# Computed Tomographic Evaluation of Facial Fractures in Head Injured Patients following Motorcycle Accidents seen in a Nigerian Tertiary Hospital

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ABSTRACT

**Aim**: This study aims to determine the prevalence and nature of facial fracture associated with head injury as seen in motorcycle accident using a cranial CT scan.
**Patients and Methods**: This was prospective study carried out at the University of Benin Teaching Hospital on patients who were involved in motorbike accident with history of head injury and associated injury to the face necessitating a cranial Computed Tomographic scan.
**Results**: A total of one hundred and six patients made up of 99 (93.4%) males and 7 (6.6%) females were recruited. The male to female ratio was 14:1. The mean age of the study population was 36.3 years ± 1.3 years (range18 years to 80 years). Majority (36.8%) of the patients were within the 20-29 years range followed by age group 30-39 years (22.6%). Seventy-three (73.7%) of the ninety-nine male patients were motorbike riders while 6 (85.7%) of the 7 female patients were passengers. Sixty cases had facial fractures associated with head injury representing a prevalence rate of 56.6%. Fracture of the upper third of the face - frontal bone n = 36 (57.1%) was the commonest finding on the CT scan. Eighty-one (76.4%) patients had evidence of one or more types of intracranial hemorrhage. Forty-four patients had both facial fracture and some forms of intracranial haemorrhage. Intracerebral haemorrhage 35 (58.3%) was the commonest form of intracranial haemorrhage.
**Conclusion:** There is a high prevalence of facial fractures associated with head injury in motorcycle accident victims. Males in the third decade of life are mostly affected. There is an urgent need for the regulatory bodies to enforce the existing traffic codes and engage in public enlightenment programs on the consequences of non-adherence to traffic rules.

**Keywords:** Head injury, facial fractures, motorcycle accident, computed tomography scan

## Introduction

Trauma is the leading cause of death occurring commonly in the first four decades of life and frequently associated with facial injuries. Vital structures involved in important physiologic functions such as respiration, speech, mastication, sight, and smell are located in the facial region, necessitating that serious attention be given to facial injuries (Arslan *et al*., 2014). The face is also responsible for expressed physical beauty and the care of the face has created a multi-billion-dollar industry. Furthermore, emotional distress due to aesthetic complications has been recognized as a major fall out of facial injuries. Post-traumatic stress disorder following facial injury has been reported in about 26% to 41% of adults sustaining facial injuries (Ramli *et al.,* 2014).

Studies in developed countries reveal interpersonal assault as the leading cause of facial fractures followed by motor vehicle accidents, pedestrian collisions, stumbling, sports and industrial accidents. On the contrary, road traffic accident is the leading cause of facial injuries in underdeveloped or developing countries of the world followed by assaults and other reasons including warfare (Arslan *et al.,* 2014; Mijiti *et al.,* 2014; Elarabi *et al.,* 2018).

Socioeconomic and cultural factors as well as awareness of traffic regulations and alcohol consumption are strong determinants of the incidence of maxillofacial trauma in different regions of the world (Arslan *et al*., 2014). The poor economic situation reflected in the low per capita income and increased unemployment rate have resulted in teeming youths taking to motorcycle riding as a means of income and livelihood. Furthermore, the poor state of roads has made commuters patronize motorcycle riders in order to get to their otherwise unmotorable destinations.

Documented evidence suggests that most of the riders are young males, with low education, ill prepared and ill

equipped for the roads; they do not know the traffic regulations and possess little or no riding experience. This has resulted in a steady increase in the incidence of motorcycle related maxillofacial injuries (Iribhogbe and Odai 2009; Abiodun, Atinuke and Osuagwu, 2012). Accidents due to motorcycles riding especially in developing countries like Nigeria have continued to increase every year largely due to the fact that the motorcyclists do not follow the traffic rules and they in their mentality believe they are "the king on the roads" (FRSC 2007). One third to half of such victims in developing countries sustained various degrees of cranial and facial injuries (Fasola *et al*., 2003; Adeyemo *et al.,* 2005).

