

## ORIGINAL ARTICLE

# Pattern of mandibular fractures in a Nigerian tertiary health institution; a 4-year retrospective study

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## ABSTRACT

**Background:** According to surveys, mandibular injuries aetiology varies between countries and even between centres in the same country. Mandibular fractures are the second most frequent facial injury, accounting for 15.5% to 59% of all facial fractures globally. The study aimed to find out if there were predictable patterns of fractured in the north central part of Nigeria.

**Materials and Methods:** Mandibular fracture patients treated during a 4-year period were identified in a retrospective analysis and examined based on factors including age, sex, mode of trauma, month and day of the week of presentation, number and anatomic location, treatment method and sequelae.

**Results:** The study reviewed 75 participants between the ages of 2 and 70. The mean age was  $30.69 \pm 11.22$  years, and the gender split was 70 males (93.20%) and 5 females (6.80%), with a p-

value of 0.09. The main cause was motorbike accident (51, 68%) and head on collision was the major mechanism of trauma road traffic accidents (52, 68.8%) and none of motorbike riders nor did passengers wear crash helmet. A total of ninety-nine fractures out of one hundred and six fractures were observed in males. A small percentage of patients (25, 33%) exhibited altered consciousness, however there was no statistically significant link between the aetiology and level of consciousness ( $p=0.818$ ).

**Conclusion:** The mandibular body was most severely impacted and the primary mechanism of injury was head-on collision between two motorbikes. Speed restrictions and legislative law should be placed on the use of crash helmet.

## INTRODUCTION

The mandible is the largest and strongest facial bone. Its unique feature of being the only movable bone of the skull<sup>1</sup> makes it vulnerable to fractures. Surveys show that mandibular injuries aetiology varies between countries and even between centres depending on the prevailing socioeconomic,

**Keywords:** mandibular fractures, mechanism of injuries, collision, crash-helmet, aetiology, prevention

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This article is available online at: <http://www.mjz.co.zm>, <http://ajol.info/index.php/mjz>, doi: <https://doi.org/10.55320/mjz.50.3.422>

The Medical Journal of Zambia, ISSN 0047-651X, is published by the Zambia Medical Association

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cultural, and environmental factors in the same country. Mandibular fractures are the second most frequent facial injury, accounting for 15.5% to 59% of all facial fractures globally<sup>1-4</sup>.

Mandibular fractures occur commonly in Nigeria. Olosoji et al<sup>4</sup>, Adebayo et al<sup>5</sup> and Oginni et al<sup>6</sup> reported mandibular fractures accounting 66.02%, 68% and 69.13% respectively of all maxillofacial injuries in their studies. Most mandibular injuries in Nigeria are due to crashes<sup>7,8,9,10</sup> on slick roads, reckless motorcycle riding, and driving while intoxicated.<sup>11,12</sup> Complications arising from mandibular fracture such as Chronic pain, chewing and obstructive airway, prolonged hospital stay, loss of work hours and worsened social qualities of the patients and place a huge economic burden on treatment of mandibular fracture<sup>7,8,13,14,15-17</sup>

Despite many reports about the incidence, diagnosis, and treatment of mandibular fracture, there is scarcity of studies investigating the pattern of mandibular fractures in Kwara State North-Central Nigeria. The purpose of this study was to describe the frequency and pattern of mandibular fractures seen in a Tertiary Health Institution in North Central Nigeria.

Understanding the epidemiological pattern in our geographical location will help evidence-based approach to prevention and treatment of mandibular fracture in our environment and different environment.

## MATERIALS AND METHODS

Patients with mandibular fractures who visited the dental unit of the University of Ilorin Teaching Hospital, North central Nigeria between January 2018 and December 2021 were included in this retrospective study. Records of patients presenting with developmental disorders or pathological fractures were excluded. A specially designed proforma was used to collect the data. Data of interest were patients demographic, anatomic fracture site based on clinical and radiological findings, agent of injury, the use of a protective

helmet, weekdays and month of presentation, the loss of consciousness at the time of the injury, and the length of hospital stay and treatment modalities and complication

The fractures were classified based on the type of combination of fracture and neurological status. Treatment protocol in the study centre during the study period included treatment primary closure of soft tissue defect at the time of presentation, prescription of liquid diet, antibiotics, and pain medications while definitive treatment included open reduction with miniplate and screw fixation or traction with intermaxillary fixation

The information was entered into a Microsoft Excel spreadsheet and analysed using SPSS Statistics version 22. Categorical variables were presented in numbers and percentages. Qualitative variables were compared using chi-square test.  $P \leq 0.05$  was considered statistically significant. All the experiments in this study were conducted in accordance to relevant guidelines and regulations. This research was approved by ethical review committees of Ministry of Health, Ilorin, Kwara State. ERC Approval Number: ERC/MOH/2022/10/076. Informed consent was obtained from all subjects and/or their legal guardian(s).

