Prehospital Trauma and the Golden Hour

All Bleeding Stops..... But When!!!

Dave Duncan MD
Director, EMS Authority
Objectives

- Brief Review of Trauma Demographics
- Cover Prioritization in Prehospital Trauma Management: Focus = hemorrhage

1. Safety
2. Time (The Right Care at the Right Time)
3. Massive Hemorrhage
4. Airway
5. Breathing
6. Circulation
Trauma Demographics

-- A 50/50 disease --

Annual Trauma Deaths:
- World: 4,000,000
- US: 200,000
- California: 15,000 (30 a day!)

Ranking as cause of death
- #1 for age group 1-46 (causes 50% of the deaths for those under 50!)
- #3 as leading cause of death overall, across all age groups

Traumatic injury accounts for nearly half of all deaths for Americans under 46
But What About Life Years Lost ???

→ “Life Years” are how we attach value to life!
→ Average age for traumatic death = 36
  (about 40 “life years” lost)

Trauma is responsible for the most “Life Years” Lost
(more than Heart Disease and Cancer combined)
When do our Trauma Patients Die???

How Do We Make A Difference???

The Golden Hour in Trauma: Dogma or Medical Folklore?
Frederick B. Rogers, MD, MS, FACS Medical Director, Trauma Program, LGH

HISTORICAL BACKGROUND

The term “golden hour” is attributed to R. Adams Cowley, founder of Baltimore’s famous Shock Trauma Institute. In a 1975 article, he stated:

“The first hour after injury will largely determine a critically-injured person’s chances for survival.”
When do our Trauma Patients Die??

Most Trauma Mortalities are in the “DOA” Group
When do our Trauma Patients Die??

Of the 30% that die an “early death”

→ MOST OF THESE OCCUR IN THE FIRST HOUR!
When do our Trauma Patients Die??

What About the timing of a Trauma Death??

Trauma Deaths have a “Trimodal” distribution

Epidemiology

Trimodal Distribution of Trauma Deaths

- Golden Hour = 80% of trauma deaths in first hour after injury
- Rapid trauma care has greatest level of impact in these patients

Immediate 30% Early 50% Late 20%
CRASH-2 Results: bleeding

Deaths Due to Bleeding

Deaths Due to All Other Causes

Golden Hour Trajectory

Days
Deaths per Minute

The Golden Hour is where we have drawn a PERFECT arbitrary line.

The earlier the minute, the more likely the intervention will save a life.

Each Minute From Injury ------- deaths taper off.
Trauma Deaths ---- 50/50’s:

50% die on scene
50% are transported then die

Bleeding 45%
50% of these die in the first 2 hours

CNS injury 41%

Other 4%
Organ failure 10%
ZERO Preventable Deaths Program

A NATIONAL TRAUMA CARE SYSTEM

Integrating Military and Civilian Trauma Care Systems to Achieve Zero Preventable Deaths After Injury
ZERO Preventable Deaths

Study Sponsors

- American College of Emergency Physicians
- American College of Surgeons
- National Association of Emergency Medical Technicians
- National Association of EMS Physicians
- Trauma Center Association of America
- U.S. Department of Defense’s U.S. Army Medical Research Command
- U.S. Department of Homeland Security’s Office of Health Affairs
- U.S. Department of Transportation’s National Highway Traffic Safety Administration

Civilian Trauma System
- Shared aims, infrastructure, system design, data, best practices, and personnel

Military Trauma System

The National Academies of
SCIENCES • ENGINEERING • MEDICINE
Evidence Based Medicine (EBM)
(Levels of Evidence for Clinical Application)

Level of evidence

1. Systematic reviews and meta-analyses
2. RCTs with definitive results*
3. RCTs with non-definitive results**
4. Cohort studies
5. Case-control studies
6. Cross-sectional surveys
7. Case reports
Evidence Based Medicine

What Really Happens!

- Systematic review and meta-analyses
- RCTs with definitive results*
- RCTs with non-definitive results**
- Cohort studies
- Case-control studies
- Cross-sectional surveys
- Case reports
But not everything lends itself to a prospective study!

Parachute use to prevent death and major trauma related to gravitational challenge: systematic review of randomised controlled trials

Gordon C S Smith, Jill P Pell

Abstract

Objectives To determine whether parachutes are effective in preventing major trauma related to gravitational challenge.

