

## Diagnostic and Therapeutic Thoracoscopy for Mediastinal Disease

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**Objective and Methods:** In order to clarify the utility of video-assisted thoracoscopic surgery (VATS) for mediastinal disease, we analyzed retrospectively 34 thoracoscopic surgical cases (seven lymph node, nine thymic, eight cystic and 10 cases with solid lesions that excluded thymic diseases) between February 1993 and July 2002.

**Results:** In lymph node disease, adequate specimens were obtained in all cases; pathologic diagnoses were three sarcoidosis, two tuberculosis, and two other tumors. In thymic disease, all cases underwent thoracoscopic partial resection of the thymus. Conversion to thoracotomy or mediansternotomy was necessary in two cases of epithelial thymic tumors. In cases of cystic diseases, complete resections of the cysts were performed in five cases. Final diagnoses of these cysts were four bronchogenic, three pericardial, and one parathyroid cyst. In solid diseases, nine tumors were completely resected. Final diagnoses of these tumors were six neurogenic, and four other tumors.

**Conclusion:** VATS is an effective and reliable approach for managing mediastinal diseases. Cases of small lesions surrounded by thymic tissue, cystic lesions excluding lymphatic duct origin, and neurogenic tumors without evidence of intraspinal invasion are good indications for VATS. (*Ann Thorac Cardiovasc Surg* 2004; 10: 14–8)

**Key words:** thoracoscopy, mediastinal disease

### Introduction

Video-assisted thoracoscopic surgery (VATS) has been established as a standard practice for various thoracic diseases such as pneumothorax, peripheral pulmonary lesions, and some pleural diseases. Although VATS techniques are now becoming recognized as an effective approach for the diagnosis and treatment of some mediastinal diseases, the indications for or limitations of the VATS approach for each kind of mediastinal disease are still

under investigation. We analyzed 32 thoracoscopic surgical cases of various mediastinal diseases to clarify the utility and safety of VATS, and discuss the indication of VATS for mediastinal diseases.

### Material and Methods

From February 1993 to July 2002, 34 patients (15 males and 19 females, aged 20 to 78 years with a mean of 49.0 years) with mediastinal diseases underwent diagnostic or therapeutic thoracoscopy. All patients had undergone chest computed tomography (CT), which provided evidence of anterior mediastinal masses in 11 cases, middle in 14 cases, and posterior in nine cases. The mass size as calculated from CT scans, ranged from 2 to 12 cm in cystic lesions and from 1 to 10 cm in solid lesions. There were seven cases with lymph node diseases, nine with thymic diseases, eight with cystic lesions, and 10 cases with solid lesions but excluding thymic diseases. Symptoms were

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**Table 1. Lymph node diseases**

Case	Location	Procedure	Trocars number	Operation time (min)	Blood loss (ml)	Histological diagnosis
1. 72/F	LN#3	Biopsy	2	70	a little	Sarcoidosis
2. 65/M	LN#4	Biopsy	3	80	a little	Sarcoidosis
3. 53/M	LN#4	Biopsy	2	85	a little	Tb
4. 50/M	LN#3	Biopsy	4	315	280	Lymphoma
5. 25/F	LN#3	Resection	4	145	90	Tb
6. 30/F	LN#3	Biopsy	2	30	a little	Sarcoidosis
7. 56/M	LN#7	Biopsy	3	110	50	TCC meta

Tb, tuberculous lymphadenitis; TCC, transitional cell carcinoma; LN, lymph node; LN#3, pretracheal; LN#4, tracheobronchial; LN#7, subcarinal.

