



Outcome after ORIF of intra articular calcaneal fractures without augmentation

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Abstract

Introduction: Calcaneum fracture is most common fracture in hind foot. In management of calcaneum fracture there is a lot of controversies either to use bone graft augmentation or not. But in this study we done Calcaneum plating without use of augmentation to reduce chance of infection, reduce graft site morbidity and reduce bleeding. In this prospective study we analyzed outcome of intra-articular calcaneum fracture treatment by open reduction internal fixation with calcaneum plate without any augmentation.

Material and Method: We selected 26 patients with intra-articular calcaneal fractures on basis of strict inclusion and exclusion criteria's from January 2016 to December 2016. All fractures were treated by calcaneum locking plate without any bone grafting, using the standard extended lateral approach. All patients were followed regularly at 2 weeks, 2 months, 3months, 6 months and 1year and outcome were evaluated by using American Orthopedic Foot and Ankle Society (AOFAS) Score.

Results: All fractures were healed with 84.6% of excellent to good results according to American Orthopedic Foot and Ankle Society (AOFAS) Score, only 2 patients had poor results. Radiologically average preoperative Bohler's angle was 6.8° and the average Bohler's angle at follow-up was 31.4°. At final follow up mean Gissane angle was 123.20 degree. Three patients (11.54%) developed chronic ankle pain on walking. Two patients (7.7%) were developed subtalar joint incongruity, two patients (7.7%) developed wound dehiscence, peroneal tendons irritation in one Patient and one patient developed Calcaneum Osteomyelitis.

Conclusion: Well Timed open reduction and internal fixation of intra articular calcaneum fracture with Locking Calcaneum Plate with respect of soft tissue envelope and early rehabilitation lead to therapeutic success. It does not required bone grafting or augmentation to early fracture healing.

Keywords: calcaneum plate, intra-articular calcaneum fracture, lateral extensile approach

Introduction

Calcaneum is the most common tarsal bone to get fractured. It account for approximately 2 % of all fractures, with displaced intra-articular fractures comprising 70–75 % of these injuries [1, 2]. Displaced intra-articular fractures carry a high morbidity and still a therapeutic challenge for orthopedic surgeons. Most common mechanism of calcaneum fracture is high energy axial load in falling. In such injuries, the lateral talar process driven into angle of gissane likes a wedge [3]. Plate osteosynthesis of the intra-articular fracture is a standard method of treatment. The first documented treatment of a series of calcaneum fractures with internal fixation was reported by Leriche [4] in 1922.

Ever since Lenormant first described the use of bone grafting to fill the space created after open reduction of a calcaneum fracture in 1928, this technique has maintained its popularity. However, the need for bone grafts in the treatment of intraarticular calcaneum fracture is still controversial, and there is no strong evidence to support any functional benefits of using bone grafts [5]. Surgeons in favour of bone grafting believe that it could stimulate fracture healing, leading to early full weight-bearing; may prevent posttraumatic arthritis; and could increase mechanical strength, thus helping to prevent significant late collapse [6, 7]. Those not in favour of bone

grafts have stated that the highly vascular calcaneum heals radiographically in 4-8 weeks after surgery without bone grafting [8, 9, 10]. Only internal fixation adequately support the articular surface and bone grafting increases the infection rate, blood loss, postoperative pain [11, 12], and they also consider donor site morbidity and complications involved with harvesting an autograft [13, 14]. We also believe that there is no need of bone grafting in treatment of intraarticular calcaneum fracture.

The purpose of the current study was therefore to evaluate the outcomes and complications of surgical treatment of intra-articular calcaneum fractures without any augmentation. We analyzed cases of displaced intra-articular calcaneum fracture treated by open reduction and internal fixation (ORIF) without bone grafts and observe the outcomes and complications in study group.

Aims and Objectives

Aim of this study was to evaluate outcome and complications after open reduction and internal fixation of intraarticular fracture of calcaneum without augmentation. We analyzed the infection rates, times to full weight-bearing, reduction of the posterior facet, subtalar fusion rates, reduction of Bohler's angle, changes in the crucial angle of Gissane, changes in

calcaneum height, and efficacy outcomes in study group.

Material and Method

This prospective and non-randomized study included 26 patients who were aged from ≥ 18 years and were diagnosed as having intra-articular calcaneum fracture. The fractures were stabilized with the open reduction and internal fixation with calcaneum locking plates by using extensile lateral approach without any augmentation at the authors' institutions from January 2016 to December 2016. All patients were selected on basis on following strict inclusion and exclusion criteria's.

Inclusion criteria: Patients(age ≥ 18 years) with Unilateral, displaced intra-articular calcaneum fractures (posterior articular facet step-off more than 2 mm, loss of height, and widening of the calcaneum, valgus deviation $> 10^\circ$, varus deviation $> 5^\circ$) of Sanders type II, III, or IV

Exclusion criteria were patients can treated conservatively due to patient's own choice or lack of surgical indication, associated fractures, lack of adequate skin condition, edema, and blisters in the lateral aspect of the foot, associated with other comorbidities, heavy smoking, refusal to undergo surgical treatment, bilateral fractures; and refusal to sign the inform consent form.

