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Minimally invasive fixation of intra-articular calcaneus fracture using sinus tarsi approach

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Abstract

Introduction: The present study presents the outcomes of 45 patients of intra-articular fracture who were treated by minimally invasive technique with sinus tarsi approach.

Methodology: 45 adult patients with intra-articular calcaneus fractures (Sander type 2 & 3), who were operated in the Department of Orthopedics, Post Graduate Institute of Swasthiyog Pratishthan, Miraj were included. All cases underwent sinus tarsi approach for minimal invasive surgery.

Results: Mean age of the patients included in the study was 43.55 ± 3.08 years and males comprised 64%. Approximately two thirds of the patients had a fall and rest had a road traffic accident. Post-operative outcomes were assessed at an average of 7.5 months. At the point of last follow-up, we observed that the mean Bohler's angle increased from 15.44 degrees (SD 2.07) pre-operatively to 26.73 degrees (SD 3.83) post-operatively. Mean Gissane's angle increased from 144.73 degrees (SD 3.06) pre-operatively to 130.69 degrees (SD 2.53) post-operatively. A statistically significant increase and decrease was observed in the Bohler's and Gissane's angle respectively. It was observed that Bohler's angle decreased in 9% of the patients, while Gissane's angle increased in 11% of the patients. Rest had their angles maintained. AFASS was found to be good in 80% of the patients, fair in 16% and poor in 4% of the patients. No post-operative complications were noted in 96% of the patients, only 4% had skin infection.

Conclusions: In our study, functional outcome was good or fair in 96% of the patients, with very few complication cases. Sinus tarsi approach is a less invasive method for treatment of calcaneal fractures.

Keywords: Calcaneal fractures, intra-articular fractures, children, K-wires fixation, open reduction, sinus tarsi approach

Introduction

Calcaneus fractures comprise 1% to 2% of all human fractures, and 60% of all tarsal bones injuries^[1]. Common causes include high-energy axial traumas such as fall from height or motor accidents. Intra-articular fractures are caused due to vertical fall where as twisting forces and direct blows mainly cause extra-articular fractures^[2]. Open Reduction and Internal Fixation (ORIF) is the standard surgical treatment of calcaneal fractures. However, it is associated with wound problems (43%), skin necrosis (11%), superficial infections (19.7%), deep infection (5.6%), and osteomyelitis (nearly 1%)^[3]. Therefore, the optimal treatment of calcaneal fractures remains debatable and many surgeons adopt conservative approach to avoid complications of surgical therapy. But conservative management is not able to obtain excellent anatomical reduction, especially for displaced calcaneal fractures. As a result, various alternative approaches have been developed for treating intra-articular calcaneus fractures, including extensile lateral approach, medial approach, combined lateral and medial approach, limited posterolateral approach, and sinus tarsi approach^[4]. In 1948, the sinus tarsi approach, which included a lateral approach, was developed by Palmer for direct visualization of the articular surface for reduction^[5]. He and other authors proved this approach to be useful and reasonably safe^[6]. The present study presents the outcomes of 45 patients of intra-articular fracture who were treated by minimally invasive technique with sinus tarsi approach.

Methodology

Study Design and Sampling

In this prospective study, 45 adult patients with intra-articular calcaneus fractures (Sander type

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(Sander type 2 & 3), who were operated in the Department of Orthopedics, Post Graduate Institute of Swasthiyog Pratishtan, Miraj were included. Cases of polytrauma, open fracture, smoking history, uncontrolled diabetes, Sander I & IV types, delayed presentation and deemed unfit for surgery were excluded from the study.

Surgical procedure

Pre-operative antibiotics were administered, patients were given regional nerve blocks or spinal anesthesia, depending on the suitability. All procedures were performed under thigh tourniquet. A 2 to 4 cm incision was made over the sinus tarsi following a line from the tip of the fibula to the base of the fourth metatarsal. Dissection was carefully carried down to the posterior facet as the extensor digitorum brevis was retracted. A C-arm was brought in from the ipsilateral side to facilitate acquisition of multiple lateral and axial heel radiographs. The depressed posterior facet was visualized to expose borders of the fracture fragment. A periosteal elevator was then placed under the posterior facet fragment to elevate it up into an anatomic position. The Steinman pin and elevator were used together to position the posterior fragment into place. Once the posterior fragment was anatomically reduced, a 1.4mm K-wire was inserted into the fragment, across the subtalar joint into the talus to hold the fragment in a reduced position. The screw position was confirmed under C Arm. A 6.5 mm or 4.0mm cannulated screw was inserted from lateral to medial just beneath the Gissane's angle to support the posterior facet. To restore axial height and length and correct any varus of the heel, a percutaneous Schanz pin was placed in the calcaneal tuberosity. The Steinman pin was then removed and a guide pin for a 6.5-mm partially threaded cannulated screw was inserted posteriorly directed into the anterior aspect of the calcaneus. This guide pin helped to maintain calcaneal height and alignment, supported the posterior facet. Finally lateral, axial and Broden's heel radiographs were taken, and the subcutaneous tissues and skin sutures were applied.

