MANAGEMENT AND IMMEDIATE OUTCOME OF CHEST INJURIES AMONG TRAUMA PATIENTS ADMITTED AT MUHIMBILI NATIONAL HOSPITAL

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MANAGEMENT AND IMMEDIATE OUTCOME OF CHEST INJURIES AMONG TRAUMA PATIENTS ADMITTED AT MUHIMBILI NATIONAL HOSPITAL.

By

Janeth S. Masuma.

A Dissertation Submitted in (Partial) Fulfillment of the Requirement for the Degree of Master of Medicine (Anaesthesiology).

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CERTIFICATION

The undersigned certify that they have read and hereby recommend for acceptance by Muhimbili University of Health and Allied Sciences a dissertation entitled, ‘‘**Management and immediate outcome of chest injuries among trauma patients admitted at Muhimbili National Hospital, Dar-es-salaam, Tanzania’’,** in partial fulfillment of the requirements for the degree of Masters of Medicine in Anaesthesiology, of the Muhimbili University of Health and Allied Sciences.

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Date: _____

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(Co-Supervisor)

Date:_____

DECLARATION AND COPYRIGHT

I, Janeth S. Masuma, declare that this **dissertation** is my own original work and that it has not been presented and will not be presented to any other university for similar or any other degree award.

Signature……. **Date**……

ACKNOWLEDGEMENT

I would like to extend my sincere gratitude to Almighty God for his blessings that enabled me complete this work.

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Last but not least I thank my family for their support as I try to advance through my career. They have tolerated me throughout my studies and supported me socially as well as spiritually through their endless prayers.

DEDICATION

The dedication of this dissertation goes to my lovely kids Collin and Abigail for their prayers and patience in my absence during my study period.

I also dedicate this work to my precious parents and family, for they encouraged me and supported me throughout.

ABSTRACT

Background:

Chest injuries prevails about 1/5 th of all trauma patients. The magnitude varies from different parts of the world because of differences in infrastructure, social economic activities, wars and crimes. Fortunately enough, majority of chest injuries can be managed by nonsurgical methods .Complications in chest trauma develop as a result of pain and inadequate ventilation.

Objective:

This study aimed at determining the prevalence, associated factors, management and immediate outcome of chest injuries among trauma patients admitted at Muhimbili National hospital.

Methodology:

Prospective analysis of 282 trauma patients who were admitted at Muhimbili hospital from September 2019-february 2020. Systematic random technique was used to enrol trauma patients in this study. Data were collected using a pretested structured questionnaire and a check list, and were analysed using SPSS version 23. Statistical association between mortality of chest injury patients and management pattern, and various associated prognostic factors was done using cross tabulations and Chi-square test was used to compare proportions, p value <0.05 was considered to be statistically significant. Multivariate analysis was done to examine the influence of the selected (associated) independent variables to the outcome variable.

Results: This study involved 282 trauma patients who were admitted at MNH**.** The median age was 30 years with age range of 1-82. Many patients with chest injuries were in the age group 20-39 years. The prevalence of chest injury among trauma patients was 18.1 %. The majority 17 (33.3%), presented with lung contusion, followed by pneumothorax 8(15,7%) and rib fracture 8(15,7). Road traffic accident (80.4%) was the leading mode of injury. Associated injuries were noted in 44(86.3%) of patients and head/neck 34(66.7%) were commonest

affected. All patients (100%) were treated successfully with non-operative approach. Majorities (52.9%) of the patients were managed by tube thoracostomy and (42.1%) were managed conservatively. Most of the patients were provided with more than one type of pain medication 28(55%), while 23(45%) were provided with one type of pain medication. 12(23.5 %) patients necessitated invasive ventilation while,16(31.4%) required noninvasive ventilation and 23(45.1 %) did not require any assisted ventilation. There was a statistically significant association between pain management and ventilation. Mortality rate was 21.6%. Using multivariate logistic regression analysis, associated injuries, ISS >25, delayed presentation to hospital and invasive ventilation were found to be significant predictors of mortality.

Conclusion: Chest injuries prevails significantly among trauma patients. Adequate pain management, multimodal pain approach, assisted ventilation are determinants of quick recovery and avoidance of complications. Early use of NIV in appropriately identified patients with chest injuries and without respiratory distress may prevent intubation and mortality. Associated injuries, ISS, severity of chest trauma and shorter duration of injury and presentation to hospital significantly determine mortality.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

A: LIST OF ABBREVIATIONS

ABG	Arterial blood gases
$AISS_{thorax}$	Abbreviated Injury Severity Score for thoracic injuries
ASA	American society of anesthesiologists
ARDS	Acute Respiratory Distress Syndrome
CNS	Central Nervous System
CT	Computed tomography
CXR	Chest X-ray
RTA	Road traffic accidents
USS	Ultrasound
ICU	Intensive care unit
IV	Invasive ventilation
MNH	Muhimbili National Hospital
MODS/MOF	Multiple organ dysfunction /Multiple organ failure
ISS	Injury severity score
LOHS	Length of hospital stay
RTA	Road Traffic accidents
SSA	Sub Saharan Africa
RR	Respiratory rate
BP	Blood pressure
SPO2	Saturation percentage of oxygen
GCS	Glasgow coma scale
AVPU	Alert/Verbal/Pain/Unconscious
ECMO	Extracorporeal membrane oxygenation

B: DEFINITION OF TERMS

$AISS_{thorax}$- is an anatomical scoring system which provides a reasonably accurate ranking of the severity of injury of the thorax.

Advanced trauma life support- is a systematic concise approach to the early care of trauma patients. It is also a training program for medical providers in the management of acute trauma cases, developed by the American College of Surgeons.

Critical care service – is the service that meet the needs of patients facing an immediate life-threatening health condition—specifically, that in which vital system organs are at risk of failing.

ECMO - is a treatment that uses a pump to circulate blood through an artificial lung back into the bloodstream of a very ill patient, and where the usual methods of invasive ventilation failed**.**

Flail chest- 3 or more ribs with segmental fractures.

Golden hour-period which there is a likelihood that prompt medical and surgical treatment will prevent death.

Immediate Outcome- is the short-term result of a chest injury patient after an intervention, eg. State of improvements of signs and symptoms, or worsening or ultimately death.

Invasive Ventilation - it involves the use of any instrument penetrating via the mouth (such as an endotracheal tube), nose, or the skin (such as a tracheostomy tube through a stoma, a surgically-created hole in the windpipe) to serve as an artificial airway.

Length of mechanical ventilation – this is the number of days spent in ICU with ETT or tracheostomy and mandatory mechanical ventilation**.**

Primary survey- is the initial assessment and management of trauma patients.

Secondary survey - is the type of care performed once the patient has been stabilized.

Noninvasive ventilation-refers to the provision of ventilatory support through the patient's upper airway using a mask or similar device**.**

Resuscitation - to revive from apparent death or from unconsciousness; also, to revitalize.

Ventilator induced lung injury -Lung injury as an adverse consequence of mechanical ventilation. Eg. Pneumothorax development after positive pressure ventilation, or lung collapse.

CHAPTER ONE

1.0 INTRODUCTION AND LITERATURE REVIEW

1.1 Background

Accidents which are unpredicted events are becoming the major epidemic of non-communicable disease in the present century, probably due to technological advancement, increased in human activities, civil wars geographical origin and seasonal changes(1). It causes about 10% of deaths, (5.1 million deaths) worldwide per year. About 90% of deaths due to trauma occurs in low- and middle-income countries, due to poor enforcement of traffic safety rules, inadequacy infrastructure, lack of advanced pre hospital care services and some deficits in our medical services including ineffective ambulance system and less accessible diagnostic tools (2–4) . In many developing countries , not only the incidence of various injuries is increasing but also the causative factors are changing from historical pattern such as falling from trees, occupational risks , interpersonal violence, occupational hazards and RTA (5,6). Thoracic trauma contributes heavily, and may present as isolated injury or as part of polytrauma (1,7,8) .Chest trauma can significantly cause a threat to the airway, breathing and circulation in the traumatized patient thus directly affecting the clinical cause and outcome (9).

Trauma limited to thoracic cage itself may cause profound pathophysiology changes, which maybe fatal if not promptly treated (10). Thoracic trauma is exceptional because of the potential for rapid deterioration, the need for aggressive resuscitation and an associated high mortality rate (11). Hypoxia is the most serious feature of chest injury. About 90% of the patients with life threatening thoracic trauma injuries can be managed by a simple intervention like intercostals tube drainage and non-invasive ventilation, despite its high mortality rate (1,12). Therefore, by improving emergency trauma treatment, and critical care services**,** we are going to save lives of many chest trauma patients.

