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Minimally invasive techniques in treatment of fracture calcaneus

Mohamed Bissar[1], Faisal Hasan Yousef Zayed[1], Ahmed Mohamed Mostafa Ahmed [2]

[1]Professor at Department of Orthopaedic Surgery, Faculty of Medicine, Al-Azhar University, Cairo, Egypt
[2]Resident Doctor at Department of Orthopaedic Surgery, El-Fayoum General Hospital, Egypt
Email: a2magdo@gmail.com

Abstract: Calcaneum fractures accounts for about 2% of all body fractures. Minimally invasive fixation for displaced intra-articuler calcaneal fracutres was mainly used to overcome associated complications with open techniques such as infection and skin problems. Patient and method: the study was performed on twelve patients (6 male and 6 females) with displaced intra-articuler calcaneus fractures managed by lateral sinus tarsi approach and k wires fixation. the most common cause of injury was fall from height specially with heavy work. post operative follow up was performed for one year. Results: the mean Maryland score among cases was (86.8± 5.6) ranged between 75 and 96. Four patients were excellent representing 33.3% and eight patints were good representing 66.6%. the average time for k wire removal was 8 weeks (91.7%) and average time for full weight bearing in 11 cases was 12 weeks or less (91.7). Conclusion: minimal invasive fixation of displaced intra articular calcaneal fracures is an effective method with a low rate of complications if compared to open techniques.
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Key words: Calcaneal fracture, minimal invasive, percutaneous fixation,

Introduction

Calcaneal fractures accounts for 2% of all body fractures, 75% of these fractures are intra articular which can jeopardize work and day to day activity. (1)

Calcaneal fractures have multiple procedures for surgical interventions with different approaches and implants used. Many open surgical pparoaches have been described including lateral, medial and combined approaches. open methods are usually complicated with infection and soft tissue damage. (2)

Minimally invasive intervention was firstly used by west hues who introduced the method of closed reduction with percutaneous pinning fixation. This method was later modified and known as Essex-Lopresti technique. (3)

The aim of this study is to evaluate the efficacy and the outcomes of surgical treatment of displaced intra-articular fractures of the calcaneus using limited lateral approach and trans-articular k-wires fixation.

2. Patient and method:

Twelve feet of recent intraarticular fractures of the calcaneus were treated by minimal invasive percutaneous pinning. The patients were operated by multiple surgeons and followed up in Al Azhar university Hospitals & Fayoum General Hospital during the period between September 2016 to may2018.

All patients in this study were classified according to Essex-Lopresti classification.

Evaluation criteria:

Inclusion criteria:

Our inclusion criteria include all patients with intraarticular fracture calcaneus, with the following criteria:

1: Essex-lopresti joint depression type fractures.
2: Bad soft tissue condition and open injuries.

Exclusion criteria:

1: Old fractures (more than 2 weeks of trauma).
2: Extraarticular fractures.

Perioperative treatment and surgical technique:

Standard lateral and axial views were taken for evaluation of the fracture. CT scan was also done for the affected calcaneus for further evaluation and preoperative planning of the fracture.

The operation was carried out on 12 patients under spinal anesthesia.

All patients were placed on prone position with the foot protruding beyond the edge of the table so that fluoroscopy can be used intraoperatively.

All patients were operated using limited lateral approach (sinus tarsi approach). Straight skin incision is made about 1-2 cm at the talocalcaneal joint guided by flouroscopy.

The sural nerve and peroneal tendons can be identified and protected by retracting posteriorly.

If there is varus malalignment of the tuberosity fragement, loss of height or length of the calcaneus, a 5 mm Schanz screw is inserted into the calcaneal tuberosity from medial to lateral. With gentle manual distraction and varus-valgus levering, a closed reduction of the tuberosity is attempted.

Figure1: Intra-operative photo showing position during operation

Figure2: Intraoperative photo showing skin incision.

The lateral wall blow out is displaced laterally to get access to the depressed articular fragement (s) of posterior facet. If there is depressed medial articular fragment (s), they should be reduced and fixed before the lateral one. A small elevator is used to disimpact and rotate the depressed fragment by pulling it back and pushing it underneath the articular surface of the talus. Reduction assessment is checked by the use of flouroscopy.

Once the reduction is achieved, the articular fragment is fixed using k-wire (s) inserted percutaneously from the sole and passing through the indirectly reduced tuberosity, the reduced articular fragment and the subtalar joint to the talus (trans-articular k-wires fixation). The stability of fixation is checked intraoperatively.

The indirectly reduced tuberosity fragment is fixed using 2 k-wires inserted from both sides of achilles tendon insertion posteriorly and passed distally and somewhat laterally to the cuboid.

