GTS

Comparison of surgical techniques for early-stage thymoma: Feasibility of minimally invasive thymectomy and comparison with open resection

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Objective: The minimally invasive, video-assisted thoracoscopic surgical (VATS) approach to resection of the thymus is frequently practiced for benign disease; however, a VATS approach for thymoma remains controversial. The objective of the present study was to evaluate the feasibility of VATS thymectomy for the treatment of early-stage thymoma and to compare the outcomes with those after open resection.

Methods: A retrospective review of 40 patients who underwent surgical resection of early-stage thymoma during a 12-year period was conducted. Data on patient characteristics, morbidity, recurrence, and survival were collected. The primary endpoint studied was overall survival.

Results: Of the 40 patients, 14 underwent thymectomy for stage I and 26 for stage II thymoma; 19 were men and 21 were women (median age, 64 years; range, 35–86 years). Open thymectomy was performed in 22 patients, and VATS was performed in 18. The operative mortality rate was 0%. The tumor stage and number of patients undergoing adjuvant radiotherapy were comparable in both surgical groups. The median length of hospital stay was shorter in the VATS group (3 days) than in the open group (5 days) ($P = .0001$). The median follow-up was 36 months. No significant differences were found in the estimated recurrence-free and overall 5-year survival rates (83%–100%) between the 2 groups.

Conclusions: VATS of early-stage thymoma appears safe and feasible and was associated with a shorter hospital stay. The oncologic outcomes were comparable in the open and VATS groups during intermediate-term follow-up. Additional follow-up is required to evaluate the long-term results of thoracoscopic thymectomy for early-stage thymoma. (J Thorac Cardiovasc Surg 2011;141:694-701)

Tumors of the mediastinum are relatively rare.[1] Thymoma is the most common primary neoplasm of the mediastinum in the adult population, with surgery the primary treatment modality, except for very advanced stages.[2] In approximately 30% of patients with thymoma, myasthenia gravis (MG) is coexistent.[3] Several controversies exist with regard to thymomas, including the staging systems used, the approach to surgery, and the use of adjuvant therapy.

During the past 1 to 2 decades, minimally invasive approaches have been described for the performance of several thoracic procedures. These have included treatment of benign diseases and the treatment of esophageal and lung cancer.[4-8] Blalock and colleagues[9] described a series of patients with MG with improvement after thymectomy. Since then, thymectomy has been an important component in the management of MG.[9] In patients with thymoma, surgical resection with total thymectomy, performed using an open technique, typically with a sternotomy, has been the standard treatment. A recent systematic review of surgical resection for thymoma reported that the 5-year overall survival rate of patients with stage I and stage II thymoma ranged from 89% to 100% and 71% to 95%, respectively.[10] That review also concluded that the published evidence comparing various approaches, in particular, minimally invasive approaches, was insufficient with regard to the outcomes. Although some published data are available for thoracoscopic thymectomy for nonthymoma MG, very few data are available describing the outcomes after minimally invasive resection of thymoma.

The minimally invasive approaches described for the resection of thymus have included transcervical thymectomy and video-assisted thoracoscopic thymectomy.[11-14] Although these minimally invasive thoracoscopic approaches to

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Abbreviations and Acronyms
LOS = length of stay
MG = myasthenia gravis
VATS = video-assisted thoracoscopic surgery

resection of the thymus are frequently practiced for benign disease, a video-assisted thoracoscopic surgical (VATS) approach for thymoma remains controversial. The primary objective of the present study was to evaluate the feasibility of VATS thymectomy for early-stage (stage I and II) thymoma. Our second objective was to compare the intermediate-term outcomes of a minimally invasive approach (VATS) with those after open resection.

MATERIALS AND METHODS

We retrospectively reviewed our experience with thymectomy for the treatment of early-stage (stage I and II) thymoma at the University of Pittsburgh (during a 12-year period 1996–2008). The institutional review board at the University of Pittsburgh approved the study.

