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Antegrade-Retrograde Opposing Lag Screws for Internal Fixation of Simple Displaced Talar Neck Fractures

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ABSTRACT

The talar neck is deviated medially with reference to the long axis of the body of the talus. In addition, it deviates plantarward. The talar neck fracture line is sometimes observed to be oriented obliquely (not perpendicular to the long axis of the talar neck). This occurs when the medially deviated talar neck strikes the horizontally oriented anterior lower tibial edge. Internal fixation of a simple displaced talar neck fracture usually requires 2 lag screws. Because the fracture line is obliquely oriented, a better method for positioning the screws perpendicular to the fracture line is to place them in a reversed direction to provide maximum interfragmentary compression at the fracture site, which could increase the likelihood of absolute stability with subsequent improvement in the incidence of fracture union and a reduction of complications, such as avascular necrosis of the body of the talus. Two lag screws are used, with the first inserted from posteriorly to anteriorly (perpendicular to the fracture line) using a medial approach after medial malleolar chevron osteotomy. The second screw is inserted from anteriorly to posteriorly (perpendicular to the fracture line) using an anterolateral approach. Both screw heads should be countersunk. A series of 8 patients underwent this form of internal fixation for talar neck fracture repair, with satisfactory functional outcomes. In conclusion, the use of antegrade-retrograde opposing lag screws is a reasonable method of internal fixation for simple displaced talar neck fractures.

Fractures of the talus are relatively uncommon, accounting for 0.1% to 0.85% of all fractures (1). However, talar fractures rank second in frequency after calcaneal fractures when the tarsal bones are considered, and fractures of the neck and anterior portion of the body of the talus are the most prevalent forms of talus facture (2,3). The most common mechanism of talar neck fracture is excessive dorsiflexion of the foot on the leg, combined with axial loading, commonly resulting from impaction of the foot during high-energy collisions or falling from a height (4,5).

The Hawkins classification of talar neck fractures is currently the most widely used classification system. It has several advantages, in that it is rather simple, is based on findings from standard foot radiographs, provides guidelines for treatment, and is prognostic for the development of avascular necrosis (AVN) of the body of the talus (6,7). Although the incidence of AVN in Hawkins type I fractures (nondisplaced) is rare (<10%), the incidence is 40% to 50% in Hawkins type II fractures (displaced with dislocation of the subtalar joint) and nearly 100% in type III fractures (displaced with dislocation of the subtalar and ankle joints) (6,7). Hawkins classification has shown better interobserver and intraobserver reliability for classifying talar neck fractures compared with other classification systems (8).

Talar neck fractures can be simple nondisplaced, simple displaced, or multifragmental. Also, these should be distinguished from talar body fractures by the location of the inferior fracture line as it relates to the lateral process of the talus. Fractures that extend into or posterior to the lateral process of the talus are defined as talar body fractures, and fractures anterior to the lateral process are defined solely as talar neck fractures (9). Sneppen et al (10) classified talar body fractures into 6 different types, including compression, coronal shearing, sagittal shearing, posterior tubercle, lateral tubercle, and crush fractures. Thus, careful evaluation of the preoperative radiographs and computed tomography scans is important for differentiating between talar neck and talar body fractures.

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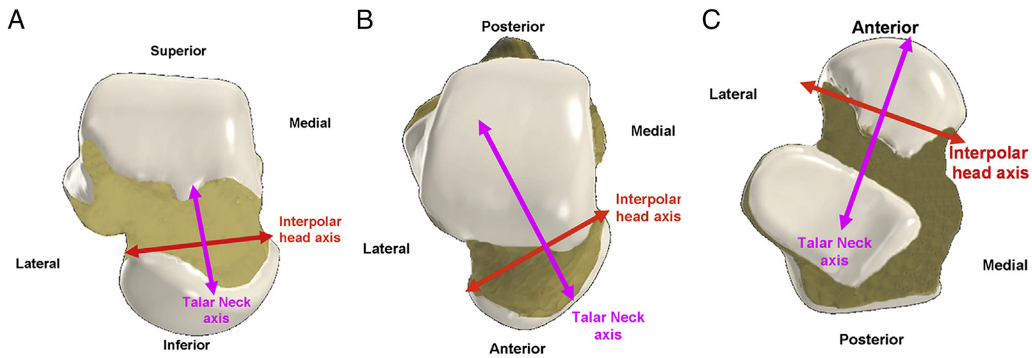

Fig. 1. Interpolar talar head axis. (*A*) Talus anterior view, (*B*) talus superior view, and (*C*) talus inferior view.

