

## COMPARISON OF TUBE THORACOSTOMY VS VATS IN THE MANAGEMENT OF EMPYEMA THORACIS IN FIBRINO-PURULENT STAGE IN CASES OF PNEUMONIA & CHEST TRAUMA

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**Abstract:** *Empyema thoracis has been considered a serious problem. Different treatment options are available for the management of empyema thoracis, and each of these procedures has its own merits and demerits. This study was designed to compare the outcome of Tube Thoracostomy and VATS in the fibrino-purulent stage of empyema due to pneumonia and chest trauma in terms of hospital stay and empyema resolution in the adult age group. Ninety patients in the study were randomly divided into two groups of equal numbers, i.e., 45 in each group, by lottery method. Patients in Group A underwent tube thoracostomy, and patients in Group B had VATS. Five days postoperatively, clinical examination and relevant investigations like CXR, USG Chest of all patients were done to find empyema resolution. The mean age, BMI, and duration of hospital stay of the patients in group A vs. B was 36±16.5 vs 28±11.4, 26.03±3.39 and 26.1±3.63 and 10±4.1 vs 5±1.24 respectively. In Group A vs. B, there were 96.7% vs. 80% males and 3.3% vs 20% females, respectively. Resolution of symptoms of empyema in group A vs. B was seen in 26.7% vs. 43.3% respectively (p=0.005). Short duration of hospital stay was seen in 15% vs. 48.3% of patients in Group A vs. B, respectively (p=0.000). The Fibrino-purulent stage of Empyema Thoracis, VATS, and Decortication led to early resolution compared to tube thoracostomy alone.*

**Keywords:** Empyema Thoracis, VATS, Tube Thoracostomy

### Introduction

Purulent fluid in the pleural cavity is called pleural empyema (Shin et al., 2013). Empyema thoracis has been considered a serious problem for a long time. The treatment of empyema remained unchanged until the middle of the 19th century. Basic principles of treatment of empyema include careful avoidance of open pneumothorax in the acute stage, prevention of chronic empyema by rapid sterilization and obliteration of the infected cavity, and careful attention to the patient's nutrition. High mortality is associated with empyema thoracis ranging between 6% and 24% (Ahmed and Yacoub, 2010).

Empyema thoracis can be broadly divided into three stages in its natural course; Exudative stage (inflammation leading to the endothelial lesion, causing increased capillary permeability and ultimately effusion), Fibrinopurulent stage (initiation of coagulation cascade, stimulation of chemotaxis of neutrophils and fibroblasts, bacterial entry due to permeability of membrane) and Organized stage (decreased fibrinolysis leading to increased fibrin layer formation on both pleural surfaces (Bhatnagar and Maskell, 2013; Porcel, 2010). Clinically, empyema thoracis can be divided into 3 stages,

namely simple effusion (pH >7.20, Glucose >60 mg/dL, LDH <1000 IU/L, free fluid, no microorganisms detected), Complicated effusion (More cloudy fluid +/- fibrous septa and loculations, pH <7.20, Glucose <60 mg/dL, LDH >1000 IU/L, microorganisms may be detected and Frank empyema (presence of pus in pleural space) (König et al., 2009).

Causes of thoracic empyema may be medical, e.g., bacterial pneumonia, lung abscess, tuberculosis, malignant lesion, viral and fungal infections of the lung parenchyma, septicemia, etc., or surgical causes, e.g., thoracic trauma, procedures on pleural cavity like pleural biopsy, thoracocentesis, chest intubation, pleurectomy, decortication, VATS, pneumonectomy, esophageal perforation. For thoracic empyema, bacterial pneumonia is the cause in 70% (Elsayed et al., 2018). Drainage and tube thoracostomy has been the standard treatment of empyema thoracis over the years. However, since the advent of VATS, thoracoscopic evacuation & debridement of the pleural cavity is becoming a potential alternative with supposedly superior outcomes. Thus this study aimed to compare the outcome of Tube Thoracostomy &

VATS in the fibrino-purulent stage of empyema due to pneumonia and chest trauma in terms of hospital stay & empyema resolution in the adult age group.

