Displaced Calcaneus Fractures

Fixation or Fusion

2026

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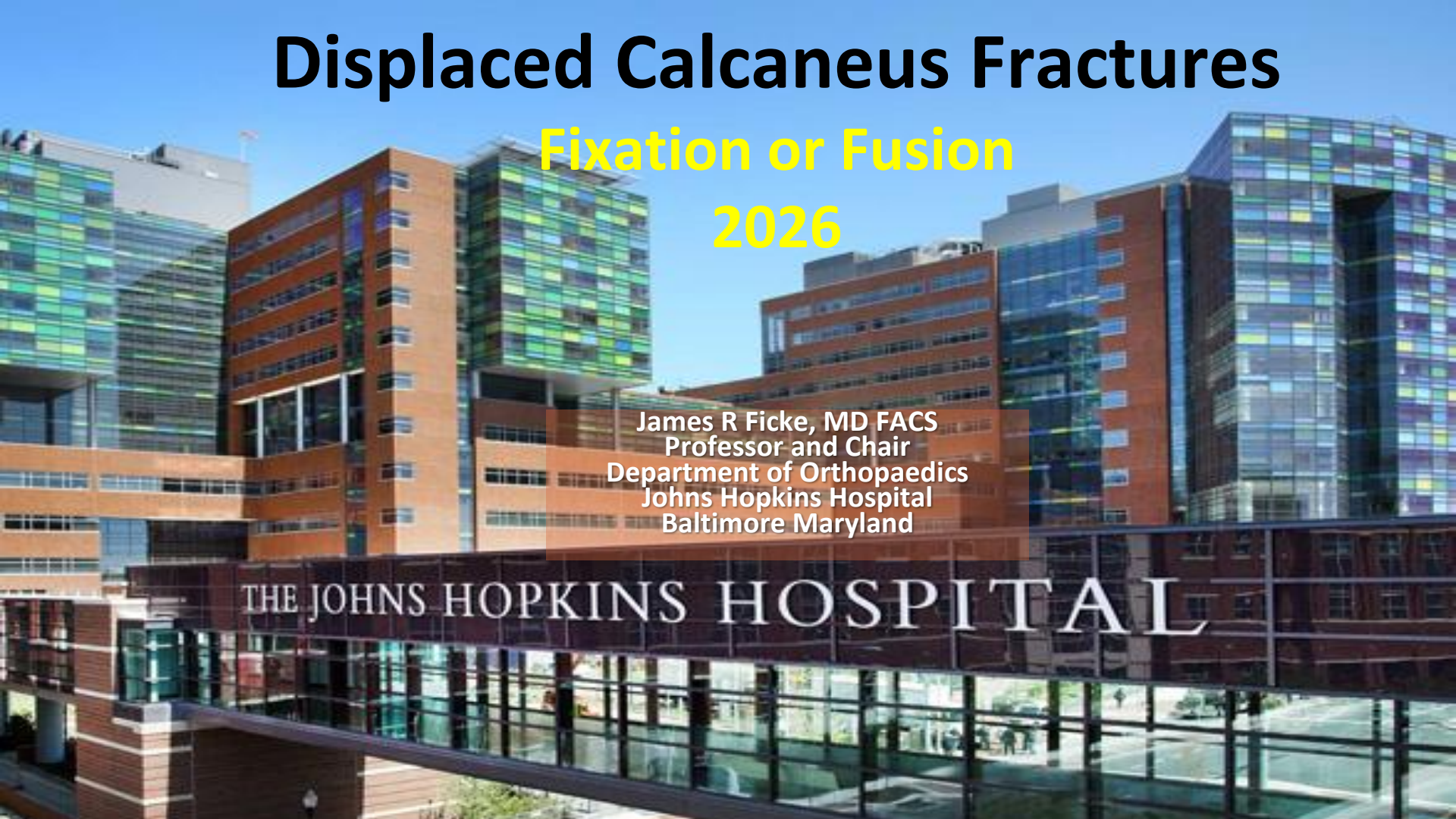

Conflict of Interest Disclosure

James R. Ficke

- **I have no financial conflicts with this presentation**
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Calcaneus Fractures

"…the man who breaks his heel bone is done."

