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Original article

Treatment of Gustilo and Anderson type IIIB open fractures of both leg bones: what are the results in a regional hospital in Burkina Faso?

Traitement des fractures ouvertes type IIIB de Gustilo et Anderson des deux os de la jambe, quels sont les résultats dans un hôpital régional au Burkina Faso ?

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Résumé

Objectif : Exposer les résultats de la prise en charge des fractures ouvertes type IIIB de Gustilo et Anderson des deux os de la jambe dans le service de Chirurgie du Centre Hospitalier Universitaire Régional de Ouahigouya (CHUR-OHG).

Méthodologie : Une étude descriptive à collecte rétrospective a été conduite chez des patients admis pour fractures ouvertes type IIIB des deux os de la jambe et pris en charge durant la période du 1er janvier 2022 au 30 juin 2024 au CHUR-OHG. Les variables sociodémographiques, cliniques, thérapeutiques et évolutives ont été collectées et analysées.

Résultats : Trente-deux dossiers ont été colligés. L'âge moyen des patients était de 34,5+/- 3ans. Il s'agissait de 22 hommes et de 10 femmes avec un sex-ratio de 2,2. Les accidents de circulation routière en étaient les principales causes (96,88%). Selon la classification de l'AO, le type A de l'extrémité distale du tibia représentait 53,13% des cas, et 60% des fractures de la fibula siégeaient en diaphyse. Le délai moyen de prise en charge était de 12,56 heures. L'antibiothérapie probabiliste était systématique et l'Amoxicilline plus Acide Clavulanique était la principale molécule utilisée dans 53,12%. Un parage et une exofixation tibio-tibiale ont été réalisés dans 62,50% des cas, et un embrochage fibulaire associé à l'exofixation dans 18,75% des cas. La couverture cutanée a été faite dans 43,75% par lambeau fascio-cutané, 46,87% par cicatrisation dirigée puis d'une greffe cutanée et dans 9,38% par lambeaux musculaires. Les complications étaient à type d'infection dans 37,50% et de pseudarthrose dans 25%. Le délai moyen de consolidation était de 9,81 mois chez 26 patients. Les résultats anatomiques et fonctionnels obtenus étaient en général bons (37,50%).et excellents dans 15,62% des cas.

Conclusion : les fractures ouvertes type IIIB de Gustilo et Anderson des deux os de la jambe sont rencontrées au cours des accidents de la circulation routière. Les sujets jeunes étaient les plus touchés avec une prédominance masculine. Le traitement

médicochirurgical faisant appel au parage et à la stabilisation osseuse donne des résultats anatomiques et fonctionnels globalement bons. L'évolution a été souvent émaillée de complications et l'infection osseuse et la pseudarthrose en sont les principales.
Mots-clés : Fracture ouverte, Jambe, Gustilo IIIB, Fixateur externe, Complications.

Abstract

Objective : To present the results of the management of Gustilo and Anderson type IIIB open fractures of both bones of the leg in the Surgery department of the Ouahigouya Regional University Hospital Center (CHUR-OHG).

Methodology : A retrospective descriptive study was conducted on patients admitted for type IIIB open fractures of both leg bones and treated between January 1, 2022 , and June 30, 2024, at the CHUR-OHG. Sociodemographic, clinical, therapeutic, and outcome variables were collected and analyzed.

Results: Thirty-two cases were collected. The mean age of the patients was 34.5 ± 3 years. There were 22 men and 10 women, with a male-to-female ratio of 2.2. Road traffic accidents were the main cause (96.88%). According to the AO classification, type A fractures of the distal tibia represented 53.13% of cases, and 60% of fibular fractures were located in the diaphysis. The mean time to treatment was 12.56 hours. Empirical antibiotic therapy was systematically administered, and amoxicillin plus clavulanic acid was the main antibiotic used in 53.12% of cases . Debridement and excision were performed . Tibial fixation was performed in 62.50% of cases, and fibular pinning combined with external fixation in 18.75% of cases. Skin coverage was achieved in 43.75% with a fasciocutaneous flap, in 46.87% with directed healing followed by a skin graft, and in 9.38% with muscle flaps. Complications included infection in 37.50% and nonunion in 25%. The mean time to union was 9.81 months in 26 patients. The anatomical and functional results obtained were generally good (37.50%) and excellent in 15.62% of cases.

