



Percutaneous Locked Plate Fixation of Displaced Intra Articular Fractures of Calcaneus through Sinus Tarsi Approach- A Case Series with a Technical Note

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Received Date: May 12, 2023; **Published Date:** July 07, 2023

Abstract

Plate fixation with conventional lateral L-shaped incision is associated with skin necrosis and dehiscence. To overcome this problem sinus tarsi approach is now used for intra-articular calcaneus fracture osteosynthesis. Fracture fixation with the sinus tarsi approach requires a special calcaneal locking plate which is expensive as well as not readily available. Hence, we worked with locally made 1/3rd tubular plates/ reconstruction plates and CC screws through a sinus tarsi approach, in a minimally invasive plate osteosynthesis (MIPO) mode, to fix intra-articular calcaneus fractures. In this study, we present 4 cases of intra-articular calcaneus fractures managed with a sinus tarsi approach and 1/3rd tubular plate/ reconstruction plates. Calcaneal Bohler's angle, and Gissane angle were measured preoperatively, postoperatively, and at 2-year follow-up. Functional outcomes were assessed based on American Orthopedic Foot and Ankle Society (AOFAS) ankle/hindfoot score. By this study we conclude that Intra Articular calcaneus fracture can be fixed percutaneously using a 1/3rd tubular plate/ reconstruction plate and CC screws, rather than a special calcaneal plate, through a sinus tarsi approach, which gives good intraoperative reduction/fixation and good functional outcome.

Keywords: Sinus Tarsi Approach; 1/3rd Tubular Plate; Reconstruction Plates; American Orthopedic Foot and Ankle Society (AOFAS) ankle/hindfoot Score; Percutaneous Fixation

Abbreviations: AOFAS: American Orthopedic Foot and Ankle Society; MIPO: Minimally Invasive Plate Osteosynthesis.

Introduction

Calcaneus fractures comprise 60% of all tarsal bone fractures [1]. High-energy axial trauma such as motor vehicle accidents and fall from height are responsible for calcaneal fractures. Sixty to 75% of calcaneal fractures are displaced intra-

articular fractures [2,3]. Previously non-operative treatment was favored by orthopaedicians but due to unsatisfactory results, nowadays osteosynthesis is the treatment of choice for displaced intra-articular calcaneal fractures.

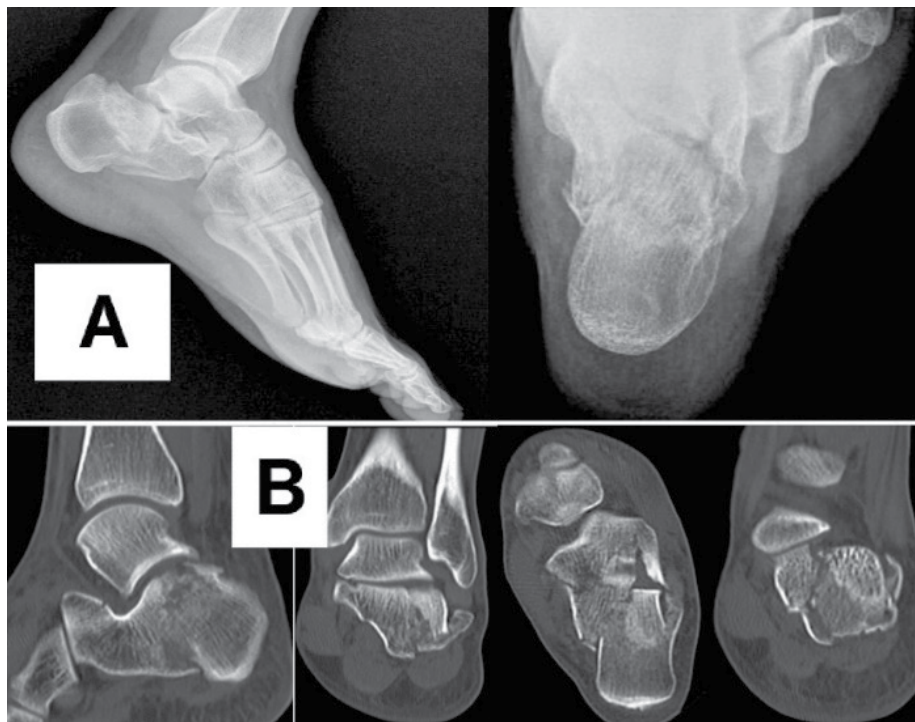
Different approaches were used for the osteosynthesis of these intra-articular fractures. The extended lateral incision is associated with multiple complications such as skin edge necrosis, wound dehiscence, and deep wound infections [4].