General physical examination, local examination, assessment of skin condition was recorded. Appropriate x-rays of ankle were taken for all patients (figure 1). All patients also underwent CT scan for further assessment of type of fracture and classified according to Sanders and Essex-lopresti classifications. All required laboratory tests were done in all patients for pre-operative fitness. Pre-operative counselling of the patient and his/her relatives regarding the method of treatment and prognosis was done and consent for surgery and for research study was taken.



Fig 1: x ray lateral view of ankle showing calcaneum fracture with decreased bohler's angle

All patients were operated with the classic L-shaped lateral approach, incision starts from midway between the posterior region of the lateral malleolus and Achilles tendon, horizontal arm passing 3 cm below the lateral malleolus, extending to the calcaneocuboid joint. Due to the high risk of skin necrosis, dissection was made at the subperiosteal level. The flap was folded down and maintained cranially with three 2.0 mm K-wires attached to the talus, with visualization of the sheath of the peroneus muscles, which was preferably preserved. Under direct visualization of the fracture reduction was carried out, with K-wire temporary fixation performed after confirmation under C-arm intensifier. Definite fixation was made with

calcaneum locking plate (figure 2). After closure by planes, an elastic compression bandage was applied with drain for 48 h and casting for four weeks. Partial load was authorized at the sixth postoperative week. Autografts to fill the space created inside the calcaneus were not used.



Fig 2: intra-operative image showing retraction with k-wire and plate placement.

All patients were followed regularly at 2 weeks, 2 months, 3 months, 6 months and 1 year. Outcomes were evaluated by using American Orthopedic Foot and Ankle Society (AOFAS) Score. Clinically, the following aspects were analyzed: subtalar joint in the standing and supine positions, varus and valgus deviation of the Hindfoot, Abduction, Adduction, Pronation and Supination of the forefoot, range of motion for ankle flexion and extension, appearance of surgical scars, and need for crutches. All patients underwent late postoperative radiographic (figure 3 and 4) assessment of Bohler's and Gissane angle and bilateral computed tomography with 5-mm thick axial, coronal, and sagittal cuts.



Fig 3: post operative x-ray lateral view calcaneum showing restoration of normal Bohler's and Gissane angle.



Fig 4: x-ray axial view calcaneum showing good reduction and no widening of calcaneum

Observation and Results

Among the 26 patients included in this study, 17 were men and 8 were women. Their average age was 42.6 (18–58). The right side was involved in 19 cases and the left side in 7 cases.

The most frequent mechanism of injury was fall from height, occurring as an isolated fracture of lower limb. All cases were closed fractures.

None of cases included in this study were two-part shear fractures (type I). There were eighteen cases of type II fractures; four type IIA, eleven type IIB, three type IIC. Eight cases were type III fractures; five types IIIAB, two types IIIBC and one type IIIAC. Fifteen cases were classified as a joint depression type and eleven as tongue depression type. (TABLE 1).

Table 1

Sander’s classification	No of patients
Type II	18
	Type II A=4
	Type II B=11
	Type II C=3
Type III	8
	Type AB=5
	Type BC=2
	Type AC=1
Essex-lopresti classifications	
joint depression type	57.7% (15/26)
tongue depression type	42.3% (11/26)

Surgery was performed after an average of duration of 8.21 days from admission (range 4–21 days).

There were thirteen excellent (50%), nine good (34.62%), two fair (7.7%), and two poor (7.7%). For simplicity, the excellent

and good cases were rated satisfactory (84.62%). (TABLE 2)

Table 2

Excellent	90-100	13	50.00%
Good	80-89	9	34.62%
Fair	70-79	2	7.7%
Poor	<70	2	7.7%
Total		26	100%

Radiologically average preoperative Bohler’s angle was 6.8° (range, -20° to 19°), and the average angle at follow-up was 31.4° (range, 20°–45°). This change represented an average restoration of Bohler’s angle to 91.4% of normal (range, 67–100%). Similarly, calcaneum height showed an average correction to 92.6% of normal height (range, 85–100%).

The average residual widening of the calcaneum at follow-up was 9.2% of normal (range, 3–27%). The majority of patients had a congruent and non-arthritic joint, only two patients (7.7%) showed 2–3-mm step of articular surface and significant arthritic changes. At final follow up mean Gissane angle was 123.20 degree.

Pain at the lateral aspect of heel was the main complain of the majority of patients. Three patients (11.54%) developed chronic ankle pain on walking. Pain was tolerable and developed only after long walk. Two patients (7.7%) were complaints of Pain related to subtalar joint incongruity, two patients (7.7%) developed wound dehiscence, peroneal tendons irritation in one patients and one patients developed calcaneum osteomyelitis. Out of the twenty six patients included in this study, eighteen patients (69.2%) had mild swelling and eight patients (30.7%) moderate swelling. (TABLE 3).

