ISSN: 2581 – 3633
PubMed - National Library of Medicine - ID: 101745081

International Journal of Medical Science and Advanced Clinical Research (IJMACR)

Available Online at:www.ijmacr.com

Volume – 8, Issue – 4, July - 2025, Page No.: 121 – 138

Prospective Observational Study for Role of Thoracoscopic Diagnosis and Treatment of Intrathoracic Pathology

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How to citation this article: Dr. Manik S Bomble, Dr. Vishal R Nandagawali, Dr. Mahendra kamble, Dr Rajshree Sharma, "Prospective Observational Study for Role of Thoracoscopic Diagnosis and Treatment of Intrathoracic Pathology", IJMACR- July - 2025, Volume – 8, Issue - 4, P. No. 121 – 138.

Type of Publication: Original Research Article

Conflicts of Interest: Nil

Abstract

This prospective observational study was conducted at the Department of General Surgery in our tertiary care center, from March 2022 to August 2024, enrolling 47 patients fitting inclusion criteria. The aim was to evaluate safety, efficacy and effectiveness of VATS. Video-Assisted Thoracoscopic Surgery is a minimally invasive procedure. Within a short period, VATS became common among thoracic surgeons. Its application has seen a steady increase in terms of its diagnostic and therapeutic utility.

The age distribution analysis indicates a younger demographic in the present study, 63.8% cases undergoing VATS were belonging to 21 – 40 years of age group. The study consistently shows a higher prevalence of males (69%) undergoing thoracic procedures (VATS), suggesting a gender disparity in the incidence or management of thoracic conditions. (Male: Female ratio 2.13:1).

Cough (65.9%) was most prevalent symptoms followed by Fever & Dyspnoea. In the present therapeutic interventions are the primary focus, representing 46.8% of cases. followed 38.3 % diagnostic and therapeutic and 14.9 % only for diagnosis. Reflecting a shift towards managing established conditions with our gaining experience and confidence in VATS procedures, therapeutic applicability is on the rising trend.

The VATS is reliable and its ability to provide accurate diagnoses (97.9%) across different intra-thoracic pathologies. Whereas one case undiagnosed due to improper tissue processing. Empyema was most prevanalence, which constitutes 31.9% of cases; followed by PE and bullae accounting 23.4% and 10.64% respectively.

However 17 % of VATS cases converted to open thoracotomy due to intra operative diffused bleeding (which obscured the visual field), thick and adhered pleura and difficulties to access lesion. The average blood loss in VATS 247 ml was noticed. 20.5% of VATS were completed in under 90 minutes, 33.3% between 90-120 minutes, 28.2% between 120- 150 minutes & 17.9 % took longer than 150 minutes; however, the average & mean operative time was 119 minute and 127.2 minute respectively.

Complications encounter in VATS, in intraoperatively (17.95% cases) three cases of bleeding (7.69%), one case of hypotension (2.56%), two cases of thick adhesions (5.13%), and one case of crowding of ribs (2.56%). In contrast to postoperative complication suture site infection is most common constitutes 7.96%, with hypotension, air leak, & recurrence of emyema (2.56% each). Following the VATS 38.5% patients were discharged in less than 7 days, 46.2% stayed between 7 and 14 days, and 15.4% remained hospitalized for more than 14 days(3 patients due to suture site infection, two cases due to recurrent empyema & one due to air leak). The pre-operative and post-operative PFT (FEV1 and FVC). The average FEV1 increased by 9.8 L, and the average FVC increased by 9.5 L post operatively. This improvement indicates that the surgeries were effective in enhancing lung function.

In contrast with converted open thoracotomy (17%) 8 cases; open surgery has more invasive & longer operative time (average operative time-150 minutes), higher complication rate (intraoperative-62.5%, postoperative-61.25%), longer recovery time, requires longer hospitalization (average-11.13 days). Despite of above mentioned factors open thoracotomy is useful in large tumor resection, difficulty in VATS.

Keywords: Postoperative Pain, PLEURODESIS, Thoracoscopie, VATS

Introduction

The appearance of the term “Thoracoscopie” dates back to as early as the 1800s. The earliest documented use of a modified cystoscope to observe the thoracic cavity is attributed to Swedish physician Jacobaeus. Thoracoscopy in those days is considered to be performed with whatever faint light available. Though diagnostic and therapeutic thoracoscopies were done in the 1980s, they were only used in sporadic ways and never gained wide acceptance. Recent developments in optic cables, video monitor systems, and endoscopic instruments, and endoscopic surgical staplers led to increased frequency of thoracoscopy. The successful usage and results of laparoscopic surgery in the late 1980s and early 1990s encouraged thoracic surgeons to understand and use the same technology.

In recent decades, thoracoscopy has emerged as a pivotal technique in the field of thoracic surgery, revolutionizing both diagnostic and therapeutic approaches to intrathoracic pathology. This minimally invasive procedure offers significant advantages over traditional open thoracotomy, including reduced postoperative pain, shorter hospital stays, faster recovery times, less morbidity and improved cosmetic outcomes. As a result, its adoption has steadily increased across various thoracic conditions. Various diseases of lungs and mediastinum, diaphragm, and thoracic trauma can be endeavoured and managed effectively by VATS.

The diagnostic capabilities of thoracoscopy are particularly noteworthy, allowing for precise visualization and biopsy of intrathoracic lesions that may not be accessible via other methods. Furthermore, advancements in technology and instrumentation have

expanded the scope of therapeutic interventions achievable through thoracoscopy, encompassing not only diagnostic biopsies but also therapeutic procedures such as pleurodesis, decortication, lung resections, and mediastinal tumor excisions.

