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Study on the effect of severity of fracture type on functional outcome in displaced intraarticular calcaneal fractures treated with plate fixation

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Abstract

Background: Presently, largely because of fear of complications, calcaneal fractures are treated conservatively. Complications can be as many when treated conservatively as when operated. About 17 in 100 cases end up with subtalar joint arthritis when treated with cast application as compared to 3 in 100 when treated operatively [1]. A good functional outcome can be expected when accurate and timely surgical intervention aiming at anatomical joint reduction, attaining normal calcaneal height, width and lengthening [2].

Methods: Twenty displaced intraarticular calcaneal fractures between July 2010 to July 2014 that presented at Victoria hospital and Bowring and Lady Curzon hospital, Bangalore were treated with Open reduction and internal fixation with locking calcaneal plates using Fernandez's approach [3], without use of bone graft. Sander's classification [5] was used to classify the fractures. Functional outcome was assessed using Maryland Foot Score [6]. The average follow up was 26 months.

Results: 85% of the cases were men and the rest women. Sander's type 1 and type 4 were excluded from the study. 30% Sander's type 2, 70% type 3. Apart from one case rest all had a near normal fracture reduction. All cases united radiologically at an average of 14 weeks time. 7 cases had excellent, 11 good and 2 had fair functional results at final follow up. There were no functional failures. Type 2 fractures had a mean MFS of 85.6 while type 3 had a mean of 87.3 showing there was no significant differences in the two fracture groups.

Conclusion: The severity of fracture does not significantly affect the functional outcome when displaced intraarticular calcaneal fractures are promptly treated surgically while focusing on the principles of intra articular reduction, attaining calcaneal height, length and width.

Keywords: Functional outcome, intraarticular calcaneal fractures, plate fixation

Introduction

Intraarticular fractures account for approximately 75% of calcaneal fractures and historically have been associated with poor functional outcome [3]. Despite many authors' [4-11] attempts to define an algorithm for the management of displaced, intra articular calcaneal fractures, it remains a controversy [12] with strong arguments supporting both conservative & operative managements. Recent studies are of varied opinion; some evidences citing no difference between the two & others suggesting operative management to be a better option [13]. Significant controversy remains over the results of nonoperative versus operative treatment. Lack of standardization of results has made it difficult to compare studies that have evaluated outcomes [3]. Over the past 25 years, however, marked advances in anesthesia, prophylactic antibiotics, CT scanning, and fluoroscopy have allowed surgeons to improve outcomes when operating on fractures, and these techniques have been applied to calcaneal fractures as well [14]. Overall, operative treatment of acute fractures has become the standard of care for many authors who, critically evaluating their results, have concluded that good outcomes are possible [13]. Despite these improvements, it is recognized that operative treatment still requires an experienced surgeon and that complications may be inevitable. There are only a few studies on this topic making it hard to choose one over the other. We expect this study to be of some use in outlining the outcomes of surgical management of intra articular fractures of the calcaneum. This study would also be of use to test whether; the recent advances in fracture management, better understanding of fracture patterns, better perioperative antibiotic use, rigid

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fixation and early mobilization has any positive effect on the operative outcomes of calcaneal fractures.

Material and Methods

We conducted a prospective study between 2010 and 2014 at Victoria and Bowring hospital, Bangalore. Following criteria were used to select cases.

Inclusion criteria

1. Intra articular displaced calcaneal fractures.
2. > 18 years less than 60 yrs.
3. Medically fit for surgery

Exclusion criteria

1. < 18.
2. Unfit for surgery.
3. Paraplegia/ paraparesis. Long bone fractures in the ipsilateral limb.
4. Extra articular fractures of calcaneum.
5. Types 2, 3 open fractures.
6. Sander’s type 1 and type 4 calcaneal fractures.
7. Uncontrolled hypertensive patients & diabetics.
8. Pregnancy.
9. Patients with chronic, local infections.

