DISCLOSURES

• Hassan R. Mir, MD, MBA, FACS

  — Medical/Orthopaedic Publications Editorial/Governing Board
    • OTA Newsletter Editor
    • Osteosynthesis, The JOT Online Discussion Forum Editor
    • JOT Associate Editor
    • JAAOS Consultant Reviewer
    • JBJS Consultant Reviewer

  — Board Member/Committee Appointments for a Society
    • AAOS Diversity Advisory Board and Council on Advocacy Member
    • AOA Leadership / Fellowships Committee
    • OTA Public Relations Committee
    • JOT Nominating and Membership Committees

  — Paid Consultant for a Company or Supplier
    • Smith & Nephew
    • Depuy – Synthes
    • Pharmacom- Group, Inc.

Nailing Principles

Starting Point
Trajectory
L/A/R
Stable Construct
Femoral Shaft Fxs

- Tx Options with IMN
  - Supine vs Lateral
  - Flat Top vs Fx Table
  - Piriformis vs Trochanteric (vs Retrograde) Entry

Piriformis Portal

- Popularized in 80’s
  - Winquist et al JBJS 84

- Advantages
  - In Line with Femoral Canal

- Disadvantages
  - Harder to Hit
  - Hoop Stresses
  - Soft Tissue Damage (ER, MCFA)
The Effect of the Entry Hole for an Intramedullary Nail on the Strength of the Proximal Femur

Trochanteric Portal

- Kuntscher Original Technique

- Disadvantages
  - Not in Line with Femoral Canal (Straight Nails Lead to Varus, Comminution)

Trochanteric Portal Advantages

- Less Operative Time, Less Fluoro
  - Ricci et al JOT 2006

- Ease of Entry and Utility in Patients With A Large Body Habitus
  - Ricci et al, JOT 2006
  - Stannard et al OTA 2005
Is There a Gluteus Medius Tendon Injury During Reaming Through a Modified Medial Trochanteric Portal? A Cadaver Study

Edward J. Pomes, MD*; Amir A. Salzberg, MD*; Rebecca J. Mandel, MD*; and Thomas A. Russell, MD*

- No Damage to Medius Tendon with Modified Medial Trochanteric Portal

Medial Trochanteric Portal

A Critical Analysis of the Eccentric Starting Point for Trochanteric Intramedullary Femoral Nailing

Robert P. Ostrum, MD, Andrew Marancakos, DO, and Robert Marburger, RN

**TABLE 2. Angulation With Trochanteric Nail Insertion**

<table>
<thead>
<tr>
<th>Type</th>
<th>Angulation (degrees)</th>
<th>Number of Derivation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Femoral</td>
<td>Lateral</td>
<td>3.8</td>
</tr>
<tr>
<td>Medial</td>
<td>Lateral</td>
<td>6.0</td>
</tr>
<tr>
<td>Lateral</td>
<td>Tip</td>
<td>2.2</td>
</tr>
<tr>
<td>Medial</td>
<td>Tip</td>
<td>3.8</td>
</tr>
<tr>
<td>Lateral</td>
<td>Tibial</td>
<td>3.8</td>
</tr>
<tr>
<td>Medial</td>
<td>Tibial</td>
<td>4.6</td>
</tr>
<tr>
<td>Lateral</td>
<td>Femoral</td>
<td>1.9</td>
</tr>
<tr>
<td>Medial</td>
<td>Femoral</td>
<td>2.9</td>
</tr>
</tbody>
</table>

If Trochanteric, Do Not Start at Tip; START MEDIAL
Retrograde Portal

- Popularized in 90’s
  - Sanders et al JOT 93

- Advantages
  - Good for Polytrauma, Obese, Ipsilateral FN or Socket
  - Equal Union Rates
  - Better Alignment for Distal 1/3 Fx’s

- Disadvantages
  - Knee Pain

Antegrade versus retrograde nailing techniques and trochanteric versus piriformis intramedullary nailing entry points for femoral shaft fractures: a systematic review and meta-analysis

- Results: We identified 483 potential studies, of which 52 were eligible. Of these, we included 13 publications and 2 abstracts (2 level I, 7 level II and 6 level III studies). Trochanteric entry significantly reduced operative duration by 14 min compared with piriformis entry (p = 0.030). Antegrade nailing had a greater risk of postoperative knee pain than antegrade nailing (p = 0.03). On the other hand, antegrade nailing had significantly more postoperative hip pain (p = 0.001) and heterotopic ossification (p < 0.003) than retrograde nailing. No significant differences in functional outcomes were observed.

- Conclusion: Although some significant differences were found, the varying quality of studies made recommendation difficult. Our meta-analysis did not confirm superiority of either antegrade over retrograde or trochanteric over piriformis entry for IM nailing of the femur.

