Analysis of Road Traffic Crashes–Related Maxillofacial Injuries Severity and Concomitant Injuries in 201 Patients Seen at the UCH, Ibadan

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Abstract

The objective of this study was to determine the prevalence of road traffic crashes (RTC)–related maxillofacial injuries, the concomitant injuries occurring with them, and to assess the relationship between the severity of maxillofacial and concomitant injuries. This was a prospective study involving 201 victims of RTC seen at the Accident and Emergency Department of the University College Hospital, Ibadan with maxillofacial injuries during the study period. Demographic data of the patients, the types of maxillofacial injuries, and concomitant injuries sustained were recorded. Severity of maxillofacial injury was determined using the maxillofacial injury severity scale (MFISS), while the severity of concomitant injuries was based on the ISS. Correlations between types and severity of maxillofacial injury and types and severity of concomitant injury were conducted to determine the predictability of concomitant injuries based on maxillofacial injury severity. Data were processed using SPSS Statistical software (SPSS, version 20.0 for windows, IBM SPSS Inc, Chicago, IL).

Maxillofacial injuries constituted 25.4% of RTC-related admission by the Accident and Emergency Department. A total of 151 (75.1%) patients who presented with concomitant injuries participated in the study. Eighty-one (53.6%) sustained injuries to more than one body region. Head injury was the commonest (99, 65.6%) concomitant injury, followed by orthopedic injury (69, 45.7%). Increasing severity of maxillofacial injury showed a positive correlation with increasing ISS. Also, positive correlation was noted with increasing severity of maxillofacial injury and presence of polytrauma ($p = 0.01$), traumatic brain injury ($p = 0.034$), and eye injuries ($p = 0.034$). There was a high prevalence of maxillofacial injuries in victims of RTC. There was a high incidence of concomitant injuries noted with these maxillofacial injuries. Significantly, this study showed a direct relationship between the severity of maxillofacial injury and head, ocular and polytrauma. This study further emphasizes the need for thorough examination of patients presenting with RTC-related maxillofacial injuries.

Keywords

- road traffic crashes
- concomitant injuries
- severity

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Road traffic crashes (RTC) is the leading cause of maxillofacial injuries in Nigeria.¹ These injuries seldom occur in isolation, and literature abounds with reports of other nonfacial injuries often occurring in association with facial injuries.²⁻⁵ Therefore, optimum care of a maxillofacial trauma patient would entail careful detection of all injuries. In an emergency situation, however, examination of the multiply injured patient could be daunting and the risk of underdiagnosis is high.^{2,3} Hence, it could be advantageous to have reliable indicators of injuries as pointers to other injuries that might otherwise be missed.

Oral and maxillofacial injuries occur at varying degree of severity.⁴ Therefore, it could be useful to categorize patients into different levels of severity to elucidate the importance of trauma mechanisms and possibility of associated nonfacial injuries. Also, a correlation between types and severity of maxillofacial injuries and nonfacial injuries could provide a clinical guide for the oral and maxillofacial surgeons during examination of a multiply injured patient and therefore aid in dispensing appropriate measure of care to individual patient. This study was executed to assess the severity of RTC-related maxillofacial injuries and determine the relationship between the severity of maxillofacial injury and concomitant injuries.

Patients and Methods

Patients presenting with RTC-related maxillofacial injury were recruited from the Accident and Emergency Department and the Oral and Maxillofacial Surgery Clinic of the University College Hospital (UCH), Ibadan, over an 8-month period. Participants were examined for concomitant injuries. Those who were found with concomitant injuries were further assessed to grade the severity of the injuries. Excluded were patients who died before detailed assessment and those from whom consent could not be achieved. Demographic information and details of the mechanism of injury were obtained from patients where possible, eye witnesses and/or attending relatives. Definitive diagnosis followed clinical and radiological examination including plain radiographs and

computed tomography where appropriate. Severity of maxillofacial and nonfacial injury was recorded using the maxillofacial injury severity score (MFISS)⁵ and injury severity score (ISS),⁶ respectively. The study protocol was approved by the University of Ibadan/UCH Joint Ethics Review Committee before the commencement of the study. Consent was obtained from all participants before recruitment.

