

TCCC Guidelines Comprehensive Review and Update

TCCC Guidelines Change 16-03

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Abstract

Based upon careful review of the Tactical Combat Casualty Care (TCCC) Guidelines, the authors developed a list of proposed changes for inclusion in a comprehensive change proposal. To be included in the proposal, individual changes had to meet at least one of three criteria:

- 1) The change was primarily tactical rather than clinical in nature.
- 2) The change was a minor modification to the language of an existing TCCC Guideline.
- 3) The change, though clinical, was straightforward and non-contentious.

The authors presented their list to the TCCC Working Group for review and approval at the 7 September 2016 meeting of the Committee on Tactical Combat Casualty Care (CoTCCC). Twenty-three items met with general agreement and were retained in this change proposal.

Proximate Causes for this Proposed Change

1. Medics, corpsmen, and pararescuemen (PJs) on the Committee on Tactical Combat Casualty Care (CoTCCC) expressed a need for a new TCCC knowledge product that is both more concise than previous products and is optimized for use on a personal electronic device such as a smart phone or tablet.
2. These combat medical personnel also requested the TCCC Guidelines be rendered in an algorithmic format.
3. Responding to these requests required a comprehensive review of the TCCC Guidelines and that afforded an opportunity for a number of improvements throughout.
4. Comprehensive review provides an opportunity to integrate lessons learned and best practices garnered from the last fifteen years of conflict that have not yet been included in TCCC guidelines.
5. The proposed changes will enable the Defense Health Agency's ongoing TCCC Web-Mobile project to produce improved and more concise TCCC messaging tailored for combat medical personnel.

Summary of Changes Recommended in this Paper

This paper contains 23 distinct recommended changes to the TCCC Guidelines:

1. Add establishing a security perimeter to the beginning of Tactical Field Care (TFC).
2. Specify securing both weapons and communications equipment of casualties with altered mental status in TFC.
3. Add a “Massive Hemorrhage” paragraph as the first medical intervention in TFC and Tactical Evacuation Care (TACEVAC).
4. Change the “Breathing” section title to “Respiration/Breathing”
5. Change the “Bleeding” section title to “Circulation.” Make the first subsection “Bleeding” and include in it pelvic binders, replacing or doubling limb tourniquets, converting tourniquets, and recording times of tourniquet events. Follow “Bleeding” with IV Access, TXA, and Fluid Resuscitation.
6. Shift the initiation of pulse oximetry to the Respiration/Breathing section.
7. Add known or suspected smoke inhalation as an indication for supplemental oxygen when available.
8. Replace the term “*wound site*” with “*bleeding site*” throughout the TCCC Guidelines when addressing hemorrhage control.
9. Add "Remove tourniquet if it was never actually needed to control bleeding" to the bleeding section.
10. Modify “check a distal pulse if possible” to specify that the “if possible” caveat applies to a traumatic amputation.
11. Clarify that XStat, unlike other hemostatic dressings, should not be removed by combat medical personnel in the field after it has been applied, but more XStat may be added and/or a different hemostatic dressing applied over the XStat.
12. Clarify tourniquet documentation requirements.
13. Specify the indications for establishing intravenous (IV) or intraosseous (IO) access.
14. Clarify the wording regarding time urgency and the duration of infusion of tranexamic acid (TXA).
15. Specify that hypothermia prevention should generally be undertaken concurrently with fluid resuscitation when the latter is indicated.

16. Eliminate cefotetan as a recommended antibiotic option.
17. Add a requirement to document the results of the rapid field test of visual acuity in known or suspected eye injuries.
18. Recommend advanced electronic monitoring in TFC if and when the technology is available in this phase.
19. Change the name of the oral medication package from “Combat Pill Pack” to “Combat Wound Medication Pack.”
20. Expand the communication paragraph in TFC to include communicating with tactical leadership and the evacuation system as well as with the casualty. Add a similar paragraph to TACEVAC.
21. Add a section on preparing the casualty for evacuation to the end of TFC.
22. Add a section on transition of care to the beginning of TACEVAC.
23. Rearrange the guidelines as needed to reflect the actual priority of clinical interventions.

Background

The original TCCC Guidelines were published in Military Medicine in 1996 (**Butler 1996**). The comprehensive review of the current TCCC guidelines presented here took place roughly 20 years after the original publication. During that period, the U.S. military has been engaged in two significant wars involving many thousands of casualties. The lessons learned and best practices recorded during these conflicts have been significant (**Butler 2012-Decade, Kotwal 2013 saving lives**).

Since they first appeared, the TCCC Guidelines have been updated numerous times by the CoTCCC to incorporate new evidence in prehospital trauma care, lessons learned in Iraq and Afghanistan, and new trauma care technology. (**Salamone 2007, Butler 2011, Butler 2014**) The methodology used by the CoTCCC to develop and vote on these proposed changes has been described elsewhere. (**Butler 2015 Combat Medic Aid Bag 2025**)

Heretofore, each change to the TCCC Guidelines resulted from an assessment of a specific clinical intervention. Prior to inclusion in the Guidelines, the evidence for the particular medication or equipment item being considered was carefully reviewed and debated. For example, when new hemostatic dressings, junctional tourniquets, and XStat were introduced, each item was carefully evaluated, and when the decision was made to

recommend it, the hemorrhage control section of the TCCC Guidelines was updated (**Kotwal 2013, Bennett 2014, Sims 2016**). As a result of this focused approach, some sections of the TCCC Guidelines have gone without updating for long periods. To address this issue, the authors of this proposal paper reviewed the Guidelines carefully, making recommendations for change wherever needed.

Methodology for this Change Proposal

The authors proposed changes throughout the 160603 version of the Tactical Combat Casualty Care (TCCC) Guidelines for Medical Personnel for items that met one or more of the following criteria:

- 1) The change was largely tactical rather than medical in nature.

The authors felt it important to emphasize tactical casualty management in TCCC training. Tactical maneuver, including casualty management, is covered extensively in doctrine and non-medical training. Inclusion of items of tactical standard operating procedure applicable to casualty management in the Guidelines provides a situational context for casualty scenarios.

- 2) The change was a minor modification to the language of an existing TCCC Guideline.

In numerous places throughout the Guidelines, the authors recommended changes in wording to add clarity without changing the underlying recommendation for what to do and how to do it.

- 3) The change, though clinical, was straightforward and non-contentious.

Changes with clinical impact were included if the authors felt the change was likely to be readily accepted by the CoTCCC.

Potential changes identified during this process that were deemed to require more extensive assessment by the CoTCCC (eliminating the second dose of TXA, for example) were excluded from this proposal. The CoTCCC will address these as individual proposals following its usual focused approach.

Discussion of Recommended Changes

1. Add establishing a security perimeter to the beginning of Tactical Field Care.

The TCCC guidelines do not currently address security as the most important tactical concern in the transition to TFC as was done for returning fire in Care Under Fire (CUF). It is important to recognize that unit reaction to casualty scenarios must conform to standard operating procedures during tactical maneuver where unit security is always a top priority. (FM 3-21.10, ATP 3-21.11, ATP 3-21.8, ATP 3-06.11, Butler 1996) Tactical security, situational awareness, and being prepared to engage the enemy is paramount during all phases of a tactical operation, especially when establishing defensive locations such as a Casualty Collection Point (CCP). This activity is similar to the “Scene Safe” consideration in Emergency Medical Technician training.