Protocol

All patients gave informed, written consents. Preliminary history and assessment was done in emergency ward. Anteroposterior, lateral and axial views of the affected calcaneum was taken. Computed tomography was done for all. Patients were given

strict limb elevation and below knee slab to reduce edema. Preoperatively Bohler and Gissane angle were measured in all patients. Heel width was measured with use of Vernier caliper. Sander’s classification was used in whom CT scan was done. Pre-operatively all patients were administered with broad spectrum antibiotics six hour before surgery.

Intervention

Wrinkle sign was assessed in cases that were not operated with in 24 hrs. Extensile lateral approach was used as described by Fernandez. Appropriate locking and non locking anatomical calcaneal plates [2, 8] were used for fixation. In none of the cases bone grafting was used [9]. Intraoperative assessment of reduction of the subtalar joint was done under vision and using fluoroscopy.

Follow up

Limb elevation to prevent edema was given in all cases. Standard protocol of postoperative antibiotic was followed. Sutures were removed after about 12 to 15 days. Patients were put in a removal slab for 6 weeks while ankle physiotherapy was started. Weight bearing was allowed after 12 weeks. Regular follow ups were performed at 8 wks, 10 wks, 12 wks, 14 wks, 16 wks, 3 months, 6 months and 1 year post operatively. Patients were discharged from follow up in cases with satisfactory outcomes, the rest were followed up further at an interval of 3 months. Detailed surgical site examination, subjective feeling, physical findings, radiological evaluation, functional scoring was done at each follow up. Functional outcome was assessed with Maryland Foot score.



A. Pre operative radiograph

B. Immediate postoperative radiograph

C. Check X ray at 16 weeks



A. Active inversion

B. Active eversion

C. Dorsiflexion

D. Plantar Flexion

Results

The mean age was 31.05 years (21 -43). 50% of the cases were between the age group 20 – 29 years. Mode of injury was fall from height in 80% of cases while the rest gave a history of road traffic accident. The side of affection was quite uniform with the right foot being affected in 55% and the left foot in 45%. The mean pre op heel width was 7.58cms which postoperatively

reduced to a mean of 6.76cms. Based on Sander’s classification 30% of cases belonged to type 2, two part displaced fractures of the posterior facet and 70% were of type 3, three part displaced fracture of the posterior facet. The average delay in surgery from the day of injury was 13.2 days. Post operatively CT based assessment showed good subtalar joint congruity in 14 (70%) cases, while it was fair in 6 (30%) of cases. The mean follow up

period was 26.65 months. The average MFS was 86.25, the range being 62 to 98. Excellent results were found in 35%, good in 55% and fair in 10% of cases. Occupational rehabilitation to the patient's pre injury state was achieved in 80% of cases. Our complications and their rates corresponded to previously performed studies, [9-16] with the incidence of wound necrosis and dehiscence seen in 2 (10%) cases, deep infection in 1 (5%) case and persistent subtalar pain in 1 (5%) of the cases.

Type 2 fractures had a mean MFS of 85.6 while type 3 had a mean of 87.3 showing there was no significant differences in the two fracture groups.

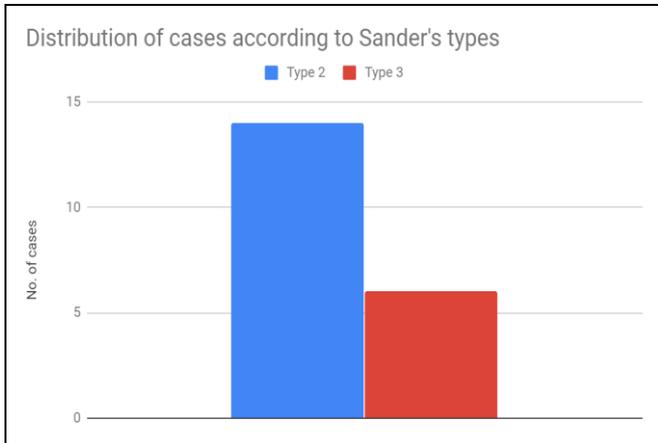


Chart 1: Distribution of cases in our study according to the Type of the fracture using Sander's classification

