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EVALUATION OF FUNCTIONAL OUTCOME OF CALCANEUM FRACTURES TREATED BY MINIMALLY INVASIVE FIXATION TECHNIQUES

Orthopaedic

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ABSTRACT

Purpose: To assess the functional outcome of calcaneum fracture treated by minimally invasive fixation technique.
Methods: 30 patients of displaced intraarticular calcaneum fractures were treated with minimally invasive fixation techniques in this prospective study after obtaining informed consent regarding the same and satisfying inclusion and exclusion criteria. They were then followed up at 3 weeks, 6 weeks, 3 months, and 6 months. Functional outcomes were assessed using American association of foot and ankle score system (AOFAS) and Radiographs were also obtained on follow up and Bohler and Gissane angles were measured.
Results: Out of 30 patients treated with minimally invasive fixation techniques bony union occurred in all patients, functional outcome by American association of ankle and foot score (AOFAS) were 24 good, and 6 fair result. Radiographs showed restoration and maintainence of Bohler angle and Gissane angle in 28 patients at 6 months follow up.
Conclusion: Minimally invasive technique for the treatment of intra articular fractures gives good to fair clinical outcome on short term follow up with very few complications. Restoration of Bohler and Gissane angle is correlated to good functional outcomes.

KEYWORDS

Calcaneum Intra Articular Fracture, Minimally Invasive Fixation, American association of foot and ankle score system (AOFAS)

INTRODUCTION:

The calcaneum is the most commonly fractured tarsal bone accounting for 65% of tarsal injuries and 2% of all skeletal injuries[1]. Fracture calcanei occur typically more in young active males with peak incidence range from 20-29 years. The most common mode of injury being axial load shedding due to vertical fall in intra-articular fractures where as in extra-articular fractures it is twisting forces and direct blows[2]. Approximately 75% calcaneal fractures are intra-articular referring to the extension of the fracture line into the posterior articular facet of the subtalar joint[2]. An unreduced intra-articular fracture will lead to subtalar arthritis hence the goal of treatment is anatomic reduction whenever possible.

Management protocols for Calcaneal fractures have evolved from non-operative treatment with bandaging and elevation, through open reduction and plate fixation, to minimally invasive surgeries at present. Currently the most common approach for Open reduction and internal fixation of Calcaneal fractures is the extended lateral approach (Letournel[3] modification of Palmer's approach) which provides excellent exposure of posterior facet and lateral wall of calcaneus. A major issue with open reduction of Calcaneal fractures was the development of major wound complications owing to the vulnerable soft tissue envelope on the lateral aspect.

Previous studies report 0.4 to 14% incidence of wound edge necrosis and 1.3 to 7% infection rates with extended lateral approach[4]. Medial approaches carry the risk of neurovascular injury along with inadequate exposure. Chances of wound necrosis increase to 27% when combined medial and lateral approaches are used[5].

Minimal invasive reduction of fractures is the upcoming chosen modality of treatment as it reduces the complications of open reduction while providing near anatomical reduction if performed correctly. This study describes thirty patients with calcaneal fractures who were treated with minimal invasive fixation techniques followed by cast immobilization for minimum 5 weeks followed by guided physiotherapy.

MATERIALS AND METHODS:

30 patients of displaced intraarticular calcaneum fractures were included in this prospective study after obtaining informed consent regarding the same. These 30 patients satisfied the inclusion and exclusion criteria. Inclusion criteria were skeletally mature patient, with displaced intra articular fractures (Sanders type 2&3) of calcaneum. Exclusion criteria were patients with polytrauma, open fractures, smoking history, uncontrolled diabetes, Sander I & IV types, delayed presentation of more than three weeks, neurovascular involvement and compartment syndrome.

All the patients were evaluated with X-ray of the calcanaeum-axial, lateral and AP views along with CT scan. In this study, we followed the Sander's classification to classify the fractures. All patients were treated by limb elevation, below knee slab application, ice application and crepe bandage to reduce the edema. Except for a few, due to gross edema, most of the patients were operated within 10-14 days of injury following wrinkle sign appearance.

