CLINICAL PROFILE AND PREDICTORS OF OUTCOMES OF ADULT PATIENTS WITH CHEST TRAUMA PRESENTING TO THE EMERGENCY DEPARTMENT OF MUHIMBILI NATIONAL HOSPITAL.

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By

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A dissertation submitted in partial fulfilment of the requirement for the degree of Masters of Medicine – Emergency Medicine Muhimbili University of Health and Allied Sciences

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CERTIFICATION

I, the undersigned certifies that have read and recommends for acceptance by the Senate a dissertation entitled**, "Clinical profile and predictors of outcomes of adults patients with chest trauma presenting to the emergency department of Muhimbili National Hospital"** in partial fulfilment of the requirements for the degree of the Masters of Medicine – Emergency Medicine of Muhimbili University of Health and Allied Sciences

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Prof. HENDRY SAWE (SUPERVISOR) Date

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Dr. Said Kilindimo (Co-supervisor) Date

DECLARATION AND COPYRIGHT

I, Aliasghar G. Mukhtar declare that this dissertation is my original work and that it has not been presented and will not be presented to any other university for a similar or any other degree award.

Signature……. Date……..

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DEDICATION

To my adorable son, Muhammad Hasan.

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LIST OF ABBREVIATIONS

A&E	Accidents and Emergency
ATLS	Advanced Trauma Life Support
CPR	Cardio-Pulmonary Resuscitation
CXR	Chest X ray
ED	Emergency Department
E-FAST	Extended focused assessment with sonography for trauma
EMD	Emergency Medicine Department
EMS	Emergency Medical Services
GCS	Glasgow Coma Scale
ICU	Intensive Care Unit
ISS	Injury Severity Score
IVF	Intravenous Fluid
LMIC	Low- and Middle-Income Countries
MNH	Muhimbili National Hospital
MUHAS	Muhimbili University of Health and Allied Sciences
PAO2	Partial Pressure of Oxygen
RTA	Road traffic accident
UWSD	Under water seal drainage
USS	Ultrasound
WHO	World Health Organization

ABSTRACT

Introduction: Trauma causes significant morbidity and mortality across the world. Injuries to the chest are one of the leading causes of mortality in high-income countries; however, there is a paucity of data regarding the clinical profile and predictors of outcome in chest trauma patients in low-middle income countries. This study highlights the causes, management and outcome of chest trauma in Tanzania

Aim of the Study: To describe the clinical profile and predictors of outcome in adult patients with chest trauma presenting to the Emergency Medicine Department (EMD) of the Muhimbili National Hospital (MNH).

Methods and Material: This was a retrospective case review study involving all adult chest trauma patients captured in the trauma registry available at the EMD MNH, between June 2019 and December 2020. Data was captured in a data collection form developed in Research and Electronic Data Capture (REDCap) and was entered in the form using data from the EMD Trauma Registry and patient files form the wards. Demographics, mechanism of injury, the severity of injury using ISS, management offered, complications and mortality was recorded and analyzed. Descriptive analysis was was summarized as frequencies and median with IQR. Logistic regression and odds ratios were used to calculate association between predictors and outcomes.

Results: We enrolled 218 (9.1%) from 2387 trauma patients screened. The overall median age was 32 years (IQR 26 – 43 years), and 183 (83.9%%) were male. The majority of patients were involved in the Road Traffic Accidents, 151 (69%), among them, 85 (39%) were motorists. Overall, 132 (61%%) of patients had extra thoracic injuries, of which 72 (33%%) had a traumatic brain injury (TBI). The 24-hours and 7-days mortality were 2.9% and 3.9%, respectively. Severe and moderate TBI were significantly associated with mortality, AOR 60.4 (CI 95% 5.38 – 678.07, p-value < 0.001), and AOR 22.67 (CI 95% 2.66 – 193.4 p-value 0.004), respectively. Furthermore, shock index and haemothorax were significantly associated with mortality, AOR 7.2 (CI 95% 1.28 – 40.32, p-value 0.025) and AOR 5.9 (CI 95% 1.3 – 26.9, p-value 0.022)

Conclusion: Road Traffic Accidents involving motorcyclist is the main mechanism of injuries among patients presenting with chest injuries. The presence of extra thoracic trauma, especially traumatic brain injury, was associated with higher mortality. Future studies should focus on the improvement to be made, including factors related to the motorist's adherence to traffic regulations to address morbidity and mortality.

DEFINITION OF KEY TERMS

Chest trauma: A chest injury, also known as chest trauma, is any form of physical injury to the chest , including the ribs, heart and lungs (1)

Needle decompression: Is the process of evacuating air from the pleural space using a large-bore needle for a tension pneumothorax (2)

Tube thoracostomy: Is a procedure whereby a tube is inserted into the pleural cavity and secured in place in order to drain blood or air or both, accumulated secondary to trauma. (5)

Severe chest trauma: Injury to the chest that causes significant impediment in ventilation and can lead to cardiopulmonary compromise (1)

Thoracotomy: A thoracotomy is a surgical procedure to gain access into the pleural space of the chest (3)

CHAPTER ONE

INTRODUCTION

1.0 BACKGROUND

Injuries are a significant public health concern and remain a growing problem in some countries. Globally, more than 5 million people die each year because of injuries. This accounts for 9% of the world's deaths, nearly 1.7 times the number of deaths that are caused by HIV/AIDS, tuberculosis and malaria combined. One-quarter of the 5 million deaths from injuries result from suicide and homicide, while road traffic injuries account for nearly another quarter. Injuries affect all age groups but directly impact young people and people in their prime working years. For people between the ages of 15 and 29 years, injury-related causes are among the top five causes of death. Road traffic injuries are the leading cause of death in this age group.

Survivors of violence, road traffic crashes, suicide attempts or other causes of injury are left with temporary or permanent disabilities – injuries are responsible for an estimated 6% of all years lived with disability (1). There are regional differences in the profile of injury and violence in Africa depending on the prevailing economic, political, socio-cultural and historical factors of a particular country or region. In the African Region, an estimated 725,000 people die due to injuries annually, accounting for 7% of all deaths within the region and 15% of worldwide injury-related deaths: road traffic injuries accounting for 22 % and war accounting for 22% of the total. Also, interpersonal violence accounting for 15% of the total deaths (4).

The injury death rate of men (49.7%) was more than double compared to women (5). In Tanzania, the overall injury death rate was 33.4/100 000 population. Injuries accounted for 4% of total hospital deaths. Up to 50% of trauma patients present with a chest injury. Deaths due to chest injury in trauma account for 25% (9). Trauma to the chest could lead to injury of all or part of the thoracic cavity and its contents. From ribcage, lung parenchyma to the mediastinum, heart and great vessels and as such, chest injuries could be deadly if intervention is not immediate.

Morbidity and mortality associated with thoracic trauma are due to the disruption of respiration, circulation, or both. Respiratory compromise can occur due to direct injury to the airway or lungs, as is the case with pulmonary contusions, or interference in breathing mechanics, as with rib fractures. The typical outcome is the development of ventilation-perfusion mismatch and decreased pulmonary compliance. This then results in hypoventilation and hypoxia, which may necessitate intubation. Circulatory compromise occurs in the setting of significant blood loss, decreased venous return, or direct cardiac injury. Intrathoracic bleeding most commonly manifests as hemothorax in both blunt and penetrating trauma and a massive hemothorax can lead to hypotension and hemodynamic shock (6)

In a study at MNH done in 2010, motor traffic injury was the most typical cause of chest injuries accounting for 72.3% of the cases admitted at Muhimbili National Hospital. The majority of patients were passengers and pedestrians (63%). Blunt chest injury occurred in 90 (75.6%) cases, while penetrating injury was encountered in 29 (24.4%) patients. Other causes were assault, gunshot and fall from height seen in 16%, 7.6% and 4.4% of cases, respectively (5). Whereas, at Bugando Medical Centre, in 2011, road traffic accident accounted for 50.7 % of total patients admitted with chest trauma, 28.0% assault, 16.0% fall, and 1.3 % sport injuries (7).

Nature of an injury to a patient with chest trauma varies from one patient to another depending on the mechanism of injury, the severity of the injury and the chest organ(s) involved in the injury. Chest trauma patients can present with chest wall wounds, rib fractures, flail chest, clavicular fractures, scapular fractures, thoracic spine injury, haemothorax, pneumothorax, pneumohaemothorax, lung laceration haemopericardium, oesophagal injury and Acute Respiratory Distress Syndrome (7,8)

The clinical presentation of patients with chest trauma varies widely and ranges from minor reports of pain to coma. The presentation depends on the mechanism of injury and the organ systems injured (9). Patients with blunt chest trauma often present with mild symptoms, which can later evolve to severer symptoms depending on the organs involved. While penetrating injuries may result in a faster onset of symptoms, blunt injuries have a slower onset.

Proper diagnosis ensures proper treatment and improves the outcome of the patient. In patients with chest trauma, the following investigations are used in the evaluation. Ultrasound of the abdomen and thorax using the focused assessment with sonography in trauma (FAST) exam is essential in the trauma assessment's initial phase. It allows for the rapid detection of pathologic pericardial effusion or tamponade, intraperitoneal, or intrathoracic free fluid. The extended FAST (E-FAST) exam employs additional chest views to evaluate for pneumothorax. The chest x-ray can also be used in detecting fractures, haemothorax and pneumothorax; less sensitive for the latter. Spiral (helical) computed tomography (CT) techniques have greater sensitivity than chest x-ray and are used more frequently to evaluate the rib cage, the mediastinum, the lung parenchyma, and major vascular lesions, e.g. injuries to the thoracic aorta and its branches. In chest trauma, the decision to obtain chest CT should be based on physical findings, injury mechanism, and clinical judgment and stability of the patient (1,9). The majority of the patients with chest trauma can be managed conservatively, and a study done at Muhimbili showed that 56% of chest injured patients were managed with closed tube thoracostomy only.

