EFFICACY OF VIDEO ASSISTED THORACOSCOPIC SURGERY VERSUS TUBE THOROCOSTOMY IN THE MANAGEMENT OF EMPYEMA THORACIS

By

DR KRUTHI .S.R

Dissertation submitted to

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MASTER OF SURGERY

In

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Under the guidance of

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अखण्डमण्डलाकारंव्याप्तंयेनचराचरम्।
तत्पदंदर्शितंयेनतस्मैश्रीगुरवेनमः

Salutations to that respected Guru who showed us the place of the one who pervades the vast universe with all its movable and immovable things.

It is appropriate that I begin by expressing my gratitude to the Almighty for having blessed me to pursue Postgraduate study in General Surgery. I dedicate this study to the God.

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DR KRUTHI.S.R

LIST OF ABBREVATIONS

CRP – C reactive protein

CT – Computed tomography

DLT – Double lumen tube

ESR – Erythrocyte sedimentation rate

ICD – Intercostal drainage

ICS – Intercostal space

LDH – Lactate dehydrogenase

ml – milli litre

mm – millimeter

μm – micro meter

Rs – Rupees

OD – Open decortication

VATS – Video assisted thoracoscopic surgery

WBC – White blood cell

ABSTRACT

Background and objectives:

Empyema thoracis is a condition where pus collects in the pleural cavity which occurs most commonly as a reaction to underlying pneumonia. Empyema progresses through 3 stages like exudative, fibrinopurulent and organized stage. Although various treatment modalities have been described, the optimal modality and the better timing for surgical intervention remains controversial. Though tube thorocostomy appears as simple intervention, Video assisted thoracoscopic surgery has a better outcome in treatment of empyema with regarding to morbidity. VATS also has other advantages like being minimally invasive, can provide visualization of thoracic cavity, assist in pleural biopsy and can also treat advanced stages of empyema thoracis.

The present study was done to evaluate the efficacy of video assisted thoracoscopic surgery versus tube thorocostomy in treatment of empyema thoracis with regarding to duration of postoperative hospital stay, duration of chest tube insitu, treatment failure, cost of treatment and mortality.

Methodology

The prospective comparative study was conducted in the Department of General surgery, BLDEU'S Shri B.M Patil medical college, hospital and research centre, Vijayapur from October 2014 to September 2016. A total of 60 patients diagnosed to have Empyema thoracis were divided into 2 groups of 30 each ,based on the treatment modality received which includes tube thorocostomy and video assisted thoracoscopic surgery. The efficacy of the treatment were evaluated.

Results

In the present study, majority of the patients had duration of symptoms with in 7-14 days. The mean duration of chest tube insitu and cost of treatment were less in VATS group (9 days and 12,726 Rs respectively) compared to ICD group (13.3 days and 17,533Rs respectively)which was statistically significant. The mean duration of postoperative hospital stay was less by 2.2 days in VATS group. Total of 2 cases in VATS group and 1 in ICD group were converted to open thoracotomy and 2 mortality were noted in ICD group.

Conclusion

Video assisted thoracoscopic surgery is a minimally invasive procedure with good therapeutic results with reduced morbidity and hospitalization. VATS should be considered as primary modality of treatment in Empyema thoracis, Routine use of VATS in early stages of empyema appears to be more efficacious with added advantage of visualization of thoracic cavity to identify other pathology, for staging empyema and also for pleural biopsy.

Keywords

Empyema thoracis, Tube thoracostomy, Video assisted thoracoscopic surgery, Decortication.

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INTRODUCTION

Empyema thoracis is a condition in which pus collects in the pleural cavity. It most often results from contiguous spread of infection from an underlying region of pneumonia. However other sources include reaction to a subphrenic abscess as well as extention of mediastinal, retropharyngeal, or paravertebral infections. Empyema can also develop secondary to infection after thoracic surgery or trauma [1,2]. In our country, tubercular empyema continues to be an important cause [3].

It has been estimated that 5% of the 1.2 million annual cases of pneumonia will progress on to involve the pleural space[4]. Empyema in children usually develops as a complication in 0.6% of bacterial pneumonias [5].

As defined by American Thoracic Society, Empyema progresses through 3 stages[6,7] –

Stage 1 - The early exudative phase , involves a collection of thin fluid and low white cell count in the pleural space

Stage 2 – The fibropurulent phase, with large quantities of white cells and fibrin deposition, which results in the formation of loculations.

Stage 3 – The organizing phase , in which a thick fibrinous peel (pleural peel) encases the lung, and result in chronic restrictive lung disease.

The primary therapeutic aim: ubi pus evacua – if you find pus, remove it – has not changed since the age of Celsus [8]. Various treatment modalities for empyema thoracis include tube thorocostomy [ICD] , Intrapleural fibrinolysis, Video assisted thoracoscopic surgery [VATS] and open thoracotomy.

Video assisted techniques offer distinct advantages

- In the accurate staging of the disease process,
- Effectiveness of management of organizing pleural disease,
- Cost effectiveness,
- Postoperative patient comfort and
- Cosmesis.

With thoracoscopy, the essentials of open thoracotomy and debridement can be achieved under vision with less trauma and better cosmesis.

AIM AND OBJECTIVES

To evaluate the efficacy and advantages of video assisted thoracoscopic surgery over tube thorocostomy in the treatment of empyema thoracis with regard to-

- Duration of hospital stay after procedure
- Duration of chest tube in situ
- Complications
- Treatment failure
- Mortality

REVIEW OF LITERATURE

EMBROLOGY [9,10]

The respiratory diverticulum (lung bud) appears as an outgrowth from the ventral wall of the foregut when the embryo is around 4 week old. Transcription factor - TBX4 induces formation of the bud and the continued growth and differentiation of the lungs. Hence, epithelium of the internal lining of the larynx, trachea, and bronchi, as well as that of the lungs, is entirely of endodermal origin. The cartilaginous, muscular, and connective tissue components of the trachea and lungs are derived from splanchnic mesoderm surrounding the foregut

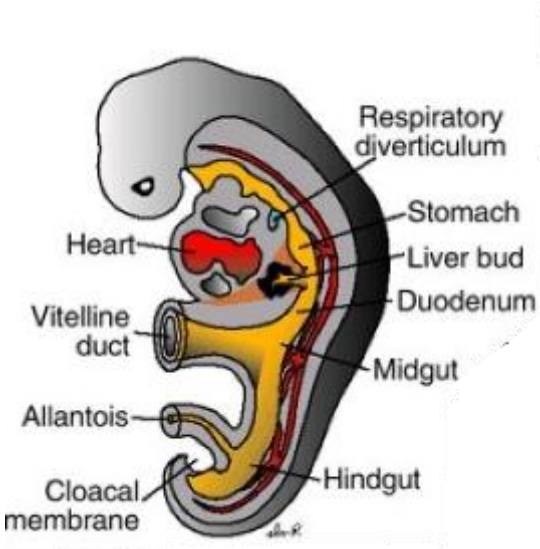

Figure 1 – Appearance of respiratory diverticulum

Initially the lung bud is in open communication with the foregut. When the diverticulum expands caudally, the tracheoesophageal ridges separate it from the foregut . Further ,when these ridges fuse to form the tracheoesophageal septum, the foregut is divided into a dorsal portion, the esophagus, and a ventral portion, the trachea and lung buds .The respiratory primordium maintains its communication with the pharynx through the laryngeal orifice

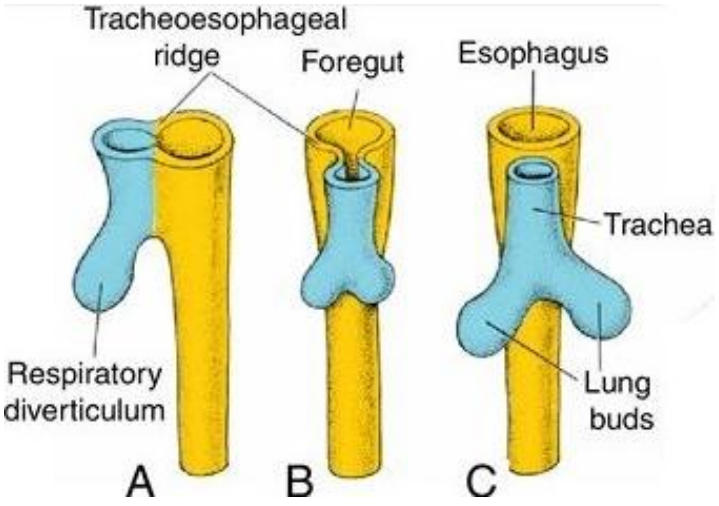

Figure 2, A-C : Successive stages in development of the respiratory diverticulum

The lung bud forms the trachea and two lateral bronchial buds . At early fifth week, each of these buds enlarges to form right and left main bronchi. The right then forms three secondary bronchi, and the left, two , which later forms three lobes on the right side and two on the left.

With further growth in caudal and lateral directions, the lung buds expand into the body cavity .The spaces for the lungs, the pericardioperitoneal canals, lie on each side of the foregut and are gradually filled by the expanding lung buds. Ultimately the pleuroperitoneal and pleuropericardial folds separate the pericardioperitoneal canals from the peritoneal and pericardial cavities, respectively, and the remaining spaces form the primitive pleural cavities.

The mesoderm, which covers the outside of the lung, develops into the visceral pleura. The somatic mesoderm layer, covering the body wall from the inside, becomes the parietal pleura the space between the parietal and visceral pleura is the pleural cavity.

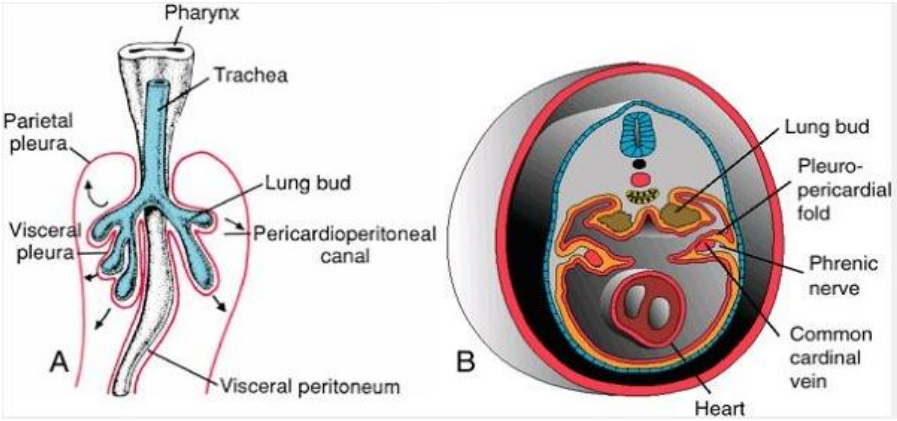

Figure 3 – Expansion of the lung buds into the pericardioperitoneal canals. A- Ventral view, B – Transverse view

The bronchioles divide upto 7th month into smaller canals . Respiration is possible when some cells of the cuboidal respiratory bronchioles change into thin, flat cells. These cells are closely associated with numerous blood and lymph capillaries, and the surrounding spaces are now known as terminal sacs or primitive alveoli.

During the last 2 months of prenatal life and few years after birth, the number of terminal sacs increases steadily. In addition, cells lining the sacs, known as type I alveolar epithelial cells, become thinner, so that surrounding capillaries protrude into the alveolar sacs. Type II alveolar epithelial cells, develop by end of 6 months which produce Surfactant, a phospholipid-rich fluid capable of lowering surface tension at the air–alveolar interface.

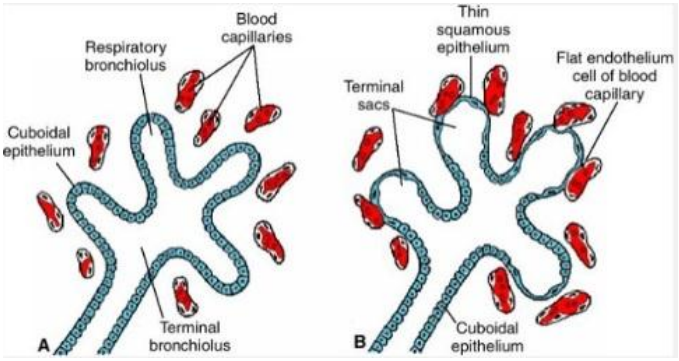

Figure 4 – Histological and functional development of lung. A] Canalicular period with cuboidal cells lining the respiratory bronchiole, B] Terminal sac period with cuboidal cells forming terminal sacs

Fetal breathing movements begin before birth and cause aspiration of amniotic fluid. When respiration begins at birth, most of the lung fluid is rapidly resorbed by the blood and lymph capillaries, and a small amount is probably expelled via the trachea and bronchi during delivery. With air entering alveoli during the first breath, the surfactant coat prevents development of an air–water (blood) interface with high surface tension. Without the fatty surfactant layer, the alveoli would collapse during expiration (atelectasis).

Respiratory movements after birth bring air into the lungs, which expand and fill the pleural cavity.

ANATOMY [11,12]

The **thorax** is an irregularly shaped cylinder with a narrow superior thoracic aperture and a relatively large inferior thoracic aperture.

The **thoracic wall** consists of musculoskeletal element which –

Posteriorly- is made up of 12 thoracic vertebrae and their intervening intervertebral discs

Laterally - the wall is formed by ribs (12 on each side) and 3 layers of flat muscles, which span the intercostal spaces between adjacent ribs, move the ribs and provide support for the intercostal spaces;

Anteriorly- the sternum, which consists of the manubrium of sternum, body of sternum, and xiphoid process.

The **thoracic cavity** enclosed by the thoracic wall and the diaphragm contains-

- Left and a right pleural cavity, each surrounding a lung
- Mediastinum

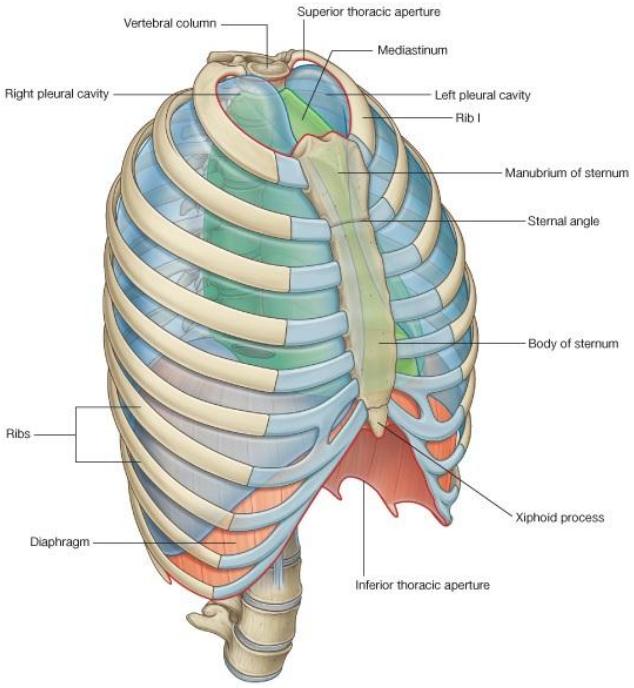

Figure 5 – Thoracic wall and cavity

Pleural Cavity

Two **pleural cavities**, one on either side of the mediastinum, surround the lungs

- Superiorly, they extend above first rib into the root of the neck;
- Inferiorly, they extend to a level just above the costal margin; the medial wall of each pleural cavity is the mediastinum

Pleura associated with the walls of a pleural cavity is **parietal pleura**;

Pleura that reflects from the medial wall and onto the surface of the lung is **visceral pleura** which adheres to and covers the lung

The two pleural surfaces glide over each other for facilitating proper lung movements during various phases of respiration. Each pleural cavity is the potential space enclosed between the visceral and parietal pleurae which is lined by a single layer of flat cells, mesothelium, and an associated layer of supporting connective tissue and contains only a small amount of liquid which functions mainly as a lubricator.

