

Outcome of Operative Treatment in Patients with Joint Depression Variety of Calcaneum Fracture: A Prospective Study

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ABSTRACT

Introduction: Calcaneum is a principle weight bearing bone, so an intra-articular fracture of calcaneum may, if not reduced anatomically; eventually leads to subtalar arthritis and painful walking on uneven surface. 75% of calcaneal fracture are Intraarticular. Treating calcaneal fractures is a challenge for orthopaedic surgeon due to the complex fracture pathology and wide range of treatment modalities.

Purpose: The purpose of this study is to assess the functional outcome of operatively managed intra articular calcaneal fractures in terms of pain, restoration of normal anatomy and return of the patient to his/her routine daily activity.

Method and Material: Twenty-four patients with twenty-nine calcaneal fractures (five patients with bilateral involvement) were enrolled in this study who visited B.J Medical College and Civil Hospital, Ahmedabad. All of them were operated within a week with standard lateral approach. They were followed at regular interval for period of one year in terms of pain, restoration of normal anatomy of the bone and their ability to carry out their daily activities.

Results: In our study all the patients underwent open reduction and internal fixation with either of the one implant amongst Steinmman's pin, Steinmman's pin with lag screw or Plate fixation. Most of the patients who underwent open reduction and internal fixation achieved near normal Bohler's angle postoperatively. Eighty percent of the total number of patient in the study group achieved painless heal.

Conclusion: Due to smaller study group, we were unable to

detect significant differences between the excellent, good, fair and poor results with regards to the patient's sex, the mode of injury or the duration of follow-up. Moreover patients with poor results had occupation involving strenuous labor as compared to that of the patients with excellent and good results. However the patients in poor result group continued to improve in terms of pain intensity and walking distance as time lapsed. Radiographic results shows that subtalar congruity was restored in twenty patients postoperatively out of total twenty-nine heals.

Key words: Bohler's Angle, Calcaneum Fractures, Internal Fixation, Joint Depression Type, Lateral Extensile Approach.

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INTRODUCTION

Calcaneum is a principle weight bearing bone and forms the subtalar joint which helps in fine movements of foot, so an intra-articular fracture of calcaneum may, if not reduced anatomically, eventually leads to subtalar arthritis and painful walking on uneven surface.

The incidence of these fractures comprises about 60 % of all tarsal bone fractures and 1 to 2 % of all fractures.¹ Out of those 60–75% are intra-articular fractures.

Severe, painful osteoarthritis of the subtalar joint often follows. Recovery is prolonged, typically taking two years. Even then, most patients have a painful, stiff, deformed foot, and are unable to wear a normal shoe; walking is painful and many need the

assistance of a walking stick.² These poor outcomes are especially problematic for the typical patient who is a laborer or outdoor worker, as they are unable to resume their occupation. This affect on working life was recognized as early as 1916: "Ordinarily speaking, the man who breaks his heel bone is done, so far as his industrial future is concerned."³

Numerous controversies exist for management of patients with calcaneal fracture. The major conflict exists between whether the better outcome can be achieved by operative or by non-operative management. Conservative, non-operative care includes elevation, application of ice, closed reduction and immobilization by cast application followed by a period of non-weight bearing and

early mobilization with the use of a splint.² Various modalities of operative management include open reduction and internal fixation, primary arthrodesis and percutaneous reduction. Orthopaedic surgeons have aimed to treat severe calcaneal fractures to accelerate recovery and reduce pain and deformity. In the 1950s, operative treatment with a percutaneous "spike" became popular and was widely performed.⁴ In the 1960s, enthusiasm waned because of reported difficulties of the technique.⁵ In the 1980s, limited exposure of the subtalar joint and fixation with wires was attempted, but a randomized controlled trial showed no benefit from surgery.⁶ In the 1990s, computerized tomography allowed a better understanding of fracture patterns, and new surgical approaches were developed that allowed surgeons to realign the bone fragments, fix them with plates and screws, and restore the subtalar joint.⁷ Observational studies of these treatments⁸ reported low complication rates and better clinical outcomes than had been observed in historical non-operative series,

Open reduction and internal fixation is the commonest modality of treatment in present time and it includes medial, lateral or combined medial and lateral approach.

