

# TACTICAL COMBAT CASUALTY CARE: FROM THE BATTLEFIELDS OF AFGHANISTAN AND IRAQ TO THE STREETS OF AMERICA

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Photos courtesy of Jason R. Pickett, MD, EMT-P/T



The care provided by medical personnel in combat is often accomplished under the most difficult conditions imaginable. The challenges faced by medics, corpsmen and pararescuemen (PJs) in caring for their wounded teammates on the battlefield are legendary and may include an ongoing engagement with hostile forces, darkness, equipment limitations, environmental extremes and lengthy evacuation delays. The physicians who supervise these warrior

medics face the different but also daunting challenge of defining best practice guidelines for this unique subset of trauma patients. There is no ability to rely on carefully performed randomized, controlled trials to provide definitive answers to the medical decisions required in battlefield trauma care. Knowledge of the prehospital trauma literature and expert tactical medicine judgment must be combined to develop best practice guidelines for this setting.

It is noteworthy that historically, especially during and after war, military medicine has significantly advanced the science and best practices around resuscitation and care of the injured. These advances often took decades to reach and be assimilated into the civilian EMS' practices. For the last decade the Committee on Tactical Combat Casualty Care (CoTCCC) has worked diligently to rapidly develop, vet and accelerate the transfer of evolving military medicine best practices to the civilian EMS and TEMS community. A comprehensive review of TEMS and its evolution pre-CoTCCC is available in "Topics of Emergency Medicine" (Carmona et al. 2003).

## Origins of TCCC

Most combat casualties die before ever reaching a hospital. In the mid-1990s, a Special Operations medical research project was undertaken with the goal of improving combat trauma outcomes by optimizing the care rendered in the tactical prehospital environment. This project produced a paper entitled "Tactical Combat Casualty Care in Special Operations" (Butler 1996) which was published as a supplement to the journal *Military Medicine* in August 1996. This original TCCC paper included a proposed set of prehospital trauma care guidelines that were customized for use on the battlefield. These guidelines were

developed both through analysis of the most common historical causes of preventable death in combat and through consultation with subject matter experts. Innovations proposed in this paper included:

- Recognition of the need to combine good tactics and good medicine
- Dividing battlefield trauma care into three phases:
  - Care Under Fire
  - Tactical Field Care
  - Casualty Evacuation (CASEVAC) Care
- Aggressive use of tourniquets for life-threatening extremity bleeding
- Tactically appropriate fluid resuscitation
- Improved battlefield analgesia
- Use of nasopharyngeal airways when feasible
- Surgical airways for maxillofacial trauma with airway compromise
- Aggressive needle thoracostomy for tension pneumothorax
- Battlefield antibiotics
- Scenario-based combat trauma training

TCCC was implemented as the standard of care for battlefield trauma by the Navy SEALs and the Army Rangers in 1997 (Richards 1997; Butler 2001; Kotwal et al. 2011), while most conventional forces and most Special Operations forces did not immediately implement either. In 1998, Ranger surgeons and medics briefed TCCC information to then-Colonel Stanley McChrystal, Commander of the 75<sup>th</sup> Ranger Regiment, who in turn made soldier response to casualties, including tourniquets, one of four essential components of training for all Rangers (Kotwal et al. 2011).

When U.S. forces went to war in Afghanistan in 2001, with the exceptions noted above, they went without the battlefield tourniquets commonly used today and without TCCC training. Studies performed by the U.S. Army Institute of Surgical Research (USAISR) examining causes of preventable death on the battlefield in the

early years noted a significant incidence of deaths on the battlefield that were potentially preventable had basic TCCC measures been employed (Holcomb 2007, Kelly 2008). Early efforts to transition tourniquets and other aspects of TCCC were undertaken by USSOCOM and USAISR and led the way for wider use of TCCC by U.S. forces (Butler 2005).

