

## Committee on Tactical Combat Casualty Care Meeting Minutes

San Antonio, TX

20–21 February 2019

*Dr Frank Butler; Dr Stephen Giebner*

### Chairman's Note:

These minutes mark the last meeting at which CAPT (Ret) Stephen Giebner served as the Developmental Editor of the Committee on Tactical Combat Casualty Care (CoTCCC). CAPT Giebner was the Founding Chairman of the CoTCCC and continued in that capacity for 6 years before assuming the position of Developmental Editor. His contributions to improving the care that the US military provides to its wounded Servicemembers over the past 25 years have been sustained and remarkable. Without CAPT Giebner's leadership, there would have been no CoTCCC. A heartfelt thank you, Steve!

Wednesday – 21 February 2019

### 1. Chairman's Welcome: Dr Frank Butler – Chairman of the CoTCCC

Dr Butler, Chairman, welcomed the attendees, reminded everyone to sign the attendance sheets, and then had all of the attendees introduce themselves.

He announced that COL Bob Mabry and LTC Steve DeLellis will soon be leaving the CoTCCC as a result of their pending retirements. MSG Danny Morrisette is leaving the committee in anticipation of beginning medical school in the near future. Dr Butler thanked all three members for their outstanding service on the CoTCCC.

Dr Butler thanked Mrs Danielle Davis, Mr Dallas Burelison, Ms Margarita Carter, and Mr Darin Schwartz of the Joint Trauma System for their outstanding work in preparing for this meeting. He noted that the next CoTCCC meeting will be held either at the Uniformed Services University in Bethesda or here in San Antonio. The planned dates are September 10th and 11th.

Dr Butler extended a call for combat medics to present combat casualty scenarios at future meetings and noted the importance of these presentations in helping the group to be aware of the challenges encountered by combat medics, corpsmen, and pararescuemen (PJs) in caring for casualties on the battlefield.

Dr Butler continued with a brief summary of the history of TCCC and then reviewed this meeting's agenda. He requested that attendees reveal any financial interest that they might have in items to be discussed at the meeting. Dr John Holcomb disclosed that he is the Chief Medical Officer of Prytime, the company that markets the ER-REBOA catheters.

### 2. Senior Leader Remarks: Maj Gen Lee Payne – Assistant Director, Defense Health Agency, (Combat Support)

Maj Gen Payne is double-boarded in Emergency Medicine and Internal Medicine, as well as being a Flight Surgeon. He was formerly the Command Surgeon for Air Mobility Command and commanded the hospital at Travis AFB.

Maj Gen Payne noted that the DHA is leading the effort to develop standards for cross-Service operations in medicine and that the JTS and the CoTCCC are excellent models of such DHA-led initiatives.

We need to preserve advances and capabilities to be ready for the next major conflict. Clinical currency is a big problem at all levels of medical care. Our military direct care system as currently structured cannot provide the currency that the US military needs in trauma care. Where possible, we must strengthen our direct care system to provide that currency first. Any additional capacity will likely be met by establishing partnerships with civilian medical centers, and multiple efforts are under way to develop this kind of synergy.

With respect to standardized cross-Service medical training, the TCCC for All Servicemembers course is coming online soon. Standardized training at higher levels of prehospital care is on the way.

MHS Genesis, the electronic health record, is a tool that will help with the transition to medical interoperability. It will drive commonality and standardization across the DoD and the VA.

In the Question and Answer (Q+A) session, COL Bob Mabry asked who was going to own battlefield trauma care under the new DHA model and whose responsibility it was going to be to implement corrective action when preventable combat fatalities are identified? Maj Gen Payne responded that operational medicine is still within the Services responsibilities, but the JTS will have the responsibility of collecting the data to provide oversight of the care being delivered, sharing that data across the system for leader visibility, and setting up the process improvement structure necessary to improve where needed.

Dr Butler asked if the JTS has the authority to communicate directly with line combat commanders when potentially preventable combat deaths are identified and corrective action is

needed. Maj Gen Payne responded that the JTS does not have that authority at present.

### 3. Combat Medic Presentation: SO1 Terence Byrne – Naval Special Warfare Combat Medic Training Center, Stennis AFB, MS

SO1 Byrne, a SEAL medic, presented a casualty scenario from his recent deployment to Iraq. He presented helmet cam video footage of this event. He thanked Mr Rick Strayer, one of his instructors at the Joint Special Operations Medical Training Center, for training him so well and preparing him to deal with scenarios like the one presented today.

While setting up sniper positions in Mosul, his vehicle was struck by an RPG. The unit's indigenous translator suffered shrapnel wounds high on both thighs with arterial bleeding. First responders in the unit placed tourniquets high and tight on both legs, which controlled the bleeding. SO1 Byrne was severely concussed by the blast but soon took over the casualty's care. He was helped by an Air Combat Controller who had joined the unit the day before. They carried out treatment in the rear of the Mine Resistant Ambush Protected All-Terrain Vehicle (M-ATV).

Ketamine, first IM and then IV, was given for pain control. When given IV, it was titrated to keep the casualty calm. TXA was given twice – first by IV push, then by slower infusion. The first tourniquets became loose and slipped and were replaced. A thermal blanket from an HPMK was applied to prevent hypothermia.

The evacuation helo went to an unrequested LZ, so the unit had to move with the casualty. They put the casualty on a TALON litter and strapped the litter to the hood of the M-ATV.

SO1 Byrne's observations from this casualty scenario were:

- Ketamine at the medic level works well. When given intranasally, it does not work as well as when given IV or IM.
- Responders trained in TCCC (i.e., SO1 Byrne and the Air Traffic Controller) worked well together, even though they had not trained together or worked together previously.
- He worked as he had trained despite his concussion.
- Packing his med bag in a standard way facilitated the rapid deployment of gear and medications.

### 4. BATDOK: 1st LT David Feibus – Air Force Research Laboratory

The Battlefield Assisted Trauma Distributed Observation Kit (BATDOK) is a software tool designed to facilitate point of injury casualty care documentation by combat medics. The software resides on an electronic device about the size of a mobile phone. Data entered or collected via various sensors (e.g. Spo2) can be handed off to the next medic by Bluetooth link with no interruption of care. The device can also transfer information to a plastic card like a hotel door key for transport with the casualty.

Network capability allows for wireless monitoring of multiple casualties at the same time. The system can produce trending graphs with custom warnings for each parent. Walking blood bank management is also included. Networking data from multiple casualties allows casualty collection point management wherein casualties can be assigned to evacuation

platforms by priority. A filtering capability allows you to focus on certain casualties as needed, e.g. only those in your unit. Developers at the Air Force Research Laboratory are working to link this system to the DODTR and to AHLTA.

Encryption enables transmission of HIPAA-regulated information over NIPRnet, SIPRnet, and the open internet.

Initial fielding of the BATDOC is currently planned for September 2019.

**Q+A:**

**Q:** Dr Mel Otten: Will this device work if it is dropped in the water?

**A:** Depends on the tactical case that it is used with.

**Q:** Will BATDOK work with an iPhone?

**A:** No – it is designed for use with Android devices.

### 5. JTS Director's Brief: COL Stacy Shackelford – Joint Trauma System

The transfer of the Joint Trauma System to the Defense Health Agency is now complete. The JTS falls under the DHA Assistant Director for Combat Support, and its mission has expanded. Col Shackelford introduced MSG Mike Remley, the first Senior Enlisted Advisor for the JTS.

The Defense Committee on Trauma now oversees the CoTCCC, the Committee on En Route Combat Casualty Care, and the Committee on Surgical Combat Casualty Care. Because the JTS is now part of the DHA, it can now readily communicate with the Combatant Commanders to give them what they need in terms of trauma care support.