Data Analysis

Data collected were analyzed using the SPSS Statistical software (SPSS, version 20.0 for windows, IBM SPSS Inc, Chicago, IL). Statistical correlation between severity of maxillofacial injury and concomitant injury was assessed using Spearman correlation coefficients. For all analyses, statistical significance was established at a p -value < 0.05.

Results

During the study period, a total of 1,290 trauma patients were admitted to the Accident and Emergency Department out of which 791 (61.3%) were RTC-related injuries. Of the RTC-related injuries, 201 patients (25.4%) presented with maxillofacial injuries; 151 patients who sustained concomitant injuries participated in the study with a male to female ratio of 4.8:1. The mean age of the participants was 30.3 ± 14.3 years. Maxillofacial injuries were most prevalent in the 31 to 40 years age group which accounted for 33.9% of the participants, while 47 patients (31.1%) were between 21 and 30 years of age (►Fig. 1). Motorcycles were the most commonly involved vehicle in RTC accounting for injuries in 69 participants (45.7%) (►Fig. 2). Only 24% of occupants of automobile/SUV/minibus wore the seat belt at the time of the impact, while 15.5% of victims of motorcycle crashes wore the crash helmet. Soft tissue injuries were the commonest maxillofacial injuries and were the only maxillofacial injury seen in 81 participants (53.6%). The mandible was the most frequently fractured facial bone in isolation, while naso-orbitoethmoidal (NOE) fracture was rarely diagnosed in isolation (►Table 1). The maxillae showed a low frequency

Figure 1 Age and gender distribution of 151 participants.

Figure 2 Vehicles involved in road traffic crashes.

of injury but presented the two most severe injuries seen in a single facial unit. Multiple facial injuries were however seen in 19 participants (12.6%), 9 of these patients presented with severe maxillofacial injuries (► **Table 1**).

A total of 253 concomitant injuries were recorded. Ninety-nine (65.6%) participants presented with varying degree of head injury, giving a relative incidence of 39.2% (► **Table 2**). Orthopedic injury was the second commonest injury with a relative incidence of 27.3% and was seen in 69 (45.7%) participants. The lower limb was more frequently injured and was involved in 28 (18.5.9%) participants (► **Table 2**). Eighty-one (53.6%) participants presented with concomitant injury to more than one body region.

Majority (130; 86.1%) of the participants had mild to moderate injuries, while 21 (13.9%) had severe to critical injuries. The median MFISS in this study was 6.0. The median MFISS in male (6.0) was higher than in females (5.0). This observed difference was not statistically significant ($p = 0.54$).

Injury severity scale score also showed that most of the participants 71 (47.1%) had minor to moderate injury, while 80 (52.9%) had severe or critical injury. A linear regression test for the predictability of ISS using increasing severity of maxillofacial injuries showed a standardized coefficient of 0.265. This relationship was statistically significant ($p = 0.001$) (► **Table 3**). There is also a statistically significant correlation between increasing severity of maxillofacial injuries and ISS ($p = 0.001$).

The Spearman correlation coefficient of the statistical associations between severity of maxillofacial injuries and different types of concomitant injuries showed a statistically significant association between increasing severity of maxillofacial injury and the incidence of traumatic brain injury and ocular injuries ($p = 0.034$ and 0.046) (► **Table 4**). The presence of head injury showed a statistically significant association with the presence of cranial fracture, eye, and chest injury ($p = 0.001$, 0.015 , and 0.024), respectively.

Discussion

The peak age of incidence of road traffic maxillofacial injuries reported in this study is consistent with literatures.^{1,7–11} The 21 to 40 years age group comprises the most active members of the society who are frequently engaged in commuting from one location to another and are therefore more exposed to the threat of RTC than any other age group. There was a male preponderance of 4.8:1 in this study which is far less than 16.9:1 reported by Adekeye,⁷ but slightly greater than the 2.9:1 reported by Fasola et al⁹ and 3.7:1 reported by Ajike et al.¹⁰ This shows that females are getting more involved in activities that expose them to RTC which may not be unconnected with the prevailing economic recession in the nation requiring more members of the family to be involved in sourcing for income for the family.

