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Review Article

Complications of Talar Neck Fractures by Hawkins Classification: A Systematic Review

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ABSTRACT

The goal of the present study was to perform a systematic review of the published data on talar neck fractures for a better understanding of the postoperative clinical outcomes using open reduction and internal fixation stratified by Hawkins type. A PubMed search was performed using the keywords "talar," "neck," and "fracture." This search identified 209 potential studies, which were reviewed to yield 16 studies that met the criteria. The surgical outcomes of talar neck fractures stratified by the Hawkins classification analyzed in the present study were as follows: American Orthopaedic Foot and Ankle Society scale score was 77.00 for type I, 86.10 for type II, 68.30 for type III, 68.30 for type IV, and 76.50 for all talar neck fractures. Avascular necrosis presented in 0.00% of type I fractures, 15.91% of type II fractures, 38.89% of type III fractures, 55.00% of type IV fractures, and 26.47% of all fractures. Osteoarthritis presented in 25.00% of type I fractures, 41.33% of type II fractures, 54.23% of type III fractures, 72.73% of type IV fractures, and 51.69% of all fractures. Subtalar arthritis presented in 0.00% of type I fractures, 54.29% of type II fractures, 46.43% of type III fractures, 45.45% of type IV fractures, and 44.97% of all fractures. The malunion prevalence was 13.29% and the nonunion prevalence was 3.97% for all fractures. Type II fractures were the most common (50.88%) fracture type reported in the reports reviewed in the present study.

Talar neck fractures are among some of the rarest and most challenging injuries for surgeons to repair (1–9). Although they account for <1% of all bone fractures of the ankle and foot, many controversies surround their treatment, including assessment measures, surgical approaches, fixation methods, and frequency of postoperative complications (10–12). During the past 2 decades, substantial improvements have occurred in the surgical treatment of these fractures. The implementation of mini-fragment and small-fragment implants has demonstrated effectiveness in maintaining fragment placement without causing excessive damage to the adjacent blood supply (13–15).

The talus is the most superiorly located bone of the foot and is vital in maintaining ankle function and range of motion (16). For anatomic purposes, the talus can be classified into a head, neck, body, posterior process, and lateral process. Talar neck fractures account for nearly 48% of the fractures of the talus and most commonly occur as a result of high-energy trauma, such as falling from a height or automobile accidents (17,18). The high-energy nature of these injuries produces fracture displacement, comminution, and acute soft tissue damage, which commonly correlate with open lesions (11). Management of these injuries is difficult owing to the unique osseous and vascular anatomy of the talus, resulting in historically poor outcomes and a high incidence of complications.

The most common mechanism of talar neck fractures is hyperdorsiflexion of the ankle, which often occurs in high-energy trauma to the ankle. In such cases, the posterior ligaments of the subtalar joint initially rupture and the talar neck contacts the leading anterior edge of the distal tibia, causing a fracture line. With continued force, the calcaneus and the rest of the foot, including the head of the talus, sublux anteriorly. At this point, concomitant eversion can cause lateral dislocation, and inversion can cause medial dislocation (19).

Fractures of the talar neck and body are commonly categorized using the Hawkins classification system, modified by Canale and Kelly (20), which provides descriptive and prognostic information. Type I fractures indicate a nondisplaced fracture. Type II fractures indicate a fracture with subluxation (IIA) or dislocation (IIB) at the subtalar joint. Type III fractures refer to a fracture with a dislocated tibiotalar joint, and type IV fractures indicate a dislocated talonavicular joint (18,20,21).

A variety of complications, including avascular necrosis (AVN) and osteoarthritis (OA), are understood to be related to the initial fracture displacement. They result from the increased risk of trauma to the

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vascular blood supply of the talar body. Talar neck fractures with associated body fractures have had a greater prevalence of AVN than talar neck fractures without body injury. Talar body fractures are associated with weakening of the talar trochlea, which can subject the body to full collapse and subsequent degenerative changes (19,22). Urgent open reduction and internal fixation (ORIF) of dislocated talar neck fractures is recommended to minimize soft tissue complications and increase the chances of revascularization (12). Nonoperative treatment or percutaneous fixation is most commonly used for nondisplaced talar neck fractures.

Currently, multiple systematic reviews are available on fractures of the talar neck; however, minimal information has focused entirely on the outcomes of ORIF-treated fractures stratified by the Hawkins classification. The goal of the present study was to perform a systematic review of the available published data on talar neck fractures repaired using ORIF for a better understanding of the postoperative clinical outcomes and complications stratified by Hawkins classification type.

Materials and Methods

A PubMed search was performed using the keywords "talar," "neck," and "fracture." This search identified 209 studies, which were then reviewed. The exclusion criteria were studies reported in a language other than English, studies that did not use ORIF as the surgical method, and studies that did not use the Hawkins classification system (Fig). The references of each of the 16 selected studies were examined to locate any additional studies that had not been found in the initial PubMed search. However, no additional studies that met our criteria were identified. Additionally, no unpublished studies were included.

When the studies included both talar neck fractures and other talus fractures (body), only the data referencing the talar neck fractures were extracted. This was the case for 3 of the 16 studies (11,12,23). The data extracted from the 16 studies were compiled and analyzed. Particular emphasis was placed on data pertaining to postoperative AVN, OA (subtalar and tibiotalar arthritis), malunion, nonunion, and average American Orthopaedic Foot and Ankle Society (AOFAS) scale score. Unreported information, based on our criteria, was noted. Furthermore, the data were divided and analyzed by the Hawkins classification system.