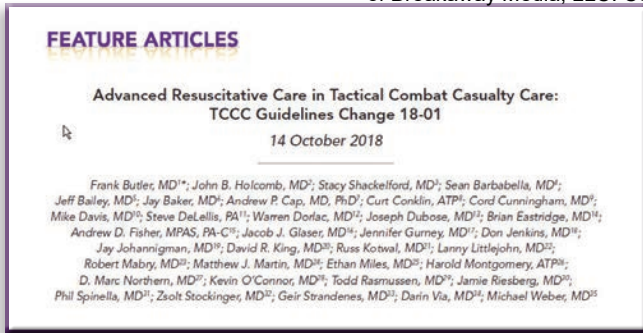
Dr Mary Ann Spott, Deputy Director of the JTS, discussed the results of the JTS operational assessment. Eighteen new command policies have been identified for development. The Combatant Command Trauma System and the Joint Trauma Education and Training Branch, which will now have oversight for the development of DoD trauma training curricula, including TCCC, are being set up at present.

MSG Remley discussed the evolving plans for the Joint Trauma System to fully assume its congressionally mandated role as the reference body in the DoD for developing trauma care standards.

### 6. TCCC Update: Dr Frank Butler – Chairman, Committee on Tactical Combat Casualty Care

Noncompressible torso hemorrhage is the largest remaining cause of preventable death on the battlefield for which combat medical personnel have had no definitive treatments in the past.

The TCCC paper on Advanced Resuscitative Care (ARC) has now been published in the *Journal of Special Operations Medicine* to address that capability gap. The ARC in TCCC change advocates for the earlier prehospital use of whole blood transfusion for casualties in hemorrhagic shock and for far-forward Zone 1 REBOA in prehospital settings for casualties with non-compressible torso hemorrhage who meet the TCCC-recommended selection criteria for this procedure. The DoD now needs to work with the Services and the combatant commands to help accelerate the fielding of an ARC capability for units that are interested in implementing this change.



document that Dsuvia performs equivalently, better, or worse than OTFC as a prehospital analgesic. And it costs 4 times as much as OTFC. In the long run, Dsuvia may turn out to be a better battlefield analgesic than OTFC, but there is not yet evidence to establish that.

Quality assurance in TCCC training continues to be a problem. Instances of incorrect messaging in nonstandard TCCC courses have been directly associated with adverse outcomes, including a leg amputation from prolonged tourniquet use and respiratory arrest from using midazolam after fentanyl lozenges. Some nonstandard TCCC courses have also been found to contain inappropriate training, such as the pharmacologic induction of hypotension in student volunteers to demonstrate the signs and symptoms of shock. Another unacceptable practice reported in media coverage of this topic has been the administration of potent analgesic medications to students to illustrate the cognitive impairment that these medications cause.

Colloids and crystalloids are the LEAST desirable of the options for fluid resuscitation of hemorrhagic shock. Plasma is a much better option and has been shown to improve survival when administered as the first resuscitation fluid for hypotensive trauma patients.<sup>1</sup> The French dried plasma product FlyP™ has received an FDA indication for battlefield use as a result of input from the recently established DoD-FDA panel. The DoD is currently working with the French manufacturer of this product to explore options for increasing production of FlyP.

Ketamine autoinjectors with the TCCC-recommended analgesic dose of this medication could be manufactured and would avoid the time delay and risk of incorrect dosing created by medics having to draw up ketamine injections from multidose vials – IF there were an FDA indication for battlefield use of ketamine. The DoD-FDA panel could undertake this action as well and has been asked to do so by the DoD.

The TCCC for All Servicemembers (TCCC-ASM) course is a new, abbreviated TCCC course mandated by DOD Instruction 1322.24. TCCC-ASM provides basic TCCC training in external hemorrhage control for Servicemembers who are not envisioned to be combatants, such as a Navy finance clerk at the Pentagon, an Army recruiter, or an Air Force missile technician serving at a CONUS Air Force Base. This course parallels the “Stop the Bleed” training promoted by the White House/ACS-sponsored campaign of the same name and will be taught during Service basic training. The Stop the Bleed course was in turn adapted from the 2-hour course in external hemorrhage control that was developed in 2011 by the CoTCCC for the New Orleans Police Department – at the request of Dr Norman McSwain, the NOLA Police Department Surgeon – using material from the TCCC curriculum. The new TCCC-ASM curriculum is being developed by an ad hoc working group sponsored by the Defense Health Agency; pilot courses are planned for this spring.

## 7. Optimizing Partial Zone 1 REBOA: Dr Marty Schreiber – Oregon Health and Science University

Complete REBOA in Zone 1 produces supraphysiologic mean arterial pressures proximal to the occlusion and total body ischemia distal to the occlusion. Ischemia-reperfusion injury is a significant danger when the balloon is inflated after extended periods of occlusion. Partial REBOA, in which some blood is allowed to continue past the site of balloon inflation, ameliorates the reperfusion injury without excessive additional blood loss.

CoTCCC member Dr Jim Bagian is presently participating in a National Academies of Science, Engineering, and Medicine panel that has been convened to look at the lag time between when new innovations in trauma care are recommended and when they are actually introduced to combat units. As stated succinctly by General Joseph Votel, the former Commander of the US Central Command, battlefield trauma care is military line leaders’ responsibility – and one that cannot be delegated. The CoTCCC-recommended approach for expediting the fielding of an ARC capability is the TCCC Transition Initiative model that was used so successfully by the USSOCOM/USAISR team in 2005–2007 to implement TCCC training and equipment throughout the deploying units in the US Special Operations Command.

The CoTCCC has implemented a new approach to managing TCCC changes. Guideline changes will now be conducted as parallel (vs. sequential) efforts. This change is designed to help expedite the TCCC change process. Changes currently under development – along with the respective Change Leaders are:

19-01	Tourniquet Review	Mr Harold Montgomery
19-02	TXA Relook	CAPT Brendon Drew
19-03	Hypothermia Prevention Relook	Dr Brad Bennett
19-04	iTClamp Relook	CDR Dana Onifer
19-05	Evisceration Injuries	LTC Jamie Riesberg
19-06	Fluid Resuscitation	Maj Marc Northern

An email forwarded by Command SGM Tim Sprunger at the Army Medical Research and Materiel Command noted that the production of morphine autoinjectors has ceased, and that all backorders have been canceled. The demise of this outdated approach to battlefield analgesia in favor of the TCCC Triple-Option Analgesia plan is a significant advance in battlefield trauma care for the US military.



Sufentanil sublingual 30µg tablets have now been approved by the FDA. Sold under the brand name Dsuvia, this medication will be available on 19 Feb 2019 in boxes of 10 individual packaged prefilled single-dose applicators (SDAs) with 1 tablet per SDA.

Of concern, neither the manufacturer nor the military has yet funded a study that compares the safety and efficacy of Dsuvia to that of OTFC—the currently recommended transmucosal opioid analgesic in TCCC—despite a specific recommendation for such a study in the 2014 Triple-Option Analgesia paper. Until this study is performed, there is no evidence to

Dr Schreiber presented a study he conducted at Oregon Health and Science University comparing Zone 1 partial REBOA\* in swine using two different catheters. Prytime, the manufacturer of the REBOA catheters used funded the study.

The Prytime pREBOA-PRO™ catheter has two balloons. The second smaller balloon pushes the first away from the aortic wall to create blood flow bypass channels. In this way, partial occlusion is achieved without deflation of the main balloon.

The study examined physiologic responses in subjects receiving partial REBOA with Prytime ER-REBOA catheters, partial REBOA with pREBOA-PRO catheters, and no REBOA (controls). After a 4mm punch biopsy of the supraceliac aorta, uncontrolled hemorrhage was allowed for 30 seconds in the partial REBOA arms. This was followed by full inflation for 10 minutes to allow for stable clot formation. Thereafter partial occlusion was maintained for 4 hours, maintaining mean arterial pressure at  $40 \pm 5$ mmHg.