After an engagement with enemy forces in which casualties have been sustained, the unit focus is on achieving tactical success and reducing or eliminating the threat. After that has been done, the focus shifts to: establishing security; accounting for personnel, weapons, ammunition, and equipment; and treating casualties and moving them to a CCP. In accordance with infantry battle drill 07-2-5027 (Conduct Consolidation and Reorganization-Platoon/Company), the first performance measure is to establish 360-degree local security. (FM 3-21.10, ATP 3-21.11, ATP 3-21.8, ATTP 3-06.11) This effort may expand to include the establishment of observation posts, sectors of fire, placement of early-warning devices and registering protective fires. Accordingly, the first measure in establishing a CCP is the establishment of the security perimeter. A CCP security perimeter is also critical to the triage and movement of casualties in and out of the site through choke points. (Butler 2014) The tactical threat that produced the casualties may be reduced but not necessarily eliminated and may quickly return. Even if a CCP site is not fully established, TFC must be accomplished with the unit in a strong defensive posture to protect both casualties and care providers if the unit is attacked while care is ongoing.

It is important that the tactical context always remain the predominant consideration in TCCC, and ensuring that a defensive perimeter is in place should be the first step in TFC.

2. Specify securing both weapons and communications equipment of casualties with altered mental status in TFC.

Combat casualties may have an altered mental status due to shock, traumatic brain injury (TBI), or analgesic medications. (Butler 2014) Their weapons should be cleared and secured to prevent inappropriate or accidental use. Similarly, the mission might be compromised or inappropriate information passed to command and control elements if a unit member with altered mental status makes an improper transmission.

3. Add a “Massive Hemorrhage” paragraph as the first medical intervention in TFC and TACEVAC.

In previous versions of the TCCC Guidelines (**PHTLS 6**), massive external hemorrhage was controlled with either extremity tourniquets or hemostatic dressings in the Care Under Fire (CUF) phase. Combat medical providers on the CoTCCC, however, pointed out that hemostatic dressings require at least 3 minutes of direct pressure to apply, and that Care Under Fire is therefore not the right time to perform this intervention. Accordingly, hemostatic dressings were moved to TFC, but no mention was added to the guidelines at the start of TFC that control of ongoing massive hemorrhage should be the initial medical intervention in that phase. This step should have been taken concurrently with moving hemostatic dressings to TFC, since hemorrhage is a far more common cause of preventable death on the battlefield than airway compromise. (**Eastridge 2012**)

Currently in the TFC section of the TCCC Guidelines, however, massive hemorrhage is not addressed until after airway management and breathing. In both the 2016 TCCC Curriculum for Medical Personnel and the Military eighth edition of the PHTLS text (**Butler 2014**), control of life-threatening *extremity* hemorrhage is the only medical treatment rendered in CUF, and control of massive hemorrhage is the first priority in TFC. no tourniquets or hemostatic dressings have yet been applied. The widely-used training mnemonic “MARCH (for Massive hemorrhage, Airway, Respiration, Circulation, and Hypothermia prevention) reflects the fact that and presents control of massive hemorrhage as the top priority in battlefield trauma care. (**Savage 2011, Rush 2015, 2016 TCCC-MP Curriculum, RgrMed Handbook 2012, PHTLS-8, USSOCOM TMEPs, Ramirez 2010**). The same priority is given to massive hemorrhage control in other mnemonics. For example, “CABC” stands for Catastrophic hemorrhage, Airway, Breathing, and Circulation (**Hodgetts 2006**), and “THREAT” stands for Threat suppression, Hemorrhage control, Rapid Extraction, Assessment by providers, and Transport (Jacobs HCS II – 2014).

4. Change the “Breathing” section title to “Respiration/Breathing”

Breathing was chosen as the title of the third major paragraph of TFC in the original TCCC paper (**Butler 1996**) to conform to the traditional Airway-Breathing-Circulation or “ABC” memory aid. In TCCC, however, this section paragraph addresses far more than just ventilation. It also deals with chest injuries and their management. The title “Respiration/Breathing” better encompasses the actual contents of this section.

5. Change the “Bleeding” section title to “Circulation.” Make the first subsection “Bleeding” and include in it pelvic binders, replacing or doubling limb tourniquets, converting tourniquets, and recording times of tourniquet events. Follow “Bleeding” with IV Access, TXA, and Fluid Resuscitation.

“Bleeding” was originally chosen in TCCC to reinforce the importance of hemorrhage control in combat casualties over the traditional “circulation” in the ABC terminology. Establishing a section entitled “Massive Hemorrhage” earlier in the TCCC guidelines, however, makes “Circulation” a more apt title for this section.

Under “Circulation,” the former “Bleeding” section makes an appropriate first subsection. It should incorporate the recent change to TCCC adding pelvic binders and the former sections 3(c) on replacing or doubling limb tourniquets, 3(d) on converting tourniquets, and 3(e) on marking tourniquets with time of application. Former sections 4 (IV Access), 5 (TXA), and 7 (Fluid Resuscitation) should be moved into “Circulation” as subsections following “Bleeding.”

6. Shift the initiation of pulse oximetry to the Respiration/Breathing section.

Currently, the initiation of pulse oximetry is not mentioned until Section 10 of the TFC Guidelines, but this action is referred to earlier in the Respiration/Breathing section in the discussion of Traumatic Brain Injury (TBI). Avoidance of hypoxia (hemoglobin oxygen saturation < 95) is a critical aspect of prehospital care in TBI patients to prevent secondary brain injury. (**Butler 2014 PHTLS 8, Chi 2006**) Assessing oxygenation requires pulse oximetry, so this intervention should appear earlier in the guidelines.

7. Add “known or suspected smoke inhalation” as an indication for supplemental oxygen when available.

The current indications for supplemental oxygen when it becomes available in TCCC include:

- Low oxygen saturation by pulse oximetry
- Injuries associated with impaired oxygenation
- Unconscious casualty
- Casualty with TBI (maintain oxygen saturation > 90%)
- Casualty in shock
- Casualty at altitude (**Butler 2014**)

Casualties who have suffered burn injury may also have inhaled toxic substances, including smoke and carbon monoxide (CO.) Smoke inhalation and CO poisoning are especially likely to be present in casualty scenarios involving vehicle fires or fires in other enclosed spaces. Smoke and other products of combustion may cause direct pulmonary damage leading to impaired oxygenation. Carbon monoxide occupies oxygen

binding sites on hemoglobin, preventing oxygen transfer to the tissues. Additionally, carboxyhemoglobin is mistakenly read by pulse oximeters as oxygen-saturated hemoglobin. (Butler 2014) A casualty suffering CO poisoning may be profoundly hypoxic in the face of normal oxygen saturation values.. For these reasons, supplemental oxygen should be started as soon as it becomes available in cases of known or suspected smoke inhalation on , regardless of the hemoglobin oxygen saturation level. The indications for supplemental oxygen in burn casualties should be modified to cue medics to the potential need for supplemental oxygen in casualties with burns, especially if they have co-existing TBI.

8. Replace the term “wound site with “bleeding site” throughout the TCCC Guidelines when addressing hemorrhage control.

The term “wound site” is not the best descriptive terminology to use when discussing external hemorrhage control measures. The surface area of wounds may be large, especially in casualties who have sustained blast injury, but areas that have been injured may not necessarily be bleeding. When employing external hemorrhage control measures such as tourniquets or hemostatic dressings, the focus of interest should be on the site of vascular injury. It follows that “bleeding site” should be substituted for “wound site” throughout the TCCC Guidelines.

9. Add "Remove tourniquet if it was never actually needed to control bleeding" to the bleeding section.

Optimal TCCC requires frequent re-assessment of the casualty. Vessels initially in spasm after injury may start to bleed after the first assessment, and tourniquets that are initially successful at controlling extremity hemorrhage might later loosen, allowing bleeding to resume. After establishing a security perimeter, disarming casualties with altered mentation and removing their communication equipment, addressing any massive hemorrhage, opening the airway, and performing any interventions required to ensure effective ventilation, the next step in TFC should be to re-assess previous interventions aimed at external hemorrhage control. This may entail tightening a tourniquet or applying a second tourniquet if needed to control the bleeding. Furthermore, if a more thorough evaluation of the injury site reveals that the tourniquet was not actually needed in the first place, then the tourniquet should be removed. (Shackelford 2015) While it may seem self-evident that a tourniquet should be removed if further evaluation makes it obvious that the tourniquet was never actually needed in the first place, the TCCC Guidelines do not specifically state this at present. It is worth noting here that a tourniquet placed on an extremity proximal to a traumatic amputation should not be removed in prehospital settings since there is a high risk of subsequent bleeding if the tourniquet is removed and there is no distal extremity at risk of ischemia.

