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Fractures of the tibia with intact fibula: Assessment of factors influencing therapeutic outcomes at Brazzaville University Hospital Center

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Abstract
Introduction: fractures of the tibia with intact fibula remain a controversial subject. Orthopedic treatment in the management of these fractures remains an option, but is associated with significant morbidity. The aim of our study was to evaluate the factors influencing the functional, clinical, and radiological outcomes of tibial fractures with intact fibula.
Materials and methods: we carried out an analytical, transversal study over a five-year period from January 2019 to December 2024. We included all patients hospitalized or seen in outpatient consultations for fractures of the tibia with intact fibula, with a minimum follow-up of 6 months.
Results: forty-five (45) cases were enrolled, with a mean age of 34.83 years. The main etiology was road traffic accidents in 71.11% of cases. The fracture was located in the middle third in 51.10% of cases. In 31 cases (68.89%), the fracture was simple, and displaced in 33 cases (73.33%). The main displacement on frontal views was translation in 27 cases, with an average of 7.4 mm. Type A according to the AO classification was the most common in 35 cases, with a predominance of type A3 in 28.89%. Orthopedic treatment was provided in 30 cases, and surgical management was performed in 15 cases. The average time to treatment was 3.83 days for orthopedic treatment and 15.15 days for surgical treatment. The average time to weight-bearing for orthopedic treatment was 12.30 weeks. The average time for healing was 4.70 months for orthopedic treatment and 5.17 months for surgery. The average follow-up was 18.48 months. Complications from orthopedic treatment included joint stiffness in the knee and ankle in 10 cases.
Conclusion: orthopedic treatment remains a therapeutic option for this injury. Joint stiffness in the knee and muscle atrophy of the limb are the main complications of orthopedic treatment. The lack of health insurance is one of the principal factors limiting surgical management of this injury in countries with limited healthcare resources.

Keywords: Tibial fracture, intact fibula, predictive factors, orthopedic treatment, intramedullary nailing, external fixation, osteosynthesis

Introduction
Tibia fractures are common injuries among young people due to road accidents, which are frequent in this age group [1-3]. Fractures of the tibia with intact fibula remain a controversial problem in terms of treatment choice. If some authors claiming that its integrity contributes to stability and better conditions for tibial fracture healing. However, others consider that its integrity is associated with significant morbidity, which influences the choice of procedure and the long-term prognosis for these fractures [4-7]. These injuries are often considered to be at risk of pseudarthrosis or malunion [8]. Several studies have shown the superiority of surgical management with intramedullary nailing, leading to excellent medium- and long-term outcomes [6, 9]. In countries with limited resources where care costs are supported by patients, orthopedic procedure remains a therapeutic option of last resort, although its results have been assessed very rarely in the literature.

We performed an analytical, cross-sectional study to evaluate the functional outcomes of tibial fractures with intact fibula treated orthopedically and those treated surgically. The aim of our research was to determine the factors influencing the time to union and to evaluate the long-term functional, clinical, and radiological results.

Materials and Methods

We conducted a retrospective, cross-sectional, analytical review over a five-year period from January 2019 to December 2024.

The study was conducted in the orthopedics and traumatology department and the ambulatory care department of the University Hospital Center.

We included all patients hospitalized in the orthopedics and traumatology department for closed fractures of the tibia with intact fibula; open fractures of the tibia with intact fibula classified as Gustillo Anderson types 1 and 2. We excluded from the study all patients with Gustillo Anderson type III open fractures of the tibia with intact fibula. The fractures were assessed according to the AO classification. A survey form, with different treatment and follow-up protocols, was established according to the treatment being orthopedic or surgical.

Protocol for orthopedic treatment

Orthopedic treatment consisted of utilizing a plaster boot for no fewer than 90 days or a cast leg brace with knee release after 45 days of immobilization. For the second option, immobilization was continued for an additional 6 weeks. The minimum immobilization period was defined at 90 days, or 3 months.

Some patients admitted to the emergency department, who had been temporarily immobilized with a splint due to significant post-traumatic oedema, kept their splints for at least two (2) weeks before a circular plaster cast was applied.

Instructions for surveillance of a plaster cast were given to all patients associated with prophylactic treatment for venous thrombosis, either orally with Apixaban or with low molecular weight heparin.

Protocol for surgical treatment

Patients underwent surgery with locoregional anesthesia, except for those who had other bone lesions or for personal reasons, in which case general anesthesia was used.

