Tactical Combat Casualty Care
A Civilian Perspective

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EMS Medical Director
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“THE FATE OF THE WOUNDED LAYS WITH THOSE WHO APPLY THE FIRST DRESSING.”

Col. Nicholas Senn, 1844-1908
“Rigid, en bloc application of TCCC guidelines in civilian protocols is as fundamentally flawed as utilizing civilian ATLS principles for battlefield trauma management.”

Committee on Tactical Combat Casualty Care 2011.
Larry Phillips, Jr. (left) and Emil Matasareanu (right) engaged LAPD officers in a firefight after robbing a branch of Bank of America February 28, 1997.

“The police radioed for an ambulance, but Matasareanu, cursing, succumbed to his wounds before the ambulance reached the scene.”
<table>
<thead>
<tr>
<th>Name</th>
<th>Age</th>
<th>Relationship</th>
</tr>
</thead>
<tbody>
<tr>
<td>Charlotte Bacon</td>
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<td></td>
</tr>
<tr>
<td>Daniel Barden</td>
<td>7</td>
<td></td>
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<tr>
<td>Olivia Engel</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>Josephine Gay</td>
<td>7</td>
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<tr>
<td>Ana M. Marquez-Greene</td>
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<tr>
<td>Dylan Hockley</td>
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<td></td>
</tr>
<tr>
<td>Madeleine F. Hsu</td>
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<td></td>
</tr>
<tr>
<td>Catherine V. Hubbard</td>
<td>6</td>
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<tr>
<td>Chase Kowalski</td>
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<tr>
<td>Jesse Lewis</td>
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<td>James Mattioli</td>
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<tr>
<td>Grace McDonnell</td>
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<tr>
<td>Emilie Parker</td>
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<td>Jack Pinto</td>
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<td>Noah Pozner</td>
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<td>Caroline Previdi</td>
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<tr>
<td>Jessica Rekos</td>
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<td>Avielle Richman</td>
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<td>Benjamin Wheeler</td>
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<tr>
<td>Allison N. Wyatt</td>
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<tr>
<td>Rachel Davino</td>
<td>29</td>
<td>Teacher</td>
</tr>
<tr>
<td>Dawn Hochsprung</td>
<td>47</td>
<td>School principal</td>
</tr>
<tr>
<td>Nancy Lanza</td>
<td>52</td>
<td>Mother of gunman</td>
</tr>
<tr>
<td>Anne Marie Murphy</td>
<td>52</td>
<td>Teacher</td>
</tr>
<tr>
<td>Lauren Rousseau</td>
<td>30</td>
<td>Teacher</td>
</tr>
<tr>
<td>Mary Sherlach</td>
<td>56</td>
<td>School psychologist</td>
</tr>
<tr>
<td>Victoria Soto</td>
<td>27</td>
<td>Teacher</td>
</tr>
</tbody>
</table>
The “holy grail” of trauma care outcomes remains eliminating preventable deaths.
Potentially Preventable Deaths (232) in OIF and OEF

- Hemorrhage: 85%
  - 31% Compressible (prehospital target)
  - 69% Non-Compressible (FST/CSH target)

- CNS: 9%
- MSOF: 4%
- Airway: 14%

From evaluation of 982 casualties, and casualties could have more than 1 cause of death. (Kelly J., J Trauma 64:S21, 2008)
Law Enforcement Injuries

Locations of Potentially Preventable Police Officer Deaths

- Chest: 90
- Neck: 21
- Other: 10
- Extremity: 2

N=533, 123 potentially preventable


12 tactical officers died during this time period of wounds sustained in the head/neck area.
What is the military doing to improve survival rates?

