

A Comparison Between Functional Results in Intra-Articular Displaced Calcaneus Fractures Managed with Conservative and Operative Treatment: A Randomized Controlled Trial

FARUKH HUSSAIN¹, ALI MUHAMMAD BHUTTO², WASEEM AHMED³, HUSSAIN BUX PALH⁴, SIJAD AHMED MAHAR⁵, AHMED RAZA LAGHARI⁶, NIAZ HUSSAIN KEERIO⁷

¹Assistant professor Orthopaedics, ward 17 JPMC Karachi Pakistan

²Consultant Orthopaedic Surgeon Department of Orthopaedics, Ghulam Mohammed Mahar Medical College / Civil Hospital Sukkur Pakistan

³Assistant professor Orthopaedics, Muhammad Medical College and Hospital Mirpurkhas

⁴Assistant professor Orthopaedics, Gambat Medical college Pir Syed Abdul Qadir Shah Jellani Institute of Medical Science GIMS Gambat Pakistan

⁵Assistant professor Orthopaedics, Ghulam Mohammed Mahar Medical College Sukkur Pakistan

⁶Senior Registrar Orthopaedics, Ghulam Mohammed Mahar Medical College / Civil Hospital Sukkur Pakistan

⁷Assistant Professor Orthopaedics, Muhammad Medical College and Hospital Mirpurkhas, Pakistan

Corresponding author: Farukh Hussain, Email: farukh_dr@hotmail.com

ABSTRACT

Aim: To make a comparison between functional results in intra-articular displaced calcaneus fractures which are treated conservatively and operative treatment

Study design: A randomized controlled trial

Place and Duration: This study was conducted at ward 17 JPMC Karachi from January 2021 to January 2022.

Methodology: This study includes 32 individuals who had displaced intra-articular calcaneal fractures. These individuals were classified into two groups, each group with 16 individuals. They were randomly assigned to either operative or conservative treatment. Clinical results, as well as radiological results (Modified Rowe's score), were assessed at a 1-year follow-up.

Results: All results were measured using Modified Rowe's score. With a 1-year follow-up of the operative group, according to Modified Rowe's score, 6 individuals had excellent results representing 37.5%, 8 individuals had good results representing 50%, and only 2 individuals had satisfactory results representing 12.5%. On the other hand, with a 1-year follow-up of the conservative group, only 2 individuals had excellent results representing 12.5%, 7 individuals had good results representing 43.75%, 5 individuals had satisfactory results representing 31.25%, and 2 individuals had poor results representing 12.5%. A few challenges were seen in each group. In the operative group, delayed wound healing was a complication seen in 2 cases while in the conservative group, peroneal tendonitis, subtalar arthritis and malunion were seen as a complication.

Conclusion: In conclusion, the operative group was seen to be more effective to cure displaced intra-articular calcaneus fractures rather than the comparative group. Only a few complications, better functional recovery, early rehabilitation, and early weight bearing were seen in the operative treatment.

Keywords: Calcaneus fractures, functional outcome, rehabilitation, conservative treatment

INTRODUCTION

Among all fractures, calcaneal fractures make up about 2 percent along with displaced intra-articular fractures containing 60-70 percent of these injuries. When individuals suffer from calcaneal fractures, 25% of individuals had severe injuries while 105 suffer with spine fractures [1]. When someone goes through a high-energy trauma that involves falling from a height or from an automobile, it results in displaced intra-articular fractures of the calcaneus. Swelling, pain, deformity and hematoma at the hind foot are observed in the clinical evaluation. Foot inversion and eversion, whether active or passive, are severe and painful. A lateral radiograph series is included in the radiological examination of a patient who is expected to have a calcaneal fracture [2]. There are 2 significant angles, which are the crucial angle to Gissane and the tuber angle of Bohler, which are displayed in the lateral radiograph of the hind foot [3, 4]. In order to understand and interpret calcaneal fractures better, CT scanning is used. CT scans are acquired in three planes: axial, thirty-degree semi-coronal, and sagittal. The images in the 30-degree semi coronal plane show the overall shape of the heel, the articular surface of the posterior facet, the position of the peroneal and flexor hallucis tendons, and the sustentaculum [5]. Sanders et al. developed an articular fracture classification system based on coronal plane imaging [6].

For an orthopedic surgeon, these calcaneus fractures continue to be the most difficult to treat. In a nonoperative treatment, a supportive splint is involved that allows the initial fracture hematoma to dissipate. Later, it is followed by conversion to a prefabricated fracture boot with the ankle locked in neutral flexion to block equinus contracture, and an elastic compression stocking to reduce dependent edema. Until the radiographic union is confirmed, non-weight-bearing restrictions are kept in place for 10 to 12 weeks after the initiation of ankle joint range-of-motion exercise and early subtalar [7].

