

## Comparative Study of Outcome between Operative and Non-operative Treatment of Intra-articular Calcaneal Fractures

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### Abstract:

**Background:** Calcaneal fractures accounts for 75% fractures of the foot and 2% of fractures overall. The majority of fractures are intra-articular comprising 75%. Between 7.7% and 17% calcaneal fractures are open.

**Aim:** To compare the outcome between operative and nonoperative treatment of intra-articular calcaneal fractures.

**Methods:** A total of 26 patients with 32 fractures with displaced intra-articular calcaneal fractures were included in the study. Only Sanders II, III, and IV part fractures were included in the study. The patients were randomly allocated in study group operative and nonoperative treatment.

**Results:** The modified Maryland foot score at the end of 1 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%).

**Conclusion:** To conclude open reduction with internal fixation with plate osteosynthesis provide excellent functional outcome compared to nonoperative management and also statistically significant P-value.

**Keywords:** Bohler's angle, Gissane angle, Intra-articular, Maryland foot score.

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### Introduction

The calcaneum or Os calcis is the most frequently fractured bone in the foot. Most calcaneal fractures occur in young, active male industrial workers, making its treatment economically significant. [1] Many studies have reported that the patients may be totally incapacitated for a period of 3-year and partially incapacitated for 5 years after injury. [2] Open reduction and internal fixation have the advantage of anatomic reduction and rigid internal fixation of the subtalar joint. It restores the anatomic morphology of the calcaneus and the biomechanics and function of the hindfoot. [3] Operative treatment is complicated by wound infection which results in osteomyelitis and may require multiple surgeries.

These complications can be avoided by delayed intervention after the appearance of wrinkles, extensile lateral approach and by subperiosteal exposure. With the advent of newer techniques of radiological imaging, improved methods of fixation and rehabilitation, operative treatment of calcaneal fractures has now become a standard method. The advent of computed tomography scans has allowed

classification systems to offer prognostic significance. It provides information regarding the size and number of fracture fragments, displacement of sustentaculum relative to the super medial fragment, congruity of posterior facet and lateral malleolus impingement on the tuberosity. [4] Calcaneal fractures accounts for 75% fractures of the foot and 2% of fractures overall. [5] The majority of fractures are intra-articular comprising of 75%. [6] Calcaneal fractures are associated with other injuries such as spine fractures accounting for 10% and 26% are associated with other extremity injuries.

Between 7.7% and 17% calcaneal fractures are open. 90% of calcaneal fractures occur in men between 21 and 45 years of age. In these patients displaced intra-articular calcaneal fractures are the result of high-energy trauma such as fall from height or a motor vehicle accidents.

Aims of this study to compare the outcome between operative and nonoperative treatment of intra-articular calcaneal fractures.

## Materials and Methods

This is a prospective study conducted in Department of Orthopedics, Indira Gandhi Institute of Medical Sciences, Patna, Bihar from January 2015 to December 2015. 26 patients with 32 fractures with displaced intra-articular calcaneal fractures were included in the study.

Only Sanders II, III, and IV part fractures were included in the study. The patients were randomly allocated in study groups.

Included patients age group between 19 and 50 years, displaced intra-articular calcaneal fractures with >2 mm step, decrease in Bohler's angle <20°, increase in Gissane's angle >115°, and Sanders II,

III and IV part fractures. Patients with open fractures of calcaneum, Fractures >3 weeks old, severe soft tissue compromise like blistering, massive prolonged edema with absent wrinkle sign, associated major injuries, peripheral vascular disease and insulin dependent diabetes mellitus, and refusal to undergo surgery were excluded in this study.

## Results

From Table 1, it is very clear that majority of the operative cases (52.9%) belongs to the age group of 31-40 years. Similarly, the majority of the nonoperative cases (60%) also belong to the age group of 31-40 years.

**Table 1: Distribution of operative and nonoperative group based on age**

Age group	Operative n=17 (%)	Non-operative n=15 (%)
<30	5 (29.4)	5 (33.3)
31-40	9 (52.9)	9(60)
>41	3 (17.6)	1 (6.7)
Total	17 (100)	15(100)

Table 2 shows comparison between operative and nonoperative group by "t" test which shows that it is statistically insignificant.

