



FUNCTIONAL OUTCOME OF DISPLACED INTRA-ARTICULAR FRACTURES TREATED WITH CONTOURED LOCKING PLATES AND SCREWS

Orthopaedics

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ABSTRACT

INTRODUCTION: Calcaneal fractures are the most common tarsal bone fractures. If fractured, they cause significant morbidity since they occur mostly in young working adults. There is significant disagreement as to the method of treatment of these fractures.

AIM: to determine outcome of displaced intra-articular calcaneal fracture treated by ORIF with plate and screw fixation

METHOD: a prospective interventional study involving 20 patients with calcaneal fractures treated with ORIF and plating and outcome measured at intervals of 2 and 6 weeks; and 3 and 6 months with parameters of Bohler ratio, heel width and subtalar movements and functional assessment using Creighton-Nebraska score (CNHF score).

RESULT: this study shows that 65% of patients were below 40 years of age. All fractures subsequently went for union. 80% went for excellent to good results. Older age and reduced Bohler ratio had poorer prognosis. Subtalar arthritis may lead to arthrodesis of this joint as occurred in 3 of our patients.

CONCLUSION: Open reduction and fixation with contoured locking plates gives excellent to good results in fractures that are not grossly comminuted. Bohler's ratio is a reliable indicator of prognosis. Sub-talar arthrodesis is not the first line surgical intervention in fractures of calcaneum. Increasing age is associated with poorer outcome in displaced intra-articular calcaneum fractures.

KEYWORDS

intra articular fractures, calcaneum, internal fixation, contoured plates, Bohler ratio, CNHF score.

INTRODUCTION

Calcaneal fractures account for nearly about 65% of tarsal injuries. It is the most frequently fractured tarsal bone. These fractures account for approximately 2% of all fractures (1). Most (70%) calcaneal fractures are intra-articular. Many (7.9%) of these fractures are bilateral. A fall from significant height or motor vehicle collision is the frequent cause. Many of these patients are totally incapacitated for 3 years and partially impaired for 5 years following injury. This results in more financial burden apart from the significant morbidity for the patient. Calcaneal fractures are often associated with thoracolumbar fractures, further adding to morbidity (2).

There is no consensus as to the appropriate or correct treatment of all calcaneum fractures because different methods of classifications are used by different surgeons, making comparison difficult (3). Same can be said for post surgery evaluation of outcome, different outcome measures are used by different authors. (4)

Accurate anatomic restoration of three dimensional anatomy of calcaneum and its articular surface, restoring calcaneal height and width is the goal of surgery. Various techniques have been in place to achieve this outcome in the past few years. Common themes of these techniques are disimpaction of fragments, anatomic reduction and fixation either by manual, percutaneous methods and maintenance of reduction by plates, K-wires, external fixators or screws and plasters. The final aim is a plantigrade foot and ankle, pain free ambulation and ability to return to meaningful occupational and social endeavors (5). The aim of this study is to evaluate the functional outcome of intra-articular fractures treated by open reduction and plate and screw fixation.

MATERIALS AND METHODS

Source Of Data:

This study is a prospective study, the material for which has been collected from patients who reported to Vinayaka Missions Kirupananda Variyar Medical College during the period between July 2019 and January 2021, treated in the hospital by open reduction and internal fixation with contoured locking compression plates by extensile lateral approach.

Sample Size:

A sample size of 20 patients of either sex with closed displaced intra-articular fractures of calcaneum, were analyzed and studied.

Method Of Collecting Data:

Inclusion Criteria:

All patients above 18 years to 65 years with displaced intra-articular calcaneal fractures.

Fresh fractures.

Patients should be walking prior to fractures.

Exclusion Criteria:

Open fracture.

Pathological fracture.

Calcaneal fracture with other associated fracture of lower limb.

Grossly comminuted fractures.

Fractures in children.

Severely osteoporotic bone.

Fractures in adults above 65 years of age.

Surgical technique:

Patients in lateral position under spinal anaesthesia, with tourniquet applied, through extensile lateral approach, a single layered flap raised anteriorly, protecting sural nerve and mobilizing the peroneal tendons anteriorly, the tuberosity fragment is mobilized from varus position and fixed to medial fragment by K wires, the lateral wall is usually comminuted, this portion is retracted to visualize the subtalar articulating surface. The lateral part of posterior facet is usually depressed, this is elevated by using a periosteal elevator and fixed with K wires to medial 'constant' fragment. Then contoured locking plates are placed and reduction held with locking screws. Reduction being constantly checked under C-ARM control.

