

# Management of Comminuted Calcaneum Fractures by Closed Reduction and Percutaneous Fixation-A Case Study

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## Abstract

**Objective:** Calcaneum is the most common tarsal bone to fracture and is attended by considerable morbidity. Many treatment techniques are described in literature but indications for specific techniques are vague. This study analyses the outcome of treatment of comminuted calcaneum fractures by closed reduction and percutaneous fixation.

**Methods:** Between MAY 2012 and NOVEMBER 2014, 20 patients with comminuted fractures of calcaneum who got admitted at a general hospital were subjected to closed reduction and percutaneous screw fixation. Creighton Nebraska Health Foundation Assessment sheet for calcaneum fractures was used for evaluation.

**Results:** Incidence was more common in males with right side more frequently involved than the left side. The commonest mechanism of injury was fall from height and landing on the heel. It was found to be more common in age group 20-39 years. Associated spine and lower extremity injuries were seen in 10%. There were 25% excellent, 65% good, 10% fair results and no poor results.

**Conclusion:** The Essex-Lopresti method of closed reduction and screw fixation is a useful method for the treatment of Intra Articular fractures of calcaneum.

**Keywords:** Essex-Lopresti, Closed reduction, CNHF Score, Bohler's angle

## Introduction

Fractures of the calcaneus, or heel bone, make up about 2% of all fractures and are the commonest fracture of the tarsal bones [1]. Calcaneal fractures have a track record of being difficult to treat and have frustrated doctors for years. The problem in treating calcaneal fractures is in trying to rebuild the fracture so that healing may take place. The calcaneus is much like an egg; an outer firm shell and soft on the inside

[2]. As a result, the calcaneus often shatters when broken. The soft tissue cover around the calcaneus is delicate with a vulnerable layer of skin over the lateral calcaneal wall that is prone to wound healing problems and a unique plantar skin that cannot be replaced with adequate tissue once it is avulsed or severely damaged [3,4]. Calcaneal repair not only requires re-apposition of multiple fracture patterns, but also requires restoration of the subtalar joint. Anatomic restoration of the three-dimensional anatomy of the calcaneum is the goal of surgical management of calcaneal fractures. Over the years, various techniques have been developed to accomplish this goal. Techniques using fine wire external fixation have also been described [5]. All these techniques have certain steps in common including disimpaction of the fragments, reduction of the displaced fragments either manually or percutaneously and protection of reduction [6]. The economic impact becomes even more

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apparent when one considers that 20 percent of patients may be incapacitated for upto 3 years following the fracture and many are still partially incapacitated as long as 5 years after the fracture [7].

### Aims And Objectives

To study and evaluate the results of percutaneous reduction and fixation of intra- articular fractures of the calcaneum.

### Materials And Methods

Inclusion criteria:

1. Patients with intra-articular fractures of calcaneum.
2. Patients in age group of 15- 60 of either sex.
3. Patients who are fit for surgery.

Exclusion criteria:

1. Open fractures with gross contamination.
2. Undisplaced fracture calcaneum.
3. Patients presenting after 4 weeks of injury.
4. Patients not giving written consent for surgery

Cases were selected by diagnosis on history, clinical examination, x-rays and routine investigations. Specific mention about the presence or absence of vascular or neurological deficits, open or closed injury, associated spine or extremity injuries were made. Performa specially made for this study was used. Clinical diagnosis was confirmed by Antero-Posterior, Lateral and Harris-axial views. Special views were taken only when the interpretation of these routine x-rays were difficult. In all cases the opposite calcaneus was x-rayed for comparative studies. All calcaneal fractures were classified and assigned to a particular group based on Essex-Lopresti's classification system. The present study included 20 cases of comminuted fractures of calcaneum treated by closed reduction and percutaneous fixation.

### Observations And Results

#### AGE INCIDENCE

The age incidence was as follows, no patients in the age group 15-20 years, 3 patients (15 %) in the age group 21-29 years, 14 patients (70 %) in the age group 30-39 years, 3 patients (15 %) in the age group 40-49 years and no patients in the age group 50-55 years. Higher patient age does not appear to negatively affect outcome after operative treatment of calcaneal fracture [8,9].

#### SEX INCIDENCE

The sex incidence was as follows, 13 patients (65%) were male and 7 patients (35%) were female.

#### Side Incidence

The side incidence was as follows, 11 patients (55%) had a fracture of the right side, 7 patients (35 %) had a fracture of the left side and 2 patients (10%) had bilateral fracture.

#### Mode of Injury and Associated Injury

The mode of injury was as follows, 14 patients (70 %) had a fall from height, 2 patients (10 %) slipped and 4 patients (20 %) had a history of RTA.

