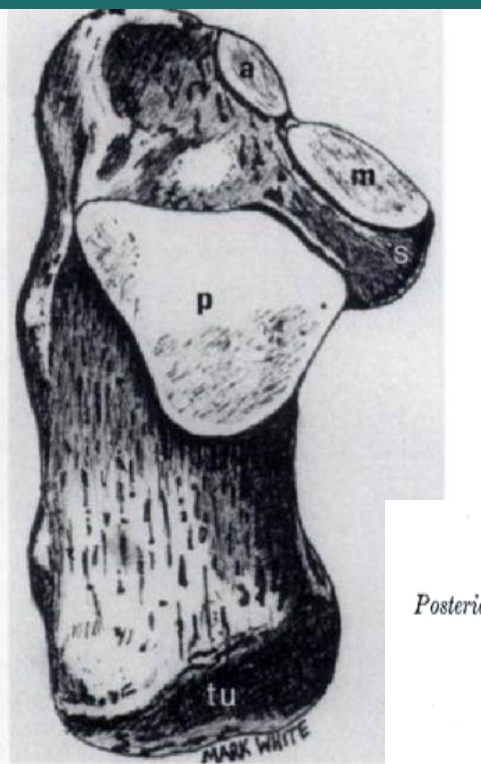
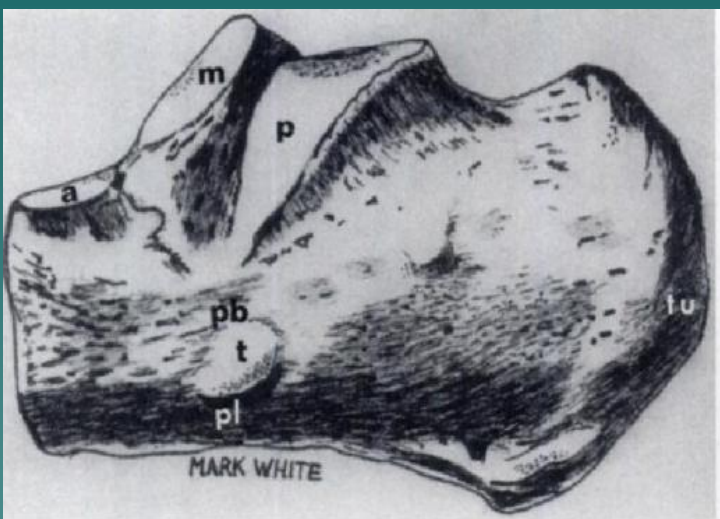


# Radiographic Evaluation of Calcaneal Fractures

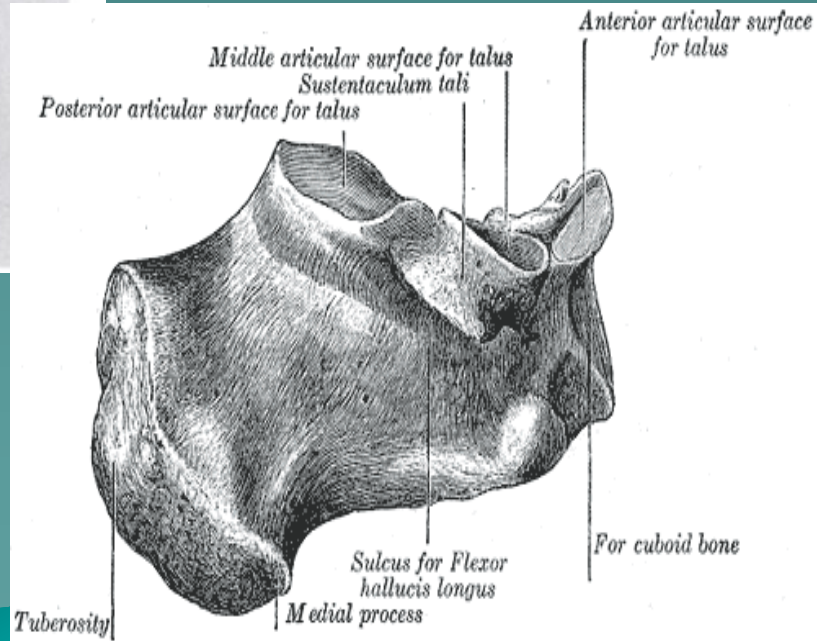
Kali Luker, PGY-1

A decorative silhouette of a mountain range in a darker shade of teal, located at the bottom right corner of the slide.

