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## A Comparative study of outcome between operative and non-operative treatment of intra-articular calcaneal fractures

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### Abstract

Open reduction and internal fixation has the advantage of anatomic reduction and rigid internal fixation of the subtalar joint. All patients were treated with operative management based on our inclusion criteria - Age group between 19-50 years, displaced intra-articular calcaneal fractures with >2mm step, decrease in Bohler's angle <20 degrees., and increase in Gissane's angle >115 degrees. Only sanders II, III, and IV part fractures were included in the study. Calcaneal fractures caused by fall from height includes 27 fractures (84.37%) and by Road Traffic Accident includes 5 fractures (15.6%) overall. The average time from injury to surgery was 12 (range 6-19) days. All patients were grafted with autogenous graft in 13 patients (76.5%) and G-bone in 4cases (23.5%).

**Keywords:** Calcaneal fractures, operative and non-operative management.

### Introduction

Historically, displaced intra-articular calcaneal fractures were treated non-operatively, since predictable operative reduction and fixation were not possible. Non-operative treatment led to increased morbidity due to incongruity of articular surface, widening of heel, loss of talo-calcaneal lever arm and peroneal tendon impingement <sup>[1]</sup>. Operative treatment includes percutaneous, minimally invasive techniques with screw or k wire fixation or open reduction with various techniques with or without grafting using a medial or lateral approach.

Open reduction and internal fixation has the advantage of anatomic reduction and rigid internal fixation of the subtalar joint <sup>[2]</sup>. We compare the outcome between operative and non-operative treatment of intra-articular calcaneal fractures admitted at our Institution from July2010 to Jun 2013.

### Materials and methods

In our institution 26 patients with 32 fractures with displaced intra-articular calcaneal fractures were selected for this prospective study. The study period is from July 2010 to June 2013. Out of these patients 9 patients had bilateral intra-articular calcaneal fractures. 28 fractures occurred in men and 4 fractures occurred in women. All patients were treated with operative management based on our inclusion criteria - Age group between 19-50 years, displaced intra-articular calcaneal fractures with >2mm step, decrease in Bohler's angle <20 degrees., and increase in Gissane's angle >115 degrees. Only sanders II, III, and IV part fractures were included in the study. Open fractures of calcaneum, fractures >3 weeks old, severe soft tissue compromise like blistering, massive prolonged edema with absent wrinkle sign, associated major injuries, patients with peripheral vascular disease and insulin dependent diabetes mellitus and non compliance for surgery were taken as indications for nonoperative treatment. All patients were operated within three weeks of injury, ranging from 6-19 days from the time of fracture, if the soft tissue condition was satisfactory. The mean duration was 12 days. An extensile lateral approach was used in all patients. Once the bone is reached over the lateral wall of the calcaneum, a full thickness flap is raised along with the periosteum by sharp dissection until subtalar joint is exposed.

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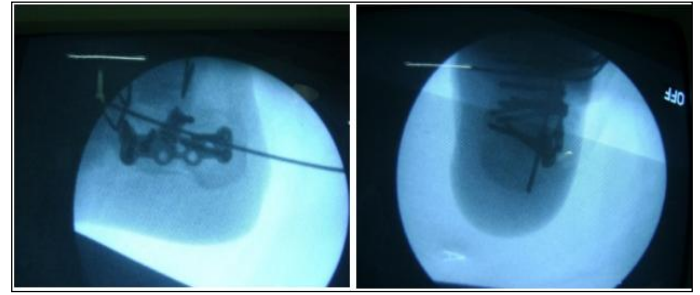
**Fig:**

The reduction of posterior facet results in a large void which is filled with bone graft or bone graft substitutes and impacted. Graft impaction prevents postoperative collapse of the posterior facet.



**Fig:**

The lateral wall remnant is then placed and the low profile calcaneal plate is positioned. The plate is secured by 3.5mm cancellous screws over the anterior process, posterior tuberosity and the thalamic portion which lies beneath the facet.



**Fig:**



**Fig:**

All patients were immobilized with posterior plaster splint and limb elevated. We maintained the operated foot in below knee slab until suture removal which is done at 18<sup>th</sup>-21<sup>th</sup> post operative day. All patients were kept non-weight bearing until 10 weeks and partial weight bearing up to 30% of body weight is allowed until 12 weeks. Full weight bearing is allowed after 12 weeks.