Patients were placed in a posterior splint in non-weight bearing position with strict elevation. Range of motion exercises were started at 2 weeks, slab was removed after 4 weeks. Progressive weight-bearing and physical therapy was started 10 weeks to 12 weeks after surgery and full weight-bearing was allowed 12 weeks to 16 weeks after surgery. Patients were released for full activity 8-12 months after surgery.

Data Collection and Data Analysis

Post-operative assessment of the patients was carried out at 3 weeks, 6 weeks, 3 months, 6 months and 1 years. At each assessment, x-rays were ordered, American Foot and Ankle Society Scoring System (AFASS) and development of any complications were noted. Patients' demographic information and medical history was noted from the medical records. Statistical analysis was performed with Statistical Package for Social Sciences [SPSS] for Windows Version 22.0. Student paired t-test was used to compare the mean of pre-operative and post-operative Bohlers and Gissane's angle. The level of significance was set at $p < 0.05$.

Results

Mean age of the patients included in the study was 43.55 ± 3.08 years. Majority of the patients (47%) were in the age group of 41 to 60 years. Males comprised 64% of the study population and right side was affected in 58% of the patients. Approximately two thirds of the patients had a fall and rest had a road traffic accident (Table 1). Post-operative outcomes were

assessed at an average of 7.5 months. At the point of last follow-up, we observed that the mean Bohler's angle increased from 15.44 degrees (SD 2.07) pre-operatively to 26.73 degrees (SD 3.83) post-operatively. Mean Gissane's angle increased from 144.73 degrees (SD 3.06) pre-operatively to 130.69 degrees (SD 2.53) post-operatively. A statistically significant increase and decrease was observed in the Bohler's and Gissane's angle respectively (Table 2). It was observed that Bohler's angle decreased in 9% of the patients, while Gissane's angle increased in 11% of the patients. Rest had their angles maintained. AFASS was found to be good in 80% of the patients, fair in 16% and poor in 4% of the patients. No post-operative complications were noted in 96% of the patients, only 4% had skin infection (Table 3).

Discussion

In the present study, mean age of the patients included in the study was 43.55 ± 3.08 years. Majority of the patients (47%) were in the age group of 41 to 60 years. Males comprised 64% of the study population and right side was affected in 58% of the patients. Approximately two thirds of the patients had a fall and rest had a road traffic accident. Meraj *et al.* reported 20 cases with intra-articular, 14 patients were male and 6 were females. In 17 patients (85%), the mechanism of injury was fall from height, whereas in 3 patients the injury was due to road traffic accident^[7]. Shariatzadeh *et al.* investigated 62 patients with the mean age of 41.8 ± 12.7 years (range: 29 to 53 years)^[8]. The sample included 59 (95.2%) men and 3 (4.8%) women. The main mechanism of injury was falling that occurred in 93.5% of patients.

In our study population, we observed that the mean Bohler's angle increased from 15.44 degrees (SD 2.07) pre-operatively to 26.73 degrees (SD 3.83) post-operatively, while the mean Gissane's angle increased from 144.73 degrees (SD 3.06) pre-operatively to 130.69 degrees (SD 2.53) post-operatively. Meraj *et al.* reported that pre-operatively, the mean Bohler's angle and angle of Gissane were 5.13° (range, 2° - 18°) and 113.57° (range, 95° - 135°) respectively, which improved postoperatively to 20.47° (range, 14° - 35°) and 104.95° (range, 95° - 115°). We observed that Bohler's angle decreased in 9% of the patients, while Gissane's angle increased in 11% of the patients. Rest had their angles maintained. Furthermore, AFASS was found to be good in 80% of the patients, fair in 16% and poor in 4% of the patients. Our results are supported by previous work. Kikuchi *et al.* employed the limited sinus tarsi approach to treat intra-articular calcaneum fractures^[9]. They studied 22 cases and found statistically significant restoration of Bohlers angle in majority. Similar findings were obtained by Park *et al.*, who used sinus tarsi approach in treatment of 47 displaced intra-articular calcaneum fractures, with a mean 1year post-operative AFASS score of 94 (80-100). The authors found that the functional outcome correlated well with degree of reduction of posterior facet joint and the amount of Bohlers angle restoration. In another study, of the total 40 cases operated by Patil *et al.* using the minimally invasive techniques, post-operative AFASS was found to be good in 30 cases, 9 cases were fair and one had a poor outcome^[10]. Shariatzadeh *et al.* reported that the mean preoperative Bohler angle changed significantly from $2.93 \pm 15.7^\circ$ to $25.4 \pm 21.8^\circ$ after the surgery and the mean preoperative Gissane angle increased significantly from $96.5 \pm 23.8^\circ$ to $113 \pm 8.7^\circ$ after the surgery.

