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Functional Outcome of Percutaneous Screw Fixation of Intra-Articular Calcaneum Fractures- A Prospective Study

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Background: *The treatment of displaced calcaneum fractures has been a subject of intense discussion. Displaced intra-articular calcaneum fractures gives poor result with conservative treatment and requires reduction and internal fixation for favourable long term results. Open procedures are more prone to complications regarding wound healing. Percutaneous fixation offers a middle pathway in treating simpler variety of displaced calcaneal fractures. The aim of the study was to access the functional outcome of intra articular fracture calcaneum managed with closed reduction by Essex-Lopresti technique and percutaneous screw fixation.*
Methods: *This study was done in department of Orthopaedics Jubilee Mission Medical College , Thrissur , Kerala from January 2015 to January 2018. 26 intra-articular calcaneal fractures treated with closed reduction and percutaneous screw fixation under image intensifier.*
Results: *25 cases evaluated (one patient had lost follow-up), all fractures were united, average time of union was 8 weeks. The mean AOFAS score was 80 (range from 45 to 96), 9 patients had excellent, 12 patients had good, 3 patients had fair and one patient had poor result for that subtalar arthrodesis was done after one year of follow-up. Average Bohler's angle 24.5 and Gissane angle was 120 degree. No clinically significant varus or valgus in any case (less then 5 degree).*
Conclusions: *Treatment of intra-articular fractures of calcaneum is challenging but close reduction and internal fixation with 6.5 cannulated cancellous screws yields favorable outcome in majority of cases.*

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I. Introduction

Calcaneum fracture represents 1-2% of all fractures, they account for 2/3rd of all hind foot fractures.[1] Calcaneum fracture may be intra-articular or extra-articular. As far as treatment is concerned, the extra-articular types do well in terms of recovery. Intra-articular type of calcaneum fractures represents 75% of all calcaneum fractures are the result of high energy trauma like fall from height or motor vehicle accidents. So, these types are more common in young labors who work on bridges and ladders The treatment of this type of fractures has been a subject of intense discussion and controversy for both operative and non-operative methods. Possible treatment options for depressed intra articular fracture include limb elevation and bulky jones dressing, ORIF with specially designed calcaneal plates and CRIF with cancellous cannulated screws, other techniques using fine wire external fixation is also described.[2]

Complex anatomy, precarious blood supply and limited soft tissue protection make these fracture a challenge to treat. Non-operative treatment leads to early subtalar arthrosis with painful gait and difficulty in wearing footwear due to broadening and shortening of heel. Because of these long term impairment this type of fracture results in career ending in young and middle aged male workers and labors.[3,4] Displaced intra-articular fractures requires anatomical reduction with stable internal fixation to maximize the chances of good joint function. One of the prognostic indicator of outcome of calcaneal fracture is the amount of injury to the posterior facet.[5,6] The study of Buckley and Meck suggested that a facet reduction with in 1mm is required to produce result superior to close or non-operative treatment.[7] The same results also been described by sanders et al.[8] Many types of operative treatment have been recommended like spike elevation and K wire fixation, open reduction plate fixation. Open reduction has a very high rate of wound complication.[9] Percutaneous technique may take advantage of minimizing complication from open procedures. This minimally invasive technique for tongue type intra-articular fractures was proposed by Westhues in 1935, modified by Gissane and propagated by Essex- Lopresti.[10]

Aims and objective

The aim of the study was to access the functional outcome of intra articular fracture calcaneum managed with closed reduction by Essex-Lopresti technique and percutaneous screw fixation using 6.5 mm cannulated cancellous screws

II. Methods

This study was done in department of Orthopaedics, Jubilee Mission Medical College , Thrissur , Kerala from January 2015 to January 2018. Initially 26 patients were included in study but one patient had lost follow up so, 25 intra-articular calcaneal fractures treated with closed reduction and percutaneous screw fixation under image intensifier were included. Open fractures, other fractures in ipsilateral lower limb and patient have spinal injury was excluded from study. Antero-posterior, lateral, and axial views of x-ray and CT scan in patients were taken for radiological evaluation of fracture. Lateral view of x-ray facilitates the measurements of both Bohler's and Gissane angles and has prognostic value

Surgical technique

All patients were operated in prone position on the radiolucent table under image in spinal anaesthesia. At first reduction was done by elevation of posterior facet with 3 mm Steinman pin inserted from superolateral to tendoachalis under image intensifier (Essex-Lopresti method). Two guide wires were inserted in such manner that fracture would compressed when screw inserted over them. Self-tapping 6.5 mm partial threaded canullated cancellous screw was inserted after drilling. Post operatively below knee cast applied, at 4 weeks cast was removed, non-weight bearing ankle movements were started. Subsequent follow-up done at 6wks, 8wks, 12wks and 6 months, full weight bearing started as radiological union seen. Functional and radiological evaluation done by using American Orthopedics Foot and Ankle Society (AOFAS) score and measurement of Bohlar and Gissane angles. AOFAS score has 100 points, 40 points for pain, 45 for function and 15 points for alignment. A score of 90-100 was graded as excellent, 75-89 as good, 50-74 as fair and less than 49 points was graded as poor result.

