Video-assisted thoracic surgery for pulmonary aspergilloma

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Abstract

The purpose of this retrospective study was to review our experience with video-assisted thoracic surgery (VATS) for pulmonary aspergilloma. The patients (n=20) were aged 62±12 years, and eight (40%) were aged 70 years or more. The disease types were simple aspergilloma (SA) in six patients and complex aspergilloma (CA) in 14. The surgical procedures performed were lobectomy in 14 patients, segmentectomy in two, and wedge resection in four. The operation time was shorter (143±69 min vs. 216±85 min; P=0.08) and the blood loss was less (10±17 ml vs. 307±346 ml; P<0.01) for patients with SA than those with CA. Postoperative death occurred in one patient with CA who developed a bronchial stump fistula (30-day mortality; 5.0%). During follow-up, three patients died from other non-disease-related causes, and the remaining 17 patients survived without recurrence. The 5-year survival rate was 89%. In suitable cases, VATS for pulmonary aspergilloma may not be inferior to open surgery with regard to safety and efficacy. In particular, SA is considered to be a good indication for VATS.

Keywords: Aspergilloma; Lung infection; Video-assisted thoracic surgery; Outcomes

1. Introduction

Medical management of pulmonary aspergilloma is difficult. Surgery is a valid indication because unresolved cases may result in hemoptysis. Pulmonary resection, which is most likely to result in a complete cure, is the first-choice surgical procedure. Procedures, such as a cavernostomy with fungus ball removal are performed in patients with reduced pulmonary function or poor general condition. The rule in our department is to perform a pulmonary resection even in high-risk patients, taking advantage of the minimal invasiveness of video-assisted thoracic surgery (VATS). This report presents the details of patients who underwent VATS for pulmonary aspergilloma.

2. Materials and methods

This study was approved by the Toranomon Hospital Institutional Review Board of Clinical Research. The need for informed consent from patients was waived because of the retrospective design of the study.

2.1. Patient groups

Twenty-three patients with pulmonary aspergilloma were surgically treated at our department between 2001 and 2008 (20 underwent VATS, three underwent a thoracotomy). We analyzed the pre-, peri- and postoperative details of the 20 patients surgically treated by VATS. This series included four patients with invasive pulmonary aspergillosis (IPA) and hematological diseases. We operate on unresolved patients who have taken medication for several months, those who have side effects from antifungal agents or severe hemoptysis, if there is difficulty distinguishing the lesions from malignancy, and if there is a need for bone marrow transplantation or chemotherapy for the hematological diseases. All aspergillomas were retrospectively classified as simple aspergilloma (SA) or complex aspergilloma (CA) based on CT-scan image findings and the description reported by Belcher and Plummer [1]. SA has a thin-walled (<3 mm) cavity with little or no surrounding parenchymal disease. In contrast, CA has a thick-walled (>3 mm) cavity, surrounding parenchymal disease, and greater pleural thickening.

2.2. Operative technique

Patients were placed in the lateral decubitus position under general anesthesia with single-lung ventilation. For VATS, two 1-cm and one 7-mm port access incisions were made on the right side at the sixth intercostal space on the mid-axillary line, the fourth intercostal space on the anterior axillary line, and the fourth intercostal space on the posterior axillary line, respectively. All major pulmonary vessels and bronchi in the affected lobe were resected using an endoscopic stapler. One of the incisions was extended approximately 2.0–3.5 cm in length to facilitate the removal of the resected lobe from the thoracic cavity, which was extracted in a retrieval bag. A metal chest retractor was not used for this incision.
Table 1
Underlying factors

<table>
<thead>
<tr>
<th>Local factors</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tuberculosis sequelae</td>
<td>4</td>
</tr>
<tr>
<td>Emphysema</td>
<td>2</td>
</tr>
<tr>
<td>Lung abscess</td>
<td>2</td>
</tr>
<tr>
<td>Operation for esophageal cancer</td>
<td>1</td>
</tr>
<tr>
<td>Interstitial pneumonia</td>
<td>1</td>
</tr>
<tr>
<td>Systemic factors</td>
<td>4</td>
</tr>
<tr>
<td>Diabetes mellitus</td>
<td>4</td>
</tr>
<tr>
<td>Immunocompromised</td>
<td>4</td>
</tr>
<tr>
<td>No factors</td>
<td>4</td>
</tr>
</tbody>
</table>

2.3. Follow-up and statistical analysis

In May 2009, the survival data were updated based on information obtained from the charts, imaging findings, or by contacting the patients, their families, or the referring physicians. Continuous data are expressed as the mean ± standard deviation (S.D.). Survival rates were calculated by the Kaplan–Meier method.

3. Results

The patients were aged 62±12 years (range, 31–78 years), and eight patients (40%) were aged 70 years or more. Fifteen patients were male and five were female. The underlying diseases were systemic, such as diabetes and hematological diseases in eight, local diseases, such as pulmonary tuberculosis and pulmonary emphysema in 10, and neither in four (Table 1). Hemoptysis was observed in 12 (60%), of whom four underwent arterial embolization before surgery. Thirteen patients were treated preoperatively with antifungal agents for several months. The lesion sites were the right upper lobe in 11, right lower lobe in four, left upper lobe in four, and the left lower lobe in four.

