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Management of fracture calcaneum by reconstruction locking plate

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ABSTRACT

Background: There is a considerable amount of literature on calcaneal fractures and their treatment; however the best management approach has yet to be determined. The results of ORIF and conservative treatment have been described and compared in several studies. These studies show improved outcome after operative management.
Methods: This is a study of 30 patients with ages ranged from 18 to 65 years with displaced intraarticular fractures of the calcaneus treated by open reduction and internal fixation. 4 patients had bilateral fractures. Out of 34 fractures in 30 patients, 22 fracture calcaneum were joint depression type and 12 fractures were tongue type.
Results: In 17 cases normal Bohler angle (i. e. 20^0-40^0) was achieved. There were 3 cases of post operative delayed wound healing, 2 cases of superficial wound infection and 1 case of sural nerve complication in the form of loss of sensation on lateral aspect of foot. According to American Orthopaedic Foot And Ankle Society (AOFAS) score, 13.33% of the patients had excellent results, 63.33% had good results, 13.33% had fair result and 10% had poor results.
Conclusions: Operative fixation of displaced intra-articular fractures of the calcaneus by reconstruction locking plate, restores the calcaneal height, allows early mobilization and weight-bearing, and maximizes the chances for good joint function.

Keywords: Calcaneum, Fractures, Reconstruction locking plate, Management

INTRODUCTION

Calcaneum is the commonest tarsal bone to be fractured.[1] Injuries to calcaneum are caused by falling from a height and landing on foot. It is common in young adults engaged in building construction work and in those climbing trees and electric pole. Calcaneal fractures are one of the most disabling fractures in men, with frequent occurrence during the wage-earning period of life.[2] The rehabilitation process can be time-consuming, and take up to 9 months and even longer in 20 percent of patients. calcaneal fractures are a large economic burden to society.[3-5] The incidence of intra-articular calcaneal fractures is currently unknown. Calcaneal fracture is estimated to comprise approximately 1 to 2 percent of all fractures. Of all calcaneal fractures, 70% has involvement of the posterior subtalar joint, and approximately 80% of all fractures occur in male patients. Calcaneal fractures are rare in childhood; only 5% of all calcaneal fractures are seen in children.[2,6] There is a considerable amount of literature on calcaneal fractures and their treatment; however the best management approach has yet to be determined. The treatment of calcaneal fractures is complex and has to be individualized depending on patient characteristics and fracture type. Patient characteristics (e.g., age, co-morbidities, substance abuse, smoking habits, psychological condition, and anticipated non-compliance) and the condition of the soft tissues are at least as important as the type of fracture as seen on the

radiographs and CT-scan.[7-10] Several open surgical techniques have been described in the past, of which the extended lateral approach has been applied most frequently.[11-15] Alternative operative techniques include a medial approach, plantar approach, combined lateral and medial approach, limited posterior approach, and the sinus tarsi approach.[16-25] Disadvantages of the open repair include wound complications, which may occur in up to 30 percent of patients.[26,27] In an attempt to lower the complication rates encountered with ORIF, various minimal invasive techniques were introduced to reduce and fixate displaced fragments.[28] Determining the best treatment option and quantification of clinical outcome is mainly hampered by a lack of agreement on the best classification and outcome scoring systems.[29] The results of ORIF and conservative treatment have been described and compared in several studies.[30,31] These studies show improved outcome after operative treatment in subgroups and a higher rate of failed initial treatment with an increased need for a subtalar arthrodesis in conservatively treated patients.[32] With this background we conducted this study to evaluate clinical and radiological outcome in fractures of calcaneum with relation to type of fracture stabilized by reconstruction locking plate.

METHODS

The present study "operative management of fracture calcaneum by reconstruction locking plate" was undertaken at the department of Orthopaedics after obtaining ethical clearance. This study involved both male and female patients with fractures calcaneum. In our present series 30 patients who had fracture calcaneum were treated by open reduction and internal fixation by reconstruction locking plate during the period from October 2009 to September 2011. All the cases were fresh fractures and were traumatic in nature. Inclusion criteria were Age between 18 and 65 years, Intra-articular fractures and who were willing for operative management. Patients with Age less than 18 years, Extra-articular fracture, Compound calcaneal fracture, Pathologic fractures and patient with neuromuscular disorders, Previous wound or bone infections were excluded.