- Cotton and Henderson,1916

"…results of crush fractures of the os calcis are rotten."

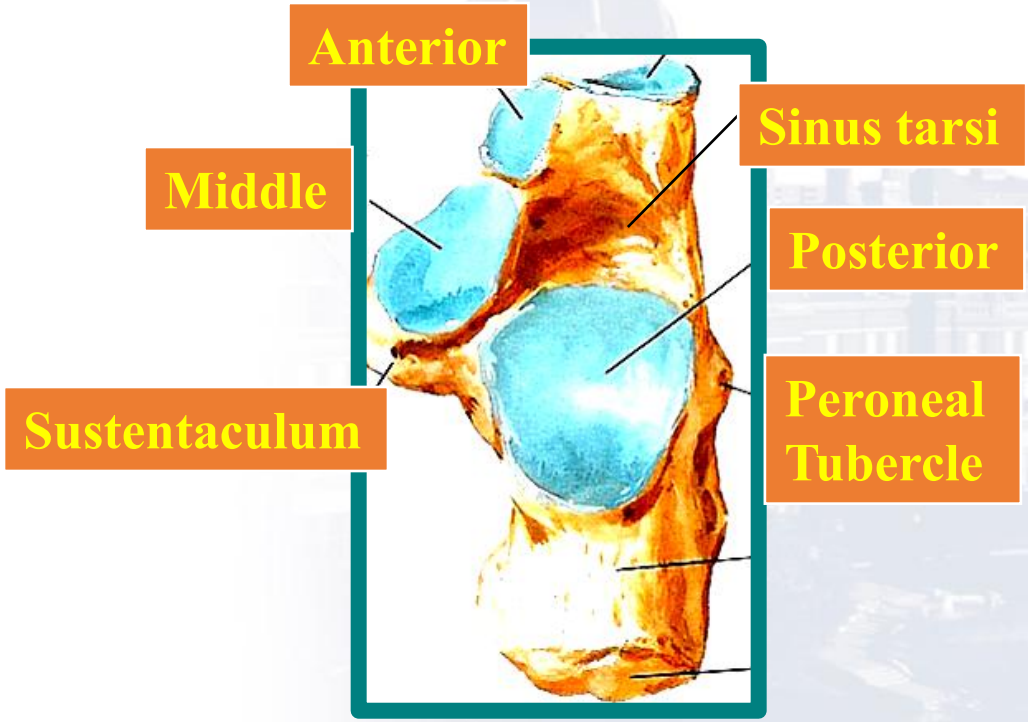
- Bankhart, 1942

Introduction

- 2% of all fractures
- 60% of **tarsal fractures (#1)**
- 90% occur in ages 20-40 yrs
  - Mostly males
  - Most common injury mechanisms are:
    - Falls from > 6’
    - Motor vehicle collisions
- 26% with other LE fractures
  - Spine
  - Tibia
  - Foot

