

# Gunshot Injuries In A North Eastern Nigerian Tertiary Hospital

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## Abstract

Background: Worldwide gunshot injuries are causes of considerable burden to patients and the society. Such burdens are not limited to huge financial demands but may lead to outright victims' permanent disability or demise.

Objective: To determine the incidence, causes, pattern and outcome of gunshot injury in patients presenting to a tertiary Nigerian hospital.

Design: A five year retrospective study.

Method: The analyzed data were retrieved from patients' registers in the wards and operating theatre and from case notes.

Outcome: There were substantial morbidity and mortality despite the preponderance of low velocity missiles necessitating admission in 73.9% of patients. Intentional injuries occurred in 91 (76.5%) patients and were caused by armed robbery in 78 (65.5%) and by assault in 10 (8.4%) patients while 28 (23.5%) patients had accidental discharges. The lower limbs (45 patients; 37.8%), the upper limbs (21; 17.6%) and the abdomen (13; 10.9%) were the frequently involved sites while gluteal region (2; 1.7%) and perineum (1; 0.8%) were the least affected sites. Multiple-site injuries were seen in 11 (9.2%) patients. Duration of hospitalisation ranged from one to 183 days (mean: 29.9 days). Most of the admissions were a result of long bone fractures (32 patients; 26.9%), abdominal injuries (12; 10.1%) and major soft-tissue injuries (9; 7.6%). Long-bone fractures were also responsible for the longest hospital duration while patients admitted on account of long distances had the shortest stay. Wound infection was the most frequent noted complication and there was a mortality rate of 3.36%.

Conclusion: A concerted effort at preventing local proliferation of firearm use and prevention of further regional and sub-regional influx of firearms from wars through sustainable peace initiatives and surveillance systems is imperative.

## INTRODUCTION

Gunshot injuries result from the effect of a bullet or projectiles emanating from the use of firearms. There is equally a considerable contribution to the wound process by tissue fragments.<sup>1</sup> Gunshot injuries are on the increase globally and have wide regional variations;<sup>2</sup> they are a known cause of high morbidity and mortality and have become the leading external cause of non-natural deaths in some parts of the African continent.<sup>3</sup>

Firearm injuries are associated with substantial emotional, physical and financial burden causing an enormous human toll and imposing huge costs on the society despite outcomes that could be lethal.<sup>4</sup> This is a result of the unpredictability of gunshot injuries with potentials for causing damages through wide mechanisms.

Direct impact of gunshot injuries causes laceration, crushing, abrasion, fragmentation of bone and tissue along the missile tract. These may lead to an instant death through exsanguination from haemorrhagic shock or through hypoxia from cardiac tamponade, pneumothorax or damage to vital systems like the central nervous system. Remote tissue damage may also occur through production of temporary cavitations and generation of high-pressure shock in a closed compartment.

Firearm injuries are increasingly seen in many developing countries,<sup>5</sup> which has been attributed to spates of communal and ethnic clashes, political violence and armed robberies.<sup>6</sup> Wars within and around the West African sub-region have also encouraged easy access to sophisticated and locally manufactured firearms leading to a high incidence of

gunshot injuries even in peace times through armed violence.

While fatal gunshot injuries can result in immediate death, non-fatal wounds can result in serious disability. The pathological effects of gun wounds do not merely depend on the caliber of weapons but on the quantity of energy transferred, the rate of such transfer and the energy flux which is influenced by the range at shot, impact velocity and body tissue resistance. The pathological outcomes thus depend on the resultant tissue interactions and a 'high-energy' bullet may sometimes produce a low-energy transfer wound. Although previous reports have indicated a rising incidence in our region, they were restricted to maxillofacial gunshot injuries. Moreover, there have been no prior documentations on this subject in our immediate locality. This study is, therefore, undertaken to document our experience and the morbidities associated with gunshot injuries in order to advance ways of curbing the growing trends.

**PATIENTS AND METHODS**

This study was done at the Federal Medical Centre Gombe, a tertiary hospital in Gombe state that also receives patients from its five neighbouring Nigerian states.

The subjects of this study were all patients that presented to our hospital with gunshot injuries from November 2002 to October 2007. The patients' data were retrieved from patient registers kept in the A&E, the wards, operating theatre and patient records in the central medical library. The information retrieved was analysed using "epi info 2005, version 3.3.2" and this includes: patients' biodata, anatomical site of injury, the event leading to injury, type of injury sustained, the type of gun used, patients' morbidity that necessitated admission, outcome of treatment and the duration of hospital stay.