All patients were evaluated clinically and radiographically to assess for any other injuries. Radiographs were taken in three planes, A-P, Lateral views and axial view.

Fractures were classified according to Essex-lopresti system into tongue shaped and joint depression types. Bohler angle was measured preoperatively and post operatively, and correction achieved was documented. Radiographic follow-up was performed at 6 weeks, 12 weeks, 6 months and 12 months. Functional assessment was carried out using the American Orthopedic Foot and Ankle Society (AOFAS) Foot Score. All patients were operated with 3.5 mm locking recon plate and screws.

Surgical technique

Patients were operated under spinal/ general anastesia. The patient is positioned in a lateral decubitus position. Pneumatic tourniquet/ Esmarch rubber tourniquet was used in all patients. The landmarks for incision are the distal fibula, the anterior process of the calcaneus, the calcaneocuboid joint and the base of the 5th metatarsal. A large L-shaped (right side) or J-shaped (left side) surgical incision is made beginning approximately 4 cm above the tip of the lateral malleolus, midway between the posterior border of the fibula and the Achilles tendon. The incision begins proximally, curves below the sural nerve, and then moves upward to the calcaneocuboid joint. It is imperative to avoid harming the sural nerve and prevent skin flap difficulties. The incision is made down to the bone in order to make a cutaneous - subcutaneous flap that includes the peroneal tendons. The flap is developed anteriorly to expose the posterior subtalar joint. The flap is elevated, along with the sural nerve and peroneal tendons. Pins are then inserted and bent to hold the flap and the soft tissues. The subtalar joint is opened and the fractures of the lateral calcaneal wall are dissected, in order to expose the fractured and depressed articular fragments. The reduction maneuver usually begins at the posterior articular surface and proceeds to the Gissane angle and to the body of the calcaneus. However, if varus tilt of the calcaneus prevents anatomic reduction of the posterior facet, the alignment of the body may need to be corrected prior to the reduction of the joint surface. The fractured lateral wall of the calcaneus is gently opened, leaving the fracture fragments within their periosteal envelope. The fragments are elevated, the articular surface is reduced, and fixation is made using temporary Kirschner wires. Restoration of posterior facet joint is confirmed by fluoroscopy. When there is large bone defect, bone graft is used. For fixation the reconstruction locking plate is used. The size that best fits the calcaneal anatomy is chosen. The plate is then positioned at the appropriate location on the lateral calcaneal wall. If necessary the plate can be moulded and contoured to the lateral aspect of the anterior process, the posterior facet and to the tuberosity. Plate benders should be used for this bending procedure. The drilling sleeves are first screwed in the hole located on the anterior extremity and in the hole on the posterior extremity of the plate. They allow axial drilling and perfect insertion of the locking screws. The holes for fixation screws are drilled using the drill through the drilling sleeves. The plate is fixed using specific 3.5 mm screws. The appropriate length of the screws to be inserted is evaluated using the depth gauge. Then incision was closed in layers after keeping drain. Sterile dressing was applied over the wound. Below knee posterior plaster slab was applied to all patients. Post operative check X-ray of the operated calcaneum in A-P, lateral views and axial view are done. Alternate sutures were removed on 10th postoperative day and remaining suture removed on 14th postoperative day after checking for gaping. During the first 3 weeks, only active and passive talo-crural and toe mobilization was worked on,

so as to allow the lateral ligament to heal. After 3 weeks, posterior below knee slab is discarded and sub-talar and ankle mobilization was initiated. Partial weight bearing was allowed in six weeks time and full weight bearing on the affected limb was allowed after 3 months post-op.We followed our patients according to standard proforma of our department (annexure) and collected relevant data. Patients were followed up at 6 weeks, 3 month, 6 month and 1 year. All the patients were assessed clinically and radiographically.

