

Avulsion of the Posterior Calcaneal Tuberosity (Beak Fracture): A Case Report

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ABSTRACT

Calcaneal fractures account for 2-3.1% of all fractures¹; among these, the least common are avulsions of the Achilles tendon, described by Dr. Bohler as “Beak fractures”². Descriptions in the literature are very scarce, the largest report being that of Sang-Myung et al. in 2012, where a summary of 764 cases of calcaneal fractures contained 20 avulsion fractures. The most common mechanisms of trauma are tripping, falling, or a direct knock³. This report presents the clinical case of a 48-year-old patient who attended the Emergency Service of a second-level hospital after falling from a tree which resulted in being suspended by the lower right limb. Radiographs revealed signs of a calcaneal avulsion fracture, which was surgically managed via osteosynthesis with excellent clinical outcomes in follow-up. Given the infrequency of this type of fracture, we considered it important to present this article.

Key words: Calcaneus, fracture, fracture treatments, fracture complications.

Level of Evidence: IV

Avulsión de la tuberosidad posterior del calcáneo en pico de pato. Reporte de un caso

RESUMEN

Las fracturas del calcáneo representan el 2-3,1% de las fracturas en general y las avulsiones del tendón de Aquiles son las menos frecuentes de este grupo. Fueron descritas por Bohler como “fracturas en pico de pato”. Los casos publicados son muy escasos, Sang-Myung y cols. publicaron la revisión más grande con 764 casos de fracturas de calcáneo, 20 de ellos con avulsión de la tuberosidad del calcáneo. Los mecanismos de acción más frecuentes son tropiezo, caída o golpe directo. Se presenta a un paciente de 48 años que concurre al Servicio de Urgencia de un hospital de segundo nivel, tras caerse de un árbol y quedar suspendido sobre la pierna derecha. Ingresó para estudio con evidencia radiográfica de fractura por avulsión del calcáneo y fue sometido a una osteosíntesis, con una excelente evolución clínica.

Palabras clave: Calcáneo; fractura; tratamiento; complicaciones.

Nivel de Evidencia: IV

INTRODUCTION

Among tarsal fractures, the calcaneus is the bone that is most often injured, about 60% of cases; however, they represent a minimum percentage of all fractures in general, between 2% and 3.1%.¹ According to its morphology, fractures of the posterosuperior angle of the greater tuberosity of the calcaneus can be of two types, according to Lelièvre: type I, a fracture that sits above the insertion of the Achilles tendon in the calcaneus, called “beak fracture” because the avulsion fragment is small; and type II, a fracture that ends in the posterior side at the level of the plantar tuberosities of the calcaneus in which the posterosuperior angle is pulled in its entirety.² For this type of fracture, three different production mechanisms have been determined:

- 1) violent dorsal flexion of the foot at a time of maximum plantar flexion, as typically occurs in a fall from height;

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2) powerful and abrupt contraction of the triceps surae muscle associated with a simultaneous extension of the knee, as occurs when starting a race or jump;

3) after direct trauma to the posterior side, such as a kick.^{3,4}

However, in addition to the above classification, Sang-Myung et al. propose a classification from type I to type IV for avulsion fractures of the tuberosity of the calcaneus taking into account the findings on magnetic resonance imaging (MRI). Type I corresponds to a “simple extra-articular avulsion” fracture, more common in older women and as a result of minor trauma; type II is the “beak” fracture, where there is an oblique fracture line that extends backward just behind the Böhler angle; type III is the infrabursal avulsion fracture involving superficial fibers of the middle third of the posterior tuberosity; and type IV fracture, where there is a “beak”, but a small triangular fragment is separated by deep fibers at the superior edge of the tuberosity. These last three types are more frequent in young men, caused by a more severe trauma mechanism.⁵

Avulsion fractures of the tuberosity of the calcaneus often involve the thin posterior skin covering the insertion of the Achilles tendon, hence the importance of timely management of these patients due to the risk of rupture of the skin at the back of the heel and tissue necrosis.⁶