Design Systematic review of randomised controlled trials.

Data sources: Medline, Web of Science, Embase, and the Cochrane Library databases; appropriate internet sites and citation lists.

Study selection: Studies showing the effects of using a parachute during free fall.

Main outcome measure Death or major trauma, defined as an injury severity score > 15.

Results We were unable to identify any randomised controlled trials of parachute intervention.

Conclusions As with many interventions intended to prevent ill health, the effectiveness of parachutes has not been subjected to rigorous evaluation by using randomised controlled trials. Advocates of evidence based medicine have criticised the adoption of interventions evaluated by using only observational data. We think that everyone might benefit if the most radical protagonists of evidence based medicine organised and participated in a double blind, randomised, placebo controlled, crossover trial of the parachute.
Time
The “Golden Hour”

The Golden Hour is hard to prove prospectively

- TCCC – Tactical Combat Casualty Care:
  “the right Intervention at the right Time”

Timely Interventions for those with preventable deaths!
Emergency medical services intervals and survival in trauma: assessment of the "golden hour" in a North American prospective cohort.

STUDY OBJECTIVE:
The first hour after the onset of out-of-hospital traumatic injury is referred to as the "golden hour," yet the relationship between time and outcome remains unclear. We evaluate the association between emergency medical services (EMS) intervals and mortality among trauma patients with field-based physiologic abnormality.

METHODS:
This was a secondary analysis of an out-of-hospital, prospective cohort registry of adult (aged ≥15 years) trauma patients transported by 146 EMS agencies to 51 Level I and II trauma hospitals in 10 sites across North America from December 1, 2005, through March 31, 2007. Inclusion criteria were systolic blood pressure less than or equal to 90 mm Hg, respiratory rate less than 10 or greater than 29 breaths/min, Glasgow Coma Scale score less than or equal to 12, or advanced airway intervention. The outcome was in-hospital mortality. We evaluated EMS intervals (activation, response, on-scene, transport, and total time) with logistic regression and 2-step instrumental variable models, adjusted for field-based confounders.

RESULTS:
There were 3,656 trauma patients available for analysis, of whom 806 (22.0%) died. In multivariable analyses, there was no significant association between time and mortality for any EMS interval: activation (odds ratio [OR] 1.00; 95% confidence interval [CI] 0.95 to 1.05), response (OR 1.00; 95% CI 0.97 to 1.04), on-scene (OR 1.00; 95% CI 0.99 to 1.01), transport (OR 1.00; 95% CI 0.98 to 1.01), or total EMS time (OR 1.00; 95% CI 0.99 to 1.01). Subgroup and instrumental variable analyses did not qualitatively change these findings.

CONCLUSION:
In this North American sample, there was no association between EMS intervals and mortality among injured patients with physiologic abnormality in the field.
Time
The "Golden Hour"

- 9,254 total subjects
  - 1,385 died at scene
  - 7,555 transported
    - 307 alive, not transported
    - 7 missing out-of-hospital disposition
    - 909 children
    - 126 missing age
    - 140 missing hospital forms
  - 6,520 adults
    - 6,380 with hospital information available
      - 2,104 transported to Level III, IV, V trauma centers or non-trauma hospitals
      - 130 enrolled in clinical trial with embargoed outcomes
      - 152 missing survival status
      - 338 missing geospatial data or other important fields
    - 4,276 transported to Level I or II trauma centers
      - 4,146 observational study patients
    - 3,994 with known survival status
  - 3,656 cases available for analysis
Time

The “Golden Hour”
Time
The “Golden Hour”

<table>
<thead>
<tr>
<th>Shock subgroups</th>
<th>N</th>
<th>OR (95% CI)</th>
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</thead>
<tbody>
<tr>
<td>All patients</td>
<td>778</td>
<td>1.42 (0.77–2.62)</td>
</tr>
<tr>
<td>Ground</td>
<td>567</td>
<td>1.01 (0.37–2.76)</td>
</tr>
<tr>
<td>ISS &gt; 15</td>
<td>544</td>
<td>1.31 (0.68–2.53)</td>
</tr>
<tr>
<td>Blunt</td>
<td>485</td>
<td>1.53 (0.80–2.95)</td>
</tr>
<tr>
<td>Penetrating</td>
<td>293</td>
<td>0.83 (0.10–6.79)</td>
</tr>
<tr>
<td>Required critical intervention</td>
<td>484</td>
<td>2.37 (1.05–5.37)</td>
</tr>
</tbody>
</table>

Decrease adverse outcome with total OOH time > 60 minutes
Increase adverse outcome with total OOH time > 60 minutes
Time…. The “Golden Hour”…..

