THE PATTERN OF CHEST TRAUMA AND COMPLICATIONS OF CLOSED TUBE THORACOSTOMY AT MUHIMBILI NATIONAL HOSPITAL DAR ES SALAAM.

By

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CERTIFICATION

The undersigned certify that he has read and hereby recommend for acceptance by the Muhimbili University of health and Allied Sciences a dissertation entitled, **The pattern of chest trauma and complications of closed tube thoracostomy at Muhimbili National Hospital**, in partial fulfillment of the requirement for the degree of Masters of Medicine in General Surgery.

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Dr.Mabula Mchembe (Supervisor)

Date.....30/October/2009

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DEDICATION

To my children: Vestina, Ingrid and Allan.

ABSTRACT

Background: Chest trauma is a life threatening condition because it involves vital organs. It is a significant cause of morbidity and mortality worldwide especially among productive members of the society. However, majority of patients are treated conservatively with close observation and closed tube thoracostomy. Tube thoracostomy sometimes is associated with significant number of complications. Thus, prompt recognition and early intervention would save the majority of patients from untoward complications and death.

Setting: Muhimbili National and Teaching Hospital Dares salaam –Tanzania.

Objective: To evaluate the pattern of chest injuries and the complications of closed tube thoracostomy.

Patient and Methods: This was a prospective study of all patients admitted with chest trauma in the surgical wards between November 2007 and September 2008.

Results: One hundred and nineteen patients were studied. Their ages ranged from 12years and 72 years with the mode of 32years. There were 95 males and 24 females giving a male to female ratio (M: F) of 6.7:1. The commonest age groups were 10-29 and 30 - 49yrs. Motor traffic injury (MTI) was the commonest cause of chest injury accounting for 72.3% of the cases. Majorities were passengers and pedestrians (63%). Majority of the elderly people were involved in MTI, especially the females. Blunt chest injury occurred in 90 (75.6%) cases while penetrating injury was encountered in 29 (24.4%) patients. Rib fractures were the most common clinical type of injuries and accounted for about 42.9% of cases. Other injuries encountered were pneumohemothorax in 39(32.85%) cases, hemothorax and lung contusion in 25(21%) cases each. Rare but severe injuries such as cardiac contusion, esophageal perforation and diaphragmatic rupture were encountered in about 5.9% of cases. Seventy-three (61.3%) patients had other associated injuries. Fractures of the extremities and head injuries were the most common associated injuries encountered in 30(25.2%) and 26(21.8%) patients respectively. Sixty-seven (56.3%) patients were treated with closed tube thoracostomy only, 5(4.2%) patients had thoracotomy and one patient had laparotomy.

The overall complication rate of the tube thoracostomy was 32.9% of which infective and malfunctional tubes were the commonest seen in 11(15.1%) and 10(13.7%) respectively. Infection was treated with antibiotics only except one case that required thoracotomy. Most of malpositioned tubes clinically were functional however tube adjustment was done where was necessary. The average duration of tube stay was 4days (range 1- 32days) while the average hospital stay was 9days (range 1- 131days). A mortality rate of 24.4% was recorded.

Conclusion: Chest trauma is a common problem of public health importance to be addressed. It affects mainly the young active members of the society. Passengers and pedestrians often suffer this injury following blunt motor traffic injury. The clinical pattern of chest trauma remained similar with other studies of which closed tube thoracostomy been the treatment of choice in most cases. The complications associated with the chest tubes were unacceptably very high in this study. This study also has shown a high mortality rate which was mainly due to the associated injuries.

Recommendations:

1. Further research on the causes of chest injury to establish the reasons why MTI is the commonest cause and hence to establish the preventive measures on this preventable cause.
2. Young school age group and productive members of the society are affected mostly; there is a need of doing a big research on this age group to establish the reasons. This will help to establish and give the necessary information on the preventive measures on this risk age group.
3. Clinical types of chest injury are similar in most series, management protocol or guideline is suggested to have better and early intervention of which closed tube thoracostomy is the main stay.
4. Closed tube thoracostomy is simple but yet is associated with many complications; there is a need for further research on this to establish why it is so. Patient, Doctors and facilities related factors should be looked upon.
5. All this will help to establish primary preventive measures as it is known that prevention is better than cure.

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ACRONYMS

1. MNH - Muhimbili National Hospital
2. MOI - Muhimbili Orthopedic Institute
3. MUHAS - Muhimbili University of Health and Allied Sciences
4. MT I - Motor Traffic Injuries
5. RTA - Road Traffic Accidents
6. DSM - Dar es salaam
7. ABCD - Airway, Breathing, Circulation, Disability
8. ATLS - Advanced Trauma Life Support
9. UWSD - Under Water Seal Drainage
10. BTLS - Basic Trauma Life Support
11. MCL - Midclavicular line
12. ICS - Intercostal space
13. ETT - Endotracheal tube
14. IPPV - Intermittent Positive Pressure Ventilation
15. PPV - Positive Pressure Ventilation
16. EMST - Early Management of Severe Trauma
17. CXR - Chest X-ray
18. CT - Computed Tomography
19. NJOT - Nigerian Journal of Orthopedic and Trauma.
20. MAST - Military Antishock Trousers
21. CVP - Central Venous Pressure
22. ECHO - Echo-cardiogram
23. MRI - Magnetic Resonance Imaging

CHAPTER 1: INTRODUCTION

1.1. HISTORICAL BACKGROUND:

Thoracic trauma has been an integral component of medicine, providing the foundation of the pathophysiology of the chest for more than 5,000 years. The Smith Papyrus, 3000 BC, contains reports of three chest injuries; two large penetrating wounds treated with wound covering of fresh meat, grease or honey, and rib fractures for which no treatment was advised. Homer described a variety of chest wounds sustained during the siege of Troy in 950 BC, including one death from penetrating cardiac injury [1].

Theodora espoused the advantage of primary closure of chest wall wounds in 1267 [2]. In 1346 firearms were first used in the battle of Crecy[3].

Since that time gunshot wounds to the chest have continued to grow in medical importance both during war and in civilian life. In the Crimean war, it was estimated that 6-8% of all wounds were blunt and penetrating chest wounds, with a mortality rate of 79%. In the American civil war, the incidence was 80% of all wounds, with a 63% mortality rate. In World War I, chest wounds accounted for approximately 2.5% with a 25% mortality rate. In the World War II, the incidence of chest wounds was about 8%, with only 12% mortality rate. This drop in mortality rate during World War II was attributed by the understanding of the physiologic principle of immediate closure of chest wounds, and major advances in the immediate therapy of the wounded. The placement of thoracic surgeons in military field hospitals also contributed to this improvement in survival[3]. The mortality rate from penetrating thoracic wounds in Vietnam War was estimated to be as low as 2%. Statistics from many developing countries ascertain to the changes that most of chest injuries arise from MTA as opposed to falling from height seen in the past [4].

1.2. ANATOMY OF THE THORAX

Chest Wall:

Anatomy and physiology of the chest wall are completely intertwined. The musculoskeletal structure of the chest wall has evolved as a mobile but firm encasement of the lungs and thoracic viscera, which provides for functional utility while affording some protection for vital organs. Certain muscles of the upper extremities and trunk assist the chest wall in performing its physiologic functions under usual circumstances[5]

The chest wall integrity is mandatory for adequate ventilation, and this is achieved by the bony part which includes ribs, sternum, clavicles and the thoracic vertebrae. The muscular part includes the diaphragm, intercostal muscles and the accessory muscles of respiration. Blood supply originates from the subclavian artery and the aorta itself. The intercostal arteries which run under each rib supply the posterior and lateral aspect of the chest wall. The internal thoracic artery and anterior intercostal arteries combine to provide arterial supply to the anterior portion of chest wall. The internal thoracic and the highest two intercostals arise from the subclavian artery while the lower ten intercostal arteries arise from the descending thoracic aorta. Distally the internal thoracic artery bifurcates into two major branches, superior epigastric and musculophrenic arteries. Other small branches include the perforators and the pericardiophrenic arteries.[5]

The venous drainage of the chest wall consist of numerous intercostal veins which course with intercostal arteries and nerves. These veins drain to the hemiazygous and azygous systems, depending on their anatomic position. The intercostal nerves provide primary motor and sensory innervations of the entire chest wall. They arise from the spinal cord within the spinal canal, exit through the intervetebral foramina and course anteriorly underneath the inferior margin of each rib. The sympathetic trunk conveys sympathetic fibers to the nerves just after their exit from the spinal canal of the first six intercostal nerves[5]

Superior and inferior thoracic apertures:

The superior thoracic aperture is made by the first rib, manubrium stern and first thoracic vertebrae. The main muscles of this region are stenocleidomastoid and scalene which are inserted on the first rib and clavicle.

The major vessels to the head and upper extremities as well as to the trachea and esophagus exit the thorax through the superior thoracic aperture. The subclavian vein is the most anterior vascular structure and lies directly behind the clavicle. The axillary vein becomes subclavian vein soon as it transverses the angle of first rib and clavicle. The subclavian vein combines with the internal jugular vein to form the brachiocephalic vein. The confluence of the two brachiocephalic veins creates the superior venacava. Three great arteries exit the chest through the superior thoracic aperture; these are innominate artery (Brachiocephalic artery) which gives rise to the right carotid artery and right subclavian artery. Secondly is the left carotid and left subclavian arteries which are branches of the aortic arch. The brachial plexus though not a true thoracic structure, lies in proximity to the apex of the pleura posteriorly near the first rib.