The control group experienced 100% mortality within 20 minutes after the onset of bleeding. There were no significant differences in mortality, blood loss, blood pressure or other physiologic parameters between the ER-REBOA and pREBOA-PRO catheter groups. The pREBOA-PRO catheter required 70% fewer adjustments and this could allow for automation.

#### 8. Comprehensive Tourniquet Review: Mr Harold Montgomery – CoTCCC

The first 2 tourniquets recommended for use on the battlefield were the Combat Application Tourniquet (C-A-T) and the Special Operations Forces Tourniquet – Tactical (SOFT-T). These two tourniquets have performed well in combat casualty care and there have been no updated TCCC tourniquet recommendations made since 2004.

The CoTCCC has recommended in the past that periodic, comprehensive, and standardized testing of the various commercially tourniquets be conducted by the DoD. This would be helpful both to study new tourniquets and to evaluate the impact of changes that have been made to previously recommended tourniquets. (Both the CAT and the SOFT-T tourniquets have been modified from the versions tested in 2004.)

Other factors also make it important to review TCCC tourniquet recommendations at the present time:

1. Although the C-A-T and the SOFT-T have performed well in combat, there may be newer tourniquet technology that offers advantages in speed of application, simplicity of application, occlusion pressures achieved, safety, durability, user preference, or other aspects of tourniquet performance.
2. Some tourniquets that have become commercially available have performed poorly – either in laboratory testing or in actual use. Agencies making tourniquet purchase decisions should be aware of these issues.
3. The newer versions of the C-A-T and the SOFT-T need to be evaluated in comparison to other tourniquets to identify and characterize the effects of post-2004 design changes on their performance.
4. Tourniquet use is increasing in the U.S. civilian sector as a result of the American College of Surgeons “Stop the Bleed” campaign. Many civilian agencies request guidance from the CoTCCC on which tourniquets to acquire.

\*REBOA Zone 1 extends from the celiac axis to the subclavian artery.

†Final criteria determined by the TQ breakout working group at the Sept. 2018 CoTCCC meeting.

Some tourniquet evaluation studies have been performed in recent years, but these studies have not been comprehensive or standardized, making comparative quality assessments of the available tourniquet options more difficult. The criteria selected and weighted scoring system standardizes a method for comparable future assessments. No change in the wording of the TCCC Guidelines is necessary, but should the proposed change be approved, an updated list of CoTCCC-recommended tourniquets will be published. Both the published medical literature and unpublished military laboratory reports were searched for evaluations of tourniquet performance published since the original CoTCCC recommendations in 2004.

The Criteria for Tourniquet Assessment were†:

1. Arterial Occlusion
2. Time of Application
  - a. Time to Occlusion <60 seconds
  - b. Time to Complete <90 seconds
3. Simplicity of Application
  - a. “Usability” / Ease of Use
  - b. Steps to Complete
4. Pressure
  - a. To Achieve Initial Occlusion
  - b. Evaluation for Potential Harm
5. Specifications
  - a. Width
  - b. Length
  - c. Locking Mechanism
  - d. Time Recording
  - e. Weight
6. Complications & Safety
  - a. Reported Failures/Problems
  - b. Safety Issues
7. Usage Reports
  - a. Combat Usage Reports
  - b. Civilian Usage Reports
  - c. User Preferences
8. Logistics
  - a. NSN Authorized
  - b. GSA Cost per Unit
  - c. Commercial Cost per Unit

Weighted Scoring:

- Each component of the assessment criteria was scored with a weighted scale approach with each criterion having a 0-5 score range.
- Data points resulting from studies with n greater than or equal to 20 were weighted higher than those with less than 20.

The tabulated scoring results from the currently available literature (in draft format) is shown at the top of the left-hand column on page 138.

The CoTCCC will vote on changing the CoTCCC recommendations for tourniquets in the near future.

#### 9. Management of Hemorrhage From Craniomaxillofacial Injuries and Penetrating Neck Injury in TCCC: The iTClamp® Mechanical Wound Closure Device: CDR Dana Onifer – Naval War College



Source: Courtesy Mr. Harold Montgomery.

Device	Weight	Time	Volume	Pressure	Temperature	Humidity	Altitude	Distance	Duration
Recommended Link Torquants for PFA/PAE/Wilting									
CAT Gen 6	8.95	4.64	8.55	4.25	5	3.25	3.40	3.67	41.74
CAT Gen 7	8.60	4.86	8.50	4.71	5	5	3	4	43.67
SOFTT-White	8.09	4.50	8.13	4.33	5	4	3	4.33	41.39
TMT	8.29	4.10	7.17	4.43	5	5	2	4.33	40.31
MAAT-2/TK2	9.29	4.71	8.17	4.75	4	4.50	3.71	3.67	41.83
SARAT	8.20	3.60	9	5	5	5	1.33	3.67	40.80
Recommended Pneumatic Link Torquants for Medics, Role US Teams & TACEVC Platforms for TQ Replacement, Conversion or Prolonged Application									
Delphi DMT	9.33	4.67	5.67	4.67	4	5	2.33	2.33	38.00
TPF3	8.83	3.25	4.00	4.20	5	5	1.33	2.33	34.62
NOT Currently Recommended Link Torquants based on existing data									
BSF	8	5	5	5	3	5	1.33	1.67	33.9
SWIFT II	4.90	1.67	6.73	4.60	3	3	1.33	3	28.13
NATS	8	5	10	1	3	5	1.33	2.67	34.00
TPF3	6.67	3.50	1	4	5	5	1.33	0.67	27.17
SOFTT	4.33	4	10	1	3	5	2.50	4.33	34.17
MAAT	4.50	5	4	1	5	4.50	1.33	4	29.33
MET/TK2	5.50	2.40	6.50	1	4	4	1.33	3.67	28.40
TK2/TK2/TK2	3.50	2	4	1	3	1.33	1.33	5	21.17
Multiten	0	1	1	1	1	5	1.33	0	10.33
NATO TQ	0	1	1	1	3	5	1.33	1.33	13.67
Remedy's	0	0	0	0	0	0	0	0	0

*hematoma that may compromise the airway. Consider placing a definitive airway to avoid airway compromise if there is evidence of an expanding hematoma.*

- **DO NOT APPLY on or near the eye (within 1 cm of the orbit).**

The iTClamp will be a CoTCCC vote item in the near future.

**10. TXA Relook: CDR Travis Deaton, Head of Emergency Medicine at Naval Hospital San Diego**

The Change Leader for this proposed change to the TCCC Guidelines is CAPT Brendon Drew from the First Marine Division. CDR Deaton is part of CAPT Drew's team developing this change.

The original recommendation for tranexamic acid (TXA) appeared in the Tactical Field Care and Tactical Evacuation Care guidelines in 2011. That recommendation was for a 1g dose administered by 10-minute IV infusion before fluid resuscitation, and a second 1g dose given after fluid resuscitation is complete.

Since 2011, some 400 articles about TXA have been published, so experience with the drug in both military and civilian settings has expanded considerably.

Practical considerations argue against the original two-dose plan. If only one dose is practical in the field, then what should that dose be? The literature supports a 1g dose for bleeding patients, as used in the CRASH-2 and MATTERS studies, but emerging research has found that the 2g dose confers a survival benefit in severe TBI patients.

Medics report that the 10-minute TXA infusion is not ideal for use on the battlefield and question whether the medication could be administered via slow IV push over 1 minute. Hypotension secondary to this mode of administration has not been found to be a problem in USSOCOM units that give TXA in this manner, despite the package insert cautionary note about this technique of infusion.

