Rod Diameter Does Not Influence Rod Fracture Rate after Surgical Treatment using Magnetically Controlled Growing Rods

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Disclosures

• Research Support
  • POSNA
  • OSRF
  • SRS
Introduction

• Device related complications persist in the face of evolving growth friendly constructs for EOS treatment
• Risk of fracture cited between 6% and 29%
• At the time of study, few risk factors for fracture of magnetically controlled growing rods (MCGR) identified
• Rate of rod fracture is important because it takes into account when the fracture occurred in treatment. Not all rod fractures are equal.
Purpose

• To investigate the association between rod diameter and rod fracture in patients with EOS undergoing treatment with MCGR

• Hypothesis: MCGR constructs with 4.5mm diameter have an increased rate of rod fracture compared to larger diameter rod constructs in use by patients with EOS
Study Design and Patients

• Retrospective Cohort Study
  • Patients identified in a multicenter registry
    • Pediatric Spine Study Group Registry

• Inclusion Criteria
  • Diagnosis of Early Onset Scoliosis (EOS)
  • Primary or converted MCGR implant from 2013-2017
Study Intervention and Outcomes

• Exposure:
  • MCGR Diameter:
    • 4.5 diameter vs 5.5/6.0mm

• Primary Outcome:
  • Rod fracture determined by radiographs at each participating site and medical record confirmed by database audit
Study Participants – 1054 Rods in 527 patients

% of Rods Utilized

- 45.4% for 4.5mm rods
- 54.4% for 5.5/6.0mm rods
## Baseline Comparison

<table>
<thead>
<tr>
<th></th>
<th>4.5 mm (N)</th>
<th>5.5 mm/6.0 mm (N)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Follow Up</strong> Years</td>
<td>1.7 (522)</td>
<td>1.4 (441)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td><strong>Major Curve</strong> Degrees</td>
<td>70 (516)</td>
<td>69 (397)</td>
<td>0.273</td>
</tr>
<tr>
<td><strong>Kyphosis</strong> Degrees</td>
<td>53 (432)</td>
<td>50 (327)</td>
<td>0.065</td>
</tr>
<tr>
<td><strong>Age at Surgery</strong> Years</td>
<td>7.0 (552)</td>
<td>8.9 (461)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td><strong>Gender</strong> Male</td>
<td>45.1% (249)</td>
<td>47.1% (217)</td>
<td>0.532</td>
</tr>
<tr>
<td></td>
<td>54.9% (303)</td>
<td>52.9% (244)</td>
<td></td>
</tr>
<tr>
<td><strong>Patient Type</strong> New</td>
<td>80.6% (445)</td>
<td>69.8% (322)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Conversion</td>
<td>19.4% (107)</td>
<td>30.2% (139)</td>
<td></td>
</tr>
<tr>
<td><strong>Weight</strong> kg</td>
<td>20.1 (488)</td>
<td>26.0 (383)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td><strong>Halo Traction</strong> Yes</td>
<td>13.0% (72)</td>
<td>3.5% (16)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td></td>
<td>87.0% (480)</td>
<td>96.5% (445)</td>
<td></td>
</tr>
</tbody>
</table>
Overall Risk of Fracture

Total # of rod fractures = 19 / 1013 (1.9%)  

Rod Diameter

<table>
<thead>
<tr>
<th>Risk of Fracture</th>
<th>4.5mm (N = 9/552)</th>
<th>5.5/6.0mm (N = 10/461)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.5%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.0%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.5%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.0%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.5%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.0%</td>
<td></td>
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</tr>
</tbody>
</table>

p = 0.529
No difference in rate of rod fracture between smaller and larger rod diameters using cox regression
No difference in rate of rod fracture at different weight thresholds and curve thresholds
Discussion

- Absolute number of rods fractures is low (20 total, 1.6% in 4.5mm rod and 2.2% in 5.5/6.0mm rods)
- Probable that not all fractures have been reported
- However, large dataset encompasses significant amount of MCGR in the US

- No difference in the rate of fracture between 4.5mm and 5.5/6.0mm rods
- Even when stratify by age, weight/ BMI, curve magnitude…
Discussion

• MCGR is relatively new in the US.
• Still uncovering risk factors for complications like fracture

• Interesting unexpected finding that traction seems to have a protective effect
Any type of traction (intra-op or Halo) may have a protective effect.

<table>
<thead>
<tr>
<th>Traction Utilization</th>
<th>Risk of Rod Fracture</th>
</tr>
</thead>
<tbody>
<tr>
<td>Traction</td>
<td>1/250</td>
</tr>
<tr>
<td>Non-Traction</td>
<td>19/804</td>
</tr>
</tbody>
</table>

\[ p = 0.059 \]
Conclusion

• Data suggests that rod diameter does not have an effect on the RATE of rod fracture
• Counterintuitive finding

• Continue to collect fractures and evaluate possible risk factors

• Further evaluate role of peri-operative traction as possible protective factor
Thank you!
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