The Pattern and Outcome of Chest Injuries in South West Nigeria

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Abstract

Objective: The pattern and management outcome of chest injuries presenting to our tertiary university hospital located in a semi-urban population in the South West of Nigeria, has not been documented previously. We therefore sought to identify factors that may contribute to mortality.

Method: We analyzed 114 patients presenting to the Accident and Emergency Unit with chest trauma, prospectively entered into a data base over a two year period.

Results: Chest trauma accounted for 6% of all trauma admissions with a male preponderance (M:F = 3.6:1). Rib fractures were the most common injury (46.3%) while limb fractures were the most common associated injury (35.8%). Associated head injury accounted for most deaths (56%) in those with severe ISS. Majority of patients (51.8%) required only analgesics, while additional closed tube thoracostomy drainage was necessary (41.8%) in the others who suffered blunt trauma. Thoracotomy was indicated for only 5 (4.5%) penetrating injuries. There is a rising trend towards penetrating gunshot injuries, with mortality increasing with age (p=0.03) and severity of associated injuries (ISS) (p=0.003).

Conclusion: Majority of the patients required only minimal intervention with chest drainage or analgesics, with low mortality. Increasing age and severity of injury contributed significantly to mortality. Initiation of care for chest trauma victims is still delayed in our centre.

Introduction

Trauma is a leading cause of morbidity and death in developing countries with thoracic trauma contributing significantly to these figures especially where infrastructure and personnel are ill equipped to cater for these critically ill patients. It is estimated that death from unintentional trauma is on the increase in developing countries though not as significantly as that from infectious diseases like diarrhoea and malaria, while it is on the decrease in industrialized countries (1). Previous reports on incidence of blunt versus penetrating injury from Nigeria have been conflicting depending on the urbanisation of the region as well as prevailing circumstances of peace or regional armed violence which occur sporadically (2-3).

We have examined the spectrum of these civilian chest injuries during times of peace to determine the incidences of blunt and penetrating injuries and the outcomes of our management strategies, evaluating the emergency room initiation of care for these critically ill patients to determine factors that may contribute to mortality and ascertain whether our current setup is achieving results comparable with other trauma centers.

Patients and Methods

The Obafemi Awolowo University Teaching Hospital, Ile-Ife, (OAUTH), is a major trauma referral center in South Western Nigeria with compliment of specialists in all major surgical and other disciplines. The Accident and Emergency Unit of the hospital is a 15- bedded ward staffed by trauma doctors and nurses overseen by a trauma consultant, while a 6-bedded Intensive Care Unit caters for the critically ill. The hospital is strategically positioned in a network of highways linking major cities in the South West and other parts of Nigeria.

All patients with blunt or penetrating chest trauma presenting to the Accident and Emergency Unit of the OAUTH, Ile-Ife and having had appropriate chest radiographs, were prospectively entered into a database which was collected over a period of two years (May 2008 – April 2010). All patients who did not require chest radiographs after careful physical examination were excluded from the analyses.

The demographics, mechanism of injury, time to presentation, vital signs on admission, injury sustained, Injury Severity Score (ISS) as well as management instituted were evaluated.

Continuous variables were summarized using means and standard deviations or medians and inter-quartile ranges (IQR) for the highly skewed variables and analyzed using two-sample t-test or Wilcoxon rank-sum test. Discrete variables were summarized as counts and percentages and compared using Chi-square test or Fisher's exact test as appropriate. A multivariate logistic regression model was used to identify factors that are independently associated with mortality. P-values less than 0.05 were considered statistically significant. The data was analyzed using Stata version 10. Statacorp, Texas, USA.

This study was approved by the Hospitals' Ethical Committee.

Results

Demographics

Out of a total of 1847 patients admitted to the Accident and Emergency Unit following trauma during the study period, 114 (6.2%) patients had chest injuries. There were 89 (78.1%) males and 25 (21.9%) females (ratio 3.6:1) with mean age of 40.4 ±15.8 years. The mean age for the female patients was 38.6±14.3 years while that of the males was 40.9±16.2 years. Twenty six (22.8%) of the patients were traders; 26 (22.8%) were office workers, 21 (18.4%) were artisans, 15 (13.2%) university students, 11 (9.7%) were drivers and 9 (7.9%) were farmers. There were 2 children (1.8%).

Injuries

Blunt trauma accounted for 99 (86.8%) patients while penetrating injuries were 15 (13.6%). Automobile accidents caused the majority of blunt trauma (79.1%), with 68.2% in- volving passengers while 10.9% were pedestrians. The ve- hicular types and their frequencies are shown in Figure 1. Other causes of blunt trauma include crushing by objects

5 (4.6%), falls from heights 2(1.8%) and electrocution 1(0.9%).

