Epidemiology of trauma deaths

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Summary

Objectives: **This study was done to highlight the pattern and distribution of trauma deaths in a Nigerian teaching hospital in order to enhance trauma research, improve treatment strategies and prevent trauma deaths.**

Patients and methods: **a prospective data collection was done for 24 months beginning September 1999 detailing the age, sex, occupation, diagnosis, mechanism of trauma, injury-arrival time, and circumstances of death and determining retrospectively the severity of trauma using Revised Trauma Score (RTS), Injury Severity Score (ISS) and Trauma and Injury Severity Score (TRISS).**

Results: **There were 129 deaths but 84 (65.1%) had sufficient data for trauma scoring. Male:Female ratio was 60: 24 = 2.5:1. The age range was 2.95 years, mean 36.8 ± 15.2 years for males and 45.5 ± 23.0 years for females. Two thirds (66.7%) of the deaths occurred among traders/business 27.4%, artisans 20.2%, drivers and students 9.5% each. Three quarters of the deaths (75.0%,63) were in patients involved in road traffic accidents (RTA) followed by violent trauma (10.7%), falls 9.5% and burns 4.8%. The trauma deaths include head injury (26 deaths, 31.0%), multiple injuries (30.0%), fractures (13.1%), cervical spine injury (10.7), gunshot injuries (8.3%), burns (4.8%) and others (5.0%). Sixty-two patients (73.8%) reached the hospital within 6 hours of the injury. The patients were brought by the Police, Good Samaritans or relatives in nearly equal proportions. The mean RTS, ISS and TRISS probability of survival scores were 5.16, 25 and 67% for males but 6.0, 22 and 75% for females, respectively.**

Conclusions: **The pattern and distribution of trauma revealed a typical trauma death is a male aged below 40 years, who is a trader/businessman involved in RTA or violent trauma. Despite a probability of survival above 60% and majority of the patients getting to hospital within 6 hours, the inadequate A and E care has thrown up possibilities for prevention of trauma death, improving treatment strategies and enhancing trauma research.**

Keywords: ***Epidemiology, Trauma death, Nigeria.***

Résumé

Objectifs: Cet étude a été effectuée afin de souligner la tendance et la distribution des morts à travers des traumatismes dans un centre hospitalo-universitaire au Nigeria afin de renforcer des recherches sur le traumatisme, améliorer des stratégies du traitement et faire des efforts d'empêcher des morts à travers le traumatisme.

Patients et méthodes: La collecte des données en perspective a été effectuée pendant 24 mois à partir du septembre 1999 tout en faisant attention aux détails tels que: âge, sexe, profession, diagnostic, mécanisme du traumatisme, temps de la présentation de blessure, et des circonstances de la mort et la décision rétrospectivement décidée sur la gravite du traumatisme tout en utilisant le score Traumatisme Revisé, (RTS) Score de gravité de la blessure (ISS) et le Score du Traumatisme et de gravité de la blessures (TRISS).

Résultats: Il y a 129 morts mais 84 soit 65.1% avaient suffisamment des données des points traumatisme. Rapport mâle/femme était 60.24 = 2,5:1. Tranche d'âge était de 2 – 95 ans, moyen 36,8 ±15,2 ans pour des mâles et 45,5 ±23,0 ans pour des femmes, deux tiers soit 66,7% des morts étaient recensé parmi des commerçants/hommes d'affaires 27,4%, artisans 20,2%, chauffeurs et étudiants 9,5% chacun. Trois quarts des morts (75,0% soit 63) étaient des parents impliqués dans les accidents de la circulation routière (RTA) suivi par traumatisme violent (10,7%), tomber à terrre 9,5% et brûlures 4,8%. Morts à travers le traumatisme comprend blessure de la tête (26 morts soit 31,0%), blessures multiples (30,0%), fractures (13.1%), blessure dans l'épine cervicale (10,7%), blessures par balle (8,3%), brûlures (4,8%) et d'autres (5.0%). Soixante deux patients soit 73,8% arrivent à l'hôpital dans les six heures de blessure.