The literature does support the administration of TXA via the IO route, but IM administration needs further assessment before being recommended. Delay in bioavailability in a casualty who may be severely bleeding is the concern, especially when hypotension has caused vasoconstriction.

Adjusting the dose of TXA in casualties who are known or suspected to have ongoing bleeding in an attempt to replace the medication lost to hemorrhage also is being evaluated by the change team. Work on this change proposal continues.

**11. A Relook at Fluid Resuscitation in TCCC: Dr Frank Butler**

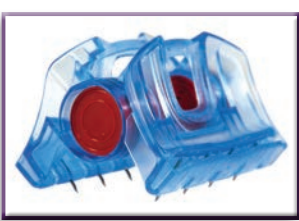
The Change Leader for this proposed change to the TCCC Guidelines is Major Marc Northern, but he is currently deployed with a Special Operations Surgical Team. Dr Butler reviewed the evolution of the present TCCC fluid resuscitation recommendations. The guidelines currently list multiple fluid options in order of preference, with whole blood being the best option and Hextend and crystalloids being the least desirable options.

A growing body of literature says that crystalloid resuscitation is not good for trauma patients. Despite that fact, recent papers from both the military and civilian sectors report that normal saline is the most commonly used resuscitation fluid.

Recent literature on hetastarch resuscitation shows associations with increased mortality and renal damage, although the

The 2012 study *Death on the Battlefield (2001–2011)* by Eastridge et al., demonstrated that 7.5% of the prehospital deaths caused by potentially survivable injuries were due to external hemorrhage from the cervical region. The standard of care in these cases now is CombatGauze plus direct pressure or XStat, but these are not always effective at controlling major cervical bleeding, as evidenced by the recent case report by Chovanec et al.

The iTClamp® is a mechanical device for controlling hemorrhage in craniomaxillofacial injuries and penetrating neck injuries. Its two sets of four opposing needles close the edges of a wound and create pressure on a bleeding site that promotes hemostasis. The device does not inflict significant tissue damage, is easy to train, and is easy and quick to apply, and application is easy to remember. Application pain has been found to be relatively mild.



The report that provides the evidence supporting the use of the iTClamp in TCCC is nearly complete. The draft wording for the proposed change to the TCCC Guidelines at present is as follows:

**Tactical Field Care Guidelines (Proposed)**

3. **Massive Hemorrhage (continued)**
  - b. *For compressible (external) hemorrhage not amenable to limb tourniquet use or as an adjunct to tourniquet removal, use CombatGauze as the CoTCCC hemostatic dressing of choice.*
    - *Alternative hemostatic adjuncts:*
      - *Celox Gauze or*
      - *ChitoGauze or*
      - *XStat (Best for deep, narrow-tract junctional wounds)*
      - *iTClamp*
  - c. *For external hemorrhage of the head and neck where the wound edges can be easily re-approximated, the iTClamp may be used either alone or in combination with other hemostatic adjuncts. Wounds can be packed with hemostatic gauze or XStat prior to closing the edges with the iTClamp.*
    - *The iTClamp does not require additional direct pressure, either when used alone or in combination with other hemostatic adjuncts.*
    - *If the iTClamp is applied to the neck, perform frequent airway monitoring and evaluate for an expanding*

applicability of most of these papers to combat trauma care is questionable.

The best option for resuscitation of trauma patients is whole blood, given as soon as possible after the need for resuscitation is identified. For this reason, the recent Advanced Resuscitative Care in TCCC guidelines added an elevated lactate level (>4mmol/L), measured at the prehospital point of care, as an indication for transfusion. The intent of this recommendation is to identify casualties in preclinical shock and treat their hypovolemia earlier, rather than waiting for hypotension to occur before fluid resuscitation is initiated.

The FDA has also recently approved the battlefield use of the French freeze-dried plasma product FLYP, thus offering another good option if whole blood or blood components are not feasible.

With whole blood and blood components becoming increasingly available in the prehospital phase of combat casualty care, is it time for the CoTCCC to stop recommending the use of Hextend and crystalloids altogether? The recent papers by Shackelford and Kotwal emphasize the need for increased emphasis on early transfusion of blood or plasma. There have been no papers from Iraq and Afghanistan that show a similar benefit from asanguinous fluids.

Issues that need to be addressed in developing this proposed change also include the end-point for resuscitation for casualties with and without TBI and noncompressible torso hemorrhage. This change effort will continue in the coming months.

#### 12. TCCC Web-Mobile Project: Mrs Cynthia Barrigan DHA J-9; Mr Harold Montgomery – CoTCCC

A standardized TCCC longitudinal curriculum is being developed by the DHA Education and Training Directorate (J7) IAW with Medical Readiness Training DODI 13422.24. This initiative is being funded by the DHA Research and Development Directorate (J9) as part of the Learning Strategy, Tactics and Technology (LSTT) Research Program. The curriculum consists of four tiers that are role-based. Tier 1 or TCCC for All Servicemembers (TCCC ASM) for nonmedical personnel is the first tier (most basic) tier and has been under development by a joint working group chartered by DOD Health Affairs. The TCCC-ASM course will incorporate the latest in adult learning design. Piloting of the new course will begin at the end of March. The final version is due at the end of July and formal TCCC-ASM training in the Services is due to start in April 2020. Mrs Barrigan previewed the ASM curriculum assets which included selected instructional video content from the course. She also provided an update on the current utilization of the Deployed Medicine (DM) platform (web/mobile app) and indicated that the DM will serve as a distribution platform for the new standardized TCCC training content.

#### 13. The United States Army in Afghanistan and Iraq: The Tan Books: Dr Sanders Marble, Senior Historian, AMEDD Center of History and Heritage

The “Tan Books” will be a multivolume history of the Services’ combat activities in these two countries.

Individual elements of the Army (e.g. JAG, Materiel Command, Medical Department) will describe the roles they played, the services they provided, and the functions they fulfilled. These will be written in a narrative format for general audiences.

Dr Marble called for volunteers to contribute to the sections on medical support in the two conflicts as well as medical care provided off the battlefield. He requested stories of deployments, case histories, and anything else we consider important for inclusion.

#### 14. New Business: Dr Frank Butler

**Question:** Attendees asked whether there is a recommendation for sedation included in TCCC, and if so, should the use of this medication be limited to paramedics only?

**Answer:** There is presently no specific recommendation for a sedative medication in the TCCC Guidelines, although narcotics and ketamine can have a sedating effect.

A suggestion was made that a rapid process improvement assessment should be conducted to capture the incidence and outcomes of benzodiazepine use on the battlefield by Special Forces medics, since those medications are part of their scope of practice.

Dr Butler also noted that TCCC curriculum development functions will transfer in the near future from the CoTCCC to the newly established Joint Trauma Education and Training Branch.

Thursday – 22 February 2019

#### 14. Advanced Resuscitative Care (ARC) in TCCC: Dr Frank Butler

There is presently an opportunity to eliminate 40% of the preventable prehospital deaths in US combat casualties through the use of the newly approved TCCC ARC recommendations.

ARC focuses on the use of early whole blood resuscitation and far-forward Zone 1 resuscitative endovascular balloon occlusion of the aorta (REBOA) to treat hemorrhagic shock in combat casualties.

ARC identifies cold-stored, low-titer type O whole blood (CS LTOWB) as the best option for whole blood. Blood typing and screening of the donated blood for pathogens results provides FDA compliance and increases safety. CS LTOWB can be collected in CONUS or closer to the theater and carried far forward in a cooler.

The 75th Ranger Regiment Type O Low (ROLO) program is the second choice for sourcing donor whole blood. Type O low-titer donors within the unit are identified ahead of time. When needed, their blood is collected and transfused to casualties needing resuscitation. This process takes longer in that the blood must be collected before transfusion. There is also an administrative requirement to follow up on both donors and recipients. Further, there is the realization that both casualty and donor are still in a tactical environment and the individual who just donated blood may be the next person to be wounded.

