CASE STUDIES IN ADULT TRAUMA AND CRITICAL CARE

26th Annual Duke Trauma Conference
March 10, 2016

Steven N. Vaslef, MD, PhD
Chief, Division of Trauma and Critical Care
Department of Surgery
Duke University Medical Center
Case #1 – “The Unexpected”
Case #1

• DCEMS dispatched to home of a 44 yo male with a chief complaint of right leg pain
• EMS arrived on scene to find pt in bed, diaphoretic, febrile, c/o nausea/vomiting for several days, and unable to move right leg – flaccid for the past 6 hours
• PMH – HTN, depression, ulcerative colitis dx’ed in 1995
Case #1 (cont)

• Brought to Duke ED
• Awake, oriented, appears toxic
• VS : 200/115, P 100 Afebrile, tachypneic
• Right leg with massive swelling from foot to groin, no pulses, + DVT, 0/5 motor, no sensation
  » No history of trauma
• Lactate 8.6
• Pt intermittently hypotensive requiring pressors
Case #1 (cont)

- Initial concern for venous thromboembolism/PE
- Administered tPA, then heparin

Upon Further Review…
Case #1 (cont)

- Patient re-examined and found to have large amount of crepitus in soft tissue of right leg
- Labs:  CK > 27,000  
  WBC 12.7  
  BUN/Cr 32/4.1  
  Na 132  K 5.1  
  Cl 95  HCO3 18
What is the calculated anion gap?

A. 19
B. 24
C. > 25,000
D. Not enough information to calculate
Anion Gap

• Difference between the measured cations and anions, but potassium is typically omitted:

\[ AG = \text{Sodium} - (\text{Chloride} + \text{Bicarbonate}) \]

\[ AG = 132 - (95 + 18) \]

\[ AG = 19 \]

Normal 3 – 12 mmol/L
Which is **not** a cause of high anion gap acidosis?

A. Lactic acidosis  
B. Uremia  
C. Diabetic ketoacidosis  
D. Protracted vomiting
**High Anion Gap Metabolic Acidosis**

- Methanol
- Uremia
- Diabetic Ketoacidosis
- Propylene Glycol
- Infection, Iron, Isoniazid, Inborn error of metabolism
- Lactic Acidosis
- Ethylene Glycol
- Salicylates
This ain’t right
What is the most common bacterial cause of gas gangrene?

A. MRSA
B. Group A Streptococcus
C. Clostridium Septicum
D. Clostridium Perfringens
Gas Gangrene

- About 1000 cases per year in the US
- Mainly occurs in traumatic wounds or post-surgical wounds, but may occur spontaneously
- Etiology
  - Clostridium Perfringens most common
  - Clostridium Septicum – associated with colon cancer
  - Group A Streptococcus
  - Bacteroides species
- Surgical Emergency for aggressive debridement
- Mortality 25-100%, highest in spontaneous cases
Case #1 (cont)

- Patient emergently taken to the OR
- Exploratory laparotomy – perforated colon cancer
  » Subtotal colectomy
- Right hip disarticulation
- Clostridium Septicu
- Taken to SICU unstable
  » Comfort measures
  » Died within hours
Case #2 – “I’ve Been Shot”
Case #2

- 19 yo male sustained single GSW to right neck
- Awake at scene, unable to move arms or legs
- Brought by EMS to Duke ED
  - Awake
  - VS P 52    BP 90/50
  - Single GSW to right anterior neck, Zone II
  - Bruit present in right neck
  - Quadriplegic at C3-C4 level
Classification of Penetrating Neck Wounds
Which of the following neck zones is not accurately paired with potential structures injured?

A. Zone I – Injuries to great vessels, airway, esophagus
B. Zone II – Injuries to cervical vessels, airway, esophagus
C. Zone III – Injuries to cervical vessels and esophagus
D. None of the above
Penetrating Neck Wounds

• Zone I
  » Injuries to great vessels, airway, esophagus

• Zone II
  » Injuries to cervical vessels, airway, esophagus

• Zone III
  » Injuries to cervical vessels
Which of the following most accurately describes the patient’s pulse of 52 and BP of 90/50?

A. Spinal shock
B. Neurogenic shock
C. Hemorrhagic shock
D. All of the above
Spinal Shock vs. Neurogenic Shock

- **Spinal shock**
  - Temporary, up to 2-3 days
  - Like a spinal cord contusion or stunned cord
  - Loss of motor and sensation
  - Loss of all spinal cord reflexes, even below level of injury

- **Neurogenic shock**
  - Hemodynamic phenomenon due to loss of sympathetic innervation
    - Bradycardia and hypotension
    - Vasodilation of arteriovenous system
    - Occurs in cervical spine or high thoracic spine – up to T4
Bulbocavernosus Reflex

- Spinal cord reflex
- Gently squeeze penis or clitoris (or pull on Foley)
- Reflex anal contraction
- Absence signifies spinal shock or injury at level of reflex arc (S1-S3)
Case #2 (cont) – Traumatic AV Fistula

- Doppler ultrasound
- “Yin/Yang” sign resulting from injuries to vertebral artery and jugular vein
Case #2 (cont) – Traumatic AV Fistula with Pseudoaneurysm
Case #2 (cont) – Traumatic AV Fistula with Pseudoaneurysm

Post-Angioembolization
Case #2 (cont) – SCI

- Patient remains a ventilator-dependent quadriplegic
- Home ventilator
Put the following causes of SCI in the correct order, from highest frequency to lowest frequency

A. Fall, MVC, sports injury, assault
B. Fall, sports injury, MVC, assault
C. MVC, fall, assault, sports injury
D. MVC, fall, sports injury, assault
Etiology of SCI

- MVC: 47%
- Fall: 23%
- Assault: 14%
- Sports Injury: 9%
- Other: 7%
- Other: 7%
Which of the following might be included in the treatment plan of an acute SCI patient?

