Open Fractures

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AH MSKI Cabarrus – Orthopedic Trauma
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Objectives

1. Understand the classification of open fractures
2. Direct emergent management
3. Create an appropriate operative plan
Classification
Classification

• Why?
  • Communication
  • Prognosis
  • Treatment
# Gustilo – Anderson Classification

<table>
<thead>
<tr>
<th>Type</th>
<th>I</th>
<th>II</th>
<th>IIIA</th>
<th>IIIB</th>
<th>IIIC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy</td>
<td>Low</td>
<td>Moderate</td>
<td></td>
<td>High</td>
<td></td>
</tr>
<tr>
<td>Wound size</td>
<td>≤ 1 cm</td>
<td>1 – 10 cm</td>
<td></td>
<td>&gt; 10 cm</td>
<td></td>
</tr>
<tr>
<td>Soft tissue damage</td>
<td>Minimal</td>
<td>Moderate</td>
<td></td>
<td>Extensive</td>
<td></td>
</tr>
<tr>
<td>Contamination</td>
<td>Clean</td>
<td>Moderate</td>
<td></td>
<td>Extensive</td>
<td></td>
</tr>
<tr>
<td>Fracture comminution</td>
<td>Minimal</td>
<td>Moderate</td>
<td></td>
<td>Severe</td>
<td></td>
</tr>
<tr>
<td>Periosteal stripping</td>
<td>No</td>
<td></td>
<td></td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Neurovascular Injury</td>
<td>Normal</td>
<td></td>
<td></td>
<td></td>
<td>Exposed fracture with arterial damage that requires repair</td>
</tr>
</tbody>
</table>
Classification

I

II

IIIA

IIIB

IIIC

JBJS, 1976; JTrauma:1,1,&CC, 1984
Classification

I

II

IIIA

IIIB

IIIC

JBJS, 1976; JTrauma:I,I,&CC, 1984
Emergent Management
Emergent Management

- Examine the patient
  - Assess neurovascular status
- Take a picture / measurements
- Administer antibiotics
- Remove gross debris
- Superficial irrigation
- Reduce and splint
- Tetanus status / update if needed
Antibiotics

• Timing
  • Mixed results from major studies
  • Suggested that time to antibiotics is single greatest factor influencing morbidity
  • Do it as early as possible (ideally < 1 hour)
## Antibiotics

<table>
<thead>
<tr>
<th>Type</th>
<th>I</th>
<th>II</th>
<th>IIIA</th>
<th>IIIB</th>
<th>IIIC</th>
</tr>
</thead>
<tbody>
<tr>
<td>First line antibiotics</td>
<td>First generation cephalosporin</td>
<td>First generation cephalosporin (G+), Aminoglycoside (G-)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Duration</td>
<td>24 hours after wound closure</td>
<td>48 hours OR 24 hours after wound closure</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gross contamination</td>
<td></td>
<td>+ metronidazole 500 mg q8h</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Farm injury / bowel contamination</td>
<td>First generation cephalosporin + aminoglycoside + penicillin</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Freshwater wounds</td>
<td></td>
<td>+ fluoroquinolones</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Saltwater wounds</td>
<td></td>
<td>+ fluoroquinolones OR + doxycycline and third/fourth generation cephalosporin</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Example: AH Cabarrus Open Fracture Antibiotic Management

<table>
<thead>
<tr>
<th>Type</th>
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<th>II</th>
<th>IIIA</th>
<th>IIIB</th>
<th>IIIC</th>
</tr>
</thead>
<tbody>
<tr>
<td>First line antibiotics</td>
<td>Cefazolin 2g IV q8h (3g if &gt; 120 kg)</td>
<td>Ceftriaxone 2g IV q24</td>
<td>Ceftriaxone 2g IV q24h + metronidazole 500 mg IV q8h</td>
<td></td>
<td>Piperacillin-tazobactam 4.5 g IV q8h</td>
</tr>
</tbody>
</table>
Operative Treatment
Operative Treatment

• Timing
• Debridement
• Irrigation
• Stability
• Closure
Operative Treatment - Timing

• Time **NOT** correlated with infection
• BUT nearly all patients treated within 12 hours

**The Relationship Between Time to Surgical Débridement and Incidence of Infection After Open High-Energy Lower Extremity Trauma**

By Andrew N. Pollak, MD, Alan L. Jones, MD, Renan C. Castillo, MS, Michael J. Bosse, MD, Ellen J. MacKenzie, PhD, and the LEAP Study Group

**Does Timing to Operative Debridement Affect Infectious Complications in Open Long-Bone Fractures?**

A Systematic Review

Mara L. Schenker, MD, Sarah Yannascoli, MD, Keith D. Baldwin, MD, MSPT, MPH, Jisoo Ahn, MD, PhD, and Samir Mehta, MD

**Time to Initial Operative Treatment Following Open Fracture Does Not Impact Development of Deep Infection: A Prospective Cohort Study of 736 Subjects**

Donald Weber, MD, FRCS,* Sukhdeep K. Dulai, MD, MSc, FRCS,* Joseph Bergman, MD, FRCS,* Richard Buckley, MD, FRCS† and Lauren A. Beanie, PT, PhD*
Operative Treatment - Debridement

- Systematic
- Extensile
- Zone of injury
Operative Treatment - Irrigation

• Soap vs. no soap
  • 3.2% absolute risk increase with soap
• High vs. low vs. very low pressure
  • No outcome difference
  • Cost?

*A Trial of Wound Irrigation in the Initial Management of Open Fracture Wounds

The FLOW Investigators*
Operative Treatment - Closure

• Cover as soon as possible
  • Temporary
    • Wound VAC
    • Bead pouch
  • Definitive
    • Primary closure / flaps
    • < 5 days is ideal
## Operative Treatment – Summary

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Conclusion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Timing</td>
<td>Use judgementIdeally within 12 hours</td>
</tr>
<tr>
<td>Debridement</td>
<td>Be thorough</td>
</tr>
<tr>
<td>Irrigation</td>
<td>Use saline</td>
</tr>
<tr>
<td>Closure</td>
<td>As soon as possibleIdeally within 5 days</td>
</tr>
<tr>
<td>Stability</td>
<td>Fracture management</td>
</tr>
</tbody>
</table>