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Outcome of Vats in Management of Empyema Thoracis

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Abstract: ***Background: Empyema thoracis can produce significant morbidity in any age group if inadequately treated. Correct evaluation of the stage of the disease, the clinical condition and proper assessment of the response to conservative treatment is crucial in deciding the mode of further surgical intervention. Aim: The principle aim of our study was to evaluate the outcome of VATS in different stages for empyema thoracis in patients referred to our department after failure of conservative treatment. Material /method: The study was conducted in our SMIMER Hospital, Surat from Jan 2015 to Dec 2018 for 24 patients posted for VATS. 10 out of 24 patients were converted to open thoracotomy.All these patients were followed post operatively at 24 hrs,4 weeks and 6 weeks and were evaluated on basis of symptomatic relief and radiological resolutions. Results: The outcomes of VATS were favourable in young age, females, patients without comorbidities, empyema with no underlying active lung pathology,patient with in situ icdt, cases of empyema in stage 2 and early stage 3, presentation of patients within 2 weeks of symptoms.***

1. Introduction

1) Empyema thoracis is an infection of the pleural space that progresses seamlessly through three recognized hallmark phases that are not sharply demarcated but present easily identifiable points in a continuous spectrum : exudative, fibrinopurulant and fibroblastic(organizing).it most commonly occurs as a complication of:
   a) pneumonia (parapneumonic)[(1)(2)(3)]
   b) primary fungal or mycobacterial infections (tuberculous),
   c) abdominal infections (sub-phrenic abscess, infected pancreas necrosis, spontaneous bacterial peritonitis) or following trauma[(4)]
   d) infected retained clotted hemothorax,[(5)]
   e) esophageal perforation or surgical procedures (post-resection or post-pneumonectomy empyema).
2) Appropriate management of empyema thoracis is dependent upon accurate diagnosis of the etiology of empyema and the phase of disease progression.The most common error in treatment of empyema is failure to recognize extent of loculations, degree of lung entrapement, resulting in futile continuation of conseravative therapy.
3) Minimal access surgery using video-assisted thoracoscopy (VATS) is one of many useful techniques in treating early thoracic empyema.
4) The major conceptual change leading to development of VATS was the realization that adequate intrathoracic visualization can be obtained without a large incision because of improved video equipment and that manipulative technique can often be modified to safely achieve the same results previously obtained only through large incision.(7)
5) The standard treatment guideline followed at our institute is below:
6) Stage 1(exudative phase): Antibiotics and thoracocentesis
7) Stage 2(fibrinopurulant phase):ICDT with or without fibrinolytic therapy
8) Stage 3(fibroblastic phase):VATS or Thoracotomy

If the disease process has clearly progressed beyond stage 1 simple thoracocentesis, ICDT with or without fibrinolytic therapy has not resulted in resolution of plueral sepsis, clinical improvement or radiological clearance within few days then more invasive therapy with VATS or thoracotomy is indicated. Apart from this clear diagnosis of stage 2 and stage 3 empyema warrant VATS or thoracotomy.

1.1 Aims and Objectives

1) To evaluate the outcomes ofVATS indifferent stages of empyema thoracis. Outcomes are evaluated on the basis of:

- Symptomatic relief: fever, chest pain, breathlessness
- Radiological resolution and lung expansion

2. Material and method

Study was conducted here in our SMIMER hospital,Surat from 2015- 2018(4years). 24 patients were planned for operative management of empyema referred from pulmonary medicine/ pediatrician/physician.