Conclusion: Gustilo and Anderson type IIIB open fractures of both lower leg bones are frequently encountered in road traffic accidents. Young people were most commonly affected, with a male predominance. Medical and surgical treatment involving debridement and bone stabilization generally yields good anatomical and functional results. The postoperative course was often complicated, with bone infection and nonunion being the main complications.
Keywords: Open fracture, Leg, Gustilo IIIB, External fixator, Complications.

Introduction

An open leg fracture is a diaphyseal or metaphyseal -diaphyseal, extra-articular fracture of both leg bones with communication between the fracture site and the external environment [1] . Open fractures are classified according to Gustilo and Anderson [2] into types of increasing severity. Gustilo and Anderson type IIIB open leg fractures, characterized by extensive tissue damage and significant contamination, require a specific approach to minimize complications and promote healing. Currently, musculoskeletal injuries account for 14 to 28% of primary healthcare visits in many countries, and 60% of disability is attributable to musculoskeletal trauma [3] . Leg fractures are the most frequent skeletal fractures, representing 15 to 20% of all fractures [4] . Their treatment must take into account the bony aspect, requiring initial stabilization, but also the surrounding soft tissues [5] . In the United States, the frequency of open fractures of both leg bones is estimated at 12% and is caused by road traffic accidents [6] . In France, open leg fractures were the leading cause of trauma, with an estimated frequency of 25% for fractures of both leg bones [7] . In Africa, open leg fractures represent 39% of leg fractures [5] . In the Democratic Republic of Congo, the hospital frequency of open leg fractures was approximately 13.53% [8] . Fractures unfortunately affect young people, the most economically active segment of the population [9] . In Cotonou, Madougou [4] noted that open fractures accounted for 9.01% of hospitalizations in the trauma unit at the Hubert Koutoukou Maga National University Hospital Center in Cotonou. In Mali, the frequency of open leg fractures ranged from 21% to 39% in the trauma unit of Gabriel Touré Hospital [6] . In Bobo Dioulasso, Burkina Faso, open fractures represented 34% of leg fractures [10]. Given the severity of Gustilo and Anderson type IIIB open fractures of both leg bones and the complexity of their management, we undertook this study to present the results of their management in the Surgery Department of the CHUR-OHG.

Methodology

This was a retrospective, descriptive, cross-sectional study conducted in the Surgery Department of the CHUR-OHG (University Hospital of Haute-Garonne) between January 1, 2022 , and June 30, 2024. It included all patients with an open fracture of both lower leg bones, classified as type IIIB according to the Gustilo and Anderson classification, who were treated in our department. Patients excluded were those with incomplete medical records or those lost to follow-up. Data were obtained from patient records, operating room and emergency department operative reports, consultation records, and questionnaires completed during patient interviews. The variables collected were sociodemographic (age, sex, occupation), clinical (circumstances, lesion diagnosis and topography), paraclinical (radiographic signs and fracture classification), therapeutic (type, time to treatment, duration), and outcome-related. Anatomoclinical results were evaluated according to the modified Ketenjian criteria [11]. The collected data were entered into an Excel spreadsheet and analyzed on a computer using Stata software, version 2016. Our data were collected while respecting patient confidentiality and anonymity.

