Right Side Approach for Video-Assisted Thoracoscopic Thymectomy in Treating Myasthenia Gravis

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Background: Thymectomy is an effective method of improving myasthenia gravis. Video-assisted thoracoscopic surgery provides a new approach to thymectomy, for the treatment of myasthenia gravis. We present our experience using video-assisted thoracoscopic thymectomy to treat Taiwanese patients with myasthenia gravis.

Method: From January 1997 to August 2002, 51 patients with myasthenia gravis were enrolled: 18 males and 33 females, ranging in age from 11 to 64 years (average, 37.9 years). Preoperative Osserman's classifications were: class I, 11 patients; class IIA, 18 patients; class IIB, 18 patients; class III, 2 patients; and class IV, 2 patients. Only 2 patients received preoperative plasmapheresis; during surgery, all except 2, were placed supine position in the 45-degree left-lateral decubitus position under double-lumen intubated anesthesia. Both the thymic gland and anterior mediastinal adipose tissue can be harvested using the right-side approach for video-assisted thoracoscopic surgery.

Results: All procedures were performed using a right-side approach without conversion. The average operating time was 150 minutes (range, 120 to 260 minutes). The harvested thymus gland weighed an average of 49.4 grams (range, 21.4 to 90 grams). Two patients required prolonged postoperative ventilator support. Final pathologic results were: 3 encapsulated stage I thymomas, 45 hyperplastic thymus glands, and 3 atrophic thymus glands. Complications included 1 segmental atelatasis of the lung and 1 hemothorax; no surgical mortalities occurred. Mean postoperative hospital stay was 6 days (range, 4-20 days). After a mean follow-up of 36.1 months (range, 6-60 months), 47 (92.1%) patients experienced improvement or resolution of symptoms: 14 (27.5%) patients obtained complete remission without any medication, 14 (27.5%) patients were categorized as class 2, 21(41.1%) patients were class 3, 2 (3.9%) patients were class 4, and none were class 5, according to DeFilippi postoperative classification.

Conclusion: Complete thymectomy can be achieved by video-assisted thoracoscopic thymectomy, and this procedure is technically feasible and associated with favorable outcomes. (*Changhua J Med* 2003;**8**:149-154)

Key words: myasthenia gravis, video-assisted thoracoscopic surgery, video-assisted thoracoscopic thymectomy, thoracoscopic thymectomy

Introduction

The thymus gland is thought to play a central role in the pathogenesis of myasthenia gravis [1]. Thymectomy has long been an accepted treatment for this disorder, and is the treatment that offers the best chance of complete remission [2]. A variety of surgical approaches have been advocated, involving transcervical [3-5], transsternal [6-10], subxiphoid approach [11] and combined exposure of the anterior mediastinum [12,13]. The appropriate timing of the operation and the best surgical approach remain somewhat controversial. Landreneau successfully performed video-assisted thoracoscopic surgery (VATS) for resection of an anterior mediastinal tumor in 1992 [14]. Since 1993, more studies have reported the use of video-assisted thoracoscopic thymectomy (VATT) for the treatment of myasthenia gravis [15-22]. We report our method of thoracoscopic thymectomy, using a right-side approach to treating myasthenia gravis.

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Material and Methods

From January 1997 to July 2002, 51 patients with myasthenia gravis were referred to Changhua Christian Hospital, Changhua city for VATT. Per our hospital's protocols, preoperative plasmapheresis was not routinely administered. If a patient was receiving perioperative steroids, IV steroids with 1000 mg of solumedrol diluted to 400 mL of normal saline were infused for 4 hours during the perioperative period. As with any surgical procedure involving a patient with myasthenia gravis, neuromuscular blocking agents and aminoglycoside were avoided. A left double-lumen endotracheal tube was routinely used, but a bronchial blocker, which was used instead of a double-lumen tube, was occasionally needed for children and young females. Blood pressure was monitored with an arterial line and pulse oximetry was continuously monitored because 1 lung collapsed during surgery. Intraoperative pneumomediastinum with CO_2 was not necessary. All patients were placed in the supine position in the 45-degree left-lateral decubitus position. We routinely approached the thymus gland from the right side with 3 trocars and placed the first 10-mm trocar at the 6^{th} intercostal space in the midaxillary line. A 0-degree, 8-mm rigid scope (Karl Storz, Germany) was then placed through this trocar for visualization. Two subsequent trocars were placed, one usually at the third intercostal space in the midaxillary line and the other at the fifth intercostal space in the anterior axillary line (Figure 1). Occasionally, a fourth incision, measuring 2-3 cm in diameter at the second or third intercostal space just lateral to the sternum, was useful to retract a larger thymus gland or coincident thymoma out of the chest wall.

