

# Minimally invasive radical thymectomy

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## Clinical vignette

We present the case of a 54-year-old female with long-standing history of myasthenia gravis, on whom an anti ACH antibody test was positive. We performed a minimally invasive video-assisted thoracoscopic thymectomy (VATS) on this patient. Preoperatively, the patient was stabilized with intravenous immunoglobulin (IVIg) and Mestinon (Pyridostigmine). The pre-operative workup included a computed tomography scan of the chest which showed thymic hyperplasia and no evidence of thymoma. Bilateral VATS radical thymectomy (Bi-VATS) is described, with complete exenteration of the mediastinum and cervical region (*Video 1*).

## Surgical technique

### Preparation

The patient is placed in a supine position with both arms abducted to enable a smooth left to right transition without repositioning, and the entire thorax is prepped and draped.

### Position

As we prefer to begin on the left, the patient's left arm is extended while the right arm remains abducted to a comfortable ninety degrees perpendicular. Three trocars are inserted through the left hemithorax to permit visualization of the entire mediastinum, with use of 8 to 10 mmHg of carbon dioxide for insufflation. The initial five millimeter port is placed two to three ribs below, inferior to the infra-mammary crease in the midaxillary line, and allows direct visualization for insertion of the

most caudal port. With time, our most caudal port has migrated so that it is now placed under direct visualization the anterior axillary line at the insertion of the diaphragm. The third port is placed in the infra-mammary crease. This port placement facilitates resection of diaphragmatic mediastinal fat, and also improves the neck dissection by allowing the instruments more direct access to the supra-innominate dissection.

### Operation

Presently, the majority of our resections, including those for thymoma, are performed by a minimally invasive approach. However, if after starting with a left VATS approach, a safe tumor resection is not possible, we convert to a trans-sternal open thymectomy. Thymic lesions with obvious vascular invasion on preoperative imaging are approached by an open technique. With either approach, great care is taken to not directly manipulate the thymus (touch-free thymectomy). A radical dissection as previously described by Jaretzki and Wolff using a bilateral thoracoscopic approach is started from the phrenic nerve and the diaphragm to the inferior portion of the thyroid (1). Using a LigaSure (Covidien, Mansfield, Massachusetts, USA), sharp dissection is begun at the diaphragmatic sulcus and continued across to the contralateral pleura. At this point, the mediastinal pleura is released from the sternum and the tissue in line with the left internal mammary vein is resected, leading the dissection to the brachiocephalic vein for easy and safe identification. Once the phrenic nerve has been identified, care is taken to preserve its vascularity while removing any adherent thymic tissue. We follow the phrenic nerve superiorly until the innominate vein is identified and



**Video 1** Minimally invasive radical thymectomy.

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dissected to allow visualization of all the tributaries to the thymus gland. Notably, thymic tissue almost always plunges under the phrenic toward the aorto-pulmonary (A-P) window. By incising the mediastinal pleura close to the phrenic nerve, the soft thymic fat and tissue is then easily delved from under the phrenic nerve. Using either a LigaSure or an appropriately sized clip, the branches are ligated. The innominate vein is freed anteriorly and inferiorly of all attachments until the right internal mammary vein is identified; this is a vital landmark as staying medial to this safeguards the phrenic nerve on the right. The dissection is extended above the innominate vein, identifying the carotid, innominate arteries and trachea. Through identifying these structures and avoiding dissection below the anterior plane of the trachea, all cervical horns and tissue can be dissected while protecting the recurrent laryngeal nerves. Dissection is extended to the inferior draining veins and horns of the thymus, and at this point the superior horns of the thymus can be identified. If for any reason this dissection is not possible, the surgeon should be prepared to add a cervical incision and an open neck dissection. A 16 French chest tube is placed in the pleural space and attention is then turned to the contralateral side. The left arm is taken off extension, and the right arm placed in an extended position. Three trocars are placed on the right side to permit visualization of the mediastinum. The dissection is performed along the entire phrenic nerve and diaphragmatic/cardiac recess, and is repeated on the right side in a similar fashion to the left.

### Completion

Once the thymus gland is dissected free, it is placed into

a bag and removed through the inferior site. A 16 French chest tube is placed in the right hemithorax with lung re-expansion before closure of all incisions in the standard fashion.

### Comments

#### Clinical results

A total of 140 Bi-VATS thymectomies were performed at our institution between January 2000 and June 2015. The average age was 52 years (range, 13-86 years), and there were 84 females and 56 males. Diagnoses for a Bi-VATS thymectomy included: myasthenia gravis [75], thymoma [20] and mediastinal masses [45]. Median length of stay was 2 days (range, 1-16 days), median ICU length of stay was zero days (range, 0-6 days), and blood loss was 20 mL (range, 0-600 mL).

#### Advantages

With minimally invasive techniques, a Bi-VATS thymectomy can be performed with the same radical approach as an open thymectomy (2,3). Our group, as well as other institutions, have reported their experiences in performing minimally invasive thymectomies (MIT) in patients with thymic lesions. We have suggested that Bi-VATS thymectomy is not inferior to median sternotomy in terms of disease control and that the morbidity of the thoracoscopic approach appears sufficiently low (4,5). Low perioperative morbidity and shortened hospital course make Bi-VATS thymectomy an attractive option for thoracic surgeons. Importantly, regardless of surgical approach, we believe the surgeon should strive for a complete maximal thymectomy.

#### Caveats

MIT may be safely used to approach both benign and malignant mediastinal lesions, with the expectation of achieving similar results to the standard open thymectomy. Convincing data support the use of any maximal approach so that the operating surgeon is able to perform a complete and maximal thymectomy.

### Acknowledgements

None.

## Footnote

*Conflicts of Interest:* The authors have no conflicts of interest to declare.

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