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Surgical outcomes of video – assisted thymectomy

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ABSTRACT

Introduction: With the advancement of minimally invasive surgery, the use of video-assisted thoracoscopic surgery (VATS) for thymectomy in thoracic surgical practice has steadily increased. Although thymectomy was traditionally performed using conventional surgical approaches, minimally invasive techniques have now become the gold standard. In this study, we aimed to evaluate the clinical characteristics and surgical outcomes of patients who underwent VATS thymectomy at our institution.

Materials and Methods: Patients who underwent VATS thymectomy at our institution between 2019 and 2026 for a thymic mass or non-thymomatous myasthenia gravis were included in the study. Demographic characteristics, surgical indications, histopathological diagnoses of the resected specimens, postoperative complication rates, operative time, chest tube duration, and length of hospital stay were analyzed.

Results: A total of 33 patients were included in the study. Nineteen patients (57.6%) had MG. The mean chest tube duration was 2.66±2.44 days, with a median chest tube removal time of 2 days. The mean postoperative length of hospital stay was 4.15±4.76 days, with a median of 3 days. Conversion from VATS to open surgery was required intraoperatively in two patients. Operative time was significantly longer in patients with malignant lesions than in those with benign lesions (p=0.007).

Conclusions: Our study demonstrated that VATS thymectomy was associated with a short postoperative hospital stay and early chest tube removal. Although postoperative complications were rare, the possibility of major complications requiring conversion should not be overlooked.

Keywords: Myasthenia gravis, thymectomy, thymoma

Introduction

Thymectomy, performed for indications such as thymoma, thymic carcinoma, myasthenia gravis, and thymic cysts, has gradually evolved from conventional surgical approaches to minimally invasive techniques with advancements in surgical technology. The most common indications for thymectomy are thymoma and non-thymomatous myasthenia gravis. As myasthenia gravis is the most common paraneoplastic syndrome associated with thymoma, the coexistence of thymoma and myasthenia gravis is frequently encountered in surgical practice.

Surgical resection remains the gold standard treatment for patients with early-stage thymoma. Thymectomy has been considered a treatment modality for myasthenia gravis since the 1940s. In 2016, the randomized controlled trial conducted by Wolfe et al. [1] prospectively demonstrated for the first time that thymectomy was associated with superior clinical outcomes in patients with non-thymomatous, acetylcholine receptor (AChR) antibody-positive myasthenia gravis.

With advancements in surgical technology and the widespread adoption of video-assisted thoracoscopic surgery (VATS) for procedures such as lobectomy and segmentec-

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tomy, minimally invasive approaches have increasingly been applied to the surgical management of thymoma and non-thymomatous myasthenia gravis. These approaches have been associated with shorter hospital stays, reduced surgical costs,[2] and significantly lower postoperative morbidity and mortality.[3,4] In addition, conditions such as great vessel invasion by thymoma, inability to tolerate single-lung ventilation, previous surgery involving the anterior mediastinum, or prior radiotherapy to the anterior mediastinum constitute contraindications to minimally invasive thymectomy. Similarly, in patients with non-thymomatous myasthenia gravis, one of the most common indications for thymectomy, minimally invasive surgery has demonstrated more favorable outcomes than the open surgical approach.[5,6] In this study, we aimed to evaluate the surgical outcomes of patients who underwent VATS thymectomy for a thymic mass or myasthenia gravis.

Materials and Methods

Patients

Patients who underwent thymectomy for a thymic mass or myasthenia gravis at our institution were retrospectively reviewed. Those who underwent VATS thymectomy were included in the study. Patients in whom the procedure was initiated via median sternotomy or thoracotomy were excluded. This study was approved by the Ethics Committee of Kartal Dr. Lütfi Kırdar City Hospital (Number: 2026/010.99/29/17, Date: 30/06/2026) and was conducted in accordance with the principles of the Declaration of Helsinki. Informed consent was obtained from each participant.

Data Collection

The patients' demographic characteristics, anti-acetylcholine receptor (AChR) antibody status and preoperative intravenous immunoglobulin (IVIG) therapy in patients with myasthenia gravis, tumor size and capsular invasion in patients with thymoma, operative time, postoperative complications, chest tube duration, length of hospital stay, and histopathological diagnoses of the resected specimens were retrospectively evaluated.

