DISSERTATION

ON

STUDY OF VARIOUS FACTORS INFLUENCING THE OUTCOME IN PATIENTS WITH BLUNT INJURY CHEST

Dissertation submitted to

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CERTIFICATE

This is to certify that this dissertation entitled " **STUDY OF VARIOUS FACTORS INFLUENCING THE OUTCOME IN PATIENTS WITH BLUNT INJURY CHEST."** is the bonafide original work of **Dr.MUTHUKUMAR.S** in partial fulfilment of the requirements for M.S Branch -I (General Surgery) Examination of the Tamilnadu Dr. M.G.R. Medical University to be held in APRIL - 2013. The period of study was from january - 2011 to june - 2012.

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DECLARATION

I, **Dr.MUTHUKUMAR.S**, solemnly declare that the dissertation titled **" STUDY OF VARIOUS FACTORS INFLUENCING THE OUTCOME IN PATIENTS WITH BLUNT INJURY CHEST."** is a bonafide workdone by me at Thanjavur Medical College, Thanjavur during janauary2011 to june2012 under the guidance and supervision of **Prof.Dr.P.RAJAGOPAL, M.S.,** Professor ,department of general surgery and **Prof.Dr.A.RATHANAVEL ,M.S , Mch.** Head of Dept of Cardiothoracic surgery Thanjavur Medical College, Thanjavur. This dissertation is submitted to Tamilnadu Dr. M.G.R Medical University towards partial fulfilment of requirement for the award of **M.S. degree (Branch -I) in General Surgery**.

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CONTENTS

INTRODUCTION

With increasing advancement in the rapidity of transport and pre-hospital management of trauma victims , road traffic injuries still constitute one of the leading cause of death in all the age groups. Thoracic trauma is common and constitutes around 25% to 30% of all injuries.

Thoracic trauma causes a wide variety of injuries ,which may range from simple abrasions to life-threatening injuries.

Blunt trauma to chest is associated with a high morbidity. Fifteen percent of all trauma deaths involve chest , thus making it the second leading cause of death among traumatic injuries. Fortunately, 85% of thoracic injuries do not require any major surgical intervention.

Most chest wall and intra-thoracic injuries can be managed with Simple tube thoracostomy , mechanical ventilation , aggressive pain control, and other supportive care. The elderly and other patients with diminished pulmonary reserve are the most vulnerable for pulmonary deterioration and will require critical care observation at the least.

Because critical care physicians will encounter patients with pulmonary and chest wall injuries frequently, an in-depth knowledge of the patho-physiology and treatment of thoracic trauma is necessary.

AIM AND OBJECTIVES OF THE STUDY:

1. To study the etiology of blunt injury Chest.
2. To study the clinical features of blunt injury Chest.
3. To study the factors influencing the prognosis.
    - Age of the patient.
    - Site of chest wall injury.
    - Associated lung parenchymal disease.
    - Associated injuries to organs of thoracic cavity.
    - Associated poly-trauma.
4. To study various treatment aspects in blunt trauma Chest.
5. To assess the prognosis of blunt injury Chest.

MATERIALS AND METHODS

TYPE OF STUDY

Prospective study

CASES

50

INCLUSION CRITERIA

All patients with blunt trauma injury to the chest with pneumothorax or haemothorax or both and who required a inter-costal drainage procedure as treatment .

EXCLUSION CRITERIA

1. Patients without pneumothorax or haemothorax.
2. Patients with minimal pneumothorax or haemothorax with or without rib fractures who do not require a intercostal drain insertion.

MATERIALS USED

Intercostal drainage tube with size 30 OR 32fr with drainage bag.

Injection lignocaine 1%

Needle holder,

Kellys clamp

1 “0” silk,

Sterile gloves

Alcohol scrub

Good light source

PERIOD OF STUDY

Jan 2011 to june 2012

PLACE

Thanjavur medical college hospital,Thanjavur

METHOD OF STUDY

The type of injury ,its variable presentations and the factors that influence the outcome in patients with blunt injury chest have been evaluated. These included age of the patient, site and number of fractured

ribs ,associated lung parenchymal injuries, associated pre-existing lung diseases and other associated injuries such as head injury ,orthopaedic injuries , abdominal injuries have been evaluated .

All patients who presented to the casualty were assessed and resuscitated using advanced trauma life support system . Life threatening injuries whether related to chest or other sites were given priority. The life threatening chest injuries such as tension pneumothorax, airway obstruction, flail chest were looked into and treated.

In stable patients with suspected chest injuries radiographic evaluation was done which included a routine X-ray chest PA view and a CT thorax . Selected patients who presented with poly-trauma were subjected to a CT head or USG abdomen. Selected X-rays were taken according to orthopaedicians advice.

In unstable patients who presented with clinical signs of significant haemothorax or pneumothorax with significant respiratory distress were immediately treated with intercostal drain insertion without radiological investigations. These patients underwent radiological investigations after stabilization.

Patients with simple rib fractures were managed with parenteral analgesics and antibiotics . Most of the patients were switched over to oral analgesics and antibiotics on day 3.

Patients with serious chest or associated serious injuries were treated in intensive care unit and mechanical ventilation was provided to them if warranted . For all patients cardiothoracic surgeons opinion was obtained and treated accordingly. For selected patients neurosurgeons , orthopaedic surgeons, plastic surgeons opinion were obtained according to patients need.

Most of the tube thoracostomy were done in operation theatre except in a few cases the intercostal drainage was inserted in the emergency ward itself. Thorocotomy was done on a emergency basis if indicated. All patients were subjected to check X-ray of the chest on the day of insertion to look for the proper positioning of the tube. If the tube was not in position a reinsertion of the tube was done.

Normally thoracostomy tube was removed on 4^{th} to 6^{th} day,if the drainage was clear and less than 50ml. All patients were subjected to a thorough clinical examination , for looking into the air entry and were also subjected to repeat the X-ray chest to look for a lung

expansion. Routine ultrasound lung was done to confirm that the fluid is less than 50ml in cases of haemothorax. Cardiothoracic surgeons opinion was obtained before removal of the tube.

Purse string sutures were routinely applied during tube thoracostomy . The dressing was changed daily. The wound site was routinely closed after removal of the tube if there are no signs of infection.

REVIEW OF LITERATURE

HISTORICAL REVIEW

During early times trauma was frequent , which was mostly due to accidental injuries. Surgery for trauma induced injuries developed in ancient India between 2500BC to 500BC. The word Trauma was derived from a greek word which meant " the wound that you have, we did not do it".

Early man had survived with many chest injuries. According to Shanidar neandrethels ' a neandrethel skeleton unearthed in Iraq showed multiple healed rib fractures'.

Chest injuries has been managed through variety of methods during the early period. Edwin smith surgical papyrus at the time of 3000 BC has excellent instructions as how to manage a vast variety of chest injuries.

The management of chest injuries developed during the late eighteen and nineteenth century. The physicians recognized all forms of chest injuries and the various modalities of treatment , after doing a detailed autopsy study.

Early surgeons knew the importance of internal injuries their treatment and its outcome . Hence Ambrose pare said ‘ When midriff (diaphragm) is wounded , patient feeleth a great weight in the place , troubled with shortness of winde, cough and fit of grievous pain. When these accidents happen we may pronounce death is at hand’ .

World war 2 witnessed a great rise in the number of chest injuries. It was during this period that the guidelines for the management of chest injuries was formed to have a better treatment outcomes.

The first primary repair of traumatic aortic injury was done by Klassen in 1958.

With the advent of ultrasound in 1971 and CT in the year 1972 there was a revolutionary break through in the diagnosis of chest injuries.

EPIDEMIOLOGY

Trauma is an unsolved epidemic which continues to rise as time progress. Trauma is very expensive in terms of financial burden and loss of man power and so involves the whole society. It is considered a major public health problem .It is a neglected disease of the modern society. Thoracic injury accounts for around 20% to 25% of the total traumatic injuries.

Our society continues not to abide by the law , there by resisting to wear helmets, seat belt, fire safety norms and drunken driving. In nearly half of the of fatal injuries , death occurs at the scene of incident or in the way to the hospital. The major cause of death being massive hemorrhage or extensive brain or spinal injury.

Majority of the expenses incurred are due to non fatal injuries. Injuries can be divided based on

(1). Mechanism of injury -- road traffic accidents.

Accidental fall

Assault

Fire arm

Sports injury

(2). Intent -- intentional (homicide, suicide)

Unintentional (road traffic accidents).

(3). Place of injury -- domiciliary

Roads

War

Incidence of accidental fall is higher in very young and very old people when compared to middle aged people. Between age group of 1 to 34, fatality is more due to traumatic causes when compared to all non traumatic causes combined together. The higher rate of accidental fall in old age is attributed to co- morbid illnesses such as dementia, diabetes mellitus and neurological disorders.

In people with age ranging from 1 to 45 years, males have twice more fatality rate than females in road traffic accidents. In the age group of above 45 years , there is no significant sex difference in the mortality index due to road traffic accidents.

ADVANCED TRAUMA LIFE SUPPORT

This is a structured trauma management program followed by the American college of surgeons.

STEPS

1. Primary survey with simultaneous resuscitation and to identify and treat the problem of prior importance.
2. Secondary survey to identify and treat all other associated injuries.
3. Tertiary survey to follow a definitive management plan.

PRIMARY SURVEY AND RESUSCITATION

AIRWAY WITH CERVICAL SPINE PROTECTION

The assessment of airway should be the first priority. If a patient can communicate , then the airway is not under immediate threat. If the patient does not reply to simple questions then the airway should be immediately assessed for signs of obstruction such as foreign bodies and tracheal fractures.

A quick assessment of the cervical spine should be undertaken before establishing a patent airway. It should be suspected in all cases of polytrauma . A fractured cervical spine exhibits tenderness on palpation . A good quality lateral view of the cervical spine will establish 95% of fractures . A hard cervical collar is given to the patient till the radiological examination.

Early measures are undertaken to clear the airway . This involves anterior displacement of the mandible which pulls the tongue so that the oral cavity can be fully visualized . The oral cavity is examined and suctioning done , if there is presence of blood or gastric contents . If the patient cannot maintain a clear airway or if there is an absent gag reflex then the airway should be secured with endotracheal intubation.

BREATHING

All injured patients should be given a high flow oxygen through the mask. The patient's neck and chest should be examined for injuries and tracheal deviation . The condition of neck veins ,the rate of respiration and effort should be recorded . Percussion and auscultation of the entire chest should be done . Tension pneumothorax should be

given priority if identified . If suspected , immediate needle decompression in to the pleural space in the midclavicular line in the 2nd intercostal space is the treatment of choice . This is followed by tube thoracostomy . In case of massive haemothorax , tube thoracostomy can be followed by emergency thoracotomy if indicated.

CIRCULATION AND CONTROL OF HAEMORRHAGE

Once breathing is established it is necessary that the oxygen is carried to the critical organs such as the heart and the brain . So the differentiation between a cardiac failure and a volume deficiency is must at this stage. Initial assessment of the colour of the skin and capillary refilling time is done , While a simultaneous assessment of the heart rate , blood pressure and arterial oxygen saturation is done . The commonest cause of shock is hemorrhage . If a source of bleeding is identified externally it should be controlled by direct pressure or by suturing if time permits . As a rule if peripheral pulses are palpable the systolic pressure will be usually above 90mm of Hg.

Internal heamorrhage may be deceiving . A patient can lose massive amount of blood into the chest , the abdomen or into the

retroperitoneum . The signs of massive blood loss includes pallor , tachycardia , hypotension and a prolonged capillary refill time . It should always be remembered that, in cases of blunt injury chest , myocardial contusion or a pericardial tamponade may be the cause for hypotension. So in patients with a steering wheel or dashboard injuries these should be suspected.

Acute spinal cord injury can also result in hypotension following the loss of vasomotor tone due to removal of neural control . In these patients assessment of motor and sensory responses can be quickly determined . If a patient with head injury presents with hypotension then other causes of hypotension should be ruled out.

The treatment includes insertion of two large bore cannulas in two large veins . If there is availability of central venous catheter establishment of a central vein will be more ideal . The goal of initial treatment is to maintain a normal cardiac output . Upto 1.5 litres of intravenous fluids can be given with continuous monitoring . A blood loss of 15% will have minimal symptoms and the body compensates without any treatment . A blood loss of more than 20% is manifested by thirst , hypotension , weakness and cold clammy skin. A blood loss

of more than 1000ml will require a blood transfusion . If compatible blood group is not available , O negative blood can be transfused.

Urine output should be monitored and central venous pressure monitoring is ideal if available . Monitoring of the respiratory system for signs of pulmonary edema is very important.

DISABILITY

Assessment of neurological status is very important . It is done by Glasgow coma scale . Glasgow coma scale of less than 8 is an indication for urgent intubation as the patient cannot maintain an optimal airway . This evaluation should be carried out only after adequate correction of hypoxia and hypovolemia.

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EXPOSURE

Exposing the patient fully is very important as a vital injury may be missed in the unexposed areas . After this inspection , the patient is clothed to prevent hypothermia . Foley's catheterization is done to assess for the urinary output . In case of suspected uretheral

injury catheterization should not be attempted . Radiological examination of the chest , pelvis , abdomen , cervical spine are obtained.

SECONDARY SURVEY

This involves a head to toe examination . This is done in a methodical fashion otherwise critical injuries may be missed. Neurological examination is a part of secondary survey . If during the course of secondary survey the patient deteriorates , he should be reverted back and reassessed for airway , breathing and circulation . No radiological or diagnostic procedure are done before fully stabilizing the patient.

TERTIARY SURVEY

After initial resuscitation and patient stabilization all diagnostic study should be done . Another survey of the patient and review of all diagnostic tests is done for further management of the patient.

BLUNT INJURY CHEST

Blunt injury chest can present as

SCAPULAR FRACTURES

Scapular fractures are very rare since they are protected by large muscles. 1 % of the patients with blunt injury chest presents with scapular fractures. Because of the associated serious injuries they are usually overlooked.

Treatment consists of conservative management.

STERNAL FRACTURES

With high speed motor vehicle accidents , sternal injuries are becoming common because of the impact of the sternum against steering wheel. It is usually a transverse fracture at the junction of body and manubrium sterni . Sternal injuries are usually associated with myocardial contusion. The diagnosis is established by lateral X-ray of the chest. The treatment includes looking mainly in to the associated injuries. Specific management of sternal fractures includes pain relief and rest. They heel without any deformity.

MINOR RIB FRACTRES

A simple rib fracture without any associated injury is the commonest presentation with blunt chest trauma . They are rarely life threatening . Since the thoracic cage in young children is elastic and compliant , the incidence of rib fractures is less . If children presents with multiple rib fractures, it indicates a higher force of impact and hence a higher associated injuries. The usual rib fractured are 4,5,6,7,8,9. Serious intra thoracic injuries may also be associated with these rib fractures.

The patients present with point tenderness and severe pain and deformity. Crepitus and subcutaneous emphysema may be a feature . Breath sounds are usually decreased on the affected side.

Treatment includes control of pain and relief of intercostal muscle spasm. Advantages of pain relief includes prevention of hypoventilation and collection of secretions . Elderly patients and patients with preexisting lung parenchymal diseases are at particular risk.

The pain relief may include oral or parenteral analgesics or narcotics. Intercostal nerve blockade or narcotic epidural analgesia is of

great use in patients with bilateral or severe injury and helps in early recovery.

FIRST & SECOND RIB FRACTURES

Since the 1st two ribs are well protected a significant force is necessary to cause fracture of these ribs and hence associated injuries are common and severe . These may include intracranial ,thoracic or abdominal injuries . There has been reports of great vessel and brachial plexus injury. So in these cases of fractures it is always necessary to identify and rule out great vessel or associated injuries.

Treatment includes analgesics and treatment of associated injuries. Thoracic outlet syndrome and brachial plexopathy may be a long term complication.

FLAIL CHEST

Flail chest is usually associated with severe thoracic injuries in which ,there is a paradoxical motion of a segment of chest wall . In flail chest the unstable segment moves paradoxically in an opposite

direction from the other parts of thoracic cage during respiration . Flail chest may be classified into sternal flail chest because of a seperation of sterno-costochondral joint . This may occur also due to fracture of multiple consecutive ribs which may cause anterior, lateral or posterior flail segment . Flail chest indicates high energy injury.

The pathophysiology of flail chest includes alteration of chest wall mechanics which interferes with adequate ventilation and collection of secretions . In paediatric age group severe pulmonary contusion is possible without obvious rib facture owing to the elastic nature whereas in older age group flail chest may occur even with trivial trauma.

The diagnosis is usually made by clinical examination and by chest radiography . Observing the patient from the lateral side during respiration will help to detect paradoxical action of the flail segment. Radiograph may demonstrate a hook like configuration . The diagnosis of flail chest may be difficult in a patient with mechanical ventilation.

MANAGEMENT

The management includes appropriate pulmonary physiotherapy , adequate pain relief , use of endotracheal intubation and mechanical

ventilation if needed . The patient should be assessed for ventilation and airway patency . Since associated injuries are common ,treatment of shock if present is necessary.

In awake and conscious patient maintaining a normal oxygen saturation is necessary . Intermittent positive pressure ventilation for effective drainage of pulmonary secretions and early ambulation will prevent pulmonary complications. Antibiotics are not routinely used . Mechanical ventilation is reserved for patients with respiratory decompensation . Indications for mechanical ventilation includes respiratory rate more than 35, fall in oxygen saturation, hypercarbia , dead space tidal volume ratio more than 0.6 , severe shock and associated injuries . When pulmonary contusion coexists the likelihood of intubation increases.

Surgical stabilization is a treatment option for patients with severe flail chest . The primary goal is to restore the ventilatory mechanics and to prevent chest wall deformity and to reduce the time on mechanical ventilator. Thoracotomy for reduction is not routinely done . Other indications for surgical fixation includes fixed thoracic impaction and failure to wean from ventilator.

Adequate pain relief is most important in patients with flail chest. Severe pain may result in hypoventilation , atelectasis and pneumonia which may result in prolonged mechanical ventilation . The modes of pain relief includes non steroidal anti inflammatory drugs , intravenous opioids and intercostals nerve blockade.

The use of continuous thoracic epidural analgesia has revolutionized the treatment of pain . It offers an immediate pain relief both at rest and at motion . The advantages are reduction in the use of narcotic analgesics, improved vital capacity and a forceful cough to clear secretions. Complications of epidural anaesthesia includes hypotension and retention of urine . Continuous fentanyl epidural analgesia has been found to be more effective.