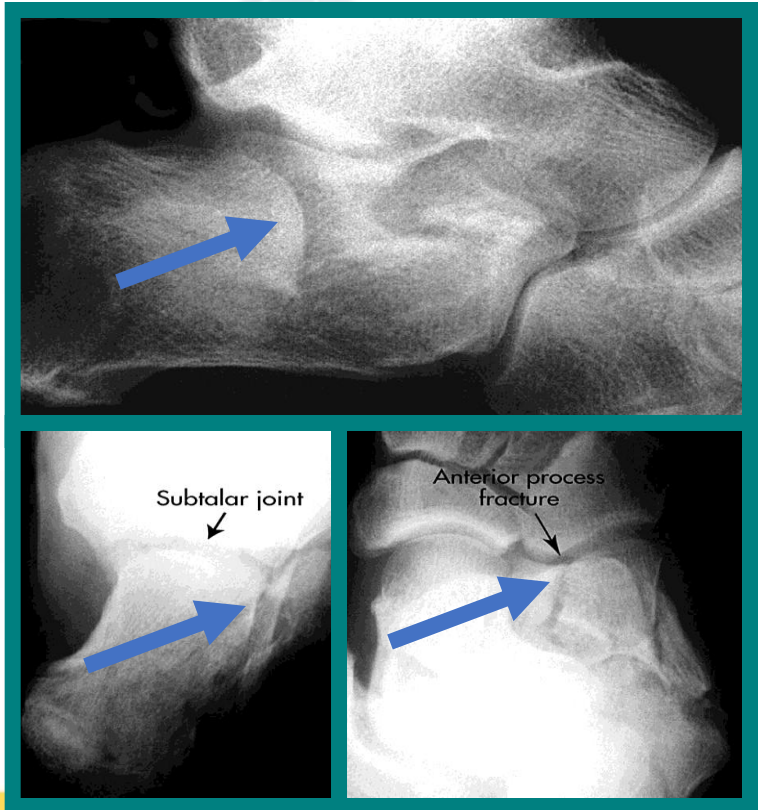
Anatomy

- Bone architecture
  - Articular facets
  - Sustentaculum talus
  - Peroneal tubercle
  - Sinus tarsi



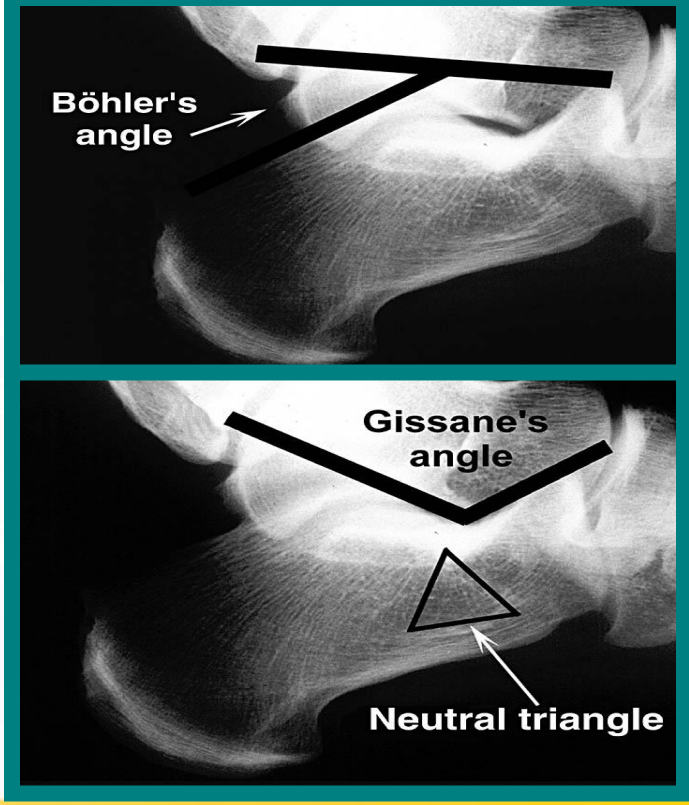
Radiologic Evaluation

- Plain films
  - Lateral (Subtalar joint)
  - AP (C-C joint)
  - Harris axial
    - Alignment
    - Posterior facet
  - Broden views



Initial Imaging- Plain Radiography

- Radiographic parameters
  - –Böhlers angle (20-40°)
  - –Crucial angle of Gissane (100- 130°)