1.1 PROBLEM STATEMENT

In Tanzania, RTA are on the increases associated with motorcycle accidents, as it accounts between 50 – 75% of all injuries admitted to referral hospitals. Motorcycles, is quick and cheap transport option. In all case, the chest is prone to injuries, accounting for almost half of the cases. The most typical surgical admission at Bugando Medical Centre was chest trauma secondary to RTA. Elderly and those with associated injuries are at increased risk of dying (4)

Chest trauma can be managed most of the time conservatively or by simple interventions like inserting a chest tube with underwater seal drainage, pulmonary toilet and analgesia (38). The accurate identification of patients at high risk for major chest injuries is necessary to avoid delays that may lead to poor outcomes (39). Aggressive management and prompt treatment of associated injuries are essential for an optimal patient outcome (12). The fact that RTAs are on the rise in Tanzania, primarily due to the increase in the number of motor vehicles and motorcycles (10) an expected rise on the incidence of chest traumas is inevitable. The study highlights the magnitude of chest trauma in Dar Es Salaam and its management. Knowing the mechanism of injuries, the outcome of the management will help the policymakers allocate appropriate resources, particularly the Regional Referral facilities in the city.

1.2 CONCEPTUAL FRAMEWORK

This conceptual framework (Figure 1) describes a clinical profile of patients sustaining chest injury and the potential predictors of injury outcomes. From the framework, it shows that after a person has sustained chest injury, the following factors may influence the outcomes of injury such as death/mortality and complications such as sepsis, pulmonary embolism, ARDS, empyema, neurological deficits, pneumonia and wound sepsis.

These factors are demographic characteristics such as age, sex and occupation. Also, the severity of the injury (ISS) and presence of extra thoracic injuries, mechanism of injury, including RTA, fall from height, assault, gunshot and stab. Clinically, type of chest injury; blunt or penetrating, and chest findings; tension pneumothorax, open pneumothorax, simple pneumothorax, massive haemothorax, simple haemothorax, lung contusion, rib fracture, flail chest and haemopericardium are described. Other factors include duration between injury and presentation at hospital and immediate interventions at the ED, and disposition.

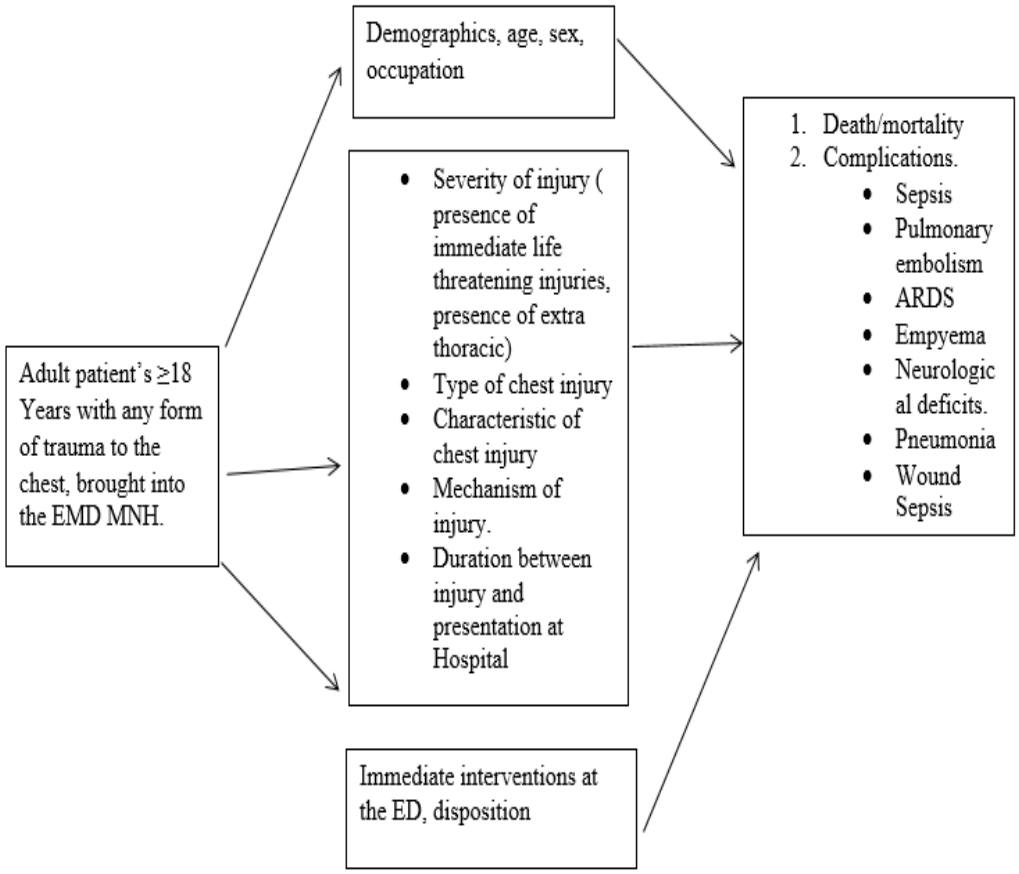

Figure 1: Conceptual framework of the clinical profile and predictors of outcomes of adult patients with chest trauma at MNH's EMD

1.3 RATIONALE

Patients with chest trauma need timely intervention so that their outcome is favorable. Chest trauma hardly ever exists on its own and thus needs a multidisciplinary approach. However, lifesaving management like needle decompression and tube thoracostomy can be easily identified and managed in the EMD. There are many factors that can influence the outcome of chest trauma patients for example, age, ISS score, time is taken to receive care and presence of extra thoracic injuries. Prior studies on chest trauma looked at the patterns of injuries and the management offered. Nevertheless, what are the factors that predict a poor or a favorable outcome in chest trauma patients? This question is yet to be answered in our setting.

Our study investigated the profile of patients presenting with chest trauma, the etiological spectrum of chest trauma, the management provided in the ED and then in the ward, the injury patterns, and predictors of outcomes. The results of this study will provide data on burden of chest trauma and what risk factors are associated with mortality in patients with chest trauma, and this will help provide grounds for prevention of modifiable risk factors.

1.4 RESEARCH QUESTIONS

What is the clinical profile and predictors of outcomes of adult patients with chest trauma presenting to the emergency department of Muhimbili National Hospital?

1.5 OBJECTIVES

1.5.1 Broad objective

To describe the clinical profile and predictors of outcomes of adult patients with chest trauma presenting to the Emergency Medicine Department (EMD) of Muhimbili National Hospital (MNH).

1.5.2 Specific objective

i. To describe demographic and clinical characteristics of patients with chest trauma presenting to the MNH's EMD

ii. To describe the mechanism of injury and management strategies and outcomes of chest trauma patients at MNH's EMD

iii. To evaluate the predictors of outcome in patients presenting with chest trauma

CHAPTER TWO

LITERATURE REVIEW

2.0 Proportion of patients with chest trauma

One of the leading causes of morbidity and mortality in Tanzania is trauma, including chest injury, which accounts for 40% of the deaths. At Bugando Medical Centre, a Hospital in Northern Tanzania, the most common cause of surgical admission was chest injury, which contributed to significant morbidity and mortality (7). The most common cause of chest injury globally, by far, is RTA's. They account for 70-80% of such injuries (3) The population who is at highest risk of getting chest trauma is young men with an average age of 32 years (7) The most familiar form of chest trauma is blunt chest trauma and commonly manifested as rib fractures (7) followed by pneumothorax, which is seen in 40-50% of patients with chest trauma (7). Chest trauma is mainly associated with other injuries and hardly ever exists; the most common associated injuries are extremity fractures and head injury followed by abdominal visceral injury (10).

A study done in Nigeria on the determinants of mortality in chest trauma patients showed that during the study period, 149 patients with thoracic trauma met inclusion criteria constituting 40% of the unit workload. There were 121 males and 28 females with an age range from 7 to 76 years (mean: 37.42 years), there was more blunt trauma (65.1%) than penetrating trauma (34.9%) (11).

2.1 Mechanism of injury of the chest trauma in injured patients

Trauma to the chest can occur by two significant mechanisms; blunt trauma or penetrating trauma.

Blunt chest trauma

Blunt trauma to the chest is seen quite frequently in the civilian population. The most typical cause is RTA, which accounts for 60-70% of the cases (8). Blunt trauma to the chest is associated with a high risk of morbidity and mortality (12). The extent of injury in blunt trauma may not be readily apparent and may not appear at their worst until 48-

72 hours after the injury (13). Blunt chest trauma causes restriction of ventilation either because of a direct lung injury/contusion, or due to a space-occupying lesion in the pleural space, like a haemothorax or a pneumothorax, and of particular concern is a tension pneumothorax, that leads to pushing of the mediastinum to the opposite side of the chest, affecting venous return and leading to shock and ultimately death if not immediately addressed by needle compression followed by a tube thoracostomy (14)

Blunt chest trauma frequently presents with rib fractures, which rarely need any intervention and are managed conservatively. However, injuries to the thoracic cavity and its contents can lead to profound pathophysiological changes, which intervention can lead to disastrous events (15). The risk of mortality was associated with the presence of more than two rib fractures, with patients over the age of 60 years and with an ISS greater than or equal to 16 in chest trauma (16)

Penetrating chest trauma

Penetrating chest injury can be divided into three types:

1. Low-velocity injuries, i.e. knives and impalement objects
2. Medium velocity injuries, e.g. handgun bullets
3. High velocity Injuries e.g. rifles and military grade weapons.

The amount of tissue damage is proportional to the speed at which the penetrating object hits, the density of tissue involved, and the penetrating object's frontal area (14). The most common cause of penetrating chest injury is due to a knife stab, followed by a gunshot wound (17)

2.2 Characteristics of chest trauma

Rib fractures

Rib fractures are the most common skeletal chest injury sustained by occupants restrained by seatbelts in a motor vehicle accident (15). Around 93.5% of fatally injured restrained victims had concomitant rib fractures (18). Rib fractures are generally non-fatal, and they are managed most of the time conservatively, especially in the younger population; however, elderly patients with rib fractures have an increased risk of dying due to the rib fractures themselves. A study done by Kent et al. showed that most

patients above the age of 60 with chest trauma died with no other significant injuries except rib fractures (19)

The presence of two or more fractured ribs is an indicator of severe injury and is associated with worse outcomes. A study done by Liman et al. showed that mortality was 0.2% in patients with no rib fractures vs 4.7% in patients with more than two rib fractures. Also, a pneumo/haemothorax development in patients with no rib fractures was 6.7%, while those with two or more rib fractures were 81.7% (20). A study done in 2005 by Flagel et al., reported the increase of mortality, pneumonia, Acute Respiratory Distress Syndrome (ARDS), pneumothorax, empyema, ICU LOS, and hospital LOS for each additional rib fracture on over 730,000 patients (21).

