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Injury Pattern among Patients with Road Traffic Crash Presenting At a Tertiary Health Facility

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Abstract:
Objective: *In order to improve road safety performance, injury details are an important part of injury prevention..*
Methods *This was a one year prospective study in which consecutive road crash victims presenting in the Emergency Department were recruited for the study.*
Results *A total of 160 road traffic crash victims presented in the period of the study. Thirty did not give their consent for the study and discharged against medical advice. Twelve were brought in dead. Only 118 patients were eventually enrolled for the study. Eighty-five (72%) were males and 33 (28%) were females. The lower limb in the musculoskeletal region was most frequently injured in all groups. Pedestrians had the highest median ISS and NISS scores; 16 (Interquartile Range (IQR), 7) and 16 (IQR, 15) respectively, while those injured on motorcycles had the lowest median ISS and NISS scores 9 (IQR, 11) and 9 (IQR, 13) respectively. Motorcycle occupants, 4-wheeled vehicle occupants and pedestrians with ISS score > 15 were 15 (24%), 12 (29%) and 10 (69%) respectively. Crude mortality rate for road traffic injured patients presenting in the Hospital was 9%.*
Conclusion*; Pedestrians are at greatest risk of severe injury and polytrauma in the event of a road traffic crash.*
Keywords*: injury pattern, road user category, injury severity score, abbreviated injury scale, revised trauma score.*

I. Introduction

Road traffic injuries are a major cause of death and disability globally, with a higher number occurring in developing countries[1]. The socioeconomic burden of this epidemic is enormous and road traffic injuries is projected to rise to the third leading cause of disability adjusted life years lost by the year 2020 (1) (2) (3). The problem is increasing at a fast rate in developing countries due to rapid motorisation (4**).** It is also projected that by the year 2030, road traffic injuries would be the leading cause of death worldwide (5). A road traffic crash is said to result from a combination of factors related to the components of the system comprising roads, the environment, vehicles and road users, and the way they interact (6).

The various road user categories include pedestrian, motorcyclists and four-wheeled vehicle occupants. A few previous research have demonstrated that injury patterns vary depending on the road user category to which the victim belongs (7) (8). The Federal Road Safety Commission, the body in the country charged with the design, regulation and enforcement of road safety strategies in the country in her 2011 annual report noted that there existed an increase of 8% in the number of persons killed in 2011 over 2010 (9). It's been recommended that in order to improve road safety performance, the injury details play an important part for injury prevention (8). Also, adaptation of intervention strategies and technology requires research to document peculiar local injury pattern, and outcome of management (10).

There are various injury scale scores that have been used in describing injury severity (11). The injury severity scale score (ISS) has however assumed the 'gold standard' in trauma severity grading (12). This scoring system is an anatomical scoring system based on the Abbreviated injury severity scale score. The ISS score is the sum of the squares of the highest AIS score in three different regions of the body. The new injury severity scale (NISS) score on the other hand is the sum of the squares of the three highest AIS scores of the injuries the victim sustains, irrespective of the region (12) (13).

Research in trauma in Nigeria is still in the evolutionary stages with relatively few published data (10) (14). This study aims to describe the pattern and severity of injuries sustained by pedestrians, motorcyclist and 4-wheeled vehicle occupants involved in a road traffic crash in our study environment, and to compare this with

findings with observations from existing local and international studies. We believe this would be useful in helping to design interventional measures to help reduce the incidence and severity in future road crashes.

II. Methodology

This was a one year prospective study in which consecutive road crash victims presenting in the Emergency Department of the Ladoke-Akintola University of Technology Teaching Hospital, Ogbomosho between Dec 2012 – Nov 2013 were recruited for the study. The Hospital is a 200 bed tertiary healthcare facility. The Nigerian national health system has three tiers of health care: primary, secondary and tertiary. The tertiary health centers are teaching hospitals and Federal Medical Centers; which are similar in function to a Level I trauma center, serve as referral centers for the remaining two tiers. Patients with moderate to severe traumatic injuries needing advanced care (for example, neurosurgical and cardiothoracic) are referred to tertiary healthcare facilities. In theory, only patients with moderate to severe injuries should be taken to such centers, but in reality, almost all trauma patients, the severity of injury notwithstanding; are taken to tertiary hospitals.

