

# Calcaneal Fractures

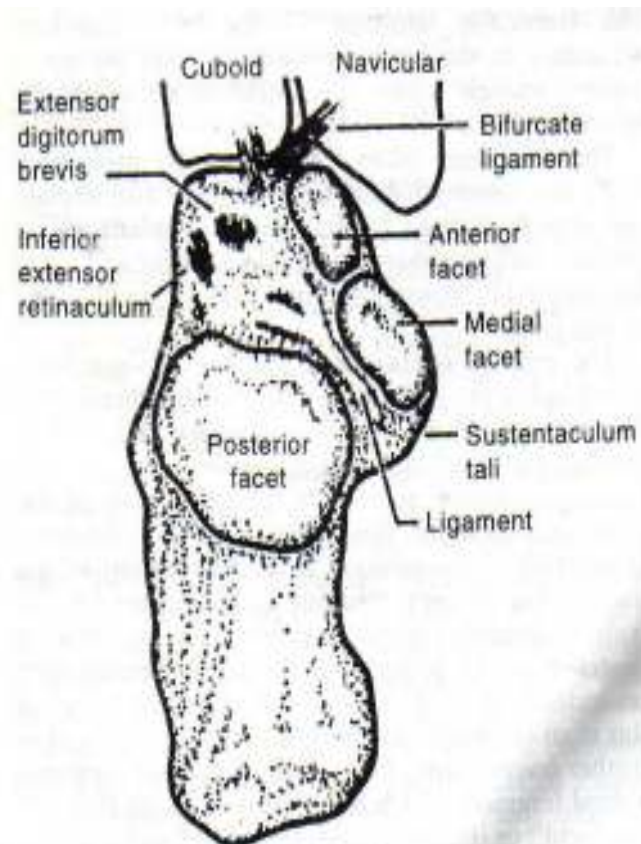


Figure 1. Superior aspect of left calcaneum.

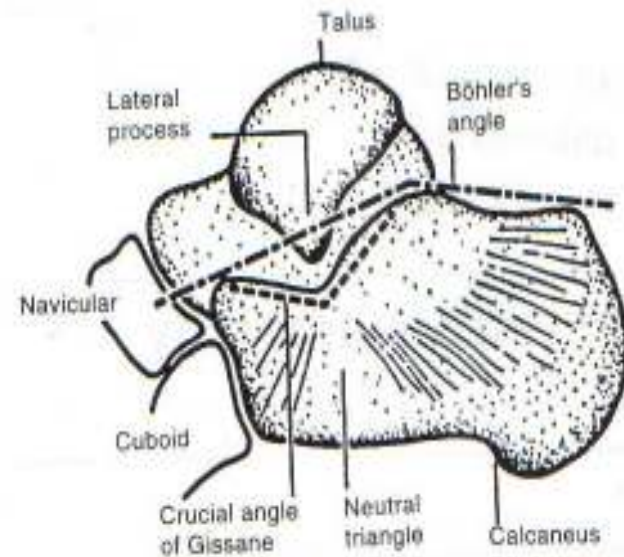


Figure 2. Lateral aspect of calcaneum. The lateral talar process initiates the primary fracture line through the neutral triangle.

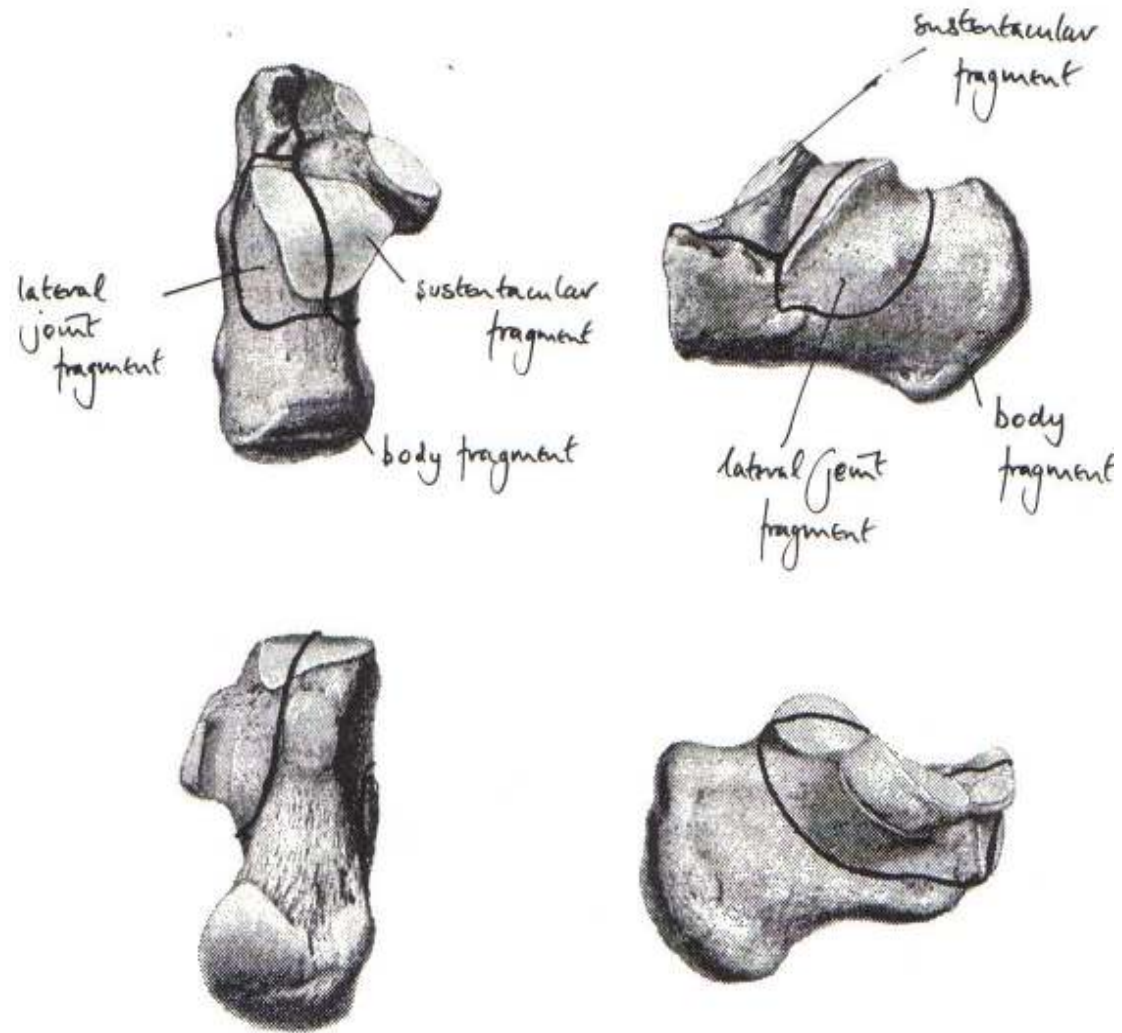
# Type of injury

- Fall from a height
- Position of foot at impact
- Bone Quality
- Force of impact
- Essex Lopresti
  - Primary Fracture line
  - Secondary fracture line
    - Force directed posterior – compression
    - Force inferior – tongue type

1. THE PRIMARY FRACTURE LINE

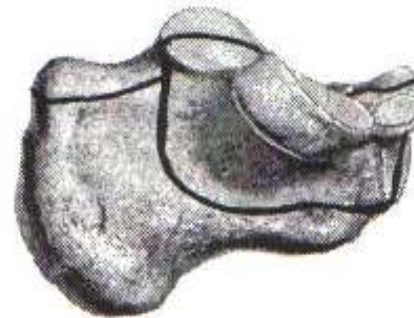


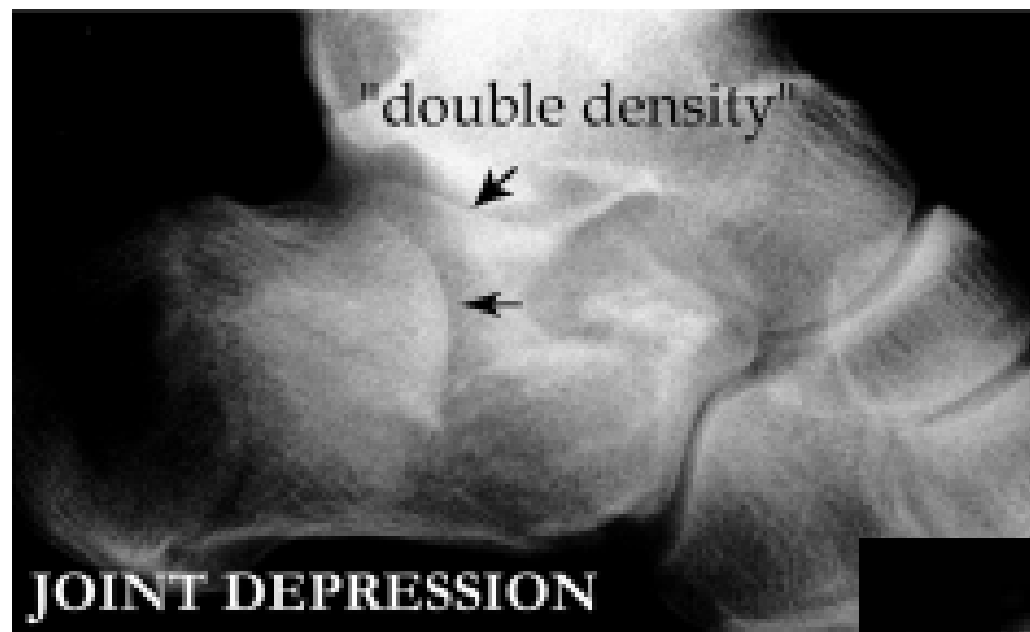
3. THE SECONDARY FRACTURE LINE  
CENTRAL JOINT DEPRESSION FRACTURE



4.

