

Calcaneal Fractures

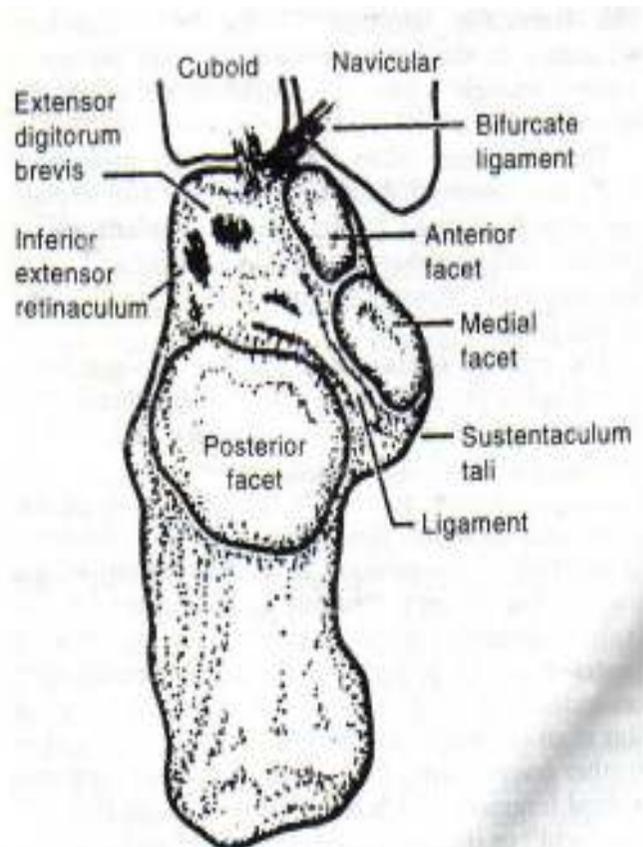


Figure 1. Superior aspect of left calcaneum.

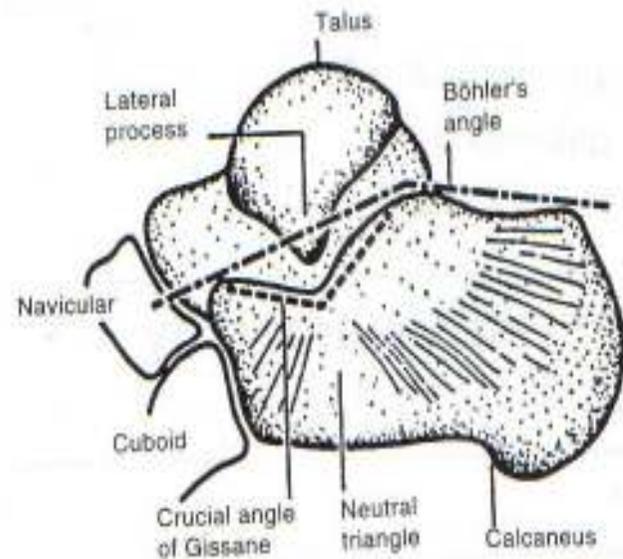


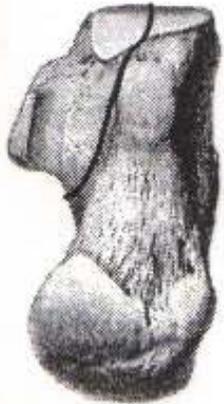
Figure 2. Lateral aspect of calcaneum. The lateral talar process initiates the primary fracture line through the neutral triangle.

Type of injury

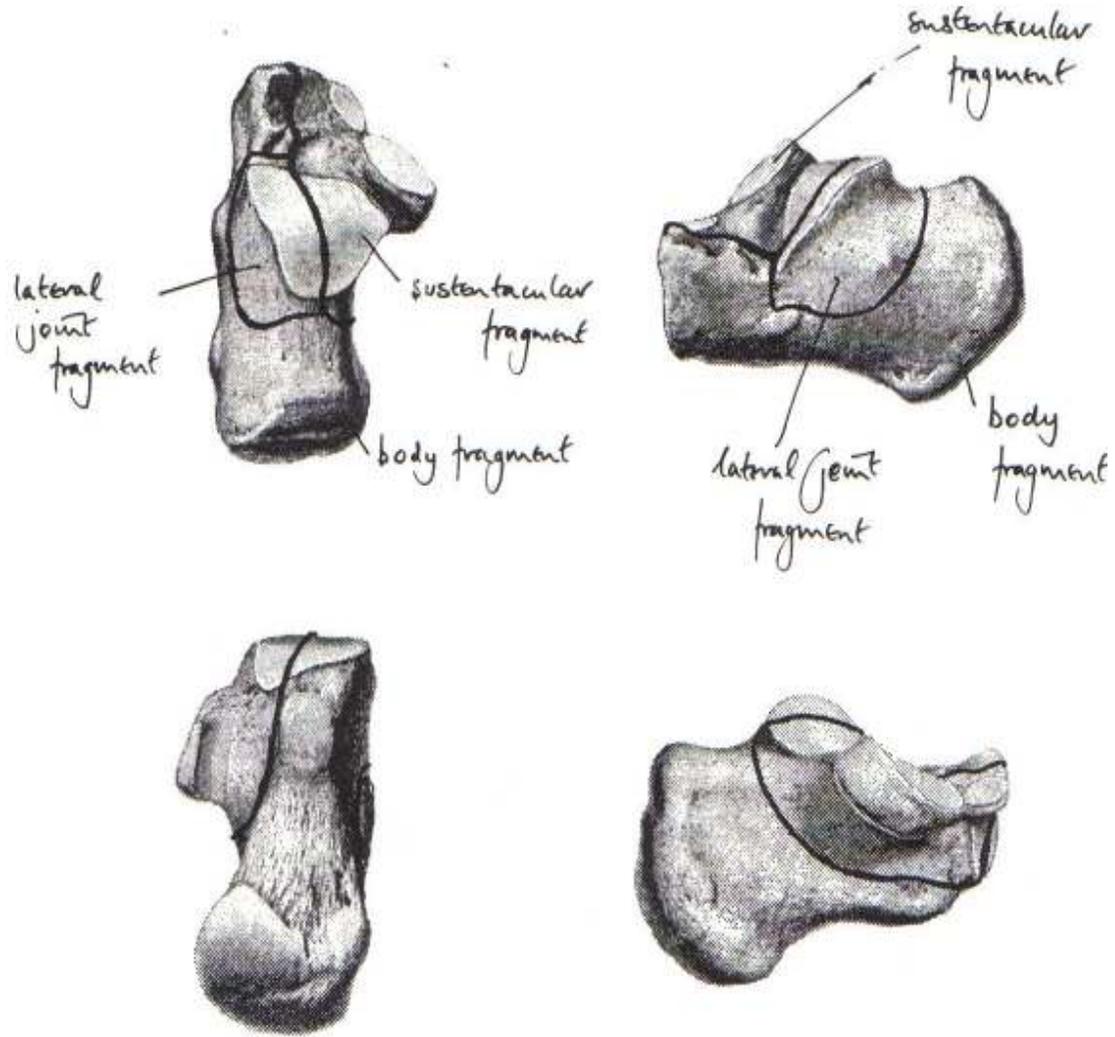
- Fall from a height
- Position of foot at impact
- Bone Quality
- Force of impact

- Essex Lopresti
 - Primary Fracture line
 - Secondary fracture line
 - Force directed posterior – compression
 - Force inferior – tongue type

1. THE PRIMARY FRACTURE LINE

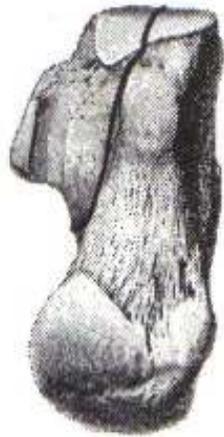
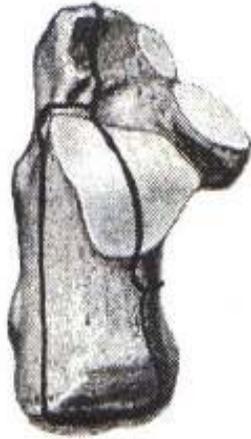