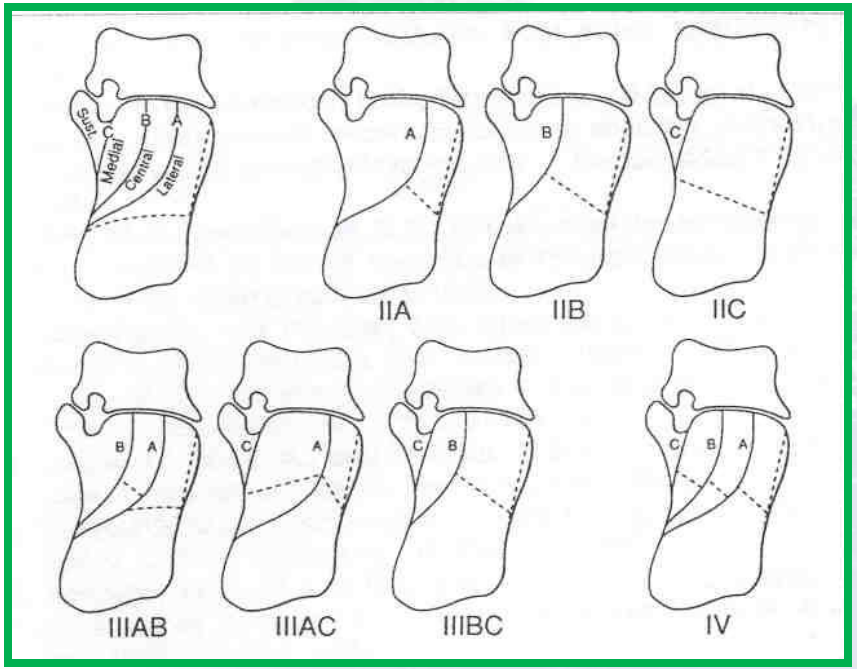


Initial Imaging: CT Scan

- Pre-op planning
- 3-5 mm cuts
- Axial, sagittal, semi-coronal cuts
  - Subtalar joint congruity
  - Heel width/shortening
  - Lateral wall
  - Peroneal impingement
  - Assesses articular fragments/varus

Sanders Classification

- #1— Look at #of fragments
  - 2 = Type II
  - 3 = Type III
  - ≥4 = Type IV
- #2— Location of fragments
  - Any combination of A,B,C
  - Lateral (A) to medial (C) – based on difficulty of reduction



Treatment Indications (Historically)

- Nonoperative:
  - Nondisplaced type I fractures
  - Open fractures/ life threatening injuries- delay
  - Soft tissue compromise
  - Severe peripheral vascular disease
  - Non/ limited preop ambulation
  - +/- smoking
- Open reduction & internal fixation
  - Type II and III patterns
  - Stable, intact soft tissue envelope
  - Within 3 weeks of injury
- Primary arthrodesis*
  - Type IV pattern
  - After restoration of calcaneal shape

Surgical Contraindications

- Contraindications to operative treatment
  - Diabetes
  - Vascular insufficiency
  - Smoker
  - Open fractures
  - Sanders Type IV
  - Elderly
  - Severe swelling
  - **Lack of experience**

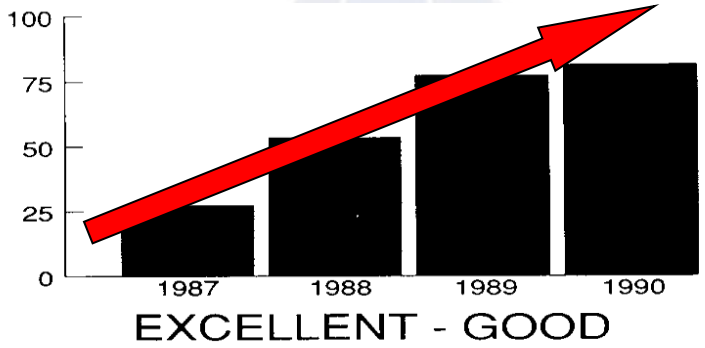
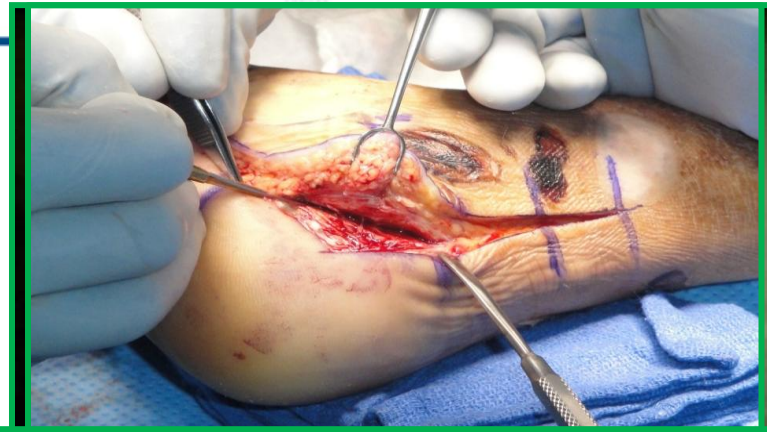