Majority of road traffic maxillofacial injuries sustained were mild to moderate. A total of 93% of participants presented with facial soft tissue injury (53% purely soft tissue injury and 40% with soft tissue injury in combination with other maxillofacial injuries). Laceration was the most common soft tissue injury seen. This prevalence of facial soft tissue injuries was previously reported as 42% by Subhashraj

Table 1 Severity of facial injuries in 151 participants

Facial injury	MFISS groups				Median	Total	%
	1–10	11–20	21–30	> 30			
Soft tissue	80	1	0	0	2.0	81	53.6
Maxillae	0	4	1	2	20.0	7	4.6
Mandible	8	15	3	0	15.5	26	17.2
Zygoma	8	8	0	0	10.5	16	10.6
Multiple fracture	0	4	6	9	30.0	19	12.6
NOE	2	0	0	0	7.0	2	1.3
Total	98	32	10	11	6.0	151	100.0

Abbreviation: MFISS, maxillofacial injury severity score; NOE, naso-orbito-ethmoidal.

Table 2 Relative incidence of concomitant injuries in 151 participants

Concomitant injury	Number of participants affected	Proportion of participants (%) (n = 151)	Relative incidence (%) (n = 253)
Head injuries	99	65.6	39.2
Mild	53	35.0	
Moderate	23	15.2	
Severe	23	15.2	
Orthopedic injuries	69	45.7	27.3
Multiple	18	11.9	
Femoral	17	11.3	
Tibiofibular	11	7.3	
Humeral	5	3.3	
Clavicular	5	3.3	
Pelvic	5	3.3	
Radioulnar	2	0.6	
Hand/foot	6	3.9	
Cranial fracture	24	15.8	9.5
Chest injury	24	15.8	9.5
Cervical spine injury	19	9.4	7.5
Eye injury	9	4.5	3.5
Abdominal injury	9	4.5	3.5
Total	253		100.0

Table 3 Severity of maxillofacial and bodily injuries in 151 participants

ISS					
MFISS	Minor	Moderate	Severe	Critical	Total
1–10	21	27	36	14	98
11–20	6	11	8	7	32
21–30	1	1	4	4	10
> 30	0	4	3	4	11
Total	28	43	51	29	151

Abbreviations: ISS, injury severity scale; MFISS, maxillofacial injury severity score.

et al,¹² 87.2% by Hashim and Iqbal,¹³ and 95.5% by Ramli et al.¹⁴ The high occurrence of soft tissue injury is usually due to the patient hitting the face on hard structure of the vehicle. Pieces of broken windshield could also be responsible for the injury. Most of the patient with purely soft tissue injury had their injury repaired under local anesthesia at the accident and emergency complex, this involved wound cleansing or debridement, suturing, and dressing.

Despite the compulsory status of the use of seat belt and crash helmet in Nigeria, compliance with this rule is still very low in our environment. The utilization of seat belt by drivers in this study is slightly higher than 52.3% reported by Iribhogbe and Osime (2008),¹⁵ so also the utilization of crash helmet has also improved compared with nonusage reported by Obuekwe et al (2003),¹⁶ Oginni et al (2006),¹¹ and

Solagberu et al (2006).¹⁷ This increased utilization of protective devices by vehicle operators might not be unconnected with stricter punishment placed on defaulting drivers and riders by law enforcement agencies. It is however a far cry from the 97.5% compliance in Italy as reported by Servadei et al (2003).¹⁸

Mandibular fracture was the commonest facial fracture seen and this is comparable to previous reports,^{9,19} the mandible is more commonly involved in facial fractures probably because of its prominence, mobility, anatomically weak points, and less bony support than the maxilla.²⁰

Maxillary fractures were the most severe isolated injury observed, this is because of the attending significant facial skeleton disruption and functional impairment. Maxillary fractures result from centrally dissipated force centered on

Table 4 Association between the severity of maxillofacial injuries and concomitant injuries^b

