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A heel of two strategies: A comparative study of conservative versus surgical management using CC Screw in intra-articular calcaneal fractures

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Abstract
Introduction: Intra-articular calcaneal fractures are among the most complex orthopaedic injuries. The optimal treatment—conservative or surgical—remains debated due to variable outcomes and complication profiles.
Aim of The Study: To compare the functional and radiological outcomes of conservative treatment versus closed reduction and internal fixation (CRIF) using cannulated cancellous (CC) screws in displaced intra-articular calcaneal fractures.
Materials and Methods: Thirty patients with intra articular fractures, were prospectively studied. Group A (n=15) received conservative treatment; Group B (n=15) underwent CRIF with CC screws. Patients were evaluated over 1 year using the American Orthopaedic Foot & Ankle Society (AOFAS) score, Bohler's angle, and complication rate.
Results: Group B had significantly better AOFAS score, improved radiological restoration of Bohler's angle, and earlier return to weight-bearing and occupation. Group B showed a 10% rate of minor wound complications; Group A had higher incidences of malunion and chronic pain.
Conclusion: Surgical management using CC screws provides superior functional and anatomical outcomes, whereas conservative management remains appropriate for those with contraindications for surgery or lower functional demand.

Keywords: Complication rate, Malunion, Chronic pain, Wound complications, Return to weight-bearing

Introduction

Displaced intra-articular calcaneal fractures represent one of the most challenging injuries in orthopaedic trauma, owing to their complex anatomy, tenuous soft-tissue envelope, and propensity for long-term functional impairment. These fractures account for approximately 1–2% of all skeletal injuries and nearly 75% of fractures involving the tarsal bones [1, 2].

High-energy axial loading mechanisms such as falls from height and road traffic accidents commonly result in depression of the posterior facet, loss of calcaneal height, increase in heel width, and disruption of subtalar joint congruity [3, 4]. These deformities adversely affect gait mechanics and frequently culminate in chronic pain and post-traumatic subtalar arthritis [5].

The optimal management of displaced intra-articular calcaneal fractures remains controversial. Conservative treatment avoids surgical complications but is often associated with malunion and inferior functional outcomes [6]. Operative management aims to restore anatomy and joint congruity; however, traditional open techniques are associated with significant wound-related complications [7, 8]. Minimally invasive techniques such as percutaneous cannulated cancellous (CC) screw fixation have emerged to balance anatomical restoration with reduced soft-tissue morbidity [9].

Aims and Objectives

1. To compare the functional outcomes of conservative management and percutaneous CC screw fixation in displaced intra-articular calcaneal fractures.
2. To evaluate and compare radiological outcomes based on American Orthopaedic Foot and Ankle Society (AOFAS) score and the Maryland Foot Score (MFS).
3. To analyse and compare complication profiles between the two treatment modalities.

Methodology

Study Design

This study was a prospective comparative study conducted in the Department of Orthopedics, KVG Medical College and Hospital, Sullia, over a period of 1 years from March 2024 to March 2025. The study aimed to assess the Comparison between of Conservative management and Surgical Management Using CC Screw in Intra-articular Calcaneal Fractures, and to document postoperative complications.

Ethical Considerations

Ethical clearance was obtained from the Institutional Ethics Committee (IEC) of KVG Medical College and Hospital, Sullia. Written informed consent was obtained from all participants before enrollment. Confidentiality of patient information was maintained throughout the study.

Study Population

Inclusion Criteria

Patients were included in the study if they met the following criteria:

1. Patients aged between 18 and 60 years,
2. Closed fractures.
3. Patients fit for surgery

4. Patients with fractures presenting within 1 week.

Exclusion Criteria

Patients were excluded if they met any of the following criteria:

1. Paediatric patients <18 years
2. Open fractures
3. Patients associated with other fractures and spine injury.
4. Patients unfit for surgery
5. Severely comminuted fractures.
6. Fractures older than 1 week.

Sample Size and Sampling Method

- A total of 30 patients were included in the study after meeting the inclusion and exclusion criteria.
- Alternate allocation and randomization was used to divide all eligible patients presenting with closed calcaneal fractures into two groups: Group A (conservative management, n=15) and Group B (percutaneous CC screw fixation, n=15).

Preoperative Assessment

All patients underwent detailed clinical examination and radiological evaluation.

- Standard lateral radiographs are utilized to evaluate the posterior facet's rotation and height loss (loss of Böhler's angle). The axial (or Harris) view is used to evaluate the heel's breadth and varus displacement [10].
- Fractures were classified according to the Essex-Lopresti classification [11].