The fracture site was approached, if possible, to allow reduction. After preparation of the fracture site, stabilization was achieved employing a Hoffmann external fixator or an antegrade intramedullary nail with bipolar or monopolar locking. If bipolar locking was used, the nail was dynamized by removing the proximal or distal screw between 6 and 8 weeks postoperatively.

Fibula osteotomy was only necessary in cases of revision surgery for pseudarthrosis or malunion.

Protocol for functional rehabilitation

Patients who underwent surgery began physiotherapy the day before the surgery or the week after the surgery, depending on their postoperative pain. Similarly, for those treated with a plaster cast, physiotherapy began as soon as pain levels allowed.

For those treated with a leg cast, rehabilitation generally began after the knee was released at 6 weeks, but self-rehabilitation was suggested for all patients treated with a cast.

Partial weight bearing was recommended for patients with early radiological bone callus formation.

Statistical analysis

- The data were recorded and processed using Epi Info software (version 7.2.6.0). Excel 2021 software was used to create the graphs.
- Qualitative variables were expressed as numbers and proportions. Quantitative variables were reported as means (or medians) accompanied by standard deviations.
- The Chi-square test was used to compare qualitative variables. The significance p-value was considered for values less than or equal to 0.05.

Results

- Forty-five (45) patients were enrolled during the study period, including 8 women and 37 men, with a sex ratio of 4.63 M/F.
- The average age was 34.83 years, with extremes ranging from 18 to 62 years. Twenty-one (21) patients, or 60% of cases, were referred directly by the emergency department, 15 cases (35.55%) were seen in the ambulatory trauma department, and 3 cases were seen in the hospital ward.
- Seventeen patients (37.78%) had health insurance, and 28 cases (62.22%) did not have health insurance.
- The medical, surgical, and toxic history revealed 14 alcoholic patients, 3 cases of alcohol and tobacco use, and 3 cases of chronic tobacco use.
- The main etiology was traffic accidents in 32 cases (71.11%), sports accidents in 8 cases (including football in 6 cases and basketball in 2 cases), 4 cases of work-related accidents, and 1 case of physical aggression.
- The right side was the most affected in 24 cases (53.33%) and the left side in 21 cases (46.67%).
- The clinical examination on admission revealed pain in all patients, associated with functional impairment that was absolute in 41 cases and relative in 4 cases. Leg deformity was observed in 8 cases (17.78%) and was not present in 37 cases (82.22%). A skin opening was noted in 7 cases (15.56%), classified as Gustillo Anderson type I in 4 cases and type II in 3 cases.
- Associated injuries were observed in four cases, including one case of floating knee, one case of contralateral femur fracture, and two cases of forearm fractures.
- All patients underwent frontal and lateral leg X-rays, and additional knee X-rays were requested in 19 cases (42.22%) and ankle X-rays in 10 cases (24.44%).
- The fracture was located in the middle third of the diaphysis in 23 cases (51.10%), in the distal third in 12 cases (26.67%), in the proximal third in 7 cases (15.56%), and was bifocal in 3 cases (6.67%).
- The fracture pattern was simple in 31 cases (68.89%) and complex in 14 cases (31.11%).
- The fracture was displaced in 33 cases, or 73.33%. On the frontal view, the main displacement was translation in 27 cases (60%), varus displacement in 3 cases, valgus displacement in 2 cases, and in 4 cases no displacement was observed.
- On the lateral view, the main displacement was translation in 12 cases (26.67%), recurvatum in 8 cases (17.78%), flexum in 4 cases (8.89%), and no displacement was noted in 10 cases (22.22%).

- No chevauchement-type displacement was observed on the frontal and profile radiographs in the entire series.
- The measurement of translation on the frontal radiographs showed an average of 7.44 mm with extremes of 3 mm and 20 mm, and a mode of 5 mm.
- According to the AO classification, type A accounted for 35 cases (77.78%), with a predominance of type A3 in 13 cases (28.89%); type B accounted for 8 cases and type C for 3 cases, mainly type C2 (Fig. 1).
- Among the 45 patients, 30 cases (66.67%) were treated orthopedically and 15 cases (33.33%) were treated surgically.

