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Original Research Article

Calcaneum Intraarticular Fracture Pattern Evaluation and Surgical Outcome of Various Methods of Fixation

Panchal Mehul A.[1], Vyas Vaibhav N.[2], Shah Hiren K.[3]

[1]Senior Resident, Department of Orthopedics, Nootan Medical College & Research Center, Visnagar, Gujarat, India

[2]Senior Resident, Department of Orthopedics, GCS Medical College, Hospital and Research Center, Ahmedabad, Gujarat, India

[3]Professor, Department of Orthopedics, GCS Medical College, Hospital and Research Center, Ahmedabad, Gujarat, India

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Corresponding author: Dr. Vyas Vaibhav N.

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Abstract

Calcaneus fractures account for approximately 60% of all tarsal injuries. Functional outcomes largely depend on the integrity and restoration of the subtalar joint, which is a key weight-bearing joint of the foot. In this study, we took 50 cases with calcaneum fracture to evaluate intraarticular fracture pattern and to evaluate outcome of various surgical methods of fixation of intraarticular fractures. Joint destruction and severe intraarticular comminution with soft tissue compromise leads to fair to poor outcomes. Good anatomical articular reduction with suitable surgical intervention along with strict post-operative rehabilitation protocol, we can achieve good to excellent outcomes. In the study, it was found that Essex lopresti classification and CT based Sanders classification are useful in better preoperative planning and management.

Keywords: Calcaneum, Intraarticular, Tongue type, Joint depression type, Essex Lopresti, Sanders.

Introduction

The calcaneus, or os calcis, is the largest and most significant tarsal bone, playing a crucial role in the weight-bearing process. It has a complex osseous structure that joint mechanics between the tarsal bones, and the delicate soft tissue envelope in which they are housed make calcaneal fractures particularly challenging to manage [1].

Historically, the prognosis of calcaneal fractures was poor. In 1916, Cotton and Henderson stated, “ordinarily speaking, the man who breaks his heel bone is ‘done’ so far as his industrial future is concerned.”

This dire outlook spurred the orthopedic community to develop methods for achieving better clinical and functional outcomes [2]. Calcaneus fractures account for approximately 60% of all tarsal injuries [3], with most cases occurring in males aged 20-50 years. Patients who present with isolated calcaneal fractures often sustain them from high-energy trauma, such as falls from height or motor vehicle accidents. In many cases, these fractures are accompanied by other injuries, including Pilon-type fractures, femoral fractures, talar dislocations, and spinal injuries [4].

Functional outcomes largely depend on the integrity and restoration of the subtalar joint, which is a key weight-bearing joint of the foot. Treatment options for calcaneus fractures include both conservative and surgical approaches. Surgical management involves open reduction and internal fixation (ORIF) using plates and screws or minimally invasive techniques such as percutaneous fixation. Despite advancements in surgical techniques and postoperative rehabilitation, challenges remain in achieving optimal functional recovery.

The outcome of treatment is influenced by factors such as fracture patterns, treatment protocols, post-treatment symptoms, duration of immobilization, and the patient’s pre- and post-treatment occupation. Long term complications, including post-traumatic arthritis, chronic pain, and stiffness, may arise, necessitating ongoing management and rehabilitation.

Aims and Objectives

- To evaluate Calcaneum Intraarticular fracture pattern.

- To evaluate outcome of various surgical methods of fixation of intraarticular fractures.

Inclusion Criteria

- Patients having intraarticular fracture of calcaneum with or without comminution.
- Patients of any age group and both sex.

Exclusion Criteria

- Patient with extraarticular fracture of calcaneum.
- Patient with intraarticular fracture of calcaneum managed conservatively.
- Patient with fracture >4 weeks old.
- Patient who are not willing for surgery.
- Patient unfit for anesthesia.

Materials and Methods

This is a prospective study of 50 cases of different age groups and both sexes with calcaneal fractures treated with different modalities in department of orthopaedics in our institute. Between March 2023 to February 2025, fifty patients with calcaneal fracture and operated with different modalities were enrolled in our study which were approved by our institutional board. Written and informed consent of each patient was taken.

Patients were given strict limb elevation on Bohler-brown splint and below knee slab along with glycerine MgSO4 application to reduce oedema. Swelling over operative site was assessed daily and strict limb elevation was maintained. After 2-3 days when swelling subsided and appearance of "WRINKLE SIGN" patient was posted for surgery on very next day.

Aims of Surgery

a) Restoring congruency of posterior facet of subtalar joint.
b) Restoring calcaneal height. (Bohler's angle)
c) Realigning tuberosity into valgus position.
d) Decreasing calcaneal width.
e) Calcaneocuboid joint reduction, if fractured.

Results and Discussion

In our study, 35 patients were younger age group between 21 to 50 years of age (70%) and 13 patients were 51 to 80 years of age (26%) group. 1 patient (2%) was in age group between 11-20 years and 1 (2%) in age group 81-90 years. Calcaneus fractures most occurred in males (85%)[5], in our study 45 patients (90%) were males and 5 patients (10%) were female. This shown that high magnitude of outdoor activities, sports as well as driving among male population.

