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A Comparative Study of Operative and Conservative Treatment of Extra Articular Displaced Calcaneal Fractures

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Abstract
Calcaneal fractures are the most frequent tarsal fractures. Indications of calcaneal extra articular fracture fixation are displaced tongue type fracture, fractures with mild shortening, large extra-articular fractures (>1 cm), early reduction prevents skin sloughing and need for subsequent flap coverage. To compare the outcomes of fracture union in extra-articular fractures of calcaneum managed through conventional pop application vs fixation through percutaneous cannulated cancellous screws. A comparative study was conducted on 40 patients with closed displaced extra-articular calcaneal fractures, aged between 18 and 65 years. The study included patients treated in the Department of Orthopaedics in our institution. Patients with un-displaced fractures, extra-articular fractures, comorbidity like diabetes, associated spine fractures with neurological injury, open fractures were excluded from the study. Pre and postoperative Bohler's angle were calculated. Non-operative treatment was done with below-knee cast. Operative treatment was done with percutaneous reduction and fixation with Cannulated Cancellous screws. After six weeks, the cast was removed follow-up x-rays were done patient mobilised. Out of the 40 patients considered in the study, 20 patients were managed conservatively with below knee pop cast and 20 patients were managed operatively with cannulated cancellous screws. Most of the calcaneal fractures were caused by fall from height (35), 3 cases were due to slip and fall from stairs, 1 due to falling of a heavy object over the foot and 1 road traffic accident. Out of 20 operated cases, Bohler's angle was restored in 17 cases and showed excellent results at one year. 2 cases showed good results, one showed fair results. 5 cases treated non-operatively showed good results, while 15 showed fair results. When compared at one-year, operated cases showed better functional outcomes with CN score. Operative treatment of displaced extra-articular calcaneal fractures showed good results at one year when Bohlers angle was restored to normal range. Non-operative treatment gave fair results. Complications were seen both with operative and non-operative treatment.

INTRODUCTION

Calcaneal fractures are one of the challenging injuries in orthopaedic practice, which usually result from an axial compressive force, such as fall from height or road traffic accident. Calcaneal fractures represent 1%-2% of all human body fractures the calcaneus is the most fractured tarsal bone[1]. Complicated anatomy and poorly understood hind foot kinematics are the foremost difficulties in the management of calcaneal fractures. The bone has very minimal soft tissue cover and very limited amount of dense cortical bone, hence fracture patterns are tremendously varied. All these problems make it difficult to treat calcaneal fractures[2]. Operative reduction became popular as fracture care improved. Calcaneal fractures occur due poor bone quality/osteoporosis, violent contraction of the triceps surae with forced dorsi flexion, strong concentric contraction of the triceps surae with knee in full extension, intrinsic tightness of the gastrocnemius and Achilles tendon, peripheral neuropathy leading to decreased pain sensation and proprioception resulting in recurrent micro trauma. Conservative treatment involves limb elevation, splinting, non-weight bearing for an average of 6 weeks physiotherapy for rehabilitation, which may take up to 2 years[3]. However, the bone deformity caused by the initial injury is left unmanaged, potentially leading to heel deformity, arthritis, or chronic pain. These are the reasons behind literature advocating for the operative treatment of these fractures[4].

Our study aimed to compare the functional outcome, quality of life and residual pain following displaced extra-articular calcaneal fractures treated operatively and non-operatively.

MATERIALS AND METHODS

In this study we have included all patients with extra articular calcaneum fractures. In total 40 patients were admitted from February 2023-February 2024. 35 of these patients had a history of fall from a height, 3 cases were due to slip and fall, 1 patient had a history of fall of a heavy object over the foot 1 patients had history of road traffic accident. Out of the 40 patients 34 were male and 6 were female. Out of all these patients 25 cases had right calcaneum involvement and 15 cases had left calcaneum involvement. All the patients were within the age group of 18-65 years. All the patients had complaints of pain and swelling in the heel with difficulty in walking. None of the patients had other limb or spine injuries. Patients with un-displaced fractures, extra-articular fractures, comorbidity like diabetes, associated spine fractures with neurological injury, open fractures were excluded from the study. Lateral and axial x-rays of heel along with 3d CT scan were taken. Below knee slab was applied to all these patients.

Non-operative treatment was done with below-knee slab after two weeks of pain killers, enzymes and once the swelling was reduced and wrinkle sign appeared, cast conversion was done and non-weight bearing crutch walking for six weeks. After six weeks, the cast was removed radiographs were done. Based on X-ray features, patients were gradually mobilized with partial weight-bearing as per their pain tolerance and full weight-bearing was started after 3 months. For operative management the patients were initially started on pain killers and enzymes. Strict limb elevation was advised they were given ice packs. Their routine blood investigations were suntan aesthetic fitness was taken. As soon as the swelling reduced with appearance of wrinkle sign these patients were posted for surgery.

They were placed in lateral position under spinal anaesthesia. Tourniquet was applied. The limb to be operated was painted and draped under strict aseptic precautions. C arm images were taken to identify the fracture and under c arm guidance, the fracture was reduced using AO clamps or osteotome and fixed with k wires. 2 cc screws were then inserted to the reduced fracture. Fracture reduction confirmed under C-arm. Tourniquet was then deflated.

Post operatively dressing was checked on the second day. None of the patients had soakage, or wound complications. Below knee slab was applied to all patients for 6 weeks and were advised non weight bearing. After six weeks, the slab was removed radiographs were done. They were advised partial weight bearing for 6 weeks after removal of below knee slab. Active mobilization of toes and ankles were started with strengthening exercises and full weight bearing after 3 months. Functional outcomes of both groups were calculated with CN score.

Inclusion Criteria:

- Age 18-65 years.
- Displaces extra-articular calcaneal fractures.
- Patient willing for surgery.

