



Original Article

Characteristics and outcome of traumatic chest injury patients visited a specialized hospital in Addis Ababa, Ethiopia: A one-year retrospective study

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ABSTRACT

Purpose: Injury continues to be an important cause of morbidity and mortality in both developed and developing countries. Globally, it is responsible for approximately 5.8 million deaths per year and 91% of these deaths occur in developing countries. Road traffic collision, suicides and homicides are the leading cause of traumatic deaths. Despite the fact that traumatic chest injury is being responsible for 10% of all trauma-related hospital admissions and 25% of trauma-related deaths across the world including in Ethiopia, only few published studies showed the burden of traumatic chest injury in Ethiopia. So, this study aims at assessing the characteristics and outcome of traumatic chest injury patients visited Tikur Anbesa Specialized Hospital (TASH) over one year period.

Methods: A single center based retrospective study was done. We collected data from patients' records to assess characteristics and outcome of traumatic chest injury at TASH over one year period. All patients diagnosed with traumatic chest injury and received treatment at the hospital from January 1 to December 31, 2016 regardless of its types and severity levels were included in the study. Patients with incomplete medical records for at least 20% of the study variables and without detailed medical history, or patients died before receiving any health care were excluded from the study. The collected data were cleaned and entered into Epidata version 3.1 and exported to SPSS Version 21.0 for analysis. Bivariate and multivariate logistic regression models were used to examine factors associated with outcome of traumatic chest injury patients.

Results: A total of 192 chest injury patients were included in the study and about one-fourth of chest injury victims were died during treatment period in TASH. Road traffic collision (RTC) was the leading cause of morbidity and mortality among traumatic chest injury victims. Age of the victims (adjusted odds ratio (AOR) 8.9, 95% confidence interval (CI) 1.51–53.24), time elapsed between the occurrence of traumatic chest injury and admission to health care facilities (AOR 4.6, 95% CI 1.19–18.00), length of stay in hospital (AOR 0.12, 95% CI 0.02–0.58), presence of multiple extra-thoracic injury (AOR 25, 95% CI 4.18–150.02) and development of complications (AOR 23, 95% CI 10–550) were factors associated with death among traumatic chest injury patients in this study.

Conclusion: RTC contributed for a considerable number of traumatic chest injuries in this study. Old age, delay in delivering the victim to health care facilities, length of stay in hospital, and development of atelectasis and pneumonia were associated with death among traumatic chest injury patients. Road safety interventions, establishment of organized pre-hospital services, and early recognition and prompt management of traumatic chest injury related complications are urgently needed to overcome the underlying problems in the study setting.

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Introduction

Injury is the major public health problem in both developed and developing countries. It is responsible for about 5.8 million deaths per year worldwide.¹ Road traffic collisions (RTC), suicides and

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homicides are the leading cause of traumatic deaths and they are responsible for approximately more than 2.7 million injury related deaths per annum. Of which, about 91% of injury related deaths occurred in developing countries.²

Chest trauma is a condition that has worsened along with growing urbanization and industrialization.³ It is the third most important cause of mortality and morbidity preceded by cancer and cardiovascular diseases worldwide.^{4,5} Chest trauma is responsible for 10% of all trauma admissions and 25% of trauma-related deaths globally.^{6,7} Even in developed countries including Europe and the United States, the mortality rate from blunt chest trauma can be as high as 60%.⁸ Several studies in Africa showed that chest trauma was a major cause of morbidity and mortality in the region.^{9–11} In South Africa, chest injury was responsible for 27.4% of trauma-related deaths.⁹

In Ethiopia, chest trauma is the major public health challenges.¹² The prevalence of traumatic chest injury is increasing over time due to a large number of RTCs in the country.^{13,14} Chest region is the fourth mostly affected body region by RTCs in Ethiopia and accounts for 9.5% of all body region injured in the country.¹⁵

Despite the fact that traumatic chest injury can cause a serious and fatal problem, it can be preventable. Study revealed that identification of traumatic chest injury cause, implementation of appropriate intervention and timely diagnosis can reduce the mortality and morbidity related to chest injury.¹⁶ However, there is a dearth of literature on chest injury in Ethiopia. Only few published studies showed the burden of chest injury in the country.^{17–19} As a result, very little is known about traumatic chest injury in Ethiopia. Therefore, this study aimed at assessing the characteristics and outcome of chest trauma patients visited Tikur Anbesa Specialized Hospital (TASH) over one year period.

