

Original article

“A study of functional outcome in surgically managed cases of displaced intraarticular fractures of calcaneus”

Dr. Amit Jadhao¹, Dr. Ajay S. Chandanwale², Dr. Sujata D. Chavan³

¹Assistant Professor, Dept. of Orthopedics, Govt. Medical College, Akola (M.S.) Pin 444001

² Professor in Orthopedics and Dean, B J Medical College Pune.

³ Senior Resident in Anaesthesia, Govt Medical College Akola.

Corresponding Author: Dr. Amit Jadhao

Abstract:

Background: Fractures of calcaneus (os calcis) are the most common of tarsal bone fractures with an overall incidence of approximately 2%.

Aims & Objectives: Aim of this study was to study the results of operative treatment of displaced intraarticular fractures of calcaneus with respect to Pain & Functional outcome of the patients

Materials & Methods: This is a prospective study of 20 patients treated for displaced intraarticular fractures of calcaneus in Govt Medical College Akola from January 2011 to December 2012. ESSEX-LOPRESTI classification was used. Significance of Böhler's angle was also studied. The results were clinically assessed by AOFAS scale (American Orthopaedic Foot and Ankle Society) for ankle and hind foot.

Results: Excellent to Good result in 11 patients (55%) and Fair to Bad result in 09 patients (45%).

Conclusions: Multiple surgical approaches are available for treatment of calcaneal fractures, ranging from minimally invasive percutaneous fixation to extensive open techniques. The functional outcome is related to the accuracy of the subtalar joint reduction, the restoration of normal heel morphology, and restoration of Böhler's angle to as near normal as possible. Timing of surgery for ORIF is when 'wrinkle sign' positive is very critical and important. The implementation of meticulous intra-operative techniques and postoperative measures to decrease swelling.

Keywords: Displaced intraarticular fractures of calcaneus, ESSEX-LOPRESTI classification, AOFAS Scale, Böhler's angle.

1. Introduction:

Fractures of calcaneus (os calcis) are the most common of tarsal bone fractures with an overall incidence of approximately 2%. Despite of increased experience with these types of fractures, however, there is considerable debate regarding their treatment and overall management. The management of calcaneal fractures is the subject of much debate and controversy. Controversies remain regarding most appropriate classification system, treatment options, indications for surgery, surgical approaches, and postoperative management.

However, there is still no clear standard in the approach to these complex fractures.

2. Aims and Objectives:

Aim of this study was to study the results of operative treatment of displaced intraarticular fractures of calcaneus with respect to –

1. Pain &
2. Functional outcome of the patients.

3. Materials and Methods:

This is a prospective study of 20 patients treated for displaced intraarticular fractures of calcaneus in J. J. Group of Hospitals from January 2005 to September 2006.

This study was undertaken with prior permission from institutions ethical committee. All the patients included were explained about such study and gave their consent to take part in the study. This study included 17 males (85%) & 3 females (15%) ranged between 20 to 50 years.

Inclusion criteria: Displaced intraarticular fractures of calcaneus.

Falls from different ground levels were the mechanism accounting for 19 fractures (95%). Only one fracture (5%) had as a cause agent of road traffic accident.

Distribution: 10 cases (50%) LEFT
 calcaneum
 08 cases (40%) RIGHT
 calcaneum
 02 cases (10%) BILATERAL
 involvement

ESSEX-LOPRESTI classification 15 of them were joint-depression type (75%) and 05 of tongue-type (25%).

Exclusion criteria for surgery and the study:

Fractures in patients with heavy smoking, severe peripheral vascular disease, poorly controlled insulin-dependent diabetes, elderly patients who are household ambulators and open fractures of calcaneus were excluded from study.

Time of surgery: Open reduction and internal fixation is ideally completed within the first 3 weeks of injury before early fracture consolidation. A criterion for surgery is 'Positive Wrinkle test' is confirmed by presence of skin wrinkling without residual pitting edema on lateral calcaneal skin with passive dorsiflexion and eversion of foot. From the 20 patients, 02 (10%) were operated on day 1 as there was no significant swelling & normal local skin condition, 10(50%) patients operated in first week and remaining 08(40%) patients operated in second week.

Position of patient: Lateral decubitus position with operative limb up.

