Welcome to Trauma Tracks

2010
Role of the Nurse in Trauma Resuscitation
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OBJECTIVES:

- At the end of this lecture the attendee will be able to:
  - Describe aspects of the nursing role in trauma resuscitation
  - Discuss assessment and management priorities that optimize trauma resuscitation
Shands at UF Level I Trauma Center
(Oct. 1, 2004 – December 31, 2009)

- Geographical Service Area= 1 mill+ people, 12 counties
- 12,000+ trauma admissions*
  - Average 6.5 trauma patients daily
  - 84% adults vs 16% peds
  - 70% male
  - 28% in (16-29 yr) old age group
  - 77% blunt trauma
- 33% with ISS > 15
- 4.9% mortality rate

*Source: SUF Trauma Registry
Current Outcomes for CY 2009

- Volume = 2578 patients
- 31% of patients with ISS > 15
- ICU LOS = 2.4 days
- Hospital LOS = 5.8 days
  - (.92 index, internal ACHA Methodology)
- 4.41% mortality rate overall
  (NTDB 4.8% 1,485,098 pts)
  - (.93 index, internal ACHA Methodology)
FRAMEWORK:

• Readiness, hyper-vigilance, consistent organization and clear cut communication produces effective outcomes
• We should all know our A, B, C, Ds
• Practice makes perfect
• The success of a trauma resuscitation is only as good as its team AND

A proficient trauma team cannot function without a “well-skilled” trauma nurse!
Profile/Credentials of a Trauma Patient

- Risk taking behavior
  - **Drinking**, distracted, speed, out for fun…
- **Male** vs. **Female**
  - 75% male
- **Average age** (young)
  - Mean age 17
- **Mechanism** frequently
  - *Blunt* trauma and **acutely episodic**

Profile/Credentials of a Trauma Nurse

- **Assertive behavior**
  - Autonomous, focused, passionate…
- **Female** vs. **Male**
  - 75% female
- **Average age** (wise)
  - Mean age 46
- **Mechanism** frequently
  - Continuous care for trauma patients is **chronically perpetual**
Framework: Readiness, hyper-vigilance--produces effective outcomes

- Pre-established trauma system based on experience from military

- 20/20 vision from a distance--expect the unexpected

“Red-tailed hawk”
Framework:
Consistent organization and clear cut communication produces effective outcomes

- Well established and maintained clear roles and goals
- Similar training - street through hospital
- Effective function of the team begins with the Team leader
New Tower

Nurse's Station

Trauma Resuscitation Room

Trauma Center Entrance

Main Entrance

Nurse's Station

Trauma Resuscitation Room
Alberta-- first trauma alert
Premise

- Cause of instability must be recognized and corrected quickly by using a systematic approach.
- It is important to identify and prioritize systemic compromise.

Premise

Situation Awareness

Detection (Perception)

Patient

Team

Tools

Environment

Diagnosis

Prediction
Most Potentially Preventable Trauma Deaths are related to:

- Airway obstruction
- Hemorrhage
  - Hemopneumothorax
  - Intracavitary bleeding
  - Intracranial hemorrhage
Framework: We all need to know our A, B, C, Ds
“Golden Rules” of Trauma

1. All trauma patients need **oxygen** until proven otherwise.

2. All trauma patients are **bleeding** until proven otherwise.

3. All trauma patients have a **cervical spine injury** until proven otherwise.

4. All unconscious/altered LOC trauma patients have a **brain injury** until proven otherwise.
Optimizing Resuscitation Across the Continuum

- Prehospital Phase
  - Key patient information must be communicated
    - Mechanism
    - GCS
    - Vital Signs
    - Interventions
  - Be familiar with modalities and controversies

Pay attention to episodic events of hypotension!
Airway: All trauma patients need oxygen until proven otherwise

- Airway patency and spontaneous breathing is the crucial first step and the single greatest priority in any injured patient

- Must be a skilled and have a backup plan if failure to intubate, i.e. surgical airway

- Be aware of controversies in pre-hospital airway control and be familiar with different types of bridge devices
Airway: All unstable trauma patients need a definitive airway

- Hemodynamically unstable trauma patients need an early definitive airway:
  - Prevents aspiration
  - Reduces the oxygen debt of breathing/maximizes $O_2$ delivery
  - Corrects acid base disturbances
  - Allow clinician to focus on other life-threatening issues
Prehospital Intubation

- **Improves outcome**
  *(Winchell & Hoyt, 1997):*
  Field intubation was associated with significant decreases in mortality from 36% to 26% in the full study group, from 57% to 36% in patients with severe head injury, from 50% to 23% in patients with isolated severe head injury.

