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Treatment of Gunshot and Explosive Device Wounds at the National Hospital of Niamey

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ABSTRACT

Introduction: *Firearm trauma is a real health problem public in several countries, especially developing one [1]. The objective of this work was to describe the epidemiological, clinical, therapeutic and evolutionary aspects of those injured by gunshots and explosive devices at the National Hospital of Niamey (HNN).*

Patients and Methods: *This is a prospective and descriptive study that took place at the HNN from January 29 to June 28, 2024. The following variables were studied: age, gender, origin, circumstances of occurrence, the vulnerating agent, the topography of the lesions, the treatment and the evolution.*

Results: *We recorded 96 patients. The male gender predominated with a sex ratio M/F of 4.33. The mean age of our patients was 27.18±16.03 years; the age group between 15 and 30 years was the most represented with a frequency of 37.5%. Terrorism was the most frequent circumstance of occurrence in 86.46%. The most affected breeders are 32.29%. The bullet represented the most frequent wounding agent found in 92.71% of cases. The lesions were more frequently located at the level of the pelvic limbs, i.e. 50%. Ballistic fractures of the limb were the most frequent preoperative diagnosis, i.e. 50.00%. Debridement was the most commonly performed surgical procedure, i.e. 78.95% of cases. The death rate was 2.08%.*

Conclusion: *It appears necessary to carry out preventive actions, particularly among local civilian populations and combat units.*

Keywords

Bullet, Explosive device, Wounded, HNN, Niger.

Introduction

Gunshot wounds are a real public health problem in several countries, especially developing countries [1]. They have experienced a resurgence in recent years, linked to the increase in gunshot crime, illegal and uncontrolled possession of firearms, armed and intercommunity conflicts and the war against terrorists. Projectile injuries now increasingly affect civilian populations [2]. The National Hospital of Niamey (HNN) is one of the main reference structures in Niger for the care of people injured by firearms and explosive devices (civilians and soldiers), hence the interest of our work, the objective of which was to describe the epidemiological, clinical, therapeutic and evolutionary aspects of people injured by gunshots and explosive devices at the National Hospital of Niamey.

Materials and Methods

This is a prospective and descriptive study, from January 29 to June 28, 2024, i.e. 5 months. All patients admitted for gunshot or explosive device trauma during the study period were included.

The following variables were studied: age, gender, origin, circumstances of occurrence, the wounding agent, the topography of the lesions, the treatment and the evolution. The data were processed using epi info software version 7.2.4.0 and Microsoft Word 2016. Chi2 ($\chi 2$) tests were used to compare qualitative variables. All tests were interpreted with a significance threshold of 5% and the confidence intervals were calculated at 95%.

Results

The total number of patients admitted to the emergency department during the period of our study was 679, among them 96 were admitted for gunshot and explosive device trauma, a frequency of 14.14%. The male gender predominated with 81.25% (n=78) or a sex ratio M/F of 4.33. The average age of our patients was 27.18±16.03 years with extremes ranging from 11 months to 70 years. The age group between 15 and 30 years was the most represented with 37.5% (n=36) followed by that of 0 to 15 years in 23.96% (n=23) of cases (Table 1).

Table 1: Distribution of patients by age group.

Age Group	Effective	Percentage (%)
0-15 years	23	23.96
15-30 years old	36	37.5
30-45 years old	22	22.92
45-60 years old	9	9.38
≥60 years old	6	6.25
Total	96	100

The majority of our patients came from the Sahel region of the 3 borders in 76.04% of cases, including Téra 37.5% (n=36), Torodi 20.83% (n=20), Tamou 8.33% (n=8), Say 4.17% (n=4), Gotheye 3.13% (n=3), Samira and Ayorou in 1.04% of cases each. Terrorism represented the most frequent circumstance of occurrence 86.46% of cases (n=83) (Figure 1).

