

Management of Calcaneum Fracture in Adults Treated with Plating

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Abstract

Background: About 60% of all tarsal bone fractures are calcaneum fractures. 70% of all calcaneal fractures are intra-articular fractures. There are disagreements on how to operate on calcaneum fractures. In order to quantify the functional results of calcaneum fractures treated with open reduction and internal fixation with plate and screws, this study was conducted. Calcaneum intraarticular fractures are not unusual. The calcaneus is the tarsal bone that fractures most commonly. 60% of tarsal bone injuries and 2% of all fractures are calcaneal fractures. The most frequent mode of injury is axial loading, which results in bilateral calcaneal fractures when someone falls from a height. It is necessary to rule out further fractures such pelvic and spinal fractures that are linked to falls from height. Thanks to improved knowledge of fracture patterns and the availability of superior implants, the care of Calcaneal fractures has changed over the past several years from conservative to surgical management.

Aim: To study the treatment of adult calcaneum fractures using plating. The goal of the current study is to evaluate the surgical outcomes of Calcaneal fractures treated with improved implants after intra-articular reduction.

Material and Method: Patients who were hospitalized from the hospital's emergency and outpatient departments were the subjects of the study at the department of orthopedics. Twenty-five patients (20 men and 5 women) who met the inclusion and exclusion criteria for the study had 26 fractures that we assessed. All patients gave their informed consent.

Results: We used plating, such as locking the calcaneal plate, to treat a total of 26 calcaneal fractures in 25 patients. There was a tendency for right-sided fractures among the 25. There were no lost patients to follow-up. Most of the patients were adults in the 30- to 45-year age range. The oldest and youngest patients were 53 and 19 years old, respectively. Therefore, falls from a height occurred most frequently when people were engaged in the construction industry. A small proportion of fractures occurred as a result of four-wheeler-related traffic accidents. In this investigation, there was a minor tendency toward right-side fractures. Compound fractures and bilateral fractures were excluded from this investigation.

Conclusion: Open reduction and internal fixation with an expanded lateral approach and calcaneum locking plates and screws produce a high percentage of positive outcomes in displaced intra-articular calcaneum fractures and very few negative outcomes. For the treatment of displaced intra-articular calcaneum fractures, it may therefore be a superior alternative.

Keywords: Calcaneum, Locking Plate, Internal Fixation, Intra-Articular Fractures, Treatment, Calcaneal Plating, McMaster Technique, AOFAS Score And Maryland Score.

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Introduction

Calcaneum intraarticular fractures are not unusual. The calcaneus is the tarsal bone that fractures the most commonly. 60% of tarsal bone injuries and 2% of all fractures are calcaneal fractures. The majority of calcaneal fractures in industrial workers are male, indicating the significant economic significance of this injury. The most frequent mode of injury is axial loading, which results in bilateral calcaneal fractures when someone falls from a height. It is necessary to rule out further fractures such pelvic and spinal fractures that are linked to falls from height. Additionally, open fractures caused by high-velocity trauma and brake pedal injuries are frequent. [1-3] Although they make up about 2% of all fractures, calcaneal fractures are rather infrequent.[4-6] About 60% of all tarsal bone fractures are caused by them. 70% of all calcaneal fractures are intra-articular fractures. They present the greatest challenges and offer unanticipated results. [7] Regarding results, there is no agreement between surgical and conservative treatment. [8]

The tarsal bone that breaks the most frequently is the calcaneum. 30% of calcaneal fractures are extra-articular, while the remainder are intraarticular. Approximately 2% of all fractures are calcaneal bone fractures. They typically occur in young, active males, are frequently accompanied by additional injuries, have subpar functional outcomes, and have a significant socioeconomic impact. The treating physician continues to struggle with calcaneus fractures. [9,10]