## RESULTS

The study sample included 75 participants with ages ranging from 2 to 70, with a mean age of  $30.69 \pm 11.22$  years and a 95% confidence interval of 28.11 to 33.27. The study population was composed of 70 males (93.20%) and 5 females (6.80%). There was no difference between the means of the gender ages in the study population  $p=0.09$ . The modal age bracket was 30-39 years (26, 34.6%) [Table 1].

Fifty one (68%) out of 75 of the study participants had Motorbike crash making it the commonest aetiology, followed by nine car crashes, 33% [Table 2]. None of motorbike riders nor passengers used crash helmet.

Table1; Age Distribution According To Sex

<b>SEX OF THE PATIENT</b>					
<b>AGE</b>	<b>MALE</b>	<b>FEMALE</b>	<b>TOTAL</b>	<b>t</b>	<b>p</b>
<b>0-9</b>	7(87.5%)	1(12.5%)	8(100%)	1.69	0.095
<b>10-19</b>	7(87.5%)	1(12.5%)	8(100%)		
<b>20-29</b>	22(100%)	0(0%)	22(100%)		
<b>30-39</b>	23(88%)	3(12%)	26(100%)		
<b>40-49</b>	7(100%)	0(0%)	7(100%)		
<b>50-59</b>	3(100%)	0(0%)	3(100%)		
<b>70-79</b>	1(100%)	0(0%)	1(100%)		
<b>TOTAL</b>	70(93.2%)	5(6.8%)	75(100%)		

Table 2; Gender distribution based on aetiology

<b>SEX OF THE PATIENT</b>			
<b>ETIOLOGY</b>	<b>MALE</b>	<b>FEMALE</b>	<b>TOTAL</b>
<b>MOTORBIKE ACCIDENT</b>	49	2	51(68%)
<b>TRICYCLE</b>	2	1	3(4%)
<b>BUS ACCIDENT</b>	3	1	4(5.33)
<b>FALL FROM HEIGHT</b>	2	0	2(2.67)
<b>FALL FROM GROUND</b>	2	0	2(2.67)
<b>CAR</b>	6	1	7(9.33)
<b>ASSAULT</b>	5	0	5(6.67)
<b>HIT BY ANIMAL</b>	1	0	1(1.33)
<b>TOTAL</b>	70	5	75(100)

The para-symphyseal region, at 25 (22.32%), was the second-most frequent fracture site after the mandibular body, at 48 (42.86%). The least affected sites were the condyle and dentoalveolar region accounting for 2(1.79 %) and 5 (4.46%) respectively. No coronoid fracture was observed in the data figure 1.

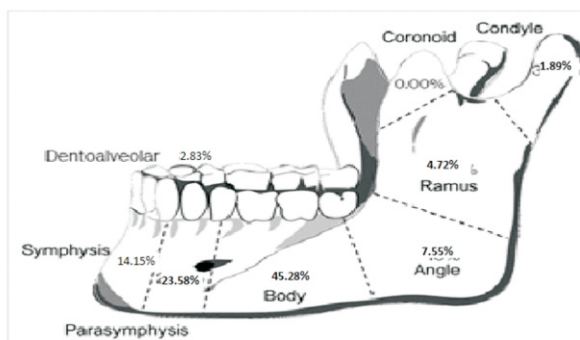


FIGURE 1; Distribution Of Mandibular Fractured Sites

A total of ninety-nine fractures out of one hundred and six fractures were observed in males. There was no statistically significant correlation between the aetiology and the different types of fractures ( $p=0.898$ ) (Table 3). One hundred percent multilateral type of fractures were due to motorbike accident (figure 2).

All ramus fractures occurred from motorbike accident and 75 % ( 79.5) of the body fracture was due to motorbike crash. The right and left parasymphysis 6.8%(7) was the commonest fracture combination followed by the right and left body fracture 4.1%(4) and the body and angle fracture 4.1%(4) respectively (Figure 3). Majority of the patients had unilateral mandibular fractures 46(61.33%)