COMPLICATIONS OF FLAIL CHEST

Complications includes pneumonia , sepsis ,respiratory failure and death. Associated barotrauma and vocal cord injury are due to mechanical ventilation.

LUNG AND PLEURAL INJURIES

Lung parenchymal and pleural injuries are usually common with blunt injury chest .They may present immediately or after a time delay of 48-72 hours . These injuries may occur as a result of direct trauma or due to associated rib fractures.

Most of these injuries interfere with physiological function through one of the following mechanism,

1.Problems in the pleural space that may interfere with lung perfusion .

2.Bleeding from the chest wall or from the lung tissue,

3.Lung parenchymal injuries which may directly interfere with ventilation and perfusion.

Pleural problems may include haemothorax and pneumothorax,

PNEUMOTHORAX ;

Pneumothorax is the most common presentation following

blunt thoracic trauma . Pneumothorax is a result of accumulation of air in the pleural space.

Pneumothorax may occur through one of the following mechanism

1.Fractures of rib which may cause a direct lung parenchymal injuries.

2.Deceleration injuries can cause lung parenchymal tear , which may cause an air leak.

3.Severe crush injuries causing a disruption of the alveoli.

4. A sudden rise in the intra-thoracic pressure resulting in alveolar rupture.

The clinical features include a decreased breath sound on the affected side and there may be a tracheal shift to the opposite side with a hyperresonant note on percussion.

Pneumothorax involving less than 10% can be managed conservatively .The standard treatment for a traumatic pneumothorax involving more than 10% is inter-costal drain with under water seal

drainage. Except in cases of tension pneumothorax and in unstable patients , a radiological evaluation is always necessary.

The radiograph offers advantages such as

1.Diagnosis is confirmed and hence can prevent unnecessary tube thoracostomies .

2.It may occasionally demonstrate a diaphragmatic hernia at which time tube thoracostomy is absolutely contraindicated.

3.There may be associated findings which may change the site of tube thoracostomy.

Rapid re-expansion of the lung following tube thoracostomy in massive pneumothorax may result in considerable pain as a result of pleural stretching , so application of negative pressure is not routinely done. A follow-up X-ray is usually mandatory following tube thoracostomy.

TENSION PNEUMOTHORAX ;

Tension pneumothorax usually occurs when air enters the pleural space from outside and there is an increase in positive pressure inside the pleural cavity . As the collection increases it causes collapse of

involved lung and thus causes a mediastinal shift which intern causes a compression of vascular structures. This leads on to decrease in venous return and thus causing a haemodynamic instability. Tension pneumothorax is more common with penetrating injuries.

The clinical features include dyspnoea , engorged veins over the neck , absent breath sound on the affected side and hyper- resonant note on percussion .

Treatment includes immediate evacuation by using a large bore thoracostomy tube . if thoracostomy tube is not available , a large bore needle is inserted into the second inter-costal space in mid clavicular line.

HAEMOTHORAX ;

Haemothorax usually occurs as a result of tear in the lung parenchymal or mediastinal vessels ,which may present in an immediate or delayed fashion.

Immediate drainage of the haemothorax is necessary because , it causes a re-expansion of the injured lung thereby compressing the torn

blood vessels thus obtaining haemostasis. This will also allow decompression of mediastinum and thereby relieving compression of opposite lung.

The treatment includes using a wide bore tube for thoracostomy usually of size more than 28F . The tube is usually placed in a dependent fashion . Continuous bleeding of more than 200-300 ml per hr for several hours will warrant an emergency thoracotomy . Delayed haemothorax which forms a dense fibrinous clot is also an indication for thorcotomy.Thoracoscopy can be tried as an alternative to surgery in these cases of clotted haemothorax.

DELAYED COMPLICATION ;

Clotted haemothorax is a known complication following thoracic trauma , the reason enlisted are,

1.failure to intervene a significant haemothorax ,

2. improper tube placement,

3. improper tube care ,

4.selection of wrong size of tube ,

The treatment includes a thoracoscopy and evacuation of the clotted haemothorax , the main indication being clotted haemothorax occupying more than 25 % of the lung volume and infection with constitutional symptoms.

PULMONARY CONTUSION ;

Pulmonary contusion results from a direct injury to the lung following which alveolar hemorrhage and edema ensues . Usually edema develops within few hours and this is primarily because of a direct lung injury . The injured lung exhibits an increased pulmonary vascular resistance with decrease in blood flow which is followed by a decrease in the pulmonary surfactant levels over a period of 48 hours . When excess fluid is overloaded ,edema increases . Steroid has not shown much promise in routine usage.

In serious pulmonary contusion , because of a capillary leak , fluid overload may double the occurence of pulmonary edema.The ultimate aim of resuscitation is to maintain adequate urine output. Pulmonary artery catheter may be used to monitor the hydrostatic pressure.

The treatment lies in adequate pain relief and judicious fluid management . In severe pulmonary contusion the need for mechanical ventilator should be considered. A pressure control mode ventilation may be ideal and thoracotomy may be rarely indicated for pulmonary contusion and mainly reserved for late complication.

PERSISTENT AIR LEAK AND BRONCHO PLEURAL FISTULAS

Significant air leak after trauma is common and rarely needs intervention . It usually occurs as a result of airway damage or due to barotrauma

Broncho-pleural fistulas occurs as a result of severe lung injury or after a surgery following a trauma. If there is a minimal fistula , conservative management is followed , surgery is rarely indicated.

LUNG HERNIATION

Traumatic lung herniation after blunt injury chest commonly occurs anteriorly adjacent to the sternum . It may present immediately or after sometime .

Clinical manifestations include pain and bulge which may increase in size with respiration. The diagnosis is usually confirmed by CT or X-ray chest . For small defects conservative management is enough , whereas for larger defects emergency thoracotomy may be needed.

CHEST WALL HAEMORRHAGE

Sites of chest wall hemorrhage includes intercostals, muscular and internal mammary arteries. Bleeding from intercostal or internal mammary arteries produces massive haemothorax . Most of the patients will need a formal thoracotomy.

EMPYEMA ;

Empyema following trauma pose a significant problem .The main causes include iatrogenic injuries following inter-costal drain , infection extending from peritoneal cavity , post pneumonic empyema , clotted haemothorax with secondary infection and adult respiratory distress syndrome.

There are two stages of empyema thoracis ,

1.diffuse suppurative pleurisy

2.localised abscess

Treatment includes broad-spectrum antibiotics and aspiration. If the pus is organised and thick, inter-costal tube drain is the treatment , thoracotomy is rarely indicated.

TRACHEAL AND BRONCHIAL INJURIES ;

The tracheo-bronchial tree is a dynamic structure that adapts to changes in the pressure and air flow. Tracheo-bronchial injuries is a rare presentation of thoracic trauma .Many patients do not survive to reach the hospital because of associated injuries . At other times they are not usually recognised. Tracheo-bronchial injuries occur due to a direct blow or a burst injury which results in antero-posterior compression of the thorax thereby causing an increase in the intra-thoracic pressure .This along with a closed glottis causes a rise in the intra-tracheal pressure which results in tracheo-bronchial injuries.

The clinical presentation includes severe respiratory distress that may result in immediate death . When injuries are confined to the mediastinum , it results in pneumo-mediastinum , which is usually a late feature .It can also present as a pneumothorax. Chest radiography will confirm the pneumo-mediastinum along with lung falling away from hilum. This finding is pathognomonic .Definitive diagnosis is made by bronchoscopy. Flexible bronchoscopy is preferred as no anesthesia is required .

Treatment includes effective management of airway .If less than $1/3^{rd}$ circumference of trachea is involved , non operative management with humidified air , voice rest followed by bronchoscopy may be done . A bronchoscopy guided temporary endo-tracheal intubation may be done and cuff inflated below the injury and the tube may be removed after 48 hours. A repeat bronchoscopy is usually done to look for condition of the tear .If the laceration involves more than $1/3^{rd}$ circumference , a primary suturing or a tension free end to end anastomosis can be done .The outcome is better with early recognition and prompt treatment

POST-TRAUMATIC PULMONARY INSUFFICIENCY ;

There may be an acute respiratory failure in patients with major chest trauma . The patients present with injury to the chest with stable vitals .The patient is pink and chest X-ray may reveal a insignificant fluffy opacification. As time progresses , a cyanotic hue develops. There is tachypnoea with marked pulmonary opacities and fall in oxygen saturation ,and patients are managed with mechanical ventilation .As time progresses , there is uniform hazy opacification on chest x-ray .The patient may fail to respond even with 100% oxygen with maximum pressure .A few patients may recover after two weeks.

Various terms such as wet lung , short lung , crush lung , blast lung , adult respiratory distress syndrome has been used for this condition.

ETIOLOGY OF PULMONARY INSUFFICIENCY;

1.Tear in the lung and alveoli which causes a decrease in pulmonary function.

2. Obstruction of small pulmonary vessels by micro-emboli.

3. Fat embolism from fracture of long bones.

MANAGEMENT ;

Maintenance of good cardio-vascular status with adequate mechanical ventilatory support is mandatory. Monitoring of central venous pressure and measurement of left atrial and pulmonary pressure using a swan-ganz catheter is ideal. Ionotropic supports may be needed and used accordingly. Tracheostomy is mandatory as mechanical ventilation will be needed for more than two weeks . Antibiotics is used to avoid infection , diuretics to avoid pulmonary edema and digoxin may be used to increase cardiac contractility

TRAUMATIC ASPHYXIA ;

It is a rare condition following blunt thoracic injury .Blood from the heart is driven into the veins of the head and neck and upper parts of the chest causing a blood extravasation into the conjunctiva and skin of those regions .There is intense venous congestion in those areas with petechial hemorrhages . X-ray will not have any characteristic feature.

Treatment includes propped-up position with nasal oxygen which helps in venous drainage.

OESOPHAGEAL INJURIES ;

Injury to the oesophagus is relatively very rare and occurs in less than 1% of thoracic injuries . Penetrating injuries are more common causes of oesophageal injury rather than blunt injuries . Oesophageal injury following blunt injury results from an increase in intra luminal pressure as a result of direct trauma to the chest against a closed glottis . The part of oesophagus proximal to gastro-oesophageal junction is injured in thoracic trauma patients.

The symptoms include difficulty and painful deglutition , haemetemesis , tenderness over the neck or chest , dyspnoea and stridor. Associated tracheal and vascular injuries determine the outcome.

Water-soluble contrast will be used in diagnosis . Oesophagoscopy is the ideal diagnostic tool . All patient with the pneumo-mediastinum should definitively be evaluated with the oesophagoscopy

Treatment includes conservative therapy for very small tears . This includes nil per oral , ryle’s tube aspiration and prophylactic antibiotics . For larger tears , surgical treatment may be considered which includes thorough debridement , drainage , primary closure of the

perforation in two layers .Tissue flaps can be used to buttress repair after primary suturing.

DIAPHRAGMATIC INJURIES

Diaphragmatic injuries are rare and are most common in penetrating than blunt injuries. The dynamic nature combined with the anatomical design helps in protecting this structure from minor injuries. The diaphragm because of its anatomical location between the thoracic and abdominal cavities is injured in association with other structures. The mechanism of diaphragmatic injury in blunt trauma is by sudden increase in the intra-abdominal or intra-thoracic pressures which are transmitted to the domes resulting in rupture. The left hemidiaphragm is ruptured more frequently than the right in the ratio of 9:1 .This is because of the fact that the right diaphragm is more protected whereas the left diaphragm is weakened because of openings for oesophagus and aorta. When the right diaphragm is injured ,the liver is the only organ to be injured, whereas in the left diaphragmatic injury any organ such as the liver, stomach, spleen ,transverse colon and omentum may be injured as a result of herniation.

The clinical features include dyspnoea and chest pain , immobile left thorax , displaced apex beat ,absent breath sounds over the affected hemithorax, presence of bowel sound over the thorax and tympanic note on percussion .

The diagnosis of diaphragmatic rupture requires a high degree of suspicion .Immediate diagnosis is the key for successful management. Any patients with a high force of trauma should be suspected for diaphragmatic injury. An immediate chest X- ray may reveal nothing except a small haemothorax. A contrast study by pushing air through the nasogastric tube will usually confirm the diagnosis. The confirmatory radiographic picture would be the presence of hollow viscera containing air in the pleural cavity.

TREATMENT

When diagnosis is established , surgery is the only option . The patient is put on nil per oral with ryle's tube aspiration and broad spectrum antibiotics. Nasogastric tube should not be forced as it may cause iatrogenic injury to oesophagus and stomach . After initial resuscitation, these injuries can be approached either through

thoracotomy or through laparotomy or thoracolaparotomy. Laceration less than 2 cm can be repaired with non absorbable horizontal mattresses . Laceration more than 2 cms are usually repaired with running locked sutures. Thoracotomy is usually better as adhesions between abdominal viscera and intrathoracic structures can be well visualized and hernia can be easily reduced and diaphragm can be easily repaired.

One of the most important and dreaded complication is gastrointestinal strangulation . The most common organ to be involved is the colon. The mortality rate with diaphragmatic injuries is around 25 % and when strangulation coexist this rate increases to 60 %.

Another complication with the central diaphragmatic injuries is intrapericardial herniations which are more common with blunt injury .The associated organ most commonly involved was colon . Treatment includes initial resuscitation with immediate exploratory thoraco laparotomy. The mortality with these kind of intrapericardial herniations approaches 67 %.

BLUNT TRAUMA TO THE HEART

Cardiac injuries following blunt chest trauma are the result of high velocity accidents. Iatrogenic injury following cardiopulmonary resuscitation can also result in cardiac injuries. These injuries can be minor such as cardiac contusion or concussion. More specific injuries include injury to the pericardium ,valves ,papillary muscles and coronary vessels.

Blunt trauma can results in pericardial tears either from a direct injury or from a rise in intra-abdominal pressure. Most of these injuries occur on the left side parallel to the phrenic nerve. It may range from a minor tear or may involve the entire pericardium. With such large tears herniation of the heart may occur resulting in sudden death.

The clinical feature includes a pericardial rub and X-rays may reveal a pneumopericardium and displaced heart .The treatment includes repair of the pericardium without tension.

The heart valves may be injured as a result of blunt injury. Aortic valve is the most common valve to get injured. Injury to coronary vessels are rare following blunt injury. For all the above conditions surgery is the treatment of choice.

CARDIAC RUPTURE

Cardiac rupture usually occurs following very high impact injuries. Various mechanisms include

1. Direct transmission of the increased intrathoracic pressure
2. Effect of a large force applied to the veins which results in transmission of this force into the right atrium
3. Initial cardiac contusion which undergoes necrosis and then rupture
4. Direct injury by a broken rib or sternum

The clinical features include severe hypotension with features of shock. There may be features of cardiac tamponade. The presence of associated injuries will make the diagnosis difficult. ECG may reveal a bundle branch block. Echocardiography is diagnostic.

The treatment includes immediate thoracotomy and pericardial decompression. Intra-aortic balloon pump may be used in patients with cardiac contusion. Prompt diagnosis and an organized resuscitative efforts will determine the prognosis.

INJURY TO THE GREAT VESSELS

Less than 10 % of great vessel injuries are due to blunt chest trauma. Iatrogenic injuries contribute as one of the important cause of these injuries.

Innominate artery,the vena cava and thoracic aorta are the commonest great vessels injured in blunt trauma. Of these aortic injuries are the leading cause of fatality. The mechanisms of these great vessel injuries include sheering forces caused by mobility of a part of the vessel near to fixed portion, direct compression between bony structures and increased intraluminal pressure caused by the accident.

Blunt aortic injuries may be partial or full thickness .The clinical features include hypotension, variable blood pressures between extremities, expanding haematoma at the outlet of the thorax, sternal fracture and flail chest. Chest X-ray reveals a large haemothorax and the loss of aortic knob contour. Mediastinal widening and tracheal deviation suggests injury to innominate artery. Conventional CT can demonstrate hemomediastinum but it is not reliable. CT angiography with three dimensional reconstruction is the investigation of choice.

The treatment includes initial resuscitation along with compatible blood transfusion. The initial treatment includes tube thoracostomy. If patient is stable non- surgical measures such as endovascular stenting can be tried. Indications for an urgent thoracotomy includes hemodynamic instability with significant hemorrhage from the tube thoracostomy. Surgery

includes primary repair of the injury or stent or graft placement depending on the site and size of the laceration.

MANAGEMENT OF BLUNT INJURY CHEST

85% of blunt chest trauma can be treated by conservative measures. Most of these patients are managed with intercostal drain insertion with underwater seal , oxygen and chest physiotherapy. Emergency thoracotomy is indicated in less than 10% of patients. They include

1. More than 1000 ml of blood drained following initial insertion of intercostal tube.
2. Continuous brisk bleeding of more than 100 ml in 10 minutes.
3. Bleeding of more than 200ml per hour for more than three hours.
4. Significant tracheobronchial rupture.
5. Great vessel injury with hemodynamic instability.
6. Pericardial tamponade.

A GUIDE TO TUBE THORACOSTOMY

In a stable and conscious patient obtain an informed written consent. A strict aseptic technique is necessary since a sterile haemothorax may be easily converted into a empyema thoracis following introduction of infection through the drain. The operator should scrub as for any surgical procedure .The skin over the proposed site of tube thoracostomy is cleaned by spirit or iodine. A dose of intravenous antibiotic at this stage will suffice. In an urgent situation , all these precaution can be over looked. In case of a tension pneumothorax a stab wound through the chest wall will provide immediate relief. Antibiotics can be given after the procedure.

The patient is draped well . Mark the site in the 5^{th} intercostal space in the mid axillary line. Infiltrate around 10-15 ml of 1% lignocaine through the periosteum along the upper border of the lower rib. Use of liberal local anaesthesia facilitates smooth insertion of the tube. The needle used for infiltration is left in-situ so that a precise skin incision can be made over that area.

Use 11 blade to incise the skin of the chest wall . Further procedure is through blunt dissection only. Using a kellys forceps blunt dissect the subcutaneous fat and the intercostal muscles. The parietal pleura is also

opened through the blunt dissection. Lignocaine can be used as and when desired for a smooth operative procedure. Digitally examine the tract. The gloved finger is inserted into the tract to confirm the entry into the thoracic cavity and also to free the intrapleural adhesions. There will be a gush of air, fluid or blood through the drain site upon insertion of the finger. Always the tube should be inserted along the upper border of the rib so as to safeguard the intercostal nerves and vessels.