In the pathophysiology of chest trauma, there is a close association of the chest wall structure with the functional mechanics of the thorax. Injury to the chest can affect respiratory function leading to altered respiratory mechanics which results into hypercarbia, respiratory failure and respiratory acidosis, also there is increased shunting

through pulmonary contusion, hemorrhage or edema from energy transfer resulting into hypoxemia. In addition to all this, pneumothorax, hemothorax, pneumohemothorax and cardiac tamponade hinders gas exchange and lead to circulatory dysfunction (13).

Here comes in a role of a critical care specialist for resuscitation with aggressive correction of acidosis, hypothermia, and coagulopathy in patients with chest injuries.

Careful fluid administration must be delivered to avoid hypo perfusion while minimizing lung edema and developing or worsening of pulmonary contusions. Immediate trauma management is in support of cardiopulmonary circuit per the airway, breathing, and circulation (ABC)'s of trauma management. Recognition of the need for ventilator support and the use of thoracostomy tubes to decompress hemorrhage and tension pneumothorax is crucial to early management.

Most of the available data concerning chest injuries are from western countries. Studies done in USA revealed that 20% of trauma deaths per year are attributable to chest as per 1985 and 6200 per 100000 persons had limited activity due to chest injury (12). This makes chest trauma second only to head and spinal cord injuries (12) .

Even though, the low-income countries including sub- Saharan Africa (SSA) has the highest prevalence of trauma due to increase in modernization (4), little is known about prevalence, predictors, and the outcome of chest injuries. Among studies conducted in SSA, a study done in Kenya revealed that motorcycle users involved in road traffic crashes are likely to die or be severely injured due to high frequency of head, chest and leg injuries. However in this study only 8.2 % of the trauma patients had chest injury (14) , in the same country Saidi et al reported the prevalence of chest injuries to be 16.1 % in a study of gunshot injuries as seen at Agakhan hospital (15). A study done in Bugando, the prevalence of chest injury among road traffic crashes was significantly high (44.2%), and the mortality rate was 17.5% indicating a need for urgent intervention in road traffic rules**.** Boniface et al (2014) found that isolated chest injuries from 3 regions (Dar-es-salaam, Morogoro and Coast) was 9%, thus next to head and extremity injuries, this statistic excludes those with multiple injuries. Despite these variations in prevalence, the mortality due to chest injuries was significantly high as reported by Massaga et al and Chalya et al,

who found a 24.7% and 17.5% mortality in chest injury patients respectively. This can be explained by severity of injuries , associated injuries and late management of the patients (8). Moreover, none of the studies has been looking at the prevalence of chest injuries in Dar-es-salaam city and their recent etiological factors.

Chest trauma can be blunt or penetrating. Many factors have been implicated to be associated with chest injury. These include patient related factors (age, gender and social economic activities) and mode of injury leading to the event (chest injury).

If not anticipated and managed both chest wall and intrathoracic visceral injuries can lead to life threatening complications (12) .

Most patients with pulmonary contusion would recover within 14 days without complications, but those with severe injuries would have consistent symptoms such as dyspnea, decreased exercise tolerance, pneumonia and chest pain on the side of injury. Other patients would have pulmonary fibrosis and persistent decrease in functional residual capacity (12).

The treatment options in chest injury patients will depend on what type of chest injury and clinical presentation of the patients. Studies have shown that patients with pneumothorax/ hemothorax or both would improve on simply a chest tube (8,16). Other patients would require mechanical ventilation, aggressive pain control , supportive therapy and critical care observation (12). For patients with moderate to severe lung injury and age above 30 early intubation would decrease the risk of mortality by 6% but withholding intubation for 24 hours until they developed clinical evidence of hypoxia and hypercapnia resulted in mortality more than 50% (12). Few numbers of patients would require surgical intervention, i.e. thoracotomy. Understanding the magnitude of chest injury in our setting will help on policy making and will provide the basis for planning of prevention strategies and establishment of protocols. These will help in reducing the mortality rate among chest trauma patients. The aim of this study is to determine the prevalence of chest injuries its associated factors, management and immediate outcome which will help in policy making for prevention and establishment management protocols.

1.2 LITERATURE REVIEW

Prevalence of chest injury

Most studies had done have revealed the prevalence of chest trauma to be varying from different parts of the world. The prevalence is high in low- and middle-income countries, while it's low in most of the developed countries. In Europe blunt chest injuries are less than 20% of all injuries (17) . This is due to variations in enforcement of road traffic policies, economic activities, geographical locations, wars and advancement in preventive measures of trauma.

A study done in India on blunt trauma chest (an experience at rural tertiary care Centre), prevalence study showed that 45% of trauma patients were admitted primarily because of chest injuries (1). However, the prevalence is lower such as in a study done in china on epidemiology of trauma and China trauma care training in subtropical regions of Hainan Province, this could be due advancement in modes of transportation, strict road traffic policies and advancement in preventive measures against trauma(2) . Another study on epidemiology of injuries seen in Nigerian Tertiary hospital revealed the prevalence to be 8.1 % (18) .

Galukande et al in Uganda , reported the prevalence of chest injury to be 34.7% in his study on motorcycle (boda-boda) injuries (19). A study done on gunshot injuries at Agakhan hospital in Kenya documented the prevalence of chest injuries to be 16.1% (Saidi et al. 2002) .

In Tanzania, Philipo et al, reported the prevalence of chest injuries among road traffic crash victims in Mwanza region to be 44.2 %. This is due to the fact that in Mwanza there are more pedestrians, bicycle riders, and motorcyclists, who constitute the majority of road traffic accidents (3). Boniface et al found that isolated chest injuries from 3 regions (Dar-es-salaam, Morogoro and Coast) was 9%, thus next to head and extremity injuries, this statistic excludes those with multiple injuries(4).Upon determination of the prevalence of chest injuries will help us to know the magnitude of chest injuries in our setting (Dar-es-salaam) and will become a baseline for other studies on chest injuries and assessment of care in acute critical care trauma management.

Factors associated with chest injuries:

Demographic factors

Age, gender and occupational activity are risk factors predisposing a person to get thoracic trauma. Most of the studies revealed that majority of chest trauma patients are in the middle and young age and few elderlies , with age ranging 12-72 years (14,20). A study done in Nigeria showed that chest injuries primarily affects youths, age of 42 years and below.

Gender is another risk factor, where by most studies show that most of chest trauma patients are of male gender (1,7,8,16,20). A good preventive strategy is focused on avoidance of identified contributing factors. It is why we would like to assess the association between patient's demographic factors and chest injury in our study population. Determination of these associated factors will help the emergency service providers, critical care providers, and the population to take actions that might contribute in decreasing of chest injury prevalence.

Mode of injury

Chest trauma can be blunt or penetrating. Blunt trauma are caused by motor vehicle accidents, compression (AP and transverse) and blast injuries. Penetrating chest injuries are caused by gunshots, missile fragments or stab injuries. 80 % of chest injuries are due to blunt trauma. Studies show that mode of injuries vary according to occupation, geographical location and harmonization status of the area. A study done in Bugando revealed that most of the chest injuries were caused by road traffic accidents (50.7%), followed by assaults, falls, sports injury and others, (3). Similar results were found by Massaga et al, in Dar-es-salaam, where 72.3% of chest injury patients were due to road traffic accidents (8). In Nigeria N. Ali etal found that most of the injuries were penetrating, and this was due to an increase in the use of guns, arrows and spears(7). In China seasonal changes determined the magnitude of trauma, trauma incidences increased during earthquakes and most of the chest injuries due to earth quicks were caused by accidentally struck. injuries due to falls were less prevalent (21). A study done in United states of America shows that the risk for serious thoracic injuries was 7% , caused by motorcycle

crash, falls from height, work or recreational related crush injuries, and assaults were less common but considerable additional causes. It also revealed that 44% of unintentional injuries in the united states were caused by motor vehicle crash (12). In this study we seek to evaluate current situation given technological, medical and economic changes happening in Tanzania.