Figure 1: Pre-operative X-ray.

Figure 2: (A) Intraoperative c-arm image;(B) intraoperative clinical picture.

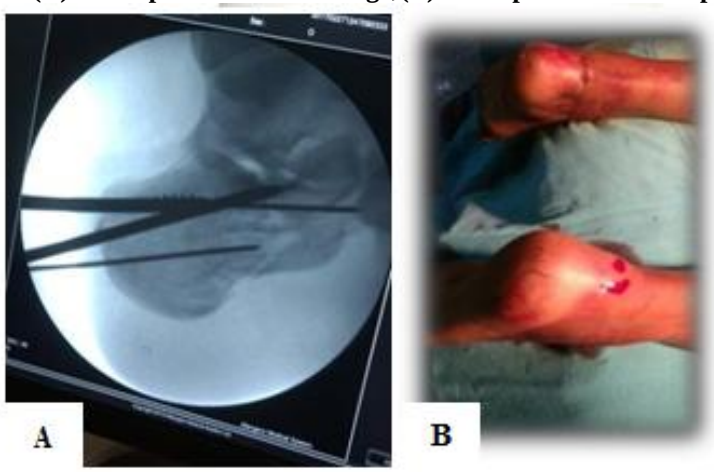

Figure 3: (A) Immediate post op X-ray lateral view; (B) immediate post op X-ray AP view; (C) follow up X-ray lateral view; (D) follow up X-ray calcaneus view.

III. Results

There were 17 male and 8 female patients were evaluated for results. The average age of the patient was 42 years ranging from 20 to 60 years. Fall from height (17) was the major cause followed by road side accident (6) and other causes (2).

Most of the patients (24) were operated within 72 hours of admission except those with medical co-morbidity. The average length of postoperative stay was 3 day (range from 2-5 days). All fractures were united, average time of union was 8 weeks (range from 6 to 12 weeks). Swelling was persist up to 12 weeks of the follow-up in 4 patients, 2 patients had superficial infection but resolved with oral antibiotics started after culture and sensitivity. Implant removal done in 2 patients due to impingement of the screws. The mean AOFAS score was 80 (range from 45 to 96), 9 patients had excellent, 12 patients had good, 3 patients had fair and one patient had poor result for that subtalar arthrodesis was done after one year Average Bohler's angle 24.5 and Gissane angle was 120 degree. No clinically significant varus or valgus in any case

IV. Discussion

Treatment of intra articular fractures of calcaneum is still controversial and challenging. Previously conservative treatment was widely accepted. These days in general it is well accepted that treatment should aim at anatomical restoration of joint articular surface and width-height- length of the heel to achieve functional recovery.[10,11]

In the present scenario there are broadly 2 operative methods of treating intra-articular calcaneal fractures. Either by open reduction internal fixation using calcaneal plates or by percutaneous closed reduction and fixation using cancellous screws. both the techniques have there certain merits and demerits with percutaneous screw being edge ahead as obtained by Tornettain his studies, where he inferred out that first, careful patient selection implies better reduction of intact facet as a whole with no intraarticular step-off.[2,12] Second, the use of percutaneous technique avoids large incisions and stripping.

Tornetta advocated the use of 6.5 mm cancellous cannulated screws similar to what we used in our study though Yip-Kan and Yuen-Fong advocated use of 4.5 mm c.c. screws to minimize screw head impingement.[13,14]

To sum up, Essex– Lopresti percutaneous technique helps to decrease scar formation which inturn reduces stiffness thus improves clinical and cosmetic outcome, as evident in study by Sanders et al. Where he inferred that by percutaneous screw fixation wound complications like dehiscence and flap necrosis are minimized when compared with plating.[15]

Patient selection, preoperative radiological analysis of fracture pattern and use of intraoperative fluoroscopy for correct implant placement are important for success of this technique.[14]

V. Conclusion

Treatment of intra-articular fractures of calcaneum is challenging but close reduction and internal fixation with 6.5 cannulated cancellous screws yields favorable outcome in majority of cases.

Although we have included small series of patients and long term results are still warranted yet the technique of percutaneous screw fixation is relatively simple, gives biological environment and optimal stability to fractures with good functional outcome.

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