

A Study of Management of Intra Articular Calcaneum Fractures with CC Screw and K Wires Using Minimally Invasive Approach

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Abstract

Intra articular calcaneum fractures remain a challenging task for management owing to the various complications of both non operative and operative procedure. Non operative management can lead to heel widening and shortening, varus mal alignment leading to difficulty in walking. On the other hand operative technique using lateral extensile approach can lead to skin necrosis and infection. As a result it is important to try and manage these fractures in a minimally invasive manner. In this study we have selected patients with intra articular depressed calcaneum fractures and we have treated them using a minimally invasive approach using k wires and cc screws. In this way we were able to avoid any wound complications and we were able to restore the normal anatomy of calcaneum.

Keywords: Intra articular calcaneum fracture • CC screw • K wires • Minimally invasive technique

Introduction

Calcaneal fractures account for approximately 2% of all fractures, with displaced intra-articular fractures comprising 60% to 75% of these injuries. Of patients with calcaneal fractures, 10% have associated spine fractures and 26% are associated with other extremity injuries. Calcaneal fractures are most commonly the result of a high energy motor vehicle crash or a fall from a height. The pattern of fracture lines and extent of comminution are determined by the position of the foot, the amount of force, and the porosity of the bone at the time of impact [1]. Based on the pattern of fracture line they are divided into two types: a) tongue type and b) joint depression type.

Lower-energy injuries with minimal force produce only mild swelling and ecchymosis, whereas higher-energy injuries result in severe soft tissue disruption and may result in an open fracture. The initial radiographic evaluation of the patient with a suspected calcaneal fracture includes a lateral radiograph of the hind foot, an anterior posterior radiograph of the foot, a Harris heel view, and an ankle series. In this way, all associated fractures, subluxations, and/or dislocations can be diagnosed. Because of the association with lumbar spine fractures, routine lumbar spine radiographs should also be obtained. If the radiographs reveal an intra-articular component to the calcaneal fracture, computed tomography (CT) scanning is indicated.

The lateral radiograph of the hind foot demonstrates two important angles: The tuber angle of Bohler and the crucial angle of Gissane. The tuber angle of Böhler is composed of a line drawn from the highest point of the anterior process of the calcaneus to the highest point of the posterior facet and a line drawn tangential to the superior edge of the tuberosity. The angle is normally between 20 and 40 degrees; a decrease in this angle indicates that the weight-bearing posterior facet of the calcaneus has collapsed, thereby shifting body weight anteriorly.

The crucial angle of Gissane is formed by two strong cortical struts

extending laterally: One along the lateral margin of the posterior facet and the other extending anterior to the beak of the calcaneus. These cortical struts form an obtuse angle 54 and are visualized directly beneath the lateral process of the talus.

CT scanning has vastly improved the understanding of calcaneal fractures and has subsequently allowed for consistent analysis of treatment results. CT images are obtained in the axial, 30° semi coronal, and sagittal planes. The coronal views provide information about the articular surface of the posterior facet, the sustentaculum, the overall shape of the heel, and the position of the peroneal and flexor hallucis tendons. The axial views reveal information about the calcaneocuboid joint, the anteroinferior aspect of the posterior facet, and the sustentaculum. Sagittal reconstruction views provide additional information as to the posterior facet, the calcaneal tuberosity, and the anterior process.

Operative treatment is primarily indicated for (a) displaced intra-articular fractures involving the posterior facet, (b) anterior process of the calcaneus fractures with more than 25% involvement of the calcaneocuboid articulation, (c) displaced fractures of the calcaneal tuberosity, (d) fracture-dislocations of the calcaneus, and (e) selected open fractures of the calcaneus. Surgery should be performed within the initial 3 weeks of injury prior to early consolidation of the fracture. Surgery should not be attempted, however, until swelling in the foot and ankle has adequately dissipated, as indicated by a positive wrinkle test [2].

Percutaneous fixation may be used as definitive treatment, in which small incisions are used for the placement of Schanz pins and small periosteal elevators in assisting with the reduction, followed by multiple small fragment screws axially and laterally.

Methods

In this study we have included all patients with intra articular depressed calcaneum fractures with or without co morbidities. In total 10 patients were admitted from October 2021 to June 2022. 8 of these patients had a history of fall from a height and the remaining 2 patients had history of road traffic accident. Out of the ten patients seven were male and three were female. All the patients were within the age group of 18 to 65 years. Two patients had history of diabetes whereas two patients had history of chronic tobacco intake; remaining 6 patients had no history of co morbidities or addictions. All the patients had complaints of pain and swelling in the heel with difficulty in walking. None of the patients had other limb or spine injuries. Out of the 10 patients, 4 patients had involvement of right calcaneum whereas other 6 had

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involvement of left side. None of them had bilateral involvement [3]. None of the patients had open fracture.

We had admitted these patients in ward after getting their lateral and axial images of heel along with 3d CT scan. All patients were given below knee slab. They were started on pain killers and anti-inflammatory [4]. Strict limb elevation was advised over pillow and they were given ice packs. Their routine blood investigations were sent and an aesthetic fitness was taken. As soon as the swelling reduced with appearance of wrinkle sign these patients were posted for surgery. All patients were operated within 6 to 12 days.

