

Evaluation of percutaneous fixation of intra articular fractures of calcaneum using Essex Lopresti manoeuvre

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Abstract

Background: Debate continues regarding the ideal management of calcaneal fractures, between open reduction and internal fixation and closed methods. Open plating has failed to prove its superiority over closed methods owing to poor soft tissue coverage, severe soft tissue swelling, lack of availability of sturdy implants and complications associated with plating. Hence we evaluated the outcome of percutaneous fixation of tongue type intra-articular fracture of calcaneum by Essex Loprestimanoeuvre.

Material and methods: 30 tongue type intra-articular fractures of calcaneum in 23 patients operated by Essex Loprestimanoeuvre by closed reduction and percutaneous pin fixation were assessed functionally by Maryland foot score and radiologically by Bohler's angle and Gissane's angle.

Results: 30 calcaneal fractures with mean age 31.6 years and mean follow up of 8.3 months were included in the study. The mean pre-operative Bohler's angle improved from 8.300 ± 3.84 , to 24.470 ± 8.31 immediate postoperatively and to 24.330 ± 8.46 at final follow up of 6 months, respectively. The mean pre-operative Gissane's angle improved from 134.130 ± 7.03 , to 123.150 ± 8.79 immediate postoperatively and to 123.550 ± 8.82 at final follow up of 6 months, respectively. Mean union time was 9 weeks. The mean Maryland Foot Score was 83.43 ± 7.53 (range 61 to 92) and 86 % cases had excellent to good results.

Conclusion: Essex-Lopresti's method for treatment of tongue-type fractures of calcaneum is easy, cost effective, day care procedure provides stable fixation, early mobilization and excellent results, with low complication rates.

Keywords: Tongue type calcaneal fracture, Bohler's Angle, Gissane's angle, Maryland Foot Score

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Introduction

Calcaneal fractures are the most common fractures of the foot and represent 1 to 2% of all fractures. Among these fractures, more than 75% fractures are intra-articular fractures, which are frequently associated with prolonged disability if not treated properly [1,2]. These fractures have a track record of being difficult to treat owing to position and nature of bone i.e. being subcutaneous,

cancellous, weight bearing small bone and also due to peculiar fracture patterns i.e. severely comminuted, depressed and intra-articular fragments [3]. Thus treatment of these calcaneal fractures require re-apposition of multiple fracture fragments and restoration of the subtalar joint anatomy, which is the interface between the calcaneus and talus and is the primary load bearing joint of the foot, along with providing respect to the thin

subcutaneous tissue covering overlying calcaneum [4].

Various modalities for the treatment of these fractures are plaster, plaster pins, external fixation, internal fixation by screws and plate. All these techniques have certain steps in common which include dis-impaction of the fragments, reduction of the displaced fragments along with joint restoration either manually or percutaneously and retaining the reduction alignment. Among the popularly used techniques, open methods have the significant issue of repeated surgeries, associated soft tissue trauma and high rate of wound healing problems while among the closed methods K-wires and pins have the advantage of easy implant removal without need of repeat surgery [5,6]. Hence we evaluated the outcome of close reduction and K-wire or pin fixation in 30 tongue type intra-articular calcaneal fractures by Essex Loprestimanoeuvre.

Material and methods

This study was conducted on 30 cases with tongue type intra-articular fractures of calcaneum treated by Essex Lopresti method at our institute. All patients of closed or grade 1 open tongue type intra-articular fractures of calcaneum, between 18 and 60 years of age, presenting within 2 weeks of injury were included in the study. All the patients with neurovascular injury, pathological fracture or other associated injuries were excluded from the study. The study was approved by the institutional review board and ethical committee of the institute and well explained written consent was obtained from all the participants.

All patients were primarily stabilized with intravenous fluids and analgesics. Standard axial and lateral calcaneal radiographs were taken and following this, a below knee slab was applied, limb was elevated and ice fomentation was done, primarily to reduce the swelling. Analgesics and anti-inflammatory medications were given.

