

# Gunshot Injuries as the Leading Cause of Maxillofacial Fractures – Implication for the Maxillofacial Surgeon

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## ABSTRACT

**Objective:** To determine the contribution of gunshot to the aetiology of maxillofacial fractures and its implication for management by the maxillofacial surgeon.

**Methods:** This was a cross sectional study of maxillofacial injuries in a tertiary hospital in north central Nigeria between January 2015 and December 2017. One in every three patients with maxillofacial injuries was recruited for the study. Case notes were reviewed and only those who met the inclusion criteria were studied. A total of 123 patients were recruited for the study. Frequencies and percentages were used to present the pattern and the commonest causes of maxillofacial fractures. While aetiology was cross tabulated against patterns of maxillofacial fractures to determine the pattern of maxillofacial fractures in patients with the commonest aetiology. All analysis was carried out using the SPSS 22 software.

**Results:** The study recruited 108 males (87.8%) and 15 (12.2%) females. Majority of the patients had primary education while gunshot was the commonest aetiological agent 60 (48.8%) in patients with maxillofacial fractures. Fracture of 3 or more facial bones was the commonest maxillofacial fractures seen in patients following gunshot.

**Conclusion:** Gunshot injuries are now becoming a problem in Nigeria. There is therefore a need for legislations regulating the sales of arms and the maxillofacial surgeon also need to adapt his practice to this alarming new trend.

**Keywords:** Gunshot, Maxillofacial fractures, Maxillofacial surgeon

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## INTRODUCTION

The human face is the first focus of human interaction and a source of man's fascination with the idea of beauty.<sup>1</sup> However, the facial area, also known

as the maxillofacial region is one of the most frequently injured areas of the body.<sup>1,2</sup>

The maxillofacial region can be divided into three parts: The upper face (the frontal bone and frontal sinus), The mid face (the nasal, ethmoid, zygomatic

and maxillary bones) and the lower face (the mandible).<sup>2</sup>

Reported aetiologic factors for mandibular fractures include road traffic crashes (vehicular, motorcycle, pedestrian), falls, assaults and sports related, occupation related and gunshot related injuries.<sup>3,4</sup> With increasing urbanization, high-speed travels, traffic congestion on our highways, trauma including maxillofacial trauma has become a public health challenge. The aetiologic factors of maxillofacial injuries reported from different regions at different times are thought to be largely modulated by prevailing socioeconomic, cultural, environmental and legislative factors, as well as the location of a trauma center.<sup>2,5,6</sup> In a recent study<sup>7</sup> trauma is the main reason for emergency room visits with road traffic accidents being responsible for the majority of deaths with reported incidences in Nigeria ranging from 22% to 66%<sup>8,9</sup> However in Nigeria in recent times, an increasing trend of assault-related mandibular fractures has been reported especially in the North-eastern region with a frequency ranging from 10.9% to 48%<sup>8,10</sup>. Olosoji et al<sup>10</sup> reported rate of 57.1% of cases of maxillofacial injuries in North-western Nigeria being as a result of assault. He attributed this to the nomadic lifestyle of the people in the region where animals are moved over several kilometers of land grazing over farms and destroying cash crops in the process, this frequently leads to fight between farmers and cattlemen. While in the study by Odai et al<sup>11</sup>, interpersonal violence accounted for 17.7 % of mandibular fractures with Gunshot accounting for 3.9% of cases.

Hence this study was carried out to determine the common aetiologic factors of maxillofacial fractures and what this implies for management by the maxillofacial surgeon.

### MATERIALS AND METHODS

The study was carried out at Jos University Teaching Hospital, a tertiary health care center, one of the two teaching hospitals located in Plateau State. Plateau state is the twelfth largest State of Nigeria, located approximately in the center of the country. It is a referral center that receives patients from neighboring States of Benue, Nassarawa, Kogi, Kaduna, Taraba, Gombe and Bauchi. It has a bed capacity of about 620 and treats about 150 patients with maxillofacial injuries yearly.

