

# Our Experience in the Surgical Treatment of Type C Tibial Pilon Fractures: About 48 Cases

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## Abstract

Tibial pilon fractures are rare injuries most often associated with soft tissue injuries, occurring during high-energy trauma. Surgical treatment represents the therapy of choice and must ensure anatomical reconstruction of the joint surface while respecting the surrounding tissues. The evolution of our results showed a majority of good functional clinical radio results by the open treatment which showed its superiority compared to the closed treatment and the combined treatment.

## Keywords

Tibial Pilon, Osteosynthesis, Surgery

## 1. Introduction

The study of tibial pilon fractures deserves particular interest because they can jeopardize the functional prognosis of the ankle.

Type C represents an articular depression fracture, with frequent epiphyseal comminution according to the classification of Ruedi and Heim (AO, 1982). They are rare and represent 3% to 10% of all tibia fractures [1]. They occur during high-energy trauma (AVP, fall from a high place, and so on). These are serious fractures given their complexities, their therapeutic difficulties and the absence of muscular coverage with poor vascularization making the prognosis severe and dominated by the risk of skin necrosis, infection, malunion, pseudarthrosis or

even osteoarthritis [2].

Fractures of the distal end of the tibia result from high-energy trauma by axial compression. They are located in an anatomical region whose tissue envelope is thin and particularly exposed. Surgical treatment must ensure bone reduction as precise as possible while respecting the surrounding tissues. The osteosynthesis must be stable to allow early mobilization. Operative planning is an essential moment in treatment and is carried out through rigorous clinical observation and exact radiological interpretation of the characteristics of the fracture. The metaphyseal-epiphyseal complexity of these lesions requires CT imaging with multiplanar reconstruction. The development of anatomical implants with angular stability and the recent improvement in the definition of surgical approaches have clearly changed the prognosis of these lesions. Recognition of the importance of the free surgical interval before definitive osteosynthesis is the principle that has certainly secured their care the most. Also, the possibility of a minimally invasive approach for certain fractures contributes to this security.

Surgical treatment remains difficult because it requires appropriate preoperative planning taking into consideration the type of fracture and the skin condition and it must ensure anatomical reconstruction of the articular surface which is the only guarantee of a good functional result.

The objective of this work is to evaluate the result of surgical treatment of type C tibial pilon in the Traumatology-Orthopedics Department IBN EL JAZZAR University Hospital of Kairouan.

## 2. Material and Method

Our work is a retrospective study collecting 48 cases of type C tibial pilon fracture treated in the trauma-orthopedics department of the IBN EL JAZZAR University Hospital of KAIROUAN, and spanning a period of 5 years (2015-2019), with a retrospective means 13 months.

### - Inclusion criteria:

Patients who presented with a type C tibial pilon fracture according to the RUEDI and HEIM classification (AO, 1982) aged eighteen years and over and treated surgically were included in our study.

### - Exclusion criteria:

Patients with a type A or B tibial pilon fracture.

Patients lost to follow-up.

## 3. Results

48 patients were collected whose circumstances were dominated by public road accidents (27 cases), the majority of patients were male (18 men and 5 women) with an average age of 44 and a half years and a sex ratio of 3.6, with predominant involvement of the left side in 31 cases.

The skin condition was assessed using the modified Cauchoux and Duparc classification [3], the fractures were open in 21 cases, of which 8 were type II.

Radiologically, all our patients had standard x-rays of the ankle face and profile, we opted for the AO classification: type C3 fractures are the most frequent (21 cases) followed by type C2 fractures (17 cases) and type C1 (10 cases).

Spinal anesthesia was the most used type of anesthesia (36), the anteromedial route was used in 23 cases.

The average operating time was 3 days, the shortest was 1 day and the longest was 28 days.

The surgical management of the 48 cases was as follows:

- 26 cases (55%) were treated by internal osteosynthesis alone including (the isolated screwed plate in 8 cases, associated with screwing in 13 cases, associated with pinning in 2 cases and simple screwing in 3 cases).
- 2 cases (4%) were treated by external osteosynthesis alone.
- 20 cases (41%) were combined treatment.