This is a busy highway and route for heavy-duty vehicles travelling between southwest part of the country and the northern part. It is also the road students of the University ply from the campus to the town and vice-versa, riding pilion on commercial motorcycles in most cases. First contact was made with the patients in the emergency room. Patients were resuscitated following the Advanced Trauma Life Support (ATLS) protocol by the attending physician. When patient's vital signs were stable, a detailed history and physical examination was conducted.

For patients that were conscious at presentation and following initial adequate resuscitation, the purpose of the study was explained to them and informed consent for the study obtained from the patient. For paediatric patients, consent was obtained from the parent or guardian available at the time of documentation. For patients who remained unconscious after initial resuscitation and stabilisation, consent was obtained from the closest relative and eye-witness account of incident documented. All patients with road traffic injuries presenting in the emergency room during the period of the study were included in the study once they gave their consent. Patients who do not give consent to the study were excluded from the study. Also excluded were patients who were brought in dead.

Data relating to bio-demographics of the patient and the type of vehicle involved in the crash and the environmental condition at the time of the crash were noted. Road users were broadly classified into pedestrians, motorcyclist and four-wheeled motor vehicle occupants. A four-wheeled motor vehicle included cars, buses and trucks. The AIS, ISS, NISS and Revised Trauma scores were computed by the lead investigator only.

Particular note was taken of patients with polytrauma; a polytraumatised patient being defined as a patient with an injury severity score (ISS) of greater than 15. The AIS score describes three things of the injury using 7 numbers written as 12(34)(56); type, location and severity of the injury. Each number signifies: 1- body region; 2- type of anatomical structure; 3,4- specific anatomical structure; 5,6- level; 7- severity of score. The AIS severity score is an ordinal scale ranges from 1 (minor) to 6 (non-survivable) as follows: AIS 0 = no injury, AIS 1 = minor, AIS 2 = moderate, AIS 3 = serious, AIS 4 = severe, AIS 5 = critical; AIS 6 = maximum/non-survivable. An AIS-Code of 9 is used to describe injuries for which not enough information is available for more detailed coding, e.g. crush injury to the head. ISS combines the three most severe injuries in three separate body regions based on AIS to create an ordinal scale ranging from 1 to 75 (11) (12) (13).

Data was analyzed with the SPSS version 17, SPSS Inc. Descriptive analysis was used to describe the demographic characteristics of victims and pattern of injury using the AIS coded regions as a guide. The median ISS and NISS scores was used as the main measure of injury severity. Spearman's rho was used in establishing a correlation between NISS and ISS. Statistical analysis for comparing categorical data across the three types of patients was done using the Kruskal-Wallis test.

III. Results

A total of 160 road traffic crash victims presented in the emergency department of the Hospital within the period of the study. Thirty-two did not give their consent for the study and discharged against medical advice while twelve were brought in dead. Only 118 patients gave consent and were ultimately enrolled for the study. Of the number enrolled 85(72 %) were males and 33(28%) were females. The age range of the patients was 10 - 86 years. Three peaks of road traffic crash (Figure 1) were observed; (i) Morning rush hour (7:00-8:00 hours), (ii) mid-day(12:00-13:00 hours) (iii) and evening rush-hour(18:00-20:00 hours).