Methods

Study setting and period

The study was conducted at TASH, which is one of the premier hospitals in Ethiopia and located in Ethiopia's capital, Addis Ababa. TASH was established in 1972 and provides a tertiary level health care service in the country. The hospital has over 700 beds and approximately serves 370,000–400,000 patients annually.²⁰

The study was conducted by reviewing patient registry at TASH from January 1 to December 31, 2016.

Study design

A hospital-based retrospective cross-sectional study design was conducted to assess characteristics and outcomes of chest injury at TASH, Addis Ababa, Ethiopia.

Study population

All patients attended TASH and diagnosed with traumatic chest injury between January 1 to December 31, 2016 were enrolled in the study.

Inclusion and exclusion criteria

All patients diagnosed with traumatic chest injury and received treatment at TASH between January 1–December 31, 2016 regardless of its type and severity levels were included to the study. Patients with incomplete medical records for at least 20% of the study variables and those without detailed medical history were excluded from the study. In addition, traumatic chest injury

patients who died immediately at the time of their arrival to the hospital before receiving health care at TASH excluded from this study.

Data collection instrument and procedure

The list of patients diagnosed with traumatic chest injury was identified from patient registry of TASH emergency department. Then, the records of each patient were accessed from TASH record office based on the identified list. To extract relevant information from the patient records, English version check list was developed after reviewing relevant literatures.^{11,21–23} The data collectors were nurses and they were recruited based on their competence and data collection experiences.

Data entry, processing and analysis

The collected data were checked for completeness and double entered to Epi-data software version 3.1 (EpiData Association, Odense, Denmark), then exported to SPSS version 21.0 (IBM Corp., Armonk, NY, USA) for analysis.

Descriptive statistics were used to summarize the data. Tables and texts were used for data presentation. Logistic regression models were used to explore the association of each independent variable with the dependent variable. Initially, the crude odds ratio (COR) for each independent variable was calculated at 95% confidence interval (CI). Then, all variables with *p*-value of <0.25 were considered for multivariate logistic regression to control the effect of confounders. Lastly, the level of significance was set at *p* < 0.05.

Results

Basic characteristics of traumatic chest injury patients received trauma care at TASH

A total of 192 chest trauma patients were enrolled in the study. The mean \pm SD of respondent age was (35.5 \pm 15.2) years. Nearly three-fourth (141, 73.4%) of chest trauma patients were male. The majority of chest trauma patients admitted to health care facilities within 2–6 h of the traumatic chest injury. The average length of hospital stay was (8.4 \pm 6.3) days. Concerning the outcome of traumatic chest injury, 53 victims (27.6%) died in TASH while receiving healthcare (Table 1).

Mechanism, type of injury and presence of chronic illness

RTC was the most common cause of traumatic chest injury followed by violence, which accounts for 85 (44.5%) and 67 (34.9%) cases respectively. The majority (123, 64.1%) of patients had blunt chest injury while 69 (35.9%) had penetrating chest trauma. More than two-thirds (136, 70.8%) of the victims were admitted with pure chest injury whereas the rest of the victims had sustained thoracoabdominal injuries (Table 2).

Injury types

Rib fracture was the most common (62, 32.3%) type of chest injury patients treated at TASH over one year period followed by hemopneumothorax (35, 18.2%) (Table 3).

Presence of associated injured body region

Nearly half (93, 48.4%) of the chest injury patients had traumatic injury to their extremities while 67 (34.9%) had abdominal injury,

Table 1
Basic characteristics of the 192 patients with traumatic chest injury.

Variables	n (%)	Outcomes		χ ²
		Dead	Alive	
Age (year)				0.000
≤20	26(13.5)	3	23	
21-35	96(50.0)	23	73	
36-50	36(18.8)	8	28	
>50	34(17.7)	19	15	
Gender				0.286
Male	141(73.4)	36	105	
Female	51(26.6)	17	34	
Time spent between injury and admission to hospital (h)				0.001
<2	63(32.8)	8	55	
2-6	67(34.9)	29	38	
7-24	62(32.3)	16	46	
Length of hospital stay (d)				0.004
≤2	25(13.0)	14	11	
3-7	92(47.9)	14	78	
8-14	39(20.3)	10	29	
15-21	23(12.0)	9	14	
>21	13(6.8)	6	7	

53 (27.6%) had injury to head and neck, 31 (16.1%) had pelvic and 19 (9.9%) had spinal injuries (Table 4).