• Improved Personal Protective Equipment.
• Tactical Combat Casualty Care.
• Faster Evacuation Time.
• Decrease preventable combat death at the point of wounding.
• Everyone on target is trained in the basic principles of Tactical Combat Casualty Care.
Tactical Combat Casualty Care
Tactical Combat Casualty Care

• Control extremity hemorrhage.
Tactical Combat Casualty Care

- Control extremity hemorrhage.
- Treat tension pneumothorax.
Tactical Combat Casualty Care

- Control extremity hemorrhage.
- Treat tension pneumothorax.
- Relieve an airway obstruction.
• Combat deaths have been significantly reduced because of improved health care in the past century.
• The causes of combat related deaths are very similar to the causes of death during the Civil War.

<table>
<thead>
<tr>
<th>Conflict</th>
<th>Civil War</th>
<th>World War II</th>
<th>Vietnam</th>
<th>OIF/OEF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Case Fatality Rate- % of those wounded that die.</td>
<td>58%</td>
<td>19.1%</td>
<td>15.8%</td>
<td>7-9.4%</td>
</tr>
</tbody>
</table>

TCCC a big development in the Global War on Terror.
Three goals of Tactical Combat Casualty Care (TCCC)

- Treat the casualty.
- Prevent additional casualties.
- Complete the mission.
The **best medicine** on the battlefield is....

**Superior firepower!!!**
Goals of Tactical Emergency Casualty Care (TECC)

• Balance the threat, civilian scope of practice, differences in civilian populations, medical equipment limits, and variable resources for responses to atypical emergencies.

• Establish frameworks that balance risk-benefit ratios for all civilian operational medical response elements.

• Provide guidance on medical management of preventable deaths at or near the point of wounding.

• Minimize providers risk while maximizing patients benefits.
Pre-Hospital Trauma Care

**Civilian**
- Adequate medical supplies.
- Based around an ambulance.
- Online and offline medical control.
- Adequate number of providers.
- Stable and secure scene.
- Rapid evacuation and short transport.
- Casualty is the mission.

**Military**
- Single medic.
- Limited supplies.
- Hostile and austere environment.
- Mission must continue despite casualties.
Pre-Hospital Trauma Care

Civilian
• Subject to negligence and liability.
• Wide scope of patient ages and debilities.
• Chronic disease present in populace.
• Anticoagulants.
• Special populations.

Military
• Younger age-group (18-33yrs).
• Secondary attacks and armed resistance to evacuation.
The goal of TCCC/TECC is to identify and treat those casualties with preventable causes of death at the point of wounding allowing them to reach definitive care.
Phases of Care

- Care Under Fire → Direct Threat Care
- Tactical Field Care → Indirect Threat Care
- Tactical Evacuation Care → Evacuation Care
Lessons Learned Establishing a TEMS Program:
Role of Medical Oversight

• Functions:
  – Provide continuing education.
  – Approve protocols and scope of practice.
    • Enhanced scope.
  – On-line medical control.
    • Operational security issues.
  – Medical equipment selection.
  – Advocate within the established EMS community.
  – Liaison with medical community.
Role of Medical Oversight

• Functions:
  – Gaining the team’s confidence.
    • Important aspect of the job.
  • Requires:
    – Positive interaction.
    – Participation in training.
    – Gaining experience.
    – “Face Time.”
Role of Medical Oversight

• Functions:
  – Time commitment.
    • Initial training.
    • On-going training with the team.
    • Number of call-outs can vary.
    • “Day-job” responsibilities.
Tactical EMS-SUPPORT

- Preventive Medicine.
  - Field hygiene.
  - Hydration guidelines.
  - Work-rest cycles.
  - Food handling.
Tactical EMS-SUPPORT

– Medical Advocacy.
  • “Commander’s Medical Conscience.”
    – Inform of risks.
    – Advise on performance decrement.
    – Watch for critical incident stress.
    – Liaison with the medical community.
# Law Enforcement Status Matrix