Despite these advancements, there remains a need for comprehensive observational studies that evaluate the efficacy, safety, and outcomes associated with different thoracoscopic approaches in managing intrathoracic pathology. Such studies are crucial for informing clinical practice, optimizing procedural techniques, and ultimately improving patient outcomes. Therefore, this prospective observational study aims to investigate the outcomes of various thoracoscopic approaches in the diagnosis and treatment of intrathoracic pathology. By analyzing a cohort of patients undergoing thoracoscopic procedures at [Institution Name], this study seeks to contribute valuable insights into the efficacy and safety profiles of these techniques, thereby guiding future advancements and enhancing the quality of care provided to patients with intrathoracic pathology.

Whereas the thoracoscopy continues to evolve as a cornerstone in thoracic surgery, this study endeavors to provide a comprehensive assessment of its role in diagnosing and treating intrathoracic pathology, fostering evidence-based advancements in clinical practice.

The thorax, often referred to as the chest cavity, is a vital anatomical region housing essential organs such as the heart, lungs, and major blood vessels. It plays a critical role in respiratory function, circulatory dynamics, and overall physiological stability. Understanding the structures within the thorax is fundamental to diagnosing and treating a wide spectrum of intrathoracic pathologies.

Aims & Objectives of the Study

To establish the diagnosis timely in a patient with undiagnosed by other method and surgical treatment for thoracic disease not responding to non-surgical treatment. To study intrathoracic diseases such as Recurrent loculated pleural effusion, Empyema thoracis, Idiopathic pulmonary fibrosis, Fungal aspergilloma, bronchiectasis, Lung abscess etc. and to evaluate effectiveness and complications related to this treatment modality in terms of intraoperative and postoperative outcomes by Video Assisted Thoracic Surgery.

In the form of

- To evaluate the diagnostic accuracy of thoracoscopy.
- To assess the therapeutic efficacy of thoracoscpic interventions.
- To study demographic profile & presentation of patient in various thoracic diseases.
- To evaluate preoperative assessment &preparation.
- To study and assess intraoperative time.
- To study intraoperative complications.
- To study postoperative hospital stay.
- To study postoperative complications.

Materials and Methods

The present study was carried out in our tertiary care center.

Study Design

A prospective observational study.

Sample Size

A total of 47 patients were included in the study (**n=47**).

Study Site and Time Frame

The study was carried at our tertiary care center, department of surgery, from MAY 2022 to AUGUST 2024.

Data (Patients) Collection Techniques

Approval to conduct the study was taken from the hospital ethical committee.

All patients visiting the surgical outpatient department (OPD) matching the inclusion criteria were admitted under the department of surgery. The majority of patients needing surgical intervention(s) for respiratory disorders for diagnostic or therapeutic purposes are referred from the department of respiratory medicine in our tertiary care center.

Patients were subsequently enrolled in this study only after obtaining consent from patients and patient's relatives. The consent form is attached in annexure 1.

The study included all patients who underwent VATS based on the following inclusion and exclusion criteria.

Inclusion Criteria

1. Patients diagnosed with empyema thoracis. i.e.

a) Computed tomography (CT) of chest showing empyema. (i.e. loculated effusion).

b) Patients with inadequate drainage of empyema despite repeated chest tube drainage.

c) Undiagnosed recurrent pleural effusion.

2. Patients with CT suggestive of the bullae.
3. Patients needing pleural, lung parenchymal, biopsies for benign disease or benign and metastatic tumor.
4. Patients with deemed resectable pleural, lung or mediastinal, esophageal tumor by radiographic imaging studies for VATS excision.
5. Lung hydatidosis cases confirmed by radiographic imaging studies.
6. Cases of symptomatic pulmonary aspergilloma despite medical management.
7. Patients with another respiratory disease needing wedge resection, or segmentectomy.
8. Patients hemodynamically stable with Age >18 year.

Exclusion Criteria

- Resent blunt trauma to chest.
- Patients with active PTB (sputum-positive tuberculosis).
- Patients with investigation S/O advance (unresectable) pleural/ lung malignancy.
- Hemodyanamically unstable patient.
- Cardiac failure /Pulmonary failure.
- Age <18 year.
- Inability to tolerate single lung ventilation.
- Immunocompromised patients;

  (1) case of malignancy with ongoing or completed radiation or chemotherapy.

  (2) patient of organ transplantation with immunosuppressive therapy.

  (3) collagen vascular disease or autoimmune disease patient needing corticosteroids and/or immunosuppressive therapy.

  (4) AIDS patient.

  (5) Chronic renal failure patients.
- Patients unfit for general anesthesia.
- Bilateral involvement of lungs.
- Patient with HIV, HbsAg positive.

Results

A total of 47 patient underwent VATS and were reviewed.

Age Distribution

Table 1: Age group of our study population

Age Group	Number of Patients	Percentage (%) n=47
21-40 Years	30	63.8%
41-60 Years	14	29.8%
61-80 Years	3	6.4%
Total	47	100%

The age distribution in the present study, age ranged between 21 to 74 years, the youngest being 21 years and the oldest being 74 years. the majority falling into the 21-40 years age group, accounting for 30 individuals. The 41-60 years group includes 14 patients, representing a moderate number of cases. The 61-80 years group has the fewest patients, with only 3 individuals. The mean age of patients in the present study is 38.6 years, while the median age is 30.5 years.

