

Emergency Intramedullary Nailing in Open Leg Fractures: What Results?

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Abstract

Introduction: Leg fractures are the prerogative of violent trauma, which lead to pluritissular lesions, including the opening of the focus, thus worsening the prognosis. The indication of centromedullary nailing (CMN) is subject to time and trained team requirements. The aim of this work is to evaluate the results of CMN in emergency cases of open leg fractures in adults. **Patients and Methods:** This was a retrospective, descriptive and analytical study from January 1, 2014 to December 31, 2018. It concerned adult patients with an open leg fracture treated by CMN in emergency at the Orthopedics-Traumatology Department of the Yalgado Ouedraogo University Hospital. During five years, 91 patients were registered. Their average age was 34.1 years with a sex ratio of 2.2. The average admission time was 1 hour 41 minutes. Cauchoix and Duparc type I open fractures predominated (64.8%). Antibiotic therapy was instituted as soon as the patient arrived. The functional results of osteosynthesis were evaluated according to the Lysholm score after an average follow-up of 48 months. **Results:** The majority of our patients (51.3%) were operated on between the 6th and 18th hour. After careful trimming of the open fracture, CMN was performed in all our patients. The average hospital stay was six days. The mean Lysholm score was 87.23 ± 11.06 with a satisfactory functional result in 81.3% of cases. **Discussion:** The satisfactory results observed in 81.3% of our study testify to the reliability of the indication of CMN as specified by Dakouré *et al.* [4] in their series. **Conclusion:** Open leg fractures are very frequent injuries and have a considerable socio-economic impact. Centromedullary nailing is a suitable solution for adequate and rapid socio-professional reintegration of the patient.

Keywords

Open Fractures, Nailing, Leg

1. Introduction

Leg fractures are the most common traumatic injury of the long bones. They are evidence of a brutal and violent trauma, responsible for pluritissular lesions, including the opening of the fracture site, which can worsen the functional prognosis of the limb and, in extreme cases, the patient's vital prognosis [1]. Since 2007, the WHO (World Health Organization) has estimated the incidence of these fractures in the world at 26.9 per 100,000 inhabitants and a prevalence of 7.8% among road traffic injuries [2]. In Burkina Faso, the 15 - 59 age group is the most affected. It constitutes the active population with a precarious standard of living, using two-wheeled vehicles involved in road traffic accidents [3] [4] [5].

Regardless of the stage, open leg fractures remain a surgical emergency. It is necessary to know how to choose a therapeutic attitude, judge it on its results and adopt it. The management of open leg fractures has evolved remarkably over the last 30 years, with many controversies [6] [7]. The use of central medullary nailing (CMN) has therefore been urgently required in order to meet the demands of time, trained teams and sufficient resources [1] [8] [9]. Its practice becomes difficult in developing countries where the patient's under-equipment and precarious means limit the possibilities of emergency osteosynthesis [10]. As a rule, for reasons of exceeding the time limit described (before six hours), the majority of our patients have always benefited from a two-stage treatment (trimming and plaster splinting followed by osteosynthesis after wound healing and normalisation of the infectious biological balance sheet). This type of procedure results in an extended hospital stay [4] [5].

Taking these realities into account and under the preconditions of a well-conducted medical treatment of the open fracture on admission, is it not possible to perform the CMN in emergency beyond the six hours recommended in the literature? In order to do this, we wish, through this study, to evaluate the results of CMN in emergencies in open leg fractures in adults in order to propose the adoption of this therapeutic method in countries with precarious health conditions.

2. Patients and Methods

This was a retrospective study with descriptive and analytical aims from 1 January 2014 to 31 December 2018, conducted in the Orthopaedics-Traumatology Department of the Yalgado Ouédraogo University Hospital in Ouagadougou, Burkina Faso. The aim of this study is to evaluate the anatomical and functional results of CMN in emergencies in adult open leg fractures (even beyond six hours) in order to propose the adoption of this therapeutic method in countries with precarious health conditions.. All patients aged at least 17 years, who presented with an open leg fracture, who were urgently treated by CMN within less than 48 hours and who were regularly followed up in our department, were included in this study.

