

# Prevalence and Factors Associated with Mortality among Chest Injury Patients Admitted at Muhimbili National Hospital in Dar es Salaam, Tanzania

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**How to cite this paper:** Masuma, J.S., Boniface, R.L. and Lugazia, E.R. (2021) Prevalence and Factors Associated with Mortality among Chest Injury Patients Admitted at Muhimbili National Hospital in Dar es Salaam, Tanzania. *International Journal of Clinical Medicine*, 12, 364-376. <https://doi.org/10.4236/ijcm.2021.129033>

**Received:** July 28, 2021

**Accepted:** September 11, 2021

**Published:** September 14, 2021

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## Abstract

**Introduction:** Accidents represent a significant proportional of non-communicable disease in the current century, and chest injury is common. However, management and outcome of these injuries is poor in low resource setting like Tanzania. The aim of this study was to determine the prevalence and factors associated with mortality among chest injury patients at a tertiary level health facility in Tanzania. **Method:** A prospective Cross-Sectional study of chest injuries among trauma patients attended at Muhimbili National Hospital between September 2019 and February 2020. **Results:** A total of 282 trauma patients were seen, out of which 51/282 (18.1%) sustained chest injury. Road Traffic Crashes were the leading cause of chest injury 41/51 (80.4%). Majority 17/51 (33.3%) presented with lung contusion, followed by pneumohemothorax and rib fractures each 8/51 (15.7%). Most of the patients 27/51 (52.9%) were managed by tube thoracostomy and 42.1% conservatively. Mortality was 11/51 (21.6%). Independent factors associated with mortality were: Associated injuries (Odds Ratio (OR) 0.07, 95% CI 0.01 - 1.16,  $p = 0.02$ ), Multimodal analgesia (Odds Ratio (OR) 0.22, 95% CI 0.05 - 0.98,  $p = 0.05$ ), more than 24 hours to treatment (Odds Ratio (OR) 5.53, 95% CI 1.25 - 24.3,  $p = 0.02$ ), Bilateral chest involvement (Odds Ratio (OR) 4.61, 95% CI 1.12 - 18.7,  $p = 0.02$ ), and Invasive ventilation (Odds Ratio (OR) 31.5, 95% CI 4.47 - 53.8,  $p = 0.00$ ). **Conclusion:** Chest injuries prevail significantly among trauma patients in Tanzania, mostly due to road traffic crashes. Injury preventive measures especially for road traffic crashes need to be reinforced, and establishment of chest injury management protocol in Tanzania.

## Keywords

Chest Injury, Road Traffic Crashes, Tanzania

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## 1. Introduction

Trauma continues to be associated with high morbidity and mortality both in developed and developing countries [1]. Chest Injuries account for 10% of Global trauma admission and 25% of trauma related deaths [2] [3]. Studies have revealed the prevalence of chest injury to be varying from different parts of the world, being high in low- and middle-income countries and low in developed countries [4], this is mostly due to variations in preventive measures of trauma. The estimated mortality due to chest injuries in Tanzania is 40% [5], and continues to be the commonest cause of surgical admissions with significantly high morbidity and mortality [6].

Causes and pattern of chest injuries vary in different parts of the world due to socio-economic status variations, the commonest cause being road traffic crashes [7] [8], majorities of victims being in the active age group sustaining blunt chest injury. Like other developing nations in the world, Tanzania has a significantly high rate of traffic related deaths and disabilities. A hospital-based injury surveillance [9] revealed traffic crashes to be the leading cause of injuries accounting for 47.5% of all injuries seen and 60.5% of injuries mortality. Chest injury is second only to head injury as a major cause of morbidity and mortality in Tanzania emergency rooms, and this can be explained by the lack of organized pre-hospital care, severity of injuries and late management of patients [10].

Management option depends on type of chest injury and clinical presentation of the patients. Patients with pneumothorax, haemothorax or both would improve on tube thoracostomy. Other patients would require mechanical ventilation, appropriate analgesics management, supportive therapy and critical care observation [11] [12]. It is therefore necessary for accurate, early identification and aggressive management of chest injuries, along with prompt treatment of associated injuries for optimal patient outcome. This study was therefore conducted to help us understand the magnitude and management of chest injury patients at a tertiary level health facility in Tanzania. The result of this study will help in establishing prevention strategies as well as management protocol to better assess, treat and monitor chest injury patients with a view of improving patient outcomes.