Sex Distribution

In our present study, Males comprising 69% of the sample (32 patients) and females accounting for 31% (14 patients).

The male-to-female ratio in the study population is approximately 2.3:1, indicating that there are about 2.3 male patients for every female patient. This reflects a higher prevalence of male patients compared to female patients in the sample.

Table 2: Sex Ratio

Sex of patient	No of patients	Percentage
Male	32	69 %
Female	14	31 %
Total	47	100%

Symptoms Incounter in Our Study Population

In the present study, clinical symptoms reported amongs 47 patients. cough emerges as the most frequently reported symptom, affecting 65.9% of patients, indicating its prominence among the clinical features. Fever is the second most common symptom, experienced by 46.8% of the patients, which underscores its relevance in the clinical presentation. Dyspnoea, or shortness of breath, is reported by 31.9% of the patients, reflecting its significant impact on respiratory function. Chest pain affects 27.7% of the cohort, highlighting its role as a notable symptom but less prevalent than cough and fever. Hemoptysis, the least common symptom in this dataset, is observed in 17.0% of patients, pointing to its relative rarity compared to other symptoms. This detailed breakdown reveals that while cough and fever are dominant features in this population, dyspnoea and chest pain are also significant, albeit less frequent, and hemoptysis is relatively uncommon.

Among the patients, a significant number present with multiple symptoms. For instance, many patients with dyspnoea also experience fever and cough, indicating that these symptoms often occur together, possibly due to underlying respiratory infections. Chest pain

frequently accompanies dyspnoea and fever in some cases, reflecting a more complex symptom profile.

Cough and fever are the most prevalent symptoms, appearing in the majority of patients. Dyspnoea and chest pain are also common.

Table 3: Clinical Features amongs our study population.

Sn.	Clinical Features	Numbers of patients	Percentage (%)
1	Cough	31	65.9%
2	Fever	22	46.8%
3	Dyspnoea	15	31.9%
4	Chest pain	13	27.7%
5	Hemoptysis	8	17%

CT Findings Amongs Study Population

The findings from CT scans of a study population consisting of 47 patients. Among these patients, 26 (55.3%) were CT findings suggestive of pleural effusion in 11 patients and empyema in 15 patients. Other notable findings include suspicious malignant pleural effusion in 3 (6.4%) of patients, indicating potential malignancies, and cystic bronchiectasis or bullae in 6 (12.8%) patients, suggesting chronic lung conditions. Less common findings are fungal aspergilloma in 2 (4.3%) patients, pleurisy and lung abscesses, each seen in 4 (8.5%) patients, reflecting inflammatory and infectious processes, and pulmonary hydatid disease in 2 (4.3%)patients, pointing to parasitic infections. This range of findings underscores the diverse and complex thoracic pathologies within the patient population.

Table 4: CT Findings amongs the our study population.

Sn.	Number of patients (%)	CT SCAN Findings S / O
1	15(31.9%)	Empyema
2	11(23.4%)	Pleural effusion
3	3 (6.4%)	Suspicious Malignant pleural effusion
4	6 (12.8%)	Cystic bronchiectasis/Bullae
5	2 (4.3%)	Fungal Aspergilloma
6	4 (8.5%)	Pleurisy
7	4 (8.5%)	Lung abscess
8	2 (4.3%)	Pulmonary Hydatid Disease
	Total = 47	

VATS Findings Amongs Our Study Population:

In a present study of 47 patients undergoing VATS, diverse pulmonary findings were observed:

Table 5: Change/ confirm case diagnosis after VATS in present study.

Sn.	CT scan features suggestive of	Number of cases	Change or Confirm diagnosis after VATS			Definitive diagnosis after VATS
			Confirm	Change to	Undiagnosed	
1	Empyema	15	15 cases			
2	Pleural effusion	11	6 cases	5 cases		3 cases of PE change to TB empyema 2 cases of non TB PE change to TB PE
	Lung abscess	4	1 cases	3 cases		2 case- TB lung abscess 1 case - bacterial lung abscess
3	Malignant pleural effusion	3		3 cases		2 cases -Malignant mesothelioma, 1 case -solitary fibrous tumor
4	Pleurisy	4		3 cases	1 cases	3 cases – chronic granulomatous infections (TB).
5	Bullae	6	5 cases	1 case		1 case - mucocele
6	Pulmonary hydatid cysts	2	2 cases			
7	Pulmonary aspergilloma	2	2 cases			
			Total =31	Total=15	Total=1	
	Total	47	47			

Empyema was the most common CT finding in the study, all the 15 cases empyema confirmed after VATS findings. While the findings of empyema on VATS was thikened sepated purulent collection (collection varies case to case from 100 ml to 500 ml, thick adhered fibrotic peel in pleural space with restricted lung expansion.

On other hand amongs the 11 cases PE on CT diagnosis, 6 cases were confirmed by VATS findings and remaining 5 cases of PE changed the diagnosis, in which 3 cases of PE were changed to tuberculosis (TB) empyema, and 2 cases of non-TB PE were diagnosed as TB pleural effusion. On VATS findings in PE, most of time we seen inflamed pleura with pale yellowish, cloudy or opaque color effusion. However, in 3 cases diffused pus collection in pleural space with mild pleural thickening seen.

(*Before VATS amongs the suspected 15 cases of empyema, while 12 cases were tubercular and 3 cases were non tubercular diagnosed on CBNAAT / ADA /

Culture report. Whereas among the 11 cases of PE, 1 cases were tubercular and 5 cases nontubercular. Remaining 5 cases of PE remain undiagnosed for cause, which was diagnosed after VATS, 3 cases as tubercular empyema and 2 cases as tubercular PE).