Figure 1: Pre-operative x-ray showing Joint depression type of fracture calcaneum.

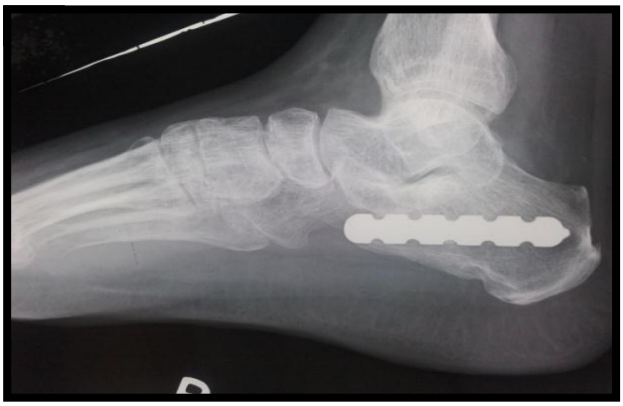

Figure 2: Post-operative x-ray showing united fracture calcaneum with reconstruction locking plate in situ.

The results were assessed as per American Orthopedic Foot and Ankle Society: Ankle-Hind foot Scale (100 points total) (AOFAS).

RESULTS

In this study, the ages ranged from 18 to 65 years. The average age of patients is 33 years. The most common age group was 30-39 years. 28 (93.3%) were males and 2(6.66%) were females. Most common mode of trauma was fall from height in 25 (83.33%) cases. And in remaining cases mode of trauma was motor vehicle accidents and assault. Right sided fracture was common in 19 (63.33%) cases. Bilateral fractures occur in 4 (13.33%) cases. Out of 34 fractures in 30 patients, 22 (64.7%) fracture calcaneum were joint depression type and 12 fractures (35.3%) were tongue type according to Essex-Lopresti classification. In present study, 2 cases (6.67%) of calcaneum fracture patients were associated with spinal injury, 1 case (3.33%) was associated with fracture tibia and 1 case (3.33%) was associated with # lower end radius. 60% cases were operated between 1 to 2 weeks. Average interval between trauma and surgery was 8.47 days. Average duration of surgery was 1hr and 55 min. 70% cases were finished within 2 hrs. In this study, for 25 cases (83.33%) total period of hospitalization ranged from 10 to 25 days. In 5 cases (16.67%) cases more than 25 days of hospitalization was required. Average union time was 10.96 weeks. 24 cases (80%) union occur within 12 weeks. In our study, Partial weight bearing was started after 6 to 8 weeks depending on patient tolerance to pain. 18 patients (60%) walked full weight bearing in 3 months duration, while 12 cases within 6 months due to delayed wound healing or associated injuries. In this study, in 17 cases (56.67%) normal Bohler angle (i. e. 20^0-40^0) was achieved. Average post-operative Bohler angle was 25.13^0 (Table 1).

Table 1: Post-operative Bohler angle.

Post-op Bohler angle (in degrees)	No. of cases	Percentage (%)
$<10^0$	2	6.66
11^0-20^0	11	36.67
21^0-30^0	8	26.67
31^0-40^0	9	30

Figure 3: Post-operative superficial wound infection.

There were 3 cases (10%) of post operative delayed wound healing (Figure 3).

The gaping was at the angle of the incision for 2-3 cm. It was deep till subcutaneous tissue but plate was not exposed. All healed with daily dressing and delayed mobilization within 3 weeks and had no further treatment. 2 patients (6.67%) had superficial wound infection and were been treated with oral antibiotics. None of the patients developed severe infection. 1 patient

developed sural nerve complication in the form of loss of sensation on lateral aspect of foot. 1 patient had painful hardware and was advised implant removal after bone union (Table 2).

Table 2: Post operative complications.

Complications	No. of cases	%
Delayed wound healing	3	1
Superficial wound infection	2	6.67
Sural nerve complications	1	3.33
Painful hardware	1	3.33

Table 3: Outcome according to AOFAS score.

