

Trauma death in a resource constrained setting: Mechanisms and contributory factors, the result of analysing 147 cases

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Abstract

Aims and objectives: The objective of the following study is to analyze the trauma type (causes), injury pattern and factors that may have contributed to death within 72 h of admission into our emergency department (E.D).

Materials and Methods: An 18 month prospective observational study, done from April 2009 to September 2010. All the patients were that admitted for 72 h following a full assessment by the attending clinician were enlisted for the study. The demographic data of each patient, time of arrival at the E.D, type of injury sustained, time of incident, previous care at any peripheral hospital, clinical state of the patient, Glasgow coma scale (GCS), Injury severity score (ISS) and treatment offered before death were entered into a Proforma.

Data Analysis: This was done using EPI-Info statistical programme version 3.4.3 of 2007 (by CDC Atlanta Georgia, USA).

Results: A total of 4011 patients were seen in the E.D during the period. 1943 (48.4%), were trauma emergencies, with a (147; 41.4%) mortality. Their ages ranged from 4 to 87 years, with an average of 34.5 years. The male:female ratio was 7:1. The assessed GCS ranged from 6 to 15, with an average of 9.1, the ISS ranged from 9 to 75 with an average of 31.3. Road traffic accidents (RTAs) accounted for 118 (80.3%) of the deaths, assaults 14.3%, falls from height 4.0% and gunshot injuries 1.4%. The overall mortality was 17.1%.

Conclusion: The major source of trauma death was RTA; The most frequently injured part of the body was head, with death resulting clinically hemorrhage. The 17.1% mortality is multifactorial: The late presentation (in some cases occasioned by interference by persons not knowledgeable in the basics of trauma care) lack of trained personnel and the systemic deficiencies.

Key words: Causes, factors contributory to death, mechanism of trauma, pattern of injuries, trauma death

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Introduction

A recent report by the World Health Organization (WHO) showed that more people die from trauma related causes than from all the endemic and emerging diseases.^[1] This report confirms the fact that trauma has become the number one cause of death world-wide. Yet there are neither non-governmental Organizations nor a WHO agency championing the cause of trauma victims as seen in the case of diseases like malaria or Human immunodeficiency virus infection/acquired immunodeficiency syndrome-making

trauma the truly neglected disease of the 21st century. Majority of trauma victims end-up being managed at least initially, in the emergency department (E.D) of health care facilities. This makes the E.D of any hospital a critical area in terms of assessment of quality of care. The initial management of these patients is often challenging: Requiring precise interpretation of symptoms and signs by specialized and experienced personnel, the utilization of high technology

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imaging modalities for accurate diagnosis, timely and appropriate resuscitation measures, frequent monitoring of response and timely consultation with the appropriate specialty. It is thus true, that the morbidity and mortality in the E.D of any hospital is an indicator of the adequacy or otherwise of the state of infrastructure and clinical care.^[2-4] In the developing world, most clinicians work in an environment of scarce resources and managing poor patients who cannot afford the cost of their treatment. Often these patients present late when life-threatening complications have set in. The obvious problems of trauma services in our setting include: The lack of emergency services to evacuate acutely injured persons from the site of the incident, the deficiency of qualified staff at the primary and secondary care centers, poverty and ignorance.^[2,3] The role played by unqualified persons such as a patent medicine operators and traditional healers claiming to give health care, even in situations beyond their comprehension, is rarely mentioned but often obvious. This may contributed to morbidity and mortality.

In general, trauma mortality is related to the: Quality of pre-hospital care, the delay between injury and treatment, type and extent of injury and level of alcohol in the blood of a traumatized victim at the time of injury.^[5-7] Often majority of the traumatized patients are from road traffic accidents (RTAs)^[8-10] presenting with bony and soft-tissue injuries^[11] which are beyond comprehension and management skills of traditional healers, patent medical shop operators and others claiming to give care.

The objectives of this study are: To analyze the type of trauma, pattern of injury and to identify factors that may have contributed to death in our E.D.

