CALCANEUS FRACTURES
No disclosures relevant to this topic

Acknowledgement: some clinical pictures were obtained from the OTA fracture lecture series and AO fracture lecture series
INCIDENCE

- 2% of all fractures
- Most commonly fractured tarsal bone
- 60% of tarsal fractures
- 75% are displaced intra-articular fractures
CALCANEUS FRACTURES

- Fall or mva
- Look for associated injury
- 75% are intraarticular
- Caring for skin is paramount
CALCANEUS FRACTURES

High incidence of associated injuries (50%)
- spine (10%)
- extremity (25%)
• High risk for disability
• Chronic pain
• Gait disturbance
• Inability to work
• Optimal treatment remains controversial
  • Must consider patient, injury, and surgeon factors
CALCANEUS FRACTURES

History and functional level are important when choosing treatment. Most calcaneus fractures will heal, but surgery is to prevent malunion and disability associated with it. Some will tolerate a malunion better than others.
CALCANEUS FRACTURES

- Detailed History
  - Important to determine appropriate treatment
    - Pre-injury level of function
      - Recreational activity
    - Occupation
      - Heavy manual labor?
    - Habits
      - Smoker?
    - Comorbidities
  - Comorbidities
    - Diabetes
    - Vascular disease
    - Smoking
    - Neuropathy
    - Age?
MECHANISM OF INJURY

Figures A-C: Joint depression fracture. Note the slight posterior vector of force leading to separation of the posterior facet in Figure B and C. Figures D-E: Tongue-type. Secondary fracture line results from a purely axial force.
PHYSICAL EXAM

- Note condition of skin
  - Fracture Blisters?
  - Threatened skin?
  - Open wound?
- Detailed neurovascular exam
- Assess for associated injuries
• Bulky splint in neutral dorsiflexion
• Period of soft tissue rest
• If considering lateral extensile approach...
• PATIENCE!
• Await return of skin wrinkling
• May take 2-3 weeks
• Foot series
  • AP, Lateral, Oblique
• Ankle series
  • Mortise
• Axial (Harris) view
• Contralateral views
• Broden’s view (intraop)
• CT scan
• Assess
  • Posterior facet
  • Middle facet
  • Calcaneocuboid joint
  • Calcaneal length and height
- 45° axial of heel
- 2nd toe in line w/ tibia
- Normal = 10° valgus
- Assesses tuber alignment
- Varus/valgus
- Translation
- Width
- Can be difficult to obtain as dorsiflexion of ankle may be difficult in injured foot
- Intraoperatively used to assess:
  - medial wall reduction
  - screw placement / length
CT SCAN

- Done in 3 planes
- Gives 3D picture of fragments
- Helpful with surgical planning and prognosis
CALCANEUS FRACTURES

Classification systems

- Essex-lopresti—based on plain x-ray
  - Joint depression
  - Tongue type

- Sanders classification—based on ct scan
Operative Compared with Nonoperative Treatment of Displaced Intra-Articular Calcaneal Fractures

A Prospective, Randomized, Controlled Multicenter Trial

By Richard Buckley, MD, FRCSC, Suzanne Tough, PhD, Robert McCormack, MD, FRCSC, Graham Pate, MD, FRCSC, Ross Leighton, MD, FRCSC, Dave Petrie, MD, FRCSC, and Robert Galpin, MD, FRCSC