<table>
<thead>
<tr>
<th>Issue</th>
<th>SWAT</th>
<th>LEO</th>
<th>Civilian</th>
<th>Stand-by</th>
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</thead>
<tbody>
<tr>
<td>Team Confidence</td>
<td>High</td>
<td>Moderate</td>
<td>Moderate</td>
<td>Low</td>
</tr>
<tr>
<td>Operational Security</td>
<td>High</td>
<td>High</td>
<td>Moderate</td>
<td>Low</td>
</tr>
<tr>
<td>Medical Skills and Training</td>
<td>Mod/Low</td>
<td>Mod/Low</td>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td>Tactical Skills and Training</td>
<td>High</td>
<td>Moderate</td>
<td>Moderate</td>
<td>Low</td>
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<tr>
<td>Manpower</td>
<td>Low</td>
<td>Moderate</td>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td>Role Confusion</td>
<td>High</td>
<td>High</td>
<td>Moderate</td>
<td>Low</td>
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</table>
# Provider Matrix

<table>
<thead>
<tr>
<th>Issue</th>
<th>Physician</th>
<th>Nurse</th>
<th>EMT-P</th>
<th>EMT-B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost</td>
<td>High</td>
<td>Moderate</td>
<td>Moderate</td>
<td>Low</td>
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<tr>
<td>Availability</td>
<td>Low</td>
<td>Moderate</td>
<td>High/Mod</td>
<td>High</td>
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<tr>
<td>Skills</td>
<td>High</td>
<td>High/Mod</td>
<td>High/Mod</td>
<td>Low</td>
</tr>
<tr>
<td>Field Experience</td>
<td>Low</td>
<td>Moderate</td>
<td>High</td>
<td>High</td>
</tr>
</tbody>
</table>
# Weapons Matrix

<table>
<thead>
<tr>
<th>Issue</th>
<th>Unarmed</th>
<th>Armed</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Inner Perimeter Security</strong></td>
<td>Tactical Team</td>
<td>One Person-One Job</td>
</tr>
<tr>
<td><strong>Fire Control</strong></td>
<td>Non-issue</td>
<td>Accuracy and Retention</td>
</tr>
<tr>
<td><strong>Weapon Retention</strong></td>
<td>Non-issue</td>
<td>Policy on securing when appropriate</td>
</tr>
<tr>
<td><strong>Legal</strong></td>
<td>Minor issues</td>
<td>Need statutory authority to arm, criminal and civil liability</td>
</tr>
<tr>
<td><strong>Role Confusion</strong></td>
<td>Unlikely</td>
<td>Potential Problem</td>
</tr>
<tr>
<td><strong>Personal Protection</strong></td>
<td>Minimal</td>
<td>Improved, limited</td>
</tr>
</tbody>
</table>
Malpractice Insurance

• Who provides malpractice coverage will most likely be based upon the type of system/provider level.
• Medical providers that are employees of the law enforcement agency should ensure that their medical activities are covered under the department’s existing insurance policies.
• If the department is self-insured, specific wording regarding malpractice needs to be included in the TOMS policy.
• If a commercial insurer or other entity covers the department for their liability coverage, make sure they include a rider that includes TOMS.
• Don’t assume the risk management office has included malpractice coverage when it shops for insurance.
Malpractice Insurance

• Medical providers that are employees of another service, i.e. EMS or Fire, must make certain that either the supported law enforcement agency or their parent organization will extend liability coverage to TOMS activities.

  – Many policies written so that coverage is only in effect when working directly for the policyholder and not during outside activities.
Disability Coverage

• Who pays the medical bills and lost wages should the medical provider be injured while supporting the law enforcement agency?

• If functioning as an employee of the supported or parent agency, workman’s compensation procedures should be used.

• Gray zone if “on loan” from parent agency to supported agency. Responsibility for coverage must be determined in advance and put into writing.

• Volunteers do not have coverage unless it is put in writing.
General Liability Coverage

• Who covers liability if:
  – You have an MVA while responding to a call-out in your personal vehicle?
  – You are sued for “assault” or “unlawful touching” because you rendered care to a perpetrator who did not want care?

