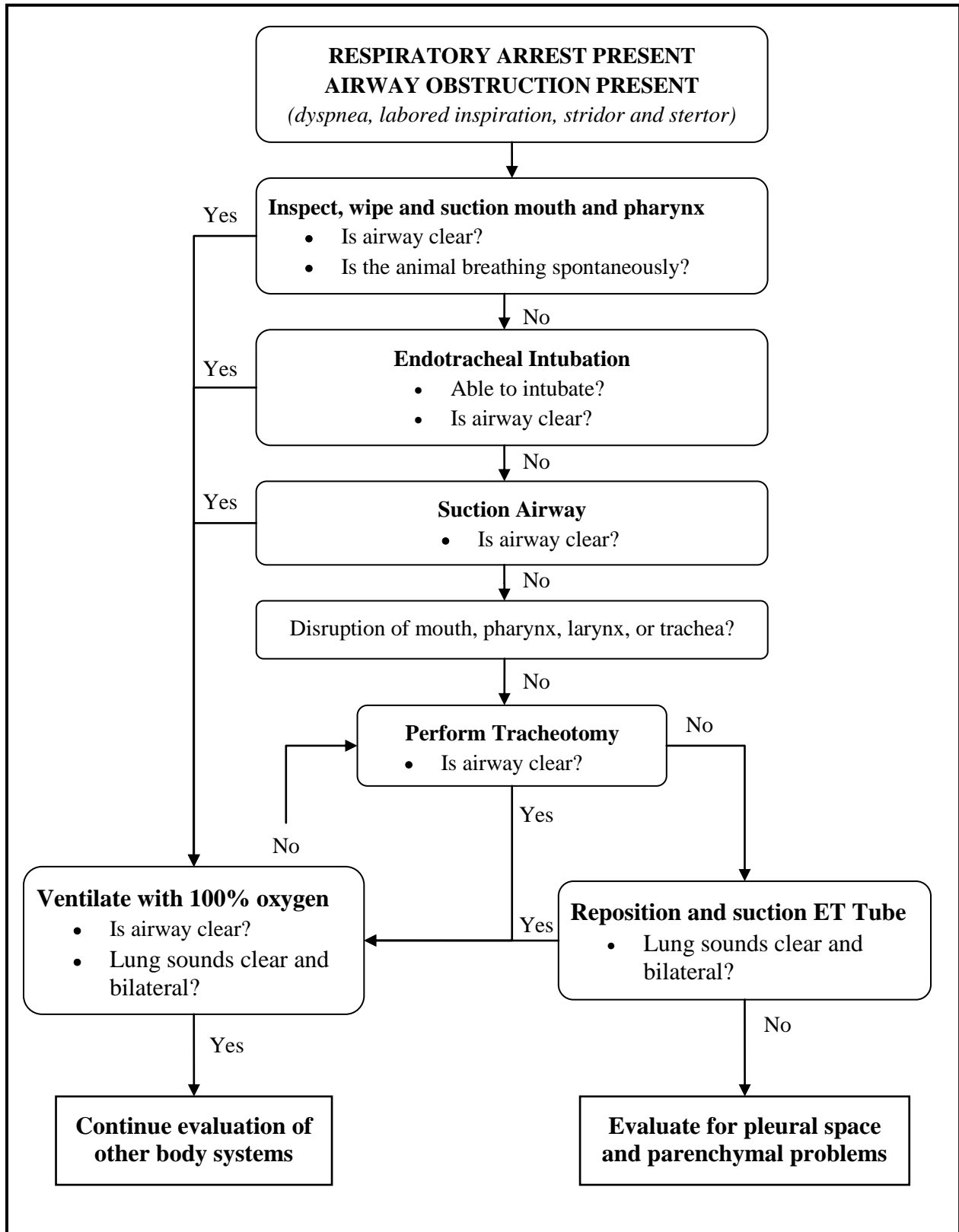
Guideline Only/Not a Substitute for Clinical Judgment

March 2012

Joint Theater Trauma System Clinical Practice Guideline

- c. **If the airway is not patent, immediately takes steps to open the airway.** See [Figure 11](#).
- 1) Provide oxygen therapy as above.
 - 2) Bypass the obstruction until the patient is more stable:
 - a) 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.
 - b) 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.
 - c) 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).
 - d) Patient anxiety is frequently a compounding factor; tranquilize, sedate, or anesthetize if needed. See [APPENDIX L](#).
 - e) Management of patients with tracheostomy tubes requires 24-hour care and observation. Instill 3-5 cc sterile saline into the tracheostomy tube and suction the tube every 4 hours. 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 11, Airway Obstruction Management Algorithm and MWDs



Guideline Only/Not a Substitute for Clinical Judgment

March 2012

Table 4, Tracheal Insufflation with Oxygen for MWDs

Technique:

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 (see [APPENDIX L](#)) 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 over-the-needle 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 over-the-needle 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 over-the-needle 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).

Table 5, Emergency Tracheostomy of MWDs

Technique:

1. Position the animal in dorsal recumbency if unconscious or sedated/anesthetized, and 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.
2. Rapidly clip the hair over the center of the ventral neck from the larynx to approximately the center of the neck, and quickly prep the skin with surgical disinfectant. Sedate (see [APPENDIX L](#)) and use 20 mg lidocaine locally in conscious MWDs.
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.
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; 7-11 mm 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 facilitate 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.

Table 6, Orotracheal Intubation of MWDs

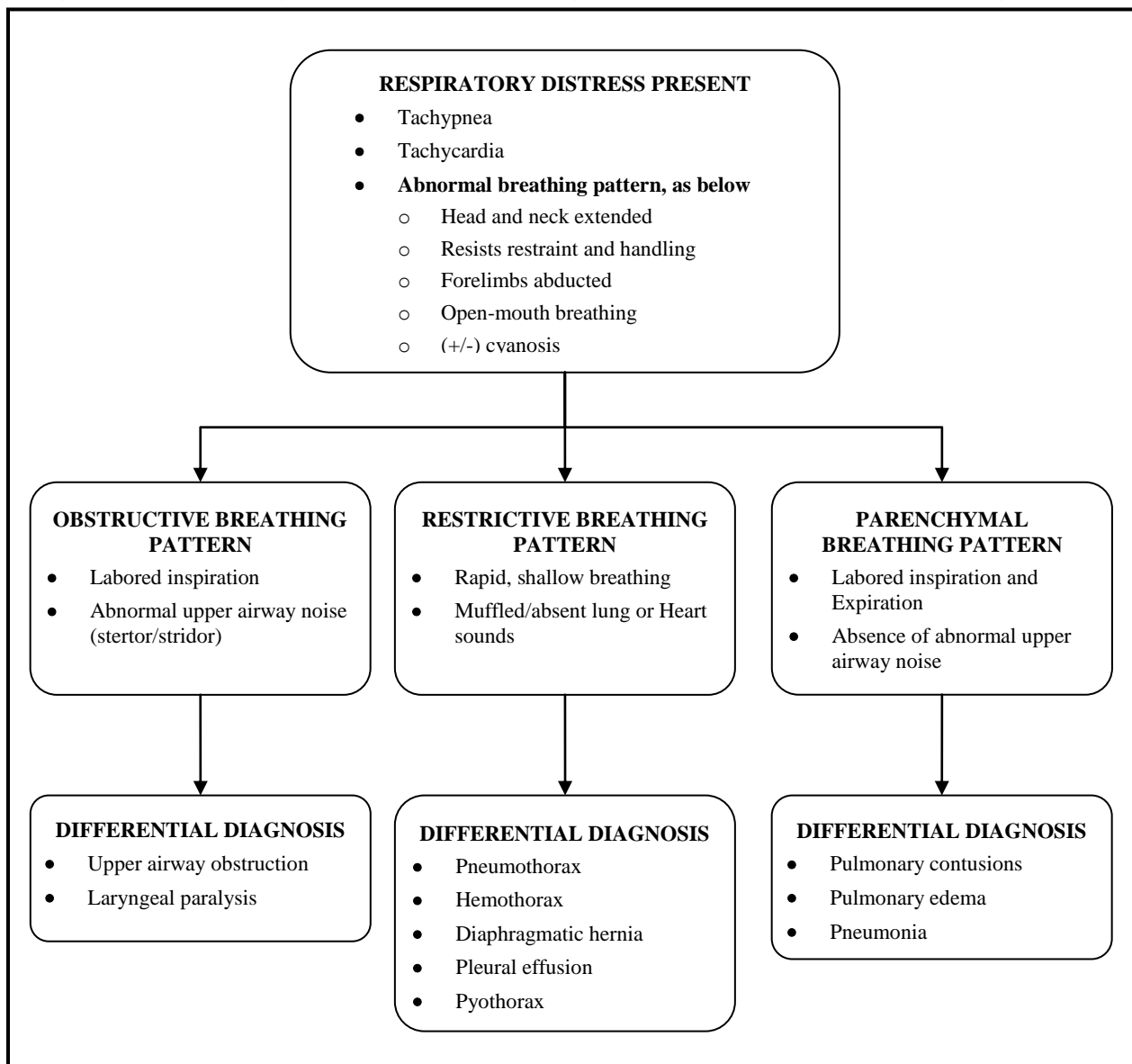
Technique:

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 to 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.
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 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 $E_T\text{CO}_2$. If CO_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.

APPENDIX C MANAGEMENT OF PENETRATING CHEST WOUNDS AND RESPIRATORY DISTRESS IN MILITARY WORKING DOGS

1. Respiratory distress develops in 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.
2. MWDs in respiratory distress typically have 1 of 3 characteristic breathing patterns that help localize the problem. [Figure 12](#) presents a clinical algorithm for differentiating the most likely cause of a patient's distress based on the pattern of breathing.

Figure 12, Clinical Algorithm for Differentiating Cause of Distress Based on Breathing Pattern



Joint Theater Trauma System Clinical Practice Guideline

3. **Oxygen supplementation is essential.** Provide 100% oxygen to all trauma patients and any patient that is showing signs of respiratory distress, until proven unnecessary. 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.
- a. 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. **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 13](#) shows simple yet effective techniques to safely provide “blow by” oxygen supplementation to muzzled MWDs.

Figure 13, Administration of Supplemental Oxygen



- b. Unconscious MWDs: Use tracheal insufflation, orotracheal intubation, or tracheostomy. See [APPENDIX B.](#))
4. Diagnostic imaging (thoracic radiography and Thoracic Focused Assessment with Sonography in Trauma (TFAST)). Thoracic radiography and TFAST exams are useful adjunct procedures at appropriate times during management of the emergency patient, 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.
- a. If available and patient status permits, perform thoracic radiography on every traumatized MWD, even if there is no clinical evidence of thoracic trauma. Veterinary studies show that 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.
- b. 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

Guideline Only/Not a Substitute for Clinical Judgment

March 2012

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. [Figure 14](#) shows the imaging locations for TFAST in the dog. [Figure 15](#) describes a clinical management algorithm for the use of TFAST in dogs.

Figure 14, Imaging Locations for TFAST

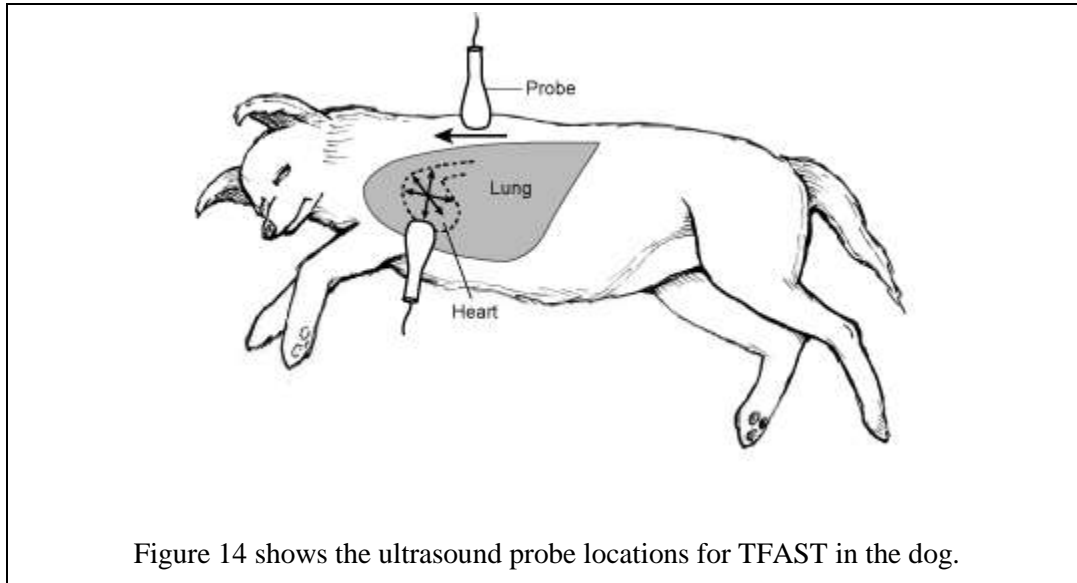
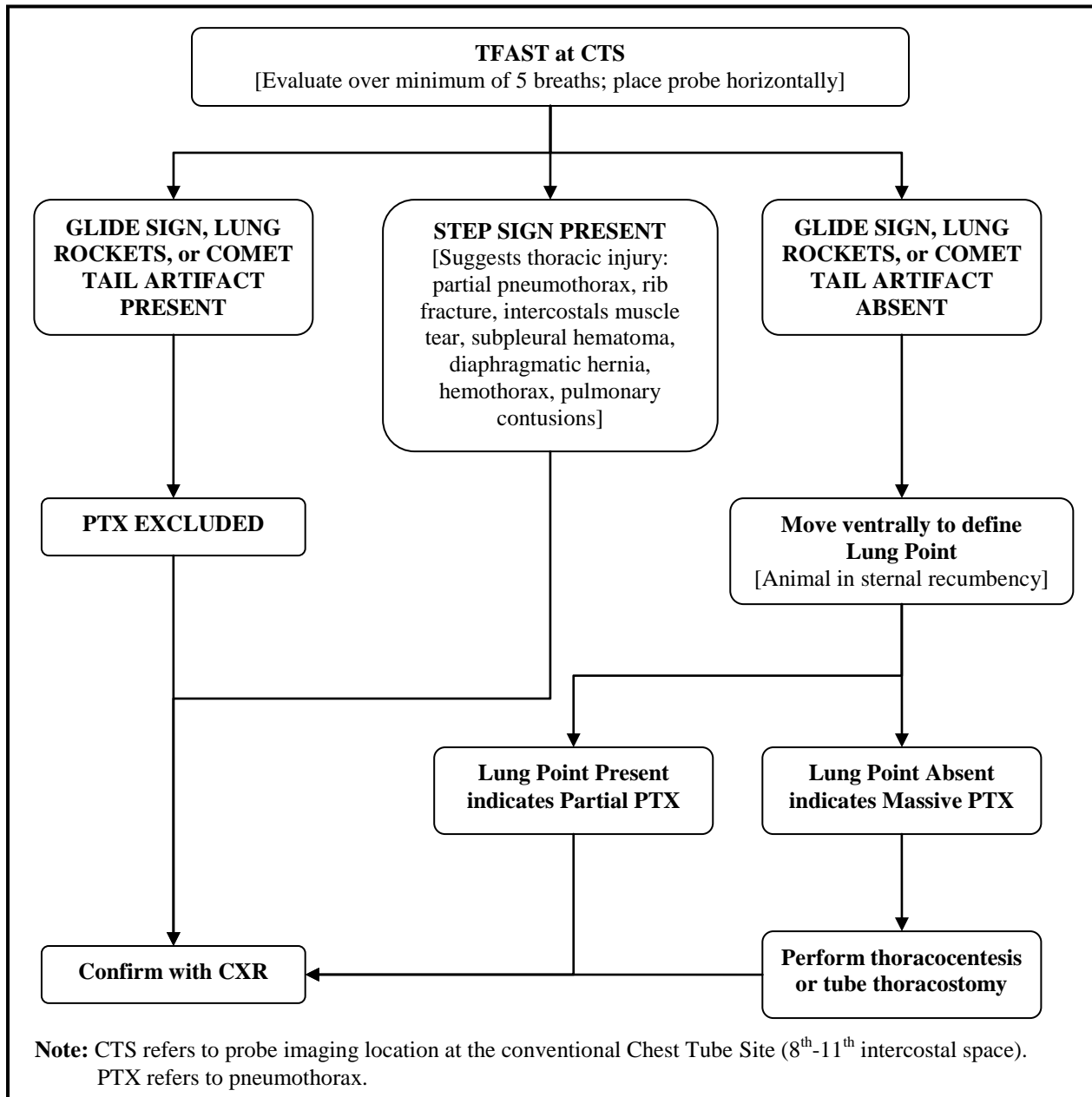


Figure 15, Clinical Management Algorithm for TFAST Use in Military Working Dogs



5. **Thoracic injury.** Up to 50% of traumatized MWDs have some form of thoracic injury. Pneumothorax and pulmonary contusions are very common. Dogs with thoracic injury typically have restrictive and parenchymal breathing patterns (see [Figure 12](#)).
 - a. Rib cage trauma 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.

Joint Theater Trauma System Clinical Practice Guideline

- 1) 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 chest wall is compromised and prolonged interference with gas exchange and ventilation are evident.
 - 2) Pain can substantially interfere with gas exchange and ventilation. Alleviating pain once the patient is stabilized will improve oxygenation and carbon dioxide elimination. Systemic or local analgesia are acceptable options. However, use caution with systemic narcotic analgesics due to potential for respiratory depression. Local analgesia is better due to less profound CNS and respiratory depression. Local nerve/rib blocks and intrapleural analgesia administration work well and are readily accomplished (see [APPENDIX L](#).)
- b. Pleural space trauma includes pneumothorax (PTX; open, closed, tension), hemothorax, and diaphragmatic hernia. A restrictive breathing pattern is 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.
- 1) ***Open PTX requires immediate action.*** Rapidly clip hair from around the wound, and apply any occlusive material (e.g., Ashmann[®] seal, Halo[®] seal, plastic material) 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.*
 - 2) ***The presence of decreased lung sounds in a trauma patient with signs of respiratory distress, or rapid clinical deterioration in an MWD with respiratory distress is sufficient justification for needle thoracocentesis.***
 - a) Thoracocentesis is readily and rapidly accomplished, and safe when performed properly – ***“When in doubt, tap it!”*** [Figure 16](#) shows the location for needle thoracocentesis in dogs. See [Table 8, Needle Thoracocentesis of MWDs](#) for thoracocentesis technique in MWDs.