A large bore drain is directed smoothly along the tract and is directed posteriorly and superiorly. Entry of blood or air will confirm the position inside the thoracic cavity. Suppose the expected contents do not come into the drain it may because of two reasons

1. the drain may not have entered the thoracic cavity
2. the contents may be so thick eg. Clotted haemothorax or pyaemia

When the position of the drain has been confirmed it is secured to the chest wall with a zero silk to prevent its displacement. The drain is connected to a standard collection apparatus. A purse string suture is placed around the drain site to close this after removal.

CARE OF THE CHEST DRAIN

The drain once introduced and secured should not be disturbed. It should be ensured that all the fenestrations of the tube lies inside the thoracic cavity or else there is a possibility of ineffective drainage, infection, and subcutaneous emphysema. Thin gauze dressing can be used to absorb the exudates. A simple adhesive bandage is enough as tight dressings may interfere with respiratory movements.

It should be ensured that the drain is never clamped in the presence of an air leak or else tension pneumothorax ensues. It should also be ensured that the drainage bag contains prescribed quantity of saline at all times and also at a level lower than the chest.

REMOVAL OF THE DRAIN

Chest drain should be removed promptly once it serves its purpose or else it may lead onto infection. Some patients may require a longer time because of pre-existing lung parenchymal diseases. In any patient with air leak for more than two – three weeks should be evaluated and treated surgically. A check X-ray is taken for looking into the lung expansion and drain may be removed following adequate expansion.

COMPLICATIONS

Usually complications occur because of improper technique. Abdominal organs such as liver, spleen, stomach and bowel have been injured. This occurs because of insertion of drain below the 6th intercostal space leading on to an iatrogenic rupture of diaphragm and there by injuring the abdominal organs. In case of injury to the liver it is advised to leave the drain in-situ for two days for the clot to resolve.

Penetration into the bowel if confirmed requires an urgent laparotomy. All these complications may be avoided by putting the drain above the 6th intercostal space.

Penetration into the heart may occur in patients with preexisting cardiomegaly as the left ventricle may be found in opposition to the chest wall. If entry into the heart is suspected the drain is left in situ and clamped and patient shifted for emergency thoracotomy.

When major pulmonary vessels has been injured inadvertently, the drain may be left in-situ and watched for the drainage. If it exceeds 1000ml a thoracotomy may be required or else conservative line of management may be required.

PATTERN OF INJURY

The commonest cause of blunt trauma chest is road traffic accidents. The primary factors responsible are the driver , the condition of the vehicle, the environmental and social factors. These include the road design , the laws such as speed restrictions, compulsory seat belt practices and adherence to helmet wearing. Speed acts as a major contributory factor for road traffic accidents. A one fold rise in speed will cause a four fold rise in fatality. Two wheeler drivers have 25 times more fatality rates than four wheel occupants. Helmets can reduce head injury by 75%.

Although seat belts have reduced the fatality rate by 50% in occupants of the car, it has however increased the risk of blunt thoracic and abdominal trauma by four fold.

Blunt trauma causes more injury because the energy is dissipated to a large surface area . In addition to this since there are multiple areas of contact the impact of injury is more in different parts of the body.Victims who are thrown far away or out of a car has greater chances of serious fatal injuries.

DRUG ABUSE

Drug abuse in the form of alcohol or substance abuse is a major factor contributing to trauma related deaths. According to national committee of injury prevention " risk of crash increases five - fold at blood alcoholic concentration of 80mg/dl". Alcoholism is associated with a sense of false confidence which translates into high speed and rash driving, contributing to increased fatality. Alcoholism also increases the incidence of accidental falls.

SURGICAL ANATOMY

For diagnosis and treatment of blunt injury chest , a thorough knowledge of anatomy of chest is necessary.

FUNCTIONS OF THORACIC CAGE

The vital function of thorax is breathing .It contains the lungs as well as the diaphragm, thoracic walls and the ribs for effective ventilation.

PROTECTION OF VITAL ORGANS

Thoracic cage protects the heart, lungs and great vessels . Because of the dome shape of diaphragm it also give protection of the abdominal organs.

CONDUIT

The mediastinum in the thoracic cavity acts as the conduit for the structures passing through the thorax. These structures include

oesophagus , trachea, thoracic aorta, superior vena cava , vagus nerve and the thoracic duct .

THORACIC WALL

The thoracic wall consist of skeletal and muscular components. The thoracic cavity is bounded anteriorly by sternum and ribs, posteriorly by twelve thoracic vertebra and their corresponding intervertebral discs , laterally by the 12 ribs and flat muscles in the intercostal space. The sternum is composed of three main parts the manubrium sterni , the body and the xiphoid process. The sternal angle is the major landmark in which the second costal cartilage articulate with the sternum. The anterior end of each rib is made up of costal cartilage. All the twelve ribs attaches with the thoracic vertebra posteriorly. The head of each rib attaches with their corresponding vertebra as well as one vertebra above. Anteriorly the costal cartilage of the first seven ribs attaches with the sternum. The costal cartilage of the eight to ten ribs attaches with the cartilage of the above rib. Ribs eleven and twelve has only posterior attachment. Since both the ribs

do not have any attachment anteriorly, they are termed as floating ribs. Hence the chances of these ribs getting fractured is minimal.

THORACIC INLET

The superior thoracic aperture is bounded anteriorly by the manubrium sterni and the first rib on both sides and posteriorly by the TI vertebra. The plane of the aperture is at an oblique angle. Structures between the upper limb and thorax passes over the superior part of pleural cavity. Structures between head and neck and thorax passes more vertically .

The inferior thoracic aperture is closed by the diaphragm with the structures passing through it . It is bounded anteriorly by the xiphoid process, T12 vertebra posteriorly, ribs seven to twelve antero and posterolaterally. The apex of the lung is above the level of the boundary of the superior thoracic aperture and since it is not well protected ,any injury of the lower neck may lead to the development of pneumothorax.

MEDIASTINUM

The mediastinum is a thick midline septum that extends from the sternum to the thoracic vertebra and between two lungs. It is bounded anteriorly by the sternum , posteriorly by the vertebral column, superiorly by the superior thoracic aperture and inferiorly by the diaphragm and on both sides by the mediastinal pleura. It is further divided into four parts .

The superior mediastinum lies above the imaginary plane passing between sternal angle and body of T4 vertebra. The plane below this is the inferior mediastinum which is further divided in to anterior, middle and posterior mediastinum. The prominent structures in mediastinum includes trachea , oesophagus, bronchus, great vessels , heart, thymus, thoracic duct, vagus , phrenic , cardiac and laryngeal nerves. There is little loose connective tissue between the organs of the mediastinum which provides space to accommodate fluids and for dilatation of heart and blood vessels.

DIAPHRAGM

It is a musculo- tendinous partition which separates the thoracic cavity from the abdomen. Muscle fibers of the diaphragm arise

radially from the inferior thoracic aperture and converge into a large central tendon . Diaphragm has right and left domes of which right dome is higher than left .

There are three major openings and many small openings in diaphragm . Aortic opening is osteoaponeurotic and lies at the level of T12 vertebrae and transmits aorta, thoracic duct and azygos vein. Oesophageal opening lies at the level of T10 vertebrae and transmits oesophagus, vagus nerve, and branches of left gastric artery. Vena caval opening lies in the central tendon at the level of T8 vertbrae and transmits inferior venacava and right phrenic nerve. Each crus of diaphragm is pierced by greater and lesser splanchnic nerves. The left crus in addition is pierced by the hemiazygos vein. The sympathetic chain passes from thorax to the abdomen behind medial arcuate ligament. The subcostal vessels and nerves passes behind the lateral arcuate ligament . The superior epigastric vessels passes between the xiphoid and costal origin of diaphragm. The musculophrenic vessels pierce the diaphragm at the 8^{th} and 9^{th} costal cartilage.

Diaphragm is innervated by phrenic nerve. The diaphragm is supplied by superior and inferior phrenic vessels. It is the main muscle of respiration.

PLEURAL CAVITY

The thoracic cavity contains the right and left pleural cavities which are potential spaces enclosed by visceral and parietal pleura. The pleura is lined by mesoepithelium and contains thin serous fluid . The pleural cavity extends superiorly above the 1st rib into the root of the neck and inferiorly just above the costal margin.

The pleura is divided into visceral and parietal pleura . Parietal pleura is associated with the walls of thoracic cavity. Visceral pleura covers the surfaces and fissures of lung except at the hilum, where it is continuous with the parietal pleura. It is firmly adherent to the lung. The various parts of parietal pleura are costal part , diaphragmatic part, mediastinal part and cervical part. The parietal pleura extends downwards beyond the root as a fold called pulmonary ligament. It is a dead space into which pulmonary veins can expand during increased venous return.

There are recesses in the pleural cavity in which fluids can accumulate and they are costomediastinal recess and costodiaphragmatic recess. The costomediastinal recess lies anteriorly between costal and mediastinal pleura , particularly in relation to the

cardiac notch of left lung. The recesses are always occupied by the anterior margin of the lung . The parietal pleura is supplied by internal thoracic , intercostal and musculophrenic arteries. The veins drain into azygos vein . The visceral pleura is supplied by bronchial artery.

LUNGS

Lungs are organs of respiration and lie on either side of mediastinum and surrounded by pleural cavity. Each lung is conical in shape and has an apex at the upper end , base resting on the diaphragm, three surfaces ;costal , diaphragmatic and mediastinal surfaces and three borders; anterior, posterior and inferior borders.

The right lung is divided into three lobes by two fissures, oblique and horizontal fissures. The left lung is divided into two lobes by oblique fissure. Air enters and leaves the lung via main bronchi and trachea. The root of each lung contains a pulmonary artery , two pulmonary veins, main bronchus, bronchial vessels, nerves and lymphatics. Right lung is supplied by bronchial artery which arise from 3rd posterior intercostal arteries . On the left side it

arises from descending thoracic aorta . The venous drainage is by bronchial veins which on right side drain into azygos vein and on left side into hemiazygos vein . The lymphatics drain into broncho pulmonary nodes.

The bronchopulmonary segments are well defined sectors of lung , each aerated by tertiary or segmental bronchus. Each segment is pyramidal in shape with its apex directed towards the root of the lung. The connective tissue septa between adjoining segments from inter segmental planes are crossed by pulmonary vein and artery. The various broncho pulmonary segments in upper lobe are apical, anterior and posterior segments. The middle lobe has medial and lateral segments. The lower lobe has superior, anterior basal, posterior basal, lateral basal and medial basal segments. The various segments in upper lobe are apicoposterior, anterior, superior and inferior segments. In the lower lobe the segments are superior, anteromedial basal, posterior basal and lateral basal.

PERICARDIUM

Pericardium is a fibroserous sac surrounding the heart and the root of great vessels. It has two components which are fibrous and

serous pericardium . Fibrous pericardium is a tough connective tissue layer forming the middle mediastinal boundary. Its base lies on the diaphragm and apex continuous with adventitia of great vessels. Serous pericardium has two layers , the parietal and visceral layer. The narrow space between two layers of serous pericardium constitute the pericardial cavity. There are two sinuses in the pericardial cavity, which are oblique pericardial sinus and transverse pericardial sinus. Pericardium is mainly supplied by internal thoracic artery.

HEART

Heart is a pyramid shaped organ with apex directed forwards and base lying posteriorly. The base is quadrilateral in shape and consists of left atrium, small portion of right atrium and proximal part of great vein. Apex is formed by left ventricle. Heart has four chambers which are right and left atrium, right and left ventricle. Right atrium and ventricles receive deoxygenated blood from the body and sends to the lungs through the pulmonary artery. Left atrium and ventricle receive oxygenated blood through pulmonary veins from the lungs and pumps to the whole body through aorta.

The atrium and ventricles are separated by mitral valve on the left side and tricuspid valve on the right side. The left ventricle is separated from aorta by aortic valve and right ventricle is separated from pulmonary artery by pulmonary valve. Heart is supplied by right and left coronary arteries.

PHYSIOLOGY OF RESPIRATION

Diaphragm contracts and pulls the lower surface of lungs downwards and increases the vertical diameter and causes inspiration. By diaphragmatic relaxation expiration occurs. During forceful inspiration , elevation of ribs occurs and increases the anteroposterior diameter by pump handle mechanism. The bucket handle mechanism increases the lateral diameter of thoracic cavity.

During inspiration negative pressure builds up in pleural cavity and sucks in air. During expiration positive pressure builds up in the pleural cavity and pushes out air.

OBSERVATION AND CORRELATION

MODE OF INJURY	NO. OF PATIENTS	PERCENTAGE
Road traffic accidents	31	62
Accidental fall	7	14
Assault	6	12
Bull hit injury	4	8
Railway track accident	1	2
Wall collapse	1	2

Among 50 patients in this study, the most predominant cause of blunt injury chest was road traffic accident which comprise 62 %. Accidental fall formed around 7 %. These patients included the persons who fell accidentally while working or while climbing stairs or trees. Bull hit injuries comprised another 8 % which was all during household work.

NATURE OF INJURY

TYPE OF INJURY		NO. OF PATIENTS	PERCENTAGE
# ribs – single / multiple		50	100
Haemothorax		14	28
Pneumothorax		24	48
Haemopnemothorax		12	24
Lung injury.	Mild	6	12
	Severe	6	12
Tracheo-bronchial injury.		1	2
Diaphragmatic injury.		1	2
Cardiac injury.		-	-
Great vessel injury		-	-

In this study of 50 patients, more number of patients presented with pneumothorax than haemothorax. There was no reported cardiac and great vessel injury since these injuries are associated with higher mortality rates.

AGE DISTRIBUTION:

Age < 60 yrs - 39 (78%)

Age > 60 yrs - 11 (22%)

SEX DISTRIBUTION :

MODE OF INJURY	NO. OF MALES	NO. OF FEMALES
Road traffic accident.	28	3
Accidental fall.	5	2
Assault	4	2
Bull hit injury.	2	2
Train traffic injury.	1	-
Wall collapse.	1	-

In this study of 50 patients, males were found to be more prone for chest injuries when compared to the females.

RIB FRACTURES:

Single rib	-	13	(26%)
Multiple ribs	-	37	(74%)
Upper ribs	-	39	(78%)
Lower ribs	-	11	(22%)
Flail chest	-	4	(8%)
1st & 2nd ribs	-	10	(20%)

ASSOCIATED INJURIES:

Head injury	-	6	(12%)
Fractures other than ribs	-	11	(22%)
Abdominal injuries	-	3	(6%)
Spine injuries	-	2	(4%)

INTERVENTION DONE:

Intercostal drain placement	-	50	(100%)
Thoracotomy	-	1	(2%)
Mechanical ventilation	-	6	(12%)
Epidural analgesia	-	2	(4%)
Thoracolaparotomy	-	1	(2%)

PERIOD OF STAY:

Less than 10 days	-	15	(30%)
10 – 15 days	-	22	(44%)
More than 15 days	-	8	(16%)

OUTCOME:

Improved well & discharged	-	45	(90%)
Death	-	5	(10%)

AN EVALUATION OF VARIOUS FACTORS WHICH HAD INFLUENCED THE OUTCOME OF PATIENTS WITH BLUNT INJURY CHEST IN THE STUDY.

AGE

In the study 39 patients were aged less than 60 years. 11 patients were aged more than 60 years. Road traffic accidents were primarily the cause of injury in patients less than 60 years whereas accidental fall was the primary cause of injury in older people. Out of 5 deaths reported in the study 2 were aged more than 60 years with a mortality rate of 18% whereas the mortality rate in less than 60 age group was around 7%.

SEX

In this study 41 patients were male and 9 were female. Road traffic accidents form the major cause of injury among males whereas in females all modes of injuries were nearly equal. In all 5 deaths reported in the study none were females.

PRE-EXISTING LUNG DISEASE

In this study 9 patients were reported to have chronic pulmonary parenchymal disease. All were treated with regular treatment protocols with continuation of their older drugs(bronchodilators). One elderly male had an acute exacerbation of asthma during the fourth day after ICD insertion. He was managed in intensive care unit with iv antibiotics, nasal oxygen, bronchodilators , nebulisation and chest physiotherapy and he improved well without any complications.

PAIN

All patients with tube thoracostomy were administered parentral analgesics and sedatives on the day of ICD insertion. Most of these patients were switched over to oral analgesics on the third day. Two patients were treated with epidural analgesia. Most of these patients reported a low grade bearable pain for about 30 days following the procedure. Out of 40 patients who came for follow up, 90% had a normal pulmonary function tests.

1ST AND 2ND RIB FRACTURE

Fractures of the 1st and 2nd rib is usually rare. If one finds a fracture of 1st or 2nd rib it indicates a serious underlying injury. In this study 10 patients presented with fracture of first or second ribs. Three patients died and one patient developed pneumo-mediastinum. A brief history of patients who sustained fracture is given below.

A 65 year old male sustained road traffic accident and admitted to our hospital. He had a stable pulse and blood pressure . He was tachypnoeic with subcutaneous emphysema . Radiological investigations revealed a fracture of first three ribs with associated pneumo-haemothorax and pneumomediastinum. Tube thoracostomy was done and burns space was opened to relieve the pneumo mediastinum. Tracheo bronchial injury was suspected and endotracheal intubation done. Bronchoscopy was done on the next day which revealed a very small tear at the lower end of trachea . Nasotracheal intubation was done ,which was removed after three days. Patient had a uneventful recovery.

A brief history of three patients who died are as follows .A 60 year old male was admitted with history of accidental fall. He was

conscious with GCS of 15/15. He had hypotension , tachycardia, dyspnoea and subcutaneous emphysema and falling oxygen saturation. Breath sounds were decreased on right hemithorax. Tube thoracostomy was done immediately and blood transfusion arranged. Intubation and radiological examination done and was shifted to intensive care unit and connected to mechanical ventilator. Radiological investigations revealed fracture 1^{st} 2^{nd} 3^{rd} ribs with haemopneumothorax with severe lung parenchymal injury .Ultrasound abdomen was normal .Inspite of all treatment measures patient died on next day.

Postmortem findings revealed fracture 1^{st} 2^{nd} 3^{rd} ribs and clavicle with extensive parenchymal injury to right upper and middle lobe. Lower lobe was contused. The cause of death was attributed to chest injury.