THE SECONDARY FRACTURE LINE,  
TONGUE TYPE FRACTURE.





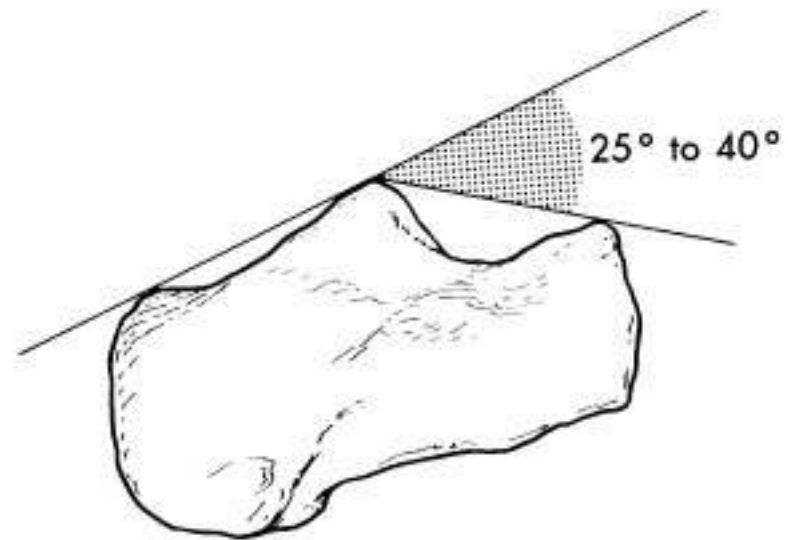


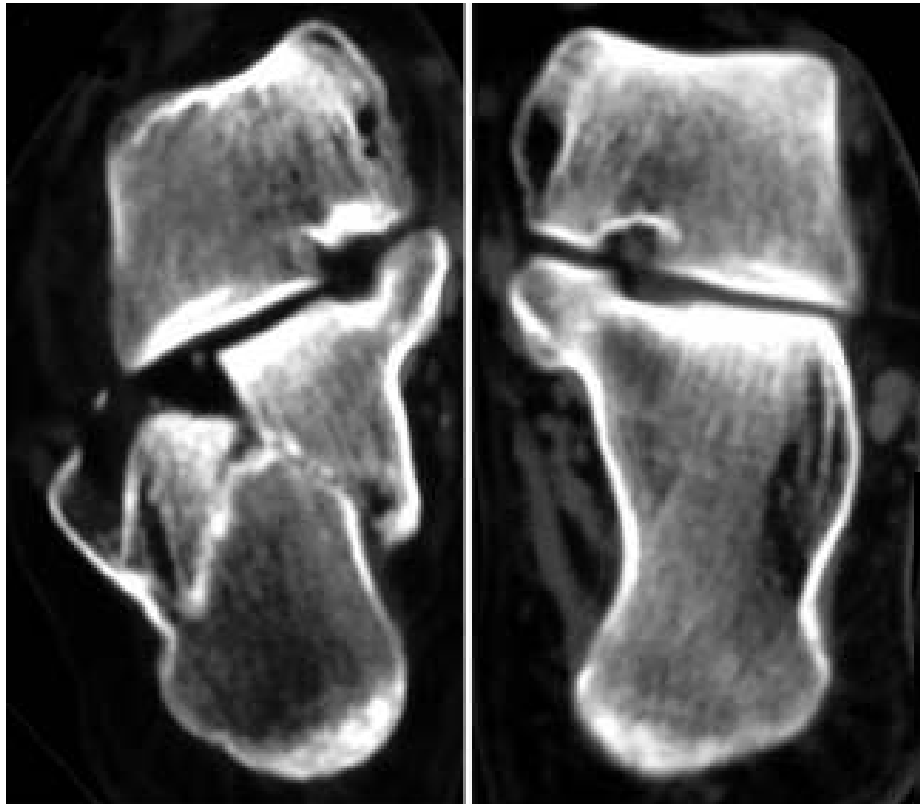
**Böhler's angle**



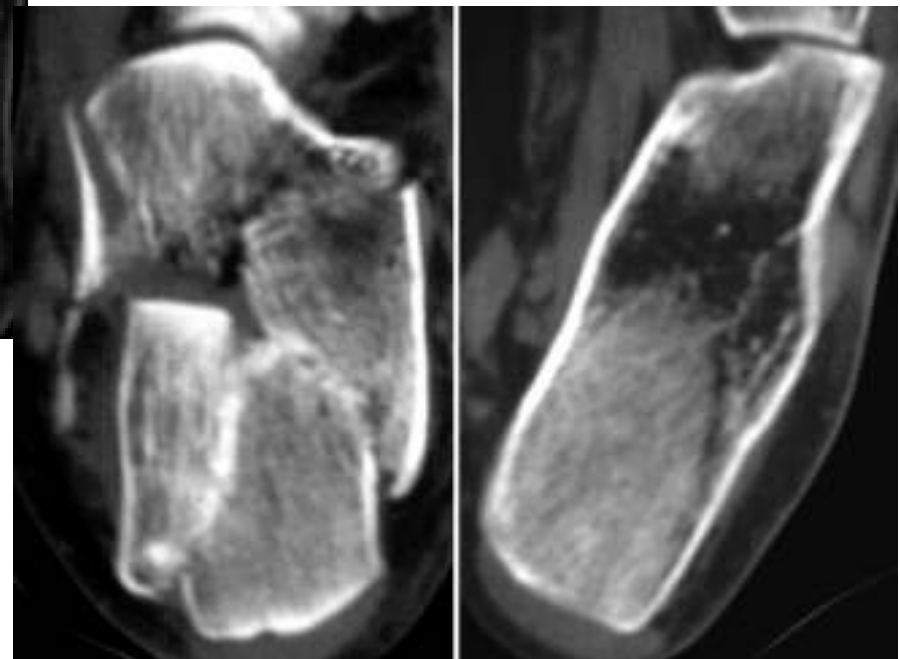
**Crucial angle of Gissane**







Coronal  
Subtalar joint



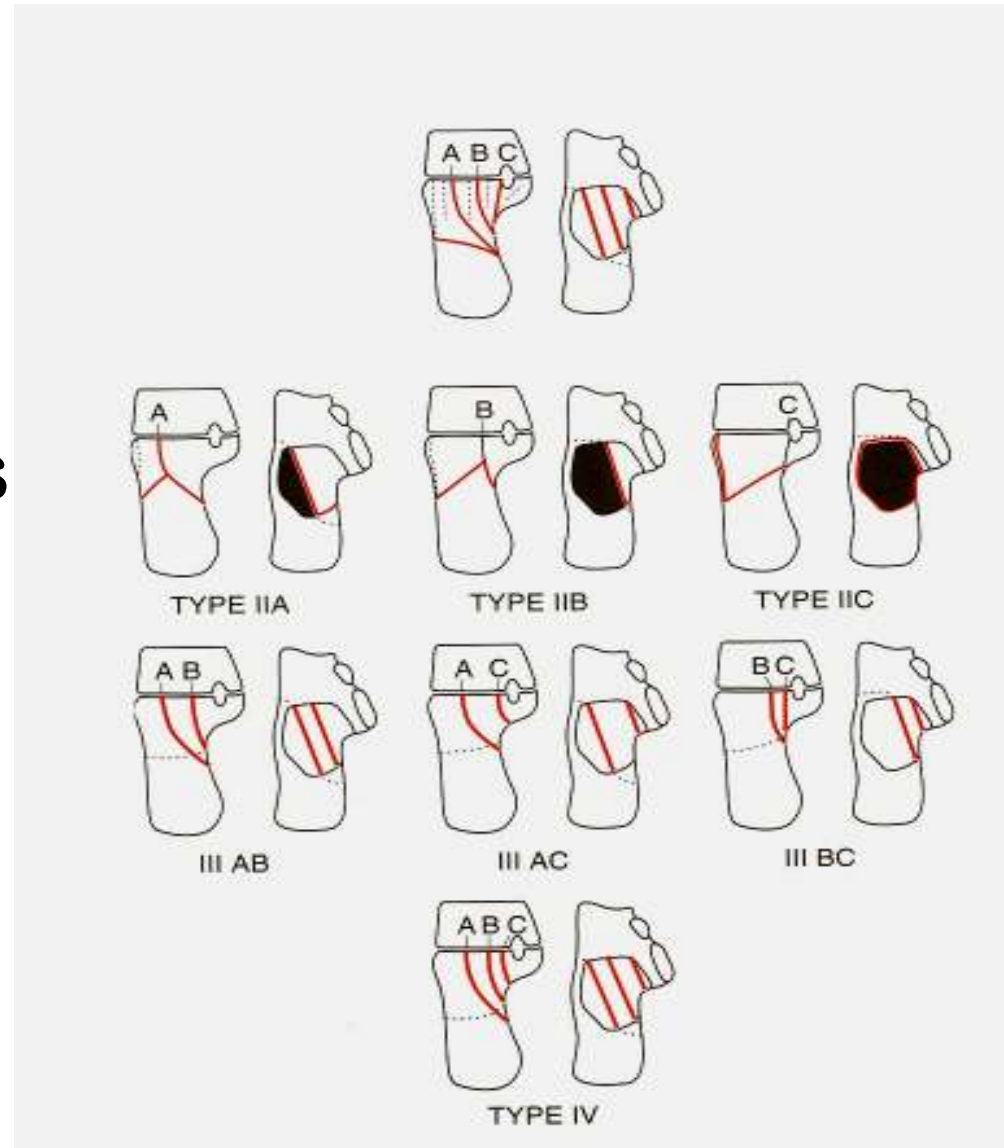
Transverse  
Calcaneo-cuboid

# Sanders classification

CT based

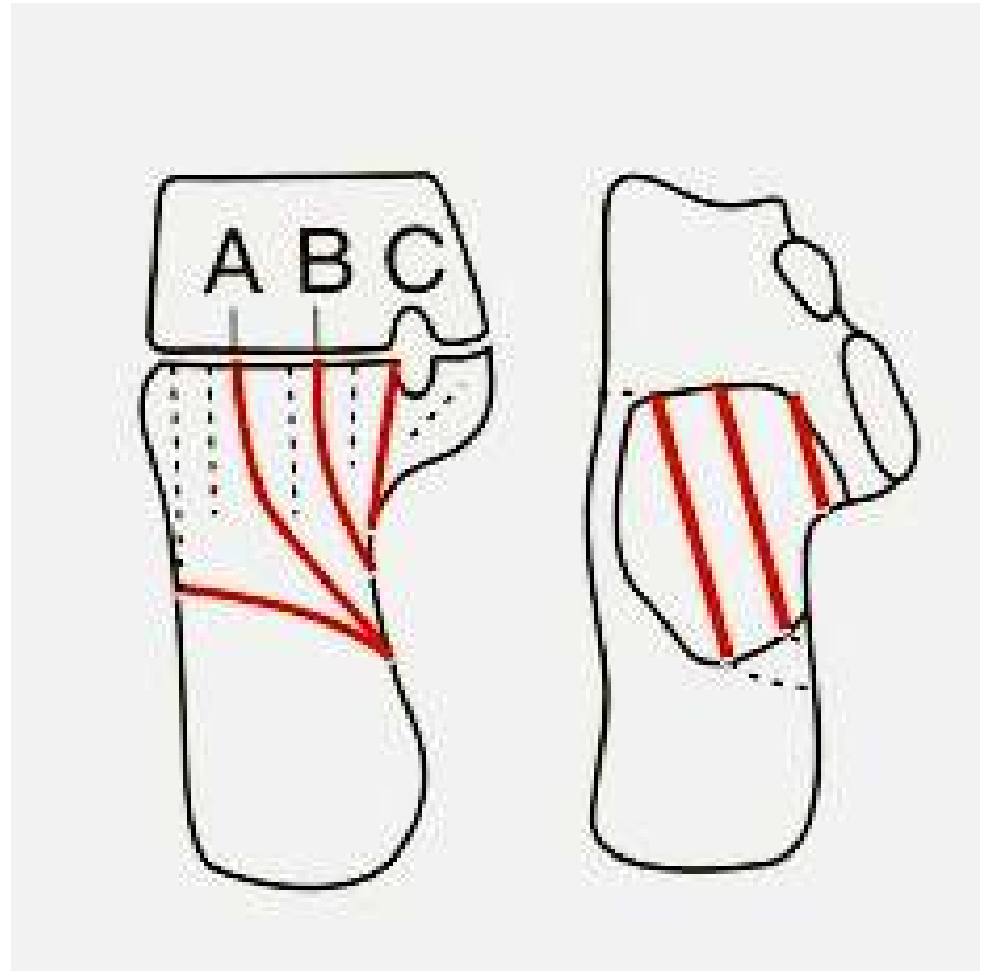
No. fracture lines

Correlation with  
outcome



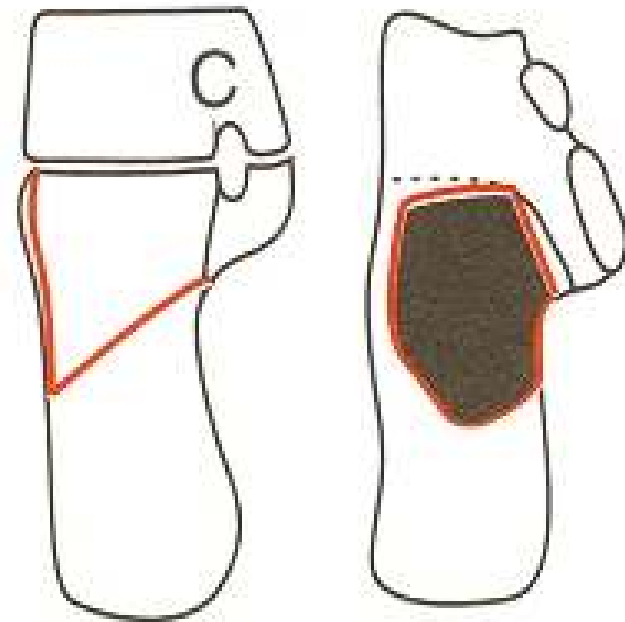
# Sanders et.al

**Classification  
based on three  
zones in coronal  
and axial planes**



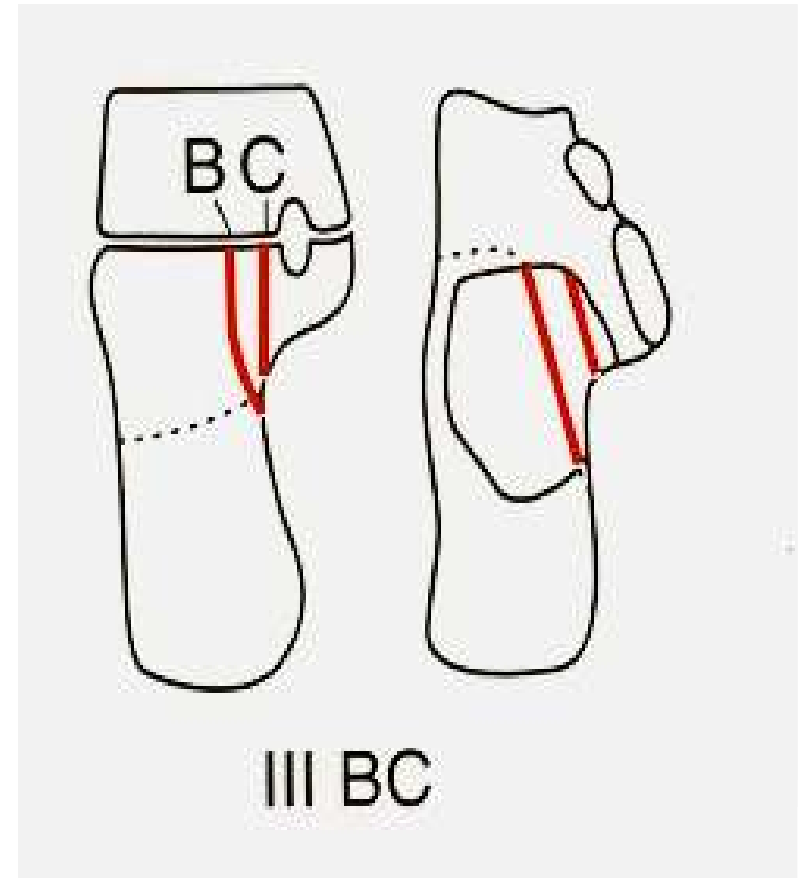
## Type 1      Undisplaced

Type 2: two lines,  
sustentaculum intac  
depression of split  
posterior facet

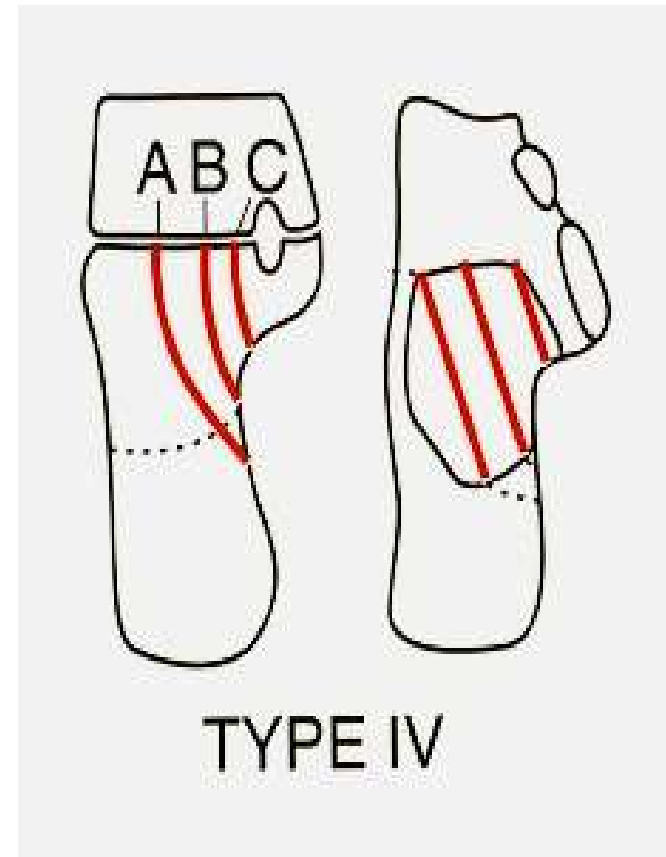


TYPE IIC

**Type 3: three fragments  
involves sustentaculum  
separating sustentaculum  
from post facet.**



**Type 4: three lines,  
multi-fragmentary**



## All fractures treated closed

- All patients who had a type-I fracture had good result
- Most type-II fracture and all who had a type-III fracture had a poor result with closed treatment, and
- Suggested operative treatment for these fractures.



- **20-25% incidence of bony injury to spine, pelvis, hip, knee\***
- **Blanching of skin**
- **Tenting of skin**
- **Blisters**
- **Stretch pain**

*\*Sangeorzan BJ Orthopaedic Trauma  
Protocols*



# The Soft Tissue Envelope

**No Returns or  
Second  
Chances**

**Handle  
With  
Care**

**Caution! Open carefully,  
intra-articular fracture  
