

Original Research Article

A comparative study of video-assisted thoracoscopic surgery and open thoracotomy in the surgical management of thoracic empyema

Avinash Dal¹, Venkata Anil Chandra Dronamraju^{2*}

¹Department of Cardiovascular and Thoracic Surgery, TX Hospital, Banjara Hills, Hyderabad, Telangana, India

²Department of Cardiothoracic and Vascular Surgery, Gayatri Vidya Parishad Institute of Health Care and Medical Technology, Marikavalasa, Visakhapatnam, India

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*Correspondence:

Venkata Anil Chandra Dronamraju,
E-mail: dranildronamraju7@gmail.com

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ABSTRACT

Background: Thoracic empyema represents a challenging clinical condition, particularly in advanced stages requiring surgical intervention. While open thoracotomy has traditionally been the standard approach, video-assisted thoracoscopic surgery (VATS) has emerged as a minimally invasive alternative with potential benefits. To compare postoperative outcomes, safety, and cosmetic results between VATS and open thoracotomy in patients undergoing surgical management for thoracic empyema.

Methods: This comparative study included 50 patients diagnosed with advanced thoracic empyema who underwent surgical management. Patients were equally divided into two groups: VATS (n=25) and open thoracotomy (n=25). Demographic characteristics, postoperative pain scores, duration of hospital stay, cosmetic outcomes, and postoperative complications were assessed and compared.

Results: Both groups were demographically comparable. Patients in the VATS group experienced significantly lower postoperative pain, shorter hospital stay, fewer postoperative complications, and superior cosmetic outcomes compared to those undergoing open thoracotomy. The overall safety profile of VATS was favorable, with no increase in perioperative risk.

Conclusion: VATS is a safe and effective surgical approach that offers clear advantages over open thoracotomy in the management of thoracic empyema, supporting its use as the preferred initial surgical modality in appropriately selected patients.

Keywords: Thoracic empyema, VATS, Open thoracotomy, Postoperative pain, Cosmetic outcome

INTRODUCTION

Thoracic empyema is a serious pleural space infection characterized by the accumulation of purulent material and remains a significant cause of morbidity worldwide, particularly in developing countries.¹ It commonly arises as a complication of pneumonia but may also occur following thoracic surgery, trauma, or tuberculosis.² Based on the pathological progression, empyema is classically divided into three stages: exudative, fibrinopurulent, and organizing stages, with advanced

disease often requiring surgical intervention for definitive management.³

Open thoracotomy with decortication has traditionally been regarded as the gold standard for the treatment of advanced empyema.⁴ However, this approach is associated with considerable postoperative pain, prolonged hospital stay, delayed functional recovery, and poor cosmetic outcomes.⁵ With advances in minimally invasive techniques, video-assisted thoracoscopic surgery (VATS) has emerged as an alternative approach that

allows effective evacuation of empyema and lung decortication with reduced surgical trauma.⁶

Several studies have demonstrated that VATS is associated with lower postoperative pain, shorter duration of chest tube drainage, reduced hospital stay, and faster return to normal activities when compared with open thoracotomy.^{7,8} Despite these advantages, concerns remain regarding its safety and efficacy in advanced stages of empyema. Hence, the present study was undertaken to compare postoperative outcomes, safety, and cosmetic results between VATS and open thoracotomy in patients with thoracic empyema.

METHODS

Study design and population

This was a comparative observational study conducted at a tertiary care teaching hospital over a defined study period. The study was approved by the Institutional Ethics Committee, and informed consent was obtained from all participants prior to enrollment.

Study population

A total of 50 patients diagnosed with advanced thoracic empyema and requiring surgical intervention were included in the study. Patients were evaluated clinically and radiologically, and the diagnosis of empyema was confirmed based on clinical findings, imaging studies, and intraoperative assessment.

Inclusion criteria

Patients aged ≥ 18 years, diagnosed cases of advanced thoracic empyema requiring surgical management. Patients deemed fit for surgery under general anesthesia

Exclusion criteria

Patients with significant hemodynamic instability. Severe cardiopulmonary comorbidities precluding surgery. Patients unwilling to participate in the study.

Group allocation

Patients were allocated into two groups based on the surgical approach employed: group A: Video-assisted thoracoscopic surgery (VATS) (n=25), group B: Open thoracotomy (n=25).

The choice of surgical approach was made by the treating surgical team based on clinical judgment, disease extent, and available expertise.

Surgical procedure

All procedures were performed under general anesthesia with standard peri-operative monitoring.

