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## Outcome of fracture calcaneum managed by conservative versus operative methods a randomized comparative study

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### Abstract

**Background:** Calcaneal fracture is a complex injury that represents 1%–2% of all fractures. However, they make up 60% fractures of the midfoot bones. Due to challenging management of calcaneal fractures, we decided to evaluate the long term outcome of the same.

**Method:** In this series of 61 calcaneal fractures 11 fractures were treated by open reduction and internal fixation method, 16 fractures by percutaneous reduction technique and 34 were treated conservatively, Creighton-Nebraska scoring has been chosen, being based on results rather than radiographic criteria. Our average duration of follow is 18 months.

**Results:** In this study total 61 feet of 50 patients. 90.9% had excellent results with 1 fair result in open reduction group with internal fixation group. 5 excellent (31.2%) with 10 good (62.5%) and 1 fair (6.3%) result were obtained in percutaneous reduction group. No patient from operative group and percutaneous reduction group showed poor result. There were Only 3 excellent (8.8%) results with 10 good (29.5%), 13 fair (38.3%), and 8 poor (23.5%) results in conservative group of patients. Complications included infection, plantar fasciitis, subtalar arthritis.

**Conclusion:** our conclusion is that intra articular fractures of calcaneum should be approached in more practical and scientific manner so that normal anatomy of the subtalar joint and overall shape of the calcaneum can be restored with early range of motion.

**Keywords:** Intraarticular fracture, calcaneum

### Introduction

Calcaneal fracture is a complex injury that represents 1- 2% of all fractures. Calcaneum fracture are 60% of fractures of the mid foot bones. Men are more often affected than women and the incidence is higher in young and middle aged person. The fracture generally occurs by high energy trauma. A common fracture mechanism is an axial stress to the talo-calcaneal joint caused by a fall from a height of more than 1 meter or by a road accident. It can be bilateral and associated with other fractures, and it can be seriously disabling it can be the most severe cases. Calcaneal fractures may be divided into extra-articular (Not affecting the joint) and intra-articular. The best evaluation of these fractures is traditional imaging, including plain xrays in anteroposterior (AP), lateral and oblique views of the foot, Harris view of the heel and Broden's views of the hindfoot. CT scan best assesses heel fractures, provides a three dimensional image and may be useful to understand fracture details and to plan a correct surgical approach [2]. The management for heel fractures is a real challenge for the orthopaedic surgeon: it varies widely and no clear consensus has been reached, Conservative treatment is well accepted for extra-articular fractures and it is based on cast immobilization, early range of motion, early compression of the plantar arch. Operative management includes closed reduction and internal fixation with pins, wires, screws or plates, with different medial or lateral incisions (or both), and arthrodesis. Fractures of the calcaneum continue to pose a therapeutic challenge out of proportion to their incidence. There remains great deal of controversies regarding the treatment: operative vs non operative. In operative, this controversy is further fueled by the disagreement on which operative approach is preferable. The success of treatment requires an understanding of the fracture, its deforming force and of the fracture classification. These allows the selection of the treatment that is specific for

fracture deformity. Unfortunately, the pattern of calcaneal injury was not adequately delineated for the orthopaedic surgeon who had not spent a significant amount of time examining the fracture to understand subtle nuances of the injury. The aim of this study was to collect and evaluate the scientific evidence supporting the different treatment in the management of calcaneal fracture

### Materials and Methods

Our study was performed from January 2018 to June 2019 at the department of orthopaedics in mahatma Gandhi college and hospital, jaipur. The average follow up period was 18 months. Most of the patients belonged to the 4th decade with male predominance ratio is 5:1. Commonest mode of injury is fall from height. Ap, lateral and axial radiographs of the calcaneum with or without CT were taken of all the patients at the time of injury. xray was taken during surgery and after discharge. These were used to classify the fractures. The outcome measures included assessment of pain, walking ability, range of motion, wear shoes and complication. Classification used for this study describe below. Intraarticular fractures describe by Essex Lopresti,1) Tounge type- in this type, secondary fracture line runs straight back to posterior border of the tuberosity from the crucial angle, so that tuberosity fragment remain attached to articular fragment. 2) Joint depression type –here the secondary fracture line runs across the body just behind the joint, so that the tuberosity fragment is not attached to the articular fragment and by sander's classification. In this study for conservative management initially below knee slab given than after reduction of swelling and wrinkling of skin, below knee cast is given applying side to side compression and the patient is kept non weight bearing with subsequent changes of cast till there are radiological signs of fracture union. After the removal of the final cast, the patient is advised physiotherapy in the form of heat and active mobilization exercises and use of hot soaks at home.