Untitered type O whole blood from donors who have been preidentified as type O beforehand can also be used. The risk of a transfusion reaction is very low, as highlighted in the recent paper by COL Shawn Nessen. Use of untitered type O whole blood was common practice in World War II and is still used by Forward Surgical Teams when there is a need for large quantities of blood in mass casualty incidents.

The final option for obtaining whole blood for prehospital blood transfusion is type-specific whole blood. Although this option is used by Role 2 surgical teams embarked on surface

ships, there is the risk of a fatal hemolytic reaction from an ABO mismatch.

ARC also emphasizes the need to identify casualties who are in shock BEFORE they decompensate and become hypotensive. This is accomplished through the use of point-of-care lactate testing. The indications for whole blood transfusion in ARC are as follows:

- Casualty has known prior external hemorrhage (even if that hemorrhage is now controlled) or suspected non-compressible torso hemorrhage  
AND
- Systolic blood pressure (SBP) is less than 90mmHg  
OR
- Point of Injury lactate is 4mmol/L or greater

The second pillar of ARC is far-forward Zone 1 REBOA. For casualties in shock whose blood pressure has not responded to the first unit of transfused whole blood AND who have had bilateral chest tubes inserted with no finding of significant hemothorax AND a cardiac ultrasound performed without evidence of hemopericardium – Zone 1 REBOA can effectively stop abdominopelvic NCTH for a limited period of time. Thirty minutes of aortic occlusion is considered safe in Zone 1 REBOA – and research done by COL Matt Martin's team at the Madigan Army Medical Center has shown in a lethal large animal bleeding model that the use of a programmed intermittency occlusion schedule resulted in 100% survival for the 120-minute study period. A modification to the Madigan intermittency schedule proposed by Col Todd Rasmussen\* calls for the balloon to remain deflated if systolic blood pressure does not fall below 80mmHg. The ARC recommendations for REBOA intermittent balloon inflation therefore may allow the safe aortic occlusion time to be extended by a factor of 4 – while still minimizing the risk of reperfusion injury – when allowed by the casualty's clinical condition.

In situations where whole blood and REBOA are indicated, MINUTES MATTER! Many patients in shock from NCTH during the prehospital phase of care will die before their "Golden Hour" has elapsed if the measures recommended by ARC are not undertaken.

ARC requires a team – the combination of whole blood transfusion and Zone 1 REBOA cannot be effectively performed by an individual. Early common femoral artery access is an essential first step in REBOA. This early access does not obligate subsequent REBOA, but it increases the likelihood of success in that it is far easier to gain common femoral artery access BEFORE the patient has become hypotensive.

#### 15. Extending the Golden Hour for Zone 1 REBOA on the Battlefield: Intermittent, Partial, and Beyond: Dr Matthew Martin – Scripps Institute Medical Center, San Diego

Dr Martin began with case reports illustrating the utility and difficulties associated with REBOA.

With the advent of limb and junctional tourniquets, non-compressible torso hemorrhage now accounts for the majority of preventable deaths from hemorrhage. REBOA is a great advance and can save lives, but it is also a procedure that entails some morbidity and the potential for mortality.

Ischemia–reperfusion injury after Zone 1 occlusion is the limiting factor for this procedure and we must seek ways to extend the time for which this technique can be used to control NCTH. Potential strategies include pharmacotherapy (Ca<sup>2+</sup> and bicarbonate), intermittent REBOA, and partial REBOA. Zone 3 REBOA is not recommended in ARC because it is difficult to completely exclude the possibility of abdominal bleeding sites below the diaphragm but above the bifurcation with only a FAST exam, and because the increase in proximal systolic blood pressure is more pronounced when aortic occlusion is performed in Zone 1 compared with Zone 3.

Partial REBOA is not recommended in ARC at this time because controlling the degree of partial aortic occlusion and the volume of distal blood flow with precision is not feasible in the far-forward environment with the current state of technology.

Dr Martin conducted a study that examined survival and end-organ function comparing complete REBOA and intermittent REBOA in swine. Mean survival in control animals with no REBOA was 15 minutes. With full REBOA for 60 minutes, survival was 63 minutes – the animals died a mean of 3 minutes after the balloon was deflated. With intermittent REBOA, there was 100% survival out to the end of the study period at 120 minutes. Survival, lactate, and bowel ischemia data indicated that intermittent REBOA can support trauma victims for extended periods with limited reperfusion injury. Both pressure-based and time-based intermittent REBOA techniques are feasible and effective. Time-based REBOA may be the better option for ARC.

#### 16. TCCC in the Maritime Environment: CAPT Christopher Kurtz – Deputy Chief for Fleet Operations – Navy Bureau of Medicine and Surgery

The Committee of Chiefs of Military Medical Services (COMEDS) is NATO's senior medical body, reporting to the NATO Military Committee. It is composed of the Surgeons General of the allied nations and the senior medical advisers within NATO's command structure. COMEDS acts as the central point for the development and coordination of common standards and for providing medical advice to the Military Committee.

Within COMEDS, the Medical Naval Panel (MedNP) addresses issues in maritime medicine. In 2018, MedNP tasked its Subpanel 5 to explore options for TCCC in the maritime environment. Subpanel 5 is developing a Maritime Module (phases and scenarios) to be incorporated into the official TCCC curriculum and is seeking CoTCCC collaboration. Subpanel 5 would like to present its work (see Enclosure 2) to the CoTCCC for endorsement of its work on phases and hopes a CoTCCC liaison will be able to participate in its Fall 2019 meeting in Rome to develop maritime scenarios. Their final product is due to MedNP in the spring of 2020.

#### 17. ARC Rollout: Col Joseph Dubose – Director, C-STARS Baltimore

The Joint Special Operations Command and the 160th Special Operations Aviation Regiment have implemented ARC training for their surgical and far-forward resuscitation teams. The initial JSOC training was held in October 2018 at Fort Bragg, NC.

\*F Edward Hebert School of Medicine, Uniformed Services University of the Health Sciences, Bethesda, Maryland and Department of Surgery, Walter Reed National Military Medical Center, Bethesda, MD.



The current training program occurs in three phases. Phase 1 is classroom familiarization. Phase 2 is initial hands on training via the Basic Endovascular Skills for Trauma (BEST) Course with its military module and static live tissue training incorporated into surgical team training. Also included in the training module was the ARC plan for use of whole blood in resuscitating casualties with NCTH and shock; there were also practical pointers regarding far-forward Zone 1 REBOA technique from JTS surgical personnel. Phase 3 of ARC training is dynamic training in exercises.

#### 18. Abdominal Evisceration Injuries in TCCC: LTC Jamie Riesberg – 10th Special Forces Group

In World War I, casualties with eviscerating injuries were triaged as expectant. Mortality ranged between 55% and 75%. During World War II, mortality dropped to 18% to 36%. Management consisted of covering eviscerated organs and transporting. In Vietnam mortality dropped to as low as 10%.

Most eviscerations are accompanied by one or more abdominal organ injuries, so evisceration is an absolute indication for laparotomy. There is no need for a CT scan.

Most commonly, current civilian practice is to cover eviscerated tissues with sterile dressings, wet down the dressings with sterile saline, and transport the patient.

Over the years various groups have published conflicting advice regarding replacing eviscerated intestines back into the abdominal cavity. Typically, though, the hole in the abdominal wall is either too small to allow replacement or so big that the replaced intestines pop right back out.

In the present conflicts, eviscerating injuries (in the absence of NCTH) have not been implicated as a significant cause of preventable death and the TCCC Guidelines are silent on this topic. There have been several recent requests, however, from the TCCC User Community for TCCC to provide recommendations on the management of these injuries. LTC Riesberg will continue to review the literature and work with his Change Team to develop a proposed addition to the TCCC Guidelines on this topic.

