Original Article

Treatment for displaced sustentaculum tali fractures

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A R T I C L E   I N F O

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A B S T R A C T

Background: Sustentaculum tali fractures are rare foot fractures accounting for 1% of all calcaneal fractures, which accounts for about 1–2% of all bone fractures. Since the importance of sustentaculum tali in maintaining the medial foot arch, its fractures should be dealt with anatomical fixation to avoid post-traumatic arthrosis. Objective: Is to delineate the importance of sustentacular tali fractures fixation mentioning operative technique and the post-operative outcome. Methodology: Ten cases with 10 consequent closed sustentaculum tali fractures were treated by ORIF. Nine of them were male gender. Patient’s age was 27.6 (ranged 22–40). Of those 10 cases, 7 were isolated sustentaculum tali fractures, while 3 cases were associated by other fractures. All patients were followed-up with a follow-up period 52.8 months (ranged 24–84 m). Results: All fractures were united with a union rate 100%. Union appeared radiologically between 6–8 weeks post-operatively with an average 6.8 weeks. Isolated sustentaculum fractures achieved post-operative 100 score while in the case with fractured talar neck, patient had a score 80, associated distal fibular fracture achieved 90 score, overall average score was 97 ranged 80–100. There was no recorded complication regarding to the operative maneuver. Conclusion: Fractures of the sustentaculum tali are rare injuries associated with high energy mechanisms. These fractures have a high incidence of misdiagnosis. A high index of suspicion is, therefore, required when there is pain and hematoma directly over the sustentaculum tali. Open reduction and internal fixation of these fractures is reliable and possible through a medial approach.

1. Introduction

Calcaneal fractures account for 1–2% of all body fractures. Isolated fractures involving the sustentaculum tali are rare. It is usually associated with midtarsal, subtalar dislocations or foot fractures. Few published series exist and most publications are limited to case reports [1,2]. The name is derived from the Latin word-sustenus which means to support and tali that refers to the talus bone. Sustentaculum tali or (talar shelf) is a bony eminence that lies at the medial surface of the calcaneus, below the middle talar facet. It provides a vital support for the medial column of the foot and it gives attachment to the plantar calcaneonaviculcar (spring) ligament, tibiocalcaneal ligament and medial talocalcaneal ligament. This Eminence is concave above, and articulates with the middle calcaneal articular surface of the talus; below, it is grooved for the tendon of the flexor hallucis longus; its anterior margin gives attachment to the plantar calcaneonaviculcar ligament, and its medial margin to a part of the deltoid ligament of the ankle joint [3–6]. Due to the strong and thick cortical bone, solitary fractures of the sustentaculum tali without additional calcaneal injuries occur in less than 1% of all calcaneal fractures [7]. Mechanism of trauma is either due to fall from a height with the foot in supination during impact or due to a direct trauma. Patients always complain of pain, which lies distal and anterior to the medial malleolus and increases by passive motion of the flexor hallucis longus tendon. Clinically, there is an area of ecchymosis that lies over the sustentaculum (Fig. 1). In lateral radiographic images sustentaculum tali fractures are difficult to diagnose, so misdiagnosis is a common finding. Radiographic diagnosis can be achieved by obtaining an axial (calcaneal) view or CT scan [8,9]. Misdiagnosis and mistreatment of the sustentaculum tali are reported to cause severe complications such as a rapidly evolving post-traumatic subtalar joint arthritis, non-union, chronic impingement of the flexor hallucis longus tendon, varus of the hindfoot, parasthesia of the medial plantar nerve, persistent pain and swelling of the medial hindfoot, progressive pes-planovalgus deformity or even symptoms of a tarsal tunnel syndrome [9,10].

The aim of this study is to delineate the importance of sustentacular...
tali fractures fixation mentioning operative technique and the post-operative outcome.

2. Patients and methods

After approval by our institutional ethical committee, this prospective cohort study was done between March 2010 and March 2015 at our institution. This study included 10 patients with consequent 10 feet suffering from closed displaced sustentaculum tali fractures. All of them were treated by open reduction and internal fixation through a medial sustentacular approach. Patient’s gender was 9 male and one female. Average age was 27.6 years (ranging 22–40 years). Right side was affected in 6 cases while left side was affected in the other 4 cases. The chief mechanisms of injury were road traffic accidents in 8 patients and fall from a height in one patient and severe supination foot trauma during descending stairs in one patient. Associated fractures were one case of ipsilateral distal end fibula that was treated by percutaneous K-wires, ipsilateral talar neck in one case that was treated by open reduction and internal fixation through an anteromedial ankle approach and subtalar dislocation in one case that was treated by closed reduction. Time elapsed between trauma and surgical interference ranged (14–18 days) with an average 15.4 days. All patients were followed-up with a follow-up period (24–84 months) with an average 52.8 months. All patients had obtained pre-operative X-rays (axial and lateral ankle views) and CT scans.

2.1. Inclusion criteria

1-Intra-articular step-off ≥ 2 mm.
2-Depression of the middle subtalar facet.
3-Entrapment of the flexor hallucis longus, flexor digitorum longus, or posterior tibial tendons.
4-Fracture line extending into the posterior facet of the calcaneus.
5-Accompanying injuries warranting surgery.