Proximal 1/3 Fxs

- Malalignment Common (> 5 degrees)
  - 30% in this series
  - Flexion
  - Varus

- Angular Malalignment After Intramedullary Nailing of Femoral Shaft Fractures
Proximal 1/3 Fxs

• Three Common Errors:
  1) Incorrect Starting point
  2) Incorrect Trajectory of the Entry Portal
  3) Destruction of the Entry Portal through Subsequent Reaming and Instrumentation

Proximal 1/3 Fxs

Malreductions

Varus

Flexion

Avoidance of Malreduction of Proximal Femoral Shaft Fractures With the Use of a Minimally Invasive Nail Insertion Technique (MINIT)

• 100 Subtrochanteric Fxs
  – 10% Overall Malalignment > 5 degrees
    • No difference
      – Supr
      – Table
      – Percut
      – Open/Closed Nailing
  – 26% vs 5.2% with use of MINIT (p<0.01)
• MINIT
  • Precise Portal
  • Trajectory Control
  • Portal Preservation
L/A/R

- Ruler
- Contralateral Films

- Rotational Profiles
  - Lesser Troch
  - Neck Version

Proximal 1/3 Fxs

- Tips
  - Closed methods
    - F-tool
    - Mallet
Proximal 1/3 Fxs

- Tips
  - Closed methods
    - F-tool
    - Mallet
  - Perc methods
    - Ball Spike
Proximal 1/3 Fxs

- Tips
  - Perc methods
    - Ball Spike

- Tips
  - Perc methods
    - Shanz Pin

Proximal 1/3 Fxs

- Tips
  - Perc methods
    - Shanz Pin
Proximal 1/3 Fxs

• Tips
  – Perc methods
    • Shanz Pin

Proximal 1/3 Fxs

• Tips
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    • Shanz Pin

Proximal 1/3 Fxs

• Tips
  – Perc methods
    • Shanz Pin
Proximal 1/3 Fxs

- Tips
  - Blocking Screws
• 44 Patients
  − Antegrade IMN with Clamp through Lateral Incision
  − No Stripping!
  − 43/44 United
  − 86% Reductions Anatomic
    • All within 5 degrees

Proximal 1/3 Fxs

• Tips
  − Clamp
Proximal 1/3 Fxs

- Tips
  - Clamp

Proximal 1/3 Fxs – Construct Stability

- Cephalomedullary Locking
  - Trochanteric Portal
    - In line with Femoral Neck

OTA 2013
- 158 pts
- 91% healed primarily

If Retro for Prox 1/3, Use 2 Proximal Interlocking Screws

Conclusions

The results suggest that retrograde nailing of proximal femoral fractures appears to be a safe and effective treatment option.
Femoral Neck Fractures

- Femoral Neck + Shaft Fractures
  - Displaced FN + Shaft Fx
    - Typically Treated with ORIF of FN
    - Most Surgeons Prefer 2 Implants
  - Non-Displaced FN + Shaft Fx
    - Typically Treated with Closed Reduction
    - 1 vs 2 Implants Based on Surgeon Preference
Non-Displaced FN/Shaft Fx

- 2 Implants
  - Already There with ORIF
  - 2 Implants Allows for Independent Tx of Late Complications

Non-Displaced FN/Shaft Fx

Displaced FN/Shaft Fx
Retrograde Nailing

Indications for Retrograde

- Associated Ipsilateral Fxs
  - Femoral Neck
  - Acetabular
  - Tibia
  - Patella
- Bilateral Femur Fxs
- Polytrauma
- Morbid Obesity
- Pregnancy
Trajectory

If the guide wire is perpendicular to joint surface, the articular segment will be in varus.

L/A/R

- Rotational Profiles
  - Lesser Troch
  - Neck Version

- Ruler

- Contralateral Films

Distal 1/3 Fxs

- Bumps on Triangle
- Fracture Reduction Tool
- F-tool, Mallets
- Skeletal Traction
- Femoral Distractor
- Clamps
- Bone Hook
- Ball Spike
- Schanz pins
- Provisional Plate
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- Provisional Plate

Distal 1/3 Fxs
- Blocking Screws
Distal 1/3 Fxs

• Blocking Screws

Internal Fixation of Type-C Distal Femoral Fractures in Osteoporotic Bone

• Torsional + Axial
  • Multiplanar
  • Fixed Angle

Comminuted
Femoral Shaft Fxs

- Tx Options with IMN
  - Supine vs Lateral
  - Flat Top vs Fx Table
  - Piriformis vs Trochanteric (vs Retrograde) Entry

Comminuted

Comminuted
Nailing Principles
Starting Point
Trajectory
L/A/R
Stable Construct

THANK YOU