Figure 16, Location for Needle Thoracocentesis



Figure 16 shows anatomic location for needle thoracocentesis in dogs, with the dog in lateral or sterna recumbency, and the needle inserted generally on the mid-lateral thorax between the 6th-8th intercostal space. Adapted from Fossum and used with permission.

- b) **The mediastinum in dogs is thin and typically ruptures**; therefore, *always tap both sides of the chest*, as air pockets and migrates – even if a positive tap is achieved on one side of the chest. This recommendation is contrary to the recommended treatment of unilateral tension pneumothorax in humans.
 - c) Repeated thoracenteses may be required to stabilize the patient.
 - d) 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!”***
 - e) In dogs, the intercostal artery, vein, and nerve run on the caudal aspect of each rib – best thoracocentesis is obtained by inserting the needle or catheter in the center of the intercostal space or at the cranial aspect of a rib.
- 3) ***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) A general rule of thumb for thoracostomy tube sizes is that 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 17](#) shows the correct anatomic orientation for chest tubes placed in dogs. [Table 9, Tube Thoracostomy of MWDs](#) describes the techniques for chest tube placement in MWDs.

Figure 17, Anatomic Orientation for Chest Tube

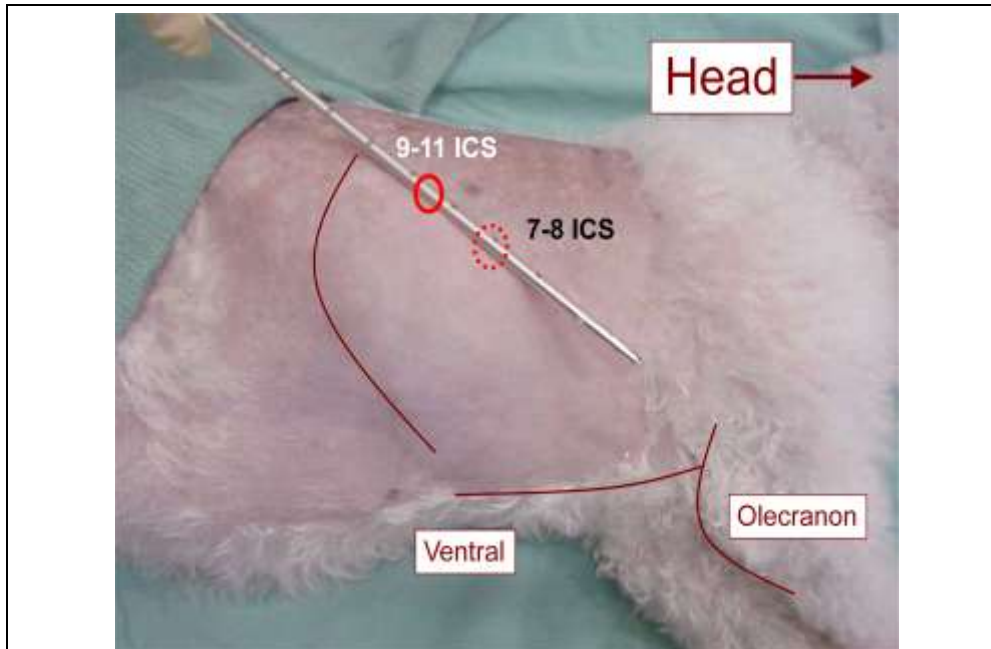


Figure 17 shows correct placement of a chest tube on the lateral aspect of the chest in a dog, with the tube penetrating the skin at the 9th-11th intercostals space (ICS), tunneling cranioventrally to penetrate the chest wall at the 7th-8th ICS, directed toward the olecranon of the elbow.

- b) 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 [APPENDIX L](#).
 - c) Remove chest tubes when air or fluid accumulation is less than 2-4 mL/kg body weight per day.
 - d) 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.
 - e) Patients with chest tubes in place **MUST** be monitored continuously!
 - f) Some form of removal of air or fluid must be used. This can be continuous suction with special evacuation systems (e.g., Pleurevac[®]), or intermittent aspiration by personnel.
- 4) Resuscitative thoracotomy.
- a) There may be instances in which emergent thoracotomy is necessary by HCPs to afford a chance at patient survival. Providers must note that emergent surgical management should be considered only if 1) the provider has the necessary advanced surgical training and experience, 2) the provider feels there is a reasonable likelihood of success, and 3) the provider has the necessary support

Guideline Only/Not a Substitute for Clinical Judgment

March 2012

Joint Theater Trauma System Clinical Practice Guideline

staff, facilities, and monitoring and intensive care facilities to manage the post-operative MWD without compromising human patient care. Thus, emergent surgical management should be considered only in Level 2 or higher medical facilities and by trained surgical specialists with adequate staff.

- b) Direct communication with a US military veterinarian is essential before considering surgical management, and during and after surgery, to optimize outcome.
 - c) Euthanasia (see [APPENDIX P](#)) should be considered for a MWD for which a resuscitative thoracotomy is deemed necessary but cannot be performed or has proven unsuccessful.
 - d) Thoracotomy in traumatized dogs is generally best done through a lateral thoracic wall approach, generally at the 4th-5th or 5th-6th intercostal space to afford optimal visualization. A median approach is not recommended in MWDs, given difficulties in post-operative management.
- 6. 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.
- a. *Diaphragmatic hernia 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).
 - b. There may be instances in which emergent repair of a diaphragmatic hernia is necessary by HCPs to afford a chance at patient survival. Providers must note that emergent surgical management should be considered only if 1) the provider has the necessary advanced surgical training and experience, 2) the provider feels there is a reasonable likelihood of success, and 3) 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. Thus, emergent surgical management should be considered only in Level 2 or higher medical facilities and by trained surgical specialists with adequate staff.
 - 1) Direct communication with a US military veterinarian is essential before considering surgical management, and during and after surgery, to optimize outcome.
 - 2) Diaphragmatic hernia repair in traumatized dogs is done through a cranial ventral midline laparotomy, with retraction of the liver and stomach caudally, to afford optimal visualization.

Guideline Only/Not a Substitute for Clinical Judgment

March 2012

Joint Theater Trauma System Clinical Practice Guideline

- a) Some means of positive pressure ventilation (e.g., manual IPPV, mechanical ventilation) is necessary intraoperatively.
- b) At least 1 thoracostomy tube should be placed intraoperatively and maintained for at least 24 hours post-operatively to manage pneumothorax.
- c) 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.

7. Parenchymal trauma.

- a. Pulmonary contusions and intrabronchial hemorrhage are common.
- b. 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.
- c. 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.
- d. A negative thoracocentesis suggests the presence of pulmonary contusions. Note that radiographic signs (mixed interstitial-alveolar infiltrates) may lag by 12-24 hours, and the stress of the process is usually not warranted.
- e. Hemoptysis, especially of arterialized (bright red) blood suggests significant larger pulmonary vessel trauma that typically carries a very guarded prognosis.
- f. *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, possible addition of colloids to 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.
- g. Severe, life-threatening major pulmonary vessel hemorrhage may require resuscitative thoracotomy. Refer to paragraph C-5.2.d for guidance and technique.

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

- a. 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).
- b. There may be instances in which mechanical ventilation (MV) is necessary by HCPs 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.
 - 1) Providers must note that MV should be considered only if 1) the provider has the necessary advanced MV training and experience, 2) the provider feels there is a

Guideline Only/Not a Substitute for Clinical Judgment

March 2012

Joint Theater Trauma System Clinical Practice Guideline

reasonable likelihood of success, and 3) 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.

- a) Direct communication with a US military veterinarian is essential before considering MV management, and during and after MV, to optimize outcome.
 - b) Euthanasia (see [APPENDIX P](#)) should be considered for a MWD for which MV is necessary but cannot be performed or has proven unsuccessful.
- 2) 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 in [Table 7](#).

Table 7, Mechanical Ventilator Settings and Key Parameters for MWDs

Parameter	Normal Lungs	Abnormal Lungs
F _I O 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 ₂ O	15 – 25 cmH ₂ O
Positive End-Expiratory Psi (PEEP)	0 – 2 cmH ₂ O	2 – 8 cmH ₂ O
Trigger Sensitivity	-2 cmH ₂ O or 2 L/min	-2 cmH ₂ O or 2 L/min
Inspiratory:Expiratory Ratio (I:E)	1:2	1:2
Inspiratory Time	~ 1 sec	~ 1 sec

Guideline Only/Not a Substitute for Clinical Judgment

March 2012

Table 8, Needle Thoracocentesis of MWDs

Technique

1. Position the animal in sternal recumbency if conscious or lateral recumbency if unconscious or sedate/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.
 - a. If pneumothorax is suspected, prepare the thoracenteses sites at the junctions of the upper 1/3rd and lower 2/3rds of the thoracic wall.
 - b. 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 16-18 gauge over-the-needle catheter is sufficient to relieve tension. For other types of PTX, use an 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.
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 MWDs

Technique:

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 (40 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 that 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 that 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. 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.
- 3) 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.
- 4) 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.
- 5) 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.

Guideline Only/Not a Substitute for Clinical Judgment

March 2012

Table 9, Tube Thoracostomy of MWDs

- 6) As the tube is advanced, begin to slide the stylet out of the tube.
- 7) Clamp the thoracostomy tube using the box lock of the Rochester-Carmalt or similar forceps as the stylet is removed to prevent pneumothorax.
- 8) 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.

Forceps Technique: (NOT recommended; 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 "Chinese 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.

APPENDIX D CARDIOPULMONARY RESUSCITATION (CPR) OF MILITARY WORKING DOGS

1. **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 should consider CPR in MWDs with CPA due to blast injury, blunt trauma, or penetrating trauma, although successful resuscitation in these cases is unlikely.
2. **Clinical management algorithm for CPR in MWDs,** see [Figure 18](#). [Table 10](#) lists drugs commonly required during CPR for dogs, with appropriate doses and routes of administration.
3. **Basic Life Support.** 2-person, closed-chest CPR should be initiated as soon as CPA is declared for those MWDs meeting CPR criteria. In general, CPR is performed in much the same manner as for people.
 - a. **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. Ensure adequate relief of downward pressure during the relaxation phase of the compressions. As for people, “PUSH HARD and PUSH FAST.”
 - b. **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 [APPENDIX C](#)).
 - c. **Breathing** – Ventilate the patient using an Ambu-bag[®] at a rate of 8-10 breaths per minute; avoid hyperventilation. Oxygen is preferred when ventilating MWDs during CPR, but room air is acceptable if oxygen is not available.
4. **Advanced Life Support.** Initiate ALS as soon as feasible. Note that ECG monitoring is essential for ALS. [Figure 18](#) directs 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%), ventricular fibrillation (VF) (20%), and sinus bradycardia (20%).
 - a. 70% of MWDs that arrest will have PEA, asystole, or sinus bradycardia as the initial arrest rhythm. Atropine (preferred) 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.
 - b. VF, while present initially in only 20% of MWDs with an arrest rhythm, often develops during resuscitation. Perform external defibrillation if possible and as rapidly as possible if VF is noted. 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 if

Joint Theater Trauma System Clinical Practice Guideline

- prior attempts are not successful, but perform aggressive chest compressions for at least 2 minutes before attempting each defibrillation.
- c. IV access is critical. Place multiple peripheral catheters, perform venous cut-down, or place IO catheters, (see [APPENDIX E](#)). Follow all drugs with at least a 20 mL sterile saline push.
 - d. 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.
- 5. Post-resuscitation care.** 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. Successful return of spontaneous circulation and resuscitation is 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.
- a. Control seizures that develop with diazepam or midazolam (15-20 mg total dose; 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.
 - b. Prevent and reduce cerebral edema with 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 v compression, and maintain normoxemia and normotension.
 - c. Maintain adequate ventilation, maintaining a patent airway and using manual IPPV at 8-10 breaths per minute, targeting an $E_T\text{CO}_2$ of 25-60 mmHg.
 - d. Maintain adequate oxygenation, targeting an $\text{SpO}_2 > 95\%$ using supplemental oxygen for a minimum of 12 hours.
 - e. 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 simplest. 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 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.***
 - f. Control pathologic ventricular arrhythmias with lidocaine CRI (60-80 mcg/kg/min).
 - g. Do not attempt tight control of blood glucose with insulin. Supplement IV fluids if hypoglycemia is present (5% dextrose), but avoid hyperglycemia.
 - h. ***There is no role for therapeutic hypothermia in MWDs during the post-resuscitation period.*** Avoid hyperthermia; tolerate mild hypothermia ($>92^\circ$ F) if it develops.
- 6. Discontinuation of CPR.** BLS should be discontinued 1) if the animal is successfully resuscitated (i.e., develops a pulse and heart beat and begins breathing), 2) if the senior HCP directs that efforts cease, or 3) if CPR has been attempted for at least 20 minutes without success.

Guideline Only/Not a Substitute for Clinical Judgment

March 2012

Joint Theater Trauma System Clinical Practice Guideline

7. Tips for successful CPR in MWDs.

- a. Avoid interrupting chest compressions! The key to successful resuscitation is to SUSTAIN chest compressions aggressively for 2-3 minutes before stopping to check status.
- b. 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.
- c. Maintain a steady and continuous rate of chest compression and ventilation. Therefore, minimize the number of times you stop to check the patient. Most people stop too frequently, which makes BLS less successful.
- d. 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.
- e. During CPR, consider magnesium sulfate (30 mg/kg IV, once) in patients with refractory VT.

8. Single-person CPR on dogs is extremely challenging, with very poor success rates. Single-person CPR 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.

9. Resuscitative thoractomy 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 [APPENDIX P.](#))

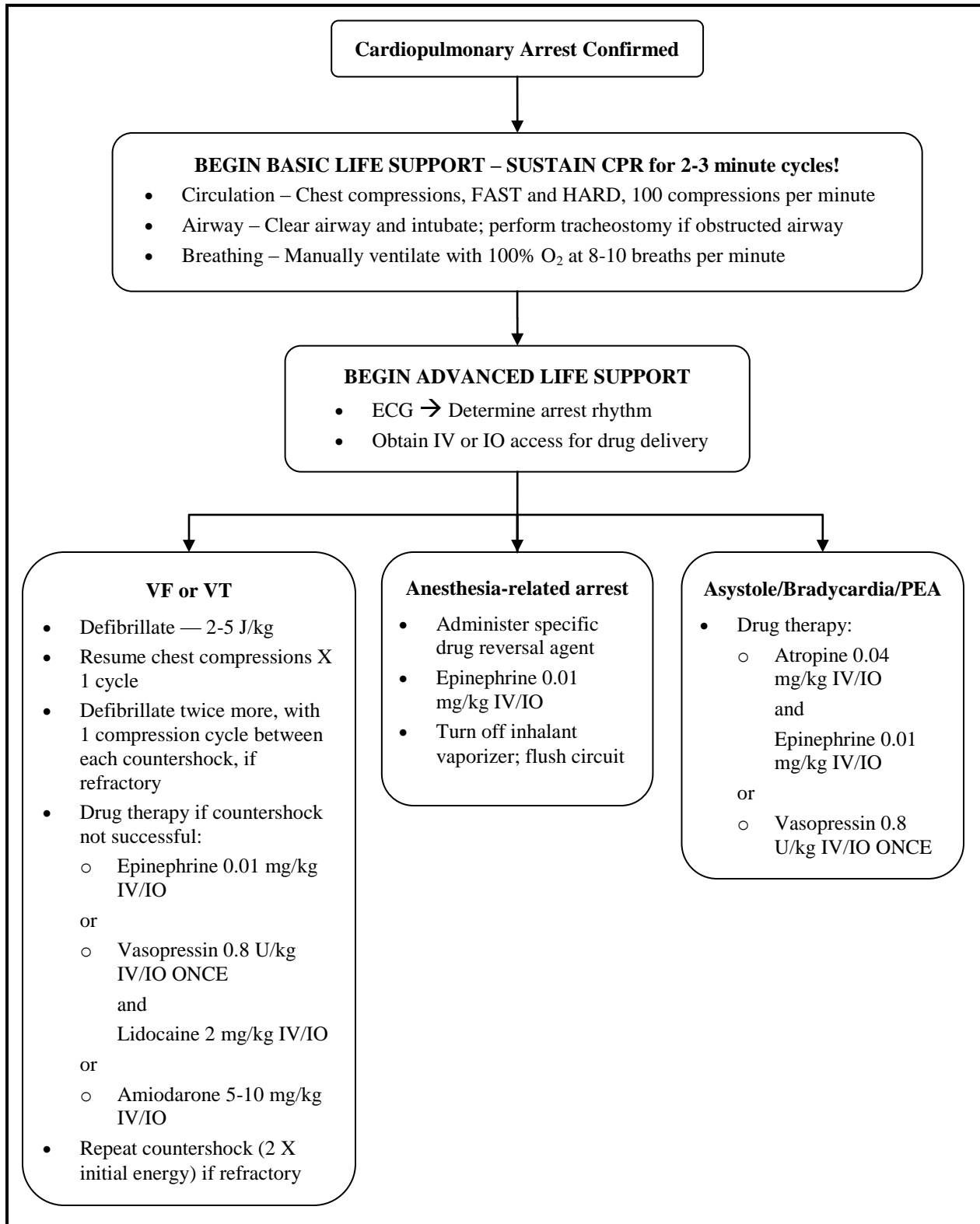
Table 10, Drugs Required during CPR for Military Working Dogs

Drug	Dose	Route
Amiodarone	5-10 mg/kg	IV or IO
Atropine	0.04 mg/kg	IV or IO
Epinephrine	0.01 mg/kg	IV or IO
Lidocaine bolus	2 mg/kg	IV or IO
Lidocaine CRI	60-80 mcg/kg/min	IV
Magnesium sulfate	30 mg/kg	IV
Sodium bicarbonate	1-2 mEq/kg	IV
Mannitol	1 gram/kg	IV
Vasopressin	0.8 U/kg	IV or IO

Guideline Only/Not a Substitute for Clinical Judgment

March 2012

Figure 18, Clinical Management Algorithm for CPR in MWDs



Guideline Only/Not a Substitute for Clinical Judgment

March 2012

APPENDIX E MANAGEMENT OF SHOCK IN MILITARY WORKING DOGS

1. Shock in deployed MWDs will most likely be due to hemorrhage from trauma or hypovolemia due to severe protracted dehydration from gastrointestinal losses. *As with human patients, the stepwise approach in MWDs is to control bleeding (if present) and then stabilize the patient using targeted fluid therapy.*
2. **Immediate hemorrhage control in trauma cases.** MWDs will likely be presented for follow-on care after the handler has already provided emergent care for severe bleeding. Handlers are trained to use direct pressure, pressure dressings, and QuikClot™ Combat Gauze® for severe extremity bleeding; tourniquets are not routinely used in MWDs due to anatomical difficulties in placement. However, some MWDs may present with untreated extremity hemorrhage, or with “hidden” (intracavitary) hemorrhage that must be addressed by HCPs.
 - a. 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.
 - b. Tourniquet use on the limbs of dogs is challenging, due to the anatomic shape of the canine leg. Experience has shown that conventional tourniquets designed for human adults do not remain in place or effectively control hemorrhage very well when used on dogs. Thus, avoid these tourniquets for extremity bleeding. Some success is reported in use of improvised tourniquets, such as surgical rubber tubing or constrictive gauze bandage placement to abate extremity arterial hemorrhage. If delay in definitive care of major extremity trauma is expected, use hemostatic agents, direct pressure, and compressive bandaging to assist with hemorrhage control.
 - c. Use thoracic FAST (TFAST) to rapidly scan for intracavitary fluid in the chest. See [APPENDIX C](#) for a discussion of TFAST use, to include diagrams of probe placement and a clinical management algorithm for TFAST use in dogs. In MWDs with trauma or in shock, assume intracavitary fluid is due to bleeding until proven otherwise.
 - d. Use abdominal FAST (AFAST) to rapidly scan for free abdominal fluid. See [APPENDIX F](#) for a discussion of AFAST use, to include diagrams of probe placement in dogs. In MWDs with trauma or in shock, assume intracavitary fluid is due to bleeding until proven otherwise.
3. **Clinical signs of shock in MWDs.** Dogs in shock are amazing in how stable they can appear on initial presentation, due to compensatory mechanisms.
 - a. 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.

