Functional Outcome of Surgically Managed Calcaneal Fractures

Surya Chandramurthy M.[1], Vivek Dubey[2], Rajeev B. Reddy[1], Hardik Kapopara[1], Sunil M. Shahane[3], Ashwin Samant[4]

ABSTRACT

Introduction: Fractures of Calcaneum are the most common of all tarsal fractures. The treatment of displaced intra-articular fractures is controversial. Earlier, most of the fractures were treated conservatively in plaster cast. These days some surgeons are operating the fractures of calcaneum with improved surgical techniques. The present study was conducted with the aim to to evaluate the functional outcome of surgically managed calcaneal fractures.

Material and methods: The present study included patients who were between 18-60 years of age and belonged to ASA grade I and II classification. A sample of 100 was selected. A complete history of patients were obtained along with a thorough clinical examination was done. The fractures in our study were joint depression type with 8 patients having Sander's type II and 17 having Sander's type III fracture. The patient was then posted for open reduction internal fixation with 6 holed 3.5mm contoured recon plates or calcaneal plates. Follow up was done clinically and radiologically at 12weeks, 6 months, and 1year. SPSS software was used for analysis.

Results: There were 40 patients operated in Dr. R.N. Cooper hospital from Feb 2010 to Feb 2014. Out of 40 patients, 15 patients were lost to follow up. The mode of injury for all the patients was fall from height. All the operated patients had a joint depression type of fracture. Of the 25 patients, 23 were males and 2 were females. Of the 25, 16 had good results with mean AOFAS score of 83.6, 7 had fair results with mean score of 73.28 and 2 had poor results with mean score of 54.

Conclusion: From the above study we can conclude that open reduction and rigid fixation offers good post operative results. It allows for early mobility with less of complications

Keywords: Calcaneal, Intraarticular, Operated, Radiologically

INTRODUCTION

Calcaneus fractures are the most common of all tarsal fractures (60%), and account for almost 2% of all adult fractures.[1] The surgeons are always in a dilemma while treating a case of displaced calcaneal fracture. Some surgeons are now operatively treating these fractures because of continuing dissatisfaction with the outcome of conservative treatment and improvements that have occurred in surgical techniques resulting in decrease in complication rates.[2] Pain and disability are the long term consequences of calceneal fractures. There have been various studies that depict that operative treatment of calceneal fractures result in better outcome than non-operative treatment.[3] Palmer (1948) and Letournel (1984) favour the lateral approach to the os calcis. It was later modified by Benirschke and Sangeorzan (1993). It is now the most commonly used approach. The purpose of this study was to evaluate the functional outcome of surgically treated calcaneal fractures.

Calcaneal fractures can broadly be classified into extra articuar and intra articular fractures based on involvement of subtalar joint. Based on plain radiography the intra articular fractures were further divided into two types by Essex-Lopresti in 1952, they are joint depression type and tongue type fracture. In joint depression type the fracture line exits behind the posterior facet and anterior to attachment of Achilles tendon. In tongue type frature, there is a secondary fracture line exits distal to Achilles tendon, and articular fragment remained attached to a tuberosity fragment. Sanders gave a improvised classification based on CT scan. It was based on the number and location of articular fracture fragments alone. The classification was found to be useful in determining both treatment methods and prognosis after surgical fixation Originally, this classification system was described for joint-depression fractures exclusively. The true extra-articular tongue is typically a Type IIC, in which the entire facet is displaced, but intact. If the tongue fracture extends intra-articularly, the fracture is typically IIB. In addition, tongue-type fractures with joint-depression components (mixed fractures) can clearly be evaluated using this CT scan classification. Type I consisted on undisplaced fractures, Type II was further divided into IIA, IIB, and IIC based on the location of the primary fracture line. In type II, fracture had three parts which were centrally depressed. Type IV was comminuted fracture. The aim of the present study was to determine the functional outcome of surgically managed cases of Calcaneal fractures.