inside**

# Soft tissue management

- No surgical intervention until soft tissues satisfactory
- Elevate to reduce oedema
- Cryocuff
- Pneumatic compression sleeve
- Blister care. Lateral blisters worse than medial blisters. Blood blisters worse than serous blisters
- Splint to prevent equinus

# **Non operative management**

- **Undisplaced fractures**
- **Smokers**
- **Diabetics**
- **Steroid use**
- **Age**
- **Noncompliant**

# **Surgical management**

- **Articular displacement > 2mm**
- **Small area of posterior facet**
- **Large forces across it**
- **Loss of height**
- **Loss of width**
- **Varus angulation tuberosity**

# Goals of surgery

- **Reconstruct anterior process**
- **Reconstruct articular post facet**
- **Attach anterior process to tuberosity**
- **Restore height width angulation tub**
- **Attach post facet to tuberosity**
- **Close without tension**

# Surgical tips

- 2 articular surfaces slope medially, calcaneocuboid and post facet
- Sustentacular fragment higher than medial end of post facet
- Don't penetrate medial wall neurovascular injury



# Surgical approach

- Full thickness down to periosteum in 1 layer
- Elevate calcaneofibular and peroneal retinaculum in same layer
- Flap contains periosteum, peroneal tendons, artery and sural nerve with skin
- Schanz screw in tuberosity to manipulate
- Flip down lateral wall if appropriate, retaining soft tissue inferiorly
- Narrow periosteal elevator as inclined plane to reposition sustentaculum and align with medial wall

