

Original Research Article

Study of outcome of displaced calcaneal fractures by closed reduction and percutaneous internal fixation with multiple k wires and screws

Akshay Ravindra Kharat¹, Dhananjay Eknathrao More^{2*}, Shrikant Sudamrao Desai³

¹Department of Orthopaedics, Mahatma Gandhi Institute of Medical Sciences, Sevagram, Wardha, Maharashtra, India

²Department of Orthopaedics, Government Medical College, Baramati, Pune, Maharashtra, India

³Department of Community Medicine, Dr Shankarrao Chavan Government Medical College, Nanded, Maharashtra, India

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*Correspondence:

Dr. Dhananjay Eknathrao More,

E-mail: moredhananjay555@gmail.com

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ABSTRACT

Background: Calcaneum is the largest of the tarsal bones and the largest bone of the foot. Calcaneum fracture account for 2% of all fracture of the body and 60% of all tarsal fractures. Many calcaneal fractures are work related as they result from a fall from height, especially in male age 35-45 years. In our study we treated the displaced calcaneal fracture with closed reduction and percutaneous fixation using multiple percutaneous K-wires and screw to evaluate their functional outcome.

Methods: The study was conducted as a prospective study at the department of Orthopaedics, Dr. Shankarrao Chavan Government Medical College, Nanded, India during the period January 2019 to June 2020. Thirty patients of 20 to 60 years, who underwent surgical fixation for displaced calcaneal fracture using multiple K wires and screws were followed up. Functional outcomes at six month follow up were assessed.

Results: In this study we selected 30 patients with displaced calcaneal fracture admitting in our institute. All patients underwent operative procedure in the form of multiple k wire and cc .screws by percutaneous approach Out of all 30 patients treated with this method had shown excellent results with minimal postoperative complications.

Conclusions: The study with percutaneous K wires and screws for displaced calcaneal fractures showed very good functional outcome. Although it was not free of complications, our study has shown very good results. Technique involve in our study is less invasive, with minimum blood loss, less operative time without soft tissue stripping.

Keywords: Calcaneal fracture, Functional outcome, K wire and screws

INTRODUCTION

Calcaneum fractures account for 2% of all fractures of the body, 60% of all tarsal fractures. The calcaneum is one of the components of the tri-tarsal articulation and has important functional tasks with regard to normal weight bearing.¹ Almost all fractures occur due to an axial load such as a fall from a height or a motor vehicle accident. Approximately 10% of patients will have a spine fracture

as well due to the axial load. Approximately 10% of injuries are bilateral and fewer than 5% are open. Many calcaneal fractures are work-related, as they result from a fall from height, especially in male age 35-45 years.^{1,2} Considering the importance of the bone in normal mechanics of weight bearing, it is easy to see why a fracture of the calcaneum causes considerable morbidity. What follows then are arduous and complicated efforts to attain a satisfactory reduction, prolonged disability, and

the tedious stages of functional restoration. In 1916, Cotton and Henderson stated, ordinarily speaking, the man who breaks his heel is done so far his industrial future is concerned.³

Calcaneal fractures have a track record of being difficult to treat. Calcaneal repair not only requires re-apposition of multiple fracture patterns, but also requires restoration of the subtalar joint. In some cases, additional joint surfaces may be affected (the calcaneal cuboid joint) but are of lesser importance due to their limited weight bearing roles.⁴

The economic importance of these is apparent in that although they represent only 2 percent of all fractures, 90 percent occurs in males between 30 and 45 years of age. They occur most often in middle aged workers. The economic impact becomes even more apparent when one considers that 20 percent of patients may be incapacitated for up to 3 years following the fracture and many are still partially incapacitated as long as 5 years after the fracture.⁵

Till early 19th century, Calcaneum fractures were managed conservatively in form of closed reduction and casting with strict non weight bearing, but the functional outcome with this method was not satisfactory. Bohler et al began to advocate the open reduction of calcaneal fractures in 1931 based on his experience with the French methods. During 1950s, subtalar fusion emerged as the most commonly performed treatment as it was easiest to perform.

Over the past 25 years, however, marked advances in anesthesia, prophylactic antibiotics, computed tomography (CT) scanning, and fluoroscopy have allowed surgeons improve outcomes when operating on fractures, and these techniques have been applied to calcaneal fractures as well.⁶

Anatomic restoration of the three-dimensional anatomy of the calcaneum is the goal of surgical management of calcaneal fractures. Over the years, various techniques have been developed to accomplish this goal. All these techniques have certain steps in common including disimpaction of the fragments, reduction of the displaced fragments either manually or percutaneously and protection of reduction with percutaneous pins and plaster, external fixation and open reduction and internal fixation.⁷

There are many methods for fixation of displaced calcaneum fractures which are closed reduction and POP cast, open reduction and internal fixation with cc screw and k wires, open reduction and internal fixation with plate and screws.