#### Results And Outcome

(As per Creighton-Nebraska health foundation assessment scale)

The following were the results and outcome at 24 months followup,

Grade	No. of Patients Cases	Percentage
Excellent	5	25
Good	13	65
Fair	2	10
Poor	0	0

#### Range of Motion at Ankle

Range of motion(Inversion/Eversion)	No. of Patients Cases	Percentage
25 to 30 (80% to 100%)	13	65
20 to 25 (60% to 80%)	5	25
15 to 20 (40% to 60%)	2	10
10 to 15 (20% to 40%)	0	0
0 to 10 (0% to 20%)	0	0

#### Complications Encountered in the Study

Complications	No. of Patients Cases	Percentage
Subtalar arthritis	3	15
Peroneal Tenosynovitis	1	5
Superficial infection	1	5
Heel widening	4	20

#### Radiological Union

The radiological union was assessed in terms of Bohlers angle and Gissane angle and was as follows,

Radiological union at : (weeks)	No. of Patients Cases	Percentage
8	7	35
9	7	35
10	4	20
12	2	10

#### Discussion

Calcaneus Fractures usually affect young males from



Preop Radiographs



Immediate Post-op Radiographs



24 Months Follow Up Radiographs



Preop Radiographs

Immediate Post-op Radiographs



24 Months Follow Up Radiographs

economically active age groups which contributes to significant socio-economical loss[10]. In present study, by observing the stratified distribution of the patients, it was shown that 85% were within 20 to 40 years old, and only 15% were old aged, goes with the statement that this condition affects individuals who are working for economic reasons[10]. Nambiar noted that 56% of his patients were in the 3rd to 4th decade of life, Parmar noticed age range between 16-64 with mean age 50.9 years and Buckley noted that in his study the maximum age incidence was between 30-39 years (60%) with age range between 15-68 years[11,12,13].

In this present study 13 patients were males (65%) and 7 patients were females (35%), showing male preponderance. Parmar noted male to female ratio of 2.3:1, Nambiar 10:1 and Paley 6:1[11, 12, and 13]. In our society, male population works for earning to serve the family.

The most common mode of injury of calcaneus intra-joint fractures, as reported by literature, is the fall from different ground levels, which was confirmed by this study, where this, kind of fall accounted for 70% of the fractures[10,14,15].

Due to the axial mechanism of trauma, existence of associated injuries is possible [16]. Various authors report this fact occurring in percentages ranging 8.5 to 46% of patients [17]. In this study, other injuries were found in 10% of the patients. Hildebrand reported associated spine fractures in 10%, Buckley reported 15% and Nambiar reported 21% associated spine injuries whereas in this study spine injuries accounted 5% of cases [11,17, and 18].

In accordance to Essex-Lopresti's classification, intra-joint fractures may be tongue-type or joint depression-type. In most of the case series, joint depression-type fractures are the most prevalent accounting for 61% of intra-joint fractures [19,20, and 21]. In this study, we found 60% of joint depression-type fractures and 40% tongue-type fractures. The kind of fracture were related to outcome and return to work. For the surgical treatment, there is a consensus of waiting sometime between trauma and surgery, ranging from immediate to 5 days for percutaneous surgeries so that oedema could be reduced and for preventing blisters to be formed, except in open fractures, which should receive immediate surgical care [22, 23]. In this study, the time interval between trauma and surgery for all the fractures was, in average, 1 to 3 days.

In a recent prospective-randomized trial, primary fusion

was not superior to open reduction and internal fixation in Sanders Type IV fractures [24]. Patients treated using percutaneous technique could be operated on as soon as possible after injury. Levine and Helfet, in their series of intra-articular fractures of the calcaneum treated with a minimally-invasive technique, were surprised that subtalar movement was almost completely preserved despite an articular surface reconstruction described as 'nearly anatomical' [25]. Thermann et al advised minimally-invasive fixation for cases with severe soft-tissue contusion, compound and Sanders type-IV fractures, and in multiply-injured patients [26]. In present case study all patients were treated by minimally invasive percutaneous surgeries.

The Bohler's angle, considered as normal within measurements ranging from 20° to 40°, is used for indication changes on the posterior joint facet and for qualifying fracture resolution. Loucks and Buckley performed a prospective and randomized study to evaluate the Bohler's angle and they observed that surgical treatment improved angle graduation as well as the functional status [27]. They stated that fractures with a Bohler's angle markedly reduced at the immediate post-trauma period provided bad outcomes and they suggested that the high energy of trauma produces angle flattening, with a more extensive bone and soft parts injury [24]. In this study, variations between 10 and 40 degree were found. The value of this angle showed a correlation with the quality of outcome. This study show that 18 of the reductions with an angle above 20° presented good and excellent outcomes. We have compared our analysis with Paley who did a similar analysis and has similar conclusions [13].

No major complications are associated with per cutaneous approach. In early complications our study shows 1 (5%) infection with wound complication which was managed conservatively. Risk factors of infection include open fractures, delay of surgery beyond 14 days after the injury, the number of people in the operating room, a high body mass index, diabetes, and smoking [27]. In the Late complications out study marks Peroneal Tenosynovitis in 1 (5%) case, Heel widening in 4 (20%) cases and Subtalar joint arthritis in 3 (15%) cases. This is comparable to Nambiar (13%), Poupa (17%) and Tornetta (10%) who had reported subtalar arthritis in their series [11,28,29].

The comparison of the results in this present series with other similar studies is given below,

SERIES	OUTCOMES			
	Excellent	Good	Fair	Poor
Leung <sup>32</sup>	39	52	9	0
Paley <sup>13</sup>	21	13	11	7
Tornetta <sup>31</sup>	55	32	13	0
Poupa <sup>30</sup>	58	29	13	0
Nambiar <sup>11</sup>	61	33	6	0
<b>Present study</b>	25	65	10	0

Comparison of Results of this Study with Calcaneum Fractures Managed by Open Reduction and Internal Fixation

SERIES	OUTCOMES			
	Excellent	Good	Fair	Poor
<b>PRESENT STUDY (PERCUTANEOUS TECHNIQUE)</b>	25%	65%	10%	0%
<b>OPEN REDUCTION AND INTERNAL FIXATION</b>	42%	37%	15%	6%

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