The inferior thoracic aperture lies at the boundary between the chest and the abdomen. The diaphragm is the major muscle of respiration and separates the peritoneal cavity from the pleural and pericardial cavities. There are three true foramina in the diaphragm; the caval foramina which contains inferior vena cava, the esophageal hiatus where esophagus and two vagus nerves pass through. The third foramen is the aortic hiatus which conducts the aorta, the thoracic duct, and azygous vein. Another potential opening exist between the sternal and costal portions of the muscular diaphragm; foramen of morgagni which carry the distal internal thoracic artery and vein to become the superior epigastric artery and vein respectively. The phrenic nerves terminate in the diaphragm without a true opening.[5]

Contents of thoracic cavity:

Basically the content includes the lungs encased in the two pleura and the mediastinum. In the mediastinum we have the thymus, parathyroid glands, lymph nodes, neurogenic and vascular structures, thoracic duct, trachea, esophagus and the heart.[4, 5]

1.3. MANAGEMENT OF CHEST TRAUMA:

1.3.1. RESUCITATION:

On the arrival at the hospital evaluation and resuscitation of all traumatized victims is done in a consistent systematic manner outlined by ATLS protocols[8]. This is done at the emergency department or at the trauma centre causality. First secure the airway, breathing and circulation (ABC's) before attention is directed towards individual organ system injuries. Throughout the evaluation and resuscitation a cervical spine injury must always be assumed to be present until proven otherwise by radiography. The neck must be immobilized with a cervical collar.
The ABC's are followed by a rapid primary survey of the patient, to identify the life and limb-threatening injuries. Following this survey the initial resuscitation phase is begun. Intravenous access, resuscitation with two large bore intravenous lines is obtained, fluid resuscitation is started and blood is drawn for typing and cross-matching. A central venous catheter is placed to monitor central venous pressure. Simultaneous therapy of life and limb-threatening injuries is initiated.[4]

As the resuscitation proceeds, secondary survey of the patient is conducted, history and in-depth, physical examination and analysis of some of the investigations like radiographs, electrocardiograms and other lab data is done. The specific focus of the thoracic surgeon is the recognition and treatment of immediately life threatening chest injuries, such as airway obstruction, tension pneumothorax, open massive hemothorax, flail chest and cardiac tamponade. As the patient, evaluation progresses, the thoracic surgeon must then focus on potentially life threatening injuries, such as pulmonary contusion, aortic disruption, tracheobronchial disruption, diaphragmatic rupture and myocardial contusion[8] The first priority of ABC's is to secure the airway. If the patient is struggling for air apnea tachypneic, stridorous, with evidence of laryngeal trauma or an expanding neck hematoma, prompt tracheal intubations is indicated. Other indications for tracheal intubations include hypoxemia, significant head injury, shock and loss of thoracic bellows mechanisms[9]. In the patient with depressed level of consciousness the upper airway may be acutely obstructed by the tongue, teeth, vomitus, or debris.

In the patient with trauma to the upper chest and neck, delayed upper airway obstruction secondary to injury to the larynx must be suspected. Laryngeal injury may produce submucousal hemorrhage leakage and swelling, which may later produce upper airway obstruction. The Initial maneuver to secure the airway is the "Jaw lift". This maneuver brings the mandible anteriorly lifting the tongue, and thereby augments the upper airways. The teeth, vomitus and foreign material may then be cleaned.[4]

Endotracheal intubation should be performed immediately if the jaw lift does not secure the airway. It may be nasotracheal or oraltracheal intubation depending on the surgeon's experience, extent of facial injury and suspicions of cervical spine injury. Nasotracheal intubation is indicated in patient who can breathe spontaneously. But in the patient without spontaneous breathing oraltracheal intubation is the choice, 7.5-8.0mm tube with or without muscle relaxant. If endotracheal intubation cannot be achieved, airway must be secured surgically, in such emergency circumstances cricothyroidotomy or tracheostomy can be performed quickly and easily. This is particularly indicated in patients with significant maxillofacial injury with suspicion of cervical spine injury.[4]

1.3.2. HISTORY

While the airway is being secured and life threatening injuries treated, information about the patient should be obtained directly from the patient, from the family or another member who transported the patient. In seriously injured patient this information is commonly relayed by paramedics transporting the patient to hospital. Early in the patients initial evaluation valuable time should not be lost in extensive discussion but the surgeon should make an attempt to learn the patient's significant medical history including allergy, current medications such as B-blockers, diuretics, insulin and antihypertensive which may have significant impact on the patient's response to both injury and resuscitation. History of Ischemic heart disease, Hypertension, and Diabetes mellitus should be requested. History of events surrounding the traumatic injury may be obtained from police or paramedics involved in pre hospital transportation.[4]

Knowledge of the mechanism of injury allows the surgeon to infer the likelihood of specific injury. In motor traffic accident, speed, direction of impact, whether patient was restrained and condition of the car is important. Deceleration injuries suggest the possibility of thoracic aortic transection. A bent steering wheel suggests cardiac contusion or rupture. Crushing chest injuries suggest possible traumatic asphyxiation or cardiac or pulmonary contusion. In case of penetrating thoracic trauma, specific knowledge of the weapon is valuable. Size of the knife allows estimating the extent of internal injury. Caliber of the gun and proximity of assailant allow a better estimate of the injury produced by thoracic gunshot wounds. [4]

1.3.3. PHYSICAL EXAMINATION

Physical examination should begin with **inspection** of the head, neck and chest. The head and neck should be inspected for evidence of maxillofacial trauma, including subtle evidence of injury to the larynx or cervical trachea. Trachea should be in midline, deviation may indicate tension pneumothorax or massive hemothorax. Distended neck veins indicate impaired venous return; suspect pericardial tamponade or tension pneumothorax. Plethora of head and neck, subconjuctival hemorrhage indicates traumatic asphyxia, a syndrome of capillary and venous bleeding. The chest should be inspected anteriorly and posteriorly for wounds, such as sucking wounds. [4] On **palpation** look for swelling or subcutaneous emphysema to exclude laryngeal or air way injury. Chest should be inspected for symmetrical expansion of hemithoraces; asymmetry may indicate improper endotracheal tube position or failure of lung expansion secondary to pneumothorax, hemothorax, or intra-abdominal herniation through diaphragmatic rupture. A segment of the chest moving paradoxically represents flail chest. Look for crepitance of ribs, sternum and clavicles fractures; as well as for tenderness and deformity. **Percusion-** Hyper-resonance indicates pneumothorax; this will help to distinguish tension pneumothorax from pericardial/cardiac tamponade in patient with distended neck vein. Dull percussion note indicates hemothorax or herniated intrabdominal content through a ruptured diaphragm. **Auscultation-** Absent or decreased breath sounds may indicate malpositioned endotracheal tube, hemothorax, pneumothorax or diaphragmatic rupture. Distant heart sounds indicate pericardial tamponade when combined with hypotension and distended neck veins.[4]

1.3.4. CHEST IMAGING- EVALUATION:

Chest radiography is one of the diagnostic modality by which potentially life-threatening injuries are usually discovered. It should preferably be taken after nasogastric or oralgastric tube placement because the radiodense tube serves as an excellent marker of mediastinal position. For penetrating injuries a radiogenic marker should be taped to the skin over entrance and exit wounds. Standard portable chest radiograph is taken from a distance of 36 inches from the patient chest during inspiration.

The following points should be determined from the chest x-ray

1. Correct position of endotracheal tube/ chest tube
2. Pneumothorax: no lung marking (Radiolucent)
3. Tension Pneumothorax: Lucent hemithorax, depressed diaphragm, trachea and mediastinal shift contra laterally
4. Hemothorax: opacification of hemithorax
5. Pulmonary contusion: diffuse density, may be absent in first film.
6. Mediastinal emphysema: Trancheo bronchial disruption.
7. Intra-abdominal content herniated to the chest in diaphragmatic rupture. Gas filled loop in the chest, stomach NGT can be seen, elevated hemidiaphragm
8. Fractures
9. Bullets/Pellets
10. Widening of mediastinum (poster lateral) suggestive of aortic disruption, if is more than 8cm it indicates more of aortic transection

Other investigations which can be done to confirm the diagnosis and the associated injuries include CT scan, MRI, ECHO, cardiac enzymes and chest collection fluid analysis.

1.3.5. TREATMENT.

1.3.5.1. IMMEDIATE LIFE-THREATENING INJURIES

TENSION PNEUMOTHORAX

If a one way valve exists through the lung, airway or chest wall, atmospheric air entering the pleural space cannot escape. Not only does the lung collapse, but the pressure within the pleural space continues to rise as air accumulates with increased pressure within the hemithorax, causes venous return to the heart to fall. The mediastinum shifts contralaterally distorting the trachea and venacava. The distortion of venacava further decreases venous return to the heart, compromising cardiac output. Tension pneumothorax should be suspected in patients with respiratory distress, hypotension, distended neck veins, and trachea deviation away from the hemithorax with no breath sounds and hyperesonance on percussion.

The immediate life-saving therapy is to decompress the hemothorax by placement of needle into the involved chest in the second intercostal space midclavicular line. This converts the tension pneumothorax into an open pneumothorax usually providing immediate improvement. Definitive therapy may then be performed by closed tube thoracostomy.[10]

OPEN PNEUMOTHORAX

An open pneumothorax or sucking chest wound must be immediately recognized and treated. An open pneumothorax results from large penetrating defect in the chest wall that allows an equillbrization of the intrapleural pressure and atmospheric pressure. As the patient inhales, the inspired air travels down the path of least resistance, therefore if the diameter of the chest wall defect is greater than two-third of diameter of trachea, most of the patients tidal volume transverses the chest wall, resulting in severe respiratory distress.[11] It may result in to and fro shifting of the mediastinum with the patient exaggerated respiratory effort, distorting the venacava and compromising various returns to the heat. Recognition is easier, and the treatment is by tapping a rubber glove over the defeat with the tip of one finger cut off. Alternatively a plastic drape may be taped on three sides over the defect. In either case, a one way valve is created that (i.e. Heimlich valve) allows air to exit the chest cavity but not to enter. A thoracostomy tube may then be placed under more controlled conditions and the chest wall repaired.[4]

If this tamponade is released by tube thoracostomy placement, the bleeding may actually increased significantly. The surgeon should wait to place the chest tube until ready to transfuse the patient rapidly. If the hemodynamic condition worsens as blood exists through the chest tube, the tube should be clamped in an effort to try to tamponade the bleeding. This situation is associated with very high mortality rate and may require emergency thoracotomy especially when immediate blood drained through chest tube is more than 2000mls[12, 17, and 18.]

