Submuscular Bridge Plating for Pediatric Femur Fractures

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Disclosures

• We have no disclosures to report
Background

- Pediatric Femur Fractures are common
Background

- Spica cast treatment
  - Younger than 5
  - Isolated injury
  - Minimal shortening
  - Length stable pattern
  - Difficult child care
  - No motion
Background

- Surgical treatment Options
  - Elastic Intramedullary Nails
  - Rigid Intramedullary Nails
  - External Fixation
  - Traditional Plating
  - Bridge Plating
Background

- Elastic Nails
  - Weight less than 45kg (100 lbs)
  - Midshaft location
  - Length stable pattern
Background

• Intramedullary Nails
  – Avascular Necrosis
  – Femoral Canal large enough
  – Greater Trochanter growth arrest
  – Heterotopic bone formation
Background

• External Fixation
  – Refracture
  – Malunion
  – Delayed healing
  – Bulky
  – Pin tract infections
  – Unsightly scars
  – Difficult for patient
Background

- Compression Plating
  - Extensive dissection
  - Increased blood loss
  - Pain
  - Infection
  - Nonunion
Background

• Bridge Plating
  – Minimal dissection
  – Stable
  – No growth plate violation
  – No avascular necrosis
Hypothesis

• Submuscular bridge plating would be:
  – Safe and effective for young patients with all types of diaphyseal femur fractures regardless of patient age or weight.
Methods

- Retrospective from 1999-2011
  - Prospectively collected data
- TTUHSC patients
- Largest study to date
- 60 fractures in 58 patients
## Results

<table>
<thead>
<tr>
<th>Table 1: Patient Demographic and Fracture Data</th>
<th>Average</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patient Age (years)</td>
<td>9.1</td>
<td>3.6-15.7</td>
</tr>
<tr>
<td>Weight (kg)</td>
<td>35.2</td>
<td>12.7-71.5</td>
</tr>
<tr>
<td>Gender (M:F)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Laterality (R:L)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fracture Condition (No. Open)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>High Energy</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Multiple trauma</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Gender (M:F)</th>
<th>Number</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>43:15</td>
<td>74:26</td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Laterality (R:L)</th>
<th>Number</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>35:25</td>
<td>59:41</td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Fracture Condition (No. Open)</th>
<th>Number</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>7%</td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>High Energy</th>
<th>Number</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>39</td>
<td>65%</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Multiple trauma</th>
<th>Number</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>23</td>
<td>38%</td>
<td></td>
</tr>
</tbody>
</table>
Results

Injury Mechanism

- Auto vs Ped
- Motor Vehicle Crash
- Fall < 5 feet
- Other
- ATV Crash
- Injured from falling object
- Football
- Fall > 5 feet
Results

Fracture Level

- Proximal Third: 30%
- Middle Third: 50%
- Distal Third: 20%
Results

AO Fracture Classification

<table>
<thead>
<tr>
<th>A</th>
<th>A1</th>
<th>A2</th>
<th>A3</th>
</tr>
</thead>
<tbody>
<tr>
<td>B</td>
<td>B1</td>
<td>B2</td>
<td>B3</td>
</tr>
<tr>
<td>C</td>
<td>C1</td>
<td>C2</td>
<td>C3</td>
</tr>
</tbody>
</table>
Results

• Length unstable fracture pattern
  – Comminuted fractures
  – Long oblique or spiral if:
    • Length twice as long as width of shaft
  – 67% of fractures
Results

• All fractures healed
• All patients returned to full activity
• Weight-bearing at 6 weeks
• Average follow up – 15.5 months
• No difference for age or weight
Results

• No significant malalignment or malrotation
Results

- No significant leg length discrepancy
  - Scanogram for 23 patients
Results

• No difference for fracture location
  – Proximal or Distal Fractures – 52% of patients
Results

• Hardware removal in 49 patients
  – No complications
  – Recommend removal at 12 months
Complications

• 2 failures of fixation seen early in the study
  – Related to small plate size and noncompliant patient who walked early
    • Revision surgery to larger plate
    • Cast treatment
  – There was no complication at final follow up
  – Now recommend larger stainless steel plate
Limitations

• Retrospective nature
• No control group
• Loss of follow up
Conclusion

• Submuscular bridge plating is safe, effective and suitable for all fracture patterns, locations and patient characteristics.

• This advantage is not present in any of the other commonly used methods of fixation.
Thank you