The indication of CMN in emergencies was retained in the following cases:

- Open fractures type I and II, according to the Cauchoix and Duparc classification;
- Fractures of both leg bones and/or isolated fractures of the tibia ;
- Simple, complex and comminuted fractures.

As soon as the patient arrived in the emergency department, after recovery of his hemodynamic state by infusion of solutes, macromolecule and analgesics, we proceeded to an abundant lavage of the wound, followed by a protective dressing and a temporary restraint by splint. Next, we administered amoxicillin-clavulanic acid intravenously. Following this medical treatment, X-ray images (face and profile) of the fractured leg segment, ipsilateral knee and ankle were taken.

After confirmation of the diagnosis of an open fracture, the osteosynthesis equipment and various consumables were prescribed to the patient. The wound dressing was renewed every 12 hours, and the patient was admitted to the operating room as soon as he had honoured his medical prescription.

Clinical and para-clinical follow-up made it possible to assess post-treatment progress with a view to detecting and treating complications. Thus, in case of suppuration, a bacteriological examination coupled with the antibiogram was systematically carried out.

Consolidation was assessed by standard radiography of the leg and functional results by the Lysholm functional score [11]. Lysholm score's criteria are presented in **Table 1**.

Data were collected on an individual form based on emergency and operating room records, medical records and patient interviews.

These data were analyzed with Epi Info 7 software.

3. Results

Thus, over the five years, 91 patients were operated, either an annual frequency of 18 cases per year. The mean age of these patients was 34.1 years (17 - 77 years). The age range of 17 - 30 years predominated (51.4%). We noted more males than females, with a sex ratio of 2.2. Road traffic accidents (RTA) were the predominant etiology (93.4%), followed by sports accidents (2.2%).

According to Cauchoix and Duparc's classification of open fractures [12] (**Figure 1**), we identified 59 type I open fractures (64.8%) and 32 type II open fractures (35.2%).

Table 1. Lysholm functional score [11].

Items	Cotation
Excellent	98 - 100
Good	84 - 97
Medium	65 - 83
Bad	64 - 0



Figure 1. Classification of open leg fractures according to Cauchoux and Duparc. (a) Open fracture type I of Cauchoux and Duparc in a 25-year-old patient following an RTA; (b) Cauchoux and Duparc open fracture type II in a 39-year-old patient following an RTA.

Seventy-six fractures of both leg bones (83.5%) and 15 isolated fractures of the tibia (16.5%) were recorded. Fracture patterns were simple in 46 cases (50.5%), complex in 27 cases (29.7%) and comminuted in 18 cases (19.8%). **Figure 2** shows *the types of fracture lines*.

Almost a third of our patients (27%) were operated on between the 12th and 18th hour. The distribution of patients according to the time of surgical intervention is shown in **Figure 3**.

Under local anaesthesia (100% spinal anaesthesia) and after careful trimming, tibial CMN osteosynthesis was performed at the same time as the operation. The universal tibial nail in static or dynamic assembly (**Figure 4**), or the Küntscher nail, were the main implants used. A universal tibial nail was used in 84 cases (92.3%) and a Küntscher nail in 7 cases (7.3%). Depending on the type of intramedullary nailing, we achieved dynamic locking in 6 cases (6.6%) and static locking in 05 cases (5.5%). However, in 80 cases (87.9%) no locking was performed, the nail was placed with hard friction.

Reduction was anatomical in 29 cases (31.87%); osteosynthesis was stable in 81 cases (89%).

The average hospital stay of our patients was 6 days (4 - 36 days). They all went out to their homes with close bandaging appointments on a case-by-case basis.

Wound healing was achieved within an average of six weeks (2 - 51 weeks). Longer delays were marked by the occurrence of suppuration. Thus, the evolution was favourable in 81 cases (89%), marked by effective healing within three weeks.

At a mean follow-up of 28 months, radiographic consolidation was effective in all of these 81 patients (89%).

Table 2 shows the distribution of 80 patients according to radiographic reduction and consolidation.