- **Worsens outcome**
  *(Murray, 2000)*
  *(Bocchichio, 2003)*
  *(Cooper, 2001)*
  *Pediatric patients*
Prehospital Intubation

- Does not change outcome in head injured patients, *(Arbabi et al., 2004).*

- Similar or greater mortality than BVM, *(Stockinger and McSwain, 2004).*

- Greater mortality than controls 33% vs 24% with RSI in head injury, *(Davis, Hoyt et al., 2003).*
The impact of prehospital ventilation on outcome after severe traumatic brain injury.


BACKGROUND: Prehospital intubation has been challenged on the grounds that it predisposes to hyperventilation, which is detrimental after traumatic brain injury (TBI), and impairs venous return in patients with hypovolemia. We sought to determine the incidence of hyperventilation among a cohort of trauma patients undergoing prehospital intubation and the impact of ventilation on outcome after severe TBI.

CONCLUSION: Targeted prehospital ventilation is associated with lower mortality after severe TBI.
Bridge Devices 2010

King Airway  LMA  Combitube
Breathing: All trauma patients need oxygen until proven otherwise

- Thoracic injuries account for 25% of all trauma deaths
- Understand the significance of patterns—1st and 2nd rib fxs, abdominal breathing
- Treat the pneumo before ETT
- Life-threatening thoracic injuries need to be detected early
  - Tension pneumo
  - Massive hemothoraces
  - Cardiac tamponade
  - Flail chest
CT Scan for thoracic trauma

- Recognize the insensitivity of the AP CXR to detection of pneumothoraces

- Remarkably large occult pneumothoraces may be present without an obvious anterolateral pleural stripe on AP CXR

An occult pneumothorax seen on a CT scan that was not detected on a plain anteroposterior supine chest radiograph.
Hemorrhage: All trauma patients are bleeding until proven otherwise

• All unstable trauma patients have a presumed diagnosis of hypovolemia even before a specific diagnosis

• Stop the bleeding -- hemorrhage control is much more important than fluid resuscitation

• Prevent shock by arresting the bleeding

• Mandates the earliest possible “goal directed therapy”
Hemorrhage PEARL

- **Recognize trouble!**
  - **Prehospital hypotension and ED instability**
    - Be aware of “episodic hypotension (systolic ≤ 90 mm Hg)” - increases morbidity and doubles mortality especially in head injured patients.
    - During the first 90 minutes in the ED, patients who were hypotensive with major abdominal injuries requiring lap sustained an additional 1% increase in mortality for every 3 minutes spent in resuscitation before surgery. **Clarke JR, Trooskin SZ, Doshi PJ, et al. J Trauma 2002;52:420-5.**
  - Truncal GSW
  - Pelvic fractures
  - VS, Lactate, BD
## Hemorrhage: 5 Anatomic Areas of Origin

### Box 1. Bedside assessment of the 5 cardinal sites of massive adult hemorrhage

<table>
<thead>
<tr>
<th>Anatomic site</th>
<th>Modality</th>
<th>Reliability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intraperitoneal</td>
<td>FAST</td>
<td>Positive test is diagnostic; negative test is suspect</td>
</tr>
<tr>
<td></td>
<td>DPL</td>
<td>Gross positive is diagnostic; technically positive only is suspect</td>
</tr>
<tr>
<td>Retroperitoneal</td>
<td>Pelvic radiograph</td>
<td>Unstable fracture pattern is suggestive</td>
</tr>
<tr>
<td>Thoracic (pleural)</td>
<td>Chest radiograph</td>
<td>Positive test is usually diagnostic</td>
</tr>
<tr>
<td>Multiple long-bone</td>
<td>Physical examination</td>
<td>US and radiograph confirmatory but do not quantify blood loss</td>
</tr>
<tr>
<td>fractures</td>
<td></td>
<td></td>
</tr>
<tr>
<td>External bleeding</td>
<td>Physical examination</td>
<td>Positive findings diagnostic but do not quantify blood loss</td>
</tr>
</tbody>
</table>

