

Comparative Study of Calcaneal Fractures Treated with Percutaneous Screw Fixation and Plate Fixation

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Abstract: ***Introduction:** About 1%–2% of all fractures are calcaneal fractures, which are the most common injuries to the tarsal bone. The subtalar joint is involved in about 75% of intra-articular calcaneal fractures. The most frequent way for an injury to occur is from a fall that strikes the heel squarely. There are several ways to treat calcaneum fractures, including Kirschner wire fixation, percutaneous cannulated screw fixation, and plate fixation, however no one technique has shown to consistently produce positive outcomes. **Material and Methods:** Patients with calcaneal fractures who were admitted to Narayana Medical College and hospital between June 2022 and Oct 2023 were evaluated for this retrospective analysis. For some of these patients, percutaneous screw fixation was the method of treatment; for the remaining patients, plate fixation was employed. Twenty patients in one group and twenty in the other met the inclusion criteria. The groups were categorized using Sanders classification, age, sex, and the mechanism of injury, among other factors. The average interval between admission to the hospital following an injury and the start of operation was four days. **Discussion:** In the past, conservative management of calcaneum fractures was thought to be the best course of action. But over time, a number of internal fixation techniques began to produce outstanding outcomes. In contrast to the 0 patients in the plating group, 12 (or 60%) of the patients in the percutaneous cc screw fixation group in our study had outstanding results. In both groups, 8 patients (or 40%) had good results; in the plating group, 4 patients (20%) had bad results and 8 patients (or 40%) had medium results. This shows that whereas patients treated with plating had inconsistent outcomes, all patients treated with percutaneous cc screw fixation for calcaneum fractures in this study had either excellent or good results. **Conclusion:** We found that, when the AOFAS score was combined with patient satisfaction, the group receiving percutaneous CC screw fixation performed better statistically than the group receiving calcaneal plate fixation for calcaneal fractures Sander's types II, IIIa, and IIIb.*

Keywords: calcaneum, locking plate, percutaneous, cc screw, internal fixation

1. Introduction

The calcaneum is the most often injured tarsal bone, accounting for 1%–2% of all fractures. Roughly 75% of calcaneal fractures occur intra-articularly, affecting the subtalar joint. A fall from a height that strikes the heel directly is the most frequent cause of damage. The course of treatment for calcaneal fractures has been hotly debated over the years. In the past, a conservative strategy was frequently used since surgical outcomes are unpredictable. While there are a number of therapeutic options for calcaneum fractures, including Kirschner wire fixation, percutaneous cannulated screw fixation, and plate fixation, no single technique has shown to consistently produce positive outcomes.

Numerous research examining the effectiveness of treatment and pain management with either CC screw fixation or calcaneal plating have been conducted in the past. Over the years, post-surgical treatment has also raised serious concerns about wound healing. There isn't much data comparing Percutaneous CC screw Fixation to Calcaneum Plating for Sander's Type II, IIIA, and III B, despite comparative research that have pitted the two approaches against one another. Through this research, we hope to provide light on the relative benefits of plate fixation versus percutaneous screw fixation for treating calcaneal fractures, as well as the relative superiority of each technique.

2. Materials and Procedures

Participant Profiles

Patients who were hospitalized to Narayana Medical College and Hospital between June 2022 and Oct 2023 for calcaneal fractures were evaluated as part of this retrospective study. For some of these patients, percutaneous screw fixation was the method of treatment; for the remaining patients, plate fixation was employed. The choice between screw fixation and plating was made at random and after careful consideration of the patients' needs.

Inclusion criteria:

- Age range of 18 to 50 years
- Fracture >2 mm dislocated intraarticular calcaneum unilateral fracture
- Closed fracture
- Patients without diabetes
- Appearing two weeks after the injury

Exclusion criteria:

- Patients with significant heart and cerebrovascular disorders are excluded. heavy smokers
- Non-reducible fractures that need to be arthroded

With 20 patients in one group and 20 in the other, 40 patients met the inclusion criteria. The age, gender, injury mechanism, Sanders categorization, and other factors were used to categorize the groups. It took an average of four days from

the time of accident that sent the patient to the hospital to when the surgery started.

Surgery Method

All patients were placed in the lateral position, with the side that was wounded facing upward. The same surgeons performed the anesthesia and standard cleaning on each patient.