The pleural cavities are completely separated from each other by the mediastinum. Therefore, abnormal events in one pleural cavity do not necessarily affect the other cavity. This also means that the mediastinum can be entered surgically without opening the pleural cavities

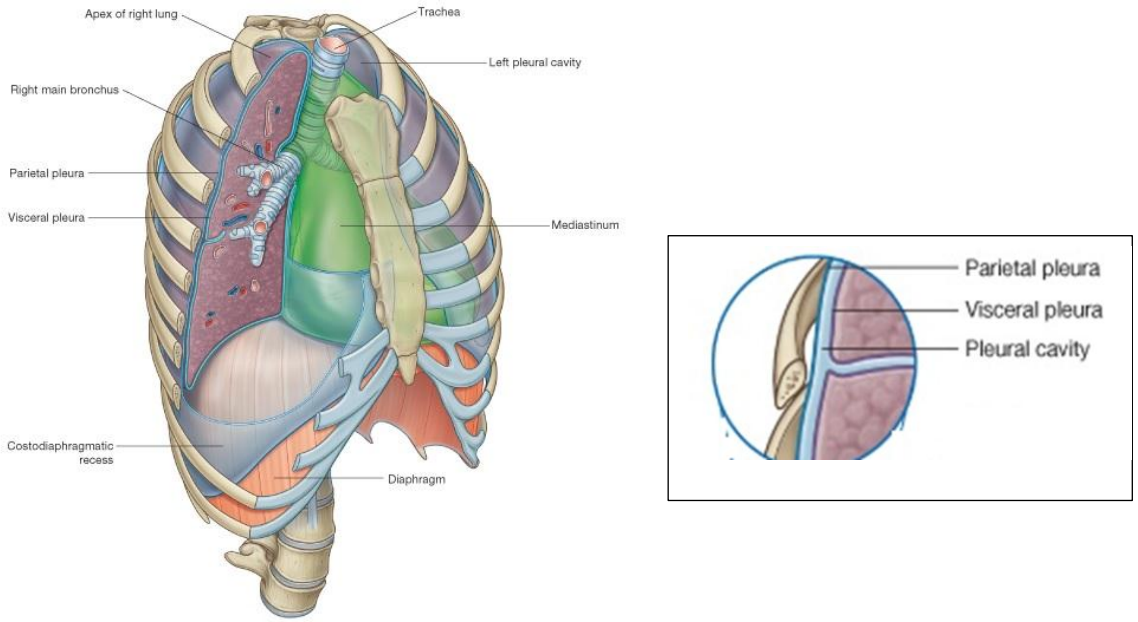

Figure 6 – Pleural cavities

Parietal pleura correspond to the parts of the wall with which they are associated

- Pleura related to the ribs and intercostal spaces is termed the **costal part**;
- Pleura covering the diaphragm is the **diaphragmatic part**;
- Pleura covering the mediastinum is the **mediastinal part**;
- Dome-shaped layer of parietal pleura lining the cervical extension of the pleural cavity is **cervical pleura** (**dome of pleura** or **pleural cupola)**.

Visceral pleura is continuous with parietal pleura at the hilum of each lung where structures enter and leave the organ. The visceral pleura is firmly attached to the surface of the lung, including both opposed surfaces of the fissures that divide the lungs into lobes.

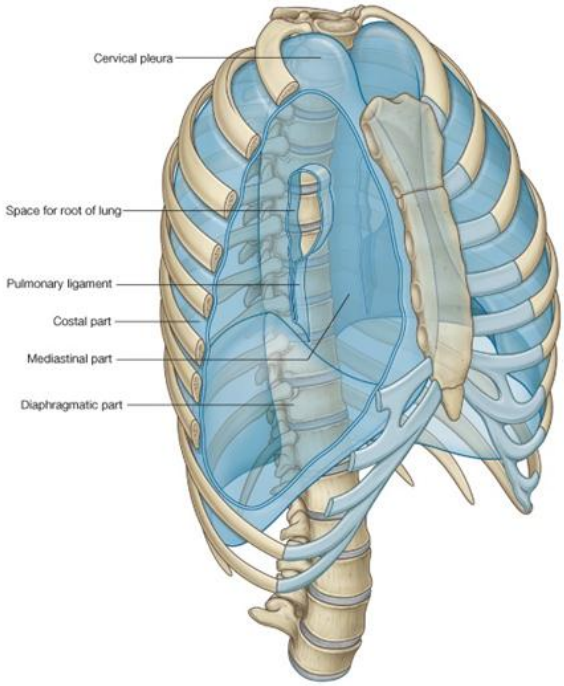

Figure 7 – Parietal pleura

Anteriorly, a **costomediastinal recess** occurs on each side where costal pleura is opposed to mediastinal pleura. The largest is on the left side in the region overlying the heart.

The largest and clinically most important recesses are the **costodiaphragmatic recesses**, which occur in each pleural cavity between the costal pleura and diaphragmatic pleura

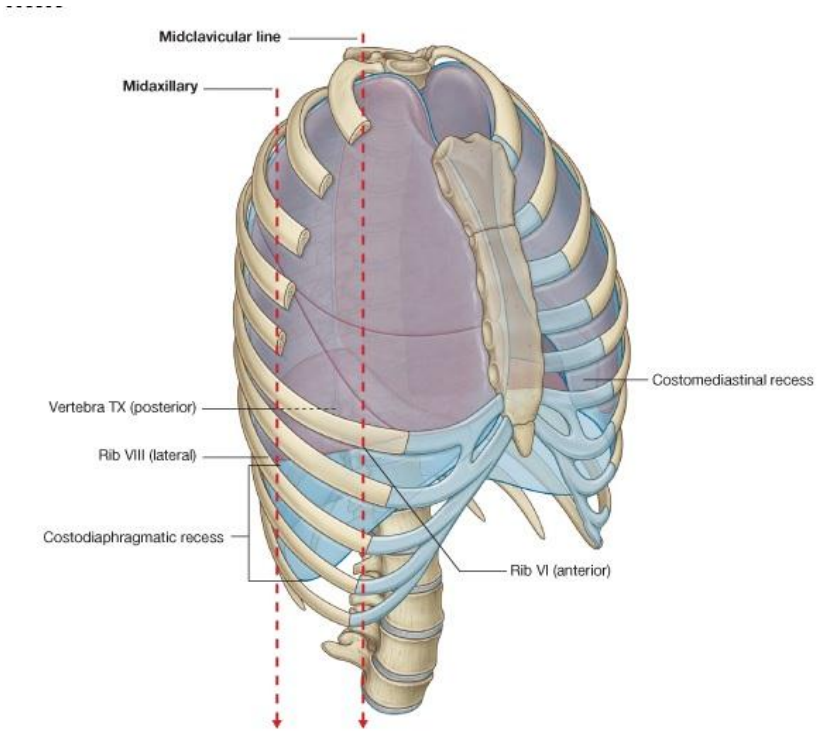

Figure 8 – Parietal pleural reflections, Costomediastinal and costodiaphragmatic recesses

Single layer of mesothetial cells overlie each pleural membrane which vary in shape from flat to cuboidal or columnar, perhaps on the basis of the degree of stretching of the underlying submesothetial tissue. Mesothelial cells can secrete the macromolecular components of the extracellular matrix and organize them into mature matrix , phagocytose particles, produce fibrinolytic and procoagulant factors, and secrete neutrophil and monocyte chemotactic factors that may be important for inflammatory cell recruitment into the pleural spaces. The mesothelial cells also produce cytokines such as transforming growth factor-β, epidermal growth factor and platelet derived growth factor, cytokines that are important in pleural inflammation and fibrosis[13].

The blood supply of the parietal pleura comes from the systemic arteries and veins, including the posterior intercostal, internal mammary, anterior mediastinal, and superior phrenic arteries, and corresponding systemic veins. The blood supply of the visceral pleura is both systemic (bronchial arteries) and pulmonary.

The parietal pleura underlying the ribs has rich nerve endings from the intercostal nerves. Generous local anesthesia is therefore necessary for chest tube insertion. The visceral pleura is innervated by vagal branches and the sympathetic system[14].

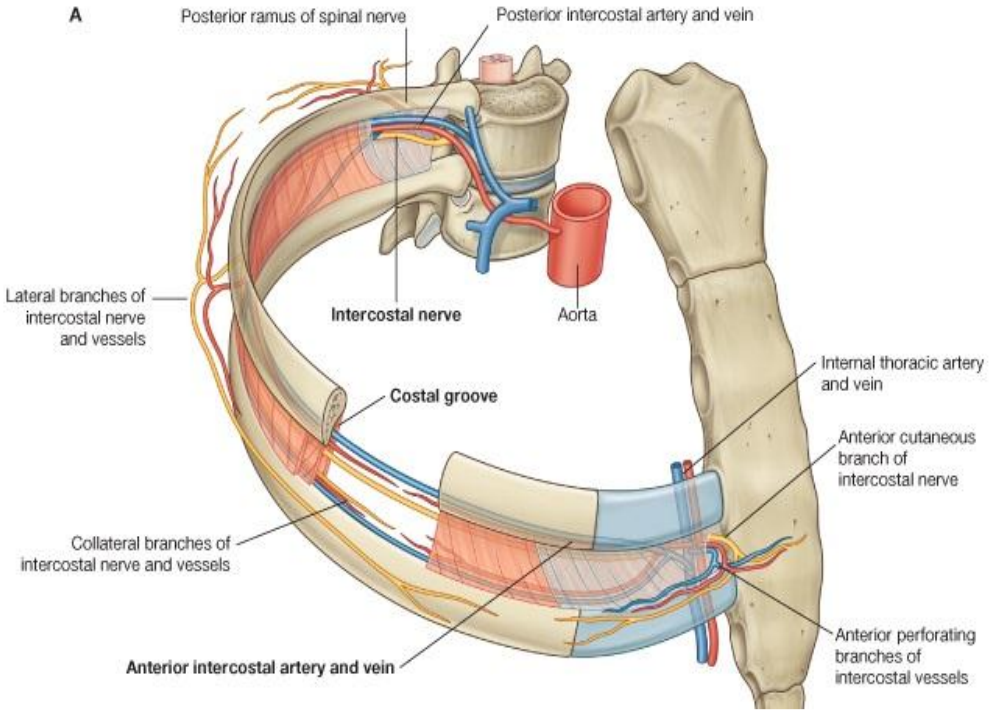

Figure 9 - Intercostal space

The lymphatic drainage of the parietal pleura is into regional lymph nodes, including the intercostal, mediastinal,and phrenic nodes and that of visceral pleura is primarily to the deep pulmonary plexus located in the interlobar and peribronchial

spaces, also direct subpleural lymphatics to mediastinal lymph nodes have been described[15].

The visceral pleura has extensive lymphatics, but they do not connect to the pleural space. If carbon particles are injected into pleural space as a visible marker of lymphatic drainage pathways, the black carbon is taken up into lymphatics on the parietal side, not the visceral side.

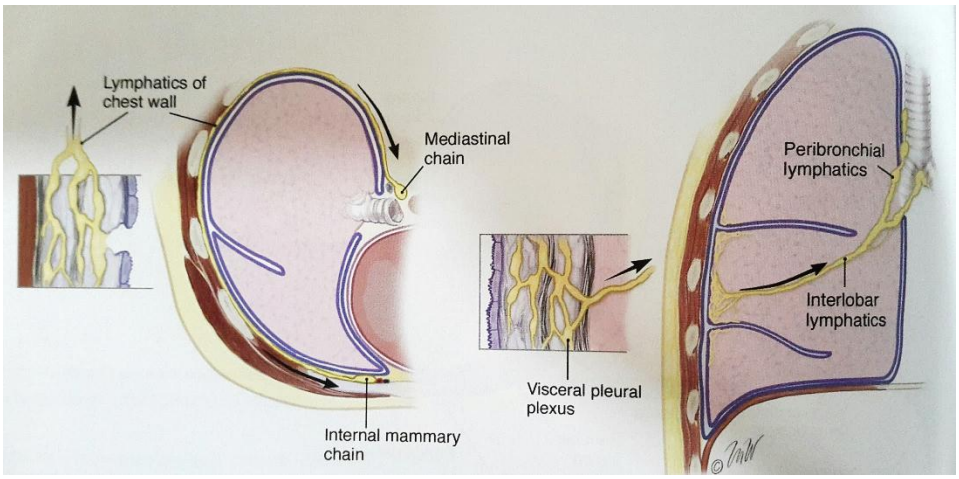

Figure 10 – Subpleural lymphatics and their drainage pathways

The parietal pleural lymphatics connect to the pleural space via stomas, holes of 8 to 10μm in diameter that are formed by discontinuities in the mesothelial layer where mesothelium joins to the underlying lymphatic endothelium. The stomas can accommodate particles as large as erythrocytes. In various experimental studies these lymphatics have been shown to be the major route of exit of liquid from the pleural space. Lymphoid cells have been described lying within aggregates underneath morphologically different mesothelial cells, forming raised structures called Kampmeier foci that may have an immune function[13,15]

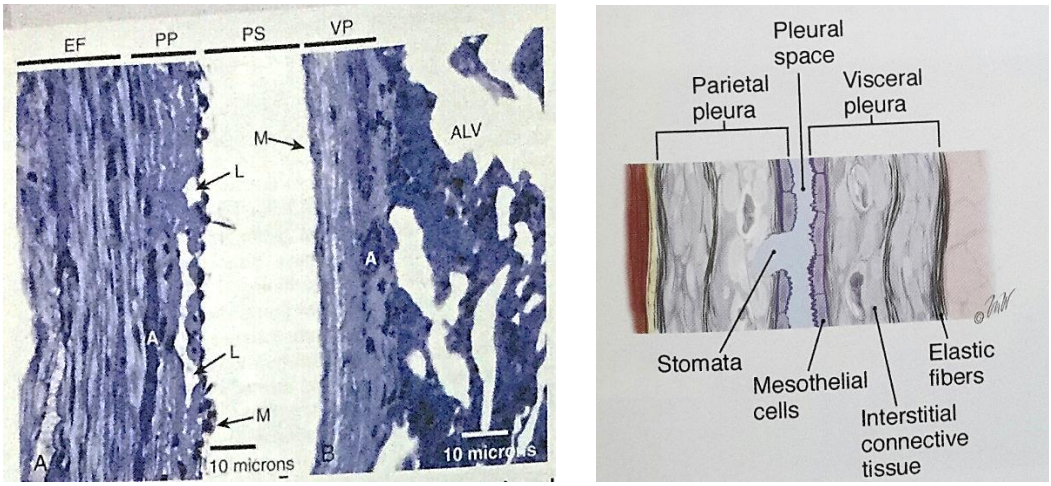

Figure 11 – Histological layers of parietal and visceral pleura. PP-Parietal pleura, PS- Pleural space, EF –Endothoracic fascia, VP- Visceral pleura, M-mesothelial cells, L-Lymphatic lacunae, A-Microvessels, ALV- Alveoli

PHYSIOLOGY OF THE PLEURAL SPACE [13,15]

Normal pleural liquid arises from the systemic pleural vessels in both pleurae , flows across the leaky pleural membranes into the pleural space, and exits the pleural space via the parietal pleural lymphatics-

- Intrapleural pressure is lower than the interstitial of either of the pleural tissues. This pressure difference constitutes a gradient for liquid movement into but not out of the pleural space.
- The pleural membranes are leaky to liquid and protein and offers little resistance to liquid and protein movement
- Mesothelial cells express various transporters and aquaporins, but these have not been shown to have a role in reabsorption of effusions
- The entry of pleural liquid is slow and compatible with known interstitial flow rates. By noninvasive studies of the equilibrium of radiolabeled albumin, the

entry rate of pleural liquid is about 0.5ml hourly or 12ml a day in a grown man.