In recent times sinus tarsi approach has become popular among surgeons. For fixation through the sinus tarsi approach special plates are required, which are not readily available and are also expensive. The purpose of our study is to use a 1/3rd tubular plate or reconstruction plate, in a minimally invasive plate osteosynthesis (MIPO) mode, through the sinus tarsi approach, to fix intraarticular calcaneal fractures, and assess their radiological and functional outcomes. We retrospectively analyzed a case series of 4 patients using this technique with a locally made 1/3rd tubular or reconstruction plate. All patients were followed up for a minimum of two years.

Case presentation

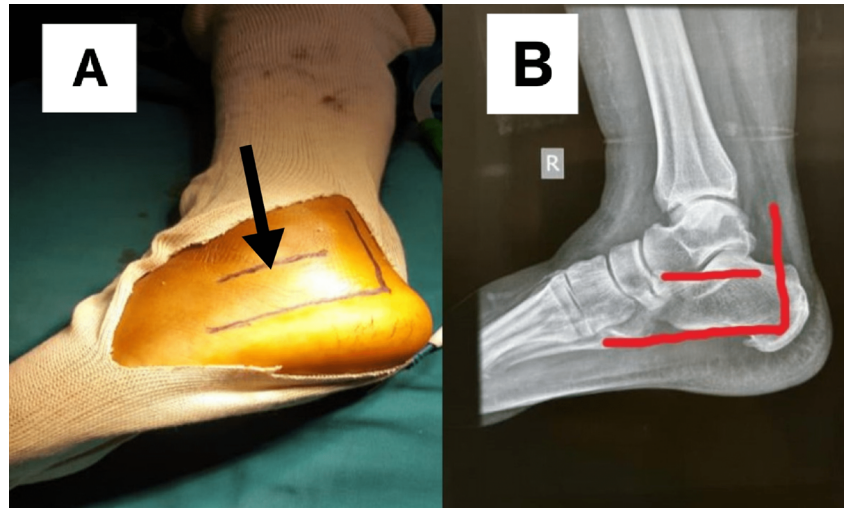
Case 1: 39-year-old male, supervisor by occupation presented with a history of fall from height and had left calcaneus Essex Lopresti joint depression type fracture. After the medical fitness and CT scan (Figure 1) diagnosis of Essex Lopresti joint depression type fracture confirmed and osteosynthesis

was planned. In the operation theater, the patient was in a supine position with a sandbag under the ipsilateral hip. Scrubbing, and painting and draping were done. The incision was taken for the sinus tarsi approach (compared with an extended L-shaped incision) (Figure 2). Provisional reduction and fixation of anterior fragment and tuberosity was done with Steinmann pin and K wire. Reduction of the depressed thalamic part was done with elevation by osteotome and fixation was achieved with cannulated cancellous screws (Figure 3). 1/3 rd tubular plate was Slides underneath along the lateral cortex was performed by subperiosteal dissection, use of a spike, and lifting of peroneal tendons to either side. Percutaneous insertion of the distal and proximal screws by initial cortical screw and subsequent all by locking screws, through stab incisions was done. Strong fixation was achieved with a 5-holed plate through a small incision. Good reduction of the fracture and good placement of all implants was confirmed under the C-arm (Figure 4).



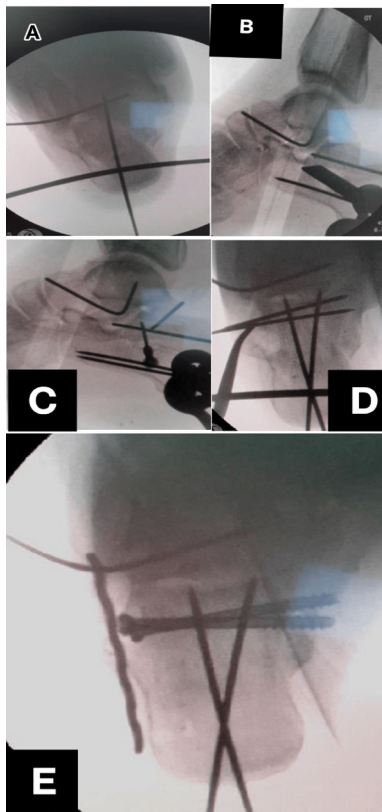
Source: Preoperative X-ray AP and Axial view of calcaneus (A) shows Depression type intra-articular fracture and CT scan (B) of foot shows comminuted intra-articular calcaneus fracture.

Figure 1: Preoperative X-ray (A) and CT (B) of the patient.