CARDIOGENIC SHOCK

Cardiogenic shock must be immediately recognized. The distinction from hemorrhagic shock may be difficult. The patient with cardiogenic shock has a high central venous pressure, despite of hypotension. This is evidenced by distended neck vein on physical examination. Direct measurement of central venous pressure is extremely valuable in distinguishing cardiogenic shock (CVP>15mmHg) from hypovolemic shock (CVP<5mmHg). If cardiogenic shock is present, pericardial tamponade is suggested by distant heart sounds on auscultation. Pulsus paradoxus is another valuable physical finding in tamponade, defined as 10mmHg drop in systolic BP during inspiration. It is caused by shifting of the intraventicular septum toward the left resulting in decreased in left ventricle stroke volume; it is extremely difficult to recognize pulsus paradoxus without intra-arterial catheter. The diagnosis of pericardial tamponade may be made by use ECHO – cardiography. Pericardiocentesis may be both diagnostic and therapeutic. If the shock is refractory to volume administration, an immediate left anterolateral thoracotomy should be performed. Open cardiac massage is more effective than closed-chest compression and aortic cross-clamping may effectively increase coronary and cerebral perfusion.[10, 19, and 20.]

AIRWAY OBSTRUCTION

In most cases this is due to foreign body or secretions. Occasionally it may occur in severe maxillofacial trauma or fracture of the larynx. Treatment includes removal of foreign bodies, suction out of secretions, and establishment of the airways with an endotracheal tube if necessary. Tracheostomy or cricothyroidoctomy may be indicated when endotracheal or nasotracheal intubation is unsuccessful.[10]

FLAIL CHEST

A flail chest is created when multiple segmental ribs fractures separates a segment of the chest wall from continuity with the reminder of the chest, the flail segment moves paradoxically with respiration and dissipates the subatmospheric pressure normally generated with inspiration. In an effort to compensate, the patient must exert tremendous effort to generate enough negative intrapleural pressure to inhale. The force required to create-flail segment usually causes significant pulmonary contusion of the underlying lung, which further compromises oxygenation. Combined with the pain produced by trying to breathe effectively, this injury may produce severe respiratory distress, frequently associated with both hypoxemia and hypercarbia. This injury is recognized on initial physical examination of the patient in distress as a chest wall deformity which moves paradoxically with respiration. On palpation it is associated with chest wall crepitance, pain and deformity.

Immediate therapy is determined by the degree of distress, the patient should be intubated and mechanically ventilated if hypoxemic or hypercarbic, but prolonged ventilatory support is not required if the chest wall can be stabilized and pain controlled. Surgical stabilization is rarely indicated i.e. open reduction of rib fracture or osteofixation. The standard method of treatment is to intubate and stabilize the flail segments with positive pressure ventilation, which has to be done for at least one week. This is called an internal pneumatic fixation. Physiologic stabilization with intubation and IPPV to be initiated before hypoxia develops. IPPV produces satisfactory ventilation and helps the fractured ribs to unite in the position of inspiration, thereby reducing the deformity and improving the pulmonary function[13, 14, 15, and 16.]

MASSIVE HAEMOTHORAX

The chest trauma patient in shock should be suspected of having a massive hemothorax. This may be suspected on physical examination by diminished or absent breath sound and dullness to percussion but it is confirmed by chest radiography. This injury usually results from exsanguinating hemorrhage into the chest cavity from either penetrating or blunt injury of aorta, its branches, or major pulmonary vessels. In massive hemothorax the pressure developed within the chest cavity may partially tamponade the bleeding vessel.

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AIR EMBOLISM

This is not an uncommon injury following penetrating trauma of the chest. The pathophysiology of air embolism is the fistula formation between a bronchus and pulmonary vein. Its diagnosis is difficult in most cases, but it should be suspected in case of the following situations.

One, patient presented with penetrating chest trauma with focal neurological deficit without head injury. Two, any patient who after endotracheal intubation and first few breaths or positive pressure ventilation has cardiovascular collapse. Three, when the initial blood drawn, froth is obtained.[4]. Treatment is mainly supportive.

1.3.5.2. RELATIVE LIFE-THREATENING INJURIES

RUPTURED TRACHEOBRONCHIAL TREE:

Diagnosis is made in patients with respiratory distress, obvious subcutaneous emphysema, who has hemoptysis at the initial examination. The degree of airway obstruction varies depending on the nature of disruption of tracheobronchial tree. The presence of a tension pneumothorax varies, majority will have some degree of pneumothorax, and all will have mediastinal emphysema on chest-x-ray films. Treatment consists of trying to establish the airway by passing an endotracheal tube beyond the region of tear; chest tube is inserted to alleviate the pneumothorax. Thoracotomy is usually indicated to control the tear[21, 22, 23, and 24.]

PULMONARY CONTUSION

Usually associated with rib fractures and represents nothing more than a bruise of the lung. It can be mild, moderate or severe. Diagnosis is from the clinical finding - distress and chest-x-ray cotton wool appearance is suggestive. Treatment regimens are controversial and include the use of diuretics, salt poor albumin, steroids, or some combination of these. However none of them improves pulmonary function. The recommended management of pulmonary contusion consists of oxygen therapy.[2, 5].

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RUPTURED DIAPHRAGM

May be quite difficult to diagnose and the clinician must maintain a high index of suspicion. It is most often to the left side when secondary to blunt trauma, although it can occur in either hemidiaphragm when penetrating trauma is the cause. Although diaphragmatic rupture can be repaired easily from above or below the diaphragm, abdominal approach is preferred in the majority of cases.[10, 25, and 26.] The surgeon can inspect other associated abdominal visceral injuries during the operation. Thoracotomy is indicated in missed or late cases because of the possibility of adhesions and fibrosis.

ESOPHAGEAL PERFORATION

It is almost always due to penetrating trauma. Depending upon the location, symptoms will differ. Cervical perforation patients will complain of dysphagia and pain on moving the head while thoracic perforation patient will present with fever, chest pain, and chest-x-ray will show pneumomediastinum or pleural effusion or both. Food material may be seen in the chest tube. Definitive diagnosis is made by Barium-swallow or Endoscopy or both. The treatment is thoracotomy, repair and drainage.[10, 12, 27]

MYOCARDIAL CONTUSION

Is analogous to pulmonary contusion and represents a bruise or intramural hematoma of myocardial wall. This is probably an under diagnosed condition and recently its incidence has been appreciated because of myocardial nuclear scanning. Clinically presents with arrhythmias. This may be a life threatening condition and procainamide given intravenously is usually therapeutic. Frank cardiac failure is rare but when present it is treated with after load and inotropic support.[10]

PENETRATING GREAT VESSELS INJURY

In the majority of cases, are incompatible with life, unless a small hole or surrounding structures causes tamponade. In patients who are unstable and have massive hemothorax operation may be not only therapeutic but also diagnostic. In some cases, aortography may be possible; this will help in planning the surgical approach. Blunt trauma to the great vessels is most common after deceleration or shear forces.

Injury may occur at the aortic root, mid of arch or distal to the left subclavian artery. Of all patients 85% have complete transection and usually these die on the scene. 15% will have incomplete rupture or contained rupture and survive long to reach the hospital. However 90% of these will rupture after 48hrs if untreated. Diagnosis is reached from history of massive trauma and evidence of widening mediastinum on chest film. Other suggestive findings includes 1st or 2nd rib fractures, left apical cap, deviation of trachea and esophagus to the right and obscuration of aortic knob[4,12,19,20.]

THORACIC DUCT INJURY

It may occur following blunt or penetrating trauma. The most common mechanism of non penetrating injury is sudden hyperextension of the spine. Penetration by gunshot or stab wounds is rare.

Diagnosis is reached by the presence of non clotting milky fluid from the pleural space and confirmed by laboratory analysis of the fluid specimen with high contents of free fat, lymphocytes and low protein contents

Treatment is mainly conservative by closed tube thoracotomy, but surgery is indicated when this fails by ligation shunting, application of glue or pleurectomy.[4]

RIB FRACTURES:

Rib fracture can be single or multiple. Often regarded as a trivial injury but should be treated with respect in elderly patients. They are caused by direct injury or excessive flexion. The common site is at the coastal angle or middle of the shaft. Patients will have pain on breathing, coughing and on palpation. They are treated by analgesics, intercostal nerve block and reassurance. Where there are only multiple rib fractures without pneumothorax or hemothorax and no other organs involved, intercostal nerve block and small amount of narcotics are required. In elderly patients consider hospitalization for observation, pain control and pulmonary toilet. Chest x-ray to be repeated after 24 hrs and at the time of discharge, to rule out late onset pneumothorax and hemothorax.

Intermittent use of Velcro belt rib support is advised. Inform the patient of deep breathing and coughing using the rib belt. They are usually associated with perforation or tear the pleura thus care should be taken when these patients needs intubations for any surgical procedure.
Epidural analgesia is becoming the standard of care for pain management in patients with multiple rib fractures [4, 29, 30]

STERNAL FRACTURE

Commonly are caused by a steering wheel injury in blunt trauma. Usually occurs at the sternal angle. They are associated with costochondral dislocations. They are classified as displaced and non-displaced fractures. Localized swelling, tenderness and deformity are the clinical findings. Displaced fracture-requires surgical fixation. Non-displaced fracture, conservative management is adequate. [4, 29, 30]

CLAVICLE FRACTURES.

It is the commonest injury to the chest wall, either as an isolated or in association with other chest injuries. It occurs in falls or blows to the lateral shoulder. The fracture most commonly occurs in the midshaft region. Uncommonly the underlying subclavian vessels or brachial plexus may be injured.

