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Calcaneus Fractures: How to Manage Them?

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Abstract **Original Research Article**

Calcaneus fractures represent 1% to 2% of all fractures. They mainly affect young men (40 years old). They are divided into two subgroups: thalamic fractures, affecting the subtalar joint (75% of cases), and extrathalamic fractures, affecting the greater tuberosity, the anterior process or the internal process (25% of cases). Their diagnosis, suspected clinically, is affirmed by radiology or by computed tomography, which sometimes guides our therapeutic choices. The goal of treatment is to prevent the long-term complications of subtalar osteoarthritis and extra-articular malunion of displaced fractures, avoiding scarring and skin problems. The localization of the fracture and the importance of its displacement make it possible to make the choice between a surgical treatment or not. Orthopedic treatments are aimed at fractures with little or no displacement, or when surgery is contraindicated, bearing in mind that a calcaneal (extra-articular) malunion leads to serious sequelae, and that a malunion thalamic (articular) almost constantly leads to very poorly tolerated subtalar osteoarthritis. In the sequel stage, the only treatment for symptomatic subtalar osteoarthritis is talocalcaneal arthrodesis.

Keywords: Calcaneus-Fracture-Boehler-Utheza-Reeducation.

INTRODUCTION

Most calcaneal fractures are articular, touching a fundamental articulation, keystone of the mechanics of the rearfoot, as it acts as a relay between the ankle and midfoot. These fractures have a very bad reputation and this one is not unfounded. Indeed, the sequences are, in most cases, long and difficult. The functional and psychological impact of sequelae of this fracture has been studied by Tetering and Buckley who judged it to be more important than that of transplant patients or having had a myocardial infarction. Note that there is no standardization of the grip responsible for these fractures. Indeed, despite a literature provided, various symposia and several monographs, this remains a subject of controversy. The goal of treatment is to achieve such normal function as possible, with at best a free walk on ground irregular, which primarily involves the prevention of calluses intra- or extra-articular defects. The objective of this work is to evaluate the results of the treatment of calcaneus fractures in our series, and to compare them with data from the literature.

MATERIALS AND METHODS

This is a retrospective study of patients with a calcaneus fracture, spread over a period of 23 months (from February 2020 to January 2022). Are included all adult patients with a fracture of the calcaneus, who were hospitalized in the orthopedic trauma department of the Ibn Sina Hospital in Rabat during the period mentioned above.

Figure 1: Clinical aspect of a traumatized ankle and foot

Figure 2: Skin lesions and blisters after an ankle trauma

RESULTS

The diagnosis is suspected clinically, thanks to the history of the trauma and examination of the hindfoot, but it is especially radiological, to confirm the existence of a fracture of the calcaneus and also to specify the type. There are two main categories of calcaneus fractures, which differ in their treatment and prognosis: thalamic fractures and extrathalamic fractures. A heel edema is always present, important, erasing its reliefs, as well as those of the edges of the Achilles tendon, and sometimes those of the malleolus. It comes with a plantar and lateral submalleolar ecchymosis and, after a few hours of evolution, blisters may appear. In most cases, the heel loses its height, and its width increases (by impaction of the greater tuberosity calcaneal).

The standard X-ray includes:

- An ankle face view;
- A dorsoplantar ap image of the foot;
- An ascending retrotibial radiography;
- An incidence of external profile of the calcaneus allowing analyze the boehler angle (intersection of a line connecting the culmination of the greater apophysis at the posterior point of the thalamus and a line connecting the posterior point of the thalamus at the highest point of the posterior edge of the tuberosity, normally between 25° and 40°);
- And, if necessary, broden's incidence to study the talocalcaneal congruence.

The ray is centered under the front lateral malleolus in medial rotation of 10°, 20°, 30° and 40° and slightly ascending. The scanner allows a more detailed analysis of the joint subtalar by coronal sections and reconstructions joints, its congruence, and the calcaneocuboid joint by axial sections. These examinations allow us to highlight the main deformities of a fractured calcaneus, which are:

- Loss of height by impaction of the greater tuberosity, especially at the level of the medial wall;
- Widening by lateral displacement of the fragment tuberosity;
- Loss of length;
- An interruption of the posterior facet of the subtalian joint;
- Bulging of the side wall.