In this study, four cases were initially suspected of being lung abscesses based on CT scan features. After performing VATS, the diagnosis was confirmed in one case (Bacterial lung abscess), while the remaining three cases had their diagnoses revised. Specifically, two of these were diagnosed as tuberculosis (TB) lung abscesses and the third case was identified as a Bacterial lung abscess.

Lung abscess On VATS found to be localized collection of pus or Cavities filled with pus with surrounding inflamed, necrotic tissue and debris in lung parenchyma.

Among study population the three cases initially identified as malignant pleural effusion via CT scan, all were confirmed to be malignant after VATS. Specifically, two cases were diagnosed as malignant mesothelioma and aggressive cancer originating from the pleura, and one case was found to be a solitary fibrous tumor, a less common but potentially malignant tumor of mesenchymal origin.

On VATS we seen Loculated pleural effusion with variable size irregular nodules over pleural surface with neovascularization and thickened pleura.

Pleurisy is an inflammation of the pleura. Four cases initially thought to be pleurisy based on CT findings underwent VATS for further evaluation. The VATS findings revealed that Inflamed pleura, pleural adhesions with restricted lung expansion. Amongs 4 cases, three were diagnosed as chronic granulomatous infections, specifically tuberculosis (TB) one case remain undiagnosed.

In this study, six cases were suspected of being bullae based on CT imaging. VATS (Small to large air-filled spaces with surrounding inflammatory changes within the lung paranchyma) confirmed the diagnosis of bullae in five of these cases. One case, however, was diagnosed as a mucocele, (on VATS single peripheraly located non inflamed approx. 4*4 cm mucus filled cyst.).

In this study, two cases initially suspected of being hydatid cysts based on CT scans, both cases were confirmed as such after VATS (VATS findings -Thin walled multiple various size cyst located in the lung's peripheral regions. The lung tissue around the cyst have signs of inflammation and fibrosis.)

On the base on the CT findings 2 suspected cases of Pulmonary aspergilloma in our study, both cases were confirmed by VATS (VATS findings-Rounded or irregular fungal mass within the lung cavity with surrounding fibrosis).

Indication of VATS

Table 6: Diagnostic and therapeutic Indication.

Indication	No of patients	Percentage n=47
Therapeutic	22	46.8 %
Therapeutic and diagnostic	18	38.3 %
Diagnostic	7	14.9 %
Total	47	100%

A 46.8% study population underwent VATS due to therapeutic indications, whereas 14.9% for sole diagnostic purposes. Another 38.3% study population underwent VATS for both therapeutic and diagnostic indications.

Diagnostic Accuracy of Vats

In the present study Only 46.8 % study population had an established diagnosis before VATS. Following VATS, diagnosis was established confirmed in 97.9 % of patients.

Table 7: Diagnostic accuracy of VATS

	No of Patients with established diagnosis	Percentage n=47
Before VATS	22	46.8 %
After VATS	46	97.9 %
Undiagnosed	1	2.1 %
Total Patients in Study	47	100 %

(Before VATS were 22 patients diagnosis confirm on the basis of CBNAAT/ADA /Culture report)

The diagnostic accuracy of Video-Assisted Thoracic Surgery (VATS). Out of 47 study cases 22 were definitive diagnosed, whereas 25 patients remain suspicious or indefinative diagnosis only. After VATS, 31 diagnoses were confirmed as initially suspected, while 15 cases had their diagnoses changed.

Specifically, 5 suspicious cases of pleural effusion diagnosed as 3 cases of PE change to TB empyema & 2 cases of non-tubercular PE change to tubercular PE.

CT scans initially suggesting 4 cases of liver abscesses were one case confirmed, while 3 cases change diagnosis as one case diagnosed as bacterial lung abscesses and 2 cases change the diagnosis as tubercular lung abscess.

Suspicious Malignant pleural effusion cases were two diagnosed as malignant mesothelioma and one as a solitary fibrous tumor.

Four cases initially suspected to be pleurisy, three were revised to chronic granulomatous infections (TB), 1 cases were remaining undiagnosed.

Among cases with bullae, five were confirmed, but one was found to be a mucocele (changed).

Both cases of pulmonary hydatid cysts and both cases of pulmonary aspergilloma were confirmed as diagnosed. Overall, the results indicate a high rate of diagnostic confirmation with VATS, reflecting the reliability of CT scans in preoperative assessment, though some diagnoses required modification. While one case undiagnosed due to improper tissue processing.

Disease Distribution

Table 8: Disease distribution in present study

Disease	No of Patients	Percentage
Empyema	15	31.9%
Pleural effusion	11	23.4%
Cystic bronchiectasis /Bulle/ Pneumothorax	5	10.64%
Lung abscess*	4	8.51%
Fungal aspergilloma	2	4.26%
Pulmonary hydatid disease	2	4.26%
Malignant mesothelioma	2	4.26%
solitary fibrous tumor	1	2.13%
Mucocele	1	2.13%
Pleurisy (TB)	3	4.26%
Undiagnosed	1	4.26%
Total	47	100%

The distribution of various diseases among a total of 47 patients in the current study. The most prevalent condition is empyema accounting for 31.9%% (Tubercular Empyema, affecting 16 patients or 34.04% of the cohort. CPE*/Empyema follows with 10 patients, representing 21.28% of cases). Cystic bronchiectasis, Bulle, and Pneumothorax collectively account for 10.64%, while Lung abscess is observed in 8.51% of patients. Fungal aspergilloma, Pulmonary hydatid disease, Tubercular pleurisy and Malignant mesothelioma each constitute 4.26% of the total cases. Solitary fibrous tumor and Mucocele each make up 2.13%, and Undiagnosed cases represent 4.26%.