Most patients with facial injuries have associated head injury which is usually the indication for computed tomographic scan. Computed Tomographic (CT) scan has been described as the gold standard for head injury and it is essential for evaluating suspected facial fractures where plain radiographs appear normal (Ogunseyinde, Obajimi and Ogundare, 1999; Agunloye *et al.,* 2003). While CT scan has the burden of radiation exposure its excellent bony details makes it indispensable in evaluation of facial fractures. Cooper, Kassel and Gruss in 1983 demonstrated the importance of high-resolution CT scan in facial fractures and its benefit of making surgical outcome better.

Our hospital is a level one trauma center serving three states with a population well over 6 million people and has a functioning CT scan machine. Motorcycle popularly known as 'okada' in the local parlance is a widely used mode of transportation in this area with its attendant risk of high accident rate due to flagrant disregard for traffic safety rules by riders (Iribhogbe and Odai 2009). This study aims to determine the prevalence and nature of facial fracture associated with head injury as seen in motorcycle accident using a cranial CT scan.

## Methodology

This was a hospital based prospective study carried out at the accident and emergency unit of the University of Benin Teaching Hospital. Approval was obtained from the ethical committee of the hospital.

Study participants were patients who were involved in motorbike accident with head injury and associated injury to the face necessitating a cranial computed tomographic (CT) scan. For the purpose of this study, motorcycle injury was defined as any injury sustained in a road traffic accident (RTA) involving a motorcycle in which the victim is either the rider or passenger.

All patients with head injury and suspected facial fracture were recruited. Each patient had cranial CT scan done with 5mm axial slices taken from the root of the neck to the vertex of the skull with the CT gantry angulated to properly image the mandible alongside. The images were examined using both brain and bone windows by two radiologists.

For the purpose of this study the face was divided into upper third (frontal bone), middle third (nasal, maxillary, orbital and zygomatic bone), and lower third (mandible).

Findings from the CT scan images and demographic data were documented in a data-capture form and then entered into a Microsoft spreadsheet and data were analyzed using IBM SPSS Statistics 21. The data were analyzed using descriptive statistics.

## Results

Table 1 shows the demographic and clinical characteristics of study participants. A total of one hundred and six patients made up of 99 (93.4%) males and 7 (6.6%) females were recruited. The male to female ratio was 14:1. The mean age of the study population was 36.3 years ± 1.3 years (range18 years to 80 years). The mean ages for the males and females were 36.3± 1.3 years and 36.4 ± 1.4 years respectively. Majority (36.8%) of the patients were within the 20-29 years range followed by age group 30-39 years (22.6%). Those below 20 years and above 69 years had the lowest incidence of fracture (3% and 1% respectively). Seventy-three (73.7%) of the ninety-nine male patients were motorbike riders while 6 (85.7%) of the 7 female patients were passengers (Table 2).

Table 1: Demographic and clinical characteristics of study participants

| Variable | n (%) |
|---|---|
| **Gender** | |
| Male | 99 (93.4) |
| Female | 7 (6.6) |
| | |
| **Age** | |
| 10-19 | 3 (2.8) |
| 20-29 | 39 (36.8) |
| 30-39 | 24 (22.6) |
| 40-49 | 27 (25.5) |
| 50-59 | 7 (6.6) |
| 60-69 | 4 (3.8) |
| 70-79 | 1 (0.9) |
| 80-89 | 1 (0.9) |

| | |
|---|---|
| **Residence** | |
| Urban | 78 (73.6) |
| Rural | 28 (26.4) |
| **Fracture associated with head injury** | |
| Yes | 60 (56.6) |
| No | 46 (43.4) |
| **Side involved in facial fracture** | |
| Left | 38 (60.3) |
| Right | 25 (39.7) |

**Table 2: Distribution of gender to patient's status**

| | Male | Female |
|---|---|---|
| Rider | 73 | 1 |
| Passenger | 26 | 6 |
| Total | 99 | 7 |