Intervention given to chest injury patient at TASH

About one-third of the chest injury patients were treated non-operatively. Chest tube was inserted in the majority (119, 62.0%) of patients. Advanced procedures such as laparotomy and thoracotomy were done for 13% and 3.6% of the chest injury patients respectively (Table 5).

Types of complications developed by chest injury patients

The vast majority (134, 77.1%) of chest injury patients were treated without developing complications. However, about one out of four patients developed complications in hospital. Hospital acquired pneumonia and wound sepsis were among the most common complications developed by chest injury patients at TASH (Table 6).

Table 2
Patients characteristics based on mechanism, type of injury and underlying comorbid chronic illness.

Variables	n (%)	Outcomes		χ ²
		Dead	Alive	
Mechanism of chest injury				0.06
RTC	85(44.3)	17	68	
Violence	67(34.9)	25	42	
Falling down	40(20.8)	11	29	
History of underlying comorbid chronic illness				0.001
Yes	44(22.9)	21	23	
No	148(77.1)	32	116	
Types of underlying comorbid chronic illness				0.014
Diabetic mellitus	23(12)	13	10	
Cardiovascular disease	25(13)	12	13	
Others	7(3.6)	3	4	
Injury mechanism				0.987
Penetrating	69(35.9)	19	50	
Blunt	123(64.1)	34	89	
Organ involved				0.000
Pure chest injury	136(70.8)	26	110	
Thoracoabdominal injury	56(29.2)	27	29	

RTC: Road traffic collision.

Table 3
Types of chest injury and outcomes.

Types of chest injury	n (%)	Outcomes		χ ²
		Dead	Alive	
Hemothorax	24(12.5)	4	20	0.087
Pneumothorax	20(10.4)	3	17	
Hemopneumothorax	35(18.2)	10	25	
Pulmonary contusion	28(14.6)	8	20	
Rib fracture	62(32.3)	23	39	
Clavicular fracture	18(9.4)	3	15	
Others	5(2.6)	2	3	

Factors associated with outcome among chest injury patients

In this study, age of the victims was associated with the outcome of traumatic chest injury patients. Accordingly, patients aged 50 years and above were almost nine times more likely to die from chest injury than those aged 20 years and below (adjusted odds ratio (AOR) 8.9, 95% CI 1.51–53.24) (Table 7).

Length of time elapsed between the occurrence of injury and receiving health care was associated with the outcome of chest injury patients. Indeed, chest injury patients who spent 2–6 h before receiving health care following injury were five times more likely to die from traumatic chest injury than those arrived at health care facilities within the first 2 h of injury (AOR 4.6, 95% CI 1.19–18.00) (Table 7).

Presence of injury to abdominal organ damage predicts the outcome of chest injury patients. A multivariate analysis showed that the chest injury that involved abdomen were 12 times more likely to cause death than those involved thoracic region alone (AOR 12.3, 95% CI 3.08–48.67) (Table 7).

Moreover, the existence of associated injuries to the other region of the body determines the outcome of chest injury patients. Indeed, chest injury patients who had associated head and neck injury were 25 times more likely to die than their counterparts (AOR 25, 95% CI 4.18–150.02). Also, patients who had associated spinal cord injury were 11 times more likely to die than their counterparts (AOR 10.7, 95% CI 3.17–36.32) (Table 7).

Discussion

The prevalence of death among traumatic chest injury patients over one year period was 53 cases (27.6%) in this study. This finding is far greater than the result reported by earlier studies conducted in Syria and the United Arab Emirates.^{22,24} The disparity might be

Table 4
Associated extra thoracic multiple injuries among traumatic chest injury patients.

Variables	n (%)	Outcomes		χ ²
		Dead	Alive	
Head and neck				0.000
Yes	53(27.6)	37	16	
No	139(72.4)	16	123	
Extremities				0.007
Yes	93(48.4)	34	59	
No	99(51.6)	19	80	
Abdomen				0.235
Yes	67(34.9)	22	45	
No	125(65.1)	31	94	
Pelvis				0.001
Yes	31(16.1)	16	15	
No	161(83.9)	37	124	
Spinal cord				0.001
Yes	19(9.9)	12	7	
No	173(90.1)	41	132	

Table 5
Types of procedure done for chest injury patients.