VATS Thymectomy

After induction of general anesthesia, the patients were intubated with a double-lumen endobronchial tube. The right arm was positioned in extension, and a thick pad was placed beneath the right side of the patient's back to elevate the right hemithorax by approximately 30°. The right hemithorax was accessed through two ports: one placed in the third intercostal space along the anterior axillary line and the other in the sixth intercostal space at the inferolateral border of the breast. The mediastinal pleura was incised beneath the sternum to establish communication with the left pleural cavity. Resection was initiated with the pericardial fat tissue. Subsequently, to protect the right phrenic nerve from the thermal effects of the energy device, dissection of the thymic tissue was initiated approximately 1 cm anterior to the right phrenic nerve and continued over the pericardium toward the left phrenic nerve. At the level of the left innominate vein, the thymic veins were identified and divided. Depending on the intraoperative findings and surgeon preference, they were either secured with clips or divided using an energy device. Both superior poles of the thymus were pulled down from the thyrothymic ligaments, and the thymectomy specimen was retrieved thoracoscopically. The procedure was completed after placement of a single chest tube in the operative field. Images of the resected specimens and the surgical field following thymectomy are presented in Figures 1 and 2. Postoperative images of the surgical incisions are shown in Figure 3.

Postoperative Period

All patients were extubated in the operating room after surgery and subsequently transferred to the surgical ward. Patients were closely monitored with serial hemodynamic assessments and radiological evaluations during their postoperative stay in the surgical ward. A postoperative chest radiograph is presented in Figure 4. Patients with myasthenia gravis underwent postoperative neurological evaluation and follow-up in collaboration with the neurology department.

Statistical Analysis

Categorical variables were presented as frequencies and percentages. Continuous variables were expressed as mean±standard deviation and compared using Student's t-test. A p value of <0.05 was considered statistically significant. All statistical analyses were performed using SPSS version 26.0 (IBM Corporation, Armonk, NY, USA).

Results

This study included 33 consecutive patients who underwent surgery at our institution between 2019 and 2026.

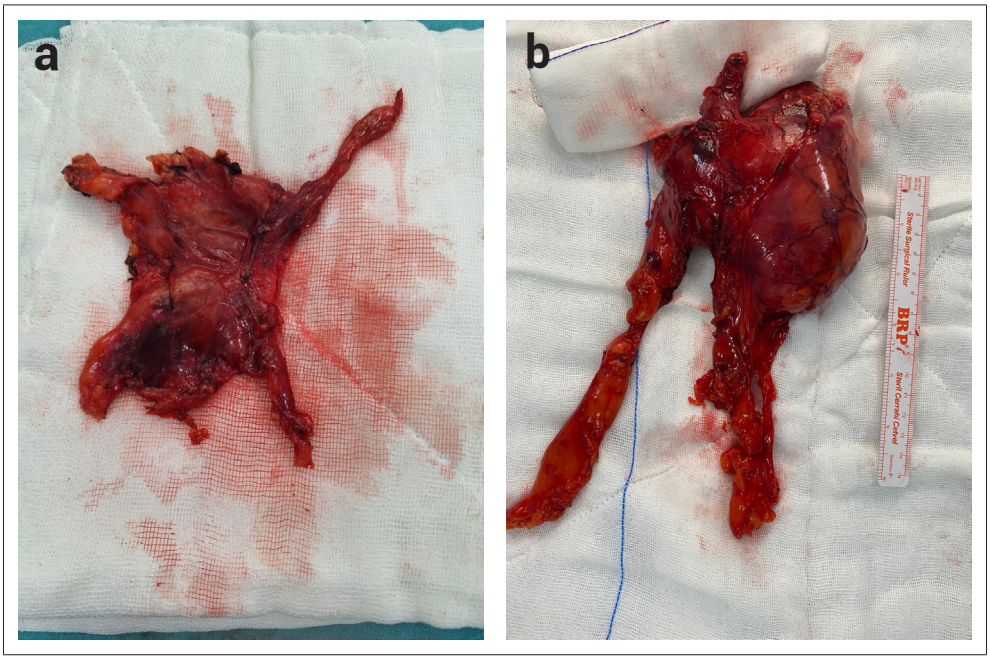

Figure 1. a) VATS thymectomy material (patient with non-thymomatous myasthenia gravis), **b)** VATS thymectomy material (thymoma).

The demographic characteristics, postoperative complications, histopathological findings, and myasthenia gravis status of the study population are presented in Table 1.

Among the patients diagnosed with myasthenia gravis, 13 (68.4%) were positive for anti-AChR antibodies.