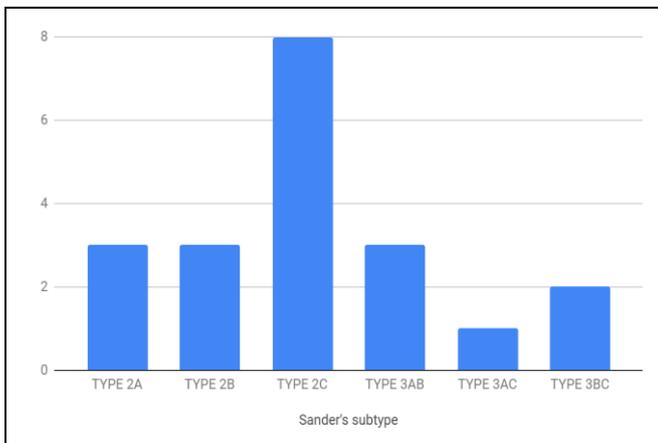


Chart 2: Case distribution based on Sander's subtypes

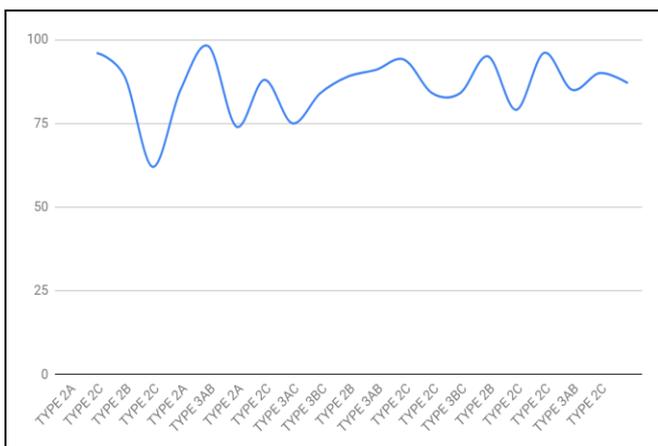


Chart 3: Functional score in each of the cases in our study

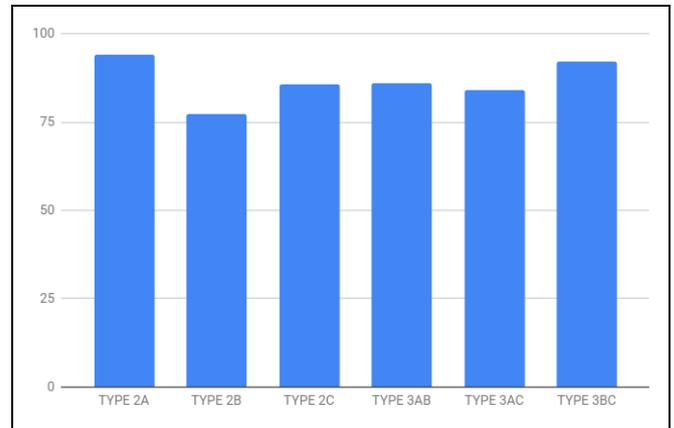


Chart 4: Average Maryland Foot Score based on the subtype of the fracture

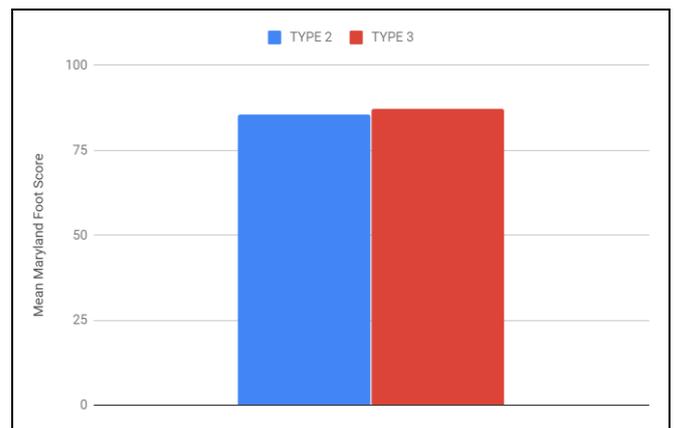


Chart 5: Functional score in accordance to Sander's fracture type

Discussion

Calcaneum is the most common tarsal bone to fracture. It accounts for 2% of all fractures and 60 – 75% of these fractures are displaced, intra-articular. Calcaneal fractures result in loss of height, varus deformity, heel widening and subtalar joint incongruity. The results for an extra articular fracture are good with a good prognosis while that for intra articular fractures are varied. There is controversy with every aspect of management of intra-articular fractures. Though there are different classifications for intra articular calcaneal fractures, there is no consensus as which is the most practical one among them. Although some studies with more than 100 cases have demonstrated good results after open reduction and internal fixation of intra-articular calcaneal fractures, the best choice of treatment remains controversial because prospective randomized studies have not shown convincingly better results after surgery [17, 18] However, in the largest prospective randomized trial done till date, Buckley *et al.* [14] found better results in some subgroups of patients after surgery.

Also it is difficult to compare between different studies as, different measures of outcome are used in different studies and there is no consensus as to which is the most reliable outcome measure. Essex Lopresti and Sander's are commonly used classification system and these show a positive correlation with outcomes but there is no correlation with the choice of treatment [19-21]

In the present study, Essex Lopresti classification based on X rays and Sander's classification based on CT scans have been used.

Cohort studies done previously [22-24], have shown similar results with operative and non operative treatment of displaced intra articular calcaneal fractures. While some of the more recent studies show no advantage [17, 25, 26] of operative management, others have shown superior results with operative treatment [5, 18, 27-29]

Earlier operative treatment was considered to be associated with wound complications and sepsis [30], however, non operative treatment is not devoid of complications like subtalar joint pain, heel varus and peroneal tendon impingement [31]