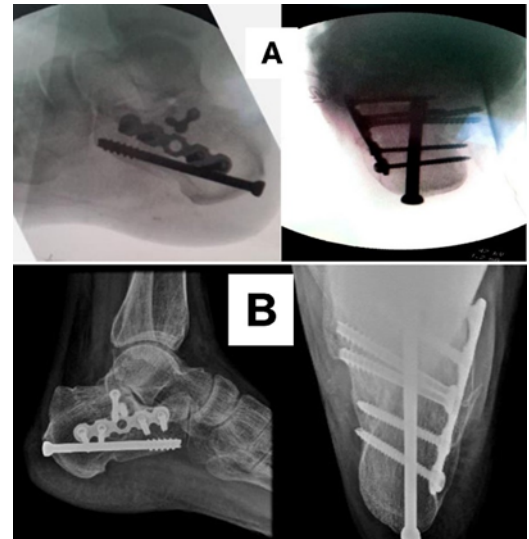
Source: In Figure A shows marking of skin incision, as compared to conventional extended L shaped incision this sinus tarsi approach incision (arrow) is small and minimally invasive, Same comparison shown on X-ray (Figure B).

Figure 2: Comparison between L- shaped and sinus tarsi approach incision.



Source: Figure A to E shows sequential intraoperative C-arm images in which first provisionally elevation of depressed maintained with K wire and finally fixed with 2 CC screws. Through the same incision reconstruction plate subperiosteally inserted (E).

Figure 3: Intra-operative C-arm images (A-E)



Source: Final C-arm images of the calcaneus (A) show complete restoration of joint with elevation of depressed fragment and stabilized with reconstruction plate. Follow up X-ray of the same patient (B) shows congruency of subtalar joint and maintenance of Bohler's and gissane angle.

Figure 4: Final C-arm images (A) and follow up X-ray images of the patient.

The wound was washed thoroughly, and closure was done with monofilament nylon. A well-padded slab was applied. Limb elevation was maintained in the postoperative course. Physiotherapy was started the next day with non-weight-bearing ambulation. Patient discharged on postoperative

day 4. After 2 sequential dressing on day 2 and day 7 suture removal was done on day 15 which was healthy without any sign of gape. The patient was kept non-weight bearing for 6 weeks. X-rays were done sequentially and the final one was at 2 yr. follow up which showed a congruent subtalar joint, and appropriate angles of Gissane and Bohler. Also, clinical photograph shows minimally invasive incision scar without any complication (Figure 5).



Figure 5: As arrow indicate skin incision scar is healed completely without any complications and cosmetic appearance.

Case 2: 45-year-old male patient presented with a history of fall from height, and had a left calcaneus joint depression type fracture, which was managed with 2 cannulated cancellous screws and 1/3rd tubular plate (Figure 6). He was followed up for 2 yrs and functional and radiological outcomes were measured with AOFAS score.

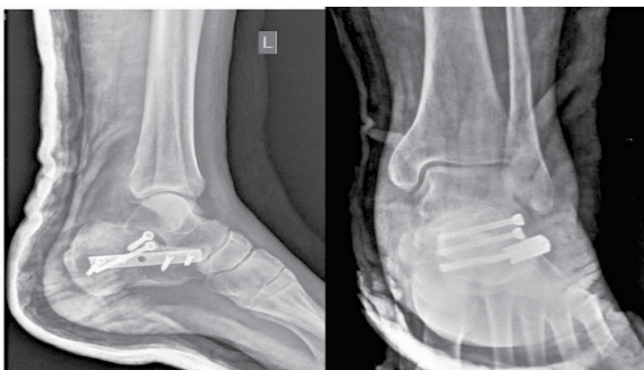


Figure 6: AP and Lat view shows fixation done with 2 CC screws and 1/3rd tubular plate with joint congruency.

Case 3: 52-year-old female patient with a history of road traffic accident, presented with right calcaneal fracture, was

surgically treated with 2 cannulated cancellous screws and K wires in addition to 1/3rd tubular locking plate (Figure 7). K wires were removed after 2 months. X-rays and functional outcome were satisfactory at the latest follow up.



Figure 7: AP and Lat view shows fixation done with 2 CC screws and 1/3rd tubular plate and further stabilized with 2 k wire which were removed after 6 week follow up.

Case 4: 28-year-old female fell from 1st floor, presented with left calcaneus intra-articular depressed fracture. The patient was managed with 2 cannulated cancellous screws and an Indian made reconstruction plate through the same sinus tarsi approach (Figure 8). Postoperatively and during follow up X-ray finding as well as clinical outcome was assessed which were satisfactory.

