



A Retrospective Audit of Thoracic Surgeries Performed in 2024: Analysis of Surgical Approaches and Short-Term Postoperative Outcomes from a Single Tertiary Care Centre

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Abstract

Background: Thoracic surgery includes diverse procedures involving the lungs, oesophagus, mediastinum, and chest wall. It has evolved with the increasing use of minimally invasive techniques. However, institutional audits assessing short-term postoperative outcomes remain valuable to monitor surgical performance and patient safety, especially in high-volume tertiary centres. This study audited all thoracic surgeries performed in 2024 at the centres to analyse surgical case-mix and short-term complications. **Objective:** To analyse the types, approaches, and short-term postoperative outcomes of thoracic surgeries performed in 2024 at a single tertiary-care institution. **Methods:** A retrospective audit of all thoracic surgeries performed from January to December 2024 was conducted. Data on demographics, surgical procedures, complication rates (graded by Clavien–Dindo classification), and specific postoperative morbidities (e.g., recurrent laryngeal nerve palsy, pleural effusion) were collected and analysed. **Results:** A total of 78 thoracic procedures were performed in 2024, with esophagectomies (41%) and metastasectomies (33.3%) being the most common. Surgical approaches were mainly minimally invasive approaches, including Video-Assisted Thoracoscopic Surgery (VATS) and robotic surgery (76.9%). Postoperative complications were observed in 19 patients (24.4%), with surgical site complications (8.8%) being the most common. Based on the Clavien–Dindo classification, Grade II complications were most frequent (10; 12.8%), while Grade V mortality occurred in one patient (1.3%) of cases, following an esophagectomy due to cardiac complications. Specific complications included 7 cases of wound complications, two cases of Recurrent Laryngeal Nerve (RLN) palsy, 6 pleural effusions, two cases of cardiac arrhythmias and two anastomotic leaks. **Conclusion:** The complication and mortality rates in this audit align with international benchmarks. The high adoption of minimally invasive approaches likely contributed to favourable outcomes. Continued expansion of minimally invasive and robotic techniques may further improve postoperative morbidity.

Keywords: Minimally Invasive, Outcomes, Postoperative Morbidity, Thoracic Surgery

1. Introduction

Thoracic surgery has experienced significant advances with the increasing use of minimally invasive techniques such as VATS, hybrid approaches, and RATS. These

techniques have consistently demonstrated reductions in postoperative pain, pulmonary complications, operative blood loss, and length of stay compared with open thoracotomy¹⁻³.

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Oesophageal cancer predominantly affects the elderly population and is frequently associated with multiple comorbidities, which significantly influence treatment selection and postoperative outcomes⁴. Minimally Invasive Esophagectomy (MIE) has shown superior short-term outcomes, including reduced respiratory complications and lower morbidity, as demonstrated in major meta-analyses and randomised trials such as the TIME trial^{1,3}. Robotic-assisted techniques further enhance precision and may reduce the risk of RLN palsy and cardiopulmonary complications⁵.

In lung surgery, VATS lobectomy has become the standard for early-stage Non-Small Cell Lung Cancer (NSCLC), with evidence showing lower morbidity and mortality and equivalent oncologic outcomes compared with open lobectomy^{6,7}. Similarly, selected patients undergoing pulmonary metastasectomy increasingly benefit from minimally invasive approaches, although open thoracotomy remains preferred in cases requiring manual palpation of deep nodules^{8,9}.

Despite substantial literature supporting minimally invasive thoracic surgery, institutional audits remain crucial for identifying performance trends and benchmarking outcomes. This study evaluates the thoracic surgeries performed at the centre in 2024 and compares short-term outcomes with published international evidence.

2. Aim and Objectives

To review thoracic surgical procedures performed in 2024 and evaluate short-term outcomes and complications in comparison with published data.

3. Review of Literature

Minimally invasive thoracic surgery has become increasingly prevalent due to its demonstrated benefits. Meta-analyses show that MIE significantly reduces respiratory complications, overall morbidity, and length of stay when compared with open esophagectomy^{1,2}. The TIME randomised trial confirmed lower postoperative complications with

MIE³. Robotic-assisted esophagectomy has shown further reductions in RLN palsy, pleural effusions, and arrhythmias⁵.