- The majoriy of liquid exits the pleural space by bulk flow, not by diffusion or active transport. This is evident because the protein concentration of pleural effusions remains constant as the effusion is absorbed, as is expected with bulk flow. If liquid were absorbed by diffusion or active transport, protein would exit at a slower rate and the protein concentration would progressively increase. The only possible exit is via the parietal pleural stomas into the pleural lymphatics. These lymphatics have a large capacity for absorption.
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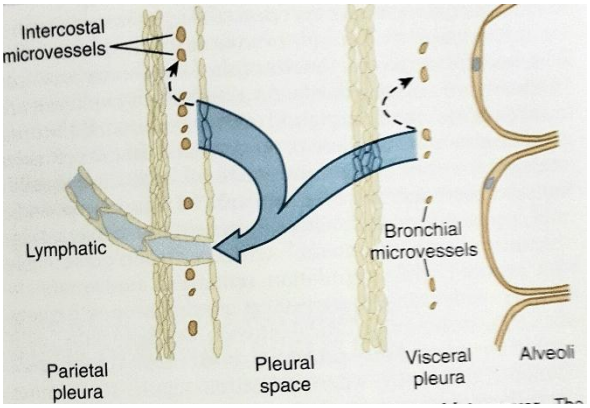


Figure 12 – Normal pleural liquid turnover. The initial microvascular filtrate is partly reabsorbed(dashed arrows). The remaining low protein interstitial liquid flows across the leaky pleural mesothelial layers into the pleural space. The pleural liquid exits via the parietal pleura

PATHOPHYSIOLOGY OF PLEURAL SPACE [13,15]

For pleural liquid to accumulate to form an effusion, it is likely that both the entry rate of liquid must increase and the exit rate must decrease. If only the entry rate increased, it would require a sustained rate more than 30 times normal to exceed the reserve lymphatic removal capacity; if the exit rate decreased, it would take more than

a month at the normal entry rate of 12ml per day to produce an effusion detectable by chest radiograph.

Thus, in the clinical setting, it is most likely that excess pleural liquid accumulates due to changes in both entry and exit rates.

General causes of pleural effusion

- Increased pleural fluid formation
    - Increased interstitial fluid in the lung
        - Left ventricular failure, pneumonia, and pulmonary embolus
    - Increased intravascular pressure in pleura
        - Right or left ventricular failure, superior vena caval syndrome
    - Increased permeability of the capillaries in the pleura d
        - Pleural inflammation
        - Increased levels of vascular endothelial growth factor
    - Increased pleural fluid protein level
    - Decreased pleural pressure
        - Lung atelectasis or increased elastic recoil of the lung
    - Increased fluid in peritoneal cavity due to ascites or peritoneal dialysis
    - Disruption of the thoracic duct
    - Disruption of blood vessels in the thorax
- Decreased pleural fluid absorption
    - Obstruction of the lymphatics draining the parietal pleura
    - Elevation of systemic vascular pressures
        - Superior vena caval syndrome or right ventricular failure
    - Disruption of the aquaporin system in the pleura

EMPYEMA THORACIS

Empyema is defined as the accumulation of pus in a body cavity and is derived from the Greek word empyein which means to 'put pus in'. The most common etiology is a reaction to an adjacent pneumonia[1].

HISTORICAL PERSPECTIVE [5,16,17]

Empyema has been recognized to be a serious problem for centuries. Around 500 B.C. **Hippocrates** recommended treating empyema with open drainage.

From the time of Hippocrates, the treatment of empyema remained essentially unchanged until the middle of the 19th century. At this time **Bowditch** in the United States and **Trousseau** in France popularized the use of thoracentesis and demonstrated that open drainage was not necessary in many patients.

In 1876, **Hewitt** described a method of closed drainage of the chest in which a rubber tube was placed into the empyema cavity through a cannula. He was the first to use the water seal for chest tubes.

In the 1890s, thoracoplasty was described as a means of obliterating the empyema cavity which involves resecting the ribs, intercostal muscles, and parietal pleural peel over the cavity, and covering the remaining defect by the few remaining muscles, the scapula, and the subcutaneous tissue and skin. At approximately the same time, the initial reports describing decortication appeared.

In 1918, The Empyema Commission headed by **Dr. Evarts Graham** soon made the following recommendations, which really form the basis for the treatment of empyema today:

a) The pleural fluid should be drained, but one must avoid an open pneumothorax in the acute exudative phase;
b) care should be taken to avoid a chronic empyema by rapid sterilization and obliteration of the infected cavity; and
c) careful attention should be paid to the nutrition of the patient

In 1950, **Tillett** and Sherry proposed enzymatic debridement with a combination of streptokinase and streptodornase for parapneumonic empyema .
In the 1950s and 1960s, the pleural fluid glucose was proposed as an indicator for tube thoracostomy

In 1972, **Light et al**. Suggested that a low pleural fluid pH was an indicator for tube thoracostomy, and in 1980, the same group suggested that a high pleural fluid lactic dehydrogenase (LDH) level was an indicator for a poor prognosis .
In the last decade, the use of video-assisted thoracoscopy surgery (VATS) has become widespread in the treatment of loculated parapneumonic effusions.

ETIOLOGY [18-20]

The bacteriological features of empyema have changed considerably since the introduction and increasingly widespread use of potent broadspectrum antibiotics. Streptococcus pneumonia and haemolytic streptococci were the most frequently organism isolated from empyemas in the preantibiotic era . Staphylococcus aureus and gram negative bacilli (e.g.Escherichia coli, Haemophilus influenza, Klebsiella pneumonia, and Pseudomonas aeruginosa) became the predominant pathogens found in empyemas later on. Preponderance of anaerobes, either alone or in combination with aerobic bacterias have been noted since the use of modern techniques for culturing anaerobic bacteria. In recent years fungi have been isolated from empyemas

especially in immunocompromised patients. Tuberculosis continues to be an important cause of empyema in a developing country like ours and also accounts for increased morbidity and mortality[21,22].

PATHOGENESIS

The natural progression of parapnemonic effusion/ empyema can be outlined in stages of increasing complexity. The pre-collection stage involves pleuritis and inflammation which is followed by exudative phase, then fibropurulent stage and finally the more advanced organized phase. The degree of patient illness need not correspond with these stages, it also depends on the extent of the concomitant parenchymal disease or the inflammatory response to the infectious processes.

Risk factors for empyema formation include –

Contamination from a source contagious to the pleural space (50% - 60%) like

- Lung
- Mediastinum
- Deep cervical
- Chest wall and spine
- Subphrenic

Direct inoculation of the pleural space (30% -40%) from

- Minor thoracic interventions
- Postoperative infections
- Penetrating chest injuries

Hematogenous infection of the pleural space from a distant site (<15%)

The chemistry of the parapneumonic fluid changes as the stage advances : glucose decreases, pH decreases, and lactate dehydrogenase (LDH) rises.

The Light criteria for complicated Parapneumonic effusion (empyema) include[1,16,23]

- pH <7.2,
- Lactate dehydrogenase >1000 units,
- Glucose <40 mg/dL or < 25% of the blood glucose,
- Gram stain or culture positive, and
- Loculations or septations documented with imaging.

Studies have shown that a pleural fluid pH less than 7.27 was the only significant factor for the formation of fibrin with/without septations and that a tumor necrosis factor level greater than 80 pg/mL in the pleural fluid suggests a complicated effusion[1].

COMPLICATIONS [2,17]

1) Pulmonary fibrosis

2) Contraction of the chest wall

3) Necrosis of the visceral pleural surface, resulting in bronchopleural fistula heralded by sudden expectoration of, at times, copious amounts of purulent sputum.

4) Necrosis of the parietal pleura and the chest wall and skin results in empyema necessitates

These conditions are usually seen in patients treated with antibiotics for pneumonia who have unrecognized empyema.

5) Rarely, osteomyelitis of the ribs or spine, invasion of the mediastinum with pulmonary esophageal fistula and pericarditis may occur.

DIAGNOSIS

Empyema should be suspected in a patient with pulmonary infection in the presence of persisting or unexplained fever after being adequately treated for pneumonia, persisting elevation of inflammatory markers like WBC count, ESR, CRP and also in patients with history of undergoing previous thoracic or esophageal surgery.

CLINICAL MANIFESTATIONS

Most common symptoms include shortness of breath, fever, cough and pleuritic chest pain. Other symptoms include malaise, anorexia and loss of appetite. Physical findings include dullness on percussion, decreased or absent breath sounds, decreased fremitus, and egophony at the level of the pleural liquid meniscus.

IMAGING STUDIES

RADIOGRAPHY

Blunting of the normally sharp posterior costophrenic angle on a lateral chest radiograph indicates the presence of atleast 25 – 50ml of pleural liquid. With further accumulation (around 150ml), the lateral costophrenic angle on a posteroanterior radiograph becomes obliterated [2].

On lateral decubitus radiograph, with the involved side down, the distance between the inside of the chest wall and the outside of the lung should not exceed 10 mm. If this distance exceeds 10 mm, thoracentesis should be performed [24].

Large amounts of pleural liquid displace the lung centrally and produce a characteristic homogeneous opacity that forms a concave meniscus with the chest wall

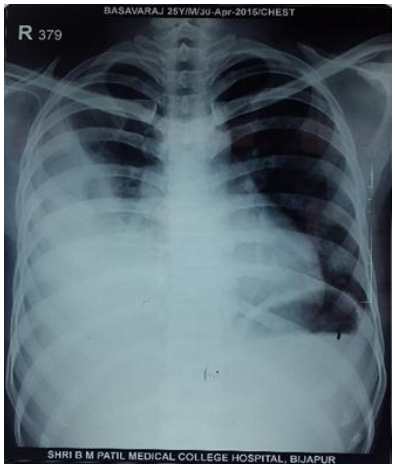


Figure 13 – Chest x ray showing right sided effusion forming concave meniscus with chest wall

Loculated effusions can result following intense pleural inflammation leading to formation of adhesions between the visceral and parietal surfaces. The classic Inverted D or Pregnant lady sign as coined by LeRoux and Dodds (1964) on lateral view can be seen in loculated effusion[24,25](also in CT scan).

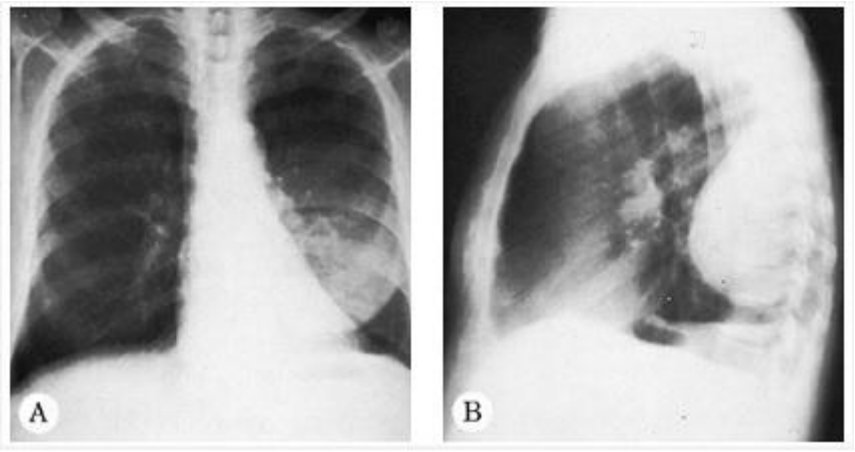


Figure 14 –A] Posteroanterior radiograph of patient with encapsulated pleural effusion. B] Inverted D or pregnant lady sign on lateral view

ULTRASONOGRAPHY

It is portable, relatively inexpensive and does not involve radiation

It is sensitive in diagnosing loculated pleural effusion and useful to identify precise site on chest wall for percutaneous drainage and chest tube placement [26].

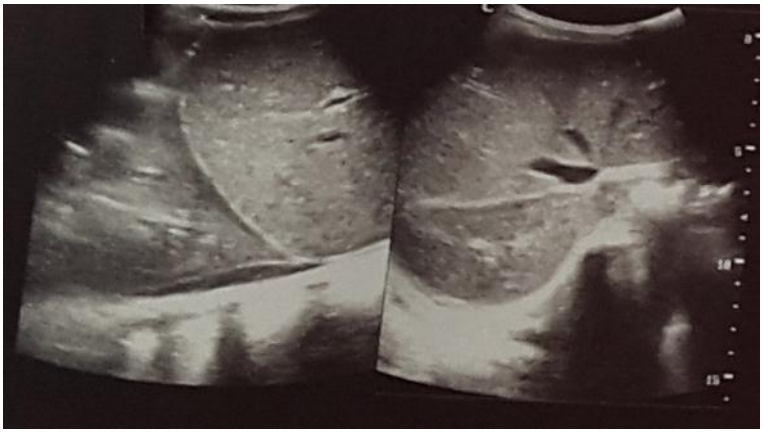


Figure 15 – USG chest showing pleural effusion with sepatations

COMPUTED TOMOGRAPHY

Computed tomographic (CT) scanning helps to identify underlying parenchymal disease and to distinguish empyema from lung abscess and pleural mass. CT is useful to stage the empyema by determining the presence of loculations, thickness of pleura and presence or absence of a trapped lung.

Specific CT signs of empyema include – visualization of thickened and separated pleural surfaces, compression of the parenchyma and pleural thickening "Split pleura sign" indicates the collection of fluid between thickened visceral and parietal pleura [27,28].

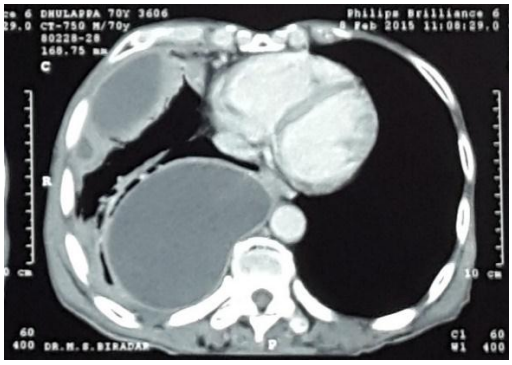


Figure 16 – CT chest showing right sided empyema with loculations and split pleura

After confirming the presence of pleural fluid, diagnostic thoracocentesis should be done and the aspirate has to be analysed by cytological study, biochemical analysis, Gram stain and aerobic and anaerobic studies ,including bacterial culture sensitivity tests.

MANAGEMENT

Surgical removal of pus by proper pleural space drainage remains the gold standard for empyema management.

Irrespective of detailed differences in specific features of thoracic empyema with regarding to its stages, the basic principles of treatment remain the same which includes –

1. Drainage – by either tube thorocostomy or VATS or intrapleural fibrinolytic enzymes or open thoracotomy
2. Appropriate antibiotic selection
3. Treatment for underlying cause of empyema
4. Supportive measures including respiratory care, nutrition, therapy for comorbid conditions.

TUBE THOROCOSTOMY (Intercostal tube drainage)

The majority of chest aspirations or drainage are performed in the triangle of safety which is situated in the anterior half of the axilla above the level of the fifth intercostal space.

The boundaries of the triangle[29] are-

a) Anteriorly – the anterior axillary line

b) Posteriorly – the mid axillary line

c) Inferiorly – a horizontal line drawn posteriorly from the level of the nipple in a man or fourth interspace in a woman.

The triangle of safety contains no important or dangerous structures in the chest wall and the reduces the chances of inadvertently perforating the diaphragm, even if it is raised

The most comfortable position for the patient is to be in bed with sitting upright and supported position.

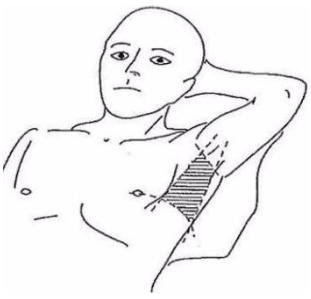


Figure 17 – Triangle of safety for ICD insertion

The chest tube should be as large a tube as will pass comfortably through the intercostal space. In general, ideal chest tube needs to be antiadhesive and transparent to prevent plugging and allow visual control of patency ; supple and smooth enough to cause only minor patient discomfort and stiff enough to prevent kinking and

occlusion. These properties are best provided by polyvinylchloride products, and to a lesser extent also by silicone.

The operator should wash and put on sterile gown and gloves.

The skin is cleaned and painted with povidine iodine and draped with sterile towels.

Local anaesthetic should be infiltrated. About 15 -20ml of 1% lignocaine are injected down to and including the parietal pleura. Ideally the track should be above a rib, thus avoiding the intercostal neurovascular bundle.

