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Steinmann pin fixation for displaced tongue type calcaneal fracture

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Abstract

The optimal treatment of the calcaneal fracture is a controversial topic. Many patients get a very good result with open reduction and internal fixation using extensile lateral approach. But there are many patients who do not qualify this category. This is the reason why many of them are either denied any surgical intervention or are put at a significant risk of developing major complications because of the open surgical intervention. The height, width, length and shape of the hind foot can be restored using minimally invasive reduction and fixation (MIRF) and also the orientation of the posterior facet of calcaneus (Bohler's angle) can be restored. In this paper we present a series of 23 patients treated with minimally invasive reduction and fixation using Steinmann as a treatment method for the patients not suitable for open reduction and internal fixation. The use of Steinmann pin in the MIRF technique proved out to be very effective. As per our experience the time of the surgery is short and it can be easily performed even in the presence of extensive soft tissue swelling in the period immediate after the injury. The risk of infection is low also the morphology of the calcaneus was improved and properly maintained in the term of Bohler's angle. This technique is very suitable for the patients with medical co-morbidities such as smokers, diabetics and is also very effective for the patients who are not suitable for extensile approach and internal fixation.

Keywords: Minimally invasive, Steinmann pin, tongue shaped fractures

1. Introduction

Intra-articular displaced fracture of the calcaneus is the most common of all the tarsal fractures (60%) and account for almost 2% of the fractures in the adults. Approximately 75% of the tongue shaped calcaneal fractures are intra-articular and occur due to an axial load such as fall from height or a motor vehicle accident. These fractures very frequently result in long-term disability can lead to severe economic impact on the patient as many patients fail to return to their original occupation after the trauma. The irregular anatomy, the complicated joint mechanics between the tarsal bones and the delicate soft tissue envelope in which they sit have made these fractures a challenge. Historically, treatment of the displaced calcaneal fractures has varied from non-operative management with or without closed fixation to open reduction with internal fixation by various surgical approaches. But the open reduction and internal fixation has been associated with high rates in the complications and also did not give improved outcomes. The reported rate of the infection ranges between 5-20% and the amputation of the limbs can also happen due to chronic osteomyelitis and personal disability. There can also be broadening of heel, muscle imbalance, loss of motion, and intractable pain due to non-operative treatment. Thus minimally invasive reduction and fixation of the calcaneal fractures (MIRF) can prove to be effective in the case of patients with the concerns regarding complications and infections.

2. Aims and Objectives of this Study

The main aim of this was to report the surgical technique of using MIRF in a group of patients that were deemed unsuitable for open reduction and internal fixation using Steinmann Pin in the tongue shaped intra-articular fractures.

3. Materials and Methods

3.1 Initial Process

Between October 2016 to September 2017 adult patients with intra-articular fractures of calcaneum were admitted to the trauma centre and emergency, Padamshree Dr. D.Y. Patil Medical College and Hospital, Navi Mumbai. Patients with Pathological fractures were excluded from the study. So altogether 23 patients who satisfied the criteria were included in this prospective study.

All the patients coming to Trauma centre were initially given first aid in the form of splintage, in the form of below knee slab, supportive care, analgesics, IV fluids and routine relevant investigations were carried out. Basic radiological investigations pertaining to the nature of fracture sustained were done in addition to standard trauma series of investigations.

After the initial management all patients were assessed for any other medical ailment and patients were managed accordingly. Informed consent was taken from all patients.

Stable patients were taken to the surgery at the earliest after the pre anaesthetic evaluation. All fractures were classified using Essex-Lopresti classifications based on pre-operative radiographs and computed tomography (CT) scans. Pre-operative, at time of intervention and final follow up radiographs were reviewed and the Böhler's angle and length were measured.



Fig 1: A large Steinmann pin is used as a reduction tool to manipulate the posterior tuberosity fragment and retraction of the Achilles tendon and restore some calcaneal height and control varus-valgus alignment

3.2 Study design and Population

A prospective study was designed for the patients who were admitted and operated for calcaneum fractures in the Department of Orthopedics, Padmashree Dr. D. Y. Patil Medical College, Hospital & Research Centre, Navi Mumbai, Maharashtra from October 2016 till September 2017. The patients that were included in the study had calcaneum fractures, were aged 20 years or more, were of both the sexes and had open injuries. The patients that were excluded from the study were the ones that had grossly compound fractures and also the ones who refused to sign the consent to be included in the study. We studied 23 cases of fractures of calcaneum. All the patients gave their consent to be included in this study and also the approval of local ethics committee was taken.