However due to lack of universal protocol for subjective, objective and radiographic evaluation of these injuries have hampered the comparison of operative results. The current situation is one of uncertainty. Some orthopaedic surgeons are enthusiastic about this surgery for calcaneal fractures, and recommend it to patients. Others consider the operations to be complex, expensive, risky,⁹ and without proved benefit, and so recommend non-operative care. Further complication arises from the lack of consistency in the classification system of intra-articular fractures of calcaneus used in different clinical studies.

Hence lack of universal classification scheme and evaluation system as well as long term follow up studies have led us to take this study.

PURPOSE

In this study we are evaluating the operative results of joint depression type of calcaneum fracture.

STUDY DESIGN

We have studied 24 patients with 29 calcaneal fractures (5 patients had B/L involvement) who were operated with different operative modalities in B.J. Medical College, Ahmedabad between 1st January 2014 to 31st December 2015, out of which 22 were completely followed up regularly and statistical data with functional outcome was collected.

MATERIALS AND METHODS

All twenty-nine patients with intra-articular calcaneum fractures were treated with open reduction and internal fixation between 1st January 2014 to 31st December 2015 through medial approach as described by McReynolds. All procedures were performed by one of us. The indication for surgical intervention was widening of heel, decrease in the Bohler angle and more than two millimeter of subtalar joint depression.

Procedure

Patient was given lateral position and L shaped incision was made over lateral aspect of the ankle. Care was taken to protect sural nerve and dissection was carried out directly over the bone.

Fragment Reduction and fixation

Initial step in reduction was to achieve anatomical reduction of sustentacular fragment with the help of schantz pin placed through tuberosity. Initial reduction of proximal fragments and its fixation by kirschner wires, proved great help in visualization of subtalar joint by elevation of the lateral fragments. Fragments in subtalar joint are gently elevated and reduced to sustentaculum. After achieving stability of reduction, lateral wall was replaced and articular fragments were fixed with small fragment 3.5mm cannulated screws into sustentaculum. Final stage was placement of 3.5mm reconstruction plate along the lateral aspect of the os calcis.

Post-operative Management

Below knee slab was given for 3-5 days, followed by early active ROM exercises. Weight bearing was started after 12 weeks postoperatively.

Follow-up

All the patients were followed on immediate post-operative day one followed by three weeks, three months and six months interval. All patients were followed post operatively in terms of pain gait, ability to walk on an uneven surface as well as walking distance and hind foot stability. Radiologically patients were examined for bony union at the fracture site, fracture reduction status as well as calcaneal height and width.

Sample Size: We studied twenty-four patients having twenty-nine calcaneal fractures (five patients with bilateral calcaneal fracture). Sample size was decided by calculating the mean number of patients with joint depression fracture treated in B.J. Medical College within last three years. Patients data was collected using properly design Performa using case sheets, X-rays, and questionnaire sheet of the patients which to be filled at the time of admission.

Inclusion Criteria

- All patients within age group of 18-60 years having joint depression type Calcaneal Fractures.
- Patients with Calcaneal Fracture not more than one week old.
- Patients willing to enroll in the study.

Exclusion Criteria

- Patients with open type calcaneal fractures
- Pathological fractures
- Calcaneal fractures with other associated fractures in the same limb

Goal of our treatment was to achieve anatomical reduction of the fracture fragments, restoration of height and width of calcaneus and to provide a pain-free and early ambulation.

A thorough clinical examination along with proper detailed history taking was done. All patients were give initial treatment in the form below knee slab and adequate elevation till the swelling subsided. Primary x-rays were taken and fractures were classified according to Essex-Lopresti and Sander's classification systems. All patients in our study had joint depression type of fracture. Patients were evaluated according to the criteria shown in **table 1**.

RESULTS

All twenty-nine fractures were evaluated by one of us using Performa, which included clinical as well as radiological observations.