	MFISS	Head injury	Cranial fracture	Cervical spine injury	Eye injury	Orthopedic injury	Abdominal injury	Chest injury
MFISS	1.000	0.149 0.034	0.032 0.652	0.690 0.334	− 0.141 0.046	− 0.025 0.727	− 0.020 0.780	− 0.390 0.582
Head injury	0.149 ^a 0.034	1.000	− 0.251 ^a 0.000	− 0.022 0.758	− 0.172 ^a 0.015	0.021 0.764	0.124 0.081	0.159 0.024
Cranial fracture	0.032 0.652	− 0.251 ^a 0.000	1.000		0.248 ^a 0.000	− 0.006 0.938	0.169 ^a 0.016	0.006 0.938
Cervical spine injury	0.690 0.334	− 0.022 0.758	0.248 ^a 0.000	1.000	0.070 0.324	0.198 ^a 0.005	0.070 0.324	0.119 0.093
Eye injury	0.141 ^a 0.046	− 0.172 ^a 0.015	− 0.006 0.938	0.070 0.324	1.000	0.106 0.135	− 0.047 0.509	0.006 0.938
Orthopedic injury	− 0.025 0.727	0.021 0.764	0.169 ^a 0.016	0.198 ^a 0.005	0.106 0.135	1.000	− 0.097 0.172	− 0.122 0.086
Abdominal injury	− 0.020 0.780	0.124 0.081	0.006 0.938	0.070 0.324	− 0.047 0.509	− 0.097 0.172	1.000	− 0.080 0.261
Chest injury	− 0.390 0.582	0.159 ^a 0.024	0.088 0.213	0.119 0.093	0.006 0.938	− 0.122 0.086	− 0.080 0.261	1.000

Abbreviations: ISS, injury severity scale; MFISS, maxillofacial injury severity score.

^aSignificant at $p = < 0.05$.

^bCorrelation chart.

the fragile maxillary complex. Associated posterior displacement portends a serious hazard for the upper airway.

The severity of maxillary and zygomatic complex fracture in this study was similar to that reported by Zhang et al.⁵ However, the mandibular and soft tissue injuries were less severe than recorded in the same study. The observed differences could be attributed to the fact that the injury severity was retrospectively scored in the earlier study and this could have a significant impact on the ability to objectively judge the severity of a soft tissue injury.

Patients with road traffic maxillofacial injuries have high susceptibility to concomitant injuries in other regions of the body.^{21–24} This is as a result of high impact which is focused toward the body resulting in multiple injuries which varies in severity; patient might be thrown around in the vehicle or even ejected to contact the harsh external environment. In the present study, 75.1% of patients with RTC-related maxillofacial injuries presented with at least one concomitant injury. This high incidence is similar to the report of 81.2% by Ugboko et al.⁸ but differs from the report of 44.1% by Fasola et al.²²

Head injury had the highest relative incidence of all the concomitant injury seen in this study and was also found to have a statistically significant association with increasing severity of facial injuries. This finding is similar to previous studies.^{7,12,24,25} It however differs from the report of Ajike et al.¹⁰ which reported orthopedic injuries occurring more commonly than head injury.

As stated by previous authors,^{21,22} incidence of head injury in patients with maxillofacial injuries could be attributed to transfer of force from the facial skeleton to the cranium. Traditionally, the facial architecture has been perceived to have an impact absorbing property, thereby protecting the

neurocranium from severe injury. However, some investigations have suggested that the facial skeleton may actually transmit forces directly to the neurocranium, resulting in serious brain injury. An association between injury to the upper and midfacial skeleton and varying severity of brain injury had been suggested.²⁶ Although the present study showed that occurrence of head injury increases with increasing severity of facial injury, it however excluded patients that succumbed to the injury before proper intervention was performed. Plaisier et al.²⁷ in a study on the relationship between facial fractures and death from neurological injury concluded that nonsurvivors with facial fractures are older, have lower Glasgow coma score, higher ISS, and lower revised probability of survival. They also noted that nonsurviving facial fracture population has a predilection for mid- and upper facial fracture patterns and neurologic injury. It is possible that the investigation of all injuries including those that resulted in early posttraumatic fatality may give a clearer picture on the relationships of facial fracture and head injuries.

The association between increasing severity of maxillofacial injuries and the presence of orbital injuries observed in this study is similar to previous findings.^{4,28} This could be due to the proximity of the orbit to the maxillofacial region and periorbital bleed associated with disruptions of the facial skeleton. Nagase et al.²⁹ concluded that there was a trend of higher rates of ocular injury as the number of orbital wall fractures increased.

