Management of the Trauma Patient

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Trauma in the United States

• 2.7 million hospital admissions per year
• Leading cause of death for ages 1-44 years
• 100,000 deaths per year from traumatic injuries
  – Half die before they reach medical care
• Hemorrhage is second-leading cause of death in trauma
Figure 6A: Number of Incidents by Age
Figure 7A: Number of Incidents by Age and Gender
Figure 8A: Case Fatality Rate by Age
Figure 10A: Number of Incidents by Mechanism of Injury
Primary Survey

• Advanced Trauma Life Support
• Assess and address life threatening injuries in order
• “ABCDE of trauma”
  – Airway
  – Breathing
  – Circulation
  – Neurologic “deficit”
  – Exposure of patient
Airway

– Identify airway obstruction
– Maintain cervical spine immobilization
– May require definitive airway
  • Orotracheal intubation
  • Blind nasotracheal intubation
  • Cricothyroidotomy
  • Tracheotomy
Breathing

- Identify life threatening deficits in breathing mechanism
  - Simple pneumothorax
  - Tension pneumothorax
  - Massive hemothorax
  - Open pneumothorax (“sucking chest wound”)
  - Flail chest
Circulation

• Or, identification of shock

**Definition of shock** – *inadequate organ perfusion*

• Causes of shock
  – Hemorrhage/hypovolemic
  – Compressive
  – Cardiogenic
  – Neurogenic
  – Sepsis
<table>
<thead>
<tr>
<th></th>
<th>Class I</th>
<th>Class II</th>
<th>Class III</th>
<th>Class IV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blood Loss mL</td>
<td>Up to 750</td>
<td>750-1500</td>
<td>1500-2000</td>
<td>&gt;2000</td>
</tr>
<tr>
<td>Blood Loss %</td>
<td>Up to 15%</td>
<td>15-30%</td>
<td>30-40%</td>
<td>&gt;40%</td>
</tr>
<tr>
<td>Pulse rate</td>
<td>&lt;100</td>
<td>&gt;100</td>
<td>&gt;120</td>
<td>&gt;140</td>
</tr>
<tr>
<td>Systolic blood pressure</td>
<td>Normal</td>
<td>Normal</td>
<td>Decreased</td>
<td>Decreased</td>
</tr>
<tr>
<td>Pulse pressure</td>
<td>Normal</td>
<td>Decreased</td>
<td>Decreased</td>
<td>Decreased</td>
</tr>
<tr>
<td>Respiratory rate</td>
<td>14-20</td>
<td>20-30</td>
<td>30-40</td>
<td>&gt;35</td>
</tr>
<tr>
<td>Urine output</td>
<td>&gt;30</td>
<td>20-30</td>
<td>5-15</td>
<td>Negligible</td>
</tr>
<tr>
<td>Mental status</td>
<td>Slightly anxious</td>
<td>Mildly anxious</td>
<td>Anxious, confused</td>
<td>Confused, lethargic</td>
</tr>
<tr>
<td>Fluid (3:1 rule)</td>
<td>Crystalloid</td>
<td>Crystalloid</td>
<td>Crystalloid and blood</td>
<td>Crystalloid and blood</td>
</tr>
</tbody>
</table>
Circulation

• Treatment of shock
• Direct pressure on external bleeding
• Initial 2 liter bolus of crystalloid fluid
  – Responders
  – Non-responders
  – Transient responders
• Definitive management for ongoing hemorrhage
Neurologic “deficit”

• Rapid assessment of neurologic status to identify life-threatening injury
  – Pupil size and response
  – Mental status (Glasgow coma scale)
  – Motor and sensory exam
Glascow Coma Scale

- 3 – 15 point scale to assess mental status only
- Best observed response
- Modified scale for children
- GCS ≤ 8 is a “coma” and requires intubation for airway protection
Eye opening
  » None = 1
  » To painful stimuli only = 2
  » To voice only = 3
  » Spontaneously open = 4

Verbal response
  » None = 1
  » Incomprehensible sounds = 2
  » Incomprehensible words = 3
  » Confused = 4
  » Oriented = 5

Motor response
  » None = 1
  » Decerebrate (extension) posturing = 2
  » Decorticate (flexion) posturing = 3
  » Withdraws to pain = 4
  » Localizes pain = 5
  » Follows commands = 6
Exposure

Head to toe examination of the patient for injury

• Pitfalls
  – Maintenance of spine precautions
  – Prevention of heat loss
  – Under cervical collar
  – Back and flanks
Adjuncts to the Primary Survey

- Exams during or after primary survey to aid in identifying life-threatening injuries
  - Chest x-ray
  - Pelvis x-ray
  - Focused abdominal sonogram for trauma (FAST)
  - Diagnostic peritoneal lavage (DPL)
Secondary Survey and Definitive Treatment

• The secondary survey is a complete head to toe evaluation of the patient
• Adjuncts to the secondary survey include CT’s, plain radiographs, blood tests
• Treatment plans, especially for multiple injuries, based on clinical status and specific injuries
Resuscitation

• Restoring organ perfusion
• How much is enough? What are the endpoints of resuscitation?
  – Heart rate, blood pressure, urine output
    • May lead to “compensated shock”
  – Organ-specific indicators of perfusion
    • ie gastric tonometry
  – Global indicators of perfusion
    • Lactic acid, base deficit
    • Cardiac output, oxygen delivery, oxygen consumption
    • Mixed venous O$_2$ saturation (SvO$_2$)
Lactic acid and base deficit

- Initial BD and serum LA are reliable indicators of the need for ongoing resuscitation
- Time to normalization of LA and BD are predictive of MSOF and mortality
Damage-control laparotomy

• A shift from definitive management of abdominal injuries to stabilizing the patient for resuscitation

• Goals
  – Stop bleeding
  – Control contamination
  – Temporary abdominal closure
Critical care and rehabilitation

Trimodal Distribution of Trauma
Deaths

- Lacerations:
  - Brain
  - Brainstem
  - Aorta
  - Cord
  - Heart

- Epidural
- Subdural
- Hemopneumothorax
- Pelvic fractures
- Long bone fractures
- Abdominal injuries

- Sepsis
- MOT

Deaths over time:
- 0-1 hour
- 1-3 hours
- 2 weeks
- 4 weeks
Questions?