MATERIAL AND METHODS

Our study included patients reporting to Dr. R.N. Cooper Hospital, Mumbai during February 2014, till June 2015; treated by open reduction and internal fixation and those who were available for follow up. This was a prospective and retrospective study. For retrospective cases, from February 2010 to February 2014, the patients were communicated

[1]Senior Resident, [2]Junior Resident, Pursuing DNB Ortho, [3]Honorary Professor and Head of Unit, [4]Assistant Honorary Professor, Department of Orthopaedics, H. B. T. Medical College and Dr. R.N.Cooper Hospital, Juhu, Mumbai, India

Corresponding author: Vivek Dubey, Room no. 305, RMO Quarters, Dr. R.N. Cooper Municipal General Hospital, N.S. Road No.1, Vile Parle (W), Mumbai, India

How to cite this article: Surya Chandramurthy M., Vivek Dubey, Rajeev B. Reddy, Hardik Kapopara, Sunil M. Shahane, Ashwin Samant. Functional outcome of surgically managed calcaneal fractures. International Journal of Contemporary Medical Research 2017;4(8):1676-1679.

Age	15-24	25-34	35-44	45-55	Mean±SD
N (%)	1(4%)	10(40%)	8(32%)	6(24)	37±9.1

Table-1: Age distribution of patients

Side Involved	Left	Right
N (%)	16 (64%)	9(36%)

Table-2: Side of fracture involved

Results	Excellent	Good	Fair	Poor
N (%)	0	16 (64%)	7(28%)	2 (8%)
Mean±SD	0	83.5±2.03	73.28±1.25	54±8.48

Table-3: Results as per AOFAS scoring

through phone calls, letters etc. Ethical approval was obtained. All the patients were informed about the study and a written consent was obtained from all. Ethical committee clearance was obtained from the institute's ethical board. The study included patients who were between 18-60 years of age and belonged to ASA grade I and II classification. Patients with Paraplegia/ paraparesis, Long bone fractures in the ipsilateral limb, open fractures or with subtalar or ankle arthritis or any other coexisting disabilities were excluded from the study.

Sample size selection - A sample size of 40 was selected for evaluation of functional outcome of surgical management of calcaneal fractures who underwent surgery. Sample size was selected based on the following formula.$N = 4*p*(1-p)/d^2$ (n = sample size, p =prevalence, d = allowable error). Allowable error of 5% was taken.

Procedure - A complete history of patients were obtained along with a thorough clinical examination was done. The swelling of the heel and condition of the skin were noted. Lateral and axial views and CT scans of calcaneum were taken on admission. Classification of fractures was based on the Essex-Lopresti and Sander's classification. The fractures in our study were joint depression type with 8 patients having Sander's type II and 17 having Sander's type III fracture. The patient was then posted for open reduction internal fixation with 6 holed 3.5mm contoured recon plates or calcaneal plates. All the patients were treated by lateral extensile approach. After the surgery, short leg splint 3-5 days post op. Early active ROM exercises started once wound gets healed. 2nd post op week active ankle and subtalar ROM exercises are started. Weight bearing is started after 12 weeks of fixation.

Follow up was done clinically and radiologically at 12weeks, 6 months, and 1year.Patients were evaluated for following: height and width of the calcaneum, range of movements at subtalar joint, and tubero-talar angles. During every follow up visit patient was assessed for pain, swelling, tenderness and clinical union. The functional outcome was assessed using classification by "American Orthopaedic Foot and Ankle Society (AOFAS) Ankle Hindfoot scoring system" at twelve months. It is a 100 point scale in which pain, function and alignment are measured. Pain has 40 points, function holds 10 points and alignment also carries 10 points.

STATISTICAL ANALYSIS

Statistical Package for Social Sciences (SPSS, Inc., Chicago, Illinois) version 18.0 was applied to confirm statistical significance of the data thus collected. Descriptive statistics was used to describe the sample in terms of socio-demographic and clinical characteristics. Parametric test (chi square, student t test) and Non-parametric tests (χ and Mann-Whitney U) was be used to compare between groups. In this study, a level of significance (α) of < 0.05 (2-tailed) was taken to consider a result (group difference) statistically significant.