10. Modify “check a distal pulse if possible” to specify that the “if possible” caveat applies to a traumatic amputation.

The current wording in the bleeding section contains a recommendation to check the distal pulse “*if possible*.” It would be more clear to specify that the only circumstance in which distal pulse check is not possible is that of traumatic amputation.

11. Clarify that XStat, unlike other hemostatic dressings, should not be removed by combat medical personnel in the field after it has been applied, but more XStat may be added and/or a different hemostatic dressing applied over the XStat.

The current guidelines recommend that if application a hemostatic dressing (Combat Gauze, Celox Gauze, or ChitoGauze) is ineffective at controlling the hemorrhage, that the dressing may be removed, repacked, or additional dressings may be added. This is not the case with XStat. Once the compressed sponges have been injected into a wound cavity and have expanded, they may be difficult to remove and this should not be attempted prior to surgical exploration of the wound. If XStat has been injected and bleeding has not been controlled, more XStat can be injected into the wound cavity or a hemostatic dressing may be applied over the XStat (**Sims 2015**).

12. Clarify tourniquet documentation requirements.

The TCCC Guidelines currently say “Expose and clearly mark all tourniquet sites with the time of tourniquet application. Use an indelible marker.” Information that should be provided in addition to the time of initial tourniquet application includes: the time that any additional tourniquet is applied; the time of tourniquet conversion; the time of tourniquet removal; and the time of re-application should that become necessary after conversion or removal.

13. Specify the indications for establishing intravenous (IV) or intraosseous (IO) access.

The TCCC Guidelines currently recommend that IV/IO access be established if indicated, but do not provide the specific indications even though they are discussed in the PHTLS Text (**Butler 2014 PHTLS-8**). The Guidelines do provide specific indications for other interventions like tourniquets, TXA, fluid resuscitation, needle decompression of the chest, and battlefield analgesia. For consistency, the criteria for establishing IV/IO access (the need for IV medication administration or fluid resuscitation) should be added.

14. Clarify the wording regarding time urgency and the duration of infusion of tranexamic acid (TXA).

The current TCCC Guidelines call for the following with respect to TXA: “Administer 1 gram of tranexamic acid in 100 mL Normal Saline or Lactated Ringers as soon as possible but NOT later than 3 hours after injury.” This is correct as written, but may be misunderstood to mean that the TXA should be administered as rapidly as possible (i.e. by IV bolus) rather than over 10 minutes as recommended by the manufacturer.

15. Specify that hypothermia prevention should generally be undertaken concurrently with fluid resuscitation when the latter is indicated.

The format of the TCCC Guidelines intentionally infers a sequential order of actions. In some instances, however, actions may be undertaken simultaneously, especially when there are multiple individuals helping to care for the casualty. Such is the case with hypothermia prevention. Fluid resuscitation may take some time to accomplish as the blood products or other fluids are being infused. It is common practice, both in training and in combat, to initiate hypothermia prevention measures simultaneously with IV access and fluid resuscitation.

In most tactical situations, it is advantageous for the unit to get a casualty onto a litter or other carrying device as quickly as possible. Therefore, combat units, in their training and rehearsals for casualty management, will typically prepare the litter as much as possible prior to moving the casualty onto it. It is common practice to open and spread the Hypothermia Prevention and Management Kit (HPMK) across the litter and then lift the casualty onto both. This can be done while resuscitation fluids are infused, and it provides hypothermia prevention to the casualty a little earlier.

This common sense approach is not currently addressed in the TCCC Guidelines. It’s inclusion would capture a lesson learned from the recent conflicts that has already been widely adopted by combat medical personnel.

16. Eliminate cefotetan as a recommended antibiotic option.

The TCCC Guidelines currently recommend either ertapenem or cefotetan as the parenteral antibiotic of choice. These two antibiotics were chosen based on their broad spectra of coverage and their relative lack of adverse effects. In recent years, two additional factors have come to bear:

1) Recent reviews of antibiotic options in TCCC have recommended ertapenem as the parenteral antibiotic of choice. **(Murray 2016, Hospenthal 2008)**

2) Recent performance improvement surveys of antibiotic usage in TCCC have found that cefotetan is being used very rarely, while ertapenem is being used far more commonly. Service-level medical equipment authorized component packing lists for

medics include ertapenem and exclude cefotetan. (**Army MES, Combat Medic; Army MES, Tactical Combat Medical Care 2012; Army MES, SOF Combat Medic Trauma Kit, , USAF PJ Handbook**)

17. Add a requirement to document the results of the rapid field test of visual acuity in known or suspected eye injuries.

The current TCCC Guidelines recommend performing a rapid field test of visual acuity on casualties with known or suspected eye injuries before covering the eye with a rigid shield and administering antibiotics. The Guidelines do not, however, specify that the results of this examination be documented on the TCCC Card (DD Form 1380). The results of this early test of visual acuity may be important for ophthalmologists who will be caring for the casualty's eye injuries later in the continuum of care.

18. Recommend advanced electronic monitoring in TFC if and when the technology is available in this phase.

The current TCCC Guidelines call for advanced electronic monitoring to be initiated in TACEVAC care. This implies that the equipment required to accomplish this monitoring will not be available in TFC, leaving pulse oximetry as the only means of vital signs monitoring that will be available in this phase of care. This may not always be the case, especially when combat missions are supported by vehicular convoys. The guidelines should include the use of advanced electronic monitoring capabilities similar to TACEVAC wherever that technology can be made available. Additionally, in the dispersed battlefield of today, aid stations and forward operating bases may constitute the TFC environment; these locations are fully capable of advanced monitoring.

19. Change the name of the oral medication package from “Combat Pill Pack” to “Combat Wound Medication Pack.”

The term used previously in the TCCC Guidelines - “combat pill pack” - has morphed in the language of logisticians to “Combat Wound Medication Pack.” Adopting this supply system phrase into the TCCC Guidelines will get TCCC practitioners and logisticians using one name for this unique combination of medicines. The recommendations for the medications contained in the package (**Butler 2014 - PHTLS-8**) remain unchanged.

20. Expand the communication paragraph in TFC to include communicating with tactical leadership and the evacuation system as well as with the casualty. Add a similar paragraph to TACEVAC.

The TCCC guidelines currently address the need for combat medical personnel the provider to discuss with the casualty the care that is being provided. Though important, this recommendation ignores other communications needs. The individual providing care should also ensure that a request for casualty evacuation is submitted if warranted. An evacuation request must include a standardized 9-Line MEDEVAC request and, depending on theater requirements, may require MIST (Mechanism / Injuries / Symptoms / Treatments) reporting to the Patient Evacuation Coordination Cell (**CENTCOM FRAGO**)

The first responders on scene or combat medical personnel should ensure that tactical unit leadership is kept fully informed of the casualty's status. If feasible, it is also helpful to interact with the evacuation platform medical personnel as well as with providers at the next level of care.

21. Add a section on preparing the casualty for evacuation to the end of TFC.

This transition from TFC to Tactical Evacuation Care (TACEVAC) is the first and one of the most critical hand-offs in a casualty's continuum of care. Moving a casualty from TFC to TACEVAC involves preparing him or her for transport on one of a number of possible evacuation platforms - aircraft, ground vehicles, or water craft. There are measures common to all evacuation platforms that the provider should take to prepare a casualty for transport, but these are presently not listed in the TCCC Guidelines.

