Section 4: Canine Tactical Combat Casualty Care (C-TCCC)
1. General
   a. Trauma care guidelines have been implemented for human combatants in the U.S. military, but appropriate parallel guidelines have not been established for multipurpose canines (MPCs) used by the U.S. Special Operations Command. Canine Tactical Combat Casualty Care (C-TCCC) guidelines were developed to align recommendations for canines with published TCCC guidelines familiar to military personnel. These C-TCCC guidelines should assist in standardization of care to these unique patients, while evolving to apply updated knowledge or new technologies to tactical care of these unique force assets.

   b. Multipurpose canines (MPCs) are increasingly used by the U.S. Special Operations Command as a force multiplier, serving as team members due to their exceptional skills in personnel, explosive, and contraband detection. Tactical Combat Casualty Care (TCCC) guidelines have been developed and successfully implemented for human combatants, with documented reduction in lives lost. Training in TCCC has led to questions by Special Operations medics and other USSOCOM personnel regarding the applicability of TCCC guidelines to their canine counterparts.

   c. Historical and epidemiological data regarding disease and injury in working dogs is very important in determining conditions associated with high mortality. However, a formalized system of data collection for tracking battlefield medical injuries in MPCs has not been established due to the relatively new use of these assets by USSOCOM. Compared to humans, the different size, stature, locomotion, and proportional conformation of torso-limbs for dogs suggest that the anatomic location or nature of battlefield injury will also differ between humans and canines. Differences in physiology and pharmacokinetics between humans and canines also dictate review of guidelines before assuming general applicability.

   d. To improve field management of MPC medical issues and develop applicable guidelines, an initial meeting was held in Tampa, FL, at the 2009 Special Operations Medical Association (SOMA) conference to form a committee that would address this need and develop Canine-TCCC (C-TCCC) guidelines.

   e. For continuity and uniformity, these guidelines have been developed using the TCCC guidelines as a template. Phases of Care have been used consistent with the most current guidelines and includes Care Under Fire, Tactical Field Care, and Tactical Evacuation Care (combining MEDEVAC and CASEVAC Care). Major differences between canine and human care guidelines are emphasized.

   f. The C-TCCC Guidelines are found in Appendix H.

2. Hemostatic Agents
The benefits of hemostatic agents have been demonstrated in animal models, although not published specifically in a canine model. It is assumed that these benefits, as well as potential side-effects, would be similar for canine as for human combatants.
3. Pharyngeal and Surgical Airways
   a. Airway management in working canines must be balanced between the need for adequate patient ventilation and safety of individuals working on/near the canine patient. Human safety usually necessitates muzzling of the canine patient, but muzzling restricts airflow to the patient, interferes with cooling mechanisms (i.e. panting), and increases the risk of aspiration if the canine vomits. Muzzling may not be required if the patient is unconscious or sedated.

   b. Laryngeal mask airways are not designed to be used with the canine anatomy and are typically unable to establish the necessary seal for safe and effective use. Proper head and neck placement can facilitate airflow. As with human patients, pulling the MPC’s tongue forward can help open airways. Intubation should be attempted in the unconscious MPC before performing a surgical tracheotomy. Be prepared to remove the endotracheal tube if the MPC regains consciousness.

   c. Trauma to the head, pharynx, and/or larynx may compromise airflow and be life-threatening. Surgical tracheotomy may be indicated although placement of a large bore needle into the tracheal lumen may provide a sufficient supplemental air portal.

4. Tension Pneumothorax
   Thoracic trauma is common in working canines on the battlefield. Tension pneumothorax may be more rapidly fatal in the canine, compared to humans, due to the fenestrated mediastinum found in most dogs, resulting in bilateral lung collapse. Patients in distress from pneumothorax, regardless of cause, are best managed by evacuating free pleural air and therefore, reestablishing normal thoracic pressure gradients. Wounds or thoracic wall defects should be sealed and covered. The canine hair coat makes obtaining a proper chest seal difficult. Reinforcement with additional dressings may be required to ensure a proper seal. Free pleural air can be evacuated with a syringe attached to a stopcock and connector tubing (if available) and small-bore (14 gauge or less) catheter or needle. Care must be taken not to produce additional lung trauma during thoracocentesis. The use of chest tubes in the C-TCCC model is not recommended. This care should occur further up the echelons of care.

5. Intravenous (IV) Access and Intraosseous (IO) Infusion
   a. Hemorrhagic shock is a recognized need for fluid resuscitation. Special Operations medics may have training in emergency placement of IV fluids in canine patients, but IV placement may be difficult in shock due to vasoconstriction. Catheters or needles that are larger than 18-gauge are typically too large for placement in peripheral (leg) veins in canine casualties. Historically, fluid therapy at point of injury has not been instrumental in survival rates of MPCs due to rapid evacuation times. New mission profiles may make this capability necessary in the future.

   b. Intraosseous devices using a manubrium route, while proven successful in combat on human casualties, have had little evaluation or use in canine patients. Military veterinarians can advise and train SOF medics on canine anatomic landmarks to aid in the successful use
of IO devices in the tibial tuberosity, humeral head, or iliac crest. It is recommended that SOF medics do not place IO devices unless previously trained by a military veterinarian.