Materials and Methods

An 18 month prospective observational study was carried from April 2009 to September 2010. The E.D of the University of Calabar Teaching Hospital, a tertiary health center South-south of Nigeria, is divided into two sections: A resuscitation bay and wards. There is a mini-theatre manned by Senior Residents in anesthesiology and anesthetic nurses. This enables residents and consultants on emergency calls to handle minor cases. Within the complex is a pharmacy shop opens for 24 h. There are also hematology, chemical pathology, microbiology laboratories and an X-ray unit within the complex that open for 12 h from Monday to Friday and on call basis on weekends.

There is no intensive or critical care unit in the complex. Patients requiring such services are transferred by ambulance to the old site of the hospital located about 4 km within the city. The department is currently run by an Orthopedic Surgeon, supported by a team of general practitioners who are permanent staff of the department and senior residents

from various departments undergoing mandatory postings in preparation for fellowship examinations.

There is no dedicated trauma or medical emergency team. The nursing staff operates on an 8 hourly shift duty and consists of emergency trained nurses at the senior and general duty nurses at the junior cadre. Other supporting staff includes orderlies, cleaners, security personnel and drivers. The ambulance service is for 24 h daily throughout the week. Currently, the department does not have trauma surgeons and emergency physicians. It does not have imaging facilities such as magnetic resonance imaging (MRI) and computerized tomography (CT) scan, considered important for accurate diagnosis and management of trauma victims.^[8,11] At the state level, there are no pre-hospital care services, nor a trauma system.

The study involved patients who were admitted in the E.D and stayed from 0 to 72 h before death. A Proforma was prepared and the demographic data of all the patients such as; age, sex, marital status, occupation and religious affiliation were recorded. Other data collected include the diagnosis, the vital signs at the time of arrival, types of injuries and time of the incident. In RTA cases other data collected include the status of the patient, i.e., whether the patient was a driver, passenger, pedestrian who was knocked down; if the accident was a collision or somersault and if protective devices like seat belt or helmet were worn at the time of the incident. The time of arrival in the E.D, previous care at any peripheral hospital, Glasgow coma scale (GCS), injury severity score (ISS), investigations done, treatment offered before death and autopsy report were documented where available. The ISS was estimated using the method described by Bull.^[12] The inclusion criteria were: All patients with a clear history of trauma, who accepted admission and were alive for up to 72 h post admission. The exclusion criteria were; patients brought in dead, patients who were not admitted, those who refused admission and those who did not live up to 72 h following admission.

Data analysis

This was done using EPI-Info statistical program version 3.4.3 of 2007.

Results

A total of 4011 patients were seen in the E.D during the period. 1943 (48.4%), were trauma patients. As you can see in Table 1, 147 (41.4%), of this traumatized patients died 72 h from the time of admission. Their ages ranged from 4 to 62 years with an average of 31.2 years. 128 were males, with 19 females, giving a male:female ratio approximately 7:1. The assessed GCS ranged from 6 to 15, with an average of 9.1, the ISS ranged from 9 to 65 with an average of 31.3. Table 1 shows the distribution of

the patients; pediatric age group 15%, young adults 74.8% and old adult patients 9.5%. Table 2 shows the causes of trauma, type of injury sustained, clinical condition on arrival at the E D and the treatment given before death. Figure 1 shows the clinical causes of death, whereas Figure 2 shows the categories of RTA (RTA) victims. 118 victims (80.3%), died from RTAs, 111 (75.5%) of this sustained head injury Table 2; of which, 15 (13.5%) were basal skull fractures and 17 (15.3%) temporal fractures. The remaining 77 (69.4%) sustained blunt head injury in association with soft tissue injuries. 31 (21.1%) of the head injured patients had associated lower extremity fractures and 3 (2.0%) upper extremity fractures. Other documented injury types were: Multiple knife lacerations 15 (10.2%), lower extremity fracture alone 7 (4.8%), cervical spinal cord injury with quadriplegia 5 (3.4%), blunt chest injury 3 (2.0%) and abdominal gunshot wounds 2 (1.4%). The lower extremity fractures were of the following types: Bilateral femoral 2; right femoral and left tibial 1, left tibio-fibular 3 bilateral tibial fractures 1 and crushed injuries 2. Two lower extremity fractures were associated with pelvic fractures and one with ribs fractures. Upper limbs fractures were further classified into: Right humeral 2, unilateral right radio-ulna fracture 1, left humerus 1 and right radio-ulna fracture 1. In terms of mechanism of the RTAs, 63 (42.9%) were collisions, 36 (24.5%) somersaults, 19 (12.9%) were pedestrian that were knocked down. Accident involving four (or more) wheel vehicles involved 72 (49.0%), motor