Investigation performed at the Calgary General Hospital, Calgary, Alberta; the Royal Columbia Hospital, New Westminster, British Columbia; the Royal Victoria Hospital, Halifax, Nova Scotia; and The Victoria Hospital, London, Ontario, Canada
<table>
<thead>
<tr>
<th>Factors</th>
<th>Surgery Recommended</th>
<th>Results Equivocal</th>
<th>No Surgery</th>
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<tbody>
<tr>
<td><strong>Patient factor</strong></td>
<td></td>
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<tr>
<td>Age(^2)(^{16-18})</td>
<td>Pediatric; adult &lt;40 yr</td>
<td>40 to 60 yr</td>
<td>&gt;60 yr</td>
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<tr>
<td>Gender(^2)(^{19})</td>
<td>Females; young males</td>
<td>Middle-aged males</td>
<td>Older patients, either gender</td>
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<tr>
<td>Smoking history(^3)(^4)(^{52})</td>
<td>—</td>
<td>—</td>
<td>X</td>
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<tr>
<td>Chronic medical illness(^6)(^{19})</td>
<td>—</td>
<td>—</td>
<td>X</td>
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<td>Workers’ compensation claim(^2)(^{19})</td>
<td>—</td>
<td>X</td>
<td>—</td>
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<tr>
<td>Workload(^2)(^{19})</td>
<td>Any patient not claiming workers’ compensation</td>
<td>Workers’ compensation patients</td>
<td>Light or sedentary work</td>
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<td><strong>Fracture factor</strong></td>
<td></td>
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<tr>
<td>Bilateral injury(^2)</td>
<td>—</td>
<td>X</td>
<td>—</td>
</tr>
<tr>
<td>Open fracture(^21)</td>
<td>X</td>
<td>—</td>
<td>—</td>
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<tr>
<td>Bohler’s angle(^2)(^{22})</td>
<td>&gt;0°</td>
<td>&lt;0°</td>
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<tr>
<td>Fracture classification(^5)(^{57})</td>
<td>Sanders type II, III</td>
<td>Sanders type IV</td>
<td>Extra-articular Sanders type I</td>
</tr>
<tr>
<td>Probability of achieving anatomic reduction(^2)</td>
<td>≤2 mm step-off in joint surface: excellent chance of achieving reduction</td>
<td>Equivocal reduction</td>
<td>&gt;2 mm step-off in joint surface: little chance of achieving reduction</td>
</tr>
</tbody>
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SURGICAL INDICATIONS
CALCANEUS FRACTURES

- Intra-articular displacement
- Distortion of height, width, and alignment of heel
SURGICAL INDICATIONS
CALCANEUS FRACTURES

- Condition of soft tissues is critical for wound healing
- May require a several week delay
- Meticulous care of soft tissues intra-operatively
EMERGENT CONDITIONS

- Threatened skin
  - Displaced tongue fragment or avulsion fracture
  - Delayed treatment results in full thickness necrosis
  - Treat with provisional or definitive percutaneous fixation

BASIC SET-UP

CALCANEUS FRACTURES

- Lateral incision (axillary roll, bean bag)
- Thigh tourniquet
- Possible bone graft
- Fluoroscopy
- Prep & drape to above knee (& hip if iliac bone graft)
- Pre-op antibiotics
IMPLANT CONSIDERATIONS
CALCANEUS FRACTURES

- Small fragment set
- Small cannulated screws
- 3.5mm reconstruction plates
- Locked calcaneal plates
- Cervical H plate
- 2.7 mm cortical screws & plates (mini frag)
- Extra k-wires
- Schanz screw & T-handle chuck
SURGICAL TECHNIQUE
CALCANEUS FRACTURES

- Meticulous soft tissue handling
  - K wires serve as retractors
- Schanz screw can serve as handle to correct deformity and reduce medial wall
- Sequence: reduce medial wall, reduce anterior fragments, reduce joint, place hardware
CALCANEUS FRACTURE

Lateral position

X-ray/fluoro: axial view of calcaneus
Drain under the flap, leave for 1-2 days

Tension free closure with nylon: simple/mattress/Allgower-donati

Splint until wound is dry and stable
CALCANEUS FRACTURES

- Other options for operative treatment
  - Percutaneous/limited open
  - Sinus tarsi approach
  - Primary fusion
  - 2 stage primary fusion
CALCANEUS FRACTURE

- Postoperative care
  - Bulky cotton dressing and splint
  - Drain for open procedures
  - Elevation
  - Leave sutures in for at least 3 wks
  - Immobilize until skin stable
  - NWB for 3 months
COMPLICATIONS—CALCANEUS FRACTURE

- Wound edge necrosis
  - Most common complication
  - Up to 25%
- Deep infection
  - 1-4% closed fractures
  - 19% open fractures
- Symptomatic hardware
- Stiffness
- Post-traumatic arthrosis
- Peroneal tendonosis
- Neuritis
- Heel pad pain
CALCANEUS FRACTURE

- After care
  - Rolling knee scooter
  - ROM exercises as soon as skin stable
  - PT once weightbearing
  - Prepare patient for long recovery
CALCANEAL FRACTURE

Summary

- High energy injury, look for associated injuries
- Many result in long term morbidity and impairment
- This can be decreased with operative treatment provided complications avoided
- Patient selection and management of comorbidities is essential for good outcomes