Treatment is usually conservative; surgery is indicated in some cases with risk of injury to the neurovascular bundle. One of the known long-term complications of clavicular fracture is thoracic outlet syndrome and this is due to the excessive callus of malunited clavicle

1.3.5.3. CLOSED TUBE THORACOSTOMY.

The insertion of an intercostal chest drain to relieve the pleural cavity of unwanted air or liquid is a common procedure. It is simple to perform and should be associated with a low mortality and morbidity. However, unnecessary problems are often encountered, both during and after the procedure. Most hospital doctors will, at some stage, insert a chest drain, either urgently in cases of trauma or electively for a pneumothorax or pleural effusion. An adequate understanding of the anatomy and pathophysiology of the pleural space is vital, as the proper teaching of the technique of insertion and subsequent management of chest drains.[31]

The aim of drain insertion is to restore and maintain the negative intrathoracic pressure necessary for lung expansion and drainage of the pleural cavity. The physiological mechanisms maintaining full expansion depend on removal of excess liquid and gas from this space. The basic principle of chest drainage is to ensure this by re-establishing the negative intrapleural pressure. When at rest (that is, at functional residual capacity), the elastic forces of the chest wall and lung try to separate the visceral and parietal pleural layers, and create a negative intrapleural pressure of -2 to -5 cm of water. During inspiration, the negative intrapleural pressure decreases to about -35 cm of water. Full expansion of the lung will also allow reactivation of the surface forces that hold the visceral and parietal pleurae together. Pneumothoraces are caused by a breach in the continuity of the pleural sac (either via the lung or chest wall), allowing positive pressure air into the cavity from the alveoli or the atmosphere. The negative intrapleural pressure is lost, causing the lung to collapse and fall away from the chest wall. A one way airflow mechanism, usually via an underwater seal drainage system, is necessary for managing a chest drain.[31]

The addition of suction (10-20 cm of water) to this system increases the negative intrapleural pressure. If suction is to be used it must be at high volume and low pressure. A low volume pump (such as a Roberts) should not be used as it will not be able to handle a large air leak and will allow air to accumulate, worsening the pneumothorax. Suction should be instituted according to individual need, but, on the whole, the more the patient can comfortably tolerate, the sooner re-expansion will occur. There is no virtue in setting a "low" drain, even for liquid.

A drain of appropriate size in any position in the pleural cavity will restore negative pressure and re-expansion of the lung, expelling excess pleural contents. Accurate placement of the tip of the drain, once inserted, will expedite the process but is not essential. Insertion in the fifth intercostal space in the mid axillary line is safe and should avoid the risk of abdominal penetration. As for size, a 32French gauge or larger drain should be used for blood to minimize blockage. However, a 24 French gauge is adequate for air or low viscosity effusions [31, 32]

PROCEDURE:

The technique of chest tube insertion is important to minimize the discomfort to the patient, the difficulties to the surgeon and to ensure proper positioning of the patient. Chest tube that are placed too low can easily be inserted through the diaphragm, causing iatrogenic injury to the liver or spleen .Tube placed more caudal also endangers the pulmonary hilum. The proper site is the mid axillary line, in this area one avoids the Pectoralis Major and Latisssimuss Dorsi Muscles and has only to go through Serratus anterior and intercostal muscles, both of which are relatively thin (safe triangle). The proper level is at the nipple line or just below it, 5^{th} or 6^{th} intercostal space since the dome of the diaphragm rises nearly to this level in full expiration. Under sterile condition, an incision is made about 3cm carried through deep fascia. Blunt dissection by using artery forceps and then a gloved finger is inserted into the pleural space and swept around to ensure that the pleural space is free, so that chest tube can be inserted without entering lung parenchyma. Use of trocher should be discouraged. [33]

The chest tube is then grasped at the tip with the forceps and inserted through the hole and directed posteriorly and superiorly. The tube is inserted until the last hole is well inside the chest and is tied in place with prolene or silk 1, making a purse string suture although other literature discourage this because it causes skin necrosis [34]

It should be remembered that posteriorly placed tubes effectively drain both fluid and air and therefore universally effective, whereas an anterior tube is ineffective for fluid removal. Use of second rib intercostal space for anteriorly placed chest tubes should be condemned, as it is technically much more difficult yet less effective for evacuation of fluid. The tube is connected to the bottle under sterile technique. When the patient is stable, control chest x-ray in upright is taken. However, when the patient is in distress and clinically points to the possibility of hemothorax or pneumothorax as the cause, a chest tube should be inserted in one or both sides depending on the presentation, without waiting for the x-ray films. The patient should rest on bed at 45 degree[33].

CHEST TUBES

Chest tube types and size must be selected. Two major materials may be chosen: Rubber or plastic. Red rubber tubes are pliable and come in small sizes. Some surgeon feel that these tubes are preferable because they irritate the pleural and cause the sticking together of the visceral and parietal layers that is so often desired. A disadvantage of the red rubber tube is that they tend to obstruct easily and quickly with clots or fibrin. Also many of rubber tubes are not radiopaque; this may impair the assessment of placement of tube by chest x-ray. Clear plastic tubes are very resistant to clotting. These tubes come in large sizes necessary postoperatively or for trauma. The plastic tubes more over always incorporate radiopaque markers.[10] Large tube are difficult to place and more uncomfortable for the patient while small tubes cannot handle heavy drainage of thick material (clots). Some general guide line for selection is as follows: Spontaneous pneumothorax or air only in the pleural space needs a small tube i.e. 16F while for trauma or for frank postoperative hemothorax a large tube, 32F or more is appropriate. For effusion that is not frankly bloody an intermediate size, 24F, 28F is appropriate.[10]

DRAINAGE SYSTEM:

The end of the chest tube cannot be left open to the air because the atmospheric pressure in the pleural cavity causes pneumothorax. A variety of drainage systems are available from simple to complex.

1. Heimlich valve.

Simplest drainage device: a rubber flutter valve that allows only unidirectional movement of air and fluid. Care should be taken to insert the valve in the proper direction. Its disadvantage is that it has no collection system.[10]

2. One Bottle system.

In this system tube from the chest connects itself to the glass or plastic straw passing through a stopcock into a large bottle. Another glass rod vents the inside of the bottle to air. Sterile saline is added to the bottle to the level of 2-3cm above the end of the drainage straw. This provides the water-seal mechanism. Air and fluid can still drain easily from the pleural space with the tip submerged. However, the pleural space remains sealed, as air cannot enter the submerged tip of straw. The amount of fluid drained is obtained by subtracting the original amount of saline used for waterseal. Air leak is determined by bubbling from the drainage straw, the greater the bubbling the greater the air leak.[10]

With inspirations, water may be lifted several centimeters up the straw, thus drainage straw acts as manometer allowing continuous monitoring of intrapleural pressure. The height of water drawn above the level in the bottle equals in centimeters of water the negative pressure in the chest. Normal inspiratory pleural pressure is 10 -15 cm of water: As the pulmonary parenchyma seals more effectively with time or after thoracic surgery, the water column raises higher in the straw while the respiratory tidal volume decreases (height of column in the tube). This reflects apposition and sticking of visceral and parietal pleural around the tube, it is the good sign that the tube can be removed. Disadvantage of one bottle system is that, as water level rises as fluid collection, water seal become stronger thus intrapleural air might not be evacuated hence pneumothorax. The bottle should be changed at interval to maintain water seal only 2-3cm in height.[10]

3. Two Bottle system.

This is the same as one bottle system except that here the addition is the collecting bottle in series between patient and water seal bottle. This avoids the problem of rising water seal as noted in one bottle system.

4. Three bottle system.

The vent of the water seal bottle is connected to suction, but via a third suction control bottle. Because hospital wall suction are excessively strong and can cause significant tissue injury a foolproof suction control is mandatory. This foolproof control is provided by the third bottle. Another straw passes out of the suction control bottle to the wall suction. A third straw passes into the bottle with its tip resting below an adjustable level of saline, normally 15- 20 cm. This simple addition of third bottle eliminates the danger of parenchymal injury from excess wall suction. Disposable system are available with simple connection, but the principle remain the same that water seal level, air leak, pleural pressure and respiratory tidal volume should be monitored.[10]

CARE OF UWSD

Almost all patients can be handled perfectly well with simple waterseal. Only patients with massive air leak needs suction. The proper state of transporting a patient with chest tube is water seal, never clamp the tube. Perhaps the most commonly encountered error in chest drain management is clamping of the tube. There is no definite indication for clamping a chest drain, and it may be highly dangerous, potentially converting simple pneumothoraces to life threatening tension pneumothoraces. Unfortunately, drains continue to be clamped, even on "specialist" units. This usually occurs during transfer to the radiology department or between units by nursing staff. It must be discouraged. The only exception of clamping the tube is during evacuation in preparation for tube removal.[10] In particular, the severity of the air leak is reflected by the proportional of the respiratory cycles during which bubbling occurs.

In spontaneous respiring patient, a mild leak will cause bubbling during peak expiration only, moderate leak bubbling occupies the entire expiratory phase, with severe leak bubbling occur during expiratory and insipiratory phases, while massive leak the bubbling is continuous. In patient with positive pressure ventilation, the relationship is reversed: mild leak expresses itself as bubbling during inspiration (on ventilation inspiration is positive pressure phenomenon) during expiration bubbling ceases except with more severe leaks. The leak may be true (patient) or false (tubing system).This can be identified by clamping the tube, true leak will cease while false leak will continue. In this case connections and tubings have to be examined. Occasionally the defect causing false leak may be between the chest tube proper and the patient's chest wall. This disappears after placement of an occlusive purse string suture or Vaseline gauze dressing around the tube entrance site. The tubings from the patient to the bottle must always remain horizontal or descending, never ascending or looping. It should be below the patient level. Stripping/milking of the tube is contraindicated as it may cause very high negative pressure in the chest, dislodge clots and hence more bleeding. In matter of fact tubes can be kept patent by finger milking[10, 31.]