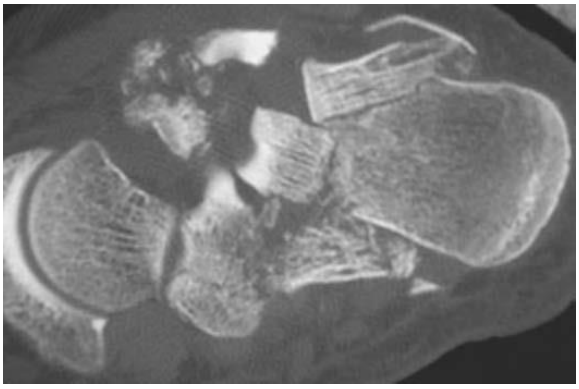

Figure 3: Tomodensitometry of a the calcaneus comminution

Figure 4 : Extrathalamic fracture of the calcaneus

All patients received medical treatment based on analgesics + anti-inflammatory + preventive anticoagulation. Thirteen patients received functional treatment. Eleven patients had an extra-thalamic fracture. Two had a type I thalamic fracture with vertical depression. Functional treatment consists of three phases:

- Rest in bed with elevation of the limb and icing until the edema disappears.
- Resumption of ambulation for 3 to 5 weeks.
- Resumption of full support and readjustment to effort.

Six patients benefited from orthopedic treatment: Plaster boot made for a period of 6 weeks. Three patients presented a type l fracture (one with vertical depression and two mixed). Two patients had a type II fracture (one with horizontal depression and the

other mixed). One patient presented a type III fracture with mixed depression. Thirteen fractures of the calcaneus were operated (11 patients including two bilaterally) or 40.62%.

Operatory steps

- Identification of the sural nerve, the dissection is made without undermining up to the periosteum.
- Arthrotomy.
- Identification of the lateral peroneal tendons which will be raised in block (their sheath is respected).
- Use of three curved pins for spacing:

+ a pin on the cuboid
+ a pin on the neck of the talus.
+ a pin on the external malleolus.

- Raising the settlement.
- Osteosynthesis: Screwed plate/Screws/Pinting/Arthrodesis
- Filling of the bone defect with a corticocancellous graft.
- Skin closure.
- Drainage (duration : 3 days)
- Boot in plaster for 6 weeks

DISCUSSION

Calcaneus fractures have been described since the time of Hippocrates and they already had the reputation of being very bad prognosis. Boyer was interested in fractures of the calcaneus by tearing in 1731, and Malgaigne to those by crushing as early as 1843. It was at the beginning of the 20th century, with the advent of radiography, that we began to understand the pathological anatomy of these fractures, to conceive the mechanisms of their occurred and therefore to classify them, emphasizing the position of the fracture lines and fragment size. Boehler insists on thalamic depression and describes its classic "cruxial angle" in 1931. But it was Palmer, in 1948, who laid the foundations contemporary classifications. It describes the basic feature separating the greater tuberosity from the sustentaculum tali and causing the fracture-separation and the fracture-compression.

Analysis of Palmer is the basis of the classification proposed by Duparc in 1967. Essex-Lopresti described, in 1952, according to the direction of the line retrothalamic, “tongue-type” fractures, where this feature is spread to the greater tuberosity, and "joint-depression type" where it isolates the thalamus. Warrick and Bremner endeavor to describe the size of the side fragment. Other classifications have focused more on determining fragmentary displacement. Kempf and Touzard founded a classification on the importance of the vertical depression and horizontal of the thalamus. In the 1980s, the analysis of thalamic fractures benefited from computed tomography imaging, which allowed in Utheza to produce a map of the different fractures.

He then highlighted a key element in the analysis of the movements of the thalamic fragments: the position of the fundamental line. This analysis makes it possible to establish a direct correlation between the images of the fractures seen on lateral profile radiographs and their classification: the fundamental line determines a boundary between two displacements, the medial thalamic fragment, which is always horizontalized (by depression), and the lateral thalamic fragment, which is always verticalized (by rotation). Once the diagnosis of a calcaneal fracture has been made, the action to be taken depends above all on the integrity or otherwise of the thalamus (calcaneal surface of the subtalar joint). It's necessary also always look for the existence of a subtalar dislocation, even if this is rare (1% of dislocations).