Joint Theater Trauma System Clinical Practice Guideline

- b. 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.
 - c. 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.
- 4. The standard therapy for shock in MWDs** includes providing immediate fluid therapy targeted to specific endpoints, providing supplemental oxygen, and identifying and treating the cause for the shock.
- a. Provide immediate fluid therapy.
 - 1) Place multiple large-bore intravenous catheters, perform venous cut-down, and/or place intra-osseous (IO) catheters.
 - a) Do not delay in placing catheters - 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.
 - b) The proximal lateral humerus and proximal craniolateral tibia are ideal for IO catheter placement, using the same technique as for people. To avoid bicortical placement of IO catheters (and thus ineffective fluid delivery), use pediatric (15mm X 15 gauge) IO catheters in dogs weighing less than ~40 pounds and adult (25mm X 15 gauge) IO catheters in dogs weighing more than ~40 pounds.
 - 2) Give crystalloid fluids as the first-line treatment. Normosol-R[®] or Plasmalyte-A[®] are optimal for dogs; however, saline or LRS are acceptable in emergent cases.
 - 3) 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 successfully resuscitated with much less than this calculated maximum volume. For MWDs, use graduated challenge boluses and assess response to therapy carefully. In MWDs, **use the “10-20-10-20 Rule” as shown in [Table 11](#)**. For example, a 40 kg MWD might need 3.6 L of fluids in the first hour to treat shock, but should be given ‘quarter-shock’ volumes of 900 mL every 10-20 minutes during initial resuscitation, based on response.

Guideline Only/Not a Substitute for Clinical Judgment

March 2012

Joint Theater Trauma System Clinical Practice Guideline

Table 11, Shock Fluid Therapy Protocol of MWDs - The “10-20-10-20 Rule”

1. Calculate total “shock volume” of fluids (90 mL/kg) that might be required.
2. Collect baseline physiologic and clinical data (mentation, NIBP, HCT, TP, HR, pulse quality, CRT, mucous membrane color).
3. Give one quarter of the calculated “shock” volume over the first **10** minutes.
4. Reassess the patient’s pulse quality, CRT, mucous membrane color, heart rate, NIBP, etc.
5. Give another one quarter of the calculated “shock” volume over the next **10-20** minutes, if necessary.
6. Reassess baseline data.
7. If HCT > 20% and TP not below 50% of starting value, and further fluid therapy is required, then give another one quarter of the calculated “shock” volume over **10** minutes.
8. Reassess baseline data.
9. If fluid therapy is still required, give the final one quarter of the calculated “shock” volume over **10-20** minutes.

- 4) Give a **hydroxyethyl starch (HES) IV or IO bolus of 10-20 mL/kg over 5-10 minutes** if clinical signs of shock do not abate after the first 30 minutes (first 2 quarter-shock IV challenges) of crystalloid fluids, or response to crystalloid challenges is not sustained. Repeat this bolus if no response to therapy. **Do not give human serum albumin or other synthetic colloids (e.g., dextrans) to MWDs.**
- 5) Give a **hypertonic saline (HTS) IV bolus of 4 mL/kg over 5 minutes** (if 7-7.5% HTS is available) for MWDs that fail to respond to two or three quarter-shock boluses of crystalloids and/or one or two boluses of HES.
- 6) **Blood product transfusions for MWDs are only available from Veterinary Service Support units and their administration is only authorized under the direct supervision of a Veterinarian.** Human blood products and albumin, or other animal blood products, must never be given to dogs, given the high risk of anaphylactic reactions.
- 7) Targeted shock resuscitation endpoints that are practical for HCPs in the deployed setting include systolic and mean arterial pressures, level of consciousness/mentation, mucous membrane color and capillary refill time, HR, RR, and pulse quality.
 - a) **Target a MAP >65 mmHg or a Sys >90 mmHg.** Note that neonatal or pediatric blood pressure cuffs must be used. See [APPENDIX A](#).
 - b) Target normal level of consciousness (LOC) and an alert mentation.
 - c) Target light pink-to-salmon pink MM and a CRT <2 seconds.
 - d) Target a HR that is 60-90 beats per minute at rest with a strong, synchronous pulse quality.
 - e) Target a respiratory rate at rest of 12-40 breaths per minute with normal effort.

Guideline Only/Not a Substitute for Clinical Judgment

March 2012

Joint Theater Trauma System Clinical Practice Guideline

- 8) Once shock has abated, continue IV crystalloid fluids at 3-5 mL/kg/hour for 12-24 hours to maintain adequate intravascular volume.
- b. Provide supplemental oxygen therapy. Oxygen supplementation is critical. Every shock patient should receive supplemental oxygen therapy until stable. See [APPENDIX B](#) for oxygen delivery methods.
- c. Identify and treat the cause of shock. The cause of shock must be corrected, if possible.
 - 1) Patients with massive intraabdominal or intrathoracic bleeding need surgery to find the site of bleeding and surgically correct the loss of blood. There may be instances in which emergent thoracotomy or laparotomy are necessary by HCPs to afford a chance at patient survival. Providers must note that emergent surgical management should be considered only if 1) the provider has the necessary advanced surgical training and experience, 2) the provider feels there is a reasonable likelihood of success, and 3) 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. Thus, emergent surgical management should be considered only in Level 2 or higher medical facilities and by trained surgical specialists with adequate staff.
 - 2) Direct communication with a US military veterinarian is essential before considering surgical management, and during and after surgery, to optimize outcome.
 - 3) 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 [APPENDIX P.](#))
 - 4) [APPENDIX C](#) addresses emergent resuscitative thoracotomy. [APPENDIX F](#) addresses emergent abdominal laparotomy.

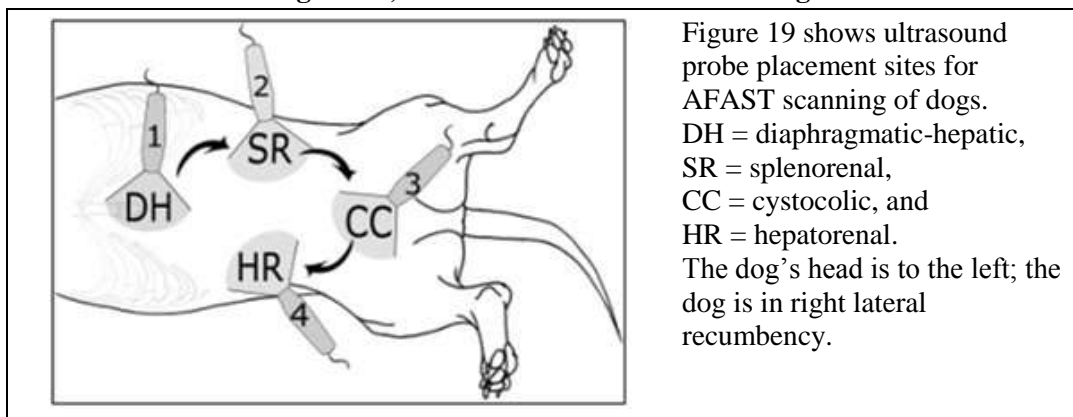
Guideline Only/Not a Substitute for Clinical Judgment

March 2012

APPENDIX F MANAGEMENT OF ABDOMINAL TRAUMA IN MILITARY WORKING DOGS

1. Abdominal injuries in deployed MWDs are the result of either blunt abdominal trauma (BAT) or penetrating abdominal trauma (PAT). 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 at [Figure 20](#).
2. **Physical examination findings 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.* Obviously, 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.
3. **Diagnosis of abdominal trauma.** The diagnostic method of choice for evaluating patients with suspected blunt abdominal trauma is the FAST exam, with ultrasound-guided or 4-quadrant needle abdominocentesis if free abdominal fluid is noted.
 - a. **Perform an abdominal FAST (AFAST) exam during the initial evaluation phase of every MWD presented for care with a history of trauma or acute collapse or weakness.** FAST has been proven in dogs to be extremely reliable in detecting free *abdominal fluid and can be performed rapidly during resuscitation.*
 - 1) **Examine 4 quadrants, just as in people.** *Probe placement terminology reported 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. [Figure 19](#) provides a schematic showing probe placement in dogs.

Figure 19, AFAST Probe Placement in Dogs



- 2) 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

Guideline Only/Not a Substitute for Clinical Judgment

March 2012

Joint Theater Trauma System Clinical Practice Guideline

increasing scores should be monitored closely and prepared for **URGENT** evacuation, as exploratory surgery may be necessary for MWDs with scores of 3/4 or 4/4.

- b. ***Perform a 4-quadrant abdominocentesis in any patient with free fluid in the abdomen.*** This technique is quick and easy to perform, and usually defines major abdominal hemorrhage 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.
- 1) The abdomen is clipped of hair and prepared as if for surgery.
 - 2) The abdomen is ‘divided’ into 4 quadrants, and each quadrant is tapped in succession unless a positive yield is obtained.
 - 3) A large bore needle (18 or 20 gauge) is quickly inserted perpendicular to and through the body wall approximately 2 inches off the midline. 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.
 - 4) It is desirable to have the animal in lateral recumbency and to tap the “down” side. The presence of blood suggests intra-abdominal hemorrhage, and the presence of clear or yellowish fluid suggests urine.
 - 5) 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.
 - a) Cytology is performed to assess for the presence of bacteria or other organisms, fecal material, 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. An abdominal fluid glucose concentration that is ≥ 20 mg/dL lower than peripheral blood glucose concentration strongly suggests a septic peritonitis.
 - b) 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.

Guideline Only/Not a Substitute for Clinical Judgment

March 2012

Joint Theater Trauma System Clinical Practice Guideline

- c) The presence of bilirubin suggests gall bladder injury, although this may not be present for several days after trauma. The presence of amylase and lipase with values higher than systemic circulation suggests pancreatic trauma. The presence of a BUN or creatinine concentration higher than systemic circulation suggests urinary tract injury and urine leakage. Elevated ALT suggests direct liver injury, and elevated ALKP suggests bowel injury or ischemia.
- c. **Perform diagnostic peritoneal lavage (DPL)** in any MWD in which major abdominal trauma is suspected, but AFAST and abdominocentesis are unrewarding.
 - 1) Use a specialized DPL catheter or aseptically fenestrate a large bore over-the-needle (OTN) catheter.
 - 2) Sedate the patient if necessary (see [APPENDIX L](#)) and locally anesthetize the site of catheter insertion using 20-40 mg lidocaine.
 - 3) Percutaneously insert the OTN catheter; a small stab incision may be needed if a larger catheter is used.
 - 4) 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.
 - 5) Infuse 20 mL/kg warmed, sterile saline aseptically infused over 5-10 minutes.
 - 6) Aseptically plug the catheter and gently roll the MWD from side to side for several minutes to allow the infusate to mix.
 - 7) Either aspirate effluent or allow gravity-dependent drainage to collect a sample for analysis.
 - 8) Analyze the sample for the same parameters described for abdominocentesis.
4. **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.
 - a. Intra-abdominal hemorrhage. Most hemoperitoneum cases in MWDs are due to splenic and hepatic fractures, which can vary markedly in size, with a significant difference in quantity of blood lost into the abdomen.
 - 1) 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.
 - 2) 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.*

Guideline Only/Not a Substitute for Clinical Judgment

March 2012

Joint Theater Trauma System Clinical Practice Guideline

- 3) Patients with massive intraabdominal bleeding need surgery to find the site of bleeding and surgically correct the loss of blood. There may be instances in which emergent laparotomy is necessary by HCPs to afford a chance at patient survival. See paragraph [6, Emergent abdominal laparotomy](#) for guidance concerning emergent abdominal surgery.
- b. Urinary tract trauma. Urinary bladder rupture, with uroperitoneum, is fairly common, especially if the animal had not voided before the trauma.
- 1) 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.***
 - 2) 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 urethrocytography) may need to be performed to rule out urologic trauma.
 - 3) 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.
 - 4) 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 laparotomy is necessary by HCPs to afford a chance at patient survival. See paragraph [6, Emergent abdominal laparotomy](#) for guidance concerning emergent abdominal surgery.
- c. 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.
- 1) Broad-spectrum antibiotic therapy is vital, especially against anaerobic and gram negative bacteria. [Table 12](#) lists antibiotics recommended for initial use in MWDs with ruptured viscus.

Table 12, Antibiotic Selection and Dosing for Military Working Dogs

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

Guideline Only/Not a Substitute for Clinical Judgment
March 2012

Joint Theater Trauma System Clinical Practice Guideline

Table 12, Antibiotic Selection and Dosing for Military Working Dogs

Antibiotic	Dose for MWD	Route	Frequency
Cephalexin	20 – 30 mg/kg	PO	q 12 h

- 2) 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.
 - 3) Patients with ruptured abdominal viscus need surgery to define the extent of injury and correct the problem. There may be instances in which emergent laparotomy is necessary by HCPs to afford a chance at patient survival. See paragraph [6, Emergent abdominal laparotomy](#) for guidance concerning emergent abdominal surgery.
- 5. 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, and if the patient’s status deteriorates despite aggressive resuscitation attempts and major organ hemorrhage is suspected or known.
- a. 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.
 - b. 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 laparotomy is necessary by HCPs to afford a chance at patient survival. See paragraph [6, Emergent abdominal laparotomy](#) for guidance concerning emergent abdominal surgery.
- 6. Emergent abdominal laparotomy.**
- a. Some patients with severe abdominal trauma surgery to define the extent of injury and attempt repair of the problem. There may be instances in which emergent laparotomy is necessary by HCPs to afford a chance at patient survival. Providers must note that emergent surgical management should be considered only if 1) the provider has the necessary advanced surgical training and experience, 2) the provider feels there is a reasonable likelihood of success, and 3) 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. Thus, emergent surgical management should be considered only in Level 2 or higher medical facilities and by trained surgical specialists with adequate staff.
 - 1) Direct communication with a US military veterinarian is essential before considering surgical management, and during and after surgery, to optimize outcome.
 - 2) Euthanasia (see [APPENDIX P](#)) 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.

