

Management of Calcaneal Malunions

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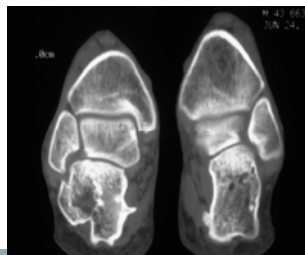
Calcaneal Malunions

- Key to treatment is understanding the complex pathoanatomy
- Not just subtalar arthrosis



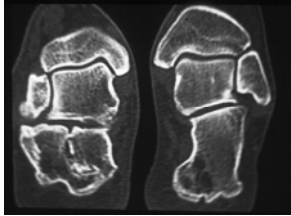
Calcaneal Malunions

- CT scan best demonstrates this pathoanatomy




Pathoanatomy

- **Lateral Impingement**
 - Subfibular
 - Peroneal tendons
- **Subtalar Arthrosis**
- **Hindfoot Angulation**



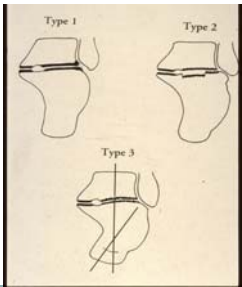
Pathoanatomy

- **Weight-bearing lateral**
 - Anterior Impingement secondary to loss of talar height and inclination




Calcaneal Malunions

- **Stephens and Sanders, 1996**
 - Developed classification system based on CT findings
 - 3 Types of malunions identified



Type I Malunion


- Lateral exostosis
- Lateral Impingement
- +/- Far lateral arthrosis



The diagram shows a lateral view of the ankle with a blue background. A red line indicates the normal axis, and a black line shows the axis shifted laterally. A small circle labeled 'Type 1' is at the tip of the lateral exostosis. The X-ray shows a lateral view of the ankle with a prominent lateral spur and joint space narrowing on the lateral side.

Type II Malunion

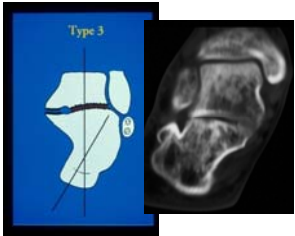
- Lateral exostosis
- Extensive subtalar arthrosis



The diagram shows a lateral view of the ankle with a blue background. A red line indicates the normal axis, and a black line shows the axis shifted laterally. A small circle labeled 'Type 2' is at the tip of the lateral exostosis. The X-ray shows a lateral view of the ankle with a prominent lateral spur and extensive joint space narrowing throughout the subtalar joint.

Type III Malunion

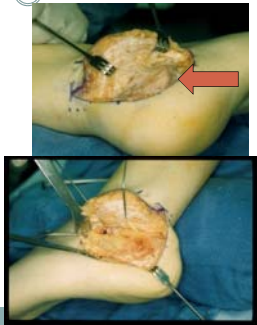
- Lateral Exostosis
- Subtalar arthrosis
- Varus or valgus angulation



The diagram shows a lateral view of the ankle with a blue background. A red line indicates the normal axis, and a black line shows the axis shifted laterally. A small circle labeled 'Type 3' is at the tip of the lateral exostosis. The X-ray shows a lateral view of the ankle with a prominent lateral spur, joint space narrowing, and a clear varus or valgus angulation of the ankle.

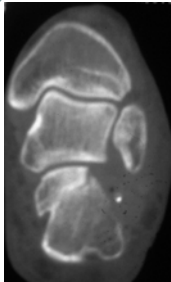
Surgical Treatment

- All 3 types have exostosis
 - Lateral decubitus position
 - extensile lateral incision
- Lateral wall exostectomy



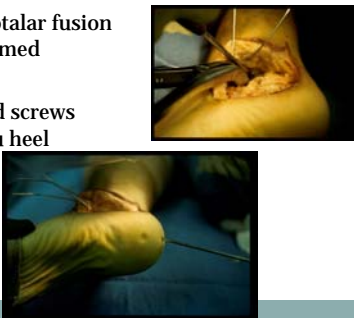
Type I

- May also need to remove the far lateral joint
- ROM started as early as possible
- Check ROM




Type II

- In situ subtalar fusion also performed
- Cannulated screws placed thru heel



Type II

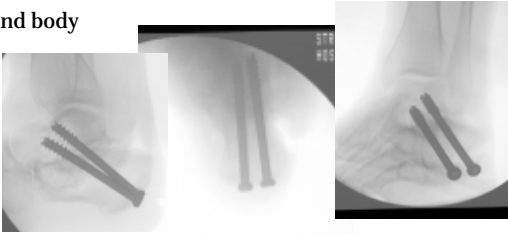
- Supplemental bone graft
 - Local (exostosis)
 - ICBG
 - Allograft



The slide shows an intraoperative photograph of a talar neck fracture being stabilized with two screws. Below it is a photograph of a jar containing allograft bone.

Type II

- Screws are placed in talar neck and body



The slide displays three X-ray views of a talar neck fracture. The first shows the fracture line. The second and third show the placement of two screws, one in the talar neck and one in the talar body.

