



Case report

Open tuber calcaneus fracture caused by a meat cleaver: A case report

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HIGHLIGHTS

- Avulsion fractures of tuber calcanei are very rarely observed.
- Direct blunt trauma to the back of the leg and direct penetrating injury (gunshot) are also infrequent causes.
- Computed tomography is beneficial in specifying the type and size of the fracture.
- Anatomic reduction and early mobilisation are the advantages of surgical treatment.
- Delaying surgery may lead to skin necrosis and severe soft tissue complications.

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ABSTRACT

Introduction: Avulsion fractures of the tuber calcanei classically occur after falling on the foot, due to the forced dorsiflexion and the sudden contraction of the Achilles tendon. Direct trauma to the back of the leg and a direct penetrating injury are also infrequent causes and may be observed predominantly in younger patients.

Presentation of case: We present a case of an open tuber calcaneus fracture resulting from a penetrating trauma in a 37-year-old patient. The fracture was reduced through the open wound and fixed using two cannulated screws. Bone union was radiologically and clinically observed at the end of the first year.

Discussion: During a physical altercation, the posterior of the patient's heel was struck directly with a meat cleaver. The position of the patient during the trauma can be considered to have increased the severity and depth of the injury. In addition, even though the injury radiologically resembled an avulsion fracture and was caused by direct trauma, the fact that it was open and that the mechanism of injury differed from the norm means that it should not be evaluated as a classic avulsion fracture in the full sense. Emergency open reduction and internal fixation were applied to an open calcaneal tuberosity fracture, and the patient was started on intravenous antibiotic therapy.

Conclusion: Surgical techniques are successful in the treatment of open tuber calcanei fractures and an open intervention is usually required. Using cannulated screws is a good treatment option.

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1. Introduction

Calcaneal fractures are the most frequently observed type of tarsal fracture. Although they account for 2% of all bone fractures, 25%–40% of these are extra-articular fractures [1,2]. Avulsion fractures of the tuber calcanei also account for between 1.3 and 2.7% of all calcaneal fractures [3]. The back end of the fracture in particular

may be displaced towards the posterosuperior aspect and may pierce the skin.

An avulsion fracture of the tuber calcaneus is a rare condition that occurs due to a sudden contraction of the Achilles tendon [4]. Osteoporosis, osteomalacia, diabetes mellitus, peripheral neuropathy, and long-term immunosuppressive treatment are all important risk factors for avulsion fractures of the calcaneus [5]. The frequency of these fractures has been reported to increase in the seventh decade in females, in parallel with a reduction in bone density [5,6]. Tuberosity avulsion fractures usually occur due to a sudden and violent pull of the gastrocnemius–soleus complex caused by a forced flexion of the foot during a low-energy stumble and fall [1,5].

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Fig. 1. Open avulsion fracture of the calcaneus.

Although the majority of calcaneal fractures are treated conservatively, calcaneal avulsion fractures require surgical treatment [2,7]. As the calcaneus is the point of attachment of the Achilles tendon, there is a permanent displacement of the fracture fragment. However, as in all other open fractures, open avulsion fractures require urgent intervention and treatment. This study evaluated the relationship between the position of the patient at the time of injury, the type of instrument (i.e., a direct cutting instrument) that caused the injury, and the location of the injury.

2. Case presentation

A 37-year-old male was admitted to the emergency room with a deep cut in the posterior aspect of his right foot, caused by a penetrating trauma originating from a meat cleaver. During a physical fight the patient fell to his knees, with his ankle in dorsiflexion and toes in extension, and was exposed to a manual, direct cutting injury. The patient's history was uneventful. Physical examination revealed a 12-cm long, deep transverse laceration on the posterior aspect of the right ankle, which had intersected the bone (Fig. 1). The avulsed section of the calcaneus was visible through the open wound line. The patient was unable to stand on his toes or to walk, and the Thomson's test was negative. Radiological evaluation



Fig. 2. Radiological view.



Fig. 3. X-ray on the first postoperative day.

indicated a beak-type calcaneal avulsion fracture, which was classified as Type II according to the Beavis classification (Fig. 2).

The wound site was dressed after debridement and thorough irrigation, and a splint was applied. The patient was vaccinated against tetanus, and Cefazolin sodium (1 g) was administered intravenously as antibiotic prophylaxis and was continued for 2 weeks at a dose rate of 3×1 g. The patient underwent surgery the following day. Without creating an additional incision, the fracture



Fig. 4. Wound healing.



Fig. 5. Rising on the toes.

was reduced through the open wound and fixed using two cannulated screws 6.5 and 4.5 mm in diameter (Fig. 3). Intraoperative evaluation revealed that the Achilles tendon was intact. The foot was placed in a short leg cast in the equinus position. The equinus was reduced every second week, and the ankle position was neutralised in the sixth week and the cast removed. Ankle range-of-motion exercises were initiated, and full weight was applied during the second month. At the 3-month follow-up examination, a full range of motion was determined in the ankle, and the radiological assessment showed a complete union along the fracture line. No wound site complications were observed during the follow-up period (Fig. 4). The patient had no complaints, and he was observed to be able to stand on his toes and walk painlessly while applying full weight on the operated foot during the clinical and functional evaluation (Fig. 5). At the 1-year follow-up, the patient had no complaints of pain or disability. A physical examination demonstrated no acquired deformities, focal weakness, or loss of function (Fig. 6).

Informed consent was obtained from the patient for data and photographs concerning his case to be submitted for publication.