The patients were first seen and resuscitated in the A&E. Patients that required admission were taken into the wards or the intensive care unit from where necessary investigations were completed and further treatment was instituted. Those who did not require admission were discharged with supportive treatment from the A&E after exploration and/or dressing of their wounds. Tetanus toxoids, analgesia and antibiotics were administered to patients while in the A&E.

**RESULTS**

There were a total of 119 patients with gunshot injuries during the period under review. A total of 88 patients

(73.9%) were admitted while 31 (26.1%) patients were discharged from the accident and emergency department. The age of the patients ranged from seven to 65 years with a mean of 34.1±10.3. The peak incidence occurred within the age group 20-30 (45.4%; Table 1). The patients comprised 114 males and 5 females giving a male/female ratio of 23:1.

**Figure 1**

Table 1: Age groups of the patients

Age range	number	percentage	cumulative percentage
0-10	01	0.8	0.8
10-20	05	4.2	5.0
20-30	54	45.4	50.4
30-40	33	27.7	78.1
40-50	19	16.0	94.1
50-60	05	4.2	98.3
60-65	02	1.7	100
<b>Total</b>	<b>119</b>	<b>100</b>	<b>100</b>

The majority of the gunshot injuries was intentional as seen in 91 (76.5%) patients and occurred mainly from armed robbery (78 patients; 65.5%) and assault (10; 8.4%). The rest were accidental discharges either by the patients themselves or from others (Table 2).

**Figure 2**

Table 2: shows the incidences leading to the gunshot injuries.

Events	frequency	percentage
<b>Self accidental discharge</b>	<b>4</b>	<b>3.4</b>
Mishandling	2	1.7
Groping in dark room	1	0.8
Fell down on the gun	1	0.8
<b>Accidental discharge from others</b>	<b>24</b>	<b>20.2</b>
Police/security	7	5.9
Stray bullets	6	5.0
Festive celebration/public display	3	2.5
Mishandling	3	2.5
Repairing loaded gun	3	2.5
Hunting accident	2	1.7
<b>Intentional</b>	<b>91</b>	<b>76.5</b>
Armed robbery	78	65.5
Assault	10	8.4
Mistaken identity	3	2.5
<b>Total</b>	<b>119</b>	<b>100</b>

The parts of the body commonly involved were the lower limbs in 45(37.8%) patients, upper limbs in 21 (17.6%) patients and abdomen in 13 (10.9%) patients while the least involved locations were the gluteal region in 2 (1.7%) patients and perineum in one (0.8%) patient. Multiple sites were involved in 11 (9.2%) patients (Table 3). The missiles involved were predominantly low-velocity as shown in table 4.

**Figure 3**

Table 3: Anatomical sites of involvement in gunshot injury.

Site	Number/Percentage
Lower limbs	45 (37.8%)
Upper limbs	21 (17.6%)
Abdomen	13 (10.9%)
Multiple	11 (9.2%)
Trunk	10 (8.4%)
Head	6 (5.0%)
Chest	6 (5.0%)
Neck	4 (3.4%)
Gluteal region	2 (1.7%)
Perineum	1 (0.8%)
<b>Total</b>	<b>119 (100%)</b>

**Figure 4**

Table 4: The type of gun used.

Missile type	frequency	percentage
Low velocity	23	19.3
High velocity	94	79.0
Not indicated	2	1.7
<b>Total</b>	<b>119</b>	<b>100</b>

There were substantial morbidities warranting patients' admission and the sustained pathologies that led to admission were mostly long-bone fractures (32; 26.9%), abdominal injuries (12; 10.1%) and major soft-tissue injuries (9; 7.6%) as shown in Table 5.

\*Others: includes severe pain preventing mobility and patients from long distance robbed on the highway.

**Figure 5**

Table 5: shows the morbidities/reasons for admission from gunshot injuries.

Morbidity/reason for admission	frequency
Long-bone fracture	32
Bowel injury	12
Major soft-tissue injury	9
Polytrauma	7
Haemo/pneumothorax	5
Head injury	4
Hand injury	3
Compartment syndrome	3
Digital gangrene	5
Major limb gangrene	2
Spinal injury	1
Others*	5
<b>Total</b>	<b>88</b>

The rarest occurring pathologies were limb gangrene from vascular injuries after delayed presentation and spinal injury. Wound infection was the most frequent complication in these patients. Table 6 shows the major outcome of treatment.

