

## Minimally Invasive Sinus Tarsi Approach for Open Reduction and Internal Fixation of Intra Articular Calcaneal Fracture with Subtalar Joint Depression

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### Abstract

Diagnosis and surgical treatment of displaced intraarticular calcaneal fractures have long been hotly debated topics in orthopaedics. In these individuals, it's important to keep an eye out for any soft tissue issues or coexisting diseases. Stability, anatomic reduction of the fracture, and preservation of soft tissue may all be achieved with the minimally invasive sinus tarsi technique. 31 individuals with 34 fractures were included in our research, with an average age of 34. (type II 47 percent and type III 53 percent ) There was a mean follow-up time of 20.45 months, a mean AOFAS of 91.38 percent, and a mean MFS of 94.79 percent for all patients. A less invasive incision allows for better vision and anatomic reduction of the articular surfaces while minimising the risk of complications.

**Keywords:** Fracture calcaneus, Sanders, Sinus tarsi, Limited open, Intra-articular fractures, Less invasive.

### 1. Introduction

Most severe tarsal-bone fractures involve calcaneum fractures, which have been linked to considerable and long-term impairment in several studies. More than half of all tarsal injuries and more than seventy percent of all calcaneal fractures are caused by calcaneum fractures that occur inside the joint. There are a large number of intraarticular fractures of the posterior articular facet (the subtalar joint). There are a variety of axial load injuries that may be connected with these fractures, including lumbar, pelvic and tibial plateau fractures, but they are all caused by falls or car accidents. The treatment of individuals with calcaneal fractures is the subject of several debates. A lack of clinical data supports the use of surgery for some patient categories, yet reports of long-term problems and negative results are common. 1. Periods of excitement for surgical intervention followed closely by periods of advocacy for closed therapy techniques define the history of treatment for these fractures. The evidence reveals that non-operative treatment results in a poor outcome for patients. Failure to sustain reduction and loss of position is the primary cause of unsatisfactory outcomes, which may lead to widening of the hind foot, reduced mobility in the subtalar joint and muscle balance, impingement of peroneal tendons or secondary osteoarthritis in the lower leg. There has long been disagreement regarding the most effective method of treating these fractures. 2,3. While a lateral extensile approach to open reduction and

internal fixation has been the most popular method of therapy, it is not without its drawbacks. In 1935, Westhues devised a minimally intrusive method for treating tongue type fractures, which was later improved upon by Gissane and popularised by Essex-Lopresti 4. To reduce the risk of complications, we've developed a minimally intrusive approach for treating complicated fractures. Furthermore, in cases like this, the primary goals are to restore the congruity of the calcaneus and the subtalar joint, to restore height of the calcaneus (Bohler's angle), to re-establish integrity of the calcaneoid joint, to decompress retro-peroneal space, and to avoid varus or valgus deformities.

### 2. Materials and methods

This prospective study was conducted on all adult patients admitted to our unit with displaced intra articular fracture calcaneus during the period between December 2017 and December 2021. We included unilateral isolated simple fractures in patients between 14 and 60 years of age. We excluded Sanders type I fractures that were treated conservatively and Sanders IV severely comminuted fractures. Initial clinical examination included assessment for the presence of soft tissue injuries, associated fractures and neurovascular compromise. Radiographic assessment included standard plain films and CT scans. All fractures were subsequently classified according to Sanders classification 5 Table (1).

**Table (1)**

<b>Age</b>	Mean	34.25
	Range	14–60
<b>Sex</b>	Males	23
	Females	8
<b>Side</b>	Right	17
	Left	11
	both	3
<b>Essex-Lopresti</b>	Tongue type	2
	Joint depression type	32
<b>Sanders</b>	II	16
	III	18

### Surgical technique

All patients were placed in the prone position with the affected foot hanging from the edge of the operating table, tourniquet was used and Using the image intensifier, A 4–5-cm incision directly over the sinus tarsi starting from the tip of the lateral malleolus directed towards the calcaneocuboid joint was performed. Dissection was carried carefully proximally to avoid injuring the calcanofibular ligament (CFL) and the peroneal tendons and distally to avoid injuring the sural nerve Fig. (1 a). exposure of the posterior facet, the angle of Gissane and the anterior process. using a blunt instrument to relocate the fragment in the anatomical position with respect to the more constant sustentacular fragment medially Preliminary fixation using K-wires and reduction was assessed using fluoroscopy Fig. (2 a). When satisfactory reduction was achieved, definitive fixation was then achieved using one or two 4.0-mm partially-threaded screws directed from lateral to the strong sustentaculum fragment). A 5.0-mm Schanz pin was later introduced into the calcaneal tuberosity from medial to lateral. Distraction with manual correction of the varus malalignment was then performed; this results in restoration of the calcaneal width, length and height which was confirmed fluoroscopically. Two parallel 3.2-mm drill bits were then placed from two separate small skin incisions on both sides of the insertion of the tendo-Achilles directed postero-anteriorly towards the calcaneocuboid joint then replaced with two 4.5-mm positional screws maintaining the calcaneal length and alignment. Finally, another two 4.5-mm screws were directed to raft the elevated posterior facet and maintain the calcaneal height Fig. (1 b,c,d,e,f). closure of the wound was done in layers The patients were placed in a compression bandage for the first two weeks and At the two-weeks visit, the wound was inspected and if satisfactory, the stitches were removed and a short leg cast was applied. Partial weight-bearing was started at six weeks then progression to full weight-bearing was gradually achieved around ten weeks Fig.(1g,h).