## 2. Methodology

*Study setting:* data were collected from Muhimbili National Hospital emergency medicine department. It is the main government tertiary hospital of Tanzania, located along Dar es Salaam region in Tanzania and has the capacity 1500 beds. It is a referral centre for all other hospitals in Dar es Salaam (over 5 million

inhabitants) and Tanzania at large, and is also a teaching hospital for Muhimbili University of Health and Allied Sciences.

*Study design:* A prospective Cross-Sectional study was conducted.

*Study population:* the study population comprised of chest injury patients attended at Muhimbili National Hospital emergency department between September 2019 and February 2020.

*Data collection and management:* a structured questionnaire designed by principal investigators was used to collect information from the study participants in a face-to-face interview, and from medical records. Questions were drawn from previously conducted studies and a pilot study was conducted to ensure validity and reliability of the data collection tool. A questionnaire had 18 items including: socio-demographic characteristics, mode of injury, type of injury, severity of injury, treatment pattern and patient's outcome (**Appendix**). Data were double-entered into Excel (Microsoft® Excel, Seattle Washington), Statistical analysis was conducted using Statistical Package for Social Sciences (SPSS) version 23 (IBM Corp. IBM SPSS Statistics for Windows [Internet]. Armonk, NY: IBM Corp; 2017).

*Statistical analysis:* all variables were categorized and described using frequency distribution. Chi-square test was used for bivariate analysis and those variables with observed frequency less than five Fisher's exact test was applied. A variable with ( $p \leq 0.05$ ) with mortality was considered to be statistically significant. Variables that demonstrated significant bivariate association with mortality were entered into the multivariate logistic regression modal to assess independent effects. Parameter of measurement to assess association was odds ratio.

*Ethical consideration:* ethical approval for the study was obtained from the Muhimbili University of Health and Allied Sciences Research Ethics Committee. An informed written consent was sought from patients or relatives.

### 3. Results

A total of 282 trauma patients were seen between September 2019 and February 2020. Chest injuries accounted for 51/282 (18.1%) of patients, majority (72.5%) belonged to the productive age group (20 to 39 years), and 74.5% were males, with a male to female ratio of 3:1 (**Table 1**).

#### 3.1. Mechanism of Injury

Road traffic crashes (80.4%) were responsible for the majority of Chest injuries, Assault (15.7%) and fall from height (3.9%).

#### 3.2. Type of Chest Injuries

Blunt trauma accounted for 88.2% of the chest injuries, 11.8% were penetrating injuries. Lung contusion was the commonest (33.3%) followed by, Pneumothorax and Rib fractures each (15.7%). Pneumothorax was present in 11.7% of the patients whereas haemothorax was present in 7.8% of the cases.

Two patients (3.9%) had an injury to the heart and 3.9% had a Flail chest (**Table 2**). Majority of patients (52.9%) had tube thoracostomy done, and 42.1% managed conservatively.

**Table 1.** Social demographic characteristics.

<b>Sex</b>	<b>Frequency (n)</b>	<b>Percentage (%)</b>
Male	38	74.5
Female	13	25.5
Total	51	100
<b>Marital status</b>		
Single	27	52.9
Married	21	41.2
Others	3	5.9
Total	51	100
<b>Education</b>		
Primary school	15	29.4
Secondary school	18	35.3
High level	13	25.5
No formal education	5	9.8
Total	51	100
<b>Age (Years)</b>		
1 to 19	2	3.9
20 to 39	37	72.5
40 to 59	11	21.6
60 and above	1	2
Total	51	100

**Table 2.** Type of chest injury.

<b>Chest injury type</b>	<b>Frequency (percentage)</b>
Pneumothorax	6 (11.7)
Hemothorax	4 (7.8)
Pneumohemothorax	8 (15.7)
Rib fracture	8 (15.7)
Lung contusion	17 (33.3)
Clavicle fracture	4 (7.8)
Cardiac injury	2 (3.9)
Flail chest	2 (3.9)

