Management of Intra-Articular Fractures of the Calcaneus

Scott A. Swanson, MD[a], Michael P. Clare, MD[b], Roy W. Sanders, MD[c,*]

KEYWORDS

• Calcaneus • Fracture • Intra-articular • Treatment

Since Malgaigne's first description in 1843,[1] fractures of the calcaneus have presented a significant challenge to orthopedic surgeons and patients alike. In describing the dismal results of early management of calcaneal fractures, Cotton and Wilson penned, "the man who breaks his heel bone is done."[2] Calcaneal fractures are the most common of tarsal bone fractures, and the majority are displaced intra-articular fractures, typically the result of falls from height or motor vehicle accidents. Calcaneal fractures affect primarily young men in their prime working years and result in a significant loss of economic productivity.[3–7] Although the development of modern imaging, surgical techniques, and fixation implants generally has improved functional outcome after these fractures, controversy continues to surround the management of these highly complex injuries. This article highlights current controversies and emphasizes treatment rationale and surgical approaches.

INTRA-ARTICULAR FRACTURES

Mechanism of Injury and Pathologic Anatomy

Displaced intra-articular fractures of the calcaneus generally occur as a result of high-energy trauma, with general agreement as to the pathomechanics involved.[4,8–11] With

One of the authors has received financial or material support (eg, equipment or services), commercially derived honoraria, or other nonresearch-related funding (eg, paid travel) from a commercial company or institution that relates directly or indirectly to the subject of this manuscript.

[a] Nebraska Orthopaedics and Sports Medicine, St. Elizabeth Medical Plaza, 575 South 70th Street Suite 200, Lincoln, NE 68510-2471, USA
[b] Florida Orthopaedic Institute, 13020 Telecom Parkway North, Tampa, FL 33637, USA
[c] Orthopaedic Trauma Service, Tampa General Hospital, The Florida Orthopaedic Institute, 4 Columbia Drive, Suite #710, Tampa, FL 33606, USA
* Corresponding author. Orthopaedic Trauma Service, Tampa General Hospital, The Florida Orthopaedic Institute, 4 Columbia Drive, Suite 710, Tampa, FL 33606.
E-mail address: ots1@aol.com (R. Sanders).

Foot Ankle Clin N Am 13 (2008) 659–678
doi:10.1016/j.fcl.2008.09.006 **foot.theclinics.com**
1083-7515/08/$ – see front matter

a displaced intra-articular calcaneal fracture, the loss of height through the calcaneus results in a shortened and widened heel, typically with varus malalignment of the tuberosity. This loss of height is reflected in a decreased Böhler's angle, whereby the normal declination of the talus is diminished and the talus becomes relatively more horizontal, which may lead to a secondary loss of ankle dorsiflexion. As the superolateral fragment of the posterior facet is impacted plantarward, the thin lateral wall explodes laterally just posterior to the crucial angle of Gissane and may trap the peroneal tendons against the lateral malleolus; in some cases, a violent contracture of the peroneal tendons may avulse the tendon sheath from the fibula, resulting in an avulsion fracture of the lateral malleolus and dislocation of the peroneal tendons. The anterior process typically displaces superiorly, which limits subtalar joint motion directly by impinging against the lateral process of the talus.

Clarification of fragment terminology is necessary to understand the relevant pathoanatomy: the anterolateral fragment encompasses the lateral wall of the anterior process and may include a portion of the calcaneocuboid articular surface; the anterior main fragment is the large fragment anterior to the primary fracture line; the superomedial fragment (also known as the sustentacular or constant fragment) is found posterior to the primary fracture line and almost always remains attached to the talus through the deltoid ligament complex and, therefore, stable; the superolateral fragment is the lateral portion of the posterior facet, which is sheared from the remaining posterior facet in joint depression fractures; the tongue fragment refers to the superolateral fragment that remains attached to a portion of the posterior tuberosity in tongue-type fractures; and the posterior main fragment represents the posterior tuberosity (**Fig. 1**).

Diagnosis/Evaluation

The severity of fracture displacement and extent of soft tissue injury are related directly to the amount of energy absorbed by the limb in producing the injury. Higher-energy injuries, therefore, produce more severe soft tissue disruption and may result in an open fracture. Fracture bleeding into the tightly enveloped fascial planes surrounding the heel produces severe pain overlying the fracture and may result in a compartment syndrome of the foot. The normal skin creases typically disappear within several hours after the injury and in the event of extreme swelling, cleavage at the dermal-epidermal junction may produce fracture blisters. A high index of suspicion for associated injuries, including fractures of the lumbar spine, should be maintained.

Plain Radiography

Plain radiographic evaluation includes a lateral view of the hindfoot, an anteroposterior (A/P) view of the foot, an axial view of the heel,[12] and a mortise view of the ankle. The lateral view of the hindfoot reveals loss of height in the posterior facet, in which the articular surface is impacted within the body of the calcaneus and usually rotated anteriorly relative to the remaining subtalar joint; a decreased tuber angle of Böhler; and an increased crucial angle of Gissane seen in fracture patterns where the entire posterior facet is separated from the sustentaculum and depressed (**Fig. 2**). If only the lateral portion of the posterior facet is involved, the split in the articular surface is manifest as a double density,[13] in which case the tuber angle of Böhler and crucial angle of Gissane may remain normal (**Fig. 3**). The lateral view also allows delineation as to whether or not a fracture is a joint depression or tongue-type fracture.[4] The A/P view of the foot reveals anterolateral fragments and extension of fracture lines into the calcaneocuboid joint. The axial view of the heel shows loss of calcaneal length, increased width, and