Conversion Rate of VATS

Table 9: Conversion of VATS to Open Thoracotomy

	No. of patients	Percentage n=47
VATS only	39	83 %
VATS converted to open	8	17 %
Total ;	47	100 %

In our study out of 47 cases, 8 cases (17 %) who underwent VATS were converted to open.

In our study out of 47 cases, 8 cases (17 %) who underwent VATS were converted to open.One patients with pulmonary aspergilloma were converted to open due to dense fibrous adhesions with distorted hilar anatomy with bleeding and infiltrative nature of the diseases. 4 patients with tubercular empyema were converted to open due to thick adhesions preventing further progress of VATS. One case converted due to bleeding obscuring the vision. One case due to large and deep seated hydatid cyst difficult to access. And one

case converted due to deep seated bullae which was difficult to access.

Intra-Operative Blood Loss

In our study blood loss during thoracic surgeries categorized by VATS and Open Thoracotomy procedures. Among the 39 VATS cases, 30.8% had blood loss of less than 150ml, indicating relatively low hemorrhage in this group. The majority, 38.5%, experienced blood loss in the 150ml – 300ml range. A smaller proportion, 17.9%, had blood loss between 300ml and 450ml, while 10.3% fell into the 450ml – 600ml category. Only 2.6% of VATS patients had blood loss exceeding 600ml.

In contrast, the 8 Open Thoracotomy cases showed a higher incidence of significant blood loss. No patients had blood loss less than 150ml. Most patients (37.5%) experienced blood loss in the 450ml – 600ml range, and 25% had blood loss exceeding 600ml. A lesser proportion (12.5%) had blood loss between 150ml and 300ml, while 25% were in the 300ml – 450ml category.

Table 10: Blood loss during surgery in study population

Blood loss (in ml)	VATS		Converted to Open Thoracotomy	
	Number of patients	(%)N=39	Number of patients	(%) N=8
Less than150ml	12	30.8%	0	0%
150ml – 300ml	15	38.5%	1	12.5%
300ml – 450ml	7	17.9%	2	25%
450ml – 600ml	4	10.3%	3	37.5%
>600ml	1	2.6%	2	25%
Total	**39**	100%	**8**	100%
	Average blood loss: 247 ml		Average blood loss: 484 ml	

While the average blood loss for VATS procedures was 247ml, whereas for Open Thoracotomy it was substantially higher at 484ml. This indicates a markedly greater blood loss associated with Open Thoracotomy, reflecting its more invasive nature compared to VATS, which involves less blood loss.

Operative Time in Study Population:

Table 11: Intraoperative time (duration) in present study population

Operative time (in mins)	VATS		Converted to Open Thoracotomy	
	Number of patients	(%) N=39	Number of patients	(%) N=8
<90min	8	20.5%	0	0%
90min – 120 min	13	33.3%	0	0%
120min- 150min	11	28.2%	3	37.5%
>150min	7	17.9%	5	62.5%
Total	39	100%	8	100%
Average operative time	119 min		150 min	
Mean operative time	127.2 min		164 min	

In present study we observed time require for VATS surgeries, a notable 20.5% of the procedures were completed in less than 90 minutes, reflecting a relatively quick operation time for a portion of the patients. The largest segment, 33.3%, had operative times ranging from 90 to 120 minutes. A substantial 28.2% of VATS procedures took between 120 and 150 minutes. A smaller proportion, 17.9%, required more than 150 minutes to complete.

In contrast, the Open Thoracotomy cases showed a different distribution. None of these surgeries were completed in less than 90 or 90 to 120 minutes. For this group, 37.5% of the surgeries took between 120 and 150 minutes. A significant 62.5% of Open Thoracotomy procedures extended beyond 150 minutes, indicating a generally longer operative time compared to VATS.

Overall, the average operative time for VATS was 119 minutes, which is significantly shorter than the average of 150 minutes for Open Thoracotomy. Where as mean operative time for VATS & Open thoracotomy was 127.2 & 164 minute respectively.

Complication Encounter in Present Study

In the study of intraoperative and postoperative complications across 47 cases, a notable distribution of issues was observed.

Table 12: Intraoperative Complications encountered in study population

Complication	VATS N= 39	Percentage (%)	Open Surgery N=8	Percentage (%)
Bleeding**	3	7.69%	1	12.5%
Hypotension	1	2.56%	1	12.5%
Thick Adhesions*	2	5.13%	3	37.%
Crowding of ribs	1	2.56%	0	0%
Total	7	17.95%	5	62.5%

(**Bleeding: It's defined in our study as continuous oozing leading to hindering of vision leading to hemodynamic instability. *Thick Adhesions: Are dense pleural adhesions not being able to be dissect with sharp or blunt dissection and further hindering operative interventions.)

Intraoperative complications encountered in a prospective observational study comparing video-assisted thoracoscopic surgery (VATS) and those converted to open surgery. In the VATS (N=39), a total of seven complications were reported, resulting in an overall complication rate of 17.95%. Specific complications included three cases of bleeding (7.69%), one case of hypotension (2.56%), two cases of thick adhesions (5.13%), and one case of crowding of ribs (2.56%).

