Section: Orthopaedics

Original Research Article

COMPARISON AND EVALUATION OF SURGICAL TECHNIQUE FOR INTRA- ARTICULAR CALCANEAL FRACTURES WITH OPEN REDUCTION AND INTERNAL FIXATION BY LOCKING CALCANEAL PLATE AND PERCUTANEOUS FIXATION BY ILIZAROV RING EXTERNAL FIXATOR

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Abstract

Background: To compare and evaluate surgical technique for intra- articular calcaneal fractures with open reduction and internal fixation by locking plate and percutaneous fixation by ilizarov ring external fixator. **Materials and Methods:** Nineteen patients (21 calcaneal fractures) were divided into 2 groups. Group I, 10 patients (11 calcaneal fractures) were treated with extensile L-shaped lateral incision and fixation with locking calcaneal plate. In the Group II ,9 patients (10 calcaneal fractures) were treated with percutaneous fixation by ilizarov ring external fixator. Functional outcome was assessed using AOFAS score. **Result:** Group I comprised of 5 males and 5 females and group II had 5 males and 4 females. Left side was involved in 6 in group I and 5 in group II and right side was involved in 4 each in group I and I1 ,with bilateral involvement in 1 in each group. Etiology was RTA was seen in 6 in group I and 4 in group II, fall in 2 in group I and 3 in group II and violence in 2 each in group I and II respectively. The difference was significant (P< 0.05). The mean AOFAS score in group I was 76.5 and in group II was 70.2. The difference was significant (P< 0.05). Functional outcome was excellent seen in 6 in group I and 5 in group II, good 3 in group I and 2 in group II, fair 1 each in group I and II and poor 1 in group II. The difference was significant (P< 0.05). **Conclusion:** Intra- articular calcaneal fractures are complex and their treatment is still up for debate. Better outcome based on patient characteristics, type of fractures and surgeon's experience with the surgical technique chosen. The calcaneal treating plating technique gives better functional outcomes and anatomical reduction depending on Bohler and Gissane angle. Thus, if the plating method can be used effectively to treat intra- articular calcaneal fractures give better outcome.

INTRODUCTION

Calcaneal fractures correspond to approximately 1% to 2% of all the fractures of the human body and constitute nearly 60% of tarsal bones fractures. They generally follow high-energy axial traumas, such as fall from height or motor accidents. It is found that 60% to 75% of these fractures are considered to be displaced and intra-articular, which evidences the difficulty of the treatment. They can cause great disability due to pain and chronic stiffness, in addition to hindfoot deformities. These fractures are characterized clinically by poor functional results due to their complexity.[1]

Anatomic restoration of the three-dimensional (3D) anatomy of the calcaneum is the goal of surgical management of calcaneal fractures. Over the years, various techniques have been developed to accomplish this goal.[2] All these techniques have certain steps in common including dis-impaction of the fragments, reduction of the displaced fragments either manually or percutaneously and maintenance of fracture reduction with plaster, pins and plaster, external fixation and open reduction and internal fixation.[3]

Since the early 1980s, the treatment of choice for displaced and intra-articular calcaneal fractures was open reduction with internal fixation; however, soft tissue complications, such as surgical dehiscence and infection, can occur in up to 30% of the patients.[4] Ilizarov ring external fixation has been commonly recognized as an option in the treatment of displaced intra-articular calcaneal fractures but rarely reported for treatment of calcaneal tuberosity avulsion

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fractures.[5]We performed this study to compare and evaluate surgical technique for intra- articular calcaneal fractures with open reduction and internal fixation by locking calcaneal plate and percutaneous fixation by ilizarov ring external fixator.

MATERIALS AND METHODS

After considering the utility of the study and obtaining approval from ethical review committee, we selected nineteen patients with 21 calcaneal fractures of both genders who underwent surgery between January 2020– July 2022. Patients' consent was obtained before starting the study. CT scan and radiographs (antero-posterior , lateral and a Harris axial view) of calcaneum were done. We used Sanders CT classification to classify calcaneal fractures into type II (4), type III (14) and type IV (3).

Inclusion Criteria

1. Intraarticular calcaneum fractures type II, type III and type IV.
2. Unilateral and bilateral closed calcaneal fracture.

