

## Pattern of Chest Injuries and Treatment Outcome in a Nigerian Teaching Hospital

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### ABSTRACT

*Chest injuries are a common type of injuries associated with significant morbidity and mortality. Its occurrence in all parts of the world with high impact on the productive age groups makes it important research area. To evaluate the pattern of chest injury with outcome of treatment in our centre. Retrospective review of patients' data and clinical information from January 2014 to December 2016 in the Surgical Out Patient Department of University of Uyo Teaching Hospital, Uyo, Nigeria. Over the three year period, 442 patients with diagnoses of chest injuries were included with age range 2years to 78years (mean=38.7years) and male: female ratio of 3.5:1. Students, civil servants and motorcyclists/tricyclists operators and drivers were commonly affected (27.6%, 25.1%, 26.9% and 9.3%). Blunt chest injury was commoner than penetrating chest injury (69.7% vs 30.1%); while motor vehicular accident accounted for the majority of chest injury (55.%) followed by assault (23.1%). Rib fracture was the commonest type of injury (85.5%) followed by haemothorax 29.3%, haemopneumothorax 25.6% and pneumothorax 9.5%. Associated injuries included fracture of upper and lower limb (3.4%), abdominal injury (3.4%) and head injury (2.8%). Majority (89.1%) of the patients were managed either conservatively or with tube thoracostomy with good outcome (96.4%) and mortality rate of 1.1%. Many clinical entities of chest injuries were treated with a low mortality figure of 1.1%.*

**Keywords:** Chest injuries; outcome; pattern; treatment

### INTRODUCTION

Chest injuries have remained an important type of injury because of their frequency of occurrence, as well as morbidity and mortality associated with them<sup>1</sup>. The incidence is estimated at 12 per million populations per day with one in every four being severe enough to warrant hospitalisation while the mortality stands at 25-50% of trauma<sup>2</sup>. Previous studies in our centre had found chest injury to be among the common pathologies<sup>3-5</sup>. Multivariate analysis of patients with blunt trauma and possible factors affecting mortality showed that chest was injured in 55.3% of all traumas being isolated injury in 23.2% and in association with other system injuries in 32.1%<sup>6</sup>.

Various studies have documented significant occurrence in males and young with predominance of blunt compared to penetrating chest injury<sup>7-10</sup>. Studies have also shown various clinical entities with the observation that the majority of patients are successfully treated conservatively while tube thoracostomy accounts for about 85% of surgical intervention when indicated<sup>11-16</sup>.

This current study aimed at evaluating the pattern and outcome of treatment of chest injuries in our practice during a three year period.

### MATERIAL AND METHODS

This was a retrospective review of medical records of all patients who were treated for chest injury from January 2014 to December 2016 in the Surgical Out Patient Department of University of Uyo Teaching Hospital, Uyo, Nigeria. Information collated included age, sex, occupation, cause of chest, type of injury, clinical diagnosis, associated injuries and treatment given, and outcome of treatment.

Data collected were entered into a computer and analyzed using statistical package for social science [SPSS] software version 11.5. Data were summarized in form of proportions and frequency tables and percentages. Ethical approval was obtained from Institutional Health Research Ethical Committee of the Hospital.

### RESULTS

Over the three years period, a total of 442 patients who were treated for chest injuries had their medical records retrieved for collection of data. Table 1 shows that chest injuries occurred from paediatric age to elderly age. However the productive age group was predominantly

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affected. This subset accounted for more than 78% of all patients. Out of this, males accounted for about 77.8% with male-female ratio 3.5:1 (there was male preponderance with statistically significant difference  $p < 0.0001$ ). Other age groups were less affected with the under 20 accounting for 13.6% and above 60 accounting for 7.9%.

Table 1: Age distribution of patients

| Age (years) | Sex        |            | Total (%)  |
|-------------|------------|------------|------------|
|             | Male (%)   | Female (%) |            |
| 0 -10       | 2 (0.5)    | 0 (0)      | 2 (0.5)    |
| 11-20       | 51(11.5)   | 7 (1.5)    | 58 (13.1)  |
| 21-30       | 82 (18.6)  | 12 (2.7)   | 94 (21.3)  |
| 31-40       | 92 (20.8)  | 19 (4.3)   | 111 (25.1) |
| 41-50       | 71(16.1)   | 21(4.8)    | 92 (20.8)  |
| 51-60       | 30 (6.8)   | 20 (4.5)   | 50 (11.3)  |
| 61-70       | 13 (2.9)   | 15 (3.4)   | 28 (6.3)   |
| >70         | 3 (0.7)    | 4 (0.9)    | 7 (1.6)    |
| Total       | 344 (77.8) | 98 (22.2)  | 442 (100)  |

According to table 2 students were victims of chest injury in 27.6% of instances, and civil servants in 25.1%. Motorcycle and tricycle operators were victims in 26.9% of instances. Drivers were victims in 9.3%. Involvement in commercial transportation played significant role in chest injury. The remaining 11.1% of victims consisted of businessmen and businesswomen, traders, retired persons, etc.

