

## Original Research Article

# Blunt Chest Injury: epidemiological profile and determinant of mortality

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### ABSTRACT

**Background:** The identification of the epidemiological profile and the determinants of mortality for blunt chest injuries (BCI) ensures the proper documentation of susceptible patients, and the implementation of strategies for prompt and improved patients' care.

**Methods:** This is a prospective study for a 4-year period at two tertiary hospitals in Nigeria. The inclusion criteria were patients who had BCI, did chest radiograph and admitted for treatment. The statistical software for analysis was SPSS version 22 and using Pearson's X<sup>2</sup> and spearman's X<sup>2</sup> for correlation of mortality with the Injury Severity Score (ISS), Glasgow Coma Scale(GCS) and Hemi-thorax affected. The p-value was significant at <0.001.

**Results:** One-hundred and twenty-six (52.3%) of 241 patients had BCI, the average age was 40.4years with a range of 0.8-79years. There were 104 (82.5%) male with a ratio of 4.7:1. Most patients 86(68.3%) were between 19-59 years of age, 85 (67.5%) were unskilled workers and 57 (45%) had no formal education. Most 66.7% of the injuries occurred in the first half of the year with a peak (16.3%) in March. Mondays and Fridays, and, morning hours were the peak periods. BCI was by motor vehicular accidents 94 (74.6%), falls 28 (22.2%), and other causes 4 ((3.2%). The associated injuries were extremities 25(19.8%), cranio-spinal injuries 17(13.5%) and blunt abdominal injuries 13 (10.3%). Eleven (8.7%) patients died within one-month of admission. The determinants of mortality were high ISS (p<0.001), severe head injury (p<0.001) and bilateral chest injury (p<0.001).

**Conclusions:** The contribution of falls to BCI is on the increase with BCI occurring at periods of increased activities like Mondays, Fridays and morning hours. The determinants of mortality were high ISS, severe head injury and bilateral chest injury.

**Keywords:** Blunt trauma, Chest injury, Nigeria, Mortality

## INTRODUCTION

Blunt chest Injury(BCI) type as a major cause of morbidity and mortality has been sparsely studied in Nigeria and, equally, the epidemiology and determinants of mortality have not been specifically reported at all in our literatures.<sup>1,2</sup>

However, a study in the country observed that there was a great gap understudying the causes of BCI.<sup>2</sup> This is even

as chest trauma was reported as the commonest clinical diagnoses made in patients seen in a cardiothoracic surgical unit and that chest tube insertion was the main modality of treatment of patients with chest trauma.<sup>3,4,5</sup> BCI is commoner than penetrating chest injury and has peculiar pathophysiological patterns especially with respect to rib fracture and lung contusion has distribution in line with some epidemiological patterns and is an identifiable risk factor for other associated injuries like severe head and abdominal injuries.<sup>2,5-11</sup>

The reported overall mortality rate of 1-36.2% for BCI.<sup>1,10,12-14</sup> shows a wide range of negative factors that when modified by proper characterization of patients and adequate patient care lead to improved outcome including prevention of deaths. The identification of the profile of patients with Traumas like BCI and the determinants of mortality will aid in implementing strategies for care of patients with chest trauma, reduce the burden of BCI.<sup>2,5,8,15-17</sup> and putting measures in place to in other to ensure prompt, and adequate patients care.<sup>12</sup>

## METHODS

This is a review of prospectively collected data in our unit on to pro forma which contained profile and outcome of chest injuries from June 2013 to May 2017 for a period of 4 years.

The data were from two tertiary health centers: University of Port-Harcourt Teaching Hospital(UPTH) in south-south and Federal Medical Center(FMC) Owerri in South East both in the old Eastern Region of Nigeria. They are tertiary health care centers and thus have referrals from so many nearby states. They attend to children, adult and old patients.

### Inclusion criteria

- Patients who had blunt chest trauma,
- Patients who underwent chest radiograph and were admitted for treatment.
- Bilateral chest injury was defined by injury affecting both hemi-thoraces such as rib fractures in both hemi-thoraces or bilateral haemothoraces or unilateral haemothorax and contralateral pneumothorax or bilateral pneumothoraces or bilateral lung contusion.