### **The Committee on TCCC**

The triservice Committee on TCCC (CoTCCC) was begun in 2001 as a U.S. Special Operations Command biomedical research effort to ensure that emerging technology and information is incorporated into the TCCC Guidelines on an ongoing basis. Membership includes combat medics as well as physicians and physician assistants. The CoTCCC was first established at the Naval Operational Medicine Institute and was supported by the Navy Bureau of Medicine and Surgery (BUMED) from 2004 through 2009. In 2007-2010, the Office of the Surgeon General of the Army and the U.S. Army Institute of Surgical Research also provided strong support for the activities of the CoTCCC.

Innovations incorporated into battlefield trauma care by the CoTCCC included the recognition of the CAT and SOFT-T tourniquets as the battlefield tourniquets of choice, the use of hemostatic agents (initially HemCon and now Combat Gauze) for external hemorrhage not amenable to tourniquet use, use of intraosseous access when peripheral IV access cannot be obtained, hypotensive fluid resuscitation with Hextend, fentanyl citrate (800ug oral transmucosal lozenges) as an alternative for battlefield analgesia, moxifloxacin and ertapenem as updated antibiotic options, meloxicam and extended-release acetaminophen for non-narcotic battlefield analgesia when appropriate, hypothermia prevention, guidelines for the battlefield management of wounded hostile combatants, and 1:1 plasma:PRBC fluid resuscitation in the Tactical Evacuation Care phase of care (Butler 2010).

In 2007, because of the increasing recognition of the success of TCCC in the conflicts in Iraq and Afghanistan and widespread use of TCCC by the U.S. military, the CoTCCC was realigned at the direction of the Assistant Secretary of Defense for Health Affairs to function as a subgroup of the Trauma and Injury Subcommittee of the Defense Health Board (DHB). The DHB is the senior external medical advisory group to the Secretary of Defense. TCCC is now recognized by the Defense Health Board to be the standard of care for managing combat trauma on the battlefield (Dickey 2011, Wilensky 2009) and is used by all services in the U.S. military and most of our coalition partner nations to train combat medical personnel in this area.

### **Saving lives on the battlefield**

Multiple reports published in the medical literature and collected from combat first responders have documented that TCCC is saving lives on the battlefield and is improving the tactical flow of missions during which casualties have occurred. Kragh's studies of tourniquet use in Iraq and Afghanistan have documented a remarkable incidence of lives saved with prehospital tourniquet use without causing preventable loss of limb from tourniquet ischemia (Kragh 2008, 2009). The Defense Health Board memo of 6 August 2009 noted that several Special Operations units that have trained all of their combatants in TCCC since before the onset of the current conflicts have now reported that they have had no preventable battlefield fatalities in their units for the entire duration of the conflicts, an unprecedented accomplishment in battlefield trauma care. This DHB memo recommended TCCC training for all deploying combatants and medical department personnel (Wilensky 2009).

A letter from Dr. Jeff Salomone (Prehospital Trauma Chair for the American College of Surgeons Committee on Trauma) to the Assistant Secretary of Defense for Health Affairs on 10 June 2008

stated: “I am writing to offer my congratulations for the recent dramatic advances in prehospital trauma care delivered by the U.S. military. Multiple recent publications have shown that Tactical Combat Casualty Care is saving lives on the battlefield.”

A recent paper by Mabry and McManus from the Army Medical Department Center and School has noted that “the new concept of Tactical Combat Casualty Care has revolutionized the management of combat casualties in the prehospital tactical setting” (Mabry 2008).

Lt. Col. Russ Kotwal has just published a study that describes the experience of the 75<sup>th</sup> Ranger Regiment with TCCC over 10 years of intense combat operations. The title of the paper is “Eliminating Preventable Death on the Battlefield.” It’s named that because that’s what the Rangers have done with their TCCC program. This *Archives of Surgery* paper documents the lowest preventable death rate among their battle casualties ever reported in a major conflict. The Rangers did not have one preventable death in 10 years that was due to a failure of prehospital trauma care (Kotwal 2011).

### TCCC in civilian trauma care

Some aspects of TCCC (the use of tourniquets to control extremity hemorrhage, the use of hemostatic agents to control external, non-extremity bleeding) have clear application in civilian trauma care, while other aspects of TCCC may not. Much depends on which specific civilian trauma context is being considered (urban EMS, tactical EMS, rural EMS, wilderness medicine).