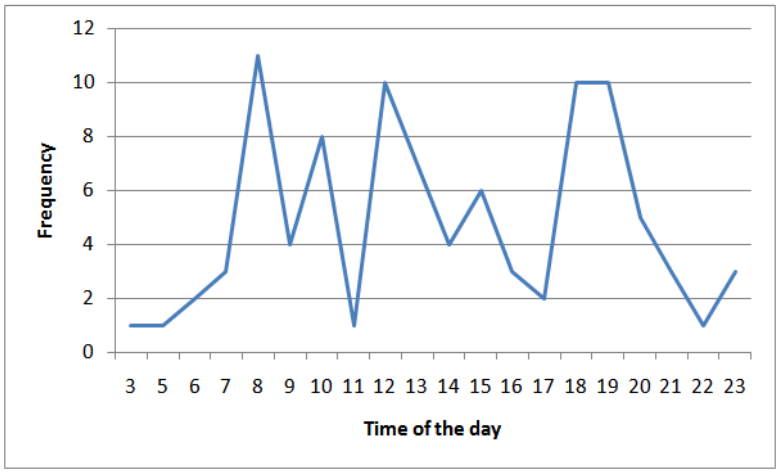

Figure 1: Relationship of frequency of crashes with time of the day.

The road user category with the highest representation was the motorized cyclist with 61 (52%). The lower limb region was most frequent injured region in all groups (Table 1). Open tibia, femoral and ankle fractures were the commonest lower injuries in pedestrians and motorcyclists. Wounds in these cases were mostly soft tissue avulsions, lacerations, and puncture wounds from the fracture fragments. Closed femoral and pelvic fractures was the commonest in 4-wheeled vehicle occupants.

Region	Injury distribution in Paedestrians (26)	Injury distribution in Motorcyclists (84)	Injury distribution in 4-wheeled vehicle occupants (85)
Head	4(15%)	14 (17%)	11(13%)
Face	--	14(17%)	9(11%)
Neck		1(1%)	2(2%)
Thorax	--	3 (4%)	8 (9%)
Abdomen	4(15%)	2(2%)	5 (6%)
Spine			6(17%)
Upper extremity	4(15%)	11(12%)	17(20%)
Lower extremity	14 (55%)	40 (47%)	27 (22%)
Unspecified			
Total	100%	100%	100%

Table 1: Injury distribution among road user categories.

The upper limb was the second most injured region in all groups with 4-wheeled vehicle occupants having a notably larger number of closed humeral fractures. Fore-arm fractures were commoner in pedestrians and, wrist and acromioclavicular injuries in motor cyclists. Bruises and friction burns accompanied upper extremity injuries in motor cyclists and pedestrians. Blunt chest injuries with rib fractures and hemothorax and, blunt abdominal injuries hemoperitoneum was observed only in motor-cyclists and 4-wheeled vehicle occupants.

Injuries to the head in pedestrians were mostly scalp lacerations and bruises. Bruises were also noted in the head, face and neck regions in motor cyclists. A case of fracture of the maxillary bone was noted in a motor cyclist. Whip lash injury to the cervical spine without a fracture was noted only in 4-wheeled vehicle occupants along with scalp, facial and neck bruises.

Pedestrians seem to the highest median ISS and NISS scores; 16 (Interquartile Range (IQR), 7) and 16 (IQR, 15) respectively, while those injured on motorcycles had the lowest median ISS and NISS scores 9 (IQR, 11)and 9 (IQR, 13) respectively**.** However, Kruskal-Wallis test revealed no significant difference between the median ISS and NISS scores of the different categories of road users (Table 2). There was a significant and strong correlation (r=0.9, p= 0.00) between the ISS and NISS scores using the Spearman's correlation coefficient. Analysis of the ISS reveals that15 (24%), 12 (29%) and 10 (69%) respectively of motorcycle occupants, car occupants and pedestrians had an ISS score of greater than 15. More patients 42 (75.6%) had severe trauma during the rush hours than during the non-rush hours 40 (65.2%).

TRAUMA SCORE	Score (IQR)	P-Value
ISS		
Motorcyclist	9 (11)	
4-wheeled vehicle	9 (12)	0.122
Pedestrian	16 (7)	
NISS		
Motorcyclist	9 (13)	
4-wheeled vehicle	12 (15)	0.063
Pedestrian	16 (15)	
RTS		
Motorcyclist	7.84 (0.04)	
4-wheeled vehicle	7.84 (0.024)	0.152
Pedestrian	7.8 (0.84)	

Table 2: Comparison of the trauma scores for the categories of road users using Kruskal-Wallis statistics.

