

Management of Intra-Articular Calcaneal Fractures by Closed Reduction with Percutaneous Steinmann PinSubodh Kumar¹, Vikas Kumar², Narendra Kumar Sinha³^{1,2}Senior Resident, Department of Orthopaedics, BMIMS, Pawapuri³Associate Professor, Department of Orthopaedics, BMIMS, Pawapuri

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Corresponding author: Dr. Vikas Kumar

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Abstract:

Background and Objectives: Calcaneum is the most common tarsal bone to fracture and is attended by considerable morbidity. Many treatment techniques are described in literature but indications for specific techniques are vague. This study analyzes the outcome of treatment of intra articular calcaneum fractures.

Methods: A Prospective study which has been carried out the BMIMS Pawapuri, Study duration of Fifteen Months. The material for the present study was collected from patients who attended and admitted in Department of Orthopaedics with tongue-type intra-articular fractures of the calcaneum. 20 cases of either sex were taken up for the study. Patients were well informed about the study in all respects and informed written consent was obtained.

Results: Incidence was more common in males with right and left side involvement being almost equal and no bilateral involvement. The commonest mechanism of injury was fall from height and landing on the heel. It was found to be more common in age group 30-39 years. Associated spine and lower extremity injuries were seen in 30%. There were 45% excellent, 30% good, 25% fair results and no poor results.

Conclusion: The Essex-Lopresti method of closed reduction and pin fixation is a useful method for the treatment of tongue-type fracture of calcaneum.

Keywords: Essex-Lopresti, Closed reduction, CNHF Score, Bohler's angle.

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Introduction

The calcaneum is the largest bone of the foot and is the major weight-bearing osseous structure of the foot. It is one of the components of the tritarsal articulation and has important functional tasks with regard to normal ambulation. With a bone so vital to the normal mechanics of locomotion, it is easy to see why a fracture of the calcaneus is attended by considerable morbidity. The mere mention of the word fracture as applied to the calcaneus brings to mind the image of a bone with its structure and shape grossly disrupted and its articular relationship seriously disorganized. What follows then are arduous and complicated efforts to attain a satisfactory reduction, prolonged disability, and the tedious stages of functional restoration [1]. Calcaneal fractures have a track record of being difficult to treat and have frustrated doctors for years. The problem in treating calcaneal fractures is in trying to rebuild the fracture so that healing may take place. The calcaneus is much like an egg; an outer firm shell and soft on the inside. As a result, the calcaneus often shatters when broken. Calcaneal repair not only requires re-apposition of multiple fracture patterns, but also requires restoration of the subtalar joint. The subtalar joint is the interface

between the calcaneus and talus and is a primary load bearing joint of the foot. 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 [2]. Calcaneal fractures make up about 2 percent of all fractures. They account for 60 percent of major tarsal injuries. The economic importance of these fractures 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 upto 3 years following the fracture and many are still partially incapacitated as long as 5 years after the fracture [3]. 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

plaster pins and plasters, external fixation and open reduction and internal fixation [4].

Objectives

To evaluate the outcome of “Tongue-type” fractures of calcaneum treated by Essex-Lopresti method of closed reduction with percutaneous Steinmann pin.

Material and Methods

A Prospective study which has been carried out BMIMS Pawapuri Bihar. The material for the present study was collected from patients who attended and admitted in Department of Orthopaedics with tongue-type intra-articular fractures of the calcaneum. 20 cases of either sex were taken up for the study. Patients were well informed about the study in all respects and informed written consent was obtained. Study duration of Fifteen Months. The period of follow up was from 6 months to 1 year. The results of 20 fractures in 20 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.

Inclusion criteria

- Patients with tongue-type fractures of calcaneum
- Patients in age group of 15- 50 of either sex
- Patients who are fit for surgery

Exclusion criteria

- Open fractures
- Patients presenting after 2 weeks of injury
- Patients not giving written consent for surgery

Cases were selected by diagnosis on history, clinical examination, x-rays and routine investigations. Specific mention about the presence or absence of vascular or neurological deficits, open or closed injury, associated spine or extremity injuries were

made. Performa specially made for this study was used. Clinical diagnosis was confirmed by Antero-Posterior, Lateral and Harris axial views. Special views were taken only when the interpretation of these routine x-rays were difficult. In all cases the opposite calcaneus was x-rayed for comparative studies.