Table 2: Occupations of the patients

| Occupation                | Frequency | Percent (%) |
|---------------------------|-----------|-------------|
| Students                  | 122       | 27.6        |
| Motorcyclists/tricyclists | 119       | 26.9        |
| Civil servants            | 111       | 25.1        |
| Drivers                   | 41        | 9.3         |
| Others                    | 49        | 11.1        |
| Total                     | 442       | 100         |

Blunt chest injuries (69.7%) predominated with penetrating chest injuries (30.3%) accounting for fewer cases. The blunt chest injury resulted from road traffic accidents, assaults, falls, etc. while penetrating injuries resulted from gunshots, stabs with knife and rods, and machete cut and one case of impalement injury. There was no significant difference between type of injury and sex (Table 3).

Table 3: Types of chest injury

| Types of chest injury | Male (%)   | Female (%) | Total      |
|-----------------------|------------|------------|------------|
| Blunt                 | 242 (54.8) | 66 (14.9)  | 308 (69.7) |
| Penetrating           | 102 (23.1) | 32 (7.2)   | 134 (30.3) |
| Total                 | 344 (77.8) | 98 (22.2)  | 442 (100)  |

Overall, the causes of chest injuries in this series included road traffic accidents in majority (55.4%) of cases, assault in 23.1%, gunshots (15.8%), fall (2.7%), and in 2.9% due to impalement injury (Table 4).

Table 4: Causes of chest injury

| Cause of injury | Frequency | Percent (%) |
|-----------------|-----------|-------------|
| RTA             | 245       | 55.4        |
| Assault         | 102       | 23.1        |
| Gun shot        | 70        | 15.8        |
| Fall            | 12        | 2.7         |
| Others          | 13        | 2.9         |
| Total           | 442       | 100         |

The pattern and spectrum of entities of chest injury seen and treated in the three year period were rib fracture(s) diagnosed in 378(85.5%) patients, haemothorax in 129(29.3%) patients, haemopneumothorax in 113(25.6%) and isolated pneumothorax in 42(9.5%). Others were lung contusion diagnosed in 17(3.9%) patients, diaphragmatic rupture in 8(1.8%), lung laceration in five (1.1%) and pericardial laceration in one (0.2%) patient. Other injuries noted in the series were clavicular fractures in 21(4.8%), sternal

fracture in four (0.9%) patients and scapular fracture in another 0.2%. There were cases of simple rib fractures with isolated fracture of  $\leq 3$  ribs, complicated rib fractures of  $> 3$  ribs or with associated intrathoracic or extrathoracic injuries, and six (1.4%) of the patients with rib fractures had flail chest (Table 5).

Table 5: Pattern of chest injury

| Pattern of chest injury | Frequency | Percent (%) |
|-------------------------|-----------|-------------|
| Rib fractures           | 378       | 85.5        |
| Haemothorax             | 129       | 29.3        |
| Haemopneumothorax       | 113       | 25.6        |
| Pneumothorax            | 42        | 9.5         |
| Clavicular fracture     | 21        | 4.8         |
| Lung contusion          | 17        | 3.9         |
| Diaphragmatic rupture   | 8         | 1.8         |
| Flail chest             | 6         | 1.4         |
| Lung laceration         | 5         | 1.1         |
| Sternal fracture        | 4         | 0.9         |
| Pericardial laceration  | 1         | 0.2         |
| Scapular fracture       | 1         | 0.2         |

Associated injuries involving the extra-thoracic organs included head injury in 12(2.8%), out of which six were referred to other centres and six managed conservatively; and of these, two died. Abdominal injury occurred in 15(3.4%) patients, and of these laparotomy was done for 10 patients for indications including splenic rupture, bowel perforation, liver rupture and kidney rupture; and four thoracotomy for left diaphragmatic rupture and gastric, bowel or splenic injury. Only one patient with associated abdominal injury (mild haemoperitoneum) was managed conservatively. Mortality among the cohort of patients with associated abdominal injury was two (Table 6).

Associated fractures occurred in 22(5.0%) patients, distributed as long bone fracture in 15, pelvic fracture in four and spinal fracture in 3. The only mortality amongst patients with associated fracture was in the only patient with cervical spinal injury resulting in quadriplegia.

