



ORIGINAL RESEARCH PAPER

Orthopaedics

OUTCOME OF MINIMALLY INVASIVE FIXATION OF CALCANEAL FRACTURE – A RETROSPECTIVE ANALYSIS

KEY WORDS: calcaneum fracture, JESS, minimally invasive screw fixation

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ABSTRACT

Calcaneal fractures are common injuries amongst industrial workers and tree climbers and add huge economic burden to the society at large. Multiple treatment modalities are described for its management. Open Reduction and internal fixation of these fractures with plates are usually associated with high skin related complications including breakdown of skin with or without infection. We conducted this study to determine the functional outcome of patients with calcaneal fractures treated with minimally invasive fixation of fractures with cancellous screws after indirect reduction with JESS or manual reduction or with Steinmen pin. Total of 24 fractures in 23 patients were studied, out of which, 22 were male, and the average age of patients was 45.39 years. The average follow up period was 34.78 months. At last follow up, the average VAS score was 2.41 and the average AOFAS (American Orthopaedic Foot and Ankle Society) score was 77.63. 2 patients had deep wound infections requiring metal exit. Minimally invasive technique gives acceptable reduction and minimizes the possibility of skin complications after surgery.

BACKGROUND:

Calcaneal fractures have been long reported to have numerous complications and poorer outcome when compared to other orthopaedic trauma and injuries. Most of these patients may require a prolonged follow up, life style modification and change in job especially those who have to stand or walk for long during their job. Intraarticular fractures account for approximately 75 % of calcaneal fractures and are associated with poorer outcome [1]. Most of these patients present following a fall from height- from tree or a building under construction or renovation, and are one of the common workplace injuries in southern India; other mechanism of injury being road traffic accident. The fracture ensues due to axial load force through the talus on posterior facet of calcaneus with shear force directed to medial wall of calcaneum. The primary fracture line extends from the proximal –medial aspect of calcaneal tuberosity, through the anterolateral wall, into the crucial angle of Gissane, with variable position of fracture line through the posterior facet. As the axial force continues, the medial spike attached to sustentaculum tali is further pushed medially and also, multiple secondary fracture lines ensue. These are classified by Essex-Lopresti into joint depression type or tongue type [2].

Various treatment modalities are described in the literature for the management of calcaneal fracture ranging from conservative treatment with POP, pin and plaster, semi invasive screw fixation, multiple K- wire fixation, external fixator application, open reduction and plate fixation and primary subtalar arthrodesis. Age of more than 50 years, pre-existing subtalar arthritis, restoration of Bohler's angle apart from surgical complications determine the outcome of these fractures. We conducted this study to determine the outcome of the patients who underwent minimally invasive screw fixation for calcaneal fracture in our institute.

MATERIALS AND METHODS

34 consecutive patients who underwent closed reduction and fixation with screw in this institute from May 2012 to May 2018 were first included in this study. Patients who had associated fractures of lower tibia/ fibula or other foot bones were excluded from the study. One patient expired due to unrelated complication (carcinoma thyroid). After excluding all the patients, 23 patients were further evaluated for outcome. Out of 23 patients, 22 were male, 1 was female. Two patients had bilateral calcaneal fracture (female: left undisplaced, right displaced and one male: bilaterally displaced). The average age of the patients at the time of injury was 45.39 years.

Surgical technique

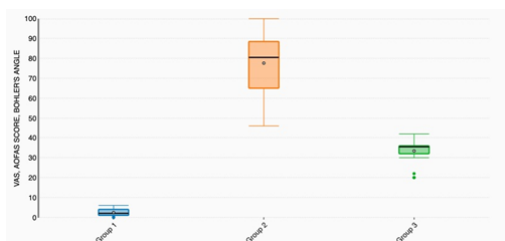
All patients had presented to Emergency Department and were evaluated for spinal injuries and other associated injuries. The patient was taken up for surgery after pre- anaesthetic evaluation and at mean time of 5.79 days (range:3 to 10 days) from time of

injury. Under spinal anaesthesia, with patients in supine position, parts are prepared and sterile draping done after confirming proper fluoroscopy to achieve lateral and axial imaging. Indirect and direct reduction maneuvers were used intra operatively to achieve acceptable reduction. Use of temporary external fixator using Joshi's External Stabilization system (JESS) was used in 12 patients on medial side of tibia and calcaneum to achieve acceptable calcaneal axis by ligamentotaxis. Manual traction and counter traction methods were used in 3 patients. Direct reduction with Steinmann pin were used in rest of the patients. Fixation was done with one to three cancellous screws depending upon fracture pattern and comminution of the fragment. POP was applied in all patients, which was removed at 2-3 weeks. Mobilization of ankle and foot was started at 3 weeks time. Weight bearing was allowed at 10-12 weeks time.