Lung contusion

Lung contusion is defined as a direct injury to the lung without laceration that leads to oedema and haemorrhage and is associated with increased morbidity and mortality following chest trauma. The most common cause is a compression-decompression injury to the chest, which is seen in high speed motor vehicle crashes (2). It is a common injury following blunt trauma to the chest and has an incidence of 30 to 75% (22). At the microscopic level, the contused lung displays oedema, haemorrhage and atelectasis. This often results in shunting, ventilation-perfusion mismatch and decreased lung compliance. The patient's blood gases will show hypoxaemia and hypercarbia, and the patient will have increased work of breathing. The full effects of lung contusion may take up to 24 hours to manifest, and usually, the contusion resolves in a week's time (22).

Most contusions will not require specific therapy. The goal of management is to prevent further lung damage, provide supportive care whilst waiting for the lung to heal on its own (3). Extensive contusions may affect gaseous exchange significantly and thus, supplemental oxygen and in severe cases, mechanical ventilation would be required for adequate oxygenation and ventilation (2). Pulmonary contusion is identified on the chest radiograph as a focal area of patchy parenchymal consolidation. The findings are typically peripheral and non-segmental. Regions of contusion tend to occur adjacent to fractured ribs (3). Patients with pulmonary contusion should be admitted for close,

serial observation and should be intubated if they show clinical signs of respiratory fatigue, tachypnea or hypoxia (3).

Pneumothorax

A traumatic pneumothorax can result from either penetrating or blunt chest trauma. With penetrating chest trauma, the wound allows air to enter the pleural space directly through the chest wall or the visceral pleura from the tracheobronchial tree. With blunt trauma, a pneumothorax may develop if the visceral pleura are lacerated secondary to a rib fracture or dislocation. Sudden chest compression abruptly increases the alveolar pressure, which can cause alveolar rupture. Once the alveolus is ruptured, air enters the interstitial space and dissects toward either the visceral pleura or the mediastinum (23). As a study done by al-Koudmani et al., in Damascus, involving 888 chest trauma patients, reported that traumatic pneumothorax was the commonest form of chest trauma, with more than 50% of chest trauma patients (24).

Diagnosis of pneumothorax is done by thorough clinical examination and investigations. Typically, this injury is diagnosed and treated during the primary survey. However, clinical interpretation of the presenting signs and symptoms is crucial for correctly diagnosing and treating the condition.

Once the diagnosis is made, chest drain insertion is usually indicated to drain air from the pleural cavity. However, some traumatic pneumothorax can resolve spontaneously without any surgical intervention for drainage. Toydemir et al. had reported that mild pneumothorax less than 20% of total haemothorax volume, fractured rib number less than three and the absence of associated major injuries as criteria for conservative management of traumatic pneumothorax (25).

Tension Pneumothorax

Tension Pneumothorax is an emergency, and can lead to shock and cardiac arrest within minutes if no intervention occurs (2). It develops due to the one-way valve system that ensues once the visceral pleura is traumatically disrupted. Air keeps on accumulating whilst failing to come out. Immediate intervention by placing an 18 gauge needle in the second intercostal space mid clavicular line above the rib is required, followed by tube thoracostomy with underwater seal drainage (2).

Haemothorax

Is defined as the accumulation of blood in the pleural space resulting from a blunt or penetrating injury to the thoracic structures, including the heart, mediastinum, great vessels, lung vasculature and chest wall (27). Haemothorax is quite common in patients with chest trauma. For example, Koudmani found out that 38% of chest injured patients had haemothorax (24); similarly, Lema et al., showed that 30% of chest injured patients had a haemothorax (7). Haemothorax can be classified based on the amount of bleeding. A massive haemothorax is defined as bleeding >1500 mls of blood or blood loss of >200 ml/hour for 3-4 hours (27)

The diagnosis of a haemothorax can be made using a chest x-ray and a bedside lung ultrasound. For a chest x-ray, at least 250 mls of blood need to be present to be seen, while a lung ultrasound can pick even minimal fluid in the pleural space (2,27). A massive transfusion protocol needs to be activated for massive haemothorax and may or may not need thoracotomy, but this is needed in less than 5% of patients with haemothorax. Most pneumothoraces can be managed by using a tube thoracostomy drain and IV fluids, as well as oxygenation as and when needed (2).

(28)

Flail chest

Segmental fractures of two or more contiguous ribs anteriorly or laterally, results in a segment of the chest wall (flail), which is no longer in continuity with the rest of the thoracic cage (28). This results in a paradoxical movement pattern of the chest, whereby the flail segment moves inward during inspiration and outward during expiration (2). Flail chest can lead to significant morbidity and mortality. It is shown to have a

mortality rate of between 10 and 20%, but usually, flail chest is associated with other significant injuries, like head injury, pulmonary contusion, hemo/pneumothorax (28). The danger to patients with flail chest is due to respiratory fatigue because of the paradoxical pattern of chest movement during breathing, and this can lead to sudden respiratory arrest (2). Patients with mild to moderate flail chest can be managed conservatively, but need close monitoring. If patients are in shock, or have a severe head injury, or Pa02 of less than 80% with supplemental oxygen, then mechanical ventilation is warranted.

2.3 Management of patients with chest trauma

Chest trauma is managed at three levels of care: pre--hospital life support, hospital ED life support, and surgical life support (29). At the hospital, after a quick assessment, immediate life-threatening injuries need to be identified and immediate intervention needs to be provided. The goal of early intervention is to prevent or correct hypoxia. Immediate life-threatening injuries associated with chest trauma are as follows: airway obstruction, tension pneumothorax, open pneumothorax, massive haemothorax, flail chest, and cardiac tamponade.

Most of the above-mentioned life-threatening injuries can be managed by airway control and by the insertion of a tube into the pleural space to relieve tension. It should be noted here that the primary cause of cardiac arrest in a trauma patient is a tension pneumothorax. Preferably this should be identified and treated pre-hospital (14). Unfortunately, in Tanzania, the EMS is in its inception stage and thus, it is very likely that chest trauma patients are dying before even reaching a healthcare facility. Once immediate life-threatening injuries are addressed, a secondary survey should be performed and additional, potentially life-threatening injuries should be addressed. These include lung contusion, myocardial contusion, aortic disruption, and diaphragmatic rupture. Patients with mild to moderate flail chest can be managed conservatively but need close monitoring. If patients are in shock or have a severe head injury, or Pa02 of less than 80% with supplemental oxygen, then mechanical ventilation is warranted. Adequate pain management by analgesia or nerve blocks should be given to allow good ventilation

Lung ultrasound has proven to be extremely important and can pick even small pneumothoraxes very effectively. Whilst chest x-ray can miss up to 30% of pneumothoraxes, and lung ultrasound has a negative predictive value of 100% (26)

2.4 Emergency room trauma life support

Recognition of severe chest trauma requires a reassessment of the patient and complete exposure of the chest wall and back. The mechanism of injury can also give a clue on how severe the chest trauma is. Breathing problem is next in line, and a tension pneumothorax needs to be diagnosed early and intervened. The trapped air in the pleural space displaces the mediastinum, decreasing venous return and compressing the opposite lung. An obstructive shock ensues. Clinically, the patient will be dyspneic with distended neck veins, hypotensive and loss of breath sounds on the affected side with hyper-resonance on percussion. Needle decompression needs to be performed early and followed by tube thoracostomy with UWSD. Circulation problems should be identified and intervened, massive blood loss needs to be managed by massive transfusion protocol. Tamponade should be evaluated for and urgent pericardiocentesis should be performed.

Surgical intervention is only needed in a few select patients, less than 10% of blunt trauma patients and 15-30% of penetrating chest trauma patients require urgent surgical intervention, the rest can be managed in the ED by the afore mentioned measures (29) The following scenarios require surgical intervention: blood loss over the chest TD >1,500 mL initially or >200 mL/hour over 2–4 hours, haemoptysis, massive subcutaneous emphysema, important air-leakage over the chest tube, uncertain images on the chest X-ray or CT thorax, penetrating chest trauma, blood loss ≥1,500 mL initially/>200 mL/hour over 2–4 hours, endobronchial blood loss; massive contusion with significant impairment of mechanical ventilation, tracheobronchial tree injury (air-leakage/haemothorax) and injury of the heart or large vessels (blood loss/pericardial tamponade) (30)

2.5 Predictors of outcome in patients presenting with chest trauma

The presence of associated extra thoracic injuries is an important determinant of the outcome of chest trauma patients. Associated extra thoracic injuries increase the risk of

complications in patients with chest injuries. The main common associated extra thoracic injuries as described in most literatures are musculoskeletal trauma, neurotrauma and intraabdominal injury (4,24). The mortality rate for isolated chest injuries has been reported to range from 4 to 8%. This value increases to 13-15% when another organ system is involved and to 30-35% when more than one organ system is involved. Early detection and treatment of associated extra thoracic injuries is important in order to reduce mortality and morbidity associated with chest injuries (4,24). The predictors of poor outcome in a study by Battle et al, showed increased age and an ISS score of >31 to be associated with increased mortality (31)

CHAPTER THREE

METHODOLOGY

3.0 Study design

This was a retrospective clinical records study covering all adult patients with any chest trauma presenting to the emergency department between 1 Jan2020 – 31 December 2020.

3.1 Study area

The study area was the Emergency Medicine Department of Muhimbili National hospital (MNH) in Dar-Es-Salaam, Tanzania and the Surgical Ward as well as ICU. MNH is located in the Ilala district, along Maliki road, Upanga. MNH has a bed capacity of 1500 and serves as top referral hospital in Tanzania. The emergency department (ED) was established in 2010 via a partnership between the Ministry of Health and Social Welfare and the Abbott Fund Tanzania. The ED is the first full capacity public ED in Tanzania and is the training site for the only Emergency Medicine (EM) residency program in the country. The department is staffed 24 hours, seven days a week by locally trained specialist emergency physicians, who oversee the care of patients and training of interns, registrars and emergency medicine (EM) residents. The ED sees an average of 45,000 patients annually. The admission rate is 65%. At the ED of MNH, EM physicians and residents are capable of performing lifesaving needle decompression and tube thoracosotomy when required. The ED also has a portable ultrasound, which can help detect pneumo and haemothoraces. Chest tubes and under water sealed drainage (UWSD) are also available. An in-house surgical team can be called upon at any time for surgical interventions.