Table 6: Associated extra-thoracic injuries, treatment and their outcome

| Associated injury  | Frequency (%) | Treatment (number)   | Outcome |
|--------------------|---------------|--|---------|
| Head injury        | 12 (2.8)      | neurosurgery referrals (6)conservative (6)                           | 2 died  |
| Abdominal injury   | 15 (3.4)      | Laparotomy by General surgery (10) thoracotomy (4), conservative (1) | 2 died  |
| Pelvic fracture    | 4 (0.7)       | Orthopaedic consultation (1) Conservative (3)                        |         |
| Spinal fracture    | 3 (0.9)       | Referral (1), conservative (2)                                       | 1 died  |
| Long bone fracture | 15 (3.4)      | Orthopaedic consultation (15)  |         |

The modalities adopted in the treatment of the patients as shown in table 7 included conservative/non-operative management in 133(30.1%) of cases, while 261(59.0%) had closed tube thoracostomy drainage. Wound

exploration/debridement and tube thoracostomy was done for 23(5.2%) patients, emergency thoracotomy in 2.0%, thoraco-laparotomy in 0.9% and laparotomy in 2.3% of the patients (Table 7).

Table 7: Treatment modalities for the patients

| Treatment modality                                  | Frequency | Percent (%) |
|---|-----------|-------------|
| Closed tube thoracostomy drainage                   | 261       | 59.0        |
| Conservative management                             | 133       | 30.1        |
| Wound exploration/debridement and tube thoracostomy | 23        | 5.2         |
| Laparotomy  | 10        | 2.3         |
| Emergency thoracotomy                               | 10        | 2.0         |
| Thoracolaparotomy                                   | 4         | 0.9         |
| Total   | 442       | 100         |

Table 8 shows that 426 (96.4%) patients recovered completely. The remaining 3.6% patients developed some complications including

clotted haemothorax (0.5%), wound infection (1.6%), and empyema thoracis (0.5%), while 1.1% of the patients died.

Table 8: Complications/treatment outcome of the chest injuries

| Complications/Treatment outcome | Frequency (%) | Percentage (%) |
|---------------------------------|---------------|----------------|
| Complete resolution             | 426           | 96.4           |
| Clotted haemothorax             | 2             | 0.4            |
| Wound infection                 | 7             | 1.6            |
| Empyema thoracis                | 2             | 0.4            |
| Death                           | 5             | 1.1            |

## DISCUSSION

The present study which analyzed 442 cases of chest injury in three years has corroborated the fact that chest trauma is a common type of injury and affects more males than females and can affect all age groups from paediatric to elderly age. Many other studies have quoted annual incidences ranging from 73 to 700,<sup>1,8,12-15</sup> and male female ratios of 2.2:1 to 9:1,<sup>1,6,8,10-14</sup> with mean age ranging from 31 years to 51 years.<sup>1,6,8,10-13</sup> The mean age of affectation in our study was 38.7 years. Male preponderance and young age in this study and other related ones connote significant loss of man hours for economic productivity. It is also in this cohort of patients that severity is high since their injury usually results from high energy impact like motor vehicular accident; the same reason that accounts for occurrence of extra-thoracic injuries and mortality. This study still demonstrated the preponderance of blunt over penetrating chest injury. This is the pattern in civilian practice where firearms play insignificant part as the

injury factor, and road traffic accident has been the major culprit where victims can be drivers/riders, occupants of such vehicles/tricycles/motorcycles, or pedestrians<sup>1,8-13</sup> Other causes of chest injury which were also noted in this study and other related studies in our country were assault, fall and gunshot.<sup>11,12,16</sup> About 36% of the victims were engaged in transportation business alone either as drivers of vehicles or riders of motorcycles or tricycles. A previous related study has discovered transportation business as a risk factor for blunt chest injury and multiple rib fractures<sup>17</sup>. Students including tertiary and secondary education students, and pupils in primary schools were affected in 29.9% of cases while civil servants accounted for 25.1%. These two groups of people are known to travel frequently during daily going to and returning from work or school. However a related study in the north-east part of our country observed more penetrating chest injuries compared to blunt<sup>11</sup>.