Patients were treated by percutaneous fixation of k wire / pin with Essex

Loprestimanoeuvre [7,8]. All patients were operated, under the C-arm following all aseptic precautions in spinal anaesthesia in lateral position with affected limb above. Primarily a Steinmann pin or K-wire (3.0mm, 3.5 mm or 4.0 mm diameter with 9" length) was inserted from posterior calcaneal tuberosity and advanced till the fracture line keeping it just proximally to fracture line, without crossing the fracture (fig 1a). Reduction of the tongue type intra-articular calcaneum fracture was achieved by plantar flexion of the forefoot and down warding pulling of the pin / k wire from outside towards the planter surface to dis-impact the fragment by joy sticking to elevate the depressed tongue type fracture (fig 1b). Intra-operative, lateral and axial C-arm views were taken to confirm reduction and restoration of Bohler's angle within normal range of 20°-40°. Once reduction was achieved, and depressed fragment was elevated, a second Steinmann pin was inserted from superior external side of calcaneal tuberosity towards tarsal bone, holding the reduction, passing across the fracture line and fixing both the fragments (fig 1c). Following this, a third pin or K-wire was inserted inferior to the first Steinmann pin for additional fracture fragment stabilization as well as fixation. Finally, the first joysticking pin / k wire was removed (fig 1d) and another k-wire was inserted from posterior of the calcaneum tuberosity, traversing the fracture fragment and reaching towards the tarsal bones (fig 1 ef). After confirming the reduction and pin placement in C arm, finally pin tract dressing was done and below knee cast was applied after shortening the pins with the help of Harrington rod cutter.

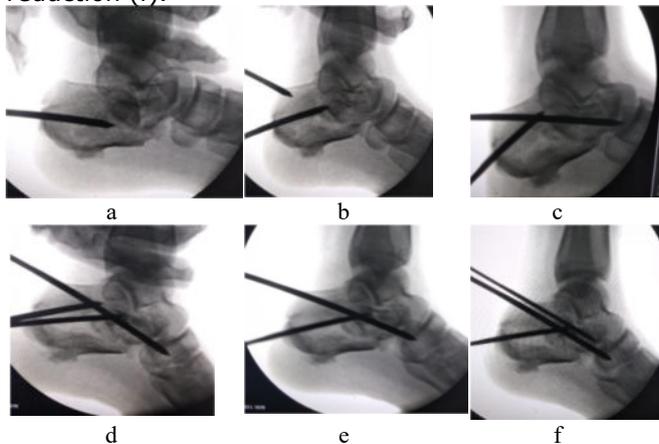
The limb was kept elevated and active toe movements were started from second postoperative day. Oral analgesics and antibiotics were given for 5 days. Cast care was explained to the patient as well as relatives. Patients were followed up regularly at 2 weeks each. Plaster and K-wires/pins were removed at 8 weeks and ankle range of motion started and full weight was started at 12 weeks. Functional outcome assessment was done by Maryland foot score and radiological outcome assessment was done by comparing

restoration of Bohler's angle and Gissane's angle, postoperatively [9,10].

Results

23 patients with 30 calcaneal fractures treated with Essex Loprestimanoeuvre were included in the study. The mean age in our series was 31.6 years (range 18 to 54 years). 19 patients were male and 4 were female. 11 patients had fracture of left side, 5 had right side and 7 sustained bilateral fractures. The most common mechanism of injury was fall from height seen in 17 patients and 6 had road traffic accident. The mean follow up period was 8.3 months (range 6 to 12 months).

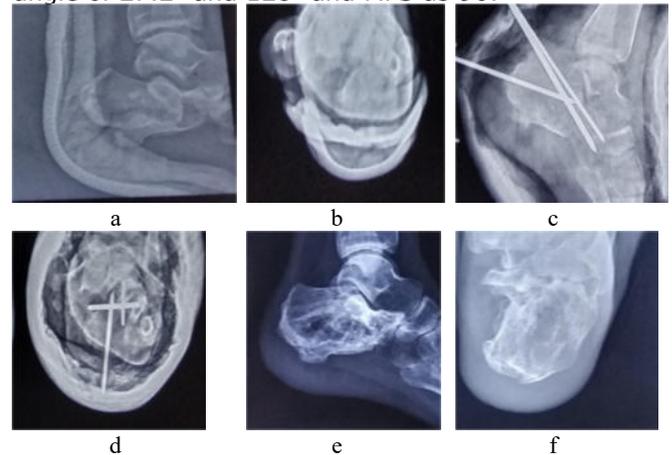
Fig 1. Intra-operative lateral fluoroscopic views (a to f) showing steps of Essex Loprestimanoeuvre – Insertion of first steinmann pin from posterior calcaneal tuberosity (a), achieving reduction by plantar flexion of forefoot and downward joysticking of the first pin (b), insertion of second and third steinmann pin from superior side of calcaneal tuberosity towards tarsal bone for holding the reduction (c & d), removal of first joysticking pin (e) and finally insertion of another pin to hold reduction (f).