# Anatomy



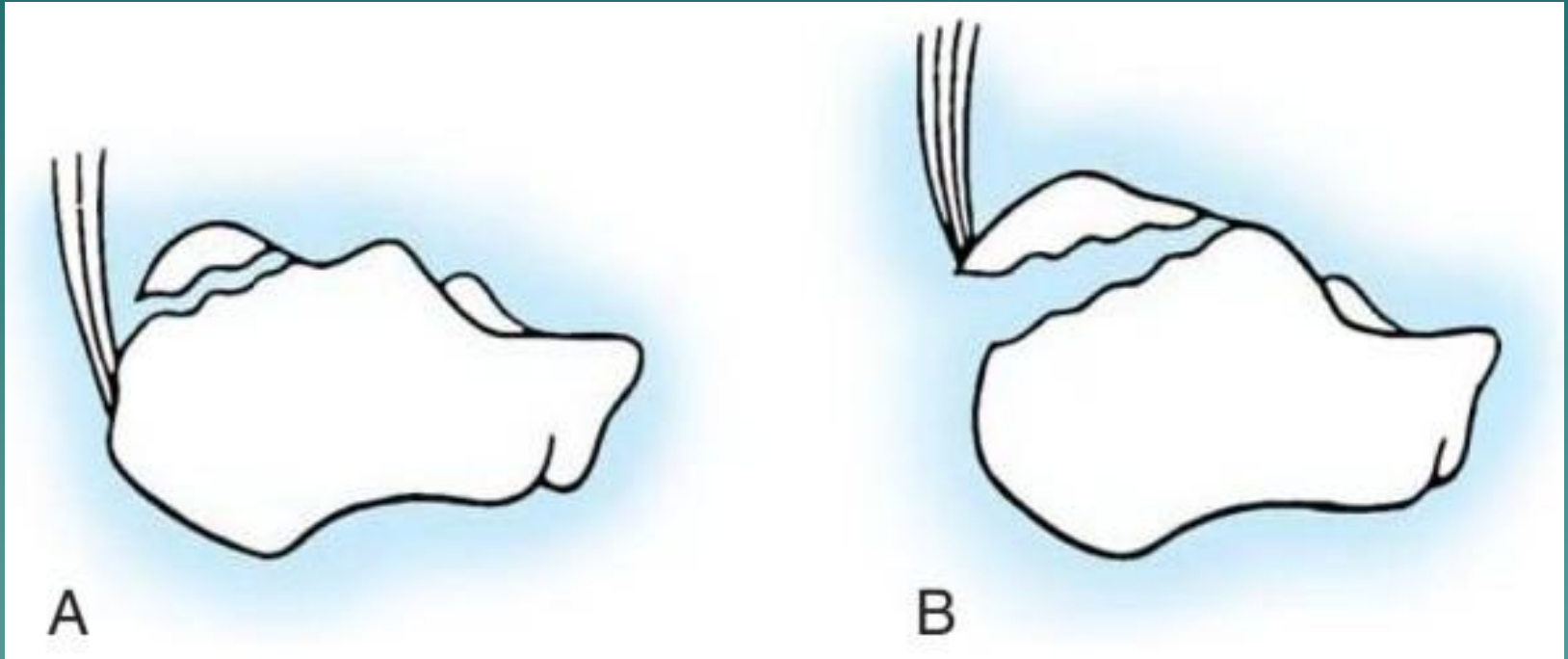
a.  
**Figure 1.** Drawings of the calcaneus. (a) Lateral surface. (b) Superior surface. *a* = anterior articular facet, *m* = medial articular facet, *p* = posterior articular facet, *pb* = groove for peroneus brevis, *pl* = groove for peroneus longus, *s* = sustentaculum tali, *t* = tubercle (trochlear process), *tu* = tuberosity.



# Extraarticular Fractures

- ◆ Involve body, anterior process or tuberosity
- ◆ Treated with immobilization and NWB x 6 wks UNLESS
  - Displaced tuberosity fracture -> attachment for Achilles tendon
  - Avulsion of anterior process by bifurcate ligament -> risk for nonunion/AVN

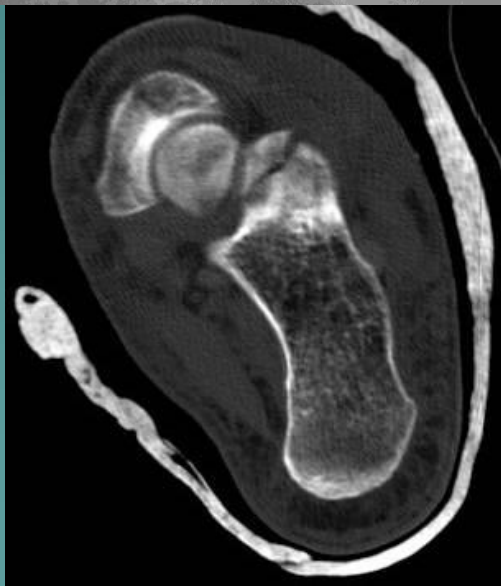
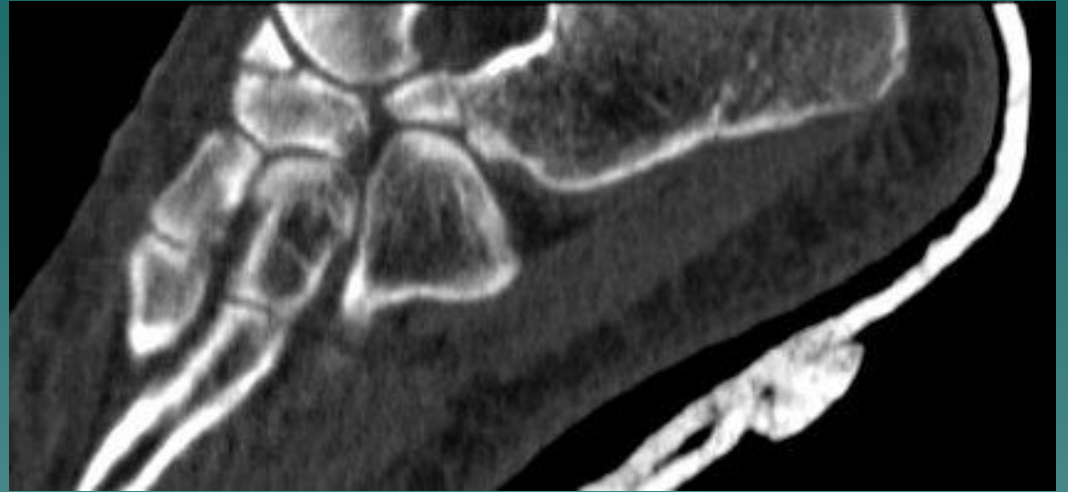
# Tuberosity Fracture