(Source: The Japan Lung Cancer Society)

**Table 2. Thymic diseases**

Case	Location (mediastinum)	Procedure	Approach	Tumor size (cm)	Operation time (min)	Blood loss (ml)	Histological diagnosis
1. 46/F	Anterior	pRe	Left Ts	4×3	80	25	Thymic cyst
2. 61/M	Anterior	cRe	Right Ts+α	1×1	230	530	SCC
3. 74/F	Anterior	pRe	Med	4×3	95	200	Thymic cyst
4. 69/F	Anterior	pRe	Right Ts+Med	3×2	85	25	Thymic cyst
5. 64/M	Anterior	pRe	Right Ts	2×2	170	200	Thymic cyst
6. 56/F	Anterior	pRe	Right Ts	4×3	95	50	HP
7. 74/M	Middle	pRe	Right Ts+α	5×4	130	a little	Thymoma
8. 78/F	Anterior	pRe	Left Ts+Med	3×2	120	a little	Thymic cyst
9. 22/F	Anterior	pRe	Right Ts	7×6	280	40	Thymus

pRe, partial resection of thymus; cRe, complete resection of thymus; Ts, thoracoscopy; Med, mediastinoscopy; +α, conversion to median-sternotomy (Case 2), mini-thoracotomy (Case 7); SCC, squamous cell carcinoma; HP, hyperplasia.

present in only two patients. One patient with a bronchogenic cyst had symptoms of cough and dysphagia. Another patient with a pericardial cyst had symptoms of dyspnea and palpitation, caused by severe heart failure.

In all cases, after induction of general anesthesia, single lung ventilation was performed and a pneumothorax was created on the operative side. The patients were positioned in the lateral or half lateral decubitus position. A 30° video telescopic camera was inserted through a port at the midaxillary line in the lower chest, or through a port at the subxiphoid for the mediastinoscopy in some cases of thymic lesion. Two or three more ports were used for introduction of the endoscopic instruments and extraction of resected tumors and bioptic specimens. Almost all resected tumors were placed in a plastic retrieval bag before thoracoscopic removal to reduce the risk to pleural and chest wall implants.

## Results

### Lymph node diseases (Table 1)

Seven cases underwent a thoracoscopy in order to obtain histological diagnoses of mediastinal lymphadenopathy.

None of these patients had accompanying lung carcinoma. Six cases underwent lymph node biopsy only, and one case underwent curative surgical procedure after the diagnosis of tuberculous lymphadenitis (Case 5); this case has been reported previously.<sup>1)</sup> Although four ports were required to dissect the lymph node adhesion to the lung in two cases, no cases required conversion to thoracotomy. Adequate specimens were obtained in all cases; pathological diagnoses found sarcoidosis in three cases, tuberculous lymphadenitis in two cases, and non-Hodgkin lymphoma in one case.

### Thymic diseases (Table 2)

We performed diagnostic and therapeutic thoracoscopy for thymic diseases in nine patients. Only two cases had shown abnormal shadow on chest X-ray film, and five had had thymic tumor detected incidentally by chest CT scan. Preoperative diagnoses were suspicious of thymic cyst in three, and solid lesions in four. All cases underwent thoracoscopic partial resection of the thymus, and the histological diagnoses were confirmed during operation. In the cases of thymic epithelial tumors, one case of tiny thymic squamous cell carcinoma required additional

**Table 3. Solid lesions (excluding thymic diseases)**

Case	Location (mediastinum)	Procedure	Trocars number	Tumor size (cm)	Operation time (min)	Blood loss (ml)	Histological diagnosis
1. 47/M	Superior	Resection	3	3×2	55	a little	Schwannoma
2. 36/M	Posterior	Biopsy	3	10×15	65	a little	Undifferentiated carcinoma
3. 56/M	Posterior	Resection	3	4×3	120	30	Schwannoma
4. 51/M	Middle	Resection	3+α	6×5	125	350	Schwannoma
5. 20/F	Anterior	Resection	4+α	9×6	300	300	Teratoma
6. 26/M	Posterior	Resection	3	6×4	150	a little	Schwannoma
7. 41/F	Middle	Resection	3	4×3	220	a little	Parathyroid adenoma
8. 47/M	Posterior	Resection	3	3×3	140	a little	Schwannoma
9. 20/F	Posterior	Resection	3	5×4	205	150	Granuloma
10. 24/F	Posterior	Resection	3	4×3	165	a little	Schwannoma

+α, conversion to thoracotomy.