### 3.3. Factors Associated with Mortality

Of the 51 patients seen 78.4% survived, and 21.6% died. The following factors were significantly associated with mortality after bivariate analysis: Associated injuries accounted for 63.6% of mortality (p-value 0.014), serious and critical injured patients each accounted for 36.4% of mortality (p-value 0.009), using a single type of analgesia accounted for 72.7% of mortality (p-value 0.038), receiving medical attention 24 hours after injury contributed 72.7% of mortality (p-value 0.016). Bilateral chest involvement contributed 63.6% of mortality (p-value 0.026) and invasively ventilated patients 81.8% of mortality (p-value 0.00) (Table 3).

**Table 3.** Factors associated with mortality.

Factor	Death N (%)	No death N (%)	P-value	Multivariate OR (95% CI)	P-value
<b>Age (Years)</b>					
1 - 19	1 (50)	1 (50)	0.66	1	
20 - 39	7 (18.9)	30 (81.1)			
40 - 59	3 (27.3)	8 (72.7)			
60 and above	0 (0.0)	1 (100)			
<b>Sex</b>					
Male	9 (23.7)	29 (76.3)	0.76	1	
Female	2 (15.4)	11 (84.6)			
<b>Associated injuries</b>					
Present	7 (15.91)	37 (84.09)	0.014 <sup>++</sup>	1	0.024 <sup>++</sup>
Not present	4 (57.14)	3 (32.86)			
<b>AIS range</b>					
Moderate	1 (14.29)	6 (85.71)	0.009 <sup>++</sup>	1	
Serious	4 (13.33)	26 (86.67)			
Severe	2 (22.22)	7 (77.78)			
Critical	4 (80.00)	1 (20.00)			
<b>Pain management</b>					
Single analgesia	8 (34.78)	15 (65.22)	0.038 <sup>++</sup>	1	0.05 <sup>++</sup>
More than 1 analgesia	3 (10.71)	25 (89.29)			
<b>Time to treatment (hours)</b>					
Less than 24	3 (10.00)	27 (90.00)	0.016 <sup>++</sup>	1	0.00 <sup>++</sup>
24 and above	8 (38.89)	13 (61.90)			
<b>Chest involvement</b>					
Unilateral	4 (12.12)	29 (87.88)	0.026 <sup>++</sup>	1	0.02 <sup>++</sup>
Bilateral	7 (38.89)	11 (61.11)			
<b>Assisted ventilation</b>					
Non invasive	2 (5.12)	37 (94.9)	0.00 <sup>++</sup>	1	0.00 <sup>++</sup>
Invasive	9 (75)	3 (25)			

AIS = abbreviated injury severity score; <sup>++</sup>P-value ≤ 0.05.

The following factors remained statistically significant after multivariate logistic regression analysis: Associated injuries, critical injury, analgesia mode, time to treatment, bilateral chest involvement and invasive ventilation. Those with no associated injuries were 93% less likely to die than those who had associated injuries. Critical injured patients were 24 times more likely to die than moderately injured patients. Presenting to hospital more than 24 hours post-injury were 5.5 times more likely to die compared to those who presented to hospital within 24 hours post-injury. Those with bilateral chest involvement were 4.6 times more likely to die than those who had unilateral chest involvement. The risk of death was 31.5 times greater in those who needed invasive ventilation than non-invasive ventilation, and it was 78% less in those who had more than one analgesia than those managed by a single analgesia (**Table 3**).

#### 4. Discussion

This study aimed at finding the prevalence of chest injuries among trauma patients and the predictors of mortality. The prevalence of chest injuries in this study was 18.1%, similar to what has been reported in other sub-Saharan African countries [11] [12]. This study also revealed majority of injured patients to be males in productive age group, with a male to female ratio of 3:1 similar to other studies in Africa and elsewhere [13] [14]. Male predominance is attributed to their active involvement in the risky daily activities for living, including speeding motorcycles, vehicles, violence and falls. Majority of injured victims in this study were in economically active group (20 - 39 years), this has a direct impact economically on individuals, families, communities and the country at large hence the need for health education aimed at reducing the incidence and severity of trauma targeting this group of people.