Patients who were excluded by our criteria for operative treatment were treated conservatively with posterior plaster splint, limb elevation and anti-inflammatory drugs. A “moulded cast” was applied with ankle in neutral flexion after subsidence of edema and allowed non weight bearing for a period of 10-12 weeks. Gradual weight bearing was allowed after radiographic union. Functional evaluation was done at the end of one year of follow up.

### Results

Our study includes 26 patients with 32 fractures. 17 patients were operated with plate osteosynthesis and 9 patients with 15 fractures underwent non-operative treatment. The mean age group of all patients in operative group was 34.5 years (21-48) and in the non-operative group was 33years (21-50). The age group 31-40 dominates the series accounting for 52.9% among operative and 60% of non-operative cases. Calcaneal fractures caused by fall from height includes 27 fractures (84.37%) and by Road Traffic Accident includes 5 fractures (15.6%) overall. The average time from injury to surgery was 12(range 6-19) days. All patients were grafted with autogenous graft in 13 patients (76.5%) and G-bone in 4cases (23.5%).

The mean preoperative Bohler’s angle is 12.47(6-18 degrees) whereas the mean postoperative Bohler’s angle at one year follow up is 20.76(15-32 degrees). Preoperative Gissane’s angle averages 128.83 (116-145 degrees) and postoperative Gissane’s angle averages 115.88 degrees (98-127 degrees). The Bohler’s angle and Gissane’s angle was maintained and there was no postoperative collapse of the angles after plate osteosynthesis.

The non-operative group had a mean Bohler’s angle of 14.80 degrees (10-21 degrees) which had a decrease during the follow up period averaging 10.67(5-19 degrees) and the



Gissane's angle is 123.33(97-160 degrees) and mean during follow up is 127.20 (105-158 degrees). There was a decrease in the Bohler's angle and a increase in the Gissane's angle in the non-operative group.

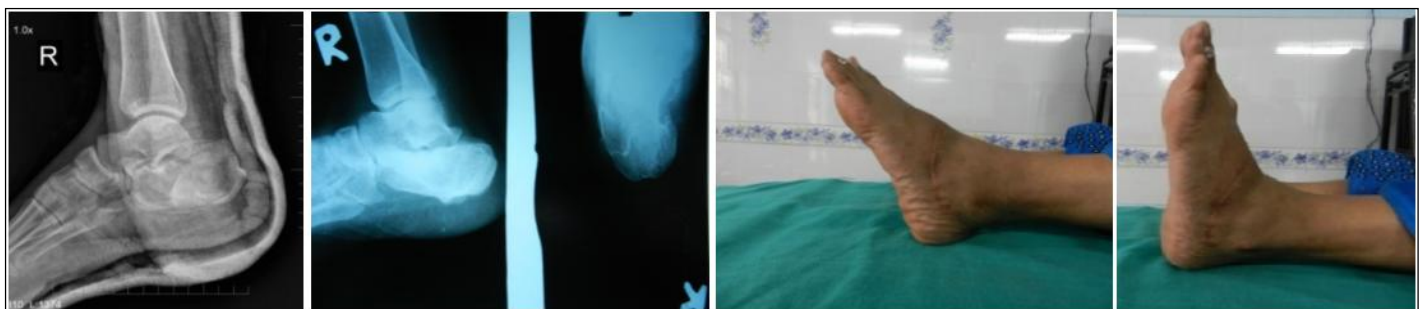
Statistically, the 't' value for bohlers angle and gissane's angle was 6.897 and 2.345 respectively with  $p < 0.05$ .

Fracture union was achieved in all patients (100%). No

patients had post-operative decrease in calcaneal height in the operative group. The mean range of movements at the end of one year includes dorsiflexion 17.94 degrees, plantar flexion 25.8 degrees which is 72% and 74.2% of normal among the operated group and dorsiflexion of 13.4 degrees and plantar flexion 19.6degrees which corresponds to 53.6% and 56% of the normal among the non-operative group.