…………...and the Gates Effect

With the premise that battlefield casualties would benefit from reduced time between injury and care, and a firm belief that one hour was a matter of “A morale obligation to the troops,”…

…on June 15, 2009, Sec Def Robert M. Gates directed a ≤60-minute standard, from call to treatment facility arrival, for prehospital helicopter transport of U.S. military casualties with critical injury…cutting in half the previous goal of two hours, and aligning with the “Golden Hour” concept.

OBJECTIVES: To compare morbidity and mortality for casualties before vs after the mandate (2009) and for those who underwent prehospital helicopter transport in < 60 minutes, vs >60 minutes.

DESIGN, SETTING, AND PARTICIPANTS:
A retrospective analysis of battlefield data examined 21,089 US military casualties that occurred during the Afghanistan conflict from September 11, 2001, to March 31, 2014.

RESULTS:
There was a decrease in median transport time from 90 min to 43 min; \( P < .001 \)

For the total casualty population, the percentage killed in action went from: 16.0% to 9.9% - after golden hour mandate; \( P < .001 \)

Missions achieving helicopter transport in <60 minutes was 25% before vs 75% after mandate, \( P < .001 \).

When adjusted for injury severity score, the percentage killed in action was lower for those critically injured who received a blood transfusion 6.8% after mandate [40 of 589] vs 51.0% before mandate [249 of 488]; \( P < .001 \)
Paramedic vs private transportation of trauma patients. Effect on outcome.

BACKGROUND:
Prehospital emergency medical services (EMS) play a major role in any trauma system. However, there is very little information regarding the role of prehospital emergency care in trauma. To investigate this issue, we compared the outcome of severely injured patients transported by paramedics (EMS group) with the outcome of those transported by friends, relatives, bystanders, or police (non-EMS group).

DESIGN:
We compared 4856 EMS patients with 926 non-EMS patients. General linear model analysis was performed to test the hypothesis that hospital mortality is the same in EMS and non-EMS cases, controlling for confounding factors.

SETTING: Large, urban, academic level I trauma center.

RESULTS:
The two groups were similar with regard to mechanism of injury and the need for surgery or intensive care unit admission. The crude mortality rate was 9.3% in the EMS group and 4.0% in the non-EMS group (relative risk, 2.32; P < .001). After adjustment for ISS, the relative risk was 1.60 (P = .002). Subgroup analysis showed that among patients with ISS greater than 15, those in the EMS group had a mortality rate twice that of those in the non-EMS group (28.8% vs 14.1%).

The adjusted mortality among patients with ISS greater than 15 was 28.2% for the EMS group and 17.9% for the non-EMS group (P < .001). (Mortality for EMS transport was twice that of homie transport)

CONCLUSIONS:
Patients with severe trauma transported by private means in this setting have better survival than those transported via the EMS system. Large prospective studies are needed to identify the factors responsible for this difference —— What?????
Increased mortality associated with EMS transport of gunshot wound victims when compared to private vehicle transport.

BACKGROUND:
Recent studies suggest that mode of transport affects survival in penetrating trauma patients. We hypothesised that there is wide variation in transport mode for patients with gunshot wounds (GSW) and there may be a mortality difference for GSW patients transported by emergency medical services (EMS) vs. private vehicle (PV).

STUDY DESIGN:
We studied adult (≥16 years) GSW patients in the National Trauma Data Bank (2007-2010). Level 1 and 2 trauma centres (TC) receiving ≥50 GSW patients per year were included. Proportions of patients arriving by each transport mode for each TC were examined. In-hospital mortality was compared between the two groups, PV and EMS, using multivariable regression analyses. Models were adjusted for patient demographics and injury severity.

RESULTS:
74,187 GSW patients were treated at 182 TCs. The majority (76%) were transported by EMS while 12.6% were transported by PV.

Unadjusted mortality was significantly different between PV and EMS (2.1% vs. 9.7%, p<0.001).