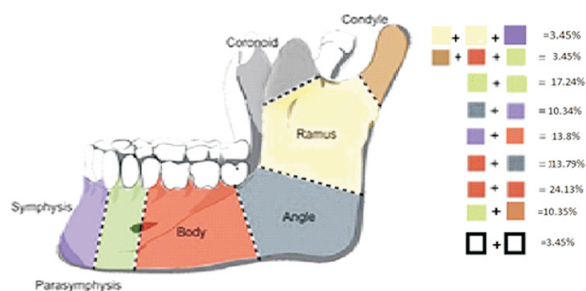
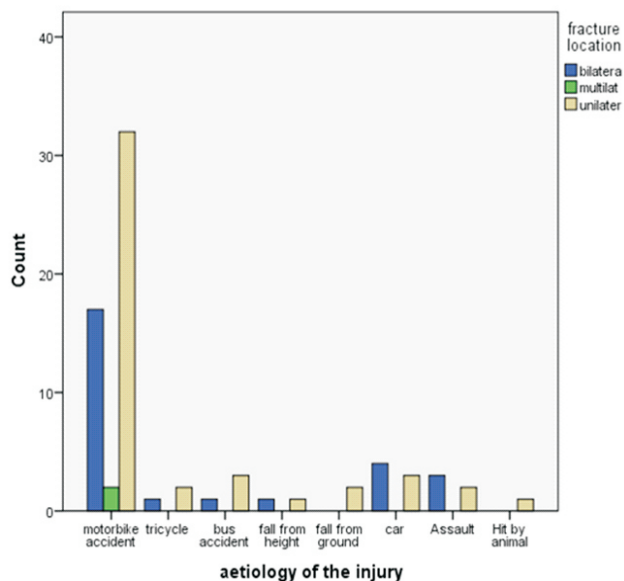


Figure.3; Distribution Of Combination Of Mandibular Fractures



Fischer's exact test  $p=0.898$

Figure 2; Pattern of fracture type of mandibular fracture based on the aetiology

Most patients 44(58.6%) sustained mandibular fractures during the fourth 24(31.9%) and third 20(26.7%) quarters of the years. The modal month was November 13(17.3%) (Figure 4).

The majority of the participants 48 (64%) presented within the first week of their injuries Twenty-six-point seven percent (20) of participants presented less than 24 hours of being injured (Figure 5). In 25 (33.3%) of the patients, there was an associated altered level of consciousness (Glasgow coma scale less than 15). A few 28(37.25%) of the motorbike accident victims and majority 43 (57.14%) of car accident victims had some level of

loss of consciousness. Hundred percent of patients with multilateral fractures were brought in unconscious (Figure 6). There is no statistically significant relationship between level of consciousness and aetiology ( $p=0.818$ ) or fracture type ( $p=0.075$ ).

Table 4 shows that two patients (2.7%) with fracture mal-union underwent open reduction and internal fixation, as well as 2 weeks maxillomandibular fixation. Most of the patients 57 (76%) had closed reduction and maxillomandibular fixation for six weeks. Few of them 13(17.3%) had slow reduction with rubber traction for one to two weeks before closed reduction with maxillomandibular fixation. The mean of hospital stay was 10.33 days  $\pm$ 13.61. The commonest complication associated with closed reduction was trismus and one patient needed corrective surgery for malocclusion

## DISCUSSION

In this study, we discovered that the age distribution is similar to previous reports<sup>7-10</sup>, with males between the second and third decades of life having the highest prevalence of mandibular fractures. The low incidence in younger patients might be due to lower likelihood of prevailing mechanism of injury and bone elasticity in younger age group.

The majority of patients in the current study presented within the first week of their injuries, which is consistent with Oginni et al<sup>18</sup> 2006 and Oginni et al<sup>6</sup> 2016 and many literature in Nigeria. This is however due to referral system in our setting where managing teams could not decide who among to refer to the next level of care and complicated by the concomitant injury at presentation. The delay in presentation might also be due to economic constraint and lack of appropriate transportation from the primary contact to tertiary facilities.

Despite the fact that maxillofacial fractures occurred throughout the year, a peak was seen in November, the fourth quarter (a dry season month in the north central of Nigeria. This period corresponds to end of the year when festive mood such as wedding and

Christmas that take place.

In this series, majority of participants that were involved in car accidents had altered level of consciousness but regained consciousness after 24hours. Although the Glasgow coma scores may be a predictor of severity of injuries, our research indicates that car accident was likely to cause altered level of consciousness.

The most common kind of collisions still include motorbikes and other vehicles. However, the percentage caused by motorbike collisions is comparable to earlier reports from Nigeria.<sup>19, 20</sup> nevertheless, less so than findings from certain other low- to middle-income nations<sup>21,22</sup> and high-income countries.<sup>23,24</sup> Our study reports 33/75(44 %) head on collision between two motorbikes which was higher than what Oluwadiya et al<sup>27</sup> reported 83 (22.3%) in their study, this might be due to risky behaviour of motorbike riders such as driving against traffic, neglecting to utilize headlights in low-light conditions, riding without a license, and driving while intoxicated although most of them were not captured in this study.

