

Ballistic Injuries among Civilians during the June 2023 Protests in Senegal: Epidemiological, Diagnostic and Therapeutic Aspects

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Abstract

Title: Gunshot injuries during the June 2023 protests in Senegal: Epidemiological, diagnostic, and therapeutic aspects at Idrissa Pouye General Hospital (HOGIP). **Background:** Political protests in June 2023 in Senegal led to an unprecedented influx of ballistic trauma in civilian settings. The aim of this study was to describe the management of these injuries at the Orthopedics-Traumatology department of the HOGIP in Dakar. **Materials and Methods:** This was a retrospective descriptive study conducted over 5 days (June 1-5, 2023). All civilians admitted for ballistic trauma were included, excluding isolated cranial or abdomino-pelvic injuries. **Results:** Sixty (60) patients were included, all male, with a mean age of 26.9 years. Injuries were predominantly located in the limbs (95.59%), particularly the lower limbs (61.76%). Open fractures occurred in 23.53% of cases, mainly affecting long bones (humerus, femur, and tibia). Imaging confirmed the presence of live ammunition or metallic fragments in 20.59% of cases. Surgical treatment was performed for 84.84% of lesions, primarily involving debridement (39.39%) and external fixation (15.15%). **Conclusion:** The June 2023 protests resulted in complex ballistic injuries among young men. HOGIP played a vital role in emergency response. The “damage control” strategy, based on surgical debridement and external fixation, was essential to stabilize severe injuries. This study highlights the need for urban hospitals to maintain constant preparedness (e.g., “Plan Blanc”) for mass casualty events. Prohibiting the use of lethal ammunition for crowd control is a public health necessity to prevent life-altering disabilities.

Keywords

Ballistic Trauma, Political Protests, Senegal, External Fixation

1. Introduction

Political demonstrations are fundamental expressions of democracy, allowing citizens to voice their opinions and demands [1]. In West Africa, these events are sometimes marked by violence, including the repression of demonstrators by defense and security forces, as evidenced by the situation in Senegal in June 2023, which saw an alarming number of gunshot injuries.

Ballistic trauma is the result of a projectile—such as a bullet, pellet, or metallic fragment from the casing or contents of an explosive device (firearm, grenade, mine, shell, bomb, etc.) penetrating the body. These injuries are no longer exclusive to armed conflicts; today, they have become a marker of urban civil violence [2].

The observed lesions are often complex, compromising not only the immediate vital prognosis but also the short- and long-term functional prognosis of the victims.

The objective of this study was to examine the epidemiological, diagnostic, and therapeutic aspects of these traumas at the Orthopedics-Traumatology Department of the Idrissa Pouye General Hospital (HOGIP) in Dakar.

2. Materials and Methods

We conducted a descriptive retrospective study over a 5-day period (from June 1st to June 5th, 2023) at the Idrissa Pouye General Hospital (HOGIP) in Dakar.

All civilian patients admitted for ballistic trauma were included. By design, the study focused exclusively on projectile-related injuries. However, the case of a burn injury resulting from the explosion of a tear gas grenade was exceptionally retained, as it occurred within the same conflict context.

Cases initially treated in other hospital departments, as well as patients who died before admission, were outside the study frame and therefore excluded. Isolated cranial or abdomino-pelvic injuries were also excluded.

Data collection was performed using emergency registries, operative reports, and patient files.

The variables studied included:

- epidemiological aspects: age, sex, and location of the traumatic event;
- diagnostic data: anatomical site and type of lesions;
- therapeutic data: type of treatment (medical, orthopedic, and surgical).

Percentages were calculated using explicit denominators to ensure clarity and accuracy. For epidemiological aspects, proportions were expressed per patient relative to the total number of patients included in the study ($n = 60$). For diagnostic and therapeutic aspects, proportions were calculated per lesion relative to the total number of documented lesions ($n = 68$). Regarding the location of open fractures, proportions were calculated solely in relation to the total number of documented

open fractures (n = 16).

3. Results

1) Epidemiological Aspects

Our series included 60 patients. The mean age of the patients was 26.9 ± 8.74 years. All patients in our series were male. According to the WHO classification, young adults (18 - 39 years) were the most represented at 76.67%, followed by older adults (40 - 60 years) at 15%. Adolescents (12 - 17 years) accounted for 8.33%. The majority of patients came from neighborhoods within the city of Dakar (66.67%). Residents of the suburbs represented 21.67%, while the origin was unspecified in 11.67% of cases.