Tourniquet: All open cases, procedure should be completed within 120-130 min to minimize wound complications. In allocating tourniquet time

Surgical approach - 20 min

Fracture reduction - 60 min

Implant placement - 20 min

Wound closure -20 min

Incisions used: The extensile lateral L-shape in 16 patients (80%); a combination of the lateral L shape and medial incision in 1 fracture (5%) and the percutaneous port in 3 (15%).

Important intra-operative steps:

1. Essex-Lopresti reduction technique with percutaneous method:

- Small (less than 1-cm) incisions,
- Schantz pins and small elevators used for the reduction.
- Performed under fluoroscopic guidance,
- Stabilized with thick Kirschner wire/Steinman pin/screws fixation.
- K wires/Steinman pins/Screws were introduced in an axial direction, and any subsequent screws were introduced from the lateral surface to secure the sustentaculum.

2. Extensile Lateral approach and internal fixation:

- Sharp dissection 'skin to bone' at apex.
- Full thickness subperiosteal flap
- 'No touch technique' by using 1.6-mm Kirschner wires are places for retraction of subperiosteal flaps (One K wire in each distal fibula, talar neck, and cuboid.)
- For Tongue type of fractures: Percutaneous reduction by pin leverage (Essex-Lopresti maneuver) followed by minimally invasive screw fixation.

- For Joint depression fractures: Exposure of posterior facet and reduction by elevation and lag screw fixation engaging the sustentaculum tali is most important step .

Implants used:

1. Kirschner wires
2. 4 mm cancellous screws
3. Steinman pins
4. Y shaped Recon plates
5. Curved Recon plates
6. Locking Calcaneal plates.

Closure:

1. Deep drain exiting proximally in line with vertical limb of incision.
2. No 0 absorbable suture are then passed intermittently. Sutures are then hand tied in sequential fashion, starting at ends proximally and distally, progressing towards the apex of the incision to minimize tension at the apex.
3. Skin layer is closed with 3-0 monofilament suture using the **modified Allgöwer-Donati**

technique. This suture is modified vertical mattress stitch, whereby the far end passes subcutaneous to the skin edge to minimize tension on the skin margin.

4. Jones-type bulky padded dressing & below knee splint given.

Bone grafting: 02 patients (10%) required bone grafting.

Postop protocol:

- Strict elevation on BB splint.
- Drain kept for 24-48 hrs until drainage <25 ml/8 hrs.
- Non-weight bearing walking on crutches.
- Late Suture removal after 15 days till 21 days.
- BK POP cast given to be continued for 6 wks.
- Active ankle & subtalar ROM started after 6 wks.
- Weight bearing allowed only after 10-12 wks.

Follow-up time: 04 – 18 months

*Indian journal of Basic and Applied
Medical Research*

Is now with

IC Value 5.09

The results were clinically assessed by **AOFAS scale** (American Orthopaedic Foot and Ankle Society) for ankle and hind foot.

Parameter	Scores
1.Pain (score: 40)	
None	40
Mild, occasional	30
Moderate, daily	20
Strong, almost always present	0
2. Function (score: 50)	
2.1 Activities restraint and need of support	
No restraints or supports	10
No daily activities restraint, recreational restraint, no supports	7
Daily and recreational activities restraint, cane	4
Major daily activities restraint, crutches, walker, wheelchair	0
2.2 Maximum gait distance (blocks)	
More than 6	5
From 4 to 6	4
From 1 to 3	2
Less than 1	0
2.3 Gait surface	
Easy in any surface	5
Some difficult in irregular grounds, stairs or slopes	3
Strong difficult in irregular grounds, stairs or slopes	0
2.4 Gait abnormality	
None or mild	8
Evident	4
Marked	0
2.5 Saggital mobility (flexion + extension)	
Normal or minimal restraint (30° or more)	8
Moderate restraint (15° to 29°)	4
Strong restraint (less than 15°)	0
2.6 Hindfoot mobility(inversion and eversion)	
Normal or minimal restraint (75 to 100%)	6
Moderate restraint (25 to 74%)	3
Strong restraint (less than 25%)	0
2.7 Ankle and hindfoot stability (anteroposterior + varus-valgus)	
Stable	8
Unstable	0
3. Alignment (score:10)	
Good – plantigrade foot, with aligned ankle and hindfoot	10
Fair - plantigrade foot, some degree of non-alignment, no pain	5
Bad – non-plantigrade foot, major and symptomatic non-alignment	0