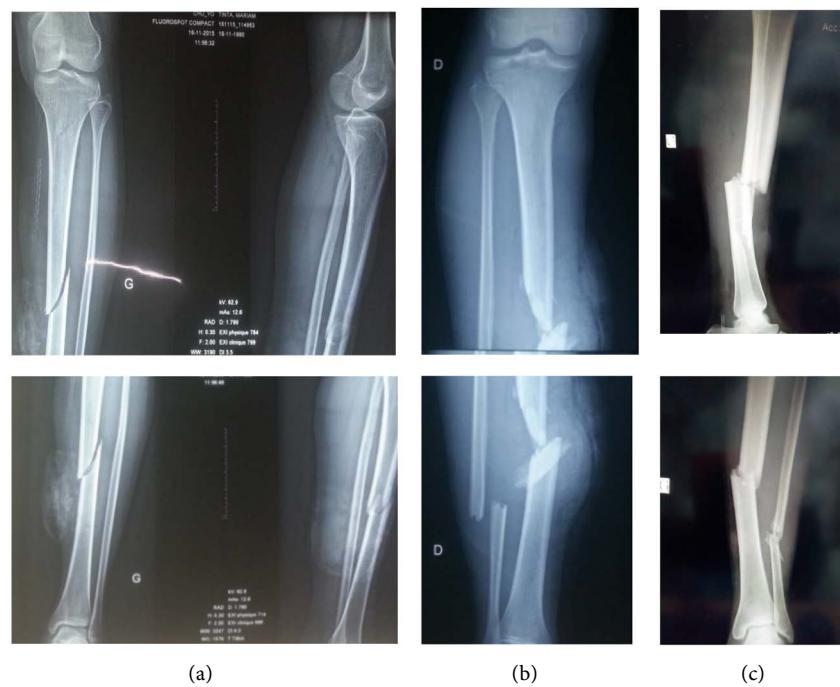


Figure 2. Radiographic images of the face and profile of the legs showing the types of fracture lines. (a) Isolated open fracture of the tibial diaphysis in a 25-year-old patient following an RTA; (b) Complex open fracture of both leg bones in a 39-year-old patient following an RTA; (c) Transverse open fracture of both leg bones in a 36-year-old patient following an RTA.

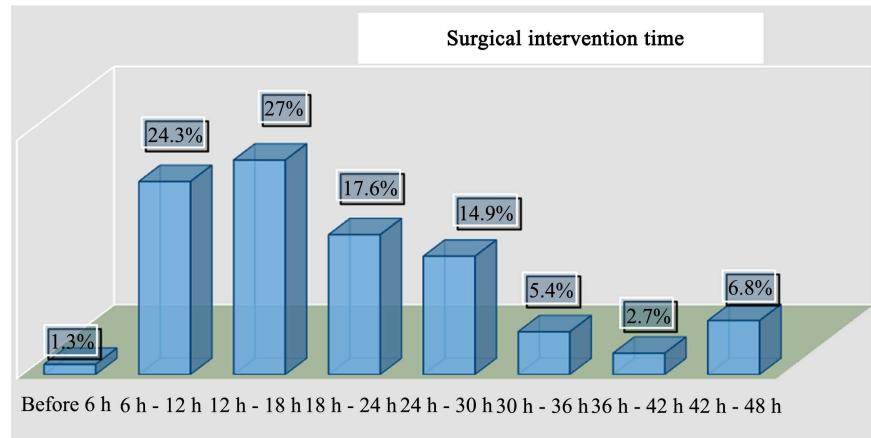


Figure 3. Distribution of patients by time to surgery.

Table 2. Distribution of fractures according to radiographic reduction and consolidation of our patients ($n = 80$).

Reduction/consolidation	Headcount	%
Anatomical	29	36
Satisfactory	51	64
Anatomical defects	0	0
Total	80	100



Figure 4. Main types of centromedullary nailing. (a) Static locking tibial centromedullary nailing of a bifocal fracture in a 35-year-old patient; (b) Dynamic unipolar locking of a transverse fracture in a 34-year-old patient; (c) Unlocked centromedullary nailing of an isolated transverse middiaphyseal fracture of the tibia in a 26-year-old patient.

Consolidation was perfect on an anatomical reduction in 29 cases (36%) (**Figure 5**).