cycles 36 (24.5%) and tricycles 10 (6.8%) of the cases. Only 21 (14.3%) persons in the four wheel vehicles, were wearing their seat belt at the time of accident mainly drivers and front seat passengers; and 19 (12.9%) motorcycle accident victims claimed they were putting on their helmets at the time of the incident.

31 (21.1%) had first aid before presentation; 19 (12.9.3%) in a Patent medicine store, 7 in a Private clinic and 5 in a General Hospital. The treatment given by these care givers consisted of wound dressing, antibiotics, analgesic, tetanus toxin and intravenous fluids.

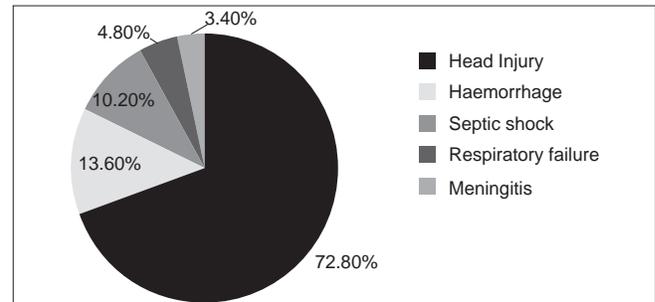


Figure 1: Clinical causes of death

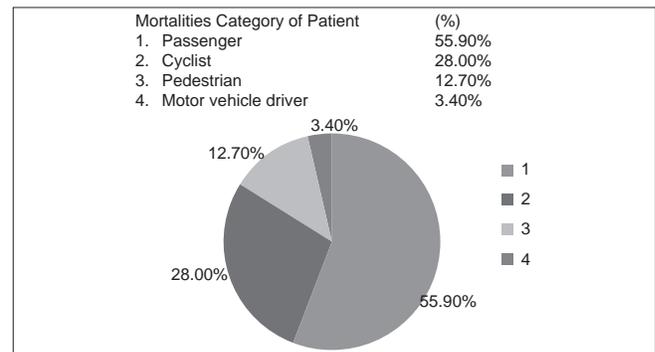


Figure 2: Categories of road traffic accident victims

Age range	Total (%)	M (%)	F (%)
0-17 (pediatric age group)	23 (15.6)	15 (10.2)	8 (5.4)
18-50 (young adults)	110 (74.8)	100 (68.0)	10 (6.8)
>51 (old adult)	14 (9.5)	13 (8.8)	1 (0.7)
Total	147 (100)	128 (87.1)	19 (12.9)

Cause of trauma (%)	Type of injury sustained	Clinical condition on arrival (%)	Treatment given before death
Road traffic accident 118 (80.3)	Head injury 111 (75.5%)	Severe anaemia (Hb < 7 g/dL) 30 (20.4)	Antibiotics, analgesic crystalloids 147 (100%) Simple wound dressing 117 (79.6%)
Assault 21 (14.3)	Multiple knife lacerations 15 (10.2%)	Clinical wound infection 28 (19.0)	Blood transfusion (> 2 units) 35 (23.8%)
Fall from height (>6 m) 6 (4.1)	Lower extremity+ pelvic fracture 7 (4.8)	Coma (glasgow coma scale 8-13) 25 (17.0)	Wound debridement 27 (19.7%) Nasal oxygen administration 27 (18.4%) Splinting of fractured limb with cast 19 (12.95)
Gunshot to the abdominal wall 2 (1.4)	Cervical cord injury with quadriplegia 5 (3.4%) Upper extremity fracture 4 (2.7%) Blunt chest injury 3 (2.0%) Abdominal gunshot wounds 2 (1.4%)	Haemorrhagic shock (systolic blood pressure < 70 mmHg) 20 (13.6) Septic shock 17 (11.6) Jaundice (with serum bilirubin > 17 μmol/L) 15 (10.2) Peritonitis 12 (8.2) Renal failure (urinary output > 30 ml/h after adequate intravenous crystalloid) 11 (7.5)	Exploratory laparotomy 9 (6.1%) External fixation 8 (5.4%) Thoracostomy 4 (2.7%)