Basically, we dissected the adipose tissue, including pericardial fat, from the inferior-most portion of anterior mediastinal tissue just anterior to the phrenic nerve and above the diaphragm. The thymus gland and anterior mediastinal tissue were bluntly dissected from the retrosternal area until the superior vena cava and left innominate vein were ascertained. The superior ligament of the thymus can be easily identified, and both upper poles of the thymus gland can be freed from the cervical area by sharp dissection. Once the dissection was achieved, the specimen was easily extracted from the chest cavity by a specimen bag placed through an anterior trocar site (Figure 2). A small (Fr 24) chest tube was placed adjacent to the mediastinum. The lung was reinflated under direct vision. The remaining trocar sites were closed in 2 layers with a subcuticular suture. The patients were usually extubated in the operating room or postoperative room. Postoperative chest radiograph was routinely obtained to rule out any pneumohemothorax. The patients' preoperative medications (anticholinergic agents and steroids) were initiated orally in the recovery room.

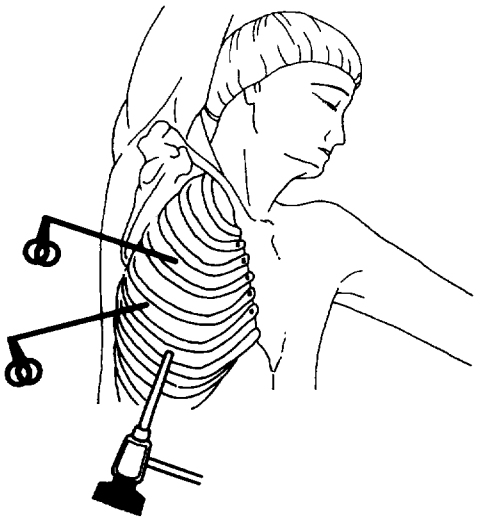

Figure 1. During the operation, patients were placed supine position in the 45 degree left lateral decubitus position under double-lumen intubated anesthesia. Usually three 1 cm incision wounds over anterior axillary line at the 3^{rd}, 5^{th} and 6^{th} intercostal spaces are necessary.

Figure 2. The completely harvested thymus gland.

Results

A total of 51 patients underwent VATT in our institution for the treatment of myasthenia gravis. The mean duration of symptoms prior to surgery was 38.2 months. More than 70% of patients were receiving steroids preoperatively. All patients were classified preoperatively by the Osserman's classification (Table 1) [22]. All procedures were undertaken using a right VATS approach without conversion. The average operating time was 150 minutes (range, 120 to 260 minutes). Most patients were extubated in the operating room or recovery room. The harvested thymus gland weighed a mean of 49.4 grams (range, 21.4 to 90 grams). Two patients required prolonged postoperative ventilator support more than one week. The final pathologic results were: 3 encapsulated stage I thymomas, 45 cases of hyperplastic thymus, and 3 atrophic thymus glands. Surgical morbidity included 1 segmental atelatasis of lung and 1 hemothorax, no surgical-associated mortalities occurred. The mean postoperative hospital stay was 6 days (range, 4-20 days). After a mean follow-up of 36.1 months (range, 6-60 months), 47 (92.1%) patients demonstrated improvement or resolution of clinical symptoms: 14 (27.5%) patients obtained complete remission without any medication, 14 (27.5%) patients were in class Class 2, 21 (42.1%) patients were in class 3, 2 (3.9%) patients were in class 4, none were in class 5 according to DeFilippi [4] postoperative classification (Table 2). Complications included an episode of bleeding from the junction of superior vena cava and left innominate vein, which was successfully stopped by the suture method using 6-O prolene without thoracotomy. One patient with concurrent pancytopenia and poor preoperative respiratory effort, as well as a concurrent 4-cm thymoma, developed postoperative respiratory failure and required prolonged ventilatory support for 7 days, despite the administration of preoperative plasmapheresis; this patient was discharged uneventfully on postoperative day 13 and obtained complete remission without any symptoms or medications at 5-year follow-up.