After adjustment for ISS and demographics: EMS transported patients had a greater than twofold odds of dying when compared to PV (OR=2.0, 95% CI 1.73-2.35).
Tactical Combat Casualty Care (TCCC)

- The goals of (TCCC) are:
  1) Save preventable deaths
  2) Prevent additional casualties

- There are three categories of casualties on the battlefield:
  1. Those who will live regardless
  2. Those who will die regardless
  3. Those who will die from preventable deaths unless.......

This is the group MEDICS can help the most.
- 60% Hemorrhage
- 33% Tension Pneumothorax
- 6% Airway Obstruction
Massive Hemorrhage

Patients can exsanguinate in a few minutes! (Really)

- Prioritize Methods of Hemorrhage Control
- Direct Pressure
- Pressure Dressing
- Wound Packing
- Hemostatic Agents
- Combat Application Tourniquet (CAT)
- TXA??
- Junctional Tourniquets?
- Reboa??
Massive Hemorrhage (an NAEMSP evidence based algorithm)

Prehospital External Hemorrhage Control Protocol

1. Apply direct pressure/pressure dressing to injury

2. Direct pressure effective (hemorrhage controlled)

3. Direct pressure ineffective or impractical (hemorrhage not controlled)

4. Wound amenable to tourniquet placement (e.g. extremity injury)
   - Apply a tourniquet*

5. Wound not amenable to tourniquet placement (e.g. junctional injury)
   - Apply a topical hemostatic agent with direct pressure#
Hemorrhage Control

Hemostatic Agent (EMSA approved products)

EMS Authority Approved Hemostatic Dressings
After an extensive review of the literature and advice from the Emergency Medical Services Medical Directors Association of California Scope of Practice Committee, the following hemostatic dressings are approved by the EMS Authority for use in the prehospital setting:

1. Quick Clot®, Z-Medica®
   a. Quick Clot®, Combat Gauze® LE
   b. Quick Clot®, EMS Rolled Gauze, 4x4 Dressing, TraumaPad®

2. Celox®
   a. Celox® Gauze, Z-Fold Hemostatic Gauze
   b. Celox® Rapid, Hemostatic Z-Fold Gauze

Note:
- The above products are “packaged” in various forms (ie Z-fold, rolled gauze, trauma pads, 4”x4” pads) and are authorized provided they are comprised of the approved product.
- Hemostatic Celox Granules, or granules delivered in an applicator, are not authorized.
Massive Hemorrhage Control
(pressure dressing, trauma dressing, Israeli Bandage)
Impact of Tourniquet Use
Kragh - Annals of Surgery 2009

- Ibn Sina Hospital, Baghdad, 2006
- Tourniquets saved lives on the battlefield.
- Survival was better when tourniquets were applied BEFORE casualties went into shock.
- 31 lives were saved in this study by applying tourniquets in the prehospital setting rather than in the ED
- An estimated 1000-2000 lives have been saved in this war to date by tourniquets. (Data provided to Army Surgeon General)
Tourniquet Misadventures ending in Death
6. Circulation

- Different tissues have different life spans with ischemia: (keep the brain alive)
  - Brain: 6 minutes
  - Heart: 30 – 60 minutes
  - Gut: 1 - 2 hours
  - Skeleton: 6 hours

- No more high volume crystalloid resuscitation
  (except maybe with TBI - more to come)

- Blood Product Resuscitation: “1:1:1” (or 2:1:1)
  (Thanks to the DOD – whole blood is the ticket)
  - 1-2 PRBC
  - 1 FFP
  - 1 PLT
6. Circulation

- **Permissive hypotension** (or low volume fluid resuscitation) was first studied in 1994,

  "Injection of a fluid that will increase blood pressure has dangers in itself. ... If the pressure is raised before the surgeon is ready to check any bleeding that might take place, blood that is sorely needed may be lost."

  — Walter Cannon, 1918
Results. Among the 289 patients who received delayed fluid resuscitation, 203 (70 percent) survived and were discharged from the hospital, as compared with 193 of the 309 patients (62 percent) who received immediate fluid resuscitation (P = 0.04). The mean estimated intraoperative blood loss was similar in the two groups. Among the 238 patients in the delayed-resuscitation group who survived to the postoperative period, 55 (23 percent) had one or more complications (adult respiratory distress syndrome, sepsis syndrome, acute renal failure, coagulopathy, wound infection, and pneumonia), as compared with 69 of the 227 patients (30 percent) in the immediate-resuscitation group (P = 0.08). The duration of hospitalization was shorter in the delayed-resuscitation group.
Cirrhosis

Liberal versus restricted fluid resuscitation strategies in trauma patients: a systematic review and meta-analysis of randomized controlled trials and observational studies

OBJECTIVE:
Hemorrhage is responsible for most deaths that occur during the first few hours after trauma. Animal models of trauma have shown that restricting fluid administration can reduce the risk of death; however, studies in patients are difficult to conduct due to logistical and ethical problems. To maximize the value of the existing evidence, we performed a meta-analysis to compare liberal versus restricted fluid resuscitation strategies in trauma patients.