Type II

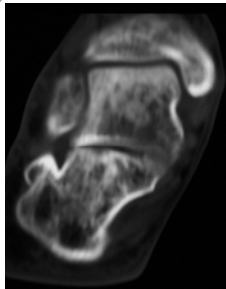
- Post-op
 - 10-12 weeks in cast
 - NWB 6 weeks



The slide shows a lateral X-ray of a foot with a talar neck fracture. Two screws are visible, one in the neck and one in the body of the talus.


Type III

- Subtalar Fusion
- Osteotomy to correct angulation

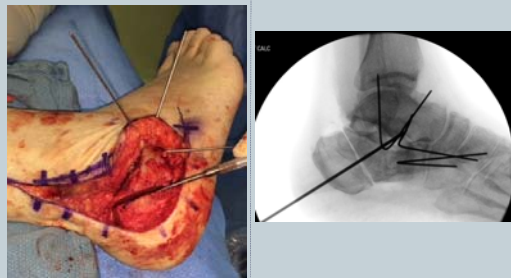


Type III

- Varus deformity
 - Lateral closing wedge(DWYER) osteotomy
- Valgus deformity
 - Medial slide



Osteotomy



Sanders Classification



- Does not address
 - loss of talar height
 - loss of talar inclination
 - indications for a bone block arthrodesis

Distraction Bone Block Arthrodesis

- Carr et al 1988
 - Subtalar bone block fusion
 - Restore height
 - Restore talar inclination
 - Relieve Anterior impingement




Distraction Arthrodesis

- Lateral decubitus position
- Posterolateral approach
 - Minimize wound problems

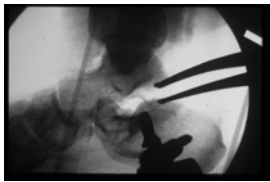


Ext.Lat vs PL approach



Distraction Arthrodesis

- Lateral wall exostectomy
- Medial femoral distractor (prevent varus)
- Lamina spreader



Medial ex fix



Bone Block: allograft vs autograft



Distraction

- Tricortical posterior iliac crest graft

- 2 screws
 - Fully threaded
 - Partially threaded



Bone Block Fusions

- Higher complication rate, **malunion** and **nonunion** with bone block fusions vs in situ fusions

Myerson & Quill, 1993

Flemister et al 2000

Easley et al 2000

- Bone blocks performed for more complicated malunions

Subtalar Arthrodesis

When is a bone block arthrodesis indicated versus an in situ arthrodesis?

Subtalar Fusion Bone Block vs In-situ

Good results with in situ fusions regardless of **talar height** or **talar inclination** provided **anterior impingement** was not present (2 to 5 yr f/u)



Chandler et al, 1999
Flemister et al, 2000

Anterior Impingement

- Painful forced dorsiflexion < 10 degrees
- Anterior ankle tenderness



Subtalar Fusion

- In situ fusion if anterior impingement is not present clinically

Complications

- Nonunion
- Malunion (usually varus)
- Wound healing
- Persistent Pain



Union Rate

- >90% in nonsmokers
- 75% in smokers
- Structural allografts also risk factor for nonunion

Persistent Pain

- On uneven ground
- Sural and tibial neuritis
- Heel pad pain

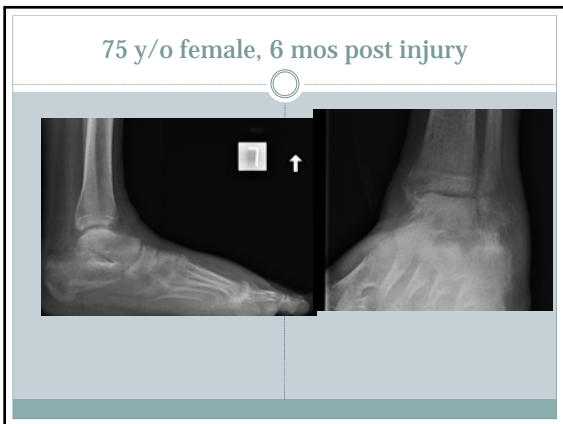
Timing of Surgery

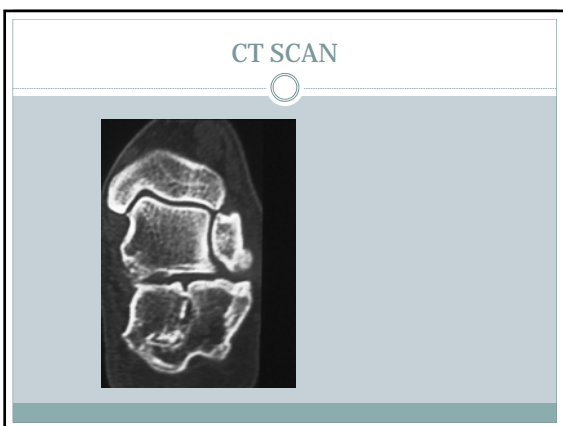
- 8 – 12 months after injury
- Sooner if significant lateral wall impingement