Inclusion Criteria

- All age groups
- Hemodynamically stable
- With/without chest tube drainage

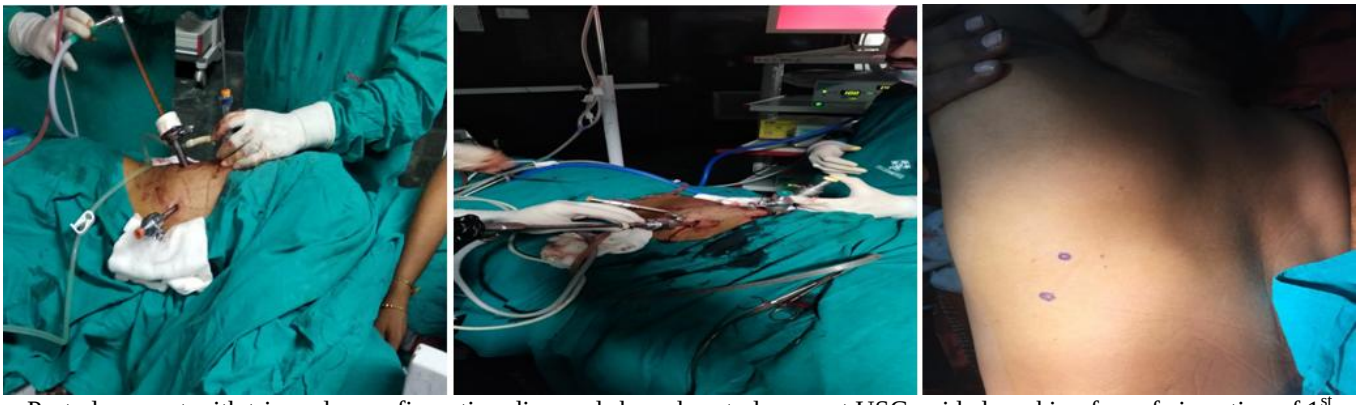
Exclusion Criteria

- Pt unfit for anaesthesia

2.1 Methodology

All the patients referred from different departments were evaluated through:

1) Proper history(duration)
2) Signs and Symptoms: cough ,fever, breathlessness, sputum production, weight loss, anorexia, malaise
3) Investigations:
   a) Basic: blood investigations: CBC (complete blood count)RFT (renal function test)LFT(liver function test), blood culture, urine routine micro, ultasonography of abdomen, x ray spine, coagulation profile, nutritional profile, BMR, investigations for other co morbidities
   b) Special: Chest x ray, diagnostic plueral tapping, fluid evaluation for culture and sensitivity, CECT scan thorax(high resolutions)
   c) Pre operative: pulmonary function tests, air blood gas analysis
   d) Depending on CECT thorax report and patients' history and symptoms they were planned for VATS with a clinical diagnosis of stage 2 or early stage 3 disease.
   e) All patients taken for the study were retrospectively followed for onset of symptoms ,relative history since presentation, time for operation, placement of drainage tube in chest, antibiotic coverage before operative intervention, use of fibrinolyticspre operative (here streptokinase injection)
   f) Also the converstion rate to open thoracotomy and repetition of the procedure again for development of complications (air leak(bronchoplueralfistula), atelectasis, pneumonia, wound infections)were followed at 24 hrs 4 weeks and 6 weeks through serial x rays ,pain scoring and symptomatic relief(subjective) from patients through proper follow up.

