Original Article

Crash Characteristics and Pattern of Motorcycle Related Facial Bone Fractures in a Sub-Urban Nigerian Teaching Hospital

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ABSTRACT

Context: Recent studies indicated that significant proportion of facial fractures attributed to road traffic mishaps in the middle- and low-income countries are caused by motorcycle (MC) crashes. However, there is limited information on crash characteristics of such injuries. This study was designed to examine the crash characteristics, pattern of fracture, and sociodemographics of patients with facial bone fractures due to MC crashes in our institution. **Subjects and Methods:** Data on patients' sociodemographics, pattern of presentation, type(s) of fracture, patient status, crash characteristics, level of consciousness, and treatment offered were collected and analyzed. **Results:** A total of 151 patients, aged 7–59 years were reviewed during the study period. A male preponderance was observed (M:F = 4:1) and the patients were predominantly motorcyclists (64.8%, $n = 98$). The most common mechanism of crash was collision with another MC (51.6%, $n = 78$). A total of 194 fractures were reviewed and the mandible (58.8%, $n = 114$) was more commonly affected than the midface (41.2%, $n = 80$). The predominant site on the mandible was the body (31.6%) while zygoma (32.5%) was the most affected part of the midface. Patient status was found to have a statistically significant relationship with loss of consciousness ($P = 0.02$). Eighty-two fracture sites (42.3%) were managed with open reduction and internal fixation. **Conclusions:** Facial bone fractures occur in a significant proportion of MC crashes and riders are predominantly affected. In addition, a larger proportion of commuters rarely wear crash helmet which could have offered protection. Continual advocacy on preventive measures and enforcement of road safety regulations is hereby advised.

KEYWORDS: *Facial bone, fractures, motorcycle*

INTRODUCTION

It has been documented that injuries will likely become the fourth leading cause of mortality and disability worldwide by 2030.[1] Low- and middle-income countries are said to be disproportionately affected, accounting for a significant proportion of the overall injury-related mortality.[1-4] Most of these deaths are attributable to road traffic crashes (RTC) involving the vulnerable road users.[5-8] Facial bone fracture constitutes a substantial proportion of trauma globally, and it often results in serious morbidity and sometimes fatal consequence.[3,9,10] These injuries pose a huge economic burden due to treatment costs, rehabilitation, disabilities, and man-hour loss occasioned by hospital stay.[3,7]

In developing countries, maxillofacial injuries due to RTC continue to rise alarmingly and motorcycle (MC) crash victims form a high proportion of those killed or injured in road mishaps.[11-16] The high incidence of oral and maxillofacial injuries has been attributed to the heavy reliance on MC as a mode of transportation in the low- and middle-income countries.[2,7,11,14-17]

There is dearth of information on crash characteristics, epidemiology, and sociodemographics of victims

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of MC-related facial fractures in Nigeria and other countries in Sub-Saharan Africa. Thus, the present study was designed to examine the relationship between crash characteristics, pattern of fractures, and sociodemographics of patients with facial bone fracture due to MC crashes in our institution.

SUBJECTS AND METHODS

The data of patients who sustained facial bone fractures due to MC crash between January 2010 and December 2014 were collected on individual proforma. The patients presented either through the accident and emergency ward or maxillofacial surgery clinic of our institution.

The information gathered included patient's sociodemographics (age, sex, and occupation), crash characteristics (type and nature of crash), pattern of fracture, radiologic diagnosis and treatment offered. Patient's status (rider, pillion passenger, pedestrian) and the number of persons on the MC at the time of crash were also documented. Level of consciousness was determined using Glasgow Coma Scale.

Diagnosis of maxillofacial fractures was achieved through clinical and radiologic evaluation. All patients had plain radiographs for radiologic evaluation. In addition, computerized tomography scan was done for those who could afford it.

Ethical approval for the study was obtained from our institution's ethical review board.

Data obtained were summarized in figures and frequency tables. Analysis was done using SPSS (Statistical Package for Social Sciences, Chicago, Illinois) version 20. Descriptive statistics and Chi-square test were carried out and the level of significance was set as $P < 0.05$.

