Pattern of Chest Injuries Following RTA – A Study from a Nigerian Tertiary Health Institution

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Authors’ contributions

This work was carried out in collaboration between all authors. Author Olaejirinde O. Olaofe was involved in the conceptualization and study design as well as in the collection, analysis and interpretation of data and literature review. He wrote the first draft of the manuscript. Authors WOO, KAA and AOK were involved in the conceptualization; study design and were also involved in the analysis of data and the review of the manuscript for intellectual content. Author DS was involved in the study design. He was also involved in the analysis and interpretation of data. He wrote the final draft of the manuscript. Author Oluwole O. Odujoko was involved in the collection and analysis of data as well as the review of the manuscript for intellectual content. All authors read and approved the final manuscript.

Article Information

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ABSTRACT

Background: Worldwide, road traffic accidents are a leading cause of death. Severe chest injuries from such accidents are frequently fatal due to the presence of vital organs within the chest cavity. This study seeks to review these injuries and their implications for the safety of road users.

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**Study Design:** Descriptive retrospective study.

**Place and Duration of Study:** Obafemi Awolowo University Teaching Hospitals Complex, Ile-Ife, Nigeria. 1st January 2000 to 31st December 2009.

**Methods:** This was a descriptive retrospective analysis of the postmortem autopsy findings from cases of road traffic accidents with chest injuries at the Obafemi Awolowo University Teaching Hospitals Complex, Ile-Ife, Nigeria over a 10-year period. Analysis was performed using the IBM SPSS version 15.0 (P is significant at <0.05)

**Results:** A total of 75 cases were reviewed. The male to female ratio was 5.8:1 while the age range was from 6 to 80 years. The most frequently involved age-group was the 30 to 40-year age-group which accounted for 24 cases (32.0%). The most common anatomic finding in the chest was fracture of the ribs which occurred in 70 (93.3%) cases while 44 cases (58.7%) showed haemothorax and 19 cases (25.3%) had laceration of the lungs. The least affected chest structure was the diaphragm with only one case (1.3%). Most (81.3%) of the deaths were due to multiple injuries involving other regions of the body. About 40 victims (53.3%) died at the accident scene. About 54.7% of the victims were passengers while 32.0% were drivers and 13.3% were pedestrians. Minivans and saloon cars were involved in 42.7% and 24.0% of cases respectively.

**Conclusion:** Chest injuries in road traffic accident fatalities are more frequent in males and in the active young adult population. The ribs are the most frequently injured structures in the chest. Injuries to intra-thoracic organs and vertebrae are very uncommon. Majority of deaths are due to multiple injuries.

**Keywords:** Accident; chest; injuries; postmortem.

1. **INTRODUCTION**

In 2004, the World Health Organization (WHO) estimated road traffic accident (RTA) as the 9th leading cause of death globally [1]. It also estimated that by the year 2030, if current trends persist, it will become the 5th leading cause of death worldwide [1]. Reports from many studies have shown that various forms of injuries may be sustained within the chest cavity following RTA and such injuries may be rapidly fatal because of the presence of vital organs, like the heart, great vessels and the lungs, within the chest cavity.

Hossack, in his review of the pattern of chest injuries in 470 pedestrians killed in RTA in Australia, showed that head and chest injuries were the major causes of death [2]. He also noted that injuries to the spine and lower extremities were relatively more common in pedestrians than in saloon car occupants [2]. Curiously, some injuries sustained by RTA victims have been attributed to the cardiopulmonary resuscitation originally aimed at saving their lives. Such injuries are, however, unlikely to be the major causes of death in RTA cases. These injuries, which include rib and sternal fractures as well as haemothorax, are sometimes difficult to differentiate from those actually caused by the RTA itself. Nevertheless, many authors have shown fractures of the ribs to be the most common form of chest injury following RTA [3,4,5].

Very few published work has been done on RTA in developing countries, including Nigeria, where there is a high incidence of RTA related fatalities [6-11]. Nigeria is one of the countries with the highest numbers of deaths from RTA in the world [12,13,14]. It is therefore important that more research work be conducted on RTA in order to critically evaluate its impact on the socioeconomic life of the citizens. The aim of this study, therefore, is to determine the pattern of chest injuries, the categories of victims involved and their contribution to the mortality of RTA victims as seen at the Obafemi Awolowo University Teaching Hospitals Complex, Ile-Ife, Nigeria over a 10-year period.

2. **MATERIALS AND METHODS**

This was a descriptive retrospective study of the autopsy findings from postmortem examinations conducted on cases of road traffic accident (RTA) at the Department of Morbid Anatomy and Forensic Medicine, OAUTHC, Ile-Ife, Nigeria between January 1, 2000 and December 31, 2009. The cases selected for the study were those in which the victims sustained injuries to the chest wall and/or intra-thoracic organs. Data for this study were obtained from the departmental autopsy records and register as well as from the victims’ clinical records for those who died while on admission in the hospital. Information such as the victim’s age, sex, sitting position in the vehicle, type of vehicle, type of
chests injury, final anatomic cause of death, among others, was extracted. The timing of the accidents, alcoholic history and personal disease history of the victims were not considered because these were not routinely recorded as part of the forensic investigations of such cases during the period covered by the study.