The overall mortality in the hospital (wards and E.D combined) during the period, was 859. The total death in the E.D was 355 (41.3%); of which trauma accounted for 147 (17.1%) of the total hospital death.

Time from incident to presentation

This ranged from 30 min to 14 days, with an average of 3.2 days. 49 patients (33.3%) presented within 6 h of the accident. These were mostly victims of accident that occurred within Calabar city; 27 (18.4%) of these early presenters, were motor cycle accident victims. The rest of the patients presented beyond this period.

Investigations

The investigations requested were: Full blood count (complete blood count), urinalysis, electrolytes, urea and creatinine; random blood sugar level; X-rays and ultrasonography scan. Within the 72 h defined by the study, only 53 (36.1%) were able carry out these tests.

Autopsy

None of death from trauma was autopsied. The four autopsies carried out during the study period, were in medical death.

Discussion

This study has shown that death involved mainly people in the 18-50 years age bracket in both sexes, 110 (72.8%). This high mortality rate from trauma among such a productive age group, has been reported by other researchers.^[13-15] The death of such active individuals in any population constitutes both social and economic loss to families and society. Nearly 89% of the patients spent up to 48 h in the E.D before death. A study done by Trunkey^[16] described this as 3rd modal death and stated that it often due to institutional deficiencies in manpower; inadequacies in resuscitation, organ support, monitoring facilities; and a delay in early intervention. Thus, leading to the onset of sepsis, organ failure and culminating in death. The major source of trauma in our study was RTAs, 80.3% [Figure 2]; Solagberu *et al.*^[9] and Soroush *et al.*^[17] reported similar findings from Ilorin and Tehran respectively. A total of 111 (55.5%) of the death suffered a head injury. This represent 111/135 (82.2%) of the documented cases of head injuries during the study. However, detailed assessment of these head injured patients with CT or MRI scan could not be done. The role of CT scanning of acute trauma patients is well-documented,^[18] and in recent years imaging for trauma patients has migrated toward multi-slice CT (MSCT). The integration of modern MSCT scanners in the emergency room area allows the immediate assessment of trauma victims following admission. Using modern MSCT scanners, total whole-body scanning time may be reduced to less than 30 s. In a retrospective study comparing 370 patients

in two groups, A study done by Weninger *et al.*^[19] showed that faster diagnosis using MSCT led to shorter emergency room and operating room time and shorter ICU stays.^[20] Huber-Wagner *et al.*^[21] also showed the benefit of integration of the whole-body CT into early trauma care. CT diagnosis significantly increases the probability of survival in patients with polytrauma.^[20,21] Whole-body CT as a standard diagnostic tool during the earliest resuscitation phase for polytraumatized patients provides the added benefit of identifying head and chest injuries and other bleeding sources in patients with multiple injuries.

Several previous reports have documented the role of a functional Intensive Care Unit in reducing morbidity and mortality in critically injured patients especially in head injured victims, with associated shock and intracranial hemorrhage.^[18,19] Our patients did not the opportunity of been treated in an ICU facility. It is thus not surprising that complications resulting from head injury with associated cerebral hypoxia, such as intracranial hematoma and shock were among the leading causes of death in our series, even though clinically, as shown in Figure 1. In our observation, we believe that the phenomenon of late presentation, either as a result of ignorance, delayed referral from peripheral hospitals, intervention from traditional healers and patent medicine shop operators, played a considerable role. In our earlier report,^[22] we emphasized the negative impact on trauma outcomes by the activities of untrained care givers; such as, bone setters, and spiritualists who delay patients' presentation at the point of proper care, by claiming to provide the necessary treatment. The usual result, been patients presenting late, with sepsis and shock, as was the case in a majority of our patients.