Results

- *Socio-demographic aspects*

We collected 32 cases of Gustilo -Anderson type IIIB open fractures of both leg bones. During the same period, we recorded 194 patients with open leg fractures, representing 0.51% of hospitalizations. Gustilo -Anderson type IIIB open fractures of both leg bones accounted for 16.49% of all open leg fractures in the CHUR-OHG surgical department. There were 22 men and 10 women, for a male -to-female ratio of 2.2. The mean age of the patients was 34.5 years ± 3 years, with a range from 4 to 74 years. The age range was 31-40, representing 28.13% of cases .

- *Clinical Aspects*

Patients received were admitted directly by the National Fire Brigade in 53.13% of cases and referred from other healthcare facilities in 46.87%. The average admission time was 3.5 hours, with extremes ranging from one between 6 a.m. and 6 a.m. Road traffic accidents were the primary cause, accounting for 96.88% of cases. Fractures resulted from rockfalls in 3.12% of cases. Direct impact was the most frequent mechanism, occurring in 93.75% of patients.

- *Diagnosis*

There was a predominance of the left side in 53.12% against 46.88% for the right side. Of our patients, 93.75% had good hemodynamic status on admission, while 6.25% had an unstable hemodynamic status due to associated injuries such as hemoperitoneum from splenic rupture and extradural hematoma. All patients underwent standard leg radiography and laboratory tests. According to the AO classification , For the tibia, extra-articular type A fractures of the distal end were the most frequent (53.13%), followed by diaphyseal fractures (40.63%) and extra-articular fractures of the proximal end (6.25%). For the fibula, diaphyseal fractures predominated (60%). Figure 1 illustrates the radioclinical images of a Gustilo -Anderson type IIIB open fracture of both bones of the right leg.

- *Therapeutic Aspects*
  - Medical treatment

All patients received medical treatment consisting of antibiotics, analgesics, and tetanus immunoglobulin vaccination. Amoxicillin/clavulanic acid was administered to 53.12% of our patients, followed by amoxicillin/ clavulanic acid and gentamicin in 25% of cases. The duration of empirical antibiotic therapy ranged from 5 to 7 days during hospitalization. Oral amoxicillin/clavulanic acid was administered to all patients. Thromboprophylaxis with enoxaparin sodium was administered in 78.12% of cases for a duration ranging from 5 days to 14 days in hospital and continued after discharge with oral rivaroxaban until support was authorized.

- Surgical treatment

The average time to surgical intervention was 12.56 hours, with a range of 6 to 24 hours. Seventeen patients (53.12%) underwent surgery between 6 and 12 hours after admission , three patients (9.38%) before 6 hours , and ten patients (31.25%) between 12 and 24 hours after admission. All patients underwent debridement . The fracture immobilization method varied. In 20 patients (62.50%), excisional fixation was performed in addition to debridement. tibial and in 18.75% of cases a debridement associated with exofixation tibiotalar and fibular pinning. Table I shows the distribution of patients according to the type of surgical treatment.

The average duration of the surgical procedure was 2.5 hours, ranging from one to four hours. All patients underwent either primary or secondary coverage of the fracture site. In 43.75% of cases, this involved a fasciocutaneous flap, in 46.87% directed wound healing followed by a skin graft, and in 9.38% muscle flaps. 86.20% of patients received functional rehabilitation.

- *Evolutionary Aspects*

Healing was achieved in an average of 83 days, with extremes ranging from 45 days to 4 months, in 96.87% of cases. The outcome was favorable in 15.62% of cases, but it was marked by complications in 84.38%. Table II illustrates the complications.

Infection of the perifracture soft tissues was the most frequent complication, occurring in 37.50% of cases. We observed one case (3.13%) of septic nonunion with irreparable bone loss, for which amputation was performed. Consolidation was achieved in an average of 9.81 months, ranging from 6 to 18 months, in 26 patients. The average time to weight-bearing was 12.5 months, ranging from 11 months. and 24 months in 26 patients. Of the 31 patients who underwent osteosynthesis, 80.64% had the osteosynthesis hardware removed after consolidation. The average length of hospital stay was 65 days, ranging from 30 to 270 days. Figure 2 illustrates the radiographic and clinical results at 10 months, showing skin healing but the presence of osteomyelitis of the tibia on a consolidated bone in the presence of an external fixator and fibular pinning.