• These issues not covered by malpractice policies!
  – Will your personal homeowner’s or motor vehicle insurance cover these?
  – Will the supporting agency?
Agreements

• Put it in writing!
• A Memorandum of Understanding or Letter of Agreement should be in place between the TEMS provider or his parent agency and the supported agency that addresses all these issues.
• Document should be signed by the provider and someone with authority to enter into agreements for the supported agency (not the SWAT sergeant!).
Insurance Summary

• Insurance and liability issues are not routinely addressed when developing a TOMS program.

• To avoid confusion and potential problems when an incident occurs, specific responsibilities should be delineated in the start-up process.

• If it’s not in writing, you’ll be left flapping in the breeze!
TCCC Lessons Learned:
Tourniquets-CoTCCC

• “Tourniquets have been very successful. In Iraq, 5 years ago, I saw casualties come in in shock and dying from single extremity injuries without tourniquets. Here, we are seeing triple and quadruple amputee amputee come in with tourniquets applied, awake and talking to us.” (KAF Role III-Neurosurgeon).
Circa 1850
WW II German

WW II American
Tourniquet Debacle

• “We believe that the strap-and-buckle tourniquet in common use is ineffective in most instances under field conditions...it rarely controls bleeding no matter how tightly applied.”

Wolff, Army Medical Department Journal 1945
Tourniquet Debacle

• Over 2500 deaths occurred in Vietnam secondary to hemorrhage from extremity wounds. These casualties had no other injuries.
SOF® Tactical Tourniquet

Combat Application Tourniquet™
Tourniquets: Points to Remember

• Training tourniquets should never be used as mission tourniquets
• Repetitive applications may cause tourniquet failure
Spinal Immobilization Indications:

Concerning mechanism of injury (Such as violent impact to head, neck, torso, or pelvis; Sudden acceleration, deceleration, or lateral bending forces to neck or torso; Axial loading, shallow-water diving incident, Ejection or fall from any motorized or human powered transport device. Car rollover; Any fall.).

Spine pain or tenderness.

Neurologic deficit.

Altered mental status (Patient must be awake, alert, oriented, calm, and cooperative, without evidence of intoxicants to give reliable exam.).

Head injury to include severe head and facial trauma.

Patients with significant mechanisms of injury with painful, distracting injury.

Patients with significant mechanisms of injury and communication barriers.

Patients with significant mechanisms of injury and extremes of age. (Elderly are most susceptible to concomitant spinal injury from relatively innocuous trauma).

Patients with significant mechanisms of injury and history of rheumatoid arthritis or ankylosing spondylitis.

Initiate Trauma Alert for a patient who experiences a traumatic injury and:

- GCS < 14
- SBP < 90 mmHg
- HR < 50 or > 22
- Penetrating trauma
- Fractured skull
- Two or more long-bone fractures
- Crushed, dislocated, or mangled extremity
- Amputation
- Pelvic fractures
- Skull fractures
- Paralysis

Assess Scene Safety.

Routine Patient Care.

Control life threatening hemorrhage.

Perform Initial Assessment.

Attention to airway with cervical spine precautions

Apply occlusive dressings to open chest wounds.

Initiate care as indicated.

Initiate transport.

Perform ongoing assessment and treatment as indicated.

Monitor patient condition.

Transport.

X-Control exsanguination:
- Direct pressure.
- Pack wounds with pressure dressing.
- Pack wounds with Combat Gauze if bleeding not controlled by direct pressure.
- Tourniquet for life-threatening or uncontrolled hemorrhage.

A- Airway:
- With C-spine precautions.

B- Breathing:
- Assess rate, depth, effort, and adequacy.
- Inspect, palpate, auscultate, percuss, and look for flail chest or sucking chest wounds.
- Cover open wounds with occlusive dressing.
- Needle decompression of chest as indicated.

C- Circulation:
- Peripheral pulses.
- Capillary refill.
- Ensure IVIO access as indicated.
- Control hemorrhage.