Percutaneous Fixation

Through the lateral aspect of the Achilles tendon, a 3.5 mm k-wire was percutaneously bored at the supero-posterior edge of the calcaneum with the use of C-arm fluoroscopy. The insertion angle was then maintained at 15 - 20 degrees medially from the lateral margin of the foot and 60 - 70 degrees from the plantar aspect while the k-wire was inserted just below the distal portion of the posterior facet of the subtalar joint. Though it was outside the joint, the k-wire tip was stopped around 1 cm below the posterior facet, touching the fracture bone block on the calcaneum's posterior aspect. Using the k-wire, the midfoot and calcaneum were then bent in the direction of the plantar aspect. The posterior facet of the subtalar joint was shifted closer to the sustentaculum tali by correcting the rearfoot valgus. Then, under the C-arm, reduction was examined. A 1.5 mm k-wire that was drilled medially from the posterior articular surface of the lateral bone block was then used to transversely secure the sustentaculum tali fracture block. One K-wire was bored from the calcaneal tubercle toward the sustentaculum tali and subsequently towards the calcaneal axis in order to fix the primary and secondary fracture lines. The height, length, and Bohler's angle of the calcaneum were then measured using the c-arm. In order to transversely fixate the bone block on the posterior facet of the subtalar joint, 1 mm-24.0 mm cannulated screws were inserted from the calcaneal tubercle

Plate Fixation

Parallel to the sole, a 5-7 cm incision was made from the tip of the fibula to the lateral wall bone of the anterior process of the calcaneum. The joint fracture fragments were realigned using a Steinmann after the fracture's visual field was made visible and the hemorrhage was removed. Following a sufficient reduction, a 2 mm-3 mm K-wire was temporarily attached and identified by fluoroscopy C-arm. Subsequently, a manual lateral side calcaneus squeeze was performed, and then a poking reduction. In order to expose the subtalar joint, the calcaneum's body and lateral wall, and to realign the posterior articular surface of the joint, the calcaneum's height was modified. After measuring the calcaneal length, height, and width, the Bohler's and Gissane's angles were ascertained using a C-arm X-ray equipment. the incision, the plate was inserted, and then the screws were fixed.

Postoperative Care

For 4 - 6 weeks, a cast immobilization without weight bearing was administered. After 4 - 6 weeks, the patient was placed in a fibre cast and allowed to bear some weight. After three months, the patient was evaluated both clinically and radiographically, and activity was initiated. Following surgery, the patients were evaluated and monitored at one, three, and six months.

Plate Fixation Group

Case - 1



Pre - OP Xray



Post - OP Xray



Day 1 Wound pic



Day 12 wound pic

Case - 2:

Screw Fixation Group



Pre - OP Xray



Post - OP Xray



Day 1 Wound Pic

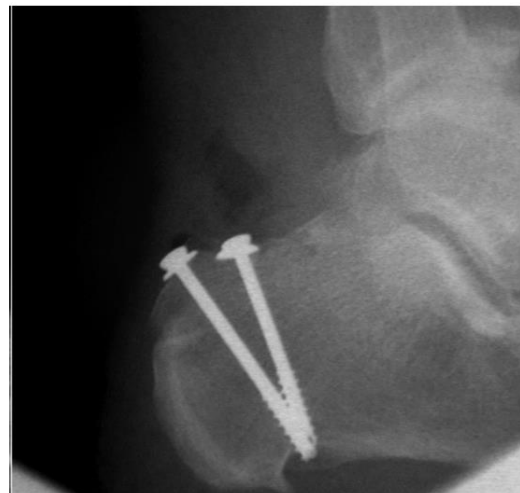


Day 12 Wound Pic

Case 1



Pre - OP Xray

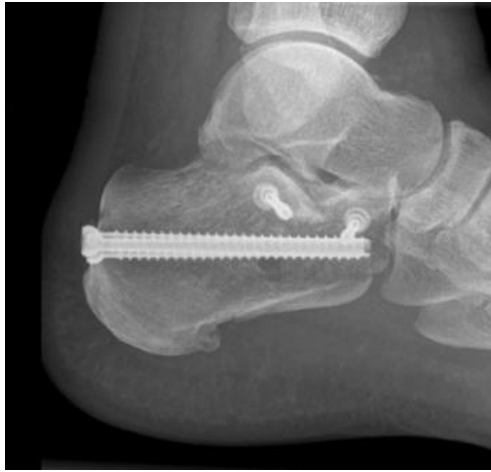


Post - OP Xray

Case 2



Pre - OP Xray



Post - OP Xray

Statistical Analysis

When selecting the samples, there was no bias based on age, sex, or mechanism of injury. Since the sample size was small overall—less than 50—the Shapiro - Wilk test for normal distribution was used to verify the study's validity. (W=0.9142; P=0.0051)