In the VATS group, surgery was carried out using a minimally invasive thoracoscopic approach with evacuation of purulent material, breakdown of loculations, and decortication as required to achieve lung re-expansion. In the open thoracotomy group, patients underwent conventional thoracotomy with formal decortication and pleural cavity clearance.

Chest drains were placed in all patients at the end of the procedure and managed according to standard postoperative protocols.

Outcome measures

The following parameters were assessed and compared between the two groups: demographic characteristics (age, sex). Postoperative pain, assessed using the Visual Analogue Scale (VAS) at postoperative day 0, postoperative day 7 and at one-month follow-up. Duration of postoperative hospital stay. Cosmetic outcome, assessed based on scar size, location and patient satisfaction. Postoperative complications, including prolonged air leak, wound infection, and pulmonary complications.

Statistical analysis

Data were recorded in a structured proforma and analysed using descriptive statistical methods. Categorical variables were expressed as frequencies and percentages, while continuous variables were expressed as mean $\pm$ standard deviation. Comparative interpretation between the two groups was performed based on observed differences, with statistical significance considered at $p < 0.05$ where applicable.

RESULTS

A total of 50 patients were included, with equal distribution between VATS and open thoracotomy groups. The mean age and gender distribution were comparable between the two groups, ensuring baseline homogeneity. Postoperative pain scores were consistently lower in the VATS group across all time points. Patients undergoing VATS had a significantly shorter duration of hospital stay and demonstrated superior cosmetic outcomes. Postoperative complications were less frequent in the VATS group, with prolonged air leak being the most common complication in both groups. Overall, VATS demonstrated a favorable safety and recovery profile compared to open thoracotomy.

Table 1 shows an equal distribution of patients between the two surgical approaches, with 25 patients (50%) undergoing video-assisted thoracoscopic surgery (VATS) and 25 patients (50%) undergoing open thoracotomy, ensuring balanced comparison between the groups and minimizing selection bias in outcome assessment.

Table 1: Distribution of patients according to surgical approach.

Surgical Technique	Frequency (n=50)	Percentage (%)
VATS	25	50%
Open Thoracotomy	25	50%
Total	50	100%

Table 2 demonstrates that the mean age of patients was comparable between the VATS group (48.6±12.4 years) and the open thoracotomy group (50.2±11.8 years). Both groups showed a male predominance, with males constituting 76% of the VATS group and 80% of the open thoracotomy group. The similar age and gender distribution indicates that the two groups were demographically well matched, allowing for a valid comparison of surgical outcomes.

Table 2: Demographic characteristics of the study population.

Variable	VATS (n=25)	Open Thoracotomy(n=25)
Age (Mean±SD)	48.6±12.4	50.2±11.8
Male n (%)	19 (76%)	20 (80%)
Female n (%)	6 (24%)	5 (20%)

Table 3: Comparison of postoperative pain scores (VAS) between study groups.

Time Point	VAS score category	VATS (n=25)	Open thoracotomy(n=25)
Post-op Day 0	Mild–Moderate (VAS ≤5)	17 (68%)	6 (24%)
	Severe (VAS >5)	8 (32%)	19 (76%)
Post-op Day 7	Mild / No pain (VAS ≤3)	20 (80%)	9 (36%)
	Moderate–Severe (VAS >3)	5 (20%)	16 (64%)
1 Month	No pain (VAS 0)	23 (92%)	14 (56%)
	Mild Pain	2 (8%)	11 (44%)

Table 4: Length of postoperative hospital stay.

Duration of Hospital Stay	VATS (n=25)	Open Thoracotomy(n=25)
≤ 7 days	14 (56%)	5 (20%)
8–10 days	6 (24%)	4 (16%)
> 10 days	5 (20%)	16 (64%)
Days (Mean±SD)	8.2±2.6	12.9±3.8

Table 3 indicates that postoperative pain scores were consistently lower in the VATS group when compared with the open thoracotomy group at all assessed time points. On postoperative day 0, a higher proportion of VATS patients experienced mild to moderate pain (68%), whereas the majority of open thoracotomy patients reported severe pain (76%). By postoperative day 7, 80% of VATS patients had mild or no pain compared to 36% in the open thoracotomy group. At one-month follow-up, complete absence of pain was observed in 92% of VATS patients, while persistent mild pain was noted in a substantial proportion (44%) of patients undergoing open thoracotomy, highlighting the superior postoperative pain control achieved with the minimally invasive approach.