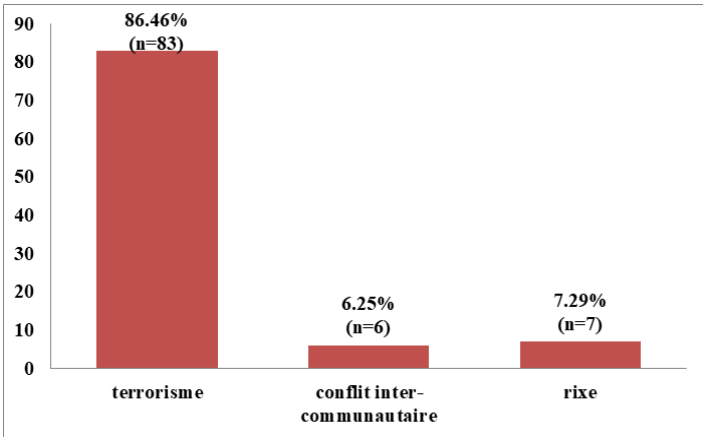

Figure 1: Distribution of patients according to circumstances of occurrence.

The civilian population was the most affected in 98.96% (n=95), we noted only 1 soldier or 1.04%; these were mainly breeders and farmers in respectively 32.29% (n=31) and 26.04% (n=25). The musculoskeletal system was most affected in 84.38% of cases (n=81), followed by the thoracic wound and the abdominal wound in 9.38% (n=9) and 7.29% (n=7) of cases, respectively (Table 2). The bullet represented the most frequently found wounding agent in 92.71% of cases (n=89) (Table 3).

Table 2: Distribution of patients according to the location and type of lesion.

Device	Effective	Percentage (%)
Thorax		
Chest wound	9	9.38
Neurological		
Creniocerebral injury	2	2.08
Cervical spine injury	3	3.13
Abdomen		
Abdominal wound	7	7.29
Cutaneous-phaneric		
Burn	2	2.08
Locomotor system Fracture and ballistic wound of soft tissues		
thoracic limbs	33	34.38
Right	12	36.36
LEFT	16	48.48
Bilateral	5	15.15
pelvic limbs	48	50
Right	15	31.25
LEFT	25	52.08
Bilateral	8	16.67

Table 3: Distribution of patients according to the causative agent.

Vulnerable Agent	Effective	Percentage (%)
Ball	89	92.71
Explosive device	4	4.17
Projectile splinter	3	3.13
Total	96	100

Patients were classified predominantly as ASA1 in 73.17% of cases (n=60), followed by ASA2 class in 24.39% (n=20) and ASA3 and 4 classes in proportions equal to 1.22% (n=1). Debridement was the most commonly performed surgical procedure with 78.95% of cases (n=75), it was associated with the placement of an external fixator in 15 patients or 15.79% of cases. A patient who refused treatment was discharged against medical advice (Table 4).

Patients were classified predominantly as ASA1 in 73.17% of cases (n=60), followed by ASA2 class in 24.39% (n=20) and ASA3 and 4 classes in proportions equal to 1.22% (n=1). Debridement was the most commonly performed surgical procedure with 78.95% of cases (n=75), it was associated with the placement of an external fixator in 15 patients or 15.79% of cases. A patient who refused treatment was discharged against medical advice (Table 4).

Postoperative complications affected 7 patients or 7.37%, including 6 for infection and 1 for pulmonary embolism representing 6.32% and 1.05% respectively. The evolution was marked by a cure

without sequelae in 94.74% (n = 90); 03 patients had sequelae; this was a case of deformation of the left arm; a case of bilateral blindness following craniofacial trauma and a case of limb amputation. Two (2) patients had died. These 02 deaths occurred in a context of trauma by explosive device + blast with a statistically significant correlation (p = 0.003) (Table 5).

Table 4: Distribution of patients according to surgical procedures performed.

Surgical Gestures	Effective	Percentage (%)
Trimming	75	78.95
Trimming + external fixator	15	15.79
Transfemoral amputation	1	1.05
Trimming + esquillectomy + duroplasty + ball extraction	4	4.21
Total	95	100

Table 5: Association between vulnerable agent and death.

