Improving Prehospital Trauma Care in the United States Military: Tactical Combat Casualty Care

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Disclaimer

“The opinions or assertions contained herein are the private views of the authors and are not to be construed as official or as reflecting the views of the Departments of the Army, Air Force, Navy or the Department of Defense.”
Battlefield Trauma Care: 2001

• Based on trauma courses NOT developed for combat
• Medics taught NOT to use tourniquets
• No hemostatic agents
• No junctional tourniquets
• Large volume crystalloid fluid resuscitation for shock
• 2 large bore IVs on all casualties with significant trauma
• Civil War-vintage technology for battlefield analgesia (IM morphine)
• No focus on prevention of trauma-related coagulopathy
• No tactical context for care rendered
• Heavy emphasis on endotracheal intubation for prehospital airway management
NSW/USSOCOM Review of Battlefield Trauma Care 1993-1996

- Biomedical research project
- Naval Special Warfare then USSOCOM funding
- Partnership with USUHS for the review
- Sharply focused on the major causes of preventable death on the battlefield – hemorrhage, airway obstruction, and tension pneumothorax
- Designed for Combat: Good Medicine AND Good Tactics
- Prolonged evacuation time considered
- Extensive combat medic input to the TCCC Guidelines
- Rule of evidence applied to current practice as well as proposed new interventions
TCCC: A Brief History

• Original paper published 1996
• First implemented by Navy SEALs, the 75th Ranger Regiment, and Air Force Pararescue in 1997
• Updates published in the PHTLS textbook since 1999
• ACS COT and NAEMT endorsement
• USSOCOM adopted in 2005
• TCCC is now used throughout the U.S. military
• Allied nations and civilian sector
Battlefield Trauma Care: Now

- Phased care in TCCC
- Aggressive use of tourniquets in CUF
- Combat Gauze as hemostatic agent
- Aggressive needle thoracostomy
- Sit up and lean forward airway positioning
- Surgical airways for maxillofacial trauma
- Hypotensive resuscitation
- IVs only when needed/IO access if required
- PO meds, OTFC, ketamine as “Triple Option” for battlefield analgesia
- Hypothermia prevention; avoid NSAIDs
- Battlefield antibiotics
- Tranexamic acid
- Junctional Tourniquets
TCCC: How Do We Know That It’s Working?

- Near universal DoD acceptance after 14 years of war
- 67% reduction in deaths from extremity hemorrhage
- Tarpey 2005: “Overwhelming Success” in 3rd ID
- Kragh: Estimated over 1000 lives saved with tourniquet use – in 2008
- Kotwal: Lowest incidence of preventable deaths ever documented by a combat unit
- Savage: Highest casualty survival rate in Canadian Military’s history
- Acceptance by NAEMT/American College of Surgeons
Questions?
Backup Slides
“All seem uncertain regarding the best method to implement factual knowledge to the man most in need, the front line trooper… citing our ineptness in the field of self-help and first aid …..”little if any improvement has been made in this phase of treatment of combat wounds in the past 100 years.”

CAPT J.S. Maughon
Mil Med 1970
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- Combat environment considered
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Tactical Combat Casualty Care in Special Operations

Military Medicine Supplement
August 1996

Trauma care guidelines customized for the battlefield
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TCCC: How Do We Know That it’s Working?
Tourniquets in the U.S. Military - 2003
Lest we forget – most of the U.S. military went to war in Afghanistan and Iraq without tourniquets
“The striking feature was to see healthy young Americans with a single injury of the distal extremity arrive at the magnificently equipped field hospital, usually within hours, but dead on arrival. In fact there were 193 deaths due to wounds of the upper and lower extremities, or two percent of the 2600.”

CAPT J.S. Maughon
Mil Med 1970
“It is very important, however, to stop major bleeding as quickly as possible since injury to a major vessel may result in the very rapid onset of hypovolemic shock...Although ATLS discourages the use of tourniquets, they are appropriate in this instance because direct pressure is hard to maintain during casualty transport under fire. Ischemic damage to the limb is rare if the tourniquet is left in place less than an hour and tourniquets are often left in place for several hours during surgical procedures. In the face of massive extremity hemorrhage, in any event, it is better to accept the small risk of ischemic damage to the limb than to lose a casualty to exsanguination....The need for immediate access to a tourniquet in such situations makes it clear that all SOF operators on combat missions should have a suitable tourniquet readily available at a standard location on their battle gear and be trained in its use.”
A Preventable Death: 2003

This casualty was wounded by an RPG explosion and sustained a traumatic amputation of the right arm and a right leg wound. He bled to death from his leg wound despite the placement of three field-expedient tourniquets.

What could have saved him
CAT Tourniquet
TCCC training for all unit members

*Note: Medic killed at onset of action
Tourniquet Use Early in the Iraq and Afghanistan Conflicts

- NOT widely used at the start of the wars
- Increased use by both Special Operations and conventional units beginning in 2005

The Drivers:
- Early reports of success with TCCC, especially TQs
- USAISR tourniquet study by Walters et al (2005)
- USSOCOM TCCC message - March 2005
- USCENTCOM tourniquet and hemostatic agents (HemCon) message - 2005
Preventable Combat Deaths from Not Using Tourniquets

• Maughon – *Mil Med 1970*: Vietnam
  – 193 of 2,600
  – 7.4% of total combat fatalities

  – 77 of 982 (in both cohorts of fatalities)
  – 7.8% of total fatalities – no better then Vietnam

• Tourniquets became widely used in 2005-2006

• Eastridge – *J Trauma 2012*: OEF + OIF (to Jun 2011)
  – 119 of 4,596
  – 2.6% of total fatalities – a 67% decrease
Tourniquet Outcomes in TCCC Transition Initiative Report