Gunshot wounds accounted for 8% of chest injuries and was the commonest cause (9/15; 60%) of penetrating chest injury. Other penetrating injuries were from stabs (5/15; 33.3%) and fall unto a sharp object (1/15; 6.7%). The median time to presentation was 120 minutes (interquartile range 40 – 540 minutes). The front seat passengers of cars (35.5%) and passengers in the second row of buses (35%) were the most likely to suffer chest trauma while the driver of a car was more likely to suffer chest injury than the driver of a bus (p=0.02). Seat belt usage was low at 8.3% with only 36% of drivers using seat belts at the time of the accident.

The most common injury were rib fractures (46.3%) while 49 (44.6%) had hemothorax and 34 (30.9%) presented with pneumothorax both necessitating chest drainage. The most common extrathoracic injuries were limb fractures in 29 (35.8%) and head injury in 24 (29.6%) patients. Abdominal injuries were seen in 8 (9.9%) patients. The median ISS score was 9 (interquartile range 4 – 18). Figure 2 shows the proportion of individuals with ISS score less than 16, 16 – 24 and greater than 24. Our study showed a median ISS of 27 (IQR 23.5-36) in those who died and a median ISS of 9 (IQR 4-16) in those who survived.

Treatment

Fifty three (48.1%) had closed tube thoracostomy drainage (CTTD) as part of their treatment with 26.4% inserted on the right, 14.6% on the left and 6.4% bilateral. 91.67% of those that died had a CTTD performed on them (p= 0.002). Insertion of CTTD, based on positive thoracocentesis alone without prior chest radiography occurred in only 3 (2.7%) patients. Supportive chest radiographs were available in the others (97.3%) before chest drainage.

Thoracotomy was necessary in only 5 (4.5%) patients, 3 of whom were gunshot victims. The mean hospital stay was 7.1 ± 7.7 (0 - 26) days.

Factors affecting mortality

The overall mortality was 12 (11%) patients. At univariate level, the factors that were found to be associated with mortality included increasing age, respiratory rate, mean arterial blood pressure and ISS score. Table 1 shows the multivariate logistic regression model showing the independent predictors of mortality in the patients with chest injury in our centre.

For every one year increase in age, there was an 8% increased risk of mortality after adjusting for the effect of differences in gender, type of vehicle, mean arterial blood pressure at presentation, time to presentation, respiratory rate and pulse rate at presentation. The higher the ISS score, the greater the risk of mortality in this cohort of patients. For every unit increase in the ISS, the odds ratio for mortality was 1.27 (95% CI 1.09 – 1.49), p = 0.003.

Discussion

Previous reports on chest trauma have documented a variable incidence of chest injuries from 10% in developing countries like India (4) to about 25% - 50% of total trauma in developed countries of Europe (5). Although data of chest trauma are not readily available from developing countries, Adesunkanmi et al (6) reported 2.5% of total trauma admissions among the pediatric age groups in our institution a decade ago, while our study recorded only 6% of our total trauma admissions both suggesting a generally lower incidence than industrialized societies. However, this may be due to under-reporting as occurs with many cases of trauma in developing countries. This may also be responsible for the low absolute numbers of chest trauma seen during the study period.

It is estimated in some studies that thoracic trauma accounts for about one quarter of deaths from trauma though two thirds of these deaths unfortunately occur in a hospital facility (7). In our setting, this is difficult to substantiate as post mortems on dead trauma victims are not routinely performed for various religious and cultural reasons. However, it is believed that death from unintentional trauma is on the increase in developing countries though still behind infectious diseases like diarrhoea and malaria, while it is on the decrease in industrialized countries (1).

Our study showed that active males (78%) still remain the population at greatest risk despite the supposed increasing role of women outside the home to support the domestic income. A slightly older but comparable mean age of 40±16 years in our study might be attributed to older people seeking better economic prospects. However, this is still comparable to other studies from Nigeria and elsewhere (8,9,10).

Small to medium scale traders on business trips to neighboring cities, formed the largest occupation group (23.9%) amongst the victims, reflecting the large business community of South Western Nigeria. Another emerging population at risk are students of higher educational institutions (13.8%) who are exposed as they ply the highways during university holidays or unfortunate closures of their university campuses for one reason or the other.