Table 1. Osserman classification of myasthenia gravis.

Class	Description	Patient No (%)
I	Ocular myasthenia gravis: involvement of extraocular muscles only	11 (21.6%)
IIa	Mild generalized myasthenia gravis: generalized weakness without respiratory muscle involvement	18 (35.3%)
IIb	Moderately generalized myasthenia gravis: significant manifestation of weakness with exercise tolerance	18 (35.3%)
III	Acute fulminating myasthenia gravis: rapid onset (within 6 months) of respiratory muscle involvement	2 (3.9%)
IV	Late severe myasthenia gravis: progressive in severity for 2 or more years	2 (3.9%)

Table 2. DeFilippi postoperative classification.

Class	Description	Patient No (%)
1	Complete remission, no medications	14 (27.5%)
2	Asymptomatic, decreased medications	14 (27.5%)
3	Improved, decreased symptoms or decreased Medications	21 (41.1%)
4	No change	2 (3.9%)
5	Worsening symptoms	0 (0%)

Discussion

Myasthenia gravis is an autoimmune disease affecting neuromuscular transmission [1]. Treatment of myasthenia gravis was first described by Sauerbruch in 1912 [23]. To date, thymectomy is an effective therapeutic option for treating myasthenia gravis with or without thymoma. There are various conventional approaches for thymectomy, but the best surgical approach remains controversial. The extent of thymectomy has also been a matter of debate. Most authors agree that it is important to remove the thymus as well as most of the

adjacent fatty tissue when treating myasthenia gravis [7,12,13].

Transsternal thymectomy is the most common operation performed by thoracic surgeons today because it is relatively easy to do, with low morbidity [6-10]. Transsternal thymectomy may provide a more complex dissection of mediastinal adipose tissue, rather than ectopic thymic tissue beneath the thymus gland and potential accessory cervical lobe. Herein, Jaretzki et al suggest that the maximal thymectomy allows wide exposure in the neck and mediastinum and removal of all surgically accessible thymic tissue via a T-shape incision that includes a transverse cervical incision and a vertical sternal incision [12]. The disadvantage of both the maximal thymectomy or transsternal thymectomy is the disfiguring scar necessitated by the procedure. Transcervical thymectomy was initially encouraged due to its lower morbidity and cosmetic effect. The best known of these techniques, described by Cooper, DeFilippi, and Ferguson et al [3-5], is reported to allow the removal of as much thymus as the maximal resection. The main concern with the transcervical approach is the inability to completely remove the whole thymus gland and ectopic thymic tissue within the anterior mediastinum [9]. Henze and Fischer noted that about 27% to 32% of patients in 2 series required reoperations because residual thymus has been found in all patients with a previously failing transcervical thymectomy [9,10].

Although both VATT and transcervical thymectomy can yield better cosmetic results, the former has additional advantages over the conventional transcervical approaches in that the visualization is much better and avoids a crowd of instruments through a single access site. Clinical course after VATT seems to be comparable to other series performed via the transsternal approach. Concern has been raised whether complete or total thymic resection is possible. In our experience, this procedure can provide a complete dissection of the whole thymus and complete anterior mediastinal adipose tissue, except in the vicinity of the aortopulmonary window or below the left innominate vein. Although the procedure is technically advanced, a well-trained thoracic surgeon familiar with the VATS procedure should be capable of performing thoracoscopic thymectomy. We advocate the VATS approach and hope that longer-term follow-up in a larger series will clarify the role of VATT in the management of myasthenia gravis.