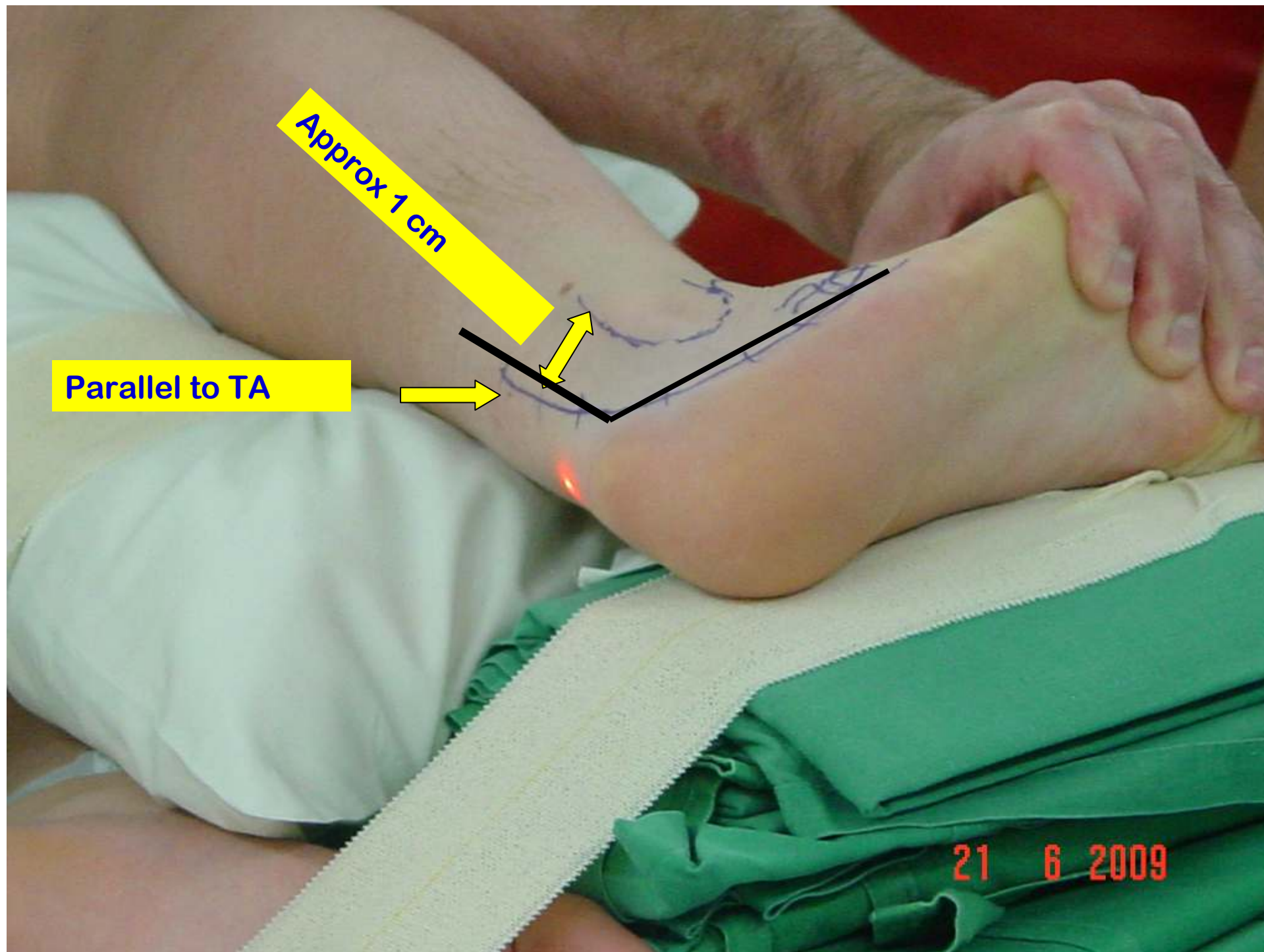




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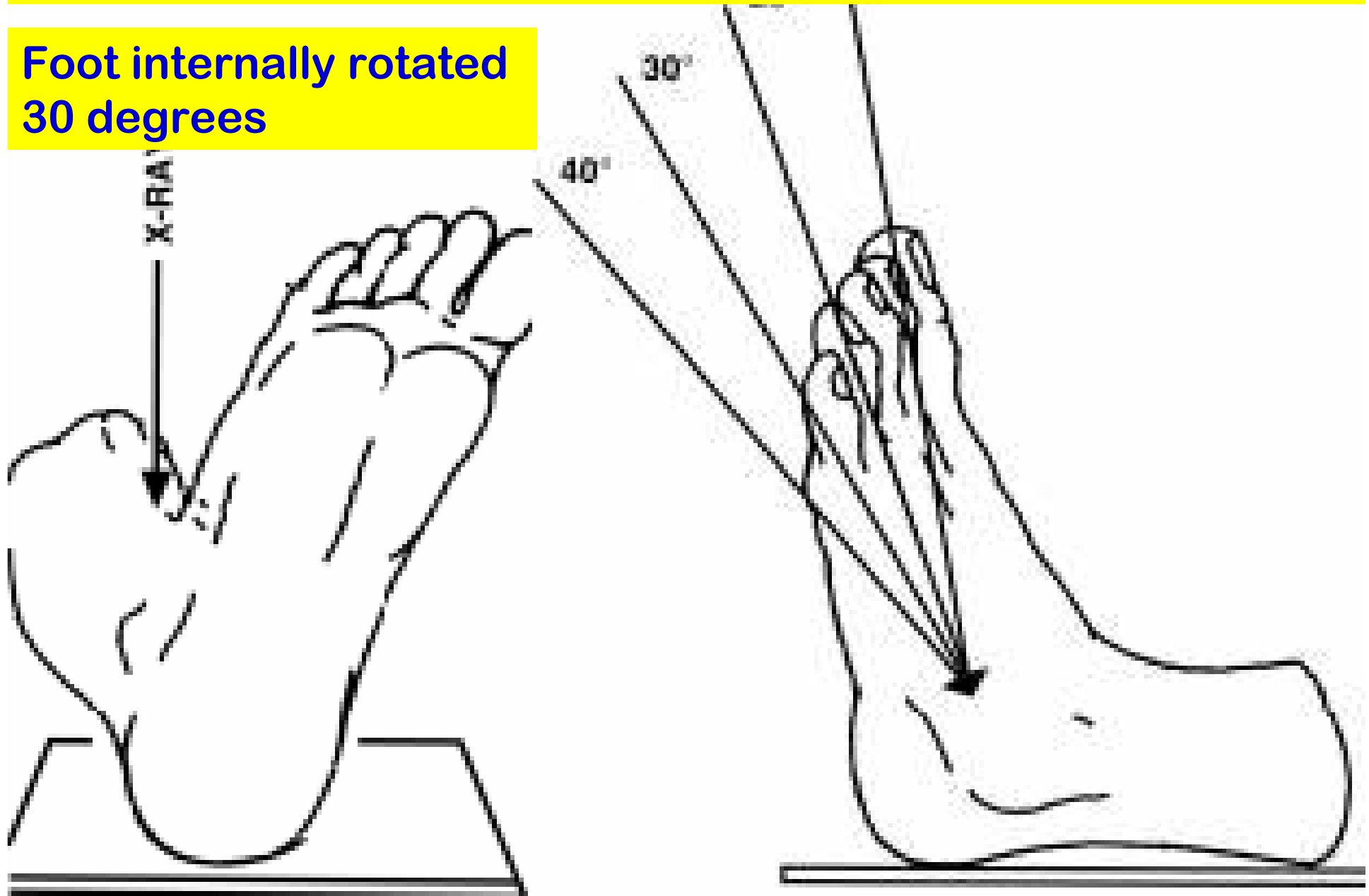






*Broden's view: Xray tube centred on lateral malleolus and angled 10,20,30,40 degrees to head*

Foot internally rotated  
30 degrees



# Filling the void

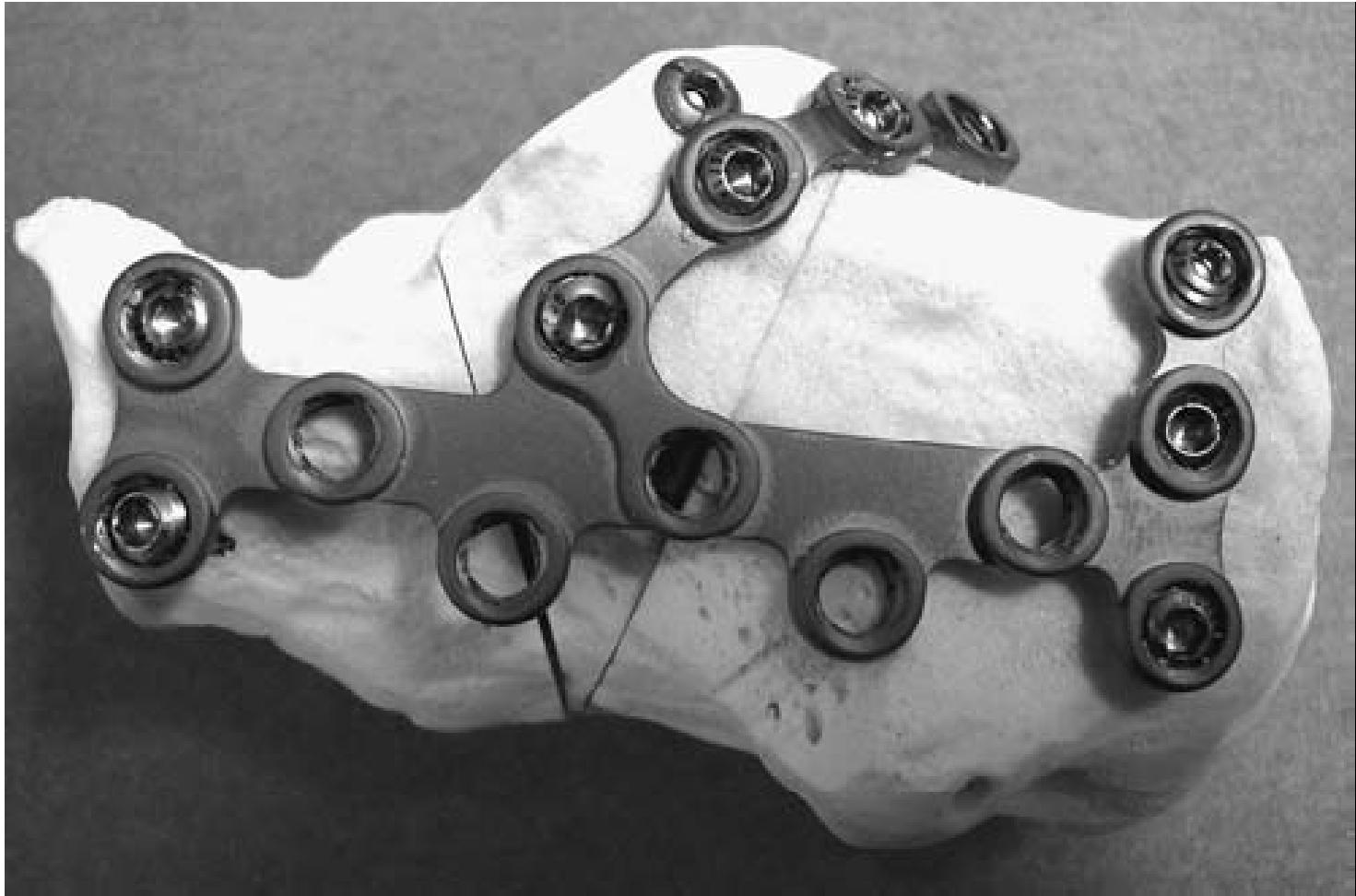
- Nothing
- Autologous bone graft
- Allograft
- Synthetic bone substitutes



# The use of Calcium Phosphate in Calcaneal fractures

- Metanalysis of Distal radial, tibial plateau and calcaneal fractures
- Less pain in calcium phosphate group compared to no graft
- Less loss of reduction in Calcium Phosphate group as compared to autogenous
- 3 studies showed increased functional outcome with Ca P compared to no graft

# Which implants are best



# Operative Vs Nonoperative

- Multicentre RCT
- 4 trauma centres
- Lateral approach, Rigid internal fixn
- Nonop No reduction, ice elevation rest
- SF36, VAS

# Operative Vs Nonoperative

- 471 calcaneal fractures in 424 patients
- 73% (309) followed up
- Minimum 2 years max 8 years



# **Surgical better in...**

- **Women**
- **Non Workers compensation**
  - Younger than 29**
  - Bohler angle  $>0$**
  - Comminution**
  - Anatomical reduction  $<2\text{mm}$**

- Does ORIF of displaced calcaneal fractures lead to better general health outcomes and disease specific health outcomes as compared to nonoperative treatment ?
- **Yes in clearly identified groups.**
- Does the outcome after ORIF correlate with postop CT ?
- **Yes. Anatomical reduction does much better.**
- Are radiographic classifications predictive of prognosis ?
- **Yes. Sanders II does much better with ORIF than non-op. In Sanders IV no difference**

# Message

- **Acute surgical management of displaced calcaneal fractures supported in**
  - **Suitable patients**
  - **By surgeons with a specialist interest**
  - **In centres with a significant volume**