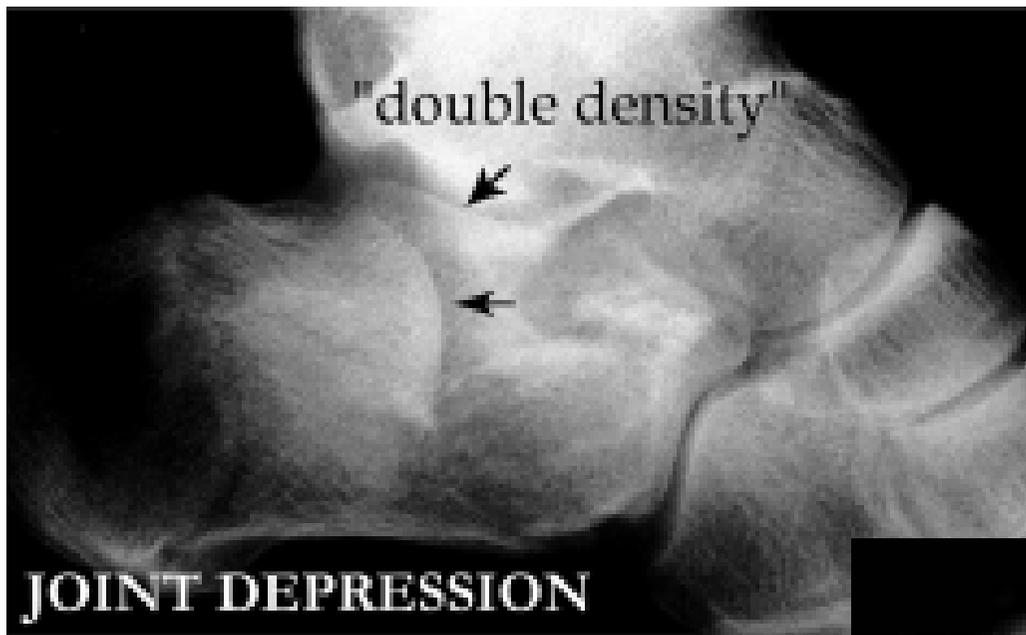
3. THE SECONDARY FRACTURE LINE
CENTRAL JOINT DEPRESSION FRACTURE



4.

THE SECONDARY FRACTURE LINE,
TONGUE TYPE FRACTURE.