Table 1: Evaluation Criteria based on AOFAS, MFS and ACFAS Scoring Scales

EVALUATION PROTOCOL AND SCORING SYSTEM FOR PAIN AND FUNCTION OF THE HINDFOOT	
Criteria	Score (Points)
Subjective	
Pain	
No pain	20
Occasional, mild pain	18
Moderate pain, necessitating occasional use of medication	10
Severe pain, necessitating regular use of medication	5
Pain at rest	0
Total	20
Activities of daily living and occupation	
No change	20
Modified, without difficulty	15
Same or modified, with difficulty	10
Disabled; cannot work or perform activities of daily living	0
Total	20
Sports and recreational activities	
No change	10
Modified, without difficulty	8
Same or modified, with difficulty	5
Disabled; cannot participate in sports or recreational activities	0
Total	10
Walking surfaces	
Normal walking on any surface	10
Difficulty or discomfort on uneven ground, stairs, ladders, and inclines	
Slight	5
Moderate	2
Severe	0
Total	10
Walking distance	
Same	5
Less than before, but more than 6 blocks	4
Less than 6 blocks	2
Around the house only	0
Total	5
Walking aids	
No new walking aid or shoe insert or modification since the time of the injury	5
Insoles, heel cushions, wedges, inserts, or special shoes since the time of the injury	3
Cane, crutches, walker, or wheelchair since the time of the injury	1
Both of the two previous categories	0
Total	5
Total for subjective criteria	70
Objective	
Range of motion*	
Ankle	
66 to 100 per cent; 50 to 75 degrees	10
33 to 65 per cent; 25 to 49 degrees	5
0 to 32 per cent; 0 to 24 degrees	0
Total	10
Subtalar joint	
66 to 100 per cent; 31 to 45 degrees	15
33 to 65 per cent; 16 to 30 degrees	10
5 to 32 per cent; 3 to 15 degrees	5
0 to 4 per cent; 0 to 2 degrees	0
Total	15
Limp	
None	5
Slight	2
Moderate or severe	0
Total	5
Total for objective criteria	30

Table 2: Age Distribution

Age (Years)	No.	Percentage
18-29	10	35%
30-39	10	35%
40-49	6	20%
50-59	3	10%
Total	29	100%

Table 3: Distribution of Patients according to Implants used

Implants	Number of Patients	Percentage
ST Pin	14	48%
ST Pins + Lag Screws	05	17%
Plates	10	35%

Table 4: Assesment According To Bohler's Angle

Bohler's Angle	<10 Degree	11-20 Degree	21-30 Degree	>30 Degree
Pre-op	6	8	1	00
Follow up	0	2	11	02

Table 5: Post-Operative Pain Assessment

ROM of Subtalar	Number of patients	Percentage
Painless	23	80%
Painful	6	20%
Total	29	100%

Table 6: Outcome Assessment

Outcome	Number of patients	Percentage
Excellent	19	76%
Good	4	16%
Fair	3	4%
Poor	3	4%

In our study all the patients underwent open reduction and internal fixation with either of the one implants described below.

Almost all patients in our study achieved near normal Bohlers angle after open reduction and internal fixation.

In this study twenty-two patients out twenty-nine achieved normal heel width at final follow up. Patients achieving painless range of motion of subtalar joint were twenty-three that is 80% of the total study size.

These results were obtained from patients by comparison of the injured foot with the opposite foot in twenty-four patients who had unilateral fracture of calcaneum and the remaining five patients were evaluated by comparison with normal calcaneal parameters for that particular sex and age.

Because of smaller number of patients, we were unable to detect significant differences between the excellent, good, fair and poor results with regards to the patient's sex, the mode of injury or the duration of follow-up.

The patients who had poor result were significantly shorter in stature and with greater body weight than the other patients. Moreover patients with poor results had occupation involving

strenuous labor as compared to that of the patients with excellent and good results. However the patients in poor result group continued to improve in terms of pain intensity and walking distance as time lapsed.

Radiographic results shows that subtalar congruity was restored in twenty patients postoperatively out of total twenty-nine heals.