The lateral wall reduction is achieved and checked by lateral and axial fluoroscopic views.

The wires were bent above the skin level, the wire traction removed and the stab incision closed with sutures, a below knee splint was applied for immobilization and the lower portion of the operative side was elevated.

All patients were followed up at 2,6,8 weeks in the outpatient clinic. Plain x-ray of the calcaneus anteroposterior, lateral and axial views were obtained. At 8th week, the k-wires were removed and the patients were instructed to start subtalar range of motion.

At 12th week the patients were allowed to start weight bearing after assessment of fracture union both clinically and radiologically. Assessment of the patients by Maryland foot score was done starting from the 6th month postoperatively.

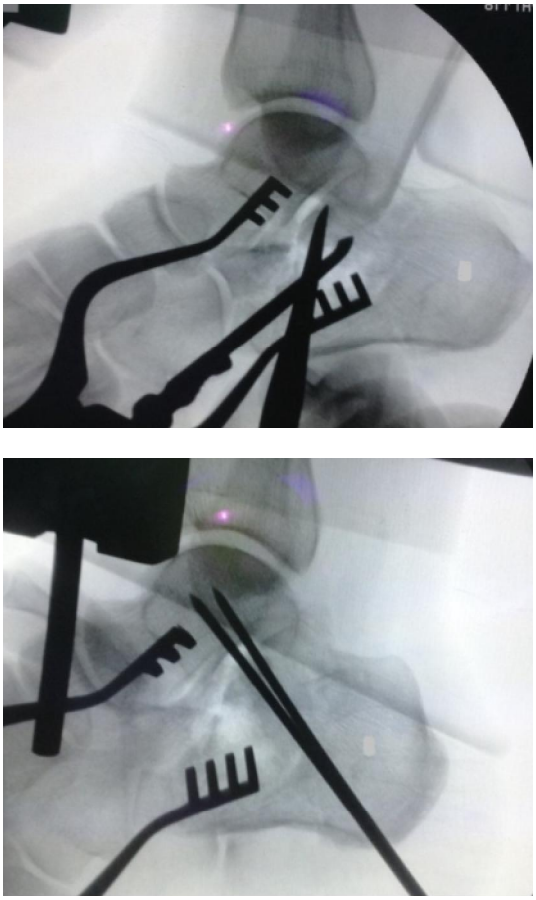


Figure3: Intraoperative fluoroscopic image showing the posterior articular facet after reduction and trans ariculer k wire fixation.

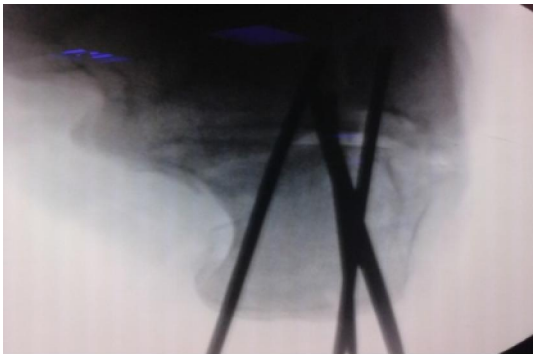
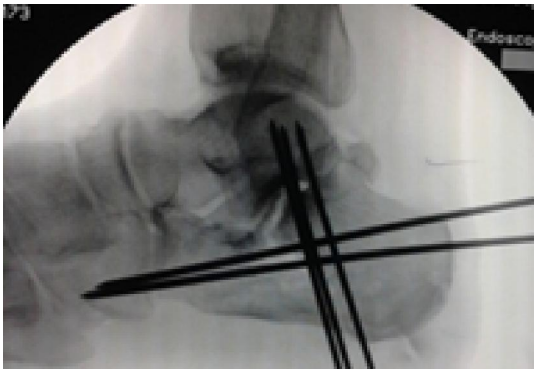


Figure 4: Intraoperative fluoroscopic images showing lateral (A) and axial (B) views of calcaneus after fracture reduction and fixation.

Figure 5: Intraoperative photo showing the wound after closure.



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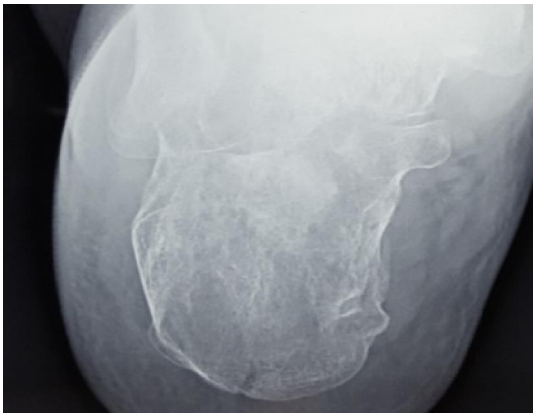

B

Figure 6: Plain x-rays, lateral (A) and axial (B) views of the calcaneus at the last follow up visit.

