Fractures of the Talus

Anatomy Review

- The talus articulates with the tibia and fibula at the ankle, dividing planes of movement into directions: dorsi/pantar-flexion at the tibiotalar joint, and rotation at the subtalar joint.
- Talus itself is 60% covered by articular cartilage, and lacks any muscular insertions thereby compromising vasculature.
- Composed of dome + body, and neck + head
  - Lateral and posterior processes
  - Dome wider anteriorly, allowing for tighter stability in mortise upon dorsiflexion
- Neck meets body at an angle of 15-20° medially
- Ligaments:
  - Lateral talocalcaneal (lateral process)
  - Anterior talofibular (neck of talus)
  - Posterior talofibular (lateral tubercle of posterior process)
  - Deltoid ligament – both deep part (inserts below comma-shaped facet on medial surface), and posterior portion of superficial part (medial tubercle of posterior process)
  - *In between the medial and lateral tubercles of the posterior process is a groove in which the FHL tendon runs.*
  - Spring ligament (plantar calcaneo-navicular ligament) runs underneath head of talus to support it and prevent downwards depression during weight bearing. It is strengthened by the tibialis posterior to maintain the medial longitudinal arch.
- Sinus Tarsi – funnel-shaped and lies on lateral under surface of neck. This narrows medially to be in continuation with the tarsal canal – containing a vascular anastomotic loop from the artery of the sinus tarsi and the artery of the tarsal canal. This anastomosis sends numerous branches into the talar neck to supply the neck, head and body.
Blood supply:
- Artery of sinus tarsi – receives communicating branches of peroneal artery (perforating br.) and dorsalis pedis (lateral tarsal artery)
- Artery of tarsal canal (br. posterior tibial artery)
- Dorsalis Pedis → direct branches to supply dorsal surface of neck and head
- Peroneal artery → direct branches to posterior process of body
- Deltoid br. of artery of tarsal canal principally supplies medial 1/3 of body.

Subtalar Dislocation
- Often in conjunction with a fracture, but pure dislocation can occur in athletes.
- Talus remains in ankle mortise, but disruption of talo-calcaneal and talo-navicular ligaments
- Common mechanism is a fall from a height, or inversion onto a plantar flexed foot: talus rides dorsal and laterally over navicular, while foot & calcaneus lie medially
- Closed reduction usually possible in 80%, followed by NWB below-knee cast for 6 weeks.

Pantalar Dislocation
- High energy open injuries associated, and much less frequent
- Controversial whether to routinely discard the talus is extruded without any soft-tissue attachments, but poor prognosis with high rates of avascular necrosis (AVN) and infection.

Talar Neck Fracture
- Forced dorsiflexion injury or axial loading, where anterior tibial plafond strikes neck of talus causing an extra-articular fracture
- 25% associated with adjacent fracture (e.g. of malleoli)

- The Hawkin’s Sign:
  - A subchondral radiolucent band in the talar dome at 6-8 weeks post injury, seen on an AP-mortice view of the ankle
  - Represents re-vascularisation of talar body, and sufficient blood supply to allow for disuse osteopaenia from resorption
  - Absence is worrisome for AVN.

- Hawkin’s Classification
  - I – undisplaced neck fracture
  - II – displaced neck fracture with body subluxation at subtalar joint
  - III – displaced neck fracture with body subluxation at subtalar & tibiotalar (ankle) joints
  - IV – displaced neck fracture with pan-talar dislocation (including talo-navicular joint)

- Surgery is indicated if 3-5 mm over displacement at the neck fracture, or if any rotation (frequently varus).
  - Achieved by ORIF via antero-medial incision (medial malleolus to navicular tuberosity) or anterolateral incision (lateral to extensor tendons and in line with 4th metatarsal)
  - Place retrograde K-wires inferiorly to avoid impingement during plantar flexion
- Lag screw compression using cannulated screw in antegrade or retrograde direction, with countersink again to avoid impingement.
- NWB for 10-12 weeks.

Complications:
- Post-traumatic arthritis – ankle 15%, subtalar 50% *(Elgafy H 2000, Foot & Ankle International)*
- Avascular Necrosis
  - I = 10%
  - II = 30%
  - III = 90%
  - IV = almost 100%
- Infection – up to 30%

Talar Body Fractures
- Axial loading or forced dorsiflexion mechanism again.
- Often intra-articular fracture with line running from ankle joint superiorly to subtalar joint inferiorly

Boyd & Knight Classification:
- 1 = coronal or sagittal shear
  - A = undisplaced
  - B = displaced at dome surface
  - C = displaced with subtalar dislocation
  - D = displaced with subtalar and tibiotalar dislocation
- 2 = horizontal – may be associated with crush and loss of height

Surgical treatment recommended with ORIF screw fixation, attempting to maintain height. Medial malleolar osteotomy may be required.