Initial evaluation and treatment for chest injury patients

In the care of the patients with chest injuries, initially basic Advanced Trauma Life Support guidelines should be followed. Management with prompt endotracheal intubation is required in patients with obvious respiratory distress or those unable to protect their airway. In injuries, such as rib fractures and pulmonary contusion, are not likely to recover in the short term and, if required, positive-pressure ventilation should be initiated early (11). Evidence of a pneumothorax on examination should quickly be followed by tube thoracostomy. Given the possibility for ongoing blood loss, large-bore intravenous access should be secured.

Further intervention can be delayed until the patient is stabilized unless life-threatening hemorrhage is noted. After the initial evaluation and resuscitation, severely injured patients should be treated in the intensive care unit. Chest radiographs or Chest USS can be done rapidly and can diagnose potentially life-threatening injuries.

Rib fractures are common in chest trauma and exist in upwards of 10–20% of trauma patients (13). Significant morbidity is observed in the aged from loss of efficient respiratory mechanics, pain-related chest wall splinting, and underlying lung injury. For each additional rib fracture in the elderly, mortality increases by 19% and the risk of pneumonia by 27% (22). These patients also have a higher incidence of commodities such chronic lung disease and cardiovascular disease that can worsen outcomes (22,23) . The main goal in management of patients with rib fracture is to minimize the sequelae of impaired chest wall mechanics. In the acute period, this is done by giving adequate analgesia to maintain the patient’s ability to cough, take adequate tidal volumes, and mobilize. For patients with simple rib fractures oral and intravenous opioid analgesia are commonly used. Other modalities such as intercostal nerve blocks, paravertebral blocks,

and epidural analgesia have been used in some settings to avoid the systemic effects of opioid analgesia.

Early intubation in chest injuries was discovered to be associated with increased mortality due to ventilator associated complications (24)**.** Mandatory mechanical ventilatory support merely for chest wall stabilization has been abandoned. It is stated by the EAST guidelines that "obligatory mechanical ventilation should be avoided (25). Noninvasive strategies are preferred. Meta-analysis done by Roberts et al. and Duggal et al. supported the use of NIV. NIV was safe with no increased morbidity and mortality although there was significant variations in terms of injury severity, level of hypoxemia and timing of intervention(26). In a study done by Chiumello et al. overall arterial oxygen saturations were significantly higher with a significant reduction in intubation (27).

For patients on non-invasive ventilation close observation should be undertaken in the intensive care setting to monitor for acute decompensation. Head injury and shock patients do not make good candidates for NIV and are at high risk of aspiration as it was reported by Razlo et al (11).In well-developed health care facilities there is a room for ECMO in severely injured patients who do not improve despite Invasive ventilation. Lung trauma needs to be treated on an individual basis, depending on the magnitude, location and type of lung or chest injury. In addition to treatment modalities mentioned above, other patients would require tube thoracostomy, thoracotomy and laparotomy. Tube thoracostomy is done in patients with hemothorax, pneumothorax or hemopneumothorax. Thoracotomy is performed due to ongoing thoracic hemorrhage, cardiac tamponade, injury to a great vessel and rupture of the diaphragm, and laparotomy due to diaphragmatic rupture with associated visceral injury (3,16,28).

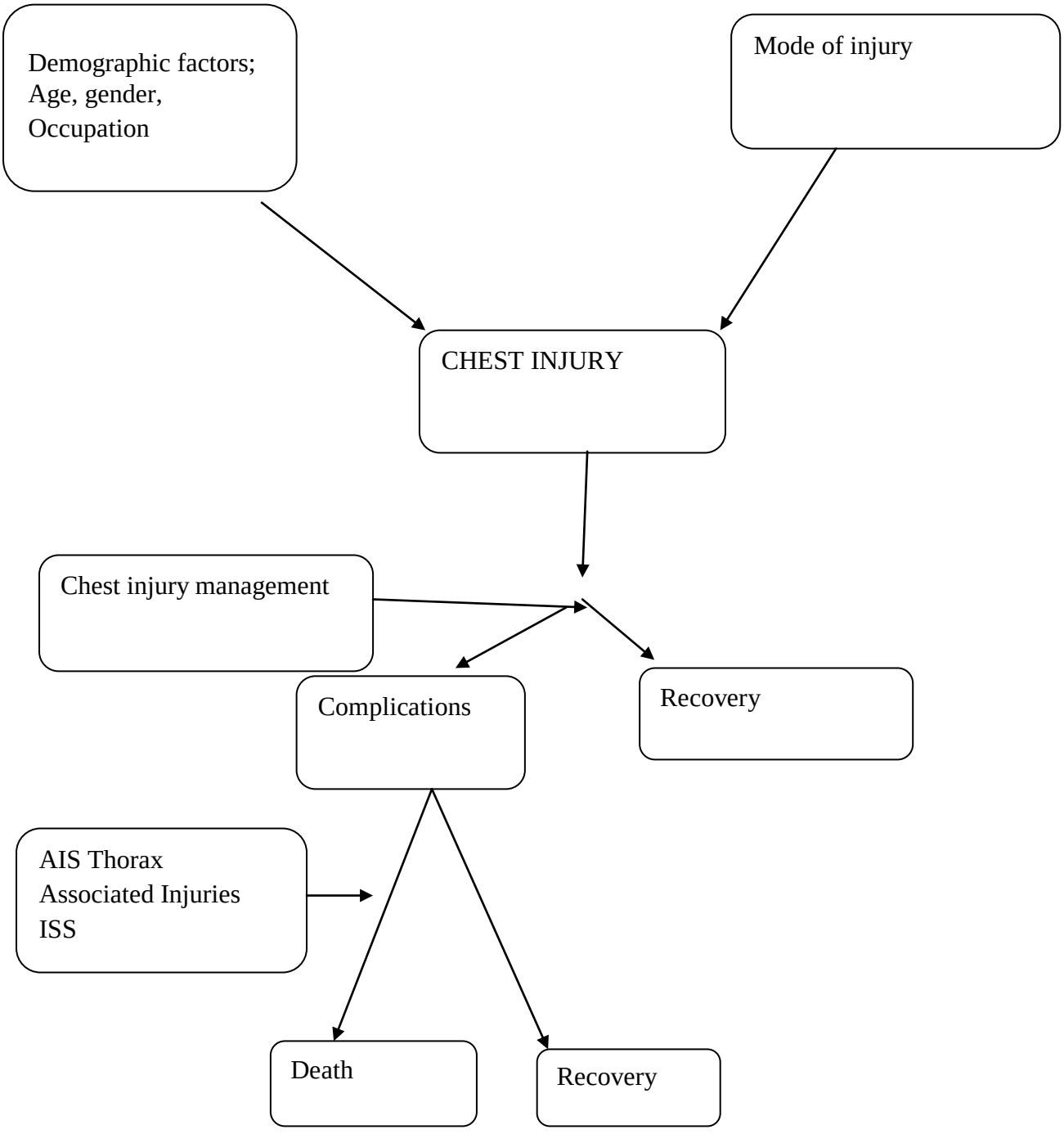
The assessment of treatment pattern will indicate the quality of management provided to chest injury patients and address the challenges faced especially during resuscitation and maintenance of adequacy ventilation to these patients and ultimately come up with standards of care and management to such patients.

Immediate outcome and factors associated with mortality

This includes the outcome of the patients during the reassessment (thus at 24 and 36 hours), which could be resolutions of the primary injury, development of complications or death. A study done in India by Sharma et al revealed that, 84% improved and were discharged with satisfactory conditions within 7-9 days, 34.4 % had prolonged hospital stay, because of multiple rib fracture associated with other extra thoracic injury and various complication. Complications which were noted in 5.9% of patients mainly include residual hemothorax, recurrent pneumothorax, deep vein thrombosis, broncho pleural fistula, ARDS, aspiration pneumonitis, pressure sore etc. 2.3% of the patients died, despite suitable and aggressive treatment. Out of 17 patients who expired, 10 had multiple fractured ribs with associated abdominal injury and pelvic fracture and 7 patients had flail chest with massive bilateral pulmonary contusion (1). In Tanzania, a study done by Monafisha et al in Bugando revealed the complication rate of chest injury patients to be 26% which were due to infections and complications due to long bone fractures, and the mortality rate was 3.3% (16). Mchembe et al revealed a mortality rate of 24.2 %, and the overall complication rate was 32%, and this was due to wound infection and non-functional tubes (8). Severely injured patients with associated injuries (3 patients had esophageal perforation and 1 had diaphragmatic rupture).