Out of the 106 head injured patients with suspected facial fractures, 60 cases had facial fractures associated with head injury representing a prevalence rate of 56.6% (Figure 1). Figure 2 shows the distribution of the type of facial fracture sustained. Fracture of the upper third of the face - frontal bone n = 36 (57.1%) was the commonest finding on the CT scan. The lower third of the face was the least involved with only two cases (3.2%). The frontal bones 36 (52.9%) and the parietal bones 19 (27.9%) were the commonly associated cranial fractures observed on the CT scan (Figure 3).
Eighty-one (76.4%) patients had evidence of one or more types of intracranial hemorrhage (Figure 4). However, only 44 (54.3%) of these eighty-one patients had intracranial hemorrhage associated with any form of facial fracture


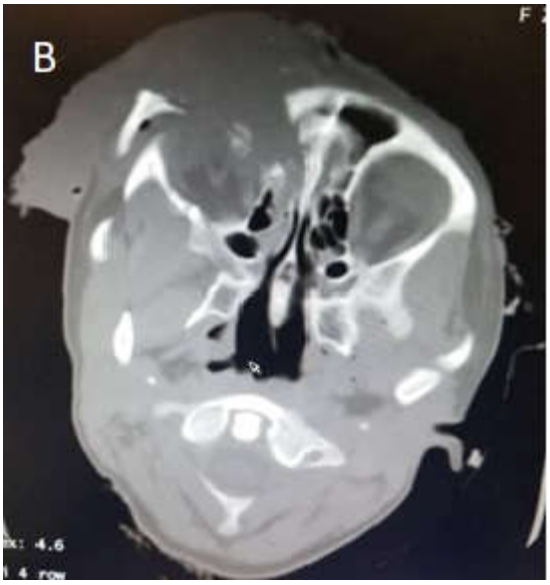


Figure 1: Axial section of CT scan showing mandibular fracture (A) and right superior orbital rim fracture (B).

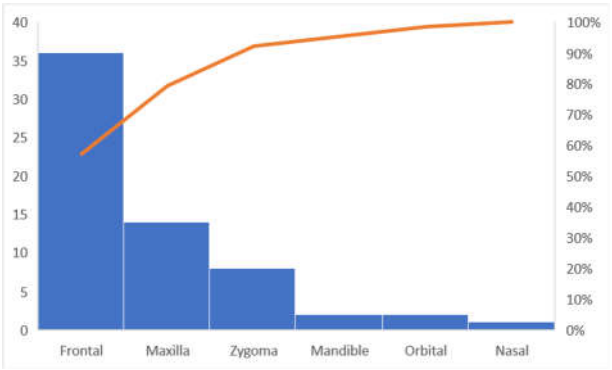


**Figure 2: Distribution of fractures among the facial bones.**

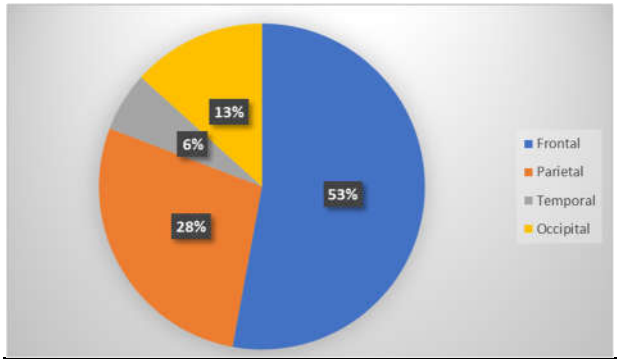


Figure 3: Distribution of associated cranial fractures.