They were operated in a floppy lateral position under spinal anesthesia and tourniquet control. The operative foot and leg was prepared, painted and draped under strict aseptic precautions. C arm images were taken to identify the depressed fracture. Artery forceps was used to identify the site of incision. Horizontal incision was taken just below the depressed intra articular fracture about 2 cm in length. Using an artery forceps or osteotome the depressed intra articular fragment was elevated. A thick k wire was then passed along the anterior and posterior facets to keep the depressed fragment elevated. Multiple k wires were used to fix the remaining fragments [5]. C arm images were taken to see the fracture reduction and once it was found satisfactory, multiple cc screws were inserted. In some cases the k wires were removed whereas in some they were retained and the ends were cut short. Tourniquet was deflated after the procedure and the incision was closed with 3-0 ethilon.

Post operatively dressing was checked on the third day. None of the patients had soakage, or wound complications. Sutures were removed on the 14th day and the wound was found to be healthy in all the patients. All the patients were given below knee slab for 6 weeks and were advised non weight bearing. For patients with K wires, they were removed after 6 weeks. They were advised partial weight bearing after 6 weeks and full weight bearing after 3 months. All the patients treated in this manner had good functional outcomes with pain relief and ability to walk. They were able to do their routine activities after 4 to 5 months. None of the patients had any wound complications [6].

Here are few of the examples of cases which were managed accordingly (Figures 1 and 2).

Results

The average age of the patients was 38 years ranging from 18 to 65 years. Injury mechanism included fall from height in 8 patients and road traffic accident in two. The average length of postoperative hospital stay was 3 days. There were no wound complications or neurovascular injury. 9 patients were pain free post op whereas one patient had mild pain. All the patients were able to walk unaided. None of them had ankle stiffness.

Discussion

Depressed intra articular calcaneum fractures management remains challenging. There is still debate whether open reduction is better or percutaneous fixation is better. Articular reduction using percutaneous method is challenging and cannot be achieved in all the patients as compared to open reduction. But wound complications and infection are far less using percutaneous reduction as compared to open reduction. Recent studies have shown a trend toward better functional outcomes in the operatively managed groups than those treated non-operatively. However, the major concern about wound-related complications with the extensile lateral L-shaped approach has troubled many orthopaedic surgeons with complication rate reported to range from 11 to 25%.

There are a few limitations in this study. First, we had a relatively small number of patients and short average follow-up time. Therefore, further investigation with a larger sample size and longer follow-up time is needed to obtain more overall clinical data.

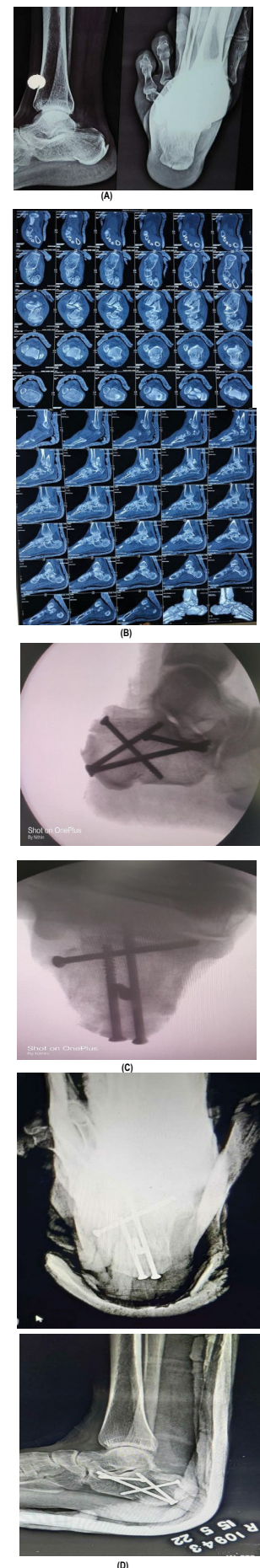


Figure 1. 40 year old male with left calcaneum fracture due to fall from height. (A) Pre-op X-ray, (B) CT images, (C) Post-op c arm images and (D) Post-op X-ray images.

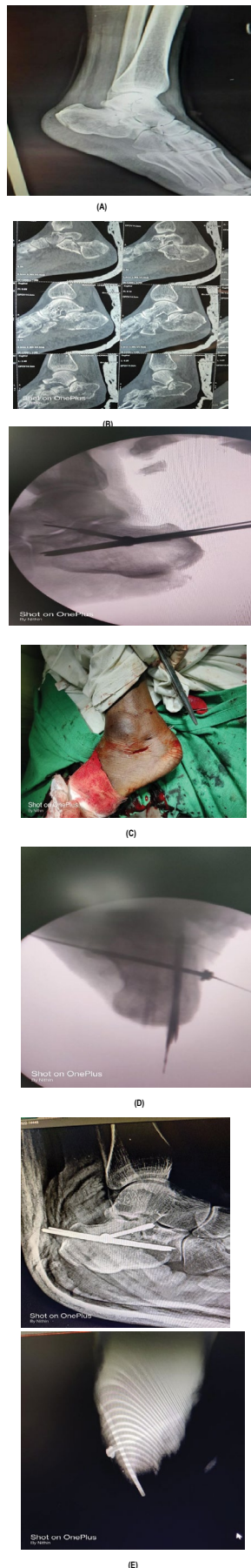


Figure 2. 38yr old male with left calcaneum fracture due to history of fall from height with chronic history of tobacco intake. (A) Pre-op X-ray image, (B) CT scan images, (C) Intra-op image of skin incision, (D) Intra-op c arm images, (E) Post-op X-ray images.

Conclusion

Surgical treatment of intra articular calcaneal Fractures remains challenging task. However minimally invasive reductions remains good option to minimize wound complications. Ideal methods of fixations still remain debate. Cannulated cancellous screw and k wire fixation are good options for intra articular calcaneal fracture.

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