Fracture fixation was done using minimally invasive surgical technique by Steinmann pin elevation either by a stab incision just lateral to tendo Achilles in essex lopresti variety(tongue type) fracture and control of the tongue fragment with inserted pin to reduce fracture; or in a joint depression variety fracture, a lateral incision was place and one pin passed in posterior fragment to distract and another pin was used to elevate the depressed fragment; this was followed by maintenance of reduction by cannulated cancellous screw fixation supported by below knee cast application; occasionally Steinmann pin was left in situ to maintain the reduction in cast.

Leg elevation was given to avoid postoperative swelling. Follow up was done on 3 weeks, 6 weeks, 3months and 6 months with serial radiographs. Cast was removed at 5 weeks post operatively and gradual weight bearing was started after 6 weeks. Functional outcome was assessed using the American Orthopaedic Foot and Ankle Score (AOFAS) 6 months postoperatively. It ranged from 0-100 with 95-100 suggesting excellent, 75-94 suggesting good, 51-74 suggesting fair and below 50 suggesting a poor outcome. Figure 1 show pre and postoperative radiographs of one such case.

a) b)

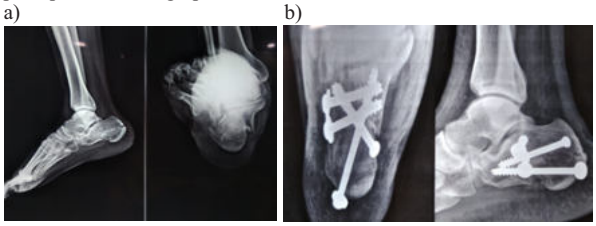

Figure 1: a) preoperative radiographs b) postoperative radiographs

RESULTS:

Out of 30 patients with Calcaneal fractures; including 18male patients

and 12 female patients, which were operated through minimally invasive technique, we achieved bony union in all patients. 19 patients had joint depression type fracture while 11 had tongue type fracture for which surgery for done as mentioned earlier. 17 patient had history for fall from height; rest 13 had history of road traffic accident.

Functional outcome by American association of ankle and foot score (AOFAS) were 24 good, and 6 fair result at 6 months follow up. Radiographs showed restoration and maintainence of Bohler angle and Gissane angle in 28 patients at 6 months follow up.

Two patients had superficial infection which was managed through antibiotics according to sensitivity. One patient had screw head impingement and the screws were removed 7 months postoperatively. Other complications like heel pad problems, peroneal tendinitis, compartment syndrome, reflex sympathetic dystrophy were not seen in any of the patients.

DISCUSSION:

Calcaneus is the most commonly fractured tarsal bone. The treatment of calcaneal fracture has, in recent years, been systematized by the use of classification systems and treatment algorithms. In the last few decades, operative treatment of displaced intra-articular calcaneus fracture has become a preferred treatment method with the advantage of less complication rates and better quality of life after the surgery[6].

The lateral extensile approach faced a high incidence of postoperative infection, so to overcome this minimally invasive techniques gained popularity. Percutaneous reduction and screw fixation of calcaneum aims at reducing the risk of wound complication and postoperative scarring as compared with open reduction via extended approaches. The method of closed reduction with percutaneous pin leverage has found reappraisal for less severe fracture patterns, like Sanders type IIC fractures, with the posterior facet being displaced as a whole; when applying this method to Sanders type IIA and IIB fractures, anatomic reduction of the posterior facet should be controlled with intra-operative subtalar arthroscopy[7] or fluoroscopy because subtalar joint congruity is highly predictive of the functional outcome[8].

In our study 24 out of 30 patients(80%) had good result which is comparable to the study by Dr. Bhagawanth Kumar B Patil et al who reported 75% good results[9]. The average AOFAS score of the patients in our study at 6 months postoperative period was 75.67 comparable to a mean score of 70 for operative interventions in Ibrahim et al[10]. 28 out of 30 patients(93.33%) showed restoration and maintenance of Bohler angle and Gissane angle at 6 months follow up; this result was comparable to the radiological outcomes observed in study by Shengl Xia *et al*[11].

The short comings of our study include small sample size and short follow up period. Hence we are not able to comment regarding the development of arthritis following this treatment modality. Long term results and comparability with open reduction in terms of functional outcomes needs to assessed with a longer duration; wider span study.

CONCLUSION:

Minimally invasive technique for the treatment of intra articular fractures gives good to fair clinical outcome on short term follow up with very few complications. Restoration of Bohler and Gissane angle is correlated to good functional outcomes.

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