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# Open Lower Limb Trauma in Children

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## Abstract

**Purpose:** To evaluate open lower limb trauma management in children. **Method:** We conducted a twelve-month cross-sectional prospective study. **Results:** Open trauma of lower limb had 7.9% of hospital frequency. Mean age was 8 years with a sex ratio of 2.45. In 68.4% of cases, trauma occurred in road traffic accidents. Average consultation time was 2.4 hours. Trauma mainly affected the leg in 39.5% of cases, and the thigh in 34.2%. Soft tissue wounds occurred in 52.6% of cases, and open fractures in 47.4%. Average response time was one hour. Wound trimming and suturing were performed in 76.3% of cases and combined with bone nailing in 15.8%. The outcome was favorable in 92.1% of cases. Average hospital stay was 4.37 days. **Conclusion:** Open trauma to the lower limb is a frequent and occurs mainly in road traffic accidents. Management was early, with a favorable outcome for most patients and a short hospital stay.

## Keywords

Open Trauma, Open Fractures, Lower Limb, Children, CHUME, Chad

## 1. Introduction

Pediatric trauma accounts for only 14% of all trauma cases [1]. Traumatic injuries remain the predominant cause of mortality among children [2]. Diagnosis primarily relies on clinical examination findings, with radiographic imaging serving to confirm the diagnosis and evaluate fracture characteristics and prognostic factors [3]. Initial management focuses on the urgent control of hemorrhage, followed by addressing other potential life-threatening conditions [4].

In Afghanistan, the limbs were identified as the most common site of traumatic injuries in children [5]. In Mali, traumatic injuries to the limbs constituted 5.57% of consultations in the orthopedic and trauma surgery department [6]. Childhood

trauma is proportionally more important in the causes of morbidity and infant mortality. They represent a major public health problem worldwide. Childhood trauma is responsible for about 950,000 deaths per year [5]. In the paediatric population, the management of limb trauma has its own particularities. It must be precocious, respecting the anatomy and physiology of the growing child. This study aimed to assess the management of open lower limb injuries in children.

## 2. Patients and Method

This study was conducted within the pediatric surgery and pediatric emergency departments.

It was designed as a prospective, cross-sectional study over a twelve-month period, from November 1, 2023, to October 31, 2024.

The study focused on all patients aged 0 to 15 years who were admitted for lower limb trauma. The inclusion criteria encompassed all patients aged 0 to 15 years admitted to the aforementioned departments with open lower limb trauma. Exclusion criteria included patients over 15 years of age and cases of longstanding open lower limb trauma. Additionally, patients were excluded if parental consent was not obtained. The study examined epidemiological, clinical, and therapeutic variables. Emergency management was the use of the venous catheter, the administration of analgesics and antibiotics, wound washing and immobilization with a cast. Data collection was performed using a pre-established individual survey form. Survey sheets were used first in the emergency department and then in the pediatric surgery department during the hospitalization. Analysis was conducted with Epi Data and SPSS version 11.0. Before collect data, parental consent was obtained and the National Ethics Committee gave its approval before the study began.

## 3. Results

During a one-year period, 481 patients were admitted for trauma, with 38 cases involving open lower limb injuries, indicating a hospital frequency of 7.9%. The average age of the patients was 8 years, ranging from 10 months to 15 years. The most common age group was 6 to 10 years, accounting for 47.4% of the cases. There was a male predominance with a sex ratio of 2.45. A majority of patients, 65.8%, were from urban areas, and 68.4% were attending school.

Open lower limb injuries primarily resulted from road traffic accidents, accounting for 68.4% of cases, followed by domestic accidents at 23.7%. The injuries were caused by a direct mechanism in 78.9% of cases. The average time to consultation was 2.4 hours, with 60.5% of patients being seen within 6 hours. Transportation to the hospital was by private vehicle in 52.6% of cases, and by taxi or motorcycle taxi in 42.1% of cases. Only 5.3% of patients were transported by ambulance.

The left side was predominantly affected, accounting for 47.4% of the cases, with bilateral involvement observed in 13.2% of the cases. Trauma was identified

in the leg in 39.5% of the cases, the thigh in 34.2%, and the foot in 21.1%. In 52.6% of the instances, these were soft tissue injuries (Figure 1(a), Figure 1(b)), while 47.4% involved open fractures.