All the case notes of patients with maxillofacial fractures seen between January 2015 and December

2017 were retrieved and numbered. Simple random sampling by balloting was used to determine the patients to be selected. The numbers 1 to 5 was written on a piece of paper and placed in a cup, one number then was randomly selected, the number 3 was the number eventually selected and this was the first case note to be recruited and subsequently every third case note thereafter was selected to be recruited into the study. If the selected patient had a pathological fracture, or fracture from third molar extraction, they were excluded from the study and the next eligible case recruited in its stead. A total of 123 patients were recruited for the study.

Information was obtained using a well-structured questionnaire. This included age, gender, occupation, education and aetiology of injury. All patients' plain radiographs were reviewed to determine the type and site of maxillofacial fractures. All patients had a CT-scan done as part of their standard of care.

The age of the study population which is a continuous variable was presented with frequency, percentage, mean and standard deviation. While the categorical variables in the study were pattern and aetiology of maxillofacial fractures and this was represented with frequencies and percentages. With gunshot injury being the commonest aetiology of maxillofacial fractures, this aetiology was cross tabulated against patterns of maxillofacial fractures to determine the pattern of maxillofacial fractures in patients with the gunshot as the aetiology of their maxillofacial fractures and this was also presented in tabular form. All analysis was carried out using the IBM SPSS 22 software.

Ethical approval was obtained from the institutional review board. Patients case notes were numbered and coded with all identifiers removed from the data. Patients information was then stored in a computer which was passworded and only the principal investigator had access to the data.

### RESULTS

The study recruited 108 males (87.8%) and 15 (12.2%) females for the study. The aetiology of maxillofacial fractures are presented in table 1. The socio demographic characteristics of the study population are documented in Table 2 while table 3 shows the pattern of maxillofacial fractures in the 60 patients with gunshot as the aetiologic agent of their fractures.

Table 1- Aetiology of maxillofacial fractures (n=123)

Aetiology of Maxillofacial fractures	Number (%)
Gunshot	60 (48.8)
Motorcycle related	41 (33.3)
Vehicle related	16 (13.0)
Fight/assault	6 (4.9)
Total	123 (100.0)

Table 2: Association between socio-demographics and Gunshot Injuries (n = 123)

Socio-demographics	Gunshot Injury		Chi-square	P – Value
	Yes (%)	No (%)		
<b>Gender</b>			19.144	< 0.001
Male	53 (88.3)	55 (87.3)		
Female	7 (11.7)	8 (13.7)		
<b>Age (years)</b>			47.452	< 0.001
11 – 20	10 (16.7)	9 (14.3)		
21 – 30	25 (41.7)	34 (54.0)		
31 – 40	24 (40.0)	10 (15.9)		
41 – 50	1 (1.6)	5 (7.9)		
≥ 51	0 (0.0)	5 (7.9)		
<b>Level of Education</b>			47.110	< 0.001
Uneducated	3 (5.0)	0 (0.0)		
Primary	33 (55.0)	13 (20.6)		
Secondary	12 (20.0)	32 (50.8)		
Tertiary	12 (20.0)	18 (28.6)		

## DISCUSSION

In this study the commonest cause of maxillofacial fracture was gunshot injuries accounting for as high as 48.8% of cases followed by motorcycle related injuries seen in 33.3% of cases. Vehicle related injuries and injuries following assault accounted for

13% and 4.9% of cases respectively. Even when the motorcycle cycle related injuries and vehicle related injuries were combined as Road traffic accidents, the combined prevalence was still less than that observed to have been due to gunshot injuries.

Table 3: Pattern of maxillofacial fractures in gunshot patients (N=60)

Type of fracture	Number of patients (%)
Fractures of 3 or more facial bones including mandible	45 (75)
Zygomatic complex fractures	10 (16.7)
Parasymphyseal	3 (5)
Multiple facial bone fracture excluding the mandible	2 (3.3)

When looking at the causes of maxillofacial injuries generally, it has been reported that road traffic accidents, assaults and fights, falls, sports injuries,

industrial accidents, domestic violence, gunshot/firearm injuries and animal bites/accidents are the commonly recognized causes.<sup>12-15</sup> These

aetiologic factors are however known to be influenced by factors such as social trends, alcohol and drug abuse, seasons of the year and geographic location<sup>6,15</sup>.