Patients were retrospectively included in the study and were interviewed and follow up was done. The average follow up time was months. At 4 and 8 weeks time, X ray evaluation was done along with VAS and AOFAS evaluation and similar evaluation was done at 3 months, 6 months and last follow up.

RESULTS

The average age of the patients was 45.39 years, ranging from 17 to 71 years, which means most of them from earning class and hence a huge economic burden to society. 22 patients were males and 1 was female. Since one patient had underwent the procedure in both calcaneum, the total number of calcaneal fractures which underwent study was 24. Nine patients were of sander type II, 13 patients were of sanders type III, and 2 patients were of Sanders type IV. The average follow up period was 34.78 months (range:12 to 79 months). The VAS score at last follow up was 2.41(range:0 to 6). This was significant improvement ($p<0.05$). The AOFAS score at last follow up was 77.63(range: 61 to 100); this improvement was significant ($p<0.05$). The mean Bohler angle at the last radiographic evaluation was 33.41°(range: 20° to 42°). The complications noted were proud implant with superficial wound infection in one, deep infection in 2 patients, delay in wound healing in 2 patients, persistent pedal edema in 2 patients. Two patients with deep infection required implant removal, whereas patient with superficial wound had done well with debridement.





1. Box and whisker plots of VAS (group 1), AOFAS (group 2), and Bohler's angle(group 3)
2. Clinical picture showing fracture pattern, immediate post op picture, follow up picture with normal calcaneum x-ray at 29 months follow up and clinical picture at 29 months follow. Nb: note cortical holes in tibia after JESS fixator use intra-operatively for achieving reduction through ligamentotaxis

DISCUSSION

Magnusson noted that he saw practically no calcaneum fracture which did not result in significant disability of foot [3]. Out of many controversies regarding treatment modalities of fracture calcaneum, the debate between operative and non-operative treatment for a good functional outcome still continues. Because different evaluation criteria were used in different studies for functional and radiological outcome, a comparison between them is difficult. AOFAS (American Orthopaedic foot & ankle Society) score however is being now used regularly to assess the functional outcome after a calcaneum fracture. Bohler angle is one of the most objective markers for calcaneal fracture but is not accurate as a sole – reference in an intra-operative reduction in one study; hence other radiographic features should be taken into account [4].

Though internal fixation with plate and screw is being routinely advocated by many authors, complications such as skin and soft tissue complications and superficial and deep infections are being reported as high as 12% [5,6]. Use of External fixators has been reported by many authors as adjuvant to open reduction and internal fixation (ORIF) with the advantage of attaining reduction with ligamentotaxis prior to ORIF and also helping in early weight bearing [7,8]. Yu et al reported that ORIF assisted by medial distraction technique is an effective method for intra-articular calcaneal fractures, especially in correcting the calcaneal axis. [9]. Percutaneous screw fixation with limited sinus tarsi incision had shown good functional and radiological outcome with minimal complications and can be undertaken without delay [10].

We started indirect reduction technique after our Senior Orthopaedic Surgeon Prof U Jayaprakash started medial placement of JESS fixator to achieve reduction by ligamentotaxis and thereafter fixation of the fracture with cancellous screws(6.5mm). Reduction with Steinman pin was used in 9 patients. Three patients underwent reduction with manual reduction maneuver. The advantages of this procedure were that the patients could be taken up for surgery earlier, and skin complications could be minimized. Though three patients had evidence of infection and two had delayed wound healing, these were less than skin complications reported with ORIF. The disadvantages of this study were that multiple reduction maneuvers were included in the same group and they were not individually assessed for restoration of Bohler's angle. The sample size is small and a larger sample size would be useful to arrive at definite conclusion.

CONCLUSIONS:

Calcaneal fractures has poorer prognosis when compared to other fractures. Multiple management methods are described the literature. ORIF of calcaneal fractures is associated with high skin complications and comorbidities. Percutaneous screw fixation has fewer skin complications and can have satisfactory functional outcome. JESS or similar external fixator can be used intraoperatively for achieving reduction through ligamentotaxis

and achieve acceptable calcaneal axis.

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