A: Beak Fracture – does not involve Achilles tendon -> can be treated nonoperatively if <1cm displacement

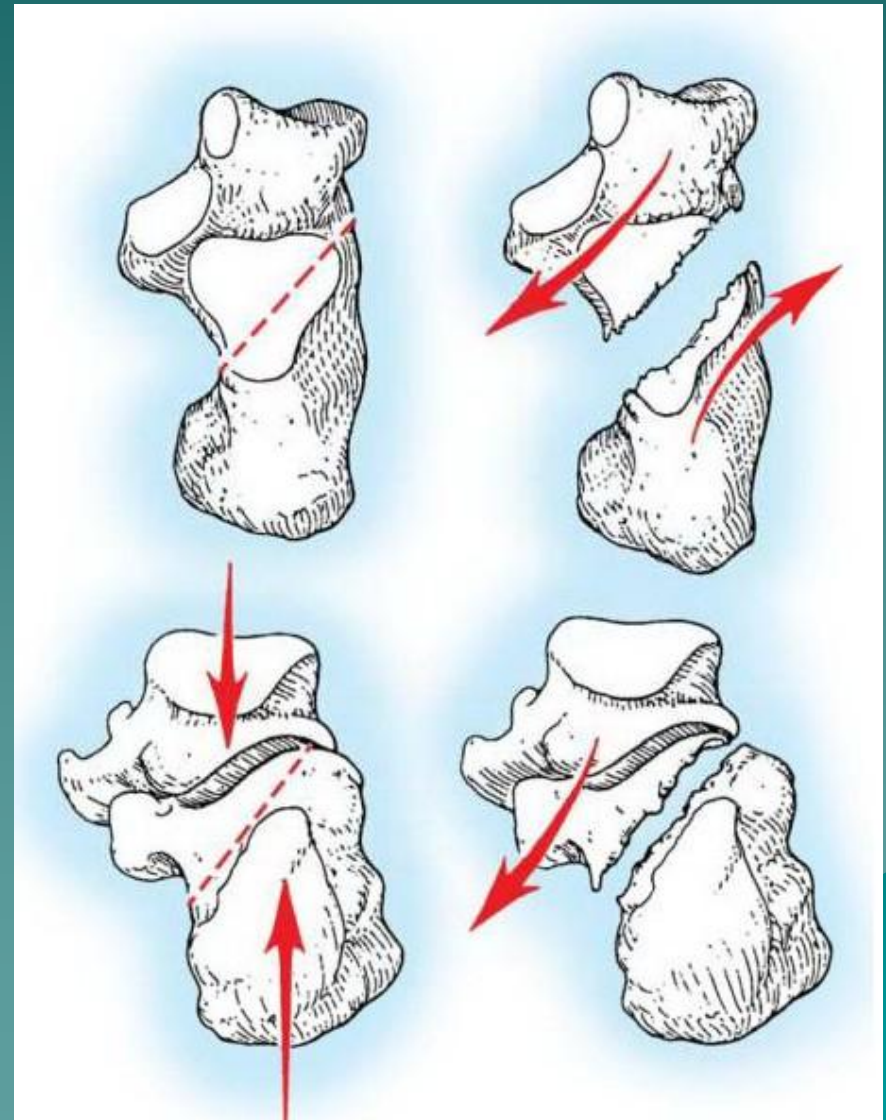
B: Avulsion Fracture – involves Achilles tendon insertion -> ORIF recommended