Capsular invasion was observed in 7 (63.6%) of the patients who underwent surgery for thymoma, whereas no capsular invasion was detected in the remaining 4 (36.4%). All patients with a histopathological diagnosis of thymoma or thymic carcinoma were staged as T1. Perithymic and deep intrathoracic lymph node dissection was performed in each case, and no lymph node metastases were encountered. R0 resection was achieved in all patients. Histopathological examination of the patients who underwent surgery for thymoma revealed microscopic thymoma in 1 (9.0%) patient, type

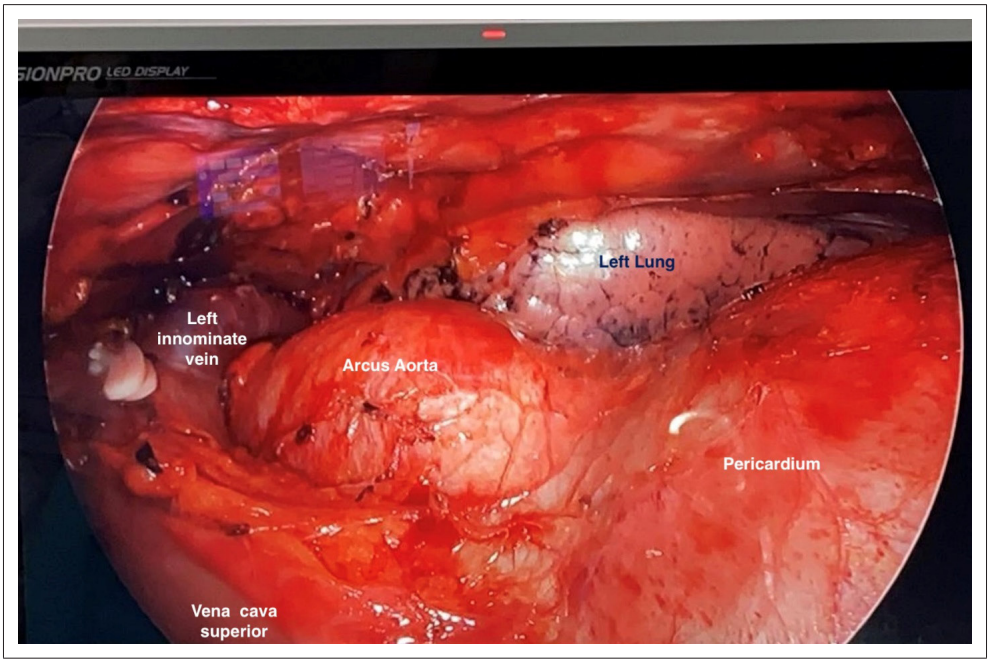

Figure 2. Image of postoperative surgical field.

Figure 3. Incisions for VATS thymectomy.

Figure 4. Postoperative X-ray after vats thymectomy.

AB thymoma in 2 (18.1%) patients, type B1–B2 thymoma in 2 (18.1%) patients, type B2–B3 thymoma in 2 (18.1%) patients, and type B3 thymoma in 4 (36.3%) patients. The mean tumor size in patients who underwent surgery for thymoma or thymic carcinoma was 3.98±1.09 cm. None of the patients experienced recurrence of thymoma or thymic carcinoma during follow-up. Two patients with type B3 thymoma died due to non-oncological causes 7 and 32 months after surgery.

The mean chest tube duration was 2.66±2.44 days. The median chest tube removal time was 2 days. The mean postoperative length of hospital stay was 4.15±4.76 days, with a median of 3 days. Conversion from VATS to open surgery was required in 2 patients during the operation. In one patient, bleeding from the left internal mammary vein during right-sided VATS necessitated conversion to right thoracotomy. In the other patient, VATS was abandoned because of the size and location of the thymoma, and the procedure was completed through a median sternotomy. None of the patients required reoperation for any postoperative complication, and there were no intraoperative deaths.

A comparison of chest tube removal time, postoperative length of hospital stay, age, and operative time between patients undergoing surgery for malignant and nonmalignant conditions is presented in Table 2.

Discussion

Over the past decade, VATS thymectomy has emerged as the standard surgical approach for patients with myasthenia gravis and those with thymic masses. In previous decades, thymectomy was typically performed through a median sternotomy. However, this approach was associated with longer recovery times, an increased risk of sternal osteomyelitis, and exacerbation of myasthenic symptoms.

Table 1. Demographics, complications, histopathology and presence of myasthenia gravis.