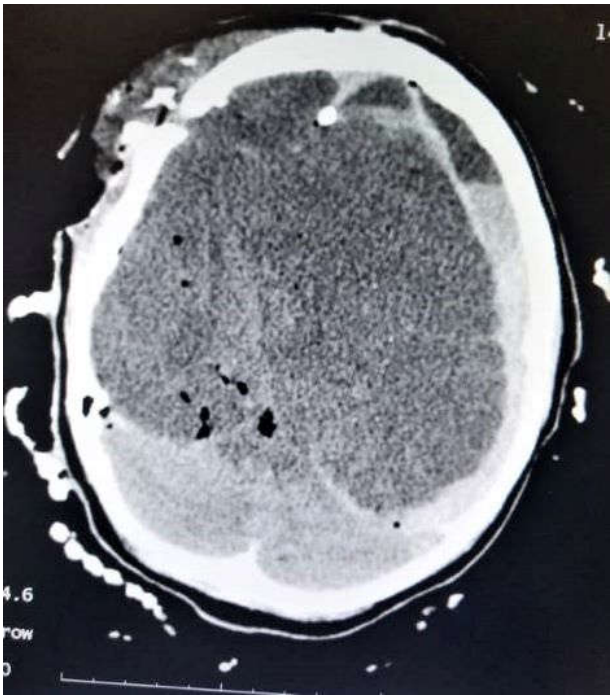

Figure 4. Acute on chronic subdural haematoma in left frontal area with linear fracture of right frontal bone.

(Table 3). Forty-four patients had both facial fracture and some forms of intracranial haemorrhage. Intracerebral haemorrhage 35 (58.3%) was the commonest form of intracranial haemorrhage followed by subdural haemorrhage 10 (16.7%) (Figure 5). Only one case of intraventricular haemorrhage was documented. The frontal lobe was the commonest site of haemorrhage in these head injured patients with facial fractures while the cerebellar lobes and the midbrain were the most uncommon sites of haemorrhage (Figure 6).

Table 3: Distribution of intracranial haemorrhage in relation to fracture.

| | Presence of intracranial haemorrhage | |
|---|---|---|
| Presence of Fracture | Yes | No |
| No | 9 | 37 |
| Yes | 16 | 44 |
| Total | 25 | 81 |

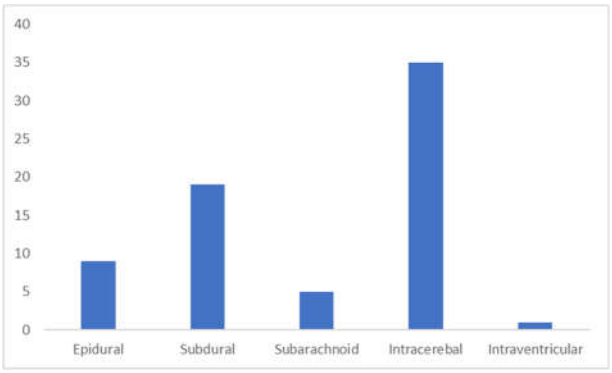


Figure 5: Distribution of intracranial haemorrhage.

## Discussion

The predominant causes of facial fractures and injuries vary from one geographical location to another and among different age groups (Udeabor et al., 2014). Factors such as socio-economic activities, the seasons of the year, alertness of the rider/driver, degree of obedience of traffic rules, usage of alertness-modifying substances, and usage of safety gadgets are contributory to the various causes (Obuekwe et al., 2003).

In the last two decades, there has been a drastic increase in the use of motorbike as a means of commercial transport both in the urban and rural areas of Nigeria. This is attributable to the low socio-economic capacity of the general populace with purchase of vehicles out of the reach of many, and the trend of politicians donating new motorcycles as part of constituency projects to the teeming unemployed youths. Furthermore, the very deplorable state of the roads makes it inaccessible for vehicular movement, thus making the use of motorbikes a viable alternative. However, there seems to have been a lapse of responsibility on the part of the government to properly regulate the activities of the motorbike riders – traffic test and issuance of authentic rider's license, use of helmet, and road worthiness assessment of the motorbikes. This failure of the regulatory agency has resulted in cases of motorbike accident due to reckless riding, over speeding, drunkenness, disobedience to traffic rules and non-usage of helmet by motorbike riders.

Abiodun et al., (2012) and Batista et al., (2012) documented a higher prevalence of maxillofacial trauma in the third decade of life in Ibadan, southwest Nigeria and in Brazil respectively. This is in agreement with our study and it is also corroborated by other authors. Chalya *et al.,* opined that the higher frequency of maxillofacial injuries in the third decade may be adduced to the fact that people in this age

group are more active regarding sports, fights, violent activities, industry and high speed transportation while Abiodun et al5 deduced that the higher incidence in this age group may be due to the inexperience of our youth, or recklessness amongst young motorcyclists who are sometimes seen to compete when riding on the road.