Extrathalamic fractures

Extrathalamic fractures (25%) are often treatment and follow-up fractures simpler than fractures joints. They include the following fractures: Fractures of the greater apophysis (anterior process), These fractures affect the superolateral part of the process lateral, with a simple avulsion of the bifurcated ligament. A larger fracture may include the calcaneocuboid joint. These fractures often go unnoticed and are well visualized by the scanner.

Fractures of the body not involving the subtalar joint

Fractures of the body not involving the subtalar joint often have a good prognosis.

Fractures of the lesser apophysis (or sustentaculum tali)

These fractures can cause the rearfoot to collapse if they are not reduced and can be associated with a dislocation of the greater tuberosity.

Calcaneal tuberosity (or greater tuberosity) fractures

Calcaneal tuberosity fractures include fractures of the superior angle of the greater tuberosity with sometimes tearing of the Achilles tendon, which are surgical, and the “duckbill” fractures.

Thalamic fractures

Thalamic fractures account for 75% of fractures of the calcaneus and cause many problems. They result from the action of opposing forces between the ground and the transmission of impact by the astragalus on the thalamus. Their treatment is a source of many controversies. This is to restore the calcaneal height, to avoid a disorder of orientation of the large tuberosity, but also to preserve the function of the subtalar joint, to recover a painless short and long walk long-term, and reduce the risk of long-term subtalar osteoarthritis term. There are many classifications of these thalamics fractures.