All calcaneal fractures were classified and assigned to particular group based on Essex-Lopresti's classification system. The present study included 20 cases of tongue-type fractures of calcaneum treated by Essex-Lopresti's technique of closed reduction with percutaneous Steinmann pin. Bohler's tuber joint angle was measured in normal foot, and affected foot at radiological union and ratio was calculated. The basic aim of the surgery was to achieve as near anatomical realignment and perfect subtalar joint congruity as possible.

Laboratory investigations: performed routinely were: Blood routine, Urine routine profile, BT, CT, and Blood grouping and typing. Other investigations: (Wherever necessary) Blood urea, Serum creatinine, RBS, HIV, HBsAg, ECG.

Anaesthesia: Surgery was performed under Spinal or General Anaesthesia depending on the patients general condition,

Surgery: Closed reduction with percutaneous Steinmann pin (Essex-Lopresti Method),

Rehabilitation: All patients were allowed to ambulate without weight-bearing on 1st post-operative day. Almost all patients were discharged by 2nd or 3rd post-operative day. Initial cast and pin was removed at 6 weeks and below- knee cast was applied. The cast was removed and weight-bearing started only after radiological evidence of union.

Results

Table 1: Age incidence

Age group	No. of Cases	Percentage
15 – 20	0	0
21 - 29	3	15
30 - 39	12	60
40 - 49	5	25
50 - 55	0	0

From the above table it is seen that the maximum age incidence in this study was from 30-39(60%) with a mean age of 35.2 years. Second commonest was the 40- 49 (25%) years. The youngest patient in this study was 24 years old and the oldest was 48 years old.

Table 2: sex incidence

Sex	No. of Cases	Percentage
Male	18	90
Female	2	10

In this study there were 20 patients in total of which 18(90%) were males and 2(10%) were females showing male

predominance. M: F = 9:1. Both the females were in the 40-49 years group

Table 3: Side incidence

Side	No. of Cases	Percentage
Right	11	55
Left	09	45

In this study there were 20 patients in total of which 11(55%) were affected on the right side and 9(45%) were affected on the left side. There were no cases of bilateral involvement.

Table 4: Mechanism of injury

Mechanism	No. of Cases	Percentage
Fall from height	17	85
Road traffic accident	03	15

The predominant mechanism of injury was fall from height and landing on the heel, 17 cases (85%). The other mechanism was the road traffic accident, 3 cases (15%).

Table 5: associated injuries

Injury	No. of Cases	Percentage
Thoraco-lumbar spine	02	10
Head injury	01	05
Malleolus fracture	01	05
Colle's fracture	01	05
Metatarsal fracture	01	05

Total of 6 patients (30%) had associated injuries, of which Thoraco-Lumbar spine injuries were commonest (10%). Both were compression fractures and none of them had neurological compromise. One patient (5%) had close head injury which was managed conservatively. One patient had malleolus fracture (5%), treated with open reduction and internal fixation. One patient had Colle's fracture (5%) and another patient with closed metatarsal fracture were treated conservatively.

Table 6: results and outcome

Grade	No. of Cases	Percentage
Excellent	09	45
Good	06	30
Fair	05	25
Poor	00	00

All the results were graded as per criteria of Creighton Nebraska Health Foundation assessment sheet for fracture of calcaneum. Of the 20 cases, 9 cases(45%) had excellent, 6 cases (30%) had good and 5 cases (25%) had fair results. None of the patients in this series had poor results.

Table 7: complications encountered in the study

Complications	No. of Cases	Percentage
Subtalar arthritis	03	15
Peroneal Tenosynovitis	03	15
Plantar spur	02	10
Superficial infection	01	05
Heel widening	04	20

A total of 9 patients (45%) had surgery related complications. There were 4 cases (20%) of heel widening. Of these 4 patients, 3 patients (15%) developed subtalar arthritis and one had Peroneal Tenosynovitis.

Overall there were 3 cases of Peroneal Tenosynovitis which was managed conservatively. One case recurred and was offered surgery.