Les patients ont été emmenés par la police, bon samaritain, ou la famille dans presque des proportions égales. Le RTS, ISS et TRISS probabilité moyenne des scores de survie était 5, 16, 25 et 67% pour des mâles mais 60.22 et 75% pour des femmes respectivement.

Conclusion: La tendance et la distribution du traumatisme a révéle une mort à travers le traumatisme typique chez un homme âgé au-dessous de 40 ans, qui est commerçant/homme d'affaire impliqués dans RTA ou trauma voilent. En dépit de la probabilité de survie au dessus de 60% et la plu part des patients arrivent à l'hôpital en moins de 6 heures, des soins insuffisant de A et E a déjà empêché des chances de succès d'éviter la mort à travers le traumatisme, amélioration des stratégies du traitement et le rehaussement des recherches sur le traumatisme.

Introduction

The significance of trauma in surgical practice is well documented – it is the highest cause of morbidity and mortality in persons below 40 years of age[1,2] and third for all ages, behind cardiovascular diseases and cancers. Indeed, trauma is displacing infectious and nutritional diseases as a major cause of mortality in children in Africa[3,4]. In the developed countries, trauma has gained sufficient ground principally in the areas of prevention, improvement in the quality of care and enhancement of research efforts[2]. These efforts encouraged the endorsement of new legislation to improve the funding of trauma care and research[5]. More than 30 years ago, Adeloye and Odeku[6] predicted that trauma would become a major public health concern in Nigeria. A previous report from our centre showed that trauma

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was responsible for the highest morbidity and mortality in the accident and emergency (A and E) room[7]. Considering the situation in a developing country like Nigeria where there is no organised pre-hospital trauma care, transport of patients to the hospital is inefficiently done and the quality of care received in the A and E suboptimal, it is pertinent to examine the pattern and distribution of the ensuing trauma deaths. These deaths are quite prevalent in many hospitals including the tertiary centres, which should represent the peak of health care delivery in the country. The basis for the present study is to present the epidemiological statistics of trauma deaths from our institution as a stereotype tertiary centre in Nigeria.

Patients and methods

A prospective study of trauma patients seen in A and E of the University of Ilorin Teaching Hospital, Ilorin, Nigeria was done for 24 months (September 1999 to December 2001 – excluding September 2000 to December 2001) when there was health workers' industrial action). Data collection included the age, sex, occupation, mechanism of trauma, the injury-arrival time, and eventual outcome of the patient (whether discharged, admitted or died in the A and E). For trauma due to road traffic accident (RTA), further data took into cognisance whether the occupant was driver, passenger, pedestrian or cyclist. The person bringing the patient to the hospital was also documented (whether by patients themselves or relatives, the police or a Good Samaritan) so as to know the current state of affairs because there is no organised transport from the scene of trauma to hospitals. In order to determine the severity of injury and predict the probability of survival, trauma scores were allotted each of the trauma deaths retrospectively using the Injury Severity Score (ISS) according to Baker et al[8], the Revised Trauma Score (RTS) according to Champion et al[9], and the Trauma and Injury Severity Score (TRISS) according to Boyd et al[10]. The ISS is an anatomical determinant of the degree of injury, with values from 3 to 75, the RTS is a function of physiological derangement, with values from 1 to 16, while the TRISS scores combine both to determine the probability of survival, with values as percentages – 1-100.