STUDY SELECTION:
We selected randomized controlled trials and observational studies that compared different fluid administration strategies in trauma patients. There were no restrictions for language, population, or publication year.

DATA SYNTHESIS:
The quantitative synthesis indicated that liberal fluid resuscitation strategies might be associated with higher mortality than restricted fluid strategies, both in randomized controlled trials (risk ratio, 1.25; 95% CI, 1.01-1.55; three trials; I(2), 0) and observational studies (odds ratio, 1.14; 95% CI, 1.01-1.28; seven studies; I(2), 21.4%). When adjusted odds ratios were pooled for observational studies, odds for mortality with liberal fluid resuscitation strategies increased 26.3%.

CONCLUSIONS:
Current evidence indicates that initial liberal fluid resuscitation strategies may be associated with higher mortality in injured patients. However, available studies are subject to a high risk of selection bias and clinical heterogeneity.
“Brain Circulation” - a battle against ICP

- The survival of the patient with significant TBI is directly proportional to their SBP:
  - Up to about 120
  - 10% increased mortality for each 10 pt drop in SBP!

Spaite, et al
6. Circulation

- How about medications to help maintain blood volume in trauma ?????
274 Hospitals
20,211 Patients
40 Countries
CRASH-2 Results: bleeding

- Deaths Due to Bleeding
- Deaths Due to All Other Causes

Days

Deaths Due to Bleeding
Deaths Due to All Other Causes
CRASH-2 Results

“the results weren’t that impressive”

<table>
<thead>
<tr>
<th>Cause of Death</th>
<th>TXA</th>
<th>Placebo</th>
<th>Risk of Death</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Death</td>
<td>10,060</td>
<td>10,067</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bleeding</td>
<td>489</td>
<td>574</td>
<td>0.85 (0.76–0.96)</td>
<td>0.0077</td>
</tr>
<tr>
<td>Thrombosis</td>
<td>33</td>
<td>48</td>
<td>0.69 (0.44–1.07)</td>
<td>0.096</td>
</tr>
<tr>
<td>Organ failure</td>
<td>209</td>
<td>233</td>
<td>0.90 (0.75–1.08)</td>
<td>0.25</td>
</tr>
<tr>
<td>Head injury</td>
<td>603</td>
<td>621</td>
<td>0.97 (0.87–1.08)</td>
<td>0.60</td>
</tr>
<tr>
<td>Other</td>
<td>129</td>
<td>137</td>
<td>0.94 (0.74–1.20)</td>
<td>0.63</td>
</tr>
<tr>
<td>Any death</td>
<td>1463</td>
<td>1613</td>
<td>0.91 (0.85–0.97)</td>
<td>0.0035</td>
</tr>
</tbody>
</table>
CRASH-2 Results: bleeders

- **≤1 hour**: 0.68 (0.54–0.86), p = 0.0001
- **>1 to ≤ 3 hours**: 0.79 (0.60–1.04), p = 0.033
- **>3 hours**: 1.44 (1.04–1.99), p = 0.004
- **All Bleeding Patients**: 0.85 (0.76–0.96), P = 0.0077
“CRASH was done in 3rd World Countries”
Reduces mortality everywhere - particularly well in modern countries

*** Note: High Income Countries mortality risk reduction = 37% (3/4 of participants were moderate or high income countries)
RESULTS:
The TXA group had lower unadjusted mortality than the non-TXA group (17.4% vs. 23.9%, respectively; \( P = .03 \)) despite being more severely injured (mean ISS = 25.2 vs. 22.5, respectively; \( P < .001 \)).