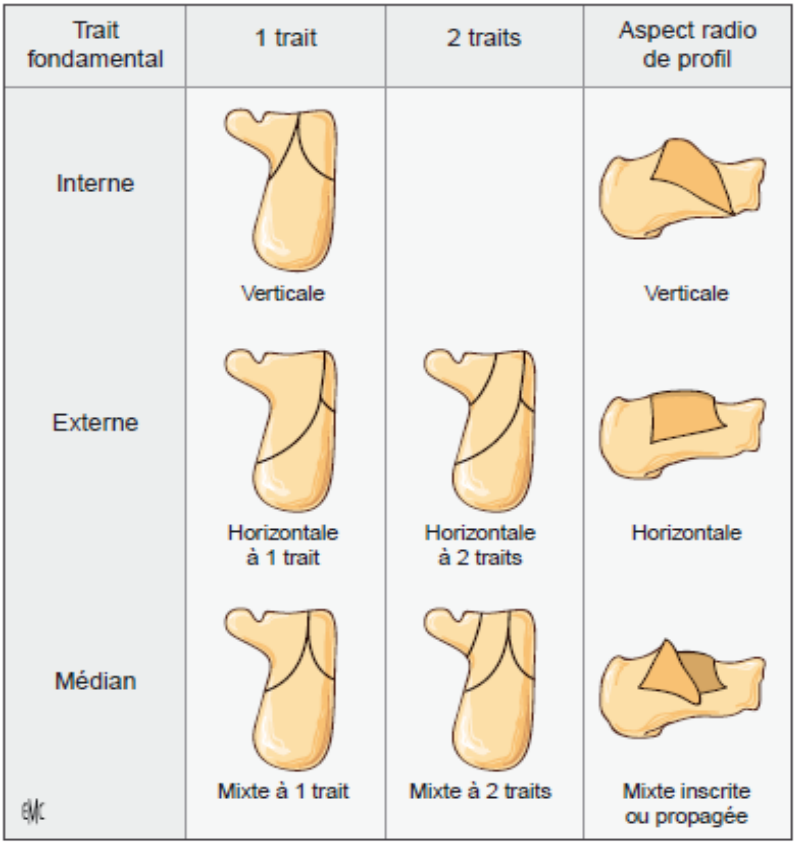

Figure 5: Utheza Classification

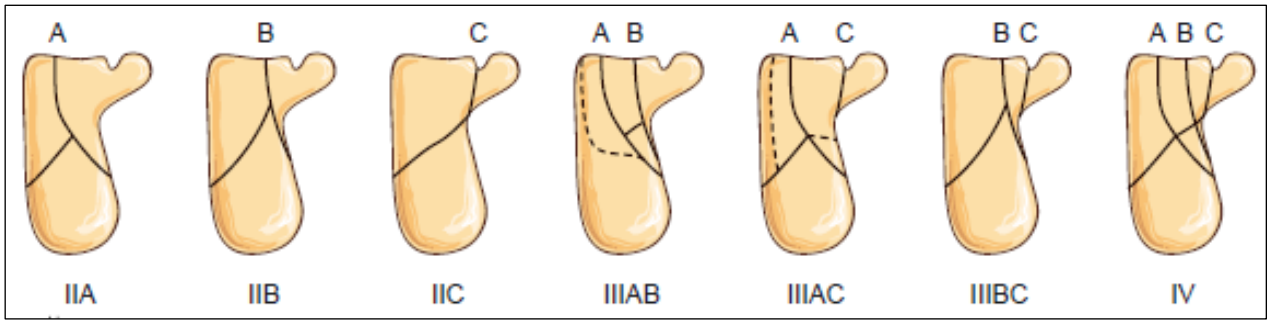

Figure 6: Sanders Classification

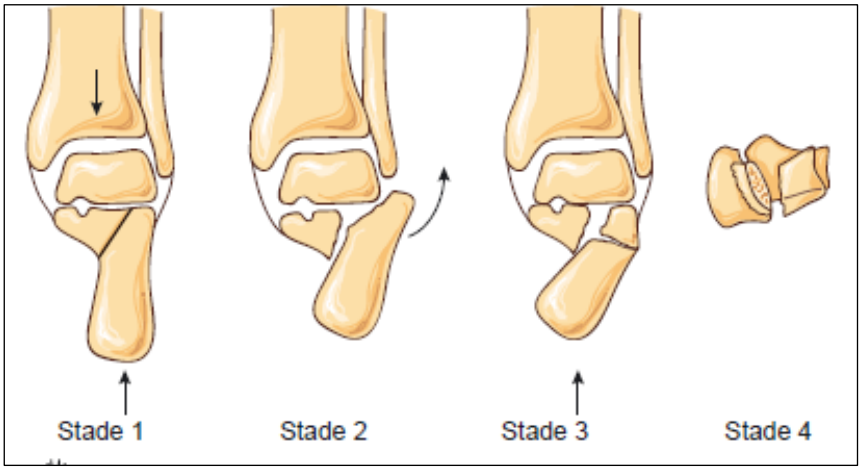

Figure 7: Duparc and De La Caffinière classification

Figure 8 : Osteosynthesis of the calcaneus fracture

THERAPEUTICS

Non-invasive treatments

Undisplaced fractures are always treated orthopedically, and functional treatment is always favored treatment by cast immobilization, which limits stiffness and allows monitoring of the skin. These treatments are intended primarily for simple fractures, types I and II of Duparc, type I of Sanders, for which they give very good results, with few complications. This treatment is also indicated in case of contraindication to surgical treatment. The aim of functional treatment is to preserve the amplitudes joints (midtarsal and subtalar), but some patients (about a third of cases) will have disturbed subtalian mobility. It also allows group work neighboring muscles (to avoid adhesions and amyotrophy). After this type of treatment, the overall anatomy of the hindfoot remains disturbed with a constant widening of the heel, contrasting with a regularly normal footprint at the podoscope.

Surgical treatments

The goals of surgery are:

- Reconstruction of the subtalar joint, and sometimes of the calcaneocuboid joint;
- restoration of the height and width of the calcaneus;
- correction of rearfoot orientation disorder;
- and sometimes the subtalian fusion from the outset.

Displaced extra-articular fractures may require surgical treatment. Their reduction is often easier, and screw fixation may be sufficient. Displaced thalamic fractures of the calcaneus are joint fractures for which it is appropriate, when this is possible, to apply the therapeutic principles appropriate to this category of fracture: the most anatomical reduction perfect as possible, stable assembly, minimum skin aggression to preserve healing and early functional rehabilitation. Very comminuted fractures (stages IV and V of Duparc, and Sanders stage IV) may require subtalar arthrodesis, either immediately or after non-invasive treatment. In the event of a calcaneal "fracas" or contraindication of order general to surgery, the main thing is to avoid the calcaneal malunion. For this, you can use a reduction/mobilization under anesthesia, or raising nails closed hearth and, if necessary, subtalar arthrodesis which could be considered secondarily.

CONCLUSION

Three quarters of calcaneus fractures are articular, the more often complex and difficult surgical treatment. Therapeutic indications are to be adapted to the patient and to the type of fracture. Whether the treatment is conservative or surgical, it is necessary warn the patient that a calcaneal fracture, especially if it is articular, is a serious fracture, which may lead to heavy sequelae especially if the anatomical reduction is not obtained, and that its surgical treatment can evolve towards skin and infectious problems sometimes leading to iterative interventions. It should be kept in mind that an extra-articular calcaneal malunion is always badly tolerated, and of complex correction. A thalamic malunion can be tolerated well, and otherwise, subtalar arthrodesis should be considered.