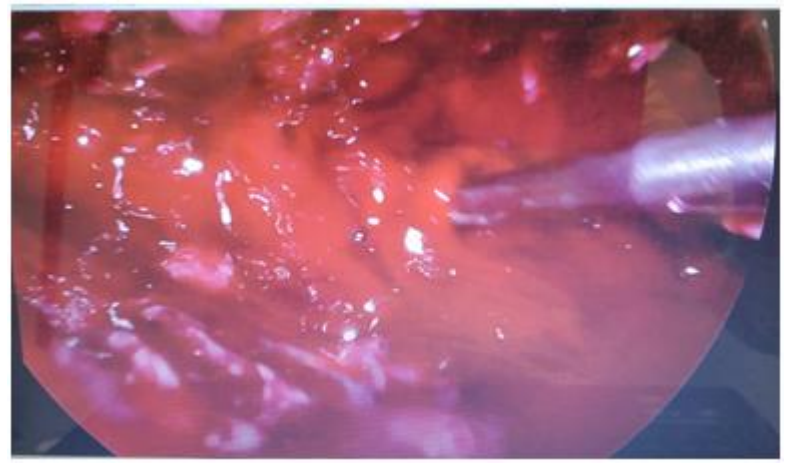


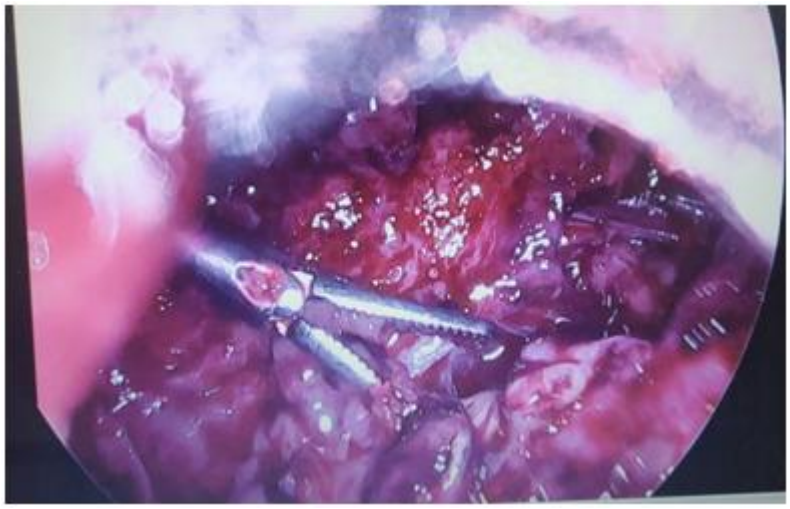
Port placement with triangular configuration diamond shaped port placement USG guided marking for safe insertion of 1st port (Pre Operative)

2.2 Methodology in Short

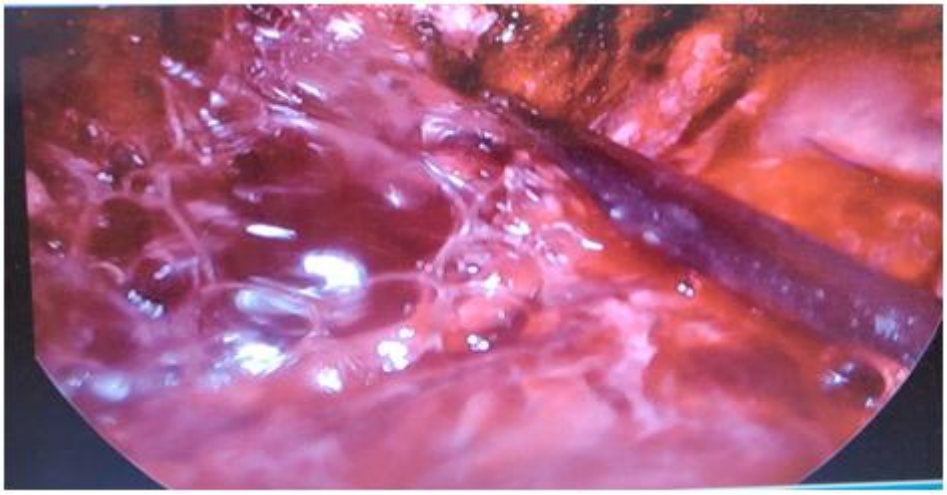
- Most patients referred for VATS in our series already had atleast 1 ICD and this tube site was used as the camera or instrument port. Though 1 port to 4 port VATS has been described in different series. We have used 3 to 4 ports in most of our cases with aim to have triangulation in case of 3 ports and diamond configuration in case of 4 ports to access most of the pleural cavity.the first port or camera port was marked pre operatively with the help of USG thorax and rest of the working ports(2 to 3) were placed under vision (using 30 * 10mm laparoscope) at appropriare sites after confirming the position with help of spinal needle.
- First we evacuate the pus ,break all the loculations and adhesions followed by debridement of thick infected fibrin deposits with tip of metal suction cannula. We have found 10mm suction cannula tip to be very useful for this part of dissection. Intermittent suction irrigation was continued during this process.