RESULTS

There were 40 patients operated in Dr. R.N. Cooper hospital from Feb 2010 to Feb 2014. Out of 40 patients, 15 patients were lost to follow up. The mode of injury for all the patients was fall from height. All the operated patients had a joint depression type of fracture. Of the 25, 17 (68%) had Sander's type III fracture and 8 (32%) had a Sander's type II fracture. Of the 25 patients, 23 were males and 2 were females. All were between the age group of 18- 60 yrs (mean age- 37yrs). (Table 1, Figure 1)

Two patients had bilateral fractures (operated only on one side) and one underwent implant removal at 5 months. Of the 25 patients, 16 (64%) had left sided fractures, while 9 (36%) had right sided fractures.(Table 2)

Of the 25, 16 had good results with mean AOFAS score of 83.6, 7 had fair results with mean score of 73.28 and 2 had poor results with mean score of 54. Of the patients with good results, 2 patients underwent implant removal after union of fracture at one and a half year from surgery. Post operatively patients had no complaints. The mean ROM of subtalar and ankle joints of patients with good results are as follows. Inversion and eversion are 21.66 and 18.33degrees respectively, and the mean dorsi flexion and plantar flexion of ankle are 30 and 25 degrees respectively. The mean ROM of subtalar and ankle joints of patients with fair results are as follows. Inversion and eversion are 16.42 and 12.85 degrees respectively, and the mean dorsi flexion and plantar flexion of ankle are 20 and 15 degrees respectively. The mean ROM of subtalar and ankle joints of patients with poor results are as follows. Inversion and eversion are 10 and 7.5degrees respectively, and the mean dorsi flexion and plantar flexion of ankle are 15 degrees each (Table 3).

DISCUSSION

The most commonly fractured tarsal bone is calcaneum. As far as prognosis is concerned, it is better for extra articular fracture but for intra articular fracture it varies. Even the management of intra articular fracture is varied and highly controversial. Various treatment protocols have