We found 10 cases (10.99%) of suppuration of the surgical wound. The time to onset of suppuration ranged from three days to 23 days, with an average of 11.3 days. The most frequently found germ was *Escherichia Coli* in 9 cases, followed by *Staphylococcus aureus* in 1 case. These patients were treated according to antibiotic susceptibility testing. These suppurations were mainly located in the middle third of the leg (50%). The onset of suppuration was not related to the time to management. **Table 3** shows the distribution of suppuration according to the time to management.

There was no correlation between the onset of suppuration and the time to patient management ($\text{Khi}^2: X^2 = 5.806$ et $P = 0.56$).

In **Figure 6**, we have a good healing of the surgical wound in 2 weeks.

At the average 18-month follow-up, the evolution was favourable in 80 cases (87.9%) and with late complications in 11 cases (12.1%). These 80 patients had had regular clinical and radiographic follow-up until the removal of the osteosynthesis material. The mean time to consolidation in these patients was five months (2 - 9 months). The distribution of patients by time to consolidation is shown in **Figure 7**.



Figure 5. Consolidation on static locked centromedullary nailing in a 29-year-old patient.



Figure 6. Surgical wound healing in a 40-year-old patient.

Table 3. Surgical wound healing based on time to management.

Time to management	Appearance of suppuration		Total
	No	Yes	
Before H6	1	0	1
Between H6-H12	20	2	22
Between H12-H18	19	5	24
Between H18-H24	14	2	16
Between H24-H30	14	0	14
Between H30-H36	04	1	05
Between H36-H42	03	0	03
Between H42-H48	06	0	6
Total	81	10	91

The 11 patients who presented late complications (pseudarthrosis, delayed consolidation, osteitis and vicious callus), were retreated. **Figure 8** shows the frequency of these late complications.

At the average 48-month decline, our functional results were satisfactory in 81.3%; these patients had returned to activity at a variable level of ability. The mean overall Lysholm score was 87.23 ± 11.06 (64 - 100). **Table 4** summarizes the functional results according to the Lysholm score.

Our therapeutic results were good and excellent in 61 patients (81.3%).

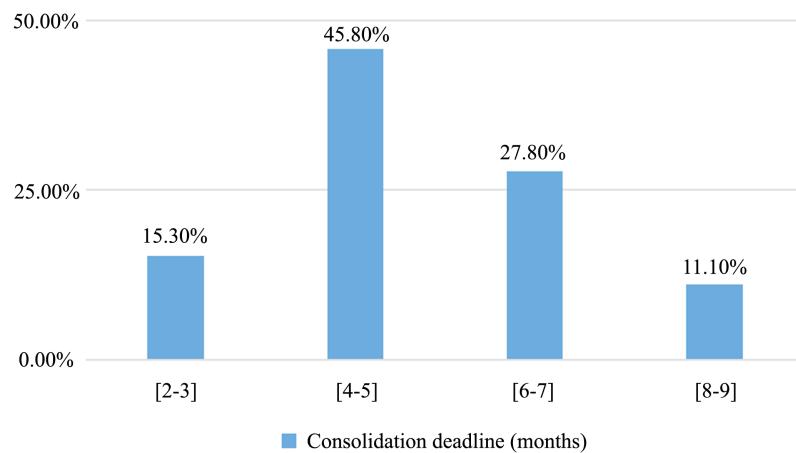


Figure 7. Time to consolidation in follow-up patients (n = 80)

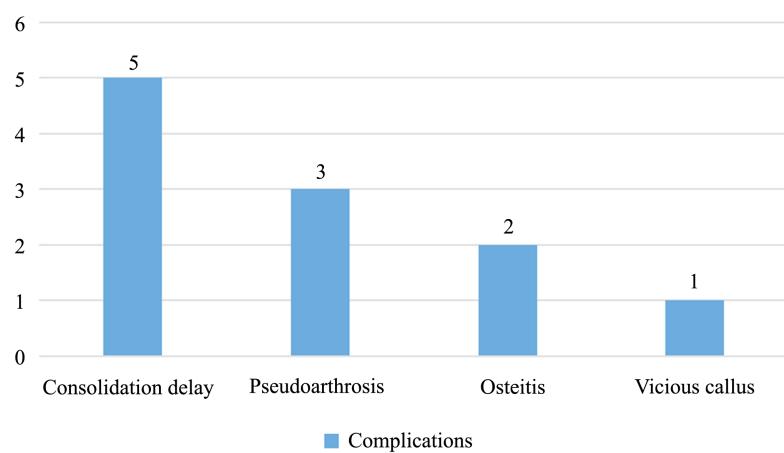


Figure 8. Distribution of late complications among the 11 patients.