In lung surgery, VATS lobectomy is associated with reduced postoperative complications and mortality compared with open thoracotomy⁶. Single-port VATS techniques may provide additional reductions in minor complications⁷. Pulmonary metastasectomy, particularly for germ-cell tumours, sarcomas, and colorectal cancers, remains a key component of treatment, and minimally invasive approaches are increasingly used when feasible^{8,9}.

For thymomas, minimally invasive thymectomy is considered safe and effective, offering decreased morbidity compared with open surgery¹⁰. Chest wall tumours, however, frequently require open approaches for adequate exposure and resection¹¹.

3. Materials and Methods

3.1 Study Design and Setting

A retrospective observational audit was conducted of all thoracic surgeries performed between January 1 and December 31, 2024, at the Thoracic Surgical Unit, Cancer Institute (WIA), Chennai.

Inclusion Criteria:

- All major elective or planned thoracic surgical procedures.

Exclusion Criteria:

- Diagnostic or minor procedures (biopsies, thoracentesis).
- Cases with incomplete documentation.

Data Collection:

Data were collected from operative logs, inpatient records, and pathology reports, including:

- Demographics
- Type of thoracic procedure
- Surgical approach (open, VATS, robotic, hybrid)

- Histopathology
- Postoperative complications (Clavien–Dindo classification¹²)
- Length of hospital stay and 30-day mortality

3.2 Definitions

- Clavien–Dindo classification: Grade II (pharmacological therapy), Grade IIIa (intervention without general anaesthesia), Grade IV (life-threatening complication requiring ICU), Grade V (death).
- Short-term outcomes: Complications occurring during the index admission or within 30 days of surgery.

3.3 Analysis

Data were analysed descriptively using frequencies and percentages.

4. Results (Including Observations)

4.1 Total Surgical Distribution

A total of 78 thoracic surgeries were performed.

Table 1 shows the distribution of thoracic surgeries and the surgical approaches. Overall, 60 (76.9%) surgeries were performed via VATS/minimally invasive approach, 15 (19.2%) through open thoracotomy, and 3 (3.8%) using hybrid techniques.

Indications for conversion to minimally invasive procedures to open surgery (hybrid technique) in our studies were dense hilar adhesions, difficult vascular anatomy, and poor visualisation compromising oncologic resection.

4.2 Demographics

- Esophagectomy group (n = 32): 16 males and 16 females
- Other thoracic procedures (n = 46): 27 males (58.6%), 19 females (41.4%)
- Most patients who underwent surgery were in the 50–70-year age group.

4.3 Pathology Distribution

- Esophagectomies: Predominantly squamous cell carcinoma 29 (90.6%) and adenocarcinoma 3 (9.4%).
- Metastasectomies: Pulmonary metastases from Germ cell tumours 15 (57.6%), bone and soft tissue sarcomas 5 (19.2%), colorectal 4 (15.2%) and SCC 2 (7.6%).
- Lobectomy and pneumonectomies: Lung adenocarcinoma, colorectal, Carcinoid tumours.
- Mediastinal Tumours: Thymoma and germ cell tumour.
- Chest Wall Tumors: Ewing's sarcoma, chondrosarcoma and one benign.

Table 1. Distribution of thoracic surgeries and surgical approach

Procedure Type	Number	Percentage (%)	Main Surgical Approach
Esophagectomy	32	41.0	2 open (transhiatal), 10 VATS (lap-thoroscopic), 20 minimally invasive (Robotic)
Metastasectomy	26	33.3	20 VATS, 4 Robotic, 2 Open thoracotomy
Lobectomy	12	15.3	4 VATS, 4 Open, 3 Hybrid, 1 Robotic
Pneumonectomy	1	1.2	Open thoracotomy
Chest Wall Tumour Resection	5	6.4	All Open
Mediastinal Tumour Excision	2	2.4	1 Robotic, 1 open