Given their dismal prognosis, intra-articular calcaneal fractures provide a special problem. A high-energy mechanism that frequently results in complex fracture patterns, a significant risk of post-traumatic arthrosis and

persistent pain, and a requirement for further arthrodesis is what causes calcaneal fractures. Internal fixation with low-profile locking plates has evolved into the standard of care for calcaneal fractures in recent years in order to provide the greatest possible repair of the 3-dimensional anatomy.¹¹ The axial pressure pushes talus into the calcaneum, causing the primary fracture line to cross the posterior facet and break into anteromedial and posterolateral fragments. Because it contains the posterior facet, the posterior fragment is significant. Secondary fracture lines, which can result in calcaneal fractures with tongue- and joint depression-like patterns, were first reported by Essex Lopresti. If a secondary fracture line passes through the calcaneum's tuberosity, it causes a tongue-type fracture; if it passes through the dorsal part of the calcaneum joint, it causes a depression-type fracture. [12,13] Depending on the severity of the damage and where the pieces are located, the open procedure may be used to treat these fractures.[14-16]

Calcaneus fractures frequently cause a varus deformity with broadening of the heel, loss of calcaneal height, and incongruity of the subtalar articular surface. These abnormalities can be treated by open reduction and internal fixation (ORIF), which also improves the biomechanics and function of the hindfoot by restoring the anatomic morphology of the calcaneus. Restoring heel width makes it easier to wear shoes, prevents chronic peroneal tendinitis from being caused by impingement from lateral wall blowout of the calcaneus, and maintains plantar flexion strength while restoring the length and alignment of the Achilles tendon. Additionally, ORIF offers the chance to

anatomically reduce and rigidly internal fixate the subtalar joint, as well as to restore the angle of the Bohler's tuber joint. If surgery is required, there are a number of options available, including lateral plating using the extended lateral L-shaped technique [17,18] percutaneous reduction, internal fixation with pins or screws, and external fixation. [19,20] The extended lateral method has been reported as one of these laborious procedures. The purpose of this study was to determine how effectively locking the calcaneum plate would treat misplaced intra-articular calcaneal lesions after open reduction and internal fixation. [21,22]

Material and Methods

Patients who were hospitalized from the hospital's emergency and outpatient departments were the subjects of the study at the department of orthopedics. Twenty-five patients (20 men and 5 women) who met the inclusion and exclusion criteria for the study had 26 fractures that we assessed. All patients gave their informed consent. The patients were between the ages of 19 and 53. According to Sanders' classification, fractures were categorized using coronal pictures of the posterior aspect. According to the prevalent literature, patients with type-I Sanders fractures received conservative treatment, which is the recommended protocol. [13,15] Sanders type-I fractures were not included in the present study.

- Sander's type II-IV underwent surgery and was taken into account in this investigation.
- The L-approach was the surgical technique utilized for lateral plating. With a thigh tourniquet, the patient is positioned in the lateral position.
- There was follow-up at 3, 6, 12, and 24 months.
- X-rays were taken repeatedly.
- The angle of Gissane was calculated.
- The angle of Bohler was calculated.

- Based on the aforementioned findings, the final result was calculated using the Ankle-Hindfoot Scale of the American Orthopaedic Foot and Ankle Society (AOFAS).
- The clinical outcomes were given the following grades: 90 excellent, 80 good, 70 acceptable, and 70 bad. [23,24]

Patients who have been admitted to this facility with a diagnosis of calcaneum fracture make up the study population. After receiving the necessary approval from the relevant authority, hospital records, including case files, operation details, and discharge records, were evaluated to enroll the patients for the study. The study comprised patients who were 19 years of age or older who had displaced intra-articular calcaneum fractures treated with open reduction and internal fixation with calcaneum locking plates and screws. Patients with compound fractures, undisplaced calcaneum fractures, and reduced sensation in the lower limbs were excluded from the study.