2.2. Exclusion criteria

1-Infected or grossly contaminated soft tissue.
2-Open fractures.
3-Severely restricted vascular supply to the foot and high peri-operative risk.
4-Immobile patients.

3. Operative technique

Under completely aseptic conditions, patient lays supine with a bellow beneath the affected foot. Regional or general anesthesia was used. A pre-operative antibiotic was used. Pneumatic tourniquet was inflated. Draping was prepared. A medial calcaneal approach was performed (Fig. 2). The longitudinal approach made plantar to the medial malleolus, parallel to the path of the posterior tibial tendon sheath. After opening the deep fascia, the posterior tibial tendon sheath is then incised and the tendon was mobilized. The posterior tibial tendon is retracted plantarly for access to any cephalic extra-articular fracture cortical involvement and implant placement. The floor of the tendon sheath is carefully detached from the periosteum and secured for re-attachment after fracture fixation. The fragments of the sustentaculum tali are identified and the amount of joint involvement is noted. Sometimes the flexor retinaculum needs to be incised proximally to gain full sight of the middle facet. The tibiocalcaneal portion of the deltoid ligament should be left intact in order to avoid medial instability and damage to the blood supply to the talar body via the deltoid branches. The sustentaculum was reduced to the main body of the calcaneum. The fragment was fixed temporarily with a guide wire and reduction was checked fluoroscopically by obtaining an axial
(calcaneal view) (Fig. 3), definite fixation is usually achieved mainly by one 4 mm cannulated screw with a washer. Following the irregular shape of the calcaneum the screws are directed posteriorly and plan- tarly to avoid posterior subtalar facet affection [11,12].

4. Post-operative regimen

A splint or split below the knee cast for 2 week post-operatively till stitches removal, then a below the knee cast was applied for 6–8 weeks till appearance of radiological signs of union. During this period patient was instructed to do non-weight bearing. After cast removal and appearance of radiological signs of union patient was allowed to bear weight with range of motion of the operated ankle and foot.

5. Results

The results of open reduction and internal fixation of displaced sustentacular fractures can be assessed either clinically or radiologically.

5.1. Radiological evaluation

Fractures were considered as consolidated when X-ray check-ups in all projections showed the significant presence of trabeculation crossing the fracture, without pain. All fractures were united with a union rate 100%. Union appeared radiologically between 6–8 weeks post-operatively with an average 6.8 weeks (Figs. 4–6).

5.2. Clinical evaluation

Clinical assessment was obtained using the American Orthopedic Foot and Ankle Society (AOFAS) score of the hindfoot [13]. Isolated sustentacular fractures achieved 100 score; while in the case with fracture talar neck, patient had a score 80, associated distal fibular fracture achieved 90 score. Overall average score was 97 ranged 80–100 (Table 1).

With regard to post-operative complications, there was no recorded case of wound complications, no soft tissue or bone infections, and no neurovascular injuries using the direct medial sustentacular approach.
total for the subtalar joint. This indicates that the anterior and middle facets carry loads and thus its fracture should be reduced anatomically to avoid anterior and middle facet joint arthropathy.

The ideal approach to deal with this fracture is through the medial sustentacular approach, as it cannot be accessed through the ordinary extensile lateral approach of the calcaneus [11,12]. This supports Dürr et al. findings that direct sustentacular approach is a safe one and admit full access of the fractured sustentacular tali.

In Dürr et al. study [12] the score averaged 83.6 (SD 19.9; range 28–100). The 4 patients with isolated sustentacular fractures had a mean AOFAS scale of 100 which is equivalent to the maximum score. In contrast, the 7 patients with additional talar fractures had a mean score of 70.3 and the 14 patients with additional fractures at the same foot had a mean score of 78.9. Another study done by Mu et al. showed 7 cases; 5 are excellent and 2 were good using AOFAS score [15].

In the present study, the AOFAS score of the ankle-hindfoot was 97 (range 78–100). Isolated sustentacular fractures showed 100 score which is equivalent to the maximum score, while there was a decrease in the score when it was associated by other fractures. There was no recorded complication.

There was no published study that can describe a percutaneous screw fixation and it is the authors point of view that this fracture should be dealt by open methods to avoid injury of the vital medial neurovascular structures that lies near to the sustentacular tali.

7. Limitation of study

Only few small case series report on the injury mechanism, injury pattern, and the functional results after operative treatment of sustentacular fractures. A multi-center prospective cohort study is required for a more in-depth exploration of outcomes of patients who sustain isolated sustentacular fractures of the calcaneus. Other research should be done to properly understand the anatomy of this important area and to describe a percutaneous technique for fixation of those fractures.

8. Conclusion

Fractures of the sustentacular tali are rare injuries associated with high energy mechanisms. These fractures have a high incidence of misdiagnosis. A high index of suspicion is, therefore, required when there is pain and hematoma directly over the sustentaculum tali. Open reduction and internal fixation of these fractures is reliable and possible through a medial approach.

Conflicts of interest

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