A 30 year old male was brought to casualty with a GCS of E1V1M2.He had hypotension and was gasping. Breath sounds were decreased on left side with deformity of left thigh .Patient intubated and blood transfusion arranged. Radiological examination revealed fracture 1,2,3 ribs with left haemothorax with severe lung injury. He also had a diffuse subarachnoid hemorrhage with fracture of C7 vertebra with fracture left femur. Fracture stabilization was done and the patient was

shifted to Intensive Care Unit and connected to ventilator. ABG was done and treated accordingly.

The post – mortem findings revealed severe lung parenchymal injury and also revealed # C7 vertebra with multiple areas of sub arachanoid hemorrhage with small subdural clot. The primary cause of death was attributed to head and cervical spine injury with lung injury as a cofactor.

A 35 year old male presented with hypotension and tachypnoea with a deformity over left clavicle and a left flail chest. Radiology revealed fracture of first 4 ribs with underlying severe lung injury. Intercostal drainage procedure done and blood transfusion arranged. ICD drained more than 1200 ml of blood on insertion. He was immediately taken up for thoracotomy. Intra-operatively the source of bleeding was found to be from a mediastinal tear on the left side with severe lung contusion of left upper lung and around 150 ml of clotted blood. The bleeding vessel was ligated. ICD was placed and the wound was closed in layers. The patient was put on mechanical ventilator for 2 days. ABG was monitored and treated accordingly. Totally 4 units of compatible blood were transfused. The patient was extubated on 2nd day and discharged on 20th day without complications.

MULTIPLE RIB FRACTURES:

Multiple rib fractures were found in around 37 patients. Out of these, fracture of 4 or more ribs were found in 5 patients. Out of these 5 patients one patient underwent emergency thoracotomy and was on mechanical ventilator for 2 days. He had an uneventful recovery.

Another 2 patients had associated injuries in the form of liver and splenic contusion. All these patients were treated with intercostal drain insertion. They were given analgesics , antibiotics and other treatment as per regular protocols. All the five patients recovered well.

FRACTURES INVOLVING LOWER RIBS:

The lower ribs included 9-12 ribs. In this study, 4 patients had fracture of lower ribs. Out of these 4 patients, one had exclusively lower rib fractures. The other 3 patients had a combination of lower and other ribs. All patients with lower rib fractures were routinely subjected to ultrasound abdomen and CT Abdomen if warranted. In this group, ultrasound of 2 patients revealed liver and splenic contusions. Both had stable vitals with no free fluid in the peritoneal cavity. Both were managed conservatively and discharged after improvement.

FLAIL CHEST

In this study, 4 patients had a flail chest. In all these patients strapping of the flail segment was done. Of these, 2 patients had only flail chest and both of them had an uneventful recovery following conservative line of management.

One patient with fracture first and second ribs had severe lung injury with right haemopneumothorax. He was given mechanical ventilation. He expired on the next day and the Post-mortem findings attributed the cause of death to be because of chest injury.

Another patient with flail chest had a severe lung injury. ICD tube drained more than 1200 ml and the patient was taken up for emergency thoracotomy and also fixation of flail segment. He was given mechanical ventilation and had an uneventful recovery.

HAEMOTHORAX

In this study, 14 patients had isolated haemothorax with significant respiratory distress. Another 12 patients had an associated pneumothorax. Out of these one patient needed emergency thoracotomy as the ICD drained

more than 1200 ml. 3 patients had associated injuries, out of which one patient died. The post-mortem revealed death due to associated injuries and not due to haemothorax.

LUNG PARENCHYMAL INJURY:

Lung parenchymal injury is an indication of the severity of the trauma. In this study, 12 patients had lung parenchymal injury with more than half of the patients having less than 10% of lung involvement. Out of the 6 patients with severe lung injury, 3 patients required mechanical ventilation. Out of these 3 patients, one died. The cause of death was attributed to severe lung injury. One patient needed thoracotomy. All patients with minimal lung injury recovered well without any complication with conservative line of management.

TRACHEOBRONCHIAL INJURY:

One patient in the study group presented with haemopneumothorax with associated Pneumomediastinum. Bronchoscopy revealed a tear in the lower part of trachea . Patient was treated with right tube thoracostomy and

opening of the burns' space. The patient was put on nasotracheal tube for 3 days. Tube was extubated after 3 days and the patient discharged after improval.

DIAPHRAGMATIIC INJURY:

Presence of diaphragmatic injury indicates severe injury. In this study, one patient had diaphragmatic injury.

A 50 year old male presented to the casualty with respiratory distress and hypotension with tachycardia. On examination, his breath sounds were found to be absent on the left hemithorax. The abdomen was scaphoid. Radiology revealed fracture ribs with bowel loops inside the left hemithorax. The patient was immediately taken up for thoracolaparotomy. Operative findings were multiple bowel loops inside the left hemithorax with a rent in the diaphragm of size 2 x3 cm. The bowel segments were found to be gangrenous because of constricted diaphragmatic rent.

Gangrenous bowel segments were resected and end-end anastamosis was done. Repair of the diaphragmatic rent done with 1- 0 prolene. ICD placed and the wound was closed. The patient was given intensive unit care with mechanical ventilation. ABG was done and treated accordingly.

However the patient expired after 2 days. Post mortem findings attributed the cause of death to be diaphragmatic injury associated with sepsis.

CARDIAC / GREAT VESSEL INJURY:

In this study, no patient presented with cardiac or great vessel injury. Since cardiac and great vessel injuries needed greater force of trauma, patient rarely survive to present to the hospital. They die due to the primary cardiac or associated injury.

ALCOHOL CONSUMPTION:

Out of 50 patients, 26 patients had a history of alcohol consumption before the incident. All these 26 patients were males. There were no female patients in this study with history of alcohol intake.

DISCUSSION

Trauma is the leading cause of death in patients with less than 34 years. Use of seat belts has reduced the incidence of death by more than 50%. But it has increased the risk of thoracic and abdominal injuries. Wearing of helmets has brought down the fatal head injuries. Strict enforcement of laws is necessary for bringing down the death rate.

In management of a traumatized patient, the steps in advanced trauma life support system should be followed. This includes

1. Airway with cervical spine protection
2. Establishment of airway
3. Maintenance of circulation
4. Disability evaluation.
5. Complete exposure and re-examination.

A study conducted in the Al-Mouassat university hospital revealed the leading cause of the trauma to be violence (41%) followed by traffic accidents (33%). Pneumothorax (51%), Haemothorax (38%), rib fractures (34%), and lung contusion (15%) were the most common types of injury. Associated injuries were documented in 36% of patients (extremities 19%, abdomen 13%, head 8%). A minority of the patients required thoracotomy

(5.7%), and tube thoracostomy (56%) was sufficient to manage the majority of cases. Mean hospital LOS was 4.5 ± 4.6 days. The overall mortality rate was 1.8%, and morbidity (n = 78, 8.7%).

In this study road traffic accident was the leading cause of blunt trauma with 48% pneumothorax, haemothorax 28 %, rib fractures 100% and lung injury 24 %. 2% of patients needed an emergency thoracotomy. Mean length of hospital stay was around 9days. The overall mortality was 10 %.

Louie et al. reported an increase in the morbidity and mortality index in patients over the age of 60 years in a study of 232 patients. The mortality rate was 22 %. He attributed this to co-morbidities and pre-existing lung diseases. In my study, in elderly patients, the morbidity was higher and the length of stay in hospital was more by 2-3 days. The mortality percentage was around 18 % when compared to 7% in patients with less than 60 years.

In this study, Patients with preexisting lung diseases had a slightly higher morbidity with in-patient hospital stay increased by about 3 days.

Amir et al. in a study of 742 patients reported first and second rib fractures in around 7 % of the patients. The mortality rate was 21 % and the cause of death was attributed to chest and associated injuries.

In this study, fractures of 1st and 2nd ribs were associated with a higher morbidity and mortality due to the higher force of trauma involved. In around 10 patients with fracture first or second rib, 3 died with a mortality ratio of 30 %. The length of hospital stay was also higher.

FLAIL CHEST AND LUNG PARENCHYMAL INJURIES

Canella et al hypothesized in unilateral lung contusion that each lung will have a different compliance. Hence separating the lung and ventilating each lung according to its compliance at different tidal pressure will increase the prognosis.

But Vidhani et al reported good outcome in patients with pulmonary contusion with noninvasive ventilation.

Landercasper et al reviewed 62 patients who sustained a flail chest,including 42 who had a concomitant pulmonary contusion. Thirty-two patients were available for follow-up for a mean of 5 years. On examination, 46% were unable to expand their chest circumference by greater than 5 cm, and 57% had abnormal spirometry.

Similar data were presented by Beal and Oreskovich, showing 64% of patients sustaining a flail chest injury had long-term morbidity of persistent chest wall pain exacerbated by activity, chest wall deformity, and dyspnea on exertion . Despite such morbidity, 50% to 86% of these patients were able to return to full-time employment .

Livingston and Richardson studied 28 patients surviving severe chest injuries prospectively to assess the degree of pulmonary dysfunction and the duration of this disability . They found severe pulmonary dysfunction with pulmonary function tests (PFTs) at 40% to 50% of predicted values within 2 weeks of hospital discharge. At 4 months of follow up nearly 95 % patients were normal with good pulmonary function tests.

Kishikawa et al prospectively followed 18 patients with severe blunt chest trauma. Patients without a pulmonary contusion had normal PFTs within 6 months of the injury.Some patients experience dyspnea indefinitely following their injury.

In my study, pain in case of flail chest or in thoracic trauma did not affect long term morbidity and nearly all patients were able to return to normal activity.One patient had a thoracotomy with fixation of the flail

segment and mechanical ventilation In my study, 4 patients had flail chest and one patient died.

. In my study, 12 patients had lung parenchymal injury. Out of these, one patient died with a mortality ratio of around 8 %. All patients had significant morbidity during the early period , but all improved subsequently.Follow up pulmonary function tests revealed near normal values in more than 90% of patients. I could not do selective lung ventilation because of the limitation in using double lumen tubes.

DIAPHRAGMATIC INJURY

Boulinger et al study in 1993 revealed a mortality ratio of 41 % in around 80 patients with diaphragmatic injury. Paglierello and carter et al. described a mortality ratio of 30 % among 43 patients. Voeller et al study revealed a mortality ratio of 24 % in 33 %.

In this study, one patient had diaphragmatic injury, and he survived after thoracolaparotomy and mechanical ventilation. One patient had a tracheobronchial injury and improved after intervention.

ASSOCIATED INJURIES

In a study of 144 blunt thoracic trauma patients, mortality was 16% When the patient had either a flail chest or a pulmonary contusion, but it increased to42% if patients had both injuries .The most common cause of death following significant blunt thoracic injury, however, is brain injury.

In this study, 24 patients had associated injuries. Out of 5 deaths reported, 3 were due to head and associated injuries.

CONCLUSION

The various factors which influence the outcome of patients with blunt injury chest are ,

1. Advanced age of the patients.
2. Pre-existing pulmonary diseases.
3. Fracture of first and second ribs.
4. Flail chest.
5. Associated lung parenchymal injury.
6. Associated injuries to vital organs.

The commonest cause of blunt injury chest is road traffic accident.

- Strict enforcement of the rules is necessary for decreasing road traffic accident.
- Patient should be managed by advanced trauma life support.
- 85% of patients can be managed conservatively or by tube thoracostomy.
- Flail chest should be managed by tube thoracostomy and mechanical ventilation , if warranted.
- Good pain relief ensures early recovery of patients to normalcy.

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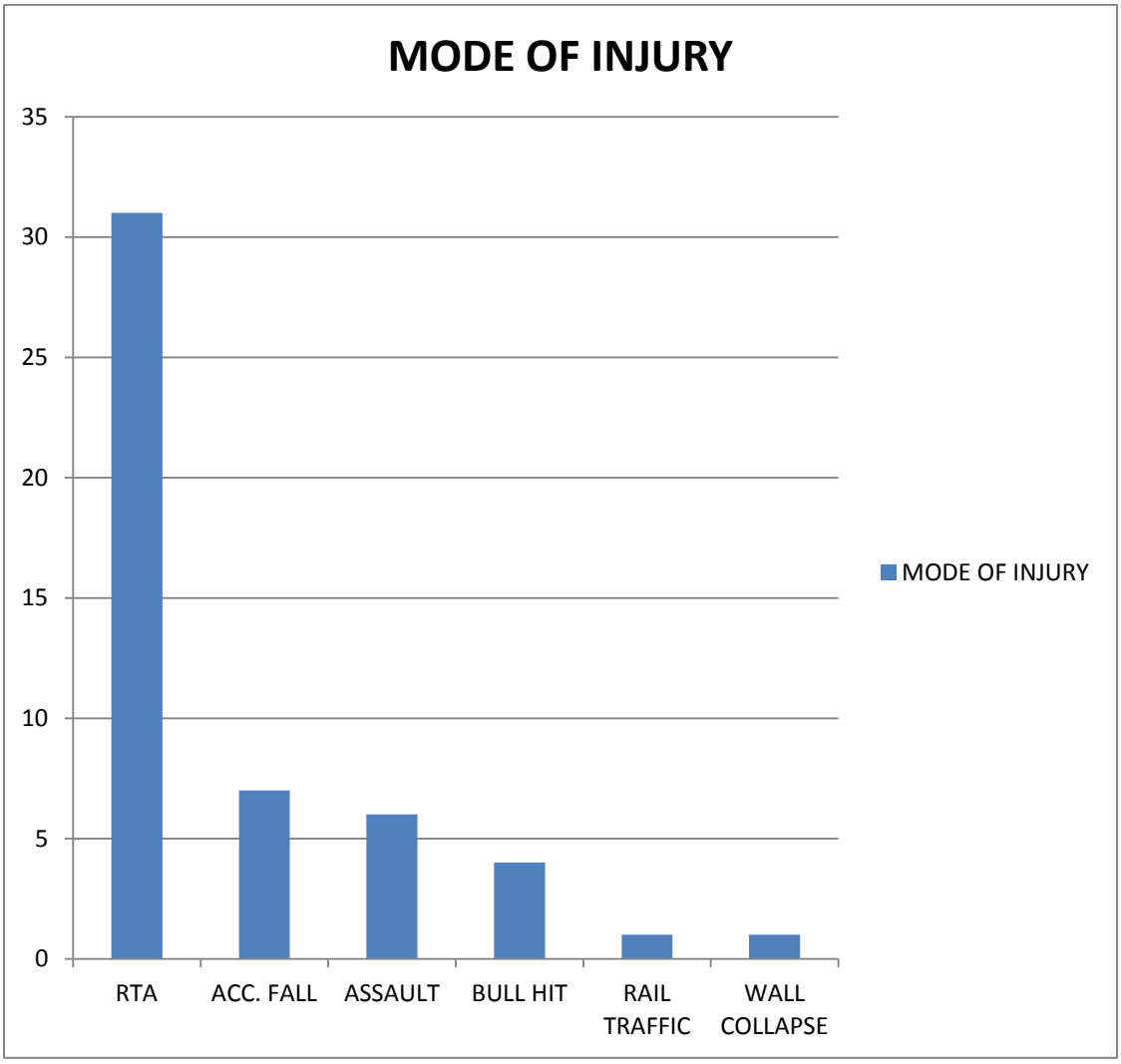
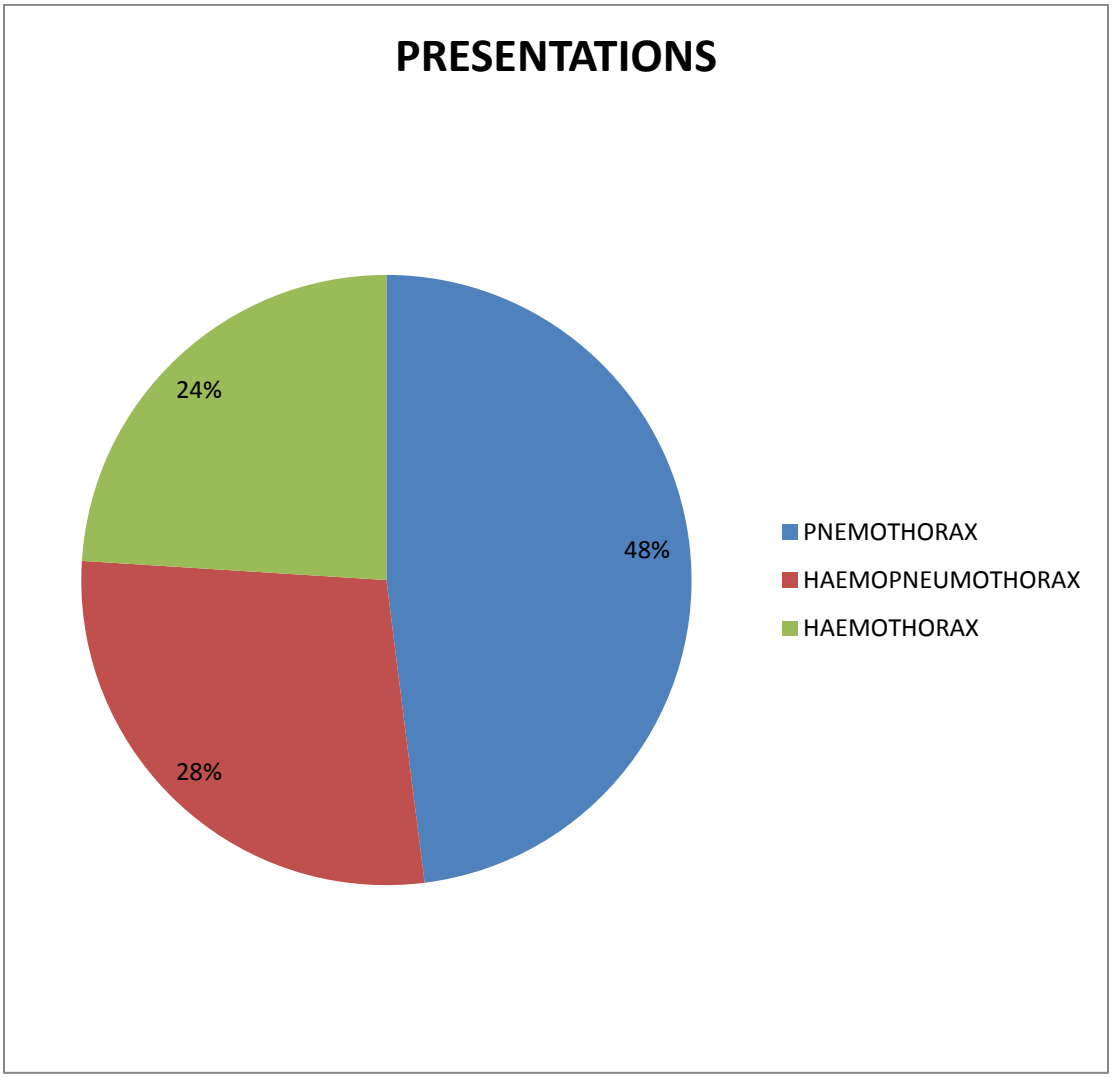