In Nigeria, the law requires that all cases of death following road traffic accident be investigated by the coroner using the autopsy as part of the forensic investigation.

All cases with incomplete bio-data and/or documentation of the various injuries sustained were excluded from the study.

The data obtained were analyzed for differences in proportion using chi-square by the Statistical Package for Social Sciences (SPSS) version 15.0.

3. RESULTS

Overall, there were 685 cases of RTA related deaths for which postmortems were performed during the study period. Fifty-seven cases had incomplete data and were thus excluded from the study. The results showed that in 75 cases (12.0%) the victims sustained various forms of injuries related to the chest. Of these, 64 (85.3%) were males while only 11 (14.7%) were females giving a male to female ratio of 5.8:1. The mean age of all the patients was 38.4 years (∓16.7 years SD) while the victims’ ages ranged from 6 to 80 years (Fig. 1). The most frequently involved age group was the fourth decade of life which accounted for 24 cases (32.0%). This was followed by the 20 to 30-year age-group with 16 cases (21.3%). Victims younger than 10 years old were the least involved with only 2 cases (2.7%).

According to Fig. 2 about 32 (42.7%) of the victims were in commercial minivans at the time of the accident while 18 (24.0%) were in saloon cars and 15 (20.0%) were on motorcycles. Heavy duty timber-carrying lorries accounted for 7 cases (9.3%). In 3 cases (4.0%), the type of vehicle was unknown.

About 41 victims (50.7%) were passengers, while 24 (32.0%) were the drivers of the vehicles and 10 (13.3%) were pedestrians. There was no adequate information on the exact sitting position of the passengers within the vehicles. In all the pedestrian cases, the victims were knocked down by fast moving vehicles. Majority (68.0%) of the accidents occurred within inter-city routes compared to intra-city routes which accounted for only 16 cases (21.3%). In about 57.3% of cases, multiple vehicles were involved in the accidents with lone accidents accounting for 27.0% of cases.

The rib cage was the commonly involved chest structure. Fractures of the ribs were found in 70 cases (93.3%). There was no adequate documentation of the nature of the fractures of the ribs as radiological evaluations are not routinely performed as part of the postmortem examination in cases of RTA at the OAUTHC. Haemothorax was the next most frequently pathology found in the chest and this accounted for 44 cases (58.7%). Haemothorax was found in 40 (57.1%) of the 70 cases with rib fractures. In 60 cases (85.7%), victims with fractures of the ribs also had severe multiple injuries in other regions of the body. Laceration of the lung was found in 19 cases (25.3%) and all these were associated with fractures of the ribs. There were only four cases (5.3%) with varying degrees of injuries to the heart. All of these were associated with varying degrees of myocardial laceration associated with haemopericardium and/or haemothorax. In two of these four cases, there were fractures of both the sternum and ribs while the other two cases were associated with only fractures of the ribs. Moreover, two of these victims died as a result of the chest injuries while in the other two cases death was as a result of the combined effects of multiple injuries sustained in different parts of the body. One case with rupture of the diaphragm was recorded in a thirty-year old male mini van driver who also had fracture of the skull associated with a subdural haemorrhage. There were no cases of pneumothorax. Other types of chest injuries encountered at autopsy are listed in Table 1.

According to Table 1, majority of the deaths associated with chest injuries (85.3%) were ultimately due to the combined effects of all the multiple injuries sustained while chest injuries were solely responsible for only 4 deaths (5.3%).

According to Table 1, 40 victims (53.3%) died at the scene of the accident while 29 (38.7%) died while on admission in the hospital (all within 3 days of admission). Interestingly, there were no deaths after 3 days of admission in the hospital.

4. DISCUSSION

The high male to female ratio of chest injuries in fatal RTA is similar to what has been reported by
various authors including the WHO [1,6,7,8]. While this seems to suggest that women may be more careful drivers and road users than men and thus less likely to be involved in RTA, it may actually be due to the fact that there are more male drivers and road users on our roads. Nevertheless, it is important that efforts are made by the road safety authorities to improve the driving habits of all those concerned.

Road traffic accident fatalities usually affect the most productive age group in terms of economic and social development [3,6,10,13]. About 57.1% of deaths were between the ages of 20 to 40 years. Similar findings have been reported by other authors [7,15,16,17]. Meel in Transkei region of South Africa found RTA fatalities to be most common among the productive age groups with more than 50% of fatal RTAs in Transkei region occurring among victims between the ages of 21 and 40 years [18]. The 21 to 40-year age-group is perhaps the most active and hence most vulnerable age-group [19,20]. It has long been recognized that for developing countries to attain a meaningful level of economic growth, deaths of people in this age group from RTA, acquired immune deficiency syndrome and violence must be properly controlled [18].