Skin incision of about 1cm should be made along the skin crease and intercostal tube with trocar is inserted. Once the parietal pleura is breached and pleural cavity entered, trocar is withdrawn. The drain should be held securely and clamped. Thick nonabsorbable suture is then placed through the larger portion of the incision and tied around the chest tube to hold it in position. In a more traditional surgical approach, a superficial skin incision of about 3cm is followed by blunt dissection along with careful digital exploration and dissection of the muscle planes down to the pleura.

The chest drain is then attached to an underwater seal and unclamped. Further chest radiograph is then performed to assess the position of the drain and to confirm that no damage has been done.

The rapid evacuation of a large collection of fluid within the pleural cavity may sometimes cause pulmonary edema to occur and hence large effusions should be drained over several hours (4- 6 hours).

Chest drains are removed when they have achieved their objective and ceased to function. In the case of fluid, apart from pus, this is when the fluid both clinically and radiologically has disappeared and there is not more than 20 -30ml per day discharge. In patients with empyema thoracis, abrupt removal of the drain will lead to

a poorly drained track which will then become another abscess. In these cases, the tube is removed gradually when repeated sinograms show that there is no cavity remaining at the end of the tube. Removal of chest drain in expiration is safer, as the positive pleural pressure minimizes the odds for air re-entry. Except with a large skin incision , sutures are not usually needed. Appropriate dressing will serve the purpose.

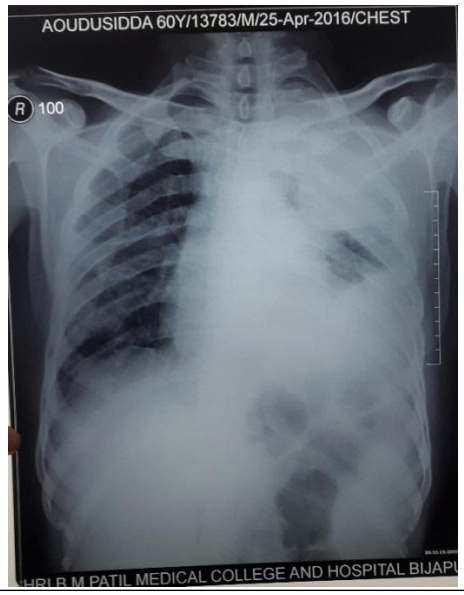


Photo 1 – Chest x-ray showing effusion on left side before ICD insertion for left empyema thoracis

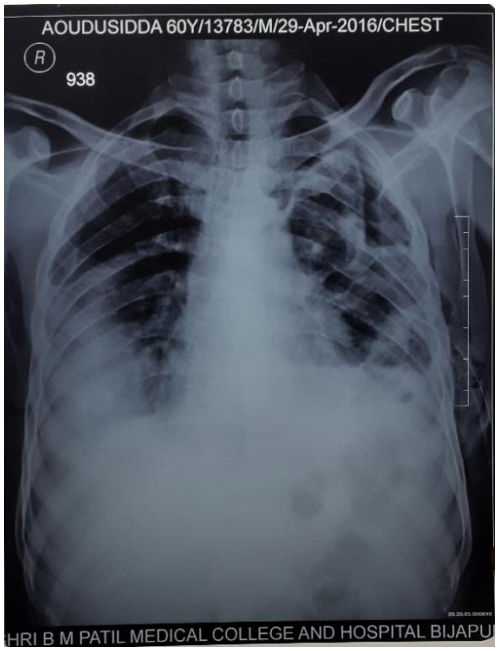


Photo 2 – Chest x-ray showing lung expansion on left side, post ICD insertion for left empyema thoracis

VIDEO ASSISTED THORACOSCOPIC SURGERY [VATS]

VATS has evolved from a simple pleural diagnostic procedure - thoracoscopy. The first reported thoracoscopic procedure was performed by the Swedish physician Hans Christian Jacobeus in 1910, who used primitive rigid cystoscope to explore the pleural space and to facilitate collape of therapy for pulmonary tuberculosis [24,30].

Thoracoscopy was subsequently used for pleural procedures and biopsies. The interest in VATS was renewed in the late 1980s with the development of laproscopic procedures. The development of endoscopic surgical instruments and techniques further accelerated the evolution of thoracoscopy from a diagnostic to a therapeutic modality.

Since 1991, minimally invasive VATS has evolved as the preferred approach to many thoracic surgery problems.

The goals of VATS is to reduce postoperative pain and other post thoracotomy morbidity without compromising the therapeutic efficacy of open thoracic surgery.

TECHNIQUE OF VATS IN EMPYEMA THORACIS

ANAESTHESIA

VATS is performed under general anaesthesia with single lung ventilation. A double lumen endotracheal tube [DLT] is preferably used , but an endobronchial blocker may also be employed [31,32].

The DLT is a bifurcated tube with both endotracheal and endobronchial lumen used to achieve isolation of either the left or right lung. There are two technique to insert DLT

1- The blind technique where DLT is passed with direct laryngoscopy and then turned 90 degree to either left or right side after the endobronchial cuff has passed beyond the vocal cords

2- The fibrooptic guidance technique – where the tip of the endobronchial lumen is guided after the DLT is through the vocal cords with aid of a flexible fibrooptic bronchoscope.

Standard monitoring techniques are used to measure the patient's oxygenation, ventilation, circulation and temperature.

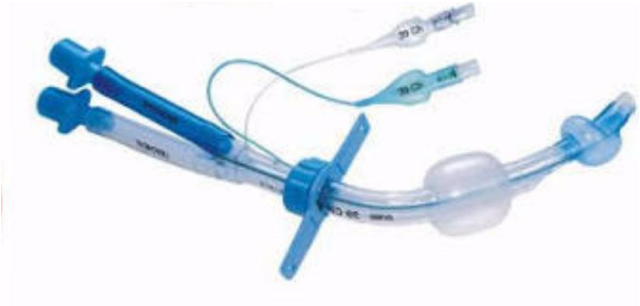


Figure – 18. Double lumen tube for one lung ventilation

POSITION AND PORT PLACEMENT –

Patient is placed in lateral decubitus position under general anaesthesia with one lung ventilation and the lung on the operative side being collapsed. Instruments used for laproscopy can be used but for convenience 0 – 30 degree scopes are most useful and the flexible thoracoscope allows proper vision.

Pre operative chest radiograph and CT scan provides information like site of fluid loculation and visceral peel requiring extensive decortication. The 10mm camera port is placed first and is positioned at a vantage point that will give maximum visibility, which is usually in the 7^{th} intercostal space in the midaxillary line. Two 5mm additional working ports are then placed directly over the involved areas , usually in 5^{th} intercostal space in anterior axillary line and posterior axillary line. Triangulation of target area will provide optimal thoracoscopic visualization.

PROCEDURE

The pleura is entered carefully using blunt trocar in the area of maximal fluid collection and evacuation of fluid was followed. Digital palpation allows to remove any chest wall adhesions which is followed by camera port insertion without traumatizing lung parenchyma. The fluid and debris are removed using a suction catheter. Adhesions are taken down with blunt dissection using the camera or sharply with thoracoscopic instruments. It further defines the areas of thicker adhesions that require more extensive adhesiolysis and areas of pleural peel. The fibrous peel is completely stripped away from the lung using a combination of blunt and sharp dissection. Sometimes, long open surgical instruments were passed directly through the ports and aided in the removal of the peel. A Thoracoscopic sponge forceps can be used to tamponade bleeding sites by gentle, direct compression. Thorough wash was given to thoracic cavity with normal saline and fluid suctioned out.

After the procedure, lung is reexpanded under vision to confirm the full expansion. An ICD was placed through the camera port before closure of the ports.

Post operatively patient was monitored in recovery room for about 6 hours. An immediate postoperative radiograph was carried out to visualize the condition of ipsilateral and contralateral lung.

All patients received chest physiotherapy and breathing exercises.

The ICD tube was removed once it stopped draining any purulent material or the column movement stopped moving. Parenteral antibiotics during hospital stay and later oral antibiotics during discharge were given.

Adequate pain management with parenteral analgesics and intercostal nerve blocks prevented splinting and aided in more effective breathing, thus preventing postoperative pneumonias and other pulmonary complications.

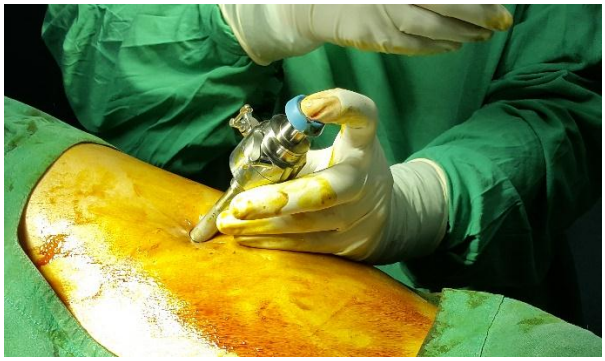


Photo 3-Trocar placement for VATS in 7th ICS in midaxillary line

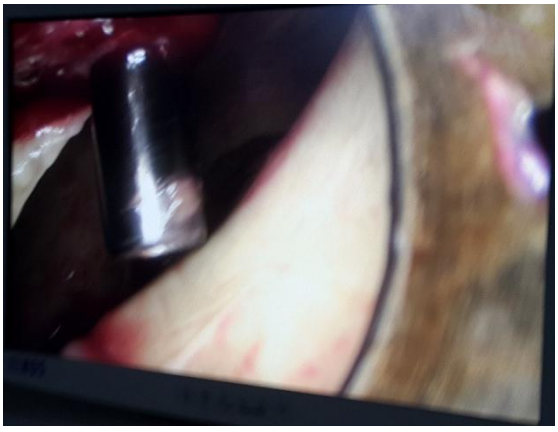


Photo 4- Additional working port insertion under vision

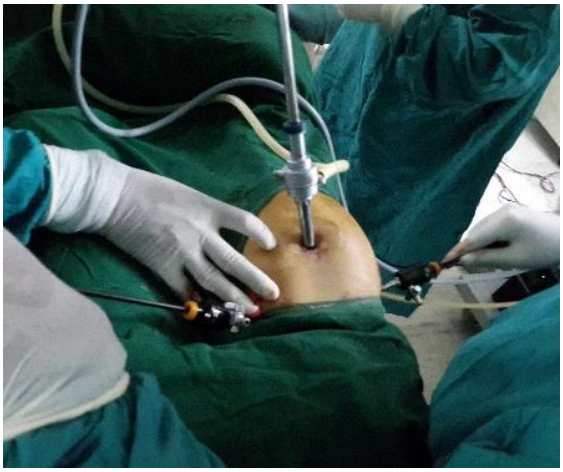
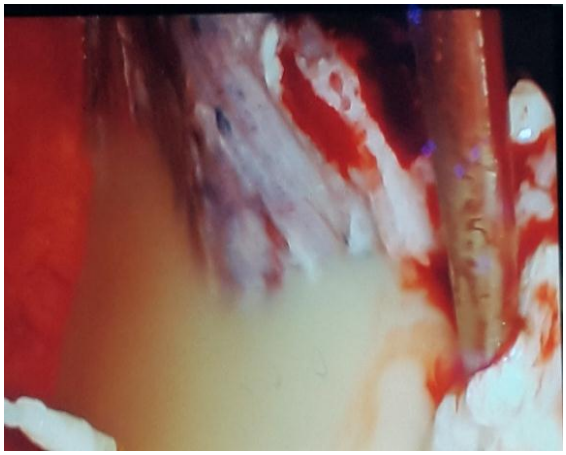


Photo 5 - Triangulation of target area.

A



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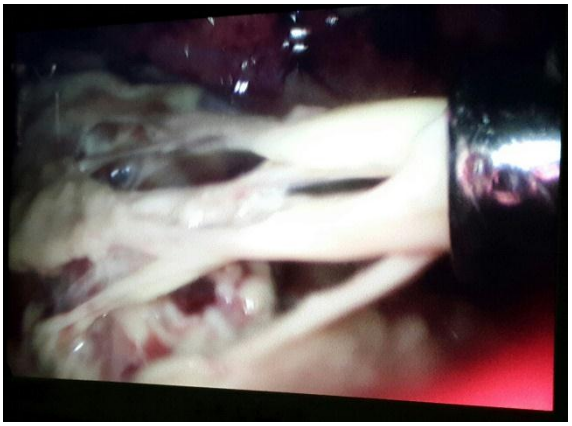

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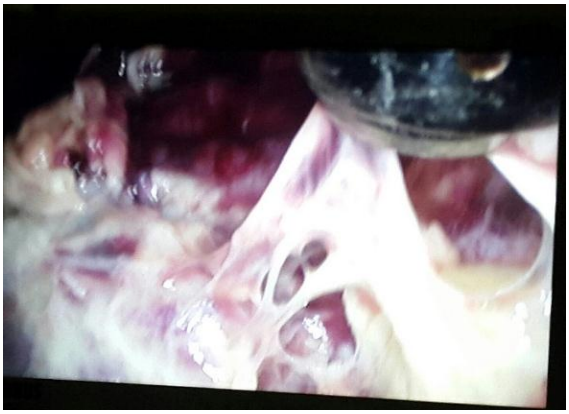
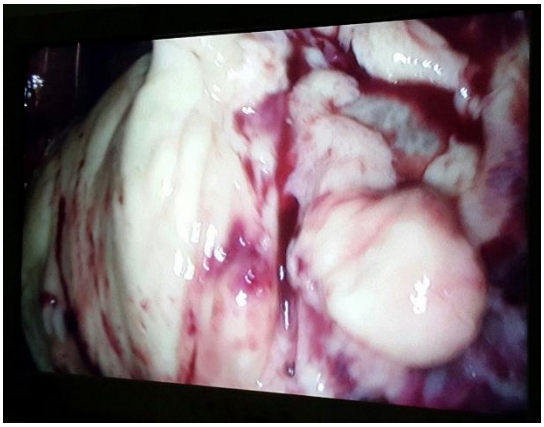


Photo 6 (A – C) – Suction evacuation of empyema fluid and debris

A



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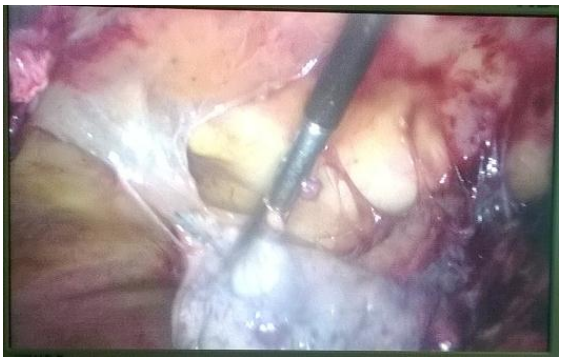

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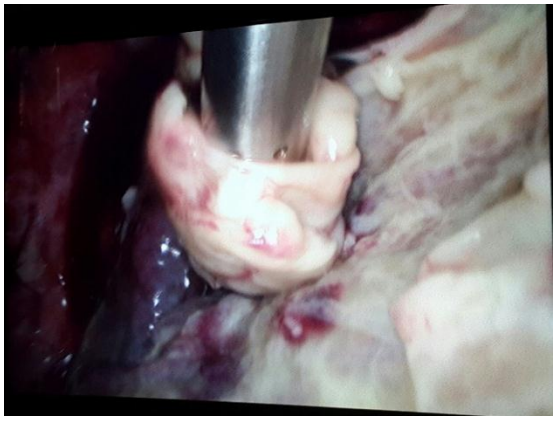


Photo 7. A) – Fibrous collection over visceral peel.