Results

During the period under review, 4,164 patients presented to the surgical A and E out of which 2,913 (70.0%) were trauma related. There were 171 deaths in A and E but only 129(75.4%) were trauma deaths comprising 90 males and 39 females (M:F = 2.3.:1). However, complete parameters were available for 84(65.1%) of these 129 patients for the purposes of awarding trauma scores. They comprise 60 males and 24 females (M:F = 2.5:1) and are therefore quite representative. Figure 1 shows the male: female distribution of the trauma deaths by decade with the total curve determined mainly by the male curve. The male curve showed a sharp rise to the third and fourth decades and a sharp fall thereafter unlike the female curve with a steady rise and a low peak in the fifth decade. The average female age distribution is higher than the males' even though the average severity of trauma is anatomically (by a higher ISS) and physiologically (a lower RTS) worse in males than in females, Table 1. Hence, the mean TRISS (probability of survival) for females is higher than males'. When the three trauma scores were analysed by decades in males (Figure 2) and in females (Figure 3) major-

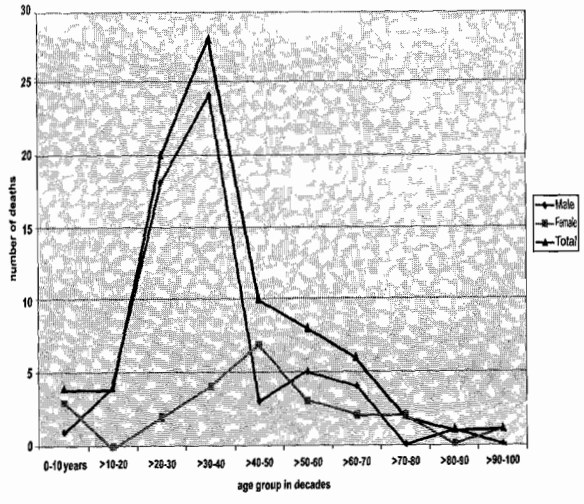

Fig. 1 *Distribution of trauma deaths by age and sex*

Table 1 Mean age and trauma scores among males and females

Sex	Age	Injury severity Score[8](ISS)	Revised Trauma Score[9](RTS)	Trauma and injury severity Score[10](TRISS%)
Male	36.8± 15.2	25 ± 10	5.16 ± 2.16	67 ± 33
Female	45.5 ± 23	22 ± 7	6.0 ± 2 18	75 + 34

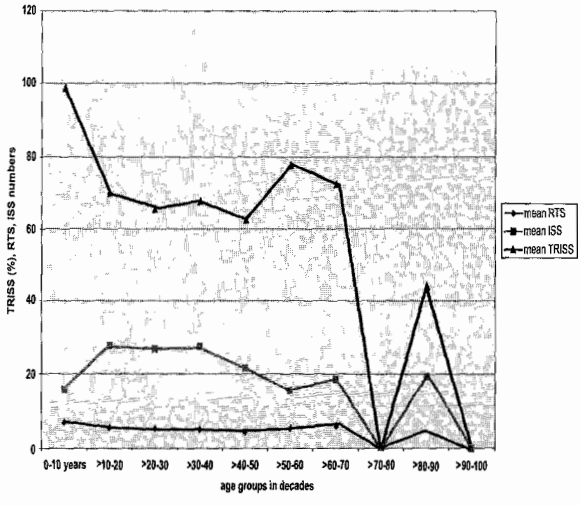

Fig. 2 *Mean trauma scores for males by decades*

Table 2 Morbidity and mortality by mechanism of injury

Mechanism of injury	Morbidity (%, n=2913)	Mortality: actual, studied (% in the group)
Road traffic accident	1,816 (62.4)	93 (5.1).63 (3.5)
Falls	308 (10.6)	9 (2.9), 8 (2.6)
Assaults	258 (8.9)	4 (1.6), 2 (0.8)
Burns	159 (5.5)	8 (5.0), 4 (2.5)
Home accidents	122 (4.2)	1 (0.8), 0 (0.0)
Gunshot injuries	107 (3.7)	12 (11.2),7 (6.6)
Industrial accidents	73 (2.5)	1 (1.4), 0 (0.0)
Foreign bodies	70 (2.4)	1 (1.4), 0 (0.0)
Total	2,913	129,84