**Figure 6**

Table 6: Outcome of gun shot injury

Outcome	Number
Wound infection	17
Chronic osteomyelitis	4
Permanent neurological deficit	3
Limb loss	2
Mal-union	1
Lama*	4
Referred	3
Death	4
<b>Total</b>	<b>38</b>

\*Lama: Left against medical advice

The duration of stay in hospital ranged from one to 183 days with a mean of 29.9 days. Long-bone fractures accounted for the longest stay while patients admitted on account of long distance had the shortest stay.

**Figure 7**

Table 7: Duration of hospital stay

Number in weeks	Number of patients
1-2	27 (30.7%)
≥2-4	18 (20.5%)
≥4-6	11 (12.5%)
≥6-8	9 (10.2%)
≥ 8	23 (26.1%)
<b>Total</b>	<b>88 (100%)</b>

**DISCUSSION**

There were a total of 119 patients seen over 5 years in this study with an average yearly incidence of 40 patients. There was a preponderance of low-velocity gunshot wounds largely resulting from the use of locally fabricated guns. The majority of the gunshots were intentional, mostly from armed robbery attacks and assaults during civil conflicts. The armed robbery attacks occurred mainly on the road and occasionally while at home or work. This underscores the

need for adequate security and protective measures both on the roads and within the cities. The civil violence resulted mostly from conflict between the cattle rearers and local farm owners over cattle grazing on farmlands and disputes over land/village boundaries. There is, therefore, a case for serious regulations of the use of firearms to settle disputes and strict enforcement of laws to combat this trend.

Patients whose age range was between 20-40 years (72.8%) were the most affected reflecting the involvement of the most active and productive population of the society. Over 75% of injuries occurred in those below 40 years. Eighty-eight (73.9%) patients were admitted while 31 (26.1%) were discharged from the accident and emergency department. This is a similar finding to a study from western Nigeria where about 70% of their patients were admitted and this illustrates the loss of valuable hours from hospitalisation<sup>10</sup>. The male sex predominance in this study is not surprising as males engage more in violence, hunting, security jobs and cattle rearing etc.

Accidental gunshot injuries occurring in 28 patients constituted 23.5% of the injuries. There were 7 cases among police/security agents while being transported in a van, 6 cases from stray bullets while testing guns or dispersing crowds and 3 cases occurred each during a festive celebration/public display and while repairing loaded guns. The need to incorporate safety mechanisms and caps into gun designs should therefore be re-emphasised<sup>11</sup>. Gun repairs should preferably be carried out on unloaded guns and testing should be done in open fields. Other strategies for limiting these harms include the discouragement of gunshots in the midst of crowds during celebrations, avoidance of the use of live bullets if it must be done at all and ensuring that such gunshots are well directed away from the gathering<sup>12</sup>.

Four cases were self accidental discharges which occurred in a child who was sent to bring a gun, a woman groping in a dark room for matches, a hunter who accidentally fell into a ditch with his gun and a vigilante hunter who fell asleep while holding a loaded gun which slipped down and discharged on him. Children need to be prevented from handling or carrying guns and guns should always be safely kept away from where they could easily provoke accidental injuries. Likewise, guns must always be handled with utmost caution and care to avoid accidental discharges. There were no cases of suicidal or homicidal gunshots in this study.

The majority of the gunshot injuries occurred in the limbs

which is similar to other studies<sup>6,10,13</sup>. This pattern is not surprising because of the uncommon suicide and attempted suicide gunshots in our environment in contradiction to countries with a high suicide rate such as the United States where the weapon is typically aimed at the head or heart.

All our patients were first resuscitated and given first-aid treatment including anti-tetanus prophylaxis. Their wounds were subsequently explored and dressed and the skin left open for delayed closure. There were long-bone fractures in 32 patients consisting of 15 tibiofibular, 9 femoral, 5 humeral, and 3 radioulnar fractures. They were all conservatively managed with skeletal traction for femoral fractures, external fixators/plaster of Paris cast for tibiofemoral fractures and plaster cast with opened window dressings/slings for upper limb fractures. Lack of relevant facilities/technology and high infection rates are among factors that make early primary internal fixation yet infeasible in our domain<sup>14</sup>.

Thirteen patients sustained injury to the abdominal region; however, only 12 injuries were significant to warrant admissions as one of the patients had an injury that did not actually breach the peritoneum at exploration and consequently was not admitted. These 12 abdominal injuries consisted of 3 large bowel injuries, 5 small bowel injuries including a patient who presented with peritonitis from enterocutaneous fistula, 1 each of hepatoduodenal and gastric injuries and 2 multiple-site bowel injuries. At laparotomy, bowel exteriorization was done for distal large-bowel injuries while closure of perforations or resection and anastomosis were done for proximal large bowel, gastric and hepatoduodenal injuries. Closed tube drainage proved sufficient treatment in 5 cases of haemo/pneumothorax. Major soft-tissue and hand injuries were thoroughly debrided with primary vascular repairs where necessary. Nerves and tendons were tagged for future repairs.