2) Diagnostic Aspects

Anatomical site of lesions:

A total of 68 lesions were identified, predominantly involving the limbs (95.59%). The lower limbs were the most frequent site of injury (61.76%). The femur and the lower leg were the most affected segments, accounting for 22.06% and 16.18%, respectively. Upper limb involvement represented 32.65%. The thorax was affected in 2.94% (**Table 1**), and spinal lesions represented 1.47%.

Table 1. Distribution of injuries by location.

	Location	Number	Percentage
Upper limbs	Shoulder	5	7.35
	Arm	5	7.35
	Elbow	4	5.88
	Forearm	1	1.47
	Wrist	4	5.88
	Hand	4	5.88
Lower limbs	Hip	2	2.94
	Thigh	15	22.06
	Knee	4	5.88
	Leg	11	16.18
	Ankle	3	4.41
	Foot	7	10.29
Thorax		2	2.94
Spine		1	1.47
Total		68	100

Type of lesions:

Skin lesions predominated (63.24%), including one case (1.49%) of thoracic and arm burns caused by a tear gas explosion (**Figure 1**). Open fractures were frequent

(23.53%), while closed fractures represented 11.76%. One patient (1.47%) suffered a traumatic amputation of the hand (**Figure 2**). Regarding open fractures (n = 16), they were mainly located in the long bones: humerus (31.25%), lower leg (31.25%, see **Figure 3**), and femur (25%). Other locations included the radius (1.47%) and the foot (1.47%).

Projectile type:

X-rays and CT scans showed the presence of live ammunition (**Figure 4** and **Figure 5**) and metallic fragments in 14 cases (20.59%).



Figure 1. Burns to the chest and upper limbs.



Figure 2. Amputation of the first three fingers of the right hand.

3) Therapeutic Aspects

Therapeutic management involved 58 patients (66 lesions). Two patients (2.94%) were referred to another healthcare facility.

Medical treatment was administered to all patients, including analgesics, antibiotics, and tetanus prophylaxis. Anticoagulant treatment was administered to patients with lower limb injuries (58.33%).

Therapeutic decisions were guided by clinical presentation and lesion severity. Debridement alone was performed for superficial skin lesions without bone involvement. Bullet extraction was indicated when the projectile was accessible, symptomatic, or posed a risk of infection. External fixation was chosen for unstable open fractures of long bones, particularly when associated with soft tissue damage. Pinning was reserved for closed or minimally displaced fractures suitable for internal stabilization. Orthopedic treatment (immobilization, splints, or casts) was applied to stable fractures and non-surgical lesions. This decision rule facilitated consistent interpretation of the therapeutic strategy.

Surgical treatment was performed for 84.84% of the lesions. It consisted of:

- Debridement alone in 39.39%;
- Debridement combined with bullet extraction in 22.73% (**Figure 6**);
- Debridement combined with external fixation in 15.15% (**Figure 7**);
- Debridement combined with K-wire fixation (pinning) in 4.55%;
- Debridement combined with orthopedic treatment in 3.03%.

Orthopedic treatment alone was performed in 9.09% of cases, and local wound care in 6.06%.

4. Discussion

1) Epidemiology

With 60 patients admitted for gunshot wounds in just five days in the Orthopaedics

