CERTAIN Trauma

A Systematic Approach to Trauma Critical Care, Disaster Medicine

https://www.icertain.org/certain-trauma
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“Less Is More” – Efficient, Effective Critical Care Delivery

• Doing the basics correctly is the most important outcome determinant in critical illness and injury
  • Mass critical care delivery creates additional challenges

• Standardized, structured approach to care delivery is essential to achieve the best possible outcomes

Viyajan et al BMJ Opinion July 23, 2020
CERTAIN
CHECKLIST FOR EARLY RECOGNITION, TREATMENT OF ACUTE ILLNESS, INJURY

Standardized, simplified approach to evaluation, treatment of acutely ill patients

• Combines scattered “bundles” into comprehensive plan of care
  • A-F, ACLS, ATLS, Surviving Sepsis

• 5-year international quality improvement trial
  • Improved adherence to best practices
  • Reduced mortality, length of stay

• Lower costs with 12-month longitudinal coaching program

Critical Elements of Critical Care

Stabilization
Coordinated, early diagnosis
Aggressive resuscitation

Rounding
Shared mental model
System-based plan

Patient-Centered
Needs of patient, family
come first
CERTAIN Approach

Immediate Threats to Life
- Airway
- Work of Breathing
- Poor Circulation (shock, arrhythmia)
- Disability (neuro-deficit, seizure)
- Exposure (bleeding, acute abdomen, rash)

Unconscious Apneic/gasping

Full Code?

CPR

Focused History
- Allergies
- Medications
- Past Medical History
- Social History (*code status)
- Bedside tests
  - Ultrasound
  - Labs

CERTAIN Primary Survey
- Monitor, establish IV access
- Assess ABCs: airway, breathing, circulation
- Breathing: rate, rhythm, effort, color, accessory
- Circulation: pulse, blood pressure, cardiac sounds
- Disability: hemodynamic instability, chest
- Exposure: bleeding, acute abdomen, rash
- Focused history: allergies, medications, past medical history
- Difficult airway
- Allergies, sensitivity

CERTAIN Differential Diagnosis
- Problem list
- Syndrome recognition
- Differential diagnosis algorithms

During stabilization

CERTAIN Systems-Based Plan
- Multidisciplinary rounding checklist
- Perform with every admission
- Daily goals of care

CERTAINly Human
- Understand the patient as a person
- Preferences, next of kin
- Psychological, social, spiritual support

CERTAIN Procedure Checklist
- Urgent Interventions
  - Oxygenation: BVM
  - Ventilation: NIV vs MV
  - Fluids (IV/IO) +/- vasoressors
  - Cardioversion, pacing
  - Chest / Percardial drainage
  - Antibiotics


Developed by the CERTAIN Team
Mass Critical Care

Triage

- **Immediate**
  - Emergency Department / Intensive Care Unit
  - Serious wounds: resuscitation and immediate surgery

- **Delayed**
  - Ward
  - Secondary priority wounds: can wait for surgery

- **Minimal**
  - Clinic
  - Superficial wounds: ambulatory management

- **Expectant**
  - Administration
  - Severe wounds: supportive treatment

*Adapted from Defense Health Agency Joint Trauma System: Current Tactical Combat Casualty Care Guidelines. Department of Defense. Developed by Claudia Castillo Zambrano, MD, and Alexander S. Niven, MD, on behalf of CERTAIN Network*
Step 1: Primary Survey: Address Immediate Threats to Life

**CERTAIN Primary Survey**

- **A** Airway: obstruction, compromise, check endotracheal tube
- **B** Breathing: air entry, crackles, wheezing, check ventilator
- **C** Circulation: shock, arrhythmia, check vasopressors/CRRT
- **D** Disability: AVPU, focal deficit, seizure, check ICP
- **E** Exposure: bleeding, acute abdomen, rash, wounds

Focused history: Allergies, Medications, Past medical history

**U** Ultrasound as a stethoscope: lungs, heart, abdomen

**L** Point-of-care Laboratory: ABG, Glu, Lactate, K⁺, Ca²⁺, Hct

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**CERTAIN Trauma Primary Survey**