Stage 1: Exudative Phase

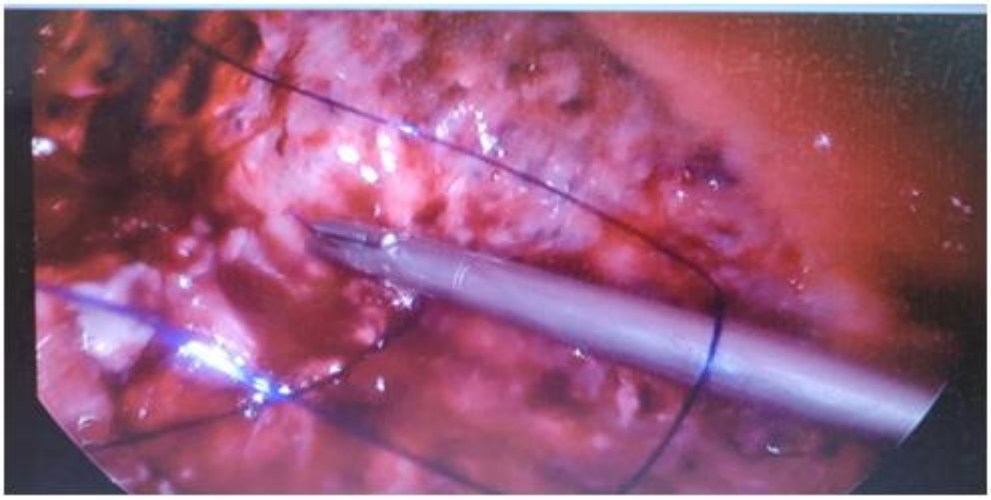




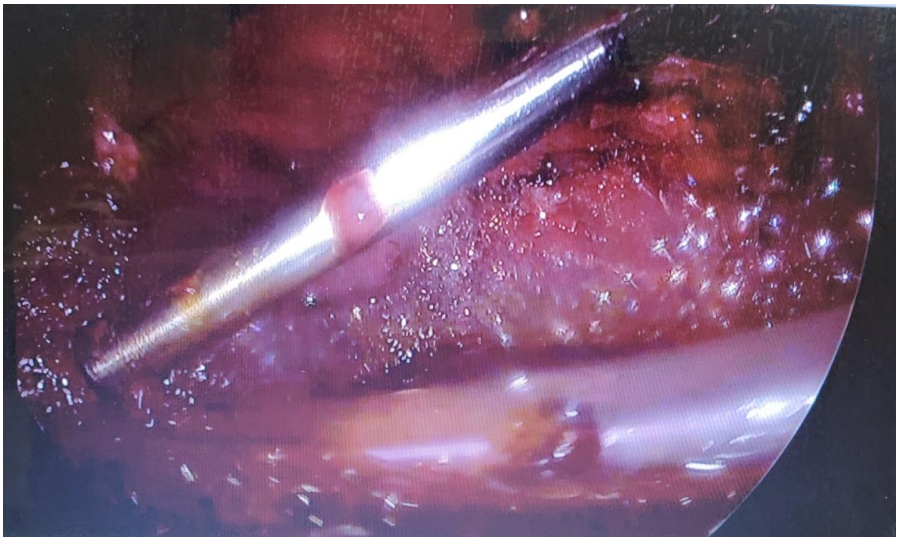
Stage 2: Fibrinopurulant Phase



Stage 3: Fibroblastic Phase



BRONCHOPLUERAL FISTULA DEMONSTARATED INTRAOPERATIVELY
BRONCHOPLUERAL FISTULA REPAIRED WITH PDS 2-0 SUTURING



ADEQUATE WASH OF THE CAVITY WITH NORMAL SALINE AND PLACEMNT OF ICDT

Observations

- Out of 24 patient posted for VATS ,14 patients were continued with VATS while 10 were converted to open procedure due to difficult accessibility , dense adhesions, severely thickened pleura.
- These 14 cases were 4 child 10 adults. And amongst the 10 adults 6 had the history of tuberculosis,1 had severe infiltrative fungal infection and 3 were without any underlying etiology and or pathology. Children in our study ha history of upper respiratory tract infection with pneumonia .
- For pediatric age group pneumonia solely was the target disease for effusion followed by thick collection as empyema.