The principles of TCCC were included in a new military trauma care chapter of the *Fourth Edition of the Prehospital Trauma Life Support Manual* in 1998. Through the leadership of Dr. Norman McSwain, a strong partnership has developed between the CoTCCC, the American College of Surgeons Committee on Trauma, the National Association of Emergency Medical Technicians and the Prehospital Trauma Life Support Executive Council. There is now a military edition of the *PHTLS* manual



that focuses on the principles of TCCC and other military-specific topics. Some of the successes noted in TCCC are gaining increasing acceptance in civilian trauma care systems, including tourniquets, hemostatic agents, intraosseous devices, hypotensive resuscitation, and modified spinal protection techniques for penetrating injury to the head and neck. Dialogue between the ACS COT, the PHTLS Executive Council, and the CoTCCC is extensive and ongoing. Many of the principles of care recommended by TCCC have also been incorporated into wilderness trauma care practice (Auerbach 2007).

The CoTCCC has been following the transition of TCCC concepts into civilian prehospital practice. Dr. Steve Flaherty, a CoTCCC member, now a civilian trauma surgeon at Cape Fear Valley Hospital in Fayetteville, NC, noted that their hospital had just received a patient who bled to death from a brachial artery injury caused by a knife wound. In a follow-up email dated 16 March 2011, Dr. Flaherty noted that there was a recent presentation at the University of North Carolina Medical

Center in which the front seat passenger in a small plane crash had suffered bilateral traumatic below-the-knee amputations, but had survived because two Special Forces medics had responded to the scene and quickly applied field-expedient tourniquets. The patient arrived at the Emergency Department alert and fully oriented. UNC is now moving to add tourniquets to their prehospital trauma protocols.

Mr. Mark Lueder, who is a paramedic from Chicago, also reported at a recent CoTCCC meeting that the Chicago EMS has added tourniquets and combat gauze as standard equipment on the ambulances in their EMS. He went on to say that one of their ambulances recently responded to a scene in which a person put his arm through a glass window. When the paramedics arrived, the person had a belt wrapped around the arm, but there was still active bleeding from the radial artery. The victim was estimated to have lost about a liter of blood. The paramedics bypassed direct pressure and applied a CAT tourniquet immediately. The bleeding was promptly stopped and the patient survived.

## Transition into Tactical Emergency Medical Support (TEMS) practice

One of the best examples of how TCCC applies to TEMS was the mass casualty shooting incident at Fort Hood in 2009. Officer Kim Munley's life was saved by a 68W Army medic. She was wounded in both thighs, and was showing signs of shock despite the attempts of bystanders (including physicians) to control the hemorrhage with direct pressure and improvised tourniquets. The medic had a Combat Application Tourniquet (CAT) with him and applied it to Officer Munley's leg, successfully controlling the hemorrhage (CoTCCC Minutes 1002). Without this intervention, Officer Munley might have died.

A *Washington Post* article dated 21 January 2011 describes the use of TCCC techniques in the recent mass shooting incident in Tucson involving Congresswoman Gabrielle Giffords. The article notes in part, "Doctors and law enforcement officials told reporters here that the incident would have been much worse without a small brown kit devised by David Kleinman, a SWAT team medic who had become concerned about rising violence. Kleinman cobbled together the individual first aid kits out of simple items used by combat medics in Iraq and Afghanistan: an emergency bandage pioneered by the Israeli army; a strip of gauze that contains a substance which coagulates blood on contact; a tactical tourniquet; shears that are sturdy and sharp enough to slice off victims' clothing; and sealing material that

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works especially well on chest wounds. The items in the kit were each inexpensive; the Israeli bandage, for example, cost only \$6, but deputies reached for one 'over and over' at the scene," Kleinman said.

It is unusual for police officers to carry such medical equipment, but Capt. Byron Gwaltney, who coordinated the Pima County Sheriff's Office's response to the shooting, said it proved crucial in this case because the deputies were the first to arrive. "It would have been a lot worse" without those tools, Gwaltney said. The deputies were trained to use the kit six months prior in a program the Pima force called "First Five Minutes." The deputies who initially responded said they were not the ones who arrested the suspect, Jared Lee Loughner. Instead, their focus was conducting triage through the parking lot: figuring out who was dead, who was injured and who was simply a bystander who had jumped in to help. They used the tourniquets and gauze to stop the bleeding. They used a chest seal, also in the kit, to close bullet wounds. They used the shears in the kit to cut off the victims' clothes. CoTCCC member Dr. Peter Rhee reported that Combat Gauze was used on many of the shooting victims (CoTCCC Minutes February 2011).

