Scholars Journal of Applied Medical Sciences
Abbreviated Key Title: Sch J App Med Sci
ISSN 2347-954X (Print) | ISSN 2320-6691 (Online)
Journal homepage: www.saspublishers.com

OPEN ACCESS

Orthopedic Surgery

Original Nail Removal Technique for Closed Thalamic Fracture of the Calcaneus

Issa Fathi*, El Mehdi Ouissaden, Mohamed Kharmaz, Moulay Omar Lamrani, Ahmed El Bardouni, Mustapha Mahfoud, Mohamed Saleh Berrada

Department of Orthopedic Surgery, Ibn Sina Hospital, University Mohamed V, Rabat, Morocco

DOI: 10.36347/sjams.2019.v07i11.043 | **Received:** 05.11.2019 | **Accepted:** 12.11.2019 | **Published:** 24.11.2019

***Corresponding author:** Issa Fathi

Abstract **Original Research Article**

The fracture of the calcaneus is a fracture with high energy intra or extra-articular. because of its complexity, associated lesions, difficult treatment and the high rate of possible complications, this lesion remains one of the most great challenges of the orthopedic surgeon and traumatologist. We operated our patients according nail removal technique. The technique was used in 13 calcaneus articular fractures in an average age of 35 years (17-61 years). The fracture was classified as vertical in five cases horizontal in three cases and mixed in five cases. The average initial Böhler angle was -4◦ (-42-26◦). We performed the technique of raising closed nail nailing under fluoroscopic control: patient installed in left lateral decubitus, under rachianesthesia. Reduction and percutaneous osteosynthesis with 2 Steinmann nails raising the thalamic surface and restoring the Bohler angle. Complete surgical treatment with plaster immobilization for 6 weeks. The Operative Suites were simple; removal of plaster and nails from Steinmann at 6 weeks, and re-education was undertaken. Partial support was allowed at 8 weeks, total support at 3 months. The functional result was good with a decline of 12 months.

Keywords: Calcaneus; fracture; nail removal technique.

INTRODUCTION

The fracture of the calcaneus is a fracture with high energy intra or extra-articular. because of its complexity, associated lesions, difficult treatment and the high rate of possible complications, this lesion remains one of the most great challenges of the orthopedic surgeon and traumatologist. The etiology of this fracture is a crush injury, most often due to a fall from a height or an accident of the public highway. The talus acts with a large axial force in the caudal direction and crushes the calcaneus. The severity, type and location of the fracture are determined by the direction and magnitude of the force, by the quality of the bone and the position foot at the moment of impact. Two primary fracture paths can appear: a first sagittal that separates the calcaneus into two lateral and medial fragments, and a second transversal that separates anterior part of the calcaneus of another posterior. Depending on the strength, one or more features secondary appear.

METHODS

Between 2013 and 2016, 13 joint fractures calcaneus, were treated according to method of lifting and firm nailing. It was nine men and four women, mean age 35 ± 17 years (range, 17 to 61 years, median, 31 years). The right side was eight time, the left side five times. Superficial skin lesions (phlyctenes) were initially present in five cases. In one case, a calcaneal fracture had a cutaneous opening medial stage II of Cauchoix and Duparc. High energy trauma was identified for eight fractures, corresponding to five falls (seven fractures), an average height of 4 m and an accident of the public road. A voluntary defenestration in a psychiatric context was found for three patients. Two patients were concerned by an accident at work. For the rest, these were domestic accidents involving fall from a variable height, always greater than 50 cm (drop ladder, ladder, fall on the stairs). Associated lesions of the musculoskeletal system were observed in three patients with lumbar spine fractures. The fracture analysis was performed preoperatively on standard radiographs with an incidence of face and ankle profile and a retrotibial impact (Figure-1). A scanner of the hindfoot was performed in all cases (Figure-2). The

thalamic fractures were classified according to the description Uthéza et al. based on the situation of the fundamental trait and the displacement of the corticothalamic fragment and according to Duparc and De La Caffinière and Sanders and al. The fracture was vertical in five cases, horizontal in three cases and mixed in five cases. Nine fractures were classified type III according to Duparc and nine fractures classified type IV. The average preoperative Böhler angle was -4 ± 22◦ (range, -42 to 26◦, median, 2◦). We performed the fluoroscopic closed nail nailing technique: left lateral decubitus patient under spinal anesthesia. Reduction and percutaneous osteosynthesis using 2 Steinmann nails 1 nail raising the thalamic surface and restoring the angle of Böhler and the 2nd nail correcting the varus of the big tuberosity (Figure-3). Surgical treatment completed by immobilization plastered for 6 weeks. The operating suites were simple; removal of plaster and Steinmann nails at 6 weeks, and rehabilitation was undertaken. Partial support was allowed at 8 weeks, total support at 3 months. The functional result was good with a decline of 12 months (Figure-4). A severe algodystrophic syndrome has been observed in a patient, the disorders had decreased after medical treatment and physiotherapy. The average postoperative Böhler angle was 20°. According to Babin's classification, the quality of the reduction was considered good.

