

Clinical Outcome of Tongue Type Intra-Articular Calcaneal Fractures Managed with Percutaneous Screw Fixation

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ABSTRACT

Introduction: Calcaneal fractures are a common category of tarsal bone fractures. Percutaneous screw fixation is an effective modality and offers excellent functional and radiological outcome with exceptionally low complication rate. In this study, we analyze the functional and radiological outcome of patients with tongue type calcaneal fractures managed using percutaneous screw fixation.

Method: This is a prospective study conducted at the Department of Orthopedics, Civil Hospital Karachi during a duration of three years i.e January 2017 to January 2020. During the study duration, all patients presenting with tongue type calcaneal fractures were included in the study after taking informed consent. Inclusion criteria includes patients with uncomplicated tongue type calcaneal fractures among patients aged 20-65 years of age. Exclusion criteria includes patients with depression type fractures, open or infected fractures or calcaneal fractures in patients aged less than 20 or more than 65 years of age. Patients with multiple fractures were also excluded from the study. Percutaneous reduction and screw fixation was performed among all patients and functional outcome was analyzed.

Results: Out of 34 cases, 26 were males while 8 were females. The mean age of patients was 41.8±9.97 years. The mean pre-operative Bohler's angle was 16 degrees while mean post-operative Bohler's angle was 36 degrees. The mean pre-operative Gissane angle was 121.3 degrees while mean post-operative Gissane angle was 112.8 degrees. Majority patients had excellent functional outcome i.e 64.7% (n=22). Good functional outcome was found in 26.4% (n=9) while 8% (n=3) had fair outcome. Post-operative complications were found in two patients. One patient had subtalar osteoarthritis which was managed by subtalar fusion while one patient had peroneal tendinitis.

Conclusion: Percutaneous reduction and screw fixation technique offers promising results with good functional outcome and minimal complications. It should be routinely used for the management of tongue type calcaneal fractures

Keywords: Calcaneal fractures, percutaneous reduction, closed reduction.

INTRODUCTION

One of the most common category of tarsal bone fractures are fractures of the calcaneal bones. The incidence of calcaneal fractures are around 11.5 cases among a population of 100,000 individuals. It is particularly common among males aged 20-29 years. The most common causes for these fractures are trauma and axial loading of the foot^{1,2}. Majority of calcaneal fractures are intra-articular fractures (Sandars type II and III fractures) accounting for around 75% cases³.

Various techniques have been advised for the management of tongue type calcaneal fractures which are also known as Sandars type II fractures. Percutaneous screw fixation is an effective modality and offers excellent functional and radiological outcome with exceptionally low complication rate. Previously calcaneal fractures were managed using non-operative techniques such as bandage application and foot elevation. With the advancement, minimally invasive techniques were introduced which provide good functional outcome and are increasingly used these days. These include percutaneous screw fixation for tongue type fractures and use of screws, K-wires or other techniques for depressed type calcaneal fractures. Open

reduction of calcaneal fractures is rarely used as the soft tissue located on the lateral aspect is vulnerable to post-operative wound formation. When extended lateral approach was used, 0.4 to 14% cases caused wound edge necrosis. The post-operative infection rate was found to be around 1.3 to 7%^{4,5}. Researchers have concluded that medial approach is also ineffective as it offers inadequate visualization along with increased chances for neurovascular injuries. In studies where combined medial and lateral approach was used, the rates of wound infection were 27%⁶.

METHOD

This is a prospective study conducted at the Department of Orthopedics, Civil Hospital Karachi (CHK), Pakistan. The study duration was from January 2017 to January 2020 i.e three years. During the study duration, all patients presenting with tongue type calcaneal fractures were included in the study after taking informed consent. Probability sampling technique was used. All patients presenting during the study duration giving informed consent were included in the study. Demographic variables such as age, gender along with the presence of co-morbid

conditions, mode of injury, type of fracture, intra-operative blood loss, pre- and post-operative Gissane and Bohler's angles, post-operative functional outcome and complications were recorded. Inclusion criteria includes patients with uncomplicated tongue type calcaneal fractures among patients aged 20-65 years of age. Exclusion criteria includes patients with depression type fractures, open or infected fractures or calcaneal fractures in patients aged less than 20 or more than 65 years of age. Patients with multiple fractures were also excluded from the study. Due to limited means, pre-operative CT scan was only performed in limited patients (n=15).

