The relevance of Tactical Combat Casualty Care (TCCC) guidelines to civilian law enforcement operations

By Kevin B. Gerold, DO, JD; Capt. Mark Gibbons, EMT-P; and Sean McKay, EMT-P

The National Tactical Officers Association (NTOA) endorses and supports the incorporation of a well-trained and equipped Tactical Emergency Medical Support (TEMS) element into all tactical teams.[1] TEMS is the provision of preventative, urgent and emergent medical care during high-risk, extended duration, and mission-driven law enforcement special operations. Just as law enforcement special operations teams have responded to changing patterns of violence and criminal activity by adopting military-style weapons and tactics, TEMS providers are turning to military-style medical practices when conventional EMS practices fail to address the needs of these unconventional law enforcement missions.

States such as Maryland and major cities such as Dallas are responding to the needs of the law enforcement special operations community by adopting expanded practices to their EMS practice guidelines to accommodate the unique needs of emergency medical providers supporting law enforcement and special operations.

Tactical Combat Casualty Care (TCCC) guidelines currently form the basis for combat trauma training within the US Special Operations Command. First implemented more than 10 years ago and recently updated, these guidelines were developed when it became apparent that civilian pre-hospital medical care models, including Advanced Trauma Life Support (ATLS), Basic Trauma Life Support (BTLS) and Advanced Cardiac Life Support (ACLS) were unsatisfactory models for providing care during combat missions.

In 1993, the Naval Special Warfare Command began researching combat associated deaths due to penetrating trauma. This study was later assumed by the United States Special Operations Command (USSOCOM) and their results were published in a supplement to *Military Medicine* in 1996 (Butler, F.K. Jr., 1996). The findings from this study became the foundation for a combat trauma curriculum intended to combine good medical care with good small unit tactics. The premier course was first taught by the Navy Bureau of Medicine and Surgery in 1996 during the Undersea Medical Officer's Course and was later adopted by the Navy SEALs. This course has been tested during combat operations, updated periodically, and now represents the best practices for providing care during combat missions. This course is now taught to soldiers throughout the Department of Defense.

During conventional ground combat operations, most deaths (85%) result from catastrophic wounds (Table 1). Regrettably, no amount of modern medical care can save these soldiers. TCCC directs medical resources to caring for the remaining 15% of injured soldiers, who, when treated aggressively, will survive their wounds. Most of these (60% of preventable or 9% of all ground combat deaths) result from exsanguinating extremity hemorrhage amenable to a tourniquet or direct pressure. Other causes of preventable injuries include tension pneumothorax (33% of preventable or 5% of all deaths) from penetrating chest trauma, and from maxillofacial trauma causing airway obstruction (6% of preventable or 1% of all deaths). Advances in medical care, personal and vehicular armor, changing tactics, and the widespread use of improvised explosive devices by opposition forces in Iraq and Afghanistan are changing these numbers slightly.[2, 3]

Despite the evolving characteristics of warfare, the vast majority of potentially survivable deaths due to injuries

sustained in combat remain compressible extremity hemorrhage, readily controllable with tourniquets, direct pressure and hemostatic agents.[4] The lessons outlined in TCCC remain valid; the success of medical care provided during active combat operations must incorporate good small unit tactics to minimize the risk of incurring additional casualties, and initial lifesaving care requires a small number of simple interventions and requires minimal equipment.

As law enforcement programs incorporate TEMS into their special operations missions, EMS medical directors are increasingly asked by law enforcement commanders to expand or modify existing pre-hospital care guidelines so that EMS providers can support law enforcement missions. While we recognize that civilian law enforcement operations differ significantly from active combat operations, we believe that TCCC should serve as a foundation for TEMS protocols, practices and training. Medical directors should incorporate relevant aspects of the TCCC guidelines into their TEMS program. To assist medical directors with developing TEMS protocols, we are publishing the recently updated version of the TCCC guidelines with minimal editorial comment.

TCCC divides the care rendered during active combat operations into three phases:

Care Under Fire: The initial medical care provided to a casualty when operators remain under effective fire by a hostile opposition force.

Tactical Field Care: The initial care provided by medical providers after effective hostile fire has ended, often in austere conditions.