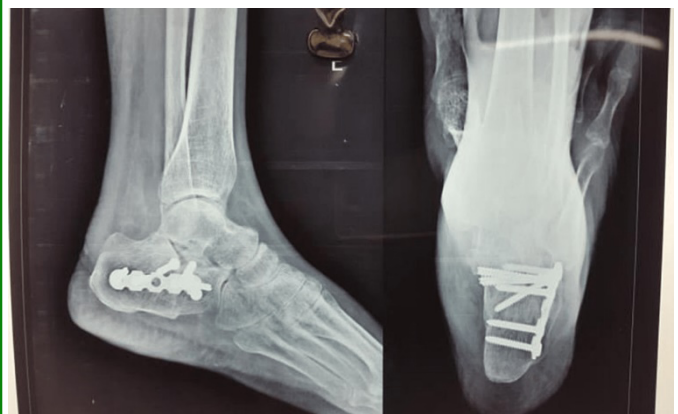


Figure 8: AP and Lat view shows fixation done with 2 CC screws and reconstruction plate with subtalar joint congruency.

We studied clinical and radiological outcomes of all cases (Table 1).

Patient	Follow up	AOFAS Score	Bohler's angle	Gissanne angle
Case 1	2 Years	AOAFS 87	25	125
Case 2	2 Years	AOAFS 87	25	135
Case 3	2 Years	AOAFS 85	25	125
Case 4	2 Years	AOAFS 91	30	120

Table 1: The radiological and functional outcome of all 4 cases with AOFAS score

Discussion

Various approaches have been described to fix the intra-articular calcaneal fractures such as extended lateral approach, medial approach, medial and lateral combined approach and a sinus tarsi approach [5]. In 1948, Palmer originally introduced a laterally based approach through the sinus tarsi for direct visualization of the articular surface for reduction. He and other authors proved this approach to be useful and reasonably safe [6]. In 2005, Holmes described the minimally invasive sinus tarsi approach for depressed calcaneal fractures. He reported that the sinus tarsi approach provides adequate exposure to achieve successful reduction and fixation without any wound infection, wound dehiscence, or osteomyelitis, over 18 years [7]. The extensile lateral approach provides excellent visualization of the fracture site but is associated with high rate of wound complications (2% to 27%). Osteosynthesis through sinus tarsi approach achieves nearly the same adequate restoration of displaced intra-articular calcaneal fractures along with similar functional outcomes compared with an extensile lateral approach.

In this case series, we have combined the advantages of the sinus tarsi approach and the advantages of a strong fixation given by a locked plate. It is shown here that the standard 1/3rd tubular locking plate or a locking reconstruction plate can be positioned by the MIPO technique which in our search has not been published earlier. The results are good as shown by AOFAS scores, at adequate follow-ups with no wound complications. The technique of a minimally invasive 1/3rd tubular plate or reconstruction plate fixation is executed through the sinus tarsi approach, which has been demonstrated to be effective in decreasing the risk of acute or secondary postoperative complications, like infections or hardware failure [8].

Conclusion

Intra articular calcaneus fracture can be managed with a locked 1/3rd tubular plate/ reconstruction plate used in

percutaneous (MIPO) mode, rather than special calcaneal plates which may not be available everywhere, by opting for the sinus tarsi approach. This technique gives good intraoperative reduction and good functional outcomes.

Conflict of Interest

No conflict of interest exists.

Patient Consent Form

All patients consents related case series has been taken and the permission from concerned patients granted for this study.

References

1. Zwipp H, Rammelt S, Barthel S (2004) Calcaneal fractures--open reduction and internal fixation (ORIF). *Injury* 35(2): SB46-54.
2. Sanders R (2000) Displaced intra-articular fractures of the calcaneus. *J Bone Joint Surg Am* 82(2): 225-250.
3. Besch L, Schmidt I, Mueller M, Wredenhagen MD, Hilgert RE, et al. (2008) A biomechanical evaluation to optimize the configuration of a hinged external fixator for the primary treatment of severely displaced intraarticular calcaneus fractures with soft tissue damage. *J Foot Ankle Surg* 47(1): 26-33.
4. Meng Q, Wang Q, Wu X, Peng A, Yan J (2018) Clinical application of the sinus tarsi approach in the treatment of intra-articular calcaneal fracture. *Medicine (Baltimore)* 97(13): e0175.
5. Buckley RE, Tough S (2004) Displaced intra-articular calcaneal fractures. *J Am Acad Orthop Surg* 12(3): 172-178.
6. Lopresti PE (1952) The mechanism, reduction technique, and results in fractures of the os calcis. *Br J Surg* 39(157): 395-419.
7. Roukis TS, Wünschel M, Lutz HP, Kirschner P, Zgonis T (2008) Treatment of displaced intra-articular calcaneal fractures with triangular tube-to-bar external fixation: long-term clinical follow-up and radiographic analysis. *Clin Podiatr Med Surg* 25(2): 285-99.
8. Yao H, Liang T, Xu Y, Hou G, Lv L, et al. (2017) Sinus tarsi approach versus extensile lateral approach for displaced intra-articular calcaneal fracture: a meta-analysis of current evidence base. *J Orthop Surg Res* 12(1): 43.