Rib fractures occurred in a great percentage of our patients. Other studies reported rib fractures in 100% of blunt chest injury,<sup>11</sup> in 78.5% of all chest injury patients<sup>15</sup> and in lower number of chest injury patients<sup>1,10</sup>. This is because of the mechanism and force responsible for chest trauma. This also explains the occurrence of multiple rib fractures including flail chest<sup>7,15</sup>. Flail chest was diagnosed in 1.4% of victims of chest injury in the index study. Haemothorax, pneumothorax and haemo-pneumothorax usually connotes significant impact. The air is commonly from the lung while the blood can be from the lung, parietal pleura, intercostal vessels or rarely from the pericardium, major vessel or cardiac chamber.<sup>2</sup> In this review, about 64% of the patients were so affected. Lung contusion rate of 3.9% found in this study also confirms the high energy impact associated with motor vehicular accident which was the mechanism of injury in up to 55.4%. Therefore the co-existence of multiple rib fractures, flail chest and lung contusion is common in motor vehicular accident and has been so discovered in other studies<sup>4,7,10</sup>. Clavicular fracture occurred in about 4.8% of the cases because the clavicle is a subcutaneous bone which is highly exposed and prone to impact. Other studies have documented clavicular fracture rate ranging from 0.2-2.7%.<sup>8,10,11,13</sup> Other entities occurred rarely; these include pericardial laceration in one patient who was assaulted on the chest with machete which cut through the chest wall and lacerated the lung and pericardium; diaphragmatic injury in 1.8%; lung laceration in 1.1%; sternal fracture in 0.9% and scapular fracture in 0.2%. Some related studies have observed rarity of these entities of chest injury.<sup>1,8,10,18,19</sup>

Associated injuries in other organ systems constitute multi-system injuries. This study found multi-system injury rate of 11.2% distributed as extremities fracture (3.4%), abdominal injury (3.4%), head injury (2.8%), spinal injury (0.9%) and pelvic fracture (0.7%). Mortality figures among chest injury patients are usually most common in the cohort sustaining associated extra thoracic multi-systems injuries. In this series all the five patients that died had associated extra-thoracic injuries with associated head and abdominal injuries weighting highest (40% each). Review of related literatures has corroborated this

same pattern of injury deaths<sup>1,6,9,10,18</sup> other factors that have been found to be associated with mortality in chest injury are elevation of cardiac troponin, chest injury severity score, injury severity score, and high score of early warning signs.<sup>4,14,20</sup>

Thirty percent of the patients were treated conservatively which involved administration of analgesics for chest pain, external wound care including administration of antibiotic where necessary and chest physiotherapy. Conservative management is successful in many patients in other series<sup>9,10</sup>. Many of our patients with rib fractures received intercostal nerve blocks or systemic analgesics. Only few of them received thoracic epidural analgesia (TEA). Although TEA is known to be the most effective of the three modalities of chest pain control in multiple rib fractures, its utilisation is more technically demanding than the other two modalities<sup>21,22</sup>. None of our patients with rib fractures underwent surgical fixation of the fractured ribs although this has been done for some patients and reported to give better outcome<sup>7</sup>. Of the 308 patients that underwent operative interventions, 84.7% underwent closed tube thoracostomy drainage (CTTD). This conforms to the global average which shows that CTTD constitutes operative intervention in about 85% of chest injured patients that require surgical intervention.<sup>2</sup> Other related studies have reported CTTD as the most common surgical procedure among chest injury patients.<sup>10,11</sup> The remaining 15.3% underwent more invasive surgical procedures including wound exploration and debridement, emergency thoracotomy, thoracotomy and laparotomy. Similar pattern of treatment have been reported in other series<sup>11</sup>.

The treatment outcome in this series is adjudged excellent with 96.4% having achieved complete resolution. Chest wound infection rate was 1.6%, clotted haemothorax necessitating open thoracotomy for evacuation in 0.5%, and acute empyema thoracis occurring in another 0.5% and was successfully treated with antibiotic and pleural drainage. Mortality rate was 1.1%. All deaths were in victims who sustained associated injuries in other organ systems which included head injury 2/5, abdominal injury 2/5, and cervical spine injury with quadriplegia 1/5.

One patient who underwent thoraco-laparotomy died in the intensive care unit. The operation was as a result gunshot wound with penetrating chest and abdominal injuries with fatal lacerations of the left lung lobes, left hemi-diaphragm, the stomach, spleen and transverse colon. Another patient died in the operating room during laparotomy for penetrating chest and abdominal injury which involved the inferior vena cava. Other series have reported varying mortality rates ranging from 1% to 17%<sup>13,14</sup>. In almost all civilian chest injury series, mortality rate is dependent on the type and pattern of chest injury, severity of chest injury, associated injuries and the magnitude of the injury severity scores.<sup>14</sup> The excellent outcome in this series is contributed to by the presence of cardiothoracic surgery unit in our centre which is dedicated to the management of chest injury. A study has discovered that mortality rate in chest injury is lower when the treatment of chest injury is done by expert<sup>22</sup>.

## CONCLUSION

Many clinical entities of chest injuries were treated with mortality rate of 1.1%.

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