Open fractures were categorized according to the Cauchoix and Duparc classification, with type I constituting 50% of cases, type II 27.8%, and type III 22.2%. The fractures predominantly affected the leg, with a transverse fracture line observed in 55.5% and an oblique line in 33.3% of cases. The fractures were primarily located in the diaphysis in 72.2% of cases, followed by the metaphysis in 16.7%. Displacement was characterized by overlapping in 55.6% of cases, while 27.8% showed no displacement.

In cases of lower limb trauma, cranioencephalic injuries were present in 26.3% of patients, abdominal contusions in 7.9%, and thoracic contusions in 5.3%.

Nerve damage was observed in 13.2% of cases, while tendon injuries were noted in 7.9% (Figure 2(a), Figure 2(b)).

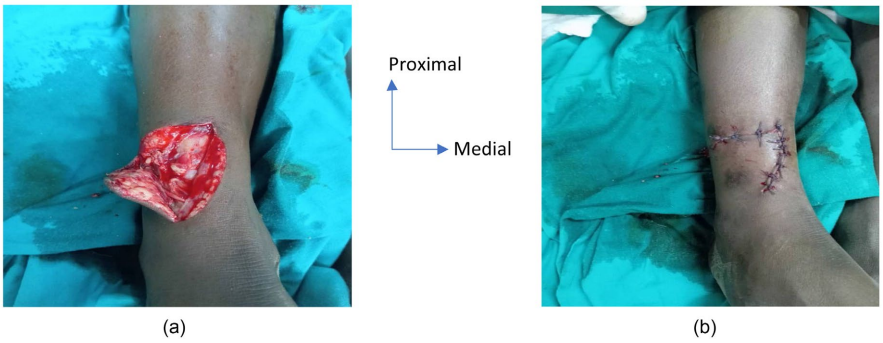


Figure 1. (a) Distal 1/4 soft tissue wound; (b) Image of the wound after trimming and suturing of the right leg with detachment of a triangular flap.

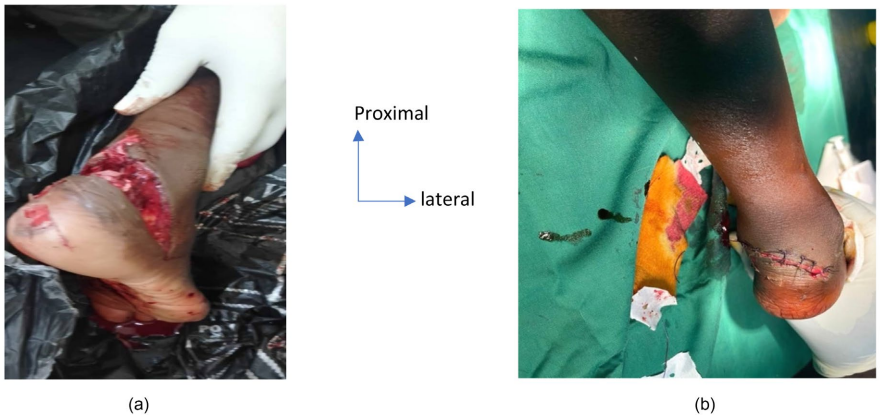


Figure 2. (a) Large wound on the right ankle; (b) Wound on the ankle after with section of the Achilles tendon, trimming and suturing.

The average time to initiate treatment was one hour, with 86.8% of patients receiving care within 6 hours of admission. All patients received local wound care and analgesics upon admission. Intravenous access with fluid resuscitation was

provided in 84.2% of cases. Antibiotic prophylaxis was administered in 95% of cases, and antitetanus serotherapy was given in 84.2%. Blood transfusions were necessary in 26.3% of cases, and 52.6% received temporary orthopedic treatment, such as a plaster splint. General anesthesia was used in 60.5% of cases, while locoregional anesthesia was employed in 39.5%. Debridement and wound suturing were conducted in 76.3% of cases, with bone pinning applied in 15.8% and external fixators in 2.6%. Directed healing approaches were chosen for wound management in 7.9% of cases, and amputations were performed in 2.6% of cases.

The mean duration for wound healing was 10.5 days, and the mean time for bone consolidation was 2.3 months.

A favorable outcome was observed in 92.1% of the cases. During the long-term follow-up, we recorded two instances of limping associated with type II open fractures as classified by Cauchoix and Duparc, and one case of partial functional impairment resulting from tissue destruction. The mean hospitalization period was 4.37 days, with a range extending from 6 hours to 14 days.

## 4. Discussion

Open lower limb injuries accounted for 7.9% of all trauma cases. This incidence is higher than that reported by Kolié [7], who found a rate of 3.81%. The elevated frequency observed in our study may be attributed to our hospital being the sole referral center for pediatric surgical and trauma emergencies nationwide.