Age, sex, injury mechanism, laterality, fracture type according to Sander's classification, surgery type, postoperative wound complication, and duration between the injury and surgery were all noted. The American Orthopedic Foot and Ankle Society (AOFAS) Hindfoot questionnaires were used to measure the ultimate results for patients who visited for follow-up on their own and those who returned after telephone conversation was reviewed (Scores). [25] The AOFAS hindfoot score system primarily evaluates nine aspects: ankle-hindfoot stability (anteroposterior, varus-valgus), alignment, maximum walking distance (blocks), walking surfaces, gait abnormality, sagittal motion (flexion plus extension), hindfoot motion (inversion plus eversion), and pain intensity (20 points for pain, 25 points for function). The score could go up to 50 points (the best possible outcome). At the final checkup, lateral and axial x-rays of

the calcaneum were collected for radiological evaluation. Bohler's angle was measured in a plain lateral radiograph of the calcaneum; an angle is reduced in displaced intra-articular fracture.[26]

Statistical Analysis: Proforma data were entered and documented. The data was then coded and entered into SPSS version 16.0, a statistical tool for the social sciences. Utilizing straightforward descriptive statistics in terms of percentage and frequency, the data was processed and examined. Where appropriate, the mean,

standard deviation (SD), and median of continuous values are reported. χ^2 test and a Wilcoxon's rank-sum test, respectively, were used to assess differences in categorical and continuous data.

Result: -

We used plating, such as locking the calcaneal plate, to treat a total of 26 calcaneal fractures in 25 patients. There was a tendency for right-sided fractures among the 25. There were no lost patients to follow-up.

Table 1: Shows The characteristics of study participants.

| Characteristics | | Findings |
|--|----------|--------------------|
| Age in years | | 28.2 \pm 5.33 |
| range 18-53 years | | 10:1 |
| Male: female | | |
| Mechanism of injury Fall from height | | 10 |
| Fractures as per Sander's classification | Type II | 12 (63.33%) |
| | Type III | 8 (30%) |
| | Type IV | 5 (7.66%) |
| | | 18.93 \pm 1.39 |
| The average duration between the injury to surgery | | Range 8 to 15 days |

The majority of patients were adults belonging to the age group 30-45 years. The youngest patient was 19 years old and the oldest was 53 years.

Table 2: Shows the Mechanism of injury and the Side of the calcaneus

| Mechanism of injury | | |
|---------------------|-------|------------|
| Mechanism | Cases | Percentage |
| Fall | 24 | 95% |
| RTA | 1 | 5% |
| Side of calcaneus | | |
| Side of calcaneus | Cases | Percentage |
| Right | 16 | 55% |
| Left | 9 | 45% |

Therefore, falls from a height occurred most frequently when people were engaged in the construction industry. There were a few fractures brought on by four-wheeler-related traffic incidents. In this study, there was a modest prevalence of fractures on the right side. Compound fractures and bilateral fractures were excluded from this investigation.

Table 3: Pre-operative Bohler's angle and Post-operative Bohler's angle

| Pre-operative Bohler's angle | | |
|--------------------------------------|--------------|-------------------|
| Pre-op angle | Cases | Percentage |
| <20 | 16 | 66.67% |
| 21-25 | 5 | 16.67% |
| 26-30 | 3 | 13.33% |
| 31-35 | - | - |
| Above 36 | 1 | 3.33% |
| Post-operative Bohler's angle | | |
| Post-op angle | Cases | Percentage |
| <20 | 4 | 16.67% |
| 21-25 | 1 | 6.67% |
| 26-30 | 14 | 50% |
| 31-35 | 5 | 20% |
| Above 36 | 1 | 6.67% |

Discussion

The incidence of subtalar arthritis is reduced by open reduction and internal fixation of displaced intra-articular calcaneal fractures by locking calcaneal plate. Although conservative therapy was once regarded as the gold standard, internal fixation is becoming more popular and has outstanding results. If there is substantial edema or the development of fracture blisters, surgery for calcaneus fractures should be postponed, ideally for 10–14 days.[18] Open fractures and the presence of compartment syndrome in the foot are exceptions to this rule, which call for rapid surgery for the necessary treatment.[27] According to Buckley et al report 's on a prospective, randomized investigation, certain groups of patients with displaced intra-articular calcaneus fractures had superior functional outcomes following surgical fixation than those receiving non-operative care.[28] To verify these findings, more prospective research are necessary.[29,30]