Patient Characteristics

A total of 40 patients who underwent thymectomy for stage I or II thymoma were identified. Of the 40 patients, 14 had stage I thymoma and 26 had stage II thymoma; 19 were men and 21 were women (median age, 64 years; range, 35–86 years). Open thymectomy was performed in 22 patients, and VATS resection in 18. MG was present in 11 patients (27.5%). The patient characteristics are summarized in Table 1.

TABLE 1. Patient characteristics

Characteristic	Value
Gender (n)	
Male	19
Female	21
Age (y)	
Median	63
Range	35–86
Stage	
Stage I	14
Stage II	26
WHO histologic type	
A	6
AB	12
B1–B3	20
C	1
Not determined	1
Surgical approach	
VATS	18
Open	22
Stage and surgical approach	
Stage 1	
VATS	5
Open	9
Stage 2	
VATS	13
Open	13
Median tumor size (cm)	
VATS	3.6*
Open	6.1
Myasthenia gravis	
VATS	7
Open	4

VATS, Video-assisted thoracoscopic surgical resection; *WHO,* World Health Organization. *$P = .0003$.

Surgical Technique

The technique of VATS thymectomy has been previously described[11-13] and can be performed with a unilateral or bilateral approach. In brief, general endotracheal anesthesia was established with a double-lumen endotracheal tube or a single-lumen tube with carbon dioxide insufflation. For the unilateral right-sided approach, the ports were placed along the right anterior axillary line, conforming to the mammary crease. Three 5-mm ports were placed in the third, fifth, and eighth interspaces. After right lung isolation, the inferior portion of the thymus was mobilized. Dissection was started in the normal thymus, away from the tumor, with minimal manipulation of the tumor to avoid any breaches in the capsule. It is critical that the tumor manipulation is kept to a minimum and that the plane of dissection is kept beyond the capsule. Similarly, direct traction by grasping the tumor should be avoided to limit capsular tears and contamination locally and in the pleural space. The dissection plane was extended cranially, taking care to preserve the integrity of the right phrenic nerve. The left portion of the thymus was mobilized free from the pericardium overlying the ascending aorta. The thymic veins were clipped and divided. The right and left thymic horns were dissected free, and the specimen was removed in a plastic retrieval bag.

Our current approach has been bilateral VATS, which promotes better visualization of key anatomic structures and facilitates the accomplishment of complete thymectomy. We have typically used a single-lumen tube with carbon dioxide insufflation, with the patient in the supine position. The procedure was begun on the left, and a similar 5-mm port arrangement was established. The mediastinal pleura was incised just anterior to the phrenic nerve. The base of the left thymic lobe was mobilized and retracted superiorly. All thymic and perithymic fatty tissue was mobilized en bloc with the specimen, allowing exposure of the underlying pericardium and aorta. The thymus was then carefully dissected along the innominate vein, and the thymic tributaries were clipped and divided. The dissection was continued to the innominate–superior vena cava junction. The cervical horns were mobilized and swept inferiorly with the specimen. Once maximal mobilization was achieved on the left, the ports and instrumentation were withdrawn. The lung was re-expanded with a red-rubber catheter positioned within the pleural space to evacuate the pneumothorax, and the catheter was removed. Similar to the left side, 3 ports were placed on the right side, and dissection was completed along the innominate–superior vena cava junction, the venous thymic branches were clipped, any residual attachments were divided, and the specimen was removed. The techniques for open total thymectomy have been well described previously.[15]

Data Collection

The objective of the present study was to determine the feasibility of a minimally invasive VATS approach for resection of early-stage thymoma and to compare the outcomes of minimally invasive VATS resection with those of standard open surgical resection. Information on patient demographics, co-morbidities, Charlson co-morbidity index,[16] the presence of associated MG, tumor characteristics, staging information, surgical approach, and adjuvant treatment was collected. The Masaoka staging system was used to define the stage I and stage II tumors.[17] In patients with MG, the Osserman score and the Myasthenia Gravis Foundation of America scores were collected.[18,19]