Vulnerable Agent	Death		
	No	Yes	Total
Ball	88	0	88
Projectile splinter	3	0	3
device + blast	2	2	4
Total	93	2	95

P=0.003

The 02 cases of death also occurred in patients with burns whose SCB was estimated at 80% and this correlation was statistically significant (p=0.02) (Table 6). The ABSI index (Abbreviated Burn Severity Index) was 12 in both patients with a survival probability of less than 10%.

Table 6: Association between death and type of injury.

Type of Injury	Death		
	No	Yes	Total
Penetrating	60	0	60
Perforating	21	0	21
Burn+blast	12	2	14
Total	93	2	95

P=0.02

Discussion

During the study period, 96 patients were collected for gunshot and explosive device trauma out of a total of 679 admissions, representing a frequency of 14.14% of cases. This result is lower than those of Diallo S et al., who found a hospital frequency of 24.05% [3]. This decrease in the frequency of gunshot and explosive device trauma could be explained by the continued efforts of states, especially in the Sahel, in the fight against acts of terrorism.

The male gender predominated with a rate of 81.25% (n=78) and a sex ratio of 4.33. This result is comparable to those of Diallo S et al., Traoré T et al., who reported a respective predominance of the male sex in 93% and 95.5% of cases [3,4]; but higher than those of Konan KJ et al. who reported a male predominance in 53.50% of cases [5]. On the other hand, our result is lower than those of Chaibou MS et al., and Ly L who found the male gender in 100% [6,7]. The difference with the study of Chaibou MS et al., is explained by the fact that in his study only civilian combatant victims and FDS (defense and security forces) injured on the battlefield were included [6]. This male predominance in our study could be explained by the fact that men represent the most active population in our societies. Thus they are the most mobile, therefore more exposed to firearm injuries.

The mean age was 27.18 years with extremes ranging from 11 months to 70 years. The age group of 15 and 30 years was the most represented in 37.5% of cases. Our result is similar to those of Diallo S et al., who reported an age group of 21 to 30 in 61% and a mean age of 28 years [3]; but lower than those reported by Konan KJ et al., Kra O et al., who reported a mean age of 34.30 years and 34 years respectively [5,8]. This predominance of young patients could be explained by the demographic distribution of the African population which is predominantly young. The most affected socio-professional groups were civilians, breeders in 32.29% (n=31) followed by farmers in 26.04% of cases. This result is comparable to those of Traoré T et al., who had reported a predominance of civilians, farmers in 43.2% [4]. This result could be explained by the fact that gunshot wounds are increasingly frequent due to the resurgence of attacks by terrorist groups, but especially the increase in juvenile delinquency in large African cities given the failure of poverty eradication policies in most countries in the sub-region.

In our patients, terrorism represented the most frequent circumstance of occurrence in 86.46% (n=83). Our result is different from those of Traoré T et al., who had reported an assault in 59.1% and Koutora B et al., who had reported shell fragments in 73.7% of cases [4,9]. This result is explained by the fact that the Sahel region of which Niger is a part, has been experiencing growing insecurity due to terrorism since 2011. This region has become a haven for terrorists who frequently target civilians, leading to significant population displacement. The majority of our patients came from the three-border area, namely Téra with 37.5%, Torodi 20.83% and Tamou 8.33% of cases. The three-border area has become the military epicenter of the security crisis in the Sahel. This area is marked by an unprecedented concentration of diverse security threats. Since 2012, the climate of insecurity and violence has further intensified due to the proliferation of armed groups, the increase in intercommunity clashes and the rise of violent extremism.

The lesions were frequently located at the level of the pelvic limb in 50% of cases. This result is similar to those and Zida A et al., with 51.8% of Chaibou MS et al., who had reported 54.90% of cases [6,10]. Our result is lower than those of Diallo S et al., Ly L who reported pelvic limb involvement in 75.7% and 69.6% of cases respectively [3,7]. However, our results are different from those of Traoré T et al., Konan KJ et al., who reported injuries to the thoracic limbs in 47.7% and 9% of cases respectively [4,5].

