Aggressive Infections In Patients Treated With External Fixators

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Disclosures

I have no conflicts.

This study was approved by our institutional review board.
Background

- Infections are extremely common in external fixation
  - Range 11-97% ⁴⁻⁸
- Vast majority are managed without difficulty ²,⁴,⁷,⁹⁻¹⁰
- Uncommon reports of atypical and aggressive infection
  - TSS ¹¹⁻¹²
  - Necrotizing fasciitis ⁴
Study Aim

• To describe unusual, rare, and aggressive infections in patients with external fixators

• To identify potential risk factors

• To identify management protocols and correlate with outcomes
Material and Methods

- Single-surgeon database from 1991 to present
  - 1166 patients
- Retrospective chart review

**INCLUSION**
- Any form of ex fix
- Atypical infection as determined by senior author

**EXCLUSION**
- Standard superficial or deep pin site infection
- Typical osteomyelitis
Demographics

- 12 patients (11 M, 1 F)
- Median age 43.5y (range 16 to 65y)
- No patient treated for isolated deformity

<table>
<thead>
<tr>
<th>Risk Factors for Severe Infection</th>
<th>Positive response (of 12)</th>
<th>TIME IN DAYS</th>
<th>RANGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Open fracture</td>
<td>8</td>
<td>1.4</td>
<td>0 to 12 days</td>
</tr>
<tr>
<td>HIV status</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Smoking status</td>
<td>4</td>
<td>16.0</td>
<td>0 to 354 days</td>
</tr>
<tr>
<td>Adult comorbidities</td>
<td>0</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Unusual / Aggressive Infection Types

Atypical Bone or Joint
1. Late
2. Aggressive

Soft Tissue Infection
1. Pan-pin cellulitis
2. Necrotizing fasciitis

Less severe

More severe
### Presenting characteristics

<table>
<thead>
<tr>
<th>INFECTION TYPE</th>
<th>PRESENTING FEATURES</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Atypical late</td>
<td>1. Vague, nonspecific pain/drainage 1+ years after tx</td>
</tr>
<tr>
<td>2. Atypical aggressive</td>
<td>2. Fluctuance, effusion, drainage (aggressive features)</td>
</tr>
<tr>
<td>3. Pan-pin cellulitis</td>
<td>3. Diffuse swelling, erythema, drainage, smokers</td>
</tr>
<tr>
<td>4. Necrotizing fasciitis</td>
<td>4. Severe swelling, purulent drainage, sepsis</td>
</tr>
</tbody>
</table>
## Atypical Late Infections

- Mean number of debridements: 3.0 / patient
- Mean time from injury to infection: **1162.3 days**  
  – Range 204-2056 days

### Patient Injuries, Risk Factors, Infection Type, Number of Debridements, Microbiology, Outcome, and Function

<table>
<thead>
<tr>
<th>Patient</th>
<th>Injury</th>
<th>Risk Factors</th>
<th>Infection Type</th>
<th>Number of Debridements</th>
<th>Microbiology</th>
<th>Outcome</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>G3B tibia</td>
<td>Crush</td>
<td>Olive wire abscess</td>
<td>3</td>
<td>MSSA</td>
<td>Salvage</td>
<td>Good; required late ankle fusion</td>
</tr>
<tr>
<td>5</td>
<td>Closed plateau</td>
<td>Acute definitive tx</td>
<td>Late septic knee with recurrence</td>
<td>5</td>
<td>MRSA, recurrent MRSA</td>
<td>Salvage; knee arthrodesis</td>
<td>Fair</td>
</tr>
<tr>
<td>6</td>
<td>G3B tibia</td>
<td>1 PPD smoker</td>
<td>Intramedullary abscess in mature regenerate</td>
<td>1</td>
<td>Group A strep</td>
<td>Salvage</td>
<td>Good; full work on motorcycles</td>
</tr>
</tbody>
</table>
Olive wire abscess 3 years after fixator removal, pt previously asymptomatic
Atypical Aggressive Infections