- Ensure scene safety and C-spine protection
- **X** eXanguinating hemorrhage: compression, tourniquet
- **A** Airway: obstruction, compromise
- **B** Breathing: hypoventilation, flail chest, s.c. emphysema
- **C** Circulation: shock, external/internal hemorrhages
- **D** Disability: neurological status, pupil size/reactivity
- **E** Exposure: pelvic instability, acute abdomen, wounds

Monitor, IV/I0 access, prevent hypothermia

Focused history: Allergies, Medications, Past medical history

**U** Ultrasound as a stethoscope: lungs, heart, abdomen

**L** POC Laboratory: Hb, ABG, glucose, lactate, K⁺, Ca²⁺
Step 2: System-Based Assessment & Plan

- Use system-based checklist on admission, during rounds for treatment de-escalation
- Reduce errors of omission
Step 3: Differential Diagnosis

- Develop problem list
- Identify syndromes
  - Checklist-based decision support
  - Emergent interventions, advanced diagnostics, consults
Step 4: Humanizing Critical Care

“We are evolutionarily wired social beings in need of a protective relationship. If this is not taken into consideration, treatment is 25-30% longer, mortality may increase, and quality of life may worsen because of psychological iatrogenic effects and PTSD”

Szilagyi et al Ann Palliative Med 2017
23 year-old male with gunshot wounds to right leg
Tactical Combat Casualty Care (TCCC)

- Triage
- Primary Survey
- Address massive hemorrhage
- Airway management
- Breathing
- Circulation
- Disability
- Exposure
- Secondary Survey
- Analgesia, antibiotics
- Assess / address wounds
- Hypothermia prevention
- Document
<table>
<thead>
<tr>
<th>Triage</th>
<th></th>
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</thead>
<tbody>
<tr>
<td>Immediate</td>
<td>ER / ICU</td>
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<tr>
<td>Delayed</td>
<td>Ward</td>
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<tr>
<td>Minimal</td>
<td>Clinic</td>
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<tr>
<td>Expectant</td>
<td>Administration</td>
</tr>
</tbody>
</table>
Causes of Death from Battle Injury

**Nonsurvivable**
- Severe Head Trauma
- Hemorrhage
- Other

**Possibly Survivable**
- Hemorrhage
- Traumatic Brain Injury
- Multiple Organ Failure
- Other

Eastridge BJ et al. J Trauma Aug 2011; 71: S4-8
Main Hemorrhage Focus in Possibly Survivable Deaths

Eastridge BJ et al. J Trauma Aug 2011; 71: S4-8

Prehospital care:
1. Control compressible injuries: Tourniquet, dressings
2. Resuscitation, pain control

Immediate Hospital Care
1. Control noncompressible injuries
2. Damage control resuscitation
## Primary Survey

<p>| | |</p>
<table>
<thead>
<tr>
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</table>
| **A** | - Ketamine, RSI, vasopressors for induction  
- Early surgical airway in severe facial trauma  
- Cervical spine stabilization  
- No succinylcholine in prolonged crush/burn |
| **B** | - Pneumothorax common in blast injuries  
- Lung protective ventilation (6 - 8 cc/kg PBW) |
| **C** | - IO access, large bore peripheral IV  
- Hypotensive resuscitation (SBP 100 mm Hg) |
| **D** | Document baseline neurologic exam |
| **E** | - Pattern of injury, treat active hemorrhage  
- Check pulses after splint, stabilization |
| **U** | eFAST to identify occult injuries, risk stratify |
| **L** | Hgb, pH/base deficit, Ca, INR |
## Damage Control Resuscitation Indicators

<table>
<thead>
<tr>
<th>SBP &lt; 100 mm Hg</th>
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</thead>
<tbody>
<tr>
<td>HR &gt; 100 bpm</td>
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<tr>
<td>Hct &lt; 32%</td>
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<tr>
<td>pH &lt; 7.25</td>
</tr>
</tbody>
</table>