The test statistic Z (adjusted for ties) was 5.061, and the two - tailed probability (p<0.0001) was found in the Mann - Whitney test for independent samples, with the average for the plating group being 11.1500 and the percutaneous cc screw group being 29.8500

Table 1: Statistical Analysis

Type of Surgery	Treatment efficacy				Total
	Excellent	Good	Medium	Poor	
Percutaneous CC Screw	14 (70%)	6 (30%)	0 (0%)	0 (0%)	20 (100%)
Plating	0 (0%)	10 (50%)	6 (30%)	4 (20%)	20 (100%)
TOTAL	14 (35%)	16 (40%)	6 (15%)	4 (10%)	40 (100%)

Score (CAT)

Excellent	7 (100%)	0 (0%)	0 (0%)	0 (0%)	7 (100%)
Good	7 (29.1%)	16 (66.66%)	1 (4.16%)	0 (0%)	24 (100%)
Medium	0 (0%)	0 (0%)	5 (100%)	0 (0%)	5 (100%)
Poor	0 (0%)	0 (0%)	0 (0%)	4 (100%)	4 (100%)
TOTAL	14 (35%)	16 (40%)	6 (15%)	4 (10%)	40 (100%)

Table 2: Age Distribution

Age in Years	Cases	Percentage
<20	2	5%
20 - 30	16	40%
31 - 40	12	30%
>40	10	25%

Table 3: Sex Distribution

Sex	Cases	Percentage
Male	30	75%
Female	10	25%

Table 4: Mechanism of Injury

Mechanism	Cases	Percentage
Fall	30	75%
RTA	10	25%

Table 5: Side of Calcaneus

Side	Cases	Percentage
Right	24	60%
Left	16	40%

Table 6: Pre - Operative Bohler's Angle

Pre - op angle	Cases	Percentage
<20	25	62.5%
21 - 25	8	20%
26 - 30	6	15%
31 - 35	-	-
36 and above	1	2.5%

Table 7: Post - Operative Bohler's Angle in Plating

Post op angle	Cases	Percentage
<20	3	15%
21 - 25	2	10%
26 - 30	12	60%
31 - 35	-	-
36 and above	3	15%

Table 8: Post - Operative Bohler's Angle in Percutaneous Screw Fixation

Post op angle	Cases	Percentage
<20	1	5%
21 - 25	2	10%
26 - 30	15	75%
31 - 35	-	-
36 and above	2	10%

Outcomes

The Tables 2 - 8 provide the results.

3. Discussion

Conservative management was the gold standard of care for calcaneus fractures in the past. All the same, throughout time, a number of internal fixation techniques began to demonstrate outstanding outcomes.40 patients at Narayana Medical College and Hospital between June 2022 and Oct 2023 were used in this study to compare internal fixation using plating and percutaneous cc screws. It was shown that the most prevalent age group, with a male majority, was between 20 and 30 years old (35%). Falling from a height was the most frequent mechanism of injury. (67.5%) While there was no

statistically significant difference in the post - operative Bohler's angle between the two groups, the plating group experienced greater post - operative wound healing issues.

In our study, compared to 0 patients in the plating group, 12 (60%) patients in the percutaneous cc screw fixation group had great outcomes. Eight (40%) patients in both groups had good results, while four (20%) and eight (40%) patients in the plating group had medium and poor results, respectively. This implies that whereas patients treated with plating had inconsistent outcomes, all patients treated with percutaneous cc screw fixation for calcaneum fractures in this study had either excellent or good results.

4. Conclusion

Thus, when we compared plating and percutaneous CC screw fixation for calcaneal fractures Sanders types II, IIIa, and IIIb, we discovered that the group receiving percutaneous CC screw fixation had a statistically significant higher AOFAS score when combined with patient satisfaction than the group receiving calcaneal plate fixation.

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