Complications include arthritis and AVN.

Talar Head Fracture
- Usually from impaction or crush mechanism (compression fracture)
- Assess for adjacent fractures.
- Undisplaced fractures treated in NWB plaster boot for 6 weeks.
- If displaced attempt ORIF and anatomical reduction with countersunk screws or bioabsorbable pins. Small comminuted fragments may simply be excised.

Posterior Process Fractures
- Medial tubercle avulsion during forced ankle dorsiflexion with pronation
- Lateral tubercle fracture during forced plantar flexion (seen playing football or ballet-dancing)
- Treatment is generally immobilisation and NWB for 6 weeks; excise if chronic symptoms.
- May need CT as difficult to pick up on x-ray.
Lateral Talar Process Fracture (Snowboarders’ Ankle)

- Usually from forced eversion, axial loading and dorsiflexion, and often mistaken for a sprain from the history and clinical findings. The pain is usually more inferior to lateral malleolus, and untreated will be refractory.

- The lateral process of the ankle includes weight-bearing articulations between the fibula and talus, all the way through to the middle facet articulation of the talus and calcaneus.

- Type 1 = simple vertical fracture line (entire lateral process)
- Type 2 = comminuted vertical fracture line (entire lateral process)
- Type 3 = chip fracture of antero-inferior portion involving only middle facet articulation of talus with sustentaculum tali of calcaneus

- Undisplaced → NWB 6-8 weeks in below knee plaster boot
- Displaced → ORIF if large fragment, and late excision if symptomatic a small fragment(s)

Osteochondral Lesions of the Talus (Osteochondritis Dissecans)

- Detachment of a segment of cartilage and subchondral bone from the articular surface of the talus
  > This can be an acute event, or chronic if it leads to a non-union (the classic osteochondritis dissecans)
  > 60% posteromedial – deeper and traumatic in 70%; usually caused by a recoil injury after plantarflexion and inversion
  > 40% anterolateral – broad and wafer like, and traumatic in 98% caused by inversion and dorsiflexion

- Berdt & Harry Classification (1959) – CT and MRI classifications very similar principles:
  > 1 = small area of subchondral bone impaction
  > 2 = partial detachment of fragment
  > 3 = complete detachment but no displacement
  > 4 = osteochondral loose body

- Symptoms:
  > Typically occurs in conjunction with ankle sprain: ecchymosis, ligament pain, swelling and limited ROM.
  > Difficult to differentiate from ankle sprain in the acute phase.
  > Chronic injury presents with activity-related pain and intermittent swelling
  > Locking is rare
  > Assess for tenderness on palpation at the interval between the talus and tibiofibular ligament (anterolateral talar dome)

- X-rays should include mortise view in plantar flexion (posterior talar dome) and dorsiflexion (anterior dome). MRI or CT usually needed to visualise.

- Medial sided injuries have greater potential for healing. Therefore up to grade 3 medial lesions and grade 2 lateral lesions can be trialled for 6 months with conservative treatment: walking boot or cast for 6 weeks followed by physiotherapy.
Surgical options – based on arthroscopic classification for stability.

- A = smooth and intact, but softening (stable)
- B = rough surface (stable)
- C = fibrillations or fissures (stable)
- D = flap with bone exposed (unstable)
- E = loose, non-displaced (unstable)
- F = displaced

Acute OLT that are stable can be treated with retrograde drilling. If overlying cartilage is not completely intact, it can be debrided to a stable rim.

Acute unstable OLT treated with internal fixation using Herbert screws, K-wires or bioabsorbable pins/screws. Medial sided lesions may require a medial malleolar osteotomy.

Chronic lesions:
- 1 & 2 = drilling with curettage of any cystic lesions; large cysts may need bone grafting
- 3 & 4 = excision of loose bodies with non-viable cartilage, with debridement and drilling of base. Rarely if fragment is viable it can be internally fixed.
- Autologous osteochondral grafting (mosaicplasty)
- Autologous chondrocyte implantation (ACI) using cultured chondrocytes.