According to this study it was noted that most fractures occurred in the body (42.2%), accounting for about half of the recorded injuries. This is in agreement to some other Nigerian studies<sup>4, 11</sup>. Chaurasia et al<sup>8</sup> and Barde *et al*<sup>6</sup>, however found the parasymphiseal region ranged from 39.8 % to 40.3% to be the commonest fracture site in their geographical location. Coronoid fractures have been reported by various literature as the least mandibular fractures, this is attributed to the protected position it occupies deep under the zygomatic complex and muscle buttresses<sup>27</sup>. We did not record any coronoid fracture in this study. Although Singh et al<sup>28</sup> and Shein et al<sup>29</sup> reported incidence of 1.23-3.58% of coronoid fractures in their studies,

The most frequent mandibular fracture combination in our analysis was the right and left body 24.13% fracture. In contrast, Para symphiseal and Angle Fractures were shown to be the most frequent

mandibular fracture combination by Sirimaharaj et al.<sup>3</sup> and Natu et al where the most frequently encountered fracture combination was parasymphseal fracture and subcondylar fracture<sup>15</sup> This difference in the common site of fractures could be attributed to difference in mechanism of impact prevalent in various geographical locations and also major aetiologies in these locations.

The relationship between the injury's mechanism and the mandibular fracture site is statistically significant ( $p=0.001$ ). 100% of the fractures of the ramus occurred due to motorbike accident while 81.5% of the body fracture was attributed also to motorbike crash. 66.6% of the condylar fractures were because of fall from ground. The different aetiologies' result in different focus of impact hence the hence the association and other external factors that were not captured such as the magnitude, direction, and force of the impact<sup>30, 31</sup> and internal factors such as mouth opening<sup>32, 33, 34</sup> dental states such as third molar impaction<sup>35, 36</sup> and characteristics of the bone itself, such as pathological processes, physiological atrophy, and osteoporosis<sup>30</sup> might also be due to the association. However, just a few investigations explored the mechanism underlying mandibular fractures.<sup>30, 32, 32</sup>

The growing population and urbanization in Nigeria with the limited Government funded and regulated public transportation system have led to the proliferation of the less organized commercial motorcycles and tricycles as a means of movement of people and products within a city. The combination of inherent risk in motorcycle and tricycle, poor compliance on traffic rules by users and bad roads leads to increased road traffic crashes and injuries.<sup>10</sup> All these factors participate in the number of mandibular fractures seen and the pattern of its epidemiology. Efforts should be geared to reduction of environmental (e.g. unsafe road; road design faults, large pothole) and behavioural risk-factors (e.g. alcohol consumption, high speed, poor maintenance of the vehicle, poor driving skills, noncompliance of wearing of crash-helmet etc.) for

mandibular fractures and this may have a great impact on prevention.

In the current study, maxillomandibular fixation was the most often used type of treatment. Slow reduction with elastic band was used for grossly displaced fracture for about week before immobilization for six to seven weeks. Only a small number of individuals received open reduction and internal fixation. This was due to the financial capability of the patients. The majority could not afford the cost of a kit for internal fixation. None of patient treated with open reduction and internal fixation had complication. There was no scar formation in our study because it was intraoral approach

The study was not left out of limitation. It was a single centre designed study. Some information such as impact's size and direction of the agent of injury could not be measured. The intrinsic bone characteristic like physiological atrophy, osteoporosis and pathological processes could not be ascertained. These are tough variables to measure. The mechanism of the mandibular fracture should therefore be the subject of multicentre prospective clinical investigation in the future.

## CONCLUSION

The pattern of mandibular fracture was highly related to the age and sex while the level of consciousness was correlated with either aetiology or fracture type. The study also demonstrates that the primary mechanism of injury for the cause of mandibular fractures was head-on collision between two motorcyclists, and none of the victims wore a crass helmet. The mandibular body was most severely impacted. Educational programs that inform commercial motorbike riders of the high-speed restriction and place a strong emphasis on the use of crash helmets should be advocated. The findings of this epidemiological pattern will help evidence-based approach to prevention and treatment of mandibular fracture in our environment and different environment

### Conflict of Interest.

All authors declare that they have no conflicts of interest.

### Author Contributions

Conceived and designed the experiments: **Adeyemi MF (BDS)**.

Analysed the data: **Igben Ehigie**

Wrote the paper: **Adeyemi MF (BDS)**

Substantial contribution to acquisition of data: **Nnebedum Mirian Nneamaka**

Critically revised article for important intellectual content: **Garba Ashiru**

Critically reviewed the manuscript: **Ernest MA, Sanni-Abdullahi SO**

Approved the final version of the manuscript: **Adeyemi MF (BDS)**

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