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ORIGINAL ARTICLE

Thoracic trauma in national hospital Abuja, Nigeria: The epidemiology, injury severity and initial management options

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ABSTRACT

Background: Trauma is the leading cause of death in individuals between the ages of 1 and 44 years and it is the third commonest cause of death regardless of age. Thoracic trauma is a relatively common cause of preventable death among trauma patients. The spectrum of injuries after blunt chest trauma presents a challenging problem to the emergency physician. This study is intended to discuss the epidemiology, severity and initial management strategies in chest trauma patients, in a low income country.

Methods: A cross sectional retrospective study among chest trauma patients seen in the emergency room of National Hospital Trauma Centre, Abuja, Nigeria, from January 2015 to December 2017. Relevant patients' information was retrieved from the trauma registry kept in the trauma centre. Data processing and analysis was done using statistical package for social sciences (SPSS) version 24. Test of significance was done where applicable using chi square and student t test, using p value less than 0.05 as significant. Results are presented in tables and figures.

Results: A total of 637 patients, male to female ratio of 3.6 and mean age of 34.18 ± 11.34 were enrolled into the study. The most common mechanisms of injury were MVC (54.6%) and assault (23.5%). Blunt injuries were 3.5 times more frequent than the penetrating injuries. The RTS of 12 (76.3%) and the ISS of 1-15 category (52.3%) were the most common scores. Up to 98% of patients were managed non-operatively. Recovery rate was high (89%) with relatively low mortality rate of 4.2%.

Conclusion: Majority of thoracic trauma can be managed effectively by employing simple, non-operative procedures such as needle decompression and chest tube insertion. Efforts should be made to include these procedures in the skill set of every medical officer working in the emergency room, particularly in low and middle income countries where there is paucity of emergency physicians.

Introduction

Trauma is the leading cause of death in individuals between the ages of 1 and 44years and it is the third commonest cause of death regardless of age [1] Establishment of good trauma centres and systems have been shown to have a significant impact on outcomes of trauma services around the world [1–3] Motor vehicular crashes in addition to other forms of trauma have become a major health problem throughout the world and especially in the developing countries [4–6] Trauma incidence in Nigeria is rising accounting for half of all surgical emergencies with the greatest impact on the economically productive male adults [7,8].

Thoracic trauma is a relatively common cause of preventable death among trauma patients [9,10] Thoracic trauma is seen in more than 50% of trauma patient with mortality rate of about 25% [11,12]. Thoracic trauma is a major cause of morbidity and mortality second only to head injury. It is the third most common diagnosis next to extremities injury and head injury in multiply injured patients making it an important public health problem [13]. Morbidity and mortality in chest trauma varies widely from one country to another and even in the same country and is different for blunt and penetrating injuries [14–18]

Blunt chest injury is associated with higher mortality and account for more than 50% of all thoracic trauma case from most series [19–22] Road traffic accident is the commonest cause of chest injuries in civilian practice accounting for up to 70% in some series [23,24]. The spectrum of injuries after blunt chest trauma presents a challenging problem to the emergency physician [25] With increasing use of firearms, the incidence of penetrating chest injuries is increasing in civil

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society [26] They are often associated with other injuries particularly to the abdomen and long bones [26,27]

Approximately 85% of thoracic injuries can be treated definitely with a chest tube [28]. Two third of patient with blunt chest injury are successfully managed by tube thoracostomy [21,29,30]. Only less than 10% of blunt chest injuries and 15% to 30% of penetrating chest injuries requires operative intervention [19,23,31]. Emergency thoracotomies for resuscitation of patients with blunt chest trauma with absent vital signs proved unsuccessful in 100% of the patients [32].

This study is intended to review the epidemiology, severity and initial management measures employed in the management of thoracic trauma in a dedicated trauma centre, in Nigeria.

Methods

Study design

This is a retrospective cross sectional study carried out in a clinical setting of a tertiary health centre in Abuja, Nigeria.

Setting

The study was carried out in the trauma centre of National Hospital Abuja, a tertiary healthcare centre dedicated to trauma. The trauma resuscitation room is manned by a trauma team comprising nurses, house officers, surgical resident doctors, trauma fellows and an in-house trauma surgeon, on a twenty-four-hour call basis. Bed side ultrasound for extended-FAST and other radiological facilities including lodox, computed tomography and magnetic resonance imaging are available. Abuja is the federal capital territory, located in North Central Nigeria with a population of over three million people. The trauma centre receives patients from Abuja and other neighbouring states. Majority of the patients come from the scene with little or no pre-hospital care.