Guideline Only/Not a Substitute for Clinical Judgment

March 2012

Joint Theater Trauma System Clinical Practice Guideline

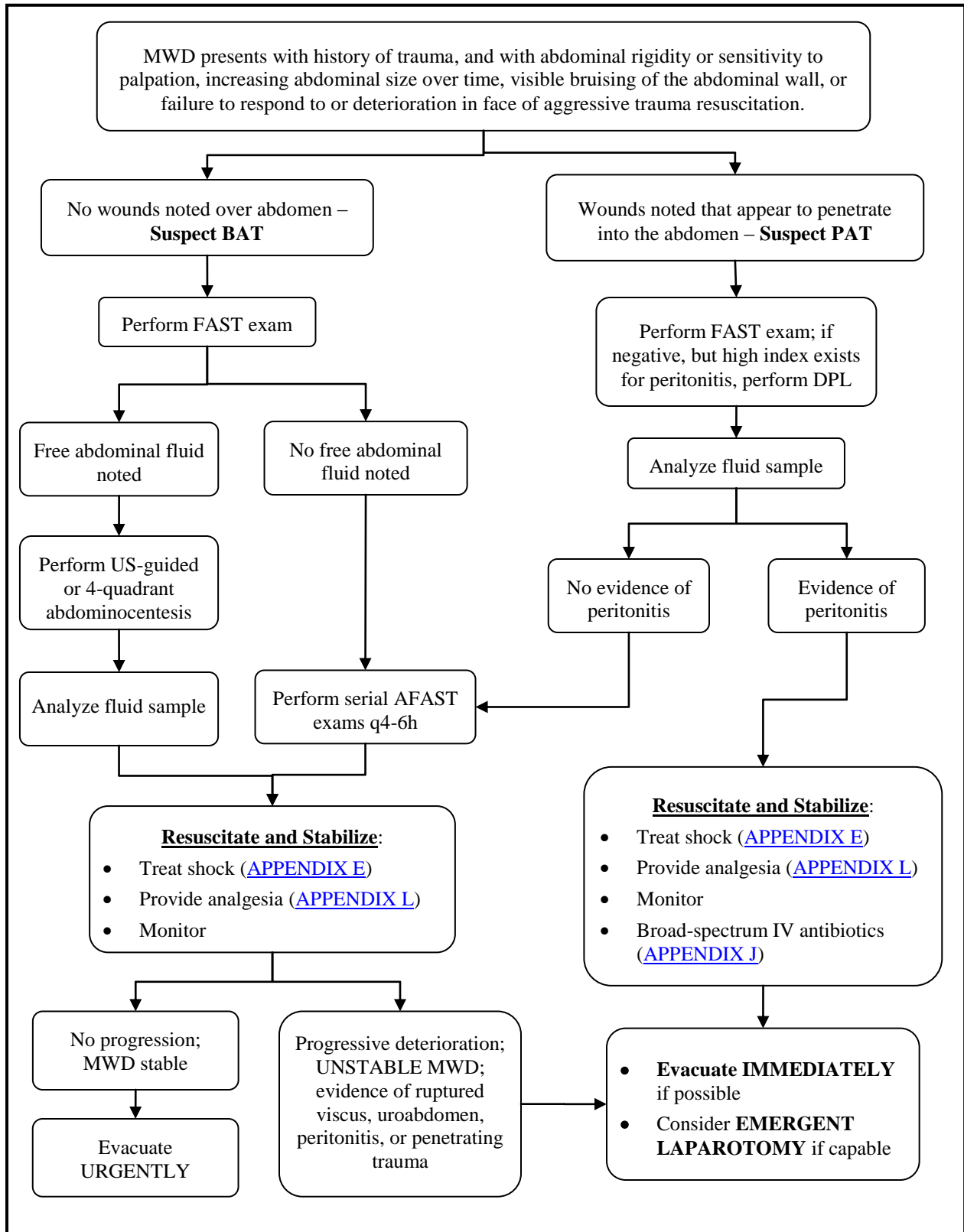
- b. Surgical management includes an approach through the ventral midline under general anesthesia (see [APPENDIX L](#)), with the dog in dorsal recumbency, to expose the abdominal cavity.
- c. A complete abdominal exploratory is necessary to define all injuries. Routine exploratory techniques used for people are appropriate for dogs.
- d. Surgical management will depend on the injuries noted. As in human casualties, 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.
- e. 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.

Guideline Only/Not a Substitute for Clinical Judgment

March 2012

Joint Theater Trauma System Clinical Practice Guideline

Figure 20, Clinical Management Algorithm for MWDs with Abdominal Trauma



Guideline Only/Not a Substitute for Clinical Judgment

March 2012

APPENDIX G MANAGEMENT OF GASTRIC DILATATION-VOLVULUS SYNDROME IN MILITARY WORKING DOGS

1. **Gastric Dilatation-Volvulus Syndrome** (GDV, or “bloat”) is a rapidly life-threatening condition common in large-breed dogs, to include MWDs. 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.*
2. **Prophylactic gastropexy.** Many 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 MWDs may not have been gastropexied, and – in rare cases – a gastropexy can fail, and dogs are thus at risk of GDV.
3. **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.
 - a. 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).
 - b. 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.
 - c. *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.*
4. **Definitive diagnosis of GDV.** Confirmation of GDV is based on abdominal radiographs that demonstrate marked gastric dilation with air, see [Figure 21](#). 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.

Figure 21, Radiograph with Gastric Dilation Due to GDV

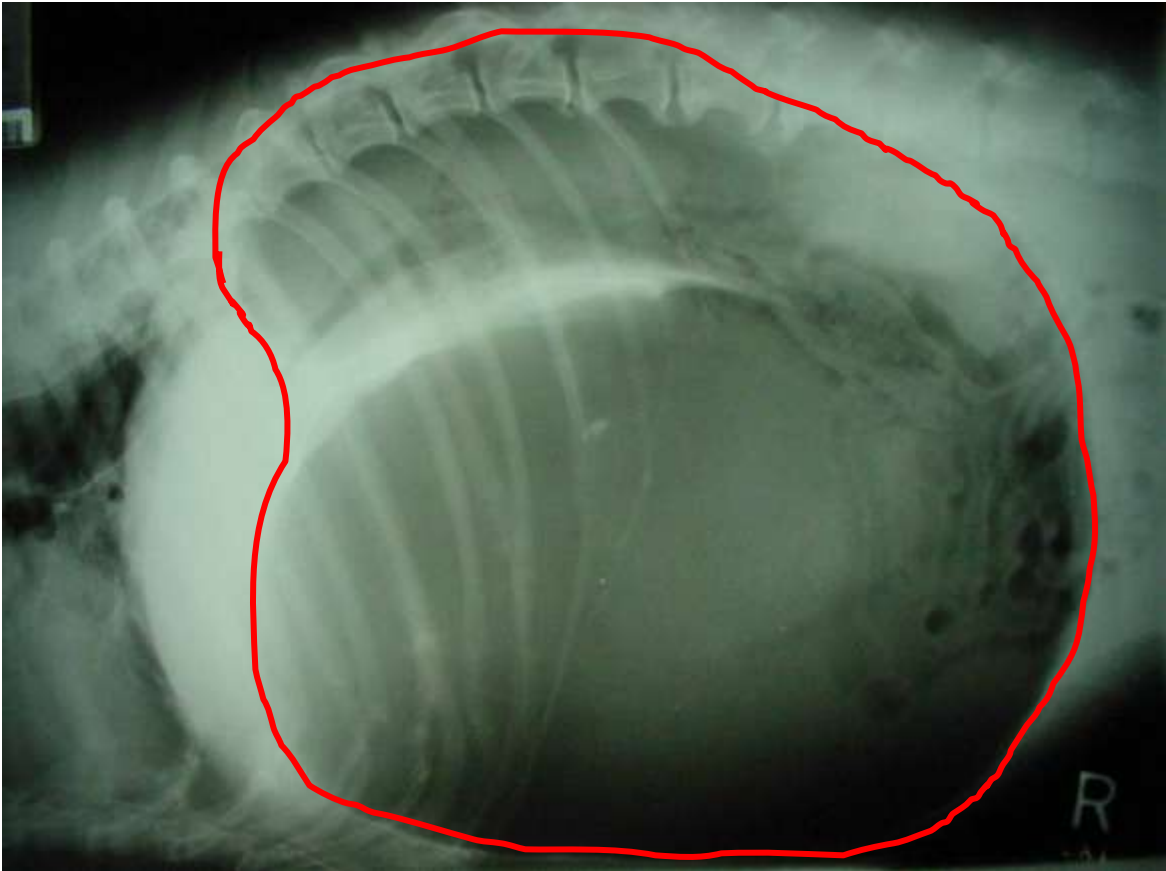


Figure 21 shows the right lateral radiograph of a dog with marked gastric dilation due to GDV. Head is to left. Red line depicts general outline of the stomach.

5. **Treatment of GDV by HCPs.**(See [Figure 22](#)). *The hallmark immediate treatment of GDV by HCPs in the deployed setting 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 to derotate the stomach, perform gastropexy, partial gastric resection or splenectomy (when warranted), and extended monitoring for common life-threatening sequelae in the post-operative period.
 - a. **Treat shock**
 - 1) Provide 100% oxygen. See [APPENDIX C](#).
 - 2) Administer intravenous fluids to targeted endpoints. See [APPENDIX E](#).
 - b. **Decompress the stomach by percutaneous trocarization of the stomach**
 - 1) Position yourself on the left side of the patient, or lay the dog with its left side down (left lateral recumbency).

Joint Theater Trauma System Clinical Practice Guideline

- 2) Locate the insertion point:
 - a) Palpate the last rib.
 - b) 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.
 - c) 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."
 - 3) Clip the hair over a 6-inch X 6-inch area over this area.
 - 4) Prepare the area using surgical scrub.
 - 5) Forcefully insert a 10-14 gauge trocar or 14-18 gauge IV over-the-needle catheter through the skin, abdominal wall, and stomach wall.
 - 6) 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.*
 - 7) Gently apply external pressure to the abdominal wall to assist in decompressing air from the stomach.
 - 8) Once the majority of the air is evacuated, remove the trocar/needle, because leaving it inserted may cause trauma to internal organs.
- 6. Common complications associated with GDV.** If possible, HCPs should monitor for the most common complications seen in MWDs with GDV, to include ventricular arrhythmias, persistent shock, recurrent gastric dilation, nausea and vomiting, ileus, and metabolic acidosis. Multi-organ failure may develop, depending on the degree and duration of shock.
- 7. Definitive management of GDV.** The MWD should be evacuated to a veterinary facility as soon as it is stabilized. For planning purposes, 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.
- a. ***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.***
 - 1) As for other emergent surgical conditions in MWDs, surgical management of GDV should be considered only if 1) the provider has the necessary advanced surgical training and experience, 2) the provider feels there is a reasonable likelihood of success, and 3) 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. Thus, emergent surgical management should be

Guideline Only/Not a Substitute for Clinical Judgment

March 2012

Joint Theater Trauma System Clinical Practice Guideline

considered only in Level 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.

- a) It is essential to counter shock and stabilize the dog before considering operative management.
- b) Surgical management includes an approach through the ventral midline under general anesthesia (see [APPENDIX L](#)), with the dog in dorsal recumbency, to expose the abdominal cavity.
- c) GDV is confirmed once the abdomen is open by identifying a dilated stomach covered by omentum.
- d) 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.
- e) 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 post-operative mortality in dogs that require gastrectomy is approximately 25-35%, compared to mortality <10% in dogs that do not require gastrectomy.
- f) Typically, intrabdominal 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.
- g) 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.
- h) 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.

Guideline Only/Not a Substitute for Clinical Judgment

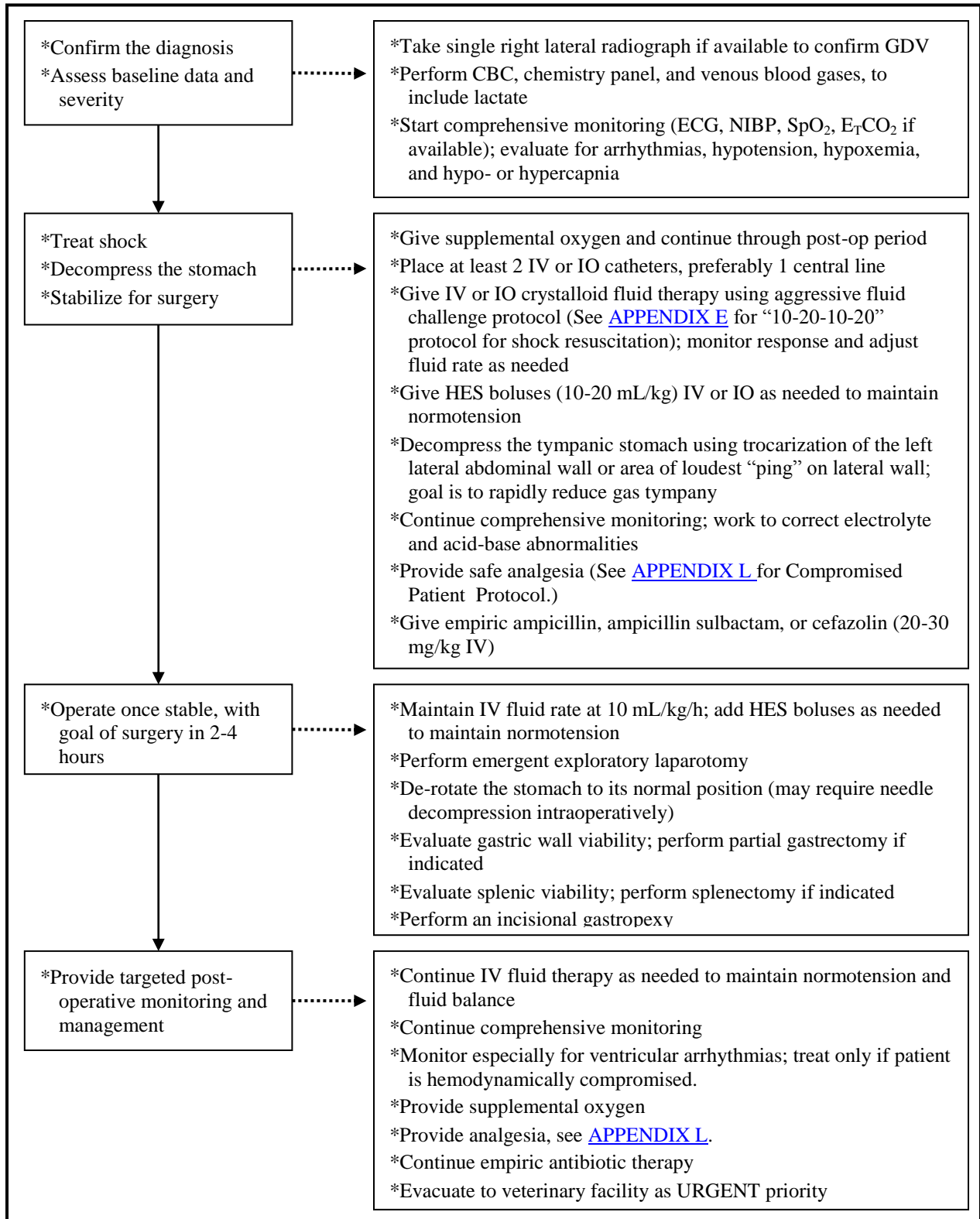
March 2012

Joint Theater Trauma System Clinical Practice Guideline

- b. Euthanasia should be considered for an MWD presenting *in extremis*, that fails to respond to therapy, or that deteriorates despite care before evacuation can be arranged, see [APPENDIX P.](#)

Joint Theater Trauma System Clinical Practice Guideline

Figure 22, Clinical Management Algorithm for Gastric Dilatation-Volvulus (GDV) in Military Working Dogs



Guideline Only/Not a Substitute for Clinical Judgment

March 2012

APPENDIX H MANAGEMENT OF ENVIRONMENTAL INJURIES IN MILITARY WORKING DOGS

1. **Heat-induced injury.** Panting is the only significant cooling mechanism for dogs. 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”).
 - a. Mild heat-induced injury (*heat stress*) is characterized by development of excessive thirst, discomfort associated with physical activity, and sodium and chloride abnormalities, but with controlled panting (i.e., the patient can control or reduce panting when exposed to a noxious inhalant such as alcohol).
 - 1) Treatment of heat stress 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.
 - 2) Close monitoring for several hours is necessary to ensure heat stress does not progress, or rebound hypothermia does not develop.
 - 3) Key parameters to monitor, in addition to frequent body temperature measurement, include changes in mentation, development of petechiae or ecchymoses, hematuria, weakness or collapse, clinical signs of shock (e.g., tachypnea, tachycardia, weak pulse quality, pale mucous membranes), and anxiety or restlessness.
 - b. Moderate heat-induced injury (*heat exhaustion*) is present when the signs of heat stress are present, as well as weakness, anxiety, and uncontrolled panting (i.e., the patient cannot reduce panting when exposed to a noxious inhalant), but CNS abnormalities are not present.
 - 1) Treatment of heat exhaustion is the same as for heat stress, but more aggressive measures at cooling are often necessary.
 - 2) The patient must be removed from the source of heat and all activity must be stopped.
 - 3) 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 to reduce core body temperature.
 - 4) 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.
 - c. Severe heat-induced injury (*heat stroke*) 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

Guideline Only/Not a Substitute for Clinical Judgment

March 2012

Joint Theater Trauma System Clinical Practice Guideline

organ injury with risk of progression to multiple organ dysfunction syndrome (MODS). 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.*** [Table 13](#) describes the management of MWDs with heat-induced injury.

1) Initial management considerations.

- a) Triage of the heat stroke MWD 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 comma are in imminent danger of death. Some heat stroke patients present actively seizing.
- b) 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 an 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.
- c) Rectal temperature may lag behind core body temperature by up to 15 minutes. 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.

2) Emergency management of hyperthermic MWDs.

- a) 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, as oxygen masks can increase humidity and prevent maximal heat dissipation. Do not attempt nasal oxygen delivery.
- b) 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 run 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.***
- c) *The value of intravenous fluids in patient cooling and support cannot be overstated.* Unless there are specific contraindications, ***intravenous fluid therapy***

Guideline Only/Not a Substitute for Clinical Judgment

March 2012

Joint Theater Trauma System Clinical Practice Guideline

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.

- d) *Use additional cooling methods!* Direct fans on the MWD to facilitate surface cooling. If possible, move MWD to cool room or reduce the ambient temperature of the treatment room.
- e) *Use of cold intravenous fluids, ice-water baths, and surface cooling with ice water or ice packs are contra-indicated* 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 generally ineffective because the paw pads have such a small surface area.
- f) *Once the patient's body temperature is <105°, the rate of cooling can be reduced* to avoid rebound hypothermia. Discontinue ancillary cooling measures can be removed (e.g., remove fans, return room temperature to normal), and dry the MWD's skin.
- g) *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.
- h) *HCPs should evacuate any MWD heat stroke casualty to veterinary facilities on an URGENT basis* if feasible.
- i) Monitor for and treat concurrent problems.
 - (1) Shock is common in MWDs with heat stroke. *Manage shock as per [APPENDIX E](#)*. Monitor blood pressure, lactate clearance, clinical assessment of perfusion, and assessment of volume status until the MWD is evacuated.
 - (2) 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 IV fluids with dextrose to 5% and with KCl at 20 mEq/L routinely* to maintain normoglycemia and normokalemia.
 - (3) 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*

Guideline Only/Not a Substitute for Clinical Judgment

March 2012

Joint Theater Trauma System Clinical Practice Guideline

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 (petechiae, 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.***

- (4) 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).
- (5) Vomiting and diarrhea are typical. Diarrhea is often hemorrhagic. ***Start systemic antibiotic therapy*** (see [APPENDIX J](#)) ***for appropriate antibiotics 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.
- (6) Renal insufficiency is uncommon. ***Maintain urine production at 1-2 ml/kg/hour.*** Monitoring urine output 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.
- (7) ***Treat seizures with a benzodiazepine*** (diazepam or midazolam, 15-20 mg per dog; 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.