4.4 Postoperative Complications

Postoperative complications occurred in 19 patients (24.4%). The most frequent complications included surgical site infection (7; 8.8%); 4 of which were managed conservatively with cleaning and dressing, and another 3 required secondary suturing under local anaesthesia. The second most frequent complication was pleural effusion (6; 7.7%); 2 of which required Intercostal Drain (ICD) tube placement, and 3 patients required pleural tapping. Other complications observed were anastomotic leaks post esophagectomy (2; 2.6%), which were managed conservatively, cardiac arrhythmias (2; 2.6%), one of which expired, and RLN palsy (2; 2.6%). Notably, no cases of re-exploration were reported. Table 2 shows specific postoperative morbidities.

4.5 Mortality

- One patient died in the postoperative period (Grade V).
- Table 3 describes postoperative complications as per Clavien Dindo grade.
- Overall morbidity (Grades II–IV): 25.7%
- Mortality (Grade V): 1 patient (1.3%), following esophagectomy due to cardiac complication on postoperative day 11.
- Mean hospital stay: 7.8 ± 3.4 days (range 5–14 days).

Table 2. Specific postoperative morbidities.

Type of Complications	Number of Cases n=78	Percentage (%)
Lung, Mediastinum and Chest Wall (46)		
Surgical Site Infection	4	5.1
Pleural Effusion	2	2.6
Esophagectomy (32)		
Surgical Site Infection	3	3.8
Anastomotic Leak	2	2.6
RLN Palsy	2	2.6
Pleural Effusion	4	5.1
Cardiac Arrhythmias	2	2.6

Table 3. Postoperative complications as per Clavien Dindo grade

Grade	Definition	Number of Patients (n = 78)	Percentage (%)
II	Pharmacological treatment required (antibiotics, transfusion, TPN)	10	12.8
IIIa	Intervention not under general anaesthesia (e.g., pleural drainage, secondary suturing)	8	10.3
IV	Life-threatening complication requiring ICU management	2	2.6
V	Death	1	1.3

5. Discussion

This audit reviewed the thoracic surgical workload in 2024 and benchmarked outcomes against international standards. The predominance of minimally invasive techniques (76.9%) reflects global practice trends and is likely associated with the favourable postoperative outcomes observed.

5.1 Oesophagectomy Outcomes

Esophagectomy represented the largest proportion of surgeries in our series. Anastomotic leak and recurrent laryngeal nerve palsy are well-recognised postoperative complications following esophagectomy, particularly in elderly patients, and have been consistently reported in institutional audits⁴. The low anastomotic leak rate (2.6%) compares favourably with published leak rates of 5–15%^{1,2}. RLN palsy (2.6%) was within the ranges reported for minimally invasive esophagectomy and lower than the rates described with open techniques in some studies⁵. Overall morbidity for esophagectomy also aligns with large meta-analyses reporting 25–50% postoperative complication rates^{1–3}. Our mortality rate of 1.3% is consistent with international high-volume centres, where mortality ranges from 1.5–5%^{1,3}.

5.2 Lung, Metastatic, and Mediastinal Surgery

The high utilisation of VATS and robotic approaches for metastasectomy and lobectomy in our series mirrors contemporary global trends. Although VATS lobectomy has demonstrated superior short-term outcomes compared with open lobectomy, the selective adoption of a hybrid approach underscores a safety-first surgical philosophy, allowing timely conversion to open surgery when required without compromising outcomes^{6,7}. The complication profile observed, including pleural effusion and atrial fibrillation, is comparable to that reported in established thoracic surgery literature⁶.

5.3 Complication Profile

The overall morbidity rate of 25.7% falls within international benchmarks for major thoracic surgery. Surgical site infections (8.8%) and pleural effusions (7.7%) were the most common complications. No patient required re-exploration, reflecting safe surgical planning and postoperative care.

Implications:

The findings support the continued expansion of minimally invasive and robotic thoracic surgery programs, which are associated with improved patient outcomes. Regular audits can further guide quality improvement initiatives and resource allocation.