Mean Age	47.5±11.22	Histopathology	
Gender	n (%)	TH	13 (39.4%)
Male	12 (36.4%)	Thymoma	11 (33.3%)
Female	21 (63.6%)	Thymic Cyst	6 (18.2%)
Complications	n (%)	Thymic carcinoma	2 (6.1%)
PAL	4 (12.1%)	Hodgkin Lymphoma	1 (3.0%)
Atelectasis	1 (3.0%)	MG	
Abdominal Distension	1 (3.0%)	Absent	14 (42.4%)
Peroperative conversion	2 (6.1%)	Present	19 (57.6%)

MG: myasthenia gravis; PAL: prolonged air leak; TH: thymic hyperplasia

Table 2. Analysis of mean age, drain removal, postoperative stay and operation time based on the presence of malignancy. Malignant group consists of thymoma, thymic carcinoma and hodgkin lymphoma, on the other hand benign group consists of thymic cyst and thymic hyperplasia

	Malignant	Benign	p
Mean age	46.3±12.5	48.3±10.5	0.491
Drain removal (days)	3.50±3.48	2.05±0.97	0.093
Postoperative stay (days)	5.50±7.13	3.15±1.06	0.166
Operation time (minutes)	120.50±32.0	94.7±19.1	*0.007*

[7] The introduction of VATS has been associated with a significant reduction in these complications. In our study, the vast majority of patients were discharged within a short period after surgery and did not experience any significant postoperative complications. These favorable outcomes may be attributed to the advantages of the minimally invasive surgical approach in routine clinical practice.

In our study, all patients with thymoma, regardless of their myasthenia gravis status, underwent complete resection of the thymoma together with the entire thymic tissue. Although thymomectomy alone may be considered for early-stage thymoma, the surgical approach adopted at our institution is complete resection of the thymoma together with the entire thymic gland. Consistent with our surgical strategy, a study conducted by the European Society of Thoracic Surgeons (ESTS) Thymic Working Group recommended total thymectomy rather than simple thymomectomy for patients with thymoma. The authors also demonstrated that total thymectomy was associated with improved long-term survival, with a 5-year overall survival rate of 89% for total thymectomy versus 55% for simple thymomectomy.[8] Similarly, Kaba et al.[9] reported a 10-year disease-free survival rate of 96.6% following complete thymectomy for thymoma. Although simple thymomectomy has been reported to be associated with shorter operative time, reduced intraoperative blood loss, shorter hospital stay, and lower postoperative complication rates,[10–12] our findings demonstrate that chest tube duration and postoperative length of hospital stay are also remarkably short following VATS total thymectomy.

The introduction of VATS thymectomy and its adoption in many centers were primarily based on the right-sided triportal approach.[13–15] The right-sided approach is preferred because the right hemithorax provides a wider operative field than the left, and the confluence of the right and left brachiocephalic veins into the superior vena cava serves as an easily identifiable anatomical landmark. At our institution, we prefer a biportal VATS technique rather than the conventional triportal approach, utilizing an axillary port at the third intercostal space and an additional port placed in the sixth intercostal space at the inferolateral aspect of the breast. We believe that this approach provides better cosmetic outcomes and reduces postoperative pain compared with conventional triportal VATS.

Similar to many studies in the literature, our study also demonstrated a low complication rate. Nevertheless, it should be kept in mind that fatal complications may still occur following VATS thymectomy. In a study by Abdellateef et al.,[16] intraoperative bleeding was reported in 8.7% of cases, and conversion to open surgery was required in 1.8% of patients. In addition, catastrophic complications such as superior vena cava injury, aortic injury, and diaphragmatic injury have been reported, necessitating conversion to open surgery.[17]

Limitations

There are several limitations to this study. The first limitation is its retrospective design; however, as detailed patient data are routinely and meticulously recorded at our institution, all relevant information could be readily retrieved during data collection. The second limitation is the relatively small sample size. However, it should be noted that the incidence of conditions necessitating thymectomy, such as myasthenia gravis and thymoma, is relatively low.[18,19]

Conclusion

In our study, conversion to open surgery was required in 1 patient due to intraoperative bleeding. In patients with mediastinal tumors adjacent to the innominate vein, lower-extremity venous access should be established to allow effective and rapid fluid resuscitation in the event of intraoperative hemorrhage.

Disclosures

Ethics Committee Approval: This study was approved by The Ethics Committee of Kartal Dr. Lütfi Kırdar City Hospital (Number: 2026/010.99/29/17, Date: 30/06/2026)

Informed Consent: Written informed consents were obtained from patients who participated in this study.

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