MODE OF INJURY
35
30
25
20
15
10
5
0
RTA
ACC. FALL
ASSAULT
BULL HIT
RAIL TRAFFIC
WALL COLLAPSE
MODE OF INJURY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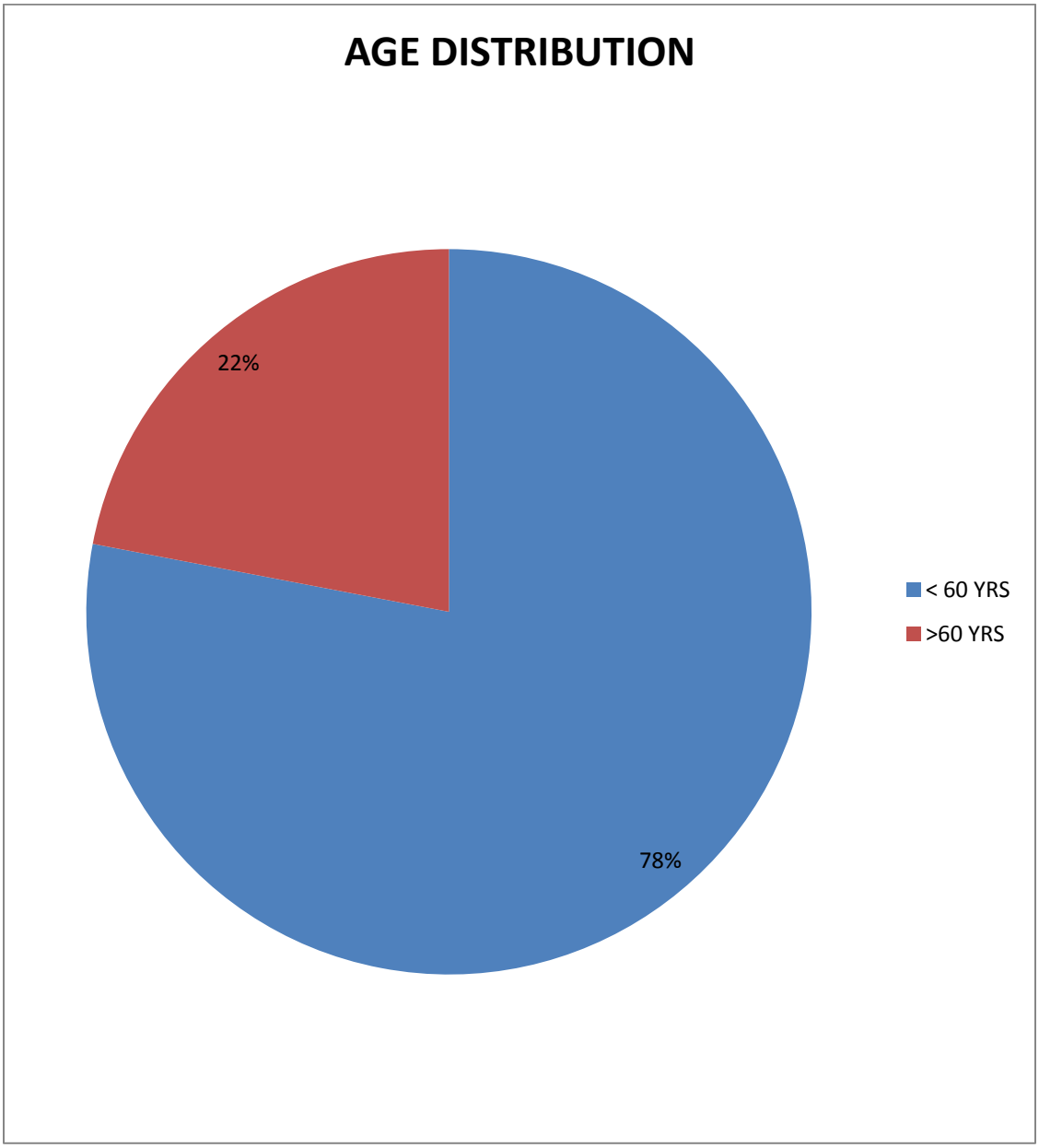
48%
28%
PNEMOTHORAX
HAEMOPNEUMOTHORAX
HAEMOTHORAX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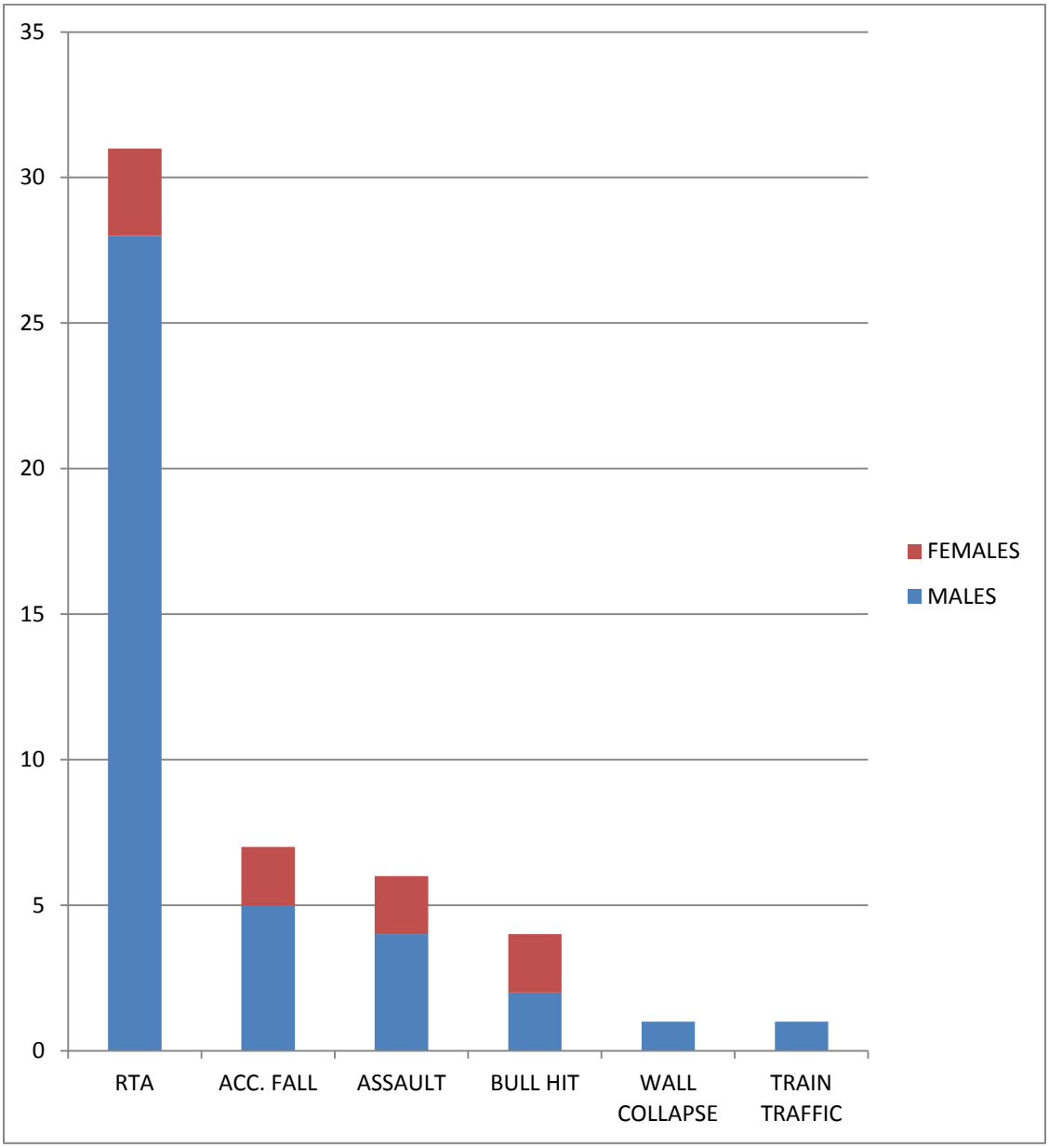
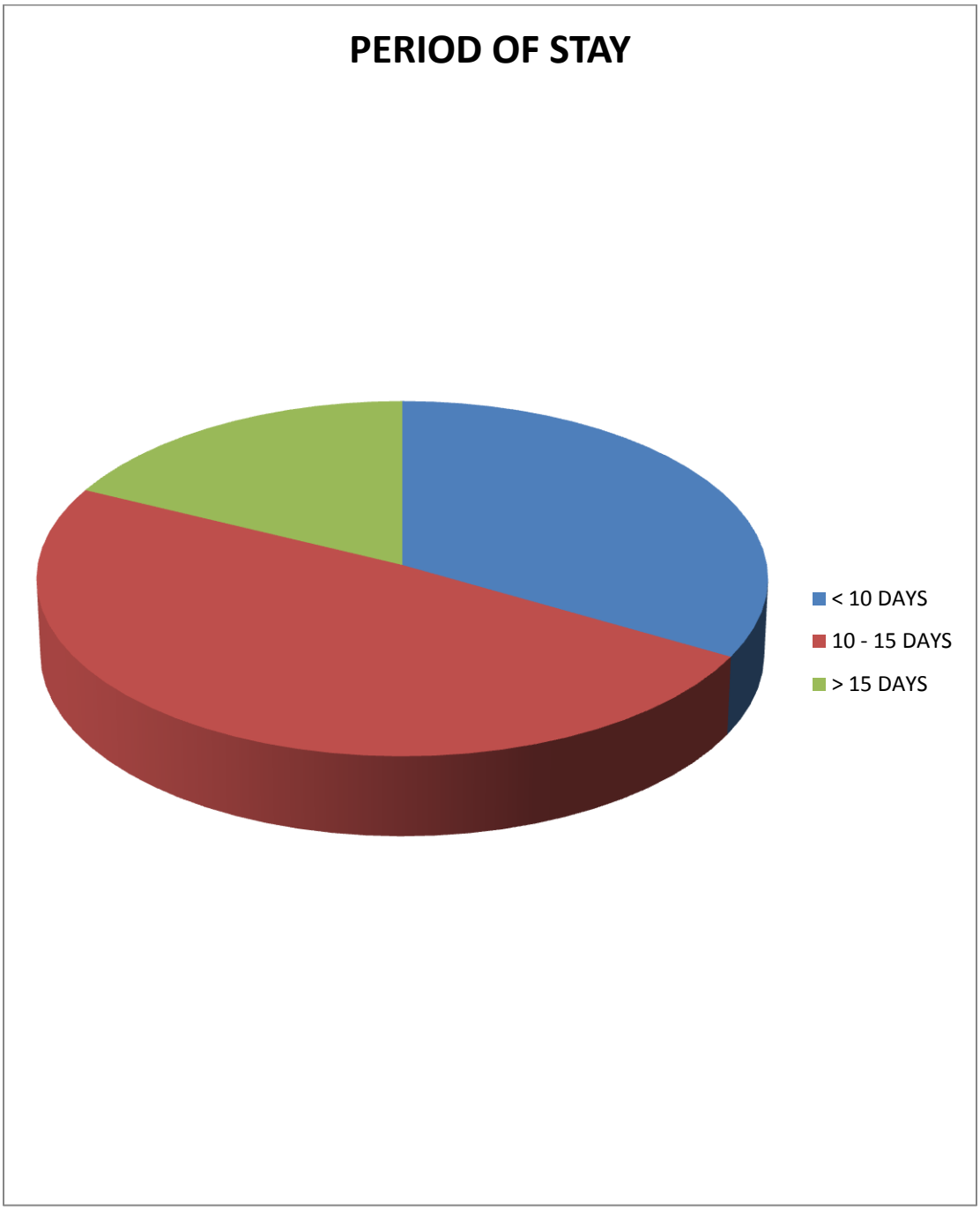
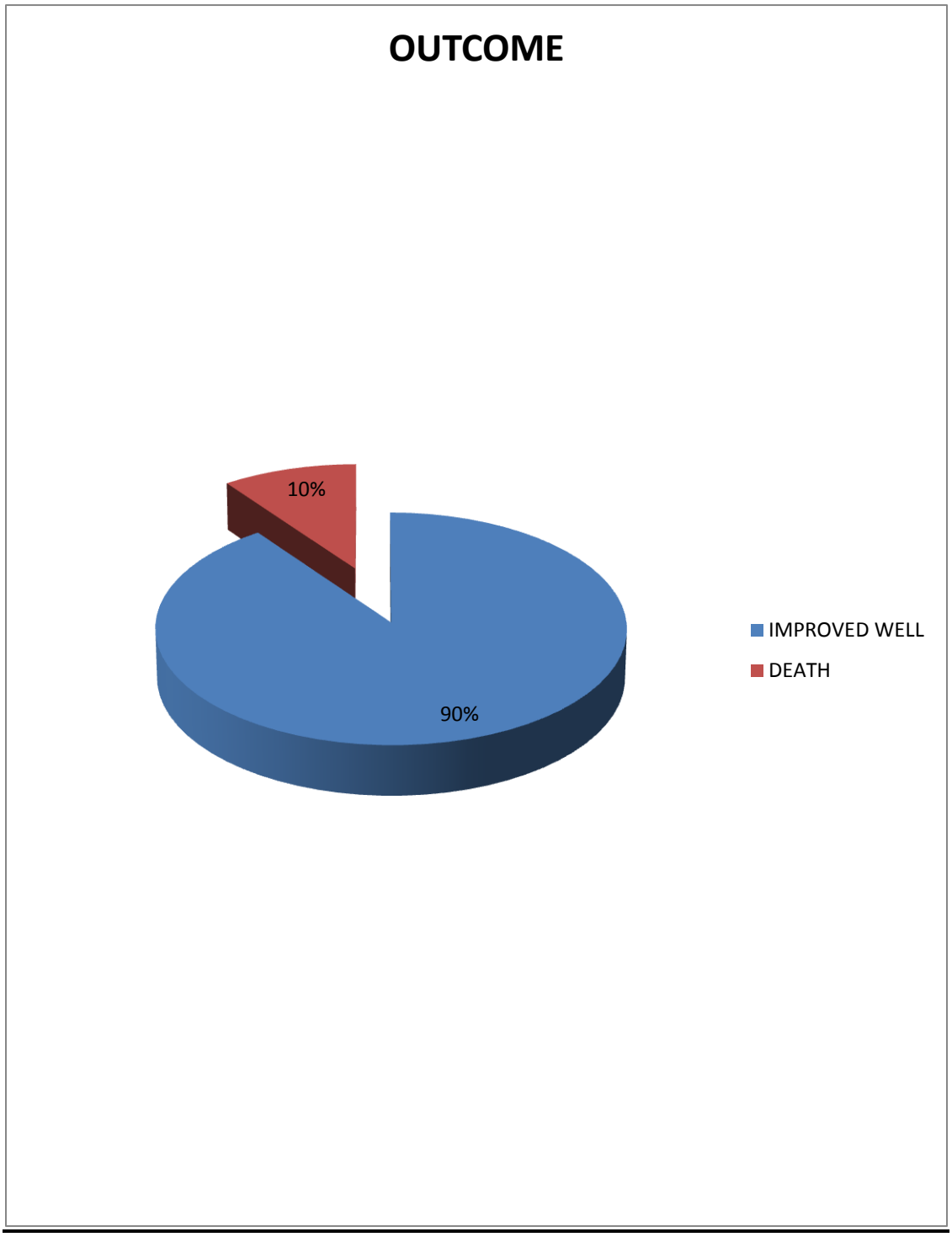
22%
78%
< 60 YRS
>60 YRS