**Table 4. Cystic lesions (excluding thymic diseases)**

Case	Location (mediastinum)	Procedure	Trocars number	Tumor size (cm)	Operation time (min)	Blood loss (ml)	Histological diagnosis
1. 56/F	Anterior	cRe	3	2×3	80	25	Bronchogenic cyst
2. 33/M	Posterior	pRe	4+α		230	530	Bronchogenic cyst
3. 42/F	Posterior	cRe	5	6×5	95	200	Bronchogenic cyst
4. 59/F	Anterior	cRe	2+α	2×2	85	25	Pericardial cyst
5. 55/F	Middle	pRe		15×10	170	200	Pericardial cyst
6. 62/F	Middle	pRe	3	6×5	95	50	Pericardial cyst
7. 51/F	Middle	cRe	3	3×3	130	a little	Bronchogenic cyst
8. 46/M	Middle	cRe	3	4×3	120	a little	Parathyroid cyst

+α, conversion to thoracotomy; cRe, complete resection; pRe, partial resection.

resection of the remnant thymus under median-sternotomy, while another case of stage I thymoma, which occurred from the right lower lobe and was located in the middle mediastinum, required partial resection of the thymus under mini-thoracotomy (this patient remains disease free nearly four years after the resection). The other seven cases with non neoplastic lesions underwent partial resection of the thymus only, by the thoracoscopic and/or mediastinal (below xiphoid) approach. There were no complications during or after operation. No recurrences of tumors or cysts were recognized in the follow-up period, which ranged from four to 48 months. A case of tiny thymic carcinoma (Case 2) has already been reported.<sup>2)</sup>

#### **Solid lesions (excluding thymic diseases) (Table 3)**

We performed diagnostic and therapeutic thoracoscopy in 10 patients for mediastinal solid tumors. All tumors were asymptomatic, but were suspected from chest radiograph, in nine cases, and from abnormal accumulation in the Sestamibi scan, in one case of ectopic parathyroid adenoma. Conversion to thoracotomy was necessary in two cases because of adhesion to the descending aorta.

Nine tumors were completely resected. The final diagnoses include six neurogenic tumors, one inflammatory tumor, one undifferentiated carcinoma, and one parathyroid adenoma. There were no complications and no recurrences of the tumors during the follow-up period, which ranged from eight to 96 months. For one case of invasive tumor in the posterior mediastinum, only a biopsy was performed, which yielded a diagnosis of undifferentiated carcinoma; this case had undergone chemotherapy, but succumbed 11 months later due to carcinomatosis.

#### **Cystic lesions (excluding thymic diseases) (Table 4)**

Eight patients with mediastinal cysts were treated by the thoracoscopic approach. All of these cases demonstrated an abnormal shadow on chest X-ray, and three patients had symptoms as mentioned above. Conversion to thoracotomy was necessary in three cases, because of adhesion to vital structures in one case, and rupture of the cyst in two cases. Complete resections of the cysts were performed in five cases, but a portion of the cyst wall was left in place because of adhesions in three cases. Final diagnoses of these lesions were bronchogenic cysts in four

cases, pericardial cysts in three, and a parathyroid cyst in one case. In five cases of complete resection of the cyst there was no recurrence during the follow-up period, which ranged from three to 126 months. In the three cases of partial resection of the cyst there were no recognized recurrences during the follow-up period, which ranged from 45 to 88 months.

## Discussion

The mediastinum is divided into the anterior (which includes the superior), middle, and posterior compartments. Because mediastinal masses encompass a wide spectrum in each location, it is important to use the appropriate diagnostic or therapeutic strategy in a given mediastinal compartment.