Inclusion of casualty care basics like securing loose dressings and straps, casualty marking, and completion of the TCCC Card should help to ensure smooth handover of the casualty to TACEVAC personnel. (**Montgomery - Ranger Medic Handbook-4, Hammesfahr Nightstalker Medicine Handbook**).

22. Add a section on transition of care to the beginning of TACEVAC.

The transition from TFC to TACEVAC involves actions by both the tactical force relinquishing care of casualties and by the medical personnel on the evacuation platform assuming responsibility for care. It often occurs in loud environments such as under spinning rotor blades, at the tail of a fixed-wing aircraft, in the back of a truck with other vehicles moving around it, or on small boats bobbing on the waves with engines running. To transfer care successfully in these confusing environments, every attempt should be made to streamline this transition with preplanned procedures, rehearsals and effective communication.

The tactical force must ensure that the evacuation site (helicopter landing zone or ambulance exchange point) is appropriately selected, cleared, and secured prior to the arrival of evacuation platforms. The tactical force then moves casualties to the evacuation site and stages them for loading. Staging must be carried out according to the evacuation platform (helicopter, fixed-wing aircraft, ground vehicle or boat) to be employed. It is imperative for tactical force leaders to account for both casualties and tactical personnel moving casualties onto evacuation platforms to ensure 100% personnel accountability during the transition phase.

Tactical force personnel, medical or non-medical, should communicate casualty information and status to TACEVAC personnel if possible. The minimum information communicated should include whether the casualties are stable or unstable, injuries identified, and treatments rendered. All information should be documented on every casualty's DD 1380 (TCCC Card), but the reinforcement of physically pointing to injuries and interventions can be critical to relaying information to the next care giver.

As TACEVAC personnel receive casualties onto their platform, they should triage them and ensure appropriate placement for best access during en route care. Casualties must be secured in accordance with platform configurations, unit policies, and safety requirements. TACEVAC personnel should double-check all casualty securing devices, and re-assess all previous interventions and treatments.

23. Rearrange the guidelines as needed to reflect the actual priority of clinical interventions.

The order in which individual guidelines appear in the Guidelines document should reflect the actual priorities of treatment in combat. Combat trauma care training programs should be configured likewise. (**Rush 2015; Biggs 2011; Savage 2011; USSOCOM 2012 TMEPs; Ramirex 2010, Hodgetts 2006**). Massive Hemorrhage was recommended as the first medical treatment paragraph in compliance with this principle. In Care Under Fire, control of life-threatening bleeding should precede any discussion of airway management. In TFC and TACEVAC, administration of analgesics and antibiotics will occur before inspecting and dressing wounds and searching for additional wounds.

Conclusions

These proposed updates address a number of needed changes identified during a comprehensive review of the TCCC Guidelines. They will make the Guidelines as shown in Appendix 1 more tactically appropriate; will correct minor imprecisions in the wording; and will incorporate a number of lessons learned from Iraq and Afghanistan.

Appendix 1. Proposed TCCC-MP Guidelines 31 January 2017

RED text indicates changes to current wording or new text.

BLUE text indicates unchanged current wording that shifted to a different location or sequence in the guideline.

Vote:

The above proposed change was passed unanimously by the voting members of the CoTCCC.

Level of evidence: (AHA/ACC – Tricoci 2009)

The levels of evidence used by the American College of Cardiology and the American Heart Association were outlined by Tricoci in 2009:

- Level A: Evidence from multiple randomized trials or meta-analyses.
- Level B: Evidence from a single randomized trial or nonrandomized studies.
- Level C: Expert opinion, case studies, or standards of care.

Using this taxonomy, the level of evidence for this change is Level C.

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Disclaimers

The opinions and assertions contained herein are the private views of the authors and are not to be construed as reflecting the views of the Department of the Army or the Department of Defense. This recommendation is intended to be a guideline only and is not a substitute for clinical judgment.

Author Disclosures

The authors have no commercial interest in any of the devices or medications mentioned in this paper.

Release

This document was reviewed by the Director of the Joint Trauma System and by the Public Affairs Office and the Operational Security Office at the U.S. Army Institute of Surgical Research. It is approved for unlimited public release.

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Author Bios

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CAPT (Ret) Butler was a Navy SEAL platoon commander before becoming a physician. He is an ophthalmologist and a Navy Undersea Medical Officer with over 20 years of experience providing medical support to Special Operations Forces. Dr Butler has served as the Command Surgeon for the US Special Operations Command. He is currently the Chairman of the Department of Defense's Committee on TCCC and Chief of Prehospital Trauma Care at the Joint Trauma System.

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Appendix 1

TCCC Guidelines for Medical Personnel

31 January 2017

RED text indicates changes to current wording or new text.

BLUE text indicates unchanged prior wording that was shifted to a different location in the guidelines.

Basic Management Plan for Care Under Fire

1. Return fire and take cover.
2. Direct or expect casualty to remain engaged as a combatant if appropriate.
3. Direct casualty to move to cover and apply self-aid if able.
4. Try to keep the casualty from sustaining additional wounds.
5. Casualties should be extricated from burning vehicles or buildings and moved to places of relative safety. Do what is necessary to stop the burning process.
6. Stop life-threatening external hemorrhage if tactically feasible:
 - a. Direct casualty to control hemorrhage by self-aid if able.
 - b. Use a CoTCCC-recommended 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.
7. Airway management is generally best deferred until the Tactical Field Care phase.

Basic Management Plan for Tactical Field Care

1. Establish a security perimeter in accordance with unit tactical standard operating procedures and/or battle drills. Maintain tactical situational awareness.
2. Triage casualties as required. Casualties with an altered mental status **should have weapons and communications equipment taken away** immediately.
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 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 or as an adjunct to tourniquet removal, use Combat Gauze as the CoTCCC hemostatic dressing of choice.
 - Alternative hemostatic adjuncts:
 - Celox Gauze or
 - ChitoGauze or
 - XStat (Best for deep, narrow-tract junctional wounds)
 - Hemostatic dressings should be applied with at least 3 minutes of direct pressure (optional for XStat). 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. (**Note: XStat is not to be removed in the field, but additional XStat, other hemostatic adjuncts, or trauma dressings may be applied over it.**)
 - If the bleeding site is amenable to use of a junctional tourniquet, immediately apply a CoTCCC-recommended junctional tourniquet. Do not delay in the application of the junctional tourniquet once it is ready for use. Apply hemostatic dressings with direct pressure if a junctional tourniquet is not available or while the junctional tourniquet is being readied for use.
4. Airway Management
 - a. Unconscious casualty without airway obstruction:
 - Chin lift or jaw thrust maneuver
 - Nasopharyngeal airway
 - 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, perform a surgical cricothyroidotomy using one of the following:
- Cric-Key technique (preferred option)
 - Bougie-aided open surgical technique using a flanged and cuffed airway cannula of less than 10 mm outer diameter, 6-7 mm internal diameter, and 5-8 cm of intratracheal length
 - Standard open surgical technique using a flanged and cuffed airway cannula of less than 10mm outer diameter, 6-7 mm internal diameter, and 5-8 cm of intra-tracheal length (least desirable option)
 - Use lidocaine if the casualty is conscious.
- d. Spinal stabilization is not necessary for casualties with penetrating trauma.