*FAST = focused assessment with sonography for trauma; DPL = diagnostic peritoneal lavage; US = ultrasonography.*

Hemorrhage: Importance of Lactate & BD

• For Resuscitation to Occur:
  – Adequate perfusion and
  – Tissue oxygenation must be restored

• Measures Directed at:
  – Enhancing $O_2$ transport and $O_2$ uptake
  – Controlling the bleeding
Persistent Acidosis Indicates

- Continued bleeding
- Inadequate resuscitation
- Myocardial dysfunction

↓ serum pH (7.35 – 7.45)
↑ base deficit (2 to -2)
↑ serum lactate (0.4 – 1.8)
Base Deficit Categories

- Normal  (2 to -2)
- Mild    (-3 to -5)
- Moderate (-6 to -9)*
- Severe  (-10 or higher)

*A base deficit of -6 is a marker of severe injury & significant mortality.
Uses of Base Deficit in Trauma Care

• Excellent correlation of base deficit to lactate and pH

• Normalizes rapidly with adequate resuscitation and control of hemorrhage

• Assessing shock and efficacy of resuscitation

• Predicting:
  – abdominal injury
  – transfusion requirement
  – complications (RDS, MODS)
  – mortality
Resuscitation End Points

• Re-evaluation of resuscitation end points
  – B/P, HR, pulse pressure
  – Mentation
  – U/O
  – Labs: base deficit, serum lactate, serum pH
Eastern Association for the Surgery of Trauma Practice Guidelines
“Endpoints of Resuscitation”

• www.east.org
• Traditional markers of blood pressure, heart rate, urine output remain standard of care.
• Uncompensated shock requires additional resuscitation.
• However, after normalizing the above, up to 85% of severely injured patients have evidence of inadequate tissue perfusion based on ongoing metabolic acidosis or evidence of gastric mucosal ischemia.
• Better markers of adequate resuscitation are needed.
Goal Directed Therapy PEARL

- **Recognize trouble!**
  - High risk patients
    - Geriatric patients
    - Pediatric patients
    - Pregnant women
  - Anticoagulants
  - Beta blockers
- **Early invasive monitoring**
- **Follow resuscitation goals**
Optimizing Prehospital Resuscitation

- Low volume fluid administration in penetrating injuries
- Splint all fractures
- Dress all wounds
- Wrap pelvic fractures with sheets/binder
- Tourniquets?
- Scoop and run transports based on “golden hour”
Optimizing Resuscitation

“to resuscitate or not to resuscitate”
(hypotensive resuscitation)

- Immediate versus delayed fluid resuscitation for hypotensive patients with penetrating torso injuries. “a prospective randomized trial ..”
  Bickell, WH, Wall, MJ, Pepe, PE, et al:
  NEJM 1994:331:1105-1109

- Hypotensive resuscitation during active hemorrhage: impact on in-hospital mortality.
  Dutton RP, Mackenzie CF, Scalea TM.
Hemostatic Field Dressing

- Chitosan - derived from chitin from shellfish & crab shells
- QuickClot - powder from volcanic material
Tourniquets 2010
Indications for Tourniquets

- Stop bleeding when life-threatening limb hemorrhage otherwise uncontrollable, such as mangled extremity
- Stop bleeding with traumatic amputation
Blood Substitutes 2010

• Ideal Red Cell Substitute
  – Deliver oxygen
  – No compatibility testing
  – Few side effects
  – Prolonged storage capabilities
  – Persist in the circulation
  – Reasonable cost

• Ready for prime time – not yet but soon - maybe?