D- Disability:
- AVPU.
- Pupil status.
- Sensory/Motor exam.

E- Exposure:
- Expose injuries to examine completely.
- Log roll to assess injuries.

PAY PARTICULAR ATTENTION TO PROTECT PATIENT FROM HYPOTHERMIA.

ESTABLISH IV ACCESS ENROUTE TO THE HOSPITAL: MINIMIZE DELAYS IN TRANSPORT.
**CODE 40**

**ROUTINE TRAUMA CARE**

**Assess Scene Safety.**

**Routine Patient Care.**

**Control life threatening hemorrhage.**

**Perform Initial Assessment.**

**Attention to airway with cervical spine precautions.**

**Apply occlusive dressings to open chest wounds.**

**Initiate care as indicated.**

**Initiate transport.**

**X-Control exsanguination:**
- Direct pressure.
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- Cover open wounds with occlusive dressing.
- Needle decompression of chest as indicated.

**C- Circulation:**

**Indications:**
- Mechanism of injury:
  - Impact to head, neck, or thorax.
  - Internal bending forces to thorax: Ejection or fall.
  - Significant mechanism of distracting injury.
  - Significant mechanism of penetration barriers.

**Alarm:**
- Wake, alert, oriented, responsive, without evidence of reliable exam.

**Injuries:**
- Severe head injury.
- Moderate to severe laceration involving skin, subcutaneous tissue, muscle, bone, or viscera.
Airway-CoTCCC

- Supraglottic airways.
- Up to a 33% failure rate for surgical airways in theater.
- Severe maxillofacial injury should **NOT** trigger a knee jerk reflex for the medic to attempt a surgical airway.
- LOC in absence of airway obstruction is not an indication for a surgical airway.
- Do not perform surgical airways unless there is an observed airway obstruction.
Repetition and Realism in Cricothyroidotomy Training

To prepare for scenarios like this one, combat medics should perform cricothyrotomy at least five times during training on an anatomically realistic model.
Intraosseous-CoTCCC

- Humeral IO insertions can be difficult.
- Although preliminary data from the Baltimore CSTARS (Center for the Sustainment and Readiness of Trauma Skills) study denotes IO flow rate to be greatest with humeral method (humeral > tibial > sternal), the humeral IO dislodges easier.
- FAST-1 IO as the primary for TFC, and the EZ IO as primary for TACVAC.
TXA-CoTCCC

- TXA. Binds to lysine sites on plasminogen. Safe medication. May be the best intervention for pre-hospital care of patients with Junctional and truncal hemorrhage.
TXA-Review

• TXA does not promote new clot formation
• Prevents forming clots from being broken down by the body
• Helps stop the bleeding
• Helps prevent death from hemorrhage
• Two major studies have shown a survival benefit from TXA, especially in casualties that require a massive transfusion of blood products
TXA-Review

• Survival benefit GREATEST when given within 1 hour of injury
• Survival benefit still present when given within 3 hours of injury
• DO NOT GIVE TXA if more than 3 hours have passed since the casualty was injured – survival is DECREASED by TXA given after this point
• DON’T DELAY WITH TXA!
TXA-Review

- Trade name: Cyklokapron®
- FDA-approved
- Possible side effects:
  - Nausea, vomiting, diarrhea
  - Visual disturbances
  - Possible increase in risk of post-injury blood clots
  - Hypotension if given as IV bolus
TXA
Administration – 1st Dose

• Supplied in 1 gram (1000 mg) ampules
• Should NOT be given with Hextend or through an IV line with Hextend in it
• Inject 1 gram of TXA into a 100-cc bag of normal saline or lactated ringer’s
• Infuse slowly over 10 minutes
• Rapid IV push may cause hypotension
• If there is a new-onset drop in BP during the infusion – SLOW DOWN the TXA infusion
• Then administer blood products or Hextend
TXA
Administration – 2nd Dose

• Typically given after the casualty arrives at a Role II/Role III medical facility