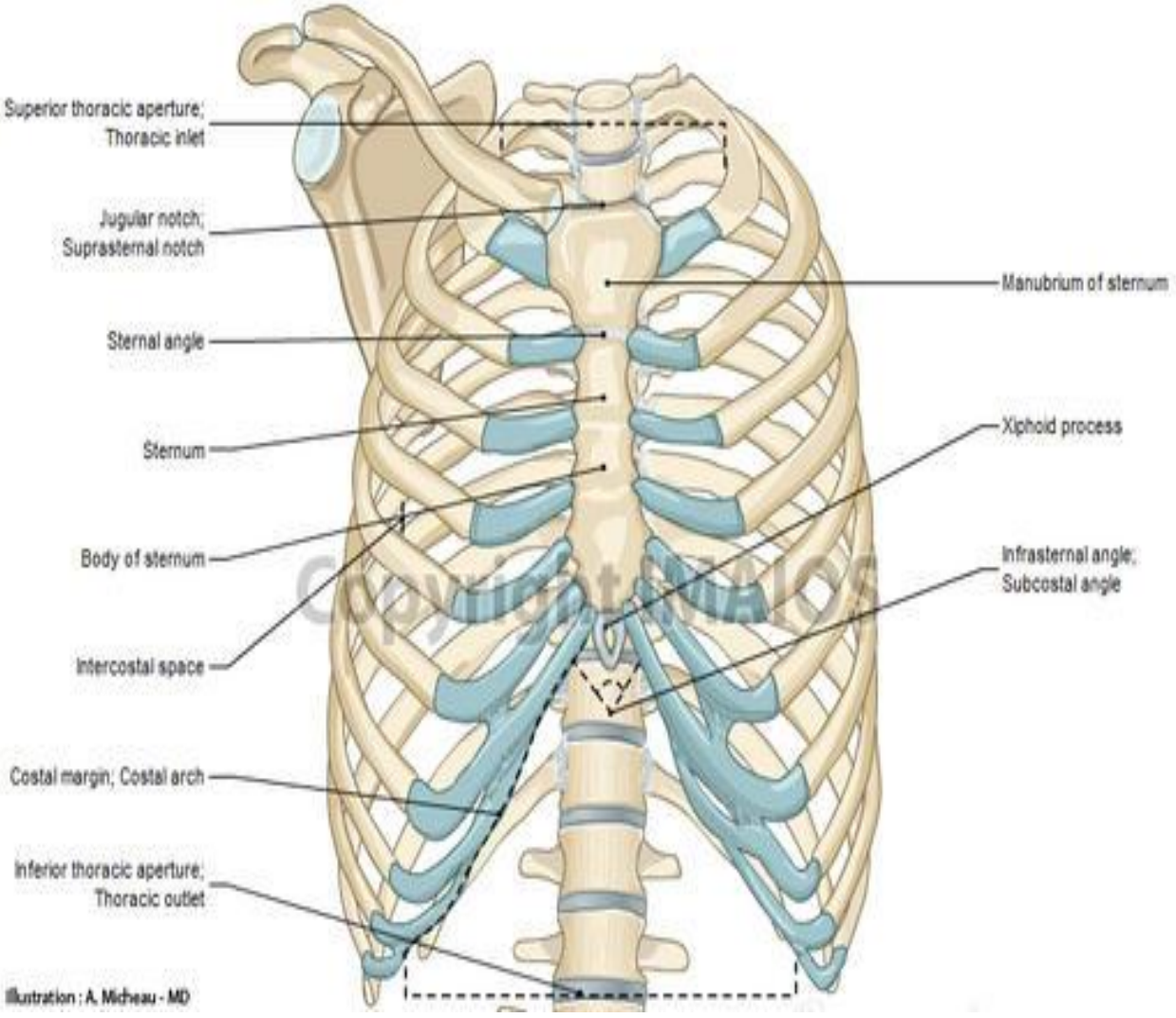
SEX DISTRIBUTION



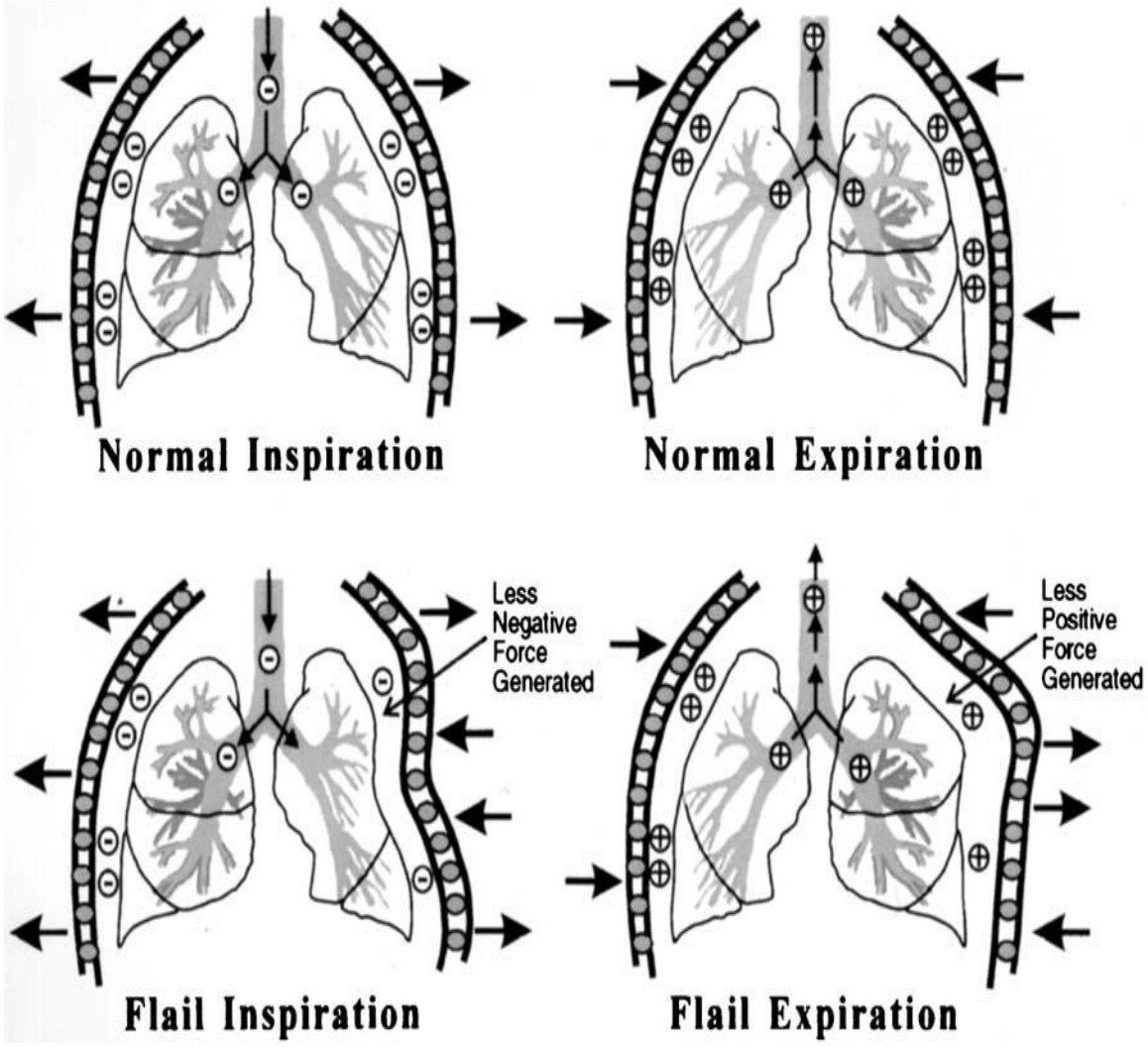

PERIOD OF STAY
< 10 DAYS
10 - 15 DAYS
> 15 DAYS


OUTCOME
10%
90%
IMPROVED WELL
DEATH

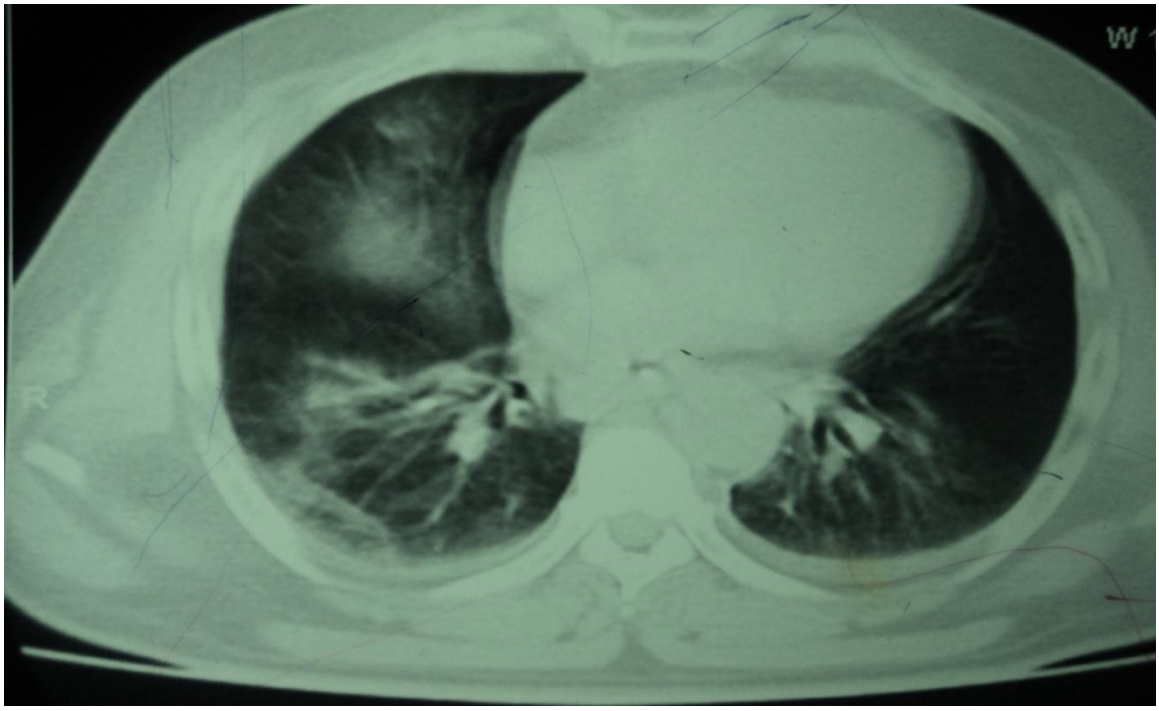
THORACIC WALL



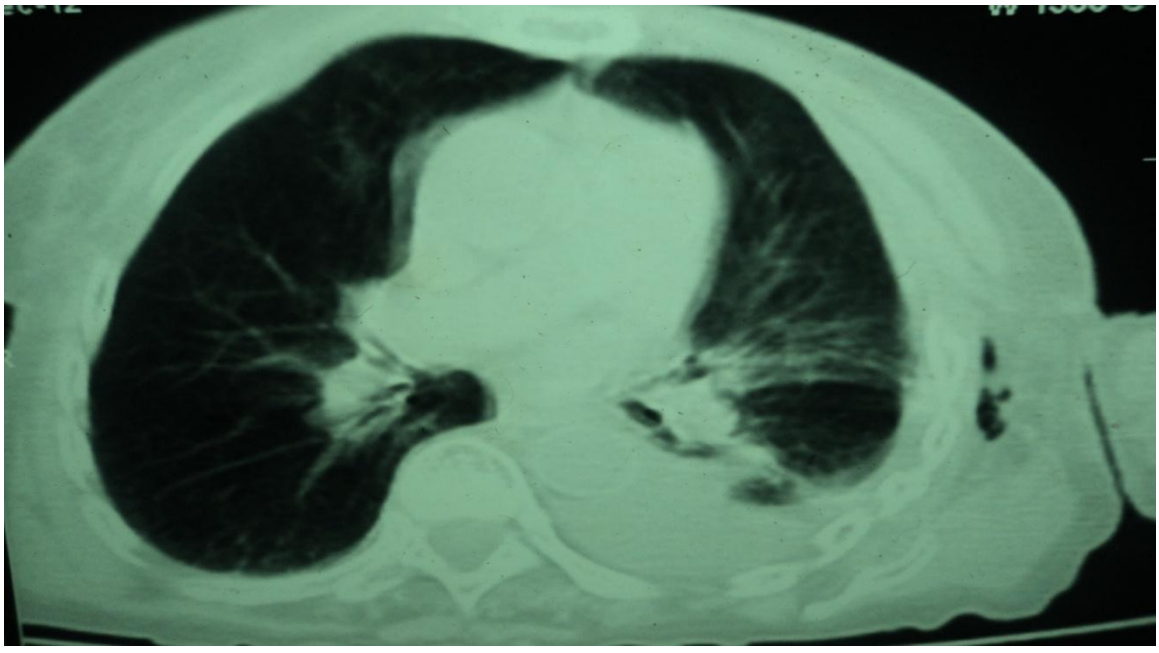
FLAIL CHEST


Normal Inspiration
Normal Expiration
Less
Negative
Force
Generated
Less
Positive
Force
Generated
Flail Inspiration
Flail Expiration

CT OF LUNG CONTUSION IN ONE PATIENT WITH RTA

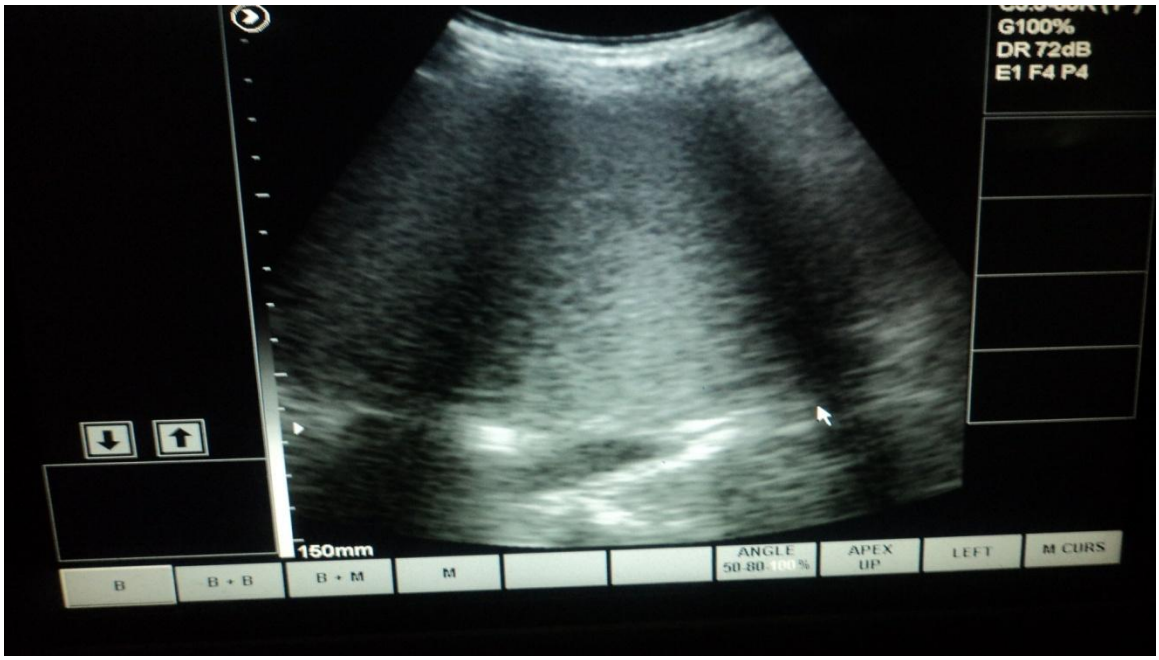


CT OF HAEMOTHORAX

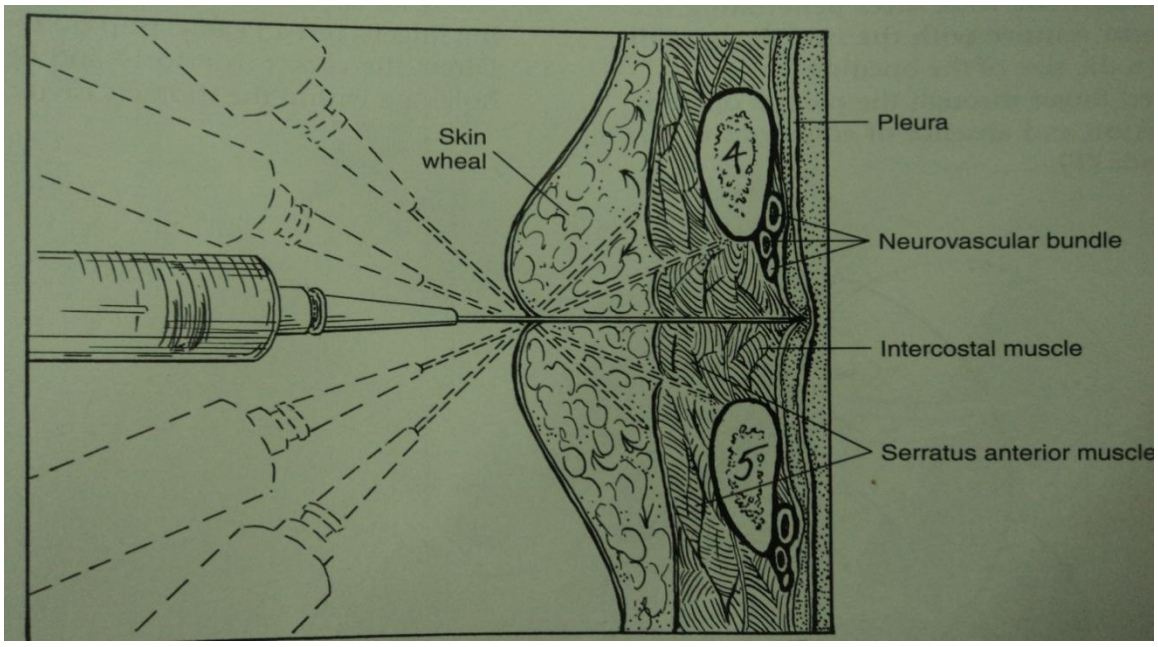


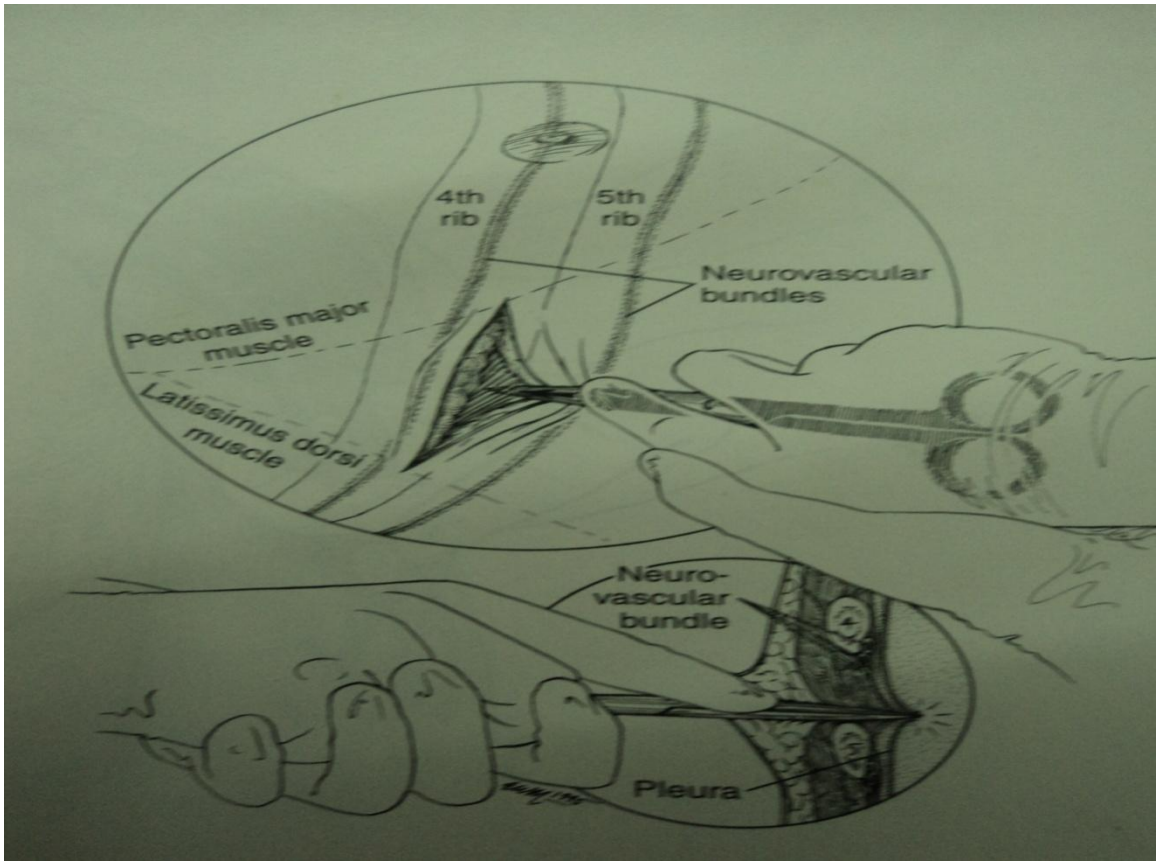
TUBE THORACOSTOMY WITH EPIDURAL ANALGESIA