All patients were evaluated both clinically and radiologically. Clinically, patients were evaluated using the American Orthopedic Foot & Ankle Society (AOFAS) ankle-hindfoot scale and the Maryland foot score (MFS) 6 as well as the presence of any complication documented.

### 3. Results

Thirty-one patients with a mean age of 34 years were included in our study Table (1). The mean time from injury to operation was 8.5 days (range one–18 days). The mean follow-up period was 20.45 months (range 6–45 months). In all cases, adequate reduction of the fracture, including regaining of the calcaneal length, width and height as well as anatomical reduction of the intra-articular fragments with restoration of the congruity of the subtalar joint was reached Figs. (1) We had no cases of failure of reduction or displacement of hardware. No patients developed significant subtalar arthritis that warranted subtalar arthrodesis During the follow up period, there was a single case of superficial wound infection with the removal of the screws. The patient was treated by repeated dressings and antibiotics. 14 patients complained of “pain and tenderness” in their feet. After further assessment, 7 patients complained of tenderness at the sites of the posterior screws and their symptoms were relieved by removal. The other seven patients were diagnosed as complex regional pain syndrome (CRPS) as denoted by prolonged pain in the hind foot especially with weight bearing. There was neither clinical nor laboratory evidence of infection. Those patients were treated by physiotherapy and medical treatment. Only one patient complained of sural nerve dyesthesia which was treated conservatively and improved in 4 month. One patient had mild clawing of the toes which caused neither cosmetic nor functional problem to the patient and no treatment was given. The overall results according to AOFAS ankle / hindfoot and Maryland scores are summarized in Table (2) the mean AOFAS WAS 91.38 and the mean MFS was 94.79.

**Table (2)**

<b>AOFAS</b>	no	%
excellent(90-100)	24	70.5
good (80-90)	8	23.5
fair (70-80)	1	2.94
poor (lessthan 70)	1	2.94
<b>MFS</b>		
excellent(90-100)	29	85.29
good (75-89)	4	11.76
fair (50-75)	1	2.94
poor (lessthan50)	0	0

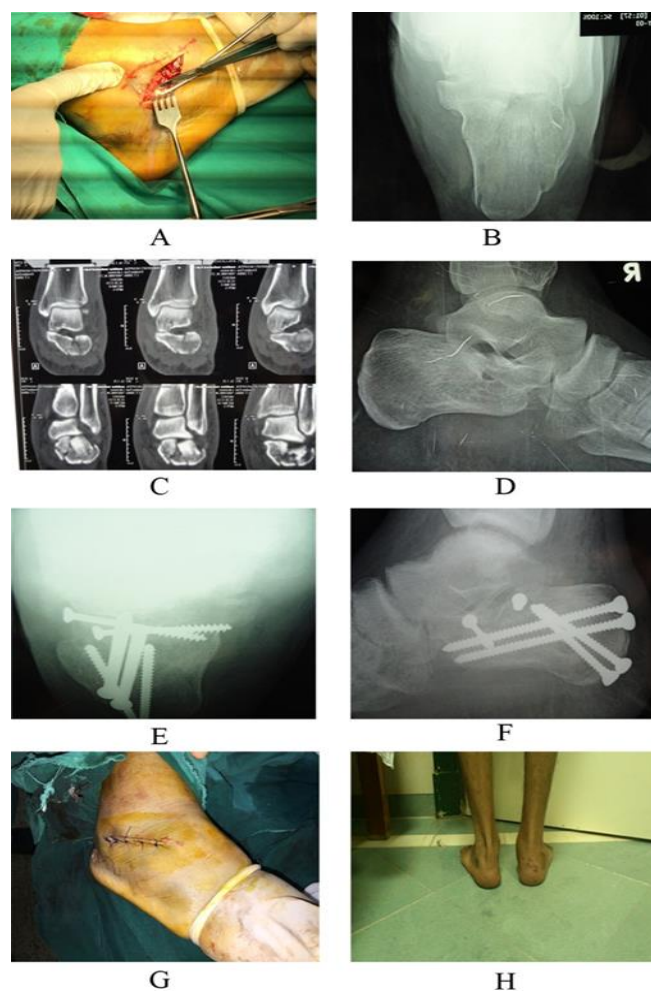


Fig. (1)