**Injury pattern**
- Multiple or above knee amputation
- Chest / abdomen wound

<table>
<thead>
<tr>
<th>&gt; 2 regions positive on FAST</th>
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</thead>
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| INR ≥ 1.5, base deficit > 6 mEq/L |
## Damage Control Resuscitation

<table>
<thead>
<tr>
<th>Early calcium</th>
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</thead>
<tbody>
<tr>
<td>Balanced transfusion</td>
</tr>
<tr>
<td>1:1:1:1 FFP / platelets / PRBCs / cryoprecipitate</td>
</tr>
<tr>
<td>Fresh whole blood</td>
</tr>
<tr>
<td>Avoid / treat hypothermia</td>
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<tr>
<td>Rapid infuser preferred</td>
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<tr>
<td>Tranexamic acid within 3 hours of injury</td>
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<tr>
<td>1 gm IV/IO, repeat in 8 hours</td>
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</tbody>
</table>
Damage Control Surgery

- Rapid control of non-compressible hemorrhage, life threatening injuries

“Correcting physiology, not anatomy, is the priority”
Secondary Survey

- Vital signs to guide analgesia
  - NSAIDs, opioids, ketamine
  - Serial eFAST to exclude occult hemorrhage

- Combat wounds are always contaminated
  - Antibiotics for mixed infection
  - Tetanus booster
  - Wide local debridement, large volume irrigation essential to limit antibiotic duration

- Multiorgan trauma is the rule
  - Systematic imaging (all involved areas)
  - “Hand scan” for fragments, fractures
  - Otoscope for ruptured tympanic membranes
  - Fluorescein for corneal abrasions, foreign body

- Systematic documentation saves time, errors
# Case / ICU Arrival

<table>
<thead>
<tr>
<th>A</th>
<th>RSI with ketamine</th>
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<tbody>
<tr>
<td>B</td>
<td>Normal sliding lung, CXR</td>
</tr>
</tbody>
</table>
| C   | IO access, large bore peripheral IV x 2  
DCR criteria met  
- 23u FFP, 20u PRBC, 3 plt, 2 cryo, Ca, TXA  
- Right below the knee amputation  
- Right femur external fixation, artery repair |
<p>| D   | Baseline neurologic exam normal |
| E   | Doppler flow confirmed, no other injuries |
| U   | eFAST to guide resuscitation following OR |
| L   | Serial Hgb, pH/base deficit, Ca, INR |</p>
<table>
<thead>
<tr>
<th>Category</th>
<th>Details</th>
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<tbody>
<tr>
<td>Sedation break</td>
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<td>Delirium</td>
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<td>Pain treatment</td>
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<tr>
<td>Cardiovascular</td>
<td></td>
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<tr>
<td>medications</td>
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<tr>
<td>Lung protective</td>
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<tr>
<td>vent.</td>
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<tr>
<td>Spont. breathing</td>
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<tr>
<td>trial</td>
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<tr>
<td>Head elevation</td>
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<tr>
<td>Fluid balance</td>
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<td>reviewed</td>
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<td>Electrolytes</td>
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<td>Glucose control</td>
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<td>Ulcer prophylaxis</td>
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<td>Nutrition</td>
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<td>Venous thrombosis</td>
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<td>Antimicrobials</td>
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<tr>
<td>Skin integrity</td>
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<td>Wound care</td>
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<td>Devices reviewed</td>
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<td>Urinary catheter</td>
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<td>Central line</td>
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<tr>
<td>Arterial line</td>
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<tr>
<td>Other</td>
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<tr>
<td>Physical therapy</td>
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<td>Family present</td>
<td></td>
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<tr>
<td>Goals of care</td>
<td>Social</td>
</tr>
<tr>
<td>Safe for ICU</td>
<td>discharge</td>
</tr>
</tbody>
</table>

Early LMWH / heparin once stable, bleeding stopped
Early tube / line removal, physical therapy
Care For Your Patients by Caring For Yourselves

- Teamwork
- Protocols, checklists
- Rest, recovery, mutual support
THANK YOU