- **Sixty-seven** successful tourniquet applications identified
- No avoidable loss of limbs due to tourniquet use identified

*Butler, Greydanus, Holcomb*

2006 USAISR Report

“TCCC: Combat Evaluation 2005”
• Ibn Sina Hospital, Baghdad, 2006
• Tourniquets are **saving lives** on the battlefield
• **31 lives saved in 6 months** period by the use of prehospital tourniquets
• Author estimated **2000 lives saved with tourniquets in this conflict** (Extrapolation provided to MRMC)
Tourniquets – Kragh et al J Trauma 2008

- Combat Support Hospital in Baghdad
- 232 patients with tourniquets on 309 limbs
- Best were EMT (92%) and CAT (79%)
- No amputations due to tourniquet use
- Approximately 3% transient nerve palsies
“Tourniquets have been very successful. In Iraq, 5 years ago, I saw casualties come in in shock and dying from single extremity injuries without tourniquets. Here, we are seeing triple and quadruple amputees come in with tourniquets applied, awake and talking to us.” (KAF Role III – Neurosurgeon)
“Tourniquets have been the signature success in battlefield trauma care in Afghanistan and Iraq. Based on the work of Army COL John Kragh and colleagues, the number of lives saved from this intervention has been estimated to be between 1,000 and 2,000.”

Davis et al
Journal of Trauma Acute Care Surg
2014

And the “1,000-2,000 lives saved” estimate was made in 2008 – six years before the end of the conflicts.
The American College of Surgeons Committee on Trauma now endorses the use of both tourniquets and hemostatic dressings.

- So does the American College of Emergency Physicians
- So does the National Association of EMTs
External Hemorrhage Control – ACEP Policy

ACEP Policies Lead to Evidence-Based Medicine

Fri, May 1, 2015

The new policy also suggests protocols should address the use of a commercially produced tourniquet with demonstrated arterial flow occlusion; that tourniquets not be released until the patient reaches definitive care; that providers consider the use of topical hemostatic gauze pads in combination with direct pressure/dressing for wounds where a tourniquet isn't possible; that tourniquets may be the first-line treatment for extremity arterial hemorrhage; the consideration of the use of tranexamic acid (TXA); and specific training for EMS personnel include hemorrhage control techniques using tourniquets and topical hemostatic gauze agents.
External Hemorrhage Control Practice Guidelines

Improving survival from active shooter events: The Hartford Consensus

Lenworth M. Jacobs, MD, MPH, Norman E. McSwain, Jr., MD, Michael F. Rotondo, MD, David Wade, MD, William Fabbri, MD, Alexander L. Eastman, MD, Frank K. Butler, Jr, MD, and John Sinclair on behalf of the Joint Committee to Create a National Policy to Enhance Survivability from Mass Casualty Shooting Events

J Trauma Acute Care Surg 2013

- So does the Hartford Consensus Working Group
- Sponsored by the American College of Surgeons
- Participants include the WH Staff, DoD, DHS, and the FBI
Overall Impact of TCCC
TCCC: Success in Combat
3rd Infantry Division

“The adoption and implementation of the principles of TCCC by the medical platoon of TF 1-15 IN in OIF 1 resulted in overwhelming success. Over 25 days of continuous combat with 32 friendly casualties, many of them serious, we had 0 KIAs and 0 Died From Wounds, while simultaneously caring for a significant number of Iraqi civilian and military casualties.”

CPT Michael Tarpey
Battalion Surgeon 1-15 IN
AMEDD Journal 2005
CONCLUSION

For the first time in decades, the CF has been involved in a war in which its members have participated in sustained combat operations and have suffered increasingly severe injuries. Despite this, the CF experienced the highest casualty survival rate in history. Though this success is multifactorial, the determination and resolve of CF leadership to develop and deliver comprehensive, multileveled TCCC packages to soldiers and medics is a significant reason for that and has unquestionably saved the lives of Canadian, Coalition and Afghan Security Forces. Further-
Eliminating Preventable Death on the Battlefield

- Kotwal et al – Archives of Surgery 2011
- All Rangers and docs trained in TCCC
- U.S. military preventable deaths: 24%
- Ranger preventable death incidence: 3%
How Is TCCC Updated?

The Committee on TCCC
Committee on Tactical Combat Casualty Care (CoTCCC)

• First funded by USSOCOM in 2001-2002 at the Naval Operational Medicine Institute (NOMI)
• Later sponsored by Navy and Army Surgeons General, U.S. Army Institute of Surgical Research and the Joint Trauma System
• 42 members - all services
• Trauma Surgery, EM, Critical Care, operational physicians and PAs; medical educators; combat medics, corpsmen, and PJs
• 100% deployed experience
• Relocated to the Defense Health Board in 2007 at the direction of ASD/HA
• Moved to the Joint Trauma System in 2013
TCCC Team 2015
CoTCCC/JTS PLUS

- Prehospital Trauma Life Support/NAEMT
- Trauma and Injury Subcommittee - DHB
- Special Operations Medicine
- Designated TCCC Experts
- Service Surgeons General/TMO offices
- COCOM Surgeons’ offices
- Other government agencies
- USAISR & other military medical research labs
- Coalition partner nations
- Defense Health Agency – MEDLOG
- Armed Forces Medical Examiner System
- Combat medical schoolhouses
All TCCC change papers are now published in the JSOM
“Military units that have trained all of their members in Tactical Combat Casualty Care have documented the lowest incidence of preventable deaths among their casualties in the history of modern warfare.”