Reduced Port Thoracoscopic Surgery for Mediastinal and Pleural Disease: Experiences in a Single Institution

Masaya Tamura¹ · Yosuke Shimizu¹ · Yasuo Hashizume¹

Received: 28 January 2015 / Accepted: 26 August 2015 / Published online: 7 September 2015
© Association of Surgeons of India 2015

Abstract The purpose of this study was to present our current experience with reduced port thoracoscopic surgery (RPTS) for the treatment of mediastinal and pleural disease and thereafter discuss its indications and technical challenges. A total of 11 patients underwent surgery by the RPTS approach for the following conditions: thymoma ($n=2$), bronchogenic cyst ($n=2$), metastatic pleural tumor, thymic cyst, solitary fibrous tumor, pulmonary sequestration, pericardial cyst, neurinoma, and malignant lymphoma ($n=1$). An Endo Relief forceps (Hope Denshi Co, Ltd, Chiba, Japan) was used for three of the surgical procedures. The elements of the data set consisted of gender, age, duration of operation, drain placement, hospital stay, mass location, and mass size. The median surgical time was 45 min (range, 40–78 min). There were no intraoperative complications and no need for a second surgery to open additional ports. The duration until chest tube removal was 1 day for all the cases. The median hospital stay was 4 days (range, 3–6 days). The median mass size was 2.2 cm (range, 1.2–4.2 cm). The median length of skin incision was 2.0 cm (range, 2.0–3.5 cm). In conclusion, RPTS for mediastinal and pleural disease may be a possible alternative approach to conventional multiportal video-assisted thoracoscopic surgery (VATS). Although it is technically plausible and feasible for selected cases, the issues of patient acceptability and cosmetic and oncological results remain to be determined in the future with randomized-controlled trials and long-term follow-up.

Keywords Minimally invasive surgery · Reduced port surgery · Mediastinal and pleural disease · Single-incision video-assisted thoracoscopic surgery

Introduction

There are several advantages of thoracoscopic surgery, including minimal wound pain, less scarring, and a shorter postoperative hospital stay [1–3]. These advantages are the result of smaller incisions made during surgery; however, there may be additional benefits if even smaller incisions are made [4]. Efforts are underway to improve postoperative cosmetic outcomes by decreasing scarring even further. With the aim of decreasing the invasiveness of video-assisted thoracic surgery (VATS) further, Rocco et al. demonstrated the feasibility of performing pulmonary wedge resections through a uniportal VATS approach [5]. With regard to spontaneous pneumothorax, several studies compared reduced port thoracoscopic surgery (RPTS) and conventional 3-port VATS (3P-VATS) [6–8]. However, only a few studies have assessed the feasibility of RPTS for mediastinal and pleural disease. In this report, we present our current experience with RPTS for the treatment of mediastinal and pleural disease, and thereafter discuss its indications and technical challenges.

Clinical Experience

Patients

From April 2012 to February 2014, a total of 23 patients underwent surgery for mediastinal and pleural disease. Of these, a total of 11 patients (3 males and 8 females) underwent surgery by the RPTS approach for the following conditions:

✉ Masaya Tamura
masatamu2007@yahoo.co.jp

¹ Department of Surgery, Fukui Prefectural Hospital, Yotsui 2-8-1, Fukui, Fukui 910-8526, Japan

thymoma ($n=2$), bronchogenic cyst ($n=2$), metastatic pleural tumor ($n=1$), thymic cyst ($n=1$), solitary fibrous tumor ($n=1$), pulmonary sequestration ($n=1$), pericardial cyst ($n=1$), neurinoma ($n=1$), and malignant lymphoma ($n=1$) (Table 1). An Endo Relief forceps (Hope Denshi Co, Ltd, Chiba, Japan) was used for three of the surgical procedures (cases no 7, 8, and 9). All the cases enrolled in this study were operated on by a single surgeon (M.T.). The elements of the data set consisted of gender, age, duration of operation, drain placement, hospital stay, mass location, and mass size. The data were obtained retrospectively.

Surgical Procedure

Ethical Considerations

The protocol was approved by the Fukui Prefectural Hospital Institutional Review Board. Before enrollment in the trial, all patients provided a written, informed consent.

Surgical Technique

General anesthesia was administered to patients in the lateral or semi-lateral decubitus position via double-lumen endobronchial intubation. In addition, single-lung ventilation was established prior to surgery. A skin incision (2.0–3.5 cm) was placed, and a wound retractor system (Alexis Wound Retractor, Applied Medical, Rancho Santa Margarita, CA, USA) was applied. The length and position of the skin incision were changed depending on the size and location of the mass. A rigid 5-mm 30° video-thoracoscope, an endograsper, and an electric cautery were passed through the same single small incision. The mass was suspended using articulating endograspers (Covidien, Norwalk, CT, USA) and resected using electric cautery or harmonic knife, LigaSure. The mass was extracted in a protective bag through the incision under inspection by the thoracoscope. Endo Relief forceps (Hope Denshi Co, Ltd, Chiba, Japan) were used for retraction of the mass [9]. Placement of the Endo Relief forceps and the port depended on the location of the target area in the chest. Operative setup of single-incision thoroscopic surgery (SITS) (Fig. 1a) and SITS plus one puncture methods using Endo Relief (Fig. 1b) was shown. A 20-Fr chest tube was introduced under direct camera visualization and placed at the pleural apex.