# Anterior Process Fracture



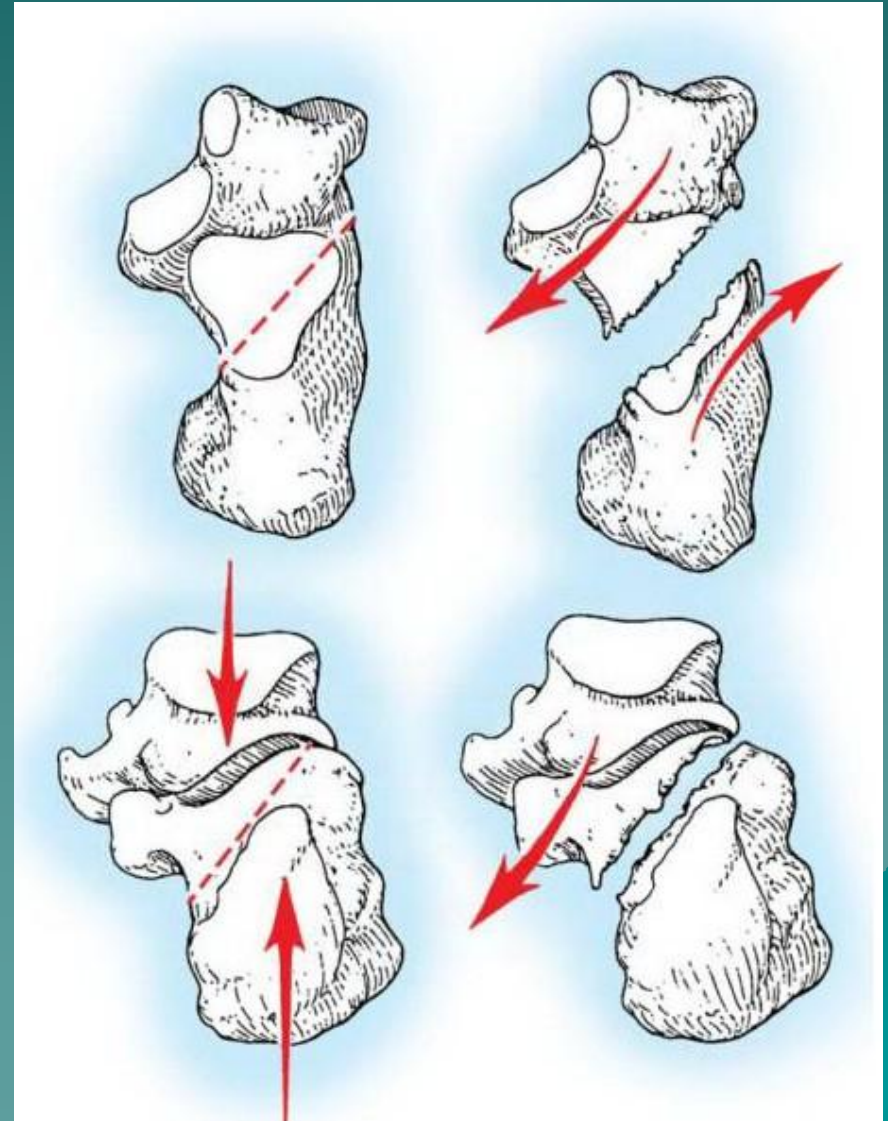
# Intraarticular Fracture Mechanism

- ◆ Axial load to posterior facet through talus -> shear through posterior facet toward medial wall
- ◆ Primary fracture line extends from the proximal, medial aspect of the tuberosity through anterolateral wall near crucial angle of Gissane



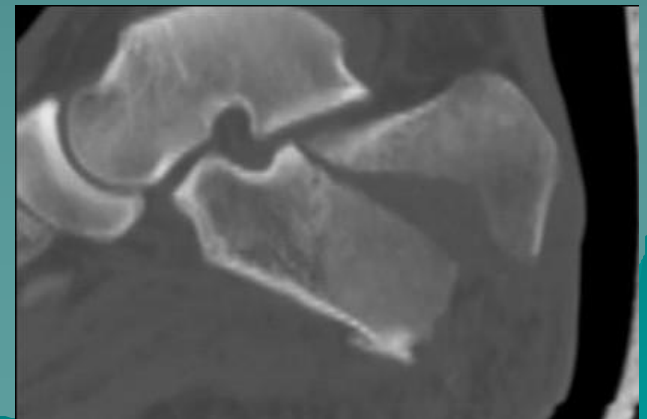
# Intraarticular Fracture Mechanism

- ◆ Continued axial force causes
  - Medial sustentaculum spike forced into medial heel skin -> possibility for open fracture
  - Secondary fracture lines in posterior facet



# Classification

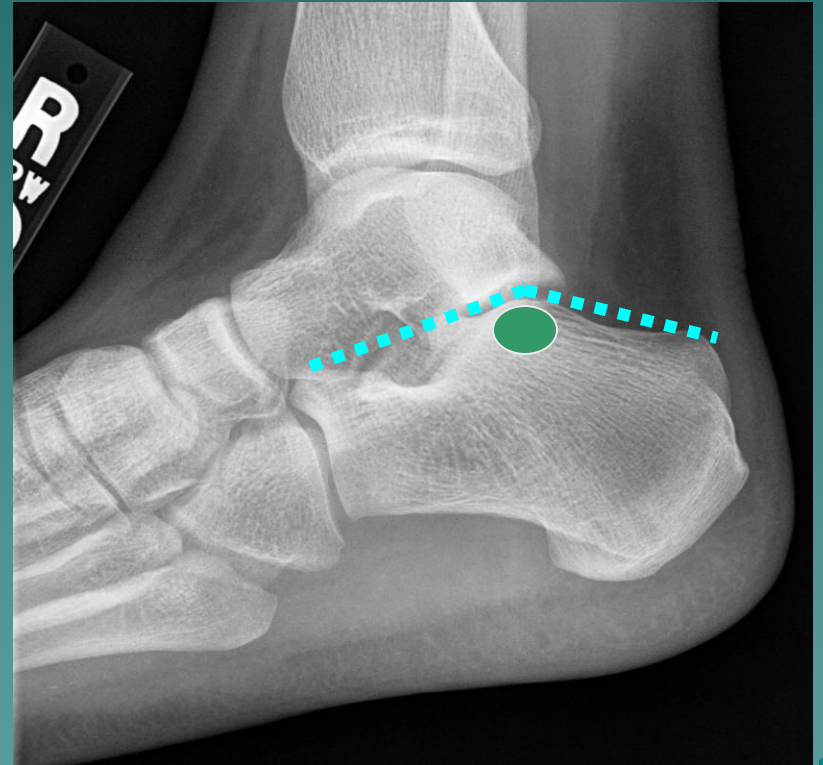
- ◆ Joint Depression Type: fracture line exits behind posterior facet and anterior to attachment of Achilles tendon
- ◆ Tongue Type: exits distal to Achilles tendon insertion