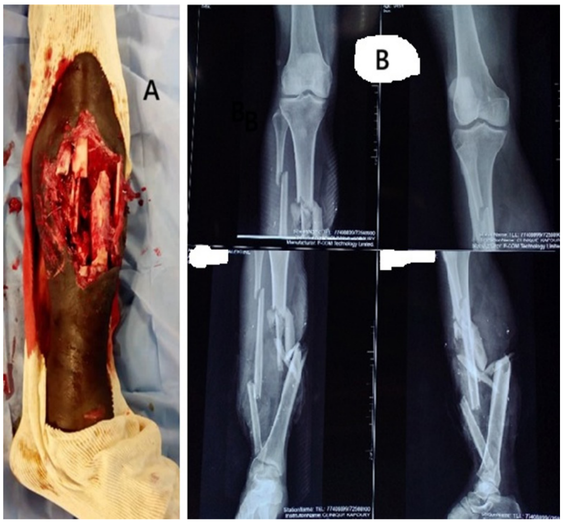

Figure 1: Radio-clinical images of a Gustilo and Anderson type IIIB open fracture of both bones of the right leg (A: intraoperative view; B: radiographs).

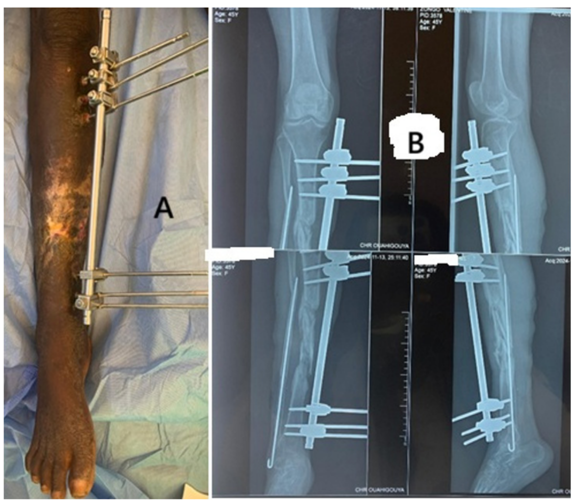

Figure 2: Radioclinical results at 10 months postoperative of the patient in Figure 1.

Table I: Distribution of patients according to the type of surgical treatment

Surgical treatment	Effective	Percentage
Trimming + External Fixator	20	62.50
Trimming + External Fixation + Fibular Pinning	6	18.75
Trimming + Skewering fibular + Plaster cruro -pedal	4	12.50
Trimming + Fibular Pinning + Double Ender Nailing	1	3.13
Trimming + Plaster cruro -pedal	1	3.13
Total	32	100.00

Table II: Distribution of patients according to the type of complications (N=27)

Type of complications	Effective	Percentage
Infection of the perifractured soft tissues	12	37.50
Pseudarthrosis	8	25.00
Vicious Cal	4	12.50
Chronic osteomyelitis	2	6.25
Skin necrosis	1	3.13
Total	27	100

Discussion

The limitations of our study were related to its retrospective nature, resulting in missing data and therefore a small sample size. Despite these limitations, we obtained results that we will discuss.