**Fig:** Case illustrations of Operative group



**Fig:** (Case illustration of Non-operative group)

The average subtalar range of movements is inversion 12.4 degrees and eversion 9.4 degrees in the operated foot and inversion of 8.9 degrees and eversion of 7.1 degrees in the non-operated foot. The Modified Maryland Foot Score at the end of one year is excellent in 8 cases (47.1%), good in 4 cases (23.5%), fair in 3 cases (17.6%) and poor in 2 cases (11.8%) among the operative group whereas among the non-operative group excellent score in one patient (6.7%), good in 8 patients (53.3%), fair in 3 patients (20%) and poor in 3 patients (20%). Statistically, the score had a 't' value of 2.247, 0.340 and 1.612 for Sander's type II, III and IV respectively. The average

score is 82.70% among the patients who underwent surgery and 73.46% among the patients treated operatively. The operative group had complications in 5 patients accounting for 29.41%. Two patients had deep seated infection and had implant removal. Superficial skin necrosis was present in 3 patients which was treated conservatively. The non-operative group had complications in 6 fractures (40%). Subtalar arthritis was present in 3 patients for which one patient underwent subtalar arthrodesis. 2 patients had heel exostosis for which steroid injections were given. One patient had heel pad pain treated by analgesics and foot wear change.

## Discussion

Intra articular calcaneal fractures remain a dilemma to the treating orthopaedic surgeons. Comparative studies, usually provides a useful guide in the decision making regarding treatment of calcaneal fractures. Potter and Nunley<sup>[3]</sup> have reported comparable results on long term follow up of intra articular fractures and supported operative treatment. Operative management includes various methods like closed reduction and percutaneous fixation, open reduction and internal fixation with screws or plate osteosynthesis and primary subtalar arthrodesis.

Since the last decade, open reduction and plate osteosynthesis has become a standard surgical modality in the operative treatment of intraarticular calcaneal fractures. Plate osteosynthesis has been improved by fixation with locking plates, which is more stable, allows early weight bearing and rarely requires bone graft. All patients were grafted of which 4 cases were grafted with G bone. Though criticized by sanders *et al.*, grafting has the advantage of maintaining the calcaneal height and prevents postoperative collapse. In our series the calcaneal height was maintained and the allograft incorporation with host bone was satisfactory.

Excellent results have been obtained by multiple studies using an extensile lateral approach and plate osteosynthesis. Richard Buckley *et al.*<sup>[4]</sup>, in his randomized prospective trial, stated that the functional results after operative and non-operative treatment were equivalent, but led to a better outcome among operative group when workers compensation injuries were excluded. The mode of operative treatment is variable with plates, screws or pins and grafting was optional. Buckley and meek *et al.*<sup>[5]</sup> in their comparative study of 34 cases stated that operative treatment yields better outcome provided an anatomical reduction of subtalar joint is achieved.

Our study correlated with Lamglait E<sup>[6]</sup> regarding comminution. The most comminuted fractures in sanders IV shows excellent and good results with plate osteosynthesis than with non-operative treatment.

The Modified Maryland foot score which evaluates pain, functional ability, cosmesis and range of movements is better than non - operative group but statistically insignificant, since the fractures are not randomized and the non-operated group has 4 severely comminuted fractures whereas the operative group has 8 patients in sanders IV. The number of patients and the follow up period is much lower. Our study is coherent with Jain V *et al.*<sup>[7]</sup> and other studies<sup>[8-12]</sup> by the fact that, type IV fractures experiences poor results even after open reduction. This may be due to subtalar restriction and arthritis, soft tissue impingement and smashed heel pad syndrome. But type IV fractures do require open reduction to correct heel varus, height and to decompress peroneal tendons, since functional results continue to improve even one year after surgery.

## Conclusions

Accurate anatomical restoration of the posterior facet is associated with excellent outcome and it should be the primary aim in reduction techniques. Bone grafting is recommended in all cases with a void and to prevent post-operative collapse. Operative treatment is associated with restoration of normal anatomy of the calcaneus and offers excellent and statistically significant better results than the non-operative group with respect to the radiological parameters in Sanders type II, while the results are statistically insignificant in Sanders type III and IV cases.

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