Participants

Subjects were all trauma patients of all ages who presented to the trauma centre with both blunt and penetrating chest injuries between January 2015 and December 2017 representing the approximate duration of the trauma registry at the time of analysis. Both isolated chest injuries and patients with chest injuries in the setting of multiple trauma were included. Patients who did not require resuscitation room care after initial triage using revised trauma score (RTS) and mechanism of injury, and those with minor soft tissue injuries who did not require any observation after the initial assessment were excluded. Patients with no signs of life on arrival were also excluded.

Sample size

All the patients who met the inclusion criteria within the period of the study were included consecutively from the database.

Data sources

Relevant information and data from the selected patients were retrieved from the trauma registry. Parameters extracted from the registry included bio-demographic information, mechanisms of injury, findings on primary and secondary survey and treatment options. A comprehensive trauma registry is kept in the centre where patients' data are prospectively entered on a daily basis by the doctors on call. The RTS and injury severity scores (ISS) were derived from the original input. Some parameters missing in the registry including the outcome data of some patients were retrieved from the patients' case notes.

Table 1
Gender and age of patients.

Variable		Frequency	Percentage (%)
Gender	**Female**	139	21.8
	Male	498	78.2
	Total	637	100.0
Age in years	(Mean ± Standard deviation)	34.18 ± 11.34	
Where the incident happened	**Abuja city**	298	46.8
	Outside the State	110	17.3
	Suburb	229	35.9
	Total	637	100.0

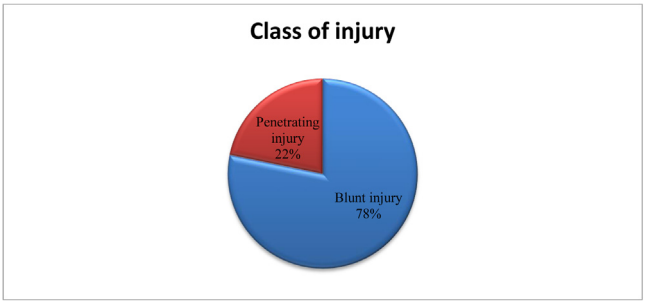

Fig. 1. Class of injury.

Statistical method

The data collected was analyzed for the mean and standard deviation. Data processing was done using SPSS (statistical package for the social science) version 24.0. Test of significance was done using Yates modification of chi-square test (x^2) for qualitative variables and the student t test for quantitative variables. A value of $P < 0.05$ was considered significant.

Tables, charts, and figures were used to present the results.

Ethical consideration

Permission for this study was obtained from the institution review board of National Hospital Abuja, Nigeria.

Results

A total of 637 patients who met the inclusion criteria were included in the study, 498 males and 139 females, with male to female ratio of 3.6 and mean age of 34.18 ± 11.34. Nearly half (46.8%) of the injuries happened in the city, 35.9% happened in the suburb while 17.3% took place outside the state. (Table 1) Blunt chest injuries were 3.5 times more frequent than the penetrating injuries as shown in Fig. 1.

The most common mechanism of injury among the studied population was motor vehicular crash (MVC) accounting for 54.6% of the injuries. This is followed by stab injuries (14.8%), pedestrian vehicular crash (PVC) in 10.7% of cases and gunshot wounds in 4.9% of cases. When put together, assaults make up nearly a quarter (23.5%) of the mechanisms of injury. Motor tricycle crash (MTC) which made up 1.9% of cases and a group of injuries consisting of blast, suicide attempt and building collapse together making up 1.1% of cases constitute the least common mechanisms of injury (Table 2).

The RTS of 12 was the most frequent score among the studied group accounting for 76.3% of cases. This is followed by a score of 11(14.3%) and 3–10 in 9.4%. Similarly, the Injury Severity Score (ISS) of 1–15 was the most frequent accounting for 52.3%. This is followed by a score of 16–74 accounting for 46.8% and the least was a score of 75 accounting for only 0.9% of cases (Table 3).

Table 2
Incident/mechanism of injury.