Table 4 demonstrates that patients undergoing VATS had a significantly shorter postoperative hospital stay compared to those managed with open thoracotomy. More than half of the VATS patients (56%) were discharged within 7 days, whereas only 20% of the open thoracotomy group achieved similar early discharge. In

contrast, a prolonged hospital stay of more than 10 days was observed in 64% of open thoracotomy patients compared to 20% in the VATS group. The mean duration of hospital stay further supports this finding, being 8.2±2.6 days in the VATS group versus 12.9±3.8 days in the open thoracotomy group, indicating faster postoperative recovery with the minimally invasive approach.

Table 5 shows that cosmetic outcomes were markedly superior in the VATS group compared to the open thoracotomy group. An excellent cosmetic result was achieved in 72% of patients undergoing VATS, whereas only 16% of patients in the open thoracotomy group attained similar outcomes. Conversely, poor cosmetic results were observed predominantly in the open thoracotomy group (48%) compared to a minimal proportion (4%) in the VATS group. These findings highlight the advantage of the minimally invasive approach in achieving better postoperative cosmesis due to smaller incisions and reduced surgical trauma.

Table 5: Cosmetic outcome assessment.

Cosmetic Outcome	VATS (n=25)	Open Thoracotomy (n=25)
Excellent	18 (72%)	4 (16%)
Good	6 (24%)	9 (36%)
Poor	1 (4%)	12 (48%)

Table 6: Safety and complication profile.

Parameter	VATS (n=25)	Open Thoracotomy (n=25)
Any postoperative complication	6 (24%)	14 (56%)
Prolonged air leak	3 (12%)	8 (32%)
Wound infection	1 (4%)	4 (16%)
Pulmonary complications	2 (8%)	5 (20%)

Table 6 demonstrates that postoperative complications were less frequent in the VATS group compared to the open thoracotomy group. Overall, complications were observed in 24% of patients undergoing VATS, whereas a higher incidence (56%) was noted following open thoracotomy. Prolonged air leak was the most common complication in both groups but occurred less frequently in the VATS group (12% vs. 32%). Wound infections and pulmonary complications were also comparatively lower in patients managed with VATS, supporting the conclusion that VATS is a safe surgical approach with a more favorable postoperative complication profile.

DISCUSSION

The present study demonstrates that video-assisted thoracoscopic surgery offers significant advantages over open thoracotomy in the surgical management of thoracic empyema. Both study groups were demographically comparable, allowing meaningful comparison of postoperative outcomes.

Postoperative pain was significantly lower in patients undergoing VATS, which is consistent with previously published literature reporting reduced chest wall trauma due to smaller incisions and limited rib spreading.^{7,8} Improved pain control following VATS facilitates early mobilization and contributes to enhanced postoperative recovery. The duration of hospital stay was markedly shorter in the VATS group, a finding that has been consistently reported by other authors.^{9,10} Reduced hospital stay not only improves patient satisfaction but also decreases healthcare costs and resource utilization. Additionally, cosmetic outcomes were superior in the VATS group, which has been recognized as an important determinant of patient-reported quality of life.¹¹

The overall complication rate was lower in patients managed with VATS. Prolonged air leak was the most common complication in both groups but occurred less frequently following VATS, similar to observations reported in earlier comparative studies.¹² These findings reinforce the safety of VATS when performed by experienced surgeons, even in advanced stages of empyema.

Although open thoracotomy remains an essential surgical option in cases with dense pleural fibrosis or complex disease, the cumulative evidence from the present study supports the use of VATS as the preferred initial surgical approach for thoracic empyema whenever feasible.

Limitations

The sample size was small (50 patients), which may limit the generalizability of the study findings. The study was conducted at a single tertiary care center, and results may vary across different institutions and surgical settings. The non-randomized allocation of patients to surgical groups may have introduced selection bias, despite comparable baseline characteristics. Long-term outcomes, such as pulmonary function, recurrence rates, and quality-of-life measures, were not evaluated. Cosmetic outcome assessment was subjective, relying on patient perception, which may vary among individuals.

CONCLUSION

The study concludes that video-assisted thoracoscopic surgery is a safe and effective surgical approach for the management of advanced thoracic empyema and offers clear advantages over open thoracotomy. Patients undergoing VATS experienced significantly lower postoperative pain, shorter hospital stay, fewer postoperative complications, and superior cosmetic outcomes, while maintaining a favorable safety profile. The comparable demographic characteristics between the two groups validate the outcome comparison. Although open thoracotomy remains necessary in selected cases with extensive disease, the overall results support VATS as the preferred initial surgical modality due to its minimally invasive nature, improved postoperative recovery, and enhanced patient satisfaction.

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