The diagnosis is based on two fundamental pillars: the clinical evaluation, in which pain and swelling around the heel are observed, with deformity of the hindfoot and functional impairment for support;⁷ and diagnostic studies, mainly a plain radiograph of the ankle and with a projection of the calcaneus that provides fundamental information for decision-making regarding management.⁸ However, MRI and computed tomography (CT) are the imaging studies of choice to better characterize the fracture, taking into account that the goal of treatment is based on restoring the normal length of the Achilles tendon, as well as the anatomy of the affected area, either through conservative or surgical management.⁹

CLINICAL CASE

The patient was a 48-year-old farmer who lived in a rural area and had no comorbidities. He suffered a fall of 1.30 m in height and was suspended from the right leg between two branches. Upon admission to the hospital, he was unable to walk, had edema, deformity over the right hindfoot, phlyctenae, and abrasions (Figure 1).



Figure 1. Hemorrhagic phlyctenae and abrasions on the posterior side of the right foot.

Initially, he was given an analgesic and antibiotic, and the fracture was immobilized with a splint. The radiographs requested revealed a fracture of the posterosuperior tuberosity of the calcaneus (Figure 2). Then, a CT scan was performed for its characterization and a displacement of 1.2 cm was observed, so surgical management was indicated (Figure 3). However, the procedure was delayed due to the marked soft tissue edema associated with hemorrhagic phlyctenae; therefore, in the Emergency Department, closed reduction and immobilization with a splint plus removal of phlyctenae were carried out. On the eighth day of hospital admission, a marked clinical improvement of soft tissues was observed, so stabilization by an external tutor was not considered and the patient was subjected to a definitive surgical procedure by open reduction with internal fixation of the calcaneus with two cannulated screws of 6.5 mm, from posterior to anterior and cephalic to caudal (Figure 4). It was decided to continue the management with plaster cast immobilization for six weeks. In the postoperative control, the cast was removed and recovery was initiated through physical therapies. After three months, the evolution of the mobility of the right foot was favorable (Figure 5).



Figure 2. Lateral radiograph magnification of the right foot showing a fracture of the posterosuperior tuberosity of the calcaneus.