DISCUSSION

Calcaneal fractures account for approximately 2% of all fractures, with displaced intra-articular fractures comprising 60% to 75% of these injuries.¹ Amongst all patients with calcaneal fractures, 10% have associated spine fractures and 26% are associated with other extremity injuries

There are many systems for classifying the displaced intra-articular fractures but there is no consensus amongst surgeons as to which is the most practical one. Though some studies have demonstrated good results after open reduction and internal fixation of intra-articular calcaneal fractures, the best treatment remains controversial because prospective randomized studies have not shown convincingly better results after surgery.^{10,11}

It is difficult to compare outcome between studies since different measures of outcome are often used and there is no consensus among surgeon as to which is the most scientific and practical system. Although classifications show positive correlation with outcome, there is no correlation with choice of treatment.^{12,13} In our study we have used Essex-Lopresti and Sander's classification.

Historic cohort studies^{14,15} have suggested equal clinical outcome with operative and non-operative treatment of displaced intra-articular calcaneal fractures. While some have shown no advantage of operative treatment, many others have shown superior results with operative treatment.^{10,16,17}

Earlier surgical treatment was associated with significant incidence of complications particularly wound healing and sepsis. However, conservative treatment is not without its complications of subtalar joint arthritis, heel varus and peroneal tendon impingement.

We believe that displaced intra-articular fractures of calcaneum should be treated on the same principles as any other weight bearing joint, i.e anatomical reduction and rigid fixation so as to allow early rehabilitation, though complex anatomy and anatomical constraints have rendered delay in application of these principles.

In our study we have mainly managed displaced intra-articular fractures of the calcaneus, which are typically the result of high-energy trauma, such as a fall from a height or a motor vehicle accident. The pattern of fracture lines and extent of comminution are determined by the position of the foot, the amount of force, and the porosity of the bone at the time of impact, which mainly require open reduction for maintaining joint congruity and hence avoiding future subtalar arthritis hereby comparing with the Canadian Orthopaedic Trauma Society performed a prospective, randomized, multicenter trial and compared operative with nonoperative treatment of displaced intra-articular calcaneal fractures in 424 patients with 471 fractures and concluding that there was no difference in overall outcome between the operative and nonoperative groups; however, those having nonoperative treatment of their fracture were 5.5 times more likely to require a subtalar arthrodesis for post-traumatic arthritis than those undergoing operative treatment.

In open reduction surgical approach used in all patients was – Extended Lateral Approach, Different implants used were ST Pins, ST Pins + Lag screws and Plates, minimum duration of follow up was 15 months, was based on clinical examination, radiological assessment by x-rays, functional assessment by AOFAS score. Based on these criteria's we found that About 90% patients achieved Excellent to Good Functional results after ORIF, While only 70% patients had Better results after Closed reduction and rest 30% had Fair to Poor outcomes.

Thus in our analysis, we confirmed correlation between the Bohler's angle and patient satisfaction in terms of their functional outcome and the role of these angles as predictive factor for subsequent late complications.^{18,19} AOFAS clinical rating system the Ankle hind foot scale for calcaneal area is standard scoring system 30 that takes into account subjective and objective assessment enables to achieve relevant results and comparison of different studies.

Sander's reported excellent or good results in 73% of type 2, 70% of type 3 and only 27% of type 4 fractures. In our study 92% of

patients had excellent or good and 8% had fair or poor results despite anatomical calcaneal restoration. Melcher, in his study, subjective and objective results assessed after ten years were better than those achieved in a 3years follow up.

There were certain limitations to our study like short study period and small group of study subjects. A study involving more patients and longer follow up period can more accurately define the functional outcome calcaneal fracture treated by operative method.

Therefore, in support of operative treatment, we recommend anatomical reduction, if possible, not only of the subtalar joint but also of the width, height, length, and alignment of the heel. This form of treatment was strongly recommended by Stephenson¹⁷ who found that excellent anatomical restoration was associated with an excellent clinical result.