The benefit of having first responders trained in basic TCCC hemorrhage control measures was further discussed by FBI physician Dr. Tom Gross, who reported that he and fellow FBI physician Dr. Bill

Fabbri were working to implement training in these areas for new FBI agents. The intent is to give the new agents a kit very similar to the one described above and to give them six hours of basic TCCC "Care Under Fire" (CoTCCC Minutes February 2011).

The cooperation between PHTLS, TEMS organizations and the CoTCCC to transition TCCC techniques into civilian use continues. The PHTLS Executive Council has a TCCC training cell, led by Mr. Mark Lueder, which trains civilian law enforcement organizations in TCCC. This training cell has taught well over 100 TCCC courses on a volunteer basis.

Dr. Richard Schwartz and his colleagues at the Center of Operational Medicine at the Medical College of Georgia published a paper in *Prehospital Emergency Care* in 2011 that describes the COM's partnership with the National Tactical Officers Association to improve tactical trauma care. The paper details how COM and NTOA convened a working group to examine the military experience with TCCC and to define best-practice trauma care suitable for transition to the civilian sector. The authors noted that there are four target audiences (operator, medic, team commander and supervising physician) and presented a matrix of proposed competencies for each (Schwartz 2011).

A parallel effort is currently underway, with some overlap of team members, to establish a standing Committee on Emergency Tactical Casualty Care (CETCC). Led by

Dr. Dave Callaway at Harvard's Operational Medicine Institute and Dr. Reed Smith at Georgetown, the CETCC would function much like the CoTCCC, but with an emphasis on those elements of care that apply more directly to the civilian sector. As an example of how the military to civilian transition is being approached, the "Care Under Fire" phase is replaced by an "Ongoing Direct Threat" phase. The elements of care contained in TCCC are reviewed for applicability and updated as needed. A similar approach will be used for the other phases of care.

### Summary

With the development of the Joint Theater Trauma System and advances in hospital and evacuation medicine, the U.S. military and its coalition partners now have the best definitive care and evacuation capabilities for the management of combat trauma in history. The role of TCCC is to make sure that the casualties get to the medical treatment facility alive so that they can benefit from this extraordinary trauma care system; TCCC has been remarkably successful at presenting our combat support hospitals with casualties who have survived the critical prehospital phase of care and who can now be treated and eventually returned home to their families.

The efforts described above to transition military advances in prehospital trauma care to the civilian sector are overdue and will result in improved trauma care for tactical officers and eventually all Americans.

At a recent DHB meeting, co-author Richard Carmona, a trauma surgeon, DHB Vice President, the 17<sup>th</sup> Surgeon General of the United States, former CoTCCC member and United States Army Special Forces operator and medic said, "The nation owes a great debt to the CoTCCC for the great work they have done the past 10 years."

Hopefully, in years to come, the nation will owe a similar debt to groups such as PHTLS, NTOA, the COM and the Operational Medicine Institute for effectively transitioning these advances in prehospital trauma care to the streets of America. ◀◀

### About the authors



**Frank Butler, MD** served as a Navy SEAL platoon commander before becoming a physician. He is a Diving Medical Officer as well as a board-certified ophthalmologist. He was the

first Navy medical officer selected to be the Command Surgeon at the U. S. Special Operations Command. He is currently the Chairman of the Committee on Tactical Combat Casualty Care.



**Deputy Sheriff Richard Carmona, MD** is a 26-year veteran of the Pima County Sheriff's Department, where he served as a detective, SWAT team operator, medic, training officer and team leader. He is also a combat-decorated former United States Army Special Forces medic and weapons specialist, the 17<sup>th</sup> Surgeon General of the United States and emeritus TEMS Section Chair for the NTOA.

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