FOLLOW- UP LUNG USG SHOWING MINIMAL FREE FLUID LEVEL

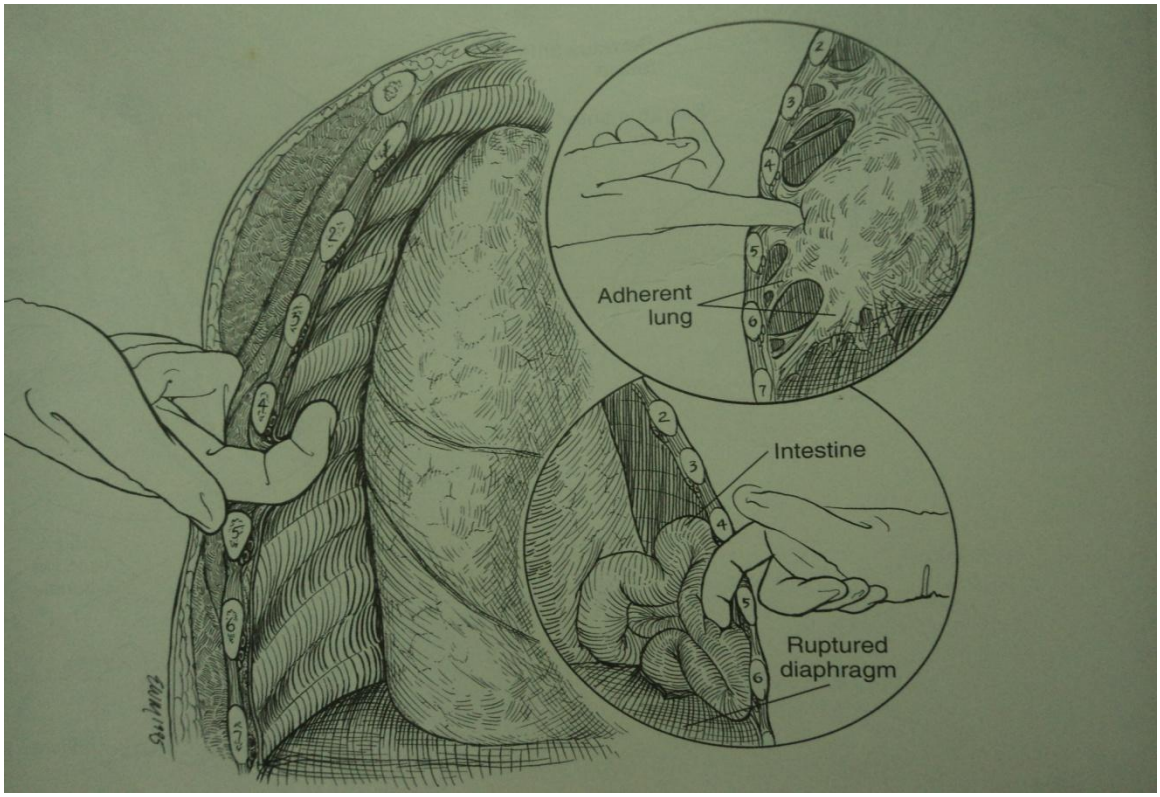


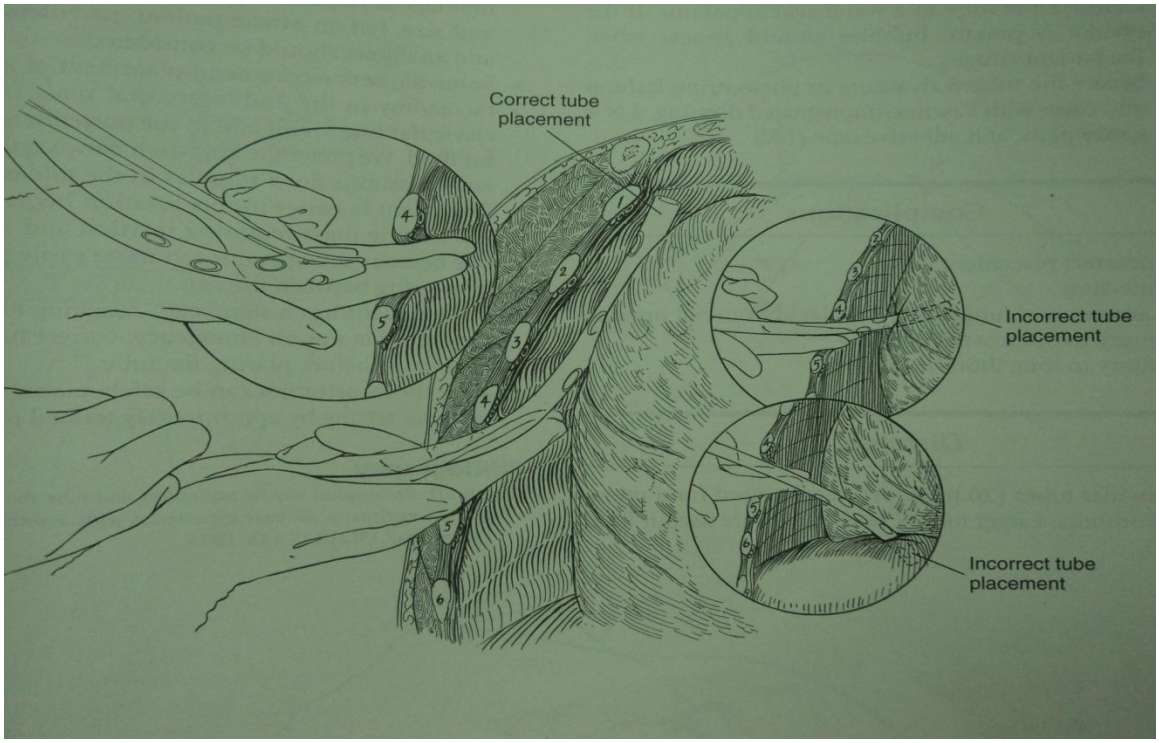
METHODS OF ICD INSERTION



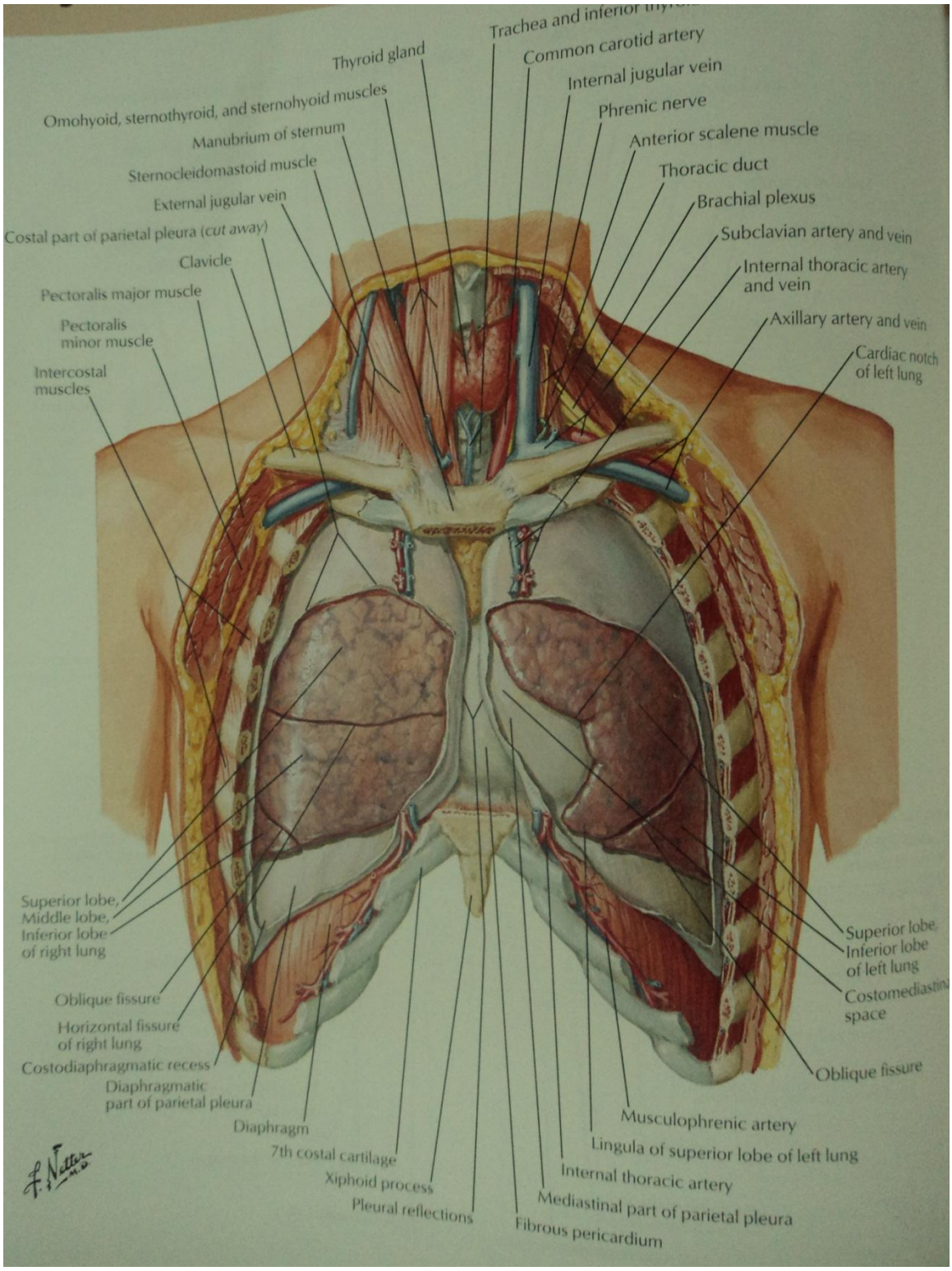


METHODS OF ICD INSERTION

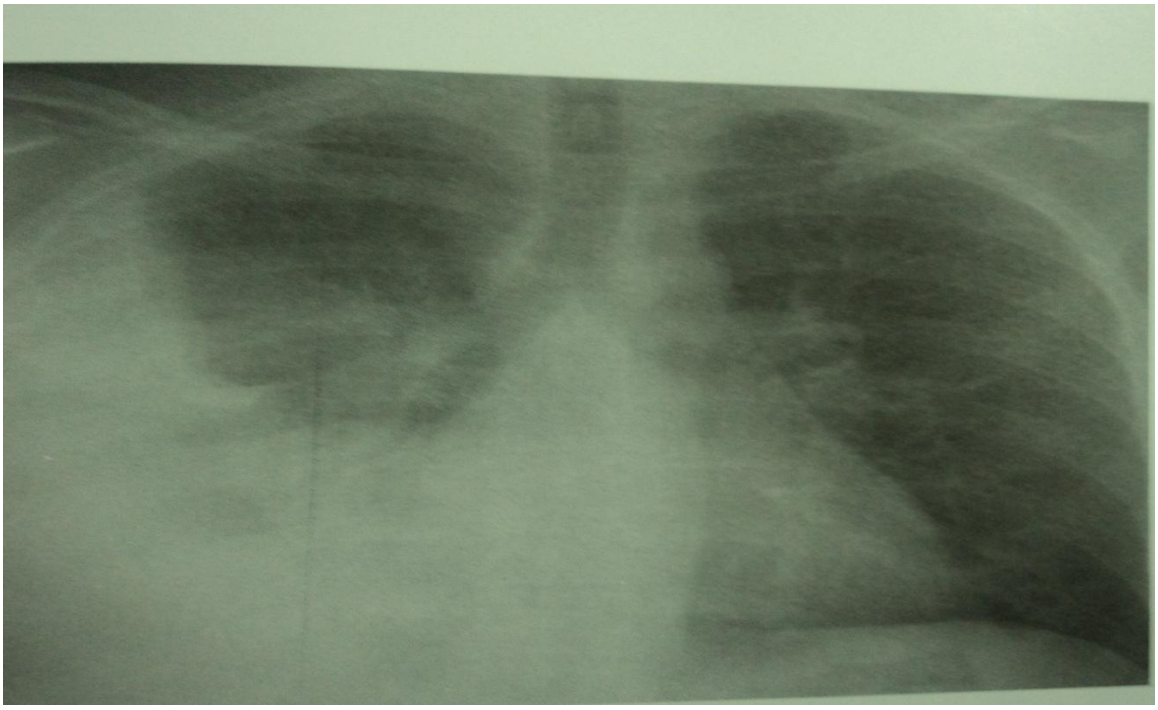




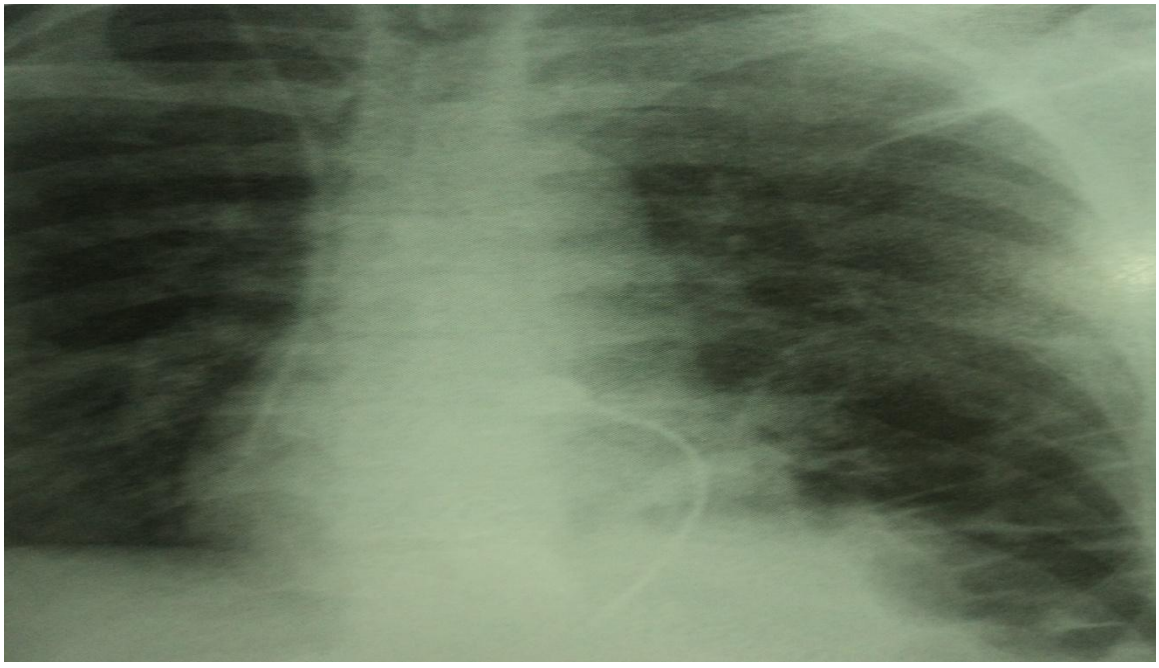
ANTERIOR VIEW OF LUNG AND ASSOCIATED STRUCTURES



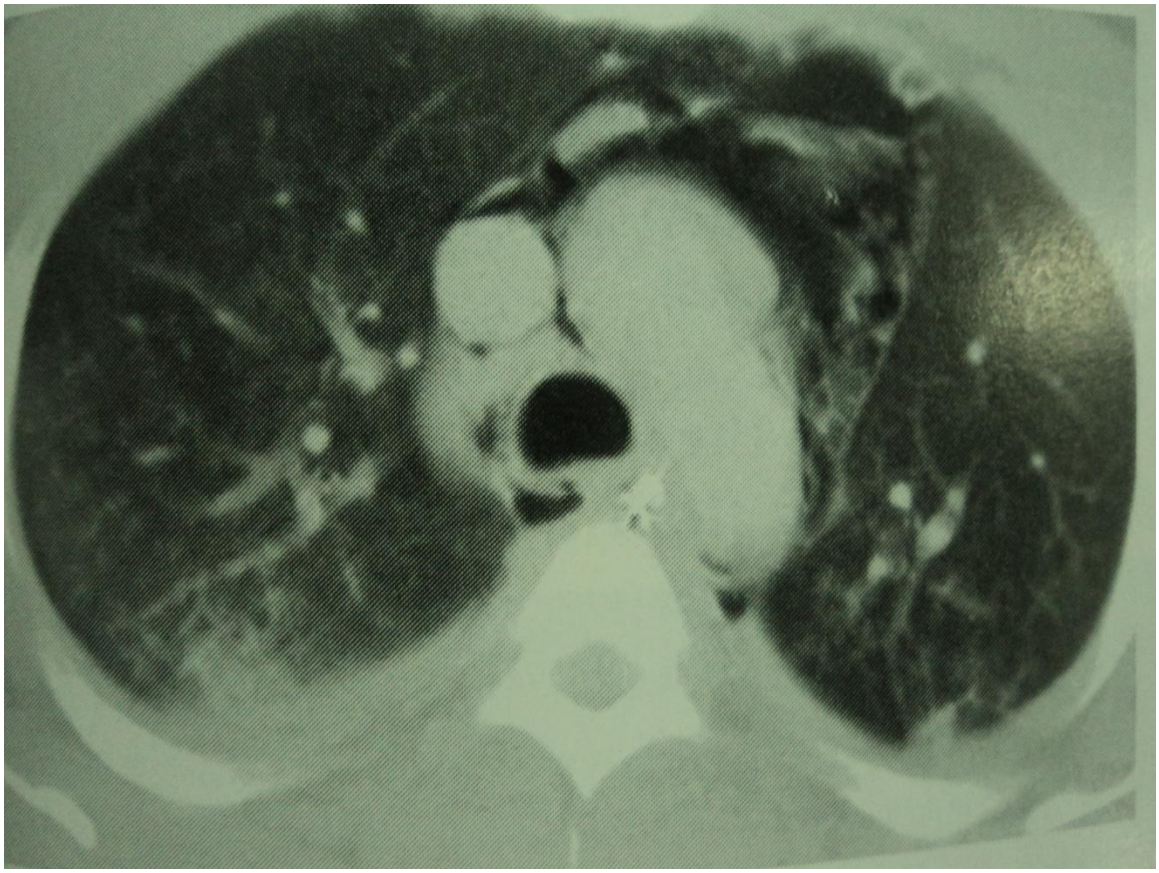
MASSIVE RIGH HAEMOTHORAX



TRAUMATIC DIAPHRAGMATIC HERNIA WITH COLON IN LEFT HEMITHORAX



PNEUMOMEDIASTINUM WITH AIR AROUND THE OESOPHAGUS AND THE LUNG BORDERS



PROFORMA

NAME

AGE/SEX

ADDRESS

IP NO

MODE OF INJURY

PRESENTING COMPLAINTS

CHEST PAIN

DIFFICULTY IN BREATHING

OTHER COMPLAINTS

PAST HISTORY

PRE EXISTING PARENCHYMAL DISEASE

SMOKING HISTORY

DRUG/ALCOHOL ABUSE

EXAMINATION

LEVEL OF CONSCIOUSNESS

DYSPNOEA

TACHYPNOEA

PALLOR

PULSE:RATE AND VOLUME

BLOOD PRESSURE

CARDIO VASCULAR SYSTEM

RESPIRATORY SYSTEM

INSPECTION	:TRACHEAL POSITION
	FLAIL CHEST
PALPATION	:TENDERNESS
	CREPITUS
PERCUSSION	:HYPER RESONANT NOTE
	DULL NOTE
AUSCULTATION	:ABSENT/DIMINISHED BREATH SOUNDS
	ADDED SOUNDS