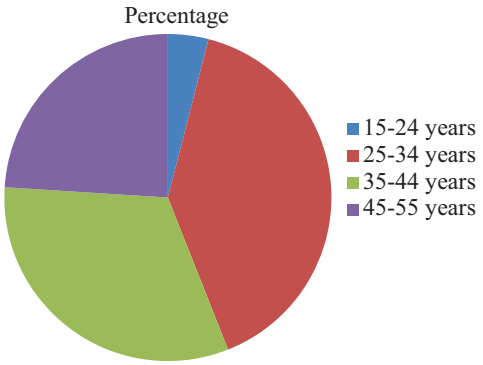

Figure-1: Age distribution of patients

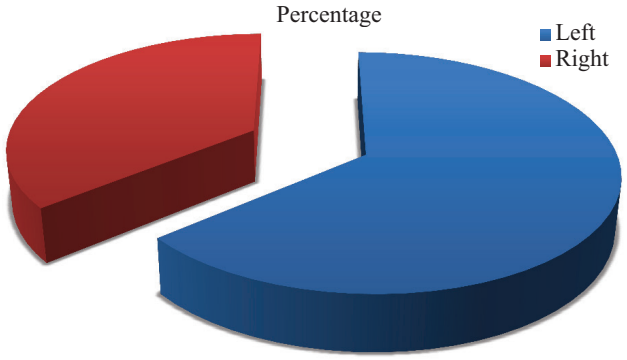

Figure-2: Side of fracture involved

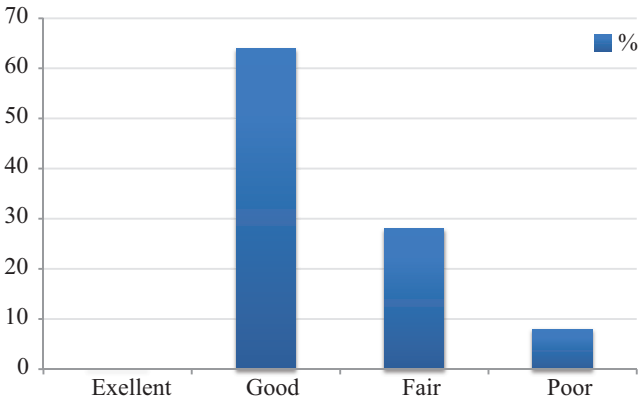

Figure-3: Results as per AOFAS scoring

been advised but there is no consensus for the treatment that offers best results. In a study conducted by Stapleton JJ et al, they concluded that calcaneal fractures are difficult to manage surgically and do not always give consistent results. Conservative management of displaced intraarticular calcaneal fractures results in significant deformity with posttraumatic arthrosis. In most of the cases an open approach is required to achieve anatomic reduction and successful long-term results[4] In 2014, Cao L et al. concluded that Sanders type II and III fractures of the calcaneus bone, treatment with a minimally invasive technique combining percutaneous reduction and locking plate fixation provided satisfactory clinical results, with a lower incidence of complications.[5] In 2015, Chen XD et al. concluded that internal fixation with titanium plate is an effective treatment for calcaneal fractures. It provides satisfactory reduction, reliable fixation, and early rehabilitation.[6] In another study conducted by Griffin D et al in 2014, there was no symptomatic or functional advantage of operative versus non operative treatment in management of displaced intra-articular fractures of the calcaneus. According to them the risk of complications was higher after surgery.[7]

In a study by Stapleton JJ et al, they saw that intraarticular calcaneal fractures were mostly as a result of high-energy trauma. The operative treatment of fractures was based on achieving anatomic reduction and minimizing complications. The lateral approach offers all the above mentioned advantages without compromising healing.[8] Although some studies with more than 100 cases have demonstrated good results after open reduction and internal fixation of intraarticular calcaneal fractures[9-11], the choice of treatment still remains controversial because certain prospective randomized trials have failed to show better results after surgery[12,13] However, in prospective randomized study, Buckley et al. Concluded with better results subgroups of patients after surgery.[14] In our study, out of the 25, 17 (68%) had Sander's type III fracture and 8 (32%) had a Sander's type II fracture. There were 23 males and 2 females. All were between the age group of 18-60 yrs (mean age- 37yrs). In a study by Melcher in which patients were followed up 3 and 10 years after the surgery, concluded that subjective and objective results after ten years were better than those achieved in a 3-year follow-up.[15] In our study, 16 had good results with mean AOFAS score of 83.6, 7 had fair results with mean score of 73.28 and 2 had poor results with mean score of 54. Of the patients with good results, 2 patients underwent implant removal after union of fracture at one and a half year from surgery. Post operatively patients had no complaints. In Sander's study, excellent or good results were obtained in 73% of type-II, 70% of type-III, and only 27% of type-IV fractures.[16] In a study by Johny Joshi et al in 2015, the functional outcome was excellent in 26.4% cases and good in 61.64% cases. None of the cases had poor outcome.[17] In another study by Tashfeen Ahmad et al[18], they concluded that there was significant improvement in anatomical parameters after surgery. According to Carlo Biz et al[19] there was a significant improvement in functional outcome after open reduction. In our study, 79% of patients had good and 21% had fair and poor results, despite anatomic calcaneal restoration (as measured by the Bohler and Gissane angles). Plate and screw fixation greatly enhances the functional results after surgery. The few limitations of our study was smaller sample size and pattern of fracture was not taken into consideration.

CONCLUSION

Calcaneal fractures are most frequently encountered in today's generation and hence they should be managed tactfully. From the above study we can conclude that open reduction and rigid fixation offers good post operative results. It allows for early mobility with less of complications.

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Source of Support: Nil; **Conflict of Interest:** None

Submitted: 15-07-2017; **Accepted:** 17-08-2017; **Published:** 28-08-2017