



## Case report

# A new treatment for avulsion fracture of the calcaneus using an Ilizarov external fixator



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## ABSTRACT

**Introduction:** In the treatment of avulsion fractures of the posterior calcaneal tuberosity, open reduction and internal fixation are prone to several complications. We describe a new treatment using an Ilizarov external fixator, which can minimise the complications and achieve sufficient stability of the displaced fragment.

**Case presentation:** A 55-year-old woman sustained an avulsion fracture of the calcaneus. Examination revealed the development of bruising with extremely taut skin over the posterior prominence of the displaced bone. Radiographs demonstrated grossly proximal displacement of the tuberosity fragment. Surgery was exclusively percutaneous using an Ilizarov external fixator. The displaced fragment was adequately reduced and stabilised. Progressive weight bearing in the equinus position was initiated at the third week after surgery and the external fixator was removed at the seventh week. There was no skin necrosis or loss of reduction while the fixator was maintained. Postoperative follow-up for 2 years revealed full recovery.

**Discussion:** Major postoperative complications after conventional open reduction and internal fixation include skin necrosis, skin irritation by metal implants and re-displacement of the reduced fragment. Our method of using an external fixator may decrease the incidence of these three complications.

Skin incision and the risk of skin necrosis are inevitable during internal fixation. On the other hand, the use of an external fixator reduces or eliminates skin necrosis, as it is applied percutaneously for reduction and stabilisation of the fragment. External fixation is mostly recommended in cases of poor vascularity or bruising. In addition, skin irritation can be avoided upon removal of the external fixator.

Re-displacement occurs occasionally as a serious complication in lag screw fixation, particularly in cases with poor purchase of the osteoporotic bone. Tension band wiring and application of an Ilizarov external fixator in avulsion fractures of the calcaneus can neutralise tension on the Achilles tendon during the healing process. Thus, both these methods are believed to provide sufficient mechanical stability to fix the fragment.

**Conclusion:** This new method, involving application of an Ilizarov external fixator, is recommended when the avulsion fragment is large enough to accommodate Ilizarov wires, especially in cases of circulatory problems or bruising.

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## Introduction

Avulsion fractures of the posterior calcaneal tuberosity are relatively rare, comprising only 1.3–2.7% of all calcaneal fractures.<sup>1,2</sup> Therefore, there is limited literature regarding this injury. Since closed manipulation often fails to achieve adequate reduction of these fractures, open reduction and internal fixation

(ORIF) involving the use of lag screws, cerclage wires or tension band wiring are most often required.<sup>3–5</sup>

Surgeons should understand that ORIF for this type of fracture can lead to several complications such as skin necrosis, metal irritation and loss of reduction of the fragment.<sup>6</sup> Occasionally, the patient's condition progresses to osteomyelitis, or breakage of the reduced fragment occurs, which may require additional treatment with debridement or creation of a skin flap, leading to prolonged immobilisation with poor outcomes.<sup>7,8</sup> Surgery is therefore crucial to minimise complications.

The purpose of this study is to introduce a new treatment method, involving Ilizarov external fixation with minimal skin incision, to achieve sufficient stability of the displaced fragment.

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**Fig. 1.** Preoperative radiograph showing avulsion fracture of the calcaneus.

This method decreases the incidence of complications, with satisfactory results.

### Case presentation

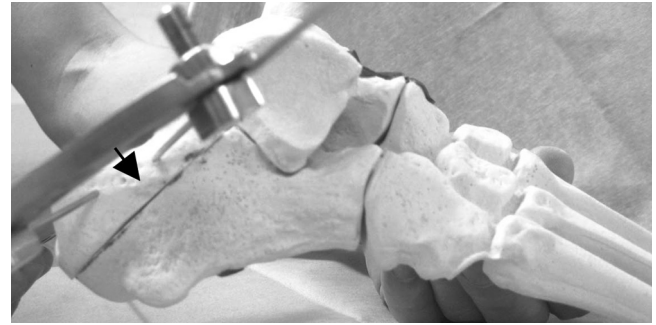
A 55-year-old woman sustained an injury to the left heel (in September 2009) when she tried to maintain her balance while holding a baby in her arms. She experienced immediate pain and sat down. Physical examination revealed tenderness and substantial swelling at the posterior aspect of the left heel. The skin was extremely taut over the prominence of the displaced bone. On calf compression, weakness of ankle plantar flexion and loss of function of the calcaneal tendon were observed. The following day, a blister developed on the left heel area, indicating impaired circulation.

Radiographs demonstrated a substantial proximal displacement of the tuberosity fragment with extension of the fracture line into the subtalar joint (Fig. 1).

Surgery was performed 4 days after the injury. Postoperatively, weight bearing was prohibited for the first 2 weeks, although non-strenuous range-of-motion exercises were allowed. Progressive weight bearing while maintaining the foot in the equinus position was initiated in the third week after surgery, with periodic radiographic evaluation. The external fixator was removed 7 weeks after surgery. During application of the external fixator, no cutaneous circulatory problems were observed. Full weight



**Fig. 2.** Follow-up examination at 6 months revealing complete fracture healing with minimal displacement.



**Fig. 3.** The displaced fragment is reduced using the external fixator apparatus (saw bone model).

bearing was permitted after 10 weeks. Good recovery and resumption of normal function without pain after 3 months were achieved.

The follow-up examination 2 years after the operation revealed neither pain in the heel nor scar formation in the hind foot. The range of movement was comparable to the normal contralateral side. The Thompson test was negative and heel raising was normal. Radiographs showed good fracture healing with no sign of reduction loss (Fig. 2).

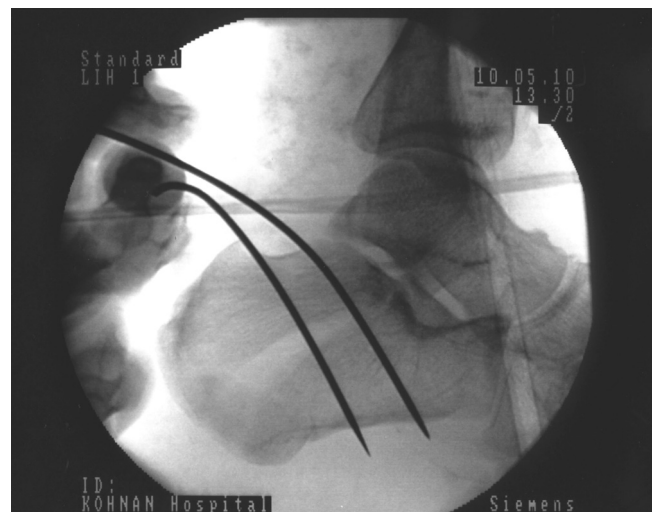
### Surgical technique

All procedures were conducted under general anaesthesia and control of an image intensifier. A closed reduction was initiated but was unsuccessful, as is often the case.

### Operative procedure

The operative procedure was as follows:

1. The patient was maintained in a right lateral decubitus position.
2. Two crossed olive wires were inserted into the displaced calcaneus fragment and were fixed to a half ring under tension.
3. The half ring with olive wires facilitated fracture reduction by applying a downward force. Lateral view using an image intensifier showed the extent of reduction (Fig. 3).
4. With adequate reduction, a Kirschner wire (K-wire) was temporarily inserted (Fig. 4).



**Fig. 4.** Kirschner wires fixing the displaced fragment. Percutaneous reduction is adequate.

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