**Table 2: Comparison of modified Maryland foot score between operative and non\*operative cases**

Variable	Mean±SD		t-value
	Operative (n=17)	Non-operative (n=15)	
Modified Maryland foot score	82.53±14.88	73.47±17.18	1.599

SD: Standard deviation

In our series, the radiological parameters which include the Bohler's angle, Gissane's angle, calcaneal height and width among the operated group when compared with the nonoperative group is statistically significant  $P < 0.05$  (Table 3).

**Table 3: Comparison of radiological parameters**

Variables	No. of cases	Mean	SD	t-value
<b>Follow-up Bohler</b>				
• Operative	17	20.76	4.055	6.897*
• Non-operative	15	10.67	4.220	
<b>Follow-up Gissane</b>				
• Operative	17	115.88	9.232	2.345*
• Non-operative	15	127.20	17.325	
<b>Follow-up height</b>				
• Operative	17	46.71	2.710	5.127*
• Non-operative	15	40.60	3.979	
<b>Follow-up width</b>				
• Operative	17	52.71	3.236	4.672*
• Non-operative	15	57.53	2.503	

## Discussion

Since the last decade, open reduction and plate osteosynthesis have become a standard surgical modality in the operative treatment of intra-articular 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. [8,9] Our operative group has been osteosynthesis with a low profile

calcaneal plate in 16 patients and locking plate in one patient. All patients were grafted of which 4 cases were grafted with G-bone. Although criticized by Sanders et al., grafting has the advantage of maintaining the calcaneal height and prevents post-operative collapse. [10,11]

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. In our study, the modified Maryland foot score is excellent for 8 cases (47.1%), good in 4 cases (23.5%), fair in 3 cases (17.6%), and poor in 2 cases (11.8%) among operated cases. Buckley et al., in his randomized prospective trial, stated that the functional results after operative and nonoperative treatment were equivalent, but led to a better outcome among operative group when workers compensation injuries were excluded from the study. [9]

The mode of operative treatment is variable with plates, screws or pins and grafting was optional. We followed a standard operative protocol but done by different surgeons and grafting was done in all patients. Buckley and Meek in their comparative study of 34 cases stated that operative treatment yields better outcome provided an anatomical reduction of subtalar joint is achieved. [11] Our study correlated with Muller et al., regarding comminution. The most comminuted fractures in Sanders IV shows excellent and good results with plate osteosynthesis than with nonoperative treatment. The most challenging fact regarding operative treatment is anatomic restoration of subtalar joint congruency which was obtained in 12 of our patients and the scoring was excellent in 8 patients and good in 4 patients.

The functional outcome correlates with subtalar congruency in our series. Operative treatment is limited by its wound complications, which averages between 16% and 25% reported by Buckley et al. and Potter requiring repeated surgeries. The complication rate, in our series, is 5 patients (29.41%) out of which two patients required implant removal. [5,14] We have evaluated the radiological parameters Bohler's angle, Gissane's angle calcaneal height and width which has statistically significant results when compared with the nonoperative group. Restoration of Bohler's angle and Gissane's angle is associated with excellent results in our study. 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 nonoperated 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. [15,16] When comparison is based on individual fracture patterns with respect to modified Maryland foot score, Sanders Type II fractures among operative group is better than nonoperative group and it is statistically significant. Sanders Type III and severely comminuted Type IV fractures when compared with nonoperative group is better but statistically insignificant. Our

study is coherent with Jain et al., [15] 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. Even then, Type IV fractures require open reduction to correct heel varus, height and to decompress peroneal tendons, since functional results continue to improve even 1 year after surgery.

### Conclusion

To conclude, open reduction and internal fixation with plate osteosynthesis provide excellent and statistically significant results when compared to nonoperative patients in Sanders Type II fractures. In Sanders Type III and severely comminuted Type IV fractures, though the outcome is better than non-operative group is statistically insignificant due to a short period of follow-up. Since the functional outcome of operated patients tends to improve even after 1 year, we recommend a longer period of follow-up of these patients for significant results when compared to the non-operative group.

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