**Methodology**

This study was conducted from December 2021 to January 2023 with a sample size of 90 patients (45 patients in each group) estimated by using a 5% level of significance, 95% power of test with the expected percentage of tube thoracostomy as 35% and VATS as 80%. 6 Patients aged between 15 and 60 years, irrespective of gender, who were not malnourished, BMI of not less than 18., and patients with a history of pneumonia or chest trauma were included in the study. In contrast, patients who were immunocompromised IV drug abusers, HIV, and patients on immunosuppressant therapy with associated comorbidities like D.M, Coagulopathy on INR, who had documented evidence of lung parenchymal diseases like pulmonary fibrosis, pneumonitis, bronchopleural Fistula and patients with already history of pulmonary tuberculosis were excluded.

After approval from the hospital's ethical review committee, 90 patients who presented in Thoracic Surgery Department, Mayo Hospital, Lahore, aged from 15 up to 60 years, and met the inclusion criteria, were included in the study and were divided randomly into two groups by Lottery method of equal numbers, i.e., 45 patients in each group. Preoperatively, detailed history and examination, complete blood count, LFTs, RFTs, serum electrolytes, hepatitis profile, and pleural fluid examination were made to meet the inclusion criteria. The 45 patients (50%) of the total sample size in Group A underwent tube thoracostomy, and in Group B, VATS of the remaining 45 patients was done. Post-operatively, vitals (Pulse, Temperature), chest drain output daily, and

examination was done. Five days postoperatively, clinical examination and relevant investigations like CXR and USG Chest of all patients were done to find resolution of empyema and categorized the patient as either curative or failure to resolve empyema. Qualitative data were represented in frequencies or percentages, and continuous parametric data were differentiated with the help of the T-test or Mann-Whitney-U test in the case of nonparametric data. SPSS version 25 was used to analyze the data, and a P value less than 0.05 was considered significant.

**Results**

A total of 90 patients were enrolled in the study. The mean age of the patients in group A vs B was 36±16.5 vs 28±11.4, respectively; the mean BMI in groups A and B was 26.03±3.39 and 26.1±3.63 respectively; mean duration of stay in hospital in group A and B was 10±4.1 vs. 5±1.24 respectively (Table 1). Resolution of symptoms of empyema in group A was seen in 26.7% of patients, whereas, in Group B, 43.3% showed resolution of symptoms, and this difference in symptoms resolution was found to be significant as indicated by a P value of 0.005, and was seen more in patients who received VATS (Table 2). In terms of duration of stay at the hospital, 15% of patients in Group A had a short duration of stay at the hospital, i.e., <7 days, compared to 48.9% of patients in Group B who had a short duration of stay at the hospital and this difference was statistically significant too as indicated by a p-value of 0.000 (Table 3).

Data was stratified for age and gender. Post-stratification chi-square test was applied, and it was seen that neither age nor gender had any significant association with the resolution of empyema and duration of stay at the hospital, as indicated by a p-value of >0.05.

**TABLE 1: SHOWING THE MEAN OF QUANTITATIVE VARIABLES IN BOTH GROUPS**

GROUPS	ARIABLES	MEAN±STANDARD DEVIATION	P- VALUE
<b>A</b> N=45	Age (in years)	36±16.5	0.925
	BMI (in Kg/m2)	26.03±3.39	0.538
	Duration of Hospital Stay (in days)	10±4.1	-
<b>B</b> N=45	Age (in years)	28±11.4	0.937
	BMI (in Kg/m2)	26.1±3.63	0.522
	Duration of Hospital Stay (in days)	5±1.24	-

**TABLE 2: COMPARISON OF FREQUENCY OF RESOLUTION OF EMPYEMA IN BOTH GROUPS**

GROUP	RESOLUTION OF SYMPTOMS		TOTAL	P VALUE
	YES	NO		
<b>GROUP A</b>	24 (26.7%)	21 (23.3%)	45 (50%)	0.005*
<b>GROUP B</b>	39 (43.3%)	6 (6.7%)	45 (50%)	
<b>TOTAL</b>	63 (70%)	27 (30.0%)	90 (100%)	