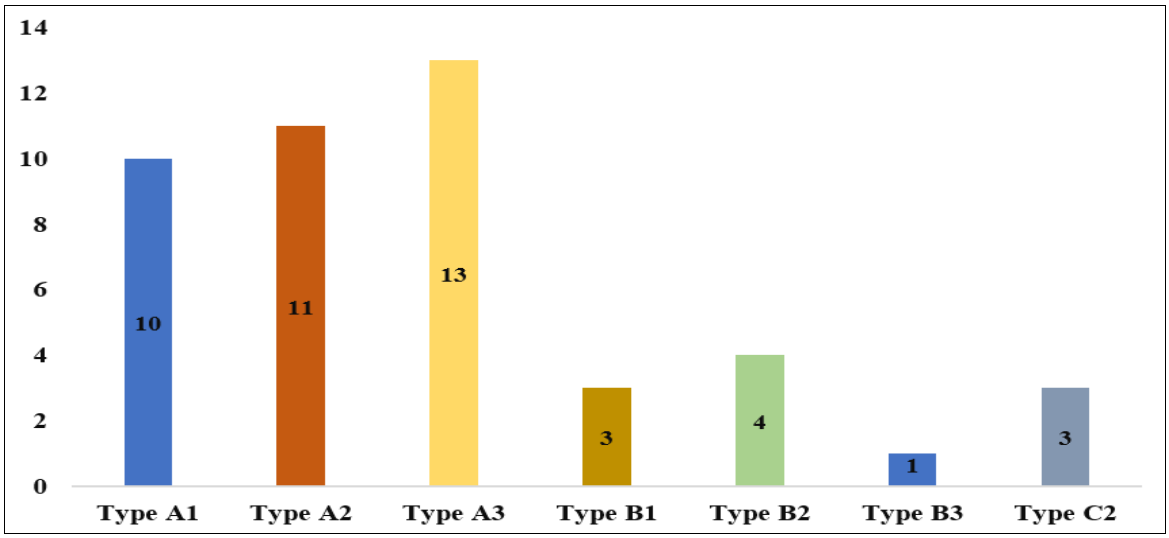

Fig 1: Distribution of fracture types according to the AO classification.

Table 1: The main complications of orthopedic treatment in the series.

Complications following orthopedic treatment.	Effective (n)	Percentage (%)
Algodystrophy	1	3.57
Amyotrophy	10	35.71
Aseptic pseudarthrosis	2	7.14
Knee and ankle stiffness	13	46.43
Rotational limb disorder	1	3.57
Malunion	1	3.57
Total	28	100.00

Orthopedic treatment

- The average time to treatment was 3.83 days, ranging from 0 to 23 days. Among the 35 cases, 15 patients received definitive orthopedic treatment within hours of the injury (fig. 2).
- Orthopedic treatment consisted of applying a leg cast in 22 cases (73.33%) and a plaster boot in 8 cases (26.67%).
- Thromboembolic prevention was achieved with low molecular weight heparin in 22 cases (73.33%) and an oral anticoagulant was prescribed in 8 cases (26.67%).
- Functional rehabilitation was initiated at an average of 5.09 weeks, ranging from 2 to 7 weeks. Partial weight bearing was authorized in 28 cases (93.33%) with an average delay of 7.41 weeks (3 to 12 weeks). Full-weight bearing was authorized in all 30 patients treated with a cast, with an average weight bearing time of 12.30 weeks, ranging from 6 to 16 weeks, with a median and mode of 12 weeks.
- Surgical revision after orthopedic treatment was performed in 2 cases, or 6.67%. The main cause of revision was aseptic pseudarthrosis in both cases. The time to surgical revision after orthopedic treatment was 8 months in one case and 18 months in the other case.
- The average consolidation time after orthopedic treatment was 4.70 months, with extremes between 2 and 14 months and a mode of 4 months. Complications of orthopedic treatment included joint stiffness in the knee and ankle in 10 cases, followed by muscle atrophy in the lower limb in 10 cases (table 1).
- There was a correlation between the duration of immobilization and the risk of knee or ankle stiffness in orthopedic treatment (P=0.042). There was a correlation between the duration of immobilization and the risk of knee or ankle stiffness in orthopedic treatment (P=0.042). There was no correlation between the delay in treatment and the incidence of joint stiffness.