Chart 1 - AOFAS (American Orthopaedic Foot and Ankle Society) scale for clinical

4. Observations and Results:-

Follow-up time: 04 to 18 months

OUTCOME

Table 1

Outcome(scores)	# Classification		Total
	Joint dep.	Tongue type	
1. Excellent (90-99)	02	01	03 (15%)
2. Good (80-89)	06	02	08 (40%)
3. Fair (70-79)	02	01	03 (15%)
4. Bad (<69)	05	01	06 (30%)
Total	15	05	20 (100%)

FUNCTIONAL OUTCOME

Table 2

Outcome	Pain	Activity restrains	Gait abnormality	ROM	
				Ankle	Subtalar
Good (28%)	No 06	No 05	No 11	Good 06	Good 00
Fair (52%)	Mild (occasional) 06	Mild (occasional) 10	Evident 08	Fair 13	Fair 15
Poor (20%)	Significant (daily) 08	Significant (daily) 05	Marked 01	Poor 01	Poor 05

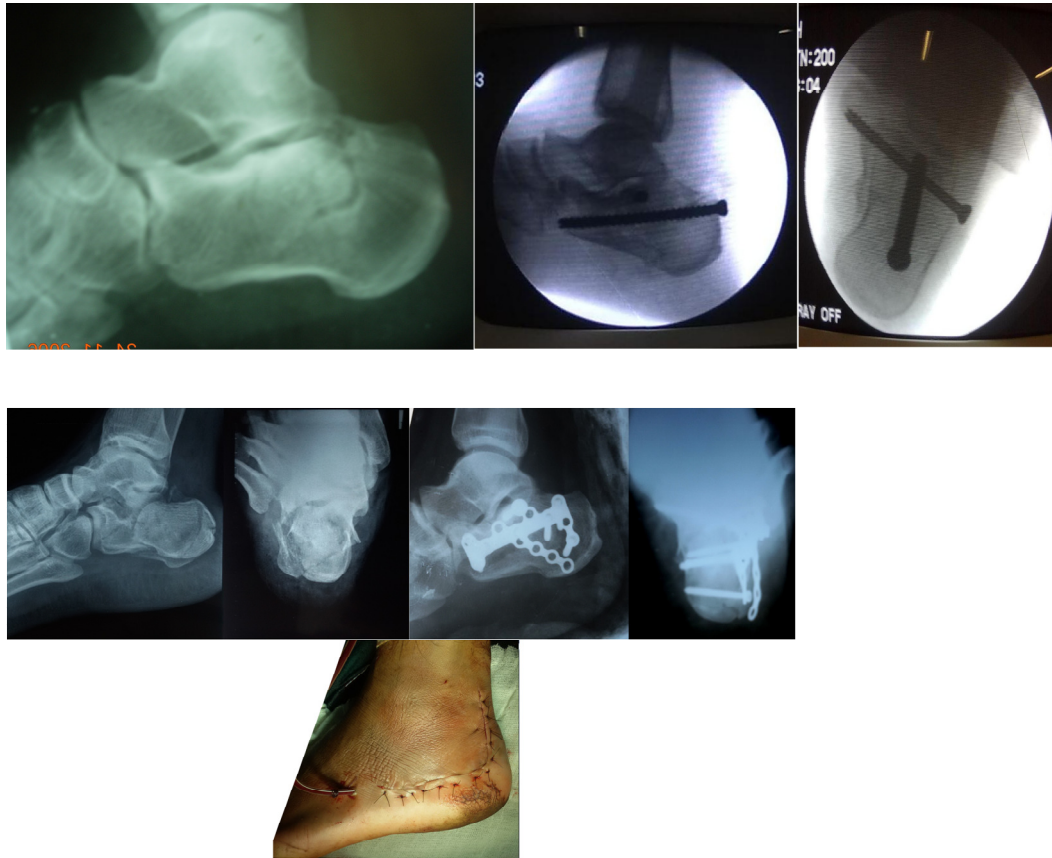
Complications observed:

Early complications like skin maceration, necrosis, and superficial skin necrosis are observed in 08 (40%) patients. Late complications like residual edema 08 cases (40%) and Arthrosis seen in 05 calcaneus (25%).

Indian journal of Basic and Applied Medical Research

Is now

Listed in HIFA 2015 & Research Bib



5. Discussion:

Calcaneus joint fractures are severe injuries and frequently cause permanent and impairing sequels. They usually affect young male individuals, within an age group that is economically active, which can impose a great social-economical loss. In this study, we have 85% of male patients, who were in 20-50 years old. By observing the stratified distribution of the patients, corroborating the statement that this condition affects individuals who are at full social capacities.