5. Respiration/Breathing

- a. In a casualty with progressive respiratory distress and known or suspected torso trauma, consider a tension pneumothorax and decompress the chest on the side of the injury with a 14-gauge, 3.25 inch needle/catheter unit inserted in the second intercostal space at the midclavicular line. Ensure that the needle entry into the chest is not medial to the nipple line and is not directed towards the heart. An acceptable alternate site is the 4th or 5th intercostal space at the anterior axillary line (AAL).
- b. 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 non-vented chest seal. Monitor the casualty for the potential development of a subsequent tension pneumothorax. If the casualty develops increasing hypoxia, respiratory distress, or hypotension and a tension pneumothorax is suspected, treat by burping or removing the dressing or by needle decompression.
- c. **Initiate pulse oximetry.** All individuals with moderate/severe TBI should be monitored with pulse oximetry. Readings may be misleading in the settings of shock or marked hypothermia.
- d. Casualties with moderate/severe TBI should be given supplemental oxygen when available to maintain an oxygen saturation > 90%.

6. Circulation

a. Bleeding

- A pelvic binder should be applied for cases of suspected pelvic fracture:
 - Severe blunt force or blast injury with one or more of the following indications:
 - Pelvic pain
 - Any major lower limb amputation or near amputation
 - Physical exam findings suggestive of a pelvic fracture
 - Unconsciousness
 - Shock
- Reassess prior tourniquet application. Expose the wound and determine if a tourniquet is needed. If it is **needed**, replace any limb tourniquet placed over the uniform with one applied directly to the skin 2-3 inches above the **bleeding site**. Ensure that bleeding is stopped. **If there is no traumatic amputation**, a distal pulse should be checked. 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. **If the reassessment determines that the prior tourniquet was not needed**, then remove the tourniquet and note time of removal on the TCCC Casualty Card.
- Limb tourniquets and junctional tourniquets should be converted to hemostatic or pressure dressings as soon as possible if three criteria are met: the casualty is not in shock; it is possible to monitor the wound closely for bleeding; and the tourniquet is not being used to control bleeding from an amputated extremity. Every effort should be made to convert tourniquets in less than 2 hours if bleeding can be controlled with other means. Do not remove a tourniquet that has been in place more than 6 hours unless close monitoring and lab capability are available.
- Expose and clearly mark all **tourniquets** with the time of tourniquet application. **Note tourniquets applied and time of application; time of re-application; time of conversion; and time of removal on the TCCC Casualty Card.** Use a permanent marker to mark on the tourniquet and the casualty card.

b. IV Access

- Intravenous (IV) or intraosseous (IO) access is indicated if the casualty is in hemorrhagic shock or at significant risk of shock (and may therefore need fluid resuscitation), or if the casualty needs medications, but cannot take them by mouth.
 - An 18-gauge IV or saline lock is preferred.
 - If vascular access is needed but not quickly obtainable via the IV route, use the IO route.

c. Tranexamic Acid (TXA)

- If a casualty is anticipated to need significant blood transfusion (for example: presents with hemorrhagic shock, one or more major amputations, penetrating torso trauma, or evidence of severe bleeding):
 - Administer 1 gm of tranexamic acid in 100 ml Normal Saline or Lactated Ringer's as soon as possible but NOT later than 3 hours after injury. **When given, TXA should be administered over 10 minutes by IV infusion.**
 - Begin the second infusion of 1 gm TXA after initial fluid resuscitation has been completed.

d. Fluid resuscitation

- Assess for hemorrhagic shock (altered mental status in the absence of brain injury and/or weak or absent radial pulse).
- The resuscitation fluids of choice for casualties in hemorrhagic shock, listed from most to least preferred, are: whole blood*; plasma, red blood cells (RBCs) and platelets in a 1:1:1 ratio*; plasma and RBCs in a 1:1 ratio; plasma or RBCs alone; Hextend; and crystalloid (Lactated Ringer's or Plasma-Lyte A). **(NOTE: Hypothermia prevention measures [Section 7] should be initiated while fluid resuscitation is being accomplished.)**
 - If not in shock:
 - No IV fluids are immediately necessary.
 - Fluids by mouth are permissible if the casualty is conscious and can swallow.
 - If in shock and blood products are available under an approved command or theater blood product administration protocol:
 - Resuscitate with whole blood*, or, if not available
 - Plasma, RBCs and platelets in a 1:1:1 ratio*, or, if not available
 - Plasma and RBCs in a 1:1 ratio, or, if not available
 - Reconstituted dried plasma, liquid plasma or thawed plasma alone or RBCs alone
 - Reassess the casualty after each unit. Continue resuscitation until a palpable radial pulse, improved mental status or systolic BP of 80-90 is present.
 - If in shock and blood products are not available under an approved command or theater blood product administration protocol due to tactical or logistical constraints:
 - Resuscitate with Hextend, or if not available
 - Lactated Ringer's or Plasma-Lyte A
 - Reassess the casualty after each 500 ml IV bolus.

- Continue resuscitation until a palpable radial pulse, improved mental status, or systolic BP of 80-90 mmHg is present.
- Discontinue fluid administration when one or more of the above end points has been achieved.
- If a casualty with an altered mental status due to suspected TBI has a weak or absent radial pulse, resuscitate as necessary to restore and maintain a normal radial pulse. If BP monitoring is available, maintain a target systolic BP of at least 90 mmHg.
- Reassess the casualty frequently to check for recurrence of shock. If shock recurs, re-check all external hemorrhage control measures to ensure that they are still effective and repeat the fluid resuscitation as outlined above.

* Currently, neither whole blood nor apheresis platelets collected in theater are FDA-compliant because of the way they are collected. Consequently, whole blood and 1:1:1 resuscitation using apheresis platelets should be used only if all of the FDA-compliant blood products needed to support 1:1:1 resuscitation are not available, or if 1:1:1 resuscitation is not producing the desired clinical effect.

7. Hypothermia Prevention

- a. Minimize casualty's exposure to the elements. Keep protective gear on or with the casualty if feasible.
- b. Replace wet clothing with dry if possible. Get the casualty onto an insulated surface as soon as possible.
- 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).
- d. If an HRS is not available, the previously recommended combination of the Blizzard Survival Blanket and the Ready Heat blanket may also be used.
- e. If the items mentioned above are not available, use dry blankets, poncho liners, sleeping bags, or anything that will retain heat and keep the casualty dry.
- f. Warm fluids are preferred if IV fluids are required.

8. Penetrating Eye Trauma

- a. If a penetrating eye injury is noted or suspected:
 - Perform a rapid field test of visual acuity **and document findings.**
 - Cover the eye with a rigid eye shield (NOT a pressure patch.)
 - Ensure that the 400 mg moxifloxacin tablet in the **Combat Wound Medication Pack (CWMP)** is taken if possible and that IV/IM antibiotics are given as outlined below if oral moxifloxacin cannot be taken.

9. Monitoring

- a. Initiate advanced electronic monitoring if indicated and if monitoring equipment is available.

10. Analgesia

- a. Analgesia on the battlefield should generally be achieved using one of three options:

- Option 1

- Mild to Moderate Pain

Casualty is still able to fight

- TCCC **Combat Wound Medication Pack (CWMP)**

- * Tylenol – 650 mg bilayer caplet, 2 PO every 8 hours

- * Meloxicam - 15 mg PO once a day

- Option 2

- Moderate to Severe Pain

Casualty IS NOT in shock or respiratory distress AND

Casualty IS NOT at significant risk of developing either condition

- Oral transmucosal fentanyl citrate (OTFC) 800 µg

- * Place lozenge between the cheek and the gum

- * Do not chew the lozenge

- Option 3

- Moderate to Severe Pain

Casualty IS in hemorrhagic shock or respiratory distress OR

Casualty IS at significant risk of developing either condition

- Ketamine 50 mg IM or IN

Or

- Ketamine 20 mg slow IV or IO

- * Repeat doses q30min prn for IM or IN

- * Repeat doses q20min prn for IV or IO

- * End points: Control of pain or development of nystagmus (rhythmic back-and-forth movement of the eyes)

Analgesia notes:

- a. Casualties may need to be disarmed after being given OTFC or ketamine.