# Radiographic Evaluation

Lateral XR:  
evaluate Böhler's  
Angle (normal  
25-40 degrees)  
and posterior  
facet rotation



# Radiographic Evaluation

Harris View:  
assesses varus  
position of  
tuberosity and  
width of heel



# Radiographic Evaluation

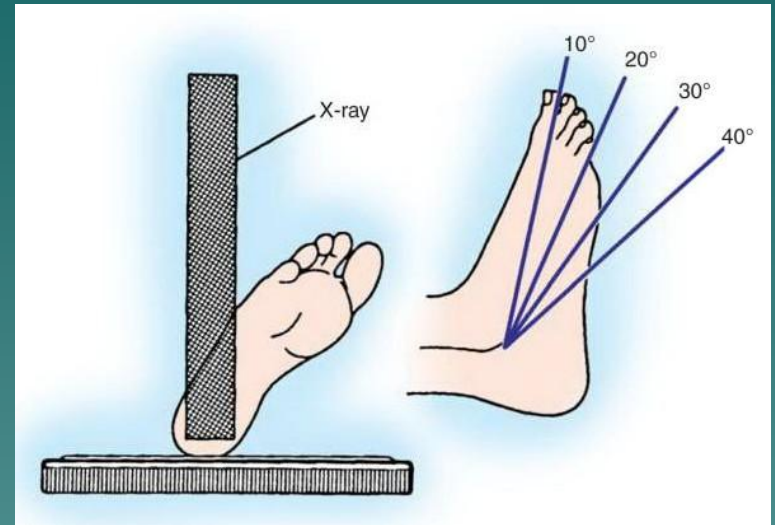
AP and oblique views to assess anterior process and calcaneocuboid involvement



# Radiographic Evaluation

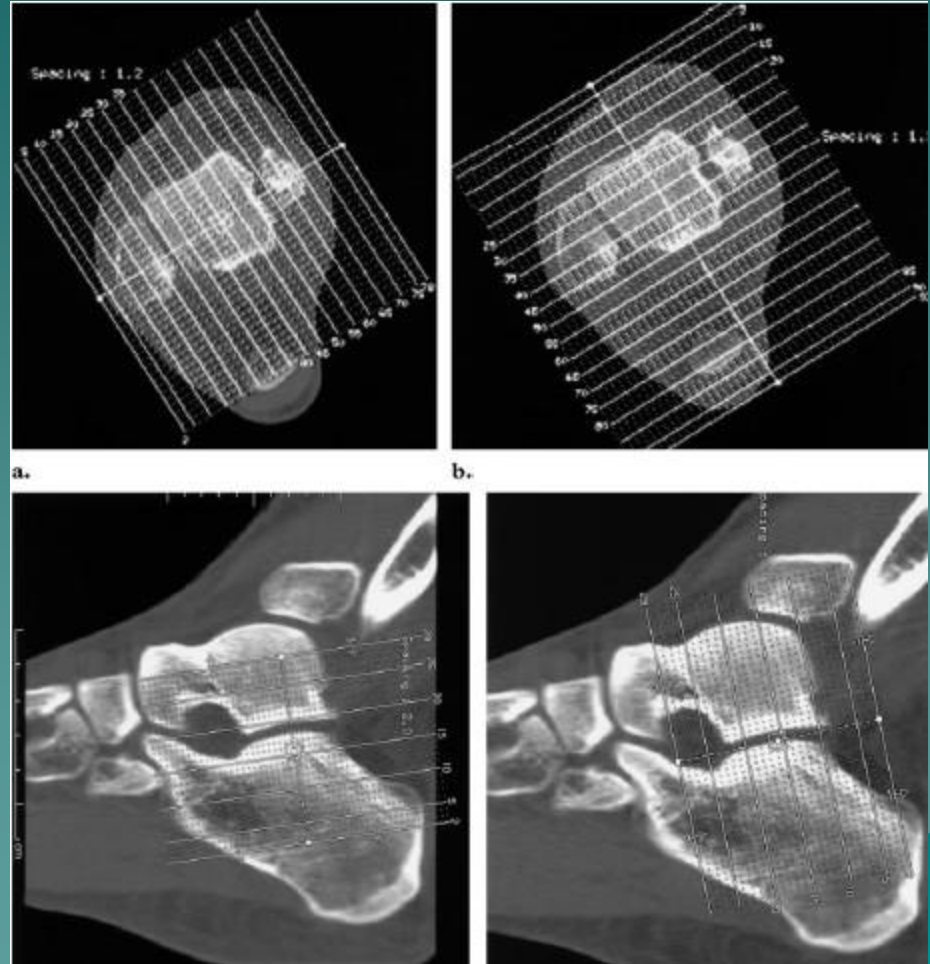
Brodén View:  
evaluates  
congruency of  
posterior facet