In contrast, the open surgery group (N=8) experienced five complications, leading to a significantly higher complication rate of 62.5%. This group recorded one case each of bleeding and hypotension (both 12.5%), along with three cases of thick adhesions (37.5%), and no cases of crowding of ribs. These findings indicate that VATS is associated with a lower incidence of intraoperative complications compared to open surgery.

Table 13: Postoperative Complications encounter in our study population.

Complication	VATS N=39	Percentage	Open Surgery N=8	Percentage
Suture site infection	3	7.96%	1	12.25%
Hypotension	1	2.56%	1	12.25%
Air leak >7 day	1	2.56%	1	12.25%
Subcutaneous emphysema	0	0%	1	12.25%
Recurrence of empyema	1	2.56%	0	0%
Pneumothorax	0	0%	1	12.25%
Total	6	15.38%	5	61.25%

In present study, postoperative complications observed in (VATS) & open thoracotomy surgery. In the VATS, overall complication rate of 15.38%. Specific complications included three cases of suture site infections (7.96%), one case each of hypotension, air leak lasting more than seven days, and recurrence of empyema (2.56% each), while no cases of subcutaneous emphysema or pneumothorax were reported.

However, in open surgery we notice five complications, leading to a much higher complication rate of 61.25%. This group recorded one case each of suture site infection, hypotension, air leak, subcutaneous emphysema, and pneumothorax (all 12.25%), with no cases of recurrence of empyema. These findings highlight a significantly lower incidence of postoperative complications associated with VATS compared to open surgery, suggesting that VATS may be a safer surgical option in this patient population.

Duration of Hospital Stay:

Table 14: Hospital Stay duration in present study

Duration of hospital stay (in days)	VATS		Open thoracotomy	
	Number of patients	Percentage (%) N=39	Number of patients	Percentage (%) N=8
Less than 7 days	15	38.5%		
7 days – 14 days	18	46.2%	4	50%
>14 days	6	15.4%	4	50%
Total	39	100%	8	100%
Average days	6.28 days		11.13 days	
Mean hospital duration	6.1 day		12.2 days	
Range	4 days to16 days		10 days to 25 days	

Following the VATS / Converted open thoracotomy surgery in our tertiary care center observed. The Hospital stay is considered from the day of admission to the day of discharge which includes surgical ICU stay. In the present study, which includes 39 patients who underwent Video-Assisted Thoracoscopic Surgery (VATS) and 8 patients who had open thoracotomy, the distribution of hospital stay durations reveals notable differences

between the two surgical approaches. For VATS patients, 38.5% were discharged in less than 7 days, 46.2% stayed between 7 and 14 days, and 15.4% remained hospitalized for more than 14 days (3 patients due to suture site infection, two cases due to recurrent empyema & one due to air leak).

In contrast, among the open thoracotomy patients, none were discharged in less than 7 days, 50% stayed between 7 and 14 days, 50% were hospitalized for more than 14 days, (amongs open thoracotomy 4 patient had delayed discharge due to suture site infection, subcute emphysema, air leak, persistant hypotension). The average hospital stay for VATS was 6.28 days, with a range of 4 to 16 days.

While open thoracotomy patients had a significantly longer average stay of 11.13 days, ranging from 10 to 24 days. while the mean hospital stay duration was 6.1 day for VATS and 12.2 days for open thoracotomy. This data underscores the generally shorter hospital stays associated with VATS compared to the more extended recovery periods required for open thoracotomy.

Preoperative and Post-Operative PFT of Present Study Patients

The comparison between pre-operative and post-operative data reveals a substantial improvement in both FEV1 and FVC. The average FEV1 increased by 9.8 L, and the average FVC increased by 9.5 L. This improvement indicates that the surgeries were effective in enhancing lung function, likely due to the removal of obstructive or diseased tissues and resolution of conditions such as pleural effusions or infections.

Table 15: Preoperative and postoperative PFT in study population

Measure	Pre-OP Average (%)	Post-OP Average (%)	Difference
FEV1	61.7	71.5	+9.8
FVC	63.2	72.7	+9.5

These findings underscore the positive impact of surgical interventions on pulmonary function, leading to better respiratory capacity and improved quality of life for patients.

Conclusion

In our prospective observational study, Video-Assisted Thoracoscopic Surgery (VATS) offers a minimally invasive option with favorable cosmetic outcomes, serving as a potent diagnostic tool that enhances therapeutic management for patients previously undiagnosed by other methods. Notably, VATS demonstrates advantages such as reduced operative time, shorter hospital stays, and fewer complications.

However, the technique carries significant limitations, including a long learning curve and specific patient selection criteria. The outcome of VATS is not only dependent on the effectiveness of surgery but also the experience and effectiveness of various other involved specialties in pre and post-operative patient management along with patient compliance.

Surgeons should keep in mind that VATS is only a method, instead of the goal, of the treatment. And thus conversion to open procedures should be done without hesitation if patients' life safeties were threatened or oncological principles were compromised. Future research with larger, multicentric studies and extended follow-up is essential to validate our findings.