Subtalar arthrodesis was done for 2 cases and one patient refused surgery. All 3 patients with subtalar arthritis ended up with fair results. 2 cases (10%) of Plantar spur was managed conservatively of which 1 patient had severe pain limiting his activities. There was only 1 case (5%) of superficial infection at pin entry site. Infection subsided with antibiotics and the patient had uneventful recovery.

Table 8: Radiological union:

Radiological union at : (weeks)	No. of Cases	Percentage
8	07	35
9	07	35
10	04	20
12	02	10

All the fractures united within 8-12 weeks. There were no cases of non-union.

*All the fractures were of closed type.

*The period of follow up was from 6 months to 1 year (average 9 months).

*There was no surgery related mortality in this study.

Discussion

The maximum age incidence in our study has been 30-39 years (60%), mean age being 35.2 years and range between 24-48 years old. Nambiar noted that 56% of his patients were in the 3rd to 4th decade of life, Parmar [6] noticed age range between 16-64 with mean age 50.9 years and Buckley [6] noted that in his study the maximum age incidence was between 30-39 years (60%) with age range between 15-68 years. In this present study 18 patients were males (90%) and 2 patients were females (10%), showing male preponderance (M:F::9:1). Parmar [7] noted male to

female ratio of 2.3:1, Pozo [5] 4:1, Nambiar [10] 10:1 and Paley [24] 6:1. 11 patients (55%) had involvement of right foot and 9 patients (45%) had involvement of left foot. There were no cases of bilateral involvement in this study. Nambiar [5] noted 44% involvement in right foot, 31% involvement in left foot and 25% bilateral involvement. 17 patients (85%) gave history of fall from height and 3 patients (15%) were involved in road traffic accidents.

There were 2 cases (10%) of associated thoraco-lumbar spine injury and 1 case (5%) each of head injury, Malleolar fracture, Colle's fracture and Metatarsal fracture. Hildebrand reported associated spine fractures in 10%, Buckley [6] reported 15% and Nambiar [5] reported 21% associated spine injuries. In the evaluation of the results in the present study, 9 patients (45%) had excellent results, 6 patients (30%) had good results and 5 patients (25%) had fair results. None of the patients had poor results. The comparison of the results in this present series with other similar studies is given below.

Series	Outcome			
	Excellent	Good	Fair	Poor
Leung	39	52	09	00
Paley [8]	21	13	11	07
Tornetta [9] (1998)	55	32	13	00
Tornetta [10] (2000)	50	35	15	00
Poupa [11]	58	29	13	00
Nambiar [5]	61	33	06	00
Present study	45	30	25	00

Test used: **F Test** $p = 0.5290016$ NS > 0.05 . There is no significant difference between the results of various series and the present study. This statistically proves that the outcome of the present study has no significant variation from the other similar series. When comparing with older studies which described results in terms of satisfactory and unsatisfactory only;

Series	Satisfactory	Unsatisfactory
Essex-Lopresti [12]	63	37
Lindsay [13]	81	19
Pozo [14]	76	24
Present Study	75	25

In our study we have compared Bohler's angle in normal foot and operated foot of patient and have statistically analyzed the outcome with the Bohler's angle ratio. We have noted that Bohler's angle ratio of the side of the fracture to the normal side was significantly lower in patients who had unsatisfactory results, compared with those who had satisfactory results, indicating that this ratio is a

negative prognostic factor. We have compared our analysis with Paley [8] who did a similar analysis and has similar conclusions. With respect to complications, 4 patients (20%) in this study had significant heel widening compared to the normal foot. 3 of these patients later developed subtalar arthritis and 1 had chronic heel pain due to peroneal tenosynovitis. All 4 of these patients ended up with

fair results. Nambiar noted that only 5 patients (13%) among his 36 patients developed heel widening. There were 3 cases of subtalar arthritis (15%), 3 cases (15%) of peroneal tenosynovitis and 2 cases (10%) of Calcaneal spur. There were no cases of osteomyelitis. This is comparable to Nambiar (13%), Poupa11 (17%) and Tornetta [10] (10%) who had reported subtalar arthritis in their series.

Conclusion

- Essex-Lopresti's method of closed reduction and percutaneous pin fixation is the ideal treatment for tongue-type fractures of calcaneum.
- Bohler's angle ratio can be used as a prognostic indicator.
- There is no observed statistical correlation between age and outcome.

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