6. Fluid Resuscitation
Physiologic principles of fluid resuscitation are applicable to canine casualties. Colloid administration has been demonstrated to be effective in dogs and is used in civilian veterinary critical care. The effect of hetastarch products on platelet aggregation times has been documented in dogs, as in people, but its clinical impact is considered minimal and not a deterrent to judicious use.

7. Battlefield Antibiotics
The use of prophylactic antibiotics for canine patients with trauma and open wounds is routine, as it is with human patients. Antibiotic spectrum is generally similar as selected for human patients due to similarity in potential wound pathogens. Pharmacokinetics, e.g. absorption and excretion, of antibiotics in dogs often differs from humans. General extrapolations such as “Always use a human pediatric dose (e.g., for 35–40kg) for a working dog” or “Always use an adult human dose for an adult working dog” are invalid. The committee has sought to make recommendations in accordance with TCCC guidelines, making adjustments to ensure adequate systemic antibiotic concentrations in a typical MPC patient.

8. Battlefield Analgesics
Analgesia and pain management are advocated for the humane medical care of canine patients, but drug options are somewhat limited. Products beneficial in humans may be impractical for canine patients (e.g., oral transmucosal fentanyl citrate (OTFC) lozenges, or potentially toxic acetaminophen). Among analgesics available to combatants through routine medical supply channels, morphine was considered by the committee to be the most practical analgesic for battlefield use in canine patients. Due to marked differences in metabolism and effect of opiates between species, significantly higher doses of morphine are required for dogs than people (on a mg/kg basis). Morphine is considered a respiratory depressant in dogs, although there may be initial respiratory stimulation. Dogs are sensitive to the emetic effects of morphine, and handlers should be prepared to immediately remove the muzzle after morphine administration to reduce the risk of aspiration.

9. Oxygen Administration and Patient Monitoring
The committee recognized that oxygen support may not be available on or near the battlefield, and most canine casualties will not require oxygen in the phases of care addressed in these guidelines. The potential for thoracic trauma however necessitates prudent patient monitoring of oxygenation. Pulse oximetry, using instrumentation for human casualties, is considered an effective indirect measurement of oxygen saturation in critical canine patients. Oximeter readings, however, are impaired by the configuration of the sensor, hair, or poor peripheral vascular flow. Measurements should be taken on the tongue (most reliable), ear, prepuce, or vulva. If the patient is intubated, a handheld capnography device can be utilized on the end of the endotracheal or tracheotomy tube to monitor end tidal CO₂ and respirations.
10. Blood Products
Canine blood (erythrocyte) antigens compose more than a dozen blood group systems, which differ from human blood types. Limited product availability and projected need makes the use of prepared canine blood products impractical. A military veterinarian should perform an evaluation of major and minor incompatibility prior to performing a dog-to-dog transfusion. Non-military or native dogs should not be used as blood donors due to the risk of transmission of blood-borne parasites and disease transmission (e.g., leishmaniasis or rabies).

11. Hypothermia on the Battlefield
Hypothermia is a documented independent predictor of mortality in combat, and management of hypothermia has been added to recent TCCC guidelines. In the face of hypothermia, non-human mammals are generally more adept at maintaining core body temperature than humans. However, sedation, loss of consciousness, and trauma in MPCs can blunt these protective mechanisms. The smaller body size of canine patients facilitates the use of issued or improvised warming or protective blankets to keep the patient warm and dry.

12. Burns
Burn injury is infrequent in military dogs due to the lack of flammable clothing or outer garments and the protective nature of the dog’s natural haircoat. As such, the committee has elected to omit this topic as a part of guidelines for standard battlefield care. Burns on canine patients may be covered with dry, sterile dressings. Additional care includes preventing hypothermia, airway management, and providing aggressive fluid management and analgesia to the canine burn patient.

