Review of Talus Fractures and Surgical Timing

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KEYWORDS

• Talus fracture • Delayed fixation • Surgical timing

KEY POINTS

- This article gives special attention to the clinical literature that evaluates the timing of surgical management for displaced talus fractures.
- Despite surgical fixation, high complication rates accompany displaced talar fractures, creating significant patient morbidity.
- Contrary to historical recommendations, delayed fixation for displaced talar fractures produces satisfactory outcomes, suggesting displaced fractures do not necessitate emergent surgical treatment.

INTRODUCTION

As the osseous link between the foot and leg, the talus is essential for normal gait mechanics. It involves both the ankle and the subtalar joint complexes through multiple articular surfaces with the fibula, tibia, calcaneus, and navicular. The talus consists of 3 main sections (body, head, and neck) and 2 processes (lateral and posterior processes). The posterior process is composed of 2 tubercles (posteromedial and posterolateral tubercles). Articular cartilage covers more than 65% of the talar surface, and no tendon or muscle attachments originate from the talus.[1] With its many articulations, fractures frequently lead to posttraumatic arthrosis, and malunions alter mechanics, creating disability. The exta-articular surface allows for ligamentous and capsular attachments and entrance for the extraosseous blood supply.[1] Traveling through these limited soft tissue attachments, the extraosseous blood supply is at risk for injury, making the talus prone to osteonecrosis. Talar injuries cause significant patient morbidity, highlighting the importance of effective and efficient treatment to minimize resultant complications.

High-energy mechanisms such as falls from a height or motor vehicle accidents account for most fractures, but low-energy mechanisms, such as sports injuries, have also been reported.[2–4] Because of the distraction of other injuries in critically ill patients or the decreased awareness in unsuspecting sport injuries, talus fractures may be undiagnosed on initial presentation. Clinicians must maintain a high index of suspicion for any patient presenting with hindfoot pain after an acute injury. These patients should have a detailed history and physical examination plus dedicated foot and ankle radiographs, and any radiographic irregularities should prompt a computed tomographic (CT) scan to better identify and characterize talar fractures.

TALUS BLOOD SUPPLY

With osteonecrosis commonly reported as a complication in talar injuries, the blood supply of the talus has been extensively researched. The extraosseous blood supply includes branches from the posterior tibial artery (artery of the tarsal canal, deltoid branches), branches from anterior tibial artery (dorsalis pedis

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branches), and branches from the peroneal artery (posterior tubercle branches, artery of tarsal sinus). The artery of the tarsal canal (branch of the posterior tibial artery) gives off the deltoid branches supplying the medial talar body. The artery of the tarsal canal continues distally to join the artery of the tarsal sinus (branch of the peroneal artery) forming an important anastomosis inferior to the talar. Branches from this anastomosis enter the inferior neck supplying a significant portion of the talar body. Dorsalis pedis branches (branch of the anterior tibial artery) enter the dorsal neck supplying most of the talar neck and a portion of the talar head. The talar head is further supplied from the artery of the tarsal canal (branch of the peroneal artery). Last, the posterior tubercle branches (branch of the peroneal artery) contribute to the posterior process (Fig. 1).[5–7]

FRACTURE CLASSIFICATION

The Orthopedic Trauma Association (OTA) has extensively classified talus fractures, in which the fractures are divided into head fractures (81-A), neck fractures (81-B), and body fractures (81-C). Included in the head fracture category, avulsion and process fractures also receive the 81-A designation. Talar neck fractures are further divided into nondisplaced fractures (81-B1), fractures with subtalar joint incongruity (81-B2), and fractures with subtalar and tibiotalar joint incongruity (81-B3). Body fractures are divided into talar dome fractures (81-C1), talar body fractures with subtalar joint involvement (B1-C2), and body fractures with subtalar and tibiotalar joint involvement (81-C3). Fractures of the talar head, neck, and body are further classified according to comminution.[8] Talar neck fractures are also commonly classified according to Hawkins,[4] which is further discussed with talar neck fractures.

TALAR HEAD FRACTURES

Talar head fractures are very uncommon, accounting for less than 10% of all talus fractures, and there is limited clinical research that assessed these fractures.[9–11] Compression and shear forces have been described as mechanisms for injury. Forefoot impaction forces along the medial column create compression fractures, and navicular shear forces resultant from midfoot adduction create shear fractures to the medial talar head.[11] Radiographic evaluation should routinely involve anterior-to-posterior (AP), oblique, and lateral foot radiographs. These fractures may be difficult to see on radiographs, particularly the plantar portion of the talar head. Any irregularities on radiographs should elicit advanced imaging.

The principles of treatment include maintenance of the medial column length and height, and restoring talonavicular joint congruity, stability, and motion. Nondisplaced fractures with a stable joint may be treated conservatively with immobilization and non-weight-bearing for 4 to 6 weeks,[9–13] but displaced fractures or joint instability requires operative treatment. Small comminuted fractures may be excised to restore talonavicular motion, but larger fragments are stabilized with headless screws, mini-fragment screws, or bioabsorbable implants (Fig. 2). Minimizing dorsal dissection, dorsal, or medial approaches are used depending on the fracture location. Unlike neck and body fractures, osteonecrosis is uncommon in talar head fractures, but posttraumatic arthritis is a likely complication following intra-articular fractures.

TALAR NECK FRACTURES

The area designated as the talar neck lies between the talar head and body (lateral process). This area is commonly injured, accounting for nearly half of all significant injuries to the talus.[4,9,10,13] Unlike most of the talus, the neck is void of articular cartilage, providing a site for soft tissue attachments and vascular foramen. Adjacent to the inferior talar neck, the artery of the tarsal canal joins the artery of the tarsal sinus forming an important anastomosis.[1,5–7] The close proximity of this anastomosis to the talar neck makes it vulnerable to injury with neck fractures, explaining the common complication of osteonecrosis.

As aforementioned, the OTA categorizes talar neck fractures according displacement and subtalar joint congruity,[8] but before the OTA classification, Hawkins classified talar neck fractures in 1970.[4] The Hawkins classification is still the most commonly used nomenclature to describe talar neck fractures. A Hawkins type I refers to a nondisplaced fracture of the talar neck. In a Hawkins type II, the neck fracture is accompanied by subtalar joint subluxation or dislocation. Type II fractures are the most common. Talar neck fractures with tibiotalar and subtalar incongruity represent Hawkins type III fractures. Last, Canale and Kelly[14] added the type IV modification, in which neck fractures are accompanied with complete talar dislocations (ie, tibiotalar, talonavicular, and subtalar joint incongruity) (Fig. 3). Osteonecrosis has been reported in type II fractures as high as