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## Original Article

# Tibiocalcaneal arthrodesis using an Ilizarov fixator

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### A B S T R A C T

**Objective:** To evaluate the results of arthrodesis with Ilizarov fixator with tibiocalcaneana. **Methods:** We studied 12 patients with a mean age of 35 years, and 9 (75%) men and 3 (25%) women, underwent arthrodesis tibiocalcaneana. The diagnosis in the preoperative talus infection. We used a modified surgical technique Reckling (6 patients) and the Ilizarov technique, modified by Catagni (6 patients). Patients were evaluated by the AOFAS scale research and patient satisfaction. **Results:** Union was achieved in 100% of cases. The mean time to healing was 6 months (range 4-12 months) and mean duration of external fixator removal was 9 months (range 4-13 months). Stretching was performed in 6 patients with an average of 4 cm. The follow-up with Vancomycin lasted around 6 months. The average AOFAS score was 72.5 points (range 57 to 89 points). All patients were satisfied with the result. **Conclusion:** Despite the small number of cases, arthrodesis tibiocalcaneana seemed to be a good solution for cases of complex pathologies of the talus, such as infection, resulting in bone healing, pain relief and patient satisfaction.

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## Introduction

Arthrodesis is a surgical procedure that induces fusion of two or more joints with the objective of improving pain, stopping disease evolution or providing local stability. The main indications for arthrodesis of the ankle are in cases of post-traumatic arthrosis, after infection, rheumatoid arthritis and sequelae from non-reducible equinus deformity.<sup>1</sup> The first case of arthrodesis of the ankle was described by Albert in 1882<sup>2</sup> and, since then, it has been shown to be the best therapeutic option for painful or unstable conditions of the ankle, if other means of treatment are insufficient.

Because of increasing numbers of traffic accidents, particularly involving motorbikes, fractures and dislocations of the talus have been occurring more frequently. These are one of the main indications for tibiocalcaneal arthrodesis, because of the high rate of long-term complications. In most cases, talar infection is resistant to surgical debridement and broad regimens of antibiotic therapy, and conventional talectomy alone presents a high complication rate with unsatisfactory results.<sup>3,4</sup>

Many authors have therefore chosen to perform tibiocalcaneal arthrodesis in this situation, using an external Ilizarov fixator, because this not only allows stability for consolidation but also makes it possible to correct the limb shortening that results from talectomy.<sup>5</sup>

The objective of this study was to evaluate the clinical, radiographic and functional results among patients who underwent tibiocalcaneal arthrodesis using an Ilizarov fixator.

## Material and methods

Between February 2007 and October 2009, 12 patients underwent tibiocalcaneal arthrodesis performed by the Foot and Ankle Group at the Emergency Hospital of Goiânia. A retrospective study was conducted by means of analysis of medical records and questionnaires applied to the patients, which enabled descriptive statistical analysis on the data gathered.

This was a convenience sample composed of nine male patients and three female patients, with a mean age of 35 years (minimum of 18 and maximum of 60). In eight patients, the surgical procedure was performed on the right lower limb and in four patients, on the left lower limb. On admission, all the patients presented an exposed fracture of the ankle, classified as Gustilo III B, and evolved with locoregional infections, a few days after hospital admission (Figs. 1 and 2).

The inclusion criterion was thus that these should be patients with talar infection due to traffic accidents, with local exposure. The exclusion criteria were that these should not be patients with diabetes mellitus or Charcot arthropathy. Each patient underwent an average of three surgical procedures during the treatment. Half of the sample (six patients) underwent stretching concomitantly with tibiocalcaneal arthrodesis, by means of osteotomy in the proximal third of the tibia, as elected by the patient (Fig. 3). For these patients, we used the modified Reckling technique, in which we created medial and lateral access routes and performed osteotomy on the fibula, resection of the medial malleolus and talectomy,

with compression of the osteotomized surfaces by means of an Ilizarov fixator<sup>4</sup> (Figs. 4 and 5). In the other six patients, we used the same surgical procedure, but we created the assembly using the Ilizarov technique as modified by Catagni, with arthrodesis of the ankle using wires and Schanz pins, without ankle stretching using Schanz wires and pins and without associated stretching of the tibia<sup>6</sup> (Fig. 6). In all the patients, the assembly encompassed both the hindfoot and the forefoot, with two Schanz pins in the calcaneus, one Schanz pin in the first metatarsal and one Schanz pin in the cuboid.

