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Original Research Article

Video-assisted Thoracoscopic Surgery for Primary Spontaneous Pneumothorax: A single Institution Experience

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Abstract: The objective is to review our experience of the treatment of primary spontaneous pneumothorax by video-assisted thoracoscopic surgery (VATS). We analyzed the clinical features of 90 primary spontaneous pneumothorax patients who underwent VATS from January 2009 to June 2015 at our institution. Retrospective chart review was followed by an on-clinic or telephone interview. Seventy-eight males and twelve female, with age ranging from 15 to 52 years (mean 28 years), were treated with VATS for primary spontaneous pneumothorax. The mean operative time was 58 min (range 39-147 min). There was no postoperative mortality. However, prolonged air leakage (>5d) occurred in five patient (5.5 %) who recovered after conservative treatment. The mean duration of chest tube drainage was 2.8 days and the median follow up period was 62 months. There were 2 recurrence cases during the follow-up. VATS is a safe and effective treatment option for primary spontaneous pneumothorax. VATS is recommended for patients with primary spontaneous pneumothorax as it has a shorter hospital stay and lower recurrence.
Keywords: Video-assisted thoracoscopic surgery (VATS), Spontaneous pneumothorax (SP), Surgery

INTRODUCTION

Spontaneous pneumothorax can be classified as of either the primary or secondary type. The primary spontaneous pneumothorax, which is defined as a pneumothorax without underlying lung disease, mostly affects young and thin males, and is usually caused by ruptured pleural bullae or blebs [1]. Primary spontaneous pneumothorax occurs in people without known underlying lung disease. Primary spontaneous pneumothorax tends to occur more commonly in their early 20s [2]. They are also more common in patients with Marfan syndrome, and can even be associated with some unusual conditions. For example, thoracic endometriosis leads to catamenial pneumothorax [3]. Primary spontaneous pneumothorax typically present with sudden onset of chest pain and dyspnea with diminished breath sounds on the affected side. Primary spontaneous pneumothorax can be life-threatening if it progress to tension pneumothorax. While tension pneumothorax can develop abruptly, cardiovascular compromise progress more gradually due to the existence of hemodyanamic deterioration [4]. Primary spontaneous pneumothorax requires prompt diagnosis and treatment.

PAITENTS AND METHODS

Patients

Between January 2009 and June 2015, 90 consecutive patients with primary spontaneous pneumothorax underwent videoassisted thoracoscopic surgery (VATS) at affiliated hospital of Guilin Medical University. The diagnosis of primary spontaneous pneumothorax was made on the basis of clinical, surgical and pathological criteria. Of these, 78 were men, 12 were women, and the average age was 28 years (ranging, 15-52 years). A left-side procedure was done in 54 cases, a right-side procedure in 32 cases and a bilateral procedure in 4 cases. The reasons for intervention were first episode with occupational risk or persistent air leak more than 5 days, recurrent ipsilateral pneumothorax, and bilateral pneumothorax. The study protocol was approved by the Institutional Review Board. Patient consent was not required because of the retrospective nature of the study.

Surgical procedures

In the lateral decubitus position, all 90 consecutive patients were operated on via three-port

VATS under general anesthesia using a double-lumen endotracheal tube. The lung on the operative side was deflated. When a chest tube was inserted preoperatively, a 10.5-mm trocar was inserted into that site and a 10-mm thoracoscope was introduced via the trocar. Otherwise, the first port was opened in the fifth or sixth intercostal space at the mid-axillary line, and a 10.5-mm trocar was inserted. The pleural cavity was examined initially for existing adhesions or effusion, and the locations of the lesions (bullae or blebs) were sought, especially in the apex. Based on the preliminary exploration results, the other two ports were created with optical observation in the fourth anterior and the fifth middle intercostal space (near the tip of the scapula) for thoracoscopic instruments. If pleural adhesion was found, it was separated and incised using electric hook or ultrasonic knife.

The location and size of the lesions were examined repeatedly in the apex, hilum and diaphragmatic faces. The endoscopic linear stapler was used to remove the pulmonary bulla or pulmonary air leakage tissue. If a normal visceral pleural was found, ablation of a small portion of the apical upper lobe was performed. Before the end of surgery and pulmonary dilatation was performed, sterile warm physiological saline was infused into the pleural cavity. The visceral pleura and parietal pleura were rubbed clean with gauze; thoracoscope was moved to the operation pole before closure. Following a careful bleeding and leakage control, a chest tube was inserted, and the operation was concluded.

RESULTS

All patients were successfully treated using VATS by the same team. Sixty patients (67%) underwent only stapled resection of the lesions, and 20 patients (22%) underwent only ablation of the lesions. The remaining 10 patients (11%) received both ablation and stapled resection of the lesions. The blood loss was so small (levels too low for measurement) that there was no transfusion in all cases. There were no complications during surgery.

Operating time depended on the presence of adhesions, on the number and extension of blebs or bullae over the lung surface. The mean operating time was 58 minutes (range, 39-147 minutes), the duration of drainage was 2.8 (range, 2-7 days), and the duration of hospital stay was 5.8 days (range, 3-16 days).

No related deaths occurred but some postoperative complications developed in 7 cases (9.4%), which was due to persistent air leak (> 5 days) in 5 cases (6.1%), and residual pneumothorax in 1 (1.1%), need to insert a new chest drain. None required reoperation.

All the patients were followed up to July 2016, with an average duration of follow-up for 62 months (range, 12-86 months). There were no cases of chronic pain requiring analgesia. Two cases of recurrence (2.2%) were seen.