• May be given in field if evacuation is delayed and fluid resuscitation has been completed before arrival at the medical facility

• If still in field or in TACEVAC when fluid resuscitation is complete, give second dose of TXA as directed for the first dose
Junctional Hemorrhage-CoTCCC

• Main causes of preventable death on the battlefield are non-compressible torso hemorrhage and Junctional hemorrhage.
Wounds that May Result in Junctional Hemorrhage

Typically caused by dismounted IED attacks
An ongoing USAISR analysis of the cause of death in recent U.S. fatalities from Afghanistan and Iraq has noted that the most common cause of preventable deaths at present is junctional hemorrhage from proximal lower extremity amputations and groin injuries.”

Eastridge and Mabry
CoTCCC Meeting 3 August 2011
Junctional Hemorrhage

“Groin hemorrhage is the most common type of junctional bleeding where regular tourniquets cannot work.”

Kelly JF, et al.

*J Trauma*. 2008; 64(suppl 2)
FLUIDS-CoTCCC

- No survival benefit from pre-hospital resuscitation of patients in hemorrhagic shock with crystalloids.
- Hypotensive resuscitation with hextend.
- Damage control and hemostatic resuscitation with 1:1 PRBC’s to plasma.
- No good evidence that giving blood products pre-hospital improves outcomes.
- TXA. Binds to lysine sites on plasminogen. Safe medication. May be the best intervention for pre-hospital care of patients with Junctional and truncal hemorrhage.
Choice of Resuscitation Fluid

• 500ml of 6% hetastarch (trade name Hextend®, weighs 1.3lbs) and will yield an expansion of the intravascular volume of 600-800ml.

• This intravascular expansion is still present 8 hours later – may be critical if evacuation is delayed.

• Hextend®
  – Less weight to carry for equal effect
  – Stays where it is supposed to be longer and does the casualty more good
  – Less likely to cause undesirable side effects
• Max dose of Hextend is 1,000ml (1,600ml of volume expansion effect)

• To get the same effect from crystalloid, it requires 7,000ml PER CASUALTY!

• Which would you rather carry?

• Hextend is preferred as a weight saving advantage for combat trauma

• For hemorrhagic shock, LR is 2\textsuperscript{nd} choice.
Fluid Resuscitation Strategy

• If signs of shock are present, **CONTROL THE BLEEDING FIRST**, if at all possible.
  – Hemorrhage control takes precedence over infusion of fluids.
• Hextend, 500ml bolus initially
• If mental status and radial pulse improve, maintain saline lock – do not give additional Hextend.
Fluid Resuscitation Strategy

• After 30 minutes, reassess state of consciousness and radial pulse. If not improved, give an additional 500ml of Hextend.

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

• Hextend has no significant effects on coagulation and immune function at the recommended maximum volume of 1000 ml (for adults).
TBI Fluid Resuscitation

• If a casualty with an altered mental status due to suspected TBI has a weak or absent peripheral pulse:
  – Resuscitate with sufficient Hextend® to maintain a palpable radial pulse.
  – Shock increases mortality in casualties with head injuries.
  – Must give adequate IV fluids to restore adequate blood flow to brain.
HEMORRHAGIC SHOCK

Routine Trauma Care

Hemorrhage Control

Fluid therapy recommendations:

For penetrating trauma victims and short (less than 30 minutes) transport times, fluids should be withheld in patients that are alert and have a palpable radial pulse. Fluids, in the form of 200ml boluses of saline should be administered to retain the patient to a coherent mental status or palpable radial pulse.

In the setting of traumatic brain injury, fluids should be titrated to maintain a SBP > 90mmHg.

Minimize prolonged scene times and minimize unnecessary delays.

Transport

External bleeding:

Routine bleeding:

Apply direct pressure.

Bleeding Controlled? NO

Transport

Catastrophic or severe bleeding:

Apply CAT tourniquet 2-3” proximal to wound.