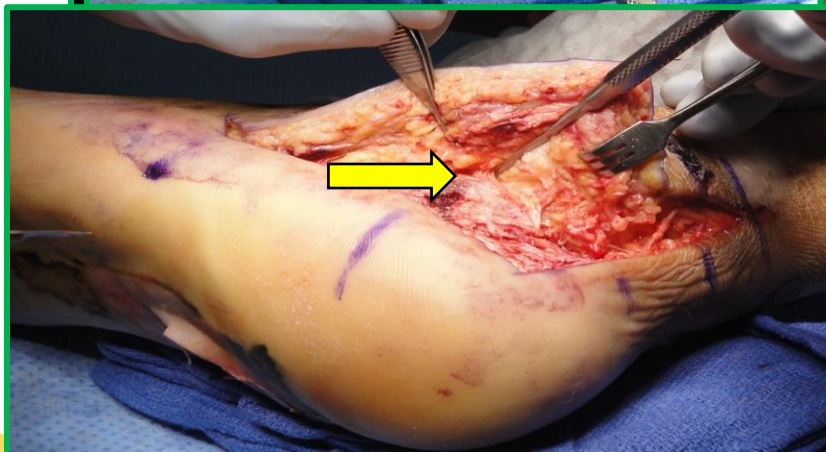
FIG. 10. The learning curve for calcaneal fractures. Results steadily improve with the surgeon's ability to treat these fractures operatively. This ability did not extend to type IV fractures.

Sanders, R JOT 1992

Extensile Lateral Approach

- L-incision:
  - Sural nerve
  - Vascular supply
  - Peroneal tendons
  - “No touch” periosteal flap
  - K-wire retraction





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Intraarticular Fractures
Surgical Treatment

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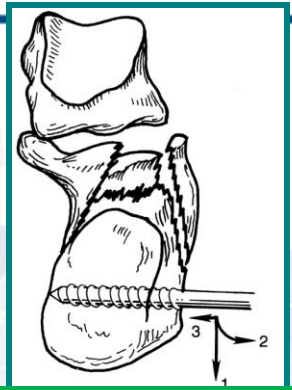
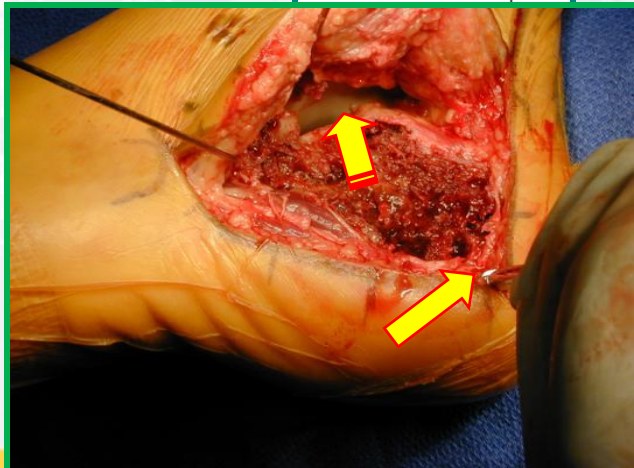
JOHNS HOPKINS HEALTH SYSTEM