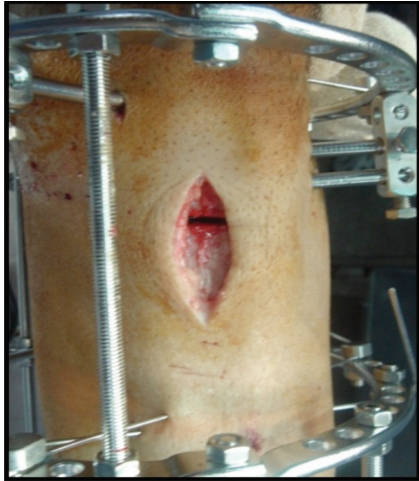
The patients underwent functional clinical evaluation by means of the protocols of the American Orthopaedic Foot & Ankle Society (AOFAS)<sup>7</sup> and measurement of the degree of satisfaction.



Fig. 1 - Preoperative clinical appearance.



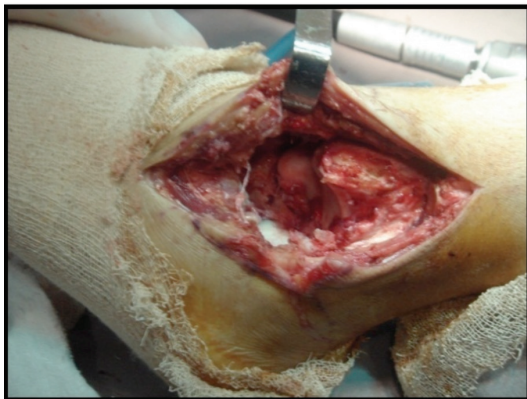
Fig. 2 - Preoperative radiographic appearance.



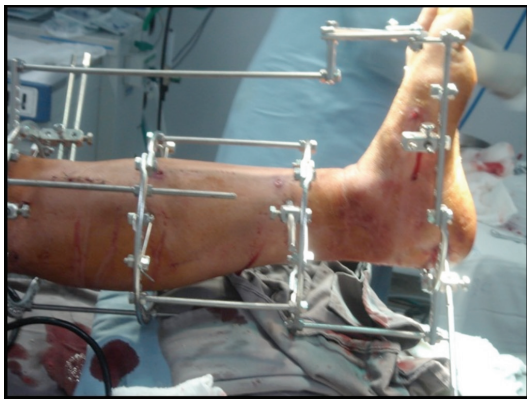
**Fig. 3 - Osteotomy for stretching concomitantly with arthrodesis.**



**Fig. 6 - Ilizarov arthrodesis, as modified by Catagni.**



**Fig. 4 - Distal osteotomy of the tibia and fibula, with talectomy.**

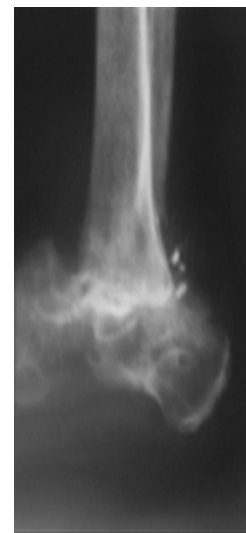


**Fig. 5 - Assembly with Ilizarov and proximal tibial osteotomy.**

### Results

Consolidation of the arthrodesis occurred in 100% of the cases, and was reached between 5 and 12 months after the operation (mean of six months) (Fig. 7). The mean time until removal of the external fixator was nine months. This difference occurred because of the characteristics of our clinic, in which there is some difficulty in scheduling outpatient removal of fixators. The stretching was performed concomitantly with the arthrodesis in six patients, with a mean of 4 cm.

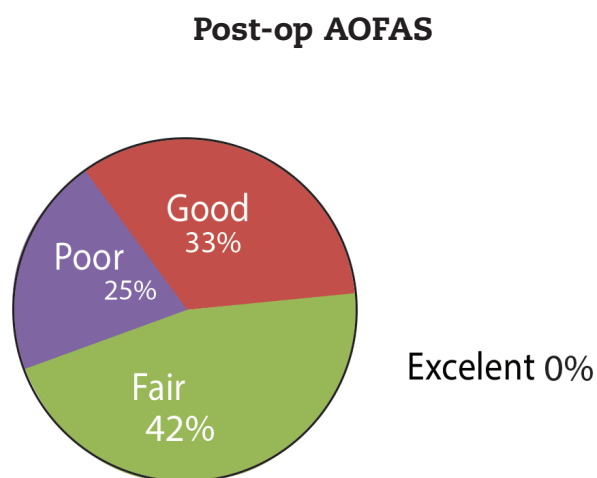
The scale used (AOFAS, Graph 1) defines excellent results as between 90 and 100 points, good between 80 and 89, fair between 70 and 79 and poor below this. The mean score