3. Discussion

Avulsion fractures classically occur after falling on the foot, due to the forced dorsiflexion and sudden contraction of the Achilles tendon. Direct trauma is a less frequently observed cause. Direct blunt trauma to the back of the leg and direct penetrating injury are also infrequent causes but may be observed, especially in the younger age group [2]. The case presented in this study is of a male patient with a very rare, open calcaneal avulsion fracture caused by a sharp object.

According to the classification by Beavis et al., avulsion fractures of the tuber calcanei are divided into three groups: real avulsion (sleeve type), beak type avulsion, and infrabursal avulsion. Infrabursal avulsion is a very rare condition and is usually observed in younger patients [7]. In an article published in 2012, Lee et al. modified the classification scheme of Beavis et al. by dividing calcaneal avulsion fractures into four subgroups according to the results from surgery, magnetic resonance imaging, and evaluation of specific features (Fig. 7). The characteristics of avulsion fractures were identified along with the recommended treatment. The present case was a Type 2 (beak type) fracture according to both classification systems. As in the current case, beak type fractures are usually seen in younger patients and are associated with a direct blow [8].

As the trauma occurred during a physical altercation, the position of the patient can be considered to have increased the severity and depth of the injury. As a stretched and stable foot position was created, with the hind foot or tuber calcanei locked to the ground with the knees bent and the toes in extension, it is considered that the severity of the blow made with the meat cleaver was increased. However, if the foot had been in plantar flexion and the dorsal of the forefoot had been in contact with the ground, the same trauma could have resulted in amputation from the ankle or an isolated Achilles tendon laceration. Thus, the same manner of trauma with the foot in a different position will change the nature of the injury. In the case presented here, the location and type of injury are directly related to the position of the extremity. Although the injury resembled an avulsion fracture according to the above-mentioned radiological classification and was caused by direct trauma from a meat cleaver, it was an open fracture and, due to the mechanism of the different posture of the patient, should not be evaluated as an avulsion fracture.

Although the majority of calcaneal fractures are treated conservatively, calcaneal avulsion fractures require surgical treatment [2,7]. Screw fixation is a good choice for adequate bone



Fig. 6. Control X-ray at 1 year.

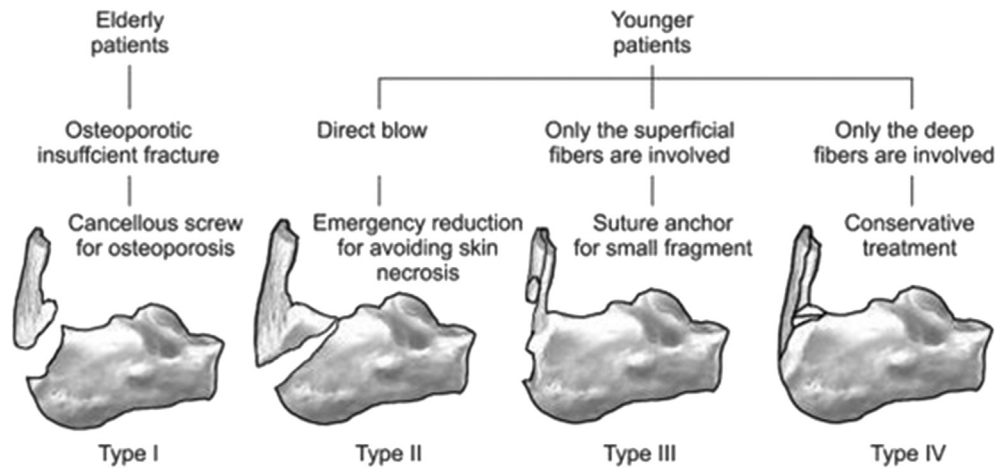


Fig. 7. SM Lee et al. classification scheme; Characteristics of the avulsion fracture of the calcaneal tuberosity and recommended treatment.

fragments for fixation [9]. In small number of bone fragments, suture anchor fixation leads to better outcomes in comparison with screw fixation [10].

In adequate bone fragments, cannulated screw fixation is an appropriate choice of treatment as it allows for positioning of the fixation screws with a guide wire at appropriate angles. In the current case, intravenous antibiotherapy was administered because there was the possibility of wound contamination by organic material from the meat cleaver. Erdmann et al. recommended that adequate and immediate debridement be applied, followed by fracture reduction, and that early primary or, if necessary, secondary, wound coverage be applied to open wounds and lacerations of the lower extremities [11]. In the case presented in this study, following surgical debridement, screw fixation was applied through the open skin area without creating an extra incision. Two screws were used to prevent a possible rotational movement in the fractured piece and to maintain a more secure fixation. As the skin edges of the wound were regular and there was no soft tissue loss, the skin was closed easily with no requirement for a skin graft.

4. Conclusion

In conclusion, open calcaneal tuberosity fractures need to be surgically treated in the early phase. Using cannulated screws in the treatment is a good option. When there is the possibility of wound contamination with organic material, debridement of the wound and antibiotherapy should be applied.

Ethical approval

This is a case report.

The patient was informed that the data concerning his case would be submitted for publication.

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Author contribution

ST, TD, SM and IK were involved in the conception, design and interpretation. ST, TD and SM wrote the manuscript. ST, IK and SM collected data, reviewed relevant published reports and provided the images. All authors read and approved the final manuscript.

Conflicts of interest

No conflict of interest was declared by the authors.

Consent

Written informed consent was obtained from patient who participated in this case.

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