3.2 Target Population

The study population included all adult patients with chest trauma presenting to a trauma centre in Tanzania.

3.3 Accessible Population

All patients presenting with chest trauma to the EMD of MNH in Dar Es Salaam, Tanzania

3.4 Study population

All patients presenting with chest trauma to the EMD of MNH in Dar-Es Salaam, Tanzania between 1 January 2020 to 31 December 2020

3.5 Sample size estimation

Sample size calculation was calculated using single proportion formula, based on proportion of patients with chest trauma, a study by Lema et al 2011 (7)

$N = p\ (z/\Delta)2p(1-p)$

Where:

N = Number of patients constituting the minimum sample size

p = % Patient with chest trauma = 0.793

z = 95% confidence interval = 1.96

Δ = 5%

Therefore, minimum sample size calculated will be:

N = 0.793(1.96/0.05)2 x 0.793(1-0.793) = 200

Following adjustment for 10% non-response rate a sample size of 220 participants will be recruited in the study.

3.6 Inclusion criteria

Adult patients ≥ 18, hospitalized and had any injury to the chest confirmed by physical exam or radiological study (x-ray and or Lung USS) between January 2020 to 31 December 2020

3.7 Exclusion criteria

- Patients whose incomplete records meaning those patients whose records in regards to their outcome within 7 days was not documented clearly
- Chest trauma patients who were discharged from the EMD
- Chest trauma patients who died before any intervention was provided.

3.8 Variables

Dependent variables (Outcome variables)

- Death / mortality
- Complications (Sepsis, Pulmonary embolism, ARDS, Empyema, Neurological deficits, Pneumonia and Wound Sepsis)

Independent variable

- Demographic data

- Vital signs (Respiratory rate, Heart rate / Pulse rate, Blood pressure, Oxygen saturation, GCS, temperature, random blood glucose)
- Chief complaints / presenting complaints
- Mechanism of injury
- Presence of immediate life-threatening injuries such as head injury, haemothorax
- Type of chest injury (Pneumothorax, haemothorax, lung contusion, flail chest etc)
- Management at ED (oxygenation, advanced airway, needle decompression, fluids, analgesics, Chest tube insertion. Chest x-ray, and some patients' ultrasound and CT-scan were conducted at the request by the ED physician.
- Alcohol ingestion
- Time to presentation to the EMD
- Presence of extra thoracic injuries
- Disposition point (Ward or ICU)

OUTCOMES:

The Primary outcome was predictors of mortality at 7 days post admission. The secondary outcomes were mechanism of injury, socio-demographics, disposition and development of complications due to the chest trauma

3.9 Data collection procedures and case identification

Data was collected retrospectively from the trauma registry, database at the EMD, the records from the wards where patients were admitted months earlier. All trauma patient ≥18 years of age, with injury to his or her chest, confirmed by physical exam or radiological study were included in the study. Chest injury patients were identified from the database by a quick search of the main complaint and diagnosis. All patients with traumatic chest pain as a primary complaint or chest injury as their diagnosis were included. Information about interventions at the ED were taken from the electronic database at the ED (Wellsoft). The remaining data of interventions and outcomes in the wards was taken from handwritten files that are stored in the Medical records office at MNH. Demographic profile was recorded and the mechanism of injury, the management offered at the ED and in the ward, outcome at 7 days that include any

complications that may have come about, including death. The collected data was cleaned, coded and entered in SPSS software.

3.10 Data collection tools

Data was collected using a standardized data collection form attached in Appendix 3. The data was retrieved from the files and trauma registry from the EMD and then fed into the data collection form and then the information and exported Redcap software.
The data collection form was in three parts:

i. The demographic information part
ii. The injury characteristics and mechanism
iii. Management offered and disposition as well as 7 days follow up.

3.11 Data analysis

The data from RedCap (Version 6.0.1, Vanderbilt University, Tennessee, USA) was exported into an Excel file (Microsoft Corporation, Redmond, WA, USA) then imported and analyzed with SPSS statistical software for analysis. Descriptive data was summarized in the form of proportions and frequency tables for categorical variables. Means with standard deviation, median with IQR, mode, and histograms was used to summarize continuous variables.
Univariate logistic regression analysis was used to examine the relationship between independent variables and dependent variables. Those variables with a p-value of less than 0.2 were further analyzed by multivariable logistic regression to eliminate confounders. Both Crude Odds Ratio (COR) and Adjusted Odds Ratio (AOR), with 95% confidence intervals, were used to determine the associations. A p-value of less than **0.05** in the multivariable logistic regression analysis was considered statistically significant association between a variable and death.

3.12 Ethical Considerations

Consent

The Senate waived the consent procedure as the study used the data from already available databases and files.

IRB and Ethical clearance

Ethical clearance to conduct this study was obtained from MUHAS Senate of Research and Publication Committee of MUHAS. Approval for data collection was sought from respective authorities at MNH. The written forms were kept in a safe cabinet accessed by only researchers.

Risks and effects

There was no risk or effect for participating in this study.

3.13 Dissemination plan

The findings of this study will be published to online journals including MUHAS repository. The findings will also be presented to conferences both local e.g. MUHAS scientific conference and internationally.

CHAPTER FOUR

RESULTS

4.0 Participants enrollment - screening to disposition

Overall, 2387 patient presented to the EMD during the study period, among them 232 (9.7%) had chest trauma. Fourteen patients with chest trauma had incomplete records in the files and thus excluded from the study. 218 were enrolled in the study.

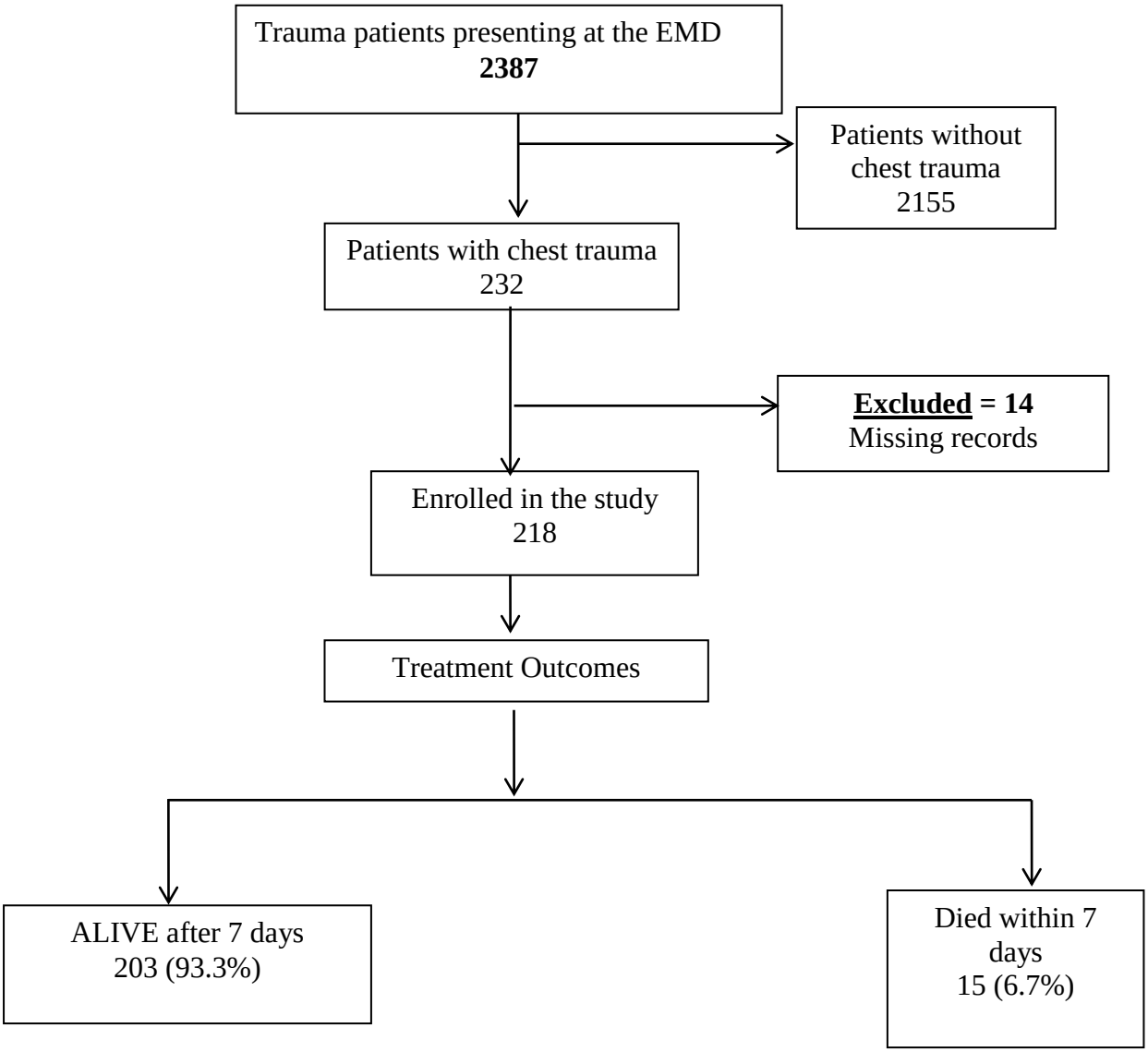

Figure 2: Patients flow chart screening to disposition

4.1 Socio-demographic characteristics of the study participants

The study included 218 participants out of 2387 trauma patients and 183 (83.9%) were male. The median age was 32 years (Interquartile Range 26 – 43 years). In total, 83

(38.1%) were self-employed. Most patients 173 (80.5%) were referred from other facilities to the EMD, and 38% of them took over 10 hours to reach the department after the accident. Arriving by ambulance, from other facilities to the EMD was reported in 122 (56.0%) of the patients with chest trauma.

