



Original Article

Gunshot injury in children: A 3-year review of cases that presented to the Jos University Teaching Hospital, North Central Nigeria

Idumagbodi Amupitan¹, Micheal Bundepon Ode¹, Solomon Danjuma Peter², Andrew Shitta², Joseph Fashe³, Foluke Ayowole Amupitan⁴

Departments of ¹Orthopedics and Trauma and ²Surgery, Accident and Emergency Unit, Jos University Teaching Hospital, Jos, Plateau, ³Department of Surgery, Federal Medical Centre, Yola, Adamawa, ⁴Department of Anaesthesia, Jos University Teaching Hospital, Jos, Plateau, Nigeria.



***Corresponding author:**

Idumagbodi Amupitan,
Department of Orthopedics
and Trauma, Jos University
Teaching Hospital, Jos, Plateau,
Nigeria.

idumagbodi@yahoo.com

Received : 19 May 2021
Accepted : 07 September 2021
Published : 28 October 2021

DOI
[10.25259/ANMRP_23_2021](https://doi.org/10.25259/ANMRP_23_2021)

Quick Response Code:



ABSTRACT

Objectives: Gunshot injuries among children are a major clinical and public health concern and one of the leading causes of pediatric morbidity and mortality. This usually takes a great financial and emotional toll on the affected children, their families, and society as a whole. The objective of the study was to determine the pattern of injury, severity, outcome, and challenges in managing the gunshot injuries in children.

Material and Methods: This is a descriptive study of patients below 18 years of age who presented with gunshot injuries to the Jos University Teaching Hospital between January 2011 and December 2014. Patient demographics and clinical details were collected on a trauma data sheet, and entered into an Excel spreadsheet. It was analyzed descriptively.

Results: Two hundred and forty-two patients presented with gunshot injuries in the period under review, of which 30 of them were children. The median age of the patients was 12 years with an interquartile range of 7.75 and 16.25. Twenty-two (73.3%) of them were male while 8 (26.7%) were female. High-velocity firearms accounted for 13 (43.3%) of the injuries and were the most predominant cause of injury. The most common part of the body involved was the extremities in 63.3% of patients. Debridement and secondary suturing was carried out in 83.3% of the patients while wound infection was the most noted complication in 33.3% of the patients.

Conclusion: There is an increasing incidence of gunshot injuries in this region. A lot of the children survive and reach the hospital though, and most of them are treated and discharged, however, attendant emotional and psychological trauma cannot be excluded in these patients. There is, thus, a need for proper policy to protect and treat these children when this happens.

Keywords: Gunshot injury, Children, Extremities

INTRODUCTION

Gunshot injuries among children are a major clinical and public health concern and one of the leading causes of pediatric morbidity and mortality.^[1,2] Firearm injuries cause both serious morbidity and death in children and adolescents.^[2,3] This usually takes a great financial and emotional toll on the affected children, their families, and society as a whole.^[3] Gunshot

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injuries in the United States of America rank second only to motor vehicle crashes as a cause of death for children ages 15–19 years. From 2001 through 2010, 29,331 children age 0–19 years died of gunshot-related injuries.^[4,5] Unfortunately, the numbers are increasing and it is not any different from most developing countries. The extremities are the most commonly involved parts of the body and could affect the soft-tissue vessels, nerves, or bones.^[6-8] However, majority of the gunshot injuries affecting the extremities are not lethal, this depends on the nature of the weapon used, either an assault or a non-assault weapon.

Gunshot injuries are usually classified into low velocity which occurs with a muzzle velocity of $<600 \text{ m/s}^2$ and high-velocity injuries which have a muzzle velocity of more than 600 m/s^2 . Although muzzle velocity is clearly an important aspect of the missile's wounding potential, tissue trauma is related to the degree of energy transfer, which depends on several factors.^[3,9] The energy transferred is determined using the equation $E = 1/2 MV^2$, where E is the kinetic energy, M is the mass of the bullet, and V is the velocity of the bullet. Two areas of projectile-tissue interaction have been differentiated: The permanent and the temporary cavity. In low-velocity bullets, the direct tissue destruction with its localized area proportional to the size of the projectile plays the major role, whereas in high-velocity injuries, the lateral tissue expansion ("cavitation") becomes more important. After passage of the projectile, there is a transient lateral displacement of tissue which can reach 10- to 40-fold diameter of the bullet. If the projectile crosses elastic tissue, such as skeletal muscle, blood vessels, and skin, this tissue may be pushed aside after passage of the bullet, but then rebound. In cases of inelastic tissue, such as bone and liver, fractures and tissue destruction can be the consequence.^[10,11]

The principles guiding the treatment of gunshot injuries include resuscitation, debridement, and absence of initial wound closure, complimentary medical treatment, mobilization, revision surgery, and possible secondary closure.