Variables	n (%)	Outcome		χ^2
		Dead	Alive	
Non-operation				0.000
Yes	66(34.4)	5	61	
No	126(65.6)	48	78	
Chest tube				0.007
Yes	119(62)	41	78	
No	73(38)	12	61	
Thoracotomy				0.358
Yes	7(3.6)	3	4	
No	185(96.4)	50	135	
Laparotomy				0.598
Yes	25(13.0)	8	17	
No	167(87.0)	45	122	

due to difference in quality of health care service delivery system and mechanism of injuries. Penetrating thoracic trauma has been shown to have a higher survival rate in previous study when compared to blunt trauma.

Male and young people were predominantly affected by chest trauma in our study. In agreement with this finding, previous studies reported similar results.^{10,11,23,25,26} Age of the victim determines the outcome of chest injury. Indeed, patients who aged >50 years were 9 times more likely to die from chest injury than those aged ≤20 years old. Earlier studies also reported similar findings.^{27–29}

Early presentation to hospital, prompt and effective management at a trauma center are the key to a good outcome among traumatic chest injury patients.³⁰ In this study, however, only one-third of the victims reached health care facilities within a golden hour. This finding is in agreement with the study conducted in Nigeria.¹⁰ Moreover, late presentation to hospital was highly associated with death among traumatic chest injury in this study. Indeed, patients who reached health care facilities within 2–6 h of the injury were five times more likely to die than those arrived health care facilities within 2 h of the injury. The reason for late presentation to health care facilities might be grossly inadequate ambulance service and a dearth of trauma center in the country, which might lead to delay in arrival and death of the victim and thus can be the cause for unnecessary death.

RTC was the leading cause of traumatic chest injury in this study followed by violence. This finding was consistent with the result of study conducted in Tanzania.¹¹ Previous studies found that the mechanism of injury predicts the outcome of chest injury patients.^{24,27} In this study, however, the mechanism of injury has no

Table 6
Complications developed by chest injury patients in hospital.

Variables	n (%)	Outcome		χ^2
		Dead	Alive	
Complications				0.016
Yes	58(22.9)	25	33	
No	134(77.1)	28	120	
Types of complication Pneumonia				0.018
Yes	40(20.8)	15	25	
No	152(79.2)	38	127	
Wound sepsis				0.694
Yes	13(6.7)	3	10	
No	183(95.3)	50	133	
Atelectasis				0.000
Yes	9(4.7)	7	2	
No	184(95.8)	46	138	

statistically significant association with the outcome of traumatic chest injury patients. Small sample size in this study might be the reason, so further investigations with large sample size are recommended to identify the association.

Blunt chest trauma was more common than penetrating chest injuries, which was 123 (64.1%) and 69 (35.9%) respectively. This finding was consistent with previous studies from Tanzania, Iran, and Syria.^{11,24–26} In contrary, previous study from Ethiopia reported penetrating chest injury as the dominant type.¹⁷ The disparity might be due to that gunshot and stab injuries were common mechanism of injury in previous study while RTC was very common in our study.¹⁷

Concerning the type of chest injury, majority of the patients sustained rib fractures (62, 32.3%), whereas hemopneumothorax and pulmonary contusion were diagnosed in 35 (18.2%) and 28 (14.6%) cases among traumatic chest injury patients respectively. This finding was in line with the study conducted in the United Kingdom.²⁵ However, previous study from Ethiopia reported hemopneumothorax as the commonest type of chest injury.¹⁷ Higher proportion of RTC casualties in the present study could be the reason for the disparity when compared with previous study.¹⁷

Nearly half (93, 48.4%) of the traumatic chest injury patients had also an injury to their extremities in this study. This finding was consistent with the result of the study conducted in Syria.²⁴ Furthermore, in agreement with other studies, the presence of extra-thoracic multiple injuries determine the outcome of traumatic chest injury patients.^{11,24} Indeed, chest injury patients who had also an injury to their head and neck were about 21 times more likely to die than their counterparts. Similarly, chest injury patients who had an injury to their spinal cord were about 11 times more likely to die than those without spinal cord injury.

The presence of underlying chronic comorbid illness predicts the outcome of traumatic chest injury in previous studies.^{11,31,32} Similarly, in this study unadjusted analysis showed statistically significant association. However, after adjusting for covariates this finding was no more significant.

The death from chest injury was strongly associated with length of stay in hospital. The more the patients stayed in hospital, the less likely they die from traumatic chest injury. The chest injury patients who stayed for 2–7 days in hospital were 88% less likely to die than those stayed in hospital for less than 48 h. This implies that the mortality from chest injury is high within the first 48 h of hospital admission. Similarly, the study from Syria reported that 56% of mortality happened within 48 h of accident.²⁴ This study calls for further investigation with strong study design to identify causal relationship between length of hospital stay and outcome of chest injury patients.