References

1. Ng, C. S. H. & Yim, A. P. C. Video-assisted thoracic surgery for thymectomy. Endosc. Surg. Infants Child. 137, 179–187 (2008).
2. Wakabayashi, A. Expanded applications of diagnostic and therapeutic thoracoscopy. J. Thorac. Cardiovasc. Surg. 102, 721–723 (1991).
3. Marchetti, G. Pietro, Pinelli, V. & Tassi, G. F. 100 years of thoracoscopy: Historical notes. Respiration 82, 187–192 (2011).
4. Luh, S. ping & Liu, H. ping. Video-assisted thoracic surgery--the past, present status and the future. J. Zhejiang Univ. Sci. B. 7, 118–128 (2006).
5. Chan, D. T. L. et al. Surgical Treatment for Empyema Thoracis: Is Video-Assisted Thoracic Surgery 'Better' Than Thoracotomy? Ann. Thorac. Surg. 84, 225–231 (2007).
6. Ahmed, A. E. H. & Yacoub, T. E. Empyema Thoracis. Clin. Med. Insights Circ. Respir. Pulm. Med. 4, CCRPM.S5066 (2010).
7. Davies, H. E., Davies, R. J. O. & Davies, C. W. H. Management of pleural infection in adults: British Thoracic Society pleural disease guideline 2010. Thorax 65, (2010).
8. Johna, S., Alkoraishi, A., Taylor, E., Derrick, M. & Bloch, J. H. Video - Assisted Thoracic Surgery: Application sand Outcome. 41–44 (1997).
9. Hoksch, B., Birken-Bertsch, H. & Müller, J. M. Thoracoscopy before Jacobaeus. Ann. Thorac. Surg. 74, 1288–1290 (2002).
10. Bertolaccini, L. & Rocco, G. History and development of minimally invasive surgery: VATS surgery. Shanghai Chest 3, 16–16 (2019).
11. Fok, N. K. H., Ma, P. K. C., Ng, C. S. H. & Li, Z. The future of thoracoscopes. Video-Assisted Thorac. Surg. 4, 6–6 (2019).
12. Rocco, G. Single-port video-assisted thoracic surgery (Uniportal) in the routine general thoracic surgical practice. Oper. Tech. Thorac. Cardiovasc. Surg. 14, 326–335 (2009).
13. Hussain, A. Anatomy, Thorax, Wall Anatomy, Thorax, Wall. (2018).
14. Kudzinskas A, Callahan AL.Kudzinskas A, C. A. Anatomy, Thorax. StatPearls Publishing, Treasure Island (FL) https:// www.ncbi.nlm.nih.gov/ books/ NBK557710/ (2020).
15. Anatomy, Thorax, Wall - StatPearls - NCBI Bookshelf. https:// www.ncbi.nlm.nih.gov/ books/ NBK535414/?report=printable.
16. Hussain, A. & Burns, B. Anatomy, Thorax, Wall. StatPearls (StatPearls Publishing, 2019).
17. Naunheim, K. S. et al. Safety and efficacy of video-assisted thoracic surgical techniques for the treatment of spontaneous pneumothorax. J. Thorac. Cardiovasc. Surg. 109, 1198–1204 (1995).
18. Uchikov, A. P., Shipkov, C. D. & Prisadov, G. Treatment of lung hydatidosis by VATS: A preliminary report. Can. J. Surg. 47, 380–381 (2004).
19. Chen, Q. K., Chen, C., Chen, X. F. & Jiang, G. N. Video-assisted thoracic surgery for pulmonary aspergilloma: A safe and effective procedure. Ann. Thorac. Surg. 97, 218–223 (2014).
20. Kumar, A. et al. Video-assisted thoracoscopic surgery for pulmonary aspergilloma. Lung India 34, 318–323 (2017).
21. Lowdermilk, G. A. & Naunheim, K. S. Thoracoscopic evaluation and treatment of thoracic

trauma. Surg. Clin. North Am. 80, 1535–1542 (2000).

22. Koegelenberg, C. F. N., Diaconi, A. H. & Bolligeri, C. T. Parapneumonic pleural effusion and empyema. Respiration 75, 241–250 (2008).
23. Sahn, S. A. Diagnosis and management of parapneumonic effusions and empyema. Clin. Infect. Dis. 45, 1480–1486 (2007).
24. Kumar, A. et al. Thoracoscopic Decortication of Stage III Tuberculous Empyema Is Effective and Safe in Selected Cases. Ann. Thorac. Surg. 104, 1688–1694 (2017).
25. Wurnig, P. N., Wittmer, V., Pridun, N. S. & Hollaus, P. H. Video-assisted thoracic surgery for pleural empyema. Ann. Thorac. Surg. 81 , 309–313 (2006).
26. Thori, R. et al. "Video Assisted Thoracoscopic Surgery (VATS) for all Stages of Empyema Thoracis: a Single Centre Experience". Indian J. Surg. 82, 520–526 (2020).
27. Subotic, D., Lardinois, D. & Hojski, A. Minimally invasive thoracic surgery for empyema. Breathe 14, 302–310 (2018).
28. Chowdhury, S. & Chakraborty, P. pratim. Universal health coverage There is more to it than meets the eye. J. Fam. Med. Prim. Care 6, 169–170 (2017).
29. Yim, A. P. C. & Liu, H. P. Complications and failures of video-assisted thoracic surgery: Experience from two centers in Asia. Ann. Thorac. Surg. 61, 538–541 (1996).
30. Jancovici, R. et al. Complications of video-assisted thoracic surgery: A five-year experience. Ann. Thorac. Surg. 61, 533–537 (1996).
31. Ayed, A. K. & Al-Shawaf, E. A survey of 150 video-assisted thoracoscopic procedures in Kuwait. Med. Princ. Pract. 13, 159–163 (2004).
32. Abbas, N. et al. Video-assisted Thoracoscopic Surgery (VATS) with mini-thoracotomy for the management of pulmonary hydatid cysts. J. Cardiothorac. Surg. 13, 4–9 (2018).
33. Zhang, P. et al. Video-assisted thoracic surgery for bronchiectasis. Ann. Thorac. Surg. 91, 239–243 (2011).
34. Striffeler, H. et al. Video-assisted thoracoscopic surgery for fibrinopurulent pleural empyema in 67 patients. Ann. Thorac. Surg. 65, 319–323 (1998).
35. Kanchan, S., Surya, K. & Ajay, V. Role of Environmental factors in Transmission of Tuberculosis. Dyn. Hum. Heal. 2, 3–6 (2015).
36. Olson, N. A. et al. A national study of socioeconomic status and tuberculosis rates by country of birth, United States, 1996-2005. BMC Public Health 12, 1 (2012).
37. Tsang, K. Y., Leung, W. S., Chan, V. L., Lin, A. W. L. & Chu, C. M. Complicated parapneumonic effusion and empyema thoracis: Microbiology and predictors of adverse outcomes. Hong Kong Med. J. 13, 178–186 (2007).
38. Rai, S., Kaul, S., Tripathi, R., Bhattacharya, D. & Kashyap, M. Decortication in chronic pleural empyema. Lung India 23, 100 (2006).
39. Abraham, S. V. & Chikkahonnaiah, P. Change in Pulmonary Function Following Decortication for Chronic Pleural Empyema. Turkish Thorac. J. 21, 27–31 (2020).
40. Chan, D. T. L. et al. Surgical Treatment for Empyema Thoracis: Is Video-Assisted Thoracic Surgery 'Better' Than Thoracotomy? Ann. Thorac. Surg. 84, 225–231 (2007).

