Case Report

Calcaneal Avulsion Fracture: Case Report and Surgical Technique

Melanie KF. Vandenberghe1*, Timothy Leenders2, Saskia Van Bouwel2, and Jozef Michielsen2

1Department of Orthopaedics, Antwerp University Hospital, Belgium
2Department of Orthopaedics, AZ Monica Hospitals, Belgium

Abstract

Avulsion fractures of the calcaneus are relatively uncommon and its incidence peaks in elderly women with reduced bone mineral density and neuropathic conditions. To be able to restore achilles tendon function, surgical treatment is warranted with displacement more than 1 cm. The use of fixation screws alone does not give enough pull out strength, so techniques have to be combined. When performing surgery, one must be aware this type of injury is notorious for its skin problems. With a bulky mass construction it is not always possible to avoid wound dehiscence.

In this case report we aim to show a novel surgical technique when presented with a Böhler type 2 calcaneal avulsion fractures. We performed a screw fixation secured with a softosynthesis. Taking a strong wire through the achilles tendon and tensioning it through the calcaneus, it is tunneled subcutaneously. This adds to the pull-out strength and prevents skin issues as much as possible.

INTRODUCTION

Avulsion fractures of the calcaneus are relatively uncommon and its incidence peaks in elderly women with reduced bone mineral density, although other mechanism of injuries includes trauma and neuropathic conditions. To be able to restore achilles tendon function, surgical treatment is warranted with displacement more than 1 cm. One should always be aware that the fracture fragment may impinge on the fragile posterior skin and create wound problems.

In this case report we aim to show a novel surgical technique when presented with a Böhler type 2 calcaneal avulsion fracture, as most cases will require surgical repair. We performed a screw fixation secured with a softosynthesis of the achilles tendon to the calcaneus to add to the pull out strength. The objective of this paper is to offer other surgeons, confronted with a similar case, the possibility to use this easy and straightforward technique in sometimes difficult avulsion fractures [1-4]. Previous surgical procedures have been described with there own issues, these can be skin problems, cost of implants or low pull out strength. With the use of a Fiber wire in combination with cannulated screws, we aim to provide the necessary pullout strength together with low risk for wound complications [5-7].

CASE PRESENTATION

A man, aged 49 years old, presented in our emergency department with a painful right foot. He fell off his motorbike whilst trying to park it and stepped in a small hole in the road. His limb was swollen and painful on palpation and he refused weight bearing. There was a haematoma and swelling over the whole posterior side of the ankle and the Thompson test was positive. Neurovascular status was intact, there were no skin abrasions or open lesions and he had no other significant injuries. Medical history was blanc other than his use of tobacco and the patient was not on any regular medication. We specifically checked for diabetes, tendinopathy and thyroid dysfunction.

X Ray (Figure 1) showed a Beavis type 2 calcaneal avulsion fracture on the insertion of the achilles tendon. At request of the orthopaedic surgeon, a plaster of Paris was applied and a CT scan was performed (Figure 1).

A multidisciplinary decision was made to go ahead with surgery and the patient agreed after being informed about all the possible complications and therapeutic alternatives. We pressured the need for smoking cessation to lower possible wound complications and delayed or nonunion [8-10].

The patient was positioned prone after application of a non sterile thigh tourniquet (250mmHG - on for 79 minutes). The feet were just hanging over the edge of the operating table; prepping and draping were done as usual. A vertical Z type posterior incision was used over the achilles tendon (Figure 2). The parathenon was longitudinally incised and the tendon visualized. We used a no-touch technique for the skin to prevent wound problems as much as possible. The fracture was visualized and carefully debrided. The two fracture parts were both attached to the achilles tendon, but not to one another. They were lifted to give full exposure.
The first fracture part was placed back anatomically, pinned with a K wire, drilled and a 5mm cannulated screw (Zimmer Biomet) was introduced with a washer, securing a tight fixation (Figure 2).