REFERENCES

1. Sanders, R., Fortin, P., & Dipasquale, T. (1993). WallingA. Operative treatment in 120 displaced intraarticular calcaneal fractures results using a prognostic Computed Tomography scan classification. *Clin Res*, *290*, 87-95.
2. Buckley, R., Tough, S., McCormack, R., Pate, G., Leighton, R., Petrie, D., Galpin, R. (2002). Operative compared with nonoperative treatment of displaced intra-articular calcaneal fractures: a prospective, randomized, controlled multicenter trial. *J Bone Joint Surg Am*, *84*(10), 1733-44.

3. Ibrahim, T., Rowsell, M., Rennie, W., Brown, A. R., Taylor, G. J. S., & Gregg, P. J. (2007). Displaced intra-articular calcaneal fractures: 15-year follow-up of a randomised controlled trial of conservative versus operative treatment. *Injury*, *38*(7), 848-855.
4. Kennedy, J. G., Jan, W. M., McGuinness, A. J., Barry, K., Curtin, J., Cashman, W. F., & Mullan, G. B. (2003). An outcomes assessment of intra-articular calcaneal fractures, using patient and physician's assessment profiles. *Injury*, *34*(12), 932-936.
5. Parmar, H. V., Triffitt, P. D., & Gregg, P. J. (1993). Intra-articular fractures of the calcaneum treated operatively or conservatively. A prospective study. *The Journal of Bone & Joint Surgery British Volume*, *75*(6), 932-937.
6. Pozo, J. L., kirwan, EO., Jackson, A.M. (1984). The long-term results of conservative management of severely displaced fractures of the calcaneus. *J Bone Joint Surg*, *66*, 396.
7. Rosenberg, Z. S., Feldman, F., Singson, R. D., & Price, G. J. (1987). Peroneal tendon injury associated with calcaneal fractures: CT findings. *American Journal of Roentgenology*, *149*(1), 125-129.
8. Rosenberg, Z. S., Feldman, F., & Singson, R. D. (1986). Peroneal tendon injuries: CT analysis. *Radiology*, *161*(3), 743-748.
9. Ebraheim, N. A., Zeiss, J., Skie, M. C., & Jackson, W. T. (1991). Radiological evaluation of peroneal tendon pathology associated with calcaneal fractures. *Journal of orthopaedic trauma*, *5*(3), 365-369.
10. Bradley, S. A., & Davies, A. M. (1992). Computed tomographic assessment of soft tissue abnormalities following calcaneal fractures. *The British Journal of Radiology*, *65*(770), 105-111.
11. Hussain, T., Al-Mutairi, H., Al-Zamel, S., & Al-Tunaib, W. (2004). Modified obtuse-angled lateral exposure of the calcaneum. *Foot and ankle surgery*, *10*(3), 145-148.
12. Hart, W. J., & Cool, P. (2005). A simple method of skin flap retraction for calcaneal fracture fixation. *Foot and ankle surgery*, *11*(2), 117-119.
13. Bezes, H., Massart, P., & Fourquet, J. P. (1984). Die Osteosynthese der Calcaneus-Impressionsfraktur. Indikation, Technik und Resultate bei 120 Fällen. *Unfallheilkunde*, *87*(9), 363-368.
14. Chan, S., & Ip, F. K. (1995). Open reduction and internal fixation for displaced intra-articular fractures of the os calcis. *Injury*, *26*(2), 111-115.
15. Palarcik, J., Bucek, P., & Vopelka, J. (1997). Surgical treatment of (selected) calcaneal fractures. *Rozhledy v Chirurgii: Mesicnik Ceskoslovenske Chirurgicke Spolecnosti*, *76*(5), 231-238.
16. Strømsøe, K., Mørk, E., & Hem, E. S. (1998). Open reduction and internal fixation in 46 displaced intraarticular calcaneal fractures. *Injury*, *29*(4), 313-316.
17. Myerson, M. (1990). Diagnosis and treatment of compartment syndrome of the foot. *Orthopedics*, *13*(7), 711-717.