Surgical treatment

Among the 45 patients, 15 patients, or 33.33%, underwent surgical stabilization. The average time to surgical treatment was 15.15 days, with extremes of 4 to 41 days and a median of 15 days. The fracture site was approached in 6 cases. Surgical stabilization was performed using bipolar intramedullary nailing in 8 cases and monopolar intramedullary nailing in 4 cases, and a Hoffmann external fixator in 3 cases (fig 3 et 4).

A fibular osteotomy was necessary as a complementary step in one case.

The average length of hospital stay was 15.15 days

- In the 15 cases, two patients had post-op complications, including aseptic pseudarthrosis in one case and a post-op infection in another.
- One of the patients with an open leg fracture treated with

an external fixator underwent revision surgery for aseptic pseudarthrosis, using intramedullary nailing with fibular osteotomy.

- This average time for the functional rehabilitation was 1 week for patients treated surgically, with extremes between 1 and 3 weeks.
- The average time to consolidation after surgical treatment was 5.17 months, ranging from 4 to 8 months, with a mode of 4 months.

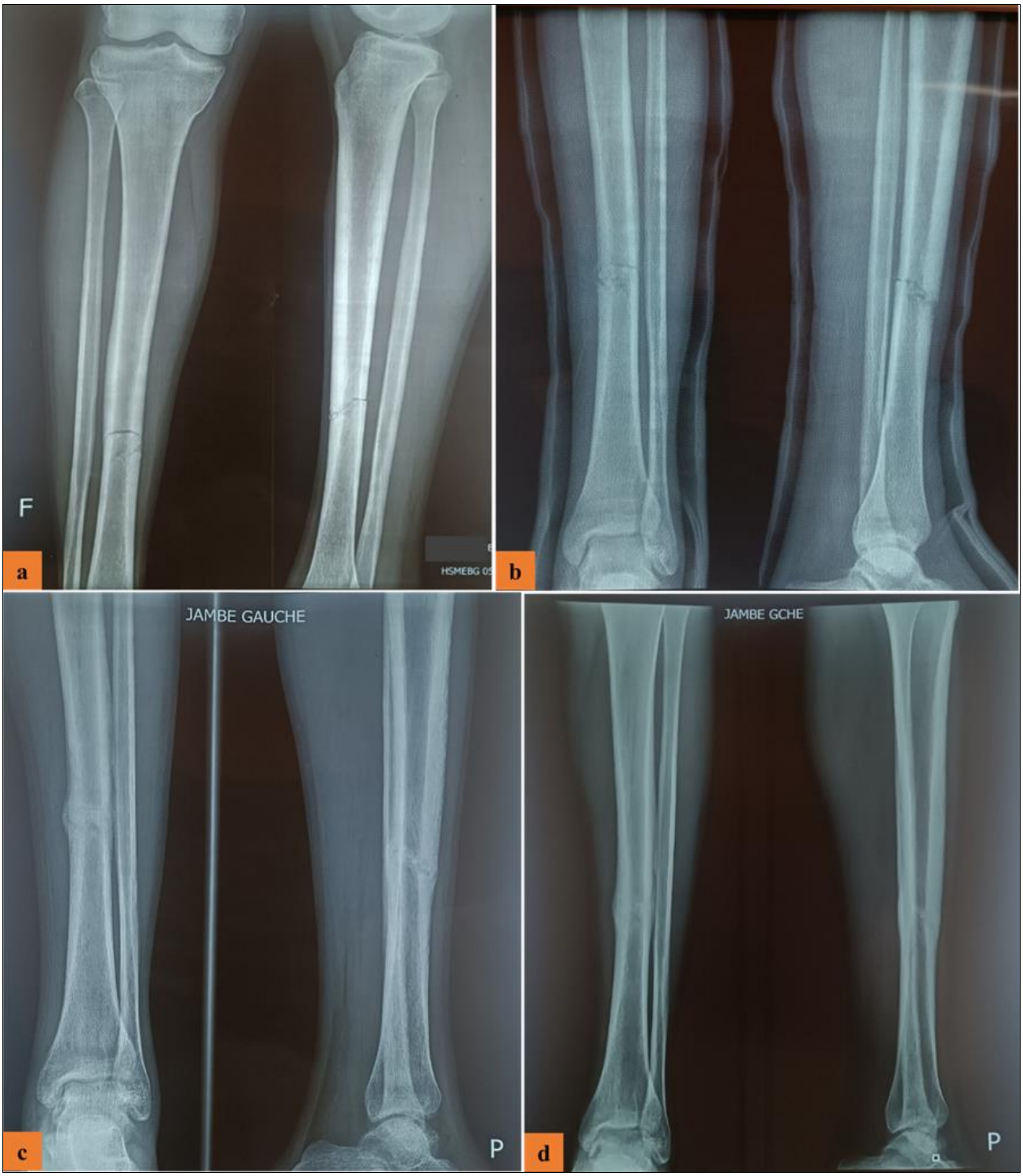

Fig 2: a and b. non-displaced diaphyseal fracture treated with a leg cast. b and c: Good healing at 6 and 12 months.

