

## Surgical Outcome of Percutaneous Fixation for Calcaneal Fractures in Adults

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**Abstract:** The management of displaced intraarticular calcaneal fractures has posed a challenge to the trauma surgeons for more than a century. Undisplaced fractures are treated with conservative approach while displaced ones need surgical interventions like minimally invasive percutaneous fixation, open reduction and internal fixation (ORIF) with plating. The aim of the percutaneous method is to improve functional outcome and to diminish the rate of secondary posttraumatic arthrosis compared to conservative treatment and, secondly, to reduce infectious complications and soft tissue compromise compared to ORIF with plating. In our study 10 patients with displaced intra-articular calcaneal fractures Sanders type II and Tongue types are managed by percutaneous screw method. Lateral wall expansion was managed by manual compression. Tuberosity fragment was elevated by percutaneously placed Steinman pin to restore Bohler's angle under fluoroscopic guidance and thereafter reduction was maintained by two cannulated cancellous screws introduced on either side of Steinman pin. Post operative outcome was assessed by using Maryland Foot Score. Majority of the cases produced good result as per MFS without any failure.

**Keywords:** Cannulated cancellous screw, close reduction, percutaneous method, Steinman pin

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### I. Introduction

Intraarticular calcaneal fractures comprises of approx 75% of all calcaneal fractures. The ideal choice of treatment for displaced intraarticular calcaneal fractures has been controversial for centuries[1]. The outcome of intra-articular calcaneal fractures is influenced by the soft tissue status and specially the subtalar joint congruity as is evidenced from numerous studies that anatomic restoration of the calcaneal shape and subtalar joint congruity predict higher functional scores and a lower incidence of posttraumatic subtalar arthrosis with potentially less need of secondary subtalar fusion[2]. Extraarticular and undisplaced fractures can be managed by conservative approach but for intraarticular displaced fractures definite fixation is needed either by minimally invasive percutaneous method or open reduction and internal fixation by plating which is associated with high soft tissue compromise and infection rate[3] compared to percutaneous method. Westhuses proposed less invasive procedure in 1935. This practice was propagated and practiced by Essex – Lopresti by minimally invasive technique for tongue type fracture. Forgon and Zadavec introduced minimally invasive technique with an external distractor followed by percutaneous fixation[4]. In this study we have performed percutaneous technique in Sanders type II fractures that has produced good functional outcome in majority of cases as per Maryland Foot Score.

### II. Materials & Methods

This is a Institution based prospective study that includes 18 to 75 yrs old patients with Sanders type IIA, IIB, IIC close fractures attended in our OPD without any comorbidity and life threatening injuries. Patients were followed up for 1.5 years. Imaging technique used was Skiagram, CT Scan. Radiological parameters used are Bohler's angle and Gissane angle. Clinical parameters are heel broadening, shortening of heel height. Maryland Foot Score is used for functional assessment. After proper preanesthetic check up patients were posted for operation. Average injury surgery interval was 7 days. Instruments used in this technique are cannulated cancellous screws (6.5mm and 4mm), 6mm Steinman pin, guidewires, power drill, C-ARM machine. Operations were conducted under regional anesthesia (spinal anesthesia). Patients were positioned semiprone and later on changed to full prone to have axial view. Half of the leg length was outside table. Proper dressing, draping done by following antisepsis protocol. 2.1 Operative steps Correction of Lateral expansion was attempted

by applying bimanual compression by surgeon's hands. Then a 6mm Steinman pin was introduced (fig.1) into posterior tuberosity fragment percutaneously through stab incision on skin under C-ARM guidance. We attempted to lift up (fig.2) the fragment to restore Bohler's angle and calcaneal height. After restoration of Bohler's angle two guidewires are introduced on either side of Steinman pin in subarticular plane (fig.3) upto anterior process under C-ARM guidance. The outer guidewire is placed as lateral as possible to prevent lateral expansion and medial guidewire is placed as per fracture and available bone mass. With cannulated drillbeat the fragment is drilled. Then two 4mm c.c screws of appropriate length are introduced along the guidewires to maintain the reduction (fig.4). Then Steinman pin is removed and its slot is used for introduction of a 6.5mm c.c. screw (fig.5).

## 2.2 Followup

Patients are discharged with advice of nonweight bearing atleast for 1 month and ankle range of movement exercise. Stitch removed on 14<sup>th</sup> day postop. Radiological and functional assessment are done at 1month, 6months, 12months and 18months. Patients are graded as per Maryland Foot Score. Partial weight bearing is allowed as per fracture type, bone quality and union status.