Table 1: Participants social demographic characteristics

Variable	Category	Frequency (n)	Percentage (%)
Age group (years)	18 - 35	133	61.0
	36 - 45	45	20.6
	>45	40	18.3
Median age (years) (IQR)	32 (26, 43)		
Sex	Male	183	83.9
	Female	35	16.1
Marital status	Single	108	49.5
	Divorce	1	0.5
	Married	108	49.5
	Widowed	2	0.9
Occupation	Employed	43	19.7
	Skilled laborer	32	14.7
	Unskilled laborer	60	27.5
	Entrepreneur	83	38.1
Referral status	Self-referral	42	19.5
	Referred	173	80.5
Time taken to reach EMD	One (1) Hour	32	14.7
	Five (5) Hours	63	28.9
	>5 Hours	39	17.9
	>10 Hours	84	38.5
Mode of transport to EMD	Ambulance	122	56.0
	Private car	44	20.2
	Public bus	10	4.6
	Motorcycle	1	0.5
	Other	41	18.8
Location of incident	Home	21	9.9
	Street	190	89.2
	At work	2	0.9
Alcohol use	Yes	25	11.5
	No	193	88.5

4.2 Clinical characteristics of injuries

Most of the patients with chest injury 171 (78.9%) had blunt chest trauma; lung contusion was present in 100 (45.9%) of the patients, followed by rib fractures, 61 (28%). Extra thoracic injuries were present in 132 (60.6%) of patients; amongst them,

head injury occurred in 70 (33%) patients, which was the most common extra thoracic injury (Table 2)

Table 2: Clinical characteristics of injuries

Variable	Category	Frequency (n)	Percent (%)
Type of chest trauma	Blunt	171	78.9
	Penetrating	47	21.6
Characteristics of chest trauma	Tension Pneumothorax	2	0.9
	Open Pneumothorax	9	4.1
	Simple Pneumothorax	57	26.1
	Massive haemothorax	3	1.4
	Simple haemothorax	45	20.6
	Lung Contusion	100	45.9
	Rib fracture	61	28.0
	Fail Chest	3	1.4
	Other	4	1.8
If rib fracture	Less than two (2) ribs	50	22.9
	Two (2) to four (4) ribs	10	4.6
Other	Tracheal injury	4	1.8
Presence of extra thoracic	Yes	132	60.6
	No	86	39.4
Extra thoracic injury	Head injury	72	33.0
	Visceral injury	24	11.0
	Long bone fractures	25	11.5
	Pelvic fracture	1	0.5
	Polytrauma	1	0.5
	Others	39	17.9
Oxygen saturation	≥ 94%	179	82.9
	< 94%	37	17.1
SBP (mmHg)	Hypotension	10	4.6
	Normal	151	69.3
	Hypertension	57	26.1
DBP (mmHg)	Hypotension	22	10.1
	Normal	187	85.8
	Hypertension	7	3.2
Pulse rate	Bradycardia	11	5.0
	Normal	140	64.2
	Tachycardia	67	30,7
Shock index	Normal	196	89.9
	Shock	22	10.1
GCS	≤ 8	19	8.7
	9 - 12	11	5.0
	13 - 15	188	86.2

4.3 Circumstances of during injuries

Road traffic accidents accounted for 151 (69.1%) of the chest trauma, followed by assault in almost 26 (12%) of the patients (Figure 3). Out of the patient with chest injuries from road traffic accidents, 24.8% were of motorbike riders, followed by their passengers (14.2%) (Figure 4)

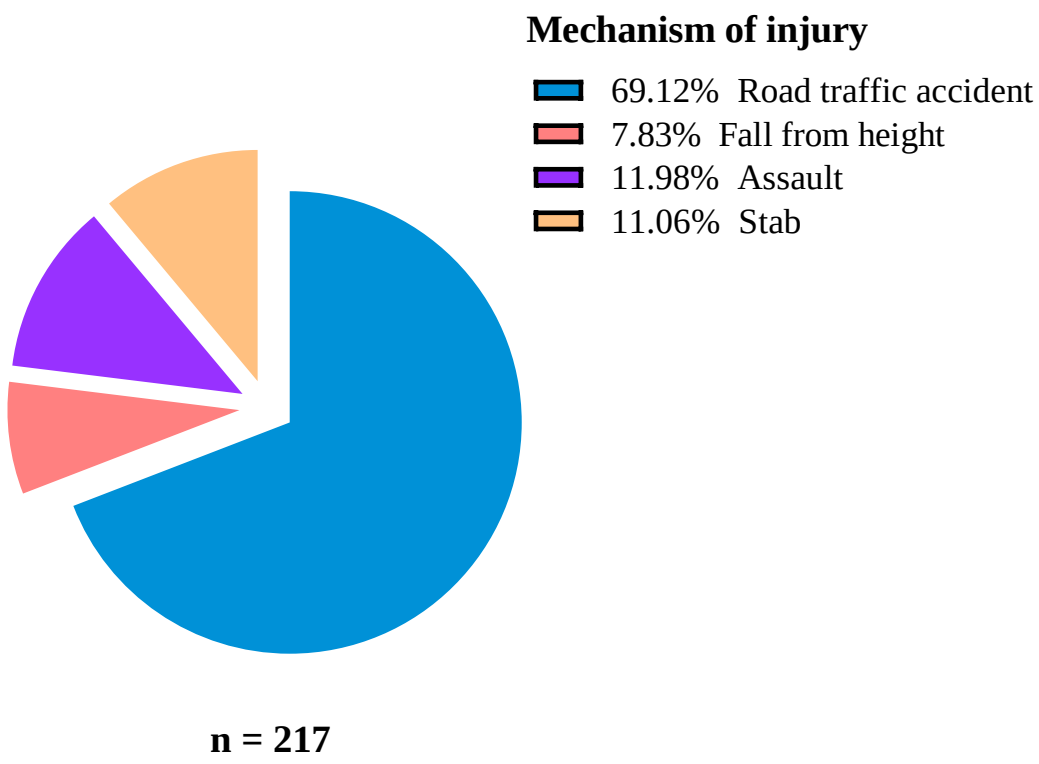

Figure 3: Mechanism of injury

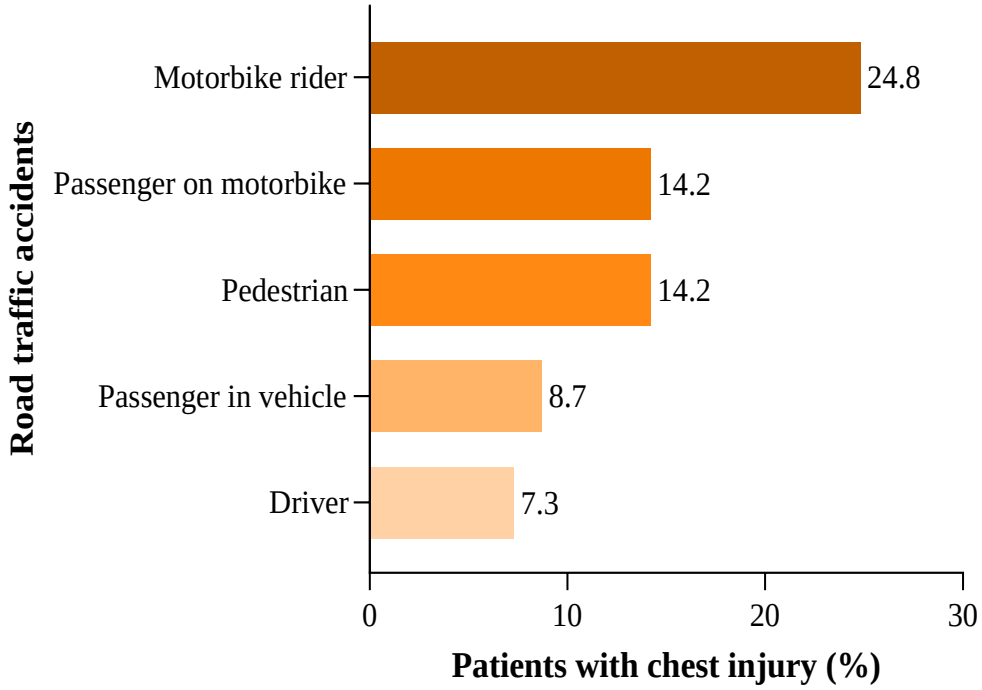

Figure 4: Percent of chest injury by road traffic accidents

4.4 Management of patients at the Emergency Department

Intubation was done in 31 (14.2%) of the patients, and chest tube inserted in 82 (37.6%) of the patients and the rest of the 140 patients were managed conservatively for their chest injury. Blood transfusion was done in only 33 (15.1%) of the patients. Analgesia and tetanus toxoid were given to 192 (88.1%) and 148 (67.9%) of the patients, respectively (Table 3).

Table 3: Patients management at the EMD

Variables	Category	Frequency (n)	Percent (%)
Airway and circulation management			
Airway management	Intubation	31	14.2
	Suctioning	1	0.5
	C- Spine stabilization	1	0.5
	None	187	85.8
Breathing management	Needle decompression	1	0.5
	Chest tube insertion	82	37.6
	Oxygenation	26	11.9
	None	122	56.0
Circulation management	Large bore cannula	200	91.7
	Bolus of crystalloid fluid	189	86.7
	Blood transfusion	33	15.1
	None	16	7.3
Other intervention	Analgesia	192	88.1
	Tetanus toxoid	148	67.9
	Sedation	94	43.1
	Fracture immobilization	3	1.4
	None	20	9.2
Radiological investigation and results			
Radiological investigation	Chest X-rays	194	89.0
	Ultrasound (EFAST)	43	19.7
	CT Scan	20	9.2
	None	17	7.8
Chest X-ray findings	Normal	17	7.8
	Pneumothorax	62	28.4
	Haemothorax	57	26.1
	Rib fractures	58	26.6
	Pneumomediastinum	1	0.5
	Lung contusion	68	31.2
EFAST findings	Normal lung sliding	17	7.8
	No lung sliding (Rt side)	2	0.9
	No lung sliding (Lt side)	2	0.9
	Fluid in the pleural space (Rt side)	5	2.3
	Fluid in the pleural space (Lt side)	3	1.4
	Free fluid in the abdomen	16	7.3

Regarding radiological investigations, chest x-ray was done in 194 (89%) of the patients, and 20 (9.2%) and 43 (19.7% got a CT-scan and EFAST, respectively. On chest x-ray almost equal proportions of patients had: pneumothorax (28.4%), haemothorax (26.1%), fractures (26.6%), some had multiple presentation (total percent > 100%).