- b. Document a mental status exam using the AVPU method prior to administering opioids or ketamine.
- c. For all casualties given opioids or ketamine – monitor airway, breathing, and circulation closely
- d. Directions for administering OTFC:
 - Recommend taping lozenge-on-a-stick to casualty's finger as an added safety measure OR utilizing a safety pin and rubber band to attach the lozenge (under tension) to the patient's uniform or plate carrier.
 - Reassess in 15 minutes
 - Add second lozenge, in other cheek, as necessary to control severe pain
 - Monitor for respiratory depression
- e. IV Morphine is an alternative to OTFC if IV access has been obtained
 - 5 mg IV/IO
 - Reassess in 10 minutes.
 - Repeat dose every 10 minutes as necessary to control severe pain.
 - Monitor for respiratory depression.
- f. Naloxone (0.4 mg IV or IM) should be available when using opioid analgesics.
- g. Both ketamine and OTFC have the potential to worsen severe TBI. The combat medic, corpsman, or PJ must consider this fact in his or her analgesic decision, but if the casualty is able to complain of pain, then the TBI is likely not severe enough to preclude the use of ketamine or OTFC.
- h. Eye injury does not preclude the use of ketamine. The risk of additional damage to the eye from using ketamine is low and maximizing the casualty's chance for survival takes precedence if the casualty is in shock or respiratory distress or at significant risk for either.
- i. Ketamine may be a useful adjunct to reduce the amount of opioids required to provide effective pain relief. It is safe to give ketamine to a casualty who has previously received morphine or OTFC. IV Ketamine should be given over 1 minute.
- j. If respirations are noted to be reduced after using opioids or ketamine, provide ventilatory support with a bag-valve-mask or mouth-to-mask ventilations.
- k. Ondansetron, 4 mg Orally Dissolving Tablet (ODT)/IV/IO/IM, every 8 hours as needed for nausea or vomiting. Each 8-hour dose can be repeated once at 15 minutes if nausea and vomiting are not improved. Do not give more than 8 mg in any 8-hour interval. Oral ondansetron is NOT an acceptable alternative to the ODT formulation.
- l. Reassess – reassess – reassess!

11. Antibiotics: recommended for all open combat wounds

- a. If able to take PO meds:
 - Moxifloxacin (from the CWMP), 400 mg PO once a day
- b. If unable to take PO meds (shock, unconsciousness):
 - Ertapenem, 1 gm IV/IM once a day

12. Inspect and dress known wounds.

13. Check for additional wounds.

14. Burns

- a. Facial burns, especially those that occur in closed spaces, may be associated with inhalation injury. Aggressively monitor airway status and oxygen saturation in such patients and consider early surgical airway for respiratory distress or oxygen desaturation.
- b. Estimate total body surface area (TBSA) burned to the nearest 10% using the Rule of Nines.
- c. Cover the burn area with dry, sterile dressings. For extensive burns (>20%), consider placing the casualty in the Heat-Reflective Shell or Blizzard Survival Blanket from the Hypothermia Prevention Kit in order to both cover the burned areas and prevent hypothermia.
- d. Fluid resuscitation (USAISR Rule of Ten)
 - If burns are greater than 20% of TBSA, fluid resuscitation should be initiated as soon as IV/IO access is established. Resuscitation should be initiated with Lactated Ringer's, normal saline, or Hextend. If Hextend is used, no more than 1000 ml should be given, followed by Lactated Ringer's or normal saline as needed.
 - Initial IV/IO fluid rate is calculated as %TBSA x 10 ml/hr for adults weighing 40- 80 kg.
 - For every 10 kg ABOVE 80 kg, increase initial rate by 100 ml/hr.
 - If hemorrhagic shock is also present, resuscitation for hemorrhagic shock takes precedence over resuscitation for burn shock. Administer IV/IO fluids per the TCCC Guidelines in Section (6).
- e. Analgesia in accordance with the TCCC Guidelines in Section (10) may be administered to treat burn pain.
- f. Prehospital antibiotic therapy is not indicated solely for burns, but antibiotics should be given per the TCCC guidelines in Section (11) if indicated to prevent infection in penetrating wounds.
- g. All TCCC interventions can be performed on or through burned skin in a burn casualty.

- h. Burn patients are particularly susceptible to hypothermia. Extra emphasis should be placed on barrier heat loss prevention methods.

15. Splint fractures and re-check pulses.

16. Communication

- a. Communicate with the casualty if possible. Encourage, reassure and explain care.
- b. Communicate with tactical leadership as soon as possible and throughout casualty treatment as needed. Provide leadership with casualty status and evacuation requirements to assist with coordination of evacuation assets.
- c. Communicate with the evacuation system (the Patient Evacuation Coordination Cell) to arrange for TACEVAC. Communicate with medical providers on the evacuation asset if possible and relay mechanism of injury, injuries sustained, signs/symptoms, and treatments rendered. Provide additional information as appropriate.

17. Cardiopulmonary resuscitation (CPR)

- a. Resuscitation on the battlefield for victims of blast or penetrating trauma who have no pulse, no ventilations, and no other signs of life will not be successful and should not be attempted. However, casualties with torso trauma or polytrauma who have no pulse or respirations during TFC should have bilateral needle decompression performed to ensure they do not have a tension pneumothorax prior to discontinuation of care. The procedure is the same as described in section (5a) above.

18. 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.

19. Prepare for Evacuation.

- a. Complete and secure the TCCC Card (DD 1380) to the casualty.
- b. Secure all loose ends of bandages and wraps.
- c. Secure hypothermia prevention wraps/blankets/straps.
- d. Secure litter straps as required. Consider additional padding for long evacuations.
- e. Provide instructions to ambulatory patients as needed.
- f. Stage casualties for evacuation in accordance with unit standard operating procedures.
- g. Maintain security at the evacuation point in accordance with unit standard operating procedures.

Basic Management Plan for Tactical Evacuation Care

* The term “Tactical Evacuation” includes both Casualty Evacuation (CASEVAC) and Medical Evacuation (MEDEVAC) as defined in Joint Publication 4-02.

1. Transition of Care

- a. Tactical force personnel should establish evacuation point security and stage casualties for evacuation.
- b. Tactical force personnel or the medic should communicate patient information and status to TACEVAC personnel as clearly as possible. The minimum information communicated should include stable or unstable, injuries identified, and treatments rendered.
- c. TACEVAC personnel should stage casualties on evacuation platforms as required.
- d. Secure casualties in the evacuation platform in accordance with unit policies, platform configurations and safety requirements.
- e. TACEVAC medical personnel should re-assess casualties and re-evaluate all injuries and previous interventions.

2. 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 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 or as an adjunct to tourniquet removal, use Combat Gauze as the CoTCCC hemostatic dressing of choice.
 - Alternative hemostatic adjuncts:
 - Celox Gauze or
 - ChitoGauze or
 - XStat (Best for deep, narrow-tract junctional wounds)
 - Hemostatic dressings should be applied with at least 3 minutes of direct pressure (optional for XStat). 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. (Note: XStat is not to be removed in the field, but additional XStat, other hemostatic adjuncts, or trauma dressings may be applied over it.)

- If the bleeding site is amenable to use of a junctional tourniquet, immediately apply a CoTCCC-recommended junctional tourniquet. Do not delay in the application of the junctional tourniquet once it is ready for use. Apply hemostatic dressings with direct pressure if a junctional tourniquet is not available or while the junctional tourniquet is being readied for use.