A. IV fluids
B. Arterial line
C. Vasopressors
D. All of the above
SCI – Treatment

• Maintain spinal cord perfusion
  » Keep mean arterial pressure (MAP) > 80-85 mm Hg
  » May need fluid + vasopressors
  » Arterial line for continuous monitoring
  » May need CVP line

• Steroids have fallen out of favor
  » If given, only for blunt SCI
What is the most common cause of death in survivors of SCI?

A. Pulmonary embolus
B. Pneumonia
C. Cancer
D. Suicide
Leading Causes of Death in SCI Survivors

- Respiratory complications
  » Pneumonia #1
- Septicemia
  » Decubiti, UTI
- Hypertensive and Ischemic heart disease
- Neoplasms
- Unintentional injury
- Pulmonary embolus
## Life Expectancy for SCI Patients

<table>
<thead>
<tr>
<th>Age at Injury</th>
<th>No SCI</th>
<th>AIS D - Motor Functional at Any Level</th>
<th>Para</th>
<th>Low Tetra (C5–C8)</th>
<th>High Tetra (C1–C4)</th>
<th>Ventilator Dependent - Any Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>58.8</td>
<td>52.1</td>
<td>44.8</td>
<td>39.6</td>
<td>35.3</td>
<td>16.8</td>
</tr>
<tr>
<td>40</td>
<td>39.9</td>
<td>33.8</td>
<td>27.4</td>
<td>23.2</td>
<td>19.7</td>
<td>7.5</td>
</tr>
<tr>
<td>60</td>
<td>22.5</td>
<td>17.5</td>
<td>12.8</td>
<td>10.0</td>
<td>7.8</td>
<td>1.6</td>
</tr>
</tbody>
</table>

For persons who survive the first 24 hours

<table>
<thead>
<tr>
<th>Age at Injury</th>
<th>No SCI</th>
<th>AIS D - Motor Functional at Any Level</th>
<th>Para</th>
<th>Low Tetra (C5–C8)</th>
<th>High Tetra (C1–C4)</th>
<th>Ventilator Dependent - Any Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>52.5</td>
<td>45.4</td>
<td>40.5</td>
<td>36.9</td>
<td>21.0</td>
<td>12.3</td>
</tr>
<tr>
<td>40</td>
<td>34.1</td>
<td>27.9</td>
<td>23.9</td>
<td>21.0</td>
<td>12.3</td>
<td></td>
</tr>
<tr>
<td>60</td>
<td>17.7</td>
<td>13.2</td>
<td>10.4</td>
<td>8.6</td>
<td>3.8</td>
<td></td>
</tr>
</tbody>
</table>
Case #3- “The Tree Always Wins”
Case #3

- 45 yo male restrained driver fell asleep while driving, veered off road and hit tree
- + seat belt, + air bag deployment
- Patient awake, alert at scene
- LF scene response in Caswell County
- Brought to Duke ED
Case #3 (cont)

- Pt awake, alert, complaining of chest and abdominal pain
- VS 117 / 70  P 110  O2 Sat 100%
- PMH - HTN, asthma, morbid obesity, s/p gastric bypass
Case #3 (cont)

- Abdominal ecchymosis and tenderness without peritoneal signs over lower abdomen – “seat belt sign”
Case #3 (cont)

- No other findings on physical exam
- No radiographic findings on CT brain, C-spine, chest, or TL spine
- Laboratory evaluation unremarkable, including normal lactate
Which of the following would not be appropriate as the next step?

A. Discharge to home with instructions to return if things got worse
B. Go to the OR for an exploratory laparotomy
C. Admit to trauma service for serial hematocrit and abdominal exams
D. None of the above
Case #3 (cont)

- No hard indications for surgery
  - No free air
  - No peritonitis
- Admission / observation not unreasonable
  - Difficult exam with tenderness due to seat belt sign and obesity
Case #3 (cont)

• Patient taken to surgery for exploratory laparotomy

Small bowel mesenteric avulsion – “bucket handle” injury requiring segmental resection
Blunt Bowel Injury

• CT may miss up to 10% of clinically significant bowel injuries
  » May have no radiographic findings or very subtle findings
• Delays as short as 8 hours may increase morbidity and mortality
• Need high index of suspicion
Blunt Small Bowel Injury

• Large multicenter retrospective study showed:
  » 13% of patients with perforated small bowel injury had *no* abnormalities on CT scan
  » Free fluid on CT without solid organ injury associated with 84% incidence of small bowel injury (though only 30% perforated)
  » Mortality rate 3x higher if greater than 24 hr delay in operation for small bowel injury

Which of the following might be sequelae to a missed or a delayed treatment of a bowel injury?

A. Hemorrhage
B. Perforation / Sepsis
C. Stricture
D. Fistula formation
E. All of the above
Blunt Small Bowel Injury

- Possible sequelae of “missed” bowel injury:
  - Perforation (early)
  - Hemorrhage (early)
  - Stricture / obstruction (late)