4.5 Management outcomes: Complications and mortality

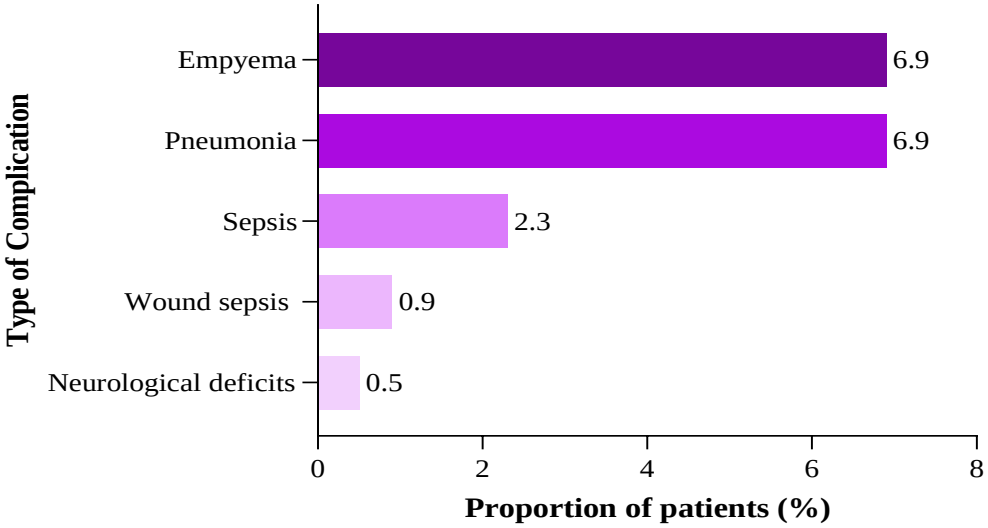

Figure 5: Proportion of patients by complication types

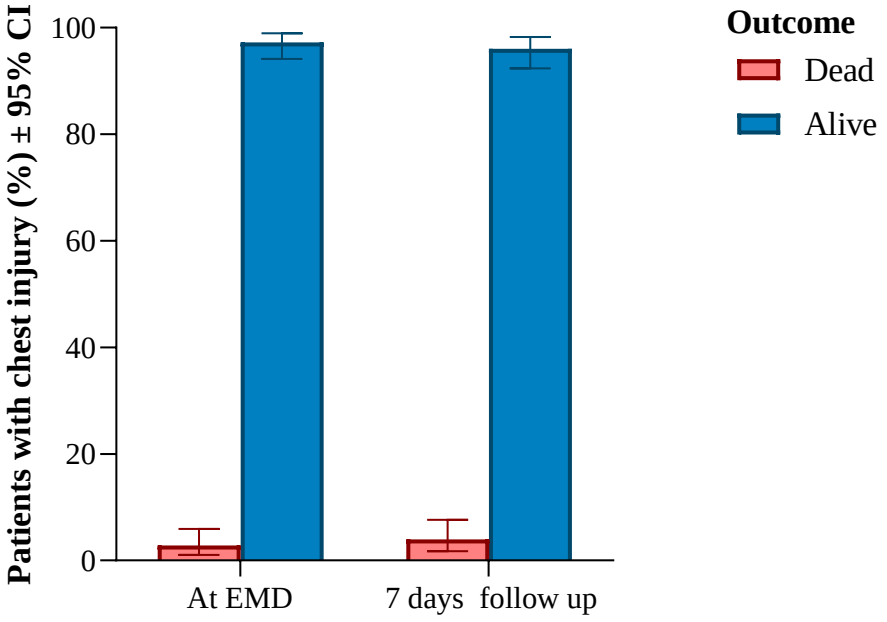

Figure 6: Mortality at the EMD and after 7 days

Figure 5 shows the treatment complications; an equal proportion of patients had empyema (6.9%) and pneumonia (6.9%). Only 0.5% had neurological deficits.

Regarding mortality, 15 patients (6.7%) died within seven days of follow up (Figure 6).

Table 4: Univariate analysis of the factors associated with death within 7 days

			95% Confidence interval		
Variable	**Category**	**COR**	**Lower**	**Upper**	**P -value**
Age (years)	18 -35	1.65	0.58	5.43	0.413
	>35	Ref			
Sex	Male	2.60	0.33	20.54	0.365
	Female	Ref			
Employed	Yes	0.30	0.04	2.33	0.248
	No	Ref			
Skilled laborer	Yes	0.97	0.21	4.54	0.966
	No	Ref			
Unskilled laborer	Yes	0.86	0.37	2.00	0.730
	No	Ref			
Entrepreneur	Yes	2.29	0.77	6.86	0.138
	No	Ref			
Extra thoracic injuries	Yes	1.19	0.38	3.66	0.768
	No	Ref			
GCS	≤ 8	26.83	6.89	104.57	< **0.001**
	9 - 12	17.25	3.29	90.35	< **0.001**
	13 - 15	Ref			
Shock Index category	Shock	6.11	1.84	20.30	**0.003**
	Normal	Ref			
Tension pneumothorax	Yes	15.62	0.92	264.07	0.057
	No	Ref			
Simple haemothorax	Yes	3.17	1.04	9.67	**0.042**
	No	Ref			
Simple pneumothorax	Yes	0.45	0.10	2.08	0.308
	No	Ref			
Lung contusion	Yes	1.19	0.40	3.53	0.749
	No	Ref			
Type of chest injury	Blunt	3.78	0.48	29.70	0.205
	Penetrating	Ref			
RTA	Yes	1.14	0.35	3.78	0.827
	No	Ref			
Fall from height	Yes	0.90	0.11	7.36	0.925
	No	Ref			
Assault	Yes	1.25	0.26	5.93	0.779
	No	Ref			
Disposed orthopedic	Yes	0.47	0.12	1.79	0.267
	No	Ref			
Disposed surgery	Yes	0.38	0.12	1.18	0.094
	No				
Stab	Yes	0.61	0.08	4.84	0.636
	No	Ref			
Time to EMD	>10 hours	0.26	0.05	1.23	0.089
	>5 hours	0.38	0.06	2.22	0.281
	Within 5 hours	0.60	0. 15	2.42	0.005
	1 hour	Ref			
Injury severity score (ISS) ≥ 16		1.67	1.24	2.26	< **0.001**

4.6 Factors associated with mortality

4.6.1 Univariate regression analysis

Using univariate regression analysis, the patient with severe and moderate TBI i.e. GCS under 13 had a higher Odds, 26.83 COR (CI 95%; 26.8 – 104.5, p-value <0.001) and COR 17.25 (CI 95%, 3.29 – 90.35, p-value < 0.001) than those with mild TBI or GCS >13. A shock index >1 had a higher Odds, 6.11 (95% CI, 1.84 – 20.30, p-value 0.003) compared with those not in shock, as did an Injury Severity Score of less or equal 16, COR 1.67 (95% CI 1.24 – 2.26, p-value < 0.001). Simple haemothorax was also associated with mortality COR 3.17 (95% CI 1.04 – 9.67, p-value 0.042), while the OR of 15.92 for tension pneumothorax did not reach statistical significance.

4.6.2 Multivariate regression analysis of factors associated with mortality

Severe head injury (as indicated by GCS) remained significantly associated with mortality (GCS ≤ 8), AOR 50.43 (CI 95% 4.97 – 511.9, p-value < 0.001), and moderate head injury (GCS level of 9 – 12) AOR 43.1 (CI 95% 3.90 - 476 p-value 0.002), Table 5.

Table 5: Multivariate analysis of the factors associated with death within 7 days

			95% Confidence Interval		
Predictor	**Category**	**AOR**	**Lower**	**Upper**	**P - value**
GCS	≤ 8	5..04	4.97	5.12	**< 0.001**
	9 - 12	4.31	3.90	4.76	**0.002**
	13 - 15	Ref			
Shock Index >1	Yes	7.20	1.28	4.03	**0.025**
	No	Ref			
Tension pneumothorax	Yes	0.53	0.02	17.82	0.725
	No	Ref			
Simple haemothorax	Yes	5.91	1.30	26.90	**0.022**
	No	Ref			
Disposed to surgical ward	Yes	0.83	0.18	3.75	0.805
	No	Ref			
Time taken to reach EMD	>10 hours	1.14	0.15	8.65	0.900
	6 – 10 hours	0.88	0.09	8.44	0.909
	Within 5 hours	0.37	0.06	2.40	0.299
	Within 1 hour	Ref			
Injury severity score (ISS) ≥ 16		0.91	0.61	1.35	0.637

Key: AOR: adjusted odds ratio, Ref: Reference categories

Furthermore, a shock index of >1 was more likely to result into deaths compared to having a shock index <1, AOR 7.2 (CI 95% 1.28 – 4.033, p-value 0.025). Simple haemothorax had higher odds than other forms of haemothorax, AOR 5.9 (CI 95%, 1.30 – 26.9, p-value 0.022).

CHAPTER FIVE

DISCUSSION

This Retrospective study aimed at finding out the predictors of outcome in adult patients with chest trauma. Most of the patients in this study were males in their prime ages, similar demographics were seen by other authors as well (7,51)

The predictors of outcomes in chest trauma patients that were found significant in our study were: a shock index >1, simple haemothorax and severe TBI. Severe head injury associated with poor outcomes in chest trauma has been reported in Uganda (50), and Nigeria and Tanzania (7,51), in similar ways as our study; a shock index >1 meant worse outcomes,. Presumably, because of direct impact to the head and blood loss. The unexpected association in our study was a simple haemothorax rather than a massive one. We may postulate the classification was underestimated, hence prompt management such as blood transfusion and decompression thoracostomy were not offered. Deaths due to haemothorax, in particular the massive haemothorax, have been reported by previous studies (20, 21). Similarly, >1 shock index due to hypotension and circulation haemodynamics has been associated with deaths by other studies (6). In all instances involving the chest, the rib-cage and haemothorax fracture are quite common and should be ruled out first (41), regardless of the magnitude. A number of authors found that an ISS > 16 is highly associated with mortality, however, in our analysis we could not come to that conclusion and this could be attributed to the fact that the ISS was taken from the records in the files and these could have been underscored. (6,7,10) An overall mortality rate reported in our study was 3.9%, a higher mortality ratio of 10% has been reported by other studies. (30). Our low mortality presumably is associated with improved patient's management capacity at the MNH. Poor outcomes, such as deaths and prolonged hospitalization, are expected when multiple organs are involved, especially with severe head injury and a high ISS score. Composite trauma, including the head, have been reported by another study as a mortality predictor (34).