3. Results

The average age of our patients was 30 years with a range of 17:47 years. The mean follow-up period was one year. The average union period of fracture was 12 weeks with a range of 10–14 weeks. The average operative time was about 50 min with a range of 45–75 min. Also as regards full WB 91.7% show full WB in less than 12 weeks, versus 8.3% who show full WB after 12 weeks. As regards time of wire removal 91.7% remove it in less than 8 weeks, versus 8.3% who remove it after 8 week. The clinical results according to the Maryland foot score revealed four cases with satisfactory results (33.3%) and eight cases with good results (86.7%). Just one patient had superficial pin-tract infections around the K-wires that resolved completely with antibiotics.

4. Discussion:

Minimally invasive reduction and fixation of calcaneal fractures was developed to minimize complications and correct fracture deformity with good results compared to open techniques. [(4)]

In the current study, the limited sinus tarsi approach was used. This approach was sufficient to expose and reduce the displaced fracture of the posterior facet and the anterolateral fragment under vision. Indirect reduction of the tuberosity fragment was sometime performed. The low incidence of wound problems in this approach may be due to the small skin incision, minimal soft tissue dissection and more preservation of calcaneal vascularity as compared to the extensile lateral approach.

We presented a minimally invasive technique for the treatment of intraarticular, dislocated calcaneus fractures and were able to produce.

Results comparable to open techniques with a lower rate of serious complications. In the majority of cases, an almost identical Böhler angle and geometry of the calcaneus was achieved when compared to the

opposite side at the time of last follow-up. Simple removal of the Kirschner wires and shorter surgery time decrease patient stress and must be recognized as an advantage of this minimally invasive technique. Thus, we feel that our minimally invasive technique is a viable alternative for the treatment of intraarticular, dislocated calcaneal fractures.

Weber et al. (2008) proposed open reduction and internal fixation by plate and screws of displaced intra-articular fractures of the calcaneus for 50 patients. 26 patients were operated upon by the extensile lateral approach and 24 patients were operated upon by limited sinus tarsi approach. The overall clinical results were similar in both groups. However, The wound related complications occurred in 15.4% of patients in the first group and in 4.2%of patients of the second group. [5]

Holmes et al. (2005) stated that the limited sinus tarsi approach offers a minimally invasive incision with excellent exposure to accomplish the goals of fracture reduction and a relatively short operative time that minimizes the risk of soft tissue injury and he had not encountered any wound dehiscence, osteomyelitis, or wound infection. [6]

Ragab et al. (2014) proposed open reduction through limited sinus tarsi approach and Percutaneous trans-articular k-wires fixation for 42 displaced intra-articular fractures of the calcaneus. The results according to calcaneal fracture scoring system were Excellent in 9 patients (21.4%), good in 17 patients (40.5%), fair in 8 patients (19%) and poor in 8 patients (19%). There was significant relationship between Sanders classification and the final results. Subtalar arthritis was observed in eight cases (17.4%), CRPS occurred in two patients (4.3%), Decreased subtalar motion was significant in eight cases (17.4%) and mild in the other patients. No cases complicated with infection or wound complication. [7]

Patient satisfaction is an essential criterion for the successful treatment of calcaneus fractures. With a comparable follow-up period of 5.4 years, Thermann et al. reported that 48.3% of patients viewed their treatment outcome as good or very good after open reduction of their calcaneus fractures, 37.3% of patients judged their treatment outcome as satisfactory and sufficient and 14.4% judged their outcome as insufficient. [8]

Our treatment method had comparable results with 33.3% of patients considering their treatment outcome excellent, 66.7% as good.

Conclusion:

Anatomical reduction for intra articular calcaneal fractures is essential for better functional results. Limited lateral approach is an effective approach for reduction of intra articular calcaneal fractures. This approach is sufficient to expose and reduce the displaced posterior facet and anterolateral fragment. As compared to the extensile approach, it has the advantage of being less invasive with less wound healing related complications.

Percutaneous trans-articular k-wires fixation is an efficient method for fixation of joint depression calcaneal fractures. It has the advantages of being less invasive, easier and the absence of problem of pain at the site of implants used for internal fixation that may require second stage operation for removal. However, this method of fixation requires postoperative immobilization for 8 weeks and abolishes the possibility of early range of motion.

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