Scoop, STOP, Squeeze, and Run: Management of Penetrating Trauma

Objectives

• Identify priorities in trauma resuscitation
• Describe interventions linked to survival
• Review novel hemostatic agents

Trauma Resuscitation Priorities

• Hemorrhage control
• Airway management
• Chest decompression
• Transport to definitive care
• Do not actively assist patient to the light!

Trauma Team goals

- Expose and cover patient!
- Avoid excess crystalloids!
- Expedite transport!
- Do not actively assist patient to the light!
- Avoid arbitrary resuscitation goals!

State of the Art (2014)

- Direct pressure
- Direct pressure
- Direct pressure
- Tourniquet
- Hemostatic agent
- Transport

STOP THE BLEEDING

- Apply to area of bleeding
- Maintain compression

USE HEMOSTATIC GAUZE

- Avoid improvised tourniquets when possible
- Use windlass/constricting bands
- Relatively safe
- Do not remove or loosen until arrival at definitive care

SWAT-T

- Self-applied
- Visual aid
- Can be used as a compression tourniquet
- Some sizes for adult/peds

Vetigel

VetiGel

- Invented by a 17 yo college student
- Stops bleeding in 12 seconds
- Composed of algae
- Builds a mesh that acts as a scaffold for fibrin
**Abdominal Aortic Compression**

- Manually inflatable balloon
- Places pressure on abdominal aorta
- Reduces blood flow in femoral arteries

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**External Aortic Compression**

- Taught in combat casualty care courses
- Published case studies
- Requires significant amount of force

Here’s some EAC in action!!!

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**XSTAT**

- FDA approved
- Severe, life threatening bleeding
- Expandable, multi sponge dressing

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**Abdominal Aortic Compression**

- May require 80-120 pounds
- Two hands
- Low position on ground
- Continued pressure

Fig. 3. Intramural external aortic compression.

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**XSTAT**

- Medical sponges coated w/hemostatic material
- Rapidly expand in wound
- Radiopaque marker
- Require surgical extractions
- Provide surface for blood clotting
PROPOSAL:
Bleeding assessed in a packed wound model
No manual pressure or occlusive dressing utilized

RESULTS:
XSTAT: less loss in pressure
Expanded more evenly
More time of removal

HOW MUCH IS TOO MUCH?

Original Study
Prehospital Intravenous Fluid Administration Is Associated With Higher Mortality in Trauma Patients: A National Trauma Data Bank Analysis

- Retrospective analysis
- 774,704 patients
- Half received prehospital IV

Table 4. Multiple Logistic Regression Showing Odds Ratio of Death for Trauma Patients With Versus Patients Without Prehospital IV Catheter and/or IV Fluid Administration—Subtopics Analyses
CAUTION

- Do dose-response relationship exists
- Study cannot differentiate between IV and IVF
- Could not differentiate between rural/urban
- No information on transport time

RESULTS

- 941 patients, 79.2% blunt trauma
- Median prehospital fluid volume 500 mL
- Volumes > 500 mL increased likelihood of tx
- Independent association >2L and tx
- IVF → less shock

***MORE RESEARCH URGENTLY NEEDED***

Take Home Trauma Tips

- Hypotension → bad
- Aggressive IVF → probably bad
- More tailored approach → better
- Bleeding control → best
- Rapid transport → best

“NO SIMPLE STRATEGY TO APPROACH ALL...PATIENTS EXISTS”

Transport Expeditiously

- If no ambo, go!
- Work with PD
- Minimize time to OR
**In the City of Brotherly Love**

- Severe penetrating trauma → PD
- Codified in medical treatment protocols
- 5 proximally located level I trauma centers

**Police Initiated Transport**

- More severely injured
- More likely to have sustained GSW
- No difference in survival

*The current practice of permitting police officers to transport penetrating trauma patients should be continued.*

**Results**

- PD transported patients “more physiologically deranged”
- PD transported patients had higher ISS