- *Sociodemographic aspects*

Open leg fractures accounted for 0.51% of hospitalizations in the Surgery Department of the CHUR-OHG. Type IIIB open fractures of both leg bones represented 16.49% of patients hospitalized for open leg fractures. Camara et al. [12] in Conakry in 2022 reported that open leg fractures represented 9.6% of all hospitalizations. These results could be explained by the fact that Camara's study was conducted in a specialized department and ours in a general surgery department. Males were the most represented sex, accounting for 68.75% of cases. These results confirm the general findings in the literature, which show a male predominance [10]. [12] [13] The male predominance in cases of type IIIB open fractures of both leg bones is explained by the fact that men are the most mobile and active segment of the population. They are therefore the main victims of motorized accidents. Road traffic accidents were the primary cause of type IIIB open fractures of both leg bones in 96.88% of cases. Drivers of two-wheeled vehicles were the most affected. These results are corroborated by several authors in the literature [10]. [14] [15] The 31-40 age group was the most represented (28.13%). The mean age was 34.5 years, with a range of 4 to 74 years. This mean age is similar to that of the series by Dakouré et al. [10] in Burkina Faso in 2013, which was 34 years. Coulibaly et al. [16] in Dakar in 2013 reported a mean age of 38 years, with a range of 17 to 68 years.

- *Clinical Aspects*

Direct admissions by the National Fire Brigade were the most frequent, accounting for 53.13% of cases. Traoré [17] in Bamako in 2019 also corroborated this observation, reporting a frequency of 74.42%. The average time to admission was 3.5 hours, with extremes ranging from one to six hours. These results are similar to those of Coulibaly et al. [16] in Senegal in 2016, who reported an average time to admission of 1 hour and 50 minutes, with extremes ranging from 45 minutes to four hours. The remoteness of villages and health centers, along with the poor and variable condition of the roads, explains this delay. According to the AO classification [18], type A fractures of the distal extremity were the most common, representing 53.13% of cases. Indeed, type A fractures are extra-articular fractures occurring from direct impact, the most common mechanism of injury among two-wheeled vehicle riders. In Korea, Oh [19] found the same predominance of type A, representing 47.82%

of open leg fractures. Hungria et al. [20] in Brazil also reported 41% type A. These results differ from those of Coudane et al. in France in 2022, who reported that type A of the diaphyseal segment (43.30%) was the most frequent [21] .

- *Therapeutic Aspects*
  - Medical treatment

The most frequently used antibiotic was the combination of amoxicillin and clavulanic acid in 53.12% of cases. Coulibaly et al. [16] in Dakar in 2016 reported that all their patients received antibiotic therapy and tetanus immunoglobulin vaccination. All their patients received amoxicillin and clavulanic acid.

  - Surgical treatment

The average time to surgical intervention was 12.56 hours, with a range of 6 to 24 hours. Monka et al. [22] in Brazzaville in 2017 reported an average delay of 5 days, with a range of 6 to 14 days. Coulibaly et al. [16] in Dakar in 2016 reported an average surgical intervention of 7 hours, with a range of 3 to 24 hours. In our setting, the lack of a dedicated emergency operating room (only 3 operating rooms used for both scheduled surgeries and emergencies, across all surgical specialties), insufficient human resources (2 anesthesiologists for the entire University Hospital Center - General Hospital), and the patients' low socioeconomic status hinder the early performance of debridement. This delay in surgical intervention is likely a significant factor in the occurrence of infectious complications. The limited financial accessibility of surgical implants increases the waiting time for surgery. Our patients had undergone debridement and exofixation . tibial -tibia in 62.50% and in 18.75% of cases of debridement with exofixation tibial -tibial and fibular pinning. Coulibaly et al. in Dakar reported that all their patients had benefited from exofixation. [16] Madougou et al. in Benin reported that 34.21% of their patients received external fixation [4] . Idé et al. from Niger also corroborated this observation (88.60%) [23] . In our study, 9.37% of patients received orthopedic treatment. Rohimpitiavana et al. [15] reported that 74.7% of open leg fractures were treated orthopedically. All patients received skin coverage, including 46.87% with directed wound healing followed by skin grafting, 43.75% with fasciocutaneous flaps, and 9.38% with muscle flaps. Umar et al. [24] in London reported that 38% of patients received muscle flaps, Almigdad et al. In 2023, studies in England reported a proportion of 12.8% of patients who underwent skin grafting and 40.8% who underwent fasciocutaneous flaps [13] . The low use of muscle flaps in our patients is related to the distal predominance of fracture sites where local muscle flaps are exceptionally available.