B)- Blunt dissection with removal of adhesions and fibrin deposits

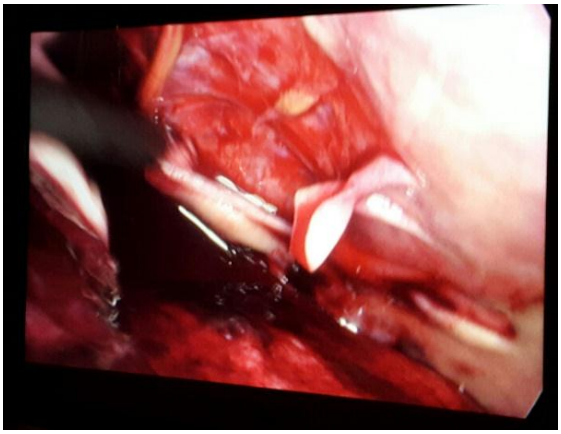
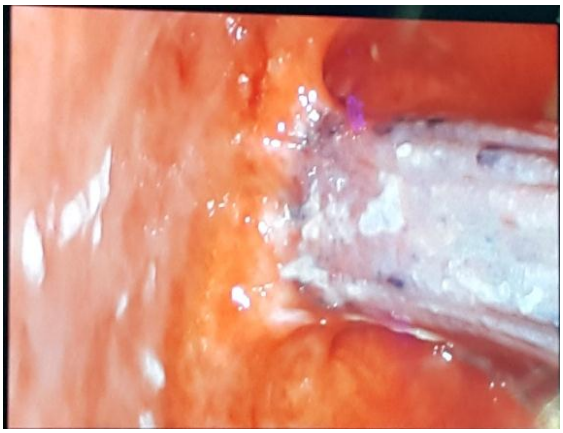


Photo 8 – VATS decortication of visceral pleura

A



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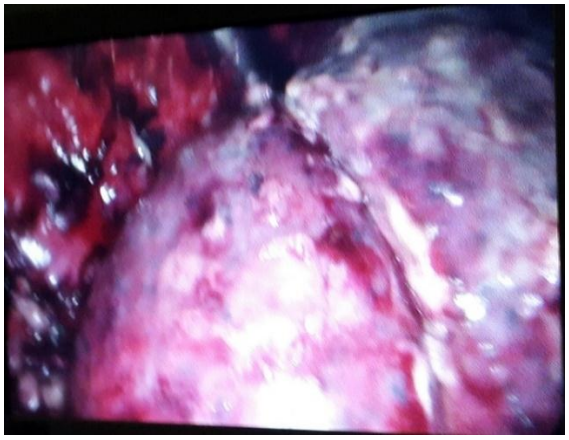


Photo 9 (A,B) – Chest wall and lung surface following VATS debridement and decortication.

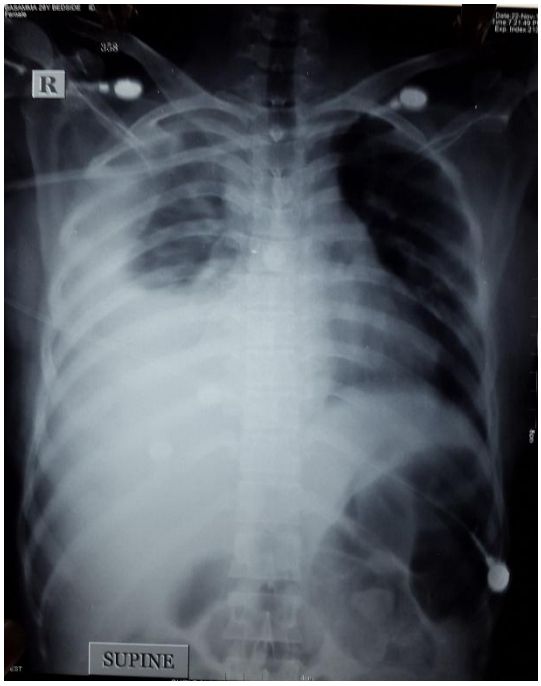


Photo 10 : Chest X –ray of right empyema thoracis before VATS

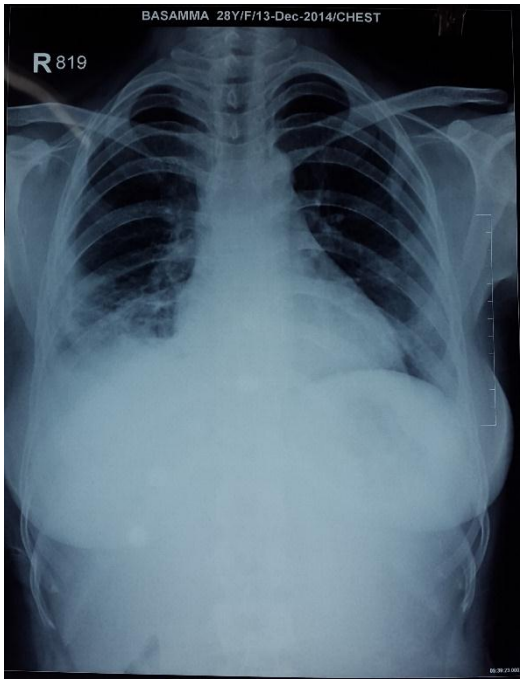


Photo 11 : Chest X ray showing lung expansion after VATS for right empyema thoracis

Relevant studies

. S N Oak, S V Parelkar, K V Satishkumar, R Pathak, B H Ramesh, S Sudhir et al reviewed on video-assisted thoracoscopy in children. A total of 133 children with various thoracic diseases who presented at a University Teaching Hospital in the Department of Pediatric Surgery, Mumbai, India, from June 2000 to December 2007 were included, of whom 116 patients had empyema and were subjected to VATS debridement/decortication and drainage was done.

In their study, the mean duration of disease was 10 days, mean duration of hospital stay was 6 days, mean duration of removal of drain was 3 days. 16 cases were converted to open surgery and 13 cases were found to have tuberculosis. 90% showed good lung expansion. It was concluded VATS is a safe and effective procedure for treatment of complicated parapneumonic effusion or empyema with less postoperative pain, a shorter hospital stay and a better cosmetic result. Application of VATS early in cases of empyema can alter the course of the disease and give better results. The success of VATS in thoracic diseases other than empyema is comparable to an open procedure[33] .

. L. Solaini, F. Prusciano, P. Bagioni, Thoracic Surgery unit, S.Maria delle Croci Hospital, Ravenna, Italy, recorded on video assisted thoracic surgery in the treatment of pleural empyema over a period of 12 years from January 1994 to December 2005, on total of 120 cases of pleural empyema. In this study, mean age of patients was 52 years, mean duration of symptoms was for 33 days, mean postoperative hospital stay was 7.1 days, mean chest tube insitu was for 6 days. Total of 9 patients(8.2%) were converted to open thoracotomy.

In conclusion, the authors consider VATS to be the technique of first choice for the treatment of pleural empyema when the disease is advanced or tube thorocostomy fails. It provides excellent results with a low level of invasiveness and considerably reduces the need for thoracotomy. These results can be achieved with good video thoracoscopic experience and the use of a very precise technique[34].

. Magdi Ibrahim Ahmed Muhammad, Department of Thoracic Surgery, Suez Canal University, Egypt, conducted a prospective study between January 2008 and June 2010 on 69 patients for Management of complicated parapneumonic effusion and empyema using different treatment modalities and noted that VATS group has less duration of hospital stay (7.76 days) and duration of chest tube insitu (5.72 days) compared to ICD and open thoracotomy group. He concluded that VATS is a safe and effective procedure for treatment of complicated parapneumonic effusion or empyema. Earlier intervention with VATS can provide better results[35].

. Yousef Shahin, John Duffy, David Beggs, Edward Black, Andrzej Majewski , Department of Thoracic Surgery, Nottingham City Hospital, Nottingham, reviewed 106 patients retrospectively ,who underwent surgical management of pleural empyema over a period of 3 years from August 2005.

Median length of hospital stay was 6 days for thoracoscopic debridement, 5 days for thoracoscopic decortication and 8 days for open decortication. Mortality rate was 0% for all procedures. They concluded that patients with VATS debridement or decortication spent less time in hospital and the convertion rate to open procedure for stage III empyema was only 19%, which encourages to consider VATS debridement/decortication as a first choice treatment[36].

. David A. Waller, Arvind Rengarajan ,Department of thoracic surgery, Glenfield hospital, Leicester, United kingdom, conducted a prospective cohart study of 48 consecutive patients with multi loculated post pneumonic pleural empyema in whom visceral pleural decortication was required was studied. The effect of VAT decortication on perioperative outcome and factors affecting its success were assessed. They found that VATS group has lower operative time, and less duration of hospital stay postoperatively (5.5 days) and good lung expansion in 98.6% of patients. They concluded that VAT decortication is a feasible new technique to achieve lung reexpansion in chronic post pneumonic pleural empyema and has perioperative benefits over thoracotomy[37].

. Nandeesh M , B J Sharathchandra and P B Thrishuli have conducted a prospective comparative study of ICD insertion Versus VATS as primary intervention in the fibrinopurulent stage of Empyema Thoracis, over a period of 2 years from December 2008 to November 2010, in a tertiary care medical college Hospital with each group consisting of 20 patients.

They have found that VATS was better than conventional ICD insertion in terms of variables like mean duration of hospital stay (15.5 days), mean duration of chest tube insitu (8.1days), mean cost of the treatment, complications and failure rate (20%) which were statistically significant and have concluded that VATS is better than ICD insertion as primary mode of treatment in the fibrinopurulent stage of Empyema thoracis[38].

. Chung JH, Lee SH, Kim KT, Jung JS, Son HS, Sun K conducted the study on 128 patients with empyema who were treated with VATS and open decortication over 8 years at Korea University Anam Hospital. Patients were divided into 3 groups based

on the onset of chest symptoms as Group 1: <2 weeks, Group 2: 2 to 4 weeks and Group 3: > 4weeks and evaluated. They concluded that patients with symptom durations of less than 4 weeks showed better early results than those with symptom durations greater than 4 weeks. Thus, symptom duration can be considered a reliable preoperative factor in deciding the surgical management of empyema or cases involving loculated pleural effusion[39].

. Aziz A, Healey JM, Quereshi F, Kane TD, Kurland G, Green M et al conducted a study on 49 pediatric patients with pneumonia complicated by parapneumonic effusion or empyema at Children's Hospital, Pittsburgh from 1997 to 2003. Patients were divided into 3 groups based on treatment which involved primary chest tube, chest tube followed by VATS and primary VATS. They concluded that patients undergoing primary VATS demonstrated a significantly shorter total stay and lower hospital charges than the other groups and suggest strategy of primary VATS as first line treatment in the management of empyema or parapneumonic effusion as a complication of pneumonia in pediatric patients[40].

. Homvises B. conducted a retrospective study of all adult patients treated for empyema between June 2009 to February 2011 at Thammasat hospital. A total of 23 patients with mean age of 59 years underwent VATS debridement and decortication. 17 patients received preoperative drainage. 8 patients had stage II empyema and underwent VATS debridement while 15 patients had stage III empyema underwent VATS decortication. Median postoperative hospital stay was 12.6 days. Median time for postoperative intercostal drainage was 5 days. Conversion rate to open thoracotomy for stage II empyema was only 13%.

They concluded that VATS debridement and decortication is safe and effective treatment in the management of stage II and stage III empyema thoracis[41].

. Tong BC, Hanna J, Toloza EM, Onaitis MW, Harpole DH, Burfeind WR et al conducted a study on outcomes of 420 consecutive patients undergoing VATS decortication (VATSD) or open thoracotomy for decortication(OD) for benign conditions from 1996 to 2006. The cohort consisted of 326 VATSD and 94 OD patients. The conversion rate from VATSD to OD was 11.4%. The operative time and median in-hospital length of stay were shorter for the VATSD group: 97 versus 155 minutes and 15 versus 21 days respectively. The median postoperative length of stay was 7 days for the VATSD group versus 10 days for the OD group. Significantly fewer postoperative complications occurred in the VATSD group.

They concluded that thorocoscopic decortication for empyema, complex pleural effusion and hemothorax yields results that are atleast equivalent to open decortication. The conversion and reoperation rates are low, suggesting that a thoracoscopic approach is an effective and reasonable first option for most patients with complex pleural effusions and empyema[42.]

MATERIALS AND METHODS

SOURCE OF DATA:

- All patients admitted in BLDEU'S SHRI B. M. PATIL MEDICAL COLLEGE HOSPITAL AND RESEARCH CENTER, VIJAYAPUR, diagnosed with Para pneumonic effusion or Empyema thoracis during the period of October 2014 to September 2016 were taken for the study.

INCLUSION CRITERIA:

All patients diagnosed as Empyema thoracis based on clinical examination, imaging modalities and pleural fluid analysis.

EXCLUSION CRITERIA

1. Empyema due to-
   Carcinoma
   Terminally ill patients
2. Patients not fit for general anaesthesia
3. Patients with Bronchopleural fistula on CT Chest

RESEARCH HYPOTHESIS

Treatment outcome is better with video assisted thoracoscopic surgery than tube thoracostomy in Empyema thoracis.

PROCEDURE

All the patients admitted in B.L.D.E.U'S SHRI B. M. PATIL MEDICAL COLLEGE, HOSPITAL AND RESEARCH CENTRE, VIJAYAPUR, during the study period who are diagnosed to have empyema thoracis based on chest X ray, pleural fluid analysis and CTchest were studied prospectively.

Patients were divided into 2 groups. One group patients were subjected to ICD tube insertion under local anaesthesia and the other to primary VATS under general anaesthesia randomly.

The following variables which includes duration of hospital stay after treatment, duration of chest tube in situ, cost of treatment, complications, treatment failure, mortality were compared between the two groups.

The treatment was considered failure, if the patient did not improve clinically, as well as, radiologically for a period of 1 week and if he/she needed Thoracotomy to clear the disease

INVESTIGATIONS / INTERVENTIONS:

Investigations or interventions required in this study are routine standardized procedures.

There are no animal experiments involved in this study.

These routine investigations are required and for routine postoperative follow-up:

1. Complete blood count.
2. Bleeding time, Clotting time
3. Urine – sugar, albumin and microscopy.
4. Random blood sugar, Blood urea, Serum creatinine,
5. Electro-cardio-gram (when age of patient is >35yrs, or if necessary).
6. Chest X ray
7. Pleural fluid analysis
8. Culture and sensitivity of pleural fluid
9. Ultrasonography /CT Scan of chest, if required.

10. Tests to detect infection with Human Immunodeficiency Virus and Hepatitis B Virus (in accordance to Universal Safety Precautions).
11. Chest X ray will be repeated following the procedure to follow the progress of procedure

SAMPLING

- Type of study-Prospective comparitive study
- Time period of study- October 2014 to September 2016
- With 5% level of significance, 90% power of test, the anticipated mean difference of hospital stay as 10.1days between comparison groups and a SD as 12 days, the minimum sample size is 30/arms.[38]
- Formula for estimating sample size:

$$n = \frac{[z\alpha + z\beta]^2 2SD^2}{MD^2}$$

α=level of significance=5%

1-β=power of test=90%

MD=anticipated mean difference=10.1days

SD=anticipated standard deviation=12 days

Z=statistic value

n=30/arms

- Calculated sample size is 30 per group
- In the study 60 cases were studied and each group was allocated 30 cases randomly.

STATISTICAL ANALYSIS

All characteristics were summarized descriptively. For continuous variables, the summary statistics of N, mean, standard deviation (SD) were used. For categorical data, the number and percentage were used in the data summaries. Chi-square (χ^2)/ Freeman-Halton Fisher exact test was employed to determine the significance of differences between groups for categorical data. The difference of the means of analysis variables was tested by unpaired t test. If the p-value was < 0.05, then the results will be considered to be significant. Data were analyzed using SPSS software v.23.0.