Road traffic crashes (80.4%) were responsible for the majority of Chest injuries in this study. Other studies conducted in Tanzania [6] [9] [10] have revealed similar results. Road Traffic Crashes especially motorcycles continue to be a leading cause of trauma and admission of most hospitals in Tanzania, hence a call for road traffic crash prevention measures. World Health Organization notes the escalating road traffic crashes in developing countries, some of the major reasons for this trend are: increasing motorization, poor road infrastructure, not complying to traffic laws and driving or riding under the influence of recreational substances [15] [16].

Majority in this study were blunt injury (88.2%), this is higher than 55.7% reported by Mwesigwa *et al.* in Mbarara, Uganda [17], and is in contrast to two other studies done by Ali, Gali [18] and Maxwell [19], which revealed penetrating injuries to be 61.5% and 77% respectively. Lung contusion (33.3%) was the leading clinical type of chest injury seen in this study; other studies however have reported rib fractures to be the commonest type of chest injury [17] [20] [21]. Otieno *et al.* reported hemopneumothorax to be the commonest injury sustained in the Kenyan rural population [22].

Two patients (3.9%) had Cardiac Injury in this study, similar to what was reported by Masaga *et al.* [20], in which they reported few patients with life threatening conditions such as oesophageal perforation, cardiac injury and diaphragmatic rupture. Majority of victims sustaining these types of severe injuries die at the site of accidents and hence don't make it to hospitals.

Majorities 58.8% of injury victims were attended in within 24 hours from injury in this study, and were more likely to survive than those who received medical attention more than 24 hours from injury. Delay in receiving medical attention minimises the chance of survival for the injured patients, especially severely injured patients. This calls for proper pre-hospital emergency care system and ambulance services in developing countries like Tanzania if severely injured patients are to survive.

Most of the patients (52.9%) in this study, required a chest tube thoracostomy and others (42.1%) were managed conservatively by (observation, analgesia and antibiotics and chest physiotherapy), similar to what has been reported in other studies done elsewhere [6] [23]. It is also reported in studies done in developed countries that observation, chest tube placement, adequate volume replacement, occasional respiratory support and serial chest X-rays are the only treatment required in 80% - 85% of the patients [24] [25].

In this study, 23 (45%) patients were given one type of pain medication and 28 (55%) were given more than one type of pain medication. Pain management option significantly influenced survival, those who received more than 1 type of pain medication were more likely to survive as compared to those who received a single type of pain medication. Results similar to Annalise *et al.* in her review on treatment of chest trauma and their impact [26], in which it was revealed that using more than one option of pain medication improved the outcome of thoracic injury patients. Other studies have demonstrated a big role of regional anaesthesia with intercostal blockade, thoracic epidurals and paravertebral blockades in significant reduction of pain in chest injury patients [6] [27]. The main options in our setting were systemic medication (Opioids, NSAIDS and paracetamol), which have been reported in literatures to be insufficient for optimal pain control [28]. Optimal pain control in chest injury patients prevents splinting of the diaphragm and atelectasis.

In this study, 12 (23.5%) patients needed invasive ventilation and were 31.5 times more likely to die than non-invasive ventilated patients. Patients with blunt or penetrating chest trauma may require mechanical ventilation. Lung protective ventilation strategies have to be applied otherwise it is associated with attributable mortality if it is set incorrectly [29], hence a need for mechanical ventilation modes training for personnel's working in our emergency rooms and intensive care units.

The mortality rate in this study was 21.6% which is almost similar to what was reported by Masaga *et al.* 24.2% [20], but higher compared to what was reported in other studies done elsewhere [6] [17]. Statistically significant predictors of mortality in this study included associated injuries, analgesia mode, time

to treatment, critical injury, bilateral chest involvement and invasive ventilation, results almost similar to what have been reported in other studies done elsewhere [6] [17] [20]. There is therefore a need for management improvement strategies targeting these predictors of mortality in order to improve outcome of chest injury patients in Tanzania, including establishing trauma care system in the country.