Guideline Only/Not a Substitute for Clinical Judgment

March 2012

Joint Theater Trauma System Clinical Practice Guideline

Table 13, Management of Heat-Induced Injury in Military Working Dogs

1. Triage the MWD – carefully assess mentation, airway and breathing, circulation, and body temperature.
 - a. Establish and protect the airway if apneic.
 - b. Provide supplemental oxygen therapy.
 - c. Establish at least 1 intravenous catheter and resuscitate from shock/hypotension. See [APPENDIX E](#).
2. Emergently cool the MWD if rectal temperature is $>105^{\circ}$, cooling as rapidly as possible until the body temperature is 105° .
 - a. Soak the MWD to the skin with copious amounts of room-temperature water.
 - b. Administer room-temperature intravenous fluids at rates necessary to combat hypotension.
 - c. Direct fans on the MWD to facilitate surface cooling.
 - d. Reduce the room temperature, if possible.
 - e. Do ***NOT*** use cold intravenous fluids, ice-water baths, or surface cooling with ice water or ice packs.
3. Reduce the rate of cooling once the patient's body temperature is 105° F to avoid rebound hypothermia.
 - a. Cease cooling with water and dry the hair/skin.
 - b. Remove fans.
 - c. Return room temperature to normal.
4. Provide supportive active or passive warming once the patient's temperature is 103° F.
 - a. Cease all active cooling efforts.
 - b. Continue temperature monitoring.
 - c. Actively warm the patient to prevent rebound hypothermia if temperature is at or below 100° .
5. Monitor for and treat concurrent problems.
 - a. Monitor blood pressures, lactate clearance, urine output, mentation, and other measures of perfusion to monitor for shock hypotension. Continue intravenous fluid therapy until targeted endpoints are met. See [APPENDIX E](#).
 - b. Monitor blood glucose and venous blood gas analyses every 6-12 hours. Maintain normoglycemia with supplemental dextrose.
 - c. Monitor arterial blood gas analysis or pulse oximetry and capnography to assess oxygenation and ventilation.
 - d. Monitor for bleeding and petechiae and ecchymoses; check platelet count q12-24h to screen for thrombocytopenia.
 - e. Monitor ECG continuously to detect cardiac arrhythmias, especially ventricular arrhythmias. Give lidocaine 2 mg/kg IV bolus and start lidocaine CRI 50-75 mcg/kg/min to control malignant arrhythmias that are causing hemodynamic compromise.
 - f. Monitor for vomiting and diarrhea, provide excellent nursing care to maintain patient hygiene, provide gastro-intestinal protectants, and provide enteral nutrition if no vomiting is noted.
 - g. Monitor urine output hourly and assess creatinine every 12-24 hours.
 - h. Monitor respiratory rate hourly, perform thoracic auscultation at least every 4 hours, and perform thoracic radiographs if pulmonary edema or other abnormalities are suspected. Perform arterial blood gas analysis or pulse oximetry and capnography every 4-6 hours initially, then as needed, to assess oxygenation and ventilation. Consider mechanical ventilation if the patient cannot oxygenate or ventilate adequately.
 - i. Monitor mentation and level of consciousness, vision, gait, and postural responses, and monitor for seizures.

Guideline Only/Not a Substitute for Clinical Judgment

March 2012

Joint Theater Trauma System Clinical Practice Guideline

2. **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.
- a. Burns in MWDs are physically similar to those in people. *Superficial burns* are red and painful, similar to sunburn, involving the outer layer of the epidermis. *Superficial partial-thickness* 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.
 - b. 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 [APPENDIX B](#).
 - c. Estimation of total body surface area (TBSA) burn extent. 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.
 - 1) Estimate the percent of the total body surface area (TBSA) that is burned by using a modification of the “Rule of 9s” used for people:
 - a) 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**
 - b) 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%.
 - 2) 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. 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

Guideline Only/Not a Substitute for Clinical Judgment

March 2012

Joint Theater Trauma System Clinical Practice Guideline

wounds often progress over a period of 3-7 days before completely manifesting ultimate severity.

d. General Patient Management Recommendations.

- 1) Monitor and treat for complications related to burn injury, to include shock, fluid losses, respiratory problems, and electrolyte abnormalities, see appropriate appendices. Stabilize the patient first. Manage pain using appropriate analgesics, see [APPENDIX L](#).
- 2) 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.
- 3) 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.
- 4) Follow strict aseptic technique when placing invasive devices and use at least 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 [APPENDIX J](#) only for MWDs presumed to be immunocompromised, with pneumonia or acute lung injury, or with sepsis or suspected sepsis.**
- 5) 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.

e. Specific Burn Wound Management Recommendations, see [Table 14](#).

- 1) 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.
- 2) 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.
- 3) 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.
 - a) 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.

Guideline Only/Not a Substitute for Clinical Judgment

March 2012

Joint Theater Trauma System Clinical Practice Guideline

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.***

- b) 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).
- c) 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 14, Management of Burn Wounds in Military Working Dogs

1. Provide heavy sedation or general anesthesia to allow debridement and management, as necessary.
2. Superficial or superficial partial-thickness burns:
 - a. Perform daily cool water lavage.
 - b. Apply topical silver sulfadiazine cream after cool lavage.
3. Deep partial-thickness and full-thickness burns:
 - a. Perform daily wound debridement as necessary:
 - 1) Perform hydrotherapy using sterile saline lavage under light pressure, or,
 - 2) 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.
4. Protect burn wounds:
 - a. Apply silver sulfadiazine cream in a thin layer directly on the wound.
 - b. Apply a light protective bandage, if the burn area is amendable to application.

3. **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.*** See [Figure 23](#) for the recommended general approach to assessing MWDs exposed to blast.
 - a. **Blast injury mechanisms.** Blasts produce injury through primary injury due to the 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.
 - 1) Primary injuries typically include ruptured tympanic membranes, lung barotrauma (“blast lung”), ruptured eyeballs, and gastrointestinal hemorrhage with possible perforation. Blast lung is the most common fatal primary injury in victims that

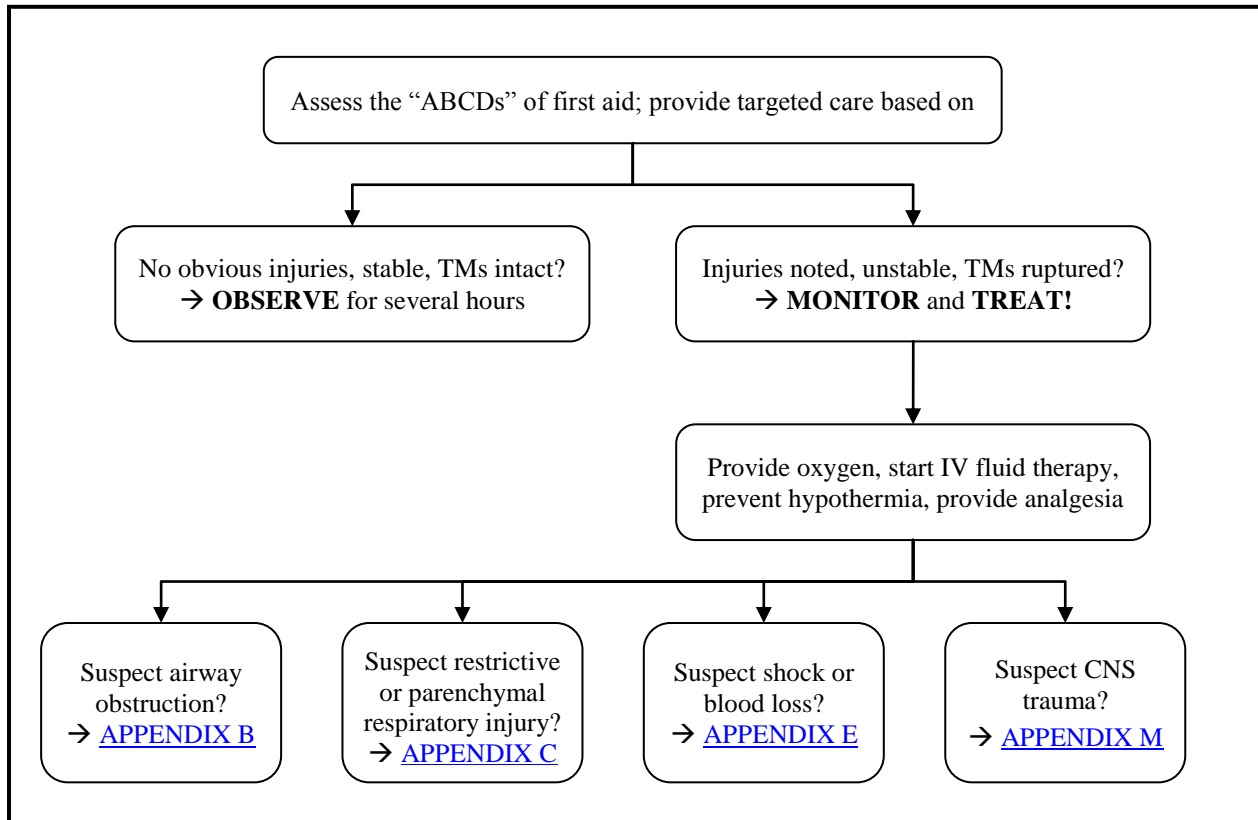
Guideline Only/Not a Substitute for Clinical Judgment

March 2012

Joint Theater Trauma System Clinical Practice Guideline

- survive initially, and consists of varying degrees of pneumothorax, pulmonary contusion, pulmonary hemorrhage, systemic air embolism, and free-radical-induced injury.
- 2) Secondary injury due to fragments displaced by the explosion ('ballistic injury') impacting victims may affect any part of the body and typically cause penetrating or blunt injury, depending on the size of the displaced object.
 - 3) Tertiary injury resulting from victims that are physically displaced into large objects can cause injury to any body part, with high potential for traumatic brain injury, blunt chest or abdominal trauma, and fractures or traumatic amputations of body parts. Many injuries to surviving MWDs will likely be due to tertiary injury, given body size.
 - 4) Quaternary injuries are due to immediate effects of explosions other than those caused by primary, secondary, or tertiary injury, and include burns, crush injury, and traumatic brain injury. Medical conditions that arise as a result of primary, secondary, or tertiary injuries can result, to include sepsis from perforated bowel, blindness, respiratory problems such as exacerbation of asthma or COPD, smoke inhalation injury, carbon monoxide intoxication, and so forth.
- b. Initial management of blast injuries. Generally, the approach to blast-injured MWDs is the same as for any other type of trauma – ***FOCUS on the initial "ABCDs"*** of immediate assessment, 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.
- 1) While 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. The absence of TM rupture, however, does not exclude potentially life-threatening internal injuries, based on recent data from people exposed to blasts.
 - 2) 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.***

Figure 23, General Approach to Military Working Dogs Exposed to Blasts



4. 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).

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

1) 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.

2) 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.

b. **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

Guideline Only/Not a Substitute for Clinical Judgment

March 2012

Joint Theater Trauma System Clinical Practice Guideline

affects the distal extremities, ears, nose, scrotum, and tail. Frostbite varies in severity from superficial (1st degree frostbite) to deep injury (4th degree frostbite).

- 1) 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.
- 2) Management of MWDs with freezing injury is summarized in [Table 15](#). 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.
 - a) 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.
 - b) ***Do not use dry heat to warm tissues, and never rub or massage the tissues***, as further injury may occur.
 - c) Provide systemic analgesia (see [APPENDIX L](#)), as frostbite is extremely painful.
 - d) Protect the affected tissues by applying loose protective bandages, minimizing movement (confine to a cage), and attaching a plastic bucket with the bottom cut out (as a field-expedient Elizabethan collar) to the MWD's collar to prevent self-trauma.
 - e) Antibiotic use is not recommended.
 - f) Aseptically aspirate large blisters that develop.

Table 15, Management of Freezing Injury (Frostbite) in Military Working Dogs

- | |
|---|
| <ol style="list-style-type: none">1. Treat whole-body hypothermia, trauma, or shock as directed in supporting appendices.2. Provide systemic analgesia. See APPENDIX L.3. Warm frozen tissues gently and slowly, using 1 of 2 methods:<ol style="list-style-type: none">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.
<i>NOTE: Do not use dry heat or rub or massage tissues to warm tissues.</i>4. Protect affected tissues:<ol style="list-style-type: none">a. Apply loose protective bandages.b. Minimize movement (confine to a cage).c. Apply a bucket to the collar to prevent self-trauma.5. Aseptically aspirate large blisters that develop. Do not use empiric antibiotics.6. Manage open, infected, or necrotic wounds. See APPENDIX J. |
|---|

Guideline Only/Not a Substitute for Clinical Judgment

March 2012

Joint Theater Trauma System Clinical Practice Guideline

5. **Hypothermia.** Hypothermia in MWDs may be caused by exposure to low environmental temperatures (primary hypothermia), or low body temperature due to trauma, toxicity, underlying illness, or anesthesia and surgery (secondary hypothermia).
- a. 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°), or profound (less than 68°).
 - 2) Secondary hypothermia is classified as mild (98-99.9°), moderate (96-98° F), severe (92-96° F), or profound (less than 92° F).
 - b. 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.
 - 1) 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.
 - 2) 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 may be necessary (e.g., insulin-dextrose administration, bicarbonate administration) may be necessary if potassium is >7-8 mmol/L. Check electrolytes, if able.
 - 3) Metabolic and respiratory acidosis are reported in most types and degrees of hypothermia; these typically correct with fluid therapy and patient warming.
 - 4) Hemostatic defects are common. MWDs are commonly in a hypocoagulable state with prolonged clotting times and platelet abnormalities are also noted. Monitor for bleeding diathesis. 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.***
 - 5) 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.
 - 6) ***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.***
 - a) “Afterdrop” is the continued decrease in core temperature as warming is provided, due to the return of cold peripheral blood to the central circulation.

Guideline Only/Not a Substitute for Clinical Judgment

March 2012

Joint Theater Trauma System Clinical Practice Guideline

To prevent “afterdrop,” it is important to warm the patient’s trunk (chest and abdomen), not the extremities.

- b) “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.*
- c. Management of MWDs with hypothermia, see [Table 16](#). Hypothermic MWDs must be warmed rapidly but carefully, and with anticipation for possible complications. Cardiovascular support (principally IV fluid therapy), management of co-existing problems, and prevention of rewarming complications are necessary.
 - 1) Rewarm MWDs at a target rate of 2-4° F per hour.
 - 2) Use a combination of methods based on the severity of hypothermia and the MWD’s status.
 - a) ***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.
 - b) Rewarm MWDs with hypothermia using active surface warming.
 - (1) 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.
 - (2) Provide IV fluid volume support to maintain normotension and prevent rewarming shock. See [APPENDIX E](#).
 - (3) *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.”
 - c) Rewarm MWDs with severe or profound hypothermia using active core warming.
 - (1) Use warmed IV fluids (run the IV administration set tubing through a bowl of warm water, microwave the bag of crystalloid fluid before use, or use commercial fluid warmers). *The temperature of intravenous fluids should not exceed 108° F* to avoid injury to cellular components of the peripheral blood.
 - (2) If the MWD is intubated and warming humidifiers are available on anesthesia circuits, use warmed inhaled air.

Guideline Only/Not a Substitute for Clinical Judgment

March 2012

Joint Theater Trauma System Clinical Practice Guideline

- (3) Given potential complications with use, HCPs should not use warm peritoneal or pleural lavage or urinary bladder or rectal lavage with warmed fluids.
- 3) 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 in hypothermic MWDs being rewarmed.

Table 16, Management of Hypothermia in Military Working Dogs

1. Warm rapidly but carefully.
 - a. Increase the body temperature by 2-4° F per hour.
 - b. Warm to a temperature of 98.5°, 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/hr 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 [APPENDIX L](#).
 - 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.”

6. **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

Guideline Only/Not a Substitute for Clinical Judgment

March 2012

Joint Theater Trauma System Clinical Practice Guideline

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.

- a. Crush injuries and Crush Syndrome in MWDs are expected after building collapses, most frequently after natural disasters or explosions. In people, 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.
- b. Pathophysiology. Crush injury develops after muscle injury and muscle cell death.
 - 1) 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.
 - 2) 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.
 - 3) 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*.
- c. Clinical Presentation. Clinical signs of crush injury/crush syndrome include some or all of the following:
 - 1) Skin injury of the affected body part (may be subtle and less impressive than other signs)
 - 2) Limb swelling (may be delayed)
 - 3) Paresis or paralysis (may be mistaken as spinal cord injury)
 - 4) Loss of sensation (may mask the severity of underlying injury)
 - 5) Pain (typically becomes severe with reperfusion)
 - 6) Absent or weak extremity pulses
 - 7) Discolored urine due to myoglobinuria or hematuria or both

Guideline Only/Not a Substitute for Clinical Judgment

March 2012

Joint Theater Trauma System Clinical Practice Guideline

- 8) Hypotension due to hypovolemia (dehydration, hemorrhage, third spacing of fluids) is commonly present and may be severe.
 - 9) Massive third spacing (often causes or exacerbates compartment syndrome and renal failure)
 - 10) Metabolic abnormalities (hypocalcemia, hyperkalemia, and lactic acidosis)
 - 11) 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)
 - 12) Renal failure (due to rhabdomyolysis and secondary myoglobinuric acute tubular necrosis).
- d. **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.
- 1) ***The hallmark initial treatment for Crush Syndrome is IV fluid therapy before release of pressure and continued 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.
 - 2) Once compression is removed, ***maintain aggressive fluid therapy.*** Specific guidelines for fluid volumes to administer are difficult to provide. As a starting point, use the “10-20-10-20 Rule” described in [APPENDIX E](#) (i.e., graduated fluid challenges, to effect) 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.
 - 3) Alkalinization of the blood with bicarbonate (as is done for people) 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.***
 - 4) Anticipate secondary complications.
 - a) MWDs with crush injury should be treated initially as any other multiple trauma victim.
 - b) Compartment syndrome is rare in dogs; this seems to be a much more common and more severe problem in people, so extreme measures to control intracompartmental pressures like fasciotomy are unwarranted.
 - c) Wounds should be cleaned and covered with sterile dressings in the usual fashion. Splint fractures if possible.