- *Evolutionary Aspects*

The outcome was favorable in 15.62% of cases. Najeb et al. in Morocco in 2008 reported 64% favorable results [25] . This low percentage could be explained by the severity of the skin and bone lesions and the long delay in initiating surgical treatment. Complications were dominated by perifracture soft tissue infections in 12 cases (37.50%). Coulibaly et al. from Senegal found mostly malunions and nonunions [16] . Najeb et al. in Morocco in 2008 reported 13% of cases of nonunion and 10% of infection [25] . Camara et al. recorded 9.5% of cases of infection and 7.5% of nonunion [12] . Hu et al. in China reported a frequency of 52% for infections [26] . Osteitis was observed in 6.25% of cases. Keita et al. and de Harraz et al. reported 8.4% and 1.64% of osteitis cases, respectively [27,28] . These significant differences in complications could be related to differences in management, varying timing of surgical treatment, and the resources used. We reported a secondary amputation rate of 3.13%. This result is approximately equal to that of Kouassi et al., who found 3.33% of amputation cases [29] . The indication for amputation had been established. In a case of septic nonunion with irreparable bone loss, some authors, such as Sow, reported a rate of 2.9% in their study [30] . The mean time to union was 9.81 months, ranging from 6 to 18 months in 26 patients. In the study by Coulibaly et al. in Senegal, union was achieved within a mean of 8.3 months, ranging from 6 to 9 months [16] . For Touré et al. in Bamako, union was achieved within 5.1 months, ranging from 3 to 9 months [31] . In France, Coudane [21] reported a mean time to union of 6.2 months, ranging from 3 to 30 months. Indeed, this long union time is explained by the complexity of grade IIIB fractures and the occurrence of complications that can delay callus formation. Healing was achieved in an average of 83 days, with extremes ranging from 45 days to 4 months in our patients. In the same context, Coulibaly et al. also reported that healing in their patients was achieved in an average of 52 days, with extremes ranging from 28 days to 5 months [16] . The average time to weight-bearing was 12.5 months, with extremes ranging from 11 to 24 months. Coudane [21] in France found an average weight-bearing time of 4 months, with extremes ranging from 1.7 to 25.8 months. The delayed weight-bearing in these complex fractures could be explained by the occurrence of complications such as infections, nonunion, and osteomyelitis, which are factors that can prolong the consolidation time. In our series, according to the modified criteria of Ketenjian [11], 15.62% of patients had excellent anatomical and functional results, 21.88% very good results, and 37.50% good results. These results differ from those of Touré et al. from Bamako, who found good results in 76.70% of cases [31] , from those of Maiga et al., who reported 63.64% good anatomical and functional results [32] , and from Keita et al., who found 88.30% [27] . The majority of patients had an average hospital stay of 65 days, with extremes ranging from 30 days to 270 days. This result is comparable to that of Camara, which was 66 days [12] , and different from that of Razafimahandry , which was shorter (41 days) [33] . Our results can be explained by the fact that patients with an open fracture had a longer stay.

Conclusion

Gustilo and Anderson type IIIB open fractures of both lower leg bones are complex injuries. Road traffic accidents are the main cause. Young males are most at risk. Medical and surgical treatment involving debridement and bone stabilization generally yields good anatomical and functional results. Their management is lengthy and difficult, marked by delays and complications. Appropriate organization of hospital facilities with sufficient infrastructure, equipment, and staff could significantly improve the emergency management of these serious limb injuries.

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References

[1] Cauchoix J, Duparc J, Boulez P. Traitement des fractures ouvertes de jambe. Mem Acad Chir. 1957;83:811-22.
[2] Gustilo RB, Mendoza RM, Williams DN. Problems in the management of type III (severe) open fractures: a new classification of type III open fractures. J Trauma. 1984;24:742-6.
[3] Banza MI, Mujinga IMW, Nafatalewa DK, Kasanga TK, Mukakala AK, Yumba SN, et al.