The statistical software used for analysis was SPSS version 22, and Pearson's X<sup>2</sup> and spearman's X<sup>2</sup> were used for correlation of mortality with the Injury Severity Scores (ISS), Glasgow Coma Scale(GCS) and the hemi-thorax affected. A significant p-value was put at <0.001.

## RESULTS

A total of 126 (52.3%) out of 241 patients had BCI, the mean age was 40.4years with range of 0.8-79years. There were 104 (82.5%) male patients and 22 (17.5%) patients were female patients with a ratio of 4.7:1. About 11 (8.7%) patients were between 0-9years, 4 (3.2%) patients were between 10-18years, 86 (68.3%) patients were between 19-59 and 25 (19.8) patients were 60 years and more (Table 1).

About 18 patients were students, 16 patients were skilled workers (like Mason, carpenter, electricians, plumbers etc),12 patients were drivers,18 patients were farmers,17 were civil servants, 20 were traders, 5 patients were police personnel and 20 patients were unemployed.

About 57 (45%) patients had very little or no formal education.

**Table 1: The relationship between causes of BCI and the age range.**

Causes BCI	Age range				Total
	0-9 years	10-18 years	19-59 years	>60 years	
Assault	0	0	2	1	3
Fall	7	3	11	7	28
Industrial	0	0	1	0	1
PaMVA	1	1	63	15	80
PeMVA	3	0	9	2	14
Total	11	4	86	25	126

PaMVA- Passenger Motor Vehicular Accident, PeMVA-Pedestrian Motor Vehicular Accident

### The year, month, day and time of BCI

Most 84 (66.7%) patients had the BCI in the first half of the year while 42(33.3%) patients had the BCI in the second half with peak of BCI in the month of march as 23 (18,3%) patients were affected. The days of BCI were distributed as follows:

Friday was 25 (19.5%) patients, Monday 28 (22.2%) patients, Saturday 16 (12.7%), Sunday 15 (11.9%), Thursday 10 (7.9%), Tuesday 17 (13.5%) patients, Wednesday 15 (11.9%) (Table 2).

Mondays and Fridays are days with increase movements of person and those travelling to or returning from their journey. When the time of the incidence was considered, 61 (48.4%)patients sustained the injury in the morning, 28 (22.2%) patients had the injury in the afternoon and 37 (29.4%) patients had the injury in the evening.

### The cause of BCI

BCI was from passenger motor vehicular accidents in 80 (63.5%) patients, pedestrian motor vehicular accidents in 14 (11.1%) patients, falls in 28 (22.2%) patients, assaults at home in 3 (2.4%)patients and industrial accident in 1 (0.8%) patient.

### The type of automobile involved in BCI

Bicycle was a cause of BCI in 1 (0.8%) patient, motorcycle in 10 (7.9%) patients, Tricycle-keke in 11 (8.7%) patients,bus in 21 (16.7%) patients , SUV in 7 (5.6%) patients, car in 34 (26.9%) patients, lorry in 8 (6.3%) patients.

### The place of falls

Falls from palm tree in7 (25.0%), fall from other tree in 3 (10.7%), fall at home in 4 (14.3) % all by children 7 years and less, fall at place of work in 10 (35.7%), fall at play

ground in 2 (7.1%) patients and falls into a gutter in 2 (7.1%).

**Time between BCI and presentation to our health center**

About 69 (54.8%) patients presented between 6 hours and less while 57 (45.2%) patients presented after 6-hours. However 23 (18.3%) patients presented within the golden hour of 1hour.

**Table 2: The distribution of BCI with the month.**

Month	Number	%
January	10	7.9
February	10	7.9
March	23	18.3
April	14	11.1
May	14	11.1
June	13	10.3
July	11	8.7
August	6	4.8
September	5	4.0
October	6	4.8
November	7	5.6
December	7	5.6
Total	126	100.0

**The Nature thoracic of injuries**

About 39 (31%) patients had subcutaneous emphysema,74 (58.7%) patients had rib fracture,69 (54.8%)patients had lung contusion,73 (57.9%) patient had haemothorax,26 (20.6%) patients had pneumo-thorax and 16 (12.7%) had pneumo-haemothorax.

