

**SURGICAL TREATMENT OF CALCANEUM FRACTURES: ABOUT 27 CASES**

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**ABSTRACT**

Fractures of the calcaneus are infrequent but most often serious. We report a series of 27 cases of surgically treated calcaneal fractures in the orthopedic trauma department of the Delafontaine Hospital in Saint Denis (Paris) between 2002 and 2017. The purpose of this retrospective study was to present the principles and evaluate the results of surgical treatment of articular fractures of the calcaneus, in comparison with the conservative treatment. There were 17 men and 10 women, ranging in age from 20 to 57 years old. The etiology was dominated by road accidents and falls from a high place. The evaluation of lesions was based on the classification of DUPARC. The treatment consisted of an open reduction and osteosynthesis by plate, or by screwing. The clinical results were evaluated based on the kitaoka score, with a mean follow-up of 12 months. 77% of our patients had a good average result.

**KEYWORDS:** calcaneus, fracture, surgical treatment.

**INTRODUCTION**

The fractures of the calcaneus constitute 60% of the tarsal fractures. Despite their frequency, their treatment is a real challenge. Thalamic fractures are a particular entity by their mechanism of occurrence (axial compression at high energy), by their treatment and by their prognosis deemed bad. They are often treated surgically to restore the anatomy of the subtalar joint. We report in this work, the results of a series of 27 cases of articular fractures of the calcaneus, treated by an external approach, a reduction, and an osteosynthesis by an anatomical plate or by screwing, with a clinical and radiological revision until last decline.

**METHODS**

We performed a retrospective study of 27 calcaneal articular fractures treated by anatomical plate or by screwing over a period of 15 years between 2002 and 2017, patients are divided into 17 men (63%) for 10 women (37%) with a 12 months decline. Radiological exploration was based on an anterior and lateral ankle image and retro-tibial impact, and a posterior scan. The classification of DUPARC<sup>[1]</sup> has been used for its pedagogical value allowing a better understanding of the anatomic-pathology of thalamic fractures of the calcaneus. . The procedure was performed under general or locoregional anesthesia.

All patients are placed in lateral decubitus approach by lateral lateral approach and sub-malleolar enlarged L (Figure 1). The dissection was done without detachment until the periosteum. Through a cutaneous speckle, a Steinman pin was placed transversely in the large tuberosity. Pulling down on this pin helped to improve the exposure of the thalamic surface, to lower the large tuberosity and to correct its varus. The second step was to reduce the thalamic surface fixed by provisional pins and perpendicular to the fundamental line. An image intensifier control was performed to verify the recovery of the calcaneal height, the quality of the bearing, the correction of the congruence of the thalamic surface and finally the final osteosynthesis by an anatomical plate or by screwing. We complete our assembly by an immobilization of the ankle by a plastered splint for 15 days, relayed after ablation son by a boot in resin for 45 days. Rehabilitation was systematic for all patients and definitive support was only allowed after 3 months. Our results were evaluated according to the postoperative Bohler angle and the kitaoka functional score.

Revision Methods: All patients were reviewed with a follow-up of 12 months. The functional results were analyzed according to the quotation of KITAOKA et al.<sup>[2]</sup> which takes into account 3 parameters: pain, function and alignment of the hind foot. Thus, the result was considered excellent, when the overall score was between 95 and 100, good when it was between 80 and 94, average when it was between 50 and 79, and bad

when it was under 50. Evaluation of anatomical findings was done on anterior and lateral profile ankle radios and an ascending retro-tibial impact. We have selected the quotation of BABIN *et al.*<sup>[3]</sup> based on the BÖHLER angle measurement and the anatomical result was considered very good when the BÖHLER angle was greater than or equal to 25 °, good when it was between 20 ° and 25 °, fair when it was between 10 ° and 20 ° and bad when it was less than 10 °.

## RESULTS

There were 17 men and 10 women, mean age 41 years old. The right side was reached 21 times, the left side 10 times. The fracture was bilateral in 4 patients. Superficial skin lesions (phlyctenes) were present initially in 3 cases and two cases presented a medial cutaneous opening stage I of cauchoux and Duparc. The etiologies are dominated by road accidents 75% and falls 25%. Associated lesions of the musculoskeletal system were observed in 8 patients (2 femur fractures, a contralateral tibial puncture fracture, 4 lumbar fractures, wrist fractures). Osteosynthesis was performed between the 5<sup>th</sup> and 7<sup>th</sup> day of posttraumatic trauma by an anatomic

plate (Figure 2) in 19 patients (70%) and by screw fixation (Figure 3) in 8 patients (30%) and. We used a cortico-spongy support graft in 3 patients.