Furthermore, this study showed a higher prevalence of facial fractures in males with a male to female ratio of 14:1. This is higher than 3:1 reported by Abiodun, Atinuke and Osuagwu (2012) in Southwest Nigeria, 3:1 reported by Udeabor *et al,* (2014) in Rivers State, Southern Nigeria, 2.5:1 reported by Etetafia and Odai, (2014), in Delta State, Southern Nigeria, 2.7:1 reported by Chalya et al., (2011) in Tanzania and 7.7:1 reported by Kamulegeya *et al,* (2009) in Uganda (7.7:1) but lower than that reported by Taiwo *et al,* (2013) in Northwest Nigeria (19:1). However, Fasola *et al,* (2003) studied the trend of maxillofacial injuries and related the recent tendency of equal male: female injury ratio to an increasing percentage of women in the workforce. The Nigerian census showed that there are more males than females in the country and the males are seen as breadwinners in most Nigerian societies. Hence, males are more likely to engage in bike riding than their female counterpart. In fact, of the seven females seen in this study only one was a rider while the remaining six were passengers.

Further analysis showed that more passengers than riders sustained facial injury. This is in consonance with the findings of Agbor *et al,* in 2014 in the Cameroonian population but in contradistinction to the study of Oginni *et al,* 2006 in Northwest and Northeast Nigeria. Agbor *et al,* 2014 opined that the passenger is more likely to sustain facial injury as there is less visibility of the anterior view and less likely to make any movement that will reduce the injury. It could also be due to the fact that the rider is more likely to envisage an accident happening since he is in control of the motorbike. Hence, by natural instinct, may swerve away from the impact thereby exposing the passenger. However, Nwadioro *et al,* in 2011 showed equal risk of sustaining injury by both riders and passengers in a study conducted in Jos, North central Nigeria.

Our study showed that the bone of the upper face (frontal) was the most fractured facial bone. This is at variance with most other studies which showed the lower facial bone (mandible) as the most fractured. The mandible is the only moveable facial bone, and has a highest propensity of being fractured than the other well-articulated facial bones. However, the frontal bone has a wider surface area compared to other facial bones and may account for its higher susceptibility to fracture on impact as documented in this study. Furthermore, motorbike accident as the cause of fracture in this study may also be responsible for the preponderance of frontal bone fracture as most victims of this accident will most likely fall forward and hitting the floor with the most superior part of the face which is the frontal bone. However, the authors are not unaware that the selection criterion of the head injured patient might have biased the pattern of fracture sites observed in the study.

Regarding fractures in the mid-facial region, factures of the maxilla were the most common, followed by fractures of the zygoma while nasal fractures were the least in this study. The maxilla has been documented to be the most commonly fractured mid-facial bone (Kamuleyega, Lakor and Kabenga 2009). However, some studies have documented the zygoma as the most commonly fractured mid-facial bone Nwadioro *et al,* 2011; Mesgarzadeh *et al,* 2011). Furthermore, the associated cranial fractures were more than the facial fracture and frontal bone was the commonest, followed by parietal bone. Abiodun et al 5 also documented more cranial fracture than facial fracture in RTA patients. However, temporal bone was the most fractured cranial bone in that study. Our study also showed that most of the facial and cranial fractures were more on the left side of the patient. This may be a chance occurrence or may be explained by the fact that most people are right handed and the motorbike rider who is such will most likely make right side movement away from the accident thereby exposing the left side of the body to the impact.

Associated intracranial haemorrhage was commonest in the frontal lobe with intracerebral haemorrhage been the commonest type. This was possibly due to the fact that frontal bone was the most fractured bone in this study and it is the bone overlying the frontal lobe.

Obajimi *et al,* in 2001 documented that intracranial haematoma was the commonest intracranial finding in patients with craniofacial fracture.

In conclusion, this study has demonstrated the enormous challenge posed to road users by motorbike. Hence, adequate steps should be taken to improve on our roads and other supporting infrastructures. The focus of the government should be to improve the socio-economic status of its citizenry such that motorbike riding should not be seen as an occupation but rather as a hobby. Furthermore, traffic rules and regulations among road users

should be strictly enforced to ensure that accident on the road is reduced to the barest minimum.

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