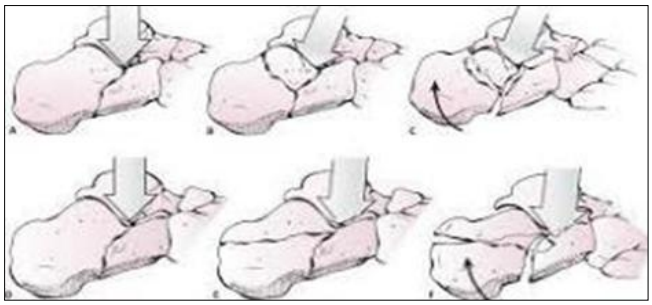

Fig 1: Essex lopresti Classification

Table 1: Fracture classified based on Essex Lopresti Classification

Types	Operative	Non-Operative	Total
Tongue type	7	6	13
Joint Depression	8	9	17
Total	15	15	30

Conservative Management

- Conservative treatment involved closed reduction followed by below-knee slab initially and cast conversion with non-weight-bearing mobilization was used as a non-operative treatment for six weeks.
- Strict non-weight-bearing was maintained for six weeks, followed by gradual progression to partial and full weight-bearing based on radiological and clinical healing.
- Full weight-bearing was initiated, by 4 months.

Fig 3: Patient-1:1: Conservative Management

Fig 4: Patient-1:2 : Conservative Management

Surgical Management

- The patient was positioned in lateral position with appropriate padding wherever required, after administering spinal anaesthesia.
- Closed reduction was achieved with k-wires or Steinmann pin, and further percutaneous cc screws were placed under the guidance of fluoroscopy.
- And below knee slab/splint was applied.

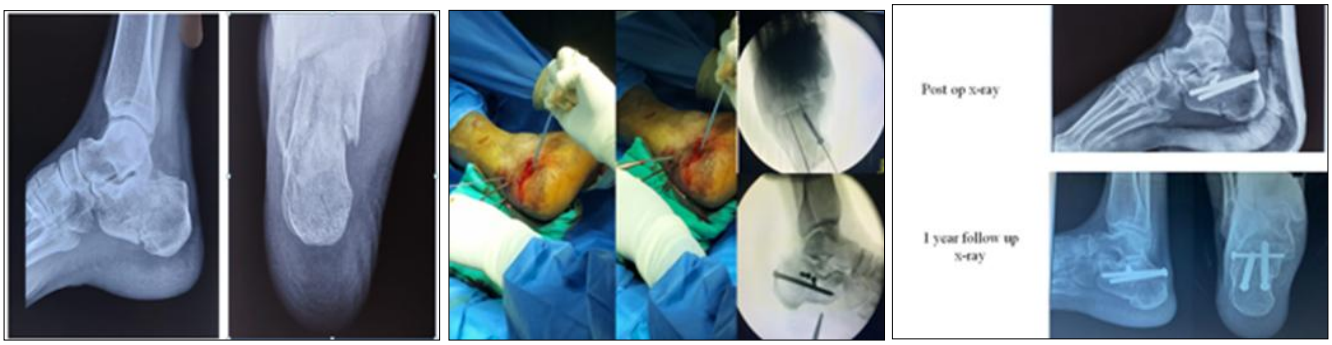

Fig 4: Patient-2:1: Surgical management

Fig 5: Patient-2:2: Surgical management

Postoperative Care and Follow-Up Protocol

- A below-knee slab was applied postoperatively with the ankle in a planti-grade position. Wound inspection and suture removal were performed on the 14th postoperative day.
- At 4 weeks**:** POP slab was removed, and partial weight-bearing with ankle range of motion (ROM) exercises was initiated. Full weight-bearing was gradually introduced based on clinical and radiological union.
- Patients were followed up regularly at the following intervals:4 weeks, 3 months,6 months, 1 year, Functional outcomes were evaluated at each follow-up using the AOFAS score and MFS score, and postoperative complications such as wound problems, malunion, chronic pain, and subtalar stiffness were documented.

Outcome Assessment

Functional outcomes were assessed using the American Orthopaedic Foot and Ankle Society (AOFAS) hindfoot score and the Maryland Foot Score [14, 15].