Guideline Only/Not a Substitute for Clinical Judgment

March 2012

Joint Theater Trauma System Clinical Practice Guideline

- d) Provide analgesia to any MWD with crush injury or Crush Syndrome.
- 7. Envenomations.** Insect and venomous snake envenomations are possible in deployed settings.
- a. Insect envenomations. Insect envenomations typically cause local pain, erythema, and swelling (angioedema or urticaria) due to edema formation. Some insect venom (e.g., Brown Recluse spider) can cause locally extensive wounds that often take several days to manifest. Rarely, insect venom can cause systemic anaphylaxis.
- 1) If the history or clinical signs suggest local insect envenomation, give the MWD an injection of dexamethasone (0.5 mg/kg, IV or IM, once), and diphenhydramine (2-4 mg/kg IM, once). Dispense diphenhydramine to be given by the handler every 8 hours for 2 successive doses (2-4 mg/kg, PO). **MWD handlers are issued diphenhydramine and may have initiated therapy prior to presentation.**
 - 2) Manage any open wounds that develop as per [APPENDIX J](#).
 - 3) Treat pain if noted. See [APPENDIX L](#).
 - 4) *If systemic anaphylaxis is suspected based on the history and clinical signs of weakness, peracute vomiting or diarrhea, collapse, or hypotension, treat the MWD as above, but also treat with IV fluid therapy as for shock (see [APPENDIX E](#)), and epinephrine (0.5-1 mg per dog, IM or IV; repeat if necessary every 20-30 minutes).*
- b. Venomous snakebite. Clinical signs of bites by venomous snakes can vary tremendously, principally depending on the type of snake involved 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.
- 1) In general, snakebites by most venomous pit vipers (e.g., rattlesnakes) 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 pit 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.***
 - a) Unwitnessed envenomations are 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.
 - b) 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 bleeding.

Guideline Only/Not a Substitute for Clinical Judgment

March 2012

Joint Theater Trauma System Clinical Practice Guideline

- c) 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.
- d) Hospitalize any MWD with history of or signs suggesting envenomation for at least 12 hours to monitor progression.
- (1) Treat mild envenomations (signs localized to face or lower limb that do not progress or progress slowly) with analgesics, (see [APPENDIX L](#)), 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, below.
 - (2) ***Treat moderate-to-severe envenomations (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 [APPENDIX L](#)), diphenhydramine (2-4 mg/kg, IM, q8h), IV fluid therapy using the guidelines recommended for shock therapy initially (see [APPENDIX E](#)), and antivenin (if available). Monitor closely for progression. Coordinate URGENT evacuation.***
 - (3) If available in theater, CroFab[®] is effective in reducing morbidity and mortality. Clinical evidence in dogs shows that antivenin has no mortality benefit when used for local bites to the face or lower extremities, but antivenin use will nearly always mitigate morbidity. Clear evidence shows that antivenin has mortality benefit when used in dogs with moderate-to-severe envenomation. CroFab[®] has been used extensively in dogs, with minimal adverse side effects. ***Thus, HCPs should give CroFab[®] antivenin, if available, to any MWD with moderate-to-severe clinical signs, or those with mild signs that appear to be progressing.***
 - i. Reconstitute CroFab[®] carefully, avoiding shaking.
 - ii. Dilute CroFab[®] in 250 mL saline and give IV over 1 hour.
 - iii. The dose for antivenin in dogs is empirical. Ideally, give 2-4 vials IV as soon as possible, and give “to effect” to slow development of clinical signs and progression of clinical signs that are present.
 - iv. Repeat this dose (2-4 vials, IV, over 60 minutes) if necessary, once.
 - v. 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, IM or IV) if signs of shock develop.
 - (4) ***Do NOT use whole IgG antivenin products in MWDs, as the risks of anaphylactic or anaphylactoid reactions are very high.***

Guideline Only/Not a Substitute for Clinical Judgment

March 2012

Joint Theater Trauma System Clinical Practice Guideline

- (5) **Do NOT use tourniquets, ice packs, heating, or local vasoconstriction** (e.g., injection of epinephrine locally) in an attempt to slow venom spread.
 - (6) Confine MWDs to minimize venom distribution.
- 2) Envenomation by members of the *Elapidae* family (e.g., Coral snake) are rare. The most common life-threatening complication is respiratory paralysis due to the neurotoxic effects of the venom. Long-term manual IPPV or mechanical ventilation is necessary for any chance of survival, in addition to use of venom-specific antivenin (likely not available in deployed settings). ***Any MWD that is suspected of being bitten by a snake in this family or showing clinical signs of profound weakness or respiratory depression after a bite must be evacuated URGENTLY for attempted management.***

APPENDIX I MANAGEMENT OF LONG BONE FRACTURES IN MILITARY WORKING DOGS

1. **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.* Take measure to *prevent further compromise to neurovascular bundles and the fracture site, and minimize infection risk.*
2. **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 paragraph [6. Management of Open Fractures](#) for specific guidance.
3. **Provide analgesia and confine the MWD.** Any MWD with possible fractures or joint injury should be given analgesia, parenterally, initially, and then orally once stabilized. See [APPENDIX L](#). Any MWD with possible fractures should be confined to its kennel or small space at all times, with limited opportunities during the day to go outside to urinate and defecate. In some cases, as defined below, analgesia and confinement may be the only treatment necessary or feasible.
4. **Long bone fractures and joint abnormalities of the lower limbs.** *HCPs should stabilize any suspected fracture or joint abnormality of the long bones of the radius/ulna and tibia or below.*
 - a. Manage wounds as per [APPENDIX J](#), and then apply splints (e.g., SAM splints) to immobilize the fracture site, ensuring the joint 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 ensure the toes are visible, to allow monitoring of swelling.
 - b. Cast application is not recommended, and cast pressure or friction sores are extremely common with MWDs and complicate recovery.
 - c. 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. A simple device can be fabricated by cutting the bottom from a plastic bucket and securing the bucket to the MWD's collar – most handlers know how to create these devices. If buckets are not available, the handler must attend the MWD at all times.
 - d. Splints and bandages generally need to be changed at least every other day. Change more frequently if soiled, wet, or loose.
5. **Long bone fractures and joint abnormalities of the upper limbs.**
 - a. *HCPs without advanced orthopedic training and experience generally should not attempt to immobilize fractures of the humerus, scapula, or femur.* 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*

Joint Theater Trauma System Clinical Practice Guideline

(see [APPENDIX L](#)) and minimize movement to the maximal extent (kennel confinement except for limited leashed walks, using ancillary support).

- b. HCPs with advanced training and experience in orthopedics (typically orthopedic surgeons, orthopedic PAs, splint labs and 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.

6. Management of open fractures. Proper management of open fractures is essential. Open fractures should be treated as a medical emergency, once more pressing problems are addressed.

- a. 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:
 - 1) 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.
 - 2) 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.
 - 3) 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.
- b. 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.
 - 1) Culture open fracture sites as soon as possible after presentation and before antibiotic use if possible.
 - 2) Administer antibiotics as per [APPENDIX J](#), focusing on use of intravenous antibiotics based on likely contaminants. Never withhold antibiotic therapy in any patient with an open fracture.
 - 3) Address pain with appropriate analgesic therapy, see [APPENDIX L](#). Reassess pain every 4-6 hours.
 - 4) Manage soft tissue injuries over the fracture site appropriately, as proper management of the wound postures the patient for successful outcome. See [APPENDIX J](#) for wound management recommendations.
 - 5) Apply a sterile wet-to-dry bandage to open fractures. Always use a wet dressing over open fractures, as it is important to keep soft tissues and bone moist for optimal

Guideline Only/Not a Substitute for Clinical Judgment

March 2012

Joint Theater Trauma System Clinical Practice Guideline

healing. Change bandages at least once daily, based on degree of strike-through, soiling, or loosening.

- 6) Apply splints and bandages as described in paragraph I-4 for open fractures of the radius/ulna or tibia, or lower. Confine MWDs with any fracture, but especially with upper limb fractures that cannot be immobilized.
7. **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. Thus, **the goals for HCP care of MWDs are initial management, stabilization and evacuation to veterinary medical personnel for definitive care.**
8. **Pelvic fractures.** Pelvic fractures in MWDs in deployed settings will most likely be due to crush or blast injury. (See [APPENDIX H.](#)) Evaluate the pelvis for external evidence of trauma or deformity.
 - a. 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.
 - b. Trauma to adjacent structures such as the rectum, descending colon, urinary bladder, urethra, and reproductive organs is fairly common. 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 the 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.
 - c. 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 [APPENDIX L.](#)

Guideline Only/Not a Substitute for Clinical Judgment

March 2012

Joint Theater Trauma System Clinical Practice Guideline

Table 17, Management of Long Bone Fractures in Military Working Dogs

1. Address life-threatening problems first!
2. During resuscitation, protect any open fractures:
 - a. Do not attempt to reduce bone(s) protruding at the fracture site.
 - b. 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.
 - c. Cover the fracture and wound with sterile non-adherent dressing and apply a light bandage.
3. LIMB FRACTURES
 - a. Lower Limb Fractures: After resuscitation, immobilize fractures or joint abnormalities involving the lower legs (below the elbow or knee), prevent bacterial infection, provide analgesia, and promote normal healing pending surgical fracture repair:
 - 1) Culture any open fracture sites as soon as possible and before antibiotic use if possible.
 - 2) Administer antibiotics as directed by [APPENDIX J](#) for open fractures.
 - 3) Manage any wounds over the fracture site as per [APPENDIX J](#).
 - 4) Provide appropriate analgesia as directed by [APPENDIX L](#). Reassess pain every 4-6 hours.
 - 5) Apply splints or heavy bandages to immobilize the fracture site, ensuring the joint above and below the fracture site are immobilized.
 - b. Upper Limb Fractures: After resuscitation, minimize further injury to fractures of the upper limbs (above the elbow or knee):
 - 1) Culture any open fracture sites as soon as possible and before antibiotic use if possible.
 - 2) Administer antibiotics as directed by [APPENDIX J](#) for open fractures.
 - 3) Manage any wounds over the fracture site as per [APPENDIX J](#).
 - 4) Provide appropriate analgesia as directed by [APPENDIX L](#). Reassess pain every 4-6 hours.
 - 5) Unless experienced in external coaptation, DO NOT apply splints or heavy bandages – these are poorly tolerated in MWDs and will likely increase risk of displacement and injury to the neurovascular bundle.
 - 6) Confine to a kennel or small space; limit walks; support as needed when taken outside.
4. Monitor MWDs with fractures:
 - a. Ensure a device is used to prevent self-trauma or splint/bandage removal
 - b. Assess pain frequently and ensure adequate analgesia.
 - c. Change splints/bandages daily (open fractures, wounds, soiled/wet splints/bandages) or every other day (clean/dry splints/bandages that do not cover open fractures or wounds).
 - d. Monitor for complications of immobilizing devices (e.g., chafing, distal swelling, pain, skin wounds, tissue maceration).

Guideline Only/Not a Substitute for Clinical Judgment

March 2012

APPENDIX J WOUND MANAGEMENT IN MILITARY WORKING DOGS

1. **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.*
2. **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.*
3. **Initial wound management recommendations,** see [Table 18](#).
 - a. Provide effective analgesia or anesthesia based on wound severity, location, and other factors. See [APPENDIX L](#).
 - b. Apply sterile water-soluble lubricant 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 this initial lavage is to remove gross contaminants and reduce the bacterial burden.
 - c. 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.
 - d. Lavage of the wound is necessary to remove particulate debris and reduce bacterial contamination – remember the adage, “The solution to pollution is dilution.”
 - 1) 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.
- 2) 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.
 - 3) 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.
- e. Generally, contaminated and dirty/infected wounds should not be sutured until healthy granulation tissue is established, which may be several days. This is especially true for bite wounds.
- 4. 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.
- a. 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.
 - b. 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.
 - c. Use topical silver sulfadiazine ointment or triple-antibiotic ointment on most wounds.
 - d. 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.
 - e. Apply a tertiary layer, typically consisting of nonadherent 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.

Joint Theater Trauma System Clinical Practice Guideline

- f. **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.
 - g. **Any MWD with a bandage applied must be prevented from chewing at the bandage.** A plastic bucket with the bottom cut out (as a field-expedient Elizabethan collar) can be used to prevent self-trauma can be attached to the dog's collar as an effective prevention practice.
 - h. 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.
5. **Antibiotic use in MWDs with open or necrotic wounds**, see [Table 19](#). **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.**

Table 18, Management of Open or Necrotic Wounds in Military Working Dogs

- | |
|--|
| <ul style="list-style-type: none">1. Manage potential local and systemic infection.<ul style="list-style-type: none">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 19 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.<ul style="list-style-type: none">a. Provide effective analgesia or anesthesia based on wound severity, location, and other factors. See APPENDIX L.b. Apply sterile water-soluble lubricant to the wound bed, 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.<ul style="list-style-type: none">i) Do not mass ligate tissues or use cautery excessively.ii) 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. |
|--|

Guideline Only/Not a Substitute for Clinical Judgment

March 2012

Joint Theater Trauma System Clinical Practice Guideline

Table 18, Management of Open or Necrotic Wounds in Military Working Dogs

- f. Lavage the wound to remove particulate debris and reduce bacterial contamination.
 - i) Thoroughly lavage the wound bed.
 - ii) Lavage under pressure.
 - iii) Sterile isotonic solutions are the fluid of choice.
- g. Bandage the wound.
 - i) 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.
 - ii) Apply several dry gauze sponges over the primary layer.
 - iii) Apply a secondary layer over the primary layer, using cast padding or roll cotton +/- splints to provide support.
 - iv) Apply a tertiary layer of nonadherent conforming bandage, adhesive bandage, or both, using light compression.
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 19, Antibiotic Selection and Dosing for Military Working Dogs

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	20 – 30 mg/kg	PO	q 12 h
Ciprofloxacin	10 mg/kg	PO	q 24 h

Guideline Only/Not a Substitute for Clinical Judgment

March 2012

APPENDIX K MANAGEMENT OF OCULAR INJURIES IN MILITARY WORKING DOGS

1. **Ocular injuries in MWDs** in deployed settings will likely include irritant conjunctivitis, corneal ulceration, eyelid lacerations, and penetrating foreign objects.
2. **Clinical signs of ocular/peri-ocular injury** include eyelid lacerations, swelling of the peri-orbital 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.
3. **Evaluation of ocular injuries in MWDs.**
 - a. Sedate the MWD as needed to allow detailed but safe examination of the affected eye. See [APPENDIX L](#).
 - b. Flush the affected eye and adjacent tissues with copious amounts of sterile saline or ophthalmic rinse.
 - c. Topically anesthetize the affected eye to facilitate examination, using 3-4 drops of topical ophthalmic anesthetic solution (e.g., proparacaine) on the cornea.
 - d. Remove exudate from the affected eye, if present, using saline-soaked cotton balls.
 - e. Examine the conjunctival area for foreign objects (e.g., particles, grass, plant seeds, thorns).
 - f. Stain the cornea of any affected eye to evaluate for ulceration, using fluorescein stain. Apply stain to the cornea, allow stain to dwell for at least 1 minute, and then rinse copiously with sterile saline or ophthalmic rinse.
 - g. Examine the eyes for symmetry, anisocoria, abnormal PLRs, or lens abnormalities. 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.
 - h. Apply a bucket to the dog's collar to prevent self-trauma in ALL cases of ocular or peri-ocular injuries in MWDs until the problem has resolved.
4. **Treatment of ocular injuries in MWDs.**
 - a. Irritant conjunctivitis.
 - 1) Noted by varying degrees of conjunctival hyperemia, mild-to-moderate chemosis, and absence of other ocular signs.
 - 2) Flush eye and adjacent tissues with sterile saline/ophthalmic rinse 1-2 times daily.
 - 3) Apply bland ophthalmic antibiotic ointment (preferable) or solution (e.g., bacitracin-neomycin-polymyxin), q8h for 5 days.
 - a) *If corneal ulceration is present, DO NOT USE topical corticosteroids*, as the risk of worsening the ulcer is high.

Joint Theater Trauma System Clinical Practice Guideline

- b) 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.
- b. Corneal ulceration.
 - 1) Noted by varying degrees of conjunctival hyperemia, mild-to-moderate chemosis, and presence of fluorescein dye uptake on the affected cornea.
 - 2) Flush eye and adjacent tissues with sterile saline/ophthalmic rinse 1-2 times daily.
 - 3) Apply bland ophthalmic antibiotic ointment (preferable) or solution (e.g., bacitracin-neomycin-polymyxin), q8h for 5 days.
 - 4) ***DO NOT USE topical corticosteroids***, as the risk of worsening the ulcer is high.
- c. Penetrating/embedded foreign object.
 - 1) 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.
 - 2) Flush the eye and adjacent tissues with copious amounts of sterile saline/ophthalmic rinse 1-2 times daily.
 - 3) If the object is on the surface of or embedded on the outer cornea, attempt cautious removal after topically anesthetizing the eye.
 - a) 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.
 - b) **DO NOT USE** topical corticosteroids, as the risk of worsening the injury is high.
 - 4) 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.
 - a) Apply topical bland ophthalmic antibiotic ointment (preferable) or solution (e.g., bacitracin-neomycin-polymyxin) to the affected eye, q8h for 5 days.
 - b) **DO NOT USE** topical corticosteroids, as the risk of worsening the injury is high.
 - c) ***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.
 - d) Evacuate the MWD to a veterinary facility on an ***URGENT*** basis once feasible.
- d. Eyelid/peri-orbital lacerations.
 - 1) Noted by the presence of lacerations or abrasions affecting the peri-orbital tissues.