Two cases of compartment syndrome were successfully managed by elevation and supportive treatments after wound exploration. One case with multiple forearm bullets, however, required generous fasciotomy in addition. Two major amputations were done at above-knee level and five others in the digits. All the head-injury patients had wound exploration debridement and craniectomy where necessary to retrieve bullets. Polytrauma was seen in the form of multiple fractures, thoracoabdominal or cranioabdominal injuries. Infective complications were the most common sequelae of treatment consisting mainly of wound infections and chronic osteomyelitis. Therefore, early and meticulous

wound care should continue to be instituted in the management of gunshot injuries.

Four patients, who all had long-bone fractures with a mean hospital stay of 30.5 days left against medical advice on financial grounds. This illustrates some of the financial burdens associated with coping with gunshot injuries. Two other patients, also with fractures, however, opted for traditional treatment *ab initio*. Traditional treatment continues to offer an alternative treatment in our environment; however, morbidity from treatment including fatality from delayed return to hospital is high<sup>15</sup>. This must continue to be made known to the patients. Three patients were referred to neurosurgical centres (two with head injuries and one with spinal injury).

The mortality rate was 3.36 % from demise of four patients which is lower than the mortality from predominantly communal-clash gunshot injuries<sup>14</sup>. This agrees with the fact that armed robbery in this part of the world is usually with the intention of scaring and maiming the victims rather than outright killing<sup>6</sup>. The deaths resulted from a head injury, an orofacial injury with mandibular fracture and from multiple injuries including abdominal injuries in two patients.

Firearm injuries are associated with an excessive mortality burden but the burden of non-fatal firearm-related injuries is estimated to be far worse and unfortunately, it is hard to quantify all aspects of this burden such as the social and emotional aspects. For instance, it is difficult to measure the income loss by patients while on admission, the fiscal/emotional trauma to the patient, the costs of patients coping with permanent disabilities, the effect of patients' disabilities on their employers/relatives and the burden of care borne by the health staff caring for patients. Consequently, many estimates are only limited to calculating patients' financial expenditures in the hospital.

Despite the limited appraisal, the estimated economic burden of rising firearm-related trauma is staggering and constitutes a threat to both national fiscal and human resources when the trend is not curtailed<sup>3</sup>. This cost is bound to further escalate where patients need multiple admissions that will increase the costs of hospital stay, costs of therapies including pharmaceuticals and blood products, laboratory services and diagnostic imaging studies which are components of costs estimations.

In our study, many of our patients required major operations like laparotomies, amputations and had prolonged hospital

stay with mean hospital duration of 30 days. More than a quarter of the patients stayed for over 8 weeks and the longest stayed for 26 weeks. Besides the regular hospital bill, they incurred expenses in procuring items like prostheses after major amputations to manage their disabilities and payment of subsequent admissions for interventions such as sequestrectomy for osteomyelitis, corrective osteotomy for mal-union and reversal of colostomy to address some of their initial complications. These all constitute extra costs to patients' initial admission.

Morbidity from gunshot injury is substantial in this study leading to admissions in 73.9% of the patients and a mortality of 3.36%. Gunshot, therefore, constitutes a harrowing experience with lots of harms in our environment. Although there has been increasing observation of rising incidence of firearm injuries in lower-income countries<sup>16</sup>, data relating to these injuries could not be said to be exhaustive where data on victims who died at the scene of an injury and those presenting at private hospitals are not readily retrievable and where police reports, if at all available in most cases, lack details of important variables including the events surrounding an injury. These call for a renewed approach to firearm control.

As a result, there is an urgent need for gun-violence reduction programs, curtailment of armed robbery and activities of miscreants. There should be coordinated national data-collection systems to facilitate effective control measures and adequate monitoring of the trends of firearm injuries. Since a successful firearm-surveillance system will not only reduce the ensuing disabilities from sustained injuries but will additionally reduce the national and regional fiscal burden, sub-regional/regional firearm-injury surveillance and collaborations becomes imperative. These efforts must be complemented by sustainable regional/international peace initiatives to prevent further firearm influx that occurs during war time.

Finally, firearm-injury morbidity-reduction strategies require high-quality trauma care. This makes training in trauma care, advanced trauma life-support schemes and vascular surgeries mandatory. Although this is capital-intensive, the resultant reduction in mortality, morbidity and burden of firearm-related trauma will be justified such an allocation of resources.

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