Most of the studies found factors associated with mortality include lack of pre hospital care, high ISS, high AISthorax. presence of associated extra thoracic organ injury, delayed presentation with injury to presentation interval longer than 24 h, and severe chest injury as characterized by bilateral chest involvement (9,16,29,30).The assessment of chest injury outcomes will indicate the quality of management of chest injuries at the emergency and surgical departments at MNH. It will also help to determine the complications of chest injury, related morbidity and mortality, with the prognostic indicators for mortality which will help in proper preventions and interventions.

1.3 Conceptual framework



Key: → **influences** **Source: Janeth Masuma, 2019**

Narration of the conceptual framework

The figure above demonstrates the factors that predispose the patient to chest injury. Variables which were studied include mode of injury, treatment employed, admission vital signs (spo2, bp, heart rate.), intensive care requirement and associated injuries which indicated the severity of the chest trauma. The outcome variable in this study mortality. Management of chest injury resulted in either recovery or complications (such as pneumonia, ARDS, local infection, improper tube placement, and residual hemothorax) and ultimately death. The prognostic factors to the outcome were ISS, AIS thorax, duration between presentation and injury, bilateral or unilateral chest involvement and associated injuries.

1.4 Problem statement

Chest injuries pose a challenge to emergency and critical care providers to provide aggressive resuscitation and adequate oxygenation while protecting the lung from further ventilator-induced injury due to complexity of injury in chest trauma patients (12). If no prompt intervention a patient would go into hypoxia and brain injury. Without proper and adequate management, patients are prone to long term morbidity such as pulmonary fibrosis, reduced lung function and ultimately death (12). The prevalence has been reported in literatures to vary from one part of the world to another, probably because of differences in infrastructure, social economic activities, wars and crimes.

In Tanzania, trauma including chest injuries continues to be one of the important causes of morbidity among the young and old with an estimated mortality of 40%.(16). There are few published studies on chest injuries in Tanzania. In Mwanza region high prevalence of chest injuries among road traffic crashes was found, thus 44.2% (3). Studies have revealed a high mortality rate due to chest trauma, in Dar-es-salaam city (26.7%), (8). Advances in diagnostic imaging and critical care contribute in the improvement of the outcome (1). Monafisha et al in Mwanza reported complications due to chest injuries were 26.0 %, but however the mortality rate was significantly low as compared to a study done in Dar-es-salaam, thus 3.3%. Chest injury patients are very common in MNH, however none of the studies has documented on the magnitude in this local setting/Dar-es-salaam. It is

important to establish demographic profiles for injury mechanisms and ascertain the burden, in the local setting. Also identifying patients at risk of chest injuries and taking required precautions is most import measure for prevention.

1.5 Rationale

This study will inform on the magnitude of traumatic chest injuries which will provide the basis for planning of prevention strategies and establishment of protocols. It will help on the establishment of treatment priorities which will guide on effective management of such patients, whereby upon delayed intervention they would die of hypoxia or even get multiple end organ damage. This study will give us clear knowledge on what measures, at what appropriate time to take so as to save the lives of such patients.

1.6 Research questions

1) What is the prevalence of chest injury among trauma patients admitted at MNH?
2) What is the management pattern for chest injury patients admitted at MNH?
3) What are the immediate outcomes of chest injury management at MNH?
4) What are the factors associated with mortality in chest injury patients admitted at MNH?

1.7 Objectives

1.7.1 Broad objective

To determine the prevalence of chest injuries, associated factors, management and immediate outcome among trauma patients admitted at Muhimbili National hospital from September 2019- February 2020.

1.7.2 Specific objectives

1. To determine the prevalence of chest injuries in trauma patients admitted at MNH from September 2019 to Dec 2020.
2. To determine the mode of injury among patients who sustained chest injuries, and were admitted at MNH from September 2019 to February 2020.
3. To describe the treatment pattern with outcome of chest injury patients admitted at MNH from September 2019-February 2020.
4. To examine the factors associated with mortality among chest injury patients admitted at MNH from September 2019 to February 2020.

CHAPTER TWO

2.0 METHODOLOGY

2.1 Study design

The study was a descriptive cross sectional hospital based study.

2.2 Study duration

The study was conducted from September 2019 to February 2020.

2.3 Study area

The study was conducted at Muhimbili National Hospital (MNH), Dar es Salaam.

Data was collected from the Emergency Medicine Department of Muhimbili National Hospital Dar-es-salaam Tanzania and admitted trauma/surgical ward/ICU where the patients were admitted.

2.4 Study population

This study included trauma patients who were admitted at Muhimbili National Hospital during the study period.

2.5 Inclusion criteria

The study included trauma patients, of all ages who were admitted at Muhimbili National Hospital during the study duration.

2.6 Exclusion criteria

- Patients with superficial / mild injuries.
- Patients with burn injuries.
- Patients who had inadequate information, regarding the details of the injury, mode and time of injury.
- Patients who presented with chest injury but, had prior chest injuries (recurrent chest trauma)
- Patients whose injuries were more than 7 days duration days since the trauma event.

2.7 Sampling method

Recruitment of participants was conducted exclusively from the emergency department. Systematic sampling technique was used after determining the number of trauma patients needed daily. Per day our population involved around 12 trauma patients who met the criteria of the study. Our sample size was 282 trauma patients for 6 months, so monthly we needed 47 patients. Per week we needed to enrol 12 patients, so daily we needed 3 patients. How to get the 3 patients daily from the population of 12 who are attended every day. We calculated the kth no which came to be four. Then we prepared cards 1-3, and asked my research assistant to pick one. Card no 2 was chosen. So daily we picked the 2^{nd}, 6^{th} and 10^{th} patient.

2.8 Training of the Research Assistants

4 medical officers were trained as research assistants. They are experienced in working at the at the emergency department (2 assistants) and in the trauma wards (2 assistants). Training of the research assistant was conducted before starting data collection tool by the researcher. The training involved a 2 hours' period explaining on the study topic, introduction and methodology including the investigation tools used. Then followed a simulation of the expected exercise between the researcher and the research assistants lasting 2 hours as well.

2.9 Sample size estimation

The sample size will be calculated using Kish Leslie formula of 1965, mortality rate of chest trauma patients admitted at MNH 2007-2008 (8).

$$N = \frac{Z^2 p (1-p)}{E^2}$$

Whereby;

N= Minimum sample size.

Z = Standard normal deviation 1.96 for 95% confidence interval.

P = Mortality rate among chest trauma patients admitted at MNH (Nov 2007-sept 2008)

24.2%, 0.242

ε = Margin of tolerable error (0.05)

$$N = \frac{1.96^2 \times 0.242 \times (1-0.242)}{0.05^2}$$

N = 282

Thus, the calculated sample size of this study was 282 patients.

2.10 Collection of data

Data collection was done through structured questionnaire which were filled by principle investigator and research assistants. Data collected included demographics, mode of injury, severity of injury, ISS, chest injury type, severity of chest injury (AISthorax), treatment pattern (tube thoracostomy, thoracotomy, pain management, need for assisted ventilation) and outcome after management. Determination of mode of injury was asked from the patient, diagnosis of chest injury was reached through clinical assessment and radiological findings. Other data such as ISS,AISthorax , treatment pattern were obtained through clinical assessment of the patient and some recordings from the file.

2.11 Data analysis

Data analysis was done using the Statistical Package for Social Sciences (SPSS) version 23. Statistical Association between management pattern and outcome, also age, sex, injury severity, ISS, AISthorax, duration between injury and presentation and outcome was done using cross tabulations and Chi-square test was used to compare proportions. P value of < 0.05 was considered statistically significant. Univariate was done to examine the influence of the selected (associated) independent variables to the outcome variable. P value of <0.05 by univariate analysis were included in the multivariate analysis to control for confounders.

2.12 Ethical consideration

The Researcher introduced himself to the patient or parent/guardian of a child and explained everything concerning the study hence permission to do the study was sought and consent was obtained from patient. The Interview was conducted in a private environment. Only the consenting patients were involved in this study. The interpretation of the Images was done by principal investigator, assistants and Radiologists. Confidentiality of patients' information was adhered to. Data was handled confidentially and stored in a secured place.