Tactical Evacuation Care: The care provided during transport to a trauma hospital and which most closely resembles conventional civilian EMS operations.

Included in this article are the "TCCC Guidelines for Care Under Fire and Tactical Field Care." Thecomplete version of the "TCCC Guidelines" (including Tactical Evacuation Care guidelines) is available in NTOA's reference library or online at http://www.usaisr.amedd.army.mil/tccc.html.

Basic plan for Care Under Fire

1. **Return fire and take cover.**
2. **Direct or expect casualty to remain engaged as a combatant, if appropriate.**
3. **Direct casualty to move to cover and apply self-aid, if able.**
4. **Try to keep the casualty from sustaining additional wounds.**
5. **Airway management is generally best deferred until the Tactical Field Care phase.**
6. **Stop life-threatening external hemorrhage if tactically feasible:**
    a. Direct casualty to control hemorrhage by self-aid, if able.
    b. Use a CoTCCC-recommended tourniquet for hemorrhage that is anatomically amenable to tourniquet application.
    c. Apply the tourniquet proximal to the bleeding site, over the uniform, tighten and move the casualty to cover.

Authors' note: *Contrary to the many stereotypes surrounding penetrating wounds, most non-lethal injuries sustained during active operations do not incapacitate the operator or prevent him from remaining in the operation. If injured while under fire, casualties should attempt to remain in the fight, take cover, provide their own initial care and control severe hemorrhage, then re-engage and assist their unit with neutralizing continued active threats. Team members and medics in this phase can assist casualties with seeking cover and may render self-aid or buddy-aid to control severe hemorrhage using tactics that minimize the chance that other members of the team will sustain additional casualties.*

During training, instructors should avoid creating training scars by running operators through scenarios during which they incur incapacitating injuries. Effective training should reinforce that operators can quickly render care self-care or assist their teammates and continue in the mission. Consider using non-operator role players as casualties when scenarios include injuries that would make continuing in an active operation impossible.

The physical and mental stress associated with active operations is known to impair decision-making and will degrade fine and complex motor skills, thus impairing the ability to perform medical procedures.[5] TEMS providers should prepare for these effects by participating in reality-based training that limits the number of decisions for providing care, simplifies the types of interventions and incorporates atypical scenarios.

Basic plan for Tactical Field Care

1. **Casualties with an altered mental status should be disarmed immediately.**
2. **Airway management**
    a. Unconscious casualty without airway obstruction:
        - Chin lift or jaw thrust maneuver
        - Nasopharyngeal airway
        - Place casualty in recovery position
    b. Casualty with airway obstruction or impending airway obstruction:
        - Chin lift or jaw thrust maneuver
        - Nasopharyngeal airway
        - Allow casualty to assume any position that best protects the airway, to include sitting up
        - Place unconscious casualty in recovery position

        If previous measures unsuccessful:
        - Surgical cricothyroidostomy (with lidocaine if conscious)

Authors' note: *Armed law enforcement operators who become injured and exhibit changes in their mental status due to shock, traumatic brain injury or hypoxemia lose their ability to interpret events around them and become incapable of making the proper judgments about threats and the use of their weapons. For this reason, disarming cognitively impaired casualties should occur promptly and the weapons rendered safe.*

When compared to conventional EMS operations, unstable injuries to the cervical spine are uncommon in penetrating injury and assume a lower priority than caring for exsanguinating hemorrhage or airway obstruction. Cervical spine injury remains a significant priority in casualties sustaining blast injuries or blunt force mechanisms such as falls or motor vehicle crashes.

Endotracheal intubation is a procedure generally deferred until the Tactical Evacuation phase of care or when hand-off to EMS occurs. In a six-year study of 1480 patients intubated in an urban trauma system, 486 were intubated without drugs. Of these, only one (0.2%) survived. The authors concluded that the easy passage of a tracheal tube without sedation or paralysis required a patient to be profoundly unconscious and this condition predicted a poor outcome and suggests a limited use for this procedure in austere conditions.[6] *During civilian operations, less invasive alternatives to cricothyroidostomy or endotracheal intubation include the King Airway, the Combi-Tube Airway and the Laryngeal Mask Airway (LMA).*

3. Breathing

a. In a casualty with progressive respiratory distress and known or suspected torso trauma, consider a tension pneumothorax and decompress the chest on the side of the injury with a 14-gauge, 3.25 inch needle/catheter unit inserted in the second intercostal space at the midclavicular line. Ensure that the needle entry into the chest is not medial to the nipple line and is not directed towards the heart.

b. Treat all open and/or sucking chest wounds by immediately applying an occlusive material to cover the defect and securing it in place. Monitor the casualty for the potential development of a subsequent tension pneumothorax.