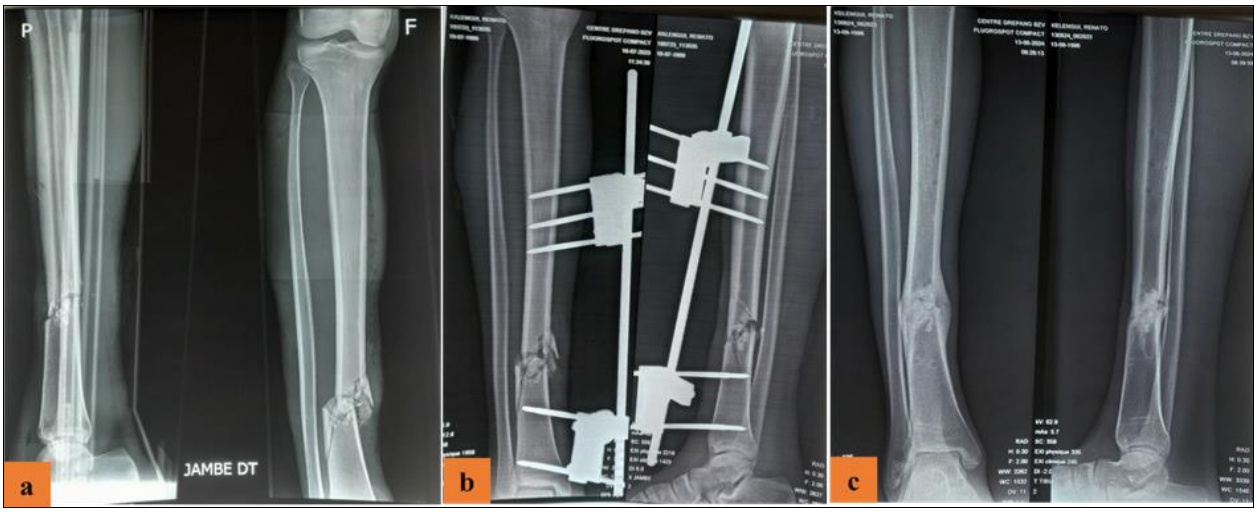

Fig 3: a. Open fracture of the distal third of the tibia with intact fibula, Gustillo Anderson type I b. Treated with a Hoffmann tibio-tibial external fixator, c. Fracture healing with a residual varus deformity of 5° at the last follow-up of 26 months.