In the anterior mediastinum, the most common adult tumor is the thymic tumor: thymoma, thymic cyst, or (rarely) thymic carcinoma, germ cell tumor. Our strategy for anterior mediastinal tumors is the following. If the thymoma is suspected from preoperative CT or magnetic resonance imaging (MRI) findings and judged to be resectable, we perform thymectomy under median-sternotomy. In cases of suspicious lymphoma, germ cell tumors, or unresectable thymic epithelial tumors, either CT-guided percutaneous needle biopsy or the Chamberlain anterior mediastinotomy<sup>3)</sup> are selected. On the other hand, in cases of small lesions surrounded by thymic tissue, we think the VATS approach is both less invasive and most useful for obtaining the diagnosis. In such cases, we first perform a thoroscopic partial resection of the thymus including the tumor or cyst, and add resection of the remnant thymus under median-sternotomy if a histological diagnosis of thymic epithelial tumors is obtained.

It is generally agreed that complete thymectomy is the proper surgical treatment for thymic epithelial tumors. Although, several authors recently demonstrated that a total thymectomy can be performed with VATS,<sup>4-7)</sup> the indication for VATS thymectomy is still a subject of debate. Roviato et al. reported 21 cases of VATS thymectomy (four patients through a left thoroscopic approach and 17 through a bilateral thoroscopic approach) for stage I thymoma, with no cases of conversion to thoracotomy, and one recurrence in the follow-up (one to 75 months, at the time of the report).<sup>5)</sup> We believe that a further accumulation of clinical data has substantiated the utility of and indication for VATS for thymic diseases.

Many lesions located in the middle or posterior mediastinum are good indications for diagnostic and thera-

peutic thoracoscopy. Posterior mediastinal lesions are predominantly of neurogenic origin, while middle mediastinal ones include a variety of tumors (some lymph node lesions, bronchial or pericardial cysts, parathyroid adenoma, and so on). We treated eight mediastinal cysts by VATS, comprising four bronchogenic cysts, three pericardial cysts, and one parathyroid cyst. Of these, only two cases were symptomatic.

Treatment of mediastinal cysts, particularly for asymptomatic patients, remains controversial. Bolton and Shahian advocated surgical resection when symptoms exist or when a malignant cyst is suspected.<sup>8)</sup> On the other hand, some authors recommend resection of asymptomatic cysts because a high proportion of these becomes symptomatic during the course of observation.<sup>9,10)</sup> We basically recommend resection of the cyst so as to obtain a histological diagnosis, to curtail the symptomatic potential, and to avoid the possibility of omission of long-term observation at the out-patient clinic. We assumed that all mediastinal cysts excluding lymphatic duct origin were good indications for VATS. Lymphangioma or thoracic duct cysts are sometimes complicated with chylothorax or recur after operation. We have also reported a case of cystic lymphangioma located in the right upper mediastinum, which required reoperation by thoracotomy at another institution, 14 days after thoracoscopic surgery.<sup>11)</sup> If the cyst was suspected to be lymphangioma or a thoracic duct cyst during operation, we believe that conversion to thoracotomy is preferable, in order to dissect the tumor and ligate the lymphatic duct completely.

We operated on six cases of mediastinal neurogenic tumors (with the tumor size ranging from 3.0 to 5.5 cm) by VATS, and no cases necessitated conversion to open thoracotomy. Histological diagnoses of resected specimens were all benign Schwannoma. Malignant neurogenic tumors are unusual in adults, because 90% are of benign nerve sheath origin.<sup>12)</sup> Operation for mediastinal neurogenic tumors is indicated because malignancy can be excluded only by pathologic examination and because the tumor can extend to become intraspinal. We assumed that all small (probably under 6 cm) mediastinal neurogenic tumors not of the dumbbell type or without evidence of intraspinal invasion are good indications for VATS.

## Conclusion

VATS is a good option for the management of mediastinal diseases. Cases of small lesions surrounded by thy-

mic tissue, cystic lesions excluding those of lymphatic duct origin, and neurogenic tumors not of the dumbbell type or without evidence of intraspinal invasion are good indication for VATS.

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