REMOVAL OF CHEST TUBE:

For the tube placed following pulmonary surgery, air and fluid drainage, criteria must be met that 24hrs or 48hrs beyond the last time of leak. This allows the visceral and parietal pleural under influence of suction to achieve secure sticking of these layers.[10] Most surgeons will not remove the tube until drainage is less than one hundred mls for 24hrs. Basically, clinical and radiological findings should be considered. Clinically patient has less pain, not dyspnoec, with good air entry. Radiologically good lung expansion, no or very little fluid one should consider removal of the tube. Tube is removed quickly in expiration phase or PPV phase in unconscious patient. When the tube is removed, tract must be sealed, a purse string or U stitch around the chest tube site tightened as the tube withdrawn. Alternatively Vaseline gauze or dry sponge is taped tightly for 48hrs.Control chest-x-ray should be done to exclude any air trapped in the chest.[10, 35]

1.3.5.4. INDICATIONS FOR EMERGENCY THORACOTOMY

1. Cardiac tamponade
2. Aortic arch disruption
3. Massive hemothorax
4. Uncontrolled leak, more than 15-20L/min
5. Perforation of esophagus
6. Disruption of tracheobronchial tree
7. Sustained cardiac arrest
8. Uncontrolled bleeding.
9. Drainage of blood is more than 1000ml or 100 ml each hour for 4hrs.
10. Suspected clotted hemothorax, opacity persisting on chest x-ray even after ICT [32]

1.3.5.5. COMPLICATIONS OF UWSD

These can be grouped by convenience purposes as positional, insertional, functional or infective[36,37.] Positional complications may be: Extrathoracic (Subcutaneous or abdominal) or Intrathoracic (Parenchymal, or interlober). Insertional complications are those associated with injury to the organ or vessel, they are rare and includes perforation of stomach, atrium, etc. Malfunctional or nonfunctional tubes are either due to wrong site, kicking, clotted blood or dislodged. They are associated with the use of small tube, less 26G in hemothorax. Infective complications may be deep (empyema, pneumonia) or superficial wound infection [38.]

CHAPTER 2: LITERATURE REVIEW:

Chest trauma is common in both developed and developing countries contributing significantly to high morbidity and mortality in trauma patients.[39, 40, and 41.] It is known that about 10% of chest trauma patients die on the spot and another 5% on arrival in the hospital [40,41,42,43.] Such rapidly occurring deaths result from aortic injuries, tension pneumothorax and myocardial injuries. It is important to emphasize that two-third of all traumatic deaths secondary to chest injuries occur after a patient reaches the hospital and are therefore potentially preventable.[4] About 25% of traumatic deaths results from chest injuries, yet more than 85% of chest injuries undergoing hospital evaluation are appropriately managed with no more than a closed tube thoracostomy while only few will require thoracotomy[44]

Ian C study at Oakland Hospital in News land in trauma patients, from 1995-1997 showed that hospital admission following trauma were 4346 of whom 663(15.2%) suffered thoracic injury.[45]

Another study from Singapore 2004, to determine the pattern of injuries among motorcyclists who formed 49.1% (1018) of all MVI victims. The proportion of patients found with thoracic injury was not different between motorcyclists (10.2%) and other MVI victims (9.9%). However, among those with thoracic injury, 79.2% of motorcyclists had severe thoracic injury, significantly more than 50% of other MVI patients.[46]

In the two different studies from Nigeria about the pattern of chest injuries; one by Misauno et al and the other by Ali and Gali, the mortality rates due to chest injury were 4.5% and 2.6% respectively[39, 47.] Cakan et al study from Izimiv, the mortality rate of 1.3% was recorded[48.]

The etiology of chest trauma, range from blunt to penetrating injuries. Motor traffic injuries are the known worldwide as the main cause of blunt chest injuries[39.] Increase in high speed of cars in both developed and developing countries has resulted in the rising incidence of chest trauma. Most of the penetrating injuries are secondary to social violence and are potentially preventable. Penetrating injuries are usually due to gunshot, implements and stab wounds as a result from wars, civil crisis, assaults and occasionally MTI. Iatrogenic penetrating thoracic injuries occur during various diagnostic and therapeutic procedures [47, 49.]

Misauno et al study of 198 cases revealed that, MTI was the commonest cause (70.7%) and majority of cases were the young male drivers (26.7%) with M: F ratio of 5:1. Blunt chest injury was common (72.2%) compared with the penetrating injuries. [39]

A similar study from Nigeria by Ali and Gali of Maiduguri on 78 cases, 79.5% was males and M: F ratio was 3.8:1. The commonest injuries were penetrating (61.53%) either by guns, arrow shot and stab wounds from bandits. Only 38.4% were blunt due to MTI.[47]

Bergaminelli C et al from Italy reviewed thoracic drainage in 191 trauma emergencies. 46% the cause was MTI. 17% accidental trauma, 17% violence trauma, 8% work accident,6% domestic accident,5% iatrogenic.[50]

Zargar M et al did thoracic injury review of 276 cases. 89.1% were male and M: F ratio was 8:1. MTI was the commonest cause especially in the pedestrians. Stab wound (32.1%) and fall injury (11.6%) of cases [51.]

A study done by Yee in Australia to determine the pattern of Road Traffic Injuries in the elderly showed that the fatality rate of the elderly group (65years and above) was almost double that of the younger group. The elderly victims had a higher rate of chest injuries (23.4% vs. 18.7% p= 0.003). The commonest road users affected were drivers and pedestrians and had rib fractures flail chest and sternum fractures. Chest injuries have been associated with seatbelt (passengers) usage. This becomes more significant in the elderly due to osteoporosis, exaggerated thoracic kyphosis, decreased muscle mass, thinning of intervetebral discs shortening of vertebral bodies and decreased chest wall compliance. It was concluded that elderly victim of MTI have higher risk of chest injuries especially of the chest wall. Age specific injury patterns are important in determining primary and secondary preventive strategies.[52]

A local study by Museru et al, Dar es salaam-Tanzania about Road traffic injuries based on police records between 1990 and 2000; MTI accounted for about 44%[53]. A different study by the same author year 1999, MTA accounts for 56% of all causes affecting mainly the passengers and pedestrians (25%) [54].

Blunt chest injury is the commonest type of chest injury mainly following RTI recorded in many series [53, 54]. The spectrum of the chest trauma is broad, ranging from simple rib fracture to exsanguinous major vascular injuries.[4] Chest trauma may affect the chest wall or any of the intra-thoracic visceral organs. The different clinical entities that make up the chest injury include; chest wall contusions, rib fractures, flail chest, clavicular and sternal fractures, sucking chest wound, pleural collections (Pneumothorax or hemothorax), major vascular injuries, lung contusion/lacerations, tracheal-bronchial injuries, thoracic duct injury and cardiac tamponade [39]

Chest injuries virtually are always accompanied by other injuries. Isolated injuries occur in only 16% of cases[48]. For this reason and because chest wall injuries are rarely life threatening, they should be noted, but the focus of primary survey of the patient evaluation should be on potential intrathoracic injuries.[4]

Bergaminelli C et al series, the clinical types observed were pneumothorax (16%), hemothorax (28%), haemopneumothorax (54%) and 2 cases with chylothorax. [50]

Zargar M et al study, the commonest injuries were hemothorax and pneumothorax (50.4%) followed by rib fractures in 38.6 %. Fractures of the extremities was the commonest associated injuries (37%) followed by head injury (25.2%) and abdominal injury (19.6%) [51]

Misauno M et al series, the commonest clinical pattern of injury was chest wall contusion (24.4%). Others were rib fractures (14.1%), thoraco-abdominal injury (13.6%), pleural collections (11.6%) and sternal fracture (0.5%) [39]. In contrast Ali and Gali study, rib fractures were the commonest[47]. No major vascular or esophageal injuries were noted however fracture of limbs and abdominal injuries also were the commonest associated injuries in the two series.

Most of patients with chest injury are treated conservatively or by closed tube thoracostomy, few will need major surgery; thoracotomy or laparotomy. [4.]

In Ali and Gali series, majority of patients were treated with tube thoracostomy (56.4%) and only 5.12% had thoracotomy [47.] In Cakan A et al study, 41% had tube thoracostomy, 56% were treated conservatively and only 3% had thoracotomy.[48.]

A recent study in 2008 by Fitzgerald M et al from Australia on pleural decompression and drainage during trauma revealed that needle thoracosentesis was unreliable means of decompression. Blunt dissection and digital decompression through pleura is the essential first step for pleural decompression and drainage and insertion of chest tube is secondary priority. Also showed that techniques to prevent tube thoracostomy complications include aseptic technique, avoidance of trocher, digital exploration of insertional site and proper direction of tube during insertion.[55.]

Another study from Germany in 2007 to evaluate emergency chest tube placement in trauma care, which approach is preferable between ventral and lateral; showed that lateral approach was preferable by the physicians but it was associated with high malpositions of tubes (2 in ventral, 20 in lateral), however only 6, (1 ventral 5 lateral) were associated with relevant clinical malfunctions, not statistically significant [56.]

Misauno et al reported that hospitalization ranged from 1 to 168 days, with a mean of 15 days. Prolonged hospitalization beyond two weeks was due to complications or associated injury.[39.] Bergaminell C study documented the duration of tube stay to be 4-18 days [50]

Closed tube thoracostomy is the simple basic procedure commonly done, but found to be associated with many complications in many series[26, 36,37,57,58.] Thus attention must be placed on training of staff.

Bailey RC study, all patients who underwent tube thoracostomy during 12 months at a large scale UK teaching hospital, showed that the commonest indications for tube thoracostomy were Pneumothorax (54%) and Hemothorax (20%) [36]. While in Golden P study, Pneumothorax (51%) Hemothorax (18%) Haemopneumothorax (22%) Rupture diaphragm (5%) and post thoracotomy (3%) [59]. Heng K et al series, indications for tube thoracostomy were Pneumothorax (45.7%), Hemothorax (15%), Pneumohemothorax (28.5%) and Tension Pneumothorax (7.5%) [38].

Cakan C et al reveled a complication rate of 4.6% among patients with chest tubes, the commonest being atelectasis [48] A study by Maxwell RA et al at University of Tennessee USA 2004; to determine whether presumptive antibiotics reduce the risk of empyema or pneumonia following tube thoracostomy for traumatic haemopneumothorax. A total of 224 patients received 229 tube thoracostomies. Empyema tended to occur more frequently in patients with penetrating injuries while pneumonia was common in blunt injuries. Presumptive antibiotic use did not significantly affect the incidence of empyema or pneumonia [60].

