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Clinical outcome of intra articular calcaneum fracture operated by sinus tarsi approach

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Abstract

Objective: This study was performed to analyze the clinical outcome of sinus tarsi approach in displaced intra articular calcaneal fractures which was fixed with cannulated cancellous screws.

Methods: This retrospective study included 30 displaced intra articular calcaneal fractures operated with sinus tarsi approach and fixed with cannulated cancellous screws. The outcome was measured by change in bohler's and gissane angles. The clinical outcomes measured by AOFAS score.

Results: We have total 12 months of follow up of all patients. After operative procedure bohler's and gissane angle improved significantly. Due to minimally invasive procedure infection rate was 0% in our study. According to AOFAS score we got excellent results in 9(30%), good result in 18(60%), fair result in 1(3.3%) and poor result in 2(6.6%) cases.

Conclusion: Sinus tarsi approach is very useful for displaced intraarticular calcaneal fractures because it allows to do anatomical reduction of intra articular surface easily and provides excellent to good clinical outcomes with very few complications.

Keywords: Sinus tarsi approach, calcaneum, intra articular fracture, open reduction and internal fixation, screws

Introduction

Calcaneum fractures are the most common of tarsal bone fractures and account for approximately 2% of all fractures [1]. There are two types of calcaneum fracture 1. Intra-articular 2. Extra-articular from which 60 to 75% fractures are displaced intra-articular calcaneal fracture [2]. Industrial Revolution and the advent of the High Velocity Transportation lead to increase number of incidences of falls from height and motor vehicle accidents and it remains the most common causes of calcaneum fractures at present. Displaced intra articular calcaneal fracture remain one of the most challenging problem for the orthopedic surgeons. Proper reduction and result are difficult to achieve with nonoperative treatment due to malunion of fracture and subtalar arthritis readily occurs [3]. After non operative treatment there is high chances of long-term disability due to pain and chronic stiffness. In contrast, open reduction and internal fixation of displaced intra articular fracture effectively restore the anatomy of the calcaneum and the subtalar joint. Kirschner wires (k-wires), cannulated cancellous screw (ccs) and calcaneum plate were used for internal fixation based upon characteristics of the fracture. in case of plate fixation there was higher chances of complications like wound edge necrosis and infection due to relatively larger incision and extensive soft tissue dissection [4, 5, 6].

We were interested in reduction of various complications of nonoperative treatment and plate fixation. Sinus tarsi approach is minimally invasive and very effective for reduction of displaced intra articular fractures of calcaneum with the lower incidence of the complications.

Materials and methods

We have done a prospective study of 30 patients of displaced intra-articular calcaneum fracture at Gujarat Adani Medical Institute of Medical Sciences, Bhuj, Gujarat from May 2018 to October 2019. All the patients were selected after strict application of inclusion and exclusion criteria.

Inclusion criteria: 1. Skeletally mature patients 2. All closed displaced intraarticular calcaneal fractures, with >2 mm intra-articular step 3. Sander's type II, III and IV fractures.

Exclusion criteria: 1. Patients with congenital deformities 2. Pathological fractures 3. Open fractures or severe soft tissue compromise includes massive blisters, severe edema, large local abrasions, previous dermatological local lesions 4. Re-fracture or previous hind foot surgeries or associated other Tarsal bone fractures.

Clinical evaluation

We attended all patients immediately. Proper general and systemic examination was done. Lateral and axial radiographs of calcaneum taken. Calcaneum fracture is immobilized with below knee slab and kept on Bohler splint. After confirmation of intra-articular calcaneum fracture, CT-scan with 3-dimension image reconstruction was done. For operation we usually wait 3 to 5 days till significant decrease in swelling and appearance of wrinkle sign over local part before going surgery.

Surgical technique

We placed the patient in lateral decubitus position with

affected limb up. The depended limb was padded and protected. Tourniquet was placed. 2-4 cm long incision was made in line with the tip of the fibula and the base of the 4th metatarsal. After dissection of subcutaneous tissue, Extensor digitorum brevis was retracted cephalad. The peroneal tendon sheath was exposed, peroneal tendons were visualized and mobilized inferiorly if needed to expose sinus tarsi and posterior facet. Peroneal tendons were retracted posteriorly. The sinus tarsi exposed and Fibrous debris, fat, hematoma were removed along interosseous ligament to expose posterior facet of subtalar joint. Schanz pin was inserted percutaneously in posteroinferior tuberosity going from lateral to medial to provide distraction and aids with reduction. Small elevator or lamina spreader placed under posterior facet fragment to aid in reduction. K-wires inserted for provisional fixation aimed towards the sustentaculum. One or two screws are placed lateral-to-medial to engage sustentaculum and support facet. One large fully threaded screw from posterior-to-anterior to support axial length of calcaneus. Additional screws can be added as needed depending on the fracture pattern. We had not used any plates or bone graft. Skin was closed with simple interrupted suture. Sterile dressing and below knee slab were applied.