Despite the large number of children affected by firearm violence, a paucity of literature exists on the management of pediatric gunshot injuries. The severity of these injuries can vary depending on the proximity of the child to the firearm, the trajectory of the projectile, and the type of weapon used. The resultant damage may affect the soft-tissue envelope, the peripheral nerves, the spinal cord, the peripheral vascular system, and/or the bones. Treatment is tailored for the specific structures injured, but the initial evaluation should focus on the achievement and maintenance of hemodynamic stability followed by the assessment of the level of wound contamination and associated injured structures.^[3]

The objective of the study was to determine the pattern of injury, severity of gunshot injury, outcome, and challenges in managing the gunshot injuries in children.

MATERIAL AND METHODS

Study setting

The Jos University Teaching Hospital is located in Jos, Plateau state in North Central Nigeria. It is a 500-bed capacity Teaching Hospital in North Central Nigeria which receives referrals from states within the region. It has a multispecialty trauma unit comprising medical officers, junior and senior residents, and two trauma consultants.

Study location

The protocol of the unit is that at presentation, the patient is initially resuscitated according to the advanced trauma life support protocol^[12] and stabilized before referral to the appropriate teams for the definitive management. In cases, where the patients present as part of a mass casualty incidence, they are managed using the mass casualty protocol as discussed in the previous studies.^[13,14]

Data analysis

Data were collected using a pro forma which was developed for the purpose and entered into an Excel spreadsheet from where it was analyzed using the SPSS version 21. Results are presented in simple percentages, tables, frequencies, means, and medians.

RESULTS

Two hundred and forty-two patients presented with gunshot injury in the period under review to the accident and emergency of the Jos University Teaching Hospital of which 30 (12.4%) of them were children. The median age of the patients was 12 years with an interquartile range of 7.75 and 16.25; this is illustrated in Figure 1. Twenty-two (73.3%) of them were male while 8 (26.7%) were female M: F of 2.75:1.

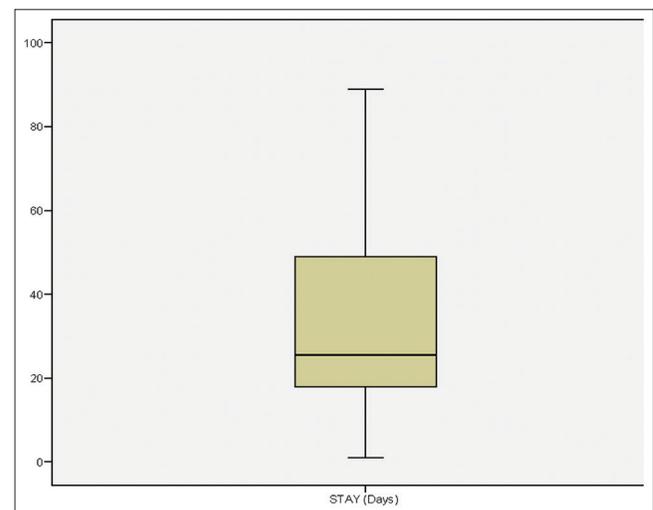


Figure 1: A box plot of the age distribution of the patient.

High-velocity firearms accounted for 13 (43.3%) of the injuries and were the most predominant weapon of choice while the other distributions are shown in Table 1. Twenty (66.7%) of the patients were conveyed to the hospital through public transportation while the other means of transportation used are shown in Table 1. Twenty-four (80.0%) of the patients did not receive any form of medical care before referral to our facility while 6 (20.0%) of the patients were initially managed at peripheral hospitals before referral to the hospital. Thirteen (43.3%) of the patients sustained polytrauma while the remaining 17 of the patients had only isolated injuries. The distribution of the injuries with respect to the region of the body is shown in Table 1

with the most common being the extremity in 19 (66.3%) of the patients.

The median time it took for the patients to present to the hospital was 8 h with an interquartile range of 6–24 h. Thirteen (43.3%) of the patients had an injury severity score of <16 while the remaining 17 were above 16. The procedures done on the patients are as shown in Table 1 but it should be noted that some patients had more than 1 procedure carried out on them. The median duration of hospital stay was 25.50 days while the distribution is shown in Figure 1. The complication noted is shown in Table 1. No mortality was recorded and 29 of the patients were discharged while one of the signed against medical advice because he wanted to continue his treatment with traditional bone setters.

