Surgical Treatment of Calcaneal Fracture Malunions and Posttraumatic Deformities

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The irregular contour of the calcaneus, the complexity of the mechanics of a three-facet subtalar joint, the surrounding neurovascular structures, and the delicate soft tissue envelope make operative intervention in this area a challenge fraught with possible complications. Many experienced surgeons acknowledge a steep and significant learning curve in the operative management of calcaneal fractures. Although controversy continues to surround this issue, nonoperative management of displaced intra-articular calcaneal fractures may result in malunion, thereby affecting the function of the ankle, subtalar, and transverse tarsal joints.[1] The primary fracture deformity contributes directly to late complications. Residual deformity and malunion after operative management of calcaneal fractures are a common reason for revisional surgery. The notion that Cotton and Henderson[2] stated in 1916 often holds some validity today that ''ordinarily speaking, the man who breaks his heel bone is 'done' so far as his industrial future is concerned.''

CALCANEAL MALUNIONS

Calcaneal malunions are problematic for several reasons.[1,3–14] Although some calcaneal fractures can be treated conservatively, a majority of them require operative

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intervention to prevent functional impairment and disability, especially because most of these fractures affect young and middle-aged industrial workers.[12] Nonoperative management of these displaced fractures may result in a severely disabling fracture malunion that is associated with several typical findings that are discussed herein.

The calcaneus is the support for body weight from the initial heel contact with the ground reaction force to midstance during ambulation. The calcaneus supports the talus and its position in relation to the floor and determines the appropriate position of the articular surface of the talus with the tibia. The surface incongruity of the posterior subtalar facet joint over time results in painful posttraumatic arthritis. The lateral calcaneal wall expansion results in heel widening with associated subfibular impingement causing peroneal stenosis, tendinitis, or dislocation. The decrease in calcaneal body height results in loss of the talar declination which results in anterior tibiotalar impingement and diminished ankle range of motion. If the anterocalcaneal fracture extends into the calcaneal cuboid joint, resulting posttraumatic arthrosis can probably occur. A malunited calcaneal fracture tuberosity can result in varus hindfoot malalignment; therefore, the function of the ankle, subtalar, and transverse tarsal joints can all be affected, leading to pain and disability.

The surgeon needs to determine the reason for operative failure and whether revisional surgery would be beneficial to pursue. At times, revisional surgery can create further complications or increased pain leading to limb loss and in certain circumstances may need to be avoided. Understanding the common problems that can be successfully managed through revisional surgery is paramount to achieving reproducible and reasonable surgical outcomes.

Patient selection is essential to prevent postoperative complications, and the contraindications are the same as for initial surgical intervention of calcaneal fractures. With revisional calcaneal fracture surgery, the most common contraindication is usually a patient who should have not been operated on initially because of multiple comorbidities, active infection, or arterial insufficiency. A history of tobacco use has been shown to have detrimental effects on soft tissue healing and union rates. Smoking cessation needs to be enforced but is not usually a contraindication for revisional surgery.[12]

Revisional calcaneal fracture surgery is often indicated for infection, wound healing complications, deformity, malunion, nonunion, subtalar joint arthrosis, anterior ankle joint impingement, lateral ankle impingement, subluxation of the peroneal tendons, painful or broken hardware, sural neuritis, and tarsal tunnel syndrome. It is beyond the scope of this article to cover all facets of revisional surgery that can be associated with poor outcomes from operative intervention of calcaneal fractures.

Clinical and Radiographic Findings

Calcaneal fracture malunions affect the function of the ankle, subtalar, and calcaneal cuboid joints, eventually leading to pain or permanent disability. The initial patient evaluation for revisional surgery begins with a thorough clinical assessment of the factors that contribute to patient dissatisfaction, functional impairment, and pain. Posttraumatic subtalar and calcaneal cuboid arthrosis occurs secondary to residual articular incongruity. Anterior ankle impingement and loss of ankle dorsiflexion are complications from a loss in vertical height of the calcaneus. In addition, subfibular impingement results from a residual lateral wall expansion and heel widening. Frequently, the malunited calcaneal fracture involves some form of peroneal tendon pathology such as stenosis, subluxation, or dislocation. An altered and poorly tolerated gait pattern is secondary to a varus malunion of the calcaneal tuberosity.