Table 3 Relationship between mechanism of injury and occupation

Mechanism/ Occupation	RTA	Falls	Burns	Gunshot injuries	Assault	Total
Trading/Business	22	0	1	0	0	23
Artisans	11	4	0	2	0	17
Driving	7	0	0	1	0	8
Students	3	0	2	2	1	8
Aged	2	3	1	0	0	6
Professionals	4	1	0	0	0	5
Unconscious unidentified	12	0	0	1	0	13
Mixed	2	0	0	1	1	4
Total	63	8	4	7	2	84

ity of the deaths in both sexes had a TRISS probability of survival higher than 60%. Most of the male deaths had TRISS in the range of 60-80% (Figure 2) whereas most females had TRISS above 80% (Figure 3). The second and ninth decades that showed

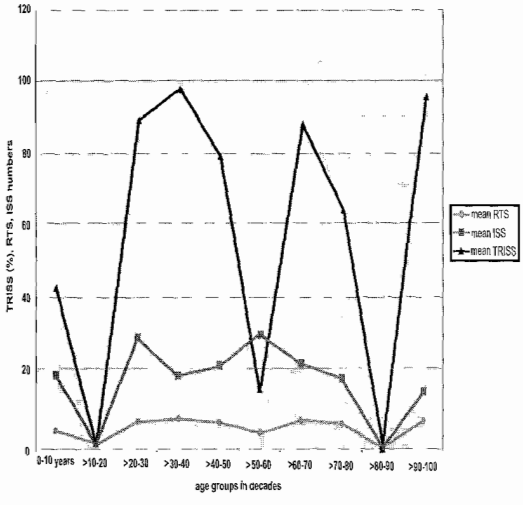

Fig. 3 *Mean trauma scores for females by decades*

0% TRISS for females had no patient in the age group.

Table 2 shows the mechanism of trauma in all patients, and in the 84 trauma deaths with trauma scores and that violent trauma (gunshot injuries and assaults) is second to RTA in importance. Even though RTA caused 62.4% of trauma, the group mortality was 5.1% (1 in 20 RTA's died) while gunshot injuries as violent trauma caused 3.7% of the trauma but had the highest group mortality of 11.2% (1 in 9 gunshot deaths). The relationship between the mechanism of injury and the occupational distribution of the patients is shown in Table 3, which also showed fatal violent cult activities among students and that the lowest morbidity and mortality were from industrial accidents and foreign bodies. Table 4 shows the distribution of the deaths by diagnosis with head injury and multiple injuries in the majority. The factors contributory to death were also documented from clinical notes because there was no post-mortem done for the patients on account of cultural and religious obstacles. Most of spinal cord injured patients involved in RTA were passengers in open lorries packed with goods or sacks of food stuff.

The injury-arrival time for most of these patients revealed

Table 4 Clinical conditions leading to death and their contributory factors

Clinical diagnosis	Factors contributory to death	Number (%)
Head injury	Severe cranio-encephalic injury, poor airway, hypotension	26 (31.0)
Multiple injuries	Severe blood loss, poor response from blood bank, poor airway maintenance, late presentation	25 (30.0)
Fractures	Severe blood loss, poor response from blood bank	11 (13.1)
Cervical spine injuries	Delayed presentation, respiratory failure, septicaemia	9 (10.7)
Burns	Hypovolaemia, septicaemia	4 (4.8)
Gunshot injuries	Hypotension, delayed presentation, delayed response to theatre (logistics)	7 (8.3)
Blunt abdominal injury	Hypotension	1 (1.2)
Chest injury	Hypotension, Respiratory failure	1 (1.2)
Total		84(100%)

that 62 patients (73.8%), got to hospital in less than 6 hours, 8 patients (9.5%) reached the A and E after 6 hours but before 24 hours, 3 (3.6%) patients reported after 24 hours but before 48 hours while the remaining 11 patients (13.1%) reported after 48 hours. Only 18(21.4%) of the deaths visited a health facility before a second referral to our centre. Obviously, the criterion for selecting the initial hospital was based on nearness to the scene of trauma rather than to capacity in care-delivery. The persons bringing the 63 RTA patients were patients themselves or their relatives (21 patients, 33.3%), the police (22 patients, 34.9%) or Good Samaritans (20 patients, 31.8%).