Post surgery, the foot and ankle were kept in a 90 degree slab and kept elevated for the first week. Mobilization started in ankle and subtalar joint by 6 days. Non weight bearing recommended for minimum 6 weeks followed by partial weight bearing.

All cases were evaluated at 2 weeks, 6 weeks, 3 months and 6 months,

clinically and radiographically with respect to :

1. Bohler's angle ratio- ratio of Bohler's angle measured in both calcaneum on lateral view.
2. Width of the heel- on both sides, measured with calipers
3. Subtalar joint movements- measured on both feet using goniometers.
4. Creighton Nebraska Health Foundation(CNHF) score for calcaneum fractures.

Case Illustrations:

Case 1:



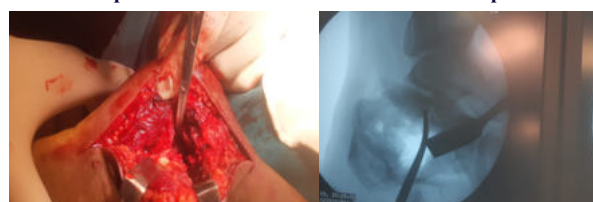
Pre-op X ray

Incision



Flap raised

Fracture exposed



Fracture disimpacted

Depressed posterior facet elevated



Fragments held by K wire and plate placed

Plate fixed with screws



Wound closure

Post op X ray

OBSERVATIONS AND RESULTS

Patients treated with open reduction and internal fixation with locking contoured plates

Table 1 Distribution Of Study Population According To Age

AGE GROUP(YRS)	FREQUENCY	PERCENTAGE
20-30	7	35.0
31-40	6	30.0
41-50	2	10.0
>50	5	25.0

35% of the study population were between the age group of 20-30 and another 30% of the study population were between 31-40 years. Overall 65% of the study population were less than 40 years

Table 2 Distribution Of Study Population According To Sex

SEX	FREQUENCY	PERCENTAGE
Male	18	90.0
Female	2	10.0

90% of the study population were males

Table 3 Distribution Of Study Population According To Side Of Injury

SIDE	FREQUENCY	PERCENTAGE
Right	11	55.0
Left	9	45.0

Table 4 Distribution Of Study Population According To Mechanism Of Injury

MECH OF INJURY	FREQUENCY	PERCENTAGE
Fall from height	14	70.0
Road Traffic Accident	6	30.0

70% of the study population sustained injury due to fall from height

Table 5 Distribution Of Study Population According To Type Of Fracture

TYPE OF FRACTURE	FREQUENCY	PERCENTAGE
Joint Depression Fracture Sanders II	14	70.0
Joint Depression Fracture Sanders III	5	25.0
Tongue type Sanders III	1	5.0

70% had Joint Depression Fracture Sanders II

Table 6 Distribution Of Study Population According To Time For Union

TIME FOR UNION WEEKS	FREQUENCY	PERCENTAGE
8	5	25.0
9	1	5.0
10	6	30.0
12	8	40.0

Table 7 Distribution Of Study Population According To Cnhf Score

CNHF SCORE	FREQUENCY	PERCENTAGE
70-80	5	25.0
81-90	6	30.0
91-98	9	45.0

75% had CNFH score above 80

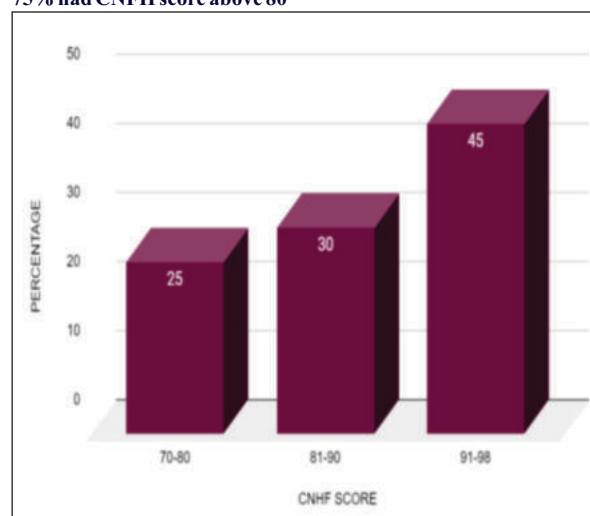
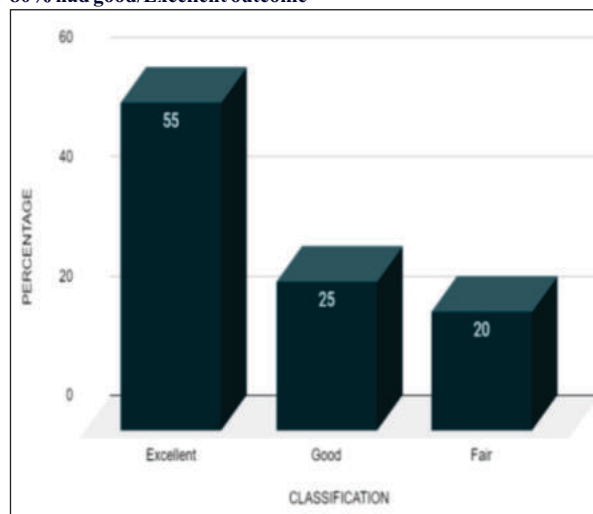