- Obtained by internally rotating leg 40 degrees with ankle in neutral and angling beam 10-40 degrees cephalad



# CT Scans

- ◆ Two Planes Necessary
  - Semicoronal: oriented perpendicular to normal position of posterior facet
  - Axial: parallel to sole of foot
- ◆ Correlate with XR since CT may underestimate sagittal plane rotation of depressed fragment
- ◆ Choose coronal image that shows the posterior facet in the widest profile



# Sander's Classification



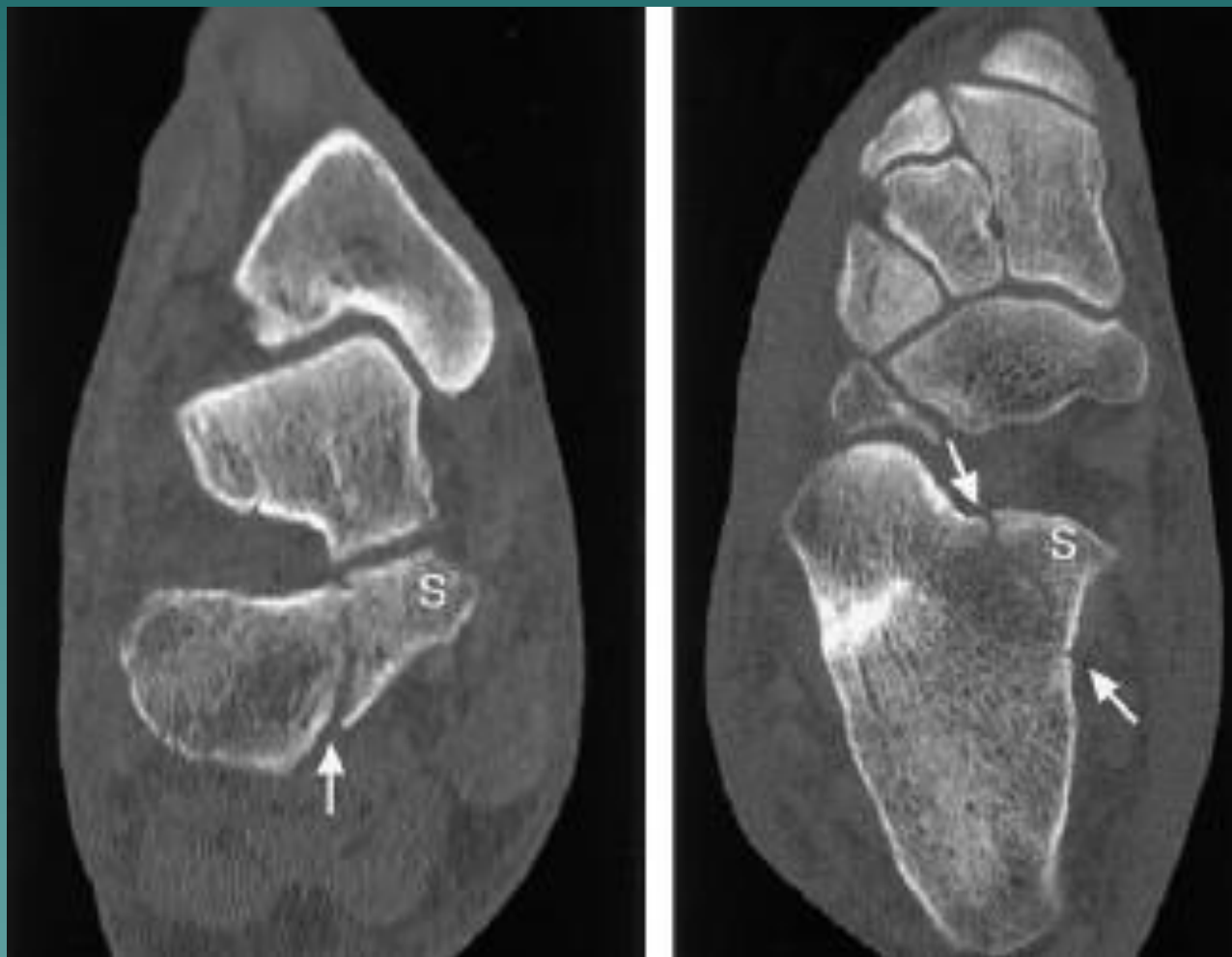
Type I: non-displaced

Type II: two part fracture

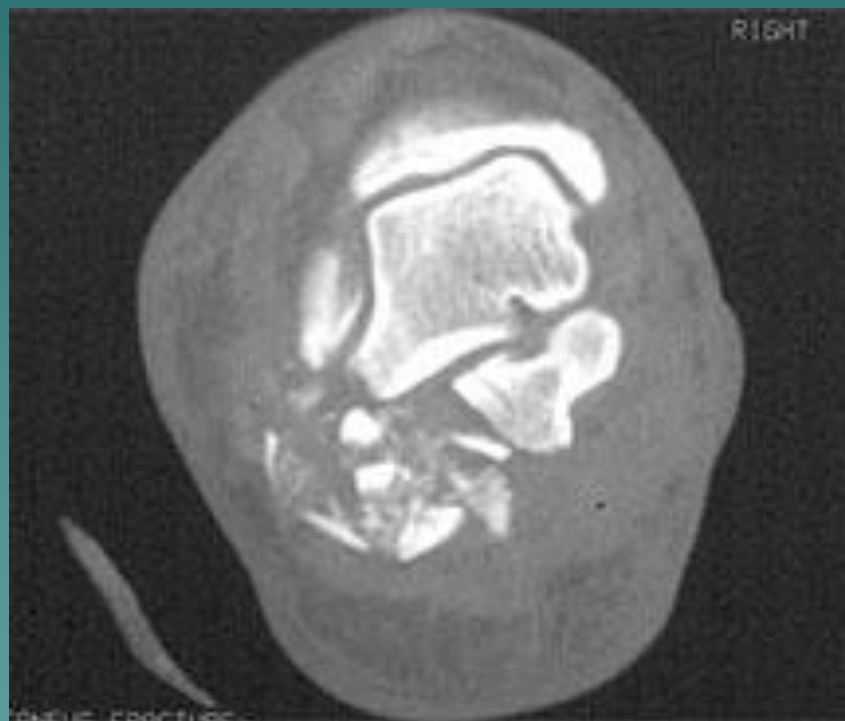
Type III: three part fracture with depression of posterior facet