Results	Joint depression	Tounge type	Total	%
Excellent	2	2	4	13.33
Good	11	8	19	63.33
Fair	3	1	4	13.33
Poor	3	0	3	10

The AOFAS score of 90-100 was considered excellent, 75-89 as good, 50-74 as fair and <49 as poor outcome. 13.33% of the patients had excellent results, 63.33% had good results, 13.33% had fair result and 10% had poor results (Table 3).

DISCUSSION

In present series of 30 cases of calcaneum fractures treated by reconstruction locking plate over a period of two years from October 2009 to September 2011 with follow up period ranging from 2 months to 2 years. We evaluated our results and compared them with the result of various studies in the literature. In the present study, we have considered 30 patients with average age of 33 years. The commonest age group was 30-39 years. The youngest patient was 18 years and oldest was 65 years of age. There were 28 males and 2 females. The results were found similar to previous studies.[33-37] In present study, most common cause of fracture is fall from height, 83.33% of cases as in most of the studies. The results were found similar to previous studies.[33-38] In present study of the 30 cases, 19 cases (63.33%) involved right side, 7 cases (23.33%) involved left side and 4 cases (13.33%) were bilateral The results were found similar to previous studies.[35-37]

In present study, out of 34 fractures in 30 patients, 22 fractures (64.7%) were joint depression type and 12 fractures (35.3%) were tongue type according to Essex-Lopresti classification. The results were found similar to previous studies.[33,35,38] In present study, 13.33% patients were having associated injuries. One patient (3.33%) was having lower end radius fracture, one (3.33%) is having tibia fracture and two (6.67%) were having spinal injuries. The results were found similar to previous studies.[33,38] In present study, out of 30 patients with ORIF using a lateral approach. There were 3 cases (10%) of post operative delayed wound healing. The gaping was at the angle of the incision for 2-3 cm. It was deep till subcutaneous tissue but plate was not exposed. All healed with daily dressing and delayed mobilization within 3 weeks and had no further treatment. 2 patients (6.67%) had superficial wound infection and were been treated with oral antibiotics. None of the patients developed severe infection. One patient developed sural nerve complication in the form of loss of sensation on lateral aspect of foot. One patient had painful hardware and was adviced implant removal after bone union. Rate of complication of our study were comparable with other studies.[33-39] In present study, the average Bohler's angle achieved was 24.6 (0-44^0) which was comparable with other study groups.[33,40] In present study, the AOFAS score of 90-100 was considered excellent, 75-89 as good, 50-74 as fair and <49 as poor outcome. 13.33% of the patients had excellent results, 63.33% had good results, 13.33% had fair result and 10% had poor results. The outcome of our patients in this series was equivalent to other study group. In present study, the average duration of surgery was 1 hours and 55 minutes and time between injury and surgery averaged 8.5 days (range 3 to 15) The results were found similar to previous studies.[33,35,36,39,40] In present study, the average duration of surgery was 1 hours and 55 minutes and time between injury and surgery averaged 8.5 days (range 3 to 15) The results were found similar to previous studies.[35,37,38] In present study, average time of union was 10.96 weeks (range 8 to 16 weeks) which was equivalent to other study group.[35] In present study, ankle mobilization was started after an average 21 days. The results were found similar to previous studies.[33,36] In present study, Partial weight bearing was started after 6 to 8 weeks depending on patient tolerance to pain. 18 patients (60%) walked full weight bearing in 3 months duration, while 12 cases within 6 months due to delayed wound healing or associated injuries. The results were found similar to previous studies.[33,38]

CONCLUSION

In this study "Operative management of fracture calcaneum by reconstructive locking plate" showed excellent to good results in 76% of the patients. The results are poor as comminution increases. A single lateral extensile approach is sufficient to reduce all fractures. Only 2 of 30 cases had wound infection with this approach. Additional bone graft was not required. Intraoperative achievement of Bohler's angle determines the final outcome. Operative fixation of displaced intra-articular fractures of the calcaneus by Reconstruction Locking Plate, restores the calcaneal height, allows early mobilization and weight-bearing, and maximizes the chances for good joint function. We recommend to open reduce and internally fix the displaced intra articular fracture of the calcaneum by reconstructive locking plate.

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