Although our study reported complications such as i empyema, pneumonia and sepsis, we have no evidence that they were responsible for deaths. Despite documented association by other studies (21). The infection is known to result from invasive technique and risk maneuvers, which introduces infection to the chest, including the insertion of the chest tube. Most of the patients in our study were managed

conservatively and that could be the reason why the proportion of complications was lower than what was seen by other authors (2,27,24,40)

Regarding the mechanism of injury, the majority of trauma in our study involved motorbike riders and or their passenger, comparable findings reported by other studies (36,40,42). Given the nature of injury, whereby the chest was the most involved, we could postulate that the injury was due to the direct impact on the chest-wall resulting into contusion of both sides of the chest, the lungs and internal organs (44–46).

Violence related causes such as stabs and assaults should not be unnoticed in major cities including Dar Es Salaam; we report nearly a quarter of total incidents resulting from intentional injuries. Crime and violence are normal occurrences in major cities. The two causes, assaults and stabs combined, were the second-largest causes of chest trauma after road traffic accidents in this study. One study reported these type of injuries occurring more in young male (47).

Study strengths and limitations

The study is the first comprehensive case series analysis to review both the EMD and wards registers regarding the patients presenting with chest trauma at the MNH, for the whole year. The findings and subsequent recommendations may help improve the city's infrastructure improvement, besides the improved management of chest injuries and traumatic head injuries, at tertiary levels. However, our study is limited to the information available in the registers. Because of that some patients were excluded because of incomplete or the information not available, hence interpretation of variables such as prevalence of chest trauma should be used with caution. Another limitation in this study is that the sample size calculation was based on proportion of patients with chest trauma by a study done by Lema et al, this was due to the fact that, using outcome or mortality to calculate the sample size would reduce the power of the study significantly as sample size would be reduced greatly.

CHAPTER SIX

CONCLUSIONS

Road Traffic Accidents (RTA), especially motorbike related, whether a rider or a passenger, play a vital role in chest trauma, although stab and assaults are also increasing in cities. The injuries involved mostly young productive age groups. Road Traffic Accidents involving motorcyclist is the primary mechanism of injuries among patient presenting with chest injuries. The presence of extra thoracic trauma, especially traumatic brain injury, was associated with higher mortality.

CHAPTER SEVEN

RECOMMENDATIONS

1. My first recommendation would be proper and timely management of associated extra thoracic injuries especially head injury, since we found from our study that moderate and severe TBI associated with chest trauma led to higher mortality.

2. I would also recommend on further studies, especially on road traffic accidents and outcomes. As we saw from our study that most of the patients were victims of RTA thus this avenue needs to be studied thoroughly so as to allow measures to be enforced to prevent RTA.

3. My final recommendation is that, another larger prospective study needs to be done so as to to capture more predictors of outcomes in patients with chest trauma.

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APPENDICIES

Appendix 1: Study Form

Confidential

PREDICTORS OF OUTCOMES OF ADULT PATIENTS WITH CHEST TRAUMA PRESENTING TO THE EMERGENCY DEPARTMENT OF MUHIMBILI NATIONAL HOSPITAL

My First Instrument

Record ID	_____
MR NUMBER	_____
DEMOGRAPHIC DATA	
age	_____
Date of birth	_____
Sex	◯ male ◯ female
Marital status	☐ single ☐ divorced ☐ married ☐ widowed
occupation	☐ employed ☐ skilled labourer ☐ unskilled labourer ☐ entrapreneur
REFERRAL STATUS	◯ SELF REFERRAL ◯ REFERRED
TRAUMA DETAILS	
Date and time of injury	_____
Location of incident	◯ home ◯ street ◯ public place ◯ at work
alcohol use	◯ Yes ◯ No
Mechanism of injury	☐ RTA ☐ FALL FROM HEIGHT ☐ ASSAULT ☐ GUNSHOT ☐ STAB

Confidential

IF RTA	☐ MOTORBIKE RIDER ☐ PASSENGER IN MOTORBIKE ☐ DRIVER ☐ PASSENGER IN VEHICLE ☐ PEDESTRIAN

INJURY SEVERITY SCORE

	No injury	minor	moderate	severe	critical	unsurvivable
Head and neck worst injury	○	○	○	○	○	○
Face worst injury	○	○	○	○	○	○
Chest worst injury	○	○	○	○	○	○
Abdomen worst injury	○	○	○	○	○	○
Extremity (including pelvis) worst injury	○	○	○	○	○	○
External worst injury	○	○	○	○	○	○

TOTAL ISS SCORE	_____
TYPE OF CHEST TRAUMA	☐ BLUNT ☐ PENETRATING
CHARACTERISTIC OF CHEST TRAUMA	☐ TENSION PNEUMOTHORAX ☐ OPEN PNEUMOTHORAX ☐ SIMPLE PNEUMOTHORAX ☐ MASSIVE HEMOTHORAX ☐ SIMPLE HEMOTHORAX ☐ LUNG CONTUSION ☐ RIB FRACTURE ☐ FLAIL CHEST ☐ HEMOPERICARDIUM ☐ OTHERS (SPECIFY)
IF RIB FRACTURE	☐ LESS THAN 2 RIBS ☐ 2-4 RIBS ☐ MORE THAN 4 RIBS
OTHERS	☐ TRACHEAL INJURY ☐ ESOPHAGEAL INJURY ☐ DIAPHRAGMATIC INJURY
PRESENCE OF EXTRATHORACIC INJURY	○ Yes ○ No
EXTRATHORACIC INJURY	☐ HEAD INJURY ☐ VISCERAL INJURY ☐ LONG BONE FRACTURES ☐ pelvic fracture ☐ POLYTRAUMA ☐ OTHERS
SEVERITY OF HEAD INJURY	☐ MILD (GCS 13-15) ☐ MODERATE (GCS (9 -12) ☐ SEVERE (GCS (≤ 8)

IF OTHER	_____
INITIAL VITAL SIGNS AT EMD	
OXYGEN SATURATION	◯ ≥94% ◯ < 94%
blood pressure	_____
pulse rate	_____
RBG	_____
GCS	◯ ≤ 8 ◯ 9-12 ◯ 13-15
INTERVENTIONS AT THE EMD	
AIRWAY MANAGEMENT	☐ INTUBATION ☐ SUCTIONING ☐ C SPINE STABILISATION ☐ NONE
BREATHING MANAGEMENT	☐ NEEDLE DECOMPRESSION FOR TENSION PNEUMO ☐ CHEST TUBE INSERTION ☐ OXYGENATION ☐ NONE
IF CHEST TUBE INSERTED	_____ (TUBE SIZE AND SITE PLACED)
CIRCULATION MANAGEMENT	☐ 2 LARGE BORE CANNULA ☐ BOLUS OF CRYSTALLOID FLUID ☐ BLOOD TRANSFUSION ☐ NONE
OTHER INTERVENTIONS	☐ ANALGESIA ☐ TETANUS TOXOID ☐ SEDATION ☐ FRACTURE IMMOBILISATION ☐ NONE
RADIOLOGICAL INVESTIGATIONS DONE AT EMD	☐ CHEST XRAY ☐ ULTRASOUND (EFAST) ☐ CT SCAN ☐ NONE

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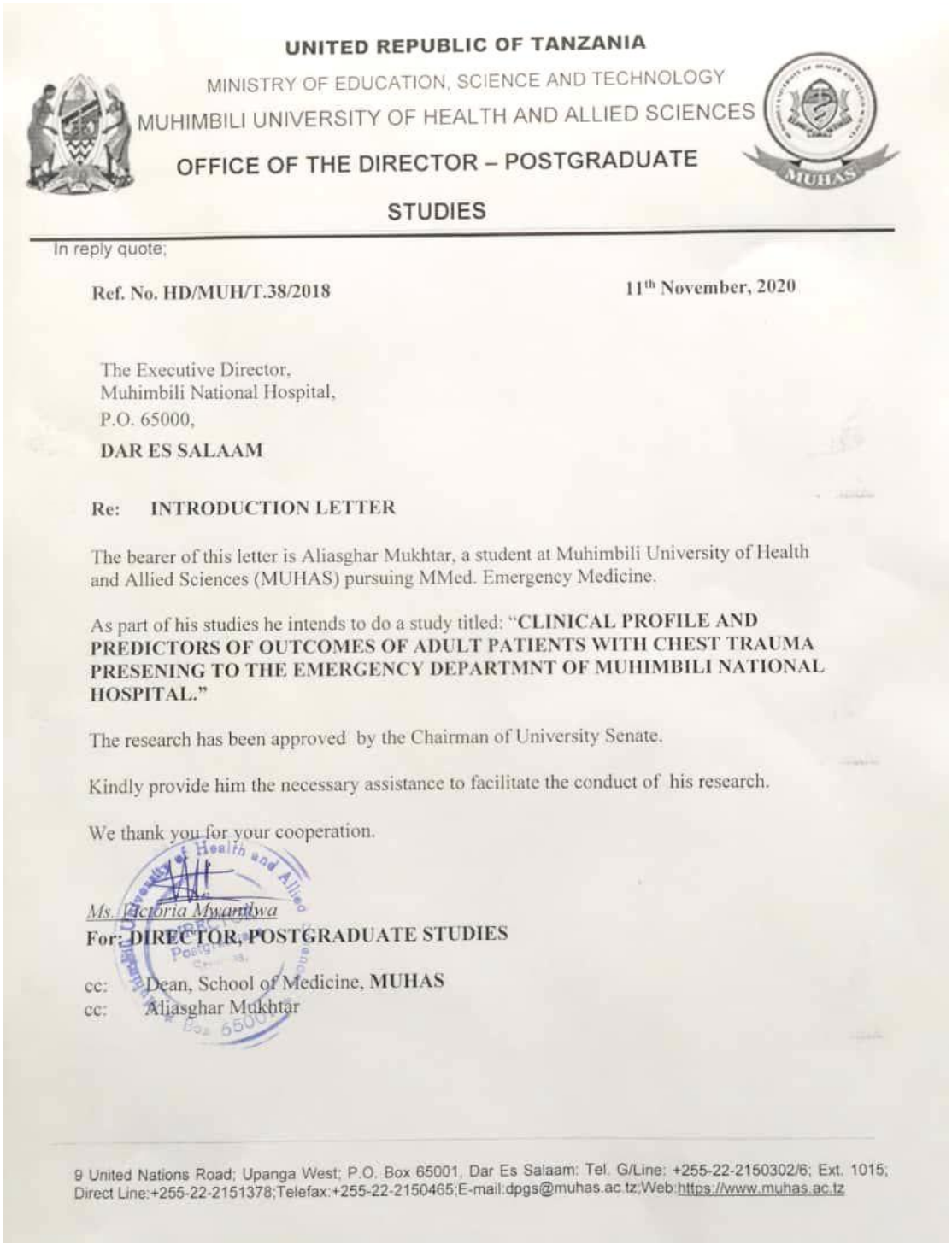
Chest Xray findings	☐ normal ☐ pneumothorax ☐ haemothorax ☐ rib fractures ☐ pneumomediastinum ☐ lung contusion
EFAST findings	☐ Normal Lung sliding ☐ No lung sliding (Rt side) ☐ No lung sliding (Lt side) ☐ fluid in the pleural space (Rt side) ☐ fluid in the pleural space (Lt side) ☐ fluid in the pericardial space ☐ free fluid in the abdomen
CT SCAN FINDINGS	_____
EMD DIAGNOSIS 1	_____
EMD DIAGNOSIS 2	_____
EMD DIAGNOSIS 3	_____
DIED AT EMD	◯ Yes ◯ No
DISPOSITION	☐ SURGICAL WARD ☐ ORTHOPEDIC WARD (MOI) ☐ ICU ☐ THEATRE