13. Tourniquets
   a. Tourniquet use is a recognized life-saving method in the TCCC guidelines, preventing exsanguination following vascular injury to the extremities. Canine extremities are a smaller proportion of body composition than in people, and while preliminary data shows that extremity injuries are the most common canine battlefield injury, they are less likely to be life threatening than a similar injury in a person. Tactical experience has shown that nearly all canine extremity bleeding can be controlled through the use of pressure dressings and hemostatic agents. Historically, tourniquets have rarely, if ever, been needed to control extremity bleeding in the MPC.
   
   b. Life-threatening exsanguinating injuries to canines are more likely to occur in non-compressible areas such as the thorax or abdomen. Furthermore, proper tourniquet application can be hindered by the tapered shape of the canine leg and the width of many commercially available tourniquets potentially carried by combatants, resulting in venous but not arterial occlusion.
   
   c. Commercially available tourniquets (e.g., combat application tourniquet or Special Operations force tactical tourniquet) can be effective in canine limb injury if properly placed and secured above a bony protuberance (e.g., olecranon or greater trochanter). Improvised tourniquets can also be applied successfully. Tourniquets should not remain in
place for more than 2 hours, and ideally less than one hour to minimize risk of peripheral neuropathy.

d. As noted in TCCC guidelines, appropriate training in tourniquet use on the battlefield is essential to their successful use. Canine handlers and medics should therefore understand the limitations and potential benefit of tourniquet use.

14. Input and Future Directions

a. These guidelines represent an important, but only an initial step, in support of MPCs. Feedback from handlers and first-responders is critical to properly adjust guidelines to current battlefield experiences and evidence-based medicine. USSOCOM veterinary personnel will be responsible for incorporation of the C-TCCC guidelines into appropriate training and training materials for the command.

b. Other DoD working dogs are ably supported by U.S. Army veterinary personnel, including clinical specialists at the DoD Military Working Dog Veterinary Services, Lackland AFB, TX, the Army Medical Department Center & School, Ft. Sam Houston, TX, U.S. Public Health Command, and the DoD Veterinary Services Activity. Representatives of these organizations serve on the C-TCCC committee to assist in harmonization of medical recommendations for all working dogs supporting U.S. armed forces.

c. This group will also help identify canine medical issues appropriate to military or civilian R&D efforts and resourcing.

15. MPC Resuscitative Care By Non-Veterinary Providers

a. MPC handlers will be trained to provide immediate lifesaving care for their dogs as outlined in the current Military Working Dog (MWD) Handler’s Handbook as published by the DOD MWD Veterinary Services at Lackland AFB, TX.

b. SOF medics will provide immediate lifesaving care, emergency, and nonemergency care to the MPC within the scope of veterinary practice for which they have been trained.

c. Advanced human healthcare providers (physicians, physician assistants, nurse practitioners, etc.) will only provide initial resuscitation of sick or combat-injured dogs in theater as outlined in the Clinical Management of Military Working Dogs Clinical Practice Guidelines (CPG) without veterinary supervision or oversight.

d. Human healthcare providers may provide other emergency and non-emergency care to MPCs only when supervised by, or at the direction of, a veterinarian.

e. Once the sick or injured MPC is stabilized, all efforts will be made to evacuate the MPC to the appropriate level of veterinary care.


g. Copies of the Military Working Dog Handler’s Handbook are available through the DOD MWD Veterinary Services located at Lackland AFB, TX, the local U.S. Army Veterinary Treatment Facility, or the Medical Detachment, Veterinary Services for deployed MPCs.
C-TCCC Guidelines

Care Under Fire: Actions taken while still engaged by the enemy.
1. Return fire/take cover
2. Expect Multi-Purpose Canine (MPC) casualty to remain engaged as a combatant, if appropriate.
3. Move MPC casualty to cover.
4. Muzzle the MPC casualty if airway is not compromised.
5. Try to keep the MPC casualty from sustaining additional wounds.
6. Remove from burning buildings or vehicles to relative safety if it does not endanger the force. Do what is necessary to stop the burning process.
7. Airway management is generally best deferred until the Tactical Field Care phase.
8. Stop life-threatening external hemorrhage if tactically feasible, using pressure bandages and hemostatic agents.

Tactical Field Care: Actions taken when no longer engaged by the enemy.
1. If not already done, muzzle the MPC casualty if airway is not compromised.
2. Airway management:
   a. Make sure the neck is reasonably straight; try to bring the head in-line with the neck.
   b. If MPC is unconscious, pull tongue forward to help open airway. If that is unsuccessful, attempt to intubate the MPC before performing a surgical tracheotomy.
   c. If previous measures are unsuccessful, perform needle or surgical tracheotomy (with lidocaine if conscious).
3. Respiration:
   a. Consider tension pneumothorax and decompress with needle thoracocentesis if casualty has torso trauma and respiratory distress.
   b. Sucking chest wounds should be treated by applying a chest seal during expiration and monitoring for development of a tension pneumothorax.
4. Circulation:
   a. Assess for unrecognized hemorrhage and control all sources of bleeding using pressure bandages or hemostatic agents if available.
5. Peripheral intravenous (IV) access:
   a. Start an 18-gauge IV or saline lock, if indicated, or if evacuation times are extended.
   b. If resuscitation is required and IV access is not obtainable, use the intraosseous (IO) route.
6. Fluid resuscitation:
   a. If not in shock: no IV fluids necessary.
   b. If in shock: colloids (250ml IV bolus), repeat once after 30 minutes if still in shock, no more than 500ml colloids.
   c. Continued efforts to resuscitate must be weighed against logistical and tactical considerations and the risk of incurring further casualties.
d. Reassess for fluid resuscitation for extended CASEVAC times.