Exclusion Criteria:

- Age less than 18 and more than 65 years.
- Un-displaced fractures.
- Intra-articular fractures.
- Comorbidity like diabetes, associated spine fractures with neurological injury.
- Patients unfit for surgery.
- Open fractures.

RESULTS AND DISCUSSION

The treatment of calcaneal fractures is controversial. Many studies have been reported but there is a lack of an understanding regarding the

treatment. Some studies have shown better outcomes with non-operative management[5], whereas some authors have investigated operative management and got good results[6,7,8].

In our study, out of 20 patients managed operatively, 17 patients had complete recovery of Bohler's angle and made an excellent recovery as per the Creighten-nebraska score at the end of one year. 2 cases had a good recovery and one with incomplete restoration of Bohlers angle and hence a fair recovery. Out of the 20 patients managed conservatively, 5 had good results with restoration of Bohler's angle whereas the rest had incomplete restoration of Bohler's angle and had fair results.

Fig. 1: Extra-articular tongue type calcaneal fracture

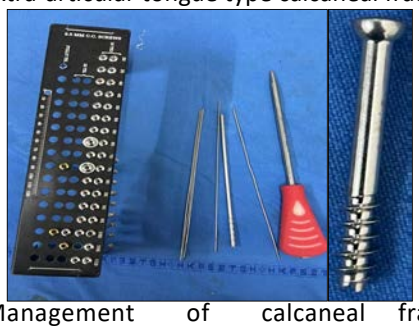

Fig. 2: Management of calcaneal fracture conservatively with plaster cast

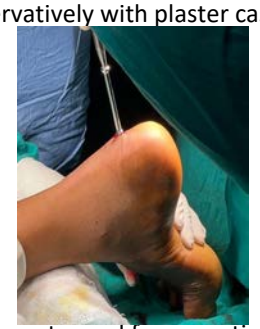

Fig. 3: Instruments used for operative management

Fig. 4: 4.5 mm CC screws

Fig. 5: Guide wire insertion across the fracture site

Fig. 6: Fluoroscopic image of guide wire across the fracture site

Fig. 7 and 8: Insertion of CC screws under fluoroscopic guidance

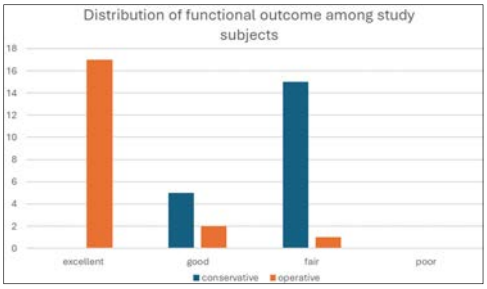

Fig. 9: X-ray of extraartocular fracture calcaneum

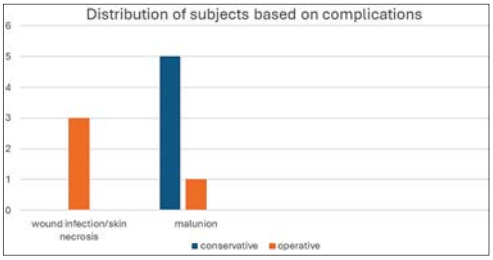

Fig. 10: Post operative x-ray of CRIF of calcaneum fracture with CC screw

Table 1: Distribution of functional outcome among study subjects

Grading	Conservative	Operative
Excellent	0	17
Good	5	2
Fair	15	1
poor	0	0

Table 2: Distribution of subjects based on complications

Complications	Conservative	Operative
Wound infection/skin necrosis	0	3
malunion	5	1

The complications were noted with both the treatment options. The commonest complications in both groups were stiffness, heel paingait abnormalities. The other complications like plaster sores and wound infection were specific to the conservative and operative group respectively. Shoe fitting problems were overall lower in the operatively treated patients most of the patients returned to their preinjury work or activity.

A study by Li[9] looked for the complication rate in the operated cases. In that study pain and necrosis were the commonest complications with the figures of 7.9% and 6.8% respectively. Infection, malunionloss of fixation were other complications encountered. The complication rate was 26.2% in the operated group and 13.7% in the non-operated group as per the study by Wei[11]. However, patients undergoing non-operative treatment were 6 times as likely to require secondary subtalar fusion than patients treated operatively.

CONCLUSION

Out of 20 operated cases, Bohler's angle was restored in 17 cases and showed good results at one year. The remaining 3 cases showed fair results. 20 cases treated non-operatively showed fair results. When compared at one-year, operated cases showed better functional outcomes with CN score. Complications were seen both with operative and non-operative treatment.

Creighton Nebraska score

Creighton-Nebraska health foundation assessment sheet for fractures of the calcaneum.

Clinical Entity	**Points**
Pain (30 Points)	
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: severe 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
Activity (20 points)	
Unlimited walking and standing	20
Walks 5 to 10 blocks; stands intermittently for More than half an hour	15
Walks 1 to 5 blocks; stands ½ an hour or less	10
Walks less then 1 block (indoors only)	5
Cannot walk	0
Range of Inversion/Eversion (20 points)	
25 to 30 = 80% to 100%	20
20 to 25 = 60% to 80%	15
15 to 20 = 40% to 60%	10
10 to 15 = 20% to 40%	5
0 to 10 = 0% to 20%	0
Return to work (20 Points)	
Full time, same job	20
Full time with restrictions	15
Full time change job	10
Part time with restrictions	5
Cannot work	0
Change in shoe size (5 points)	
No change	5
Change	0
Swelling (5 Points)	
None	5
Mild	3
Moderate	2
Severe	0
Overall Score:+	
Excellent	90-100 points
Good	80-89 points
Fair	65-79 points
Poor	65 or less

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