The average ISS was 31.3. This is high, but explained by the fact that the head, which carries the highest ISS, was the most commonly injured part of the body 55.5%. Nearly 49 (33.3%) of the traumatized patients presented within the golden period, (first 1 h of injury). The previous studies have established that, this is the ideal time lag in which trauma victims can be managed with good prognosis.^[12,16]

The time range from incident, to arrival at the E.D was 30 min to 14 days, with a calculated average of 3.2 days. This is high, when compared with previous authors, who reported averages that ranged from 2 to 6 h.^[3,4,7] Apart from the intervention by alternative practitioners, it our opinion that; poorly equipped and inadequately staffed peripheral hospitals, a dysfunctional transport system, the lack of ambulance services, are factors that are most likely responsible for this time lag. We also believe that, ignorance and poverty, the ubiquitous diseases of the developing world cannot be ruled out as independent contributory factors in this poor outcome. This is implied by the fact that, only 53 (36.1%) of the patients could afford to perform the requested investigations within the 72 h period; and many of these patients with complicated injuries, had to consult

Patent medicine operators before presenting at the point definitive care.

Majority of the dead were males, with a male:female ratio of 7:1. The high incidence of trauma death among the male gender can be explained by the fact that they constitute the majority of the commuters on the road anywhere in the world as previously documented.^[2,4,8,9,23]

The high incidence of RTA and the associated death noted in this study could be attributed to a variety of factors: Bad roads, ill-informed and untrained drivers and drunken drivers, are important factors in the scenario. More importantly, the lack of a trauma system, pre-hospital care, paucity of facilities for intensive care for the severally traumatized patients and the lack of ambulance services for quick and safe evacuate of trauma victims to any nearby health facility, where basic emergency care can be given, are the crucial issues. These lapses if corrected can reduce trauma death, as observed in the developed world, where death from trauma currently ranged from 6 to 12/100,000 populations on the average 5.^[8,24]

The use of private cars, taxis, trucks, and motor cycles in conveying trauma victims can only be obviated, with public education and awareness, but most importantly with the introduction of a state or nationwide ambulance services. The inappropriate positioning of victims, especially those with spinal cord and head injuries in these vehicles, plus the possibility of wound contamination, are documented causes of poor outcome.^[25-27]

The in-hospital estimated trauma death in this study was 7.6%, it is high, even by the standard of the developing countries. Investigators from other parts of the country A study by Afuwape *et al.*^[15] and Ekere *et al.*^[4] had 0.2% and 2% respectively. These studies were however retrospective, with the possibility of incomplete data collection. Never the less, the roles of neurosurgical services and imaging facilities (MRI and CT scan), available in these centers, in lowering mortality should be appreciated.

Conclusion

The high death rate in this study is multifactorial. First, is the deficiency of trained man power in trauma management; secondly, the systemic deficiencies such as the lack of a trauma system, prehospital care and intensive care facilities, are independent contributory factors. The factors responsible for late presentation at the definitive care center are multiple; cumulatively they justify the fact that, the public need to be aware of the fact high speed and high velocity trauma of today's world, is beyond the comprehension of alternative practitioners.

In our experience, we did not document obvious cases of clinical incompetence among the E.D staff based on

their current knowledge level nor work overload; which McDermott *et al.*^[28] reported that accounted for 68.0% death in Australian trauma victims. However we suggest that, to reduce this high mortality, there is an urgent need the upgrading of infrastructure and staff training. At the national and state levels, there is an urgent need for the establishment of a trauma system and prehospital care services. Such an investment will save our productive population from avoidable death.

We acknowledge the limitation of this study by the fact that our head injured cases were not assessed with a CT scan, to give a clear definition of cause of death.

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