7. Prevention of hypothermia:
   a. Minimize casualty’s exposure to the elements.
   b. Apply/wrap in a rescue or heat blanket, as needed.
   c. If mentioned gear is not available, use dry blankets, poncho liners, sleeping bags, body bags, or anything that will retain heat and keep the casualty dry.

8. Monitoring:
   a. Pulse oximetry should be available as an adjunct to clinical monitoring.
   b. Place on tongue, ear, flank, or other nonpigmented, highly vascular (hairless) area.
   c. Readings may be misleading in the settings of shock or marked hypothermia.
   d. If dog is intubated, use a handheld capnography device to monitor end tidal CO₂ and respirations.

9. Inspect and dress known wounds.

10. Check for additional wounds.

11. Analgesia, sedation and patient control as necessary.
   a. Morphine sulfate, 30–50mg IM, (primary analgesia), monitor for respiratory depression.

   Caution: Morphine can cause vomiting. Be prepared to remove muzzle.

12. Splint fractures and recheck pulse of the affected limb.

13. Antibiotics: recommended for all open combat wounds.
   a. If able to take PO: Moxifloxacin (400mg orally qd).
   b. If unable to take PO (shock, unconsciousness): Cefotetan, 1g IV (slow push over 3–5 minutes) or IM every 8 hours, or Ertapenam, 0.5g IV or IM every 12 hours.

14. Cardiopulmonary resuscitation should not be attempted as it is rarely effective due to:
   a. Massive noncompressible thoracic hemorrhage
   b. Massive noncompressible abdominal hemorrhage
   c. Severe head injury leading to respiratory and cardiac arrest
   d. Massive pulmonary contusions leading to respiratory and cardiac arrest
   e. Tension pneumothorax, which should be treated by needle decompression

15. Document clinical assessments, treatments rendered, and changes in casualty’s status. Forward this information with the MPC casualty to the next level of care.

Tactical Evacuation (TACEVAC) Care:

Actions taken when the injured patient is being evacuated from the point of injury.

1. Airway management:
   a. Make sure the neck is reasonably straight; try to bring the head in-line with the neck.
      If the MPC is unconscious, pull tongue forward to help open airway. If that is unsuccessful, attempt to intubate the MPC before performing a surgical tracheotomy.
   b. If measures above are unsuccessful, perform a surgical tracheotomy (with lidocaine if conscious).
2. Respiration:
   a. Consider tension pneumothorax and decompress with needle thoracocentesis if casualty has torso trauma and respiratory distress.
   b. Most MPC casualties do not require oxygen, but administration of oxygen may be of benefit.
   c. Open, or sucking, chest wounds require that a chest seal is applied during expiration and monitoring for development of a tension pneumothorax.
3. Circulation:
   a. Assess for unrecognized hemorrhage and control all sources of bleeding using pressure bandages or hemostatic agents as needed.
4. Peripheral IV access:
   a. Reassess need for peripheral IV access – if indicated, start an 18-gauge IV or saline lock; if resuscitation is required and IV access is not obtainable, use IO route.
5. Fluid resuscitation:
   a. Reassess for hemorrhagic shock; altered mental status (in the absence of brain injury), and change in pulse character.
   b. If not in shock: no IV fluids necessary.
   c. If in shock: colloids (250ml IV bolus), repeat once after 30 minutes if still in shock, no more than 500ml colloids.
6. Prevention of hypothermia:
   a. Minimize casualty’s exposure to the elements.
   b. Continue heat or rescue blanket(s), but limit warming of TBI casualties.
   c. Utilize portable fluid warmers on all IV sites if possible.
   d. Protect the casualty from wind if doors must be kept open.
7. Monitoring:
   a. Institute electronic monitoring of pulse oximetry and vital signs if indicated.
8. Inspect and dress known wounds if not already done.
9. Check for additional wounds.
10. Analgesia, sedation and patient control as necessary.
    
    **Caution:** Morphine can cause vomiting. Be prepared to remove muzzle.
11. Reassess fractures and recheck pulses of the affected limb(s).
12. Antibiotics: recommended for all open combat wounds.
    a. If able to take PO: moxifloxacin (400mg orally qd).
    b. If unable to take PO (shock, unconsciousness): Cefotetan, 1g IV (slow push over 3–5 minutes) or IM q 8 hours, or ertapenem, 0.5g IV or IM q 12 hours.
13. Document clinical assessments, treatments rendered, and changes in casualty’s status. Forward this information with the MPC casualty to the next level of care.