The most common cause agent 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 95% of the fractures. X-ray classification by Essex-Lopresti (1952) is classical. It determines fracture line, enabling treatment

planning. Tomographic classification helps on the evaluation of severity and injury prognosis, being the most used. The lateral access port in an "L shape" has been largely employed, because it allows a better visibility of the fracture, fragments reduction and internal fixation. In this study, the lateral port in "L" was shown to be efficient in 85% of the cases. The use of bone graft is a subject of controversy.

In literature, the most common early complications were the skin necrosis, ranging from 11% to 40%, and infection, ranging from 3.3% to 22%. In this study, we found 40% of early complications, being infection present in 5% of the cases, whether combined or not to skin dehiscence or necrosis and infection in 25%. In the evaluation of the results by AOFAS scale, we found rates in

literature ranging from 42.22% to 62% of excellent results.

In this study, outcomes were considered as good and excellent in 55%. One cannot say for sure that the kind of fracture may have influenced scores, because the tongue-type sample studied here is small, if compared to the joint depression-type. Scale was further divided into its items in order to provide a better assessment of the outcomes, being significant the activities restraint in joint depression-type fractures.

6. Conclusions:

Most reports suggest that the functional outcome is related to the accuracy of the subtalar joint reduction, the restoration of normal heel morphology, and the implementation of postoperative measures to decrease swelling.

Intraoperative details: Surgery should occur within 3 weeks after injury. This period allows for

1. No pain in 28%, occasional pain in 52% and significant pain in 20 % patients.
2. Functional outcome was

Functional outcome	No. of cases	Percentage
Good		28%
Fair		52%
Poor		20%

3. Multiple surgical approaches are available for treatment of calcaneal fractures, ranging from minimally invasive percutaneous fixation to extensive open techniques. The timing of surgery is an important factor in determining surgical success, as measured by long-term functional outcomes. Ideally, surgery should occur within 3 weeks after injury. A criterion for surgery is 'Positive Wrinkle test'.

any swelling and fracture blisters to completely resolve, but the procedure is still sufficiently early to prevent premature healing and coalescence of the fracture fragments. In the absence of fracture blisters, the return of normal skin wrinkling is an indication that significant swelling has resolved and operative intervention may proceed. Compared with open procedures, closed reduction with percutaneous fixation has a lower risk of wound complications, a shorter operative time, and more rapid healing because the soft tissue is handled less. Unfortunately, the limited exposure that this technique affords sometimes prevents adequate reduction and fixation of the calcaneal injury. If anatomic joint reduction is sought, ORIF may be a preferred option.

This prospective study of calcaneus intra-joint fractures allowed the observation of the following:

7. Acknowledgement:

The authors acknowledge all the patients who agreed to take part in this present study without which this study would not have become possible. We also thank medical and paramedical staff who took part in the surgical correction of calcaneum fracture and the technical staff too who helped to collect the data. The study was undertaken without any external source of funding. Hence the authors only borne the expenses incurred for the study.

References :

1. Miller, W. E.: Pain and impairment considerations following treatment of disruptive os calcis fractures. *Clin. Orthop.*, 177: 82-86, 1983.
2. O'Farrell, D. A.; O'Byrne, J. M.; McCabe, J. P.; and Stephens, M. M.: Fractures of the os calcis: improved results with internal fixation. *Injury*, 24: 263-265, 1993.
3. Paley, D., and Hall, H.: Intra-articular fractures of the calcaneus. A critical analysis of results and prognostic factors. *J. Bone and Joint Surg.*, 75-A: 342-354, March 1993.
4. Salama, R.; Benamara, A.; and Weissman, S. L.: Functional treatment of intra-articular fractures of the calcaneus. *Clin. Orthop.*, 115: 236-240, 1976.
5. Sallick, M. A., and Blum, L.: Sensory denervation of the heel for persistent pain following fractures of the calcaneus. *J. Bone and Joint Surg.*, 30-A: 209-212, Jan. 1948.
6. Varela, C. D.; Vaughan, T. K.; Carr, J. B.; and Slemmons, B. K.: Fracture blisters: clinical and pathological aspects. *J. Orthop. Trauma*, 7: 417-427, 1993; erratum, 8: 79, 1994.
7. Sanders, R., and Gregory, P.: Operative treatment of intra-articular fractures of the calcaneus. *Orthop. Clin. North America*, 26: 203-214, 1995.