The Fin Intramedullary Nail Design in the Treatment of Diaphyseal Femoral Fractures

Andrew Tice MD
Robert J. Feibel MD FRCSC
Sasha Carsen MD FRCSC

Division of Orthopaedic Surgery,
University of Ottawa,
The Ottawa Hospital,
Ottawa, Canada
Femur Fracture Fixation
SIGN Fin Nail

- Modification of the SIGN nail with a distal press-fit design
- eliminates the need for distal screws
- decreases operative time
- removes one of the most technically demanding elements of the surgery

*SIGN Technique Manual
SIGN Fin Nail Technique

- Open Reduction
- Reaming
- Optimal: fracture 10 cm from isthmus
- “Ideal fracture is transverse with rotational stability”
SIGN Fin Nail Use

*SIGN Online Surgical Database
Study Purpose

• Primary
  Assess radiologic stability of diaphyseal femur fractures with respect to subsidence/shortening

• Secondary
  Identify variables associated with increased risk of instability
Methods

• SIGN database (prospectively populated)

• Inclusion:
  – All Fin nail femur cases with adequate x-rays and complete data sets and follow up x-rays of at least 6 weeks

• Extraction of case data

<table>
<thead>
<tr>
<th>Gender</th>
<th>Age</th>
<th>Fracture Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Approach</td>
<td>Nail Length</td>
<td>Nail Diameter</td>
</tr>
<tr>
<td># of Locking Screws</td>
<td>Time to Surgery</td>
<td>F/U Interval</td>
</tr>
</tbody>
</table>
Methods

• Radiographs analyzed (single observer)
  – Fracture Classified
    • AO/OTA and Winquist and Hansen
  – Onscreen measure from constant point identifiable on bone to tip of nail
    • GT, LT, Intercondylar notch, patella
    • Calibration with nail diameter

• Immediate post-op and follow-up x-rays
Results

- 1700 Femur Cases
- 566 Cases with Follow Up
- 1134 Incomplete Follow Up
- 437 Incomplete Datasets
- 129 Cases for Analysis
<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Gender</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>84</td>
<td>65.11</td>
</tr>
<tr>
<td>Female</td>
<td>45</td>
<td>34.89</td>
</tr>
<tr>
<td><strong>Age</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Avg. 32.4 (7-86)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Fracture Location</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Proximal</td>
<td>7</td>
<td>5.43%</td>
</tr>
<tr>
<td>Middle</td>
<td>43</td>
<td>33.33%</td>
</tr>
<tr>
<td>Distal</td>
<td>79</td>
<td>61.24%</td>
</tr>
<tr>
<td><strong>Approach</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Antegarde</td>
<td>13</td>
<td>10.08%</td>
</tr>
<tr>
<td>Retrograde</td>
<td>116</td>
<td>89.92%</td>
</tr>
<tr>
<td><strong>Nail Length</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Avg. 277 mm</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Nail Diameter</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Avg. 9.7 mm</td>
<td></td>
<td></td>
</tr>
<tr>
<td># Locking Screws</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Avg. 1.9</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>F/U Interval</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Avg. 34.38 months</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
# AO/OTA Classification

<table>
<thead>
<tr>
<th>32-A</th>
<th>32-B</th>
<th>32-C</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- **32-A1**: Spiral
- **32-B1**: Spiral wedge
- **32-C1**: Complex spiral

*AO Foundation*
Winquist and Hansen Classification

*Orthobullets.com
Results

- No statistically significant subsidence detected across all fractures

- No statistically significant influence from:
  - Fracture location
  - Antegrade vs. retrograde
  - Nail length or diameter
  - Winquist classification

- Statistically significant increase in subsidence with AO/OTA 32-C

*SIGN Online Surgical Database
AO 32 C Fractures: Multifragmentary

32-C  complex fracture
32-C1  spiral
32-C2  segmental
32-C3  irregular
32-C(1–3).1 = subtrochanteric fracture
Beware: 32 C Shortening

4 of 10 32 C Fractures Shortened Excessively
Limitations

- 129 cases available from 1,700 cases
- Lack of clinical data
- Lack of assessment of rotation
- Beware a multifragmentary fracture
- Use the Fin Nail in accordance with the SIGN Manual

*SIGN Online Surgical Database
Conclusions

• The Fin nail distal press-fit design provides adequate stability to length

• Viable option for the treatment of stable diaphyseal femur fractures

• Care should be taken with complex diaphyseal fractures (AO/OTA 32-C)

*SIGN Online Surgical Database