Fig-1: X-ray of the face and profile showing a calcaneal fracture

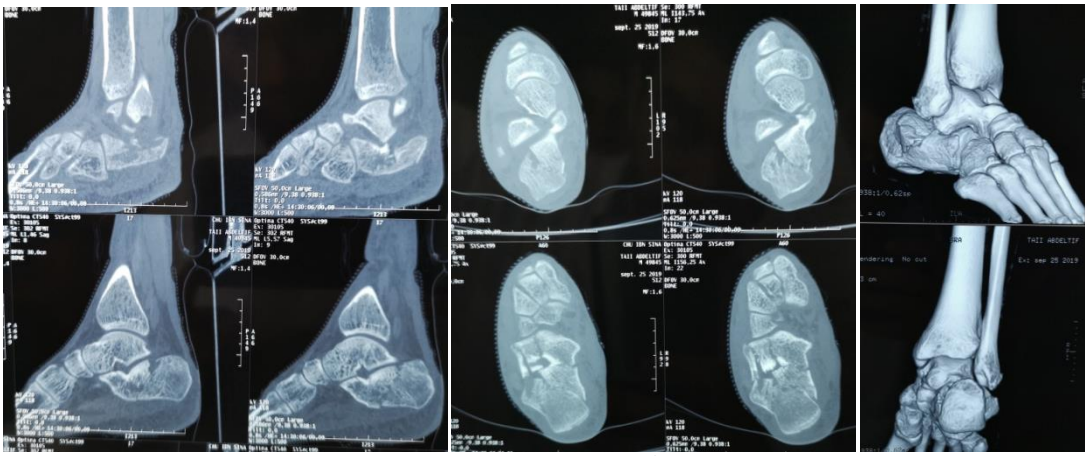

Fig-2: CT scan shows calcaneal fracture

Fig-3: CT postoperative radiography after osteosynthesis of calcaneal fracture

Fig-4: Clinical images of a patient after removal of osteosynthesis material

DISCUSSION

The natural evolution of articular fractures of calcaneus has a pejorative prognosis. The appearance of a subtalar osteoarthritis, more constant after conservative treatment, conditions the functional future of the back foot. Studies comparing blood treatment and treatment conservative showed the benefit of treatment surgery on gait pain, recovery rate by arthrodesis and return to professional activities. The heterogeneity of classifications, techniques and criteria studied in the series makes comparative analysis difficult. In particular, the correction losses radiological findings are not systematically evaluated [1].

Most authors favor a fixation by a rigid material, possibly associated with a filling spongy subthalamic vacuum. So, fixation by osteosynthesis plate, sometimes associated with additional screwing, regularly gave more 85% good and excellent functional results [2]. Nevertheless, these good results have not been reproduced by all authors. The influence of the technique is difficult to assess, but the use of a medial approach combined with a side track, regardless of the quality of the reduction, seems to have given less good functional results. In addition, the variability of the clinical results and the lack of systematic evaluation of the maintenance of the correction over time do not allow for conclude on the interest of spongy support [3, 4]. The use of smaller osteosynthesis equipment, without graft, gave varying results. Khorbi and al. have recently analyzed the results of the reduction and screw fixation of 35 articular fractures of calcaneus at two years of average decline. The function was considered good or excellent in 72 percent of cases but only 32 percent cases had an anatomical outcome considered good or very well. In addition, a loss of correction between the postoperative period immediate and the last setback was noted in 48 percent of cases, averaging 3◦. The combination of a percutaneous technique to screw osteosynthesis and a reduction control by arthroscopy yielded results encouraging in the series of Nehme *et al*., In the preliminary series reported by these authors, the functional results were good or excellent in all cases and the loss of minimal radiological correction, at a retreat of 20 months. In addition, no skin or infectious complications had not been observed [5].