Sequence of reduction

1. Remove lateral wall
2. Anterior process - sustentaculum tali
3. Posterior facet
4. Restore length, height, valgus, width (shantz pin)
5. ORIF posterior facet and lateral calcaneal plate





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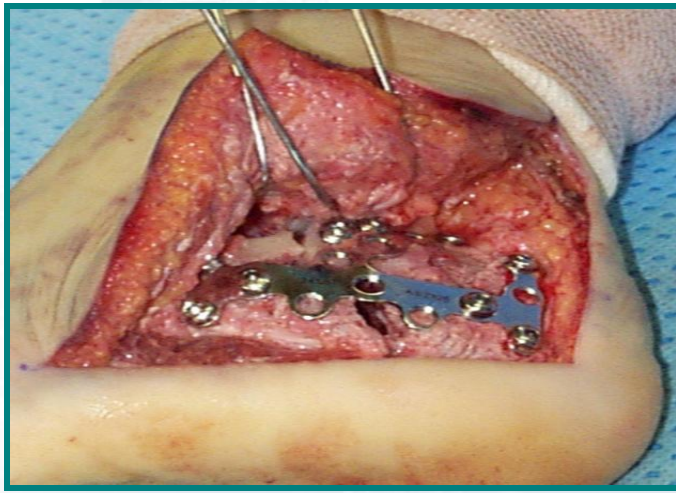

Minimally Invasive ORIF

- 24 Sanders II-III calcaneus fractures -either extensile lateral or limited lateral open approaches
- No wound complications associated with limited open technique (v. 33% in extensile approach)
- Limited open technique shorter operative time
- No difference w/ regard to union & maintenance of reduction

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Weber et al; Limited ORIF of Displaced Intra-articular Fractures of the Calcaneus; JBJS-Br; 90B; 12: 2008

Minimally Invasive Technique

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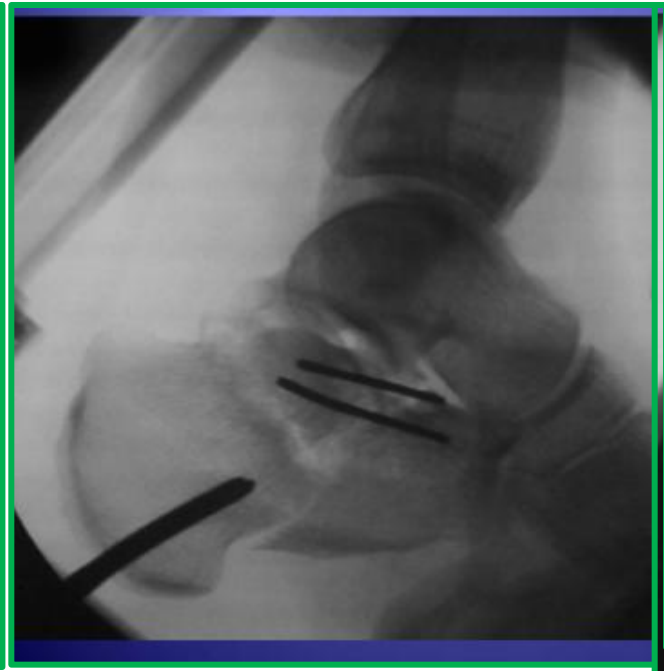
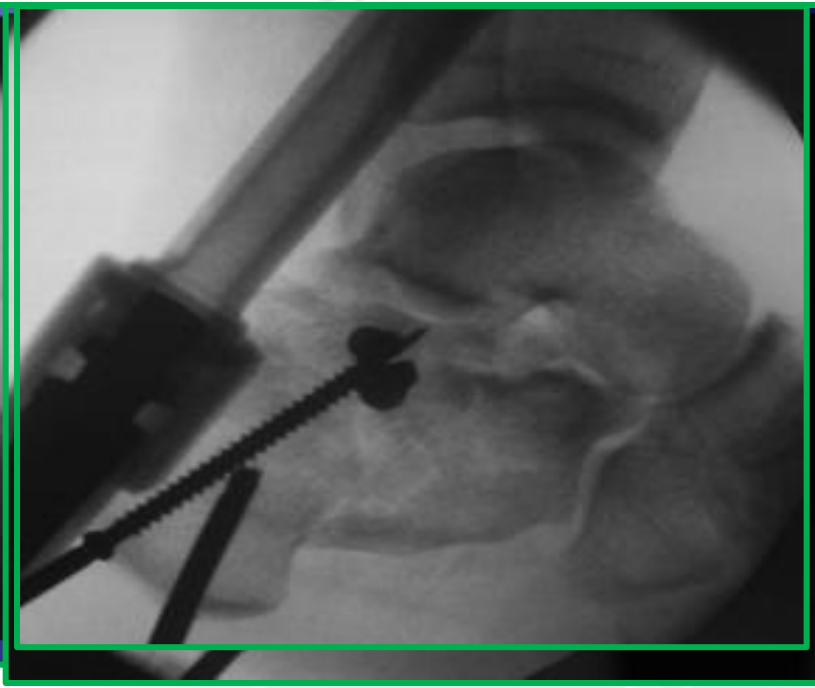
Minimally Invasive Technique