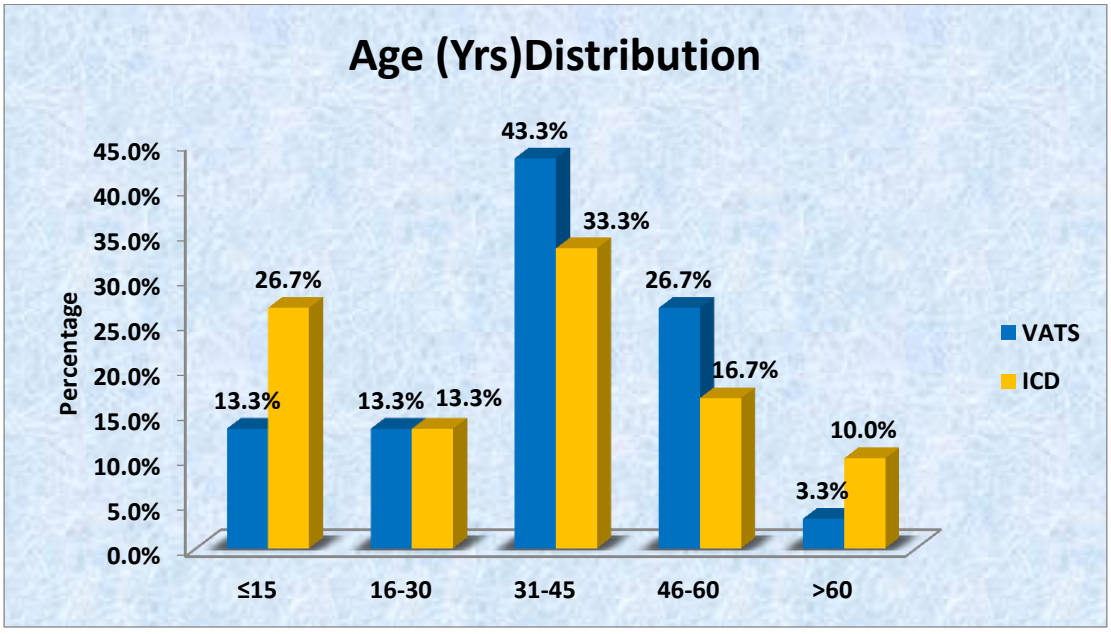
RESULTS

The prospective comparative study was conducted in the Department of General Surgery, BLDEU'S Shri B.M Patil medical college, hospital and research centre from the period of October 2014 to September 2016. A total of 60 patients diagnosed to have Empyema thoracis were enrolled in the study.

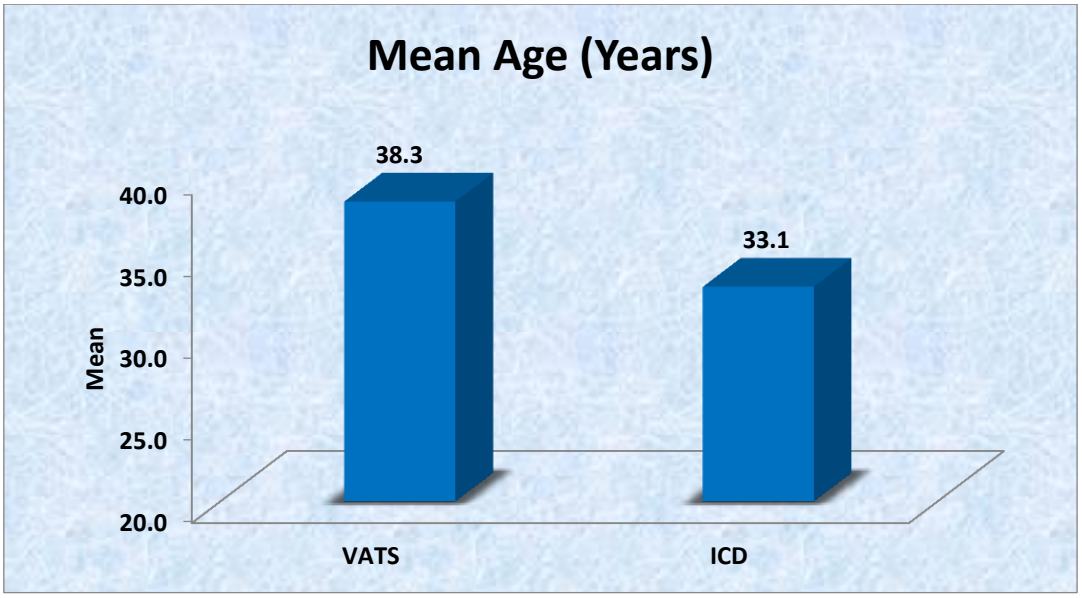
Table 1 : Distribution of cases according to Age between study groups

Age (Yrs)	VATS		ICD		p value
	N	%	N	%	
≤15	4	13.3%	8	26.7%	0.491
16-30	4	13.3%	4	13.3%	
31-45	13	43.3%	10	33.3%	
46-60	8	26.7%	5	16.7%	
>60	1	3.3%	3	10.0%	
Total	30	100.0%	30	100.0%	
Mean±SD	38.3±14.9		33.1±19.7		0.251

Graph 1 : Distribution of cases according to Age between study groups



Graph 2 : Mean Age between study groups

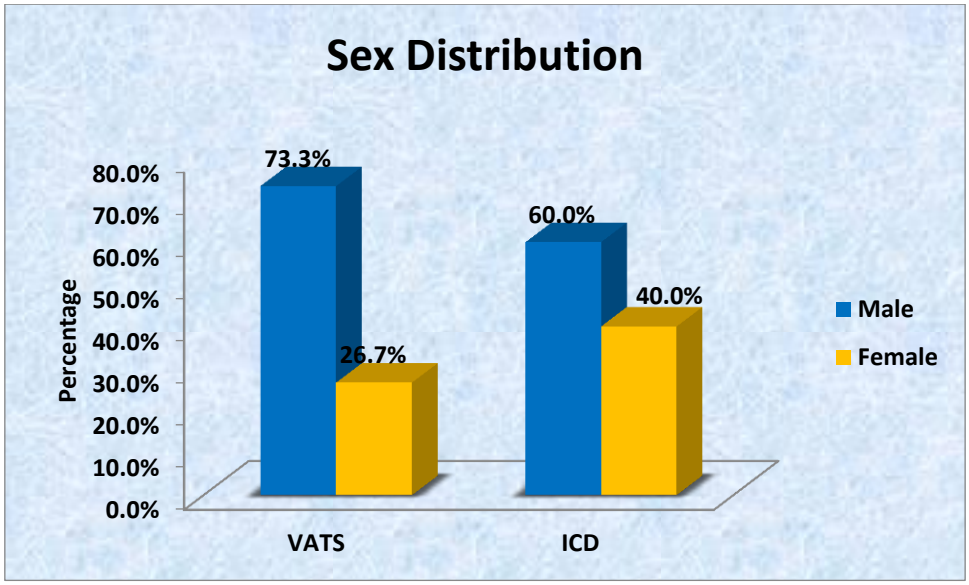


The mean age of patient in VATS group was 38.3 years and in ICD group was 33.1 years. Total of 12 pediatric cases accounted for 20% of cases in the study group.

Table 2 : Distribution of cases according to Sex between study groups

Sex	VATS		ICD		p value
	N	%	N	%	
Male	22	73.3%	18	60.0%	0.273
Female	8	26.7%	12	40.0%	
Total	30	100.0%	30	100.0%	

Graph 3 : Distribution of cases according to Sex between study groups

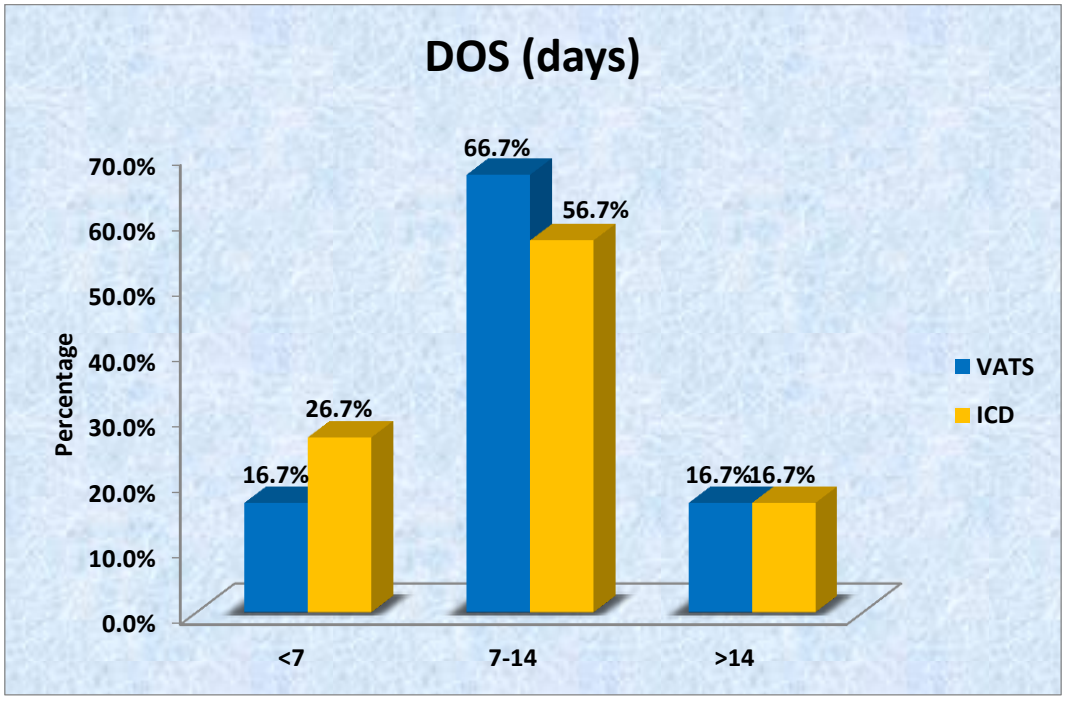


Total of 20 female patients and 40 male patients were enrolled in the study group.

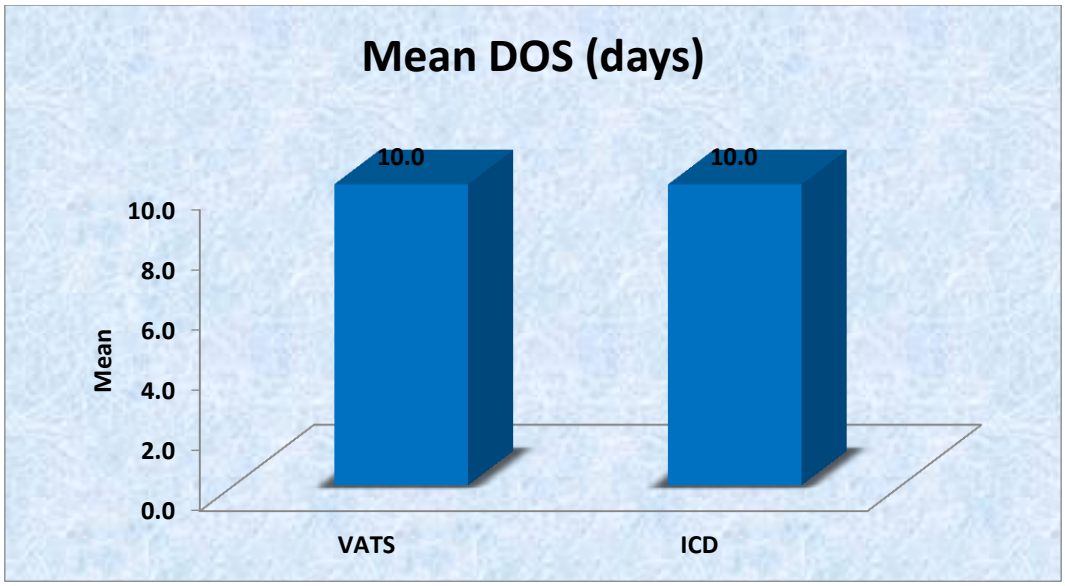
Table 3 : Distribution of cases according to Duration of symptom between study groups

DOS (days)	VATS		ICD		p value
	N	%	N	%	
<7	5	16.7%	8	26.7%	0.626
7-14	20	66.7%	17	56.7%	
>14	5	16.7%	5	16.7%	
Total	30	100.0%	30	100.0%	
Mean±SD	10±5.3		10±6.5		No Difference

Graph 4: Distribution of cases according to Duration of symptom between study groups



Graph 5 : Mean Duration of symptom between study groups



Mean duration of onset of symptoms was 10 days in both groups. Majority of patients presented within 7 -14 days of onset of symptoms (66.7% in VATS group and 56.7% in ICD group).

Table 4 : Distribution of cases according to Associated disease between study groups

Associated disease	VATS		ICD		p value
	N	%	N	%	
DM	0	0.0%	2	6.7%	0.365
DM+HTN	0	0.0%	1	3.3%	
EN	0	0.0%	1	3.3%	
HTN	3	10.0%	1	3.3%	
RVD	0	0.0%	1	3.3%	
TB	2	6.7%	3	10.0%	
Nil	25	83.3%	21	70.0%	
Total	30	100.0%	30	100.0%	

Graph 6 : Distribution of cases according to Associated disease between study groups

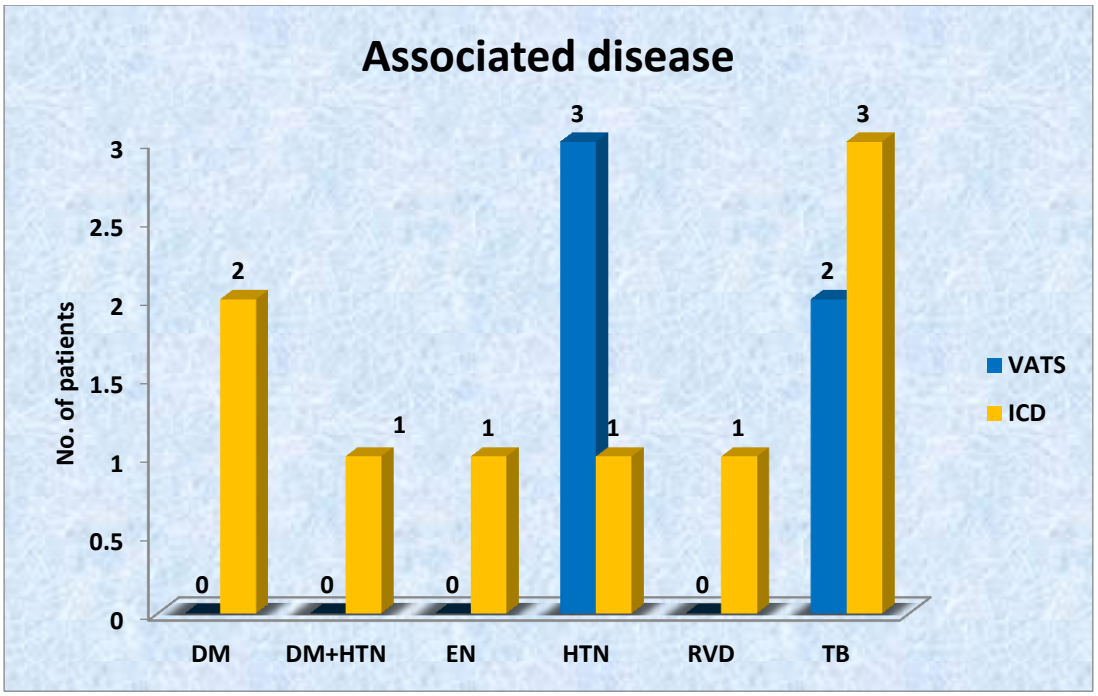
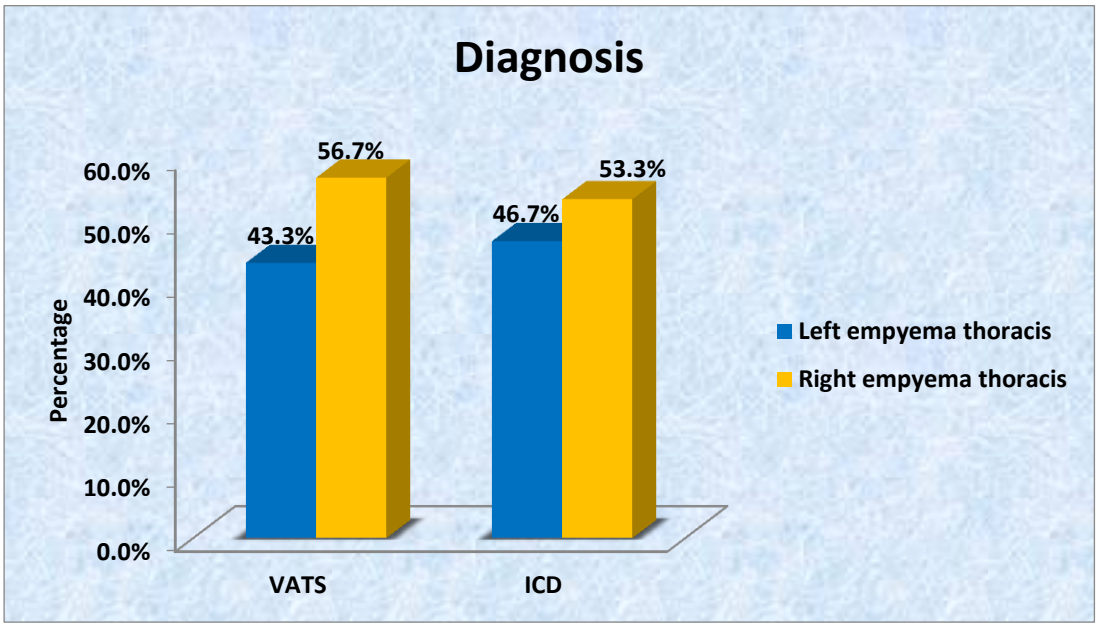