**Figure 1** showing percutaneous Steinman pin insertion



**Figure 2** showing restoration of Bohler's angle



**Figure 3** showing guidewire placement in subarticular plane



**Figure 4** showing 4mm c.c screw insertion.

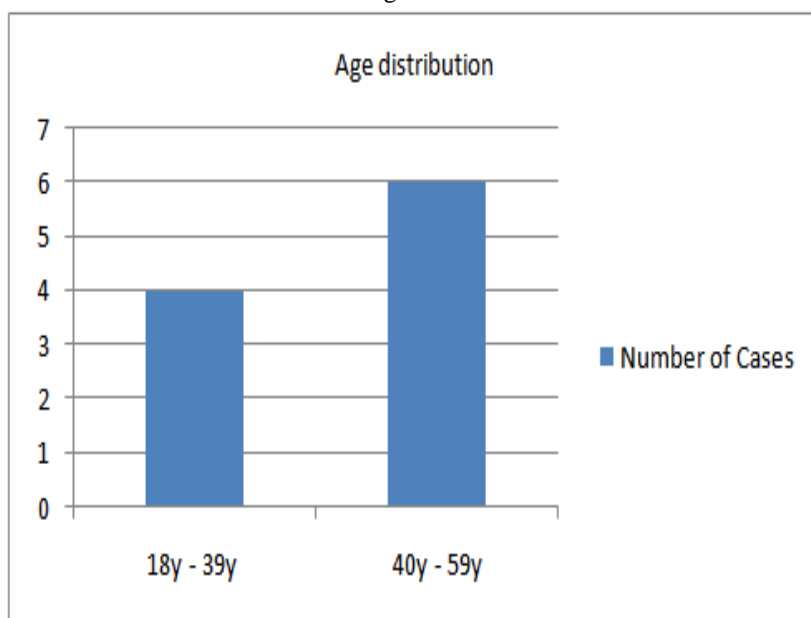


**Figure 5** showing 6.5mm c.c screw insertion through the slot of Steinman pin

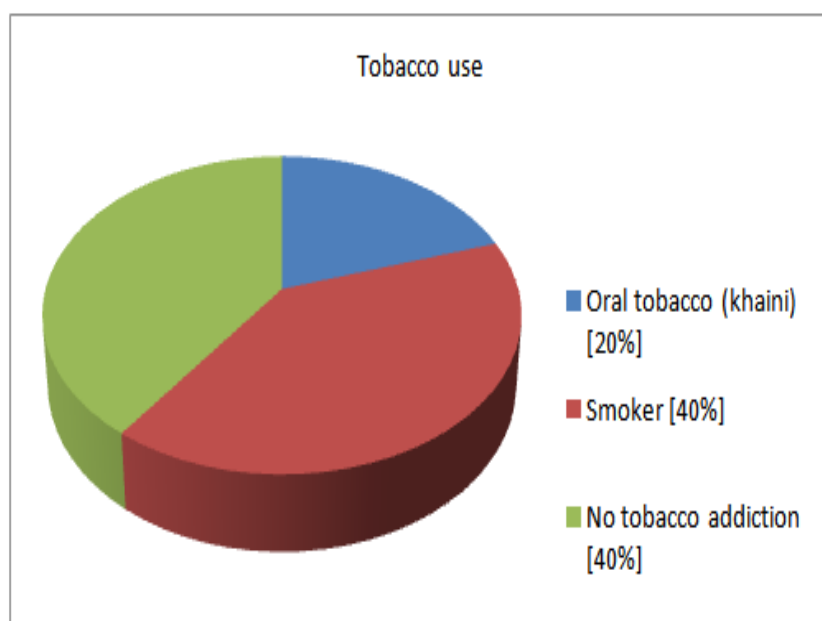
### III. Result And Analysis

In this study 60% patient was in 40 -59 age group and 40 % in 18 -39yr age group(diag.1).All patient had Sanders type II intraarticular calcaneal fractures and all of them are male. Regarding mode of injury,4 patients(40%) had high energy trauma and 6 patients had low energy trauma.Majority (60%) patients are tobacco user(diag.2). All patients are operated in semiprone position by percutaneuos screw method under fluoroscopic guidance.Patients are followed up for 1.5 years. Patients were graded as per Maryland foot score at 6<sup>th</sup>,12<sup>th</sup>, 18<sup>th</sup> follow up month .Average drop of Bohlers angle(diag.3& diag.4) at 6 month compared to post op day 1 was 5.09°.Average heel broadening(diag.5) was found to be 0.45cm.7 patients (63.6%) were complication(diag.6) free; 2 patient (18.2%) developed peroneal tendinitis,2 patients had hardware prominence.This study produced good result in 45.45%, excellent result in 27.27% cases,and fair result in 27.27% cases as per Mary Land Foot Score(diag.7 & Table1). There was no failure case.