#### 19. Prevention and Management of Hypothermia: Dr Brad Bennett – Former Vice-Chair of Military and Emergency Medicine – Uniformed Services University

There has been no change in the TCCC hypothermia prevention recommendations for over 13 years (Nov 2005).

New research (Dutta et al., 2019 – in press) reports that the HPMK was ranked last in objective and subjective measures as compared to four other rewarming kits when evaluated in a cold chamber study (-7°F for 60 minutes) using humans. (Chairman's note: The Dutta study also notes that the price for the HPMK is approximately \$100, while some of the preferred units are over \$900 and that none of the thermal ensembles tested produced a drop in core temperature in the five test subjects during the study period.)

Additionally, feedback from the field indicates that the HPMK has limitations keeping casualties warm during prolonged cold weather use, and some SOF units are augmenting with the ChillBuster 8000 (AC/DC rewarming blanket) for hypothermia management.

Feedback from the field indicates that various US Special Operations units planning for prolonged field care are teaching

to upgrade the HPMK after short-term use (<60 minutes) to a heated and insulated hypothermia wrap.

Further, the TCCC hypothermia prevention guidelines do not provide specific guidance for battery-powered intravenous (IV) blood warming devices. New research and SOF medic preferences indicate there are devices that provide improved blood delivery temperature in cold environments.

*The current wording for this proposed change is as follows:*

#### Care Under Fire

##### 7. Hypothermia Prevention

- a. *Anticipate hypothermia in all trauma patients.*

#### Tactical Field Care & Tactical Evacuation Care

##### 7. Hypothermia Prevention

- a. *Take early and aggressive steps to prevent further body heat loss.*
- b. *Minimize casualty's exposure to cold ground and air temperatures. Get the casualty onto an insulated surface as soon as possible. Keep protective gear on or with the casualty if feasible.*
- c. *Replace wet clothing with dry and minimize exposure to cold with an improvised shelter when possible.*
- d. *Apply the Ready-Heat blanket from the Hypothermia Prevention and Management Kit (HPMK) to the casualty's torso (do not place Ready-Heat blanket directly on the skin to prevent burns), and enclose the casualty with the Heat Reflective Shell (HRS).*
- e. *If an HRS is not available, the previously recommended combination of the Blizzard Survival Blanket and the Ready-Heat blanket may also be used.*
- f. *If the items mentioned above are not available in cold environments, create a hypothermia enclosure wrap using a large waterproof tarp, such as, a waterproof bivvy sack, or multiple poncho liners as the outer layer, then insulate the patient with hooded sleeping bags, wool blankets, polar fleece clothing or anything that will retain body heat and keep the casualty dry.*
- g. *Upgrade the HPMK if patient complains about being cold, or if unconscious and skin feel cold, to an insulated hypothermia enclosure wrap warming system, and during transition to prolonged field care.*
- h. *Warm (38–42°C) IV blood products are preferred if transfusion is required. The BuddyLite, ThermoSens, Warrior, or EnFlow commercial battery-powered IV warming devices with insulated IV tubing wraps are better device options when in cold environments.*
- i. *Protect the casualty from prolonged wind exposure on any evacuation platform.*

CAPT (Ret) Bennett and his team are continuing to refine the proposed change wording and to smooth up the change paper that supports it.

#### Breakout Session Briefbacks

##### 20. Maritime TCCC Breakout Session Briefback:

CAPT Chris Kurtz – Deputy Chief for Fleet Operations –  
Navy Bureau of Medicine and Surgery

It is hard to apply TCCC phase labels to emergency medical care on a ship. NATO MedNP will look at TCCC ASM in light of its emphasis on the concerns of the naval contingent. MedNP is seeking collaboration with the CoTCCC on its maritime module.



Enclosure 2 contains a proposed set of TCCC for All Service-members Guidelines customized for use in the Maritime Environment developed by Subpanel 5 of the NATO Medical Naval Panel\*.

## 21. New Technology Breakout Session Briefback: Dr Mel Otten – Distinguished Professor of Emergency Medicine – University of Cincinnati Medical Center

**Items Discussed:** The New Technology Subcommittee breakout session focused on the new sublingual formulation of sufentanil that has recently been approved by the FDA. The Subcommittee used competing pro/con presentations for this purpose.

### Sufentanil Pros and Cons:

*Pros – CSM Tim Sprunger*

- Provides an on-label option for management of acute pain severe enough to require an opioid analgesic in adults.
- Can be used in emergency department, inpatient, and postoperative settings.
- Lightweight, small packaging
- Easy to administer
- Patient cannot drop it or lose it once administered.
- Primary endpoints in studies: time-weighted summed pain intensity difference over 12 hours (SPID12)
- 2017 Minkowitz study
  - o Prospective, randomized, controlled trial
  - o Sublingual sufentanil vs placebo after abdominal surgery
  - o 161 patients
  - o Pain reduction significantly better with sufentanil than placebo
- 2014 Singla Study
  - o Prospective, randomized, controlled trial
  - o Sublingual sufentanil vs placebo after bunionectomy
  - o 100 patients
  - o Pain reduction significantly better with 30µg sufentanil than placebo

*Cons – CAPT Lanny Littlejohn*

- There are no studies documenting that sufentanil is safe in the prehospital environment.
- There is no evidence that sufentanil is safer than the currently recommended opioid in TCCC (OTFC).
- There is no evidence that sufentanil is more efficacious than the currently recommended opioid in TCCC (OTFC).
- Sufentanil is more expensive than OTFC.
- We should keep our recommendations simple. Polypharmacy is a real threat to patient safety.
- The cardiovascular effects of sufentanil in hemorrhagic shock have not been studied. There may be risk for hypotension and bradycardia.
- In TBI, there may be a risk of reduced respiratory drive and lowered seizure threshold.
- FDA Risk Evaluation and Mitigation Strategies are complex.
- There is a risk of androgen deficiency from sufentanil use.

## 22. Advanced Resuscitative Care Breakout Session Briefback: COL Joe Dubose

The working group identified important points from COL Dubose's presentation slides that should be covered in the ARC curriculum going forward.

## 23. TCCC MP Course Appraisals Breakout Session Briefback: Mr Dom Greydanus

Mr Greydanus is visiting various military and civilian TCCC training sites and observing TCCC-MP courses. He gathers data on:

- How closely the teaching adheres to the JTS-approved TCCC-MP curriculum;
- How long each segment of the training takes; and
- What post-course metrics were used to assess effective learning by the students.

Mr Greydanus is compiling a database to present his observations. His course appraisals will give us a better understanding of the current state of TCCC training and may identify opportunities to improve in ensuring that the JTS-approved TCCC-MP curriculum is used by organizations providing that training.

## 24. CoTCCC Action Items: Dr Frank Butler

**Proposed changes to the TCCC Guidelines currently being developed:**

19-01	Tourniquet Review	Mr Harold Montgomery
19-02	TXA Relook	CAPT Brendon Drew
19-03	Hypothermia Relook	Dr Brad Bennett
19-04	iTClamp Relook	CDR Dana Onifer
19-05	Evisceration Injuries	LTC Jamie Riesberg
19-06	Fluid Resuscitation	MAJ Marc Northern

**Additional potential changes to the TCCC Guidelines that may be addressed going forward:**

- Recommend plasma as a burn resuscitation fluid?
- Recommend plasma for fluid resuscitation in TBI patients?
- Recommend end-tidal CO2 monitoring in TFC?
- Recommend calcium in TFC even for casualties not being transfused?
- Replace moxifloxacin with levofloxacin as the oral antibiotic in TCCC?
- Increase the initial ketamine dose?
- Specify the two vented chest seals with laminar vents as the preferred option for treating open pneumothorax?
- Add a CBRN Section in the TCCC Guidelines?
- Add a maritime casualty scenario to the TCCC-MP curriculum?