RESULTS

One hundred and fifty-one patients with MC-related facial fractures presented during the study period. There was a male preponderance of 120 to 31 (M: F 4:1). The mean age of the patients was 23.52 ± 9.61, while the peak age range was 20–29 years [Figure 1]. A greater proportion of injured patients were MC riders (64.8%, $n = 98$). Furthermore, most of the victims (56.3%, $n = 85$) in this series were unemployed youths [Figure 2].

The most common mechanism of injury was collision with another MC (51.6% $n = 78$). Collision with motor vehicle and other objects accounted for 17.8% and 24.5%, respectively [Table 1]. Pedestrian injury accounted for just 6.0% ($n = 9$) of the study population. Only 17.2% ($n = 26$) of the victims claimed to have crash helmet on their head at the time of crash. Further examination of the crash characteristics revealed that nearly half (47.0%, $n = 71$) of the patients claimed that the MC was carrying 3 or more persons at the time of crash [Table 2]. However, the number of persons on the MC does not have a statistically significant relationship with fracture pattern ($\chi^2 = 0.24$, $P = 0.8$).

One hundred and ninety-four fracture sites were reviewed giving an average of 1.3 fractures per patient. The most commonly encountered sites of fracture were in the mandible (58.8%, $n = 114$) compared to the midface (41.2%, $n = 80$). Table 3 showed that the predominant site on the mandible was the body (31.6%) followed by the dentoalveolar region (21.9%) while zygoma (32.5%) was the most
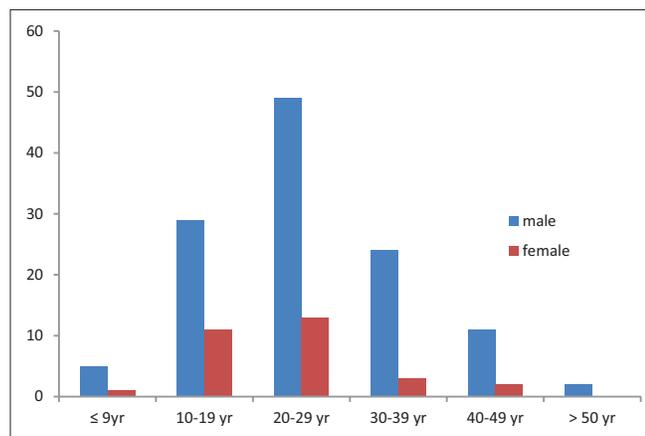
Figure 1: Patients' age and sex distribution. The figure showed the age and sex distribution of the patients. There were more males than females (male *n* = 120, 79.5% female *n* = 31, 20.5%). The predominant age group were those between 20 and 29 years in both sex categories (male 40.8%, female 41.9%). The least represented age group were those above 50 years (male 0.02%, female 0%)
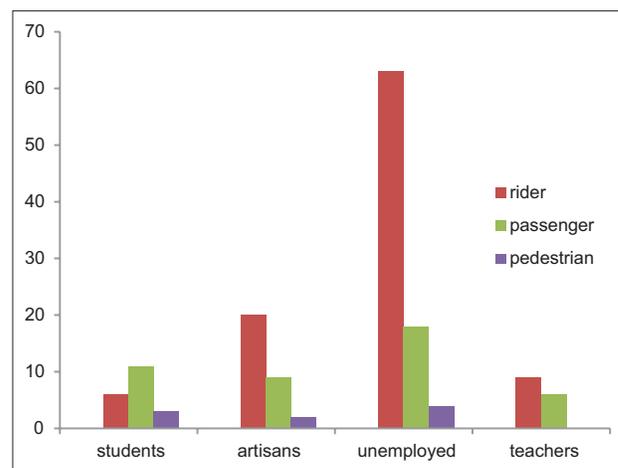
Figure 2: Status and occupation of crash victims. The charts showed that majority (*n* = 85, 56.29%) of the patients were unemployed. Artisans (*n* = 31) and students (*n* = 20) made up 20.5% and 13.3% of the patients, respectively. Furthermore, majority of those affected are motorcycle riders (*n* = 98, 64.9%) followed by pillion passengers (*n* = 44, 29.1%)