Extensile lateral approach can be used to treat most of the displaced intra-articular calcaneal fractures [8]. The majority of the doctors use a single lateral plate for internal fixation. That plate demonstrates the anatomical attributes of the calcaneus. It helps the thalamic portion with the posterior joint facet, the tuberosity, and the anterior process. Polyaxial locking plate designs are used to facilitate screw placement within the plate [9, 10].

The current study is conducted to make a comparison between functional results in intra-articular displaced calcaneus fractures which are cured conservatively and those which are cured with operative treatment

METHODOLOGY

The following research is a randomized controlled trial. This study includes 32 individuals who had displaced intra-articular calcaneal fractures. The institutional ethical committee approved this research. Patients were divided into two groups, Group A and Group B, with 16 patients in each group. Computer-generated random number tables were used for randomization and then the individuals were assigned in any of the groups. The individuals in group A were cured with conservative treatment and the individuals in group B were cured with operative treatment. All 32 patients involved in this research were aged from 19-67 years, had Sander's type II and III closed fractures that were less than 3 weeks old, and had normal bipedal gait before fracture. Patients who had calcaneal fractures connected with spinal injuries, pathological fractures, peripheral vasculopathy, or any medical contraindication to surgery were not involved in this research. Moreover, individuals who did not give their consent were also not a part of this research.

In order to evaluate the type of fracture and important angles such as the crucial angle of Gissane and Bohler's angle, radiological evaluation was conducted followed by CT images.

Closed reduction was tried in the conservative treatment. In order to reverse the mechanism of injury, it was attempted by plantarly displacing both the hind foot and forefoot. It allows an elevation of the posterior facet. Feet with swelling were treated with a temporary splint with a short leg POP back slab and suggested limb elevation while using anti-inflammatory and analgesic medications. When the swelling settled, short leg casts were applied for six weeks and range-of-motion exercises were performed. After eight weeks, progressive weight bearing was performed. After the confirmation of radiological union after 12 weeks, full weight bearing was performed. All patients were randomly selected for surgery. Consent of all patients was taken in written form. Spinal, general, or epidural anesthesia was given to patients during surgery. The extensile lateral approach was used to treat most of the displaced intra-articular calcaneal fractures. The majority of surgeons use a single lateral plate for internal fixation. It was done within 2 weeks of injury.

Individuals were handled in the ward of the hospital with antibiotics and analgesics postoperatively on a limb placed in a short-leg non-weight-bearing splint. Weight-bearing was not authorized till 10 weeks postoperatively, despite the fact that early subtalar joint range-of-motion activities were initiated out of the splint. Depending on the radiological union, partial and complete weight-bearing ambulation was initiated. Individuals were slowly transformed into regular shoes according to their tolerance after the weight bearing was started. A 1-year follow-up was performed by radiological and clinical examination. Modified Rowe's score was used to examine 1-year follow-up results [11].

RESULTS

A total of 32 patients were involved in this research who were randomly chosen to be a part of either one of the groups. Each group contained 16 individuals. All 32 individuals were aged from 19-67 years. The average age calculated was 40 years in the operative treatment group and 42 years in the conservative treatment group. Among 32 individuals, there were 21 males (65.5%) and 11 females (34.5%). 56 percent of patients had calcaneus fractures due to falls from height and 44 percent of patients had calcaneus fractures due to road traffic. Fractures were categorized into Sander's type II (52%) and Sander's type III (48%). The average time for the surgery in our research was calculated as 12.1 days ranging from 7-14 days. A 1-year follow-up was done by using Modified Rowe's score. It was the final evaluation and where a radiological examination was also done.

Table 1: Functional outcome between the two groups

Modified Rowe's score	Operative		Conservative	
	N	%	N	%
Excellent	6	37.5	2	12.5
Good	8	50	7	43.75
Satisfactory	2	12.5	5	31.25
Poor	0	0	2	12.5
Total	16	100	16	100

Pain: At 1-year follow-up, in the operative treatment group, there were 5 patients (31.25%) that had pain from exercise and the remaining 11 (68.75%) patients had no pain at all. On the other hand, in the conservative treatment group, there were 7 (43.75%) patients who had pain from exercise, 4 (25%) patients who had pain because of daily activities, 2 (12.5%) patients who had pain due to weight bearing, and 3 (18.75%) patients who had no pain at all. (P-value 0.034)