#### 4. Discussion

Intra-articular calcaneal fractures are often treated surgically using the extensile lateral technique. The subtalar joint may be anatomically reduced while the whole calcaneus can be seen. Despite this, wound complication rates are significant [7–11]. At the location of the vertical incision, the lateral calcaneal artery (lca) has been damaged, resulting in ischemia and necrosis of the flap. A number of minimally invasive and percutaneous treatments have been developed in an effort to lower the incidence of wound complications. Since less exposure is available with percutaneous procedures, correct reduction of the articular surface is more difficult to achieve, and intraoperative fluoroscopy must be used to monitor the reduction. palmer et al. published their findings in 1948. Open reduction of calcaneal fractures through the sinus tarsi was performed using a direct lateral approach, and the outcomes were positive. There was also an interesting study published in 2008 by weber and colleagues [7] in which 24 patients had open reduction and percutaneous fixation using the standard extensile method for open reduction and percutaneous fixation. There were no significant differences between the groups in the length or breadth of the calcaneal heel after an average follow-up period of 31 months. The sinus tarsi

technique, on the other hand, was shown to have less wound problems and a much quicker operating time. According to weber and coworkers, we used this method for our investigation. With a few tweaks. For all of our patients, we performed surgery in the prone position, which enabled us to see the posterior facet more clearly, as well as to avoid the use of any distractors and instead depended on manual traction to reduce the articular fracture first, then to re-establish its height and breadth. As a last step, we utilised four 4.5-mm positioning screws instead of 3.5-mm screws since we feel the bigger diameter of these screws allows for a better defect filling (4 mm more) without causing any damage. 94% of our participants achieved excellent-to-good scores on the AofAs. Compared to weber et al., our investigation revealed that the scores in our study were higher. According to which 87.2 percent of the students achieved outstanding to good marks on the Aofas test. In our research, the mean mfs was 94.79, with 97% of the participants achieving outstanding outcomes. 15. The essex-lopresti method for percutaneous treatment of tongue-type and sanders iic fractures was re-popularized by tornetta et al. in 1998. The mfs found that 55% of patients had outstanding functional outcomes, whereas 32% had good results [20,21]. gavlik and co. The mean

aofas and mfs scores of 15 patients with just sanders type ii fractures treated by the percutaneous arthroscopic aided approach were 93.7 and 95.8 respectively. The creighton-nebraska health foundation evaluation score was used in 18 separate studies to evaluate patients treated with percutaneous k-wires fixation through a minimally invasive technique. Another research found that 83.919 excellent-to-good outcomes were achieved in 85% of the cases. Aofas and mfs scores of 84 and 86, respectively, were reported by forgon 5 at a mean follow-up of 66 months by tomesen et al. [20]. In addition to the previous investigations, our study showed that restricted open and percutaneous methods may effectively treat displaced intraarticular calcaneal fractures.

We thought that the limited open strategy would be more useful in sanders type ii than type iii since the restricted approach wouldn't allow for effective exposure of the central fragment in type iii. Screw fixation was also assumed to be inadequate for three-part fractures, which are more common than two-part fractures. There were no statistically significant differences found when comparing the two fracture types for the two grading systems, proving that this was not the case. When addressing the therapy of calcaneal fractures, wound complications are the most undesirable. A superficial wound infection was the only postoperative complication in our research. 19 247 individuals were treated using a minimally invasive technique and percutaneous fixation by K-wires in another research by stulik and colleagues. Overall, they found that 8.7 percent of the wounds they examined had wound complications, with severe infection accounting for 1.7 percent. It was shown that 107 calcaneus fractures were repaired using either single or multiple pins when they were treated using the sinus tarsi method [7]. The infection rate of their wounds was 8.5%. In all percutaneous methods of calcaneal fracture fixation, the posterior scar above the screw heads is prone to discomfort, which necessitates the use of headless or bioabsorbable screws.

## 5. Conclusion

Calcaneal fractures may be fixed using the sinus tarsi technique, which is less intrusive. The fracture may be seen clearly, and the articular surfaces can be reduced anatomically. In addition, the classic extensile lateral approach's significant wound complication issues are completely circumvented. displaced intra-articular calcaneal fractures may be treated this way.

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