The mean operative time was 12.86 minutes (range 8 to 20 minutes). The mean pre-operative Bohler's angle improved from 8.300 ± 3.84 , to 24.470 ± 8.31 immediate postoperatively and to 24.330 ± 8.46 at final follow up of 6 months, respectively. The mean pre-operative Gissane's angle improved from 134.130 ± 7.03 , to 123.150 ± 8.79 immediate postoperatively and to 123.550 ± 8.82 at final follow up of 6 months, respectively (fig 2). Mean union time was 9 weeks (range 8 to 12 weeks). The mean Maryland Foot Score was 83.43 ± 7.53 (range 61 to 92). In 6 (20.0%) patients the Maryland Foot Score was

excellent, in 20 (66.7%) patients it was good and in 4 (13.3%) patients it was fair.

Fig 2. Lateral (a) and axial (b) view of heel of 20-year-old male showing tongue type calcaneal fracture with preoperative Bohler's angle of 10.6° & Gissane's angle of 133.7° . Immediate postoperative lateral (c) and axial (d) views after Essex lopresti manoeuvre showing improved Bohler's & Gissane's angle to 26.8° & 127.8° respectively. Final 6 months post-operatively lateral (e) & axial (f) views showing Bohler's and Gissane's angle of 27.2° and 128° and MFS as 90.



Complications associated with the procedure were implant loosening in 1 patient (3.3%) and subtalar arthritis in 2 patients (6.7%). None of the cases had infection or wound healing problems associated with the procedure.

Discussion

Calcaneal fractures are the most common foot fractures, accounting for approximately 2% of all fractures and 75% of all fractures of foot, of which 10% are bilateral, 10% have associated injuries and 75% are intra-articular fractures [1-5]. Debate continues regarding the ideal management of calcaneal fractures, between open reduction and internal fixation and closed methods. Open plating invariably leads to inconsistent results and had failed to prove its superiority over closed methods owing to poor soft tissue coverage, severe soft tissue swelling associated with the fracture, lack of availability of sturdy implants, complications associated with plating and comparatively poor functional outcomes [5,6].

30 tongue type intra-articular calcaneal fractures in 23 patients with mean age 31.6 years treated by Essex Loprestimanoeuvre

were included in the study. In our study, mean Maryland Foot score was 83.43 ± 7.53 with 86 % patients having excellent to good results and rest showing fair results and none of the patients had poor results. In two studies by Tornetta et al in 1998 and 2000, who had also treated these fractures by percutaneous fixation showed 85% cases having excellent to good results with 15% having fair results and no patient having poor result as per Maryland Foot Score [11,12].

The mean MFS in study by Pillai et al and Scheppers et al was 77 and 79 respectively which was slightly less than that of our study, but the study by Parikh et al had mean score of 85 which was almost same as ours [5,13,14]. In all these studies, the number of patients with excellent to good results were comparable to our study with more than 80 % patients having excellent to good results. The mean correction achieved in Bohler's angle in our study was 16.270, which was comparable to other studies of Pillai et al, Scheppers et al, Parikh et al and Arastu et al who achieved correction ranging from 15° to 20° [5, 13-15]. Pillai et al compared outcome of modified Essex Loprestimethod using Bohler's strip for reduction in tongue and depressed type intra-articular fractures and found that overall functional score was significantly better in tongue type group [5].

Various modifications of Essex Loprestimethod to achieve accurate reduction of articular

surface have been used and described by various authors like use of Bohler strip by Pillai et al, use of distractor by Scheppers et al, fixation of calcaneum fracture by screws by Parikh et al or use of elevator or laminar spreader to elevate the depressed fragment by Arastu et al [5,13-15]. All these methods have demonstrated that Essex Loprestimethod is an excellent method for reduction of tongue type fractures to achieve good restoration of hind foot morphology and provides excellent results.

Percutaneous fixation of calcaneal fracture by Essex Lopresti method has very short learning curve, does not demand much expertise, can be easily perfected, has very short surgical time and the technique can be safely performed even in presence of extensive soft tissue swelling i.e. even immediately following injury reducing the duration of hospitalization and burden on to the patient as well as on the healthcare system.

Conclusion

Essex-Lopresti's method of closed reduction and percutaneous pin fixation is a good treatment option for tongue-type intra-articular fractures of calcaneum which is easy to perform, requires average surgical skills, is cost effective day care procedure providing stable fixation, early mobilization and excellent results, with lower complications.

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