Table 3

Complication	
Chronic ankle pain	3 patients (11.54%)
Subtalar joint incongruity	2 patients (7.7%)
Wound dehiscence	2 patients (7.7%)
Peroneal tendon irritation	1 patient (3.84%)
Calcanum osteomyelitis	1 patient (3.84)
Mild swelling	18 patients (69.2%)
Moderate swelling	8 patients (30.7%)

Twenty one patients (80.7%) returned to their previous occupation full time, while four patients (15.4%) attended the same job but with some restriction, and only one patient changed his job to a more sedentary one

Discussion

Calcaneum fractures are more common in young adult male those working on height and as young adults are economically active so these calcaneum fracture also have socioeconomic effect on society. In our study, we found that 65.38% of patients were male and 34.62% patients were females and had a mean age of 42.6 years. The right side was involved in 19 cases and the left side in 7 cases.

According to the literature, the most common cause of intra-articular fractures of the calcaneum is a fall from height, [15] which was confirmed in the present study, as this cause

accounted for 92% of the fractures.

The Essex-Lopresti [16] classification determines the line of fracture and allows treatment planning. According to the Essex-Lopresti classification, intra-articular fractures can be tongue-type or joint depression type. In most series, joint depression is the most frequent type of fracture, accounting for 43%–61% of intra-articular fractures [17, 18]. In our study, 57.7% of fractures were joint depression-type and 42.3%, tongue-type

Tomographic classifications help to assess the severity and prognosis of the injury; the Sanders classification is the most commonly used [19]. However, tomographic classifications are not uniform and each group aims to create its own classification, which makes it difficult to compare results as well as to identify the type of injury they describe. Tomography is considered to be an excellent test to identify details of the fragments and the joint impairment; however, it is not available in all services. This limitation justifies the use of a radiological classification.

In the last decade, open reduction and internal plate fixation of dislocated intra-articular calcaneum fractures has become a standard surgical method with low complication rate and better quality of life after the surgery. The method has been improved by implanting locking compression plates, the osteosynthesis is more stable, enables earlier weight-bearing, and bone grafting is rarely necessary [20,21]. In our study we used calcaneum locking plate in all patients and reported better functional outcome according to AOFAS Hind foot scale with better wound healing and less complications. We operated within first two weeks after injury because the surgery in the third week from injury is burdened with higher percentage of soft tissue healing complications and ORIF performed with more than three weeks delay is not recommended [22, 23].

The use of bone graft is controversial, some authors consider it to be osteoinductive and osteoconductive, while others consider it unnecessary [24, 25]. It is noteworthy that the use of bone graft increases the incidence of morbidity, as another incision is made for graft harvesting. In the present study, any bone grafts to fill the bone loss were not used. The lateral L-shaped access route has been widely used because it allows better visibility of the fracture, fragment reduction, and internal fixation and preserves the blood supply [24, 26]. In this study, the extended lateral L-shaped access was efficient; it was used as a standard technique for all cases. Wound necrosis is usually the result of improper incision and exposure for long surgery [27]. Necrosis is observed more frequently in the end of the lateral L-shaped incision [28]. In the present study, two patients needed surgical debridement due to skin necrosis, which solved the problem without the need of a skin graft. Symptoms associated with implants problems, which are rarely reported in the literature, include prominent implant, skin irritation, and heel pain. Problems usually arise because plate and screws cause irritation to the skin, tendons, or nerves, or because a screw penetrates the facet joint [29, 30]. Tendon involvement due to implants can result in tendinitis or rupture, and lead to tendinitis and secondary pain [31]. In our study, no patients' complaints of implant related problems.

Assessing the results using the AOFAS scale, the literature presents rates of excellent results, ranging from 42.22% to

62% [32, 33, 34]. In this study, 84% of the results were considered good to excellent. It is not possible to state with certainty that the type of fracture may have influenced the score, as in the present sample, the number of tongue-type fractures was small when compared with joint depression.

Post-traumatic arthritis usually occurs in the subtalar and calcaneocuboid joints [35]. The literature reports an incidence rate of 1.2% in studies with long term follow-up [29, 36]. When intractable pain cannot be controlled by analgesics, subtalar arthrodesis may be the best option [29]. In the present study, two patients developed intractable pain due to subtalar arthritis and advised for subtalar arthrodesis to get relief from pain. In our analysis, we confirmed correlation between the Bohler's angle size and patient satisfaction in study group, as well as dependence of articular joint incongruence and the subsequent subtalararthrosis. This fact, proved and verified by a lot of other authors, confirms the role of Bohler's angle size as a predictive factor for subsequent late complications [22, 37]. Loucks in his prospective randomized study pointed out that initial negative size of Bohler's angle negatively influences postoperative results irrespective of therapy choice [5].

Conclusion

Well timed open reduction and internal fixation of intra articular calcaneus fracture with Locking Calcaneum Plate with respect of soft tissue envelope and early rehabilitation lead to therapeutic success. It does not required bone grafting or augmentation to early fracture healing. In general these fractures are operated with some delay. Considering the rare incidence of these fractures, need of special hardware equipment and relevant experience, the primary management of these injuries as well as complication treatment should be centered in specialized departments of orthopaedics or traumatology.

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