Cervical spine injury is a widely recognized concomitant injury.^{21–23,30} In the present study, the risk of cervical spine injury greatly increases in the presence of a concomitant orthopedic injury. Because of the potential for spinal cord injury, all patients with facial fractures should be assumed to have cervical spine injury unless proven otherwise.²³

This study demonstrates a positive correlation between the severity of maxillofacial injuries and the occurrence of traumatic brain and ocular injury. This implies that patient with severe maxillofacial injuries should be specifically assessed for neurological and ophthalmic injuries to prevent avoidable complications of such injuries.

The prevalence of maxillofacial injuries in a setting of major trauma is well documented,^{31,32} Hayter et al³³ in a review of patients with ISS of 16 or more reported that 33% of such patients presented with maxillofacial injuries. Though the severity of maxillofacial injuries was scored subjectively, they noted that the type of maxillofacial injuries found reflected the severity of the trauma.

Conclusion

This study is the first to document the severity of maxillofacial injuries seen at our center. It has highlighted the slight improvement but a large compliance gap in the use of seat belt and crash helmet in our environment. This study demonstrates clinically important association between maxillofacial injuries and various types of concomitant injuries. However, while the study has underscored the positive correlation between the severity of maxillofacial injuries and ISS, there is a need to generate larger prospective dataset involving all trauma patients, and to evaluate the reciprocal relationship between severity of nonfacial and maxillofacial injuries.

Note

This study was presented in part at the 53rd Annual Congress of the West African College of Surgeons, held in Lome, Togo, March 2013.