Observations: Age and sex distribution

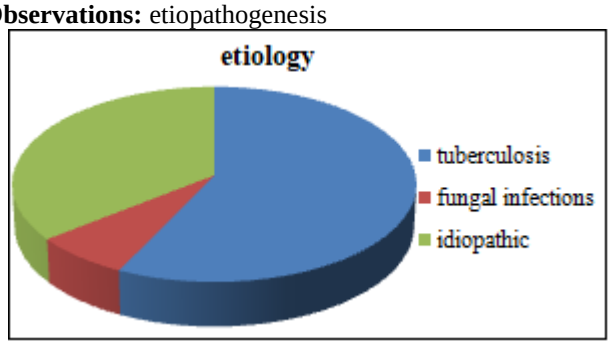
Age limit (years)	Cases
0-10	2
Oct-20	2
20-30	2
30-40	4
40-50	2
50-60	1
60-70	1

Age distribution:
1) Pediatric:30%(0 to 20)
2) Adult:60%(20 to 50)
3) Aged:10%(50 n above)

Male	Female
10	4

Sex distribution
1) Male :70%(30%pedia 70%adult)
2) Female:30%(50%pedia 50%adult)

Observations: etiopathogenesis



Observations: Symptomatic: Pain scoring

Pain score	8/10	6/10	4/10	2/10
24 hrs	8/14	3/14	3/14	-
4 weeks	3/14	4/14	7/14	-
6 weeks	-	2/14	-	12/14

Observations: Symptomatic: fever

Fever	cases
24 hrs	5/14
1 week	3/14
4 weeks	2/14
6 weeks	-

Observations: Symptomatic: breathlessness

Breathlessness	cases
24 hrs	2/14
1 week	-
4 weeks	-
6 weeks	-

Observations: Symptomatic: acceptance of procedure

Pt perception (post operation) and acceptance	Non acceptable*	Partially acceptable	Fully acceptable
24 hrs	8/14	4/14	2/14
4 weeks	3/14	8/14	3/14
6 weeks	2/14	6/14	6/14

Non acceptable: non compliant for spirometry

Observations: Radiological Resolutions: X ray chest

Chest x ray	Improving	Improved	resolved
24 hrs	10/14	-	-
4 weeks	-	12/14*	-
6 weeks	-	-	12/14*

*underlying lung collapse in 2 patients

Observations: Radiological Resolutions: USG thorax

USG thorax	Moderate underlying collection	Mild collection	Minimal collection
24 hrs	10/14	3/14	1/14
4 weeks	5/14	3/14	7/14
6 weeks	-	-	12/14

Factors Affecting Outcome

Parameters	*favourable*	*unfavourable*
Non modifiable		
Age	Young age (0 to 20 yrs)	Adult aged (20 to 70 yrs)
Sex	Female	male
Modifiable		
Duration of symptoms	<2 weeks (9of 14 cases)	>4 weeks (5of 14 cases)
Icdt insertion	Done (12of 14 cases)	Not done (2of 14 cases)
Other comorbidities	Absent (6of 14 cases)	Present (8of 14 cases)
Underlying lung pathology	Absent (7of 14 cases)	Present (7of 14 cases)
Intraoperative		
Stage 2 (with normal lumg)	yes	-
Stage 2(with lung pathology)		yes
Stage 3(with normal parenchyma)	variable	Variable
Stage 3(with pathology in lung)	-	Yes

3. Discussion

In our study;

1) The procedure was successful in treating empyema stage 2 with complete evacuation of pus and fibrinolysis.
2) The procedure was Even successful in early stage 3 for pediatric age group and for patient presenting in early symptomatic phase(>2 weeks)
3) For those converted to open the procedure further lead to decortication with pneumonectomy and/or lobectomy mostly due to residual underlying lung pathology(abscess) beyond pluera. Delay in surgical intervention and late presentation has been shown to be the most common predictor of conversion.
4) The patient were post operatively managed for initial 2 days in intensive care unit and later in wards and mostly discharged on 7^{th} to 10^{th} postoperative day with removal of drain one after other(from apex to base)on 4^{th} to 6^{th}post operative day.
5) For the role of fibrinolytics is still ill defined as to in our case it was used preoperatively in 5 adult cases that showed on ct multiple loculations with thick internal collections with consolidations. The idea was to drain the undrained tenacious thickened empyema before the procedure.
6) Also for our case VATS showed effectiveness in treating multiloculated and chronic empyemas[6] with chronic lung calcification with post operative patient well acceptance though it showed post operative lung collapse and decreased compliance.
7) The patients operated for VATS as per evaluation had favourable outcomes with easy acceptance of procedure were in
   a) Specific age distribution(0 to 20 years)
   b) Gender (female)
   c) General condition profile(no comorbidities)
   d) Early post operative compliance(early spirometry, postural drainage)
   e) Absence of underlying local pathology (abscess, infarct) and agent(fungal, tuberculous).
   f) Initially, VATS was used mostly for confirmation of the presence of empyema.

