Calcaneus Fractures

83

Jyoti Sharma and Paul J. Juliano

Anatomy

- Calcaneus acts as a lever to increase the power of the gastrocnemius soleus complex.
- Insertion site of the Achilles tendon (posterior tuberosity).
- Articular facets:
  - Anterior facet – carries the facet of the calcaneocuboid joint.
  - Posterior facet – largest, major weight-bearing surface.
  - Flexor hallucis longus tendon runs just inferior to this facet and can be injured with screws/drills that are too long.
  - Anterior portion is perpendicular to the calcaneus long axis.
- Middle facet – anteromedial on sustentaculum tali
- Superior facet – contains three facets that articulate with the talus
- Sustentaculum tali
  - Projects medially and supports the talar neck, extension of the medial wall of the body
  - FHL passes beneath it
  - Contains the anteromedial facet, which remains constant in injury settings due to ligamentous attachments
- Sinus tarsi
  - Between the middle and posterior facets

Presentation

- Calcaneus is most commonly fractured tarsal bone
- Severe pain, may have deformity, open fracture

Mechanism

- Usually traumatic loading is primary mechanism
- May also have shear component which contributes to secondary fracture lines

Physical Exam

- Pain, diffuse tenderness to palpation of heel, accompanied by swelling
- May have a varus deformity of the heel, appear shortened and wide as compared to contralateral limb

J. Sharma, MD (✉) • P.J. Juliano, MD
Orthopaedic Surgery, Penn State Hershey Medical Center, Hershey, PA, USA
e-mail: jsharma@hmc.psu.edu

A.E.M. Eltorai et al. (eds.), *Orthopedic Surgery Clerkship*, DOI 10.1007/978-3-319-52567-9_83

Demographics

- More common in males
- Must rule out associated injuries like vertebral fractures (10%) and contralateral calcaneus fracture (10%)

Fracture Types

Intra-articular

- Up to 75% of fractures, result from axial loading
- Classification
  - Essex Lopresti: primary fracture line runs obliquely through the posterior facet creating two fracture fragments; the secondary fracture line runs either behind the posterior facet (joint depression fractures) or beneath the posterior facet exiting posteriorly (tongue-type fracture).
  - Sanders classification: coronal CT cut at the widest portion of the posterior facet used to classify fracture based on number of articular fragments seen (types i–iv).

Extra-articular

- Result from twisting forces on the hindfoot
- Posterior tuberosity avulsion fractures
  - Account for 1–3% of all calcaneus fractures.
  - Due to insertion of the Achilles tendon.
  - Fractures with significant displacement can threaten the skin posteriorly and require urgent reduction to prevent skin necrosis.
- Anterior process fractures
  - Avulsion secondary to bifurcate ligament

Imaging

Radiographs

- AP, lateral, oblique of foot

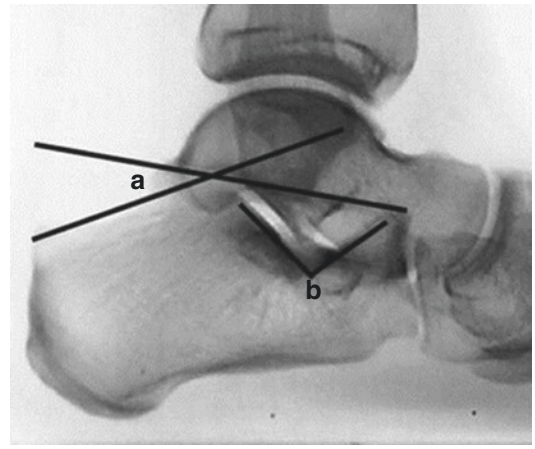

Fig. 83.1 Normal lateral radiograph of the foot showing (***a***) Bohler's angle and (***b***) crucial angle of Gissane (Image from *Core Knowledge in Orthopedics: Trauma*)

- Visualize decreased Bohler's angle (normal 20–40°), increased angle of Gissane (normal 130–145°), varus tuberosity, shortening of calcaneus (Fig. 83.1)
- AP ankle
  - Fibular impingement can be caused by lateral wall extrusion.
- Broden: posterior facet visualized
  - Ankle maintained in neutral dorsiflexion and X-ray beam moved to 10°, 20°, 30°, and 40° of internal rotation
- Harris: tuberosity visualized and assessed for shortening, widening, and varus position
  - Foot in maximal dorsiflexion with the X-ray beam at 45°

CT Scan

- Has become gold standard for imaging calcaneus fractures
- Sagittal view: shows tuberosity displacement
- Axial view: shows calcaneocuboid joint involvement
- Semicoronal view: shows posterior and middle facet displacement, used for Sander's classification (Fig. 83.2)

Fig. 83.2 Semicoronal view of the calcaneus on a CT scan used for the Sander's classification (Image from *Core Knowledge in Orthopedics: Trauma*)

- 3D reconstructions can aide in operative planning and understanding fracture patterns better.

MRI Scan

- Not routinely used unless diagnosis is unclear (stress fracture)

Treatment

Nonoperative

- Cast immobilization and non-weight bearing for at least 10–12 weeks
  - Indications: nondisplaced fractures, extra-articular fractures <1 cm with intact Achilles tendon, anterior process fractures <25% of calcaneocuboid joint, patients unable to undergo surgery due to medical comorbidities

Operative

- Closed reduction and percutaneous pinning
  - Indications: large extra-articular fractures, minimally displaced tongue-type fractures, mild shortening
- Open reduction internal fixation (ORIF)
  - Indications: displaced tongue-type fractures, large extra-articular fragments with detachment of the Achilles tendon. Anterior process fractures involving >25% of the joint, flattening of Bohler's angle, varus malalignment of tuberosity, posterior facet displacement >2 mm
  - Goals to restore calcaneal height, correct varus, and stabilize fracture
  - Wait up to 2 weeks for swelling to resolve prior to surgery (positive wrinkle sign)
  - Extensile lateral or medial approach most commonly utilized
    - Full-thickness skin flaps must be raised to maintain soft tissue integrity.
    - No-touch skin technique with the use of K-wires helps preserve the soft tissue envelope and prevent extra tissue damage from handling.
- Sinus tarsi approach
  - Best utilized in fracture patterns where anatomic reduction can be achieved through a small incision, such as Sanders type II fractures
  - Can be used in other types of calcaneus fractures, but achieving a congruent articular surface can be difficult through the small incision
- Primary subtalar arthrodesis
  - Combined with ORIF to restore height, Sanders type IV

Postoperative Rehabilitation

- Bulky U-splint initially after surgery
- Non-weight bearing for at least 10–12 weeks

- Can start subtalar range of motion exercises once incision healed after 2–3 weeks

Complications

- Wound complications (up to 25%)
  - Increased in smokers, diabetic patient, open fractures
- Posttraumatic subtalar arthritis
- Compartment syndrome (may result in claw toes)
- Lateral impingement with peroneal tendon irritation
- FHL damage
- Malunion

Outcomes

- Overall poor with 40% complication rate

Suggested Reading

1. Banerjee R, et al. Management of calcaneal tuberosity fractures. J Am Acad Orthop Surg. 2012;20:253–8.
2. Clare MP. Fractures of the calcaneus. Core Knowl Orthop: Trauma. 2008;23:386–402.
3. Heger L, Wulff K. Computed tomography of the calcaneus: normal anatomy. Am J Roentgenol. 1985;145:123–9.