Table 1. Pattern of chest injury, final anatomic cause and place of death in road traffic accident victims

| Parameter                              | Distribution                          | Frequency (%) |
|----------------------------------------|---------------------------------------|---------------|
| Type of injury                         | Rib fracture                          | 70(93.3)      |
|                                        | Haemothorax                           | 44(58.7)      |
|                                        | Laceration of the Lung                | 19(25.3)      |
|                                        | Laceration to the Heart               | 4(5.3)        |
|                                        | Sternal Fracture                      | 3(4.0)        |
|                                        | Rupture of the Diaphragm              | 1(1.3)        |
| Final anatomic cause of death (N=75)   | Severe Multiple Injuries              | 61(81.3)      |
|                                        | Severe Head Injury                    | 3(4.0)        |
|                                        | Severe Chest Injury with respiratory failure. | 4(5.3) |
|                                        | Hypovolaemia                          | 4(5.3)        |
|                                        | Cervical spine fracture with respiratory arrest | 1(1.3) |
| Place of death (N=75)                  | Accident Scene                        | 40 (53.3)     |
|                                        | Inpatient Admission                   | 29(38.7)      |
|                                        | En route                              | 6(8.0)        |

Fig. 1. Age distribution of road traffic accident victims
Fig. 2. Types of vehicles involved in road traffic accidents

This study also shows that the fatal accidents were more commonly seen in passengers especially along inter-city routes [21]. The tendency to go well above the legal speed limits is much higher along the inter-city highways than along intra-city routes. This probably explains the wide disparity between intercity vehicular fatalities compared to those that occurred along intra-city routes. Majority of the deaths on these inter-city routes may not be unconnected with the high numbers of commercial, passenger-carrying mini vans which ply these routes [21]. Many of the operators and passengers that use these vans do not comply with the minimum safety requirements. It, therefore, becomes imperative that adequate measures be put in place by the appropriate regulatory bodies to improve safety along the inter-city highways while ensuring that drivers obey recommended speed limits and all passengers use their seat belts.

The most common injury to the chest was fracture of the ribs which was found in about 93.3% of cases. This is similar to other reports [3,4,5]. More than half of the cases with rib fractures were associated with haemothorax while about 85.0% of them were associated with multiple injuries in other parts of the body. Most of these patients died before medical treatment could be rendered [21]. First care givers should, therefore, be aware of the high probability of the presence of haemothorax and other injuries in victims who sustain rib fractures so that appropriate interventions can be instituted on time in order to improve the chances of survival.

Just like it has been noted in many previous studies, fracture of the sternum, injuries to the heart and oesophagus as well as rupture of the aorta are relatively less common following RTA [21]. From this study, only 3 cases of fracture of the sternum were recorded and all these were associated with rib fractures. Only 4 cases of injury to the heart were also recorded and all these were associated with haemopericardium and/or haemothorax. We did not record any cases of injuries to the oesophagus nor rupture of the aorta. The relative rarity of injury to the heart, oesophagus and aorta may be due to the fact that they are effectively protected from direct impact by the encasing ribs, sternum and vertebrae [3]. It, thus, will require a tremendous amount of blunt force trauma to cause appreciable injury to these intra-thoracic organs [3]. On the contrary, the lungs, by virtue of their size and close proximity to the rib cage, are more readily injured in RTA’s associated with chest injury [21,22]. It is also important to note that although injuries of the intra-thoracic organs are less common and not frequently reported, they certainly do occur and should be considered in the initial assessment of victims with fracture of the rib cage and/or sternum and thoracic vertebrae [21,22]. Adequate management of such chest injuries, particularly at the scene of the accident, may help to further reduce deaths from RTA.

The most frequent cause of death (81.3%), according to this study, was from the combined effects of multiple injuries sustained in different parts of the body [23]. It is, therefore important that a full body examination be conducted on victims of RTA who have chest injuries in order to fully assess the overall extent of their injuries rather than simply concentrating on the obvious chest injuries [23]. Indirect causes of death like sepsis, pneumonia and pulmonary thrombo-embolism were not recorded in this study and are perhaps less frequent causes of death in RTA [24]. On the contrary, Mackenzie et al in the United States of America reported a high frequency of deaths due to sepsis and renal failure among RTA victims with prolonged hospital stay [25]. While majority of the patients in our study died at the accident scene, the remainder died within 3 days of hospital admission, long before complications like wound infections and thrombo-embolism could develop. It is instructive to note that no deaths were recorded among victims who were alive after 3 days of hospital admission. This emphasizes the importance of appropriate medical intervention
first at the scene of the accident (which at best is poor and disorganized if at all existent) and also in the hospital [21,22].

5. CONCLUSION

It is important that appropriate efforts are made by the road safety authorities to improve the driving habits of all those concerned and especially commercial minivan drivers in order to reduce the impact of their poor driving habits. It is also imperative that victims of RTA should be properly examined by care givers for other injuries, the combined effects of which more readily kill them. Finally, an appropriate, well organized emergency care system needs to be instituted urgently to prevent these avoidable deaths.

CONSENT

It is not applicable.

ETHICAL APPROVAL

All authors hereby declare that the research was approved by the ethics and research committee of the OAUTHC, Ile-Ife, Nigeria and has therefore been performed in accordance with the ethical standards laid down in the 1964 declaration of Helsinki.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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