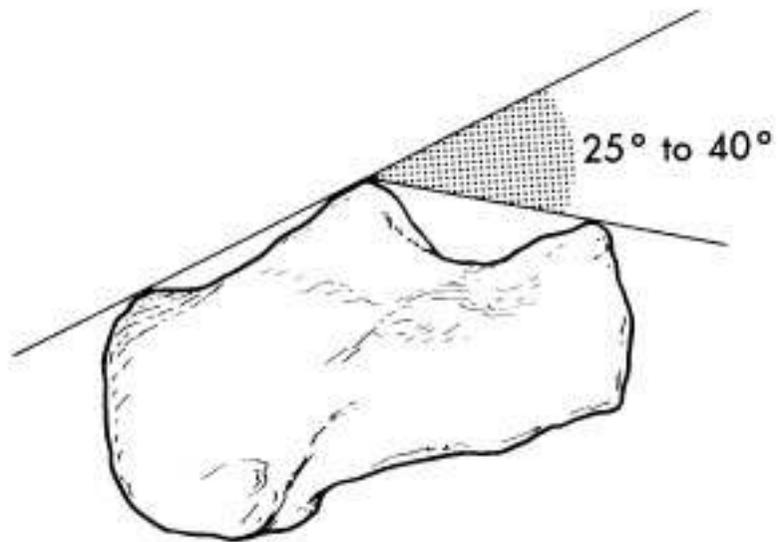


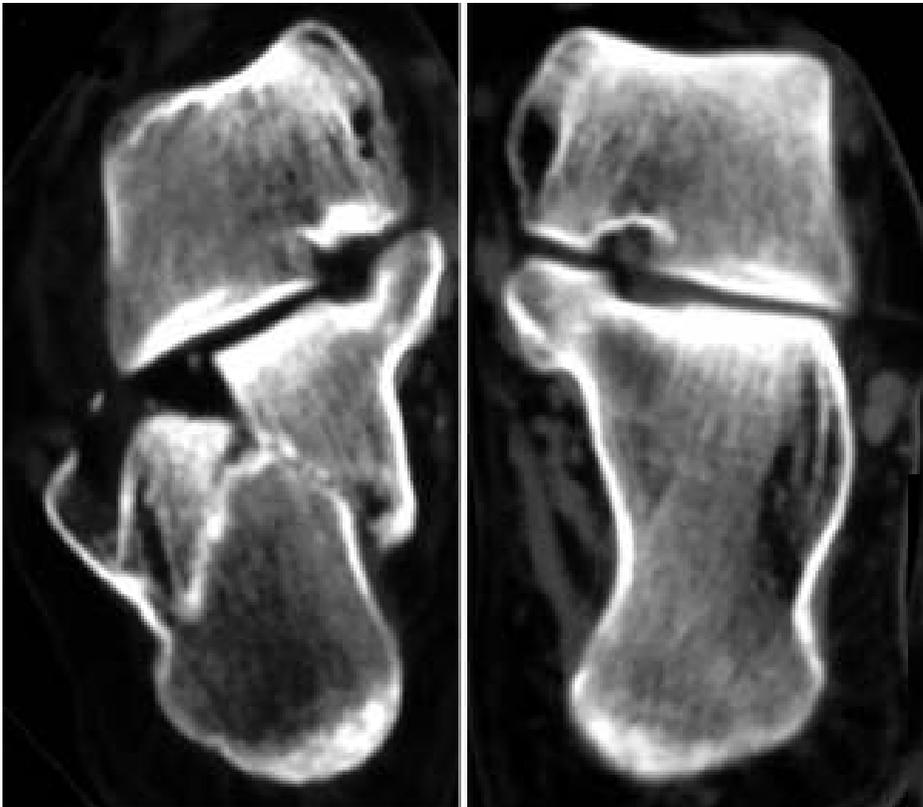


Böhler's angle

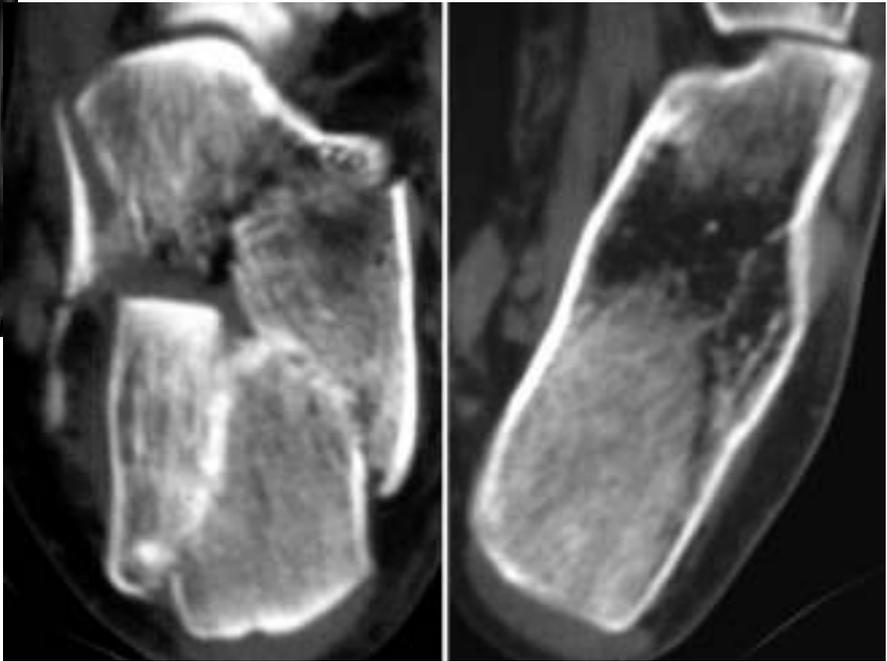


Crucial angle of Gissane





Coronal
Subtalar joint



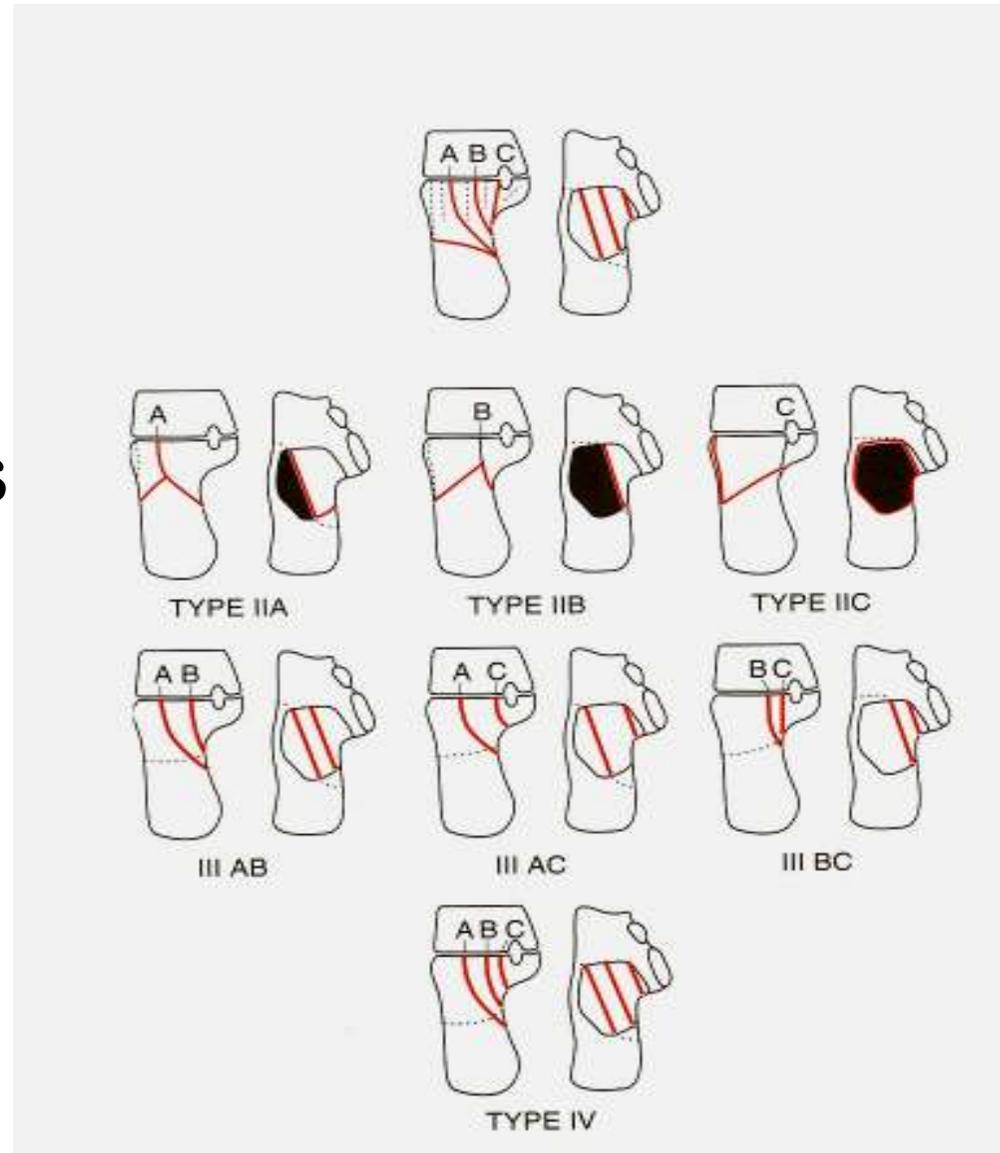
Transverse
Calcaneo-cuboid

Sanders classification

CT based

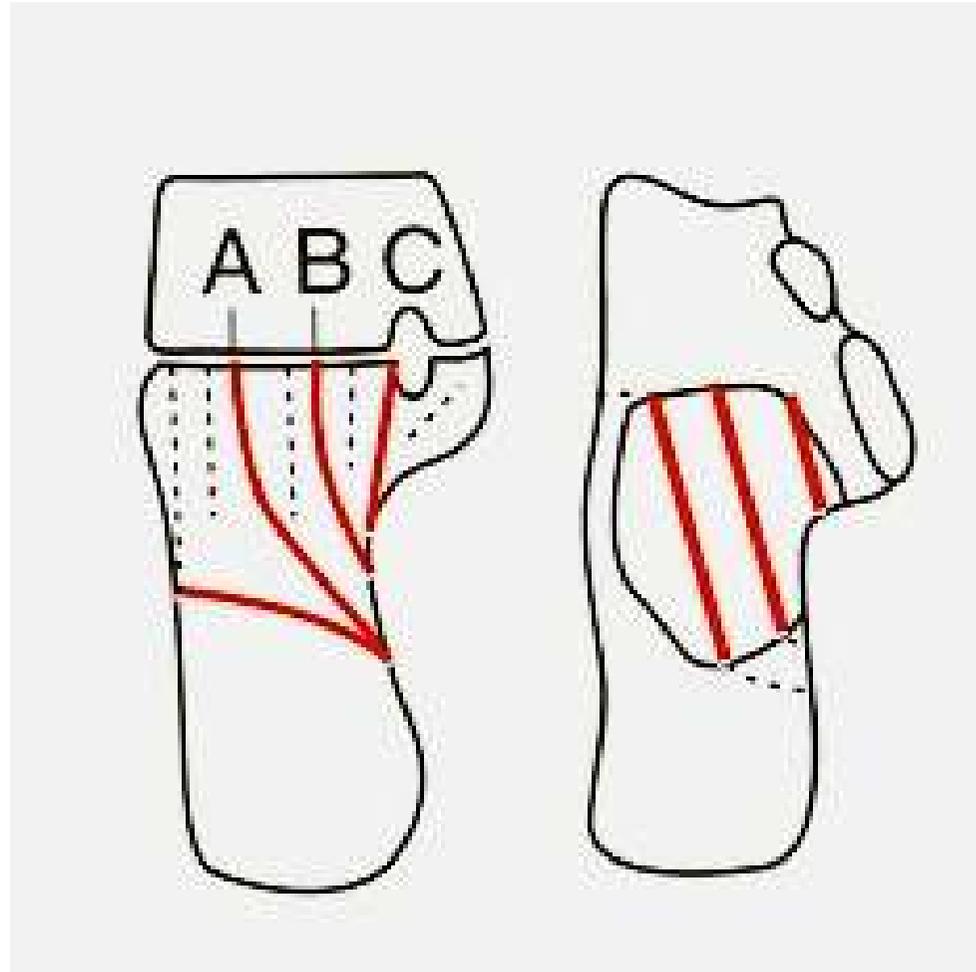
No. fracture lines

Correlation with
outcome



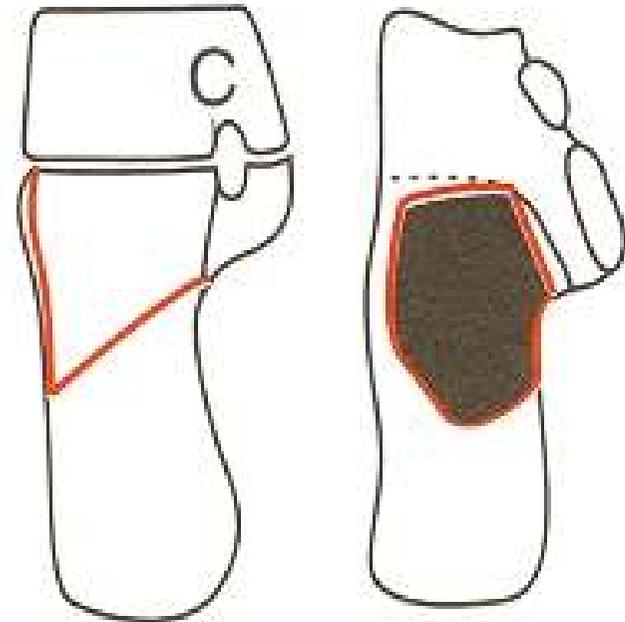
Sanders et.al

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



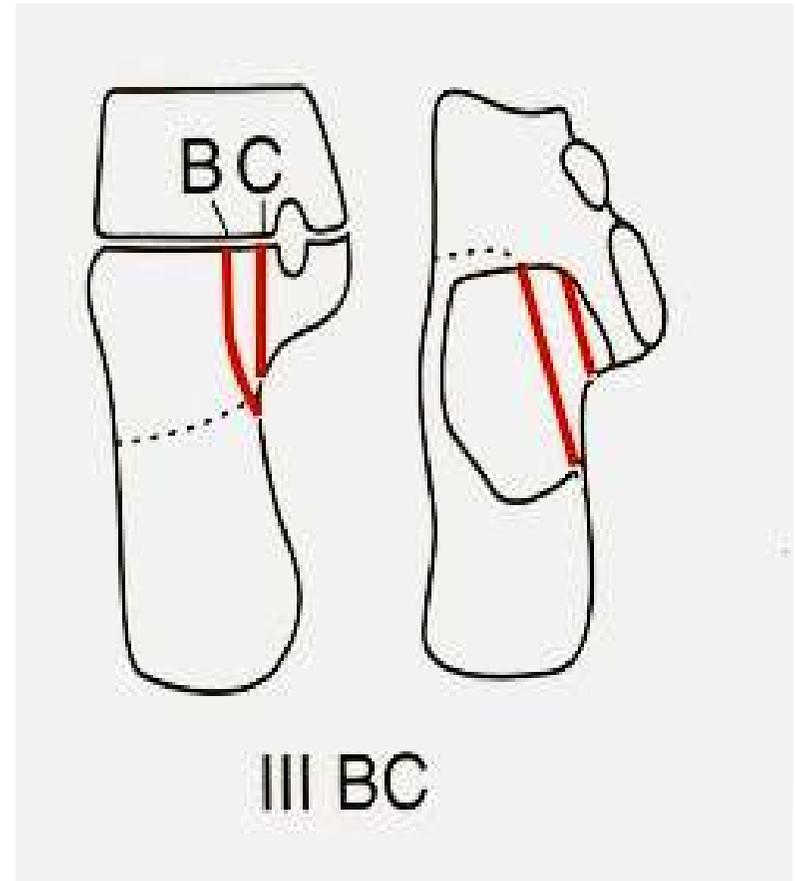
Type 1 Undisplaced

