Management of Hemorrhagic Shock in Trauma

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March 22, 2018

Hemorrhagic Shock

<table>
<thead>
<tr>
<th>Shock Class</th>
<th>Blood Loss (mL)</th>
<th>Heart Rate (bpm)</th>
<th>Blood Pressure</th>
<th>Pulse Pressure</th>
<th>Respiratory Rate (breaths/min)</th>
<th>Mental Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>75-150 (15-30)</td>
<td>&gt;100</td>
<td>Normal</td>
<td>Normal</td>
<td>14-40</td>
<td>Slightly anxious</td>
</tr>
<tr>
<td>II</td>
<td>750-1500 (15-30)</td>
<td>100-120</td>
<td>Narrowed</td>
<td>Narrowed</td>
<td>20-30</td>
<td>Mildly anxious</td>
</tr>
<tr>
<td>III</td>
<td>1500-2000 (30-40)</td>
<td>120-140</td>
<td>Decreased</td>
<td>Narrowed</td>
<td>30-40</td>
<td>Anxious, confused</td>
</tr>
<tr>
<td>IV</td>
<td>&gt;2000 (&gt;40)</td>
<td>&gt;140</td>
<td>Decreased</td>
<td>Narrowed</td>
<td>&gt;15</td>
<td>Confused, lethargic</td>
</tr>
</tbody>
</table>

Data are from the American College of Surgeons Committee on Trauma. Blood loss volume and percentage of total blood volume are for a male patient with a body weight of 70 kg.
**Damage Control Resuscitation (DCR)**

- **STOP the Bleeding**
- **Eliminate**: Hypothermia, excess crystalloids, imbalances in blood.
- **Lethal Triad**
- **Use** Massive Transfusion Protocol (MTP)
- **Selectively Administer** pharmacologic adjuncts
- **Surgical/angiographic hemostasis**

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**Damage control Resuscitation**

- **STOP the Bleed**
  - ATLS
  - Tourniquets
  - Intubation
  - Adjuncts
    - FAST
    - Thoracostomy Tube
  - CT Utilization
  - REBOA

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**Hemorrhagic Shock Intubation**

- **O2 Saturation > 97%**
- **Utilize** Video Laryngoscopy inline c-spine utilization
- **Consider** Ketamine
- **Consider ↑ Paralytic Dose & ↓ Sedation Dose**
- **Do NOT Delay**
REBOA

- Not Universal still in Development stage
- Emerging role as a bridge to bleeding control
- Complications

Damage control Resuscitation

• STOP the Bleeding
• Eliminate the lethal triad
  1. Coagulopathy
  2. Acidosis
  3. Hypothermia

Hypotensive Resuscitation

- Landmark Study Bickell et. al "Immediate versus delayed fluid resuscitation for hypotensive patients with penetrating torso injuries"
- Limit Crystalloids to < ?
- Target low-normal BP
  • 80-90 mmHg*
- Recommend early FFP and Platelet for Massive Transfusion patients
**Damage control Resuscitation**

- **STOP** the Bleeding
- **E**liminate the lethal triad
- **U**se Massive Transfusion Protocol (MTP)
  - TEG®

**When to pull MTP trigger?**

- Assessment of Blood Consumption (ABC) score
  - Penetrating mechanism?
  - ED SBP < 90 mmHg?
  - ED HR > 120?
  - Positive FAST?

**Massive Transfusion Protocol (MTP)**

- Monitoring
  - Patient Hemodynamics
- Laboratory
  - Fibrinogen*
  - CBC
  - Ionized Calcium
  - PT
  - PTT
  - ABG
  - Lactate
- Use TEG®/ROTEM®
Damage control Resuscitation

- STOP the Bleeding
- Eliminate the lethal triad
- Use Massive Transfusion Protocol (MTP)
- Selectively Administer pharmacologic adjuncts

Hemostatic Adjuncts
- Activated Recombinant Factor VII
- Tranexamic acid
- Prothrombin Complex Concentrate
- Fibrinogen Concentrate

Tranexamic Acid (TXA)
**TXA**

- **CRASH-2**
  - Severe shock SBP<75
  - <1 hour
  - None > 3 hours
  - Safe
  - Other studies

**Other Adjuncts**

- **Calcium**
  - After 4 Units of any blood product

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**Damage control Resuscitation**

- **STOP** the Bleeding
- **Eliminate** the lethal triad
- **Use** Massive Transfusion Protocol (MTP)
- **Selectively Administer** pharmacologic adjuncts
- **Surgical/angiographic hemostasis**

**GOAL: Definitive Hemostasis**

- Multi-cavity Torso Trauma
- Torso Trauma
- Extremity Trauma
- Non-Operative Management
- Angiography

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**Resuscitation End Points**

- Definitive hemostasis
- Approaching normal range
  - lactate
  - base excess
- Complications
  - TRALI
  - TACO
  - Abdominal compartment syndrome

**Damage control Resuscitation**

- **STOP** the Bleeding
- **Eliminate** Lethal Triad
- **Use** MTP
  - TEG®
- **Selectively Administer**
  - TXA
  - Calcium
- Surgical/angiographic hemostasis
  - Oh the places patients need to go!
  - **DO NOT DELAY!**