Rucker and colleagues recommend the left-side approach based on the premise that most of the thymus gland is located left of midline [18]. However, we favor the right-side approach for the following reasons: First, there is more space in the right thoracic cavity and fewer limitations on visualization or instruments imposed by the heart and pericardium. Second, it is difficult to localize the left innominate vein or to approach the recess between the innominate vein and the superior vena cava from the left side of the chest. But, the right-side approach facilitates the identification of the innominate vein by upward dissection along the superior vena cava. Third, VATT is convenient to perform due to the direction of dissection from the level of the diaphragm to the neck for most surgeons accustomed to using the right hand. The only negative aspect of right-side approach is the limitation of not being able to perform an extensive dissection of tissue in the aortopulmonary window. Mineo and his associates utilized an adjuvant pneumomediastinum with carbon dioxide insufflation to facilitate dissection into the cervical area if the cervical area could not be well visualized [16]. However, we never adopted it. Occasionally, a fourth trocar site placed in the second or third intercostal space just lateral to the right border of the sternum is helpful, especially if there is a very large amount of mediastinal adipose tissue or coincident thymoma.

Most reports indicate that marked improvement can be expected after thymectomy in patients with a short preoperative duration [17], but the beneficial effects of thymectomy are usually delayed for months or years after the procedure. DeFilippi suggests patients are more likely to be improved or in remission if thymectomy is performed within the first year of the onset of symptoms [4]. The disease frequently occurs in young females and children, and there is frequently a reluctance on the part of these patients or their treating physicians to undergo a major surgical procedure because of cosmetically unacceptable surgical scars. Because the adverse cosmetic results are minimized with VATT, patients and their physicians are more willing to consider a surgical intervention. Additional investigations with long-term follow-up are needed to further clarify the role of VATT in thoracic surgery.

Conclusion

Thoracoscopic thymectomy provides an effective and safe approach to surgical intervention for patients with myasthenia gravis. We recommend a right-sided approach under double-lumen intubated anesthesia during surgery.

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從右側胸腔利用胸腔鏡施行胸腺摘除手術治療重症肌無力症

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胸腺摘除手術已經確定爲改善重症肌無力症的有效辦法，從西元一九九七年一月到西元二零零二年八月，我們收集了五十一個重症肌無力症的病患經右側胸腔利用胸腔鏡施行胸腺切除手術來治療重症肌無力症，其中三十三位是女性，十八位是男性，平均年齡是 37.9 歲。疾病嚴重度依 Osserman 氏分類法爲 Class I (十一位)、IIa (十八位)、IIb (十八位)、III (二位)、IV (二位)。手術前不需作例行性血漿置換術，手術時病患在雙管氣管插管麻醉下採左側半躺姿勢。施行胸腺及前縱膈腔脂肪組織切除手術。手術過程僅需要三個壹公分刀口，平均手術時間一百五十分鐘(一百二十到二百六十分鐘)，大多數患者能在手術房或是麻醉恢復室拔除氣管插管，有兩例患者手術後需要使用呼吸器時間較長。手術取出的標本平均重量爲 49.4 公克，以胸腺增生爲主，有三例合併有良性胸腺腫瘤，四十五例胸腺增生，三例胸腺萎縮。併發症包括一例胸腔出血及一例肺塌陷，沒有死亡病例發生。手術後平均住院時間爲六天。經過平均三十六點一個月的追蹤，四十七 (92.1%)例患者獲得明顯症狀改善。根據 DeFiLiPPi 的預後分類方法，其中十四(27.5%)例患者手術後沒有任何症狀也不需要再服用任何藥物，十四(27.5%)例患者屬於第二類，二十一(41.4%)例患者屬於第三類，二(3.9%)例患者屬於第四類，但是沒有屬於第五類的患者。我們建議經由右側胸腔鏡的幫忙，施行胸腺切除手術治療重症肌無力症是一個安全而且可行的方法。 (彰化醫學 2003;**8**:149-154)

關鍵詞：重症肌無力症，電視輔助胸腔鏡手術，電視輔助胸腔鏡胸腺切除手術，胸腔鏡胸腺切除手術

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