Fractures ouvertes des os de la jambe: profil épidémiologique, clinique et thérapeutique aux cliniques universitaires de Lubumbashi (janvier 2018–décembre 2020). Int J Appl Res. 2022;8(8):274-82.

[4] Madougou S, Chigblo P, Tella G, Padonou A, Lawson E, Nour M, et al. Facteurs épidémiologiques et résultats de la prise en charge des fractures ouvertes de jambe de l'adulte à Cotonou. Rev Mar Chir Orthop Traumatol. 2017;69:26-33.

[5] Kiendrébéogo A. Traitement des fractures ouvertes de jambe par enclouage centro-médullaire par clou UTN: indications et résultats à propos de 23 cas au CHU Sourô Sanou [thèse de médecine]. Bobo-Dioulasso: Université Polytechnique de Bobo-Dioulasso; 2016.

[6] Ndeba Ayonga P. Aspects épidémiologiques, cliniques et thérapeutiques des fractures ouvertes des deux os de la jambe à l'Hôpital provincial du Nord-Kivu [thèse de médecine]. Goma; 2015.

[7] Kitoko W. Profil épidémiologique et clinique des fractures de la jambe à Kisangani-RDC. KisMed. 2020;10(1):389-93.

[8] Bouhelo-Pam KPB, Ossibi PE, Ollita EJLM, Zengui ZP, Ikounga PY, Nkoua MF, et al. Management and evolution of surgical bone coverage for open leg fractures in Brazzaville. Health Sci Dis. 2024;25(4):1-7.

[9] Dakouré PWH, Valéan D, Soulama M, Sidibé A, Diallo M, Ouédraogo S, et al. Résultats du traitement des fractures ouvertes de jambe par le clou tibial (UTN). Rev Mar Chir Orthop Traumatol. 2020:19-25.

[10] Dakouré PWH, Da SC, Sanou BG, Sanou A, Bationo H, Ouédraogo RK. Aspects épidémiologiques et lésionnels des fractures ouvertes récentes de jambe au CHU de Bobo-Dioulasso. Med Afr Noire. 2013;60:286-90.

[11] Ketenjian AY, Shelton MJ. Primary internal fixation of open fractures: a retrospective study of the use of metallic fixation in fresh open fractures. J Trauma. 1972;12:756-63.

[12] Camara T, Bah ML, Madjirabe NH, Keita K, Diallo M, Youla M, et al. Open leg fractures treated with external fixator at the orthopedic-traumatology department of the Ignace Deen Conakry Teaching Hospital. Health Sci Dis. 2022;23:16-9.

[13] Almigdad A, Aljawadi A, Elkhidir IH, De-Shoulepnikoff C, Pillai A. Clinical and radiological outcomes of Gustilo-Anderson type IIIB open fractures in 125 patients. Cureus. 2023;15:1-10.

[14] Moyikoua A, Ondzoto JM, Kaya JM, Pena-Pitra B. Résultats du traitement initial des fractures ouvertes récentes des membres à propos de 150 cas traités au CHU de Brazzaville. Med Afr Noire. 1992;39:756-62.

[15] Rohimpitiavana HA, Rabariarison R, Youmbri B, Razafimahandry HJC, Rabemazava A. Aspects thérapeutiques et évolutifs des fractures diaphysaires de jambe au CHU Joseph Ravoahangy Andrianavalona, Madagascar. J Med Sci Dis. 2021;8:115-8.

[16] Coulibaly NF, Diao S, Dembelé B, Sarr L, Diouf AB. Traitement des fractures ouvertes Gustilo IIIB du tiers distal de la jambe. Afr J Orthop Trauma. 2016;1(2):114-9.