Post OP

- All fusions
- 6 wks NWB cast
- 4wks in wb cast
- Wean out of boot

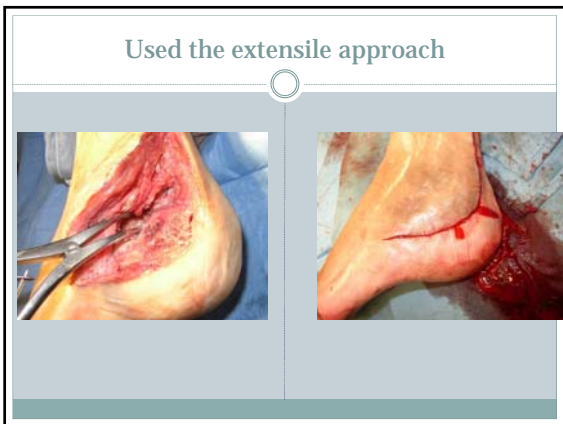




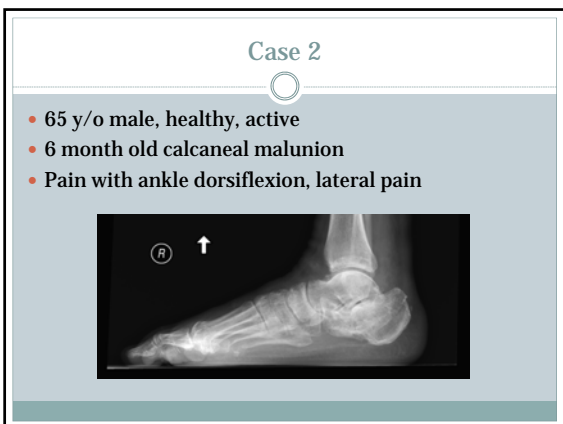
Question

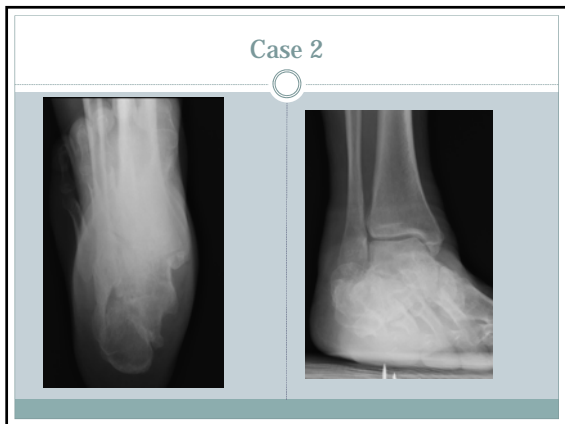
- Treatment for this 75y/0 with this calcaneal malunion? She has no anterior ankle pain, good dorsiflexion, and sub -fibular pain.

1. Osteotomy and repair without fusion.
2. Distraction bone block fusion with allograft.
3. Distraction bone block fusion with autograft.
4. In-situ fusion with lateral wall exostectomy.

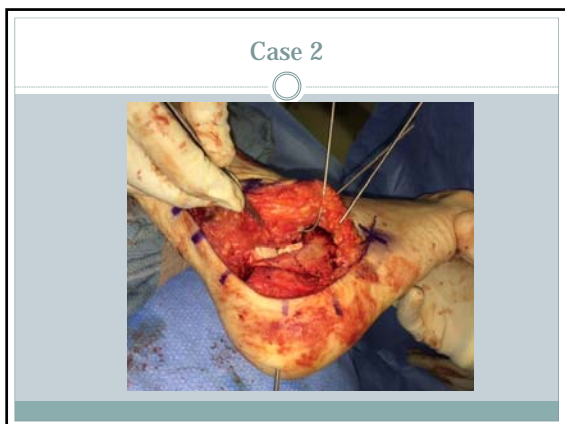


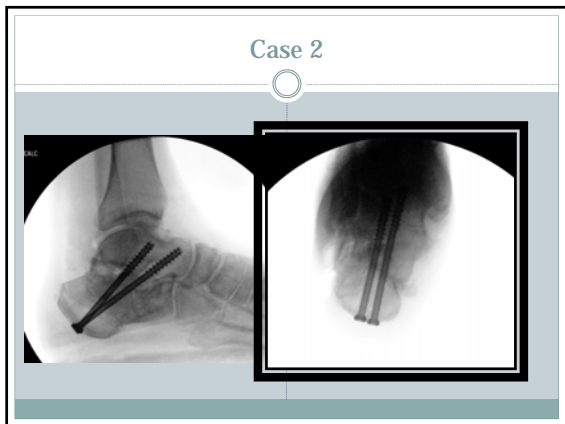












Prevention of Malunion

- Adequate ORIF in appropriate patients
- Radney et al JBJS 2009
 - Better results following subtalar fusion if they had initial ORIF

Summary

- Follow the Sanders protocol for Type 1,2,3 malunions (does not address talar height)
- Bone Block arthrodesis for anterior impingement