Our study showed that motor vehicle crashes (cars and buses) were responsible for the majority of injuries (78%), which though comparable to other countries, is rather high in spite of efforts to reduce the incidence and carnage of road traffic accidents by the Federal Road Safety Corps, which enforces the use of seat belts, increasing awareness of road safety among road users etc. Seat belt usage is still very poor at 8.3% among commuters with only 36% of drivers who suffered chest injuries using them at time of impact. Unfortunately, many vehicles do not have functioning seat belt devices especially the 14-16 seat buses which are commonly used for mass human transportation in Nigeria. Although the use of seatbelts could ironically be implicated in certain lateral impacts by keeping the passenger fixed in his seat and increase the energy dissipated to the victim from the vehicular components (11), this is rare and was not demonstrated in our patients. The contribution of poorly maintained roads and vehicles as well as failure to keep to traffic rules and lack of organized rescue mechanisms play an enormous role in the high frequency and morbidity of road traffic accidents. A lot more still needs to be done by the government to further reduce the morbidity and mortality figures.

The first 60 minutes after injury has often been described by trauma experts as the 'golden hour' and is the most effective for saving lives (12). Improved quality of patient care has also been linked to ability to considerably reduce this time to intervention which is often now measured in minutes. The median time to intervention by trained personnel of 2.5 hours in our study is rather long, and may explain why no major vascular and cardiac injuries presented to our facility during this period as these may have expired at the scene of accident or shortly on arrival at hospital. Even though time to presentation was not found to be significant for in-hospital mortality ($p>0.05$) (Table 1), this could be as a result of relatively small sample size. There is unfortunately no organized pre-hospital emergency care presently to extricate and transport these individuals to health facilities expeditiously and as such, this vital role is often played by volunteers and passersby who are largely ignorant of many life saving procedures. Many of the victims suffer more injury from untrained hands who are really doing their 'best' to help! The siting of mobile clinics at strategic intervals on our highways armed with trained ATLS personnel would go a long way to providing the much needed emergency care before onward transfer to more sophisticated care.

While most of our patients sustained blunt injuries to the chest, only 13.6% sustained penetrating chest injuries out of which 8% were due to gunshot injuries during

	Univariate analysis	Multivariate analysis
	odds ratio (95% CI) p-value	odds ratio (95% CI) p-value
Female sex	0.83 (0.21 – 3.31) 0.79	1.79 (0.12 – 27.76) 0.68
Age (years)	1.04 (1.01 – 1.08) 0.03	1.08 (1.01 – 1.17) 0.03
Vehicular type/Pedestrian		
Bus	1	1
Car	0.99 (0.21 – 4.79) 0.99	0.46 (0.04 – 5.31) 0.53
Motorcycle	1.42 (0.23 – 8.71) 0.70	0.01 (0.004 – 1.03) 0.05
Pedestrian	1.32 (0.27 – 6.48) 0.73	1.28 (0.05 – 30.94) 0.88
Mean arterial blood pressure	0.97 (0.94 – 0.99) 0.04	1.01 (0.97 – 1.06) 0.53
Type of chest injury		
Blunt	1	1
Penetrating	0.57 (0.07 – 4.78) 0.61	0.13 (0.04 – 3.84) 0.24
ISS	1.17 (1.08 – 1.26) <0.001	1.27 (1.09 – 1.49) 0.003
Pulse rate (per min)	0.96 (0.89 – 1.03) 0.24	0.96 (0.86 – 1.08) 0.52
Respiratory rate (cycles/min)	1.14 (1.02 – 1.29) 0.03	0.97 (0.79 – 1.19) 0.78
Time to presentation (minutes)	0.99 (0.99 – 1.00) 0.49	0.99 (0.99 – 1.00) 0.21

Table 1: Logistic regression models showing factors associated with mortality

armed robberies and attempted assasinations, a slight increase over 5.5% in a previous study from Nigeria by Anyanwu et al (8) over two decades ago where they identified gunshot wounds as an infrequent and often accidental cause of penetrating injuries. Very few studies report penetrating injury as being more common. Soreide et al (13), from Scandinavia, recorded a third (33%) of all injuries while Ali and Gali (2), from North East Nigeria, report penetrating injury occurring in 61.5% of cases during communal conflicts. There appears to be a changing trend with such injuries occurring more frequently from bandits. Stab wounds from bottles and knives are infrequently seen (4.5%) and there was a case of a fall from a height unto a sharp farming implement causing an open pneumothorax. Sports related injuries and falls from heights were rarely encountered in our series as opposed to some studies in developed countries where these were more frequently seen (10).

Worldwide, rib fractures are the most common pathology associated with blunt chest trauma (8,10,14) and this is consistent with our results (46.3%). All patients with isolated single rib fractures were managed as outpatients requiring no more than analgesics with instructions to return after 24-48 hours for a repeat chest radiograph to reassess the pleural space. However, none required further intervention thereafter. Flail chest was not frequently encountered (4.6%) and most required only analgesics and chest drainage when occurring with pleural collections, with none requiring mechanical ventilation.