Range of motion: All individuals in the operative group had a good range of motion from 75 percent to 100 percent than those uninjured on opposite sides. On the other hand, in the conservative treatment group, 13 patients (81.25%) had a good range of motion from 75 percent to 100 percent. The remaining 3 patients had a range of motion from 50 percent to 74 percent. (P-value 0.048)

Gait: At a 1-year follow-up, in the operative treatment group, 9 individuals (56.25%) had a normal gait while the remaining 7 patients (43.75%) had a mild limp. In the conservative treatment group, 4 patients (25%) had a normal gait, 4 patients (25%) had mild limp, 6 patients (37.5%) had moderate limp, and 2 patients (12.5%) had severe limp. (P-value 0.037)

Work: In the operative treatment group, 12 patients had no restrictions for work while the remaining 4 patients had a few restrictions. In the conservative treatment group, 5 individuals had zero restrictions for work, 7 patients had a few restrictions, and 4 patients had to change their job.

X-rays were performed regularly with a four weeks interval. In the operative treatment group, the mean radiological union time was 11-13 weeks with an average of 11.13 while in the conservative treatment group, the mean radiological union time was 11-15 weeks with an average of 12.2 weeks. (P-value 0.61)

Bohler's angle: In the operative treatment group, the postoperative Bohler's angle was 29.22°. The opposite normal side angle was 31.01°. On the other hand, in the conservative treatment group, Bohler's angle was 11.21°. The opposite normal side angle was 25°. It was highly significant in both groups. (P-value 0.001)

The crucial angle of Gissane: In the operative treatment group, the postoperative Gissane angle was 104.27°. The opposite normal side angle was 102.08°. On the other hand, in the conservative treatment group, the Gissane angle was 123.73°. The opposite normal side angle was 106.58°. It was highly significant in both groups. (P-value less than 0.001)



X-rays before treatment



X-rays after treatment



Lateral Extensile

At a 1-year follow-up, in the operative treatment group, 3 patients faced delayed wound healing and 1 patient developed subtalar arthritis. In the conservative treatment group, 5 individuals

had developed subtalar arthritis, 6 patients had calcaneal malunion, 2 patients had peroneal tendonitis, and 2 patients had heel exostosis. Values were significant. (P-value 0.029)



Subtalar Rom at 1-year follow up



CT scan

DISCUSSION

For an orthopedic surgeon, these calcaneus fractures continue to be the most difficult to treat. Their focus is on achieving early rehabilitation and proper anatomical reconstruction without any difficulties. It is still debatable to conclude the best treatment for this fracture. A number of researches have been conducted to differentiate between the results of conservative and operative treatment for calcaneal fractures but there is still a debate that exists [14-20]. This research was conducted to differentiate the results of conservative and operative treatment in a prospective manner.

After the radiological union, full weight bearing was initiated. In the operative treatment group, it was initiated with an average of 12.4 weeks while it was delayed by 1 week in the comparative treatment group. In both groups, the results were according to the radiological union time. Similar results were seen in Sanders et al.'s study which developed an articular fracture classification system based on coronal plane imaging [6].

Certain complications were observed in our research. In the conservative treatment group, 3 patients faced delayed wound healing while in the operative treatment group, no major complications were seen. The major complications include subtalar arthritis, calcaneal malunion, deep wound, and peroneal tendonitis. In the conservative treatment group, calcaneal malunion and subtalar arthritis were observed in about 75 percent of patients. Almost the same results were observed by Buckley R et al. who observed lesser complications than in the operative treatment group and in the conservative treatment group [12].

All results were measured using Modified Rowe's score in this research. With a 1-year follow-up of the operative group, according to Modified Rowe's score, 37.5% of individuals had excellent results, 50% of individuals had good results, and only

12.5% of individuals had satisfactory results. On the other hand, with a 1-year follow-up of the conservative group, only 12.5% of individuals had excellent results, 43.75% individuals had good results, 31.25% individuals had satisfactory results, and 12.5% individuals had poor results. Similar results were observed by S. Rammelt et al., who showed that results were mostly good and excellent in the operative treatment group and only 46 percent of results were good in the conservative treatment group [13].

The findings in this research are similar to those studies previously conducted with reference to complications, radiological union, and functional outcomes.

CONCLUSION

In conclusion, operative treatment is a better and more effective method to treat displaced intra-articular calcaneal fractures. In these treatments, open reduction and internal fixation with a pre-contoured calcaneal locking plate are done. Because we followed the core principle of anatomical reduction in intra-articular fracture, which also applies to intra-articular calcaneus fracture, only a few complications, better functional recovery, early rehabilitation, and early weight bearing were seen in the operative treatment.

Funding source: None

Conflict of interest: None

Permission: Permission was taken from the ethical review committee of the Institute

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