Evolution of bilateral VATS extended thymectomy

In the middle 1990s, VATS thymectomy procedures were attempted by several different surgeons for myasthenia gravis cases. Yim et al. started performing VATS extended thymectomy procedures in Hong Kong in 1993 and reported their experience with 8 cases in 1995 (1). In Japan, Ando et al. also reported 2 cases of bilateral VATS extended thymectomy with a cervical incision in 1996 (2). That latter study emphasized the merits of a VATS extended thymectomy in terms of reduced pain, smaller incision, and unnecessary postoperative mechanical ventilation, and also noted that a bilateral approach has an advantage of confirming the bilateral phrenic nerves. On the other hand, a disadvantage of longer operation time due to difficulty in resection of pericardial fat tissue was emphasized in the early period.

Soon after introduction of the VATS extended thymectomy procedure, an approach through the anterior cervical incision was added, because the peri-thymic tissues are thought to reside mostly around the upper poles of the thymus. Studies have shown that significant amounts of thymic and peri-thymic tissues are left behind without use of a cervical incision. Later, several additional techniques, including elevation of the sternum, division of the right internal thoracic vein, and CO₂ insufflation, served to make a cervical incision unnecessary and also providing a cosmetic advantage. Nevertheless, this procedure is still thought to be more invasive than a unilateral approach in terms of longer procedure time and bilateral thoracic incision.

Recently, a uniportal bilateral approach was reported and advancement to a reduced port might be a means for achieving a less invasive approach for a bilateral VATS extended thymectomy.

Keywords: Myasthenia gravis; cervical incision; elevation of the sternum; CO₂ insufflation

Abstract: Various bilateral VATS thymectomy procedures were introduced in the 1990's, of which a bilateral VATS extended thymectomy has an advantage of confirming the bilateral phrenic nerves and seems to be the most conventional method in use. Soon after introduction of the method, an anterior cervical incision approach was added, because peri-thymic tissues are thought to reside mostly around the upper poles of the thymus. Studies have shown that significant amounts of thymic and peri-thymic tissues are left behind without use of a cervical incision. Later, several additional techniques, including elevation of the sternum, division of the right internal thoracic vein, and CO₂ insufflation, served to make a cervical incision unnecessary and also providing a cosmetic advantage. Nevertheless, this procedure is still thought to be more invasive than a unilateral approach in terms of longer procedure time and bilateral thoracic incision. Recently, a uniportal bilateral approach was reported and advancement to a reduced port might be a means for achieving a less invasive approach for a bilateral VATS extended thymectomy.
wall is shown in Figure 1 (9,10), in which the original costal hooks are placed on the bilateral third ribs to maximize the operative field. Shiono et al. reported long-term outcomes of bilateral VATS extended thymectomy procedures with anterior chest wall lifting and cervical incision, including a 4-year remission rate of 44.4%, which was comparable to that reported for a trans-sternal extended thymectomy (11).

Development of bilateral VATS extended thymectomy without cervical incision

Shigemura et al. sought to determine the amounts of additional thymic or peri-thymic tissues resected through a cervical incision during bilateral thorascopic thymectomy procedures (12). They found that 0.8 g of thymic or peri-thymic tissue was able to be further resected by changing the head position with the neck flexed to drop the jaw onto the anterior chest. Then, cervical incision is further added, which enabled us to resect an additional 0.5 g of the tissue. Histopathologic studies have also revealed the presence of germinal centers as well as Hassall’s corpuscles in residual tissues in more than 70% of examined cases, which suggested that a VATS extended thymectomy without a cervical incision, might be an immunologically incomplete treatment for myasthenia gravis.

Later in 2011, we recognized that division of the right internal thoracic vein makes an approach to the anterior neck region from the right thorax easier, thus the transcervical approach was abandoned. Nakagiri et al. (13) reported that outcomes of bilateral VATS extended thymectomy procedures with anterior chest lifting without a transcervical approach in a flexed neck position were comparable to those noted in the previous report.

CO$_2$ insufflation into the thoracic cavity has been introduced to improve the anterior mediastinal view. With this technique, the left brachiocephalic vein is compressed by positive pressure inside the thoracic cavity, leading to further visualization of the anterior cervical region. Chan et al. reported results of bilateral VATS thymectomy using CO$_2$ insufflation in 2005 and noted avoidance of a cervical incision (14). Furthermore, this method has an advantage of reducing bleeding from small vessels.

Current bilateral VATS extended thymectomy method used at Osaka University Hospital

Based on the advancements noted above, the Osaka University General Thoracic Surgery group has established our current method for bilateral VATS extended thymectomy without a cervical incision (10), including patient position (Figure 2).

The techniques utilized are shown in Figures 3, 4. Briefly, the procedure starts in the right thoracic cavity with creation of 3 ports, then CO$_2$ insufflation is used to visualize the anterior mediastinum. Most of the procedures for dissecting the thymus as well as dividing the thymic veins are done from the right side, though we think that the left phrenic nerve should be confirmed from the left side. Dissection of the left lobe of the thymus is done in part from the left, though the left upper pole of the thymus is visualized more clearly and divided from the right side. Another advantage of a bilateral approach is that a better operative field can be obtained by mobilization of the thymus from the contralateral side. Lavage of the bilateral thoracic cavities is done with a physiological...
saline solution and hemostasis confirmed. Drainage tubes are inserted into the bilateral thoracic cavities, then the incisions are closed.

**Future perspectives for bilateral VATS extended thymectomy**

An advantage of a bilateral VATS extended thymectomy is ability to confirm the bilateral phrenic nerves and it seems to be the most conventional method available, though the procedure is thought to be more invasive than a unilateral approach in terms of longer procedure time and bilateral thoracic incision.

Caronia et al. reported a uniportal bilateral approach (17), in which advancement to the reduced port might be a solution to reduce the invasiveness of a bilateral VATS extended thymectomy.

**Figure 3** Right-side approach (15). The right lobe of the thymus is dissected from the superior vena cava immediately anterior to the right phrenic nerve. The right lower pole of the thymus is dissected from the pericardium. The right internal thoracic vein is divided using clips, then the anterior surface of the thymus is dissected from the anterior chest wall. The upper mediastinal space is opened, and the right upper pole of the thymus is dissected and the brachiocephalic artery is confirmed. The thymus is dissected from the left brachiocephalic vein, then the thymic veins are exposed and divided by an energy device or by using clips. A considerable portion of the left lobe of the thymus is dissected from the left pleura and pericardium. The left mediastinal pleura are confirmed and the left lobe of the thymus is dissected from the left pleura. The left pleura are opened and the left lung is confirmed, then the left lobe of the thymus is dissected from the ascending aorta. The left margin of the dissected thymus is marked with blue dye.


**Figure 4** Left-side procedure (16). This procedure moves from the right to the left side. A left-side thoracoscopy is started using 3 ports. The left lobe of the thymus is dissected from the pericardium with confirmation of the left phrenic nerve and the left lower pole of the thymus is dissected from the pericardium. The left brachiocephalic vein is confirmed from the left side, then the left upper pole of the thymus is dissected. By retracting the thymus from the right side, dissection of the thymus from the left brachiocephalic vein is easier to perform. Next, the procedure moves back to the right side. The left upper pole of the thymus is divided by an energy device from the right side.


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**Footnote**

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**References**


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