We recorded only 17 (15.5%) patients with evidence of pulmonary contusions on chest radiograph which is defined as pulmonary infiltrates following trauma in the presence of hypoxaemia. Even though pulmonary contusion may have a very significant impact on mortality (15), we caution that infiltrates in the chest radiograph could be non-specific or even absent. It may be difficult to quantify the degree of pulmonary contusion on chest radiographs and impossible when xrays are not even available.

Chest ultrasound may have a sensitivity of 94% in detecting contusions (4), but we have never needed to resort to this or chest CT in the acute management.

There is a high incidence of traumatic hemothorax or pneumothorax or a combination of both, requiring intercostal drainage. We rely on clinical examination, thoracocentesis and chest radiographs, which are relatively easy to obtain in our centre, to determine need for chest tube drainage. We have found that thoracocentesis is a fairly reliable predictor of pleural collection especially following trauma and should be utilized where chest

ISS score	Associated injury	Outcome
25	Head Injury	Died
45	Electrical burns	Died
34	Head Injury	Died
27	Paraplegia	Died
43	Head Injury/rupt spleen	Died
38	Mangled limb	Died
27	Paraplegia	Alive
27	Head Injury	Alive
27	Bilateral hemo	Died
27	Femur #	Alive
27	Avulsion foot	Alive
29	Splenic rupture	Alive
27	Tibia + Fibula #	Died
27	Femur #	Alive
27	Head Injury	Alive
34	Head Injury	Died
34	Splenic rupture	Alive
25	Pelvic #	Alive
27	Bilateral hemo	Alive
27	Paraplegia	Alive
27	Femur #	Alive
25	Pelvic #	Alive
43	Avulsion limb	Alive

Table 2: Analysis of Severe ISS (>25)

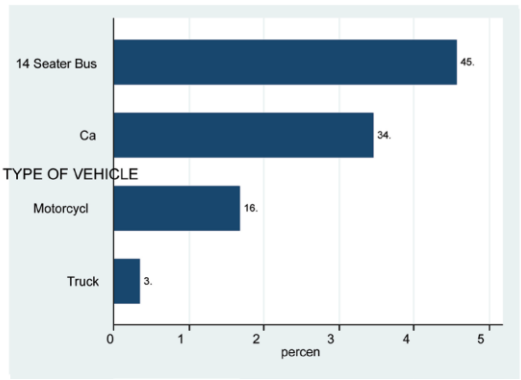

Figure 1: Frequency of Involvement by Vehicular Type

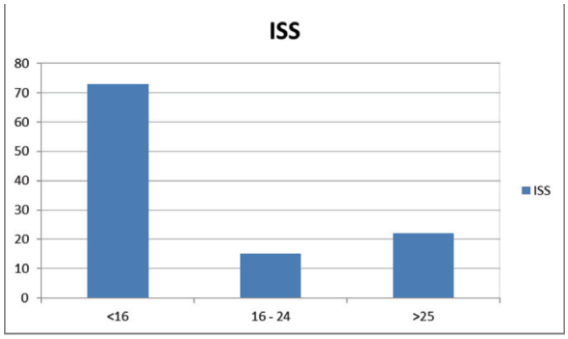

Figure 2: Injury Severity Score

radiographs may not be easily available. It is important therefore that frontline doctors be proficient in recognizing traumatic pleural collections as well as inserting chest tubes.

Thoracotomy is indicated especially when chest tube output exceeds 250 mls per hour for up to 3 hours, or an initial chest tube output of >1000mls (16). Only 5 of our patients required this and all but one were due to penetrating injury. The findings at surgery included bleeding from lung parenchymal injuries requiring only suture ligation in three patients, diaphragmatic tear with hepatic injury in one patient and intercostal artery injury in another.

Injury Severity Scoring has been devised to predict outcome of trauma cases and has correlated with morbidity, mortality and hospitalization time in many studies (9,17). We observed that limb fractures in 35.8% of our patients were the most common concomitant injury while head injury occurred in 29.6%. Associated abdominal injuries seen in only 10% were usually severe, and often required exploratory laparatomy. There was the rare case of evisceration in the patient who suffered 95% electrical burns and succumbed shortly after. The presence of associated injuries worsened the ISS classification which was significantly associated with mortality (P<0.001) (Table 1). Central nervous system injuries accounted for more than half (56%) the mortalities of severe (>25) ISS scores. (Table 2).