• Cell-Free Hemoglobin-Based Blood Substitutes and Risk of Myocardial Infarction and Death
  – *JAMA - April 28, 2008*
Optimizing ED Trauma Resuscitation - stop the bleeding and minimize delay to OR, IR

- Direct pressure to all external bleeding
- Rapid suturing of all scalp and facial wounds
- Rapid application of Thomas/Hare Traction splints for femur fx
- Binder for pelvic fx
- Rapid reduction and pressure dressings of mangled extremities
Pelvic Binders 2010

Developed by Trauma Surgeons for Trauma Surgeons

Pelvic Binder, Inc.
PH: (877) 451-3000 • www.pelvicbinder.com

- Emergency Pelvic Stabilization
- Protects Pelvic Hematoma
- Provides Pain Relief
- One Size Fits All
Optimizing ED Trauma Resuscitation (cont)

• Low volume blood sampling
  – 3 cc for ISTAT: Na/K/Cl/Ca, Hgb, Hct, PO2, PCO2, pH, PT, INR, Lactic acid, Creatinine, Troponin

• Use FAST to rapidly detect intra-abdominal fluid

• Auto transfusion of thoracic blood using the pleurevac system
  – Avoid spilling blood on floor during chest tube insertion
Optimizing Resuscitation - Interventions to Decrease the Need for Blood Transfusion

- Intervene early in resuscitation to STOP bleeding
- Conserve blood early
- Aggressive, rapid, and efficient operative interventions
- Use novel methods to STOP bleeding in the operating theater
- Early use of interventional radiology
- Correct hypothermia, acidosis, coagulopathy
Optimizing ED Trauma Resuscitation - Fluid Resuscitation

- Controversial
  - Whether to administer, type and how much
- Must maintain a critical level of perfusion to vital organs while avoiding over-resuscitation
  - reverses vasoconstriction of injured vessels
  - dislodges early clot
  - dilutes coagulation factors
  - cools the patient
  - induces visceral swelling
**MTP Process**
*Shands at UF*

- **Designated RN**:**
  - Calls BB to unlock refrigerator
  - Logs out blood from MTP refrigerator & delivers
  - Sends designated MTP Runner to BB with cross & match

- **ED/OR ICU Charge Nurse**:**
  - Calls BB with MTP alert
  - Sends designated MTP Runner to BB with cross & match

- **MTP site?**
  - ED/OR ICU Charge Nurse
  - Designated RN

- **Is more MTP needed?**
  - YES
    - Designated RN sends MTP Runner for more blood
    - Designated RN assures blood administered per MD order
  - NO
    - **END**

- **Is pt. to be transported with blood?**
  - YES
    - Designated RN transports blood with pt. to location (OR/ICU)
    - Designated RN assures blood administered per MD order
  - NO
    - **END**

**NOTE:**
- **ED = Nurse Scribe**
- **OR = Circ. RN**

**END**

6.24.06
ED Thoracotomy for Moribund Patients

- Cases of Blunt Chest or Abdominal Trauma: 5-year study by Fialka, C. et al. (2004). *Journal of Trauma*.

- Patients with blunt trunk trauma & cardiac arrest with severe hemorrhagic shock may benefit from open-chest CPR with same probability as shown with penetrating injuries.

- Aortic cross-clamping
Optimizing Resuscitation Across the Continuum

- **Operating Room**
  - Rapid exposure
  - Evacuation of blood
  - Packing
  - Control contamination
  - Anticipate and fight the "triad" of death: Hypothermia, Acidosis, Coagulopathy

- **Regroup!**
Damage Control
Focus on Physiology

- Major paradigm shift in operative management of devastating injuries.
- Abbreviated laparotomy and planned reoperation.
- Bleeding and intestinal contamination are temporarily controlled by packing, ligating, stapling & temporary vascular shunts & abdominal cavity is closed rapidly.

(Rotondo et al., 1993; Shapiro et al., 2000; Johnson et al. 2001, *J Trauma*)
Damage Control Patient Selection

- Instability
- Hypothermia (< 34° C)
- Coagulopathy
- Acidosis (pH < 7.2, BD -8)
- Major trauma

Avoid “ground zero of damage control (physiological decompensation)!”
Neurological: All unconscious trauma patients have brain injury until proven otherwise

- Expanding intracranial hemorrhage requires optimization of oxygenation, ventilation and circulatory support.

- Avoid hypotension in brain injured patients = poor outcome.

- Double jeopardy in unstable patients with severe head injury. Associated brain injuries are present in up to 60% of patients with severe blunt trauma.

- Urgent CT and expert neurosurgical care is a must.
Questions?

- Change is the constant, the signal for rebirth, the egg of the phoenix - *Christina Baldwin*
Summary and Conclusions

• It is truly all about the patient!

• Team effort and framework is needed by design.

• Be familiar with the “paradigm shift” in trauma care.

• Trauma centers save lives!