DID THE PATIENT DEVELOP ANY OF THE FOLLOWING WHILST IN THE WARD IN THE FIRST 7 DAYS

	YES	NO
SEPSIS	◯	◯
PULMONARY EMBOLISM	◯	◯
ARDS	◯	◯
EMPYEMA	◯	◯
NEUROLOGICAL DEFICITS	◯	◯
PNEUMONIA	◯	◯
WOUND SEPSIS	◯	◯

OUTCOME AT 7 DAYS	◯ DEAD ◯ ALIVE
DATE OF DEATH	_____

Appendix 2: Letter to ethics committee



UNITED REPUBLIC OF TANZANIA

MINISTRY OF EDUCATION, SCIENCE AND TECHNOLOGY

MUHIMBILI UNIVERSITY OF HEALTH AND ALLIED SCIENCES

OFFICE OF THE DIRECTOR – POSTGRADUATE STUDIES

In reply quote:

Ref. No. HD/MUH/T.38/2018

11th November, 2020

The Executive Director,
Muhimbili National Hospital,
P.O. 65000,
DAR ES SALAAM

Re: INTRODUCTION LETTER

The bearer of this letter is Aliasghar Mukhtar, a student at Muhimbili University of Health and Allied Sciences (MUHAS) pursuing MMed. Emergency Medicine.

As part of his studies he intends to do a study titled: "**CLINICAL PROFILE AND PREDICTORS OF OUTCOMES OF ADULT PATIENTS WITH CHEST TRAUMA PRESENING TO THE EMERGENCY DEPARTMNT OF MUHIMBILI NATIONAL HOSPITAL.**"

The research has been approved by the Chairman of University Senate.

Kindly provide him the necessary assistance to facilitate the conduct of his research.

We thank you for your cooperation.

Ms. Victoria Mwanziwa
For: DIRECTOR, POSTGRADUATE STUDIES

cc: Dean, School of Medicine, **MUHAS**
cc: Aliasghar Mukhtar

9 United Nations Road; Upanga West; P.O. Box 65001, Dar Es Salaam: Tel. G/Line: +255-22-2150302/6; Ext. 1015; Direct Line:+255-22-2151378;Telefax:+255-22-2150465;E-mail:dpgs@muhas.ac.tz;Web:https://www.muhas.ac.tz

Appendix 3: Letter of authorization from MNH management to conduct the study

THE UNITED REPUBLIC OF TANZANIA

MINISTRY OF HEALTH, COMMUNITY DEVELOPMENT, GENDER, ELDERLY AND CHILDREN

MUHIMBILI NATIONAL HOSPITAL

In reply please quote:

Ref. No.: MNH/TRCU/Perm/2020/022 **Date: 17th November, 2020**

Head of Department
ICT
Medical Records
Muhimbili National Hospital

RE: PERMISSION TO COLLECT DATA AT MNH.

Name of PI	**Aliasghar Mukhtar**
Title	**"Clinical Profile and Predictors of Outcomes of Adult Patients with Chest Trauma Presenting to The Emergency Department of Mnh".**
Institution	Muhimbili University of Health and Applied Sciences
Supervisor	Prof. Hendry Sawe
Period	17th November 2020, to 10th April, 2021

Approval has been granted to the above mentioned student to collect data at MNH.

Kindly ensure that the student abide to the ethical principles and other conditions of the research approval.

Sincerely,

TEACHING, RESEARCH & CONSULTANCY UNIT P.O. BOX 65000 DAR ES SALAAM MUHIMBILI NATIONAL HOSPITAL

Dr. Faraja Chiwanga
Head of Teaching, Research and Consultancy Unit

c.c DICT
c.c **Aliasghar Mukhtar**

Upanga West, Kalenga Street, Plot No. 10480/3, P.O. BOX 65000, Dar es Salaam, Tanzania.
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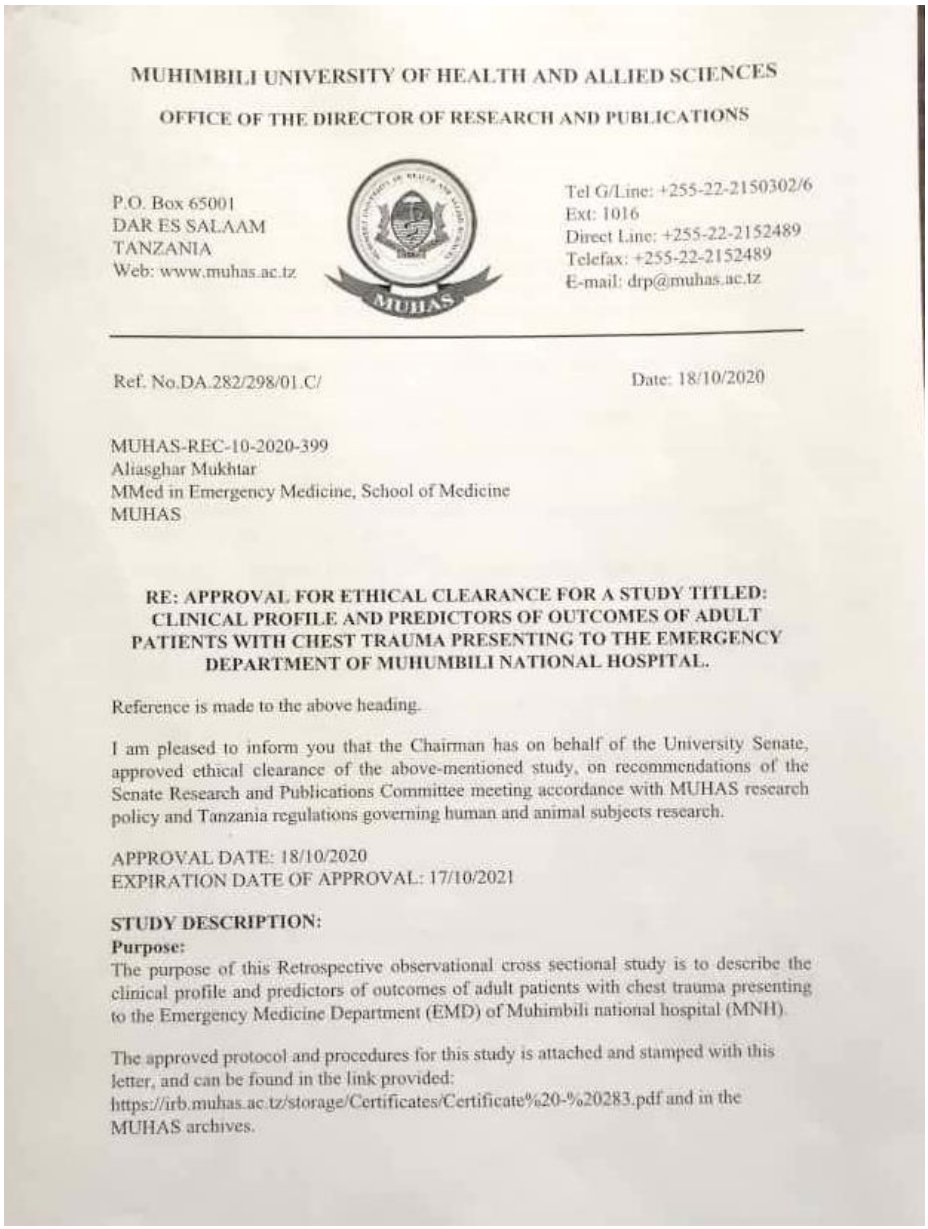
Email: info@mnh.or.tz, Website: www.mnh.or.tz

Appendix 4: APPROVAL FOR ETHICAL CLEARANCE



MUHIMBILI UNIVERSITY OF HEALTH AND ALLIED SCIENCES

OFFICE OF THE DIRECTOR OF RESEARCH AND PUBLICATIONS

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Ref. No.DA.282/298/01.C/ Date: 18/10/2020

MUHAS-REC-10-2020-399
Aliasghar Mukhtar
MMed in Emergency Medicine, School of Medicine
MUHAS

RE: APPROVAL FOR ETHICAL CLEARANCE FOR A STUDY TITLED: CLINICAL PROFILE AND PREDICTORS OF OUTCOMES OF ADULT PATIENTS WITH CHEST TRAUMA PRESENTING TO THE EMERGENCY DEPARTMENT OF MUHUMBILI NATIONAL HOSPITAL.

Reference is made to the above heading.

I am pleased to inform you that the Chairman has on behalf of the University Senate, approved ethical clearance of the above-mentioned study, on recommendations of the Senate Research and Publications Committee meeting accordance with MUHAS research policy and Tanzania regulations governing human and animal subjects research.

APPROVAL DATE: 18/10/2020
EXPIRATION DATE OF APPROVAL: 17/10/2021

STUDY DESCRIPTION:
Purpose:
The purpose of this Retrospective observational cross sectional study is to describe the clinical profile and predictors of outcomes of adult patients with chest trauma presenting to the Emergency Medicine Department (EMD) of Muhimbili national hospital (MNH).

The approved protocol and procedures for this study is attached and stamped with this letter, and can be found in the link provided:
https://irb.muhas.ac.tz/storage/Certificates/Certificate%20-%20283.pdf and in the MUHAS archives.