Residual displacement after reduction of displaced talar neck fractures is not acceptable, because it will adversely affect subtalar joint biomechanics (11). Thus, open reduction and internal fixation (ORIF) has been considered the treatment of choice for displaced talar neck fractures. The internal fixation methods used for such fractures have typically included lag screws (12–14) and small plates (15,16). The use of 2 lag screws has been the most common method for internal fixation of displaced talar neck fractures, and these can be inserted either from posteriorly to anteriorly or anteriorly to posteriorly.

A number of anatomic features of the neck of the talus are important to remember when performing screw placement for ORIF of the talus. The anatomic axis of the talar neck is oriented medially, approximately 10° to 44° relative to the longitudinal axis of the body of the talus in the transverse plane. In the sagittal plane, it deviates plantarward 5° to 50° (4) (Fig. 1). In addition, the interpolar talar head axis, which is the imaginary line connecting the poles of the talar head at the head–neck junction, is oriented obliquely relative to the talar body (Fig. 1). Furthermore, the talar neck fracture line is commonly oriented obliquely to the long axis of the neck of the talus (Fig. 2), likely from impaction of the medially deviated (10° to 44°) talar neck on the transverse (horizontal) margin of the distal tibial-bearing surface when the talus is forcibly dorsiflexed with a concomitant axial load (17). Computed tomography scans can easily confirm this oblique orientation of the talar neck fracture (Fig. 3). It is also important to appreciate the increase in bone density in the lateral aspect of the talar head and inferolateral aspect of the talar body compared with the trabecular support of the medial aspect of the talar head and body (18). Furthermore, a relative decrease will be present in the subchondral vascularity and perfusion of the posteromedial and posterocentral aspects of the talar dome, which was recently shown by Lomax et al (19). Finally, the blood supply from the distal portion of the neck of the talus to the body of the talus will often be compromised as a result of fracture of the neck of the talus, and this can cause AVN of the talar body and nonunion of the neck fracture (7).

Maintaining an appreciation of these anatomic features of fractures of the neck of the talus, it can be understood that if 2 lag screws are inserted, either from anteriorly to posteriorly or posteriorly to anteriorly, to fixate the oblique fracture, only 1 of the lag screws will be oriented perpendicular to the fracture line. Tightening the screw that is not perpendicular to the fracture line will lead to shear forces and eventual loss of reduction, decreased interfragmental compression, and inadequate fixation stability (20) (Fig. 4). Therefore, the technique of screw insertion must ensure that both lag screws are inserted perpendicular to the oblique fracture line to provide maximum interfragmentary compression and absolute stability at the fracture site (21,22). Absolute stability and maximum compression are required in cases of displaced talar neck fracture if the risks of AVN and nonunion are to be minimized. Optimal interfragmental compression of the oblique talar neck fracture, therefore, can only be achieved when the first screw has been inserted antegrade using a medial approach from posteriorly to anteriorly perpendicular to the fracture line and the second screw has been inserted using the anterolateral approach retrograde from anteriorly to posteriorly, and also perpendicular to the fracture line (Fig. 5).

Surgical Technique

Preoperative imaging of the fracture entails anteroposterior, lateral, and canale radiographic views of the ankle and foot. Computed tomography scans can also be obtained if the surgeon desires a more refined assessment of the fracture. During surgery, fluoroscopy should be used to assist in fracture reduction and internal fixation.

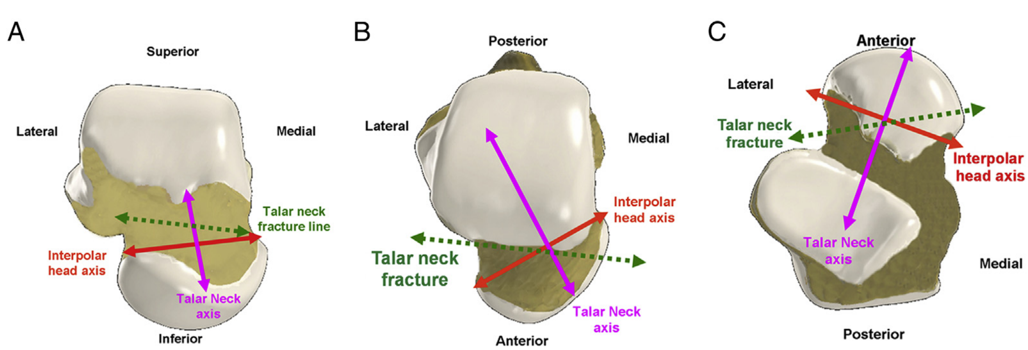

Fig. 2. Interpolar talar head axis, talar neck axis, and talar neck fracture line. (*A*) Talus anterior view, (*B*) talus superior view, and (*C*) talus inferior view.