The stability of the assembly was considered satisfactory with minimal loss of correction at maximum retreat. The functional result was considered satisfactory in two-thirds cases and 85 percent of active patients at the time of the fracture had found their position. The results presented functional appear to be lower than the series reference [6]. Although the surgical technique has been homogeneous, the defects of reduction are the reflection of a series of trauma involving operators variable experience. In light of the retrospective analysis data, the restoration of Böhler's angle has was the essential prognostic factor of the functional result. This point is in line with the conclusions already published. The absence of postoperative cutaneous complication is a notable observation in this series [7]. This complication is frequently observed after surgical treatment fractures of the calcaneus, in proportions ranging from 3 to 28 percent. Complications are closely associated with complications infectious. By the way, they drove in a quarter of the cases to iterative interventions for ablation osteosynthesis equipment [8, 9]. The data presented by these authors do not allow to evaluate the influence of this gesture on the durability of the reduction. The combined surroundings, medial and lateral, employed by Zwipp *et al.*, and by Stephenson gave skin complications in 15 and 27% of cases respectively. The interest of a material of osteosynthesis not prominent was underlined by Thordarson and Latteier, who found no complication cutaneous in their series, using a titanium plate [10].

Nail removal is an original technique described in 1975 by J. Deloux; she uses a technical idea proposed from 1934 by Westhues, then in 1953 by Gosset, finally in 1968 by Merle d'Aubigné and Dubousset who, using a posterior punch, raised the thalamic fractures calcaneus. The originality lies in the use of the image intensifier which allows to verify the reduction of the thalamic fragment during the intervention [11]. Postoperative functional rehabilitation is an integral part of the method, which of course, it does not include plaster immobilization.

The technique requires a complete preoperative radiological assessment, the principle is

based on a reduction of the hindfoot to ensure anatomy overall, maneuvers having little effect on joint congruence. Under general anesthesia, the patient is placed in the prone position, the foot going past the end of the table. The Stenman nail introduced in external Laterachilian, is depressed. Either the nail is pushed through the sinus and then planted in the body of the astragalus either he is classified in place to keep the reduction below a second nail that will definitely maintain the reduction achieved [12, 13]. The first nail is then left or removed. The technique is similar in the vertical thalamotuberosite depressions or bellow fractures, the most favorable case and in fractures thalamic verticals; horizontal fractures require small movements lever to reduce the posterior subtalar. Rehabilitation is essential: it is usually done in the center specialized; Support was initially allowed in the sixth week for the removal of nail; currently it is advocated deferred support at the eighth week. It is not made of plaster of course.

Possible technical variants are use: the lateral decubitus has the advantage of allowing, in case of failure of reduction, a surgical approach to the addition of a plastered immobilization: used by many teams, it allows to let the nail exceed, walnut in the plaster to maintain the reduction; With the use of pins or associated screws: the stabilization is entrusted to a calcaneo-cuboid pin and 2 ascending calcaneotalian pins [14].

The series of S.O.F.C.O.T. includes 146 cases. 52 cases are variants plastered

There was a gain between the initial and postoperative Bohler angles of 21° in the original technique, 10° in non-cast variants, and 19° in plastered variants. Secondary subsidence, evaluated by the difference between the postoperative Bohler angle and the final Bohler angle is encrypted at 5° in the original technique, at 3° in the variants without plaster, and at 4 ° in the plastered variants. There are therefore no significant differences as to the settlement secondary between plastered nailing [15, 16]. Vertical depressions have been noted residual talar-astragal angle of 7.6° is an angle of 2.1° in the horizontal depressions [17]. The difference found between the different techniques is not statically significant. 48% of good and very good results in the original nailing statements, 28% in variants without plaster, and 42% in plastered variants [18-20]. There is, on the other hand, a significant difference between the physical results of the original nailing statements and those of the different plastered variants. There was no statistically significant difference between results of vertical and horizontal sinking, between depressions thalamic and thalamus-tuberositic, between type III and type IV fractures [21, 22].

CONCLUSION

Fractures of the calcaneus are infrequent, occur most often at the young subject, related in more than half of the cases to accidents of work. The goal of surgical treatment of calcaneal fractures is to ensure articular surface stability by a reconstruction that restores the architecture triangular anatomical main bony spans.

In this, several osteosynthesis techniques are used that allow the recovery of Talo-calcaneal joint with a small footprint and good primary stability.

Conflicts of Interest: The authors do not declare any conflict of interest.

Contributions of the Authors: All authors have read and approved the final version of the manuscript.