Guideline Only/Not a Substitute for Clinical Judgment

March 2012

Joint Theater Trauma System Clinical Practice Guideline

- 2) Deeply sedate or anesthetize the MWD, see [APPENDIX L](#).
- 3) Close subcutaneous tissues in 1 or 2 layers, using absorbable 3-0 or 4-0 monofilament simple interrupted sutures.
- 4) Close the skin using stainless steel skin staples or nonabsorbable 3-0 nylon.
- 5) Apply topical bland ophthalmic antibiotic ointment (preferable) or solution (e.g., bacitracin-neomycin-polymyxin) to the affected eye, q8h for 5 days.

Guideline Only/Not a Substitute for Clinical Judgment

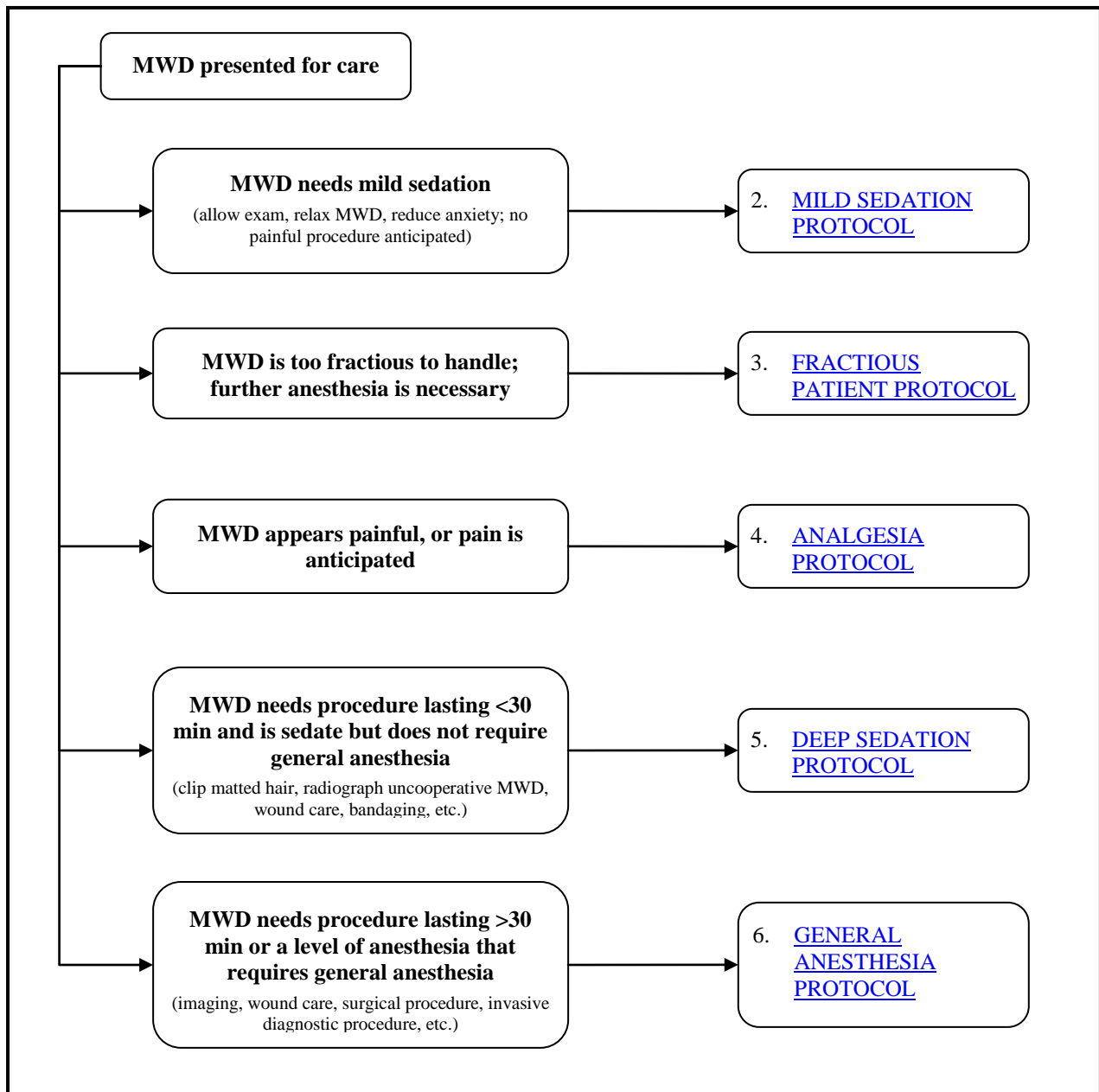
March 2012

Joint Theater Trauma System Clinical Practice Guideline

APPENDIX L ANALGESIA AND ANESTHESIA FOR MILITARY WORKING DOGS

1. **Purpose.** This appendix is intended to provide HCPs with a succinct quick reference for analgesia and anesthesia guidance to facilitate care of emergently ill or injured MWDs, using simple combinations of drugs readily available to most HCPs. [Figure 24](#) provides a decision-making algorithm 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.

Figure 24, Decision-making Algorithm for Analgesia or Anesthesia



Guideline Only/Not a Substitute for Clinical Judgment

March 2012

Joint Theater Trauma System Clinical Practice Guideline

2. Mild Sedation Protocol.

- a. Use for MWDs that need relaxation to allow exam or handling, or to reduce anxiety. Use for patients that will not be exposed to pain.
- b. Place an IV catheter at the discretion of the senior HCP.
- c. Protocol: MIDAZOLAM 0.3 mg/kg IM **and** HYDROMORPHONE 0.2 mg/kg IM.

3. Fractious MWD Protocol.

- a. Use for MWDs that are too fractious to handle safely in order to allow further care. Use instead of the Mild Sedation Protocol for fractious MWDs. Generally, this protocol is used to allow IV catheterization and induction of general anesthesia.
- b. Place an IV catheter once the MWD is controlled.
- c. Protocol: MIDAZOLAM 0.3 mg/kg IM **and** KETAMINE 2 mg/kg IM **and** HYDROMORPHONE 0.1 mg/kg IM. To facilitate placement of an IV catheter and/or for follow-on anesthesia induction, use PROPOFOL in 1 mg/kg boluses IV *as needed* to allow catheterization or intubation.

4. Analgesia Protocol. Assessment of pain in dogs is difficult. Due to the nature of MWDs (tendency to aggression, stoic/instinctively hide 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.

- a. Note that all protocols have analgesia incorporated into them. Additional analgesia can be provided by the IV/IM or PO route, as necessary.
- b. 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.
- c. For intermittent IV or IM supplementary analgesia, use 1 of the following drugs:
 - 1) HYDROMORPHONE 0.1-0.2 mg/kg q2-4h.
 - 2) MORPHINE 0.2-0.5 mg/kg q4-6h
- d. For CRI supplementary analgesia, use 1 of the following drugs:
 - 1) FENTANYL 2-10 mcg/kg/h.
 - 2) MORPHINE 0.1-0.25 mg/kg/h.
 - 3) HYDROMORPHONE 0.02-0.05 mg/kg/h.
- e. For PO supplementary analgesia, use TRAMADOL 5-10 mg/kg PO q8-12h for up to 5 days.
- f. Cautions. **Do NOT use acetaminophen or ibuprofen in MWDs**, as these drugs can cause liver toxicity. **AVOID use of NSAIDs** such as naproxen and aspirin in emergently ill or injured MWDs.

Guideline Only/Not a Substitute for Clinical Judgment

March 2012

5. Deep Sedation Protocol.

- a. 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 of fractious MWDs. Note that the MWD will not be able to walk, cannot be intubated, can be aroused with stimulation and maintains laryngeal and palpebral reflexes.
- b. Place an IV catheter once the MWD is sedate.
- c. Protocol: MIDAZOLAM 0.3 mg/kg IM **and** KETAMINE 5 mg/kg IM **and** HYDROMORPHONE 0.1 mg/kg IM.
- d. If deeper sedation or light anesthesia is necessary, or to allow general anesthesia induction, use PROPOFOL in 1 mg/kg boluses IV *as needed*.

6. General Anesthesia Protocol (*assumes emergent need for general anesthesia*).

- a. Use to facilitate imaging, allow management of fractures, perform surgical procedures, and perform invasive diagnostic procedures.
- b. Place an IV catheter once the MWD is sedate.
- c. Preoxygenate for 5 minutes using oxygen mask.
- d. Premedicate using the Fractious MWD or Deep Sedation Protocol.
- e. Induce using PROPOFOL 1 mg/kg IV boluses to effect.
- f. Intubate with an appropriate endotracheal tube. Most average MWDs require a 9-11 mm ID endotracheal tube. Use a cuffed tube.
- g. 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.
- h. Manage pain with HYDROMORPHONE 0.1 mg/kg IV boluses, not to exceed 0.2 mg/kg per hour.
- i. Monitor appropriately, give IV fluids, and keep the MWD warm, see paragraph [8](#), [Ancillary Support](#).
- j. Record anesthesia using DA Form 7389.

7. 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!*

8. Ancillary Support.

- a. *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., MWD with shock should be given IV fluids to targeted endpoints, as per [APPENDIX E](#)).*

Guideline Only/Not a Substitute for Clinical Judgment

March 2012

Joint Theater Trauma System Clinical Practice Guideline

- b. *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°.*
- c. *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.*

APPENDIX M MANAGEMENT OF TRAUMATIC BRAIN INJURY (TBI) AND ACUTE SPINAL CORD INJURY (ASCI) IN MILITARY WORKING DOGS

1. **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 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.
2. **Acute spinal cord injury (ASCI).** ASCI should be assumed to be present in every MWD trauma patient until proven it is not present.
 - a. High index of suspicion! 40-50% of MWDs with ASCI have concurrent injury elsewhere that may be more life-threatening – FOCUS on initial resuscitation and stabilization! 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.
 - b. Clinical signs suggesting ASCI.
 - 1) 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 SCI may be present.
 - 2) Specific neurological signs that strongly suggest ASCI include loss of conscious proprioception, loss of conscious perception of superficial and deep pain, and loss of function (paresis or paralysis).
 - c. 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.
 - 1) 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.
 - 2) LMN signs are characterized by flaccid or weak motor tone causing depressed limb reflexes and decreased muscle tone in areas caudal to the lesion.
 - 3) With both UMN and LMN involvement, paresis or paralysis are possible.
 - a) C1-C5 – UMN signs to all 4 limbs, possibly abnormal respiration (shallow or absent).
 - b) C6-T2 – UMN signs to the hind limbs and LMN signs to the forelimbs.
 - c) T3-L3 – UMN signs to the hind limbs with normal forelimbs.
 - d) L4-S2 – LMN signs to the hind limbs with normal forelimbs.

Joint Theater Trauma System Clinical Practice Guideline

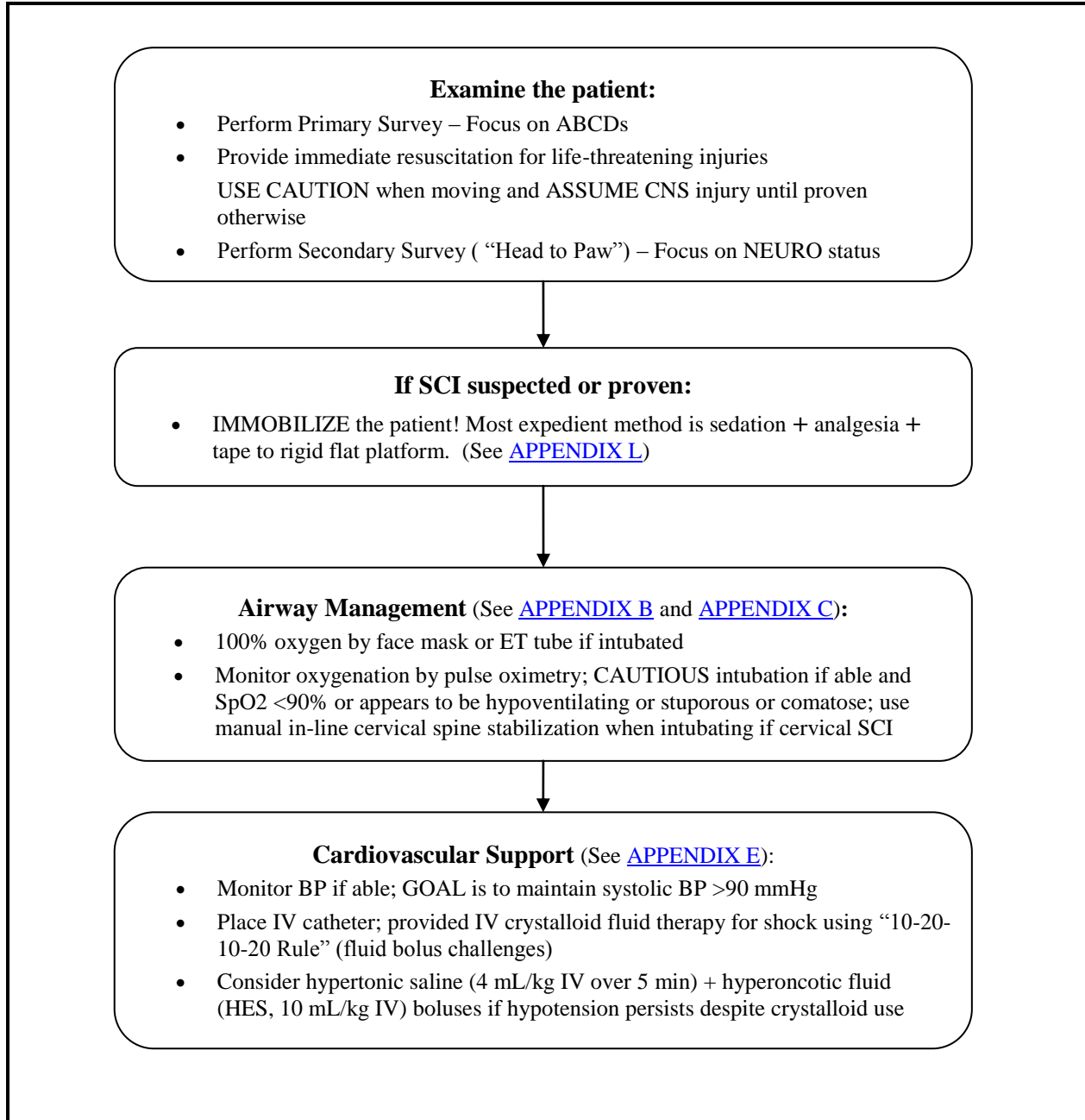
- d. Diagnostic imaging. Radiographs, CT or MRI are often necessary for definitive diagnosis in patients with fractures or dislocations to determine the site of injury. IF these imaging modalities are available AND the MWD can be managed without worsening possible injury, attempt imaging IF feasible. Heavy sedation or anesthesia will be necessary. See [APPENDIX L](#).
- e. Management of patients with ASCI, see [Figure 25](#). Goals are to reduce neurological deficit and prevent further loss of neurological function.
 - 1) Follow guidance elsewhere 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.
 - 2) If signs suggest **ASCI is 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.
 - 3) 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*.
 - 4) *Do NOT use nonsteroidal anti-inflammatory drugs (NSAIDs)*.
 - 5) *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.
- f. 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.
 - 1) Maintain enforced confinement, analgesia, and sedation as needed to minimize movement.
 - 2) Evacuate **URGENTLY** if feasible.
- g. 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 that require decompressive surgery to correct displaced or fractured spinal segments or bone fragments. Surgical management is likely not going to be feasible in a deployed setting.
 - 1) *Definitive surgical repair of ASCI in MWDs should only be performed by qualified veterinary personnel*.

Guideline Only/Not a Substitute for Clinical Judgment

March 2012

- 2) **Evacuate as soon as feasible, or consider euthanasia** (see [APPENDIX P](#)) if severe ASCI is present based on physical exam +/- diagnostic imaging results, the MWD has no deep or superficial pain, or paralysis is present at any time.

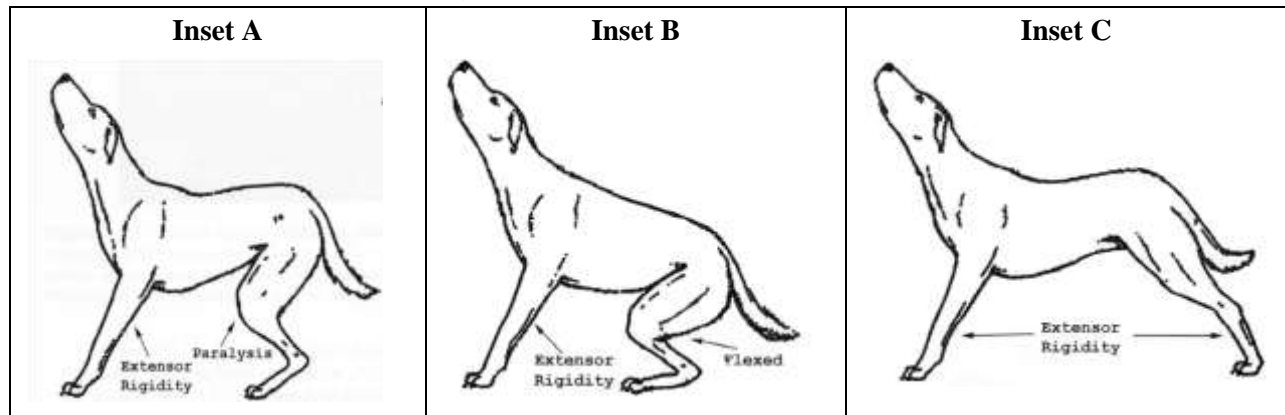
Figure 25, Clinical Management Algorithm for Acute Spinal Cord Injury in Military Working Dogs



Joint Theater Trauma System Clinical Practice Guideline

- 3. Traumatic brain injury (TBI).** There is limited data on TBI in animals. Anticipate TBI in MWDs after trauma in 25-40% of cases. 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.***
- a. 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).
- 1) Special attention should be paid 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.
 - 2) The external ear canals and nasal openings should be examined for evidence of blood or CSF.
 - 3) 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. These findings will affect treatment options.
 - 4) 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.
 - a) Patients with injury to the T₂-L₂ thoracic spine often display the Schiff-Sherrington syndrome (see [Figure 26](#), inset A below), 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.
 - b) Patients with *decerebellate rigidity* (see [Figure 26](#), inset B below) typically are obtunded or depressed, have 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.
 - c) Patients with *decerebrate rigidity* (see [Figure 26](#), inset C below) 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.