Table 1: Correlation between mode of injury and calcaneum fracture

Mode Of Injury	No. Of patients
Fall from height	31
Road traffic Accident	19

Mitchell et al [4] observed that calcaneal fractures were most occurred due to fall from height (70%) followed by motorcycle accident.

In our study 31 patients were having history of fall from height (62%) and other 19 patients were having history of road traffic accident (38%) Most injuries in male occurred due to fall from height and bilateral fractures were associated with high energy injuries. In females the injury was more likely to occur from simple fall and other low energy injuries representing an osteoporotic fracture in this group [3]. In our study 24 patients having left side (48%) and 22 patients having right side (44%) calcaneal fractures.

We found that 4 patients (8%) having bilateral intraarticular calcaneal fracture. Many articles observed that 16.6% patient having bilateral calcaneal fracture.

Table 2: Type of fracture pattern seen

Fracture Type	No. Of patients
Joint depression type	33
Tongue type	17

We found 33 patients were having joint depression type (66%) and 17 patients were having tongue type (34%) calcaneal fracture. According to Essex Lopresti [6] joint depression variety were more common in intraarticular calcaneal fracture. In this study, the time interval between trauma and surgery for all intraarticular calcaneus fractures were 1 to 10 days. In literature also mentioned that average time of all surgeries in all intra articular calcaneus fracture were between 3 to 14 days after trauma.

Table 3: Type of procedure done

Procedure	No. of calcaneum operated (out of 54)
ORIF + Plating	41
Percutaneous screw fixation	13

Out of 50 patients, in which 4 patients were operated bilaterally, so out of 54 total operative procedures 41 are ORIF+plating (76%) and 13 are percutaneous screws (24%). Scheper's et al [7] concluded that ORIF was the mainstay of all five modality of treatments while the utility of percutaneous technique was also helpful.

Table 4: Calculation of Bohler and Gissane angles

No. of patients	Mean Bohler angle (in degrees)				Mean Gissane angle (in degrees)			
	Pre Op		Post Op		Pre Op		Post Op	
	Right	Left	Right	Left	Right	Left	Right	Left
50	22.84	28.42	21.48	28.32	145.62	133.94	147.92	136.40

We found preoperative mean Bohler angle of 25.63˚ .The Bohler angle considered as normal within measurement ranging from 20˚to 40.˚ We found postoperative mean Bohler angle of 26.43˚. The difference between pre and post mean Bohler angle showed correlation with the quality of outcome.

We compared pre and post-operative Gissane angle in all patients and we found post-operative Gissane angle was less then pre-operative which suggested good outcome. We observed that after 1 year follow up the mean of inversion and eversion of affected side were near to normal range and no major difference seen compared to normal side.

In our study, 10 patients were having heel pain, 4 patients were having suture line infection, 8 patient was having subtalar arthritis and 3 patient was having screw impingement which is treated with removal of screws and patient did well and pain is subsided.

Table 5: Post-operative outcome (AOFAS score)

Outcome (AOFAS score)	No. of Calcaneum (Out of 54)
Excellent	27
Good	21
Fair	6
Poor	0

Outcomes measured with AOFAS score and we found excellent results in 25 patients (50%), good in 19 patients (38%) and fair in 6 patient (12%). No patient was having poor outcome. We compared this with the series of Voclav et al[8] who also found excellent results in 24(32%) patients, Good in 28(37%) patients, Fair in 14(18%) patients and Poor results in 10(13%) patients and Biz et al[9] who also measured outcomes with AOFAS score and he found excellent results (90–100 points) in 11 (12.6 %) patients, good results (75–89 points) in 46 (52.9%) patients, fair results (50–74 points) in 26 (29.9%) patients, while 4 (4.6%) patients were graded as failures (<50 points).

Summary

Proper radiological evaluation like lateral and axial view of fracture are must for understanding the fracture pattern. CT scan is helpful for assessment of minor fragments and comminution and which helps in better preoperative planning. Factors like age of patient, mode of injury, general medical status, osteoporosis, blisters, and hemodynamic instability affects surgical outcome. Essex lopresti classification and CT based Sanders classification are useful in better preoperative planning and management.

The goal of the treatment of the intraarticular calcaneal fracture is to restore the subtalar joint articulation, height, and width of the calcaneum. For simple tongue type intraarticular fracture, the modified Essex Lopresti method of closed reduction and percutaneous screw fixation is a good option to minimise the complications of open fixation. Open reduction and internal fixation are good option for joint depression and tongue type comminuted intra articular calcaneal fractures. Lateral extensile approach is better for visualisation of subtalar as well as calcaneocuboid joint.

Joint destruction and severe intraarticular comminution with soft tissue compromise leads to fair to poor outcomes. Good anatomical articular reduction with suitable surgical intervention along with strict post-operative rehabilitation protocol, we can achieve good to excellent outcomes.

Limitations of Study

- Small sample size.
- Single hospital study.

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