Table 4. Functional outcomes of patients reviewed at 48 months (n = 80).

Results	Headcount	%
Excellent	16	21,3
Good	45	60
Medium	13	10,7
Bad	6	8
Total	80	100

4. Discussion

During our study, we were confronted with certain difficulties and shortcomings related to its retrospective nature and its size, which was not large enough. Nevertheless, we can make comments and lead a discussion after comparing them with the data in the literature.

The average hospital stay of our patients was five days with (4 - 36 days). Duirek *et al.* [13] in 2011 in Morocco, noted an average hospital stay of 10 days in their series. Ouedraogo *et al.* [14] in 2012 and Dakoure *et al.* [4] in 2013 in Burkina Faso, reported 21.5 and 32.1 days respectively in their study. This short stay of our patients is explained by our therapeutic approach: open fractures type I and II are treated in a single operation, unlike the other authors who treat open leg fractures type I, II, III in two or even three operations [4] [14]. Emergency CMN is therefore an efficient process to cope with the lack of financial means and accommodation places in our hospital units.

The early complications in our patients were limited to suppuration of the surgical wounds observed in 10 cases (10.99%). Our results are similar to those of Soudre *et al.* [15] in Burkina Faso and Peter *et al.* [16] in England, who reported a frequency of suppuration of 12% and 11% respectively. Ndayisaba *et al.* [17] in Burundi, Ouedraogo *et al.* [14] in Burkina Faso and Tscherne *et al.* [1] in Germany, found lower infection rates than ours, respectively 7.8%, 8.7% and 3.9%. In contrast, Dakoure *et al.* [4] in Burkina Faso, Moyikoua *et al.* [18] in Congo Brazzaville, Ditengou *et al.* [19] in Mali and Ikem *et al.* [8] in Nigeria, found a higher frequency of suppuration than ours, respectively in 34.7%; 35%; 35.7% and 39.3%.

In our series, there was no correlation between the onset of suppuration and time of treatment ($P = 0.56$). This suppuration could be explained either by initial massive contamination, or by the poor quality of the external dressings, or by non-adherence to antibiotic therapy, thus a probable secondary superinfection.

The mean time to consolidation in our study was 5 months (2 - 9 months). Duirek *et al.* [13] in 2011 in Morocco, in their series of leg fractures, noted a mean time of consolidation lower than ours, with 3.5 months (03 - 04 months). Our study was limited to open fractures. The loss of the fracture hematoma through the skin opening in our series contributed to slowing down the consolidation process [12]. This may explain the long consolidation time we observed.

At a mean follow-up of 28 months, our radiographic results were favourable, marked by effective consolidation in all patients with visible callus bone on the radiographic images, and an anatomical reduction in 36% and satisfactory in 64%; which corroborates the results of Bonnevialle *et al.* [20] and those of Duirek *et al.* [13].

At an average follow-up of 48 months, our functional results were excellent and good in 61 patients (81.3%); this rate is similar to those of Dakoure *et al.* [4] in 2013, who noted 87.9% good to excellent results.

These anatomical and functional results are compatible with an adequate socio-professional reintegration; which testifies to the reliability of our therapeutic attitude which proves to be effective and to be recommended for countries with limited resources.

5. Conclusions

Open leg fractures are very common injuries and have a major socio-economic impact, as they occur most often in adult males. Emergency CMN of open leg fractures appears to be an effective solution. It favours a considerable reduction in hospital stays, while providing satisfactory results, thus allowing an early and adequate socio-professional reintegration of the patient.

Therefore, it imposes basic principles, namely the medicalisation of the wound upon admission of the patient. Therefore, postoperative follow-up must be rigorous in order to detect and treat complications early and efficiently.

Conflicts of Interest

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

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