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

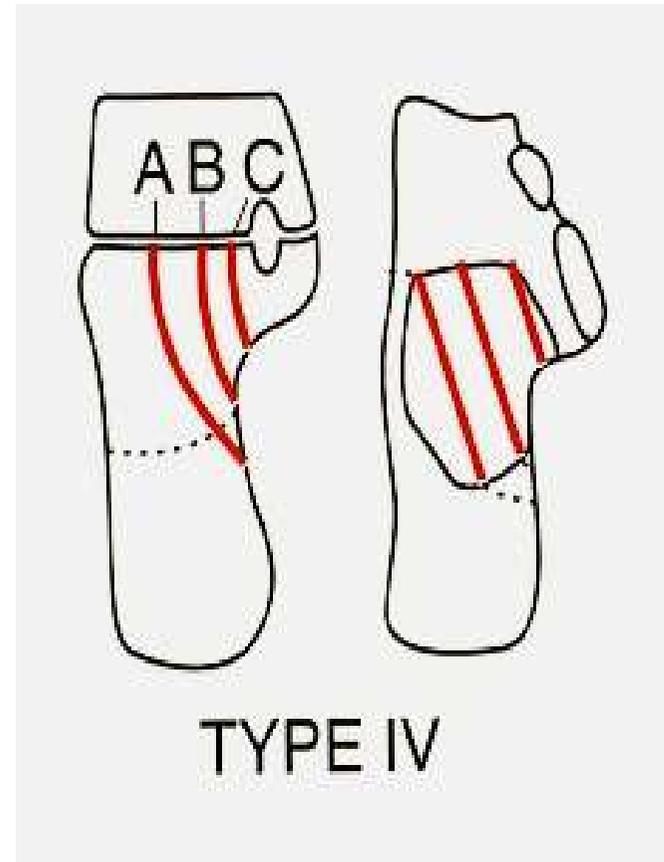


TYPE IIC

**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

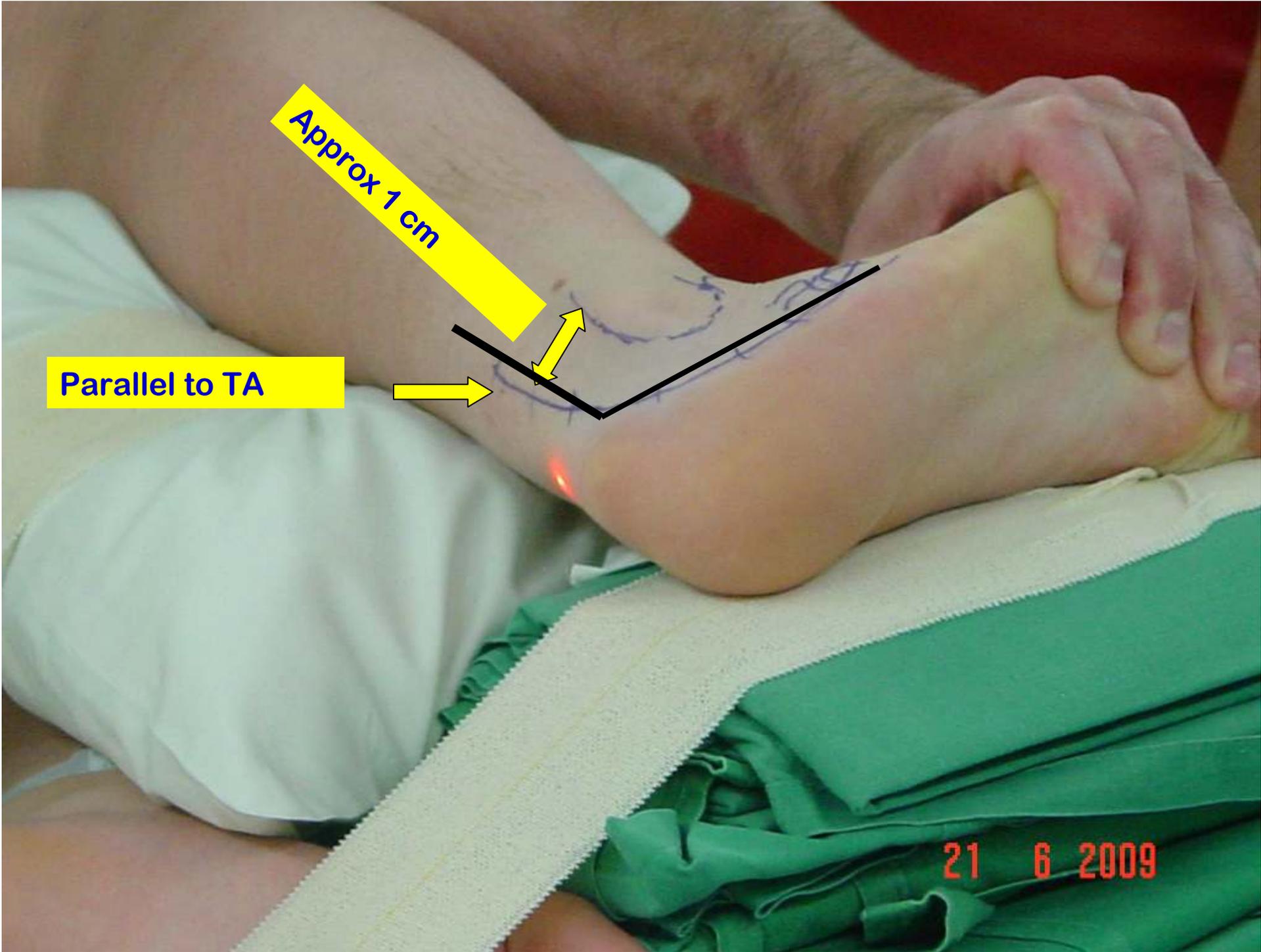
- Full thickness down to periosteum in 1 layer
- Elevate calcaneofibular and peroneal retinaculum in same layer
- Flap contains periosteum, peroneal tendons, artery and sural nerve with skin
- Schanz screw in tuberosity to manipulate
- Flip down lateral wall if appropriate, retaining soft tissue inferiorly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