In our study, no post-operative complications were noted in 96% of the patients, only 4% had skin infection. The minimally invasive technique through a sinus tarsi approach permits

rebuilding of the articular surface of the anterior and posterior facet, resulting in decreased risk of infection or hardware failure. Complication rates vary from 10–20%, and include wound dehiscence (14% of cases), deep infection (incidence range, 1.3–8.5%), peroneal tendinitis (incidence, 4%), tarsal tunnel syndrome (incidence, 2% or compartmental syndrome (incidence, 2%)^[12]. Shariatzadeh *et al.* reported 5 complications (8%) were recorded in their series, delayed wound healing in 4 cases (6.4%) and deep infection occurred in one patient (1.6%).

Table 1: Characteristics of the patients included in the study

Variables	Frequency	Percent
Age group (in years)		
Up to 20	4	9%
21 to 40	9	20%
41 to 60	21	47%
> 60	11	24%
Gender		
Males	29	64%
Females	16	36%
Affected side		
Right	26	58%
Left	19	42%
Mode of injury		
Fall	30	67%
Road traffic accident	15	33%

Table 2: Comparing pre- and post-operative radiological characteristics

Radiological outcomes	Pre-operative	Post-operative	p value
Bohler's angle	15.44 (2.07)	26.73 (3.83)	<0.01
Gissane's angle	144.73 (3.06)	130.69 (2.53)	<0.01

Table 2: Clinical and functional outcomes of the patients included in the study

Outcome assessment	Frequency	Percent
Bohler angle		
Decreased	4	9%
Maintained	41	91%
Gissane's angle		
Increased	5	11%
Maintained	40	89%
AFASS		
> 75 (Good)	36	80%
50 to 74 (Fair)	7	16%
< 50 (Poor)	2	4%
Post-operative complications		
None	43	96%
Skin infection	2	4%

Conclusion

In our study, functional outcome was good or fair in 96% of the patients, with very few complication cases. Sinus tarsi approach is a less invasive method for treatment of calcaneal fractures. It is a valid option of treatment for displaced intra-articular calcaneal fractures.

References

- Zwipp H, Rammelt S, Barthel S. Fracture of the calcaneus. *Unfallchirurg* 2005;108:748.
- Heckman James D. Fractures and dislocations of the foot, chapter 32, in Rockwood and Green's Fractures in adults, 4th Edition, Philadelphia Lippincott-Raven publishers 1996, 30.

- Giannini S, Cadossi M, Mosca M, Tedesco G, Sambri A, Terrando S *et al.* Minimally-invasive treatment of calcaneal fractures: A review of the literature and our experience. *Inj* 2016;47:S138-46.
- Buckley RE, Tough S. Displaced intra-articular calcaneal fractures. *J Am Acad Orthop Surg* 2004;12:172-8.
- Palmer I. The mechanism and treatment of fractures of the calcaneus; open reduction with the use of cancellous grafts. *J Bone Joint Surg Am* 1948;30A:2-8.
- Essex-Lopresti P. The mechanism, reduction technique, and results in fractures of the os calcis. *Br J Surg* 1952;39:395-419.
- Meraj A, Zahid M, Ahmad S. Management of intraarticular calcaneal fractures by minimally invasive sinus tarsi approach-early results. *Malaysian orthopaedic journal* 2012;6(1):13.
- Shariatzadeh H, Valiollahi B, Mohammadpour M, Haghbin M. Outcomes of Minimally-Invasive Sinus Tarsi Approach for the Treatment of Intra-articular Calcaneal Fracture. *Journal of Research in Orthopedic Science*. 2020;7(2):47-54.
- Kikuchi C, Charlton TP, Thordarson DB. Limited sinus tarsi approach for intra-articular calcaneus fractures. *Foot & ankle international* 2013;34(12):1689-94.
- Patil BK. Outcome of calcaneum fractures treated with minimally invasive fixation techniques. *International Journal of Orthopaedics* 2019;5(1):146-50.
- Crosby LA, Fitzgibbons TC. Open reduction and internal fixation of type II intra-articular calcaneus fractures. *Foot Ankle Int* 1996;17:253-8.