Table 1: Mechanism of collision and status of injured patients

	Number and status of patients		
	Rider	Passenger	F (%)
Mechanism of crash			
Head-on collision with vehicle	19	9	28 (18.5)
Head-on collision with other objects	13	8	21 (13.9)
Collision with another MC	56	21	77 (51.0)
Lone accident (slide and fall)	10	6	16 (10.6)
Pedestrian injury	-	-	9 (6.0)
Total	98	44	151 (100)

MC=Motorcycle

Table 2: Number of persons on motorcycle at time of crash and site of fracture

Fracture site/MC occupants	1 person	2 persons	3 persons	>3 persons	Total
Mandible	24	19	29	12	84
Midface	21	16	23	7	67
Total	45	35	52	19	151

MC=Motorcycle

Table 3: Pattern of maxillofacial fractures

Site	n (%)
Mandible	
Condyle	15 (13.2)
Ramus	-
Angle	17 (14.9)
Body	36 (31.6)
Symphysis	21 (18.4)
Dentoalveolar	25 (21.9)
Total	114 (100)
Midface	
Le Fort 1	18 (22.5)
Le Fort 11	12 (15.0)
Le Fort 111	4 (5.0)
Zygoma	26 (32.5)
Nasal bones	3 (3.75)
Dentoalveolar	17 (21.25)
Total	80 (100)

Table 4: Relationship between altered state of consciousness and status of injured patients

Patient status	Altered consciousness		Total
	Yes	No	
Rider	67	31	98
Passenger	16	28	44
χ^2, df, P	12.8, 1, 0.02		

Table 5: Relationship between altered state of consciousness and site of fracture

Site of fractures	Altered consciousness		Total
	Yes	No	
Mandible	39	38	77
Maxilla	44	21	65
χ^2, df, P	1.56, 1, 0.13		

Table 6: Treatment offered to victims of motorcycle-related crash

	Frequency (n)
Mandible	
2.4-mm miniplate osteosynthesis	43
Eyelet wiring/arch bars/MMF	41
Transosseous wiring	07
0.5-mm stainless steel wire splint	23
Midface	
Miniplate osteosynthesis	32
Circumzygomatic-mandibular suspension + MMF	12
Frontomandibular wire suspension + MMF	10
Eyelet wiring/arch bars/MMF	08
Elevation via Gillies temporal approach	06
Fronto-mandibular wire suspension + MMF	07
No active treatment	05
Total number of fractures	194

MMF=Mandibulomaxillary fixation

affected part of the midface followed by Le Fort 1 fractures (22.5%).

A total of 83 patients (54.9%) suffered altered state of consciousness and majority (77.1% $n = 64$) regained full consciousness within 24 h of admission. Further analysis revealed that patient's status (either rider or pillion passenger) was found to have a statistically significant relationship with loss of consciousness ($\chi^2 = 12.8$, $P = 0.02$) [Table 4]. On the contrary, fracture site, either mandible or midface did not have any significant relationship on altered consciousness ($\chi^2 = 1.56$, $P = 0.13$) [Table 5].

A higher proportion of the patients (57.7%, $n = 112$) were treated conservatively with either mandibulomaxillary

fixation (MMF), a combination of MMF with internal wire suspension or 0.5-mm stainless steel wire splint without MMF [Table 6]. Eighty-two patients (42.3%) had open reduction and internal fixation which was achieved predominantly with miniplate osteosynthesis (*n* = 75).

DISCUSSION

The poor state of roads, harsh economic condition, lack of efficient public transport system, and rising spate of youth unemployment have popularized the use of MC for road transport in Sub-Saharan Africa.[2,3,7,18] Although previous studies from Nigeria have reported the pattern of facial injuries sustained by MC crash victims,[4,15,16,18] none has been able to relate the crash characteristics to the pattern of injuries and status of patients involved in such crashes. Thus, a holistic appraisal and characterization of MC-related injuries is necessary to develop strategy on prevention and enforce adherence to road traffic safety regulations.