## Functional Results

- excellent in 16% of cases
- good in 56% of cases
- average in 25% of cases and bad in 3% of cases

## Radiological results

- very good in 22% of cases
- good in 10% of cases
- average in 26% of cases and bad in 42% of cases

## Complications

- No patient has immediate complicating vasculoneurological or infectious complications in our series
- One case of cutaneous necrosis benefited from a skin graft.
- two patients had ASD

## Figures



Figure 1: Lateral retro and sub-malleolar L-shaped lateral approach.





Figure 2 : Osteosynthesis by anatomical plate,



Figure 3 : Screwing osteosynthesis.

## DISCUSSION

The treatment of calcaneal fractures poses delicate problems because it is a particularly subtle lesion. The difficulty lies in the fact that the fracture is most often multi fragmentary, intra-articular, and lies in the context of a bone presenting a complicated three-dimensional anatomy which, moreover, can be approached surgically only on one side: the fragments are not all visible

directly. In addition, the tissue envelope surrounding the calcaneus is particularly thin and includes a number of neurovascular and tendon structures, making it all the more difficult to mobilize, their treatment remains controversial.<sup>[4,5]</sup> In 1931, Böhler<sup>[6]</sup> described the method of reduction by a pull pin followed by immobilization by plaster. In 1913, Leriche recommended osteosynthesis by plate and screw.<sup>[7]</sup> These recommendations were

supported by Palmer.<sup>[8]</sup> In recent years, thanks to a better analysis of pathological lesions and the establishment of technical bases for the reduction and osteosynthesis of calcaneal articular fractures in the open air, many authors have reported satisfactory results after surgical treatment: Buckley and Meek<sup>[5]</sup>, Crosby and Fitzgibbons<sup>[9]</sup> and Parmar.<sup>[10]</sup> This treatment is currently part of the therapeutic arsenal of articular fractures of the calcaneus. The analysis of the comparative series, surgical treatment versus functional treatment of calcaneal articular fractures, has shown that surgical treatment can lead to comparable results, even superior to functional treatment.<sup>[11,12]</sup> Parma *et al.*<sup>[10]</sup> published in 1993 the first randomized comparative study of 31 functionally treated patients and 25 surgically treated patients. With a mean follow-up of 23 months, functional outcomes were excellent and good in 65% of nonoperated patients and in 64% of operated patients. The authors found, however, that surgically well-reduced patients performed better than the others and concluded that surgery was superior if there was certainty of achieving a perfect reduction. Crosby and Fitzgibbons<sup>[9]</sup> achieved 100% good and very good results for the operated group and 20% for the nonoperated group. For these authors, in the event of any displaced fracture, surgical treatment is required. Thus, we agree with most authors that the treatment of displaced articular fractures of the calcaneus must be surgical. The risk of skin necrosis and infection, major drawbacks of this treatment, can be significantly reduced by certain rules: before the intervention, care must be taken to reduce edema and inflammatory phenomena by the elevation of the limb, icing and the administration of an anti-inflammatory treatment. The intervention must be decided upon resolution of inflammatory phenomena around the 7th day, the skin incision must be lateralized near the Achilles tendon. Acute angles should be avoided, dissection should be limited and the upper flap should be raised from the periosteum with the fibular tendons and the sural nerve. The closure of the incision must be done without tension in two planes under drainage. Postoperatively, the limb should be kept elevated for a few days. Compressive dressings should be avoided. The removal of the wires must be done at the 3rd week. By complying with these rules, our skin and septic complications have been rare and without serious impact on the final result.

## CONCLUSION

The displaced calcaneal articular fractures, as is the rule for all other joint fractures, must be the object of anatomical reduction, stable fixation and early rehabilitation. Only articular fractures with little or no displaced can be treated by the functional method.

The requirement for surgical treatment that will be rigorous, precise and respectful of the soft tissues so as to minimize the risk of cutaneous or infectious complications: the atraumatic approach, the lowering of the large tuberosity by means of a traction stirrup, the recovery of thalamic fragments driven and tilted under

the talar mold, fixation by a small plate are the keys to successful osteosynthesis.

## Consent

The patient has given their informed consent for the case to be published.

## Competing interests

The authors declare no competing interest.

## Authors' contributions

All authors have read and agreed to the final version of this manuscript and have equally contributed to its content and to the management of the manuscript.

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