Open surgical treatment was mainly used in cases of type C1/C2 fractures (**Figure 1** and **Figure 2**) and in cases of moderate skin lesions and closed surgical treatment was mainly used in cases of type C3 (**Figure 3**) fractures and in cases of severe skin lesions.



**Figure 1.** Standard front x-ray showing a type C1 tibial pilon fracture.



**Figure 2.** Standard frontal and lateral radiograph showing a type C2 tibial pilon fracture.



**Figure 3.** Standard front x-ray showing a type C3 tibial pilon fracture.

Our therapeutic results were evaluated according to the Olerud and Molander score with a good result in 19 cases, an average in 17 cases, and a poor in 12 of cases.

The majority of good results were found in type C1 fractures with a rate of 14 cases, while type C3 fractures had poor results in 12 cases.

The radiological results according to the criteria defined by Arlettaz were satisfactory in 19 cases (83% type C1) and unsatisfactory in 29 cases (89% type C3).

The complications revealed were infection in 10 cases with 6 cases of superficial infection, 4 cases of deep infection and 3 cases of infection on the fixator pin, skin necrosis in 10 cases.

For secondary and late complications: Algodystrophy and malunion in 4 cases, pseudarthrosis in 3 cases, tibiotalar osteoarthritis in 5 cases, and joint stiffness in 3 cases.

## 4. Discussion

Young male age as well as high energy trauma either by AVP and fall from a high place were found in most of the series which is comparable with our study [4] [5] [6].

According to Jorge and Milenkovic [7] [8] type C tibial pilon fractures represent 45% of tibial pilon fractures, Imren [9] reported that their number represented 43% of tibial pilon fractures.

Type C3 fractures were the majority in our study with 43%, which is consistent with the literature data with a rate of 50% in Bo GOA [6] and almost double in Abd-Almageed (*i.e.* 83.3%) [5].

Tibial pilon fractures have always represented a challenge for surgeons, due to their association with soft tissue injuries and comminution which worsen the prognosis [10].

For these reasons, emergency surgery must be carried out otherwise it is a deferred emergency [11] [12] [13].

In our series, the operating time was 4 days on average.

The anteromedial approach was the most used in our series with a rate of 48%.

Indeed this approach has been adopted by several authors: HEIM [14], MANDRACCHIA [15], ARLETTAZ [12], HELFET [13] and SIRKIN [16], followed by the anterolateral approach.

Surgical treatment uses different means and methods.

Our approach was comparable with that of Heim [14] who subdivided the moments of internal osteosynthesis into 4 stages:

- 1) Osteosynthesis of the fibula to restore length to the leg, mentioned by Rieunau and Gay.
- 2) Anatomical reduction of the tibial articular surface.
- 3) Filling of the spongy deficiency by an autologous graft.

And the last step is internal support and epi-metaphyseal meeting at the diaphysis.

According to Babis [17] series of 48 patients, external fixation represents a therapeutic choice when there is a skin opening or a closed fracture with skin lesions at major risk or communication, several other authors agree with this opinion [18] [19].

In our series, patients who benefited from a combined treatment (External Fixator + internal fixation at a minimum) had type C2 or C3 fractures and/or open fractures or fractures at risk of opening. While internal osteosynthesis was performed in patients with type C1 fractures and/or moderate skin lesions.

In the case of internal osteosynthesis, rehabilitation is started immediately after the removal of the wire, while in the case of external fixation, rehabilitation is started after 45 days to 2 months after the surgical procedure.

Weight bearing is generally decided according to the type of fracture; in our series, partial weight bearing was authorized on average at the 12th week and full weight bearing was authorized after consolidation.

Infection constitutes one of the main post-operative complications, it can be severe, affecting both the soft tissues and the after-effect, according to Heim, infection complicates closed fractures in 2.5%. Sirkin [20], in his series, obtained better results with a rate of 2% of superficial infections. On the other hand, with regard to the rate of deep infections, our results are better than those of Silluzio [21], with a rate of 28%, and those of Bacon [4] who reports a rate of 40% of deep infections, for 42 type C3 tibial pilon fractures.

