Fractures of Talus

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SpR
RBH/Poole
Plan

- Anatomy
- Blood Supply
- Fractures Neck/ Body/ Lateral process
- Treatment
- Avascular necrosis
- Clinical cases
Talus/Astragalus = Dice

Romans:
Heel bone of horse --Taxillus-- Talus

Greeks:
C2 vertebra of sheep --- astragalos
Talus

- 60% covered by articular cartilage
- No muscular attachments
- Blood supply limited to non-articular surfaces
- More weight per unit of area is borne by the superior surface of the talus than by any other bone
Superior surface
Inferior surface

- For plantar calcaneonavicular ligament.
- For navicular bone.
- Anterior calcaneal articular surface.
- Sulcus tali.
- Posterior calcaneal articular surface.
- Lateral tubercle.
- Sulcus for Flexor hallucis longus.
- Middle calcaneal articular surface.
Tarsal canal / Sinus tarsi
Tarsal canal/Sinus tarsi

- Funnel shaped
- Tarsal canal: sulci of calcaneus and talus
- Runs from post med to ant lat
- Mouth is sinus tarsi

Contents:
- Artery of tarsal canal from tib post art
- Interosseous talocalcaneal ligament
Extraosseous blood supply (Trueta et al)

- Antr tibial artery/
  Dorsalis Pedis
  - Medial tarsal branches
  - Artery of tarsal sinus \textit{variable origin (1)}
- Post tibial artery
  - Artery of tarsal canal \textit{(2)}
    - Deltoid artery \textit{(3)}
  - Calcaneal branches

- Peroneal artery
  - Contributes to the artery of tarsal sinus
Three sources of blood supply
Trueta et al

- In order of importance
  - Artery of tarsal canal (medial) (2) (Tib Post Art)
  - Deltoid artery (3) thru medial surface
  - Artery of tarsal sinus (lateral) gives off dorsal branches (1) (Ant tib and peroneal)
  - Synovial and ligamentous attachments
**Blood Supply**

**Arterial supply:**
- Artery of tarsal canal
- Artery of tarsal sinus
  - Dorsal neck vessels
- Deltoid branches

Inferior view of talus, showing vascular anastomosis
Intraosseous blood supply

- Artery of tarsal canal supplies majority of talar body
- 3 sources of blood supply
Classification of talus fractures (OTA)

- Fracture talar neck
- Talar body fractures
- Talar head fractures
- Subtalar dislocation
- Total talar dislocation
Talus neck fractures

- Aviators Astragalus

Incidence

- 6-8% of foot fractures
- Importance due to high complication rates
  - avascular necrosis
  - post-traumatic arthritis
  - malunion
Mechanism of Injury

- Hyperdorsiflexion of the foot on the leg

- Neck of talus impinges against anterior distal tibia, causing neck fracture

If force continues:
  - Talar body dislocates posteromedial
  - Often around deltoid ligament
Injury mechanism

- Usually due to motor vehicle accident or falls from height
- 50 % have multiple traumatic injuries
Talus neck fractures

- High energy injuries
- Hyperdorsiflexion
- 15-20% open
- Malleolar # in 25% (Med malleolus common)
- High risk of compartment syndrome
Investigations

- Radiographs

**Canale View:**
- Foot in Equinus
- Pronated 15°
- X-Ray Beam 15° Cephalad from Vertical
CT scan

- Can be a useful assessment tool
- Confirms truly undisplaced fractures
- Demonstrates subtalar comminution, osteochondral fractures
- Planning surgical approach
MRI Scan

- Primary role in talus injuries is to assess complications, especially avascular necrosis
- May be poor quality if extensive hardware present

Zone of osteonecrosis following distribution of Artery of Tarsal Canal
Talar Neck Fractures: Classification

- Hawkins L JBJS 1970
- Predictive of AVN rate
- Widely used
Hawkins I

- 1/3 sources of blood supply damaged
- Risk of AVN 0-13%
Extraosseous blood supply

- Antr tibial artery/ Dorsalis Pedis
  - Medial tarsal branches
  - Artery of tarsal sinus *variable origin* (1)
- Post tibial artery
  - Artery of tarsal canal (2)
    - Deltoid artery (3)
  - Calcaneal branches

- Peroneal artery
  - Contributes to artery of tarsal sinus
Hawkins II

- Orthopaedic emergency
  - Pressure over skin/NV structures
  - Damage to blood supply
- 2/3 sources of blood supply damaged
- AVN 42-50%
Extraosseous blood supply

- Antr tibial artery/ Dorsalis Pedis
  - Medial tarsal branches
  - Artery of tarsal sinus *variable origin (1)*
- Post tibial artery
  - Artery of tarsal canal *(2)*
    - Deltoid artery *(3)*
  - Calcaneal branches