**Future technology items for consideration (After FDA approval and/or more studies)**

- ResQFoam
- Compensatory reserve index monitor

**TCCC Business Practice Decisions:**

How do we handle situations in which a TCCC-recommended item is significantly changed after the recommendation to use that item in TCCC has been made? Examples include:

- Tourniquets in which the design of the device has been significantly modified after their use in TCCC has been recommended
- XStat – now that the original chitosan coating has been removed from the compressed mini-sponges
- Celox Gauze after modification to Celox Rapid
- CricKey – the recommended surgical airway device is offered for sale only as packaged with CricKnife, a device which has not been addressed by the CoTCCC

\*2017 TCCC guideline documentation has been amended by the NATO Medical Naval Panel to highlight considerations in the Maritime environment and application thereof.

Conclusion – The recommended business practice going forward should be – in selected cases in which there is significant concern about the impact of the post-recommendation modifications – to refer these items to the New Technology Suband ask for formal input from that group about whether the modified product needs a re-vote in order to remain as a TCCC-recommended item.

**Acknowledgments:** The authors gratefully acknowledge the ongoing efforts of all of the members of the TCCC working

group, our invited speakers, and other meeting attendees to improve the battlefield trauma care provided to our nations' combat wounded.

**Disclaimers:** The opinions or assertions contained herein reflect the events of the 20–21 February meeting of the CoTCCC. They are not to be construed as reflecting the views of the Department of the Army or the Department of Defense.



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## ENCLOSURE 1

### Attendance CoTCCC Meeting

20–21 February 2019 – San Antonio International Airport Holiday Inn

#### Voting Members

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Dr Jim Bagian  
CAPT Sean Barbabella  
Dr Frank Butler  
LTC Cord Cunningham  
COL Jim Czarnik  
LTC Steve DeLellis  
Col John Dorsch  
Col Joe Dubose  
COL Brian Eastridge  
COL Erin Edgar  
MAJ Andy Fisher  
COL Kirby Gross  
Dr Jay Johannigman  
Mr Win Kerr  
CAPT Lanny Littlejohn  
COL Bob Mabry  
SOCS Matt McClain  
LTC Ethan Miles  
COL Shawn Nessen  
CDR Dana Onifer  
Dr Mel Otten  
Mr Don Parsons  
MSG Mike Remley  
LTC Jamie Riesberg  
Col Stacy Shackelford  
MSgt Travis Shaw  
CSM Tim Sprunger  
Mr Rick Strayer  
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Dr Brad Bennett  
Dr Jeff Cain  
Dr Dave Callaway  
Dr Howard Champion  
Dr Warren Dorlac

Dr John Gandy  
Dr Jim Geracci  
Dr John Holcomb  
Dr Russ Kotwal  
Dr Matt Martin  
Dr Kevin O'Connor  
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Dr Alex Eastman  
Mr Josh Knapp  
Mr Joe Pappamihiel

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Maj Gen Lee Payne

#### Speakers

Ms Cynthia Barrigan  
SO1 Terence (TC) Byrne  
CDR Travis Deaton  
Lt David Feibus  
CAPT Christopher Kurtz  
Dr Sanders Marble  
Dr Matt Martin

#### Invited Guests

CAPT Steven Blivin  
MSG Josh Brady  
COL JB Buller  
Col Scott Calder  
COL Andre Cap  
Mr Eric Chaney  
Dr Victor Convertino  
Mr Reuben Garza  
CDR Jacob Glaser  
Dr Chet Kharod  
MAJ Ryan Knight  
Mr John Lacroix  
Ms Pam Lane  
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Mr Darin Schwartz  
Mr Dominick Sestito  
SGM Jason Skaggs  
MSG Matthew Spangler  
Ms Connie Welch  
SGM Tony Williams

## ENCLOSURE 2

# Proposed Tactical Combat Casualty Care Guidelines for All Servicemembers – Maritime Environment Application<sup>2</sup>

### Introduction

Although Tactical Combat Care Guidelines (TCCC) were originally developed in 1996 for utilization by United States Special Operations Forces, since that time, these guiding principles and tactical application have been further expanded for use in more general land force operations. In fact significant experience and success was gained during the International Security Assistance Force (ISAF) led mission in Afghanistan, for which TCCC was utilized by medical technicians and some combat personnel respectively (Savage, December 2011). However, TCCC should also be considered in the context of the Maritime environment, which is unique compared to land operations and for which there are nuances on application and other considerations. Although TCCC guidelines were developed for combat, there is potential whereby such skill-sets could be applicable to noncombat scenarios; these would include such entities as major collision, fire or explosion and helo-crash on deck.\* Combat tactical threats while at sea can be varied, to include enemy fire from surface and sub-surface assets, asymmetric threats from small boats and aircraft, and attack whilst alongside. In addition, Naval Boarding Parties may encounter direct enemy contact during boarding operations.

### Basic Management Plan for Care Under Threat at Sea (Phase 1)

1. Apply your personal safety gear like, flame hoods, life vest, escape mask, rescue suit or other relevant equivalents. If dark inside, turn on your headlight.
2. Stay on stations if necessary for the ship to remain operational. If not possible, escape from threats. (Staying on battle stations or damage control stations will be the maritime equivalent to return Fire. The ships integrity first priority, since a ship is dependent on its own infrastructure to collectively fight the threat)
3. Direct or expect casualty to remain engaged as a combatant if appropriate.
4. Direct casualty to move to closest safe zone and apply self-aid if able.
5. Try to keep the casualty from sustaining additional injuries, hypothermia and smoke inhalation. (This includes for instance to put on breathing device on patient if escaping smoke area)
6. Casualties should be extricated from hazardous spaces like burning/smoke-filled spaces, flooding compartments or harsh outside environment and moved to places of relative safety.
7. Stop *life-threatening* external hemorrhage if tactically feasible:
  - a. Direct the casualty to control his bleeding himself if able.
  - b. Use a CoTCCC-recommended limb tourniquet for hemorrhage that is anatomically amenable to tourniquet use.
  - c. Apply the limb tourniquet over the uniform clearly proximal to the bleeding site(s). If the site of the life-threatening bleeding is not readily apparent, place the tourniquet “high and tight” (as proximal as possible) on the injured limb and move the casualty to cover.
8. Airway management is generally best deferred until the Tactical Maritime Care (Phase 2).

### Basic Management Plan for Tactical Maritime Care (Phase 2)

1. Ensure a safe casualty collection point. Maintain tactical situational awareness.
2. Casualties with an altered mental status should have weapons and communications equipment taken away immediately (when applicable; not all sailors will have such equipment).
3. Massive Hemorrhage
  - a. Assess for unrecognized hemorrhage and control all sources of bleeding. If not already done, use a CoTCCC-recommended limb tourniquet to control life-threatening external hemorrhage that is anatomically amenable to tourniquet use or for any traumatic amputation. Apply it directly to the skin 2–3 inches above the bleeding site. If bleeding is not controlled with the first tourniquet, apply a second tourniquet side-by-side with the first.
  - b. For compressible (external) hemorrhage not amenable to limb tourniquet use, use Combat Gauze as the CoTCCC hemostatic dressing of choice.
    - Alternative hemostatic adjuncts:
      - Celox Gauze or
      - ChitoGauze or
    - Hemostatic dressings should be applied with at least 3 minutes of direct pressure. Each dressing works differently, so if one fails to control bleeding, it may be removed and a fresh dressing of the same type or a different type applied.
4. Airway Management<sup>†</sup>
  - a. Unconscious casualty without airway obstruction:
    - Chin lift or jaw thrust maneuver
    - nasopharyngeal airway<sup>‡</sup>
    - Place casualty in the recovery position
  - b. Casualty with airway obstruction or impending airway obstruction:
    - Chin lift or jaw thrust maneuver
    - Nasopharyngeal airway
    - Allow a conscious casualty to assume any position that best protects the airway, to include sitting up.
    - Place an unconscious casualty in the recovery position.
  - c. If the previous measures are unsuccessful, refer to a medic immediately.
5. Breathing
  - a. In a casualty with progressive respiratory distress and known or suspected torso trauma, consider a tension pneumothorax and refer to a medic as soon as possible.<sup>§</sup>
  - b. In a Maritime environment, smoke and fire exposure is a significant risk. Exposure risk is exacerbated by the confined spaces aboard a ship. Consider immediate administration of O<sub>2</sub> by nonrebreather mask or moving patient to open air, for sailors presenting with signs of respiratory distress.
  - c. All open and/or sucking chest wounds should be treated by immediately applying a vented chest seal to cover