In Bailey RC study, the overall complication rate was 30%. There were no insertional complication and only 2% had infection. He concluded that no persuasive evidence to support selective reduction in indications for tube thoracostomy in trauma [36]

Another study by Ball CG at Foothills Medical Center in Canada, to assess the complications of chest tube placed exclusively by resident physician, revealed that 44% of patient had tube thoracostomy. Thoracoabdominal CT scan and CXR were used to determine the rate of complication. Among these, 35% had insertional, 53% positional and 12% were infective. Only 55% of positional and insertional complications were occult to CXR. He also compared CXR and CT scan on diagnosis of posttraumatic pneumothoraces. The results showed that occult post traumatic pneumothoraces are commonly missed both by CXR and even CT scan. Basic markers available early in resuscitation are highly predictive and may guide management before CT scanning.[37].

Deneulle study on the morbidity of percutaneus tube thoracostomy in 128 trauma patients of which 134 tubes were placed revealed that, the overall complication rate was 25%. Among these 12.8% had improper placement, 10.3% improper placement with iatrogenic injury, 10.3% with undrained hemothorax or pneumothorax, 30.8% with post tube removal pneumothorax, 18% with post removal hemothorax, 2.3% had empyema and 10.3% had combined complications. 46.2% required surgery either thoracotomy or VATS. There were no different between blunt or penetrating injuries in terms of complications neither the indication of tube thoracostomy. However these complication were related with polytrauma (RR 2.7, $p< 0.05$), need for assisted ventilation (RR 2.7, $p< 0.03$) and by the surgeon (non thoracic surgeon had high rate of complications: RR 8.7, $p<0.0001$) [58]

Louisville chart review in 379 trauma patients, 599 had tubes. The complications noted included empyema, undrained pneumothorax or hemothorax, improper tube placement with or without iatrogenic injury, post-tube pneumothorax and others. The rate of complications was related with tube thoracostomy setting, operator, patient characteristics, mechanism and severity of injury. The overall complication rate was 21% per patient and 16% per tube. 8.2% of complications required thoracotomy. Complications were high in patients with tube thoracostomy placed outside hospital, tube thoracostomy placed by non-surgeon, admitted in ICU, those needed mechanical ventilation or with hypoventilation.[34]

Golden P study on follow up CXR in 113 patients who had traumatic hemothorax or pneumothorax showed that, 52 had good predischarge CXR, clinically well and had no post discharge CXR. 61(54%) had postdischarge CXR whom 92% had normal x-ray films, only 8% had minor abnormality (small pneumothorax and resolving hemothorax) but clinically were well. He concluded that postdicharge CXR are not indicated in posttraumatic hemothorax/ pneumothorax patient if had normal predischarge CXR and clinically are well. [59]

CHAPTER 3: STATEMENT OF THE PROBLEM:

Chest injury causes high morbidities and mortalities because they involve vital organs. It affects mainly the young school age and productive members of the societies[54]. Motor Traffic Injury is the known worldwide commonest cause of chest injuries in both developing and developed countries due to different risk factors[39,52, 53.] Locally, it has been observed in a pilot study that chest injuries constitute significant number of surgical admissions, however little has been documented on its pattern, treatment and their associated complications.

Most of these patients who manage to arrive at hospital are treated conservatively with no more than a chest tube, yet most of the deaths occur in hospital [34, 36,37,38,57.] . Closed tube thoracostomy is a simple and a life saving procedure but still is associated with many complications[34, 37, 38, 59.] This has been a challenge to many surgeons on this preventable cause of deaths. Thus prompt recognition and proper early intervention is the key to the successful management.

CHAPTER 4: RATIONALE:

The aim of this study is to document on the pattern, treatment modalities and the associated complications of closed tube thoracostomy in chest trauma patients. Many series has shown similar pattern though differs in different situation depending on the causes. Knowledge on the chest injury pattern and their causes is necessary for the early intervention, proper management and implementation of prevention measures. This will reduce significantly the morbidity and the mortality associated with these preventable causes.

The findings may be a challenge to the Hospital and Government authorities to equip and probably establish a chest trauma unit with a guideline of treatment for the betterment of our patients.

It is also part of fulfilment of the Masters of Medicine in Surgery.

CHAPTER 5: OBJECTIVES:

Broad Objective: To determine the pattern of chest trauma and the associated complications of closed tube thoracostomy at MNH.

Specific Objectives:

1. To determine the causes of chest injuries by age and sex at MNH
2. To determine the types of chest injuries at MNH.
3. To determine associated injuries in patients with chest trauma at MNH.
4. To determine the proportional of closed tube thoracostomy done in chest trauma patients at MNH.
5. To determine the associated complications of closed tube thoracostomy in chest trauma patients at MNH.

RESEARCH QUESTIONS

1. What are the causes of chest injuries?
2. What is the pattern of chest injuries at MNH?
3. How common is closed tube thoracostomy usage at MNH?
4. What are the complications associated with closed tube thoracostomy at MNH?

CHAPTER 6: METHODOLOGY:

6.1. **Study design:**

A prospective hospital based descriptive study of patients who were admitted with chest injury at MNH.

6.2. **Study area:**

The study was conducted at Muhimbili National Hospital. This is a referral and teaching hospital in the country. It is located in the city of Dar es salaam, which has a population of about 3.5 million. Apart from serving city residents, the hospitals also serves as a National Referral Hospital. MNH consist among other departments, it has the department of surgery, which encompasses three firms, which deal with specific specialties. Furthermore, all firms also perform general surgical procedures. Muhimbili Orthopedic Institute is the special institute which deals with orthopedics and traumatic bone injured patients.

All surgical patients are received at the casualty department where they are sorted and sent to the admitting surgical wards. Trauma orthopedic patients are sent to MOI causality department while the rest trauma patients are admitted to MNH surgical wards. The patients are then clerked by an intern and then reviewed by a registrar or a resident, followed by a consultant.

Most of the surgical emergency procedures are performed by Residents and Registrar. They are however, required to get advice from their consultants wherever necessary. Both public and private patients are currently treated in the hospital. However there is a Social Welfare Unit, which helps those patients who fail to pay hospital bills and those who are not capable of paying for expensive investigations or special mode of treatment.

6.3. **Study population:**

All patients seen at MNH and MOI causalities and admitted in the surgical wards with chest injuries

6.4. **Sample size estimation:**

All adult patients with chest injury seen at causality and admitted in surgical wards during the period of study were taken to constitute the sample size.

6.5 **Duration of study:**

From November 2007 to September 2008.

6.6. **Inclusion criteria:**

All patients with chest injuries with or without other associated injuries, males and females, more than 10 yrs of age. (Adult surgical wards admit patients with ten yrs of age in our setup)

6.7. **Exclusion criteria:**

Trauma patients without chest injury, children less than 10yrs, superficial soft tissue injury only, burn injury, or refused consent.

6.8. **Study tools:**

Questionnaires, USWD kits, x-ray films and patients file notes.

6.9. **Ethical clearance.**

The study was ethically cleared by MUHAS research and publication committee. The patients were explained about the study and were requested to participate. All consenting patients were recruited into the study. However no patient was denied of appropriate and adequate treatment upon not consenting. The information gathered about the patient was kept confidential and could only be available to interested parties only with permission of the investigator and the patient.

6.10. **Data collection:**

Data were filled in a structured questionnaire by the investigator from the patients who had consented for the study. Information on socio-demographic characteristics that included age, sex, marital status and status of road user was obtained by interviewing the patients, as well as obtained from the patients' files. Details about the cause, type of injury, clinical diagnosis, associated injuries and treatment were obtained from the patients file and x-ray films. Whenever necessary, the author performed the UWSD procedure. Relevant data about the procedure and materials were also documented.

Follow-up.

All patients were followed up while in the ward and at the clinic after 2weeks. Clinical and radiological assessment was done for any associated complication. Local wound discharge (Pus) suggested superficial wound infection. Pneumonia and empyema was diagnosed clinically (fevers and cough) and radiologically using chest x-ray.

Positional related complications were evaluated using CXR for kinking and bending while dislodging of the tube was recorded in the ward. Insertional and functional tube related complications were assessed only clinically. These included excessive bleeding, pneumothorax, and blockage while retained hemothorax was evaluated using CXR. Outcome of the treatment was also documented whether patient was cured and discharged or died.

6.11. Data analysis: Data collected were entered into statistical package of social sciences (SPSS) version 15.0. This was analyzed to determine the distribution chest injury according to age, sex; causes, diagnosis, treatment and the complications of UWSD.

CHAPTER 7: RESULTS:

A total of One hundred and nineteen patients presented with chest injuries during the study period of 10 months. All these patients were seen at casuality and admitted in the adult surgical and orthopedic trauma wards and then followed up in the ward and at the clinic. Most of these patients were from the main city (80%) and few were referral cases from upcountry.

The age ranged from 12 – 72yrs with the mode of 32yrs. Males constituted the majority of cases, 95(79.8%) and male to female ratio was 6.7:1.The commonest age groups were10-29yrs and 30-49yrs in 42(35.3%) and 52(43.7%) respectively. Table1.

Table1. Shows the age and sex distribution of the study population.

Age	Sex				Total	
	Males		Female			
	no	%	no	%	no	%
10-29	31	32.6	11	45.8	42	35.3
30-49	43	45.3	9	37.5	52	43.7
50-69	17	17.9	3	12.5	20	16.8
70+	4	4.2	1	4.2	5	4.2
Total	**95**	**100.0**	**24**	**100.0**	**119**	**100.0**

The types of injuries encountered, majorities were blunt injury in 90 cases (75.6%), penetrating injuries occurred only in 29(24.4%) cases. Most of MTI were blunt 94%.Table2.

Table2. Shows the causes and the types of chest injury

Causes	Blunt		Penetrating		Total	
	no	%	no	%	no	%
MTI	85	94.4	1	3.4	86	72.3
Assault	2	2.2	17	58.6	19	16.0
Gunshot	0	0.0	9	31.0	9	7.6
Fall	3	3.3	2	6.9	5	4.2
Total	**90**	**100.0**	**29**	**100.0**	**119**	**100.0**

MTI was the commonest cause of chest injuries in both sex encountered in 86 cases (72.3%). It occurred more frequently in females (91.7%) as it was compared with males (67.4%). Other causes were assault, gunshot and fall from height which occurred in 16%, 7.6% and 4.4% respectively, encountered mostly in males. Gunshot and fall from height injuries were not encountered in females. Table 3

Table3. Shows the causes of chest injuries in relation with sex.