3. Airway Management

- Unconscious casualty without airway obstruction:
 - Chin lift or jaw thrust maneuver
 - Nasopharyngeal airway
 - Place casualty in the recovery position
- Casualty with airway obstruction or impending airway obstruction:
 - Chin lift or jaw thrust maneuver
 - Nasopharyngeal airway
 - Allow casualty to assume any position that best protects the airway, to include sitting up.
 - Place unconscious casualty in the recovery position.
- If the previous measures are unsuccessful, assess the tactical and clinical situations, the equipment at hand, and the skills and experience of the person providing care, and then select one of the following airway interventions:
 - Supraglottic airway, or
 - Endotracheal intubation or
 - Perform a surgical cricothyroidotomy using one of the following:
 - Cric-Key technique (Preferred option)
 - Bougie-aided open surgical technique using a flanged and cuffed airway cannula of less than 10mm outer diameter, 6-7mm internal diameter, and 5-8 cm of intra-tracheal length
 - Standard open surgical technique using a flanged and cuffed airway cannula of less than 10mm outer diameter, 6-7mm internal diameter and 5-8cm of intra-tracheal length (Least desirable option)
 - Use lidocaine if the casualty is conscious.
- Spinal stabilization is not necessary for casualties with penetrating trauma.

4. Respiration/Breathing

- In a casualty with progressive respiratory distress and known or suspected torso trauma, consider a tension pneumothorax and decompress the chest on the side of the injury with a 14-gauge, 3.25 inch needle/catheter unit inserted in the second intercostal space at the midclavicular line. Ensure that the needle entry into the

- chest is not medial to the nipple line and is not directed towards the heart. An acceptable alternate site is the 4th or 5th intercostal space at the anterior axillary line (AAL).
- b. Consider chest tube insertion if no improvement and/or long transport is anticipated.
 - c. **Initiate pulse oximetry if not previously done.** All individuals with moderate/severe TBI should be monitored with pulse oximetry. Readings may be misleading in the settings of shock or marked hypothermia.
 - d. Most combat casualties do not require supplemental oxygen, but administration of oxygen may be of benefit for the following types of casualties:
 - Low oxygen saturation by pulse oximetry
 - Injuries associated with impaired oxygenation
 - Unconscious casualty
 - Casualty with TBI (maintain oxygen saturation > 90%)
 - Casualty in shock
 - Casualty at altitude
 - **Known or suspected smoke inhalation**
 - e. 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 non-vented chest seal. Monitor the casualty for the potential development of a subsequent tension pneumothorax. If the casualty develops increasing hypoxia, respiratory distress, or hypotension and a tension pneumothorax is suspected, treat by burping or removing the dressing or by needle decompression.

5. Circulation

a. Bleeding

- **A pelvic binder should be applied for cases of suspected pelvic fracture:**
 - **Severe blunt force or blast injury with one or more of the following indications:**
 - Pelvic pain
 - Any major lower limb amputation or near amputation
 - Physical exam findings suggestive of a pelvic fracture
 - Unconsciousness
 - Shock
- Reassess prior tourniquet application. Expose the wound and determine if a tourniquet is needed. If it is **needed**, replace any limb tourniquet placed over the uniform with one applied directly to the skin 2-3 inches above the **bleeding site**. Ensure that bleeding is stopped. **If there is no traumatic**

amputation, a distal pulse should be checked. 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. **If the reassessment determines that the prior tourniquet was not needed, then remove the tourniquet and note time of removal on the TCCC Casualty Card.**

- Limb tourniquets and junctional tourniquets should be converted to hemostatic or pressure dressings as soon as possible if three criteria are met: the casualty is not in shock; it is possible to monitor the wound closely for bleeding; and the tourniquet is not being used to control bleeding from an amputated extremity. Every effort should be made to convert tourniquets in less than 2 hours if bleeding can be controlled with other means. Do not remove a tourniquet that has been in place more than 6 hours unless close monitoring and lab capability are available.
- Expose and clearly mark all tourniquets with the time of tourniquet application. **Note tourniquets applied and time of application; time of re-application; time of conversion; and time of removal on the TCCC Casualty Card.** Use a permanent marker to mark on the tourniquet and the casualty card.

b. IV Access

- Reassess need for IV access.
- **IV or IO access is indicated if the casualty is in hemorrhagic shock or at significant risk of shock (and may therefore need fluid resuscitation), or if the casualty needs medications, but cannot take them by mouth.**
 - An 18-gauge IV or saline lock is preferred.
 - If vascular access is needed but not quickly obtainable via the IV route, use the IO route.

c. Tranexamic Acid (TXA)

- If a casualty is anticipated to need significant blood transfusion (for example: presents with hemorrhagic shock, one or more major amputations, penetrating torso trauma, or evidence of severe bleeding):
 - Administer 1 gm of tranexamic acid in 100 ml Normal Saline or Lactated Ringers as soon as possible but NOT later than 3 hours after injury. **When given, TXA should be administered over 10 minutes by IV infusion.**
 - Begin second infusion of 1 gm TXA after initial fluid resuscitation has been completed.

d. Fluid resuscitation

- Assess for hemorrhagic shock (altered mental status in the absence of brain injury and/or weak or absent radial pulse).

- The resuscitation fluids of choice for casualties in hemorrhagic shock, listed from most to least preferred, are: whole blood*; plasma, RBCs and platelets in a 1:1:1 ratio*; plasma and RBCs in a 1:1 ratio; plasma or RBCs alone; Hextend; and crystalloid (Lactated Ringer's or Plasma-Lyte A). **(NOTE: Hypothermia prevention measures [Section 7] should be initiated while fluid resuscitation is being accomplished.)**
 - If not in shock:
 - No IV fluids are immediately necessary.
 - Fluids by mouth are permissible if the casualty is conscious and can swallow.
 - If in shock and blood products are available under an approved command or theater blood product administration protocol:
 - Resuscitate with whole blood*, or, if not available
 - Plasma, RBCs and platelets in a 1:1:1 ratio*, or, if not available
 - Plasma and RBCs in a 1:1 ratio, or, if not available
 - Reconstituted dried plasma, liquid plasma or thawed plasma alone or RBCs alone
 - Reassess the casualty after each unit. Continue resuscitation until a palpable radial pulse, improved mental status or systolic BP of 80-90 is present.
 - If in shock and blood products are not available under an approved command or theater blood product administration protocol due to tactical or logistical constraints:
 - Resuscitate with Hextend, or if not available
 - Lactated Ringer's or Plasma-Lyte A
 - Reassess the casualty after each 500 ml IV bolus.
 - Continue resuscitation until a palpable radial pulse, improved mental status, or systolic BP of 80-90 mmHg is present.
 - Discontinue fluid administration when one or more of the above end points has been achieved.
- If a casualty with an altered mental status due to suspected TBI has a weak or absent radial pulse, resuscitate as necessary to restore and maintain a normal radial pulse. If BP monitoring is available, maintain a target systolic BP of at least 90 mmHg.
- Reassess the casualty frequently to check for recurrence of shock. If shock recurs, recheck all external hemorrhage control measures to ensure that they are still effective and repeat the fluid resuscitation as outlined above.

* Currently, neither whole blood nor apheresis platelets collected in theater are FDA-compliant because of the way they are collected. Consequently, whole blood and 1:1:1 resuscitation using apheresis platelets should be used only if all the FDA-compliant blood products needed to support 1:1:1 resuscitation are not available, or if 1:1:1 resuscitation is not producing the desired clinical effect.

6. Traumatic Brain Injury

a. Casualties with moderate/severe TBI should be monitored for:

- Decreases in level of consciousness
- Pupillary dilation
- SBP should be >90 mmHg
- O2 sat > 90
- Hypothermia
- PCO2 (If capnography is available, maintain between 35-40 mmHg)
- Penetrating head trauma (if present, administer antibiotics)
- Assume a spinal (neck) injury until cleared.

b. Unilateral pupillary dilation accompanied by a decreased level of consciousness may signify impending cerebral herniation; if these signs occur, take the following actions to decrease intracranial pressure:

- Administer 250 ml of 3 or 5% hypertonic saline bolus.
- Elevate the casualty's head 30 degrees.
- Hyperventilate the casualty.
 - Respiratory rate 20
 - Capnography should be used to maintain the end-tidal CO2 between 30-35 mmHg
 - The highest oxygen concentration (FIO2) possible should be used for hyperventilation.