Figure 26, Posture on Presentation



- b. Assessing severity of TBI in MWDs. A modified veterinary Glasgow Coma Scale (MVGCS) (see [Table 20](#)) has been validated for use in dogs. Data is limited, however, correlating long-term outcome (i.e., prognostication) with initial or serial assessment of GCS in dogs.
- 1) As with people, the lower the total GCS, the worse the TBI and the lower the expected survival with neurological function intact.

Table 20, Modified Veterinary Glasgow Coma Scale (MVGCS)

Level of Consciousness	Score
Occasional periods of alertness and responsive to environment	6
Depression or delirium, capable of responding but response may be	5
Stupor – semicomatose, responsive to visual stimuli	4
Stupor – semicomatose, responsive to auditory stimuli	3
Stupor – semicomatose, 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

Guideline Only/Not a Substitute for Clinical Judgment

March 2012

Table 20, Modified Veterinary Glasgow Coma Scale (MVGCS)

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

- 2) Limited use in veterinary trauma patients has allowed development of suggested prognoses based on the MVGCS, see [Table 21](#). *HCPs should use this guidance when assessing severity of TBI and resource allocation.*

Table 21, Suggested Prognoses Based on MVGCS

MVGCS Score	Suggested Prognosis
3-8	Grave
9-14	Guarded
15-18	Good

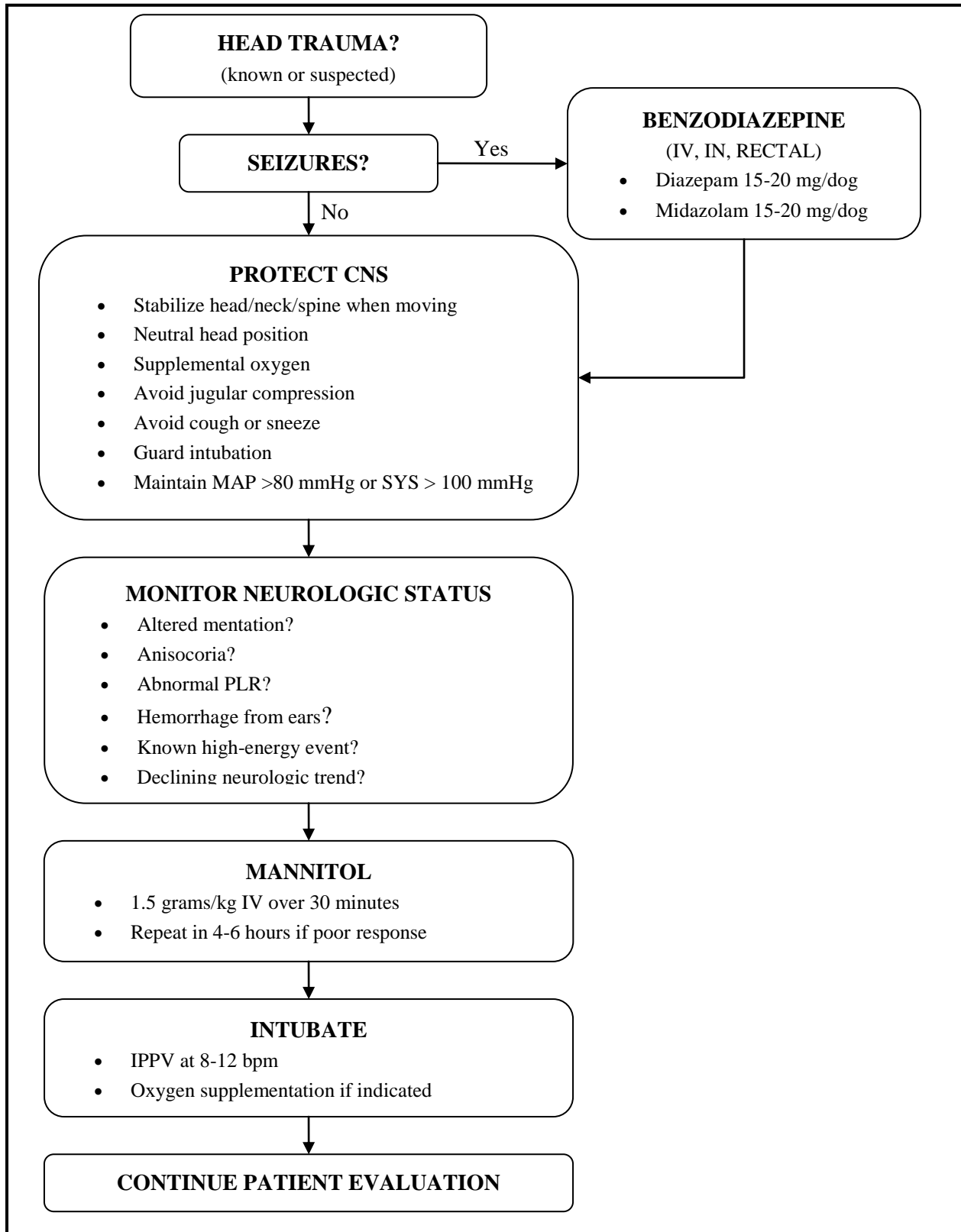
- c. Management of MWDs with TBI. It is critical to *ensure adequate resuscitation and management of cardiovascular and respiratory problems*, as hypotension, poor tissue perfusion, and hypoxia lead to progressive brain injury due to the adverse effects of secondary neurological injury due to ischemia, cerebral edema, reperfusion injury, and so forth.
- 1) Follow guidance in this CPG for management of shock, hypotension, hypovolemia, hemorrhage control, and respiratory dysfunction, see [Figure 25](#).
 - 2) 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.
 - 3) Focus care on preventing hypoxemia, maintaining cerebral perfusion pressure and systemic arterial pressure in the normal ranges, and preventing secondary ischemic cerebral injury.
 - a) 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!*
 - b) Maintain normotension. Starting IV crystalloid fluid therapy to correct shock and provide ongoing volume support. (Use the “10-20-10-20 Rule” to guide therapy, as in [APPENDIX E](#).) Fluid type depends on underlying cardiovascular status. All patients should be given crystalloid fluids. The goal is to maintain normotension (i.e., MAP 70-80 mmHg or systolic BP >90 mmHg). 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)

Joint Theater Trauma System Clinical Practice Guideline

- +/- hyperoncotic fluid (HES, 10 mL/kg IV) boluses if hypotension persists despite crystalloid use.
- c) Nurse with head elevated 30⁰ with neutral neck position, avoid external jugular vein compression and catheters, avoid procedures that stimulate coughing or sneezing.
 - d) If evacuation will be prolonged, rotate lateral recumbency and lubricate the eyes with ophthalmic ointment every 4 hours and maintain in a well-padded area if recumbent.
 - e) If the MWD is conscious, restrict activity and movement (e.g. – portable kennel), which may require sedation and analgesia. See [APPENDIX L](#).
 - f) 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).***
 - g) ***Do NOT use corticosteroids to treat MWDs with TBI.***
4. **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. ***Euthanasia*** (see [APPENDIX P](#)) ***is indicated for MWDs with catastrophic neurological injuries, and may be warranted for MWDs that are comatose on presentation. MWDs with paralysis, and MWDs that fail to respond to therapy or deteriorate despite care, may also be considered for euthanasia.***

Joint Theater Trauma System Clinical Practice Guideline

Figure 27, Management Algorithm for Traumatic Brain Injury in Military Working Dogs



Guideline Only/Not a Substitute for Clinical Judgment

March 2012

APPENDIX N MANAGEMENT OF CANINE POST TRAUMATIC STRESS DISORDER-LIKE SYNDROME

1. It is now recognized that 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 from HCPs, in the absence of veterinary personnel, medical guidance for acutely affected dogs. This appendix serves to provide basic guidance on Canine PTSD-like Syndrome (C-PTSD) and limited management direction. 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 the DOD C-PTSD expert at the DODMWDVS.**
2. **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.***
3. **Note specific behavioral signs characteristic for C-PTSD.** Further, *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).***
4. **Note possible delayed onset or delayed reporting of clinical signs supporting C-PTSD.** Although MWD handlers will most likely seek guidance after acute onset of signs, HCPs should be aware that some MWDs may not manifest obvious signs for some time, or handlers may not seek guidance until the syndrome is more 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.***
5. **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 (TBI.) See [APPENDIX M](#). ***A key tip-off that C-PTSD is likely not present is development of behavioral signs before the antecedent events noted in paragraph N-2.*** Veterinary personnel must rule out anecdotal reports and other appropriate behavioral diagnoses in order to validate a C-PTSD diagnosis.
6. **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:

Joint Theater Trauma System Clinical Practice Guideline

- a. Record the interaction and forward to supporting veterinary personnel, using [APPENDIX Q](#).
 - b. Direct the handler immediately remove the dog from the situation, if not already done.
 - c. Upon approval from the supporting veterinary officer, provide an anxiolytic for dogs that have demonstrated a moderate-to-severe response, using 1 of the following agents, given PO (preferable), IV, or IM:
 - 1) Clorazepate (TRANXENE[®]), 12.5 mg per dog PO q12h (moderate response)
 - 2) Buspirone (BUSPAR[®]), 10-20 mg per dog PO q8-12h (moderate to severe response)
 - 3) Alprazolam (XANAX[®]), 1-2 mg per dog PO q12h (moderate to severe response).
 - d. Direct the handler to provide support for the dog with social activity and play.
 - e. Direct the handler to provide work therapy by performing critical tasks in safe area, free from distress.
 - f. 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.
 - g. 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.
- 7. *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/counter-conditioning 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.

Joint Theater Trauma System Clinical Practice Guideline

APPENDIX O MANAGEMENT OF TRAINING AID TOXICOSES IN MILITARY WORKING DOGS

1. **Background.** 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.
 - a. 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).
 - b. 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.
2. **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.
 - a. 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).
 - b. Smokeless powder explosive. Ingestion may result in hypotension, CNS depression (ataxia, depressed mentation, incoordination), and methemoglobinemia (cyanosis, weakness, syncope, respiratory distress).
 - c. Potassium and sodium chlorate explosives. Ingestion may result in methemoglobinemia (cyanosis, weakness, syncope, respiratory distress), CNS abnormalities (ataxia, incoordination, depressed mentation), gastrointestinal irritation (nausea, vomiting, abdominal cramping and pain, hemorrhagic diarrhea (melena, hematochezia), hematuria and hemoglobinuria, and renal and liver failure.
 - d. 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.
 - e. Heroin. Ingestion may result in bradycardia, respiratory distress, miosis, coma, and sudden death.
 - f. Cocaine and amphetamines. Ingestion may result in restlessness, tachycardia, hyperexcitability, vocalization, excessive or unprovoked aggression, seizures, and mydriasis.
3. **Treatment of training aid toxicity.**
 - a. *If ingestion occurred \leq 4 hours before presentation **AND** the MWD is conscious and has normal CNS responses, the key initial step in management of any training aid ingestion is to induce vomiting.*
 - 1) *Apomorphine is the drug of choice to induce vomiting in the dog.*

Guideline Only/Not a Substitute for Clinical Judgment

March 2012

Joint Theater Trauma System Clinical Practice Guideline

- a) *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.*
- b) *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.*
- 2) ***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.***
- 3) ***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 and bite wounds to the HCP.*
- b. ***If the MWD ingested the training aid >4 hours before presentation, or has abnormal mentation or is unconscious or seizing, do not induce vomiting.** In these cases, the HCP must 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 [APPENDIX L](#)) 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.*
- c. ***The next critical step in management of any training aid toxicity is to administer activated charcoal.***
 - 1) *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 or Universal Animal Antidote (UAA) gel and may have initiated therapy prior to presentation.***
 - 2) *Activated charcoal WITH sorbitol as a cathartic is preferred.*
 - 3) *Repeat activated charcoal once in 4-6 hours. This dose should not include sorbitol.*
- d. ***If seizures are present or develop, treat the MWD with a benzodiazepine.***
 - 1) *Give midazolam (0.25 mg/kg IV or IN) or give diazepam (1 mg/kg IV, IN, or per rectum).*
 - 2) *Repeat in 10-15 minutes if seizures persist or recur.*
- e. ***If methemoglobinemia is suspected or confirmed and deemed causing significant respiratory distress, treat with methylene blue (if available).***
 - 1) *The dose for methylene blue 1% in the dog is 1-2 mg/kg IV slow bolus.*

Guideline Only/Not a Substitute for Clinical Judgment

March 2012

Joint Theater Trauma System Clinical Practice Guideline

- 2) This dose can be repeated once or twice if respiratory distress persists.
- 3) Methylene blue can cause severe Heinz body anemia in the dog, so monitor an HCT q6-8h if this drug is used.

Guideline Only/Not a Substitute for Clinical Judgment

March 2012

APPENDIX P EUTHANASIA OF MILITARY WORKING DOGS

1. 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 shock, and major abdominal evisceration injury, in addition to failure to respond to resuscitation, or rapid clinical deterioration with poor prognosis for recovery.
2. 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.
3. ***ALL euthanasia procedures will be performed humanely and in accordance with the American Veterinary Medical Association Guidelines on Euthanasia. Note that neuromuscular blocking agents are NOT an acceptable euthanasia agent,*** even when combined with other drugs.
4. In the deployed HCP setting, the following 3 options are recommended for canine euthanasia:
 - a. 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. Obviously, controlled substances management regulations apply.
 - 1) These products should be given by the IV route.
 - 2) The standard dose of these products is 1 mL per 10 pounds of body weight.
 - b. 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.
 - 1) Sodium pentobarbital best fits these criteria and is most widely used.
 - 2) The lethal pentobarbital dose for dogs is 40-60 mg/kg IV.
 - c. 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.
 - 1) Anesthetize the MWD as described in [APPENDIX L](#).
 - 2) Once anesthetized, rapid IV or IC administration of 1-2 mEq/kg KCL will cause cardiac arrest.

Guideline Only/Not a Substitute for Clinical Judgment

March 2012

Joint Theater Trauma System Clinical Practice Guideline

- 3) A typical dose for an average-sized MWD would be 30-40 mL of 2 mEq/ml KCl.
- 4) Bolus administration through IV catheter is the preferred route.
5. 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.
6. Whenever possible, a gross necropsy is recommended.
 - a. 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.
 - b. 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.
 - c. 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.
7. 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.

Joint Theater Trauma System Clinical Practice Guideline

APPENDIX Q AFTER-ACTION REVIEW OF MILITARY WORKING DOG EMERGENT CARE

1. To facilitate review of medical management in order to improve overall quality of care of MWDs, AARs should be submitted to the supporting veterinary unit for any incident in which HCPs provided emergent care to an MWD. To simplify reporting, the following format is recommended. AARs should be submitted within 48 hours of presentation of the MWD for care.
2. Format for AAR report:
 - a. Patient identification.
 - 1) MWD name, tattoo number (inner left ear)
 - 2) Handler name, rank, and unit of assignment
 - b. Unit/Location of HCPs.
 - c. Date/Time Group of presentation.
 - d. Synopsis of care.
 - 1) Signalment
 - 2) Diagnoses
 - 3) Treatment/procedures performed
 - 4) Outcome
 - e. Supporting documentation for care.
 - 1) What was the underlying reason for presentation of the MWD to the HCP instead of the supporting veterinary facility?
 - 2) At what point during care was an attempt made to contact the supporting veterinary personnel? IF the supporting veterinary personnel were not contacted, explain why contact was not possible, and explain if contact was attempted with any other veterinary personnel.
 - 3) How long did it take for the dog to be evacuated to a designated veterinary facility? What factors were involved in any delay in evacuation?
 - 4) Had any supporting HCPs received any prior training on emergent MWD care? IF prior training was received, who provided the training?
 - 5) Were interventions appropriate for the condition?
 - 6) Did complications or iatrogenic injury develop? If so, please explain what developed and discuss how they might have been prevented.

Guideline Only/Not a Substitute for Clinical Judgment

March 2012

APPENDIX R ADDITIONAL INFORMATION REGARDING OFF-LABEL USES IN CPGs

1. Purpose.

The purpose of this Appendix is to ensure an understanding of DoD policy and practice regarding inclusion in CPGs of “off-label” uses of U.S. Food and Drug Administration (FDA)–approved products. This applies to off-label uses with patients who are armed forces members and to MWDs.

2. Background.

Unapproved (i.e., “off-label”) uses of FDA-approved products are extremely common in American medicine and are usually not subject to any special regulations. However, under Federal law, in some circumstances, unapproved uses of approved drugs are subject to FDA regulations governing “investigational new drugs.” These circumstances include such uses as part of clinical trials, and in the military context, command required, unapproved uses. Some command requested unapproved uses may also be subject to special regulations.

3. Additional Information Regarding Off-Label Uses in CPGs.

The inclusion in CPGs of off-label uses is not a clinical trial, nor is it a command request or requirement. Further, it does not imply that the Military Health System requires that use by DoD health care practitioners or considers it to be the “standard of care.” Rather, the inclusion in CPGs of off-label uses is to inform the clinical judgment of the responsible health care practitioner by providing information regarding potential risks and benefits of treatment alternatives. The decision is for the clinical judgment of the responsible health care practitioner within the practitioner-patient relationship.

4. Additional Procedures.

- a. Balanced Discussion. Consistent with this purpose, CPG discussions of off-label uses specifically state that they are uses not approved by the FDA. Further, such discussions are balanced in the presentation of appropriate clinical study data, including any such data that suggest caution in the use of the product and specifically including any FDA-issued warnings.
- b. Quality Assurance Monitoring. With respect to such off-label uses, DoD procedure is to maintain a regular system of quality assurance monitoring of outcomes and known potential adverse events. For this reason, the importance of accurate clinical records is underscored.
- c. Information to Patients. Good clinical practice includes the provision of appropriate information to patients. For CPGs addressing human patient care, discussion of an unusual off-label use will occur that addresses the issue of information to patients. This aspect of off-label use is not applicable when dealing with MWDs.