3.3 Surgical Procedure

With the patient prone, a small incision is made over the displaced tuberosity of the calcaneus just lateral to the attachment to the Achilles tendon. A heavy Steinmann pin is introduced into the tongue fragment in the longitudinal direction, angling slightly to the lateral side. Image intensifier is used during the insertion of the pin and manipulation of the fracture.

With the knee flexed, fracture is reduced by lifting upward on the pin until the knee clears the table. The forefoot is flexed at the level of the midtarsal joints with the opposite hand, and creating a cavus deformity by hyperflexing the forefoot is avoided. By doing this maneuver, the tongue fragment is elevated from the depressed position in the body of the calcaneus.

The spreading of the calcaneus is reduced by applying pressure on each side of the bone with the heels of the clasped hands. It is important to clear the inferior aspect of the lateral malleolus from contact with any building bone fragments that may encroach on the peroneal tendons and produce chronic tenosynovitis. The calcaneus is gently rocked at this stage to settle the smaller fragments into position. Final radiographs are made to confirm the position. The pin is advanced across the fracture into the anterior fragment of the calcaneus.

3.4 Post-Operative care

The foot is carefully padded, and a splint is applied, incorporating the protruding portion of the pin. The initial cast and pin usually are removed after 4-6 weeks, and a cast is applied from the tibial tuberosity to the toes. If the radiographs confirm union and reconstitution of the depressed cancellous bone beneath the elevated articular surface, weight bearing can be started 8-10 weeks after reduction.

3.5 Follow-Up

Patients were followed up at the regular interval of one week, 6 weeks, 3 months, 6 months and 1 year post operatively.

4. Data Collection and Analysis

A detailed history of all the patients was collected at the time of the admission which included the mechanism of injury and all the complaints that patient had were noted. Antero-posterior, lateral and axial view radiographs were taken of the affected limb. Pre-operative measurement of Bohler's and Gissane's angle was done for the Steinmann Pin surgery. Below knee slab was given for the primary immobilization treatment. All type of routine investigations was done before taking the fitness from the anaesthesia department.

Patients were then posted for the planned surgery after deciding the appropriate modality for fracture fixation. No primary subtalar arthrodesis was performed.

The restoration of Bohler's and Gissane's angle intra operatively was attempted with Steinmann Pin using the image control. This was further complimented with the plaster of Paris cast.

After the surgery patients were followed up in the out-patient department at 1 week, 6 weeks, 3 months, 6 months and 1 year. The patients were mobilised with partial weight bearing walk with bilateral axillary crutches and a walker.

The patients were regularly assessed for the signs of the union of the fracture, movement of ankle and subtalar joint and complications, in case there were any. Their radiographs were also taken to confirm the process of union and then after that partial weight bearing was allowed with regular physiotherapy and gradual weight bearing. Non weight

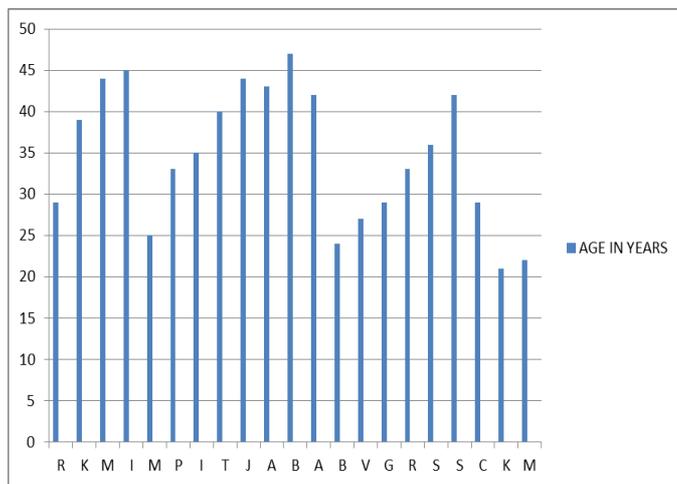
bearing walking was allowed 4 days after surgery. Steinmann Pin was removed after 1 month of the surgery and the cast was reinforced. The total immobilisation was advised primarily for 6 weeks and after that period of time partial weight bearing and active physiotherapy was instituted with elastocrepe bandage or sport shoes support as and when it was required. Assessment of functional outcome was done by the American Orthopaedic Foot and Ankle Society (AOFAS) score by Kitaoka and colleagues. y Kitaoka

5. Results

The study was conducted on 23 patients who suffered from the fractures of calcaneum and managed at Padamshree Dr. D.Y. Patil Medical College and Hospital with Steinmann Pin.