Patients were scheduled for surgery on the day of presentation or the next morning if they presented during the latter half of the day. Pre-operatively 2 grams of intravenous ceftriaxone was given. All patients underwent operative management under spinal anesthesia. After insertion of a 3 mm Steinmann pin into the fractured fragment, the posterior facet was restored. By the application of manual traction, the calcaneal alignment was restored. Parallel to the Steinmann pin, guide pin was inserted. Both lateral and axial fluoroscopy was used to confirm the correct placement of guide pin. After the confirmation of adequate placement of first guide pin, a second guide pin was inserted and placed in a crisscross pattern with the first pin. Along the guide pins, 2 crisscross 6.5 mm cannulated cancellous screws were placed. Steinmann pin was afterwards removed^{7,8}.

Post-operatively patients were placed on oral third generation cephalosporins for the next 3 days. Lateral and axial radiographs were ordered and Gissane and Bohler's angle were measured again. On the third post-operative day, ankle mobilization was encouraged. Range of motion along with radiographic assessment was performed at 3,6,12 and 24weeks post-operatively. Weight bearing was commenced at sixth post-operative week. Final assessment was performed at 6 months during which the Maryland foot scoring system was used to assess overall outcome and residual complications were recorded. According to this classification, excellent outcome accounts at score of 90-100 points, good functional outcome accounts at 75-89 points, fair outcome accounts at 50-74 points and less than 50 points is classified as failure⁹.

RESULTS

During the three years study duration, a total of 34 cases presented to the department of orthopedics, CHK. Of them 26 were males while 8 were females. The mean age of patients was 41.8 ± 9.97 years. The minimum age of study population was 27 while maximum age was 60 years. Between ages 20 to 30 years were 2 patients, 31 to 40 years were 15 patients, 41 to 50 years were 9 patients while 51 to 60 years were 8 patients. Eighteen patients had fracture on right side while 16 had left sided fracture. Two patients had bilateral fractures. The most common mode of injury was road traffic injuries (n=22), followed by falls (n=10) and assault (n=2). (Table 1)

The mean pre-operative Bohler's angle was 16 degrees while mean post-operative Bohler's angle was 36 degrees. The mean pre-operative Gissane angle was 121.3 degrees while mean post-operative Gissane angle was 112.8 degrees. The mean post-operative ankle range of

motion was 57 ± 6.2 degrees while the mean subtalar joint range of motion was 18 ± 5.2 degrees. The mean follow up time was 22 ± 1.5 weeks. All patients had radiological union at 15 ± 3.2 weeks. (Table 2)

Table No 1: Baseline characteristics of all the patients

Variables	Frequency No.	% age
Gender		
Males	26	76.47
Females	8	23.53
Mean age of patients	41.8 ± 9.97 years	-
Age distribution		
20 to 30 years	2	5.88
31 to 40 years	15	44.12
41 to 50 years	9	26.47
51 to 65 years	8	23.53
Mode of injury		
Road traffic accidents	22	64.71
Fall from height	10	29.41
assault	2	5.88
Side of Fracture		
Right	18	52.94
Left	16	47.06

Table No 2: Pre and postoperatively Bohler's and Gissane angle

Variables	Frequency No.	%age
Mean pre-operative Bohler's angle	16 degrees	-
Mean post-operative Bohlar's angle	36 degrees	-
Mean pre-operative Gissan's angle	121.3 degrees	-
Mean post-operative Gissan's angle	112.8 degrees	-

Table No 3: Functional outcomes according to the Maryland Foot Scoring System

Outcomes	Frequency No.	%age
Excellent	22	64.6
Good	9	26.4
Fair	3	8
Poor	0	0

Figure No 1: X-ray and CT finding preoperatively



Postoperatively Findings



According to Maryland foot scoring system, majority patients had excellent functional outcome i.e 64.7% (n=22). Good functional outcome was found in 26.4% (n=9) while 8% (n=3) had fair outcome.(Table 3)

Post-operative complications were found in two patients. One patient had subtalar osteoarthritis which was managed by subtalar fusion while one patient had peroneal tendinitis.

DISCUSSION

Our study results conclude that percutaneous screw fixation offers good functional outcome with very few post-operative complications. In our study, 5.8% (n=2) patients had post-operative complications. One patient had subtalar osteoarthritis which was managed by subtalar fusion while another had peroneal tendinitis. At the last follow up which was conducted at 24 weeks, none patient reports any residual pain. Hedge et al managed 23 patients with tongue type calcaneal fractures with percutaneous screw fixation. Of his study subjects, 17 patients reported good results with mean score of 82.94. Post-operative complication was only evident in one patient as subtalar arthritis¹⁰. Dalal et al in his study managed 20 patients with tongue type calcaneal fractures using percutaneous screw fixation. All his study subjects had union within 2 months of management. Functional outcome was analyzed using AOFAS score. It was good in 18 patients and fair in 2 patients. Post-operative complications were evident in 3 patients. Two patients had persistent pain and widening of heel. One patient had peroneal tendinitis. He concludes that percutaneous screw fixation is an effective management strategy for patients with mild to moderately displaced fractures of calcaneum as it offers good functional outcome¹¹. Kawalkar et al in his study managed 14 patients with 16 calcaneal fractures using percutaneous screw fixation. His study results report good functional outcome in all patients. the mean time to union was 13 weeks while the mean functional outcome score was 83¹². Patil et al in his study managed 40 patients with tongue type and depression type calcaneal fractures using screws. Of them, 30 patients report good functional outcome, 9 patients had fair functional outcome and one had poor functional outcome¹³. Patel et al conducted a study in which he managed 31 patients with percutaneous screw fixation. He concludes that minimally invasive techniques for the management of calcaneal fractures offer good functional outcome and significantly reduced chances for skin complications¹⁴.