\*P value ≤0.05 was considered significant

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**TABLE 3: COMPARISON OF STAY AT THE HOSPITAL IN BOTH GROUPS**

GROUP	DURATION OF STAY		TOTAL	P- VALUE
	SHORT DURATION (<7 days)	LONG DURATION (>7 days)		
GROUP A	44 (48.9%)	1 (0.01%)	45 (50%)	0.000
GROUP B	14 (15%)	31 (34.5%)	45 (50%)	
TOTAL	58 (64.4%)	32 (35.5%)	90 (100%)	

### Discussion

Empyema is a disease associated significantly with increased morbidity and mortality in patients with pneumonia (Shin et al., 2013). A number of treatment options are present, but VATS has been proposed recently as a reliable tool for managing empyema, in its early stages particularly (Christopoulou-Aletra and Papavramidou, 2008).

A study was conducted on 66 patients, divided into two groups, i.e. Group A (empyema thoracis treated without surgical intervention) and Group B (empyema thoracis managed by VATS) to assess the effectiveness and safety of utilizing VATS. In group A, the average stay at the hospital was 22 days, and in group B, it was 4.1 days ( $p=0.004$ ). In group A, major morbidity during treatment was encountered in 3 patients, i.e. 10.7%, and none of the patients in group B had any major morbidity postoperatively ( $p=0.039$ ). Regarding mortality in group A vs. B, the mortality rate was 7.1% vs 0%, respectively ( $p=0.094$ ). During 8 month follow-up period, open decortication was carried out in 14.3% of patients in group A, and in group B, 5.3% underwent decortication (Elsayed et al., 2018).

Another study evaluated various modalities for treating empyema thoracis in 70 children, which revealed that the success rate of drainage using intercostal tube was low, i.e. 29.41% only, VATS had a success rate of 90% with less morbidity when it was considered the first choice (Kumar et al., 2019).

The current study compared thoracostomy and VATS for early resolution of symptoms and short duration of stay in hospital in patients who had ET at the Fibrino-purulent stage. The study results revealed that resolution of symptoms of empyema in group A (thoracostomy group) was seen in 26.7% out of 50% of patients, whereas, in Group B, 43.3% out of 50% (VATS group) showed resolution of symptoms and this difference in symptoms resolution was found to be significant as indicated by a P value of 0.005 and was seen more in patients who received VATS. In terms of duration of stay at the hospital, 15% of patients in Group A (50%) had a short duration of stay at the hospital, i.e., <7 days, compared to 48.3% of patients in Group B (50%) who had a short duration of stay at the hospital and this difference was statistically significant too as indicated by a p-value

of 0.000. These results were in concordance with the previous two studies mentioned above.

It is controversial which approach is best surgically for treating chronic PE. Debridement by VATS and decortication have revealed favorable outcomes, while the uniportal VATS approach is still doubtful.

The current study also revealed that demographic variables were not associated with early resolution of symptoms.

VATS has evolved as a well-refined and renowned procedure. It has numerous benefits in terms of cosmetics and invasiveness in comparison to open thoracotomy. Empyema of stage III is still problematic that needs to be dealt with by thoracic surgeons.

For TE, different etiological factors and treatment approaches surgically exist.

The benefits of VATS are Short Duration of hospitalization, Low rate of morbidity postoperatively, and Low rate of mortality.

The results of the current study have shown that VATS was associated with early recovery and short length of stay in hospital and thus denoted that VATS is a more useful intervention compared to tube thoracostomy for treating patients who had empyema in the fibrino-purulent stage.

The current study had certain limitations. Firstly, it was carried out at a single center with a small sample size. Therefore, the results cannot be generalized. Secondly, outcomes of VATS and thoracostomy were only assessed in patients with fibrinopurulent empyema; the outcomes of these interventions in other empyema stages were not assessed.

Further studies are required based on large RCTs, and additional studies should be conducted prospectively to properly decide the management of ET at the fibrinopurulent stage for a better understanding of its management.

### Conclusion

In the Fibrino-purulent stage of Empyema Thoracis, VATS and Decortication led to early resolution as compared with tube thoracostomy alone; the use of the VATS technique in the fibrinopurulent stage (stage II) of empyema thoracis may provide additional beneficial for curative treatment and permanent resolution of empyema thoracis. It can prevent stage II

empyema from advancing to stage III, organized empyema.

### Conflict of interest

The authors declared the absence of a conflict of interest.

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