Variable	Frequency	Percentage (%)
Assault-Blunt	24	3.8
Assault-Gunshot	31	4.9
Assault-Stab	94	14.8
Fall	29	4.6
MBC	24	3.8
MTC	12	1.9
MVC	348	54.6
PVC	68	10.7
Others (blast, building collapse, suicide attempt)	7	1.1

(MBC: Motor Bike Crash, MTC: Motor Tricycle Crash, MVC: Motor Vehicular Crash, PVC: Pedestrian Vehicular Crash)

Table 3
RTS and ISS categories.

Variable		Frequency	Percentage (%)
RTS	**3 -10**	60	9.4
category	**11**	91	14.3
	12	486	76.3
ISS	**1 -15**	333	52.3
category	**16 – 74**	298	46.8
	75	6	0.9

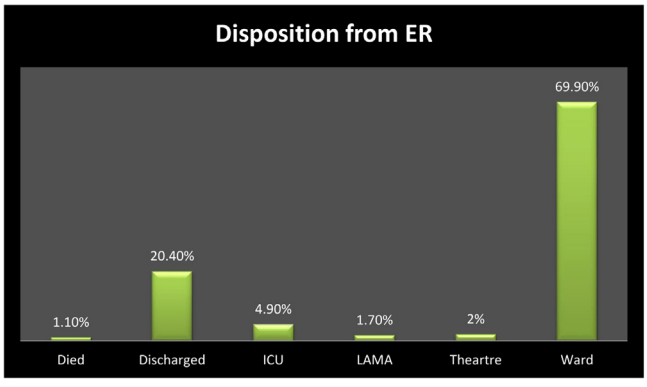

Fig. 2. Disposition from the Emergency Room (ER)
(*ICU: Intensive Care Unit, LAMA: Left Against Medical Advice)*.

Fig. 2 shows the disposition of the patients from the resuscitation room, otherwise called emergency room (ER) after initial assessment and management. Nearly three quarter of the patients (69.9%) were admitted into the ward after resuscitation. Up to 20.40% of the studied group were discharged from the ER after observation. Similarly, 4.9% of the patients were admitted into the intensive care unit (ICU) for mechanical ventilation/ haemodynamic monitoring, 2% were transferred directly to the operating theatre for emergency surgery. However, 1.7% of the subjects left against medical advice (LAMA) and 1.1% unfortunately died in the ER during resuscitation.

Among the treatments undertaken in both ER and operating theatre (OT), 98% of the patients were treated by non-operative management comprising conservative management, needle decompression and chest tube insertion while only 2% required immediate surgical intervention. In the non-operative management group, 23.3% had chest tube insertion alone using the standard semi-rigid fenestrated plastic tubes of appropriate size; 1.1% had initial needle decompression before chest tube insertion while the rest were managed conservatively using a combination of analgesia, supplementary oxygen, wound care, antibiotics, tetanus prophylaxis and a variable period of observation where indicated. Of the 2% of the patients that had urgent surgical intervention, only 5 (0.8%) had emergency thoracotomy during the study period. The remaining 1.2% had exploratory laparotomy. Meanwhile, a small proportion (2%) of patients had advanced airway in form of endotracheal intubation in the ER. These are shown in Table 4

Table 4
Interventions done for the patients.

Variable	Frequency	Percentage (%)
Conservative management	469	73.6
CTTD alone	148	23.3
Needle Decompression + CTTD	7	1.1
Surgery-Emergency Laparotomy	8	1.2
Surgery-Emergency Thoracotomy	5	0.8
Total	637	100.0
Advanced Airway (ETT)	13	2.0

(CTTD: Closed Thoracostomy Tube Drainage, ETT: Endotracheal Tube).

Table 5
Final outcome.

Variable	Frequency	Percentage (%)
Discharged	587	89.0
LAMA	41	6.4
Died	27	4.2
Absconded	1	0.2
Transferred	1	0.2

Table 5 shows the final outcome of the patients who left emergency room alive. Up to 89% of the patients were finally discharged home following satisfactory recovery, 6.4% left against medical advice, 4.2% died, 0.2% absconded and another 0.2% of the patients were transferred to some other facilities.

Discussion

The male to female ratio of 3.6 reflects the already known epidemiology of trauma as seen in other studies [1,7,8]. Males have been known to be more adventurous coupled with the near sole bread winning role in the African context. The mean age of 34.18 years is also expected, as trauma is known to be more prevalent in this young productive age group as seen around the world [1,4,5,7,8]. Though many (46.8%) of the injuries happened in the city centre where the facility is located, over half occurred outside the city centre and in the neighbouring states, in line with the referral status of the trauma centre.

