Primary Subtalar Joint Arthrodesis in the Treatment of Calcaneal Fractures

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Conflict of Interest

- No conflicts of interest
Purpose

- Review initial management
- Review common complications
- Discuss the role of subtalar fusion in management of calcaneal fractures
- Discuss outcomes
- Review common fixation techniques for primary subtalar joint arthrodesis
Incidence

- 2.6% of all bodily fractures
- 60% tarsal injuries
- 75% fall from a height
  - Average 14 feet
- 70% have associated injuries
  - 10-20% Spinal compression fracture
- 75% intra-articular in adults
Initial Management

• Multiple initial management strategies
  – Non-op, lateral extensile, mini open, sinus tarsi, percutaneous, primary arthrodesis

• Factors to consider:
  – Degree of injury/comminution
  – Skin condition/blister management
  – Timing of surgery/edema control
  – Concomitant injuries
  – Medical comorbidities

• Goals:
  – Restore articular surface
  – Regain height of the posterior facet
  – No varus
  – Reduce width
Complications in Calcaneal Fractures

• Complications occur in both operative and non-operative management
  – Wound healing complications
  – Surgical site infection/osteomyelitis
  – DVT/PE
  – Malposition/malreduction
  – Compartment syndrome
  – Painful hardware
  – Nerve injury
  – Peroneal tendon issues
  – CRPS
  – Need for shoe wear modifications
  – Anterior ankle impingement

  – Development of arthritis/need for arthrodesis
    • Typically associated with STJ, can also be CC
Role of Subtalar Arthrodesis

- Initial management strategy vs treatment for late complications
- Used in the acute setting to manage fractures with severe comminution and/or cartilage damage
  - Sanders IV
- Late used to manage post traumatic arthritis, ankle impingement, correct residual deformity
  - Often distraction arthrodesis
- Delayed vs initial fusion?
Why consider primary arthrodesis?

- Often discussed in relation to Sanders Type IV fractures
- Type IV fractures with poor outcomes regardless of surgeon experience
  - Sanders, Clinical Ortho. and Related Research, 1993
- High rate of post traumatic arthritis in intra-articular calcaneal fractures, highest rate is in Sanders Type IV
- Allows for ORIF and fusion in one stage, eliminating need for return to OR for management of post traumatic arthritis in patients with more severe injury
- Reasonably good reported outcomes in the literature
Early Primary Arthrodesis

• Harris, Annals of Surgery, 1946
  – Treatment of calcaneal fractures with distraction and arthrodesis of “subastragalar” joint
  – Necrosis of detached fragments and inability to completely restore articular surface lead to significant disability
  – 35 pts with 47 fractures—industrial and war injuries
    • All but one returned to work at 6 months

• Dick, JBJS Br, 1953
  – Recommended fusion if “significant distortion of the subtalar joint”
  – Even though fracture can be reduced, “irreparable damage to the articular cartilage”
    • All 10 patients returned to work at 6.5 months

• Hall, JBJS Br, 1960
  – Used for patients with “gross depression or comminution”
  – Reduction of deformity and arthrodesis with iliac crest graft
  – 29 patients, 25 returned to work at 6.5 month average (93%)
• 424 patients, 471 fractures
  – 44 ultimately required subtalar distraction arthrodesis 1-4 yrs after injury
  – Compared those needing fusion with others

• Evaluated:
  – Bohler’s angle, Sanders classification, VAS, SF-36, oral analoque scale

• Bohler’s angle <0 deg 10x more likely to undergo fusion than >15 deg

• Sanders Type IV 5.5x more likely to undergo fusion than Sanders II
  – 46.5% of Sanders IV went on to late arthrodesis

• Workers compensation 3x more likely to undergo arthrodesis

• Non op 6x more likely
7 case series, 1 abstract reviewed
120 patients, 128 comminuted calcaneal fractures
  - Average f/u 28 months

Average AOFAS score (7 studies) 77.4 (72.4-88)

Paley score (1 study): 75% good to excellent outcome

Return to work (4 studies): 75%-100% of patients

“The primary arthrodesis for the treatment of Sander type-IV comminuted displaced intra-articular calcaneal fractures provides overall good results considering the severe nature of the injury.”

Should consider primary arthrodesis in these patients.
• 31 patients, 31 fractures
  – Sanders Type IV
  – Randomized to ORIF (17 patients) or ORIF with primary subtalar arthrodesis (14 patients)
  – 26 patients for follow up (minimum 2 yrs)—13 from each group

• Evaluated using SF-36, Musculoskeletal Functional Assessment (MFA), AOFAS Hindfoot scale, VAS
  – No statistical difference between the 2 groups in any outcome measure

• Collection stopped after 7 years for practicality, did not achieve the 66 patients they initially calculated would be needed
  – Power calculation based on prior trial

• Patients with primary arthrodesis may heal faster and do not require additional surgery later in time, therefore needs to be considered in this patient population
  – Healing based on time to weight bearing in this study: 10 wks ORIF, 6 wks ORIF + arthrodesis
• 17 patients, 17 fractures
  – Sanders Type IV; Avg follow up 34 months

• Evaluated radiographic outcomes, AOFAS ankle-hindfoot score

• Average AOFAS score: 78.4
• Average VAS: 1.9

• Statistically significant association between higher AOFAS scores and:
  – Increasing age, improved restoration of Bohler’s angle, improvement in restoration of the talocalcaneal angle

• Outcomes of primary arthrodesis favorable, particularly when radiographic relationships restored
  – Better reduction, better outcomes
Surgical Technique

- Address
  - Height
  - Varus
  - Width

- Prepare joint surfaces

- Fixate
  - Calcaneus
  - STJ
Surgical Technique

- Full thickness classic exposure vs sinus tarsi approach
- No touch technique
  - K-wire in fibula and talus to retract flap
- Reduce fracture fragments
- Temporary fixation of fracture
  - Sometimes into talus
- Definitive fixation of fracture
Surgical Technique
Surgical Technique

- Prepare joint

- Leave enough room for STJ fusion screws
  - Need to plan fusion hardware around fracture fixation hardware

- STJ fixation
Surgical Technique – Case 1

• Fall off ladder
Surgical Technique – Case 1
Surgical Technique – Case 1
Surgical Technique – Case 2
Surgical Technique – Case 2
Surgical Technique – Case 2
Surgical Technique – Case 2
Conclusion

• Reasonable option for highly comminuted fractures/fractures with significant cartilage damage
  – Most commonly described in Sanders IV

• May have better outcomes if anatomy restored prior to arthrodesis

• Allow room for arthrodesis hardware when planning fixation

• May offer a method to reduce number of surgeries and maintain good clinical outcomes in highly comminuted fractures
References