44 patients with intra-articular calcaneal fractures were investigated by Almeida et al. [31] These patients had open reduction and internal fixation with reconstruction or a Y plate, and the results were evaluated using the AOFAS score. At the final follow-up, 31.8% of patients had great

results, 11.4% had good results, 29.5% had fair results, and 27.3% had poor results. They came to the conclusion that open reduction and internal fixation is a very good substitute for conservative therapy in intra-articular calcaneal fractures.

Santosh, et al. [32] evaluated the functional results of 24 patients with displaced intra-articular calcaneum fractures after open reduction and internal fixation using locking calcaneal plates. Results were outstanding in 43.3% of patients, good in 33.3%, fair in 10%, and poor in 13.3% of patients, according to the AOFAS score. They determined that using a locking calcaneal plate in conjunction with open reduction and internal fixation of intraarticular calcaneal fractures yielded positive outcomes.

In a study by Palange, et al. [33], 20 of the 30 patients had good results, 7 had fair results, and the final 3 had bad results. Two patients who were stable following debridement and treatment had postoperative wound problems. There were no additional difficulties. In the study by Rak et al.[34], patients treated by open reduction and fixation with calcaneum locking plate and screws had overall outcomes that, according to the AOFAS

score, were satisfactory or outstanding in 30/34 (85%) of the cases.

A meta-analysis comparing the surgical treatment of displaced intra-articular calcaneal fractures with non-operative treatment was carried out by Zhang et al. [35] using data from seven randomized controlled trials (N=908).

Since open reduction and internal fixation (ORIF) did not enhance outcomes and had a significant complication risk, the majority of calcaneus fractures have historically been treated with closed reduction and internal fixation (CRIF). [36] The extended lateral L-type method with lateral plate fixation has been favored by the majority of publications. In 60% to 85% of cases, good to exceptional results have been attained. [37-38] In our circumstances, an extended "L" lateral approach provided good exposure. However, it should be noted that the broad nature of this treatment carries the potential of difficulties with skin healing, which is the main area of dispute. As 45% of the calcaneal vascularity is derived from arteries entering at this point, it exacerbates the traumatic de-vascularization of the central and anterior regions of the lateral wall. [39]

In our analysis, we evaluated 20 fractures (66.6%) on the right side and 10 fractures (33.3%) on the left, compared to 139 instances in Weber et al. 2008[40]'s study. The mean AOFAS score was 79.9 when a follow-up evaluation of the results was calculated at the end (Range 49-96). 13 (45%) of the cases saw excellent results, compared to 10 (35% who had good results), three (10%) who had fair results, and four (10%) who had bad results. These findings were comparable to those of other research carried out by different authors.

A calcaneum fracture handled by open reduction and internal fixation with Locking Branched Calcaneal Plates through the extensile lateral approach was examined by Shrestha R, et al. [41] in

2017. There were 17 cases (77.13%) with good outcomes, 4 cases (18.2%) with fair outcomes, and 1 case (5.5%) with a poor outcome. They came to the conclusion that displaced intra-articular calcaneal fractures treated surgically with open reduction and internal fixation with locking branched calcaneal plates through the extended lateral approach, with proper planning of the operation and surgical techniques in handling soft-tissue results in good clinical as well as radiological outcomes. [42]

Conclusion

Open reduction and internal fixation with an expanded lateral approach and calcaneum locking plates and screws produce a high percentage of positive outcomes in displaced intra-articular calcaneum fractures and very few negative outcomes. For the treatment of displaced intra-articular calcaneum fractures, it may therefore be a superior alternative. As major complications are not considerable, we conclude that open reduction and internal fixation with a locking calcaneal plate is an appropriate therapeutic choice with satisfactory post-operative prognosis for displaced fracture of the calcaneum.

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