2.13 Ethical clearance

The proposal was presented to the department of Anesthesiology, Muhimbili University of Health and Allied Sciences. Ethical clearance was then obtained from the Research and Publication Committee of the Muhimbili University of Health and Allied Sciences

CHAPTER THREE

3.0 RESULTS

Table1: Social demographic characteristics

The number of trauma patients who were involved in the study were 282, 227(80.5%) being males and 55(19.5%) were females. The majority 176 (62.41%) were in the age group of 20-39, followed by the age group 40-59 who were 61(21.6%).

Sex	**Frequency(n)**	**Percentage(%)**
Male	227	80.5
Female	55	19.5
Total	282	100
Marital status		
Single	157	55.67
Married	116	41.14
Others	9	3.19
Total	282	100
Education		
Primary school	139	49.29
Secondary school	51	18.09
High level	26	9.22
No formal education	66	23.4
Total	282	100
age groups		
1 to 19	29	10.28
20 to 39	176	62.42
40 to 59	61	21.63
60 and above	16	5.67
Total	**282**	**100**

Table 2a. Proportion of patients with chest injury among trauma patients admitted at MNH from September 2019-February 2020. N=282

Among the 282 trauma patients admitted, **18.1 % (51)** had chest injuries.

Prevalence	**Frequency (n)**	**Percentage(%)**
Chest injury	51	**18.09**
Non chest injury	231	81.91

Table 2b: Distribution of chest injury pattern among chest trauma patients admitted at MNH from September 2019- February 2020.N=51

Findings below show that among the chest injury patients admitted the majority 17 (33.3%), presented with lung contusion, followed by pneumohemothorax 8(15.7%) and rib fracture 8(15.7).

chest injury type	**Frequency**	**Percent**
Pneumothorax	1	2
Hemothorax	4	7.8
Pneumohemothorax	8	15.7
Rib fracture	8	15.7
Clavicle fracture	4	7.8
Lung contusion	17	33.3
sucking wound	5	9.8
Ruptured diaphragm	1	2
Cardiac injury	1	2
Flail chest	2	2.9
Total	51	9.8

Table 3: Distribution of the study population according to the cause of injuryN=51

The results show that majority of the patients were involved in RTA (80.4%), followed by assault (15.7%) and fall from the height (3.9%).

Mode of injury	**Death**	**Survivor**	**Total**
Road traffic accidents	10(24.39)	31(75.61)	41(80.4)
Fall from height	0(0.00)	2(100)	2(3.9))
Assault	1(12.50)	7(87.50)	8(15.7)

Table 4a: The distribution showing the treatment options provided to chest injury patients who were admitted at MNH from September 2019- February 2020.

The table below show majority of patients in this study were managed by tube thoracostomy 27 (52.9%) to drain the hemo/pheumo/pneumohemothorax, followed by conservative management 24 (47.1%). 7.8% had to be sutured the wounds for closure of the open chest wounds, and 2% necessitated needle thoracostomy for the relief of the subcutaneous emphysema. None of the patients underwent thoracotomy. Among the patients who required tube thoracostomy 6(22.22%) died and for those managed conservatively 5(20.8%) died. There was no statistically significant association between the management type and mortality.

Pattern of treatment				
Variable	**Death(%)**	**Survivor**	**Total**	**P value**
Conservative	N=11	N=40	N=51	
Yes	5(20.83)	19(79.17)	24(47.1)	0.904
No	6(22.22)	21(77.78)	27(52.9)	
Tube thoracostomy				
Yes	6(22.22)	21(77.78)	27(52.9)	0.904
No	5(20.83)	19(79.17)	24(47.1)	
Wound suture				
Yes	0(0.00)	4(100)	4(7.8)	0.275
No	11(23.40)	36(76.60)	47(92.2)	
Needle thoracostomy				
Yes	0(0,00)	1(100)	1(2)	0.596
No	11(22.00)	39(78.00)	50(98)	

Table 4b; Distribution of pain management options provided to chest trauma patients admitted at MNH September 2019- February 2020.

Figure 1: The figure below shows the pain medication option that was provided to patients with chest injuries.

Majority of the patients 28 (55%) were given more than one type of medication. Mortality was greater 8(34.78) in the group that received single type of medication as compared to those who received more than one type of medication 3(10.71). The association was statistically significant with a p-value of 0.038.

Pain management option	**Death(%)**	**Survivor (%)**	Total(%)	P value
one option	8(34.78)	15(65.22)	23(100)	0.038
More than one option	3(10.71)	25(89.29)	28(100)	
Total	11(21.57)	40(78.43)	51(100)	

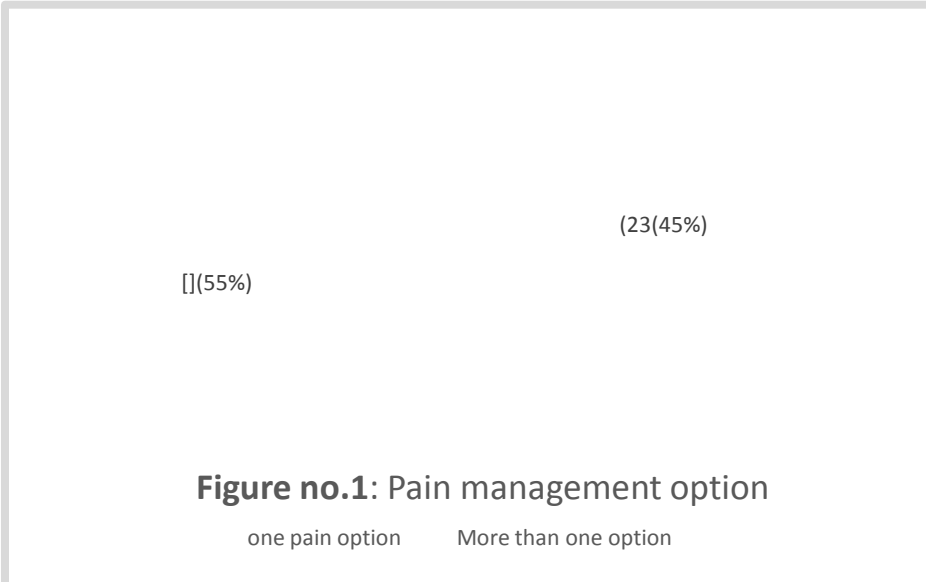


Figure no.1: Pain management option

Logistic regression analysis for pain management options

Patients who received more than one pain medication had less chance of dying by 0.22 as compared to those who received single pain medicine, with a p-value of 0.047.

	Crude		**Adjusted**	
Pain option	**OR(95% CI)**	**P-value**	**OR(95%CI)**	**P-value**
One pain option	1			
More than one option	0.22(0.05-0.98)	0.047	0.11(0.0089-1.37)	0.087

Table 5a: Factors associated with mortality

Results below show that independent variables age, sex, and type of injury did not prove to associate with mortality with p values of 0.66, 0.53 and 0.76. However, presence of associated extra thoracic injury, high ISS score > 24, high AIS thorax, delayed presentation with injury to presentation interval longer than 24 hours, severe chest injury as characterized by bilateral chest involvement and assisted ventilation had statistically significant association with mortality with P values of 0.014, 0.014, 0.009, 0.016 , 0.026 and 0.00 respectively.

It is also shown that the proportion for **mortality was 21.6%.**

Variable	**Death(%)**	**Survived(%)**	**Total**	**P-value**
Age group				
1 to 19	1(50.00)	1(50.00)	2	0.66
20 to 39	7(18.92)	30(81.08)	37	
40 to 59	3(27.27)	8(72.73)	11	
60 and above	0(0.00)	1(100)	1	
Sex				
Male	9(23.68)	29(76.32)	38	0.53
Female	2(15.38)	11(84.62)	13	

Type of chest trauma				
Blunt	10(22.22)	35(77.78)	45	0.756
Penetrating	1(16.67)	5(83.33)	6	
Associated injuries				
Present	7(15.91)	37(84.09)	44	**0.014**
Not present	4(57.14)	3(32.86)	7	
ISS range				
less than 18	1(9.09)	10(90.91)	11	**0.014**
18 to 24	1(5.56)	17(94.44)	18	
25 and above	9(40.91)	13(59.09)	22	
AIS range				
Moderate	1(14.29)	6(85.71)	7	**0.009**
Serious	4(13.33)	26(86.67)	30	
Severe	2(22.22)	7(77.78)	9	
Critical	4(80.00)	1(20.00)	5	
Dur. Injury & Presentation				
less than 24	3(10.00)	27(90.00)	30	**0.016**
24 and above	8(38.89)	13(61.90)	21	
Severity of injury				
Unilateral	4(12.12)	29(87.88)	33	**0.026**
Bilateral	7(38.89)	11(61.11)	18	
Assisted ventilation				
Non invasive	0((0)	16(100)	16	**0.00**
Invasive	9(75)	3(25)	12	
None	2(8.7)	21(91.3)	23	
Total	11(21.6)	40(78.4)	51	

Table 5b: Logistic regression between variables and mortality

The results below show that patients who had no associated injuries had 7.04 chance more likely to die compared to those who have associated injuries, and were statistically significant (OR=0.024).