- Peroneal artery
  - Contributes to the artery of tarsal sinus
Hawkins III

- 3/3 sources of blood supply damaged
- AVN 100%
Extraosseous blood supply

- Antr tibial artery/ Dorsalis Pedis
  - Medial tarsal branches
  - Artery of tarsal sinus variable origin (1)

- Post tibial artery
  - Artery of tarsal canal (2)
    - Deltoid artery (3)
  - Calcaneal branches

- Peroneal artery
  - Contributes to the artery of tarsal sinus
Canale & Kelly Type IV (1978 JBJS)

- Poor prognosis
Goals of Management

- Immediate reduction of dislocated joints
- Anatomic fracture reduction
- Stable fixation
- Facilitate union
- Avoid complications
Rx

- **Type I**: Cast immobilisation/ Percutaneous screw fixation
- **Type II**: MUA & Percutaneous Fixation/ ORIF
- **Types III and IV**: ORIF
Closed reduction technique:

- Adequate sedation
- Flex knee to relax gastrocnemius
- Traction on plantar flexed forefoot to realign head with body
- Varus/valgus correction as necessary
Treatment of talar neck fractures

- Choice of fixation and approach depends upon personality of fracture
ORIF

- Anterolateral approach
  - Least vascular risk
- Anteromedial approach
  - Injury to art of tarsal canal
- Posterolateral approach
  - Useful for percutaneous screws
- Posteromedial approach
  - High incidence of painful sequelae
Surgical Approaches: Options

1 incision techniques:
- Anteromedial or
- Anterolateral

Problem: difficult to visualize talar neck and subtalar joint without significant soft tissue stripping

Benefit: potentially less skin injury
Surgical Approaches: Options

- 2 incision technique:
  - Anteromedial and direct lateral

  - Problem: 2 skin incisions, close together
  - Benefit: excellent fracture visualization at critical sites of reduction and subtalar joint
Posterior to Anterior Fixation:

- Stronger than anterior to posterior fixation with 2 screws
- Able to withstand the theoretical shear force of active motion (Swanson, JBJS 1992)
- Screws perpendicular to fracture site
Complications

- Skin necrosis
- Delayed union
- Nonunion
- Malunion
  - Varus
- Post traumatic OA
  - Subtalar 50%
  - Tibiotalar 33%
  - Both 25%
- AVN
- Late segmental collapse
AVN

- Hawkin’s grading
- Open fractures
- Fracture comminution
- Time to surgery
AVN: incidence after talus fracture

- Canale (1978):
  - I: 15 %
  - II: 50 %
  - III: 85 %
  - IV: 100 %

- Behrens (1988):
  - Overall 25 %

- Ebraheim/Stephen (2001):
  - Overall 20 %
Hawkin’s sign

- Subchondral atrophy
- 6-8 weeks
- Good prognosis
AVN Treatment:

- Precollapse:
  - Modified WB
  - PTB cast
  - Compliance difficult
  - Efficacy unknown

- Postcollapse:
  - Observation
  - Blair fusion if symptomatic
Talar body fracture

Sneppen et al

- I osteochondral or transchondral
- II coronal-sagittal, horizontal, noncomminuted, shear
- III posterior tubercle
- IV lateral process
- V crush.
Talar Body Fractures

- Treatment strategy similar to talar neck fractures
- Medial or Lateral Malleolar Osteotomy frequently required
Talar body fractures

- Poorer prognosis
- AVN Undisplaced fractures 25%
- AVN Displaced fractures 50%
- Higher incidence of subtalar OA
Lateral process fractures (Snowboarder’s fracture)

- Treat according to injury
- Operate when associated with joint subluxation, incongruity, marked displacement
- Fragments often too small to fix and require excision
20/F, RTA
Missed initially
Rx Conservative
2 months post injury
Hawkins sign+
30/M Motorcycle accident
Nonunion 4/12 post RTA
Rx ORIF & BG
30/M RTA
Talus body & calcaneum #s
1st Approach:

- Medial to TA and Anterior Compartment contents
- Make incision more posterior for talar body fractures to facilitate medial malleolar osteotomy
1\textsuperscript{st} Approach:

- Provides view of neck alignment and medial comminution
2nd Approach:

- Tip of Fibula directly anterior
- Mobilise EDB as sleeve
- Protect sinus tarsi contents
2\textsuperscript{nd} Approach:

- Visualises Anterolateral alignment and subtalar joint
Protect the skin post op
Post op 6/12
Healed with no AVN
62/m
Fall from scaffolding
Body #, STJ subluxed, calcaneal #
Rx ORIF, 2 incision
Thank you