[17] Traoré D. Fractures ouvertes de jambe à l'hôpital Somine Dolo de Mopti [thèse de médecine]. Bamako: Université des Sciences, des Techniques et des Technologies de Bamako; 2019.

[18] Muller E. Classification of fractures: long bones. Vol. 1. Suisse: AO Foundation Education; 2007.

[19] Oh C, Park B, Park H, Ihn J. Primary unreamed intramedullary nailing for open fractures of the tibia. Int Orthop. 2001;24:338-41.

[20] Hungria JOS, Mercadante MT. Open tibial shaft fractures: treatment with intramedullary nailing after provisional stabilization with non-penetrating external fixator. Rev Bras Orthop. 2013;48:482-90.

[21] Coudane A, Soubeyrand M, Frédéric R, Arnaud G, Guillaume A, Antoine B. Secondary intramedullary nailing for open tibial shaft fractures: comparison of a one-stage surgical

procedure. Rev Chir Orthop Traumatol. 2022;108:947-53.
[22] Monka M, Mboutol M, Zengui ZF, Moyikoua A. Traitement par fixateur externe des fractures ouvertes des membres à Brazzaville. Health Sci Dis. 2017;18:39-42.
[23] Idé G, Abdoulwahab M, Dalatou MH, Hamsatou N, Illé S. Prise en charge des fractures ouvertes de jambe chez l'adulte dans un hôpital sahélien: à propos de 114 cas. Health Sci Dis. 2023;24.
[24] Umar C. Soft-tissue coverage and outcome of Gustilo grade IIIB midshaft tibia fractures: a 15-year experience. Plast Reconstr Surg. 2008.
[25] Najeb Y, Abkari A, Massous T, Kechkar M, Latifi B, Essadki. Résultats du traitement des fractures de jambe par un fixateur externe low-cost d'adaptation locale. Rev Maroc Chir Orthop Traumatol. 2008;36:14-7.
[26] Hu R, Ren YJ, Yan L, Yi XC, Ding F, Han Q. Analyse du traitement par étapes pour les fractures tibiales ouvertes de Gustilo-Anderson IIIB/C. Indian J Orthop. 2018;52:411.
[27] Keita O. Étude épidémiologique et thérapeutique des fractures ouvertes de la jambe au CHU Gabriel Touré [thèse de médecine]. Bamako: Université des Sciences, des Techniques et des Technologies de Bamako; 2013.
[28] El Harraz M. Fractures ouvertes de jambe traitées par fixateurs externes au CHU Ibn Sina-Rabat [thèse de médecine]. Rabat; 2013.
[29] Kouassi KJE, Manon J, Fonkoue L, Kodo M, Detrembleur C, Cornu O. La prise en charge des fractures ouvertes de jambe dans une structure hospitalière en Côte d'Ivoire pose-t-elle problème et pourquoi? Rev Chir Orthop Traumatol. 2019;105:654-8.
[30] Sow C, Camara E, Ndiaye A, Dansokho V, Diop E. Complications locales des fractures ouvertes de jambe au Centre de Traumatologie et d'Orthopédie de Dakar. 31e Conf Annu Coll Ouest-Afr Chir. 1991;38:163-5.
[31] Touré L, Traoré T, Diallo M, Dadé H, Sidiki S, Sidibé O, et al. Traitement des fractures ouvertes diaphysaires de jambe par des clous d'Ender dans un hôpital de seconde référence. Health Sci Dis. 2020;21:47-51.
[32] Maiga O. Étude épidémio-clinique des fractures ouvertes de la jambe au CHU Gabriel Touré [thèse de médecine]. Bamako; 2006.
[33] Razafimahandry H, Rabemazava A, Solofomalala G, Kamal A, Rakotozafy G. Les fractures bilatérales de jambe de l'adulte traitées au CHU d'Antananarivo. Rev Trop Chir. 2007;10:10-2.

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