Type IV: severely comminuted

# Type IIC

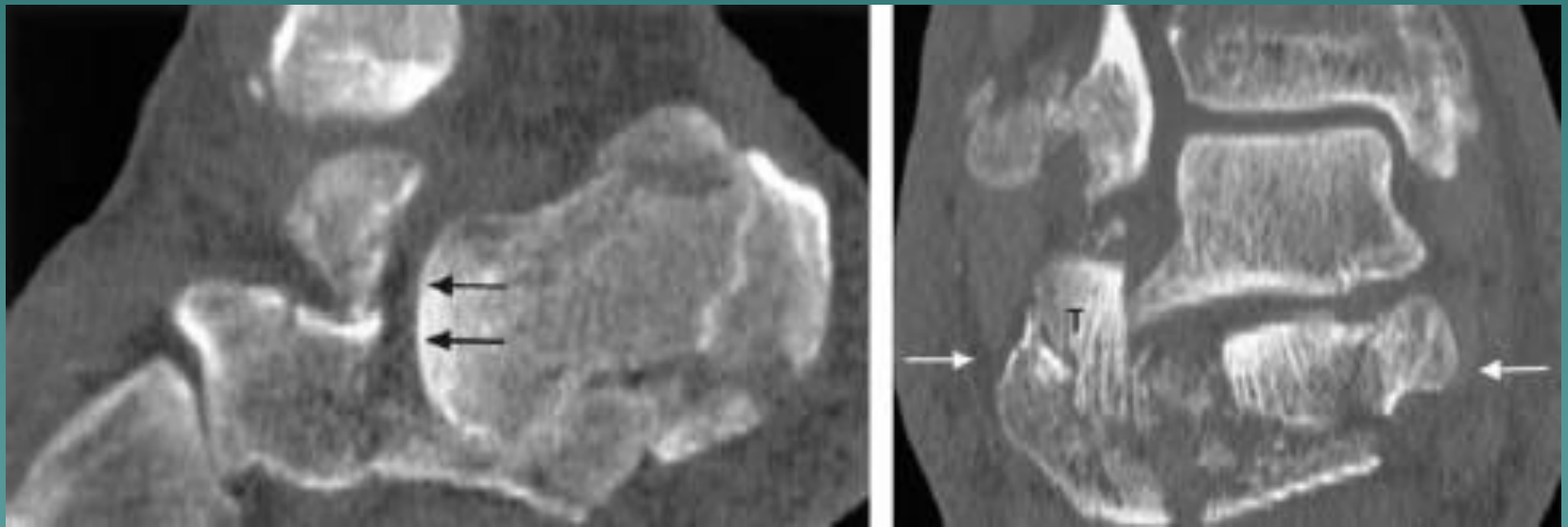


# Type IV

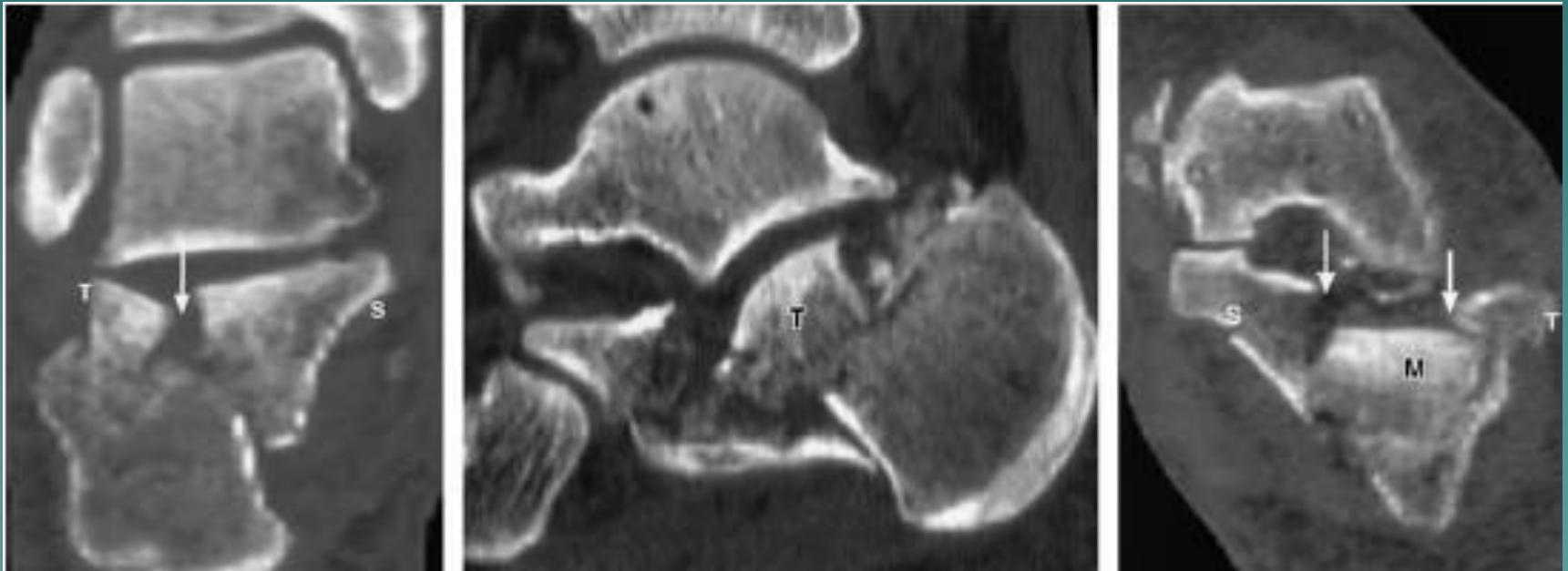




# Type III AC



# Type IIIAB



# Buckley, et al: Non-op vs Op??

- ◆ Large multicenter prospective, randomized, controlled study
- ◆ Included patients with intraarticular calcaneal fractures with more than 2 mm displacement
- ◆ Randomly assigned to
  - Non-operative treatment: no attempt at reduction
  - Operative treatment: standardized extensile lateral approach with internal fixation

# Results

- ◆ Overall, outcome scores not different
  - HOWEVER, if you exclude workers' comp then operative patients fared better
  - Women had improved scores with operative treatment
- ◆ Gait satisfaction equivalent between groups
- ◆ Subsequent arthrodesis higher in workers' comp, non-op, initial Böhler's angle  $< 0$  degrees, and Sanders type IV
- ◆ Higher complication rate in operative group

# Decision Making

## ◆ Goals:

- Restore congruency of posterior facet
- Restore calcaneal height
- Reduce width of calcaneus
- Decompress subfibular space for peroneal tendons
- Reduce calcaneocuboid joint if fractured

# Decision Making

- ◆ Non-Operative if less than 4 mm disruption between facets, no subluxation of subtalar joint, no subfibular impingement