This benefit was greatest in the massive transfusion group (TXA group mortality = 14.4% vs 28.1% in non-TXA group; \( P = .004 \)).
TXA in Pediatric Trauma – Combat Setting

Tranexamic acid administration to pediatric trauma patients in a combat setting: the pediatric trauma and tranexamic acid study (PED-TRAX)

SUMMARY:
- 766 patients < 18 yrs admitted to NATO hospital: 2008-2012
- Average age = 11
- 76% required surgery / 35% required Transfusion = SICK!!!
- 66 (9%) received TXA
- TXA group had > ISS, Hypotension, Acidosis, Coagulopathy
- TXA group had markedly and significantly reduced mortality: Odds Ratio = 0.3 (P < .03)
- (30% mortality reduction)
Case 1 --- GSW to RUQ

- 3 yr old female grabbed dad’s handgun from a cabinet ---- attempted to hand it to him ---- shooting herself in the RUQ
- Transported by ground to SRMC in extremis where she underwent DCS. Then deemed stable for transport to UCD --- about 1 hour post-op.
- Injuries: Liver, Diaphragm, R. Pneumo/Hemothorax, Shock
- CALSTAR arrived, completed logistics and lifted in 15 minutes
- VSS, blood and IV’s running.
- After lift child began to pour blood out of incision (8 min. flight)
- Delivered to UCD Trauma Bay in 15 minutes --- coded upon arrival.
Case #2 ---- MVA/Polytrauma

- 4/17/14
- 8 year old female
- 29.5kg
- Restrained front passenger in a “Razor” off road vehicle
- Helmeted / Belted
- Initial GCS 7
- Unresponsive with minimal respiratory effort ---- Dad gave rescue breaths
Initial Assessment

- **Head**
  - 2” lac above left eye
  - Blood in mouth and nose

- **Neck**
  - Trachea midline, no JVD

- **Chest**
  - 6” full thickness lac Right shoulder toward right nipple
  - Right clavicle crepitus

- **Neuro - GCS** 7 → 5
Initial Assessment

- **ABD**
  - Soft
  - Pelvis stable

- **Extremities**
  - Open right tib/fib fracture with 5” full thickness lac
  - Multiple exposed bone segments
  - No distal pulse
  - Significant bleeding controlled
Treatment En Route

- NRB 15lpm
- Spinal immobilization
- PIV- 18g Left AC, 20g right AC
- 100ml NS
- Repositioning right leg = positive pulses
- Transport to local hospital for airway management and stabilization
On Arrival Sierra Vista

- Decorticate posturing / GCS 4
- Intubated
  - Lidocaine 30mg
  - Etomidate 9mg
  - Succs 45mg
- Propofol gtt 20mcg/kg/min
- 1320: pH 7.21, PCO₂ 51.3, PO₂ 324, Bicarb 20.7/-7, H/H: 9.9/29
- 1325: 500ml LR bolus
- 1330: TXA 1gram/ 10mins
- 1 unit PRBC
**Diagnosis and Findings**

- Subarachnoid Hemorrhage, Subdural Hemorrhage, and diffuse axonal brain injury
- Closed fracture clavicle
- Open Comminuted Tib/ Fib fx with tissue loss
- Lung contusion
- Pneumothorax
- Hemothorax
- Small Liver Laceration
- C7, T6-8 spinal fx
Blood Products

- CRMC
  - 2 unit PRBC’s (3 total)
  - 1 unit FFP and 60ml Cryoprecipitate
Patient Outcome

DCed from UCD 5/14/14
“WHENEVER WE BEGIN TO WORRY ABOUT HER PAIN OR RECUPERATION, SHE SIMPLY REMINDS US ‘I’M A WARRIOR...I GOT THIS.’”
The Golden Hour: In Summary....
The early minutes save preventable deaths

“the Correct Intervention at the Correct Time”

- ABOVE ALL DO NO HARM — Unnecessary procedures and lengthy scene times do harm
- Remember we can only save those that have preventable deaths....
- The right time for the intervention is different for every injury that is about to kill you: Consider this MCA vs Tree case:
  1) Facial Crush with Airway compromise and
  2) Expanding anterior neck hematoma:
     - 15 Minutes for RSI
  3) Tension Pneumothorax:
     - 20 Minutes for needle thoracostomy
  4) TBI with Hypoxemia and Hypotension:
     - Correction ASAP to minimize secondary brain injury
  5) Grade 4 spleen and liver injury
     - 1 hour for TXA, Transfusion and to the OR
Questions ???

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