**Fig. 7 - Lateral X-ray showing consolidation of the arthrodesis.**

achieved was 72.5 points (fair), with a range from 57 to 89 points. There was no statistically significant difference between the patients who underwent stretching in the same procedure and those who elected not to do so. The infection was treated using vancomycin on an outpatient basis for six months after the surgery. This antibiotic therapy was used on an outpatient basis with follow-up by an infectologist, based on bone cultures with methicillin-resistant *Staphylococcus aureus*.

The sample and the study results are presented in Table 1.



**Graphic 1 - American Orthopaedic Foot & Ankle Society (AOFAS).**

## Discussion

Since the first use of surgical arthrodesis on the ankle, several techniques have been proposed, albeit without any worldwide consensus. The possibilities for arthroplasty of the ankle still present unsatisfactory results and become particularly unviable in cases of infection. In situations without current infection, tibiotalar arthrodesis can therefore be chosen, thereby preserving the talus and using internal synthesis materials, such as plates, screws and intramedullary nails.

In the literature, these techniques have been shown to produce good results, with consolidation rates ranging from 77% to 100%. Complications consisting of infection (5% to 20%) and pseudarthrosis (20%) have been described.<sup>8</sup> One of the indications for tibiocalcaneal arthrodesis is precisely the failure of previous tibiotalar arthrodesis. Other indications for this type of arthrodesis would include avascular necrosis of the talus, osteoarthritic involvement of these joints, sequelae from trauma, severe deformities due to neuromuscular diseases, Charcot arthropathy and presentation of bone failure or skeletal deformities following tumor resection.<sup>9</sup>

Arthrodesis of the ankle has been shown to be a viable procedure that can be indicated in selected cases for which all other therapeutic options have run out.

Syme described 11 cases of death due to complications resulting from talar infection,<sup>10</sup> thus demonstrating the severity of these lesions. In the literature, a low success rate in cases of tibiotalar arthrodesis with maintenance of the talus has also been described. This would be due to perpetuation of talar infection and occurrences of pseudarthrosis and delayed consolidation.<sup>11</sup>

**Table 1 - Sample and results.**

Case n°	Age	Sex	Number of procedures	Stretching	Consolidation (months)	Time until removal of fixator	AOFAS
1	18	Male	Three	No	5 months	9 months	89
2	24	Male	Two	3 cm	4 months	4 months	80
3	26	Male	Three	4 cm	6 months	10 months	68
4	26	Male	Three	No	6 months	9 months	72
5	34	Female	Two	4 cm	6 months	10 months	70
6	35	Male	Three	4 cm	5 months	9 months	70
7	35	Male	Three	4 cm	7 months	10 months	72
8	38	Male	Four	No	5 months	9 months	70
9	40	Female	Two	No	6 months	8 months	80
10	41	Male	Five	5 cm	12 months	13 months	57
11	43	Male	Three	No	5 months	9 months	62
12	60	Female	Three	No	5 months	8 months	80

AOFAS: American Orthopaedic Foot & Ankle Society.

Another treatment option that has been put forward in the literature is talectomy alone. However, studies on this have reported occurrences of pain and instability as considerable complications. In fact, amputation is not accepted by the vast majority of the patients<sup>12</sup> and, moreover, it presents a high treatment cost, including hospitalization, fitting of a prosthesis and rehabilitation.<sup>13</sup>

In this light, one good therapeutic option for severe cases of infection of the talus would be talectomy and subsequent tibiocalcaneal arthrodesis, with external fixation. Some types of external fixators for performing tibiocalcaneal arthrodesis have been described, and among these, the Ilizarov fixator has been used with good results, because it provides the possibility of compression at the site of the arthrodesis, associated stretching and correction of deformities.

In all of our patients, the clinical symptoms disappeared or diminished. The patients showed themselves to be satisfied with the treatment, with a good gait pattern and the ability to walk unaided. The patients who elected not to undergo the stretching adapted to using insoles and tennis shoes with rigid soles, and they did not present any statistical difference regarding the AOFAS score, in comparison with the group that underwent stretching.