Causes	Sex				Total	
	Male		Female			
	no	%	no	%	no	%
MTI	64	67.4	22	91.7	86	72.3
Assault	17	17.9	2	8.3	19	16.0
Gunshot	9	9.5	0	.0	9	7.6
Fall	5	5.3	0	.0	5	4.2
Total	**95**	**100.0**	**24**	**100.0**	**119**	**100.0**

MTI was the commonest cause of chest injury in all age groups. It was even more common with increase of age. Assault and gunshot was slightly high in young age groups while it was not encountered in elderly people.Table4

Table4. Shows the different cause of chest injuries in relation with age.

Causes	Age								Total	
	10-29		30-49		50-69		70+			
	no	%	no	%	no	%	no	%	no	%
MTI	30	71.4	35	67.3	16	80.0	5	100.0	86	72.3
Assault	6	14.3	12	23.1	1	5.0	0	.0	19	16.0
Gunshot	4	9.5	4	7.7	1	5.0	0	.0	9	7.6
Fall	2	4.8	1	1.9	2	10.0	0	.0	5	4.2
Total	**42**	**100.0**	**52**	**100.0**	**20**	**100.0**	**5**	**100.0**	**119**	**100.0**

The patients who were involved in MTI, majority were passengers in 42 (35.3%) and pedestrians in33 (27.7%). Majority were injured on the right hemithorax in each category. Table5.

Table5. Shows the road users involved in MTA in relation with the site of injury.

R.USER	Site of injury							
	Bilateral		Right		Left		Total	
	no	%	no	%	no	%	no	%
Driver	2	28.6	3	42.9	2	28.6	7	100.0
Pedestrian	7	21.2	16	48.5	10	30.3	33	100.0
Passenger	7	16.7	27	64.3	8	19.0	42	100.0
Cyclist	1	25.0	2	50.0	1	25.0	4	100.0
Total	**17**	**19.8**	**48**	**55.8**	**21**	**24.4**	**86**	**100.0**

The commonest clinical types of chest injury observed were pneumohemothorax in 39(32.8%), hemothorax and lung contusion which occurred in 25(21%) cases in each. However, rib fractures were the commonest of all injuries which occurred either in isolation or in association with other chest injuries in 51(42.9%).

Rare but most life-threatening conditions also were encountered and these were cardiac or vascular injury occurred in 2 cases, perforated esophagus in 2 cases, diaphragmatic rupture in 3 cases, chest sucking wounds in 3 cases and sternal fracture in one patient. (Note that some patients had more than one injury.) Table6

Table6: Shows the clinical types of chest injuries.

Types	Responses		% Of Cases
	no	%	
Pneumothorax	12	6.3	10.1
Hemothorax	25	13.0	21.0
Pneumohaemothorax	39	20.3	32.8
Rib #	51	26.6	42.9
Clavicle #	18	9.4	15.1
Lung contusion	25	13.0	21.0
Chest wall contusion	10	5.2	8.4
Others	12	5.6	10.4
Total	**192**	**100.0**	**161.3**

Forty-six (38.7%) patients had no associated injuries. Of the associated injuries noted, the commonest was fractures of extremities in 30(25.2%) followed by head and neck injuries. Soft tissue injuries occurred in 26(21.8%) each. Others were abdominal visceral injury such as spleen, liver, intestine and kidneys in 20(16.8%), pelvic injury in 11(9.2%) and spine injury in 6(5.0%) cases. Most of them were occurring in polytrauma patients; some had more than one associated injury. Table7.

Table7.Shows the associated injuries encountered.

Associated injuries	Responses		% Of Cases
	no	%	
Head and neck	26	17.3	21.8
Extremities #	30	20.0	25.2
Pelvis injury	11	7.3	9.2
Spine injury	6	4.0	5.0
Abdomen visceral	20	13.3	16.8
Soft tissue injury	11	7.3	9.2
No Associated injury	46	30.7	38.7
Total	**150**	**100.0**	**126.1**

Treatment given to chest trauma patients was mainly non-surgical 113(95%), close observation and simple surgical procedure. Closed tube thoracostomy was performed in 67(56.3%) cases; only 6 cases underwent major surgery of which 5(4.2%) had thoracotomy due to 1perforated esophagus, 2diaphragmatic ruptured and 1retained hemothorax. One case had laparotomy due diaphragmatic ruptured. Table8.

Table8. Shows the treatment modalities given to the patients.

Treatment	Responses	
	no	%
Conservative	46	38.7
Tube thoracostomy	67	56.3
Laparotomy	1	0.8
Thoracotomy	5	4.2
Total	**119**	**100.0**

Of the patients who had closed tube thoracostomy, infection was the commonest complication noted in 22 (30.2%) patients (superficial wound infection15.1%, empyema 9.6% and pneumonia in 5.5% patients.) Nonfunctional tubes were encountered in 12 (16.4%) patients. These were either due to tube kinking, dislodging, blockage and retained hemothorax. Other complications were insertional related such as excessive bleeding and tension pneumothorax occurred in 2 patients. The overall complication rate was 32.9%. (Note that some patients had more than one complication.) Table9.

Table9. Shows the types of complications associated with UWSD.

Complications	Responses		% of Cases
	no	%	
Nonfunctional tube	12	14.1	16.4
Wound infection	11	12.9	15.1
Pneumonia	4	4.7	5.5
Empyema	7	8.2	9.6
Tension pneumothorax	1	1.2	1.4
Bleeding	1	1.2	1.4
No complication	49	57.6	67.1
Total	**85**	**100.0**	**116.4**

The average duration of chest tube stay was 4days with a range of 1- 32days. Average hospital stay was 9 days with a range of 1- 131days.A mortality rate of 24.4% was recorded.

CHAPTER 8: DISCUSSION

Chest trauma is a very common problem of public health importance to be addressed since it contributes significantly to high morbidity and mortality among trauma patients.

One hundred nineteen patients were admitted with chest trauma during the study period of ten months. Of these males were mostly injured compared to females and the majorities at their young school age. Ninety four (79%) cases were between 10-49 years of age with the mode of 32yrs. This age group is more active and they engage themselves in risk activities more frequently[39]. Among this, eighty six cases (72.3%) were due to motor traffic injuries most of them resulting into blunt chest injury (75.6%). According to Museru et al, a local study done in the similar setting about accidents in general, it showed that motor traffic injuries was the commonest cause accounting for about 56% of cases[53]. Similar findings have been reported in several other studies[38, 39, 45, 48,50,51,52]. Elderly females were commonly affected a finding noted in most patients aged more than 70yrs (91.7%). Elderly victims have a higher rate of chest injuries (fractures) due to aging and osteoporosis. Yee WY et al has shown this findings (23.42%v 18.17%; p= 0.003).[52]

Other causes of injuries like gunshot, stab wounds and fall from height were not commonly encountered in this study. Females were not at all involved in gunshot or fall injuries, probably due to the nature of their activities in this urban setting. But, one could anticipate more fall injuries from a rural area setting. This also reflects the issue of urbanization and development as opposed by falling from trees in the past [4]. However, no study has reported this finding. Few studies has shown penetrating injury is the common cause of chest trauma. Ali and Gali study of Maiduguri penetrating injury occurred in 61.5% of cases and these were mainly due to the civil wars and bandits where by young males were mostly affected[47]. Maxwell et al has shown similar findings, penetrating injuries accounting for 77% while blunt injuries for 33% in one of the multicenter study. This also reflects the nature of the activities in a certain locality such as civil wars due to any cause.

Among the road users, passengers and pedestrian were commonly injured seen in 35.3% and 27.7% respectively. Similar findings were reported by Museru et al whereby 56% and 25% were passengers and pedestrian respectively[53]. Zargar, M also has shown similar results[51]. This could be due to the fact that car accidents involving public transports which occur frequently in our setup carry many passengers.

On top of that, the city with poor road infrastructures is overcrowded by pedestrians such as petty traders who are at a high risk of been knocked by the cars. It was found that chest injury was occurring more on the right hemithorax a finding which needs further evaluation as it was not reported anywhere in other series. In contrast, Misauno et al reported that drivers were mostly affected and this was due to their occupational exposure. [39]

Rib fracture was the most commonly encountered clinical type of chest injury. This is related to its anatomical location as well as aging and osteoporosis as it was seen more frequently in elderly females. One study at Australia and that of Maiduguri Nigeria has shown similar findings[47, 52]. However, Misauno et al revealed that chest wall contusion was the commonest clinical type of injury[39]. Pneumohemothorax and hemothorax were also common similar to many other series.[39, 47, 50, 51, 62]. Rare but life threatening conditions such as esophageal perforation, cardiac injury and diaphragmatic rupture were encountered in a few patients, a similar finding to other studies[39, 47, 50, 64, 65]. These injuries frequently has high mortality usually at the scene.[4]

Fractures of extremities and head and neck injuries were the commonest associated injuries reported in many other series. Ali and Gali study has shown fractures of extremities and abdominal injuries to be the commonest associated injuries. This was related to the cause of the injury, since motor traffic injuries frequently results into multiple injuries[47].

Majority of patients were treated conservatively with close observation and closed tube thoracostomy. More than a half of cases (56.3%) had closed tube thoracostomy, 5 (4.2%) cases had thoracotomy and laparotomy was done in one patient. This was in conformity with many other series[39, 47, 54, 55, 60.]

Complications associated with tube thoracostomy were insertional, positional, functional or infective. The overall complication rate was high, (32.9%) compared to the other studies. (Bailey RC 30%, Cakan et al 4.6% and Avlwin CJ et al 2-25 %.) Infection was the commonest complication followed by non-functional tube. Infection rate and non-functional tubes were unacceptably high, 30.2% and 16.4 % respectively. The reasons for these were due to either facility, patient or doctor related factors[26.] In this study, these complications were probably related with improper and unsterile techniques, this was not evaluated in this study. Fitzgerald M et al showed that methods to prevent tube thoracostomy complications included aseptic technique, avoidance of trocher, digital exploration of insertional site and guidance of tube posteriorly and superiorly during insertion[55.] Malpositions probably could be more than what has been revealed here simply because CXR can detect only 55% of positional complications [37.] In Heng K et al study the complications were only positional (5.2%) and infective (2.4%) while in Bailey RC et al study were only infective (2%)[36, 38.]