In the developed countries violence is the leading cause of maxillofacial fractures followed by road traffic accidents while in the developing countries, road traffic accidents have been reported to be the most common causative factor.<sup>16</sup> It is however important to note that the aetiology of maxillofacial injuries tends to vary from country to country and even within the same country and it is usually dependent on the prevailing socioeconomic, cultural and environmental factors.<sup>14,17</sup>

Studies from other African countries like Rwanda<sup>18</sup> Uganda<sup>19</sup> and Tanzania<sup>20</sup> where vehicle related and motorcycle related injuries were grouped together as Road traffic accidents (RTA), the prevalence of maxillofacial fractures following RTA's was 58%, 50.6% and 13.7% respectively with the motorcycle being most commonly associated. Their findings<sup>18-20</sup> correlated with the common pattern seen in developing countries. Although in our study when we combined the motorcycle related and the vehicle related etiologies the prevalence was 46.3% similar to the Ugandan and Rwandan study. The fact that in our own environment gunshot injuries still remained the leading cause of maxillofacial injuries is very alarming.

In the study by Ajike et al<sup>21</sup> from Kaduna state northern Nigeria, road traffic accidents were the commonest causes of maxillofacial fractures accounting for 50.8% of cases followed by falls and fights. In the study by Obimakinde et al,<sup>22</sup> the major cause was road traffic accidents and this accounted for as high as 78.5% of cases and the second cause was assault. No case of gunshot injuries was documented by these studies.<sup>21,22</sup>

In a study in Benin<sup>23</sup>, southern Nigeria, gunshot injuries to the maxillofacial region was studied over a period of six years and only 28 cases were documented which was less than half of the cases we observed in our study over a three-year period. In Benin earlier, Odai et al.<sup>24</sup> saw 47 in five years. In a one-year review of maxillofacial fractures carried out in Sokoto State in 2011, only 2 cases of fractures from gunshot injuries were documented.<sup>25</sup> This is much lower than the 15% reported by Akinbami and Udeabor<sup>26</sup> in Port Harcourt. The prevalence of gunshot injuries to the maxillofacial area in their study<sup>26</sup> is lower than what we have documented in our study.

Now the question- what does the fact that gunshot injuries are now more common than other causes of maxillofacial injuries imply for the maxillofacial surgeon?

With combined mandibular and facial bone fractures being the commonest fracture pattern in gunshot patients, the maxillofacial surgeon is faced with a patient whose aesthetics and functionality are affected which may require longer surgery time or even several surgeries to correct. In addition to the need to use bone plates for reduction and fixation to return the face to its anatomical position, the patients may on the long run require longer periods of hospitalization. With longer periods of hospitalization, patients are predisposed to hospital acquired infections or even multi- drug resistant infections.

A multidisciplinary approach involving the plastic surgeon, ophthalmologist, psychologist, rehabilitative services amongst others would also become essential for patient management. With majority of patients in our environs having to pay out of pocket for health care, the cost of the illness on the family would be enormous.

So this begs the question- What needs to be done? - Well- equipped (in terms of man-power and equipment) trauma centers need to be established. The training of the maxillofacial surgeons also needs to be improved upon to enhance patient management.

The government also has a role to play which would include among others, increasing the coverage of the national health insurance scheme so that the financial implications and burden of the disease can be reduced. There is also the need for the government to work on ensuring strict legislation regulating the sales and use of arms and ammunitions.

### CONCLUSION

Gunshot injuries is now a problem in Nigeria where poverty, political instability, easy access to firearms and terrorism are becoming common. The high prevalence of gunshot injuries in this study could be attributed to the high incidence of political, ethnic and religious crisis that has bedeviled the region in the last few years. There is a need for legislations regulating the sales of arms in order to stem this alarming observation. The maxillofacial surgeon also needs to adapt his practice to this alarming new trend.

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