References

- Adeyemo WL, Ladeinde AL, Ogunlewe MO, James O. Trends and characteristics of oral and maxillofacial injuries in Nigeria: a review of the literature. *Head Face Med* 2005;1:7
- Brooks A, Holroyd B, Riley B. Missed injury in major trauma patients. *Injury* 2004;35(4):407–410
- Lawson CM, Daley BJ, Ormsby CB, Enderson B. Missed injuries in the era of the trauma scan. *J Trauma* 2011;70(2):452–456, discussion 456–458
- Ugboko VI, Udoeye C, Olateju SO, Amole AO. Blindness and visual impairment from severe midface trauma in Nigerians. *Int J Oral Maxillofac Surg* 2006;35(2):127–131
- Zhang J, Zhang Y, El-Maaytah M, Ma L, Liu L, Zhou LD. Maxillofacial injury severity score: proposal of a new scoring system. *Int J Oral Maxillofac Surg* 2006;35(2):109–114
- Champion HR. Trauma scoring. *Scand J Surg* 2002;91(1):12–22
- Adekeye EO. The pattern of fractures of the facial skeleton in Kaduna, Nigeria. A survey of 1,447 cases. *Oral Surg Oral Med Oral Pathol* 1980;49(6):491–495
- Ugboko VI, Odusanya SA, Fagade OO. Maxillofacial fractures in a semi-urban Nigerian teaching hospital. A review of 442 cases. *Int J Oral Maxillofac Surg* 1998;27(4):286–289
- Fasola AO, Nyako EA, Obiechina AE, Arotiba JT. Trends in the characteristics of maxillofacial fractures in Nigeria. *J Oral Maxillofac Surg* 2003;61(10):1140–1143
- Ajike SO, Adebayo ET, Amanyiewe EU, Ononiwu CN. An epidemiologic survey of maxillofacial fractures and concomitant injuries in Kaduna, Nigeria. *Nig J Surg Res* 2005;7(3):251–255
- Oginni FO, Ugboko VI, Ogundipe O, Adegbehingbe BO. Motorcycle-related maxillofacial injuries among Nigerian intracity road users. *J Oral Maxillofac Surg* 2006;64(1):56–62
- Subhashraj K, Nandakumar N, Ravindran C. Review of maxillofacial injuries in Chennai, India: a study of 2748 cases. *Br J Oral Maxillofac Surg* 2007;45(8):637–639
- Hashim H, Iqbal S. Motorcycle accident is the main cause of maxillofacial injuries in the Penang Mainland, Malaysia. *Dent Traumatol* 2011;27(1):19–22
- Ramli R, Rahman NA, Rahman RA, Hussaini HM, Hamid ALA. A retrospective study of oral and maxillofacial injuries in Seremban Hospital, Malaysia. *Dent Traumatol* 2011;27(2):122–126
- Iribhogbe PE, Osime CO. Compliance with seat belt use in Benin City, Nigeria. *Prehosp Disaster Med* 2008;23(1):16–19
- Obuekwe ON, Ojo MA, Akpata O, Etetafia M. Maxillofacial trauma due to road traffic accidents in Benin City, Nigeria: a prospective study. *Ann Afr Med* 2003;2(2):58–63
- Solagberu BA, Ofoegbu CKP, Nasir AA, Ogundipe OK, Adekanye AO, Abdur-Rahman LO. Motorcycle injuries in a developing country and the vulnerability of riders, passengers, and pedestrians. *Inj Prev* 2006;12(4):266–268
- Servadei F, Begliomini C, Gardini E, Giustini M, Taggi F, Kraus J. Effect of Italy's motorcycle helmet law on traumatic brain injuries. *Inj Prev* 2003;9(3):257–260
- Adebayo ET, Ajike OS, Adekeye EO. Analysis of the pattern of maxillofacial fractures in Kaduna, Nigeria. *Br J Oral Maxillofac Surg* 2003;41(6):396–400
- Fonseca RJ, Walker RV, Betts NJ, Barber HD, eds. *Oral and Maxillofacial Surgery Trauma I*. 2nd ed. Philadelphia, PA: Saunders; 1997
- Haug RH, Prather J, Indresano AT. An epidemiologic survey of facial fractures and concomitant injuries. *J Oral Maxillofac Surg* 1990;48(9):926–932
- Fasola AO, Obiechina AE, Arotiba JT. Concomitant injuries in 531 patients with maxillofacial fractures. *Afr J Med Med Sci* 2002;31(2):101–105
- Follmar KE, Debruijn M, Baccarani A, et al. Concomitant injuries in patients with panfacial fractures. *J Trauma* 2007;63(4):831–835
- Allareddy V, Allareddy V, Nalliah RP. Epidemiology of facial fracture injuries. *J Oral Maxillofac Surg* 2011;69(10):2613–2618
- Gandhi S, Ranganathan LK, Solanki M, Mathew GC, Singh I, Bither S. Pattern of maxillofacial fractures at a tertiary hospital in northern India: a 4-year retrospective study of 718 patients. *Dent Traumatol* 2011;27(4):257–262
- Haug RH, Savage JD, Likavec MJ, Conforti PJ. A review of 100 closed head injuries associated with facial fractures. *J Oral Maxillofac Surg* 1992;50(3):218–222
- Plaisier BR, Punjabi AP, Super DM, Haug RH. The relationship between facial fractures and death from neurologic injury. *J Oral Maxillofac Surg* 2000;58(7):708–712, discussion 712–713
- Roth FS, Koshy JC, Goldberg JS, Soparkar CNS. Pearls of orbital trauma management. *Semin Plast Surg* 2010;24(4):398–410
- Nagase DY, Courtremanche DJ, Peters DA. Facial fractures - association with ocular injuries: A 13-year review of one practice in a tertiary care centre. *Can J Plast Surg* 2006;14(3):167–171
- Okoje VN, Malomo AO, Obiechina AE. Concomitant craniocervical injuries with maxillofacial trauma—a review of 266 cases. *Afr J Med Med Sci* 2006;35(2):165–168
- Kraft A, Abermann E, Stigler R, et al. Craniomaxillofacial trauma: synopsis of 14,654 cases with 35,129 injuries in 15 years. *Cranio-maxillofac Trauma Reconstr* 2012;5(1):41–50
- Down KE, Boot DA, Gorman DF. Maxillofacial and associated injuries in severely traumatized patients: implications of a regional survey. *Int J Oral Maxillofac Surg* 1995;24(6):409–412
- Hayter JP, Ward AJ, Smith EJ. Maxillofacial trauma in severely injured patients. *Br J Oral Maxillofac Surg* 1991;29(6):370–373