The ideal choice of treatment, operative technique and postoperative management for displaced calcaneum fracture has still remained controversial.

Various classifications have been given for this fracture, most important and consistent being Essex Lopresti Classification. Antero posterior, lateral and Harris axial views of concerned foot were done. Computed tomography (CT) scan was done all patients.

Purpose of this study was to evaluate the functional and radiological outcome of displaced calcaneum fracture managed with closed reduction and internal fixation using percutaneous k wires and screws analysed using Meryland foot score.

METHODS

The study was conducted as a prospective study at the Department Of Orthopaedics, Dr. Shankarrao Chavan Government Medical College, Nanded during the period January 2019 to June 2020. Thirty patients of 20 to 60 years, who underwent surgical fixation for displaced calcaneal fracture using multiple K wires and screws were followed up. Functional outcomes at six month follow up were assessed. Ethical committee approval was taken for the study before starting the study.

Inclusion criteria

Patients with tongue-type and depressed type fractures of calcaneum, patients in age >18 of either sex, patients who are fit for surgery, patient with monotrauma or polytrauma were included.

Exclusion criteria

Patient with open fractures, fracture due to malignancy, patients less than 18 years of age, patients not giving written consent for surgery and medically unfit, patient with distal neurovascular deficit were excluded.

The material for the present study was collected from patients who attended and admitted in Department of Orthopedics in tertiary care centre with displaced fractures of the calcaneum. After approval from the ethics committee and with a written informed consent from the patients and relatives, for 18 months, 30 cases of either sex were taken up for the study.

The period of follow up was from 1, 3, 6 months. The results of 30 fractures in 30 patients were analyzed and studied. The analyzed data was compared with other series in literature and discussed. A master chart dealing with all aspects has been designed and presented.

Statistical analysis

All responses were tabulated by the investigator using Microsoft-Excel 2015 Software. Graphical representations were made wherever necessary. Data was analyzed by using SPSS Software version 16.0. Statistical tools used were percentage, mean, median range, proportion, Chi-square test.

All routine hematological and radio logical investigations were done. Patients were posted for operative management after proper consent and fitness from anaesthetist. In all patients we used percutaneous approach for calcaneal fixation. Post operatively limb elevation was given. IV antibiotics and analgesics was given for 3 days. Patients were usually discharged on postoperative day 3 with proper physiotherapy training. We kept regular follow up of the patients and in every follow up we did x-ray of the foot. We checked for signs of union, rehabilitation of the patient and any long term complications

RESULTS

Most of the patients were between age group of 41 to 50 with mean age 40. In the study 20 were males (66%) and 10 (33%) were females. In this study, 17 patients were affected on Right side (56.66%) and 13 were affected on left side of body (43.33%). The associated injuries 2 patients each had T12 vertebra compression fracture and L1 vertebra compression fracture. One patient each had left closed metatarsal fracture, left Colle's fracture and right lateral malleolus fracture. 20 patients showed the tongue type and 10 patients showed depressed type of Essex-Lopresti classification. Fall from height was the mode of injury for 23 patients (76.6%) and 7 (23.3%) due to road traffic accidents. Functional outcome was excellent in 19 (63.33%), good in 9 (30%) and fair in 2 (6.66%). Pin track infection was seen in 2 patients and sub talar arthritis in one patient. Minimum Maryland foot score was 77 whereas maximum Maryland foot score was 95 and mean score was 89.6.



Figure 1: Case 1: A) preoperative, B) post-op immediate, C) post op 6 months.



Figure 2: Case 2: A) preoperative, B) post-op immediate, C) post op 6 months.

DISCUSSION

In this study, the minimum age of patient was 20 years whereas maximum age was 59 years. The mean age of participants was 40 years with standard deviation ± 10.91 . The maximum patients 33.33% were belonged to 41-50 age group. Pan et al conducted a study to assess the percutaneous fixation of displaced intra-articular calcaneal fractures.⁸ In his study minimum age 23 and maximum age 62 years and mean age were 34. The study results are quite similar to present study. Abidi et al conducted a study to assess wound-healing risk factors after open reduction and internal fixation of calcaneal fractures.⁹ In his study mean age was 41 which is near to present study. Chandale et al conducted a study to assess the percutaneous fixation of displaced intra-articular calcaneal fractures. In his study mean age was 34 which is near to present study. Buckley et al found the mean age of patient to be 40 which is near to present study.¹⁰ In present study, there were 66.66% male participants and 33.33% were females. Pan et al and Chandale et al conducted similar a study in which 78.57% were males and 21.42% were females which is slightly higher than present study.