Next step was a soft-osynthesis of the achilles tendon on the calcaneus to reduce the tension over the fracture site. A Fiber Wire (Arthrex) was sutured Krakow-style through the distal 3 centimeters of the achilles tendon. With a 2mm drill we created a passing through the calcaneus, after making a skin puncture on both medial and lateral side. Using a suture retriever, the Fiber wire was tunneled subcutaneously and pulled through the calcaneus. The wire knot was made and bent inside the achilles tendon bursa to avoid skin irritation. Whilst tensioning the Fiber Wire, the second fracture piece of the calcaneus willingly takes an anatomic position with the ankle in plantar flexion. A Kirschner wire is passed over the remaining fracture piece into the calcaneus, drilled and a 5mm cannulated screw inserted, again with washer [11-14].

The construction is tested intra operatively and found strong dorsiflexing the ankle and performing the Simmonds test. Skin is closed with ethilon 3-0 Donati sutures and steri strips are put on the puncture holes on the side of the calcaneus. A short leg plaster of Paris was applied in mild equinus (10-20° less than neutral position) in order to hold the reduction. The patient is given dvt prophylaxis and was told to remain non weight bearing for six weeks. We were imperative the patient would have to stop smoking for at least a few weeks after surgery.

The sutures were removed at the two week mark and no wound dehiscence was seen. A fresh plaster in neutral position was applied for another four weeks. After that, a Walker boot was given for four weeks, allowing the patient to partially weight bear. No skin complications were seen (Figure 3). Physiotherapy was not started before the ten week mark as well as full weight bearing [15].

**DISCUSSION**

Several factors have to be taken into consideration. Gitajn et al, reported a massive amount of 39.4% skin/soft tissue complications in their review of 33 patients. Even without surgery, skin complications can be a big issue as the tuberosity is pulled cranial and the often sharp fracture piece can press against the skin. This can lead decubitus or even necrosis of the skin.

Use of double technique is necessary as available literature mentions high failure rate of 27.3 % with loss of reduction and failure of fixation. Gregor et al., found that the tensile strength over the achilles tendon whilst cycling is around 500-600N, but the fixation strength of lag screws alone is around 250N.

The hope is to reduce this failure rate by combining techniques and improving the pull out strength of the construction.

Different techniques are described in literature. Squires et al., showed how to fix the fracture with two K-wires and a tension band wire is passed around it. The idea of the tension band is to neutralize the force of the Achilles tendon, but it requires a bulky construct and this may create soft tissue complications and even peroneal tendon irritation.

The fracture fragments are often small and using screws may not always be an optimal solution. In this case, a suture anchor technique can be used as explained by Zhao et al, and Greenhagen et al. A drawback of this method of fixation is the cost of the implants.

Banerjee et al., showed a different technique in which sutures are passed through the fracture fragment and Achilles tendon and pulled through bone tunnels in the body of the calcaneus. The sutures are then tied on plantar aspect of the heel, but this can cause a chronic pain to the patient as a large knot may create scar formation on the sole and irritate the plantar fascia. Also the skin incision on the sole can cause persistent pain while walking.

Another option is to place the screws and put the wire through the screw holes. There are two problems with this, first, I wanted to avoid plantar pain. Second, as I wanted to put the screws perpendicular to the fracture, it was very difficult to place the knot somewhere where the patient would not have any irritation from it.
By pulling the wire through the calcaneus and tying the knot in the achilles tendon bursa, wire irritation is avoided whilst improving the pull out strength. To me this looks like an elegant solution and is reproducible. Next to that you have the strength of the Fiber wire aiming to create higher pullout strength, off course biomechanical studies need to be done in the future.

**CONCLUSION**

Different treatment options have been described for the surgical management of calcaneal avulsion fractures. A high percentage of skin complications and fixation construct failure are known to arise. The use of only screws or a bulky tension band construction is not always the first choice. Generally important is that the surgeon pays attention to the skin and uses a double fixation construction in order to minimize the complications. We present a technique where no expensive implants are required and with no extra risk for skin problems. This is only a case report and off course, more research is necessary.

**REFERENCES**