The patients on the ISS >25 had 6.92 times chance of dying as compared to those below 18 but not statistically significant since the p value =0.088.

Patients who presented to hospital in >24 hours of injury are 5.5 more likely to die (OR=2.4) as compared to those who presented to hospital before 24 hours, with a statistically significant p value of 0.024.

Patients with bilateral chest injury had a 4.6 chance of dying (OR=4.6) as compared to those with unilateral injuries, with a statistically significant p value of 0.034.

The odds of patients who were intubated was 31.5 times more likely to die as compared to those who required non-invasive ventilation.

For the multivariate

Patients with associated injuries had 20 times more likely chance to die as compared to those with no associated injuries.

Chest injury patients with ISS of >25 (severe) were 25 times more likely to die as compared to those of ISS <18 (mild).

Patients with bilateral chest injuries are 2.5 times more likely to die as compared to those with unilateral injuries.

Variable	Crude OR(95% CI)	P value	Adjusted OR (95%CI)	p value
Associated injuries				
Present	1			
Not present	7.04 (1.28 – 88.6)	**0.024**	20.55(1.35 - 310)	**0.029**
ISS range				
Less than 18	1			
18 to 24	0.58(0.033-10.4)	0.718	1.83(0.059 – 56.28)	0.072
25 and above	6.92(0.75 - 64.02)	0.088	25.6(1.07 – 613.67)	**0.045**
Severity of injury				
Unilateral	1			
Bilateral	4.61(1.12 -18.92)	**0.034**	2.57 (2.82 - 23.57)	0.40
AIS range				
Moderate	1			
Serious	0.92(0.086-9.8)	0.0947	0.37(0.018-7.29)	0.5
Severe	1.71(1.22 – 23.9)	0.68	2(0.05-78.2)	0.711
Critical	24(1.14 - 505)	0.041		
Dur.injury& presentation				
Less than 24	1			
24 and above	5.53 (1.25 -24.39)	**0.024**		
Assisted ventilation				
Non invasive	1			
Invasive	31.5(4.47-221.8)	**0.001**	34.4(2.9-404)	**0.036**

CHAPTER FOUR

4.0 DISCUSSION

This prospective descriptive hospital based study involving trauma patients who were admitted at Muhimbili National hospital aimed at finding the prevalence of chest injury patients among these trauma patients, their associated risk factors (demographics, mode of injury), management pattern and the outcome of thoracic trauma patients and further looking at the relationship between prognostic factors affecting mortality. Study findings show estimate of the extent of thoracic injuries.

Logistic regression analysis between mortality and their prognostic factors help to determine the more closely related factors which impact on the outcome.

In our tertiary hospital (MNH), over the period of 6 months, out of 282 trauma patients admitted, there were 51 (18%) patients with chest injury who fulfilled the inclusion criteria of this study. This proportion is higher as compared to the global percentage (thus 10%) (29). The prevalence is also higher compared to the results found by Ingabire et al in Rwanda (4%) (31) which could be explained by advancement in modes of transportation, strict road traffic policies and advancement in preventive measures against trauma. Our results are close to those reported by Saidi et al in Kenya (16.1%)(15). The results of this study show a slight increase in the proportion of chest injuries as compared to that reported by Boniface et.al in his study that involved 3 regions (Dar-es-salaam , Morogoro and Coast , thus (4%) (4), this could be due to an increase in (RTA) and an increase in motorcycle (Bodaboda) business in this setting .

Patients in this study were males and females, but males were more affected than females. This is similar to what has been reported in most of other researches (8,16,30) . They reported thoracic trauma being predominant in males though there is also female involvement in a lesser extent. This is largely due to the fact that in most of the societies males are the ones who provide for their families hence being involved in various activities which expose them to trauma.

Most of the patients were in the middle age group, lowest proportion of thoracic injury was in the age group <15 years. This is similar to the research by Philipo et al (16) . They reported the highest incidence in the age group of 21-39 years. This was also similar to the study done by Okugbo et all and Massaga et al (8,30) .This is explained by the fact they are more mobile and often involved in long distance journeys in their work ,thus getting them more involved in risky lifestyles including speeding vehicles, violence and falls.

Among etiological conditions of chest injuries, RTA appeared to be the most dominant mode of injury among chest trauma patients, who were admitted at hospital i.e. 41 (80.4%) followed by assault 8 (15.7%) and fall from the height 2 (3.9%). RTA as one the causes of trauma has been reported in several studies to be the leading cause of chest trauma (3,8,9,16,16,29,32). Most the RTA results in polytraumatization thus increasing the risk for thoracic trauma(32,33).

Results show that assault is still a significant cause of chest injuries in our communities i.e. 8(15.7 %) patients. A study done in Nigeria on chest trauma in a regional trauma Centre in the year 2008 show that most of the chest injuries resulted from assaults,ie Gun shot and stab wounds ,(24.7% and 17.8 %) respectively and in a study done by Massaga et al revealed 16.0% of chest injuries resulted from assault (7,8).

This study has shown among the patterns of chest injuries lung contusion 17(33.3%) patients is the commonest, followed by rib fractures (15.7%) and pneumothorax (15.7%). There were few patients with hemothorax, clavicle fracture, cardiac injury, open chest wounds, ruptured diaphragm and flail chest. Results were similar to those from various other researches, with rib fracture, lung contusion and pneumothorax being the commonest patterns (8,16,26,32).

Most of the chest injury patients 27 (52.7%) required a chest tube thoracostomy and others 24(47.1%) were being managed conservatively by (observation, analgesia and antibiotics). Among these 4(7.8 %) underwent wound suturing due to open wounds and none of the patients underwent a surgical intervention (thoracotomy). There were no statistically significant association between these management type and mortality. Results were similar

to those found by Massaga et al at MNH and Phillipo et al at Bugando. Also closely similar to findings which were reported by Abdelrazag et tal in his study on pattern and management outcome of chest injuries in Sudan, where the majority of the patients were managed conservatively (58.7%) and 41.1% were successfully managed by chest tube.

In this study 23 (45%) patients were given a single type of pain medication and 28 (55%) were given more than one type of pain medication. Pain management option significantly influenced mortality with p value = 0.038. Patients who received more than one type of pain medication had less chance of dying as compared to those receiving a single type of pain medicine with an odds ratio of 0.22. Results similar to those found by Annalise et al in her review on treatment of chest trauma and their impact (34) , were using more than one option of pain medication improved the outcome of thoracic injury patients

Though in other studies there was a big role of regional anesthesia with intercostal blockade, thoracic epidurals and paravertebral blockades, in the significant reduction of pain in chest injury patients(16,29,33). 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(27)**.**Optimal pain control in chest injury patients prevents splinting of the diaphragm and atelectasis.

This study shows that 23(45.1%) did not require any assisted ventilation, 16(31.4%) required non-invasive and 12(23.5%) were ventilated invasively**.** Among those who underwent NIV, none of the patients died (0%)**.** There was a statistically significant relationship between assisted ventilation and death, p value=0.01, and the patients who were intubated had the odds of 31.5 more likely to die as compared to those who did not require assisted ventilation. Results closely similar to those of Nakamaya et al (mortality in intubated patients 21%) done at Pittsburg, Pennsylvani(35).This variable also reflects more severe injuries as measured by ISS. Mortality rate of 0% in NIV patients in this study, is similar to those reported by Chiumello et al (0%), but closely to that reported by Bolliger et al (mortality 4%) (27,36)**.** Many studies report that early use of NIV in appropriately identified patients with chest trauma and without respiratory distress may prevent intubation and Mortality(26,27). The use of NIV after development of respiratory distress was associated with the necessity for intubation in up to 18% of the patients(26).

Konstantina et al found the requirement for intubation to be 29% (33).This indicates that the early use of NIV in chest trauma patients, facilitates stabilization of the chest and promoting the recruitment of collapsed lung regions, significantly reducing mortality and the intubation rate without increasing complications. However, NIV must be integrated with other medical and surgical clinical therapies (27).