In this study, 56.66% patients were affected on Right side and 43.33% were affected on left side of foot. Pan et al conducted similar a study in which 50% patients were affected on right side and 35.73% were affected on left side of foot which is near about similar to present study.

The most common (76.66%) mechanism of injury was fall from height and 33.33% patients met with road traffic

accident. Pan et al conducted a similar study in which fall from height was most common mechanism of injury. Abidi et al conducted a similar study in which fall from height was most common mechanism of injury. Chandale et al conducted similar study in which fall from height was common mechanism of injury.

The associated injuries 2 patients (6.66%) had T12 vertebra compression fracture and L1 vertebra compression fracture. One patient each (3.33%) had left closed metatarsal fracture, left Colle's fracture and right lateral malleolus fracture. In present study, 23.33% had reported some associated injuries which is similar to a study conducted by Pan et al (28.57%) and Chandale et al (28%).

The most of the patients (66.66%) showed the tongue type and (33.33%) showed depressed type of Essex-lopresti classification. In study conducted by Pan et al (71.42%) showed the tongue type and (28.57%) showed depressed type of Essex-lopresti classification which is near about to our study.

Chandale et al conducted a study to assess the percutaneous fixation of displaced intra-articular calcaneal fractures. In his study, 10 fractures (62.5%) were tongue type and remaining six (37.5%) were joint depression type of Essex-lopresti classification which is near about same to our study. The mean duration of hospital stay was 2.9 days with standard deviation 0.67. The most duration of stay was 3 days (53.33%) followed by 2 days. The 6.66% patients had pin tract infection and in 3.33% patients Sub talar arthritis was the post-operative complications.

In this study, minimum Maryland foot score was 77 and maximum Maryland score was 95 and mean score was 89.6. Chandale et al conducted a study to assess the percutaneous fixation of displaced intra-articular calcaneal fractures. In his study, the mean Maryland foot score was 73 which is lower than this study. Parikh et al evaluate results by Maryland foot score found the average score was 86 which is similar to present study.¹¹ Tomesen et al conducted a study of treatment of displaced intra-articular calcaneal fractures with closed reduction and percutaneous screw fixation.¹² In his study, the mean Maryland foot score was 86 which is similar to present study. Tornetta et al in his study, the Maryland foot score there were 12 (55%) excellent, 7 (32%) good, and 3 (13%) fair results.¹³ The patients 63.33% showed excellent functional outcome, followed by 30% showed good functional outcome and 6.66% showed fair functional outcome. In study conducted by Pan et al 86% showed excellent functional outcome which is higher than our present study.

This study has some limitations. The present study was conducted in a tertiary care hospital with sample size of 30. Generalizability of the study findings could be a concern. There were ethical issues to do a case control study.

CONCLUSION

In our study, minimum Maryland Foot score was 77 and maximum Maryland score was 95 and mean score was 89.6. 63.33% patients showed excellent functional outcome, followed by 30% with good functional outcome and 6.66% had fair functional outcome. There is no statistically significant relationship between age, sex and Essex-lopresti classification with functional outcome of surgery. There is significant relationship between post-operative complications, Maryland Foot score with functional outcome. In this study, closed reduction and internal fixation by multiple percutaneous k wire and screws is one of the better modality of treatment for displaced calcaneal fractures. The use of percutaneous techniques for fixing calcaneal fracture is associated with benefits like less soft tissue stripping, less chance of infection. In our study i.e. closed reduction and internal fixation by multiple percutaneous k wire and screws, this technique is less invasive, with minimum blood loss, less operative time without soft tissue stripping. However, for selected fractures this is an excellent method that provides results comparable with or possibly better than the results of open repair. Another advantage is that implant removal is very minor procedure, after clinical and radiological confirmation of fully united fracture. Also implant removal is very easy.

Recommendations

A multi-centric study with study subjects from rural, semi-urban places would address this concern. A multi-centric study can produce causal relationship between various factors rather than mere associations.

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Ethical approval: The study was approved by the Institutional Ethics Committee

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