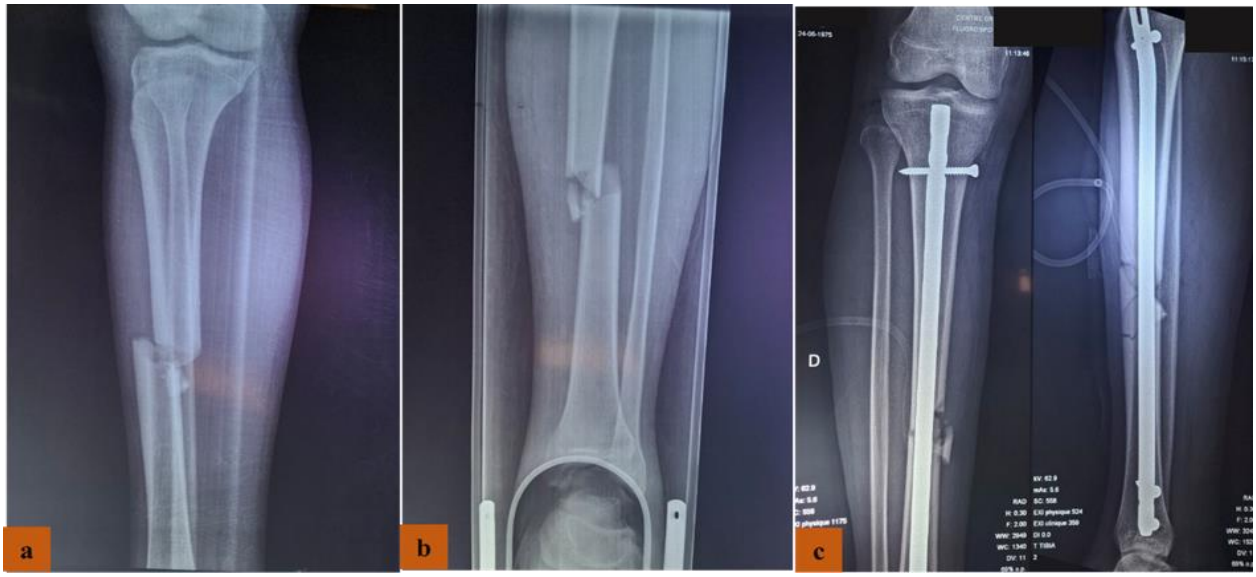

Fig 4: a and b. Complex displaced diaphyseal fracture of the tibia. c. Immediate postoperative radiograph of the locked intramedullary nailing.

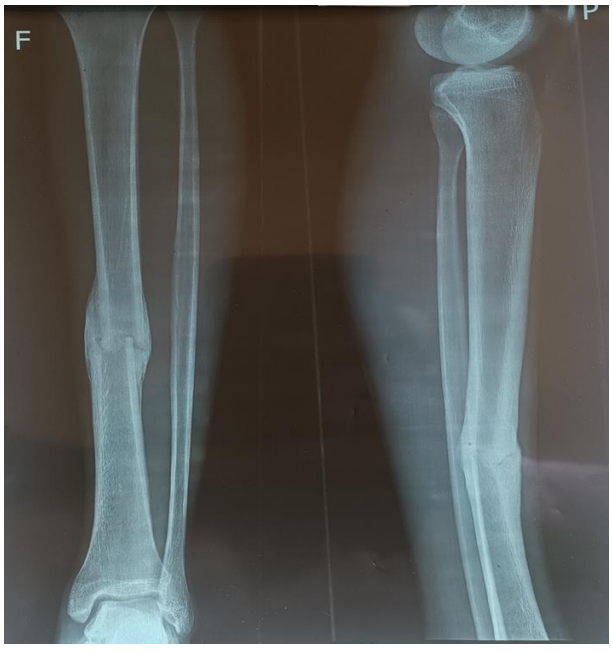

Fig 5: Illustration of a 9° recurvatum at 10 months following a fracture of the left tibia with intact fibula treated orthopedically.

Functional assessment: All patients underwent functional rehabilitation within an average of 3.98 weeks, with extremes between 1 and 7 weeks and a mode of 6 weeks.

The average follow-up period for all patients was 18.48 months, ranging from 7 months to 38 months, with a median of 18 months and a mode of 26 months.

The average follow-up time for surgical treatment was 19.67 months, with extremes of 8 months and 38 months and a mode of 8 months. For orthopedic treatment, the average follow-up time was 17.87 months, with extremes of 7 months and 36 months and a mode of 36 months.

The functional assessment noted thigh muscle atrophy in 13 cases (28.89%), which was more pronounced in the orthopedic treatment group (P=0.032); lameness when walking was observed in 8 cases (17.78%).

Leg deformity at the last follow-up was observed in 6 cases (13.33%). This was of the recurvatum type in 2 cases, measuring 5° and 9°(fig.5); lower limb length discrepancy in 1 case (1 cm), external rotation in 2 cases, measuring 9°; and varus in 1 case (measuring 5°).

In 4 cases, or 8.89%, there were socio-professional repercussions related to functional sequelae. In 3 cases, there was regret about the initial therapeutic choice, particularly orthopedic treatment (table 2).

Table 2: Summary of outcomes according to treatment modalities.

Effective (n=45)	Orthopedic treatment (n =30)	Surgical treatment (n=15)
Average time to treatment	3.83 jours	15.15 jours
Surgical revision	2 cas	1 cas
Average time to healing	4.70 mois	5.17 mois
Average follow-up	17.87 mois	18.48 mois
Regret about initial treatment	3 cas	Aucun

Discussion

Contrary to the upper limb, where the presence of both bones is essential to ensure pronosupination function, in the lower limb, the fibula appears to be an accessory bone. However, several studies have demonstrated its involvement in the outcome of tibial fractures with intact fibula, which updates this statement [4, 6, 10].