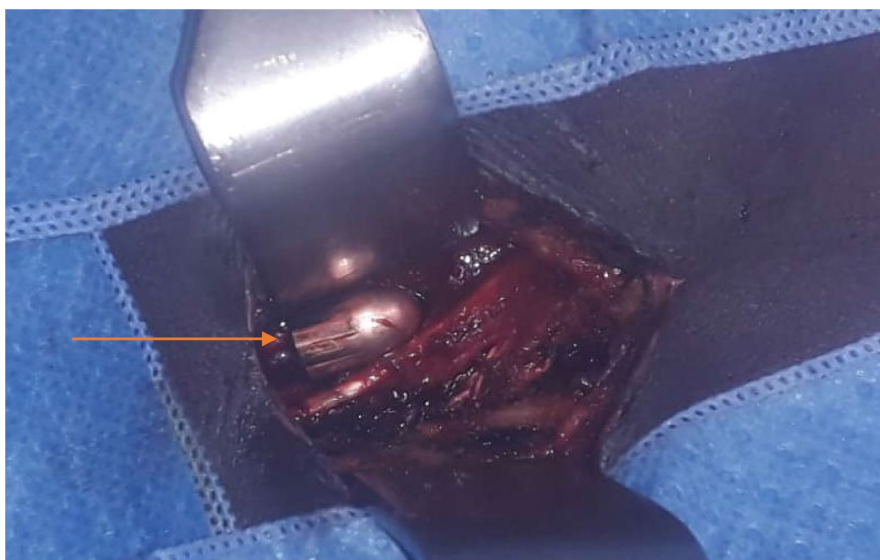


Figure 6. Real bullet in contact with the spinal column (arrow).

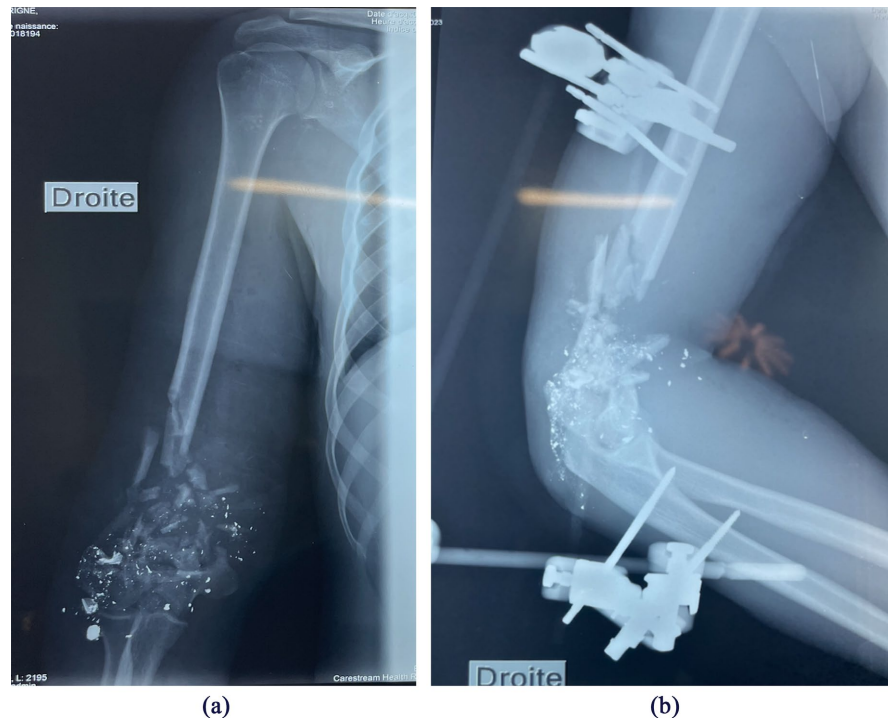


Figure 7. Comminuted fracture of the right distal humerus (a) treated by debridement and osteosynthesis using a humeroulnar external fixator (b).

and Traumatology Department alone, the HOGIP found itself facing a ‘disaster medicine’ situation. This is a global phenomenon: whether during the George Floyd protests in Los Angeles (2020) [3] or more recently in Mozambique (2024) [4], civilian healthcare facilities are now on the front line when faced with widespread political violence.

The predominance of males (100%) and the young age (average 26.9 years) in our series are consistent with data from the African literature on civil violence, as shown by the study by Gao in Mali (28 years, 93% male) [5] and by Fianarantsoa *et al.* in Madagascar (31.6 years, 94.87% male) [6]. This predominance of young men is explained by the strong involvement of this social group in street protest movements [4].

The concentration of injured patients from Dakar (66.67%) is explained by the intensity of the flashpoints of tension in the capital and the proximity of our hospital as a referral centre.

2) Diagnosis

The location of injuries in our study (95.58% in the limbs) is particularly high compared with conventional war series, where thoraco-abdominal injuries are more common.

This finding is consistent with the study by Diallo S *et al.* in Gao [5] and that by Boukhris J *et al.* in Morocco [7], where the limbs are the primary target.