REFERENCES

1. Buckley R, Tough S, Mccormack R, Pate G, Leighton R, Petrie D. Operative compared with nonoperative treatment of displaced intraraticular calcaneal fractures. Journal Bone Joint Surg Am, 2002;84:1733-44.
2. Bezes H, Massart P, Delvaux D, Fourquet JP, Tazi F. The operative treatment of intraarticular calcaneal fractures. Indications, technique, and results in 257 cases. Clinical orthopaedics and related research. 1993 May(290):55-9.
3. Howard JL, Buckley R, McCormack R, Pate G, Leighton R, Petrie D, Galpin R. Complications following management of displaced intra-articular calcaneal fractures: a prospective randomized trial comparing open reduction internal fixation with nonoperative management. Journal of orthopaedic trauma. 2003 Apr 1;17(4):241-9.
4. Thordarson DB, Krieger LE. Operative vs. nonoperative treatment of intra-articular fractures of the calcaneus: a prospective randomized trial. Foot & ankle international. 1996 Jan;17(1):2-9.
5. Järvholm U, Körner L, Thoren O, Wlklund LM. Fractures of the calcaneus: a comparison of open and closed treatment. Acta Orthopaedica Scandinavica. 1984 Jan 1;55(6):652-6.
6. Randle JA, Kreder HJ, Stephen D, Williams J, Jaglal S, Hu R. Should calcaneal fractures be treated surgically?: a metaanalysis. Clinical Orthopaedics and Related Research®. 2000 Aug 1;377:217-27.
7. Leung KS, Yuen KM, Chan WS. Operative treatment of displaced intra-articular fractures of the calcaneum. Medium-term results. The Journal of bone and joint surgery. British volume. 1993 Mar;75(2):196-201.
8. Paul M, Peter R, Hoffmeyer P. Fractures of the calcaneum: a review of 70 patients. The Journal of bone and joint surgery. British volume. 2004 Nov;86(8):1142-5.

9. Kurozumi T, Jinno Y, Sato T, Inoue H, Aitani T, Okuda K. Open reduction for intra-articular calcaneal fractures: evaluation using computed tomography. Foot & ankle international. 2003 Dec;24(12):942-8.
10. Augereau B, Mazas F, Travers V, Gagey O. Tolérance fonctionnelle des cals vicieux orthopédiques et chirurgicaux. Fractures thalamiques du calcanéum de l'adulte en pratique civile. Rev Chir Orthop. 1989;75(Suppl 1):102-5.
11. Folk JW, Starr AJ, Early JS. Early wound complications of operative treatment of calcaneus fractures: analysis of 190 fractures. Journal of orthopaedic trauma. 1999 Jun 1;13(5):369-72.
12. Palmar I. The mechanism and treatment of fractures of the calcaneus. J. Bone Joint Surg.. 1948;30:2-8.
13. Utheza G, Flurin PH, Colombier JA, Chiron PH, Tricoire JL, Potel JF, Puget J. Les fractures thalamiques du calcanéum: description anatomo-pathologique: apport de la tomodensitométrie. Revue de chirurgie orthopédique et réparatrice de l'appareil moteur. 1993;79(1):49-57.
14. Duparc J, De La Caffiniere JY. Mécanisme, anatomopathologie, classification des fractures articulaires du calcanéum. Ann Chir. 1970 Mar;24(5):289-301.
15. Sanders R, Fortin P, Dipasquale T, Walling A. Operative treatment in 120 displaced intra-articular calcaneal fractures. Results using a prognostic computed tomography scan classi-fication. Clin Orthop, 1993;290:87-95.
16. Böhler L. Diagnosis, pathology, and treatment of fractures of the os calcis. JBJS. 1931 Jan 1;13(1):75-89.
17. Kitaoka HB, Alexander IJ, Adelaar RS, Nunley JA, Myerson MS, Sanders M. Clinical rating systems for the ankle-hindfoot, midfoot, hallux, and lesser toes. Foot & ankle international. 1994 Jul;15(7):349-53.
18. Babin SR, Graf P, Katzner M, Schovingt E. Reconstruction-ostéosynthèse par plaque vissée des fractures thalamiques du calcanéum. Rev Chir Orthop. 1982;68(8):557-69.
19. Lenormant C, Wilmoth P. Les fracture sous-thalamiques du calcanéum. J Chir. 1932;40(1):1-25.
20. Maxfield JE, McDermott FJ. Experiences with the Palmer open reduction of fractures of the calcaneus. JBJS. 1955 Jan 1;37(1):99-192.
21. Dooley P, Buckley R, Tough S, McCormack B, Pate G, Leighton R, Petrie D, Galpin B. Bilateral calcaneal fractures: operative versus nonoperative treatment. Foot & ankle international. 2004 Feb;25(2):47-52.
22. Allmacher DH, Galles KS, Marsh JL. Intra-articular calcaneal fractures treated nonoperatively and followed sequentially for 2 decades. Journal of orthopaedic trauma. 2006 Aug 1;20(7):464-9.