In the literature, there are results similar to those presented in this study, regarding arthrodesis of the ankle. Vianna<sup>14</sup> achieved a long-term mean AOFAS score of 72.8 points, which was very similar to the result from our study, which was 72.5 points. However, 75% of the patients who we evaluated had scores of over 70 points, thus differing from the 60% found in the literature. The time taken for consolidation of the arthrodesis was similar to the results from other studies, which showed mean times until consolidation ranging from 4.5 to eight months, while our mean time until consolidation was six months. Some authors have described postoperative infection and pseudarthrosis as the main complications.<sup>15,16</sup> In our study, we achieved consolidation in 100% of the cases and the infections resolved after six months of outpatient treatment with vancomycin.

## Conclusion

We therefore consider that tibiocalcaneal arthrodesis using an Ilizarov fixator is a good option for treating severe fractures and dislocations of the ankle associated with talar infection, with AOFAS scores greater than 70 points, and with a good degree of final satisfaction among the patients.

## Conflicts of interest

The authors declare that there was no conflict of interests in conducting this study.

## R E F E R E N C E S

1. Salomão O, Carvalho Jr AE, Fernandes TD, Marques J, Montenegro NB. Artrodese tibiotársica via transfibular. *Rev Bras Ortop.* 1991;26(10):369-72.
2. Albert, Eduard: Einige Fälle von künstlicher Ankylosen bildung an paralytischen Gleidmassen. Viena: Wiener Medizinische Press; 1882.
3. Canale ST, Kelly FB Jr. Fractures of the neck of the talus: Longterm evaluation of seventy-one cases. *J Bone Joint Surg Am.* 1978;60(2):143-56.
4. Dennison MG, Pool RD, Simonis RB, Singh BS. Tibiocalcaneal fusion for avascular necrosis of the talus. *J Bone Joint Surg Br.* 2001;83(2):199-203.
5. Johnson EE, Weltemer MD, Lian GJ, Cracchiolo A 3rd. – Ilizarov ankle arthrodesis. *Clin Orthop.* 1992;(280):161-9.
6. Catagni MA. Fratture e pseudoartrosi – Trattamento con fissatore esternocircolare di Ilizarov. Studio CA, 1997.
7. Kitaoka HB, Alexander IJ, Adelaar RS, Nunley JA, Myerson MS. Clinical rating systems for the ankle-hindfoot, midfoot, hallux, and lesser toes. *Foot Ankle Int.* 1994;15(7):349-53.
8. Priano F, Molfetta L, Russo A. et al. Arthroscopic ankle arthrodesis: indications, technique and short-term results. *J Sports Traumatol.* 1996;18:143-8.
9. Papa JA, Myerson MS. Pantalar and tibiotalar calcaneal arthrodesis for post-traumatic osteoarthrosis of the ankle and hindfoot. *J Bone Joint Surg;* 1992;74(7):1042-9.
10. Syme J. Contributions to the pathology and practice of surgery. Edinburgh, Scotland: Sutherland and Knox; 1848.
11. Heckman JD. Fractures and dislocations of the foot. In: Rockwood CA, Green DP, Bucholz RW, Heckman, JD (Eds). *Rockwood and Green's Fractures in Adults.* Philadelphia: Lippincott-Raven; 1996. p. 2226-405.
12. Williams MO. Long-term cost comparison of major limb salvage using the Ilizarov method versus amputation. *Clin Orthop Relat Res.* 1994;(301):156-8.
13. Huang CT, Jackson JR, Moore NB, Fine PR, Kuhlemeier KV, Traugh GH, et al. Amputation: energy cost of ambulation. *Arch Phys Med Rehabil.* 1979;60(1):18-24.
14. Vianna S. Artrodese tibiotársica: resultado a longo prazo. *R. Into.* 2006;4(1):5-17.
15. Gulan G, Sestan B, Jotanovic Z, Madarevic T, Mikacevic M, Ravlic-Gulan J, et al. Open total talar dislocation with extrusion (missing talus). *Coll Antropol.* 2009;33(2):669-72.
16. Oboerien M, Ankle arthrodesis following trauma, a useful salvage procedure – A report on three cases. *J Surg Tech Case Rep.* 2011;3(2):102-5.