DISSCUSION

Spontaneous pneumothorax can be classified as either primary or secondary. Primary spontaneous pneumothorax, which is defined as a pneumothorax without underlying lung disease, predominantly occurs more commonly in men, especially those who are tall, lean. It is usually caused by ruptured pleural blebs or bullae [5, 6]. The incidence of primary spontaneous pneumothorax depends on the region and ranges from 7.4 to 37 per 100,000 for males and 1.2 to 15.4 per 100,000 for females [7]. It rarely occurs in people at the age of more than 40 years [8].Our cases were at the mean age of 28 years old.

Surgical access for the management of primary spontaneous pneumothorax can be performed via conventional open techniques (usually axillary or lateral thoracotomy) or by minimal access. With advances in VATS equipment, most operations for primary spontaneous pneumothorax are usually performed with a minimally invasive technique that involves VATS [9].The success of VATS in the treatment of primary spontaneous pneumothorax has led to earlier referral by surgeons and increased acceptance by patients for surgery [10].

The goal of treatment for primary spontaneous pneumothorax is obtaining the lung re-expansion, preventing recurrences and controlling symptoms. Surgical management aims at the resection of blebs or the suturing of pulmonary perforation and the creation of pleurodesis. Recently, based on the minimal invasiveness of VATS, several studies have recommended VATS treatment for the first choice of primary spontaneous pneumothorax. The outcomes of VATS were very good compared to conservative treatment and equal to those of the conventional thoracotomy, not only for the first episode but also for the case of recurrence. Considering low invasiveness, low morbidity, and cosmetic issues, VATS is superior to conventional thoracotomy. VATS could be considered for treatment at the first episode of primary spontaneous pneumothorax [11-14].

There are some evidences to associate VATS with less access trauma and quicker recovery, with many realizing that trauma from VATS access is often worse than the surgery for correction [10]. Compared with their conventional counterparts, postoperative proinflammatory cytokine levels were lower and T cell subgroups as well as natural killer cells were less suppressed after VATS [15, 16]. VATS reduces

cytokine responses compared with conventional surgery. In addition, patients undergoing VATS required significantly less postoperative parenteral narcotics and pain medications than the conventional thoracotomy. However, the incidence of chronic pain, numbness, and disaesthesia after VATS procedures were present in 25% to 31% of patients and the rate of chronic pain was equal for VATS and thoracotomy [10]. In our institutional experience, many of the patients who underwent VATS for primary spontaneous pneumothorax thought that chest tube insertion upon admission was more painful than VATS.

Pulmonary function tests performed postoperatively after VATS for primary spontaneous pneumothorax showed little deterioration when compared with conventional thoracotomy. In contrast, patients who underwent thoracotomy for primary spontaneous pneumothorax had a 7.5% to 16% reduction in vital capacity before returning to preoperative values after five months [17]. The difference is probably attributed to access trauma from rib spreading in conventional thoracotomy. Furthermore, Li and his colleagues found patients undergoing VATS to have significantly less shoulder mobility dysfunction in the early postoperative period when compared with posterolateral thoracotomy [18].

Recently, single-port VATS has been introduced, and some authors have reported it to be associated with less paresthesia and more positive cosmetic outcomes [19]. Beginning in 2004, more and more techniques for single-port VATS resection have been introduced [20]. However, they also concluded that it was essential to use a wide range of roticulating instruments for single-port VATS and that the procedure was difficult to perform due to the presence of many instruments in the same port simultaneously. The disadvantages of the single-port procedure were the need for articulated instruments and the difficultly in handling them in the same port.

At our institution, an apical to midlevel pleurectomy and basal pleural abrasion are the mainstay of the thoracic surgeons. This method has been described previously and may optimize the VATS results [21]. VATS is associated with a less complicated postoperative course. Recent guidelines on the management of primary spontaneous pneumothorax released have highlighted a recurrence rate of approximately 5% with a VATS approach [22]. Complications of VATS procedures are rare and the frequency is estimated as 3–4% of treated patients [23]. The most frequent complication is prolonged postoperative air leak. The other significant complications are postoperative pain, bleeding, infections, and recurrence at the port site. Different complications of VATS procedures can occur with variable frequency in different institutions. By limiting the minimally invasive cohort of patients to those operated on by an experienced VATS practitioner, it was hoped that the effects of the VATS learning curve on recurrence rates could be eliminated, producing good outcomes. Although there was no statistically significant difference, some data indicated a trend towards higher recurrence rates in the VATS group, even in the context of reduced postoperative complications. The reasons for higher recurrence rates in minimally invasive procedures for pneumothoraxes have not yet been established. One hypothesis is that the open approach allows for greater visualization and therefore a more extensive pleurectomy, which correlates directly with a lower recurrence rate [22]. We maintain that many complications can be avoided by ensuring better operative technique.

Our study population was limited to patients of only one surgeon group routinely performing VATS procedures at our institution. A large scale patient data from multiple thoracic surgeons with routine VATS practice for primary spontaneous pneumothorax are needed in the future. Analysis of pooled data may allow us to discover how we can improve the long-term results of the VATS for primary spontaneous pneumothorax while maintaining the observed short-term and cosmetic advantages, which would be the ideal therapeutic option.

CONCLUSION:

In conclusion, VATS is a safe and effective procedure in the treatment of primary spontaneous pneumothorax. However, this study does have limitations, as it was performed retrospectively with a short mean follow-up period and a small population of patients.

CONFLICT OF INTERESTS

None declared.

AUTHOR'S CONTRIBUTION

Haiyong Wang and Angui Li wrote the paper. Tianci Qian, Qiong Wang, Feng Lin, Jianbin Sun, Zhenzong Du, Jianfei Song supervised the composition of the paper. All authors read and approved the final paper.

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