*Notes:

Do not hyperventilate the casualty unless signs of impending herniation are present. Casualties may be hyperventilated with oxygen using the bag-valve-mask technique.

7. Hypothermia Prevention

- a. Minimize casualty's exposure to the elements. Keep protective gear on or with the casualty if feasible.
- b. Replace wet clothing with dry if possible. Get the casualty onto an insulated surface as soon as possible.

- 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).
- d. If an HRS is not available, the previously recommended combination of the Blizzard Survival Blanket and the Ready Heat blanket may also be used.
- e. If the items mentioned above are not available, use poncho liners, sleeping bags, or anything that will retain heat and keep the casualty dry.
- f. Use a portable fluid warmer capable of warming all IV fluids including blood products.
- g. Protect the casualty from wind if doors must be kept open.

8. Penetrating Eye Trauma

- a. If a penetrating eye injury is noted or suspected:
 - Perform a rapid field test of visual acuity **and document findings.**
 - Cover the eye with a rigid eye shield (NOT a pressure patch.)
 - Ensure that the 400 mg moxifloxacin tablet in the **Combat Wound Medication Pack (CWMP)** is taken if possible and that IV/IM antibiotics are given as outlined below if oral moxifloxacin cannot be taken.

9. Monitoring

- a. **Initiate advanced electronic monitoring if indicated and if monitoring equipment is available.**

10. Analgesia

- a. Analgesia on the battlefield should generally be achieved using one of three options:
 - Option 1
 - Mild to Moderate Pain
Casualty is still able to fight
 - TCCC **CWMP**
 - * Tylenol – 650 mg bilayer caplet, 2 PO every 8 hours
 - * Meloxicam - 15 mg PO once a day
 - Option 2
 - Moderate to Severe Pain
Casualty IS NOT in shock or respiratory distress AND
Casualty IS NOT at significant risk of developing either condition
 - Oral transmucosal fentanyl citrate (OTFC) 800 µg
 - * Place lozenge between the cheek and the gum

* Do not chew the lozenge

• Option 3

- Moderate to Severe Pain

Casualty IS in hemorrhagic shock or respiratory distress OR
Casualty IS at significant risk of developing either condition

◦ Ketamine 50 mg IM or IN

Or

◦ Ketamine 20 mg slow IV or IO

* Repeat doses q30min prn for IM or IN

* Repeat doses q20min prn for IV or IO

* End points: Control of pain or development of nystagmus
(rhythmic back-and-forth movement of the eyes)

Analgesia notes:

- a. Casualties may need to be disarmed after being given OTFC or ketamine.
- b. Document a mental status exam using the AVPU method prior to administering opioids or ketamine.
- c. For all casualties given opioids or ketamine – monitor airway, breathing, and circulation closely
- d. Directions for administering OTFC:
 - Recommend taping lozenge-on-a-stick to casualty's finger as an added safety measure OR utilizing a safety pin and rubber band to attach the lozenge (under tension) to the patient's uniform or plate carrier.
 - Reassess in 15 minutes
 - Add second lozenge, in other cheek, as necessary to control severe pain
 - Monitor for respiratory depression
- e. IV Morphine is an alternative to OTFC if IV access has been obtained
 - 5 mg IV/IO
 - Reassess in 10 minutes.
 - Repeat dose every 10 minutes as necessary to control severe pain.
 - Monitor for respiratory depression.
- f. Naloxone (0.4 mg IV or IM) should be available when using opioid analgesics.
- g. Both ketamine and OTFC have the potential to worsen severe TBI. The combat medic, corpsman, or PJ must consider this fact in his or her analgesic decision, but if the casualty can complain of pain, then the TBI is likely not severe enough to preclude the use of ketamine or OTFC.

- h. Eye injury does not preclude the use of ketamine. The risk of additional damage to the eye from using ketamine is low and maximizing the casualty's chance for survival takes precedence if the casualty is in shock or respiratory distress or at significant risk for either.
 - i. Ketamine may be a useful adjunct to reduce the amount of opioids required to provide effective pain relief. It is safe to give ketamine to a casualty who has previously received morphine or OTFC. IV Ketamine should be given over 1 minute.
 - j. If respirations are noted to be reduced after using opioids or ketamine, provide ventilatory support with a bag-valve-mask or mouth-to-mask ventilations.
 - k. Ondansetron, 4 mg ODT/IV/IO/IM, every 8 hours as needed for nausea or vomiting. Each 8-hour dose can be repeated once at 15 minutes if nausea and vomiting are not improved. Do not give more than 8 mg in any 8-hour interval. Oral ondansetron is NOT an acceptable alternative to the ODT formulation.
 - l. Reassess – reassess – reassess!
11. Antibiotics: recommended for all open combat wounds
- a. If able to take PO meds:
 - Moxifloxacin, (from CWMP) 400 mg PO once a day
 - b. If unable to take PO meds (shock, unconsciousness):
 - Ertapenem, 1 gm IV/IM once a day
12. Inspect and dress known wounds.
13. Check for additional wounds.
14. Burns
- a. Facial burns, especially those that occur in closed spaces, may be associated with inhalation injury. Aggressively monitor airway status and oxygen saturation in such patients and consider early surgical airway for respiratory distress or oxygen desaturation.
 - b. Estimate total body surface area (TBSA) burned to the nearest 10% using the Rule of Nines.
 - c. Cover the burn area with dry, sterile dressings. For extensive burns (>20%), consider placing the casualty in the Heat-Reflective Shell or Blizzard Survival Blanket from the Hypothermia Prevention Kit to both cover the burned areas and prevent hypothermia.
 - d. Fluid resuscitation (USAISR Rule of Ten)
 - If burns are greater than 20% of TBSA, fluid resuscitation should be initiated as soon as IV/IO access is established. Resuscitation should be initiated with Lactated Ringer's, normal saline, or Hextend. If Hextend is used, no more

than 1000 ml should be given, followed by Lactated Ringer's or normal saline as needed.

- Initial IV/IO fluid rate is calculated as %TBSA x 10 ml/hr for adults weighing 40- 80 kg.
- For every 10 kg ABOVE 80 kg, increase initial rate by 100 ml/hr.
- If hemorrhagic shock is also present, resuscitation for hemorrhagic shock takes precedence over resuscitation for burn shock. Administer IV/IO fluids per the TCCC Guidelines in Section (6).

- e. Analgesia in accordance with the TCCC Guidelines in Section (10) may be administered to treat burn pain.
- f. Prehospital antibiotic therapy is not indicated solely for burns, but antibiotics should be given per the TCCC guidelines in Section (11) if indicated to prevent infection in penetrating wounds.
- g. All TCCC interventions can be performed on or through burned skin in a burn casualty.
- h. Burn patients are particularly susceptible to hypothermia. Extra emphasis should be placed on barrier heat loss prevention methods and IV fluid warming in this phase.

15. Reassess fractures and recheck pulses.

16. Communication

- a. Communicate with the casualty if possible. Encourage, reassure and explain care.
- b. Communicate with medical providers at the next level of care as feasible and relay mechanism of injury, injuries sustained, signs/symptoms, and treatments rendered. Provide additional information as appropriate.

17. CPR in TACEVAC Care

- a. Casualties with torso trauma or polytrauma who have no pulse or respirations during TACEVAC should have bilateral needle decompression performed to ensure they do not have a tension pneumothorax. The procedure is the same as described in Section (4a) above.
- b. CPR may be attempted during this phase of care if the casualty does not have obviously fatal wounds and will be arriving at a facility with a surgical capability within a short period of time. CPR should not be done at the expense of compromising the mission or denying lifesaving care to other casualties.

18. 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.