Authors' note: *Tension pneumothorax from penetrating wounds to the chest is believed to cause about one-third of preventable combat associated deaths. In patients sustaining a penetrating chest wound who then go on to show signs of progressive respiratory distress, performing needle decompression poses little danger of causing further injury and can be lifesaving. In its later stages, tension pneumothorax looks clinically similar to hypovolemic shock. Needle decompression of the chest is a skill that can be taught to first responders. Recent studies measuring chest wall thickness have shown that the catheter used to decompress a chest should be at least 3.25 inches (8 cm). In a study of 110 patients admitted to a Level 1 trauma center, computerized tomography (CT) scanning measured the chest wall thickness of the second intercostal space in the mid-clavicular line to be 4.5 cm (+/- 1.5 cm) on the right, and 4.1 cm (+/- 1.4 cm) on the left. 50% of patients in this study had a chest wall thickness measuring over 4.4 cm (1.75 in). These authors concluded that among a general civilian population, a standard 5 cm (2-inch) angiocatheter would likely be unsuccessful at reaching the pleural space in 50% of patients.*[7] *In a similar study of patients who may better represent the law enforcement special operations community, CT scanning was used in 100 male military personnel to measure the chest wall thickness at the second intercostal space in the midclavicular line. The mean perpendicular thickness was 4.86 cm (SD 1.10 cm). As expected, the chest wall thickness of these men was greater than the general civilian population. These authors concluded that an 8 cm angiocatheter would have reached the pleural space in 99% of subjects.*[8]

4. Bleeding

a. Assess for unrecognized hemorrhage and control all sources of bleeding. If not already done, use a CoTCCC-recommended tourniquet to control life-threatening external hemorrhage that is anatomically amenable to tourniquet application or for any traumatic amputation. Apply over clothing has high on the extremity as possible.

b. For compressible hemorrhage not amenable to tourniquet use or as an adjunct to tourniquet removal (if evacuation time is anticipated to be longer than two hours), use Combat Gauze as the hemostatic agent of choice. Combat Gauze should be applied with at least three minutes of direct pressure.

c. Before releasing any tourniquet on a casualty who has been resuscitated for hemorrhagic shock, ensure a positive response to resuscitation efforts [i.e., a peripheral pulse normal in character and normal mentation if there is no traumatic brain injury (TBI)].

d. Reassess prior tourniquet application. Expose wound and determine if tourniquet is needed. If so, move tourniquet from over uniform and apply directly to skin 2-3 inches above wound. If tourniquet is not needed, use other techniques to control bleeding.

e. When time and the tactical situation permit, a distal pulse check should be accomplished. If a distal pulse is still present, consider additional tightening of the

tourniquet or the use of a second tourniquet, side-by-side and proximal to the first, to eliminate the distal pulse.

f. Expose and clearly mark all tourniquet sites with the time of tourniquet application. Use an indelible marker.

Authors' note: *While EMS medical directors express concern about the appropriate use and safety of tourniquets, their ability to increase survival in casualties sustaining combat associated major limb trauma is well established and concerns that their widespread use may cause additional injury and increase limb morbidity is unsubstantiated.*[9, 10]