41. Kuan-Chun Lin, Shi-Ping LuhInt J Gen Med. 2010; 3: 215–220. Published online 2010 Aug 30. doi: 10.2147/ijgm. s11652
42. Macarthur AM, Fountain SW. Intracavity suction and drainage in the treatment of emphysematous bullae. Thorax. 1977;32(6):668–672.
43. Surgical treatment of hydatid disease: prevention of complications and recurrences. Pissiotis CA, Wander JV, Condon RE. Arch Surg
44. Thoracic hydatid cysts: a report of 842 cases treated over a thirty-year period. Qian ZX. Ann Thorac Surg. 1988; 46:342–346.
45. Pulmonary echinococcosis. Morar R, Feldman C. Eur Respir J. 2003;21:1069–1077.
46. Sabbula BR, Rammohan G, Sharma S, Akella J.2024 Jun 8. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2024 Jan–. PMID: 32310380.
47. Cas Lek Cesk. 2018 Fall;157(5):226-236.PMID: 30441934
48. van Kooten JP, et al. Thorax 2022;77:1260–1267. doi:10.1136/thoraxjnl-2021-217709
49. Chen Q-K, Chen C, Chen X-F, Jiang G-N. Video-assisted thoracic surgery for pulmonary aspergilloma: a safe and effective procedure. Ann Thorac Surg 2014;97:218–23.
50. Kumar A, Asaf BB, Puri HV, Lingaraju VC, Siddiqui S, Venkatesh PM. et al. Video-assisted thoracoscopic surgery for pulmonary aspergilloma. Lung India 2017;34:318–23
51. Striffeler H, Gugger M, Im Hof V, et al. Video-assisted thoracoscopic surgery for fibrinopurulent pleural empyema in 67 patients. Ann Thorac Surg 1998;65:319-23. 10.1016/ s0003-4975(97)01188-052)
52. Angelillo Mackinlay TA, Lyons GA, Chimondeguy DJ, et al. VATS debridement versus thoracotomy in the treatment of loculated postpneumonia empyema. Ann Thorac Surg 1996; 61:1626-30. 10.1016/0003-4975(96)00194-4
53. Lin KC, Luh SP. Video-assisted thoracoscopic surgery in the treatment of patients with bullous emphysema. International journal of general medicine. 2010 Aug 30:215-20. https:// doi.org/ 10.2147/IJGM.S11652 PMid:20830196 PMCid: PMC2934603
54. Abbas et al. Journal of Cardiothoracic Surgery (2018) 13:35 https://doi.org/10.1186/s13019-018-0716-7
55. Findikcioglu A, Karadayi S, Kilic D, Hatiopoglu A. Video-assisted thoracoscopic surgery to treat hydatid disease of the thorax in adults: is it feasible? J Laparoendosc Adv Surg Tech. 2012; 22:882–885. doi: 10.1089/lap.2012.0272
56. Mingyon Mun, Junji Ichinose, Yosuke Matsuura, Masayuki Nakao, Sakae Okumura Journal of Visualized Surgery 2018;4:227
57. Journal of Visualized Surgery, 2017. http:// dx.doi. org/10.21037/jovs.2017.09.14
58. Video-Assisted Thoracic Surgery 2017;2:2 http://dx.doi.org/10.21037/vats.2016.12.03 doi: 10.21037/vats.2016.12.03
59. Kim K, Kim HK, Park JS, et al.Video-assisted thoracic surgery lobectomy: single institutional experience with 704 cases. Ann Thorac Surg 2010;89:S2118-22
60. Petersen RH, Hansen HJ, Dirksen A, et al.Lung cancer screening and video-assisted thoracic surgery. J Thorac Oncol 2012;7:1026-3161)

61. Zhang, L. et al. Subxiphoid versus lateral intercostal approaches thoracoscopic thymectomy for non-myasthenic early-stage thymoma: A propensity score -matched analysis. Int. J. Surg. (London, England) 67, 13–17 (2019)