In agreement with similar studies, we found a high male preponderance and the victims were predominantly below 30 years of age.[4,7,11,16,19-21] It has been argued that the male gender tends to be more adventurous and likely to indulge in injury prone adventures such as dangerous driving and use of automobile for commercial purposes. Furthermore, majority of the patients in this research were mostly unemployed youths. This view was also shared by some Nigerian authors[3,4,14,16] and other countries in Sub-Saharan Africa.[2,7] Rising youth unemployment, rural/urban migration, and attendant economic hardship have spurred many youths into riding MCs for commercial purpose in Nigeria.[3,14,22] These MCs are often procured with ease through hired purchase or differed payment system.

In this study, we found that majority of the crashes were due to collision with another MC (51.0%) followed by collision with motor vehicles (18.5%). This is comparable with the findings of Chichom-Mefire *et al.*[2] and Oginni *et al.*[4] who reported that collision with other automobiles represented 60% and 58% of all crashes, respectively. The high rate of collision involving MC and motor vehicles in this study corroborates the vulnerability of MC to other motorized road users. Moreover, MC riders are always impatient and often do not obey traffic signs and regulations. Furthermore, most Nigerian roads are designed for motor vehicle use without designated bands for MC, thus the MC shares the available portion with vehicles, thereby predisposing the road users to crash. The classical skid and fall of lone MC crashes were however low in this study.

Although there was a low utilization rate of helmet (17.2%) in this study, it is, however, higher than previous studies which reported poor adherence to protective measures in Sub-Saharan Africa.[2,4,16,18] This differs considerably from the high-income nations where helmet use is strict and mandatory for all MC riders and pillion passengers.[11,23,24] Studies have shown that MC helmets reduce the risk of head injury and mortality following crash, although these effects may be modified by other crash factors such as speed.[11,17,23-25] While the health benefits of crash helmets have been widely reported by various researchers,[11,21,23-27] its use has not been embraced in Nigeria despite preexisting legislation.

The effect of the number of pillion passengers on crash characteristics has not been examined sufficiently by previous reports because it is often assumed that MCs do not carry more than one passenger. Majority of the MCs involved in this series had more than one pillion passenger at the time of crash. This is similar to reports by Chichom-Mefire *et al.*[2] but contrary to the finding of Oginni *et al.*[16] Multiple pillion passengers increase the weight carried by the MC beyond its capacity, rendering it less stable and prone to accidents. Although it can be argued that excess passengers reduce the motility of the automobile and hence impact of collision, thereby limiting the severity of injuries sustained in such circumstances.

The pattern of facial bone injuries revealed a higher preponderance of mandibular fractures compared to the midface. Several authors have attributed the higher prevalence of mandibular fractures to the mobility and prominence of the bone.[2-4,6,7,10,14] In agreement with similar reports,[3,14,16] the body of the mandible was the most commonly fractured part of the bone. Furthermore, we found that zygomatic bone was the most commonly fractured bone in the midface. This corroborated the findings of previous facial trauma surveys on the prevalence of zygomatic bone fracture.[3,6,10] The prevalence of zygomatic bone fractures may be due to the prominence of the bone in the midface and hence its proneness to fracture.

In general, the prevalence of head injuries is rarely reported in most maxillofacial surveys. Few studies have reported concomitant loss of consciousness in patients with facial bone fractures due to automobile crash.[13,28,29] The proportion of those who suffered loss of consciousness in this study is comparable to similar reports.[28,29] Furthermore, we found that a statistically significant proportion of those who had loss of consciousness were riders. MC riders are often the first person in the line of crash and they are at risk of suffering more fatalities during collision. The incidence of head injury has also been linked to the impact of collision, especially in nonhelmeted individuals.[13]

Seventy-five fractures (38.7%) were treated definitively with miniplate osteosynthesis; this showed that the use of bone plates for maxillofacial fractures in Nigeria has gained ground considerably compared with previous reports[6,14] where MMF was the mainstay of facial bone fracture management.

Conclusions

Facial bone fractures occur in a significant proportion of MC-related crashes and motorcyclists were predominantly affected. In addition, a larger proportion of commuters rarely wear crash helmet which could have offered protection. Continual advocacy on preventive measures and enforcement of road safety regulations is hereby advised.

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Conflicts of interest

There are no conflicts of interest.

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