- the defect. If a vented chest seal is not available, use a nonvented chest seal. Monitor the casualty for respiratory distress. If it develops, you should suspect a tension pneumothorax. Treat this by burping or temporarily removing the dressing. If that doesn't relieve the respiratory distress, refer to a medic.
6. Circulation
    - a. Bleeding
      - Reassess every tourniquet that was applied earlier. Expose the wound and determine if the tourniquet is controlling the bleeding. Any tourniquet that was applied over the casualty's uniform should be replaced by medical personnel with another tourniquet applied directly to the skin 2–3 inches above the wound, if possible.
      - Ensure that bleeding is stopped. If there is no traumatic amputation, check for pulses further out on the limb than the tourniquet. If bleeding persists or a distal pulse is still present, consider additional tightening of the tourniquet or the use of a second tourniquet side-by-side with the first to eliminate both bleeding and the distal pulse.
      - Expose and clearly mark all tourniquets with the time of tourniquet application. Use a permanent marker to mark on the patient's forehead.
    - b. Hemorrhagic Shock
      - Assess for hemorrhagic shock (altered mental status in the absence of brain injury and/or weak or absent radial pulse).
        - If the casualty is not in shock:
        - No IV fluids are immediately necessary.
        - Fluids by mouth are permissible if the casualty is conscious and can swallow.
        - If the casualty is in shock or develops shock, refer to a medic.
  7. Drowning/near drowning
    - a. Bring the patient out of water.
    - b. Place the patient so that the head and feet are at the same level.
    - c. Check Airway, Breathing, Circulation
      - If unconscious and not breathing, start CPR, begin with 5 rescue breaths, then continue with 30:2 (compressions:rescue breaths). Five breaths are used initially because water in the airways can interfere with effective alveolar expansion initially. A drowning patient with only respiratory arrest usually responds after a few rescue breaths.
      - Cardiac arrest from drowning is due primarily to lack of oxygen.
    - d. Ventilation support with available tools
    - e. Prepare for vomiting: 65% of victims require rescue breathing vomit; 88% of those receiving chest compressions will vomit.
    - f. Hypothermia is common in drownings; make sure reduced respiratory frequency is not mistaken for respiratory arrest.
  8. Inspect and dress known wounds.
  9. Check for additional wounds.
  10. Burns
    - a. Facial burns, especially those that occur in closed spaces, may be associated with toxic or thermal injury to the airways or lungs. Aggressively monitor the casualty's airway status and refer to a medic as soon as possible.
  11. Splint fractures and re-check pulses.
  12. Hypothermia Prevention
    - a. Minimize casualty's exposure to the elements. Keep protective gear on or with the casualty if feasible.
    - c. Apply the Ready-Heat Blanket from the Hypothermia Prevention and Management Kit (HPMK) to the casualty's torso (not directly on the skin) and cover the casualty with the Heat-Reflective Shell (HRS).<sup>¶</sup>
    - d. If an HPMK is not available, use dry blankets, comforters, or anything that will retain heat and keep the casualty dry.
  13. Communicate
    - a. Encourage and reassure the casualty.
    - b. Explain to the casualty what you are doing to help him/her.
    - c. Communicate with casualty clearing team/ship medical authority as soon as possible and throughout casualty treatment as needed.
  14. Cardiopulmonary resuscitation (CPR)
    - a. Resuscitation 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. In a maritime environment, with integral Role 1 Sick-bay/medical personnel, this should be determined on a case by case/tactical basis.
  15. Initiate transfer of casualty by the Casualty Clearing Team(s) to ship sick-bay or Casualty Clearing Station.
- ### Basic Management Plan for Tactical Medical Care at Sea (Phase 3)
16. Repeat primary survey and carry out necessary interventions
  17. Hypothermia Prevention
    - b. Replace wet clothing with dry if possible. Get the casualty onto an insulated surface as soon as possible.
  18. Penetrating Eye Trauma
    - a. If a penetrating eye injury is noted or suspected:
      - Cover the eye with a rigid eye shield (NOT a pressure patch.)
      - Ensure that the 400mg moxifloxacin\*\* tablet in the Combat Wound Medication Pack (CWMP) is taken if the casualty can swallow. If she cannot, refer to a medic for IV or IM antibiotics.
  19. Pain relief:
    - a. For mild to moderate pain<sup>††</sup>:
      - Combat Wound Medication Pack:
      - Tylenol – 650mg bilayer caplet, 2 PO every 8 hours
      - Meloxicam – 15mg PO once a day<sup>††</sup>
  20. Antibiotics: recommended for all open combat wounds
    - a. If the casualty can swallow:
      - Moxifloxacin\*\* (from the CWMP), 400mg by mouth once a day
    - b. If the casualty cannot swallow (shock, unconsciousness):
      - Ertapenem 1g IV/IM
  21. Documentation of Care
    - a. Document clinical assessments, treatments rendered, and changes in the casualty's status on a TCCC Card

(DD Form 1380). Forward this information with the casualty to the next level of care.

22. Prepare for Evacuation

- a. Decision to Medevac to next level of care (patient movement at sea may include same or even lower level of care), to be determined by Senior Medical Authority (SMA) and approved by the Commanding Officer, all dependent on tactical situation and proximity to higher level of care (ship or ashore).
- b. Complete and secure the TCCC Card (DD 1380) to the casualty.

- c. Secure all loose ends of bandages and wraps.
- d. Secure hypothermia prevention wraps/blankets/straps.
- e. Secure litter straps as required. Consider additional padding for long evacuations by small boats or air.
- f. Provide instructions to ambulatory patients as needed. Ensure assessed by medical personnel.

Reference

1. Sperry JL, Guyette FX, Brown JB, et al. Prehospital Plasma during Air Medical Transport in Trauma Patients at Risk for Hemorrhagic Shock. *N Engl J Med.* 2018 Jul 26;379(4):315–326.

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\*TCCC is primarily combat-related intervention. Dependent on a nation's approval authorities, there may be circumstances whereby such interventions may be authorized for noncombat scenarios.

†Spinal immobilization consideration, especially if related to blast/blunt trauma and with transportation by Casualty Clearing Teams on ship.

‡Nasopharyngeal airway placement may not be authorized by some nations for nonclinical personnel to undertake.

§Needle decompression in certain circumstances may be authorized to be performed by nonmedical personnel, although this would be determined by SMA of casualty nation.

¶On ship, HPMK/blankets will vary, dependent on nation.

\*\*Antibiotic use by nonclinical personnel may vary, dependent on host nation TCCC guidelines/orders.

††In addition to combat related duties, in a maritime environment, sailors will be required to fight fire or flooding aboard, to ensure integrity of ship is maintained at all cost.

‡‡Analgesia will vary by nation, dependent on host nation TCCC guidelines/orders.





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