### Operative technique

these cases were operated by me and professor dr r. k verma and my colleague. Anaesthesia decided by consultant anesthetist. Preoperative IV antibiotics were given. Intraarticular fracture (tongue, depressed, comminuted) fracture treated by open reduction and internal fixation with plating. The patient was put under general or spinal anaesthesia and placed in a supine position with lateral decubitus by keeping a pad under gluteal region followed by painting and draping of the parts under aseptic conditions. The landmarks for incision were the distal fibula, the anterior process of the calcaneum, the calcaneocuboid joint and the base of the 5th metatarsal. A large L shaped surgical incision was made beginning approximately 4 cm. above the tip of the lateral malleolus, midway between the posterior border of the fibula and the Achilles tendon. Then the incision began proximally, curved below the sural nerve, and then moved upward to the calcaneocuboid joint. The incision was made

down to the bone in order to make a cutaneous subcutaneous flap so as to include the peroneal tendons. The flap was developed anteriorly to expose the posterior subtalar joint. Then the flap was elevated, along with the sural nerve and peroneal tendons. K wires were then inserted in to the lateral malleolus, neck of talus and cuboid, and then bent to hold the flap and soft tissues; it provided us a better exposure and lesser damage to soft tissue. The subtalar joint was opened and the fractures of the lateral calcaneal wall were dissected, in order to expose the fractured and depressed articular fragments. The reduction maneuver usually began at the posterior articular surface and proceeds to the Gissane angle and to the body of the calcaneum. However, if varus tilt of the calcaneus prevents anatomic reduction of the posterior facet; the alignment of the body may need to be corrected prior to the reduction of the joint surface. The fractured lateral wall of the calcaneum was gently opened, leaving the fracture fragments within their periosteal envelope. The depressed posterior facet was elevated, most of the time by using a strong elevator and when needed with the help of a shanz screw drilled in tuberosity. The articular surface was reduced, lateral wall repositioned, and fixation was made using temporary Kirschner wires. Most of the time, the posterior facet was first restored, with the medial facet in relation to the sustentaculum tali, the anterior facet and at last the posterior tuberosity. The reduction was appreciated under direct vision whenever possible. The calcaneal plate was then positioned at the appropriate location on the lateral calcaneal wall. The size that best fits the calcaneal anatomy was chosen from small, medium or large. Then the plate was moulded and contoured to the lateral aspect of the anterior process, the posterior facet and to the tuberosity. The sleeves were first screwed in the hole located on the anterior extremity and in the 2 holes on the posterior extremity of the plate. They allowed axial drilling and perfect insertion of the locking screws. The holes for fixation screws were drilling using the 2.2 mm drill through the drilling sleeves. Holes in the plate allow fixation with up to 4 screws in the posterior tuberosity (2 locking screws and 2 variable angle screws), and 3 screws in the anterior process (1 locking screws and 2 variable angle screws). The screws were inserted with the screwdriver in a normal way, and introduced in the bone until the base of their head is blocked against the plate. The flap was apposed using Vicryl 1-0 in subcutaneous plane and skin by Ethilon 2-0 followed by bulky compression dress Postoperatively, a posterior below knee slab was applied and the foot was elevated to reduce postoperative swelling. The dressing was checked on third postoperative day. Early range of motion exercises were encouraged after the surgical incision had begun healing or pain subsided, usually 10 to 12 days after surgery. Sutures were removed on an average of 19.8 days, but weight bearing was delayed for up to 8-12 weeks, depending on the original degree of comminution and the subsequent rigidity of the fixation. Check X-rays obtained at 4 to 6 weeks of regular interval. The gait and joint range of motion are known to improve gradually with time & exercise.



**Fig 1:** Pre operative and post operative xray



**Fig 2:** Intra operative photograph with calcaneum plate and photograph after 3 days

Follow up was conducted with physical and radiological examination at regular interval, outcomes assessment

performed on final follow up according to Creighton-Nebraska scoring 14.

Creighton – Nebraska Health Foundation Assessment Sheet

<b>Pain (30 points)</b>	
Activity	
No Pain when walking or ignores pain	15
Mild pain when walking; takes aspirin	10
Moderate pain when walking; takes codeine	5
Severe pain when walking; serve limitations	0
Rest	
No pain at rest or ignores pain	15
Mild pain at rest	10
Moderate pain at rest	5
Severe pain at rest	0
	30
Activity (20 point)	
Unlimited walking and standing	20
Walks 5-10 blocks; stands intermittently for more than ½ hrs.	15
Walks 1-5 blocks; stands ½ hrs or less	10
Walks less than 1 block (indoors only)	5
Cannot walk	0
	20
Range of motion (20 points)	
25-30 = 80-100%	20
20-25 = 60-80%	15
15-20 = 40-60%	10
10-15 = 20-40%	5
0-10 = 0-20%	0
	20
Return to work (20 points)	
Full time, same job	20
Full time with restriction	15
Full time, change job	10
Part time with restrictions	5