Results

All the reviewed studies were retrospective. A total of 508 talar fractures were initially reported among the 16 examined reports. However, that was reduced to 340 fractures using our criteria and because some patients were lost during the follow-up period of the original retrospective studies. Of the 340 fractures, 10 (2.94%) were type I, 173 (50.88%) were type II, 116 (34.12%) were type III, and 41 (12.06%) were type IV. The demographic data for the patient population are listed in Table 1 (11,12,24–36). The treatment type was ORIF for all patients; however, the internal fixation type was highly variable. Internal fixation included 3.5-mm cortical screws, 4.0-mm cancellous screws, small Herbert screws, bioabsorbable screws, bioabsorbable pins, cannulated screws, and Kirschner wires. Of the 447 fractures specified as open or closed, 82 were open and 365 were closed (Table 1).

The average interval to surgery across 6 of the 16 reports (11,24,26,27,33,36) that specifically reported this information was 2.36 days (Table 1). AVN is a common complication after a talar neck fracture. It results from disruption of the blood supply to the talar body, which corresponds to the severity of the initial injury and the number of joints dislocated during the trauma (8,16,18,20,37). All 16 studies (11,12,23,26,27,30–36,38) reported the overall AVN rate; however, not every study reported the AVN rates stratified by Hawkins classification type (Table 2). AVN occurred in 90 of the 340 patients, for an overall incidence rate of 26.47%. For 229 patients, the rate of AVN was stratified by the specific Hawkins classification type. Analysis revealed that AVN occurred in 0.00% (0 of 5) of type I fractures, 15.91% (21 of 132) of type II fractures, 38.89% (28 of 72) of type III fractures, and 55.0% (11 of 20) of type IV fractures (Table 2).

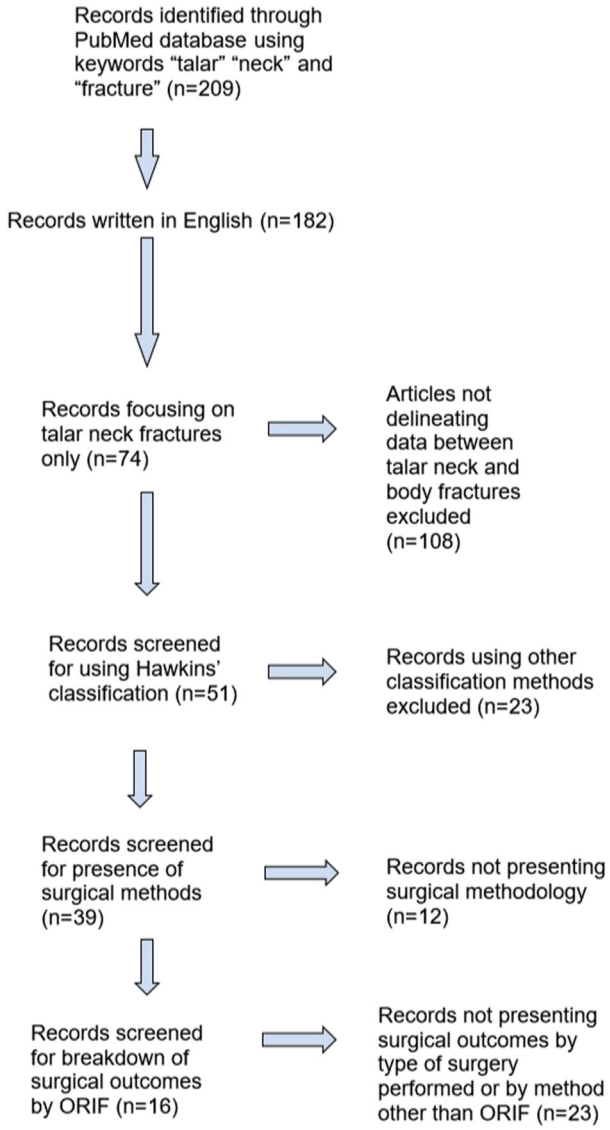

Fig. Flowchart showing the method of study selection.

Post-traumatic OA has been recognized as the most prevalent complication after talar neck fractures and has been listed as the primary cause of secondary reconstructive procedures (12,31,39). In the present review, 14 of the 16 studies reported information on OA (11,12,23,26,30–35,38). Of the 296 reported fractures, 153 (51.69%) were associated with the postoperative development of OA (Table 2). From the studies reporting OA stratified by Hawkins type, 25.00% (1 of 4) of type I fractures, 41.33% (31 of 75) of type II fractures, 54.24% (32 of 59) of type III fractures, and 72.73% (8 of 11) of type IV fractures resulted in OA (Table 2).

The AOFAS scale scores of 74 patients (11,27,32) were reported and delineated by Hawkins type (Table 2). The average functional AOFAS scale score for type I fractures was 77.00 (n = 16), 86.10 (n = 35) for type II fractures, 68.30 (n = 11) for type III fractures, and 68.30 (n = 4) for type IV fractures. Despite the increase in functional score between type I and type II fractures, the overall lesser score for types III and IV fractures was likely associated with increased soft tissue injury and the greater incidence of AVN.

Malunion and nonunion can result in incongruity and arthritis in the subtalar and tibiotalar joints and have been reported in ≤30% of cases (1,11,39). Of 143 patients, 19 (13.29%) developed postoperative