Results

The median surgical time was 45 min (range, 40–78 min). Blood loss was minimal (range, 1–10 ml) in all patients during the surgery. There were no intraoperative complications and no need for a second surgery to open additional ports. The

Table 1 Clinical characteristic and surgical results

	Sex/age (years)	Diagnosis	Location of mass	Lateral	Mass size (cm)	Skin incision (cm)	Intercostal space	Line	Operating time (min)	Drain placement (days)	Hospital stay (days)
1	Male/60	Thymoma	Anterior mediastinum	Left	1.9	2.5	Fifth	Anterior axillary	40	1	6
2	Female/72	Metastatic pleural tumor	Parietal pleura	Left	1.2	2.5	Sixth	Median axillary	50	1	4
3	Male/64	Thymic cyst	Anterior mediastinum	Right	1.4	2.5	Fourth	Median axillary	78	1	5
4	Female/80	Thymoma	Anterior mediastinum	Right	4.0	3.0	Fifth	Anterior axillary	60	1	4
5	Female/81	Solitary fibrous tumor	Pulmonary pleura	Left	4.2	3.5	Fourth	Anterior axillary	45	1	5
6	Female/46	Pulmonary sequestration	Pulmonary pleura	Left	4.2	2.5	Seventh	Posterior axillary	45	1	4
7	Female/58	Pericardial cyst	Middle mediastinum	Right	2.8	2.0	Sixth	Median axillary	40	1	5
8	Female/54	Bronchogenic cyst	Middle mediastinum	Right	1.6	2.0	Fourth	Median axillary	45	1	3
9	Male/38	Bronchogenic cyst	Middle mediastinum	Right	2.2	2.0	Seventh	Posterior axillary	50	1	4
10	Female/46	Neurinoma	Parietal pleura	Left	3.1	2.0	Sixth	Anterior axillary	45	1	4
11	Female/83	Malignant lymphoma (biopsy)	Upper mediastinum	Right	1.2	2.0	Fourth	Anterior axillary	50	1	4

Fig. 1 Operative setup of SITS (a) and SITS plus one puncture methods using Endo Relief (arrow) (b)

duration until chest tube removal was 1 day for all the cases. The median hospital stay was 4 days (range, 3–6 days). The median mass size was 2.2 cm (range, 1.2–4.2 cm). The median length of skin incision was 2.0 cm (range, 2.0–3.5 cm). Two cases of thymoma (cases 1 and 4) are alive without recurrence 42 and 38 months after surgery, respectively.

Discussion

Single-incision or reduced port thoracoscopic surgery is considered by many to be the epitome of minimally invasive thoracic surgery because it further decreases access trauma compared with standard VATS [10]. There are several studies in literature supporting the feasibility of the single-incision approach for palmar hyperhidrosis [11], wedge resection for lung nodule [5] pneumothorax [6], and lobectomy for lung cancer [12]. However, there are very few reports in literature about reduced port surgery for mediastinal and pleural disease [13].

Benign disease such as cysts and biopsy of intrathoracic lymph node or metastatic tumor may be some indications for this procedure. The indication for thymoma should be considered with caution. It is important to remember that safety and curability cannot be neglected in pursuit of cosmetic properties and minimal invasiveness. Kaiser [14] reported that a complete resection of the tumor was sufficient treatment for Masaoka stage I and II thymomas. However, many reports questioned the necessity of total thymectomy on the grounds of extremely few cases of recurrence [15]. Thus, although there is a general consensus that a complete resection of the tumor should be performed, there is no consensus on the appropriate extent of thymic resection. In this series, a subtotal thymectomy was performed for two cases of non-myasthenia gravis thymoma (non-MG thymoma). It was ensured that pathologically the tumor was completely encapsulated, and resected with enough intraoperative margins.

The advantages of SITS or RPTS include better cosmetic outcomes, less incisional pain, and less paresthesia than those

associated with conventional multiport procedures because only one intercostal space is involved in the procedure. Although no prospective, randomized trials have been conducted so far to compare uniportal versus conventional VATS, the evidence in the literature is growing in favor of lesser postoperative pain and paresthesia with uniportal VATS [16, 17].

However, there are technological challenges with RPTS. For example, the RPTS technique is not naturally ergonomic because the traditional thoracoscopic principles of triangulation are lost. To overcome these limitations, new instruments are needed. In this report, we describe the use of new small-diameter forceps (Endo Relief forceps) [9]. The forceps were designed with ends that are the same size and structure as those of a conventional 5-mm forceps, except that the diameter of the shaft is lost at 2.4 mm. Endo Relief forceps have several advantages for use in thoracoscopic surgery. First, these forceps are safer with a lower risk for organ damage than the existing small forceps, which needs cautious surgical use. Second, Endo Relief forceps cause little scarring after surgery because it creates a smaller puncture wound and does not require a port for access. Third, these forceps are economical as the instrument is reusable and a trocar is not required.