CONCLUSION

Fractures of Calcaneum are one of the common fractures affecting present generation and treatment modality has to be decided carefully. We are of opinion that the operative management of calcaneal intra-articular fractures should be done as anatomical reduction and rigid internal fixation are essential to allow early rehabilitation. It also shows that anatomical reduction in terms of Bohler's angle and Gissane's angle restoration plays an important role in determining the good functional outcome.

REFERENCES

- Mitchell MJ, McKinley JC, Robinson CM. The epidemiology of calcaneal fractures. *Foot (Edinb)* 2009;19:197-200.
- Crosby LA, Fitzgibbons T. Intraarticular calcaneal fractures. Results of closed treatment. *Clin Orthop Relat Res*1993; May (290):47-54.
- Cotton F, Henderson F. Results of fracture of the os calcis. *J Bone Joint Surg Am*1916; s2-14:290-8.
- Essex-Lopresti P. The mechanism, reduction technique, and results in fractures of the os calcis. *Br J Surg*1952; 39:395-419.
- Charnley J. The closed treatment of common fractures. 4th Ed. New York : Cambridge University Press; 2003.
- Ibrahim T, Rowsell M, Rennie W, Brown AR, Taylor GJ, Gregg PJ. Displaced intra-articular calcaneal fractures: 15-year follow-up of a randomised controlled trial of conservative versus operative treatment. *Injury*2007; 38:848-55.
- Eastwood DM, Langkamer VG, Atkins RM. Intra-articular fractures of the calcaneum. Part II: open reduction and internal fixation by the extended lateral transcalsaneal approach. *J Bone Joint Surg Br*1993; 75:189-95.
- Tennent TD, Calder PR, Salisbury RD, Allen PW, Eastwood DM. The operative management of displaced intra-articular fractures of the calcaneum: a two-centre study using a defined protocol. *Injury*2001; 32:491-6.
- Folk JW, Starr AJ, Early JS. Early wound complications of operative treatment of calcaneus fractures: analysis of 190 fractures. *J Orthop Trauma*. 1999; 13:369-72.
- Thordarson DB, Krieger LE. Operative vs. Non Operative Treatment Of Intraarticular Fractures Of The Calcaneus: A Prospective Randomized Trial. *Foot Ankle Int*. 1996; 17:2-9.
- Parmar HV, Triffitt PD, Gregg P J. Intraarticular Fractures of The Calcaneum Treated Operatively or Conservatively. A Prospective Study. *J Bone Joint Surg Br*. 1994; 76(5):851-852.

12. Schepers T, Van Lieshout EM, Ginai AZ, Mulder PG, Heetveld MJ, Patka P. Calcaneal Fracture Classification: A Comparative Study. *J Foot Ankle Surg.* 2009; 48(2):156-162.
13. Humphrey CA, Dirschl DR, Ellis TI. Interobserver reliability of a CT Based Fracture Classification System. *J Orthop Trauma.* 2005; 19(9):616-22.
14. Jarvholm U, Komer L, Thoren O and Wiklund LM. Fractures Of The Calcaneus. A Comparison of open and closed treatment. *Acta. Orthop. Scand.* 1984; 55:652-6.
15. Buckley RE, Meek RN. Comparison of Open Versus Closed Reduction Of Intraarticular Calcaneal Fractures: A Matched Cohort In Workmen. *J Orthop Trauma.* 1992; 6:216-22.
16. Tennet T, CalderPP, Salibury RD, Allen PW, Eastwood DM. The Operative Management of Displaced Intraarticular Fractures of Calcaneum: A Two-Center Study Using A Defined Protocol. *Injury.* 2001; 32:491-6.
17. Randle JA, Kreder HJ, Stephen D, Williams J, Laglal S, HU R. Shoul Calcaneal Fractures Be Treated Surgically? A Metaanalysis. *ClinOrthop* 2000; 377-217.
18. Buckley RE Letters To The Editor, *J Orthop Trauma* 2002; 16:210-1.
19. Hart AJ, Eastwood DM. Displaced intraarticular Fractures of the Calcaneus; What is New? *Trauma* 2003; 5:9-21.

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