3.1 Diagrams & table.



**Diagram 1** showing majority of cases are amongst 40-49age group



**Diagram 2** showing majority was tobacco user

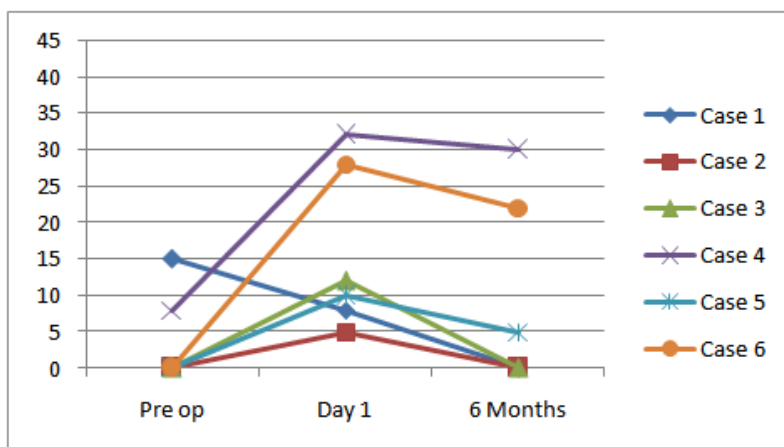


Diagram 3 showing Bohler's angle change with time of 6cases

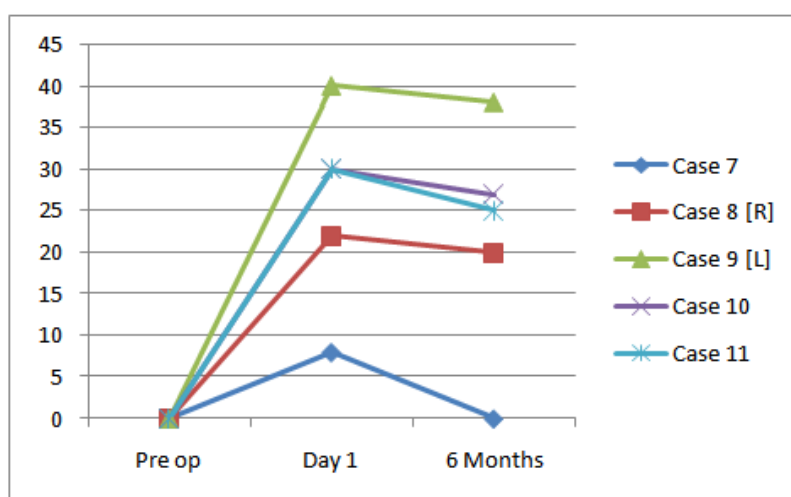


Diagram 4 showing Bohler's angle change with time for rest 4 cases

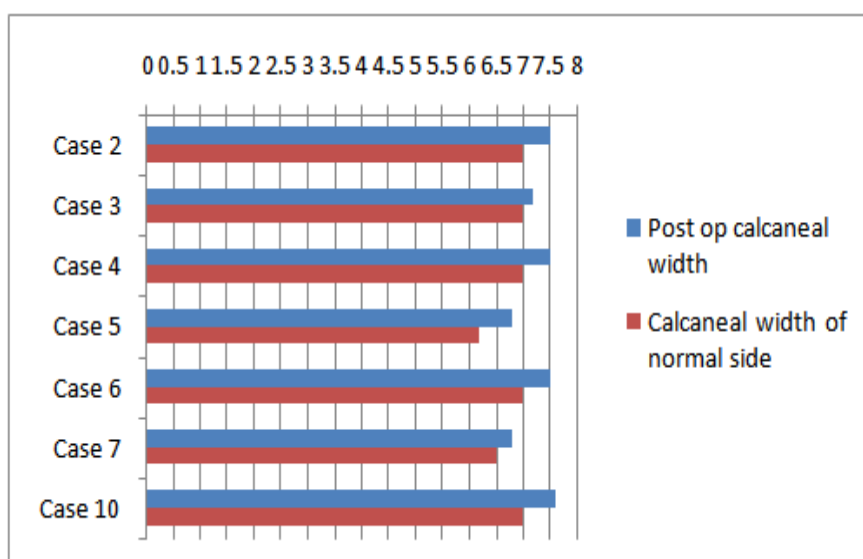
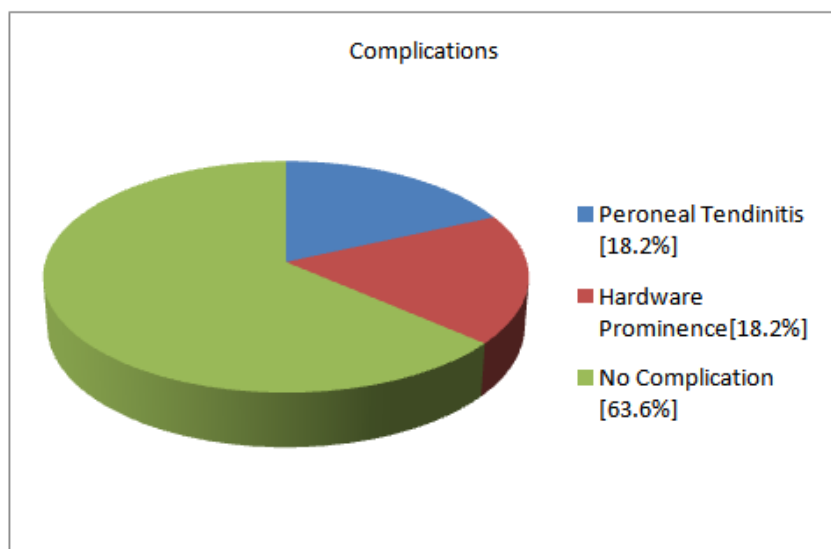
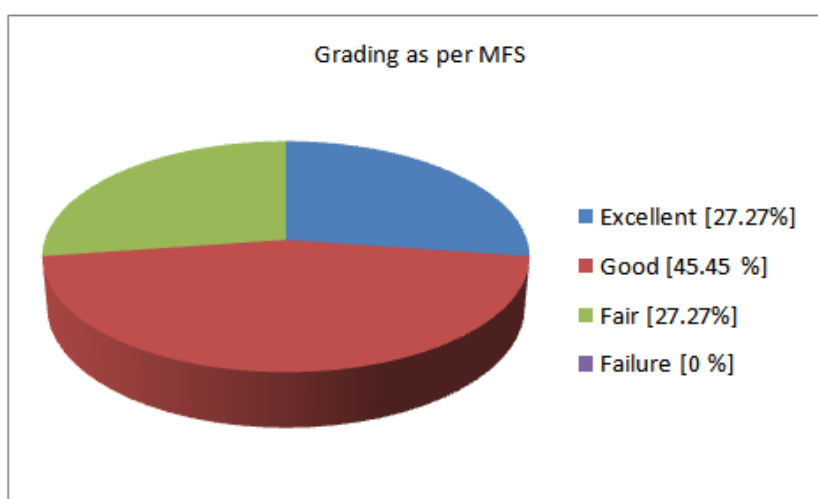


Diagram 5 showing calcaneal widening in respect to their normal side(case 1,8,9 are excluded as they had bilateral calcaneal injury)



**Diagram 6** showing various post operative complications and its percentage



**Diagram7** showing grading of cases as per Maryland Foot Score

Maryland Foot Score	Grading	Number of Cases	Percentage
90-100	Excellent	3	27.27
75-89	Good	5	45.45
50-74	Fair	3	27.27
<50	Failure	0	0

**Table 1** showing MFS grading

#### IV. Conclusion

There are myriads of opinion ,techniques already applied for intra articular calcaneal fracture management nevertheless it keeps throwing challenge to trauma surgeon .Newer horizon of ideas are upcoming. In our study we have produced good result in majority of cases. So, we can conclude, though our sample size is small , that Percutaneous technique is an useful method for treating Sanders type II calcaneal fractures to achieve an acceptable functional outcome and it is also a safe method as because in this technique, chance of post operative infection and soft tissue compromise is considerably low even in known tobacco user where plating is contraindicated.

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