The placement of the incision depends on the location of the target area in the chest. Appropriate instruments and the position of the port wounds are also important. With regular straight (non-cross) instruments, the mass cannot be resected if the port wound is at an inconvenient location. The need of using a trocar in such a procedure is controversial. When using a regular thoracopore, it is not possible to place multiple straight instruments within the trocar, which renders the procedure impossible. In the present series, the tumor was resected through an incision, which was smaller than the size of the mass. A wound retraction system provides wound dilation and protection when specimen removal is done through a smaller incision.

In conclusion, RPTS for mediastinal and pleural disease may be a possible alternative approach to conventional multiportal VATS. Although it is technically plausible and feasible for selected cases, the issues of patient acceptability

and cosmetic and oncological results remain to be determined in the future with randomized-controlled trials and long-term follow-up.

Conflict of Interest The authors declare that they have no competing interests.

References

- Shigemura N, Akashi A, Nakagiri T, Ohta M, Matsuda H (2004) Complete versus assisted thoroscopic approach: a prospective randomized trial comparing a variety of video-assisted thoracoscopic lobectomy techniques. *Surg Endosc* 18:1492–7
- Nagahiro I, Andou A, Aoe M, Sano Y, Date H, Shimizu N (2001) Pulmonary function, postoperative pain, and serum cytokine level after lobectomy: a comparison of VATS and conventional procedure. *Ann Thorac Surg* 72:362–5
- Landreneau RJ, Hazelrigg SR, Mack MJ, Dowling RD, Burke D, Gavlick J et al (1993) Postoperative pain-related morbidity: video-assisted thoracic surgery versus thoracotomy. *Ann Thorac Surg* 56: 1285–9
- Salati M, Brunelli A, Xiume F, Refai M, Sciarra V, Soccetti A et al (2008) Uniportal video-assisted thoracic surgery for pulmonary spontaneous pneumothorax: clinical and economic analysis in comparison to the traditional approach. *Interact Cardiovasc Thorac Surg* 7:63–6
- Rocco G, Martin-Ucar A, Passera E (2004) Uniportal VATS wedge pulmonary resections. *Ann Thorac Surg* 77:726–728
- Jutley RS, Khalil MW, Rocco G (2005) Uniportal vs standard three-port VATS technique for spontaneous pneumothorax: comparison of post-operative pain and residual paraesthesia. *Eur J Cardiothorac Surg* 28:43–46
- Berlanga L, Gigirey O (2011) Uniportal video-assisted thoracic surgery for primary spontaneous pneumothorax using a single-incision laparoscopic surgery port: a feasible and safe procedure. *Surg Endosc* 25:2044–2047
- Chen PR, Chen CK, Lin YS, Huang HC, Tsai JS, Chen CY et al (2011) Single-incision thoracoscopic surgery for primary spontaneous pneumothorax. *J Cardiothorac Surg* 21(6):58
- Ishii M, Nishiyama T, Naganuma H, Kaneshiro M, Nakui M, Ozawa S et al (2012) Development of new small diameter forceps for reduced-port surgery. *J Jpn Soc Endoscopic Surg* 17(2):267–71
- Gonzalez D, de la Torre M, Paradelo M, Fernandez R, Delgado M, Garcia J et al (2011) Video-assisted thoracic surgery lobectomy: 3-year initial experience with 200 cases. *Eur J Cardiothorac Surg* 40: 21–28
- Chen YB, Wu YW, Yang WT, Shi L, Guo XF, Xu ZH et al (2009) Uniportal versus biportal video-assisted thoracoscopic sympathectomy for palmar hyperhidrosis. *Chin Med J* 122(13):1525–8
- Chen CH, Lee SY, Chang H, Liu HC, Chen CH, Huang WC (2012) Technical aspects of single-port thoracoscopic surgery for lobectomy. *J Cardiothorac Surg* 7:50
- Ahn HY, Cho JS, Kim YD, Hoseok I, Lee J (2013) Single-incision video-assisted thoracoscopic surgery for benign mediastinal disease: experiences in single institution. *Korean J Thorac Cardiovasc Surg* 46(5):388–90
- Singhal S, Kaiser LR (2003) Comparison of stages I-II thymoma treated by complete resection with or without adjuvant radiation. *Ann Thorac Surg* 76:1635–41
- Murakawa T, Nakajima J, Kohno T, Tanaka M, Matsumoto J, Takeuchi E et al (2000) Results from surgical treatment for thymoma. 43 years of experience. *Jpn J Thorac Cardiovasc Surg* 48:89–95
- Salati M, Brunelli A, Rocco G (2008) Uniportal video-assisted thoracic surgery for diagnosis and treatment of intrathoracic conditions. *Thorac Surg Clin* 18(3):305–10
- Tamura M, Shimizu Y, Hashizume Y (2013) Pain following thoracoscopic surgery: retrospective analysis between single-incision and three-port video-assisted thoracoscopic surgery. *J Cardiothorac Surg* 12(8):153