**The Extra-Thoracic Injuries**

The bones of the extremities were injured in 25 (19.8%) patients, craniospinal injury in 17 (13.5%) patients (head injury in 13 (10.3%) patients and spinal injury in 4 (3.2%) patients, blunt abdominal injury in 13 (10.3%) patients distributed as follows: splenic injury, hepatic injury, diaphragmatic rupture in 2 patients each, and renal injury and ruptured viscus in 1 patient each, while isolated haemo-peritoneum without identifiably visceral organ injury in 5 patients.

**Treatment and Outcome**

About 80 (63.5%) patients were treated with chest tube insertion while 46 (36.5%) were managed conservatively by administering mainly analgesics, chest physiotherapy and antibiotics.

A total of 11 (8.7%) of patients died within one month of admission and were mainly from respiratory failure. Mortality rate was highest in patients with high ISS (p<0.001), severe head injury (p<0.001) and bilateral chest injury(p<0.001) (Table 3-5).

**Table 3: The Injury Severity Score (ISS) versus Mortality.**

ISS (3-75)	Alive (%)	Mortality (%)	P value
Low severity (1-8)	44 (35)	0 (0)	<0.001
Medium severity (9-14)	39 (31)	2 (1.6)	<0.001
High severity (15-75)	32 (25)	9 (7.1)	<0.001
Total	115 (91.3)	11 (8.7)	

**Table 4: The Glasgow Coma Scale (GCS) versus Mortality.**

GCS(3-15)	Alive(%)	Mortality(%)	P value
Mild Head Injury (3-7)	109(86.5)	7(5.5)	<0.001
Moderate Head Injury (8-12)	6(4.8)	2(1.6)	<0.001
Severe Head Injury (13-15)	0(0)	2(1.6)	<0.001
Total	115(91.3%)	11(8.7)	

**Table 5: The hemi-thorax affected versus Mortality.**

Hemi-Thorax affected	Alive (%)	Mortality (%)	P-value
Unilateral	100(79.4%)	4(3.2%)	<0.001
Bilateral	15(11.9%)	7(5.5%)	<0.001
Total	115(91.3%)	11(8.7%)	

**DISCUSSION**

Chest injury can be broadly classified into Blunt chest injury and penetrating chest injury, with the BCI type reported as commoner than the penetrating blunt chest type. In our series, the findings show that BCI is commoner than penetrating chest injury in conformity to other previous studies.<sup>1,5,8,13,18-22</sup> The reason for increased incidence of BCI is attributed to the use of rapid means of transportation mainly from motor vehicular accidents and increased contribution from falls especially in the elderly patients in our setting.<sup>2,5,17,22-25</sup> The observed average age of 40-years in this study is within the reported age in and outside the country.<sup>1,2,10,14</sup> The main reason is that trauma is common among this very active age group.

The vast majority of the BCI occurred during the 1st half of the year and peaked in the month of march. This is the beginning of the rainfalls when the roads are wet and slippery, and pot holes are filled up with rain water thereby concealing them from being noticed by drivers.

Also, these are periods of increased farm/tree cropping activities especially the cutting of palm fruits and other resources accrued leading to falls from trees. Mondays

and Fridays were days of increased BCI as these are days of increased vehicular activities on the roads as persons travel back to work and travel out of the cities for weekends respectively. Previous studies have pointed out the seasonal occurrence of trauma.<sup>26-28</sup>

The incidence of blunt chest injury is related to the number of motor vehicular accidents and thus the incidence is decreased with reduction in motor vehicular accidents.<sup>2</sup> and conversely, increased with increased motor vehicular accidents.