The updated TCCC guidelines include two new hemostatic agents, Combat Gauze and WoundStat. These agents were proven superior to the previously recommended hemostatic agents HemCon and QuikClot for controlling severe hemorrhage in animal models. In December 2008, Dr. Bijan Kheirabadi at USAISR presented his additional research on the safety aspects of WoundStat and Combat Gauze at the Special Operations Medical Association meeting in Tampa, Fla. His research concluded that "WoundStat treatment of the injured vessels resulted in development of occlusive thrombi in carotid arteries (7 of 8) and jugular veins (6 of 8) two hours after surgical repair and blood reflow. There was evidence of WoundStat residues and emboli in the lungs of two animals as well." As a result of these findings, a review of the safety aspects of WoundStat was conducted at a meeting of the Committee on Tactical Combat Casualty Care held on February 3, 2009. Dr. Kheirabadi again presented his new research findings and noted that the histology from the WoundStat-treated vessels in his recent study demonstrated evidence of endothelial toxicity. Following the review, the Committee removed WoundStat from the TCCC Guidelines, leaving Combat Gauze as the hemostatic agent of choice.[11]

5. Intravenous (IV) access

a. Start an 18-gauge IV or saline lock if indicated.

b. If resuscitation is required and IV access is not obtainable, use the intraosseous (IO) route.

6. Fluid resuscitation

Assess for hemorrhagic shock; altered mental status (in the absence of head injury) and weak or absent peripheral pulses are the best field indicators of shock.

a. If not in shock:
- No IV fluids necessary
- PO fluids permissible if conscious and can swallow

b. If in shock:
- Hextend, 500-mL IV bolus
- Repeat once after 30 minutes if still in shock
- No more than 1000 mL of Hextend

c. Continued efforts to resuscitate must be weighed against logistical and tactical considerations and the risk of incurring further casualties.

d. If a casualty with traumatic brain injury (TBI) is unconscious and has no peripheral pulse, resuscitate to restore the radial pulse.

7. Prevention of hypothermia

a. Minimize casualty's exposure to the elements. Keep protective gear on or with the casualty if feasible.

b. Replace wet clothing with dry if possible.

c. Apply Ready-Heat Blanket to torso.

d. Wrap in Blizzard Rescue Blanket.

e. Put Thermo-Lite Hypothermia Prevention System Cap on the casualty's head, under the helmet.

f. Apply additional interventions as needed and available.

g. 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. Penetrating eye trauma

If a penetrating eye injury is noted or suspected:

a. Perform a rapid field test of visual acuity.

b. Cover the eye with a rigid eye shield (NOT a pressure patch).

c. Ensure that the 400mg moxifloxacin tablet in the combat pill pack is taken if possible and that IV/IM antibiotics are given as outlined below if oral moxifloxacin cannot be taken.

9. Monitoring

Pulse oximetry should be available as an adjunct to clinical monitoring. Readings may be misleading in the settings of shock or marked hypothermia.

10. Inspect and dress known wounds.

11. Check for additional wounds.

12. Provide analgesia as necessary.

a. Able to fight:
- Meloxicam (Mobic), 15mg PO once a day; Meloxicam is an NSAID
- Acetaminophen (Tylenol), 650mg bi-layer caplet, 2 PO every 8 hours

These medications should be carried by the combatant and self-administered as soon as possible after the wound is sustained.

b. Unable to fight:
- Does not otherwise require IV/IO access

- Oral transmucosal fentanyl citrate (Actiq), 800 mcg transbucally
- Recommend taping lozenge-on-a-stick to casualty's finger as an added safety measure
- Reassess in 15 minutes
- Add second lozenge, in other cheek, as necessary to control severe pain
- Monitor for respiratory depression
- IV or IO access obtained:
  - Morphine sulfate, 5mg IV/IO
  - Reassess in 10 minutes
  - Repeat dose every 10 minutes as necessary to control severe pain
  - Monitor for respiratory depression
- Promethazine (phenergan), 25mg IV/IM/IO every 6 hours as needed for nausea or for synergistic analgesic effect *Have naloxone (Narcan) readily available whenever administering opiates.*

Authors' note: *May substitute ondansetron (Zofran) for promethazine. The dose of ondansetron is 4 mg IV/IM/PO repeated every four hours, as needed.*

13. Splint fractures and recheck pulse.

14. Antibiotics are recommended for all open combat wounds.

a. If able to take PO:
   - Moxifloxacin (Avelox), 400mg PO every 24 hours

b. If unable to take PO (shock, unconsciousness):
   - Cefotetan, 2g IV (slow push over 3-5 minutes) or IM every 12 hours or
   - Ertapenem (Invanz), 1g IV/IM once a day

15. Communicate with the casualty if possible
- Encourage; reassure
- Explain care

16. Cardiopulmonary resuscitation (CPR)
Resuscitation on the battlefield for victims of blast or penetrating trauma who have no pulse, no ventilations and no other signs of life will not be successful and should not be attempted.