Pneumonia was the commonest complication developed by chest injury patients in the present study followed by wound sepsis. However, the study from Tanzania reported wound sepsis as the commonest complication of chest injury.¹¹ The disparity might be related with the difference in quality of care given to the patients between countries. Moreover, previous study found that presence of complications determines the outcome of chest injuries.^{11,33} Accordingly, the chest injury patients who developed atelectasis were 23 times more likely to die than those without atelectasis. Unadjusted analysis also showed that the chest injury patients who had pneumonia as complication were 2.4 times more likely to die than those without pneumonia.

Our study has some limitations. It is retrospective and single-center based study. Therefore, the investigators cannot assert that it is representative of the whole traumatic chest injury in Ethiopia. Being retrospective, the study was limited to the available data in the patients' medical records, which has a tendency to miss

Table 7
Factors associated with the outcome of traumatic chest injury patients. .

Variables	Outcomes		COR (95% CI)	AOR (95% CI)
	Death	Alive		
Age				
≤20	3	23	1	1
21-35	23	73	2.42(0.66–8.78)	2.85(0.40–20.14)
36-50	8	28	2.2(0.52–9.22)	4.9(0.47–50.39)
>50	19	15	9.71(2.44–38.62)	8.9(1.51–53.24)**
Time between injury and admission (h)				
<2	8	55	1	1
2-6	29	38	5.2(2.16–12.71)	4.6(1.19–18.00)*
>6	16	46	2.4(0.94–6.09)	1.7(0.34–8.33)
Length of hospital stay (d)				
≤2	14	11	1	1
3-7	14	78	0.14(0.05–0.37)	0.12(0.02–0.58)**
8-14	10	29	0.27(0.09–0.79)	0.19(0.05–0.69)*
15-21	9	14	0.5(0.16–1.6)	0.46(0.12–1.77)
>21	6	7	0.67(0.17–2.59)	0.63(0.01–3.27)
Comorbid chronic illness				
Yes	21	23	3.3(1.63–6.73)	1.8(0.42–7.83)
No	32	116	1	1
Pure thoracoabdominal injury	26	110	1	1
Associated multiple injuries	27	29	3.9(2.00–7.75)	12.3(3.08–48.67)***
Head and neck				
Yes	37	16	17.8(8.11–38.95)	25(4.18–150.02)**
No	16	123	1	1
Extremities				
Yes	34	59	2.4(1.26–4.67)	2.3(0.72–7.37)
No	19	80	1	1
Pelvic injury				
Yes	16	15	3.57(1.61–7.91)	2.93(0.77–11.17)
No	37	124	1	1
Spinal cord injury				
Yes	12	7	5.5(2.04–14.940)	10.7(3.17–36.32)**
No	41	132	1	1
Pneumonia				
Yes	15	25	2.4(1.15–4.94)	1.71(0.61–4.79)
No	38	127	1	1
Atelectasis				
Yes	7	1	21(2.52–175.25)	23(10–550)***
No	46	138	1	1

Note: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$, AOR: adjusted odds ratio, COR: crude odds ratio, CI: confidence interval.

important information due to inappropriate documentation or missed documentation.

Chest trauma is predominantly affecting male and economically productive age group with high morbidity and mortality. Road traffic collision was the leading cause of chest injury in this study. Majority of the patients had sustained blunt chest injury. A rib fracture was the commonest type of traumatic chest injury followed by hemopneumothorax in this study. Nearly two-third of the chest injury patients were treated by operative approach and chest tube was inserted for the majority of the patients.

Old age, delay in presenting the victims to health care facilities, length of stay in hospital, an injury that involved abdominal organ, presence of multiple injuries and development of complication (atelectasis and pneumonia) were associated with death among traumatic chest injury patients.

The finding reported in this study suggests urgent need of road safety intervention policy, adequate provision of ambulance service for timely transportation of the victims and early recognition and management of chest injury complications.

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Ethical Statement

Ethical approval was obtained from Addis Ababa University College of Health Science, Research Ethics Review Committee. Letter of permission was obtained from TASH administration office through Department of Emergency Medicine. The study ensured individual information undisclosed and kept confidential. Personal unique identifiers such as name of the study participants were not taken.

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Declaration of Competing Interest

The authors declare that they have no competing interests.

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