- Mean number of debridements: 4.7 / patient
- Mean time from injury to infection: 59.6 days
  - Range 46-77 days

<table>
<thead>
<tr>
<th>Patient</th>
<th>Injury</th>
<th>Risk Factors</th>
<th>Infection type</th>
<th>Number of debridements</th>
<th>Microbiology</th>
<th>Outcome</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>G3B pilon</td>
<td>Sewage contamination</td>
<td>Unusual organism</td>
<td>9</td>
<td>M. fortuitum, E. faecalis, E. cloacae</td>
<td>Salvage</td>
<td>Good; working as plumber</td>
</tr>
<tr>
<td>4</td>
<td>G3B pilon</td>
<td>Delayed presentation</td>
<td>Recurrent aggressive septic arthritis</td>
<td>4</td>
<td>MRSA, then MSSA</td>
<td>Death</td>
<td>Death</td>
</tr>
<tr>
<td>11</td>
<td>G2 tibia</td>
<td>Prolonged ICU stay</td>
<td>Hematoma infection</td>
<td>1</td>
<td>MRSA</td>
<td>Salvage</td>
<td>Good; full work</td>
</tr>
</tbody>
</table>
# Pan-Pin Cellulitis

- Mean number of debridements: 3.7 / patient
- Mean time from injury to infection: 89.3 days
  - Range 48-124 days

<table>
<thead>
<tr>
<th>Patient</th>
<th>Injury</th>
<th>Risk Factors</th>
<th>Number of debridements</th>
<th>Microbiology</th>
<th>Outcome</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>G3A pilon</td>
<td>1 PPD smoker</td>
<td>4</td>
<td>MRSA, MRSA recurrence, E. Cloacae + A. baumannii</td>
<td>Salvage</td>
<td>Poor; debilitating ankle arthritis</td>
</tr>
<tr>
<td>9</td>
<td>G3A tibia</td>
<td>1 PPD smoker, degloving injury</td>
<td>1</td>
<td>MSSA</td>
<td>Salvage; nonunion</td>
<td>Good; full work as welder</td>
</tr>
<tr>
<td>10</td>
<td>Closed plateau</td>
<td>Severe fracture blisters</td>
<td>6</td>
<td>P. aeruginosa</td>
<td>Lost to follow-up</td>
<td>Lost to follow-up</td>
</tr>
</tbody>
</table>
Necrotizing Fasciitis

- Mean number of debridements*: 5.0 / patient
- Mean time from injury to infection: 35.0 days
  - Range 3-68 days
- Mean time from infection to amputation: 1.3 d

<table>
<thead>
<tr>
<th>Patient</th>
<th>Injury</th>
<th>Days from infection to amputation</th>
<th>Number of debridements</th>
<th>Microbiology</th>
<th>Outcome</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>G3B plateau</td>
<td>0</td>
<td>unknown</td>
<td>Leclercia adecarboxylata, Enterobacter agglomerans, E. faecalis</td>
<td>Through knee amputation</td>
<td>Good; functional prosthesis user</td>
</tr>
<tr>
<td>7</td>
<td>Closed pilon</td>
<td>2</td>
<td>4</td>
<td>MRSA</td>
<td>BKA</td>
<td>Good; working full time</td>
</tr>
<tr>
<td>12</td>
<td>Closed navicular</td>
<td>2</td>
<td>6</td>
<td>MSSA</td>
<td>BKA</td>
<td>Good; walking well with prosthesis</td>
</tr>
</tbody>
</table>
Patient Outcomes

- Injury and infection difficult to delineate
  - Severe post-traumatic arthritis
- 8/12 with good function
Conclusions

1. Severe and unusual infections can rarely develop in high-risk patients with external fixators

2. These can be life- and limb-threatening

3. Early, aggressive surgical debridement (including amputation as necessary) is indicated
Thank You