Discussion

The pattern and distribution of trauma deaths are a useful statistics for intervening in hospital trauma deaths[11,12]. Road traffic accidents account for the highest mechanism of injury as it is many other countries[2,6,13]. However, some variations are documented for some localities. San Francisco in the USA had violent trauma (gunshot, stab wounds and assaults) followed by falls from the Golden Gate Bridge as the highest cause of trauma even though nationally in the USA, it is still RTA[2]. In this study, violent trauma from gunshot injuries had the highest group mortality, whereas industrial injuries the lowest. However, this appears to be the highest incidence of gunshot injuries in Nigeria, probably because of the prospective nature of the study unlike other comparable reports from Enugu[14] and Benin city[15]. The former showed 77 gunshot injuries in six years while the latter 105 in ten years as opposed to 107 in two years from this study.

Three well-documented areas of trauma care system are trauma prevention, trauma care and trauma research[2]. The developed countries have made great impacts on all three while for varied reasons the developing countries still need to catch up. An important contribution of this study is its prospective nature and hence, accuracy of data. That more males than females were in trauma agree with literature worldwide[13,16,17]. This can be attributed to more males than females being breadwinners for their families and hence being more involved in road travels and RTA's. The peak of trauma death in these young healthy pro-

ductive persons suggests great economic losses to a nation[2], although this is difficult to quantify in our setting. That most of the mortalities were traders and artisans in an economy where there is great poverty and the involved persons being the financial pillars of their families would further worsen the economic prospect of affected families.

Head injury and multiple injuries as the most common cause of trauma deaths also agree with literature[2,18,19]. Spinal cord injuries especially those attributable to RTA in which the victims were travelling in open lorries packed with goods which then fall on the patients or when the passengers were thrown out, have been identified in a previous report[26]. Majority of the spinal cord injury related deaths in this study were from the same mechanism. This reinforces the need for public education, legislation and enforcement of a law that compels separation of goods and passengers, and prohibiting travelling in open lorries.

The police, some Good Samaritans and relatives of patients were the only persons involved in bringing the patients to the hospital in nearly equal proportions. The absence of emergency medical services and paramedics suggests that these persons could be targeted for paramedic training for rendering first aid or basic trauma life support for airway protection and support of circulation. The historical development of ambulance services in the United Kingdom[21] provides an excellent example to understudy for providing pre-hospital care and transport. That the TRISS of most of the deaths were above 60% on admission at the A and E despite the identified inadequacies in pre-hospital care and transport suggests that most of the deaths were preventable. It is evident that mortality rate would drop if A and E services become organised and improved upon. There is evidence that cardiopulmonary resuscitation was often attempted in most cases prior to death in the A and E but this was poorly done[19,23]. This and other factors have led to a preventable trauma death rate of 73.7%, which, to the best of our knowledge, is the first documented statistic on the subject (Solagberu et al, preventable trauma death in a developing country, in print). Preventable trauma death rates in the USA[1], Italy[23] and UK[24,25] hover around 30%.

The strength of a chain is always equal to the weakest link, and any improvement in trauma care must recognise the chain events involved – prevention, pre-hospital care and transport, A and E reception and treatment, in-hospital care, rehabilitation and further research[23]. This study has identified the non-existence of many links in the chain in this country, absent pre-hospital care and transport, inadequate A and E treatment and poor trauma research. Taking measures towards categorisation and regionalisation of hospitals as had been done in USA[26,28] is certainly preferable to dumping patients at the nearest hospital to the scene of trauma without regard for capacity in rendering efficient care as was the case in 18 of the 84 deaths (21.4%) in this study. Documentation of vital signs on a continuous basis should improve as this report could not allot trauma scores to 45 of the 129 trauma deaths (34.9%). Post-morten studies would enhance such documentation and further studies. There is need for a multi-centre report to guide national statistics.

Acknowledgement

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