

Original Research Article

Outcome of the patients who underwent minimally invasive screw fixation for calcaneal fracture: an institutional study

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ABSTRACT

Background: Calcaneal fractures account for 2% of all fractures with approximately 65-75% intra-articular. The aim of the present study is to determine the outcome of the patients who underwent minimally invasive screw fixation for calcaneal fracture in our institute.

Methods: The present study was performed in 31 patients who underwent closed reduction and fixations with screw in this institute for the duration of 2 years were included in this study. Present study was conducted 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.

Results: The average age of the patients was 44.14 years, ranging from 16 to 74 years, 28 patients were males and 3 were female. The AOFAS score at last follow up was 78.05 this improvement was also significant statistically ($p < 0.05$). The mean Bohler angle at the last radiographic evaluation was 32.87° . The complications noted were proud implant with superficial wound infection in one, deep infection in 2 patients and delay in wound healing in 2 patients, persistent pedal edema in 2 patients.

Conclusions: 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.

Keywords: Calcaneal fractures, Edema, Intra-articular, Wound infection

INTRODUCTION

The calcaneus is a cancellous bone, which usually breaks after road traffic accidents or fall from height. The calcaneus fracture accounts 2% of all adult fractures. 30% of the fracture of the calcaneus is extra articular while around 70% are intra articular. Posterior articular facet of the calcaneus is the main weight bearing area in subtalar joint and is involved mostly in intra articular fracture of the calcaneus. Of all the fractures of the calcaneus approximately 15% are open and about 10% involve spine, pelvis or contra lateral side of the calcaneus. Calcaneal fractures account for 2% of all fractures with

approximately 65-75% intra-articular.^{1,2} It has been long reported to have numerous complications and poorer outcome when compared to other orthopedic 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.³

Most of these patients present following a fall from height of tree or a building under construction or renovation, and is one of the common workplace injuries

in India; other mechanism of injury is 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.⁴

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. The aim of the present study was to determine the outcome of the patients who underwent minimally invasive screw fixation for calcaneal fracture in our institute.

METHODS

The present study was performed in 38 patients who underwent closed reduction and fixations with screw in this institute for the duration of two years from March 2013 to April 2014 which were included in this study. Patients who had associated fractures of lower tibia or fibula or who were not willing to participate were excluded from the study. After excluding all the patients, 31 patients were further assessed for outcome.

Surgical technique

All patients had presented to Orthopedic Department and were assessed for spinal injuries and other associated injuries. The patient was taken up for surgery after pre-anesthetic assessment 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 15 patients on medial side of tibia and calcaneum to achieve acceptable calcaneal axis by ligamentotaxis. Manual traction and counter traction methods were used in 7 patients. Direct reductions 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. Mobilization of ankle and foot was started at 3 weeks' time. Weight bearing was allowed at

10-12 weeks' time. 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.

Statistical analysis

The data was coded and entered into Microsoft Excel spreadsheet. Analysis was done using SPSS version 15 (SPSS Inc. Chicago, IL, USA) Windows software program. The variables were assessed for normality using the Kolmogorov-Smirnov test. Descriptive statistics were calculated.

RESULTS

The average age of the patients was 44.14 years, ranging from 16 to 74 years, 28 patients were males and 3 were females. Eleven patients were of sander type II, 18 patients were of sanders type III, and 2 patients were of Sanders type IV. The average follow up period was 35.12 months. The VAS score at last follow up was 2.35 and it was significant improvement (p<0.05). The AOFAS score at last follow up was 78.05 this improvement was also significant statistically (p<0.05).

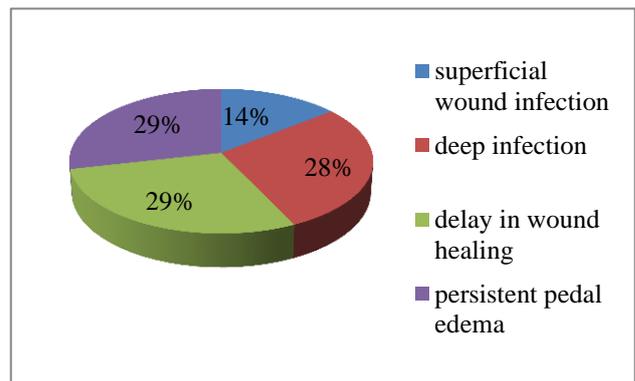


Figure 1: Complication among study participants.

Table 1: Age wise distribution of study participants.

Variable	Mean age	S.D.
Age	44.14	2.15

Table 2: Gender wise distribution of study participants.

Gender	Number	%
Male	28	90.3
Female	3	9.6
Total	31	100

The mean Bohler angle at the last radiographic evaluation was 32.87°. The complications noted were proud implant with superficial wound infection in one, deep infection in 2 patients and delay in wound healing in 2 patients, persistent pedal edema in 2 patients. One patient with

deep infection required implant removal, whereas patient with superficial wound had done well with debridement.

Table 3: type of sander fractures in the study participants.

Sander fracture	Number	%
Type II	11	35.4
Type III	18	58.06
Type IV	2	6.4

DISCUSSION

Calcaneal is situated at the inferoposterior part of the foot. It plays an important role in walking and running by supporting the axial load from the weight of the body.⁵ Calcaneal fracture is the most common fracture of the tarsal bones. Magnusson noted that he saw practically no calcaneum fracture which did not result in significant disability of foot.⁶ In the present study males had higher ratio of calcaneum fracture than females. In the Mitchell's research, the annual incidence of calcaneal fracture was 11.5 per 100,000, and occurred 2.4 times more frequently in males than in females. In males, the incidence was 16.5/100,000/year while that in females was 6.26/100,000/year.⁷

American Orthopaedic Foot and Ankle Society score 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.⁸ 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%. SooHoo et al identified 4481 patients who underwent open reduction and internal fixation of their fracture as inpatients within 30 days of the index admission.⁹

The complications noted were proud implant with superficial wound infection in one, deep infection in 2 patients and delay in wound healing in 2 patients, persistent pedal edema in 2 patients. One patient with deep infection required implant removal, whereas patient with superficial wound had done well with debridement. Findings of the present study was in agreement with Buckley et al requiring repeated surgeries.¹⁰

Oward et al found that there were 226 displaced intra-articular calcaneal fractures with 57 of 226 (25%) fractures having at least one major complication.¹¹ 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.^{12,13} 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.¹⁴ Percutaneous screw fixation with limited sinus tarsi incision had shown good functional and radiological outcome with minimal complications and can be undertaken without delay.¹⁵ Reduction with Steinman pin was used in 9 patients. Though 3 patients had evidence of infection and 2 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 Bohlers angle.

Limitation

Sample size is small and a larger sample size would be useful to arrive at definite conclusion.

CONCLUSION

Calcaneal fractures has poorer prognosis when compared to other fractures. Multiple management methods have 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.

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Ethical approval: The study was approved by the institutional ethics committee

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