Sanders IV DIACF: Primary ORIF vs ORIF + Primary Subtalar Arthrodesis

- RCT- Buckley et al 2014;
  - 31 Sanders IV fractures ORIF alone (17)
  - ORIF + primary subtalar arthrodesis (14)
  - No significant difference –validated Outcome Measures
- Broader calcaneus RCTs (Buckley 2002; UK HeFT)- routine ORIF not uniformly superior to nonoperative care
- ** Hsu, FAI 2022 PSTA Sanders II-IV 79 DIACF- 86% fusion; 9/14 WC RTW
- Recommendations: Sanders IV- ORIF + primary subtalar arthrodesis

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Buckley RE et al. J Orthop Trauma. 2014;28:577-583. PMID 24983433
Buckley R et al. JBJS Am. 2002;84:1733-1744. PMID 12377902.
Griffin D et al. BMJ. 2014;349:g4483. PMID 25059747.
Hsu JR et al FAI 2022; 43(4):509-519; 34996306

Sanders III DIACF:
ORIF Preferred When Reconstructable

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- No Sanders III-specific pRCT compared ORIF with PSTA
- Patel 2021: mixed Sanders II/III meta-analysis showed better mean AOFAS with ORIF > PSTA (82.16 vs 74.22).
- Schipper 2021- 94.3% PSTA union- 35 acute displaced intra-articular fractures, including 14 Sanders III.
- Recommendation: reconstructable Sanders III- ORIF preferred reserve PSTA major articular destruction, severe comminution, or clearly poor reconstructability.

Patel TK et al. J Foot Ankle Surg. 2021. PMID 34039510. Schipper ON et al. Foot Ankle Int. 2021. PMID 33044267. Cianni L et al. J Clin Med. 2022;11:5660. PMID 36233528.

Open Calcaneal Fractures: Soft Tissue First, Fusion Selectively

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- No prospective ORIF-vs PSTA trial specific to open calcaneal fractures
- Spierings 2019: 616 open calcaneal fractures, mostly Gustilo III/ Sanders III; overall complication rate 21% and mean AOFAS 73.7.
- Principles of soft-tissue care/minimally invasive reduction/fixation, sinus tarsi fixation with VAC, or staged/percutaneous reconstruction.
- Recommendation: debridement, antibiotics, wound control, staged MIS fixation; reserve PSTA- severely comminuted, non-reconstructable