5.4 Strengths of the Audit

- Captures all thoracic surgical activity in a full calendar year - gives a comprehensive institutional picture.
- Use of the Clavien–Dindo classification provides standardised morbidity benchmarking.
- Identification of specific complication patterns (RLN palsy, wound issues, anastomotic leak) allows targeted quality-improvement interventions.

5.5 Limitations

Limitations of this study include its retrospective design and reliance on hospital records, which may result in underreporting of minor complications or long-term outcomes. Additionally, detailed analysis of factors influencing complications, such as comorbidities, tumour stage, and adjuvant therapy, was beyond the scope of this study but would be valuable for future research.

6. Summary and Conclusion

- A total of 78 thoracic surgeries were performed in 2024.
- Most frequent procedures: Oesophagectomy (41%) and metastasectomy (33.3%).

- Surgical approach: 76.9 % minimally invasive (VATS/Robotic), 19.2% open, 3.8% hybrid.
- Complications: Minor (Grades II: 12.8%), major (Grades III–IV: 12.9%), and 1 mortality (Grade V) after oesophagectomy.
- Average hospital stay: 5–14 days.

This audit demonstrates that thoracic surgeries at our institute in 2024 were performed with low morbidity and acceptable mortality, consistent with international benchmarks. The high adoption of minimally invasive and robotic approaches likely contributed to reduced postoperative complications. Continued emphasis on minimally invasive training and technology integration may further improve patient outcomes.

7. References

1. Akhtar NM, Chen D, Zhao Y, *et al.* Postoperative short-term outcomes of minimally invasive versus open esophagectomy: systematic review and meta-analysis. *Thorac Cancer*. 2020; 11(6):1465-1475. <https://doi.org/10.1111/1759-7714.13413> PMID:32310341 PMCID:PMC7262946.
2. Kauppila JH, Helminen O, Kytö V, *et al.* Short-term outcomes of minimally invasive versus open esophagectomy after neoadjuvant therapy: Meta-analysis. *Ann Surg*. 2021; 273(4):621-629.
3. Biere SS, Henegouwen MIV, Maas KW, *et al.* Minimally invasive vs open esophagectomy for esophageal cancer: A multicentre randomized trial (TIME trial). *Lancet*. 2012; 379:1887-1892. [https://doi.org/10.1016/S0140-6736\(12\)60516-9](https://doi.org/10.1016/S0140-6736(12)60516-9) PMID:22552194.
4. Vydia G, Ramaniaiah, Radhakrishnan V, Krishnamurthy A, Arunkumar N. View of battling esophageal cancer in the elderly: A retrospective audit from a tertiary cancer centre in South India. *Asian Pac J Cancer Nur*. 2025.
5. Park S, Kim DJ, Kim HI, *et al.* Robotic esophagectomy for cancer: reduced complications and improved outcomes. *Ann Thorac Surg*. 2020; 109(2):377-384.
6. Cao C, Manganas C, Ang SC, *et al.* VATS versus open lobectomy: Meta-analysis of 61,000 patients. *Ann Cardiothorac Surg*. 2021; 10(2):115-127.
7. Harris CG, James RS, Tian DH, *et al.* Uniportal versus multiportal VATS lobectomy: Systematic review and meta-analysis. *Innovations*. 2020; 15(3):216-225.
8. Pfannschmidt J, Dienemann H. Surgical resection of pulmonary metastases. *Lancet Oncol*. 2010; 11:259-268.
9. Treasure T, Milošević M, Fiorentino F, *et al.* Pulmonary metastasectomy for colorectal cancer: Updated systematic review. *Thorax*. 2021; 76(10):999-1006.
10. Seong YW, Kang CH, Park IK, *et al.* VATS thymectomy vs open thymectomy: Long-term outcomes. *Ann Thorac Surg*. 2014; 97:429-435.
11. McCormack PM. Surgical management of chest wall tumors. *Semin Thorac Cardiovasc Surg*. 2009; 21(1):89-98.
12. Clavien PA, Barkun J, de Oliveira ML, *et al.* The Clavien-Dindo classification of surgical complications: Five-year experience. *Ann Surg*. 2009; 250(2):187-196. <https://doi.org/10.1097/SLA.0b013e3181b13ca2> PMID:19638912.