MVC has remained the most common mechanism of injury in general, in many parts of the world and this study is not an exception. This is supported by several studies done in different regions [17,18,23,24]. The high proportion of assault (23.5%) may not be unconnected with the level of violence and insecurity in the society. Higher figures have been reported in Iran where assault by stab contributed over 90% of chest injuries [33]. The thoraco-abdominal region bears the blunt of penetrating assault due to higher surface area and intention to kill in some cases. Chest was the commonest site of gunshot wounds in the South African experience [34]. MBC and MTC are not common in this study. This may be due to the ban on this type of transportation in the city centre where this study was conducted. It is possible that the few patients from this mechanism of injury were among those referred from outside the city. Blunt trauma is generally more prevalent than penetrating trauma in the civilian settings as seen in this work. This reflects the predominant mechanism of injury which is MVC as seen above. This finding is similar to findings in other parts of the world [15,16,19–22] but contrasts with few centres even in Nigeria [14,35] where penetrating injury predominated.

Majority of the injuries fell into the delayed triage category of RTS 12 while nearly ten percent that were triaged to immediate group reflects the actual severe injuries in the study. Similarly, greater proportion of

the patients (52.3%) fell into the least ISS group of 1–15. The relative high proportion of ISS above 15, despite having low number of patients triaged to immediate category is surprising. This disparity may be due to imperfect triage by the nursing staff or inaccurate calculation of ISS by the medical staff and may need further review. This finding is further supported by a systematic review which revealed some limitations in the applicability of these scores in low resource settings including sub-Sahara Africa [36]. It appears that the 6.9% of patients who were transferred directly to the ICU and operating theatre may roughly reflect and support the immediate triage category of 10%. The 1.1% death recorded in the ER may be related to the 0.9% of patients with ISS of 75 who were not expected to survive.

Majority of the patients (98%) were treated by non-operative management employing chest tube and conservative management. This affirms the old knowledge in chest injuries where most injuries are said to be amenable to simple procedures that are within the skill set of a casualty officer. Several studies have demonstrated that majority of thoracic trauma can be managed by chest tube alone [21,28–30]. This huge percentage of non-operative management is also in support of less severe injuries recorded in this series. The small proportion of subjects who needed needle decompression as a result of suspected tension pneumothorax is not surprising given the paucity of pre-hospital care in our setting. Many patients with tension pneumothorax will die before getting to the hospital in the absence of rapid pre-hospital care [37]. Furthermore, the proximity of such patients to the trauma centre may have contributed to their outcome. About 2% of patients who required tracheal intubation in the ER had persistent poor saturation despite adequate supplemental oxygen with non-rebreathing mask.

The overall discharge rate was high (89%) reflecting the less severity of injuries. However, it is worrisome that up to 6.4% of the patients left against medical advice due to financial reasons. The mortality of 4.2% is relatively lower than the findings in other climes [11,12]. This is likely due to less severe injuries recorded in this study. It is possible that majority of the severely injured patients died before getting to the hospital, given the absence of a functional pre-hospital care in the region.

Conclusion

Majority of thoracic trauma can be managed effectively by employing simple, non-operative procedures such as needle decompression and chest tube insertion. Efforts should be made to include these procedures in the skill set of every medical officer working in the emergency room, particularly in low and middle income countries where there is paucity of emergency physicians.

This study is limited by its design and extent. Some data that would have enabled more analysis and added to the validity of the study like the events during admission, morbidity and follow up could not be fully obtained due to its retrospective nature. A prospective analysis of a similar study including, but not limited to, comparing morbidity and mortality of different treatment options, is suggested.

Dissemination of Results

Results from this article are yet to be disseminated outside the institution. However, it was informally discussed in the trauma team's regular weekly presentation. It is intended to be presented in the surgery departmental meeting. There is plan to share the article with other hospitals through various platforms after it has been published. The results have not been sent to or published elsewhere.

Authors contributions

Authors contributed as follows to the conception or design of the work; the acquisition, analysis, or interpretation of data for the work; and drafting the work or revising it critically for important intellectual content:OGO contributed 60% while OOO, YBA and NA contributed 20%., 10% and 10% respectively. All authors approved the version to be published and agreed to be accountable for all aspects of the work.

Declaration of Competing Interest

The authors declared no conflicts of interest

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