For those patients treated with closed tube thoracostomy, the average tube stay was 4days with a rage of 1- 32days. Prolonged tube stay partly was contributed by complications and the associated injuries. Hospital stay also was influenced by the similar factors; longest period was 3 months in 2 patients who had severe head injury in ICU. Misauno et al reported almost similar findings with the longest hospitalization of 168days[39.] Bergaminelli C et al showed the average tube stay of 11days and a range of 4-18days[50.]

The mortality rate of chest injuries was found to be very high (24.4%) when compared with other studies. This can be explained by the severity of injury, associated injuries and complications of tube thoracostomy.

The mortality rate was lower in similar studies. (Misauno study 4.5%, Maiduguri study 2.56% and Cakan A et al 1.3%). Other studies also have shown mortality to be related with severity of injury, mechanism of injury, associated injuries, age of the patient and complications of the treatment[39, 47, 48].

CHAPTER 9: CONCLUSION AND RECOMMENDATIONS

Conclusion:

Chest trauma is a common problem of public health importance to be addressed. It affects mainly the young active members of the society. Passengers and pedestrians often suffer this injury following blunt MTI. The clinical pattern of chest trauma was similar with other studies of which closed tube thoracostomy has been the treatment of choice in most cases. The complications associated with the chest tube are unacceptably very high. This study also has shown high mortality mainly due to the associated injuries.

Recommendations:

1. Further research on the causes of chest injury to establish the reasons why MTI is the commonest cause and hence to establish the preventive measures on this preventable cause.
2. Young school age group and productive members of the society are affected mostly; there is a need of doing a big research on this age group to establish the reasons. This will help to establish and give the necessary information on the preventive measures on this risk age group.
3. Clinical types of chest injury are similar in most series, management protocol or guideline is suggested to have better and early intervention of which closed tube thoracostomy is the main stay.
4. Closed tube thoracostomy is simple but yet is associated with many complications; there is a need for further research on this to establish why it is so. Patient, Doctors and facilities related factors should be looked upon.
5. All this will help to establish primary preventive measures as it is known that prevention is better than cure.

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CHAPTER 11: APPENDICES

11.1. QUESTIONNAIRE
(ENGLISH VERSION)

CODE No.

1. ID_____

2. Name_____

3. Age_____ years

1. (12-29)
2. (30-49)
3. (50-69)
4. (70+)

4. Sex

1. MALE
2. FEMALE

5. Residence

1. DSM
2. OTHERS

6. Road users

1. Driver
2. Passenger
3. Pedestrian
4. Cyclist

7. D.O.I __/____/_____

8. D.O.A___/____/_____

9. Duration of Hospital stay ____days

1. < 7days
2. 7-14days
3. > 14days

10. Causes of injury

1. MTI
2. Assault
3. Gun shot
4. Fall
5. Others

11. Clinical types of chest injuries

1. Pneumothorax (a= bilateral, b= right, c= left) 1. YES 2. NO
2. Hemothorax (a= bilateral, b= right, c= left) 1. YES 2. NO
3. Pneumohemothorax (a= bilateral, b= right, c= left) 1. YES 2. NO
4. Rib fractures (a= bilateral, b= right, c= left) 1. YES 2. NO
5. Clavicle fracture (a= bilateral, b= right, c= left) 1. YES 2. NO
6. Lung contusion (a= bilateral, b= right, c= left) 1. YES 2. NO
7. Sucking wound (a= bilateral, b= right, c= left) 1. YES 2. NO
8. Ruptured diaphragm (a= bilateral, b= right, c= left) 1. YES 2. NO
9. Thoracic duct injury (a= bilateral, b= right, c= left) 1. YES 2. NO
10. Major vascular injury 1. YES 2. NO
11. Cardiac injury 1. YES 2. NO
12. Tracheal/ Bronchial injury 1.YES 2. NO

13. Perforated oesophagus 1. YES 2. NO
14. Sternal injury 1. YES 2. NO
15. Chest wall contusion 1. YES 2. NO

12. Associated injury
1. Head and neck 1.YES 2. NO
2. Upper limbs 1.YES 2. NO
3. Abdominal visceral 1.YES 2. NO
4. Pelvis 1.YES 2. NO
5. Lower limbs 1.YES 2. NO
6. Spine 1.YES 2. NO
7. Soft tissue injury 1.YES 2. NO

13. Mechanism of injury
1. Blunt
2. Penetrating

14. Treatment given
1. Conservative 1.YES 2. NO
2. Tube thoracostomy 1.YES 2. NO
3. Wound debridement/ sutured 1. YES 2. NO
4. Thoracotomy 1. YES 2. NO
5. Laparotomy 1. YES 2. NO
6. Needle thoracostomy 1. YES 2. NO
7. Others_____ 1. YES 2.NO

15. UWSD 1. Date inserted_____
2. Date removed_____

16. Duration of tube stay
1. < 3days
2. 3-7days
3. > 7days

17. Antibiotics given

1. YES
2. NO

18. Complications of chest tube during follow up in the ward and at the clinic

1. Tube dislodged	1. YES 2. NO
2. Wound infection	1. YES 2. NO
3. Pneumonia	1. YES 2. NO
4. Empyema	1. YES 2. NO
5. Retained hemothorax	1. YES 2. NO
6. Pneumothox	1. YES 2. NO
7. Bleeding	1. YES 2. NO
8. Kinking/bending	1. YES 2. NO
9. Blocked	

19. Outcome of injury/ treatment

1. Discharged on_____
2. Died on_____

11.2. INFORMED CONSENT FORM (ENGLISH VERSION)

ID no……

Consent to participate in the study.

Greetings! My name is Dr Massaga Fabian. I am a postgraduate student at MUHAS, investigating on the pattern of chest injuries and the complications of closed tube thoracostomy at Muhimbili National Hospital.

The purpose of the study: To determine the causes, types and treatment of the patients with chest injuries. Also to find the associated complications of closed tube thoracostomy at Muhimbili National Hospital.

What participation involves:

If you agree to participate in the study, you will be interviewed about the injury, relevant investigations done will be recoded, appropriate treatment will be provided and you will be followed up in the ward and at the clinic for any complications associated with the treatment (Closed tube thoracostomy).

Confidentiality:

All the information collected on questionnaires will be entered in the computer with identification number. The questionnaires will be handled with greater secrecy in order to maintain confidentiality.

Risks: No risk associated with this study

Right to withdraw and alternatives: Taking part in this study is completely your choice. If you choose not to participate in the study, you will continue to receive all services that you would normally get from the hospital.

Benefits: If you agree to take part in this study, you will get the appropriate treatment normally and you will be followed up closely for any problem.

In case of any injury: We do not expect any harm from the study

Who to contact: If you have any question about the study, you should contact Dr. Massaga F.A of 0754 807 295/ 0782256086.

If you have questions about your rights as a participant, you may contact Prof E. Lyamuya, Chairman of College Research and Publication Committee. P.O.BOX 65001 Dar es Salaam. Tel 2150302-6

Signature.

Do you agree?

Participant agrees…….. Participant does NOT agree……

I …… have read the content of this form .My questions have been answered.

I agree to participate in this study

Signature of the participant……

Signature of the witness…… Date of signed consent……

11.3. INFORMED CONSENT FORM (SWAHILI VERSION)
Nambari ya usaili.....

Makubaliano ya kufanyiwa utafiti:

Wagonjwa walioumia kwenye kifua, tiba yake na matatizo yanayoambatana na mpira uliowekwa kwenye kifua kwa ajili ya matibabu.

Salaaam! Mimi naitwa Dr. Massaga Fabian, ni mwanafunzi wa udhamili chuo kikuu cha tiba Muhimbili. .Nafanya utafiti wa kuchunguza matatizo ya watu walioumia kwenye kifua.

Madhumuni ya utafiti ni kuchunguza yafuatayo:

Kujua madhara mbalimbali yanayojitokeza wakati mtu anapoumia kifua ajali inapotokea. Pia kujua jinsi wagonjwa hawa wanavyotibiwa na madhara yanayoambatana na tiba ya mpira wa kutolea damu/hewa kwenye mapafu.

Tuna tarajia kusajili wagonjwa wapatao 200

Jinsi ya kushiriki

Kama utakubali kushiriki ,nita kuhoji maswali machache kuhusu ajali iliyokukuta,nitaandika chanzo, sehemu uliyoumia, vipimo ulivyofanyiwa, tiba uliyopewa na kwa wale watakaowekewa mpira kifuani, nitawafatilia wodini na kwenye kliniki pia kubaini matatizo yoyote yatakayoambatana na huo mpira.

Utunzaji wa siri.

Taarifa zitatunzwa kwa siri kwa kutumia herufi au nambari bila majina ya mgonjwa

Madhara /Athari

Hakuna adhari au madhara yoyote yatokanayo na utafiti huu.

Uhuru wa kushiriki;

Kushiriki kwenye utafiti ni hiari yako.

Kama utachagua kutoshiriki, utaendelea kupata huduma kama hapo awali.

Faida ya utafiti

Ukishiriki kwenye utafiti huu, utapewa tiba stahili kwa muda mwafaka na utakuwa kwenye uangalizi wa karibu sana mpaka utakapokuja kliniki.

Taarifa

Endapo unahitaji kupata maelezo kuhusu haki zako au taarifa ,wasiliana na Dr. Massaga F.A wa 0754 807 295, au Prof E.lyamuya ,mwenyekiti wa kamati y utafiti P.o.box 651001,Dar es salaam.,Tel 2150302-6

Je unakubali kushiriki kwenye utafiti? (weka alama) Ndiyo au Hapana.....

Mimi ....., nimeelezwa/nimesoma maelezo haya. Maswali yangu yamejibiwa vema.

Nimekubali kushiriki kwenye utafiti huu

Sahihi ya mgonjwa .....

Sahihi ya ndugu/shahidi .....

Sahihi ya Mtafiti ..... .

Tarehe.....

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