Skin necrosis represents a frequent and serious complication, because it complicates a fracture located in a complex anatomical area and is difficult to correct due to the superficial arrangement and the terminal vascularization of the region [22] [23], its rate varies from 9% to 15% [12][20] [24].

We had a skin necrosis rate of 22%, *i.e.* 5 cases which required in 3 cases directed healing with simple skin graft and 2 cases of cover by flaps.

The rate of postoperative nonunion varies from one series to another from 3% to 16% [4] [8] [20] [25]. In our series, it reaches 17%.

Osteoarthritis is one of the most important and fearsome complications. Most studies mention it [15] [26]. Indeed, there is a correlation between the type of fracture, the incidence of osteoarthritis and poor clinical results [27]. Their frequency varies from 20% to 50% of cases [6] [8] [21], in our series we found a frequency of 22%.

A malunion reflects consolidation in a vicious position, so just a few degrees of varus or valgus are enough to cause painful osteoarthritis of the ankle within a few years. We had a 17% malunion rate.

The percentage of good and average functional results is the majority in the literature as well as in our series and this is regardless of the type of fracture and the type of treatment [8] [21] [28].

In our series, the percentage of satisfactory radiological results (39%) is lower than that observed in the literature (53% and 68%) [21] [25].

A good correspondence between clinical and radiological results was observed, while in the literature we did not find radio-clinical parallelism [21].

A good final result can only be obtained after the anatomical restoration of the joint surface and the restoration of congruence.

Endres [29] and YILDIZ [30] had good functional results when using hybrid FE while in our series and that presented by Duckworth [25], we noted a high percentage of good results in patients treated by initial internal osteosynthesis.

Other authors (Dujardin [31] and Patterson [32]) recommend combined treatment with which they have obtained good functional results.

The complexity of bone and skin lesions has pushed some authors to be reluctant about the results of open reduction and fixation [5] [11] [33] [34], they then suggest closed osteosynthesis and stabilization with an external fixator, associated or not with minimal osteosynthesis Hontzch [35] found in his series a high rate of cutaneous complications after open reduction and suggests external fixation for a period of 2 or 3 weeks, until the cutaneous condition is stabilized, then placement of internal osteosynthesis.

Les résultats dépendent de la bonne réduction anatomique avec une ostéosynthèse par un matériel moins volumineux et permettant une rééducation précoce. L'ouverture cutanée, la complexité des lésions osseuses et le traitement à foyer ouvert représentent les principaux facteurs favorisant les complications [36].

In the light of this retrospective study, we highlight the severity of these fractures, since they involve the long-term functional prognosis of young and remaining subjects currently a real challenge for the surgeon.

The precariousness of the cutaneous vascularization of the tibial pilon adds to frequent lesions of soft tissues thus complicating the evolution of these fractures leading to modify the therapeutic procedure (Figures 4-6). The treatment Surgical remains the treatment of choice for these fractures. But it's difficult to achieve, requiring planning appropriate preoperative treatment, taking into consideration the type of fracture and skin condition.



**Figure 4.** Post-operative control radiograph showing third-tube plate osteosynthesis of the external malleolus and double screwing of the internal malleolus with triple antero-posterior screwing of the tibial pilon.



**Figure 5.** Standard post-operative control radiograph showing osteosynthesis using a Hoffmann type double hemi-frame external fixator with screwing of the internal malleolus and anteroposterior screwing of the anterior marginal.



**Figure 6.** Standard post-operative control radiograph showing third-tube plate osteosynthesis of the external malleolus and an anatomical trefoil plate of the tibial pilon.

## 5. Conclusions

Type C tibial pilon fractures are serious fractures since they compromise the long-term functional prognosis of young subjects.

Despite the fact that open internal osteosynthesis gives overall good functional results despite frequent complications (infections and skin necrosis).

For this, closed treatment with an external fixator associated or not with at least osteosynthesis has shown, according to certain authors, good results, both functional and radiological, and especially in fractures which are very comminuted, type C3, and in serious skin lesions.

## Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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