Bleeding Controlled? YES

Transport

Bleeding Controlled? NO

Tighten tourniquet or consider applying second tourniquet proximal to initial tourniquet placement.

If wound not amenable to tourniquet placement and on-going catastrophic hemorrhage, pack wound with Combat Gauze and maintain pressure on wound.

Do not loosen tourniquet(s).

Transport

Internal bleeding:

For suspected internal bleeding due to pelvic fractures, consider application of cravat using bed sheet and tie bind pews at level of greater trochanters.

Transport

Scene times should not be delayed for procedures. These should be performed en route when possible. Rapid transport of the unstable trauma patient is the goal.

Fluid bolus:
- 250ml bolus of normal saline to maintain palpable radial pulse and level of consciousness.
- Maintain SBP > 90mmHg for the victim of traumatic brain injury.
For penetrating trauma victims and short (less than 30 minutes) transport times, fluids should be withheld in patients that are alert and have a palpable radial pulse. Fluids, in the form of 250ml boluses of saline should be administered to return the patient to a coherent mental status or palpable radial pulse.

In the setting of traumatic brain injury, fluids should be titrated to maintain a SBP > 90mmHg.

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For suspected internal bleeding due to pelvic fractures, consider application of cravat using bed sheet and tie/bind pelvis at level of greater trochanters.

**Fluid bolus:**
- 250 ml bolus of normal saline to maintain normal saline to maintain palpable radial pulse and level of consciousness.
- Maintain SBP ≥ 90mmHg for the victim of traumatic brain injury.
Ketamine-CoTCCC

• Ketamine does not cause cardiorespiratory depression as opioids do and is well suited for casualties who are in shock or at risk for going into shock.

• Ketamine NOT IV push, but rather slow IV over 1 minute.

• Use more ketamine. Doubt TBI and eye injury are really contraindications to ketamine use. Difficult to clear a c-spine after ketamine.
Ketamine

• At lower doses, potent analgesia and mild sedation
• At higher doses, dissociative anesthesia and moderate to deep sedation
• Unique among anesthetics because pharyngeal-laryngeal reflexes are maintained
• Cardiac function is stimulated rather than depressed
• Less risk of respiratory depression than morphine and fentanyl
• Works reliably by multiple routes
  – IM, intranasal, IV, IO
Ketamine - Safety

• Very favorable safety profile
• Few, if any, deaths attributed to ketamine as a single agent
• FDA Insert:
  – "Ketamine has a wide margin of safety; several instances of unintentional administration of overdoses of ketamine (up to ten times that usually required) have been followed by prolonged but complete recovery."
Ketamine - Contraindications

• Moderate to severe TBI
  – Ketamine has been reported to cause increased intracranial pressure

• Penetrating eye injuries
  – Ketamine has been reported to cause increased intraocular pressure

• Hypersensitivity to ketamine
Ketamine – Potential Side Effects

- Elevated heart rate
- Elevated blood pressure
- Hypersalivation
- Nausea
- Muscular clonus
- Nystagmus
- Disturbing dreams
- Hallucinations
  - “Emergence Phenomena”
    - More common at higher doses
    - Decreased symptoms with benzodiazepines, barbiturates and narcotics
Ketamine - Side Effects

• Respiratory depression and apnea can occur if ketamine is administered too rapidly.
• Providing several breaths via bag-valve-mask ventilation is typically successful in restoring normal breathing.
Pain Control-CoTCCC

• The TCCC battlefield analgesia options should be simplified. Consider reducing the Prehospital pain management protocol to three treatment options:

1. Able to fight – Mobic and Tylenol.
2. Unable to fight and in no risk of shock – OTFC 800 mcg.
3. Unable to fight and in or at risk of shock – Ketamine 50 mg IM.
Pain Control – Fentanyl Lozenge

Dosing and Precautions

• Tape fentanyl “lozenge on a stick” to casualty’s finger as an added safety measure
• Re-assess in 15 minutes
• Add second lozenge in other cheek if needed
• Respiratory depression very unlikely – especially if only 1 lozenge is used
• Monitor for respiratory depression and have naloxone (Narcan) (0.4 - 2.0mg IV) ready to treat
Pain Control – Fentanyl Lozenge

Safety Note:

• There is an FDA Safety Warning regarding the use of fentanyl lozenges in individuals who are not narcotic tolerant.