“Patients transported by PD were no more likely to die than those transported by ground EMS. This held true when stratified for GSWs and stab wounds”

**Tranexamic Acid**
How it Works

- Prevents plasminogen → plasmin
- Reduces clot breakdown
- TXA is an “anti-fibrinolytic”

http://www.med.upenn.edu/apps/faculty/index.php/g305/c784/p20310

CRASH-2

- 274 hospitals, 40 countries
- Administration of 1g TXA over 10 minutes followed by 1 g over 8 hours
- Reduced overall mortality
- No increase in thrombotic events
- Double-blind, placebo controlled RCT

CRASH-2 Summary

- 20,211 patients
- TXA group well matched with placebo

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<th>No TXA</th>
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<td>Overall mortality</td>
<td>1613 (16.0%)</td>
<td>1463 (14.9%)</td>
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- All cause mortality reduction of 1.5%
- Estimated 70,000-100,000 lives worldwide

CRASH-2 Summary

- Benefit greatest in most severely injured cohort (with severe shock)
- Should be infused < 3 hr of injury
- Increased risk of death if given > 3 hours of injury

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<td>Mortality caused by bleeding in patients with severe shock (SBP &lt; 75 mm Hg)</td>
<td>18.4%</td>
<td>14.9%</td>
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J Trauma Acute Care Surg 2015

Tranexamic acid as part of remote damage-control resuscitation in the prehospital setting: A critical appraisal of the medical literature and available alternatives

Shyrtae Jones, MD, Eric Chusidberg, MD, 3MIA, Roy Nadini, MD, Kate Smith, MD, Andrew P. Cap, MD, PhD, Clive Howland, MB, Nanagaye Phung, MB, and Anne South, MB, Cancer, France
MATTERs Study

- Camp Bastion in Southern Afghanistan
- Retrospective analysis of 896 casualties who received at least 1U PRBC
- TXA administered in 293 cases
- Outcomes: survival at 30 days or hospital discharge

| Treatment | TXA | TXA-
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<tr>
<td>Overall mortality</td>
<td>17.4</td>
<td>23.9</td>
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<tr>
<td>Massive transfusion</td>
<td>14.4</td>
<td>28.1</td>
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The Wholly Grail of Perfect Fluid Resuscitation: Whole Blood

Background

- Long history of successful WB therapy
- In WW2, “almost all blood used for combat casualties.” was group O WB
- Largest program of transfusion during Vietnam war
- In remote theatres, limited ability to store blood components
- Over 10000 U WB transfusions have occurred safely in Iraq and Afghanistan

Why hasn’t it caught on stateside?

- Limited hemostatic efficacy of PLT
- Hemolytic transfusion reaction in non group O patients
- Logistics related to WB storage
3/13/2017

**Case Studies in Trauma**

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**Case 1: “I Was Minding My Own Business..”**
- 25 yo male, 1 GSW to abdomen
- Tachycardic, pale, distressed
- BP: 90/50, P: 110, R: 30, Sp02: 90%
- 1 mid abdominal entrance, no exit
- 15 minutes to trauma center by ground

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**Case 2: To the Point**
- 50 yo female, stab wound right chest
- Pt alert and oriented, visibly distressed
- BP: 100/70, P: 110, R: 30, Sp02: 95%
- Single 1 cm wound R anterior chest
- Diaphoretic, actively bleeding
- 40 minutes by ground to trauma center
Case 3: Officer, arrest that man!

- 35 yo male, multiple GSW scene secure
- Pt with agonal respirations
- Pulseless upon EMS arrival
- At least three entrance wounds
- Large amount of blood on scene
- 5 mins by ground to trauma center

Case 3: Officer, arrest that man!

- How does EMS care change with the time interval?

Summary

- Penetrating trauma care is focused
- Airway management
- Hemorrhage control
- Treatment of tension
- Rapid transport