Table 1: Pattern of firearm velocity, mode of transportation to the hospital, pattern of injury, procedures done, and pattern of resulting complication.

	Frequency	Percentage
Firearm velocity		
High velocity	13	43.3
Low velocity	7	23.3
Not specified	3	10.0
Shotgun close range	5	16.7
Shotgun long range	2	6.7
Total	30	100.0
Mode of transportation		
Ambulance	1	3.3 %
Others	2	6.7
Police	5	16.7
Private car	2	6.7
Public transport	20	66.7
Total	30	100.0
Complications		
Hypocalcemia	1	3.3
None	14	46.7
Right foot drop	1	3.3
Scalp necrosis	1	3.3
Septicemia	1	3.3
Skin necrosis	2	6.7
Wound infection	10	33.3
Total	30	100.0
Pattern of injury		
Head and neck	8	26.7
Chest	7	23.3
Abdomen	5	16.7
Extremities	22	73.3
Scrotal	1	3.3
Gluteal	1	3.3
Procedures done		
Laparotomy	1	3.3
Thoracostomy	1	3.3
Exploration	15	50
Debridement	25	83.3
Secondary suturing	1	3.3
Others	22	73.3

DISCUSSION

In recent times, there has been increased proliferation of light weapons and civil disturbance with resultant increase in firearm and missile injuries, these injuries were in the realm of the military surgeons but are now being treated more in civilian settings. Firearm injuries are an important and preventable cause of morbidity and mortality in the pediatric age range.^[3] Most of the casualties of such conflicts are usually adult males. However, children and teenagers could be victims also as noted in the study. They could have been innocent victims or as in the case of the older children, they may be active combatants as have been noted in conflicts in other regions, this may be responsible for the preponderance of majority of the patients being male and distribution of the patients higher in the 50–75 percentiles. The single most commonly used firearm was high-velocity weapons this is against previous findings in our environment that has progressed from machete cut, to low velocity and there is increasing incidence of high velocity which was previously in the exclusive preserve of the police and military but with the increase in the sectarian violence and also adolescent gang violence, this is now wide spread.^[15-18] Majority of the patients received some form of treatment at peripheral facilities which were easily accessible to them before referral to our facility. However, there is a need for training and retraining of staff in such primary and secondary facilities as they are the first point of call for victims of gunshot injuries and they will determine to a large extent the advanced care required. The study revealed that the most common form of transportation to the referral center was by commercial transportation which is due to the fact that ambulance services in this setting are still underdeveloped. There is obviously a need for some form of training in basic life support for such drivers in general as they may reduce morbidities associated with poor transportation of such victims.^[18]

The most prevalent form of injury observed was an extremity injury which was present in 73.3% of the patients. This is in

keeping with other studies which found the same.^[7,8,16] This is due to extremities injury having a non-lethal outcome most of the time compared with injuries to the torso or the head-and-neck injuries. The extremities although mostly non-lethal are usually associated with increased morbidity, especially when associated with fractures or vascular injuries.^[19,20]

The most common procedure carried out on the patients was debridement and secondary suturing which may have contributed to the non-lethal outcome of the injuries and most of this could have been done at a well-trained and equipped secondary facility instead of referring to the tertiary facility. However, one of the patients who required intensive care management was a case of polytrauma that required multispecialty care and management. A third of the patients went on to develop complications mostly wound infections. The identifiable factors responsible for wound infection include the late presentation to the facility, absence a proper means of transportation, and the injuries being predominantly located in the extremities (Gustilo and Anderson Class 3 injuries) and cannot be closed primarily so it has a high rate of infection. This, however, is in line with other studies.^[21,22]

One of the patients signed against medical advice to have his open injury and fracture treated by traditional bone setter. This is highly prevalent in our environment thus there is a need for increased awareness and advocacy on the dangers of such practice.^[23]

CONCLUSION

The percentage of the children who sustained injuries may be small compared to the general population. The extremity was the most affected site in this study and there were a few cases with complications, outcome was good in most cases, presentation at a trauma center of a hospital like Jos University Teaching Hospital may reduce attendant consequence of gunshot injuries in children.

Declaration of patient consent

Patient's consent not required as patients identity is not disclosed or compromised.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

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How to cite this article: Amupitan I, Ode MB, Peter SD, Shitta A, Fashe J, Amupitan FA. Gunshot injury in children: A 3-year review of cases that presented to the Jos University Teaching Hospital, North Central Nigeria. *Ann Med Res Pract* 2021;2:11.