21 6 2009





Approx 1 cm

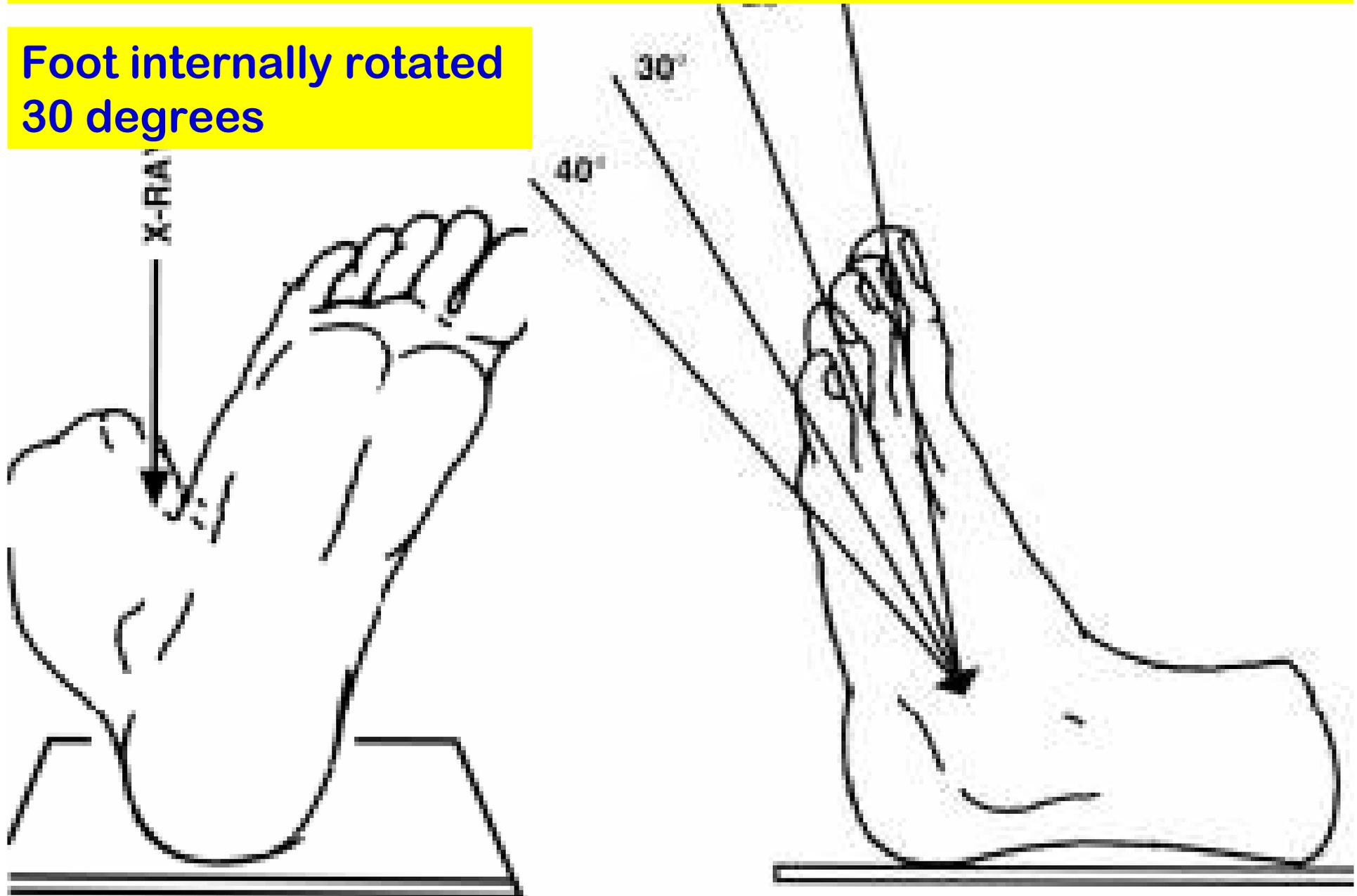
Parallel to TA

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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