We believe that like the principles followed for any other weight bearing joints, intra-articular calcaneal fractures should also be treated on the same lines, that is, anatomical reduction and rigid internal fixation to allow early movement and get a better functional outcome [2] Application of these principles to intra articular calcaneal fractures have been slow because of complex bony and fracture anatomy, tenuous soft tissue envelope and difficulty of achieving anatomic reduction and rigid fixation [32]; improvements that have occurred in surgical techniques, better understanding of the fracture anatomy, better radiographic assistance and improvement in antibiotics have encouraged surgeons to operate more on these fractures without the fear of complications associated with surgical management.

Calcaneal fractures can be approached medially, laterally or by using a combined approach [33-38] The lateral approach is the most popular approach as it provides a good exposure of the fracture and the subtalar and calcaneocuboid joints. It is also devoid of the major neurovascular bundles of the foot. It allows stabilizing the fracture with internal fixation and allowing early mobilization [10] A lateral extensile was used in all cases in this study. Various implants like the pelvic reconstruction plates [32], calcaneal plates [2, 39], K wires [39] and a combination [40] of K wires and screws [41] can be used for fixation. In our study, anatomical locking and non locking calcaneal plates were used and fixed with corresponding screws. Bone graft was not used.

In this study, restoration of Bohler's and crucial angle of Gissane was associated with a satisfactory functional outcome. This fact, proved and verified by a lot of other authors, confirms the role of Bohler's angle and Gissane's angle as predictive factor for development of late complications [42, 43]

As said earlier, there are various scoring systems for assessment of functional outcomes. As proven by studies, MFS, used in this study, is a standard and reliable scoring system for foot function evaluation.

Table 1: Maryland foot score results

Study	Maryland foot score results			
	Excellent	Good	Fair	Poor
Fouad <i>et al.</i> [15]	57.1%	35.7%	-	7.1%
B Magnan <i>et al.</i> [1]	48.1%	42.6%	3.7	5.6%
Our study	35%	55%	10%	-

Conclusion

The severity of fracture does not significantly affect the functional outcome when displaced intraarticular calcaneal fractures are promptly treated surgically while focusing on the principles of intra articular reduction, attaining calcaneal height, length and width.

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