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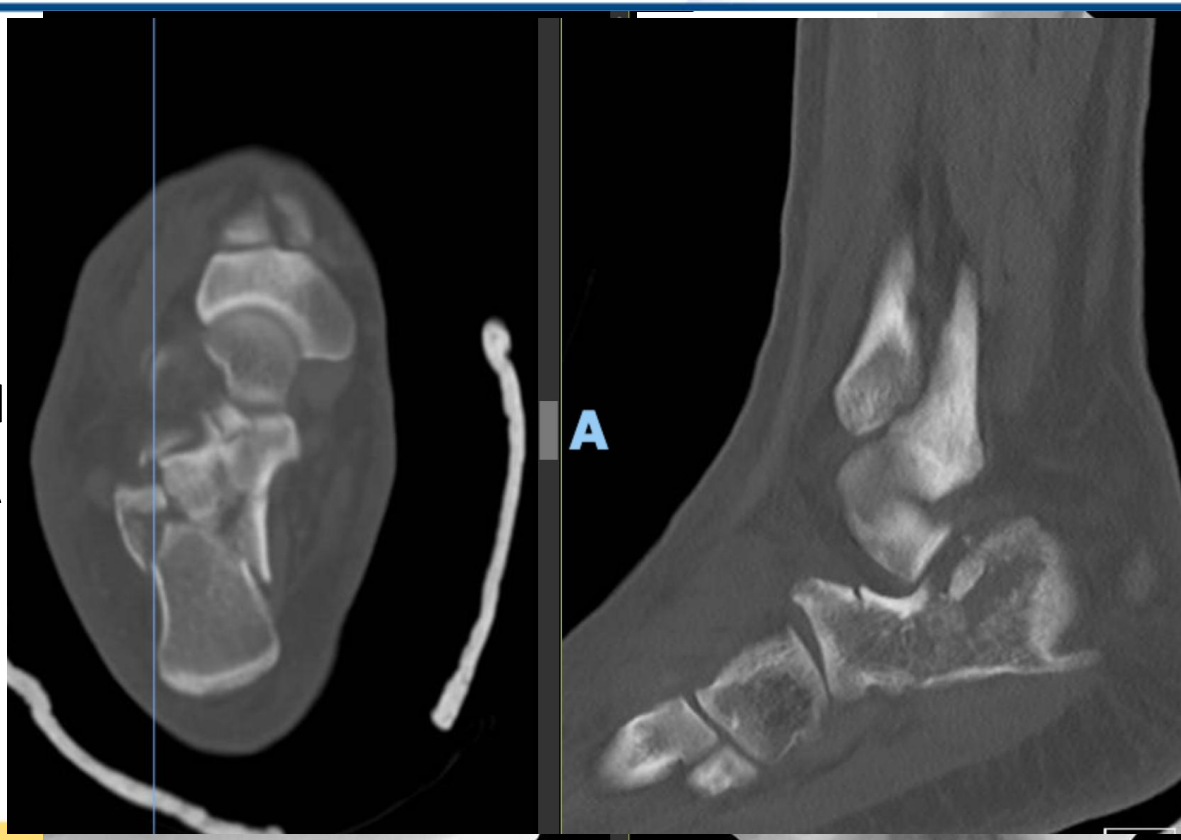
Spierings KE et al. Foot Ankle Surg. 2019;25:707-713. PMID 30467055.
Dhillon MS et al. Foot. 2015;25:134-140. PMID 26209469.
Zhang T et al. J Foot Ankle Surg. 2016. PMID 26372552.
Gao X et al. Orthop Surg. 2021. PMID 33403804.

Recent Case

- 34 yo MVC 8/2025
  - Closed left Femur
  - Open Left S III calcaneus fx
  - Cardiomyopathy EF<30%
- Left foot prolonged wound
- 7 months post injury-STDA



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Concluding Thoughts

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ORTHOPAEDIC SURGERY

- Operative Treatment- modest improvements in select groups (Nonsmokers; Women; Non-laborers)
- No surgery we perform can't hurt someone
- Soft Tissue critical determinant
- Surgical approach options
- Selective ORIF vs STDA for open/ Sanders III
- PSTA with ORIF or Distraction Sanders IV equivalent


Thank you!