This suggested that the main goal of the shooters in this study was to immobilize their target. The frequent injury to the limbs could also be explained by the protective measures taken by soldiers during armed conflicts, such as wearing helmets, bulletproof vests, etc. The bullet represented the most frequently found wounding agent in 92.71% of cases. This result is higher than those of Diallo S et al., of Koutora B et al., from Konan KJ et al., Kra O et al., which reported gunshot wounds in 83.8 %, 65.1%, 30.20% and 31.30% of cases, respectively [3,5,8,9].

The most common preoperative indication was ballistic fracture and ballistic wound of the soft parts of the limbs with a respective frequency of 50% (n=48) and 30.21% (n=29) of cases. Our results are similar to those of Zida A et al., who found 75.30% of simple wounds without fracture [10]. The work of Traoré T et al., those of Diallo S et al., highlighted the predominance of wounds without fracture in 22 cases and 48 cases respectively, i.e. 64.9%, and fractures coming second in 19 cases and 25 cases respectively, i.e. 33.8% [3,4].

The patients were classified as ASA1 with a frequency of 73.17% of cases. This result is comparable to those of Dikongue DF et al., who reported a frequency of 77% [11]. This is explained by the fact that they were mainly young patients, without any comorbidities. Trimming was the most commonly performed surgical procedure with a frequency of 78.95% of cases. Our result is lower than those of Traoré T et al., Diallo S et al., who reported a frequency of 54.6% and 51% of cases respectively [3,4]. The ballistic wound has a high potential for infection, debridement is a surgical procedure performed urgently to minimize the risk of infection. The main postoperative complication was infection in 6.32% of cases. Our result is similar to those of Diallo S et al., who had reported a frequency of 7.9% of cases [3]. This infection rate could be explained by the influx of injured people, the lack of medicalization of transport and the therapeutic delay in certain cases.

The evolution was favorable with a frequency of 92.71% of cases. This result is comparable to those of Traoré T et al., Diallo S et al., Koutora B et al., which had reported 84.1%, 89.2% and 75.6% of cases respectively [3,4,9]. These results could be explained by careful debridement and good patient monitoring. This results in several improvements, especially concerning hemorrhagic control, control of the risk of infection, the principles of resuscitation and analgesic methods. These improvements would result at the National Hospital of Niamey from the training provided by the Faculty of Health Sciences (FSS) of the University of Niamey, the International Committee of the Red Cross (ICRC) and the Spanish Agency for International Development Cooperation, hence a better knowledge of lesion ballistics. The mortality rate was 2.08%. These were cases of extensive burns (80%) + blast related to the explosion of explosive devices. Our result is lower than those of Traore T et al., who reported 3 deaths including 2 cases of sepsis and 1 case of uncontrolled internal hemorrhage [4]. These complications have been found in the literature. This result is also lower than those of Chaibou MS et al., Diallo S et al., Koutora B et al., and Konan KJ et al., who reported a respective frequency of 9.80%, 4.1%; 10.5% and 45.70% of cases [3,5,6,9]. This difference could be explained by the severity of the injuries due to the high velocity of the projectiles, but also by the long evacuation times of the injured to hospitals. There was a statistically significant correlation between explosive device + blast trauma and the occurrence of death ($p = 0.003$); burn with SCB estimated at 80% and the occurrence of death ($p = 0.02$). The ABSI index (Abbreviated Burn Severity Index) was 12 in the 2 patients who died with a probability of survival less than 10%.

Conclusion

Bullet or explosive device injuries are frequent at the HNN due to the exponential rise of terrorism in the Sahelian strip, particularly in the northern zone. This study has illustrated the relative severity of ballistic trauma, especially at the level of the musculoskeletal system due to the multi-tissue nature of the injuries caused. The male gender is the most affected with a sex ratio of 4.33. This multidisciplinary entity concerns all ages whose care includes: anesthesiologists, trauma surgeons, neurosurgeons and visceral surgeons.

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