This predominance of lower limb injuries (61.76%) could suggest a downward trajectory of the shot which could reflect a deliberate aiming strategy; however, this remains an interpretation rather than a direct finding from the dataset.

Our results are similar to those of Rocke *et al.* [8] in Northern Ireland (61% to the limbs), whilst showing a higher local severity on weight-bearing segments (femur and lower leg), which significantly compromises long-term functional prognosis.

However, a major difference emerges when compared with the study by Pearl *et al.* [3] in the USA, where 78% of injuries involved the face and head. Our low rate of head injuries (excluded by our inclusion criteria but under-represented in orthopaedic emergency admissions) suggests a different, more direct use of weapons, targeting the long bones (humerus, femur, lower leg).

The rate of open fractures (23.53%) reflects the high kinetic energy of the projectiles used. These figures are comparable to those reported by Diallo *et al.* in Gao (Mali), where fractures accounted for 33.8% of ballistic injuries. Our findings are consistent with those of Haar *et al.* [9], whose study shows that 71% of kinetic impact projectile (KIP) injuries are severe.

The apparent simplicity of skin wounds in our study (63.24%) is often misleading: as explained by Mahajna *et al.* [10], severity depends on the 'elastic limit' of the tissues. Once this is exceeded, the projectile penetrates and causes deep damage.

The low detection rate of projectiles (20.59%) confirms the frequency of high-velocity through-and-through bullets. Although live bullets and metal fragments were detected by imaging in only 20.59% of cases, this does not preclude the presence of live rounds in the other cases (through-and-through bullets that have exited the body). The case of traumatic hand amputation illustrates the injurious power of explosive devices or point-blank gunfire encountered in urban environments.

3) Therapeutic Strategies

The high proportion of surgical management in our series (84.84%) reflects the severity of the injuries encountered during these incidents.

Surgical debridement remains the fundamental procedure. In cases of extreme haemodynamic instability, the priority is vascular control, as highlighted by Boukhris J. *et al.* [7] in a case of haemorrhagic shock due to laceration of the femoral vessels requiring emergency ligation. Although simple debridement predominates in our series and that of Diallo S. *et al.* in Gao [5], the management of vascular and soft tissue damage determines the immediate vital and functional prognosis. An interesting technical divergence appears in the literature regarding bone stabilization.

External fixation was used in 15.15% of cases in our study, a figure close to the 21.6% reported in Gao [5]. For fractures of the tibia and radius, Boukhris J *et al.* [7] also recommend external fixation (Orthofix or Hoffmann type), confirming that it remains the method of choice for fractures with a high risk of infection.

In contrast to our series, in which external fixation was the preferred method for long bones, Boukhris J. *et al.* [7] reported the use of nailing for fractures of the femoral shaft in stable patients. This choice highlights that, under conditions of haemodynamic stability and depending on the kinetic energy of the projectile, in-

ternal osteosynthesis may be considered, although caution remains essential given the risk of infection associated with ballistic projectiles.

4) Limits

This study is limited by the short 5-day observation period, the conflict-related constraints on data collection, and the absence of systematic short-term hospital outcomes such as infection, reoperation, or mortality. Despite these limitations, it provides valuable insights into civilian ballistic trauma management.

5. Conclusion

The events of June 2023 in Senegal were marked by an influx of complex ballistic trauma cases among young male patients. The HOGIP played a central role in the management of these emergencies, which were dominated by lower limb injuries and open fractures. The therapeutic strategy, focused on surgical debridement and osteosynthesis using external fixation, enabled the stabilisation of the most severe injuries. This study highlights the need for urban hospitals to maintain constant preparedness for episodes of mass civil violence (activation of the Plan Blanc) to ensure the best possible functional outcome for victims. Finally, in terms of prevention, banning the use of lethal ammunition in the context of law enforcement appears to be an absolute necessity to avoid disabling sequelae among the civilian population.

Ethics Statement

This retrospective study was conducted in accordance with institutional guidelines. Approval for the protocol was obtained from the ethics committee of our hospital. Patient confidentiality was strictly protected: all data were anonymized prior to analysis, no personal identifiers were retained, and results are presented in aggregate form to prevent any possibility of individual identification.

Conflicts of Interest

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

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