AOFAS (American Orthopaedic Foot and Ankle Society) Ankle-Hindfoot Score

Category	Criteria	Points
Pain (40 points)		
	None	40
	Mild, occasional	30
	Moderate, daily	20
	Severe, almost always present	0
Function (50 points)		
Activity limitations, support requirement		
	No limitations, no support	10
	No limitation of daily activities, limitation of recreational activities, no support	7
	Limited daily and recreational activities, can	4
	Severe limitation of daily and recreational activities, walker, crutches, wheelchair, brace	0
Maximum walking distance, blocks		
	Greater than 6	5
	4-6	4
	1-3	2
	Less than 1	0
Walking surfaces		
	No difficulty on any surface	5
	Some difficulty on uneven terrain, stairs, inclines, ladders	3
	Severe difficulty on uneven terrain, stairs, inclines, ladders	0
Gait abnormality		
	None, slight	8
	Obvious	4
	Marked	0
Sagittal motion (flexion plus extension)		
	Normal or mild restriction (30° or more)	8
	Moderate restriction (15° - 29°)	4
	Severe restriction (less than 15°)	0
Hindfoot motion (inversion plus eversion)		
	Normal or mild restriction (75%-100% normal)	6
	Moderate restriction (25-74% normal)	3
	Marked restriction (less than 25% normal)	0
Ankle-hindfoot stability (anteroposterior, varus-valgus)		
	Stable	8
	Definitely unstable	0
AOFAS Ankle-Hindfoot Scale, Subjective Portion (90 points total)		

Statistical Analysis

Data were analyzed using standard statistical software.
Continuous variables were expressed as mean ± standard deviation, and categorical variables as percentages.
A p-value <0.05 was considered statistically significant.

Results

Table 2: Result according to both AOFAS and MFS score and complications

Score	Treatment	Number	Mean
AOFAS	Operative	15	81.4
	Non-operative	15	74.6
MFS	Operative	15	79.1
	Non-operative	15	75.9

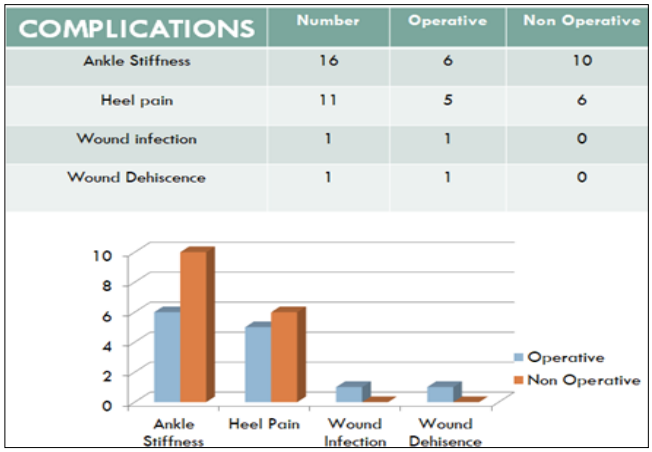

Fig 6: Case 3- pre operative and post operative radiographic images of a 60 years old female patient

Fig 7: Case 4- pre operative and post operative radiographic images of a 58 years old female patient

In the present study, functional outcomes were assessed using the AOFAS and Maryland Foot Score (MFS) in both operative and non-operative treatment groups, each comprising 15 patients. The operative group demonstrated superior functional outcomes across both scoring systems. The mean AOFAS score was higher in the operative group (81.4) compared to the non-operative group (74.6), indicating better pain relief, alignment, and functional restoration following surgical intervention. Similarly, the mean MFS was 79.1 in the operative group versus 75.9 in the non-operative group, further reinforcing the functional advantage of operative management.

Complication analysis revealed ankle stiffness as the most common complication overall, with a higher incidence in the non-operative group (10 cases) compared to the operative group (6 cases), suggesting prolonged immobilization as a contributory factor. Heel pain was observed in both groups with comparable distribution, marginally higher in the non-operative cohort. Procedure-related complications were minimal, with only one case each of wound infection and wound dehiscence, both occurring in the operative group and managed conservatively without long-term sequel.

Overall, operative management resulted in better functional outcomes with an acceptable and low complication profile, supporting its role in appropriately selected patients. In essence, surgery offered improved biomechanics at the cost of minimal soft-tissue complications.

Discussion

The management of displaced intra-articular calcaneal fractures continues to generate debate. Landmark randomized trials by Thordarson and Krieger [6] and Buckley *et al* [14]. demonstrated improved functional outcomes with operative treatment in selected patients, particularly when anatomical reduction was achieved.

In the present study, patients treated with percutaneous CC screw fixation demonstrated superior functional outcomes compared to conservative management, consistent with findings reported by Stulik *et al.* [2] and De Boer *et al* [7].

Minimally invasive fixation techniques aim to reduce soft-tissue complications associated with extensile lateral approaches while achieving acceptable anatomical restoration. Schepers [15] and Tomesen *et al* [16]. reported lower wound complication rates with percutaneous techniques, findings echoed in the present study.

Conservative management continues to have a role in patients with low functional demands or contraindications to surgery, as emphasized by Parmar *et al* [17] and Basile [8].

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