VATS debridement was found to be a very effective method of treating early fibrinopurulent empyema. VATS decortication has also been reported to successfully manage stage I/II empyema after failure of chest tube thoracostomy.

The findings of our study are comparable to following published studies quoted below

In 1997, Wait et al did a randomized prospective study to determine optimal treatment of empyema thoracis (within fibrinopurulant stage) comparing plural drainage to VATS with regard to efficacy and duration of hospitalization.Thence concluded that in patient with loculated and complex fibrinipurulant parapneumonic empyema, primary strategy of VATS is associated with higher efficacy,shorter hospital stay and less cost of treatment.[8]

In 1998, Striffeler et al assessed prospectively the debridement of fibrinopurulent stage II empyema with the

use of VATS was assessed prospectively in regard to control of infection and restoration of pulmonary function. Their conclusion was that debridement with the use of VATS is safe and efficient for stage II empyema, but open decortication should be used for more advanced disease.[8]

In 2002,Coote and kay ,in their review on surgical versus non surgical management of pleural empyema concluded thai it might appar that for large, loculated pleural empyemas VATS is superior to chest tube drainage with streptokinase in terms of duration of chest tubes and hospital stay. However there are questions about validity and the study is also too small to draw conclusions.[9]

In 2007, Solani Et a did a retrospective assessment of use of VATS in patients with pleural empyema ovr 12 years to conclude that VATS is to be the technique of f irstchoic for treatment of pleural empyema when disease is advanced or ICDT fails and it provides excellent results with low level of invasiveness and reduces need for thoracotomy.[10]

In 2014 a retrospective observational study was conducted in the department of pediatrics KIMS Hospital, Bengaluru . In this study, review of the medical records of all the children aged 2 months to 18 years, who underwent VATS for empyema was done. The children included in the study were diagnosed with empyema thoracis based on chest X-ray, USG chest and CT chest and have undergone VATS by pediatric surgical team.These results concluded that primary operative therapy in the form of VATS is an effective treatment option for children with empyema. VATS is associated with a mortality rate, re-intervention rate, length of stay and duration of tube thoracostomy.[11]

In 2014 ,Ke-Cheng chen,et al retrospectively reviewed between 2001 and 2010, the clinical characteristics, bacteriological studies, and treatment outcomes of 602 patients with acute thoracic empyema treated by thoracoscopic surgery. They concluded thatAcute thoracic empyema carries a high mortality rate, especially in elderly patients with coexisting medical conditions and polymicrobial and positive bacterial cultures. Also thoracoscopy is feasible and might provide better chances for survival in borderline operable patients.[12]

In 2016 ,hajjar WM et al had done prospective study for VATS decortications if is feasible for management of late stage of empyema or not. Results were successful in all stage 2 empyema and 32.4% cases of stage 3 needed conversion.[13]

In 2017, Ahmed Hassan ali.,et al researched about safety and efficacy of medical thoracoscopy in management of loculated empyema in thorax and concluded that such patients stratifiedby ultrasonography and treated early by VATS is safe, minimally invasive and efficient with diseases of relevant mortality.[14]

4. Conclusion

The outcomes of VATS were favourable in young age, females, patients without comorbidities, empyema with no underlying active lung pathology, patient with in situ icdt, cases of empyema in stage 2 and early stage 3, presentation of patients within 2 weeks of symptoms.

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