Table 8 Distribution Of Study Population According To Cnhf Classification

CLASSIFICATION	FREQUENCY	PERCENTAGE
Excellent	11	55.0
Good	5	25.0
Fair	4	20.0

80% had good/Excellent outcome**Table 9 Distribution Of Study Population According To Occurrence Of Complications**

PARAMETERS	FREQUENCY	PERCENTAGE
No complications	12	60.0
Calcaneal spur	1	5.0
Calcaneal spur heel widening	1	5.0
Infection subtalar arthritis heel widening	1	5.0
Peroneal tenosynovitis	2	10.0
Peroneal tenosynovitis subtalar arthritis	1	5.0
Subtalar arthritis	1	5.0
Wound dehiscence subtalar arthritis	1	5.0

40% had complications, with 4 of them developing subtalar arthritis, of whom 3 underwent subtalar arthrodesis, peroneal tenosynovitis developed in 3 patients all managed conservatively so far, there was one case of wound dehiscence, which was treated conservatively with daily sterile dressings and proceeded to secondary healing, 1 case of superficial infection was seen, which also subsided with antibiotic treatment, 2 cases of heel widening were seen, one associated with arthritis and the other was associated with mild discomfort wearing footwear, 2 cases of calcaneal spur was seen both without any symptoms.

Correlation between CNHF Score and age and bohlrs ratio

Parameter	Correlation coefficient (Pearson)	95% CI		P Value
		Lower limit	Upper limit	
Age	-0.753	-0.538	-0.902	0.004
Bohlers ratio	0.906	0.814	0.961	<0.001

There is a significant strong negative correlation between age and CNHF Ratio. There is a significant strong positive correlation between bohlers ratio and CNHF Ratio.

- All the above fractures were of closed type. Almost all were joint depression type, except one which was tongue type, but comminuted and not amenable to closed reduction.
- 80% of cases treated by open reduction and locking contoured plate fixation showed excellent to good results.
- All fractures showed union by 8 to 12 weeks.
- Increasing age was found to be related to poorer outcome; however the reason for poor outcome is not clear. Maybe due to osteoporosis, comorbidities, etc.
- Decreased Bohler's ratio between normal and affected calcaneum after union was also associated with poorer outcome.
- No non union of these cases was seen.

DISCUSSION**Patients treated with open reduction and fixation with contoured locking plate and screws:**

Out of the 20 patients in our study with displaced calcaneal fractures, who presented to VMKV medical college hospital, 19 patients with joint depression fractures and 1 patient with comminuted tongue type fracture were chosen for open reduction and internal fixation with

contoured locking plates.

Out of the 20, 65% were less than 40 years old. Buckley (6) noted age incidence to be 30-39 in 60% of his cases.

90% were males (18), 10% were females (2), male preponderance was seen in the ratio of 9:1; Paley (7) noted a ratio 6:1, while Zeman et al (8) noted males to be 84.7% and females to be 15.3%. Gulabi (9) noted 81% to be males and females 19%.

14 (70%) of cases gave history of fall from height while 6 (30%) gave history of road traffic accident.

70% (14) fractures chosen for this treatment were joint depression type Sanders type II, 30% (5) fractures were joint depression type Sanders type III. 5% (1) fracture was tongue type Sanders type III.

As for results, 11 patients (55%) had excellent results, 5 patients (25%) had good results while 4 patients (20%) had fair results. None had poor results. Results were evaluated based on Creighton-Nebraska Health Foundation Score (CNHF score) (10)

CONCLUSION

- Surgical treatment is ideal for displaced intra articular fractures when carefully selected.
- Open reduction and fixation with contoured locking plates gives excellent to good results in fractures that are not grossly comminuted.
- Bohlers ratio is a reliable indicator of prognosis.
- Sub-talar arthrodesis is not the first line surgical intervention in fractures of calcaneum.
- Increasing age is associated with poorer outcome in displaced intra articular calcaneum fractures.

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