ABDOMEN

CENTRAL NERVOUS SYSTEM

NECK EXAMINATION

SPINE EXAMINATION

INVESTIGATIONS

X RAY CHEST	: SITE AND NUMBER OF FRACTURED RIBS
	ASSOCIATED HEAMOTHORAX OR PNEUMOTHORAX

ECG

ULTRASOUND ABDOMEN :LIVER INJURIES

SPLENIC INJURIES

FREE FLUID

CT THORAX : HEAMOTHORAX OR

PNEUMOTHORAX

LUNG CONTUSION

ASSOCIATED INJURIES

TREATMENT GIVEN

1. ANTIBIOTICS
2. ANALGESICS
3. INTER COSTAL TUBE PLACEMENT
4. THORACOTOMY
5. MECHANICAL VENTILATION

TREATMENT OF ASSOCIATED INJURIES

OUTCOME

COMPLICATIONS

FOLLOW UP **:**LUNG ULTRASOUND

PULMONARY FUNCTION TESTS

MASTER CHART.

No	Name	A/S	Mode Of Injury	Blood	Radiologic Findings	Lung Injury	Previous Lung Disease	Associated Injuries	Treatment Given	Outcome
1.	Ramasamy 1300841	62/M	RTA	-	#6,7,8 ribs / haemothorax left side	-	-	Flail chest	Left ICD	Discharged on 14 days.
2.	Thyagarajan 1301802	30/M	RTA	-	#6 rib/ haemo pneumothorax left side	-	COPD	-	Left ICD	Discharged on 12 days.
3.	Sampath 1302109	43/M	RTA	-	#2-5 ribs / haemo pneumothorax left side	Severe Lung injury	-	# Left humerus	Left ICD # stabilization.	Discharged on 12 days.
4.	Raja 1303861	35/M	RTA	-	# 4,5 ribs / pneumothorax Right Side	-	-	-	Right ICD.	Discharged on 7 days.
5.	Arokiamary 1304012	36/F	Acc.Fall	-	# 3,4,5 ribs / pneumothorax Right Side	-	-	Depressed # right frontal bone	Right ICD & elevation of # segment	Discharged on 21 days.
6.	Soman 1305492	50/M	RTA	-	# 3rd rib / left pneumothorax	-	COPD.	-	Left ICD.	Discharged on 10 days.
7.	Nallammal 1306043	/F61	Bull hit injury	-	#4,5ribs / right haemothorax	-	-	# right clavicle	Right ICD & # strapping.	Discharged on 7 days.

MASTER CHART contd...

No	Name	A/S	Mode Of Injury	Blood	Radiologic Findings	Lung Injury	Previous Lung Disease	Associated Injuries	Treatment Given	Outcome
8.	Ganesan 1308045	60/M	Acc.Fall	1 unit Transfused	#1, 2,3 ribs/ haemo, pneumothorax Right Side	Severe Lung injury	-	Flail chest & # clavicle right side.	Right ICD, mech. ventilaton & # strapping	**DEATH**
9.	Rajendran 1310203	52/M	RTA	-	# left 6,7 /right 6th ribs / haemo , pneumothorax both Sides	-	-	-	B/L ICD with thoracic epidural analgesia	Discharged on 7 days.
10.	Muniyandi 1311568	50/M	RTA	-	# 6th rib / pneumothorax Right Side	-	COPD.	# both bones right forearm	Right ICD and forearm stabilization.	Discharged on 10 days.
11.	Madasamy 1312534	40/M	RTA	1 unit Transfused	# 4,5 ribs / haemothorax Right Side	-	-	-	Right ICD.	Discharged on 8 days.
12.	Subbaiyah 1314983	44/M	RTA	-	# 4th rib / pneumothorax Right Side	-	COPD	-	Right ICD.	Discharged on 11 days.
13.	Thangarasu 1315485	60/M	Assault	2 units Transfused	# 2,3,4 ribs / haemo, pneumothorax Left Side	Severe Lung injury	-	# shaft of femur left side & # pelvis	Left ICD & # splinting	**DEATH**
14.	Kaliamurthy 1317078	62/M	RTA	-	# 5th rib / pneumothorax Right Side	-	-	-	Right ICD	Discharged on 9 days.

MASTER CHART contd...

No	Name	A/S	Mode Of Injury	Blood	Radiologic Findings	Lung Injury	Previous Lung Disease	Associated Injuries	Treatment Given	Outcome
15.	Sekar 1317980	42/M	RTA	-	# 8,9,10 ribs / pneumothorax Right Side	-	-	Liver contusion.	Right ICD	Discharged on 10 days.
16.	Stephen 1319702	50/M	Bull hit injury	1 unit Transfused	# 3,4,5 ribs / haemothorax Left Side	-	-	# left humerus	Left ICD and # stabilsation.	Discharged on 12 days.
17.	Sethu 1320279	22/M	RTA	-	# 4,5 ribs / haemothorax Left Side	-	COPD	-	Left ICD.	Discharged on 12 days.
18.	Pandiyan 1321001	26/M	RTA	-	# 3rd rib / pneumothorax Right Side	-	COPD.	# right clavicle and humerus	Right ICD & # stabilization.	Discharged on 10 days.
19.	Subbaiyah 1322060	63/M	RTA	-	# 4,5ribs/ haemo, pneumothorax Right Side	Minor lung injury	-	-	Right ICD.	Discharged on 11 days.
20.	Lakshmi 1323214	35/F	Assault	-	# 2,3 ribs / haemothorax Left Side	-	-	-	Left ICD.	Discharged on 6 days.
21.	Iyyappan 1324786	25/M	RTA	-	# 5,6 ribs / pneumothorax Right Side	Minor lung injury	-	-	Right ICD.	Discharged on 10 days.

MASTER CHART contd...

No	Name	A/S	Mode Of Injury	Blood	Radiologic Findings	Lung Injury	Previous Lung Disease	Associated Injuries	Treatment Given	Outcome
22.	Ganesan 1324890	50/M	Acc. Fall	2 units Transfused	# 6,7,8 ribs / haemo, pneumothorax Left Side	-	-	Diaphragm injury with bowel herniation into thorax	Left ICD & diaphragm repair, mech. Ventilation & epidural.	**DEATH**
23.	Shankar 1325378	32/M	RTA	-	# 4^{th} rib / pneumothorax Left Side	-	-	-	Left ICD.	Discharged on 7 days.
24.	Pavendhar 1326421	50/M	RTA	-	# 4,5 ribs / haemothorax Right Side	-	-	Left occipital EDH	Right ICD,EDH evacuation & mech. Ventilation	Discharged on 23 days.
28.	Uthirapathy 1327854	65/M	RTA	-	# 1,2,3 ribs / haemothorax with pneumo-mediastinum Right Side	-	-	# right clavicle and lower wall of right orbit.	Right ICD, with burns space opening & endotracheal intubation	Discharged on 16 days.
29.	Moorthy 1328964	50/M	Acc. Fall	-	# 5^{th} rib / pneumothorax Right Side	-	-	-	Right ICD.	Discharged on 7 days.
30.	Raman 1333223	28/M	RTA	1 unit Transfused	# 2,3,4 ribs / haemothorax Left Side	Severe Lung injury	-	-	Left ICD & mechanical ventilation.	Discharged on 20 days.

MASTER CHART contd...

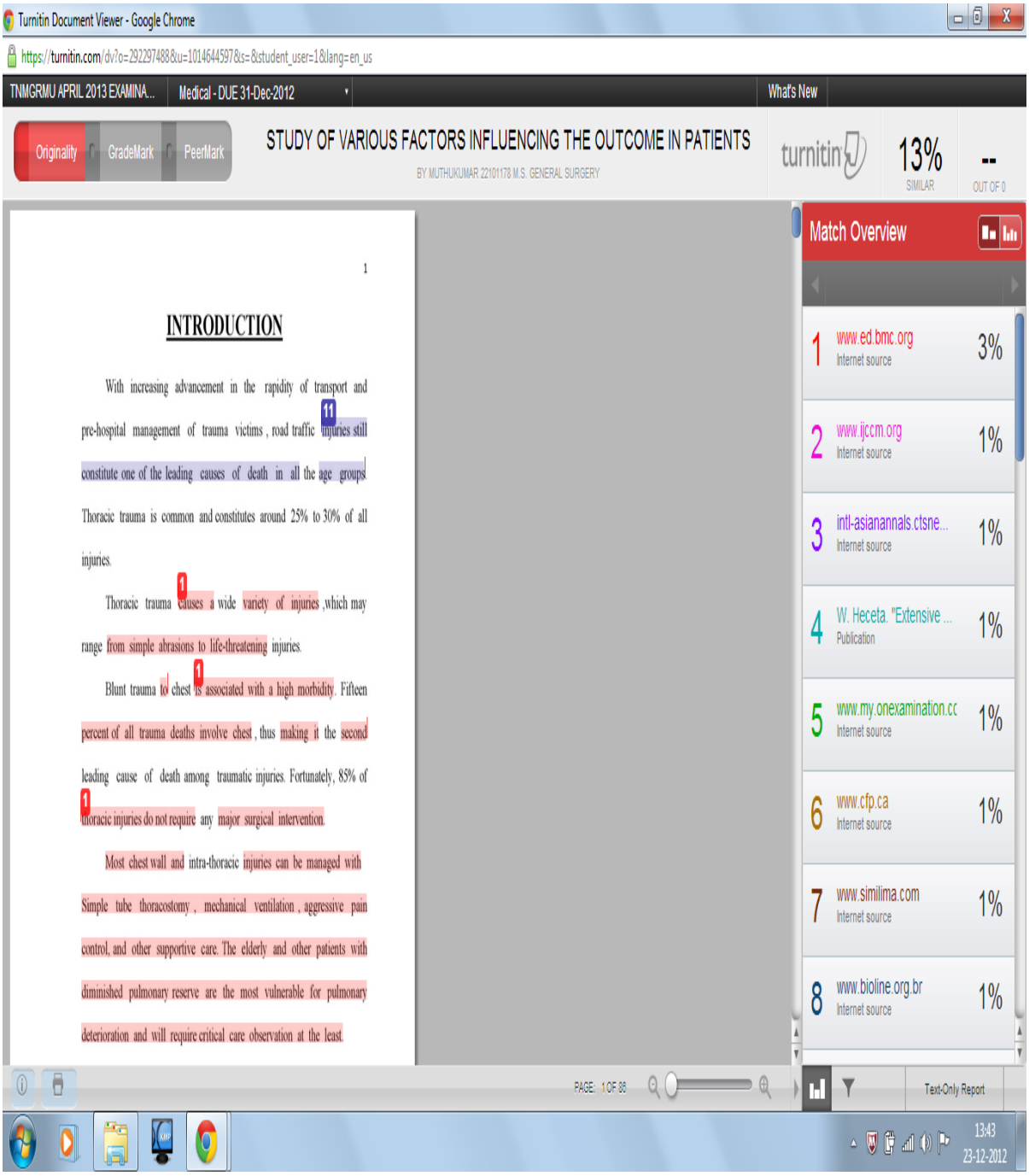
No	Name	A/S	Mode Of Injury	Blood	Radiologic Findings	Lung Injury	Previous Lung Disease	Associated Injuries	Treatment Given	Outcome
31.	Suresh 1333382	50/M	RTA	-	# left 4th/ right 5,6,7 ribs/ pneumothorax Both Sides	-	-	-	B/L ICD.	Discharged on 6 days.
32.	Anbalagan 1333682	40/M	RTA	-	# 7-10 ribs / pneumothorax Left Side	-	-	Splenic contusion.	Left ICD.	Discharged on 12 days.
33.	Saravanan 1333732	44/M	RTA	-	# 5th rib / pneumothorax Left Side	-	-	-	Left ICD.	Discharged on 5 days.
34.	Sathyaraj 1333817	22/M	RTA	-	# 4,5 ribs / haemothorax Right Side	-	-	Right parietal SDH	Right ICD & SDH evacuation.	Discharged on 20 days.
35.	Duraikannu 1334280	60/M	Wall collapse	-	# 1,2,3 ribs / haemothorax Right Side	Minor lung injury	-	D-12 Wedge compression #	Right ICD.	Discharged on 23 days.
36.	Francis prabhu 1334475	17/M	RTA	-	# 3- 7 ribs / pneumothorax Right Side	-	-	# right radius.	Right ICD & radial bone plating.	Discharged on 10 days.
37.	Basha 1343729	35/M	Assault	4 units Transfused	# 1,2,3,4 ribs / haemothorax Left Side	Severe Lung injury	-	Flail chest & # clavicle.	Thoracotomy &mechanical ventilation.	Discharged on 20 days.
38.	Ganesan 1344567	65/M	Acc. Fall	-	# 6th rib / pneumothorax Right Side	-	-	-	Right ICD.	Discharged on 10 days.

MASTER CHART contd...

No	Name	A/S	Mode Of Injury	Blood	Radiologic Findings	Lung Injury	Previous Lung Disease	Associated Injuries	Treatment Given	Outcome
39.	Nagamuthu 1346815	50/M	RTA	-	# 9,10 ribs / pneumothorax Right Side	-	COPD	-	Right ICD.	Discharged on 15 days.
40.	Radhika 1346854	32/F	Assault	-	# 2,3,4 ribs /haemo, pneumothorax Left Side	-	-	# left clavicle, # both bones left forearm	Left ICD.	Discharged on 10 days.
41.	Selvaraj 1347394	45/M	Acc. Fall	-	# 6,7 ribs / haemothorax Right Side	-	-	Right temporal contusion	Right ICD.	Discharged on 16 days.
42.	Dhanam 1350435	65/F	Bull hit injury	-	# 4 rib / pneumothorax Right Side	-	-	-	Right ICD.	Discharged on 10 days.
43.	Murugesan 1353503	30/M	Railway accident	3 units Transfused	# 1,2,3 ribs / hemothorax Left Side	Severe Lung injury	-	Diffuse SAH # C7 vertebra &# left femur	Left ICD & mechanical ventilation.	**DEATH**
44.	Chella 1353773	45/F	RTA	-	# 4,5,6 ribs / pneumothorax Left Side	Minor lung injury	-	-	Left ICD.	Discharged on10 days.
45.	Alphonse mary 1354354	54/F	RTA	-	# 3,4,5 ribs / pneumothorax Right Side	-	COPD	-	Right ICD.	Discharged on 12days.

MASTER CHART contd...

No	Name	A/S	Mode Of Injury	Blood	Radiologic Findings	Lung Injury	Previous Lung Disease	Associated Injuries	Treatment Given	Outcome
46.	Karupaiyah 1356655	28/M	Assault	-	# 4,5 ribs / haemothorax Right Side	-	-	-	Right ICD.	Discharged on 6 days.
47.	Vijaya 1357310	23/F	Acc. Fall	-	# 5 rib / pneumothorax Left Side	-	-	-	Left ICD.	Discharged on 5 days.
48.	Mohammed salli 1375405	44/M	RTA	-	# 4,5 ribs / pneumothorax Right Side	-	-	-	Right ICD.	Discharged on 6 days.
49.	Ganesan 1377576	67/M	RTA	-	# 2,3,4 ribs / haemothorax Right Side	Minor lung injury	-	-	Right ICD.	Discharged on 10 days.
50.	Kalyani 1378561	22/F	RTA	-	#4,5 ribs / pneumothorax Left side	-	COPD	Flail chest.	Left ICD.	Discharged on 15 days.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INTRODUCTION
With increasing advancement in the rapidity of transport and pre-hospital management of trauma victims , road traffic injuries still constitute one of the leading causes of death in all the age groups. Thoracic trauma is common and constitutes around 25% to 30% of all injuries.
Thoracic trauma causes a wide variety of injuries ,which may range from simple abrasions to life-threatening injuries.
Blunt trauma to chest is associated with a high morbidity. Fifteen percent of all trauma deaths involve chest , thus making it the second leading cause of death among traumatic injuries. Fortunately, 85% of thoracic injuries do not require any major surgical intervention.
Most chest wall and intra-thoracic injuries can be managed with Simple tube thoracostomy , mechanical ventilation , aggressive pain control, and other supportive care. The elderly and other patients with diminished pulmonary reserve are the most vulnerable for pulmonary deterioration and will require critical care observation at the least.
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