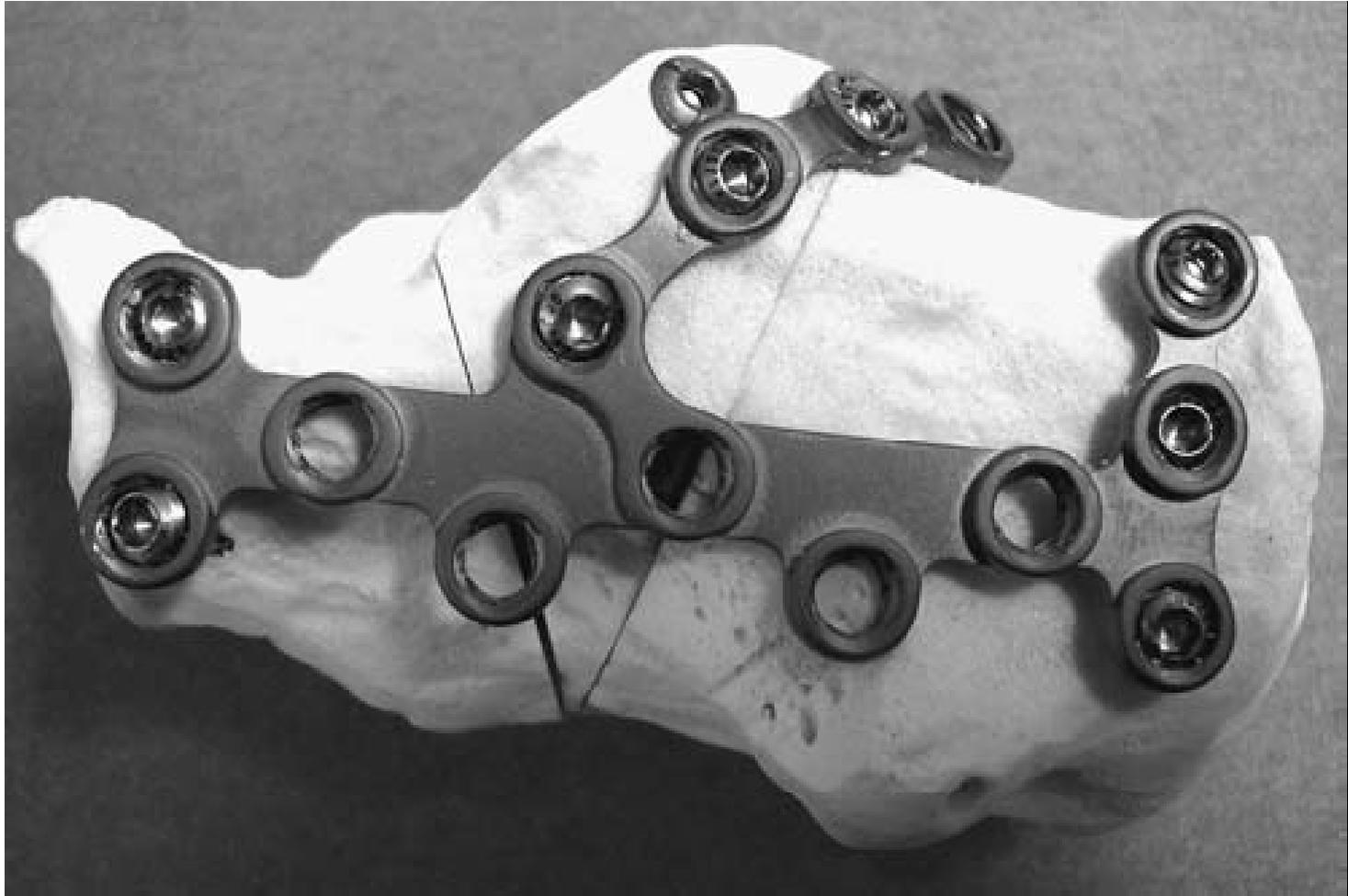
Filling the void

- **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**

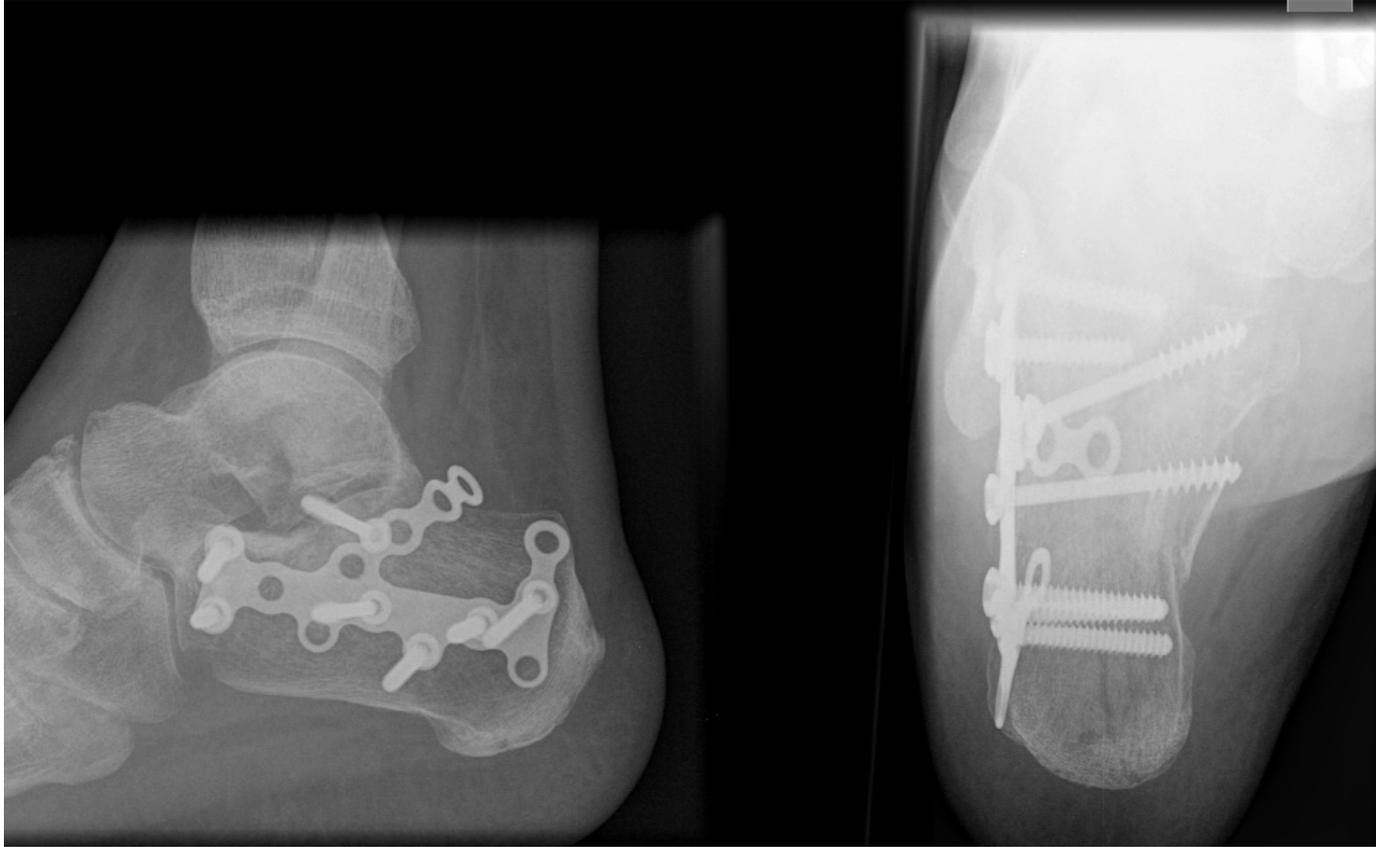
Prospective RCT Sanders IV

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