. Crude mortality rate for road traffic injured patients presenting in the Hospital was 9% .

IV. Discussion

The predominance of male in this study is in line with the fact that males are more likely to engage in adventurous tasks such driving (16). Road traffic crash was more frequent during the rush hours of the day. The peak periods of road crash occurred when road users were on their way to work in the morning and another peak at their return from work in the evening. A third peak period which may suggest "lunch time" was recorded between 12-1pm (fig 1). This may be related to impatience on the part of the road users to get to work and to return home.

Pedestrians are usually at greater risk of being severely injured in a road traffic crash and the incidence of death in pedestrians have been observed to be significantly higher than in car occupants or motorcyclists (17). This is reflected in the higher median ISS and NISS scores for this category of road users in this study compared to the other two groups.

Tanz et al (18) observed that the most common site of injury among pedestrians was the head and that the most common site of serious injuries was the leg. However, this study reveals that the most common site of injury and the region with the worst injury was the lower limb region with most injuries involving open long bone fractures. The common pattern of lower limb injuries were open tibia fractures, closed femoral fractures and open ankle injuries. As a significant number of their injuries were either open or involved long bones fractures, most of these patients presented in a state of haemorrhagic shock resulting from both internal and external blood losses.

The use of motor-cycles as a means of transport is quite common in semi-urban areas in Nigeria as in the area of our study. This group of vulnerable road users constituted the largest group in this study with the lower and upper limbs, and head regions being the most frequently injured. Long bone fractures of the lower limbs was frequent in this group with open tibia fractures topping the list and femoral fractures coming second. Previous studies in Nigeria have also documented the lower limbs and the head and neck to be the body parts most likely to be injured in motorcycle crash (19) (20).

However, Nwadiaro et al (21) in their study on motorcycle injuries in north-central Nigeria, reported that head injury (40.1%) was the most frequently occurring injury followed closely by extremity injuries (38.1%). They noted that none of their patients wore protective helmet. The helmet use rate in our study was 6% with trauma trauma to the extremities remaining the more frequent and more severe of the injuries sustained by this category of road users. Head injuries in our study group were mostly soft tissue injuries to the scalp in the form of bruises and scalp lacerations.

Motor vehicle occupants are noted to be at particularly higher risk of spinal cord and abdominal trauma (22). In our study group, the upper and lower extremities, head / neck and chest were the three most commonly injured body regions in car occupants. Pattern of extremity injuries included closed humeral shaft fractures in the upper limb and closed femoral fractures and hip joint dislocations in the lower limbs. Chest injuries included blunt chest trauma with rib fractures and haemothorax, while head/neck injuries included mostly lacerations to the scalp and whiplash injuries to the cervical spine.

Mortality among patients presenting in the Hospital was 9% with majority occurring outside of the rush hour when the speed of vehicles is likely to be higher.

V. Conclusion

The fore-going reveals that pedestrians have the most severe injury at presentation however mortality rate is higher in car occupants. Helmet and sealt-belt use rates are generally low in our study environment. Enforcement of legislations on use of passive safety device would be of benefit in this case.

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Limitations of the study

Exclusion of patients who were brought in dead leaves out a number of patients who may have had significant injuries. However, we were forced to do this because of the difficulty we had with retrieving vital information regarding this patients. The other limitation of this study is that it is a hospital based study of injured road users. Hospital based data acquisition commonly exclude on-scene deaths and some with mild to moderate injuries who would not go to hospitals. In addition, some patients may have sought treatment at other healthcare facilities apart from the tertiary health centers where the study took place. However, since most victims of road crashes in Nigeria are taken directly to the nearest tertiary health centers, this effect may be small. Finally, in the data poor setting of the study, hospital based studies are commonly the most reliable source of realistic data on injuries and its causes (23).

Conflict of Interest statements; Authours declare that they have no conflict of interest.

Compliance with Ethical Requirements; Ethical standard were followed by all authours in conducting this study and ethical approval was sort for and given by institutional ethics committee.

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