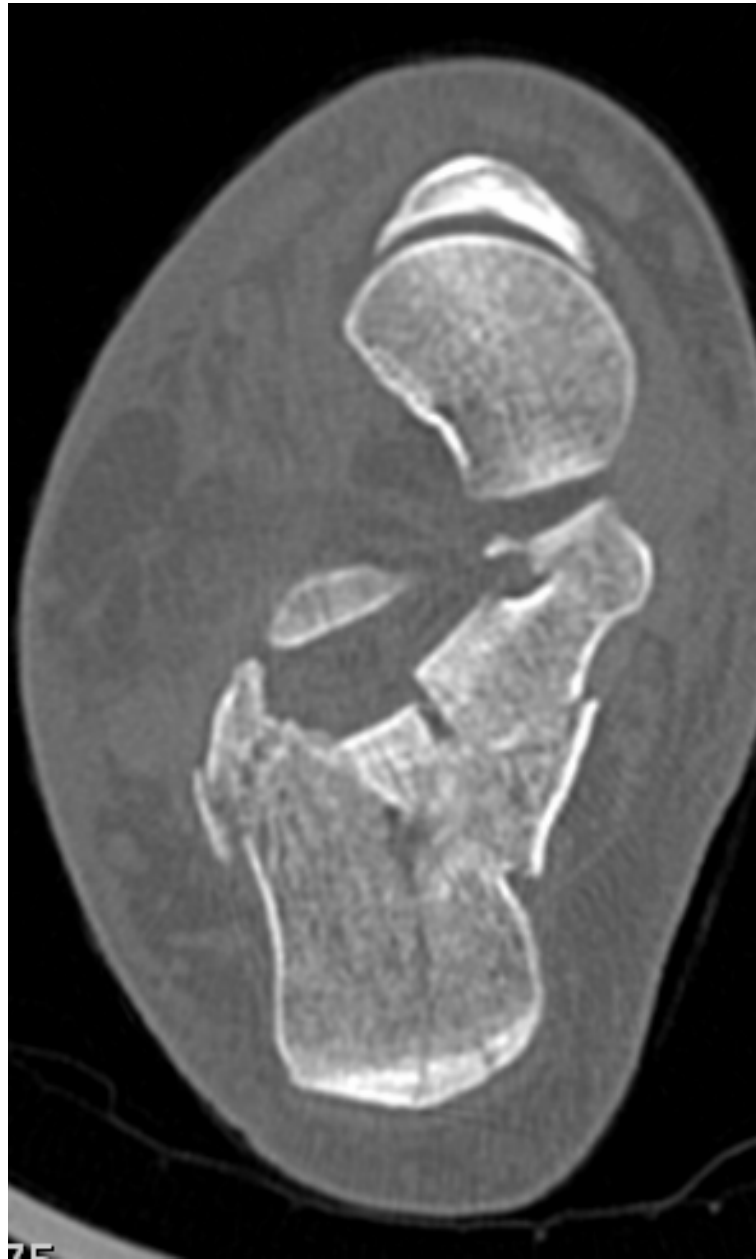


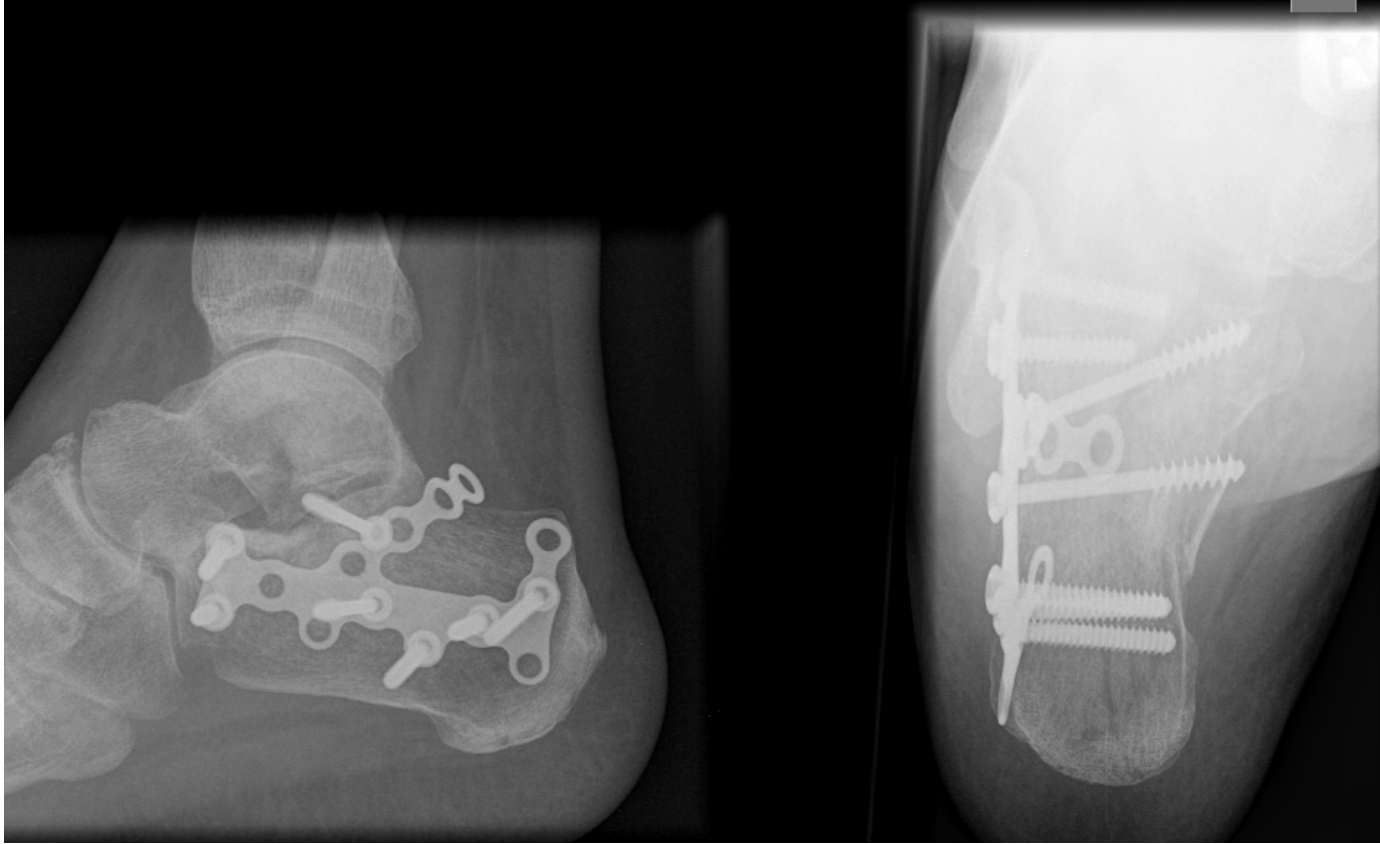
# Prospective RCT Sanders IV

- Primary ST fusion Vs ORIF
- Follow up 2 years
- Recruiting since May 2008

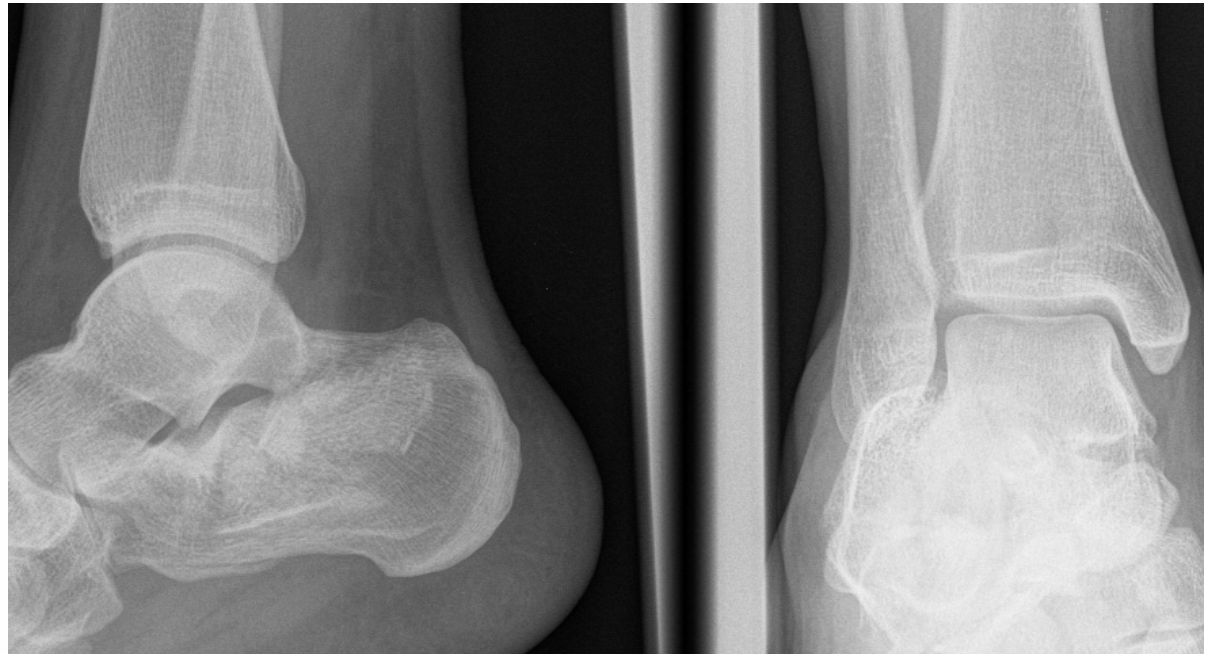
# Case 1 – 49, male fit







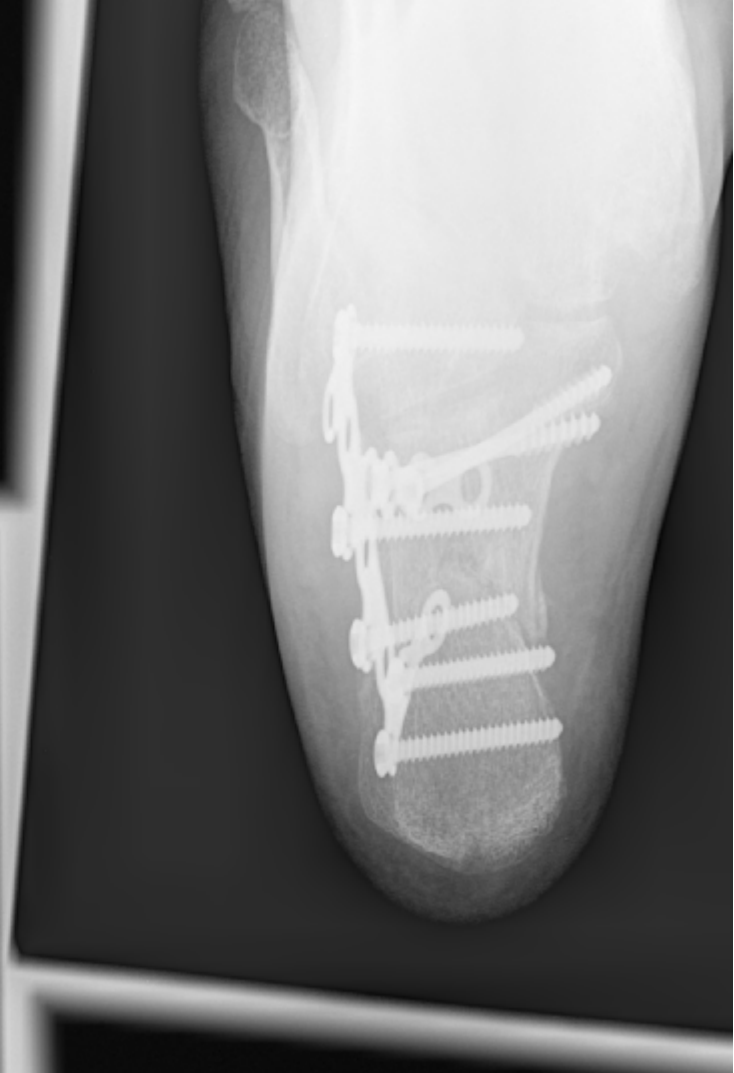
**Case 2: 52 , Female, fit**





Case 3:







Case 4:

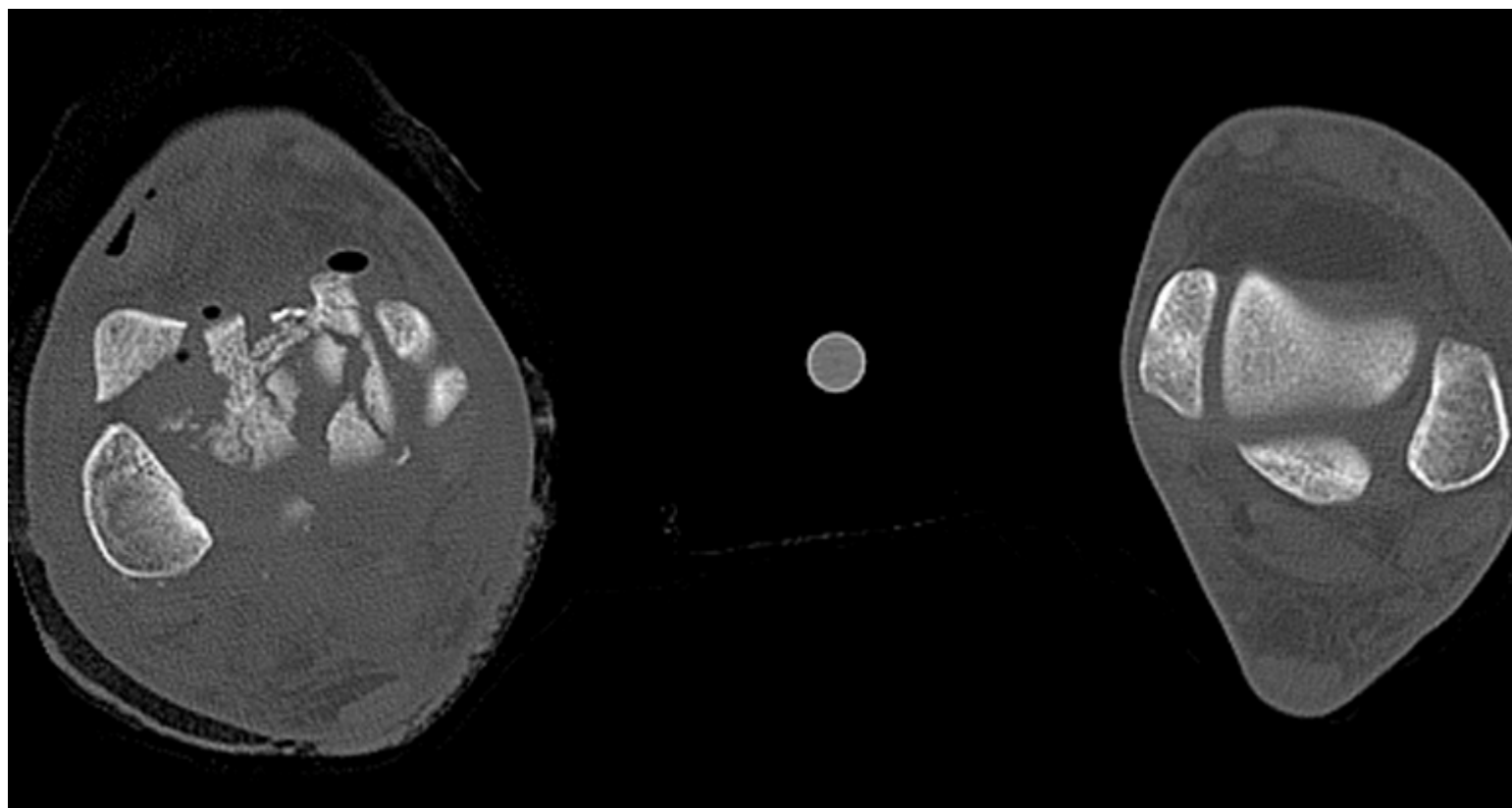


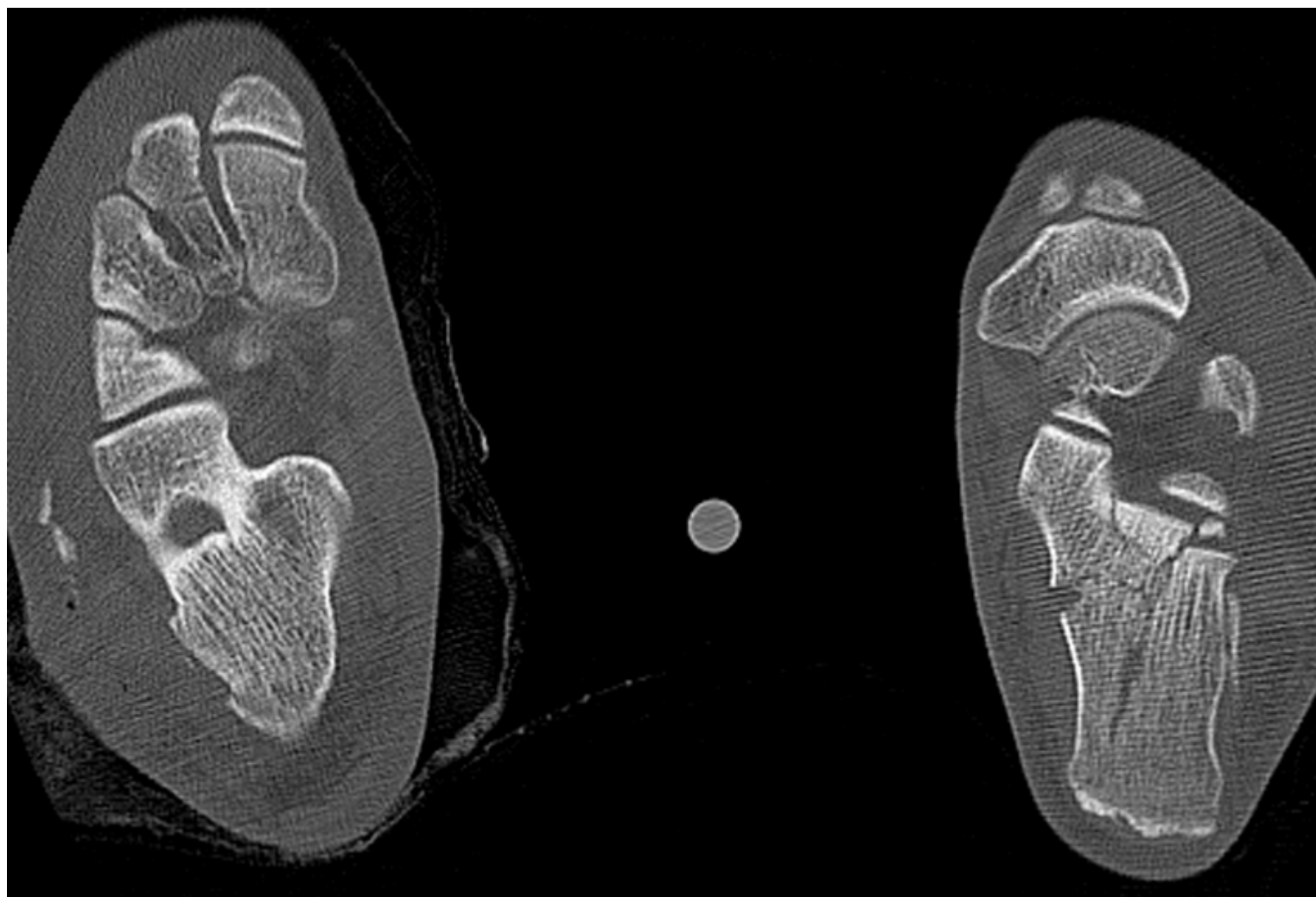


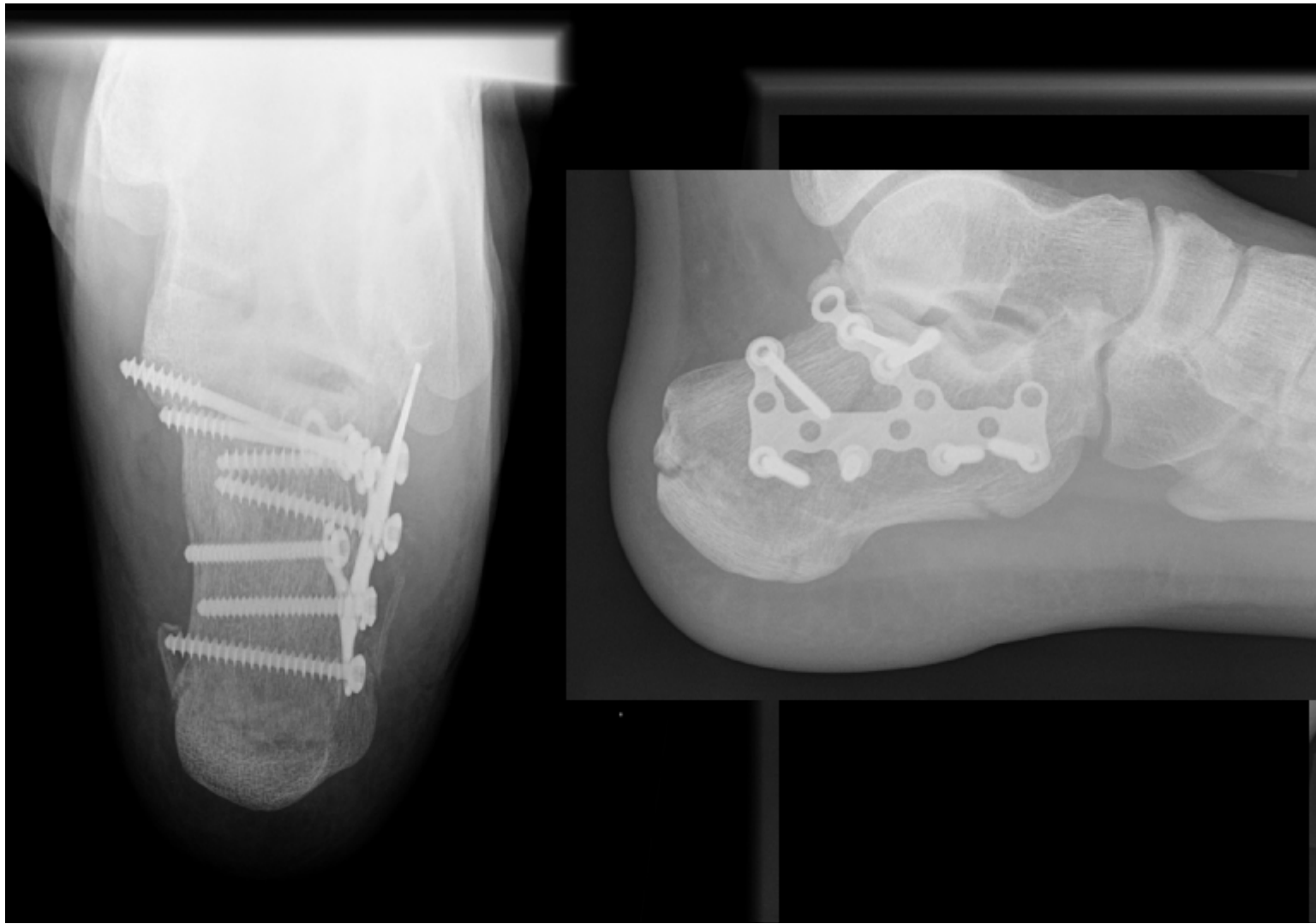
Case 5

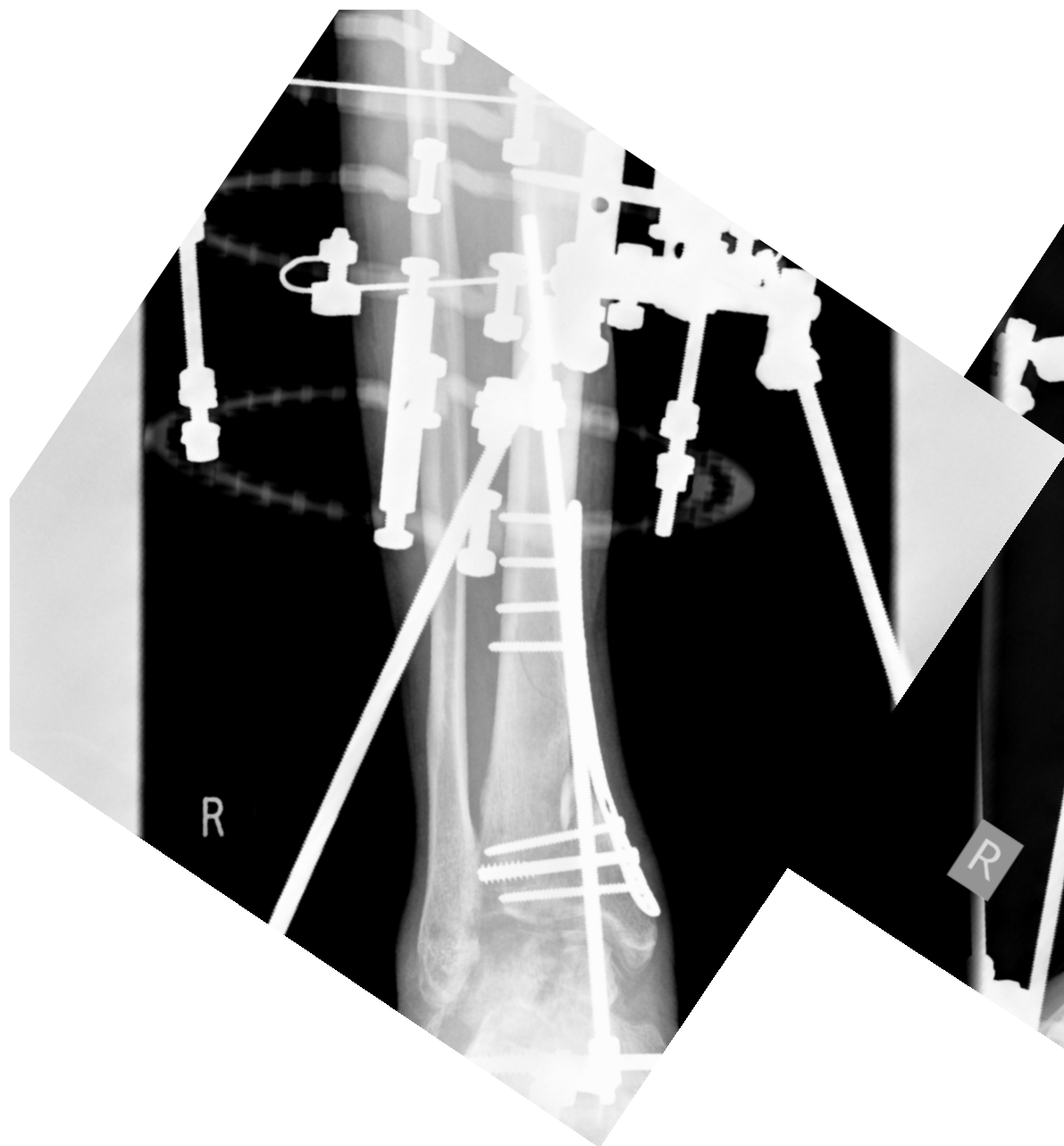














Operative methods:

- goal of restoring articular congruency
- shape and alignment of the calcaneus.

Operative treatment delayed until swelling has subsided.

A lateral approach with an extensile incision - the fewest soft-tissue complications.

Technique of choice: lag-screw  
fixation of the joint and plate  
fixation of the calcaneal body

Fluoroscopy to obtain Brodén's  
and axial radiographs.

Patients who have a highly comminuted Sanders type-IV fracture managed with an anatomical reconstruction of the calcaneus coupled with primary subtalar arthrodesis.