Mortality significantly increases with age (10) and we have found that the risk of dying increases by 8% for every year increase in age (p=0.03). This might be a result of the negative contribution of comorbid factors with increasing age. Tachypnea on admission also correlated significantly with poor outcome at univariate level (p=0.04), but this was insignificant at multivariate analysis (p=0.78) possibly because of multifactorial causes such

as pain or anxiety and not necessarily chest trauma per se. However, simple strategies of vital signs monitoring, even in poor resource environments with only the most basic of equipment, will promptly recognize patients with severe ISS and go a long way in reducing morbidity and mortality.

Our hospital mortality of 11% is slightly higher than what Anyanwu et al (8) found (9.7%) about two decades ago from the Eastern part of Nigeria, and very comparable to Atri et al from India.(12.1%) (4). However, though our mortality figures may be deceptively lower than what obtains from some reports from the developed world (9,18), we realize that their cohort of patients may be different as we do not receive patients with severe cardiac, airway and vascular injuries possibly due to suboptimal extrication and transport to hospital resulting in death prior to arriving in hospital.

Conclusion

Majority of the patients required only minimal intervention with either chest drainage or analgesics, achieving a low mortality. However, some patients may have associated extrathoracic injuries requiring multidisciplinary attention. Prompt extrication for chest trauma victims at the site as well as at trauma centres is still lacking and this must be improved.

References

1. Otieno T, Woodfield JC, Bird P, et al. Trauma in rural Kenya. Injury, Int.J. Care Injured. 2004; 35:1228-1233.
2. Ali N, Gali BM. Pattern and management of chest injury in Maiduguri, Nigeria. Ann Afr Med. 2004; 13(4):181-184.
3. Misauno MA, Sule AZ, Nwandialo HC, et al. Severe chest trauma in Jos, Nigeria: Pattern and outcome of management. NJOT 2007. l6; (2): 64-66
4. Atri M, Singh G, Kohli A. Chest trauma in Jammu region: an institutional study. Ind J Thorac Cardiovasc Surg. 2006;22:219-222
5. Hunt PA, Greaves I, Owens WA. Emergency thoracotomy in thoracic trauma – a review. Injury, Int. J. Care Injured. 2006;37:1-19
6. Adesunkanmi ARK, Oginni LM, Oyelami OA, et al. Road traffic accidents to African children: assessment of severity using the Injury Severity Score. Injury, Int .J. Care Injured. 2000;31:225-228
7. Evans BJ, Hornick P. Blunt injuries to the chest. Surgery (Oxford) 2005; 23 (11):409-411.
8. Anyanwu CH, Swarup AS. Chest trauma in a developing country. Ann R Coll Surg Engl. 1981;63:102-104
9. Hildebrand F, Giannoudis PV, Griensven M, et al. Management of polytraumatized patients with associated blunt chest trauma: a comparison of two European countries. Injury. 2005;36:293-302
10. Liman ST, Kuzucu A, Tastepe AI, et al. Chest injury due to blunt trauma. Eur J Cardiothorac Surg. 2003; 23:374-378.
11. Nirula R, Pintar FA. Identification of vehicle components associated with severe thoracic injury in motor vehicle crashes: A CIREN and NASS analysis. Accid Anal Prev 2008; 40(1):137-141.
12. Bigdeli M, Khorasani-Zavareh D, Mohammadi R. Prehospital care time intervals among victims of road traffic injuries in Iran. A cross sectional study. BMC Public Health. 2010;10:406
13. Soreide K, Soiland H, Lossius HM, et al. Resuscitative emergency thoracotomy in a Scandinavian trauma hospital- Is it justified? Injury, Int.J. Care Injured. 2007; 38:34-42.
14. Kalyanaraman R, DeMello WF, Ravishankar M. Management of chest injuries – a 5 year retrospective survey. Injury. 1998;29:443-446
15. Kwon A, Sorrells DL, Kurkchubasche AG, et al. Isolated computed tomography diagnosis of pulmonary contusion does not correlate with increased mortality. J Pediatr Surg. 2006;41:78-82
16. Onat S, Ulku R, Avci A, et al. Urgent thoracotomy for penetrating chest tauma: Analysis of 158 patients of a single center. Injury, Int.J. Care Injured. 2010; 41:876-880.
17. Chawda MN, Hildebrand F, Pape HC, et al. Predicting outcome after multiple trauma:which scoring system? Injury, Int J. Care Injured. 2004; 35(4):347-358.
18. Clark GC, Schecter WP, Trunkey DD. Variables affecting outcome in blunt chest trauma: flail chest vs. pulmonary contusion. J Trauma. 1988; 28:298-304.