Fractures of the tibia with intact fibula account for nearly 15 to 25% of leg fractures in the literature. In a retrospective series, Sarmiento noted 24% of cases of leg fractures with intact fibula [11].

This is a condition that affects young people, around the age of 30, as noted in our series with an average age of 34.83 years; with a predominance of males in our group due to the fact that the main cause is road traffic accidents; contrary to Hooper *et al.*, who noted sports accidents as the main cause of fractures of the tibia with intact fibula [4]. In our series, the predominance of road traffic accidents can be explained by the motorcycle taxis, which is often practised by men.

In our series, similar to those in the literature, we observed a slight predominance of right-sided involvement; unlike Abouchane *et al.*, who noted a left-sided predominance [12].

Deformity was evident in only 8 cases in the series. There was no correlation in the series between clinical deformity and the extent of displacement on the initial radiographs.

On the radiological aspect, more than half of the tibial fractures were located in the middle third of the tibial diaphysis (51.10%); the fracture pattern was simple in nearly two thirds of cases. The fracture was non-displaced in 73.33% of cases in the series. Our data are comparable to those of the series by Hooper *et al.*, which found 55% of fractures to be non-displaced [4]. Translation was the most commonly observed displacement on frontal and lateral views, occurring in 60% and 26.67% of cases, respectively. An average translation of 7.44 mm was measured on frontal views. Zizah *et al.*, in Morocco, as well as other authors in the literature, found similar results regarding the characteristics of the fracture on radiological examinations [13-15].

According to the AO classification, 77.78% of fractures in our series were type A, identical to the results reported by Zizah *et al.*, who reported 76% type A fracture [13].

The role of the fibula in prognosis remains a controversial topic. While some consider its integrity to be a factor in the stability of tibial fractures and favouring better healing conditions [1, 2, 11]. Others, however, have shown that an intact fibula delays axial compression and causes valgus displacement [5, 16-18]. Sarmiento, one of the pioneers in the orthopedic treatment of leg fractures, highlights the negative impact of an intact fibula in tibia fractures [11]. Other authors report excellent results in the literature after intramedullary nailing in fractures of the tibia with intact fibula [15, 19-21].

In our series, among 45 patients, orthopedic treatment provided treatment in 30 cases (66.67%) and surgical treatment in 15 cases (33.33%). The lack of health insurance and the fact patients with limited resources pay for that can explain the predominance of orthopedic treatment.

The average time to receive orthopedic treatment, which was 3.83 days, also shows support for this finding, being significantly shorter than the 15.15 days for surgical treatment. The average time to consolidation was much shorter for orthopedic treatment (average of 4.70 months) compared to surgical treatment, where the average time to consolidation was 5.17 months, but with an identical mode of 4 months in both groups.

Orthopedic treatment was associated with an average partial weight-bearing period of 7.41 weeks, which was longer than surgical treatment, where partial weight bearing was possible much earlier, within a week of surgical treatment with intramedullary nailing [1, 6, 9]. Orthopedic treatment was associated with significant secondary complications such as thigh muscle atrophy and stiffness of the knee and ankle. This can be explained by a delay in starting functional rehabilitation.

In the series, there were three cases of surgical revision for pseudarthrosis, including two cases, who had undergone orthopedic treatment. In one case, after external fixation and revision by intramedullary nailing with fibula osteotomy. Which resulted in a shortening of approximately 1 cm. In the orthopedic treatment group, two patients regretted their choice of orthopedic treatment.

Conclusion

Fractures of the tibia with intact fibula remain a condition affecting young people, often occurring because of road traffic accidents. Orthopedic treatment still plays a key role in the management of this injury, with excellent long-term results and few complications based on current data. Although joint stiffness with muscle atrophy is uncommon after intramedullary nailing, it remains very common in patients treated by orthopedic procedures. The lack of health insurance or insurance covering traffic accidents is the major obstacles to surgery, which remains very expensive in underdeveloped countries. Despite a long delay in treatment in our series, surgical treatment is associated with a low rate of reoperation and sequelae. Patient satisfaction is more important for surgical treatment, unlike the orthopedic treatment of fractures of the tibia with an intact fibula.

Conflicts of interest

The authors report no conflicts of interest.

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