17. Documentation
Document clinical assessments, treatments rendered and changes in the casualty's status on a TCCC Casualty Card.

Endnotes

1. NTOA Position Statement on TEMS, *The Tactical Edge*, Summer 2007.

2. Bellamy R.F.: Presentation to the Joint Health Services Support Vision 2010 Working Group. September 1996.

3. Bellamy R.F.: *Military Medicine*. Vol. 149 No.2, February 1984.

4. Kelly J.F., Ritenour A.E., McLaughlin D.F., et al. "Injury severity and causes of death from operation Iraqi Freedom and Operation Enduring Freedom: 2003—2004 versus 2006." *J Trauma* 2008; 64:S21—S27.

5. Siddle B.K. "Sharpening the warrior's edge." *The psychology and science of training*, 9th ed. Belleville, IL: PPCT Management Systems, 2006.

6. Lockey D., Davies G., Coats T. "Survival of trauma patients who have prehospital tracheal intubation without anesthesia or muscle relaxants: observational study." *BMJ* 323; 141.

7. Stevens R.L., Rochester A.A., Busko J., et al. "Needle thoracostomy for tension pneumothorax: failure predicted by chest computed tomography." *Prehospital Emergency Care*, 13:1, 14-17.

8. Harcke H.T., Pearse L.A., Levy A.D., Getz H.M., and Robinson S.R.. "Chest Wall Thickness in Military Personnel: Implications for Needle Thoracentesis in Tension Pneumothorax." *Military Medicine*, Vol. 172. December 2007.

9. Kragh J.F. Jr, Baer D.G., Walters T.J. "Extended (16-hour) tourniquet application after combat wounds: a case report and review of the current literature." *J Orthop Trauma*. 2007; 21:274 –278.

10. Kragh J.F. Jr., Walter T.J., Baer D.G., et al. "Practical use of emergency tourniquets to stop bleeding in major limb trauma." *J Trauma*. 2008; 64:S38--S50.

11. Butler, F. Committee on Tactical Combat Casualty Care (CoTCCC) "Hemostatic Agents in TCCC." *The JTTS Newletter*. Volume 1, No. 4. Winter 2009. http://www.usaisr.amedd.army.mil/jtts_nl.html#, Accessed June 17, 2009.

About the authors

Kevin B. Gerold, DO, JD, MA (Ed), has served as the program medical director and tactical physician for the Maryland State Police's Tactical Medical Unit since 1998. He is currently the director of critical care medicine for the Surgical and Burn Intensive Care Units at the Johns Hopkins Bayview Medical Center in Baltimore, MD. A physician and attorney, he specializes in anesthesiology and critical care medicine, and has been actively involved in trauma resuscitation and care, the emergency medical transportation of critically ill patients and the development of EMS policy and systems since he first began providing medical care as an EMT-A in 1972.

Captain Mark E. Gibbons is a 19-year veteran of the Maryland State Police and currently serves as the commander of the Education and Training Division. Captain Gibbons has served in operational and command positions within the Aviation Command, Field Operations Bureau and Special Operation Division. He has been involved with Tactical Emergency Medicine Support (TEMS) since 1986 and serves as an NTOA TEMS instructor.

Sean McKay, EMT-P, served as a firefighter/paramedic and SWAT Rescue-Medic team leader until 2006. During this time he created the Immediate Reaction Team (IRT) methodology for high-threat operator/officer extraction and instructed both DoD and civilian special operations in Tactical Combat Casualty Care and High Threat Extraction. He joined The Asymmetric Combat Institute (ACI) as an associate in 2009. Mr. McKay has taught for the NTOA since 2006.

The complete version of the TCCC Guidelines (including Tactical Evacuation Care guidelines) is available in NTOA's resource library and on the Web site at www.ntoa.org or online at http://www.usaisr.amedd.army.mil/tccc.html.