Calcaneus Fractures: 
Mini vs OPEN 

Paul Tornetta III, MD 

Boston Medical Center 

Disclosures! 

• Publications:  
  - Rockwood and Green, Tornetta and Ricci TIFS, Tornetta and Einhorn; Subspecialty series, Court-Brown, Tornetta; Trauma; AAOS; OKU Trauma, ICL Trauma, Tornetta; Op Tech in Ortho Surg, OTA Slide project  
  - Journals: JOT; Deputy editor, CORR, JAAOS, JBJS; Reviewer 

• Research:  
  - OTA, FOT, AIOD, Smith Nephew 

• Designer  
  - Smith and Nephew, Kinespring 

Introduction 

• Treatment of calcaneal fractures is controversial 
• Anatomic reduction is necessary if ORIF chosen
Essex-Lopresti

Limited Time
• ORIF via extended lateral
• Percutaneous
  • Essex-Lopresti
  • Perc incision
• Sinus Tarsi approach

30° Semicoronal
In Plane of Foot
Calcaneo-Cuboid Joint
Sustentacular Region

Sanders 2001
• 546 Calcaneus fractures
  • 2 - 11 Years followup
  • Able to reduce height, width and length
• Posterior facet
  • Anatomic reduction correlates with Sander’s type

Complications
• 29 Wound dehiscences
• 12 Osteomyelitis
• 2 Amputations
• 1 Nonunion
• 83 Hardware removal
Abductor Fascia

Full Thickness Flap

Remove Lateral Wall
Anterolateral Fragment

Replace Lateral Wall

Layered Closure
Healed

• 190 Fxs, 21% complications
• Risk factors:
  - Smoking .03
  - IDDM .02
  - Open fractures < .0001
• Additive!
  - Relative risk for diabetic smoker = 3.2

Consider Percutaneous
Essex-Lopresti
- Percutaneous reduction
- Axial pin
- Tongue type fractures
  - Tuberosity attached to the facet

Indications
- Tongue type fractures
- Sanders type 2C
  - Entire facet intact and impacted into the body
- Sanders type 2B
  - No osteopenia or comminution of facet

Operative Technique
- Lateral decubitus position
  - Convert to ORIF
- Fluoroscopy
  - Confirm lateral and AP view of calcaneus
Pin Placement

Pin Placement

Reduction

- Varus angulation
- Unlock the fracture
Reduction
• Varus angulation
  • Unlock the fracture

Reduction
• Valgus force
  • Close down fracture
  • Confirmed radiographically
  • AP and lateral views
Fixation
• Second pin or guidewire driven across fracture
  • Anterior calcaneus
  • Cuboid
    • Anterior calcaneus fractured
• Cannulated screw
• Replace first wire with straight pin or guidewire then screw

Reduction

AP View
Fixation
• Steinman pins
• Cannulated 6.5mm screws

2C

Postoperative
Healed

One of Mine...

Intraop
Healed

Mini vs. Extensile
Sangeorzan

<table>
<thead>
<tr>
<th></th>
<th>Small Incision</th>
<th>Traditional</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>53.1 +/- 14 years</td>
<td>43.3 +/- 14 years</td>
</tr>
<tr>
<td>LOS</td>
<td>2 +/- 0.5 days</td>
<td>3.75 +/- 1 days</td>
</tr>
<tr>
<td>Infection/Failures</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Results: Clinical

<table>
<thead>
<tr>
<th></th>
<th>I (mini)</th>
<th>II (ext)</th>
<th>Overall</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hospital Stay (days)</td>
<td>1.6</td>
<td>3.7</td>
<td>2.8</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Time to wt bearing (weeks)</td>
<td>12.3</td>
<td>20.5</td>
<td>16.8</td>
<td>0.03</td>
</tr>
<tr>
<td>Pain (VAS) (1 - 10)</td>
<td>2.6</td>
<td>3.1</td>
<td>2.9</td>
<td>NS</td>
</tr>
</tbody>
</table>
MFA

<table>
<thead>
<tr>
<th></th>
<th>6 weeks</th>
<th>3 months</th>
<th>6 months</th>
<th>12 months</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>41.1</td>
<td>36.0</td>
<td>23.5</td>
<td>17.0</td>
</tr>
<tr>
<td>II</td>
<td>46.1</td>
<td>40.9</td>
<td>29.9</td>
<td>28.9</td>
</tr>
</tbody>
</table>

Normal 9.3  
Injured 22.1

Complications

<table>
<thead>
<tr>
<th></th>
<th>I (mini)</th>
<th>II (ext)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>DVT</td>
<td>0</td>
<td>1</td>
<td>NS</td>
</tr>
<tr>
<td>Loss of fixation</td>
<td>0</td>
<td>0</td>
<td>NS</td>
</tr>
<tr>
<td>Implant failure</td>
<td>0</td>
<td>0</td>
<td>NS</td>
</tr>
<tr>
<td>Infection</td>
<td>0</td>
<td>0</td>
<td>NS</td>
</tr>
<tr>
<td>Symptomatic hdwre (6)</td>
<td>3</td>
<td>3</td>
<td>NS</td>
</tr>
<tr>
<td>Implant removal (7)</td>
<td>3</td>
<td>4</td>
<td>NS</td>
</tr>
</tbody>
</table>

Comparison

- Minimally invasive:
- Shorter length of stay
- Faster recovery
- Better MFA outcomes at one year
The sinus tarsi approach in displaced intra-articular calcaneal fractures: a systematic review

Tim Schepers

- 8 series, 271 fractures
- 75% good/excellent results
- Major wound issues 0.7%
- Subtalar fusion 4.3%
- Hardware removal 10-40%

Mini-Open Sinus Tarsi Approach with Percutaneous Screw Fixation of Displaced Calcaneal Fractures: A Prospective Computed Tomography-Based Study

Toseen Provsters, MD / Matthew Keung, MD / Ankit Bajaj, MD / Marie Hass, MD, PhD / Liliana Bullen, MD / J. Carl Frame, MD, PhD / Mark Travlos, MD

- 22 fractures
- Sanders 2 or 3
- CT assessment
- No subjective measures

38 Year Old Open Fx
Sinus Tarsi Approach

4 Months
Motion 4 Months

Sinus Tarsi Approach

Conclusions

- Patient factors
  - Compliance, activity, age
- Comorbidities
  - DM, smoking, open fx
- Fracture pattern
  - Essex-Lopresti + Sanders
- Surgeon ability