• Multiple studies have demonstrated safety when used at the recommended dosing levels,

BUT NOTE:

• DON’T USE TWO WHEN ONE WILL DO!
Antibiotics-CoTCCC

• Systemic antibiotics should be given to combat casualties with open wounds as soon as possible.
Tactical Field Care Guidelines

• Antibiotics: recommended for all open combat wounds:
  – If able to take PO meds:
    • Moxifloxacin, 400 mg PO one a day
  – If unable to take PO (shock, unconsciousness):
    • Cefotetan, 2 g IV (slow push over 3-5 minutes) or IM, every 12 hours
    • Ertapenem, 1 g IV/IM once a day
Outcomes: Without Battlefield Antibiotics

- Mogadishu 1993
- Casualties: 58
- Wound Infections: 16
- Infection rate: 28%
- Time from wounding to Level II care – 15 hrs.

*Mabry et al, J Trauma 2000*
Outcomes: **With** Battlefield Antibiotics

Tarpey – AMEDD J 2005:
- 32 casualties with open wounds
- All received battlefield antibiotics
- None developed wound infections
- Used TCCC recommendations modified by availability:
  - Levofloxacin for an oral antibiotic
  - IV cefazolin for extremity injuries
  - IV ceftriaxone for abdominal injuries.
Outcomes: With Battlefield Antibiotics

- MSG Ted Westmoreland
- Special Operations Medical Association presentation 2004
- Multiple casualty scenario involving 19 Ranger and Special Forces WIA as well as 30 Iraqi WIA
- 11-hour delay to hospital care
- Battlefield antibiotics given
- No wound infections developed in this group.
Recommended for all open wounds on the battlefield!
Documentation-CoTCCC

• Lack of pre-hospital care documentation is a major obstacle to advancing pre-hospital trauma care. If you cannot document what is done, then you can’t make evidence based improvements. You can’t improve what you can’t measure, and you can’t measure without data.
Oversight Issues-CoTCCC

• Many combatant unit physicians and physician assistants are not conducting combat missions with their units. Without this experience, it is difficult to understand the environment, ascertain requirements, and advance needed pre-hospital casualty care innovation and initiatives.

• It does no good to train medics, corpsmen, and PJs in TCCC if their Division, Brigade, and Battalion physicians and physician assistants do not allow them to perform the interventions recommended in TCCC. This underscores the importance of training the physicians and physician assistants in TCCC.
## C-TECC Skill Sets Based on Provider Level

<table>
<thead>
<tr>
<th>Provider Level</th>
<th>Tourniquets**</th>
<th>Pressure Bandage w/packing</th>
<th>Hemostatic Agents</th>
<th>Tourniquet De-escalation</th>
<th>Needle Thoracentesis</th>
<th>Surgical Airway</th>
<th>NPA</th>
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* Law Enforcement Officer; may have CPR/Basic First Aid Training.

** Already included in NREMT skill sheets.

*** Only with proper training, specialized protocol and OMD approval. Ideally, this is a skill that should be performed by all providers, but need to prove safety and efficacy prior to inclusion of additional provider levels.

Other EMS/medical related skills such as patient assessment, chest seal placement, splinting, and hypothermia management should be considered standard for all levels of providers. Additional skills can be considered with specific agency approval.
Summary

Medical care during tactical operations differs significantly from the care provided in the civilian and military community. New concepts in extraction, rescue, hemorrhage control, fluid resuscitation, are important steps in providing the best possible care to our tactical operators and soldiers.