Results above show that independent variables age, sex, and type of injury did not prove to associate with mortality with p values of 0.66, 0.53 and 0.76. However, presence of associated extra thoracic injury, high ISS score > 24, high AIS thorax, delayed presentation with injury to presentation interval longer than 24 h, and severe chest injury as characterized by bilateral chest involvement had statistically significant association with mortality with P values of 0.014, 0.014, 0.009, 0.016 and 0.026 respectively. Where by further analysis of associated injuries, ISS and severity of chest trauma had greater influence on the mortality impact. This findings were similar to those reported by Eyo in Nigeria in his study on determinants of mortality in chest injury patients (29).

The mortality rate in this was 21.6% thus a bit higher as compared to that found in Bugando (4. 7%).In our study the unexpected finding was the number of patients with no associated injuries having more chance of dying.

4.1 Study limitation and Mitigation

Limited study period, hence it becomes difficult to notice outcomes after a bit longer period.

Misallocation of the patients from the emergency department, so extra efforts and time were to be used searching for the patient disposition**.**

Inability to draw sufficient conclusions as to the aetiology of the outcome (especially regarding mortality of the patients with associated injuries), our study has a significant exception to add, that is patients without associated injuries were associated with mortality comparable to patients with associated injuries

CHAPTER FIVE

5.0 CONCLUSION AND RECOMMENDATION

5.1 Conclusion

Chest injuries prevail significantly among trauma patients. RTA is still the major etiological factor in our setting. Prompt management with tube thoracostomy (when needed), adequate pain management with multimodal approach including epidural analgesia and intercostal blocks, assisted ventilation (when required) and chest physiotherapy are the most important factors that influence outcome after chest trauma patients. There is statistically significant relationship between mortality and the prognostic factors of chest injury patients.

5.2 Recommendations

1. High index of suspicion for chest injuries whenever we handle trauma patients, the accurate identification of a patient at high risk for major chest injuries is important to avoid delays that may result to significant morbidity and mortality.
2. Multimodal pain management approach should be encouraged, and initiation of regional blocks to patients with chest injury.
3. Further studies on assisted ventilation to chest injury patients in our setting.
4. As a way to primary prevention, more education to the active age group, emphasis and strict rules on Road traffic rules, special trainings for motorcycle (Bodaboda) drivers to reduce the RTA.
5. Researches on studying the magnitude of chest injuries, should include patients from the area of the scene since patients with critical chest injuries might be dying at the area of the scene and before reaching to hospital.

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APPENDICES

Appendix 1: Research Questionnaire

MANAGEMENT AND IMMEDIATE OUTCOME OF CHEST INJURIES AMONG TRAUMA PATIENT ADMITTED AT MUHIMBILI NATIONAL HOSPITAL IN DAR ES SALAAM, TANZANIA from September 2019 to February 2020

a) SERIAL NO ……

b) Admitted ward ……...

c) Admitted date ……

d)Phone number …….

Part 1: social-demographic characteristics

1) General information

a. Patients file number ……

b. Gender

i) Male ii) Female

c.Age / date of birth ……

d.level of education i) Primary school
ii) Secondary school
iii) Higher levels
iv)Non formal education

e. Marital status; i) Single
ii) Married
iii)Divorced
iv) Widowed

e. occupation ……

f. Place of residence ……i) DSM
ii) Others

Part 2: screening for chest injury and mode of injury among trauma patients

2) Have you ever experienced any kind of injury in the last 31 days?

a) Yes i) within 7 days

ii)>7 days

b) No

3) What time did you get injured?

Date …….. Time …….

4) What time and date did you arrive at hospital?.....

5) What was the mechanism of injury? i)blunt ii) Penetrating

6) What mode of injury did you experience?

a. Road traffic accidents

b. Fall from a height

c. assault

d. compression by heavy objects

e. Others

7) Where did you get the injury?

a) At work

b) At home

c) Along the road

If c is the answer proceed to question 8, otherwise go to question 10

8) How did it happen?

a) As a pedestrian

b) As passenger in a car- (front seat or backward seat)

c) As passenger in motorcycle

d) As a driver in a car

e) As motorcyclist

f) As a cyclist

9) If b/c are the answer did you were a seatbelt?

10) Which parts of the body are injured?

a) Head and Neck i) Yes ii) No

b) Chest i) Yes ii) No

c) Upper limbs i) Yes ii) No

d) Abdominal visceral i) Yes ii) No

e) Pelvis i) Yes ii) No

f) Lower limbs i) Yes ii) No

g) Spine i) Yes ii) No

h) Soft tissue injury i) Yes ii) No

11) Do you have any chest pain or difficult in breathing

i)Yes

ii)No

12) Do you have any preexisting comorbid conditions

Yes-specify; Cardiac disease

Respiratory disease

Cancer

Neurological disease

If b in qn. 10 above is the answer (yes), then proceed to qn .13 otherwise end here.

13)What is the ISS and AISthorax of the patient……

Part 3: Assessment of management pattern of chest injuries

14) Clinical type of chest injury

a) Pneumothorax (1=Bilateral, 2=right=left) i)Yes ii)No

b)Hemothorax (1=bilateral,2=right,3=left) i)Yes ii)No

c)Pneumohemothorax(1=bilateral,2=right,3=left) i)Yes ii)No

d) Rib fractures (no) (1=bilateral,2=right,3=left) i)Yes ii)No

e) Clavicle fractures (1=bilateral,2=right,3=left) i)Yes ii)No

f) Lung contusion (1=bilateral,2=right,3=left) i)Yes ii)No

g) Sucking wound(1=bilateral,2=right,3=left) i)Yes ii)No

h) Ruptured diaphragm (1=bilateral,2=right,3=left) i)Yes ii)No

i) Thoracic duct injury (1=bilateral,2=right,3=left) i)Yes ii)No

j) Major vascular injury i)Yes ii)No

k) Cardiac injury i)Yes ii)No

l) Tracheal bronchial injury i)Yes ii)No

m)Perforated oesophagusi)Yes ii)No

n)Sternal injury i)Yes ii)No

o)Chest wall contusion i)Yes ii)No

16) Treatment given

a) Conservativei)Yes ii)No

b)Tube thoracostomyi)Yes ii)No

c) Wounddebribement/sutured i)Yes ii)No

d)Thoracotomy i)Yes ii)No

e)Laparatomyi)Yes ii)No

f)Needle thoracostomyi)Yes ii)No

g)Pain management option . I) Opioid

II) NSAID

III) PCM

IV) L.A

V) Others

h) Any other non-thoracic surgical procedure done.specify ……..

17) Need for assisted ventilation

a) Noninvasivei) Yes ii) No

b) Invasivei) Yes (no of days intubated) ii) No

……

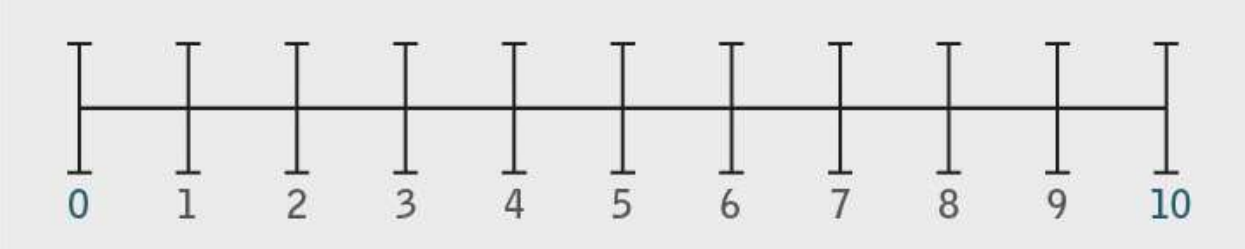
c) Nonei) Yes ii) No

Data Collection Tool (Checklist)