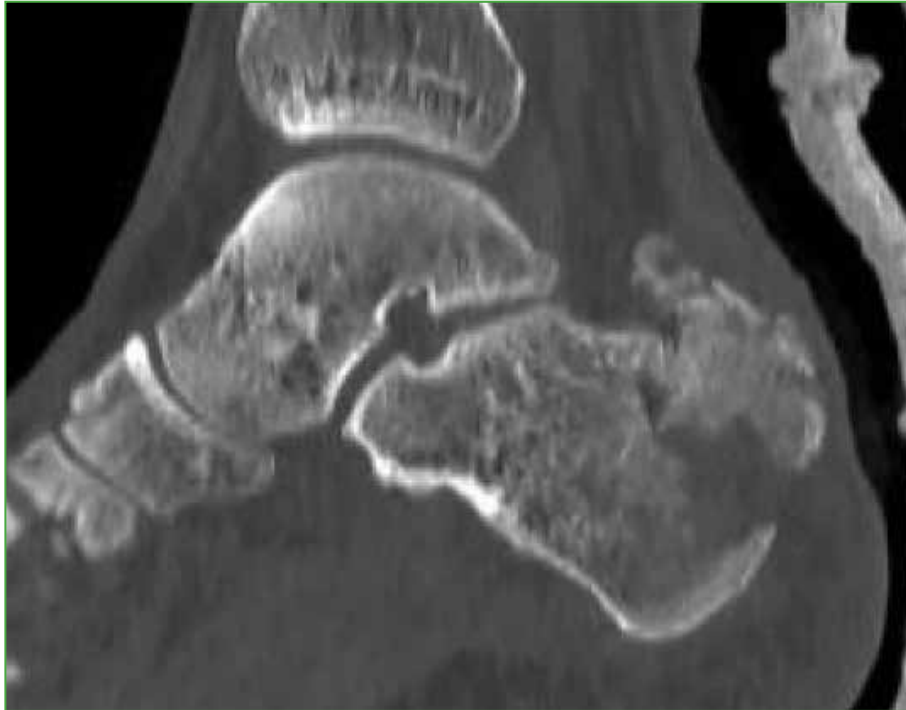


Figure 3. CT scan of the right foot in which a fracture of the posteriorsuperior tuberosity of the calcaneus with a displacement of 1.2 centimeters is observed.



Figure 4. Postoperative lateral right foot radiography showing the internal fixation of the calcaneus with two cannulated screws.



Figure 5. Evolution at three months of surgery with adequate functional outcomes and no apparent deformities.

DISCUSSION

Calcaneal fractures secondary to an avulsion of the Achilles tendon are the most unusual of this bone; this type of fracture is commonly associated with pathological fractures (osteoporosis and osteomalacia).

The mechanism of injury is divided into three types: direct trauma to the back of the foot (kick), indirect trauma secondary to contraction of the gastrosoleus complex with knee extension, and violent dorsal flexion when the foot is in plantar flexion. Although the mechanism of action by which it occurs is not described, we consider that it can be categorized within the group of indirect trauma by sudden traction of the gastrosoleus complex when suspended.^{2,4}

The reduction is achieved by flexing the knee to relax the gastrosoleus complex while simultaneously performing plantar flexion, along with digitopressure from cephalic to caudal and from posterior to anterior, on the posterior tuberosity of the calcaneus. If conservative management is considered, it is best to immobilize with a splint above the knee with flexion of 45° and plantar flexion of the ankle at 45° in order to neutralize the deforming forces, which will be maintained for three weeks, then changed to a splint below the knee with 20° of flexion of the foot to start weight-bearing at seven weeks, according to tolerance.¹⁰

It is important to emphasize that according to the findings on MRI, in type II fractures, as presented in our case, the posterior skin of the heel should be evaluated quickly, and if observed in “tent” or “branched”, it should be reduced and repaired immediately; otherwise, the risk of skin necrosis of the posterior heel is high.⁵

Wilson proposed treating fractures of the posterior tuberosity of the calcaneus according to the mechanism of trauma: if they are due to direct trauma, management would be conservative; however, if the mechanism is indirect and secondary to traction, the treatment should always be surgical. If the mechanism of trauma is unknown, a surgical procedure is always preferred.¹¹

Screw fixation is a good option for type I and II fractures, since the size of the bone fragment is still sufficient to perform osteosynthesis; however, in types III and IV, conservative treatment should be preferred, because the Achilles tendon is preserved and, if surgery is chosen, fixation with suture anchors can be performed due to the presence of small bone fragments for type III.⁵

According to Lelièvre, conservative management can be considered if the reduction is anatomical in type I fractures, whereas surgery should always be chosen for type II fractures.²

Different methods have been published for open reduction plus internal fixation, such as the use of screws, tension bands with Kirschner nails, along with the recommendation to immobilize the patient, in the postoperative period, with a below-knee splint in slight flexion (there is no consensus as to the position of the foot) until completing 6-7 weeks and then initiating physical therapy with partial weight-bearing according to tolerance. We treated our patient following these recommendations and the functional and aesthetic outcomes were adequate and allowed him to return to a normal life.¹⁰⁻¹²

CONCLUSIONS

Tarsal fractures usually involve the calcaneus; however, publications on these fractures are scarce. In this type of fracture, the mechanism of trauma must be taken into account in order to determine the need for surgery. The published articles are insufficient to establish the ideal management of this type of picture.

Timely diagnosis and management can lead to excellent results in terms of the recovery of mobility and functionality of the limb; otherwise, the sequelae can be important, such as permanent disability.

Conflict of interests: The authors declare they do not have any conflict of interests.

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