Exclusion Criteria

1. Sander's type I (Undisplaced fractures)
2. Open fractures
3. Age less than 18 years and more than 50 years.

Figure 1

Data such as name, age, gender etc. was recorded. Patients were divided into 2 groups. Group I ,10 patients (11 calcaneal fractures) were treated with extensile L- shaped lateral incision and fixation with locking calcaneum plate (Figure1). Group II, 9 patients (10 calcaneum fractures) were treated with percutaneous fixation by ilizarov ring external fixator (Figure2). Functional outcome was assessed using AOFAS score. The results were compiled and subjected for statistical analysis using Mann Whitney U test. P value less than 0.05 was set significant.

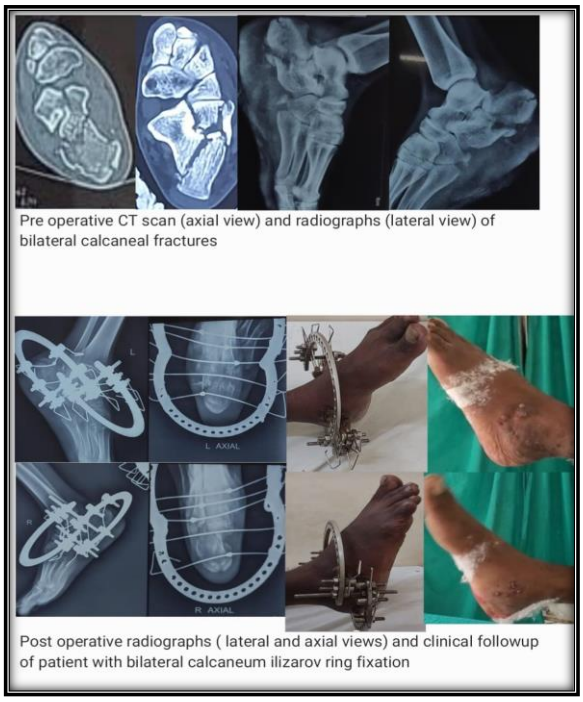

Figure 2

RESULTS

Group I comprised of 5 males and 5 females and group II had 5 males and 4 females [Table 1].

Left side was involved in 6 in group I and 5 in group II and right side was involved in 4 each in group I and I1,with bilateral involvement in 1in each group. Etiology was RTA was seen in 6 in group I and 4 in group II, fall in 2 in group I and 3 in group II and violence in 2 each in group I and II respectively. The difference was significant (P< 0.05) [Table 2].

The mean AOFAS score in group I was 76.5 and in group II was 70.2. The difference was significant (P< 0.05) [Table 3].

Table 1: Patients distribution

Groups	Group I	Group II
M:F	5:5	5:4

Table 2: Assessment of parameters

Parameters	Variables	Group I	Group II	P value
Side	Left	6	5	0.82
	Right	4	4	
	Bilateral	1	1	
Etiology	RTA	6	4	0.05
	Fall	2	3	
	violence	2	2	

Table 3: Comparison of AOFAS score in both groups

Groups	Mean	P value
Group I	76.5	0.05

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Group II	70.2	

Table 4: Assessment of final outcome

Outcome	Group I	Group II	P value
Excellent	6	5	0.05
Good	3	2	
Fair	1	1	
Poor	0	1	

Functional outcome was excellent seen in 6 in group I and 5 in group II, good 3 in group I and 2 in group II, fair 1 each in group I and II and poor 1 in group II. The difference was significant (P< 0.05) [Table 4].

DISCUSSION

The calcaneum is the largest bone of the foot and is the major weight-bearing osseous structure of the foot.[6,7] The mere mention of the word fracture as applied to the calcaneum brings to mind the image of a bone with its structure and shape grossly disrupted and its articular relationships seriously disorganised.[8,9] What follows then are arduous and complicated efforts to attain a satisfactory reduction, prolonged disability and the tedious stages of functional restoration.[10] We performed this study to compare and evaluate surgical technique for intra-articular calcaneal fractures by open reduction and internal fixation by locking plate and percutaneous fixation by ilizarov ring external fixator.