Management and immediate outcome of chest injury among trauma patients at MNH

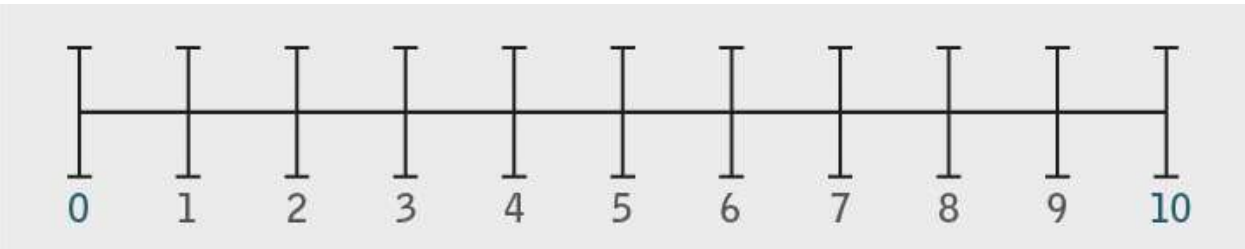
1) Physical examination findings at first encounter (to be completed by clinician)

1)GCS/AVPU		
2)Blood Pressure /MAP		
3)Respiratory rate		
4)SPo2		
5)Heart rate		
6)Local examination finding		
Dyspnoeic		
Deformed chest		
Breathing Pattern (shallow/deep)		
Cough ability		
Tenderness		
Reduced breath sounds		
Ascultation finding		
7)AIS_{thorax}		
8) ISS		
9)Pain score		



2)During reassessment of the patient (at 24 hrs, 36 hrs and at day 7)

PARAMETER	AT 24 HRS	AT 36 HRS	AT DAY 7
R.R			
SPO2			
BP			
HR			
CONTROL CXR/USS			
PAIN SCORE			
BREATHING Pattern (Shallow/Deep)			



Part 4; Outcome after management

a)Recovery	
b)complication	
-Atelectasis	
-Pneumonia	
-Residual hemothorax/pneumothorax	
-ARDS	
-Sepsis	
-MOF	
-Empyema	
c)Death	
d)Length of ICU stay	
e)LOHS/Discharged date	

Scales for injury severity

For ISS- <18- Moderate injury

18-24 Severe injury

>25 Very Severe injury

For AIS thorax- 1 - Mild

2 -Moderate

3-Serious

4-Severe

5-Critical

Appendix 2: Informed Consent – English Version

You are invited to participate in a study on trauma patients with chest injuries. We are studying the prevalence, associated factors, immediate outcome and factors associated with mortality, among trauma patients who will be admitted at Muhimbili National Hospital. Participation is strictly voluntary and unwillingness to participate in this study will not affect your treatment in one way or another. If you are willing to participate, you need to sign this form indicating your willingness. You may withdraw from the study at any time and such a decision will be respected, and will not affect your treatment.

Participants will undergo an interview for history taking, a physical examination, CXR/chest USS/ Chest CT scan, and blood test/abgs. Other investigations will depend on the condition of the patients. The blood test may involve some pain at the time of drawing the blood sample but overall, there is no physical harm expected from participation. To minimize risk of microbial infections, the needle site will be sterilized. When the results of the research are published or discussed in conferences or used in any form, no information will be included that would reveal your identity.

Participants will benefit from this study by knowing their healthy status if they have any chest injuries, they will receive treatment according to recommended guidelines.

In case of any questions regarding this study, please contact:

Dr. Janeth Masuma(principal Investigator)

Muhimbili University of health and allied sciences,

Dept of Anaesthesiology

P. O. Box 65001, Dar-es-salaam.

Tel: +255-755890328

Dr .Respicious Boniface (Study Supervisor)

School of Medicine,

Muhimbili University of Health and Allied Sciences,

P.O. Box 65013, Dar Es Salaam.

Mobile: +255 55-890328.

Or

Dr. Edwin Lugazia (Study Co-Supervisor)

Muhimbili Orthopaedic Institute,

P.O. Box, Dar Es Salaam.

Also, if you will have questions about your rights as a participant, you may call **DR Bruno Sunguya**, the Director of Research and Publications.

P.O. Box 65001, Dar Es Salaam.

Participant

I _____, I have understood the above information. I understand that my participation is voluntary and that I am free to withdraw at any time, without giving any reason, without my medical care or legal rights being affected.

_____

Signature of Patient / Next of Kin_____Date

Appendix 3: Informed Consent – Kiswahili Version

Unaalikwa kushiriki katika utafiti juu ya wagonjwa wa ajali na majeraha ya kifua. Tunajifunza uenezi, mambo yanayohusishwa na matokeo ya haraka kati ya wagonjwa wa shida ambao wataidhinishwa katika Hospitali ya Taifa ya Muhimbili. Kushiriki ni kwa hiari na kutamani kushiriki katika utafiti huu hautaathiri matibabu yako kwa njia moja au nyingine. Ikiwa una nia ya kushiriki, unahitaji kusaini fomu hii inayoonyesha nia yako. Unaweza kuondoka kwenye utafiti wakati wowote na uamuzi huo utaheshimiwa, na hautaathiri matibabu yako.

Washiriki watahusika na mahojiano ya historia ya kuchukua, uchunguzi wa kimwili,Kipigo cha Ray-Ray / kifua kikuu cha sulufu / kifua ct, na uchunguzi wa damu / uchambuzi wa damu. Uchunguzi mwingine utategemea hali ya wagonjwa. Jaribio la damu linaweza kuhusisha maumivu wakati wa kutoa sampuli ya damu lakini kwa ujumla, hakuna madhara ya kimwili yanayotarajiwa kutoka kwa ushiriki. Kupunguza hatari ya maambukizi ya microbial, sehem itayochomwa sindano itasafishwa. Wakati matokeo ya utafiti yanapochapishwa au kujadiliwa katika mikutano au kutumika kwa namna yoyote, hakuna maelezo yatakayojumuishwa ambayo yatafunua utambulisho wako.

Washiriki watafaidika kutokana na utafiti huu kwa kujua hali yao nzuri ikiwa wana majeraha ya kifua, watapokea matibabu kulingana na miongozo iliyopendekezwa.

Ikiwa kuna maswali yoyote kuhusu utafiti huu, tafadhali wasiliana na:

Dr. Janeth Masuma (mtafiti mkuu)

Chuo Kikuu cha Muhimbili cha afya na sayansi shirikishi,

Idara ya usingizi na huduma muhimu,

S.L.P 65001, Dar-es-salaam.

Tel: +255-755-890328.

Dr Respicious Boniface (Msimamizi wa Utafiti)

Muhimbili Orthopaedic Institute

P.O. Box 65013, Dar Es Salaam.

Mobile: +255 754 270 840

Au

Dr. Edwin Lugazia (Study Co-Supervisor)

Shule ya Matibabu,

Chuo Kikuu cha Muhimbili cha Afya na Sciences Allied,

P.O. Box 65000, Dar Es Salaam.

Mobile: +255 784 283 900

Pia, ikiwa utakuwa na maswali kuhusu haki zako kama mshiriki, unaweza kupiga simu kwa **DR. Bruno Sunguya**, the Director of Research and Publications.

P.O. Box 65001, Dar Es Salaam.

Mshiriki

Mimi _____, Nimeelewa maelezo hapo juu.Ninaelewa kuwa ushiriki wangu ni wa hiari na kwamba mimi ni huru kujiondoa wakati wowote, bila kutoa sababu yoyote, bila ya huduma yangu ya matibabu au haki za kisheria zinaathiriwa.

Sahihi ya mgonjwa / Ndugu karibu wa mgonjwa

_____tarehe

Appendix 3: Ethical Clearance

MUHIMBILI UNIVERSITY OF HEALTH AND ALLIED SCIENCES
OFFICE OF THE DIRECTOR OF POSTGRADUATE STUDIES

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Ref. No. DA.287/298/01A/

12th July, 2019

Dr. Janeth S. Masuma
MMed. Anaesthesthiology
MUHAS

RE: APPROVAL OF ETHICAL CLEARANCE FOR A STUDY TITLED: "MANAGEMENT AND IMMEDIATE OUTCOME OF CHEST INJURY PATIENTES AT MUHIMBILI NATIONAL HOSPITAL 2019"

Reference is made to the above heading.

I am pleased to inform you that, the Chairman has, on behalf of the Senate, approved ethical clearance for the above-mentioned study. Hence you may proceed with the planned study.

The ethical clearance is valid for one year only, from **10th July, 2019 to 9th July, 2020.** In case you do not complete data analysis and dissertation report writing by **9th July, 2020,** you will have to apply for renewal of ethical clearance prior to the expiry date.

Dr. Emmanuel Balandya
ACTING: DIRECTOR OF POSTGRADUATE STUDIES

cc: Director of Research and Publications
cc: Dean, School of Medicine, MUHAS