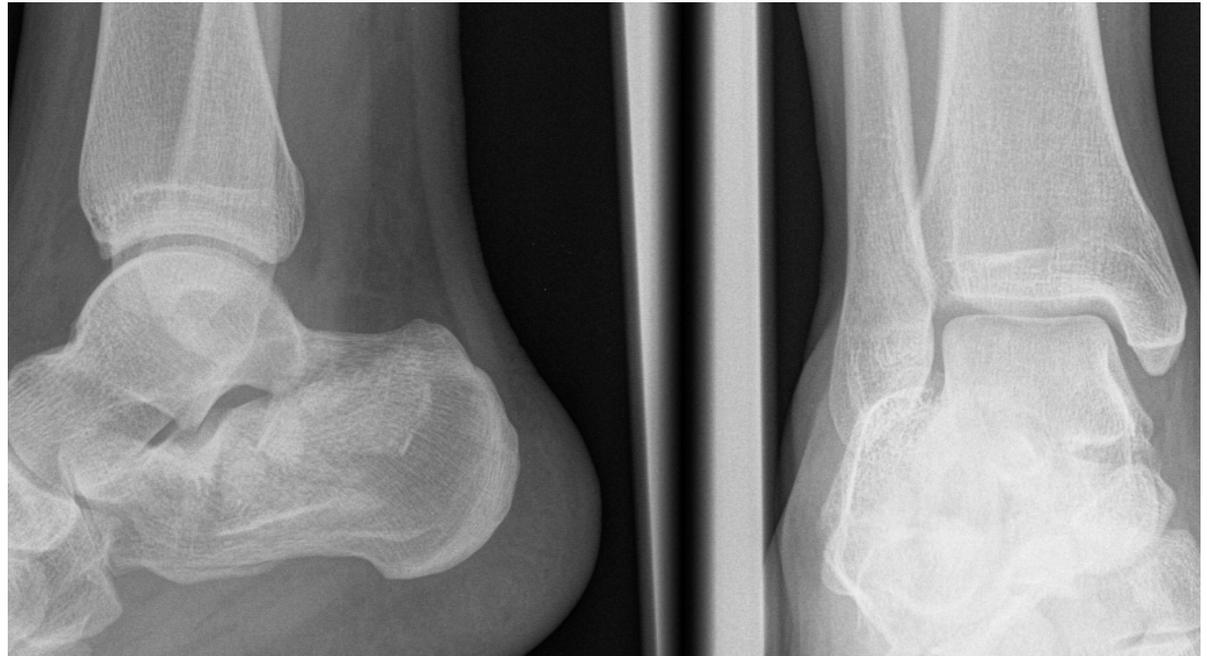
Case 1 – 49, male fit







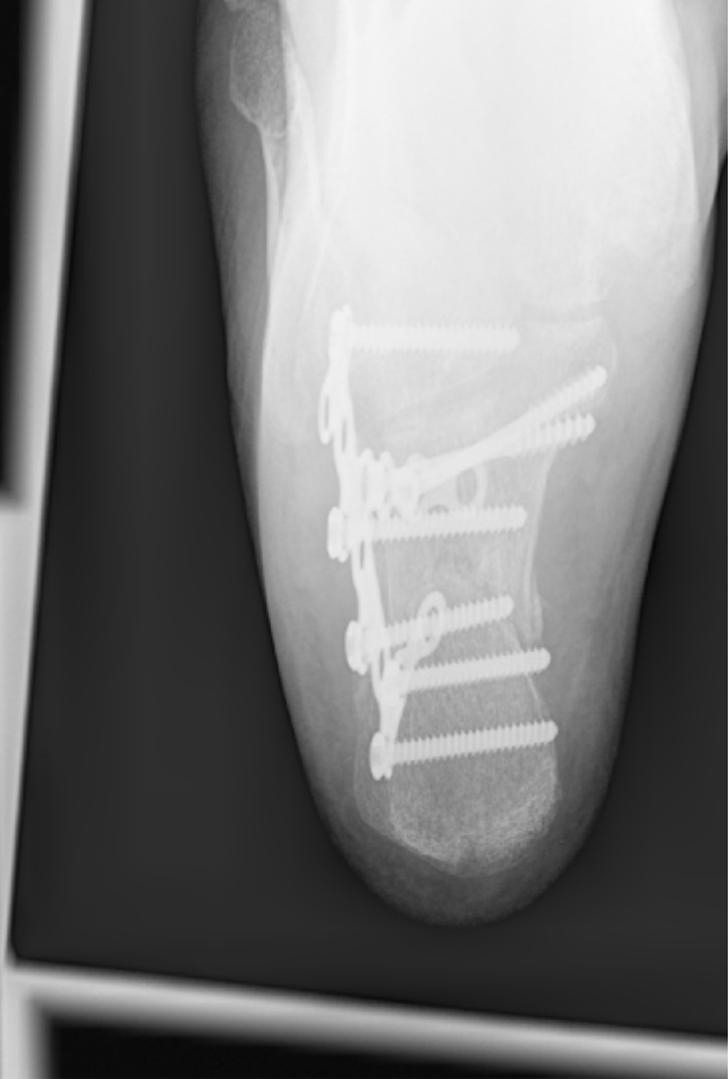
Case 2: 52 , Female, fit



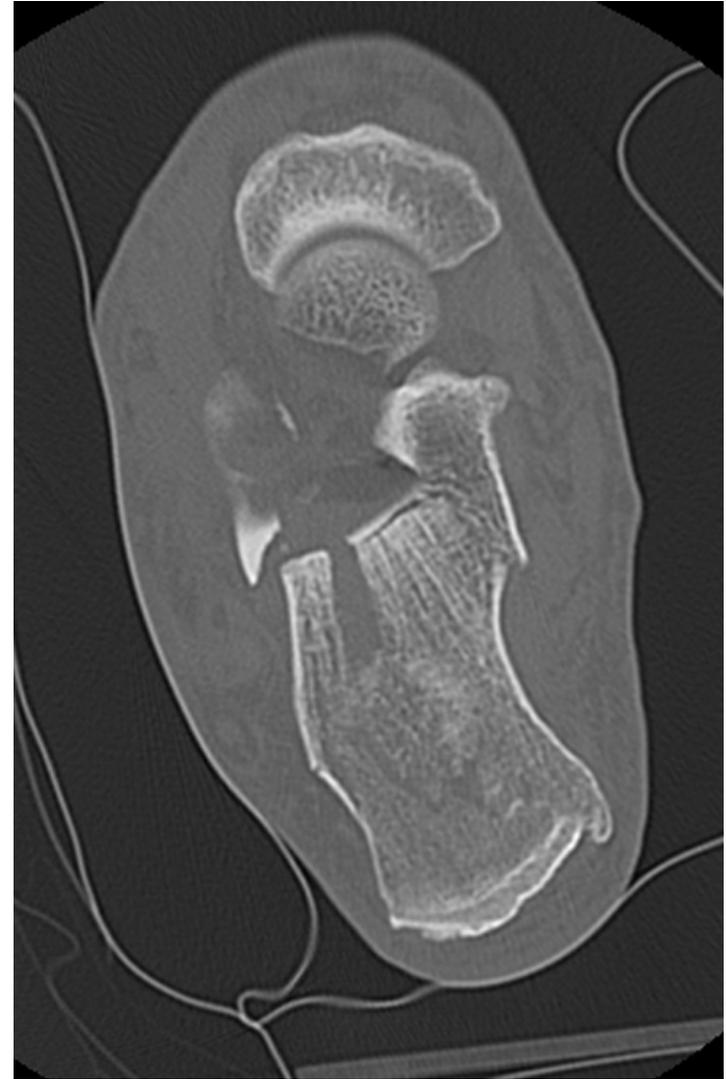


Case 3:





Case 4:

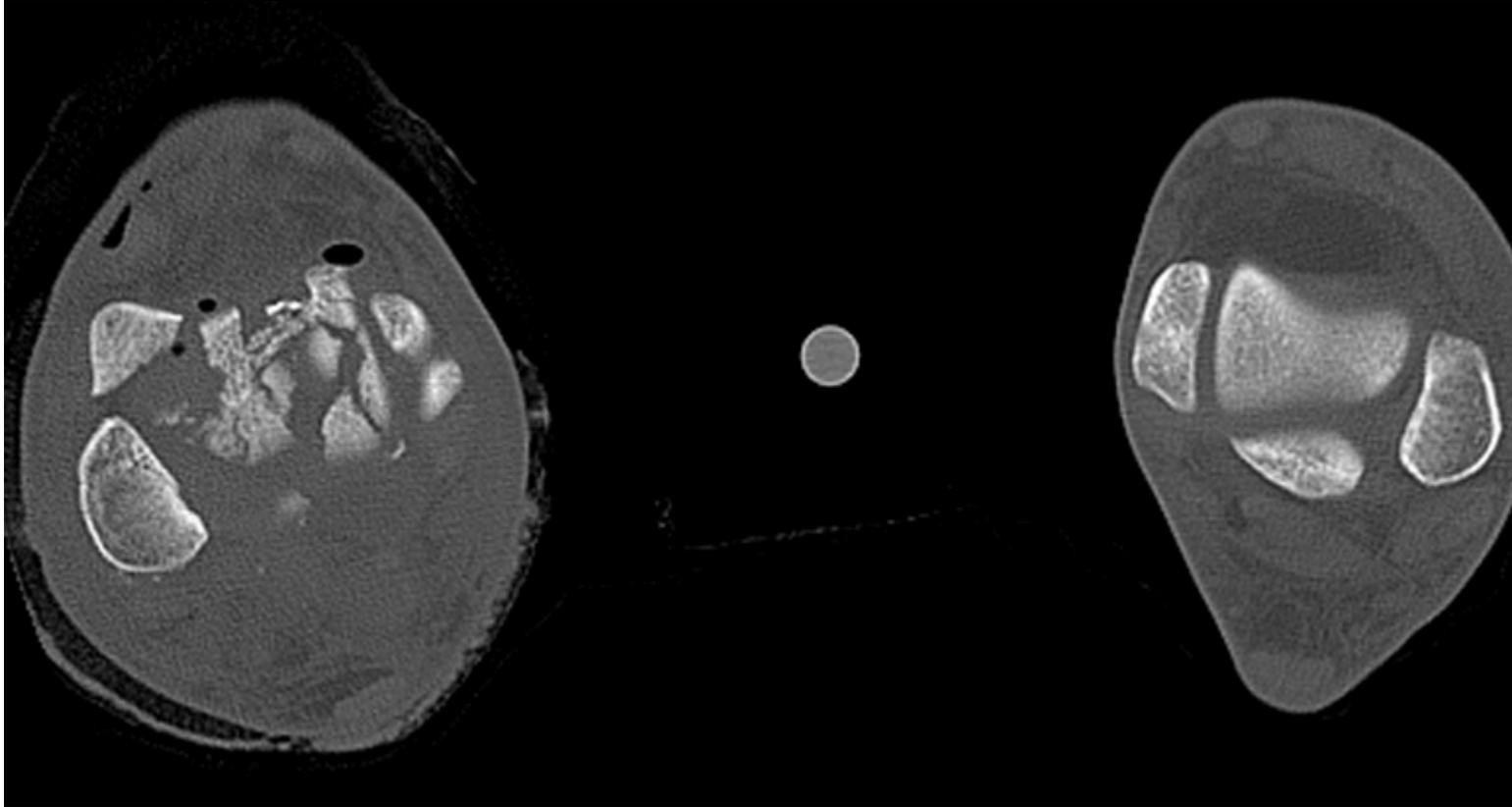


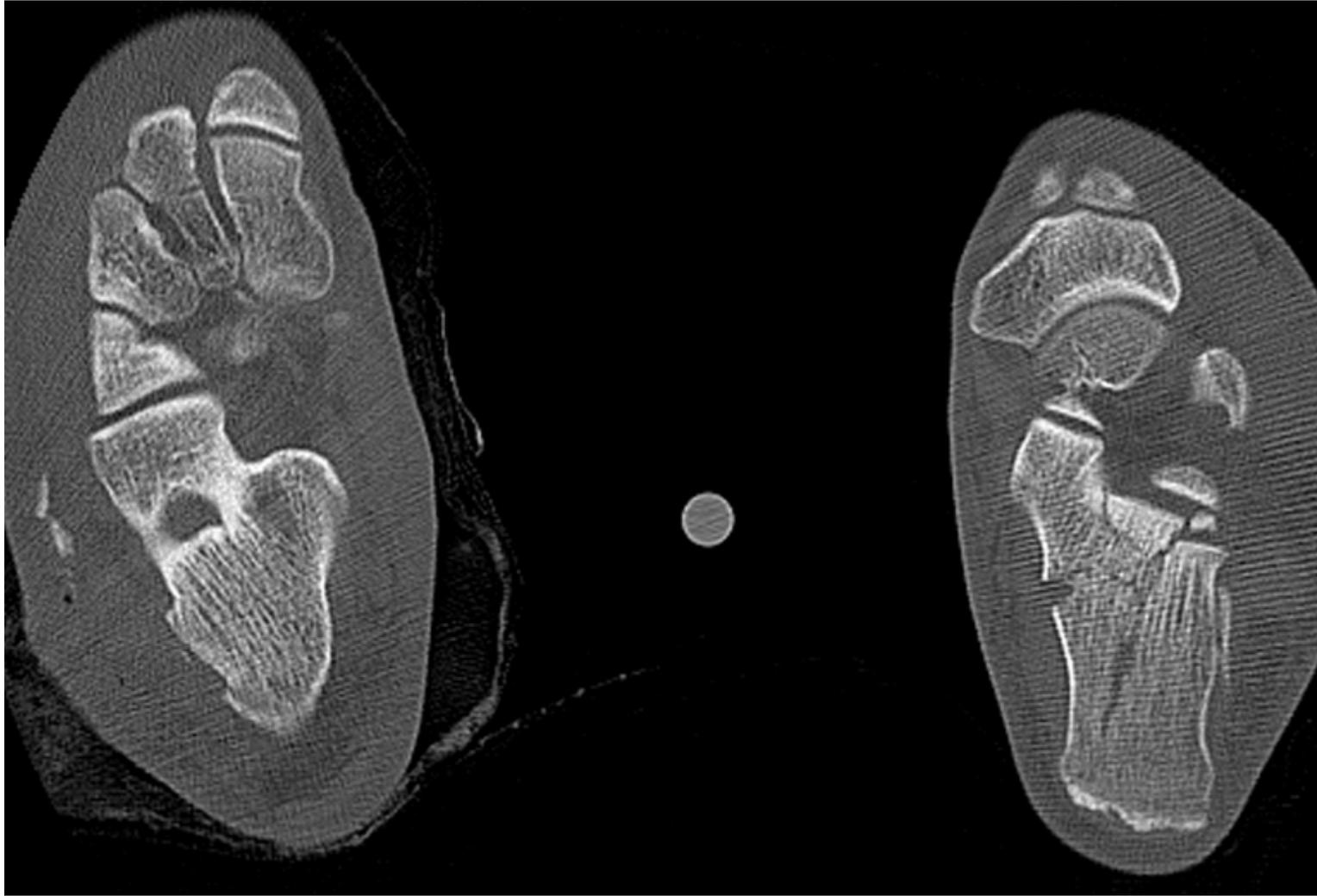


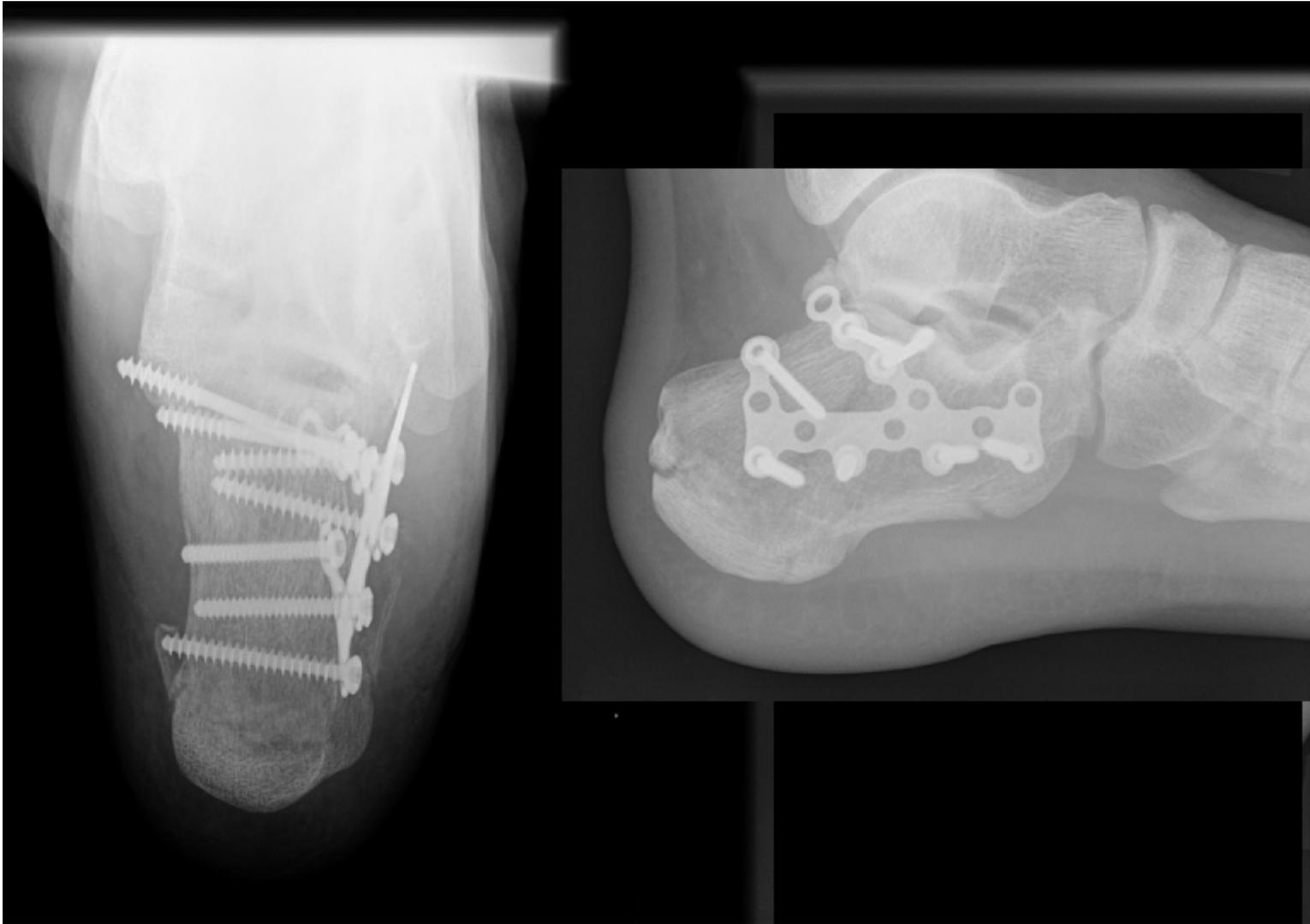
Case 5

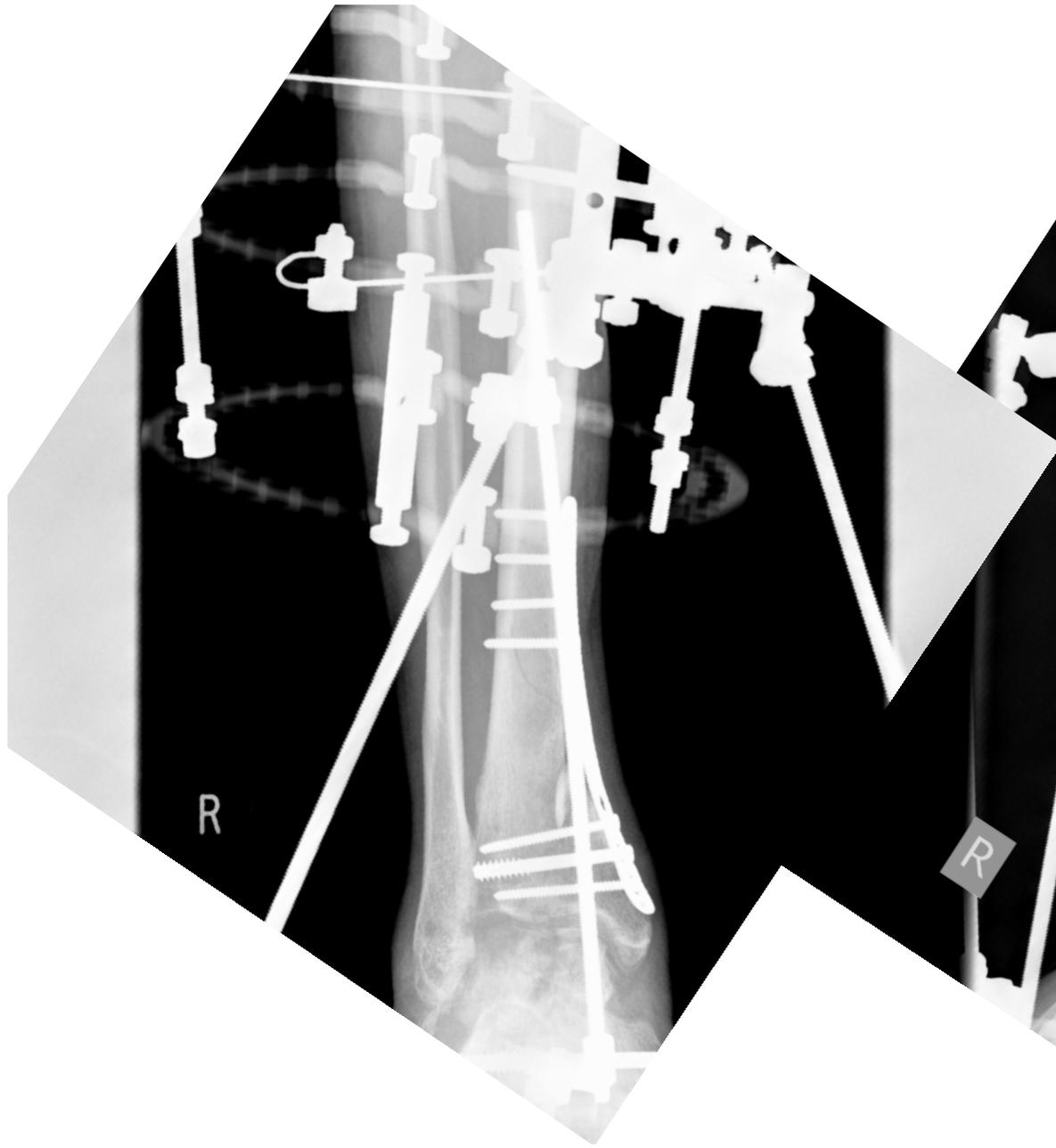












Operative methods:

- 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.