The mean age of the patients was 8 years, with the 6 - 10 year age group comprising 47.4% of the cases. These findings are consistent with those of Azhar [8], who documented a mean age of 7.7 years and a predominance of cases within the 6 - 10 year age bracket. This age range corresponds to the school-age period during which children have not yet developed sufficient cognitive skills to identify and avoid various hazards, particularly traffic-related risks.

A predominance of male patients was observed, with a sex ratio of 2.4. This finding aligns with those reported by Ka and Idé [9] [10], who documented sex ratios of 2.3 and 3.1, respectively. The observed male predominance may be attributed to the cultural norm in our setting where boys are permitted to play outdoors around the house, thereby increasing their exposure to various accidents, while girls predominantly engage in indoor activities.

The majority of patients originated from urban areas (65.8%). This finding is consistent with Kolié O [7] in Guinea, who reported a predominance of urban area patients at 84.17%. Factors such as the availability of services, proximity to hospitals, and the socioeconomic status of urban residents could account for the higher utilization of healthcare facilities in these regions.

The average time to consultation was 2.4 ± 0.5 hours, ranging from 30 minutes to 48 hours, with 60.5% of cases seeking consultation within 6 hours post-trauma. Although this duration is less than that reported by Kaboro *et al.* [11], it remains substantial. Establishing an emergency medical service could potentially decrease the time to hospital admission following trauma.

In 68.4% of cases, the trauma resulted from road traffic accidents, as similarly

observed by other African researchers [7] [12]. Factors such as the lack of designated play areas, the conversion of streets into play zones, the proximity of schools to main roads, and the disregard for traffic laws may contribute to the incidence of these accidents.

The trauma mechanism involved direct impact in 78.9% of cases, with injuries to the left pelvic limb occurring in 47.4% of cases. These findings align with those reported by Mouafo *et al.* [13].

Over half of the patients (52.6%) were transported to the hospital using private vehicles, a pattern also noted by Obamé *et al.* [1]. Conversely, Idé *et al.* [10] observed 40.3% of patients receiving prehospital medical transport.

Due to the lack of a medical assistance service and pre-hospital transportation in our setting, parents are compelled to personally transport their children to the hospital. The most common injuries, as documented by other researchers [11] [14], were soft tissue wounds. Open fractures were present in 47.4% of cases, predominantly characterized by Cauchoix and Duparc type I in 50% of instances; these mainly affected the leg, with a transverse fracture line in 55.5% of cases, and were primarily located at the diaphyseal level in 72.2% of cases, with overlapping observed in 55.6% of cases. These findings align with those reported by other authors who have observed similar patterns [15]-[17]. The average time to initiate treatment was one hour, with 86.8% of cases receiving care within six hours of admission. All patients were provided with local treatment and analgesics upon arrival. When feasible, suturing is the optimal method for closing a simple wound, which should be preceded by meticulous debridement [18]. Performing debridement before the sixth hour has consistently been advocated in the management of open limb fractures to prevent infection [19].

In 52.6% of the cases, immobilization was achieved using a plaster splint. This result is lower than that reported by Idé [10], which may be explained by the fact that their study only included open lower limb injuries.

Antibiotic prophylaxis was initiated upon admission in 95% of cases. The protocol for antibiotic prophylaxis remains consistent with that used in adults and should commence as early as possible [20].

The outcomes were favorable in 92.1% of cases, consistent with the findings of Idé *et al.* [10]. In pediatric patients, the risk of septic complications from open fractures appears to be lower than in adults [20].

The average hospital stay was 4.37 days, with a range from 6 hours to 14 days. This is shorter than the average hospital stay of 10.22 days reported by Idé G *et al.* [10]. The promptness of medical intervention and reduced consultation delays may account for the low complication rate and shorter hospital stays observed in our study. The limitations of this study are the sample size, the duration of the study and the single center of study. We suggest a next study to be extended to other centers.

## 5. Conclusion

Open injuries of the lower limb are a common occurrence in pediatric surgical

practice. These injuries predominantly affect older children, with a higher incidence in boys, and primarily result from road traffic accidents involving direct impact. The left side is more frequently affected, with the injuries mainly comprising soft tissue damage and open fractures. The majority of these are classified as type I and II open fractures according to the Cauchoix and Duparc classification, predominantly affecting the leg, particularly at the diaphyseal region. Early intervention was implemented, leading to favorable outcomes for most patients and a brief duration of hospitalization.

## Conflicts of Interest

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

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