Fig 1: Operative technique

Post-Operative Protocol

Injectable antibiotics were given post for 2 days post operatively. Strict Bohler elevation was given till local swelling subsides. Toe mobilization exercise was started after the first dressing at 48 hours. Stitches removed usually on 15th post-operative day. Below knee slab continue for 6 weeks. Active and Passive ankle mobilization exercise was started after removal of slab. Patient was mobilised non-weight-bearing for a minimum of six weeks post-operatively. Weight bearing was started after clinical and radiological union usually at 12-16th week. Lateral and axial radiographs were obtained during routine post-operative follow-up and clinical and functional outcome were assessed using AOFAS Score [7]. This score includes pain, function and alignment evaluation and allows a maximum of total 100 points,

with higher scores indicating better outcomes.

Results

Table 1: Mode of injury

Mode of injury	Numbers	Percentage
Fall from height	20	67%
Road traffic accident	7	23%
Others	3	10%

Table 2: Fracture classification

Sander's Type	Number of Cases
II	10(33%)
III	15(50%)
IV	5(17%)

Table 3: Preoperative and postoperative radiographic measurements of calcaneal dimensions and angular measurements.

Radiographic parameter	Normal	Preoperative	Postoperative	P value
Bohler's angle	20-40°	8.5±22.3°	25.06±3.1°	0.0002
Gissane angle	120-145°	100±32.9°	134.96±7.08°	0.0001

Table 4: Post operative AOFAS score

Results	No of Patients
Excellent	9(30%)
Good	18(60%)
Fair	1(3.3%)
Poor	2(6.6%)

There were total 30 patients in the study all of them treated with sinus tarsi approach for intra articular reduction and fixed with multiple cannulated cancellous screws. The mean age of the patients was 34.7 years. Male patients were more predominant than female with 25(85%) male patients while only 5(15%) female patients. Fall from height was the most common mode of injury following road traffic accident which was second most common mode of injury. This fracture occurs most commonly in laborer. In our study Sanders's type III was most common with 50% cases while 10 cases of type II and 5 cases of type IV. Average surgical time of sinus tarsi approach with screw fixation was 69.1 minutes. Radiological union seen on an average 9.61 weeks. There was very less postoperative complication in our study. There was one patient came in follow up with implant loosening and two patients had persistent pain at final follow up. Out of 30 patients not even a single patient got infected. One patient had incision edge necrosis which was treated by regular dressing. According to AOFAS score we got excellent results in 9(30%), good result in 18(60%), fair result in 1(3.3%) and poor result in 2(6.6%) cases.



Fig 4: Post operative X-rays



Fig 5: Follow up X-rays



Fig 2: Pre operative X-rays



Fig 3: Pre operative CT Scan

Discussion

The calcaneum is the most important weight bearing tarsal bone so that there is higher chances of calcaneum fracture. Because of being the most important weight bearing bone restoring the normal anatomy of the fractured bone is necessary. For reducing the displaced intra articular fracture various alternative open approaches have been developed like lateral approach, medial approach, combined lateral and medial approach, limited posterolateral approach and minimally invasive sinus tarsi approach [8]. In 1948 palmer [9] introduced a laterally based approach through the sinus tarsi for direct visualization of the articular surface for reduction. In 2005, Holems described the minimally invasive sinus tarsi approach for displaced intra articular calcaneal fracture. he reported that this approach proves adequate exposure to achieve successful reduction and fixation without any wound infection or osteomyelitis over 18 years [10]. In 2008, Hospodar *et al.* studied 16 cases using sinus tarsi approach. They were found no major wound complications. The posterior facet joint was successfully reduced to less than 2mm of displacement in 14 patients [11]. There are different methods of calcaneal fixation with sinus tarsi approach. Some authors used only pins, some used cannulated cancellous screws and some used plate with screws. In this study we used only cannulated cancellous screws. In our study bohler's angle improved from 8.5° to 25°

post operatively and without any infected case. In 2014, Abdelazeem *et al.* used limited sinus tarsi approach for displaced intra articular fracture and fracture fixed with only multiple screws in total 33 patients. Marked improvement in bohler's angle was notices in all patients from 2.8° to 19.4°^[12]. In 2018, qingting Meng *et al.*^[13] study total 49 displaced intra articular calcaneal fracture which operated with sinus tarsi approach and plated and screws. Bohler's angle improved from 7° to 29° in their study which was near same to our study.

It has been reported that wound complications were higher in calcaneum fracture ranged from 0% to 15.4%^[14]. but in this study we got near 0% wound complications. Only one case from our study got incision edge necrosis which was recovered with dressing only. Yeo *et al.*^[15] reported 5% of sural nerve injuries using sinus tarsi approach. Compared to this study our sural nerve injuries are significantly less.

Conclusion

Sinus tarsi approach is very useful for displaced intraarticular calcaneal fractures because it provides very good visualization of the fracture and allows anatomical reduction of articular surfaces. And due to minimal invasive procedure wound related complications are very less so it is valid option for intra-articular calcaneal fractures.

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