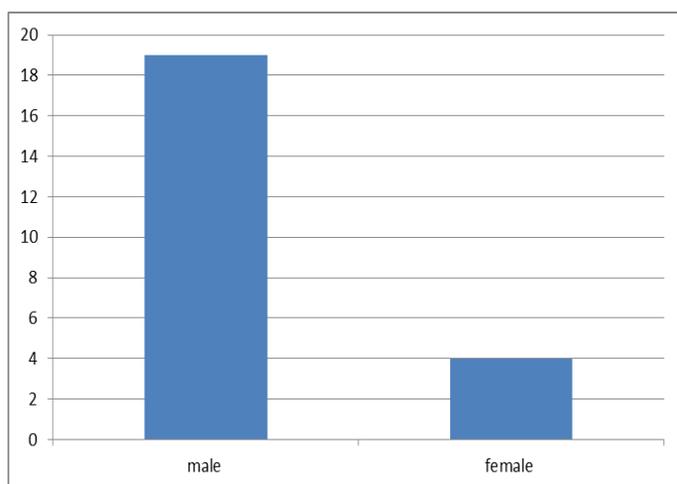
5.1 Age Comparison

All the patients were aged between 20 to 50 years with mean age of 35 years.



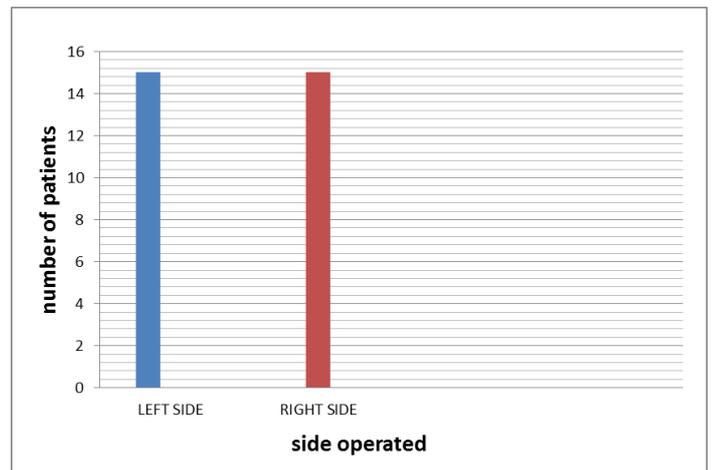
5.2 Sex Ratio

Out of 23 patients, 19 were males and 4 were females.



5.3 Side Operated

Patients sustaining from this fracture has equal incidence of injury to either side.



In our patient population a significant increase in Bohler’s angle and decrease in Gissane’s angle was seen post-operatively. It was seen that 85% of the patients had an excellent outcome.

5.4 X-rays

The X-rays are



Fig 2: Pre-Operative X-rays





Fig 3: Post-operative X-rays

6. Conclusion

The surgical technique of Minimally Invasive Reduction and Fixation (MIRF) of calcaneal fractures is technically demanding and has an extensive learning curve for surgeons who have significant experience in treating calcaneal fractures with traditional extensile open surgery. The fracture subgroups that would benefit most from MIRF remains unknown and needs further robust research. Minimally invasive calcaneal fracture surgery has many benefits in those patients where hindfoot morphology should be improved. The subgroup of patients where traditional extensile open surgery poses significant risk can be helped by this less invasive technique. To the best of our knowledge, a MIRF technique with the use of Steinmann Pin has not been previously described in the literature. In our experience, the operative time is short and can be safely performed even in the presence of extensive soft tissue swelling in the immediate period following injury. The infection risk is low and calcaneal morphology was improved and maintained in terms of Böhler's angle. This technique is suitable to be considered in patients who have significant medical co-morbidities (smokers, diabetics, peripheral vascular disease) and in those patients who are not suitable for an extensile lateral approach and internal fixation. However, the long-term outcome of subtalar arthrosis using this technique remains unknown. Steinmann Pin method for the fixation in tongue type fractures has fewer complications and good results.

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