Table 5 : Distribution of cases according to Diagnosis between study groups

Diagnosis	VATS		ICD		p value
	N	%	N	%	
Left empyema thoracis	13	43.3%	14	46.7%	0.795
Right empyema thoracis	17	56.7%	16	53.3%	
Total	30	100.0%	30	100.0%	

Graph 7 : Distribution of cases according to Diagnosis between study groups

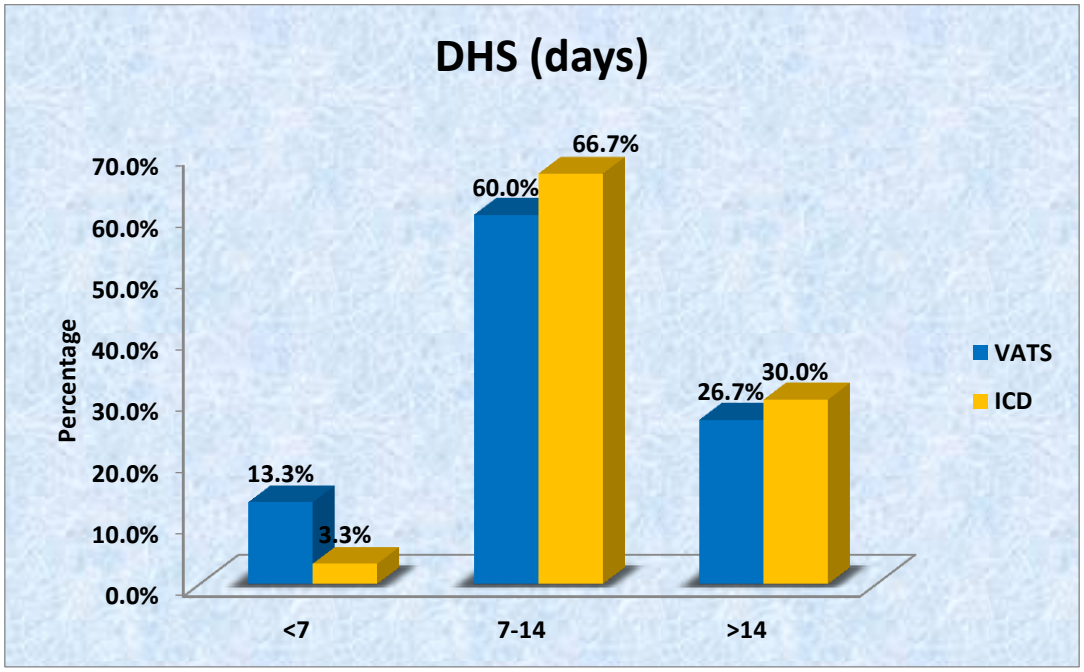


Left sided empyema was noted in 27 cases and right sided in 33 patients in total study group.

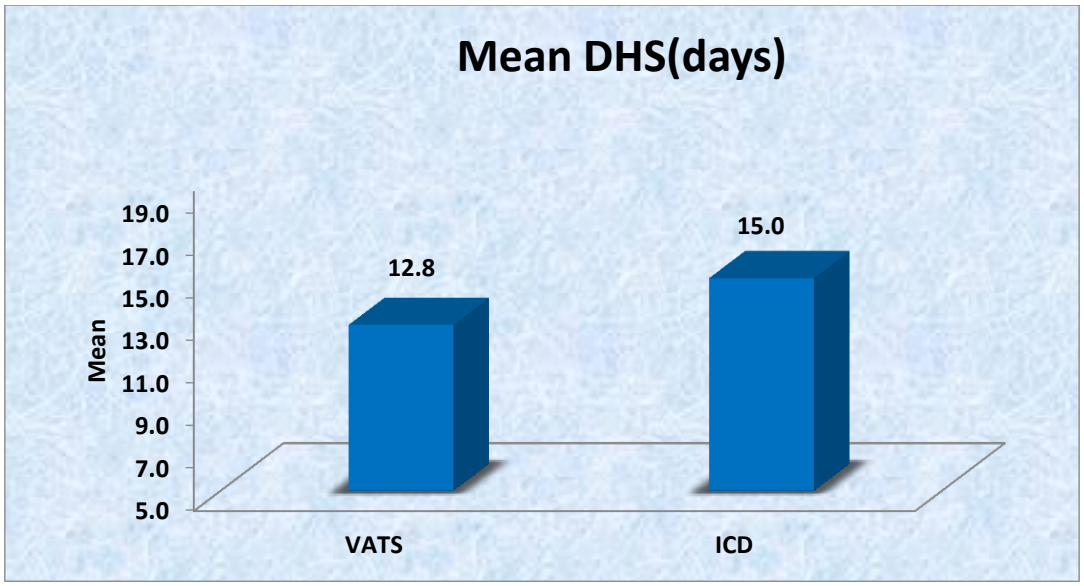
Table 6 : Distribution of cases according to post procedure duration of hospital stay between study groups

DHS (days)	VATS		ICD		p value
	N	%	N	%	
<7	4	13.3%	1	3.3%	0.375
7-14	18	60.0%	20	66.7%	
>14	8	26.7%	9	30.0%	
Total	30	100.0%	30	100.0%	
Mean±SD	12.8±6.7		15.0±7.7		0.238

Graph 8 : Distribution of cases according to post procedure duration of hospital stay between study groups



Graph 9 : Mean Duration of post procedure hospital stay between study groups

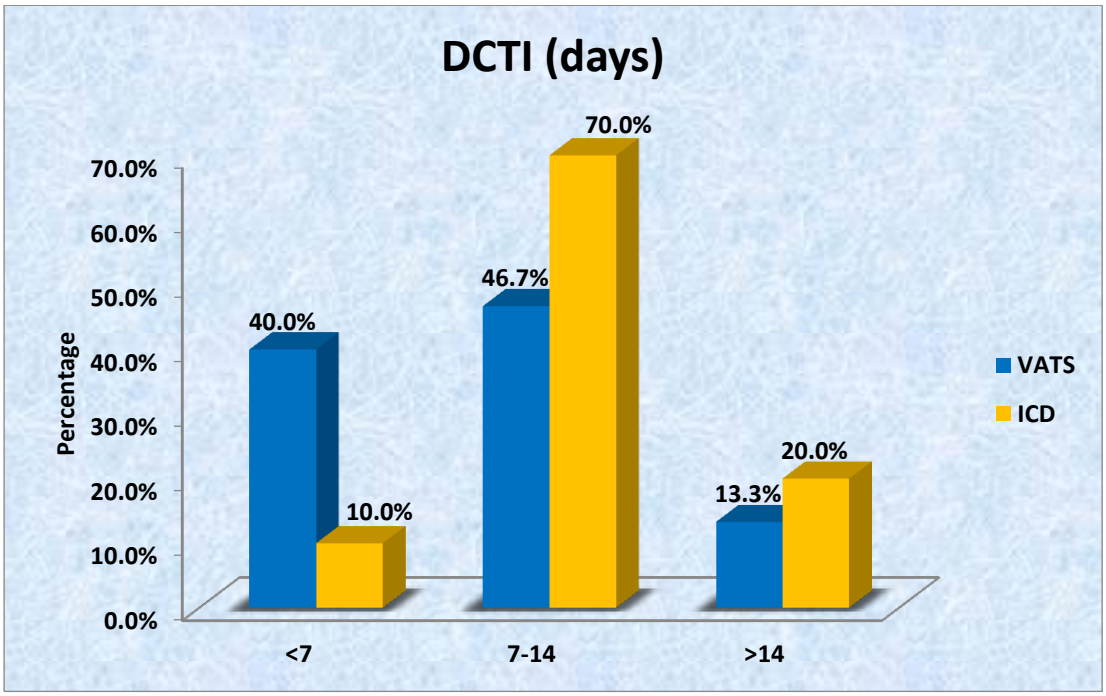


Mean duration of post procedure hospital stay was 12.8 days in VATS group and 15 days in ICD group which is lesser by 2.2 days but was not statistically significant.

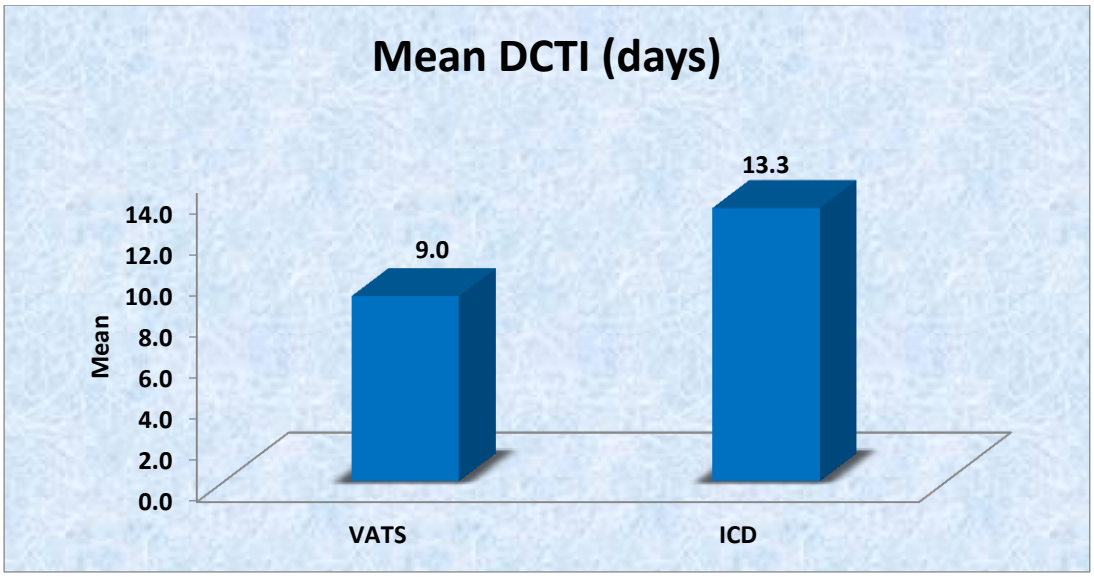
Table 7 : Distribution of cases according to Duration of the chest tube in situ between study groups

DCTI (days)	VATS		ICD		p value
	N	%	N	%	
<7	12	40.0%	3	10.0%	0.027 (Sig)
7-14	14	46.7%	21	70.0%	
>14	4	13.3%	6	20.0%	
Total	30	100.0%	30	100.0%	
Mean±SD	9.0±6.3		13.3±7.5		0.019 (Sig)

Graph 10 : Distribution of cases according to Duration of the chest tube in situ between study groups



Graph 11 : Mean Duration of the chest tube in situ between study groups

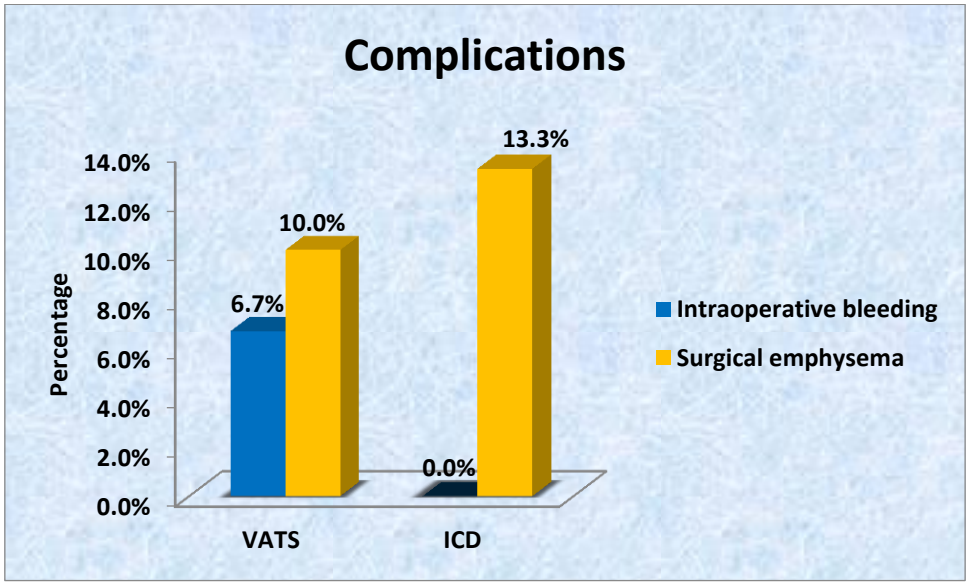


Mean duration of chest tube insitu was 9 days for VATS group and 13.3 days in ICD group which was statistically significant (p value < O.O5).

Table 8 : Distribution of cases according to Complication between study groups

Complication	VATS		ICD		p value
	N	%	N	%	
Intraoperative bleeding	2	6.7%	0	0.0%	0.339
Surgical emphysema	3	10.0%	4	13.3%	
Nil	25	83.3%	26	86.7%	
Total	30	100.0%	30	100.0%	

Graph 12 : Distribution of cases according to Complication between study groups

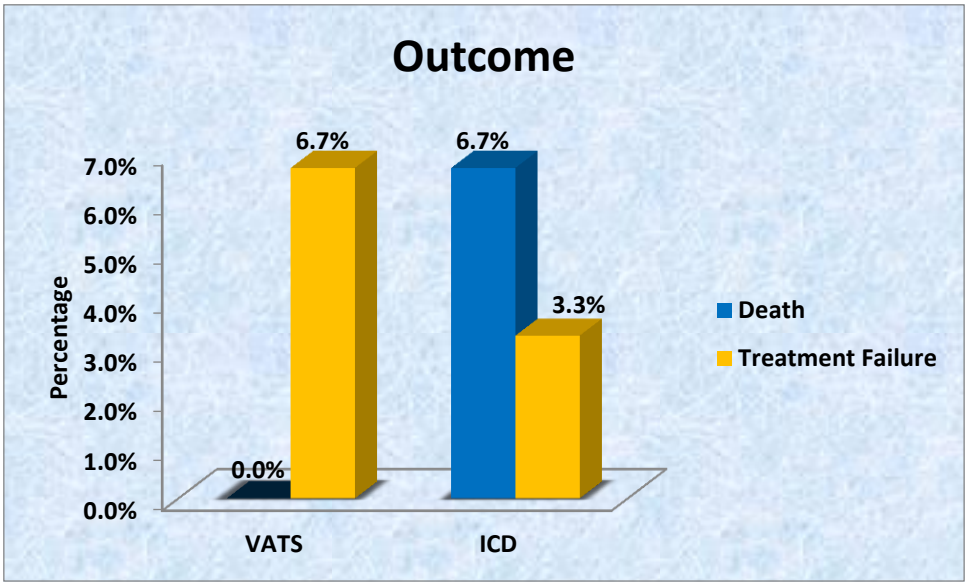


Minor complications like intraoperative bleeding in 2 cases and surgical emphysema in 7 cases were noted in total study which were managed conservatively.