Ansari et al conducted a study on the management of calcaneal fractures. Of 25 male patients, 11 had fixation with plating, 13 had fixation with percutaneous screw fixation and one patient with bilateral intra-articular calcaneal fracture underwent percutaneous screw fixation on right and plate fixation on left. In his study, excellent results were found in 52% patients, good in 40% patients and fair in 8% patients. he reports that all modes of operative fixation of calcaneal fractures show good outcome¹⁵. The Bohler's angle carries significance in the management of calcaneal fractures. Bohler's angle reflects two things: calcaneal height and arch angle. In normal conditions the Bohler's angle is between 20-40 degrees. In our study the mean Bohler's angle was 36 degrees. The

mean Bohler's angle in Ansari et al's study was 34.74 degrees¹⁵. in Hedge et al's study, the mean pre-operative Bohler's angle was 12.61 degrees while post-operative Bohler's angle was 26.22 degrees¹⁰. In Patil et al's study, the mean pre-operative Bohler's angle was 15.28 degrees while the mean post-operative Bohler's angle was 25.35 degrees¹³. Our study results are like other studies which show a decrease in post-operative Gissan angle while increase in post-operative Bohler's angle.

Popeka et al conducted a study over a duration of 8 years and reports the management and outcome of 137 patients with calcaneal fractures of different categories. Of them 23% were tongue type calcaneal fractures. He concludes that the management of choice for patients with tongue type calcaneal fractures is percutaneous screw fixation. However among patients with depression type fractures of the calcaneum, the combination of osteosynthesis of calcaneal tuberosity fragments using either screws, K-wires, C-nail can be used or the palmar's approach can be applied¹⁶. Tantavisut et al conducted a study on the post-operative outcome of patients with intra-articular fractures. These patients were managed using percutaneous reduction and fixation with screws. The mean duration of his follow up was 2.6 years during which they assessed 153 patients with 182 intra-articular calcaneal fractures. At 3 month follow up, 1% patients had superficial infections. Another 1% had screw irritation. At one year follow up, 9.3% patients had complains for screw irritation. Another 5.5% patients had subtalar osteoarthritis which was managed by subtalar fusion. Malunion was found in 1.8% patients and deep infection was evident in 0.9% cases. Subsequent follow ups revealed residual displacement however there was improvement in posterior talocalcaneal joint reduction. The last follow up revealed 54.5% patients with residual pain marked at the level 3 or less¹⁷. Wagstrom et al published a literature review in 2018 in which he discusses the use of minimally invasive techniques during past three years for the management of calcaneal fractures. He concludes in his study results that minimally invasive techniques have led to decline in post-operative complications and improvement in quality of life¹⁸.

Zwiff et al in his study managed 163 patients with 184 intra-articular calcaneal fractures via lateral approach. Of these 102 patients were followed for a duration of eight years. Of them 4 patients had post-operative hematoma which required surgical revision. Five patients had deep wound infection while two had superficial wound infection. Subtalar fusion for residual osteoarthritis was performed in 9 patients. Two patients had extensive wound which required a free flap¹⁹. Hence it can be concluded that minimally invasive techniques such as percutaneous screw fixation offers significantly improved outcome. Embrahimpur et al conducted a study in which he compared two groups of patients with calcaneal fractures undergoing either open reduction and internal fixation (ORIF) or closed reduction and internal fixation (CRIF). His study subjects had Sanders type II, III and IV calcaneal fractures. Thirty nine patients underwent ORIF and 49 patients underwent CRIF. The results of his study concludes that percutaneous screw fixation offer better functional outcome and is associated with reduced hospital

stay, decreased risk of complications and increased patient satisfaction²⁰.

CONCLUSION

Percutaneous reduction and screw fixation technique offers promising results with good functional outcome and minimal complications. It should be routinely used for the management of tongue type calcaneal fractures

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