Cannot work	0
	20
Change in shoe size (5 points)	
No change	5
Change	0
	5
Swelling (5 points)	
None	5
Mild	3
Moderate	2
Severe	0
	5
Total Score	100

## Results

- The present study consists of 61 fractures of calcaneum in 50 patients, treated in the Department of Orthopaedics MAHATMA GANDHI Medical College and Hospital, Jaipur during the year JAN 2018 to JUNE 2019.
- 33 of 50 patients (66%) belong to 3 and 4 decade thus indicating the role of dynamic mobility and activity of young male patient making them prone to injury.
- The average age in the series was 33.3 years. While male to female ratio was 9:1.
- In this present series the calcaneal fracture were found to be most common in labourers (34%), showing considerable economic Importance of calcaneal fractures in industrial workers.
- Right side involvement was 55.7% as compared to left side involvement 44.3%. Eleven patients (22%) had bilateral involvement in this study group.
- In the series fall from height Found to be most common mode of injury (84%), signifying the role of axial loading due to high velocity impact to the heel during fall from height.
- 11 patients (24%) were associated with other bony injuries, among them two (4%) were multiple injured. 38 patients (76%) were of Isolated injury.
- All the fractures included in this study were closed and intra articular. Compartment syndrome was not evident in any case included in this series.
- In the present study 3 undisplaced type, 20 Tongue type, 24 Joint depression type and rests of the 14 fractures were comminuted type according to the classification of Essex Lopresti.
- The mean duration between injury and open reduction with internal fixation method was  $13.09 \pm 9.48$  days while it was  $3.43 \pm 4.19$  days between injury and percutaneous reduction technique.
- In this series of 61 calcaneal fractures 11 fractures were treated by open reduction and internal fixation method, 16 fractures by percutaneous reduction technique and 34 were treated conservatively.
- Sutures removed on an average duration of  $19.81 \pm 3.15$  days after open reduction and internal fixation.
- Steinman pin and K wires removed on an average duration of  $56 \pm 7.76$  days after percutaneous reduction.
- Duration of follow up was 6 months to 2 years with an average of 11.34 months.
- We were able to achieve a Bohler's angle of an average  $22^\circ$  from  $1.18^\circ$  by open reduction and internal fixation method, and  $23.06^\circ$  from  $8.43^\circ$  after percutaneous reduction technique.
- The mean duration between injury and weight bearing after open reduction and internal fixation, percutaneous reduction technique and conservative methods was 74 days, 72 and 67 days respectively.
- The mean subtalar motion, after open reduction and internal fixation, percutaneous reduction technique, and conservative treatment was 78%, 63%, and 47% respectively, clearly denotes the significance of open reduction and internal fixation in terms of improved subtalar motion.
- Patients returned to work on an average of 6 months, 6.56 months, and 6.73 months in open reduction and internal fixation group, percutaneous reduction group, and conservative group respectively.
- Minimal complications found in open reduction and internal fixation group ((18%): wound edge necrosis in two patients), and percutaneous reduction group (18.8%: slough at entry point in two and pain in one patient).
- Pain was the most common complication (50%) in patients who were treated by conservative methods followed by malunion (35.3%) and heel broadening (23.5%).
- Final outcome was graded according to Creighton Nebraska scoring system. 10 patients (90.9%) had excellent results with 1 fair result in open reduction group with internal fixation group.
- 5 excellent (31.2%) with 10 good (62.5%) and 1 fair (6.3%) result were obtained in percutaneous reduction group. No patient from operative group and percutaneous reduction group showed poor result.
- There were Only 3 excellent (8.8%) results with 10 good (29.5%), 13 fair (38.3%), and 8 poor (23.5%) results in conservative group of patients.

## Conclusion

Considering the complex anatomy of calcaneum, and the way, calcaneal fractures are being treated by Orthopaedic surgeons, our conclusion is that intra articular fractures of calcaneum should be approached in more practical and scientific manner so that normal anatomy of the subtalar joint and overall shape of the calcaneum can be restored with early range of motion. So in our experience, Open reduction and internal fixation of displaced intra articular fractures of calcaneum using a lateral approach, with meticulous dissection of soft tissue and careful positioning of a plate, even without need of bone graft by experienced hands, is an excellent method with minimal complications. Though the Tongue type fractures without comminution, and cases where patients reluctant to major surgery, percutaneous reduction technique also holds good, in terms of functional outcome. This is particularly important in our setup because of the financial constraints of patients and



the relative inexperience of majority of orthopaedics in our country

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