Present study shows that motor vehicular accident is still the major cause of BCI but slightly decreased from previous account in the country.<sup>2</sup> The reasons adduced were the increasing number of the use of trunks/trailers instead of rail line to convey goods from one part of the country to another, the deplorable state of the roads, the use of motorcycle and tricycle as a means of intercity transportation instead of school or workers' buses. Recently, motorcycles and Tricycles have become the commonest mode of movement within the city; and privately owned and commercial buses are used for both intra- and intercity movements.<sup>5</sup>

Over 4 decades ago, falls from heights such as trees was observed as a significant cause of chest injuries but a study, in the same environment, showed that falls from trees as a cause of traumatic spinal cord injury was markedly decreased.<sup>26</sup>

This is at variance with our experience, as BCI resulting from falls from trees poses a new and increased challenges.<sup>9</sup> Significantly lower proportion of the patients 18.3% presented within 1-hour of sustaining the BCI; where and whence the impact of hospital care can be maximized. Though, this is a slight increase from the 11.7% of patients presenting within the 1st hour of sustaining chest injury reported in the country over 4 decades ago, however the percentage is still not enough to improve patient outcome and reduce mortality.<sup>9</sup> The different reasons given are delay at the referring hospitals and lack of funds to seek for specialist care at the tertiary hospitals.

Subcutaneous emphysema following BCI will indicate that, in most cases, that the airway or lungs were injured and thus leads to tracking of air in the subcutaneous layer of the skin. From our study, about one thirds of the patients had subcutaneous emphysema which is significant in patients with evidence of lung injury with resultant air leak like pneumothorax. It is worthy to note the technical problem of chest tube insertion for truncal subcutaneous emphysema, and the treatment of extensive subcutaneous emphysema are a great deal of challenge to us when managing our patients.

Pleural collections in chest trauma in form of haemothorax, pneumothorax and pneumo-haemothorax dictate the need for chest tube insertion. The finding from

this study was that, about 78.8% of patients with BCI had various pleural collection stated above while about 63.5% of them had chest tube insertion. It is for this singular reason of pleural collections that it was stated that chest tube insertion was the main modality of treatment of chest trauma.<sup>2,8,9</sup> Though a study reported a lower rate of chest tube insertion in chest trauma patients elsewhere.<sup>24</sup>

The extremities were the commonest associated injury. Some studies in the country alluded to this.<sup>28,29</sup> A study with a good number of BCI resulting from falls, also showed an increased fracture of bones of the extremity.<sup>10</sup> The reason given in my previous, and this study was the deployment of the limbs as a protective reflex action.<sup>28</sup> Also, blunt abdominal injuries leading to exploratory laparotomies were the commonest associated injuries in significant number of patients with BCI.

The abdomen is part of the trunk and thus what affects the chest may inadvertently affect it in most cases.<sup>14,30</sup> It is therefore desirable to examine the abdomen in patients with blunt chest injury Equally, it is imperative to do clinical examination of the chest and chest radiograph before taking a decision to pass a chest tube in a patient suspected of having diaphragmatic injury; as, diaphragmatic injury is an accompaniment of blunt chest injury, and is a predictor of severity of blunt chest trauma.<sup>30</sup>

The present study showed that the involvement of both hemi-thoraces in terms of bilateral rib fractures, bilateral haemothoraces, bilateral pneumothoraces, bilateral lung contusion and pneumothorax on one hemithorax and haemothorax on the other hemithorax were found to be determinants of mortality in chest trauma.

This conforms to a similar study done recently in the country, and most of the patients died of respiratory failure.<sup>31</sup> Other factors related to mortality are high ISS score, age of 65 years and more, premorbid conditions, Multiple rib fracture, neurotrauma, diaphragmatic score and association with neurotrauma, use of pre-injury anticoagulants and oxygen saturation levels, the need for mechanical ventilation and hemodynamic instability were risk factors for increased mortality.<sup>35 21,22,31-34</sup>

This study showed that high ISS increased mortality reaffirming that high ISS remains a significant determinant of mortality, as pointed out by previous commentators, and a marker for early surgery and increased in mortality. However, in all, aggressive treatment remains vital to reducing mortality.<sup>12,22,25,31,36</sup>

## CONCLUSION

BCI is common among the middle age group, low educational standard and unskilled/low skilled workers. Increased activities as a result of movements and tree cropping were responsible for increased blunt chest

trauma, and the determinants of mortality were high severity ISS, severe head injury and bilateral chest injury.

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