In considering the findings of this study it is important to bear in mind the following limitations: firstly, this was a single centre study with small number of patients, and the time frame of the study was short, hence it may not reflect what is happening in other centres. Secondly, data collectors not collecting all data and so some are missing. Thirdly, information bias from participants and data collectors may have affected the quality of data.

## 5. Conclusion

The results of this study provide valuable insight into the burden and management of Chest injury in Tanzania hospitals. It points to the need of establishing management guidelines for chest trauma in both pre-hospital and in-hospital setting. Since most of the chest trauma cases are due to Road traffic crashes, there is an urgent need of road traffic crash preventive measures to help reduce the frequency of chest injury in our population. Public awareness campaigns concerning road safety rules are needed as well as roads improvement.

### What Is Known about This Topic?

- Accidents represent a significant proportional of non-communicable disease in Tanzania.
- Majority are due to road traffic crashes.
- Chest injury is among the common injuries sustained by the victims.

### What This Study Adds

- This study provides valuable insight into the burden and management of Chest injury in Tanzania hospitals.
- It also points to the need of establishing management guidelines for chest trauma in both pre-hospital and in-hospital settings.

### Authors' Contributions

Janeth Stanslaus Masuma, Respicious Lwezimula Boniface and Edwin Rwebugisa Lugazia conceived and designed the study. Janeth Stanslaus Masuma undertook the data collection and statistical analysis and wrote the first draft of the manuscript. All authors contributed to intellectual content and approved the final manuscript.

### Acknowledgements

We are grateful to the management and workers of Muhimbili National Hospital



for their cooperation. This work was supported by Muhimbili University of Health and Allied Sciences (MUHAS), Muhimbili National Hospital and Muhimbili Orthopaedic Institute.

### Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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## Appendix: Questionnaire

- 1) General information
  - a) Patient's file number .....
  - b) Gender  
Male  Female
  - c) Age .....
  - d) Marital status .....
  - e) Education level .....
  - f) Time of injury .....
  - g) Time at admission .....
  - h) Time at management .....
- 2) Vital signs at admission
  - a) Pulse rate .....
  - b) Respiratory rate .....
  - c) Blood pressure.....
  - d) Spo2.....
- 3) Type of injury  
Blunt  Penetrating
- 4) Mode of injury
  - a) Road traffic accidents
  - b) Fall from a height
  - c) assault
  - d) compression by heavy objects
  - e) blast
  - f) Others .....
- 5) which part of the body is injured
  - a) head
  - b) Chest
  - c) Extremity
  - d) Abdomen
  - e) Pelvis
  - f) others.....
- 6) Any preexisting comorbid conditions?  
Yes-specify; Cardiac disease.....  
Respiratory disease.....  
Liver disease.....  
Cancer.....  
Neurological disease.....  
No
- 7) Screening for chest injury
  - a) Any chest pain or difficulty in breathing?  
If yes, proceed to question 8  
If no, end here

8) Findings on chest examination

Inspection.....

Palpation.....

Percussion.....

Ascultation.....

9) Investigations done

a) ABG

Yes , Results .....

No

b) CXR

c) Chest USS

d) Chest CT-scan

10) Pattern of chest injury

a) pneumothorax

b) hemothorax

c) pneumohemothorax

d) lung contusion

e) rib fracture

f) clavicle fracture

g) chest wall contusion

h) others

specify .....

11) Chest involvement

a) Unilateral.....

b) Bilateral.....

12) AIS<sub>thorax</sub>

a) 1

b) 2

c) 3

d) 4

e) 5

f) 6

13) Options used for analgesia:

a) opioids

b) non opioids

c) a and b

d) multimodal

Assessment of adequacy of analgesia

a) verbal analog scale

b) visual analog scale

c) others; ....

14) Ventilation modes;

a) Invasive Ventilation.....

b) Noninvasive ventilation.....

If Invasive Ventilation, what is the length of mechanical ventilation (days).....

Vital signs after ventilation

a) Spo2.....

b) ABG.....

c) RR.....

15) Any procedure/surgery done;

a) Thoracostomy

b) Thoracotomy

c) Laparotomy

d) Others.....

16) Any other treatment offered.....

17) Length of hospital stay.....

**18) Outcome**

a) Discharged.....

b) Died.....