Table 9 : Distribution of cases according to Outcome between study groups

Outcome	VATS		ICD		p value
	N	%	N	%	
Death	0	0.0%	2	6.7%	0.15
Treatment Failure	2	6.7%	1	3.3%	0.554

Graph 13 : Distribution of cases according to Outcome between study groups

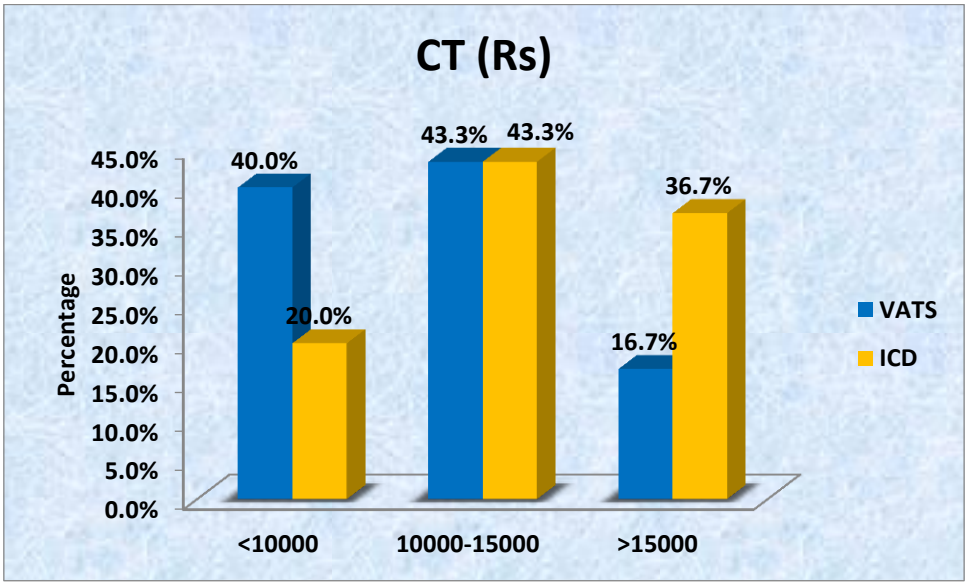


2 Cases in VATS group and 1 in ICD group were converted to open thoracotomy. Death was noted in 2 cases in ICD group.

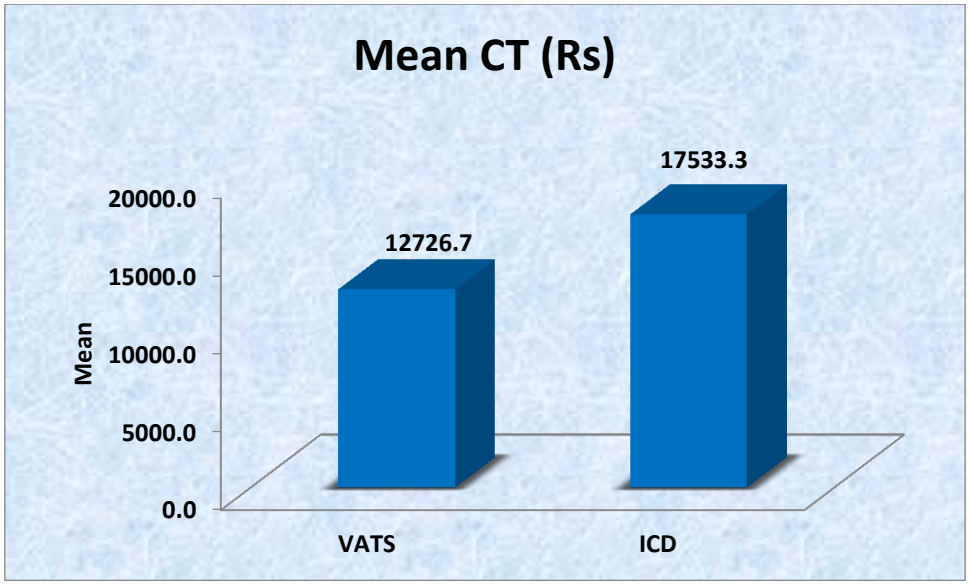
Table 10 : Distribution of cases according to Cost of therapy between study groups

CT (Rs)	VATS		ICD		p value
	N	%	N	%	
<10000	12	40.0%	6	20.0%	0.119
10000-15000	13	43.3%	13	43.3%	
>15000	5	16.7%	11	36.7%	
Total	30	100.0%	30	100.0%	
Mean±SD	12726.7±7882.4		17533.3±10460.9		0.049 (Sig)

Graph 14 : Distribution of cases according to Cost of therapy between study groups



Graph 15 : Mean Cost of therapy between study groups



Mean cost of treatment in VATS group was 12,726.7 Rs and in ICD group 17,533.3 Rs which was statistically significant (p value <0.05).

DISCUSSION

The treatment modality of choice for empyema thoracis remains controversial especially in the early stages. Although many studies suggest that VATS is the better modality of treatment , it's routine use is still limited. In this prospective study in the tertiary care medical college hospital , the efficacy and feasibility of VATS in treatment of empyema thoracis is evaluated and compared to conventional tube thorocostomy . The results obtained ,though not statistically significant with regarding to all objectives were still in favour of VATS as primary treatment modality which has lower duration of hospital stay and duration of chest tube in situ with reduced post procedure morbidity like pain and restricted mobility .It is also cost effective which should be given a consideration in a developing country like ours. Though the procedure of ICD itself did not rise the cost, but the prolonged duration of hospital stay and parenteral antibiotics and few patients requiring intensive care that has affected the cost of treatment.

The results obtained were also in accordance with previous studies as shown below.

Table 11 : Comparison of studies with regarding to Mean age (years)

Mean Age	Nandeesh et al[38]	Wait et al[7]	Magdi Ibrahim[35]	Our study
VATS	34	42	31.1	38.3
ICD	24	43	32.3	33.1

Table 12 : Comparison of studies with regarding to Mean duration of postprocedure hospital stay (days)

Mean hospital stay	Nandeesh et al[38]	Wait el al[7]	Magdi Ibrahim[35]	Our study
VATS	15.5	8.7	7.76	12.8
ICD	25.2	12.8	11.65	15.0

Table 13 : Comparison of studies with regarding to Mean duration of chest tube insitu (days)

Mean chest tube insitu	Nandeesh et al[38]	Wait et al[7]	Magdi Ibrahim[35]	Our study
VATS	8.1	5.8	5.72	9.0
ICD	17.3	9.8	6.65	13.3

Table 14 : Comparison of studies with regarding to Mean cost of treatment

Mean cost of treatment	Nandeesh et al[38]	Wait et al[7]	Our study
VATS	10,579 Rs	16,642$	12,726 Rs
ICD	17,945 Rs	24,052$	17,533 Rs

In wait et al study 2 death were noted in each group and in our study, 2 deaths were noted in ICD group. Good lung expansion uptil 90% were noted in all comparative study groups with VATS procedure. Organisms isolated in our study

mainly had Staphylococcus aureus and Klebsiella pneumonia. Sterile cultures were also noted in some patients. Though complications like bleeding, air leak, surgical emphysema were encountered in most of the studies, none were too significant to affect the outcome and all were treated conservatively.

LIMITATION

This is a prospective comparative study with a small sample size. More studies with a large randomizied trail should be considered inorder to define optimal timing of disease where VATS is more effective.

SUMMARY

- In our study comparison between tube thorocostomy versus VATS in the treatment of empyema thoracis was done which involved 30 patients in each group.
- Mean age on VATS group was 38.3 years and that in ICD is 33.1 years.
- Majority of the patients had duration of symptoms within 7 -14days [66.7% in VATS and 56.7% in ICD] which suggests more towards fibrino purulent stage of disease.
- Associated disease included Hypertensive patients in both groups, 3 diabetic patients, 1 patient with retroviral disease and 1 with empyema necassitatans in ICD group.
- Tuberculosis was noted in 2 patients in VATS group which was proved with pleural biopsy and in 3 patients in ICD group.
- The mean duration of hospital stay post procedure was 12.8 days in VATS group and 15.0 days in ICD group.
- The mean duration of chest tube insitu was 9.0 days in VATS group and 13.3 days in ICD group which was statistically significant.
- 2 cases in VATS group and 1 in ICD group were converted to open thoracotomy and disease was found to be in advanced organized stage . Both converted cases in VATS group had tubercular empyema.
- Complications involved intraoperative bleeding in 2 cases in VATS and none in ICD. Surgical emphysema was noted in 3 cases of VATS and 4 in ICD. All were treated conservatively

- Mortality was noted in 2 patients in ICD group who also had tubercular empyema
- Significant difference was noted in mean cost of treatment with VATS group of 12726 Rs and ICD group costing 17,533 Rs,.Cost was higher in converted cases and also in those who had prolonged duration of stay.

CONCLUSION

Video assisted thoracoscopic surgery is a minimally invasive procedure with good therapeutic results with reduced morbidity and hospitalization. VATS should be considered as primary modality of treatment in Empyema thoracis, more so in early stages, than going for conventional tube thorocostomy. Laproscopic instruments can also be used which makes it more feasible. Routine use of VATS in early stages of empyema appears to be more efficacious with added advantages of visualization of thoracic cavity to identify other pathology, for staging empyema and also for pleural biopsy.

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ANNEXURE I

Institutional Ethical Committee
BIJAPUR-586 103.
OUTWARD
No. 5414
Date 24/11/14
B.L.D.E.U's Shri B.M. Patil Medical College

B.L.D.E. UNIVERSITY'S
SHRI.B.M.PATIL MEDICAL COLLEGE, BIJAPUR-586 103
INSTITUTIONAL ETHICAL COMMITTEE

INSTITUTIONAL ETHICAL CLEARANCE CERTIFICATE

The Ethical Committee of this college met on 22-11-2014 *at* 3-30 pm *to scrutinize the Synopsis of Postgraduate Students of this college from Ethical Clearance point of view. After scrutiny the following original/corrected & revised version synopsis of the Thesis has been accorded Ethical Clearance.*

Title "Efficacy of Video Assisted Thoracoscopic Surgery Versus Tube Thorocostomy in The Management of Empyema Thoracis.

Name of P.G. student Dr. Kruthi. S.R.
Dept of General Surgery

Name of Guide/Co-investigator Dr Vijaya. Patil. Professor.
Dept of General Surgery

for
DR.TEJASWINI. VALLABHA
CHAIRMAN
INSTITUTIONAL ETHICAL COMMITTEE
BLDEU'S, SHRI.B.M.PATIL
MEDICAL COLLEGE, BIJAPUR.

Following documents were placed before E.C. for Scrutinization
1) Copy of Synopsis/Research project.
2) Copy of informed consent form
3) Any other relevant documents.

ANNEXURE II

Informed consent for participation in dissertation/research

I, the undersigned,_____ S/O D/O W/O_____, aged_____ years, ordinarily resident of _____do hereby state/declare that DR KRUTHI.S.R of BLDEU'S SHRI B.M.PATIL MEDICAL COLLEGE HOSPITAL AND RESEARCH CENTRE, VIJAYAPUR, has examined me thoroughly on _____at _____ (place) and has been explained to me in my own language _____ that I am suffering from _____disease (condition) and this disease/condition mimic following diseases _____. Further DR KRUTHI. S.R informed me that she is conducting dissertation/ research title "EFFICACY OF VIDEO ASSISTED THORACOSCOPIC SURGERY VERSUS TUBE THOROCOSTOMY IN THE MANAGEMENT OF EMPYEMA THORACIS" under the guidance of DR VIJAYA PATIL and DR VIDYA PATIL requesting my participation in the study. Apart from routine treatment procedure the pre-operative, operative, post-operative and follow-up observations will be utilized for the study as reference data.

DR KRUTHI. S.R has also informed me that during conduct of this procedure _____adverse results may be encountered. Among the above complications most of them are treatable but are not anticipated hence there is chance of aggravation of my condition and in rare circumstances it may prove fatal in spite of anticipated diagnosis and best treatment made available. Further doctor has informed me that my participation in this study help in evaluation of the results of the

study which is useful reference to treatment of other similar cases in near future, and also I may be benefited in getting relieved of suffering or cure of the disease I am suffering.

The Doctor has also informed me that information given by me, observations made/ photographs/ video graphs taken upon me by the investigator will be kept secret and not assessed by the person other than me or my legal hirer except for academic purposes.

The Doctor did inform me that though my participation is purely voluntary, based on information given by me, I can ask any clarification during the course of treatment / study related to diagnosis, procedure of treatment, result of treatment or prognosis. At the same time I have been informed that I can withdraw from my participation in this study at any time if I want or the investigator can terminate me from the study at any time from the study but not the procedure of treatment and follow-up unless I request to be discharged.

In the view of anticipated / unexpected complications during the course of study, that I will be treated free of cost, as explained by the investigator.

After understanding the nature of dissertation or research, diagnosis made, mode of treatment, I the undersigned Shri/Smt _____ under my full conscious state of mind agree to participate in the said research/dissertation.

Signature of patient:

Signature of doctor:

Witness: 1.

2.

Date:

Place:

ANNEXURE III

PROFORMA

SL NO

NAME

AGE IP NO

SEX UNIT

RELIGION DOA

OCCUPATION DOO

ADDRESS DOD

SOCIO-ECONOMIC STATUS

RESIDENCE:

CHIEF COMPLAINTS:

HISTORY OF PRESENTING ILLNESS:

PREVIOUS MEDICAL HISTORY:

Any surgery

Systemic illness

FAMILY HISTORY

PERSONAL HISTORY

Diet-

Appetite-

Bowel-

Bladder-

Sleep-

Habits-

DRUG HISTORY AND ALLERGIES

OCCUPATIONAL HISTORY

GENERAL PHYSICAL EXAMINATION

Built

Nourishment

Pallor

Icterus

Clubbing

Cyanosis

Generalized Lymphadenopathy

VITALS:

Temparature-

Pulse rate-

Blood pressure-

Respiratory rate-

SYSTEMIC EXAMINATION:

RESPIRATORY SYSTEM:

INSPECTION

Shape of chest

Respiratory rate

Type of breathing

Movements of chest

Mediastinum

Others

PALPATION

Position of trachea

Chest movements

Mediastinum

Tactile vocal fremitus

Others

PERCUSSION

Anteriorly

Posteriorly

In Axilla

AUSCULTATION

Breath sounds

Vocal resonance

Others

PER ABDOMINAL EXAMINATION

CARDIOVASCULAR SYSTEM EXAMINATION

CENTRAL NERVOUS SYSTEM EXAMINATION

DIAGNOSIS:

INVESTIGATIONS

HB%

TOTAL COUNT

DIFFERENTIAL COUNT: N/L/E/B/M

URINE ROUTINE:

RBS

B.UREA

S.CREATININE

BLEEDING TIME

CLOTTING TIME

PLEURAL FLUID ASPIRATION

PLEURAL FLUID ANALYSIS AND CULTURE SENSITIVITY

BLOOD CULTURE

BLOOD GROUPING

HIV

HBsAg

CHEST X RAY:

CT SCAN OF CHEST

OTHERS

OPERATIVE PROCEDURE (DATE AND TIME):

INTRA-OPERATIVE DIAGNOSIS:

DURATION OF PROCEDURE:

POST OPERATIVE INVESTIGATIONS:

POST OPERATIVE COMPLICATIONS

1. BLEEDING.

2. POST OPERATIVE SURGICAL SITE INFECTIONS.

3. SEPTIC COMPLICATIONS.

4. CARDIAC.

5. RESPIRATORY COMPLICATIONS.

LENGTH OF STAY IN HOSPITAL AFTER PROCEDURE:

DURATION OF CHEST TUBE IN SITU :

TREATMENT FAILURE :

COST OF TREATMENT :

KEY TO MASTER CHART

DOS = duration of symptom

AD = associated disease

DIAG = diagnosis

DHS = duration of hospital stay

DCTI = duration of chest tube insitu

COMP = complication

TF = treatment Failure

MM = morbidity/mortality

CT = cost of therapy

RET = right empyema thoracis

LET = left empyema thoracis

HTN = hypertension

DM = diabetis mellitus

TB = pulmonary tuberculosis

SE = surgical emphysema

IOB = intraop bleeding

EN = empyema necessitans

D = death