- ◆ Lean Towards Non-Op
  - Sanders type I and usually type IV
  - Older patients
  - Insensate limb (traumatic or disease)
  - Smokers
- ◆ Open Fractures
  - Expose medial spike and aggressively debride
  - Wait approximately 2-3 wks for definitive tx
- ◆ EXTREMELY important for outcome is surgeon's experience

# Complications

- ◆ Wound Necrosis, Dehiscence and Infection
  - Increased risk with diabetes, smoking and open fx
  - Decreased incidence with careful retraction, drains, sutures x 3 wks, no ROM for 3 wks, perioperative abx
- ◆ Loss of Reduction
  - NWB x 8-12 wks to prevent this
- ◆ Malreduction
  - Must restore valgus alignment of tuberosity fragment
  - Get intraoperative Harris views to avoid this
- ◆ Sural Nerve and Peroneal Tendon Injuries
- ◆ Chronic Pain
  - Can perform arthrodesis or lateral decompression

# Thank You!!

## References:

1. Canale and Beaty. *Campbell's Operative Orthopaedics, 11<sup>th</sup> ed.* Elsevier (2007): 4833-50.
2. Kowall. *Orthopaedic Knowledge Update 7.* AAOS (2002): 550-3.
3. Sanders. Intra-Articular Fractures of the Calcaneus: Present State of the Art. *Journal of Orthopaedic Trauma* 6(2), 1992: 252-65.