Our results showed that group I comprised of 5 males and 5 females and group II had 5 males and 4 females. Khetan et al,[11] in their study 41 patients (50 fractures) with calcaneum fractures from 15 to 60 years of age, managed either conservatively or operated. Ninety-three per cent fractures had good to excellent result in non-operative group and 77% fracture had good to excellent result in the operative group. In intra-articular fractures with joint depression pattern, 9 (69%) of the percutaneously fixed fractures had good to excellent results and 8 (66%) of the Open reduction and internal fixation (ORIF) group had good to excellent results. Eight (33%) with fair result had persistent heel widening and pain. One patient had loss of reduction, but all of them have returned to their original occupation. In intra-articular fractures with Tongue type fracture, all 7 (100%) fractures had good to excellent results, whether they were fixed percutaneously or via open fixation.

Our results showed that left side was involved in 6 in group I and 5 in group II and right side was involved in 4 each in group I and 1I with bilateral involvement of 1 in each group. Etiology was RTA was seen in 6 in group I and 4 in group II, fall in 2 in group I and 3 in group II and violence in 2 each in group I and II respectively. Takasaka et al,[12] evaluated and compared the surgical technique for treating intra-articular calcaneal fractures. 54 patients with fractures of the calcaneus were treated with open reduction with extended L-shaped lateral incision and fixation with double-H plate of 3.5 mm; open reduction with minimal incision lateral approach and percutaneous fixation with wires and screws; and open reduction with minimal incision lateral approach and fixation with adjustable monoplanar external fixator. Patients treated using a lateral approach, with fixation using a plate had a mean AOFAS score of 76 points; those treated through a minimal incision lateral approach with screw and wire fixation had a mean score of 71 points; and those treated through a minimal incision lateral approach with an external fixator had a mean score of 75 points. The three surgical techniques were shown to be effective for treating intra-articular calcaneal fractures, without any evidence that any of the techniques being superior.

Our results showed that the mean AOFAS score in group I was 76.5 and in group II was 70.2. Ibrahim et al,[13] in their study 46 patients were allocated to either conservative or operative treatment. Clinical [American orthopaedic foot and ankle society hindfoot scale (AOFAS), foot function index (FFI) and calcaneal fracture score] and radiological (Böhler's angle and calcaneum height) outcome measures were used. The grade of osteoarthritis was also assessed at long-term follow-up. At long-term follow-up, the clinical outcomes were not different between conservative versus operative treatment. AOFAS hindfoot scale: conservative=78.5 and operative=70, p=0.11; FFI: conservative=24.4 and operative=26.9, p=0.66; calcaneal fracture score: conservative=70.1 and operative=63.5, p=0.41. The radiological outcomes were also not different between both groups. Böhler's angle: conservative=10.4 degrees and operative 16.9 degrees, p=0.07; height of calcaneum: conservative=37.2mm and operative=38.2mm, p=0.57; grade of osteoarthritis of the sub-talar joint: p=0.54. There was no correlation between Böhler's angle and the outcome measures in either group.

Our results showed that functional outcome was excellent seen in 6 in group I and 5 in group II, good 3 in group I and 2 in group II, fair 1 each in group I and II and poor 1 in group II. Buckley et al,[14] treated 512 patients with calcaneal fractures. Of those patients, 424 with 471 displaced intra-articular calcaneal fractures were enrolled. Three hundred and nine patients (73%) were followed and assessed for a minimum of two years and a maximum of eight years of follow-up. The outcomes after nonoperative treatment were not found to be different from those after operative treatment; the score on the SF-36 was 64.7 and 68.7, respectively (p = 0.13), and the score

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on the visual analog scale was 64.3 and 68.6, respectively (p = 0.12). However, the patients who were not receiving Workers' Compensation and were managed operatively had significantly higher satisfaction scores (p = 0.001). Women who were managed operatively scored significantly higher on the SF-36 than did women who were managed nonoperatively. Patients who were not receiving Workers' Compensation and were younger (less than twenty-nine years old), had a moderately lower Böhler angle (0 degrees to 14 degrees), a comminuted fracture, a light workload, or an anatomic reduction or a step-off of < or =2 mm after surgical reduction scored significantly higher on the scoring scales after surgery compared with those who were treated non-operatively.

CONCLUSION

Intra- articular calcaneal fractures are complex and their treatment is still up for debate. Better outcome based on patient characteristics, type of fractures and surgeon's experience with the surgical technique chosen. The calcaneal fracture treating by locking plating technique gives better anatomical reduction depending on Bohler and Gissane angle and gives better functional outcome. Thus, if the plating method can be used effectively to treat an intra-articular calcaneal fracture give better outcome.

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