3.1. Simple and complex aspergilloma

The disease types were SA in six patients and CA in 14. Four of the six SA patients (67%) and eight of the 14 CA patients (57%) were symptomatic. The surgical procedures performed were lobectomy in 14 patients, segmentectomy in two, and wedge resection in four. The mean lesion sizes were 31 mm in patients with SA, and 39 mm in those with CA. The operation time was relatively shorter (SA, 143±69 min; CA, 216±85 min; \( P=0.08 \)) and the blood loss was significantly less (SA, 10±17 ml; CA, 307±346 ml; \( P<0.01 \)) in patients with SA than those with CA (Table 2).

3.2. Mortality and long-term results

Death within 30 days after the operation was observed in one CA patient who developed a bronchial stump fistula (30-day mortality: SA, 0%; CA, 7.1%; total, 5.0%). There were no other major complications. During the follow-up period of 1–113 months (median, 43 months), three patients died due to other non-disease-related causes (pneumonia, AML, and liver failure in one patient each), and the remaining 17 patients survived without recurrence of the lesion. The five-year survival rate was 89% (SA, 100%; CA, 85%).

4. Discussion

In patients with pulmonary aspergilloma, surgical resection is generally performed by a thoracotomy because of severe adhesions and the risk for massive hemorrhage. However, because the preoperative general condition is unsatisfactory in many patients, minimally invasive surgery with a smaller incision is considered advantageous. Gossot et al. [2] reported VATS for 15 young patients with IPA. They concluded that in these debilitated and immunocompromised patients, a full thoracoscopic resection for a fungal infection is feasible, even for lobectomies. Furthermore, it allows a simpler postoperative course and minimizes sequelae. Several other authors have reported video-assisted wedge resections for IPA, and Whitson et al. [3] described a thoracoscopic lingulectomy for IPA. However, VATS for CA has not been reported until now.

We conducted VATS for pulmonary aspergilloma in 20 patients, and satisfactory outcomes without complications or recurrence were achieved in six patients with SA. In 14 patients with CA, the operation time was longer, blood loss was greater than in SA, and there was an operative death in one patient (7.1%). High mortality rates of 10.0–34.3% were previously reported in patients with CA [4–12], and mortality rates of 1.4–6.2% are still reported after 2000 [13–17]. It must be noted that many elderly patients were included in our series compared with previous reports, with eight patients (40%) aged 70 years or older (Table 3). The favorable results in the elderly patients are considered to have been due to the early postoperative recovery made possible by thoracoscopic surgery.

Table 2
Operative outcome

<table>
<thead>
<tr>
<th></th>
<th>Simple aspergilloma (n=6)</th>
<th>Complex aspergilloma (n=14)</th>
<th>( P )-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>57.3 (31–77)</td>
<td>63.9 (48–78)</td>
<td>0.41</td>
</tr>
<tr>
<td>Symptom</td>
<td>4 (67%)</td>
<td>8 (57%)</td>
<td></td>
</tr>
<tr>
<td>Procedure (L/S/W)</td>
<td>3/1/2</td>
<td>11/1/2</td>
<td></td>
</tr>
<tr>
<td>Size (mm)</td>
<td>31±21</td>
<td>39±16</td>
<td>0.40</td>
</tr>
<tr>
<td>Operation time (min)</td>
<td>143±69</td>
<td>216±85</td>
<td>0.08</td>
</tr>
<tr>
<td>Blood loss (ml)</td>
<td>10±17</td>
<td>307±346</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Chest drain (days, median)</td>
<td>1.5</td>
<td>2.0</td>
<td>0.91</td>
</tr>
<tr>
<td>Hospital stay (days, median)</td>
<td>5.5</td>
<td>8.0</td>
<td>0.51</td>
</tr>
</tbody>
</table>

L, lobectomy; S, segmentectomy; W, wedge resection.
Operative death occurred in a 70-year-old male with a history of surgeries for esophageal cancer (right thoracotomy) and middle pharyngeal cancer. He had undergone a thorascoscopic right upper lobectomy. The upper lobe was completely adherent, and the adhesion on the mediastinal side was particularly marked. Dissection of the upper lobe bronchus was notably difficult, and part of the membranous section was damaged and repaired by suturing. The bronchial stump was covered using bioabsorbable mesh and fibrin glue. The patient developed a bronchial fistula 11 days after surgery and died due to contralateral pneumonia 22 days after surgery. Lobectomy is a high-risk surgery in patients with pulmonary aspergillosis. In particular, adhesions on the mediastinal side are marked in patients after mediastinal lymph node dissection for lung or esophageal cancer, and dissection of the bronchus is difficult. Also, the bronchial wall is already ischemic due to previous lymph node dissection. Furthermore, after an operation for esophageal cancer, patients are in a particularly poor nutritional state before surgery and are likely to develop aspiration pneumonia postoperatively. These factors markedly increase the risk for postoperative complications. Reflecting on this experience, we consider that covering the bronchial stump or packing the thoracic cavity with a pedicled muscle flap is necessary in patients with such factors to prevent complications, such as pyothorax or a bronchial stump fistula.

If there is hemoptysis before surgery, and when marked adhesions to the thoracic wall are expected based on imaging findings, we perform preoperative percutaneous intra-arterial embolization. Many vessels supplying the lesion from the bronchial, intercostal, subclavian, and internal thoracic arteries often run through the adhesion site to the thoracic wall [18], and their preoperative embolization leads to the alleviation of symptoms, such as hemoptysis and bloody sputum and reduces hemorrhage during the adhesiotomy.

Furthermore, surgical resection of pulmonary aspergilloma complicated with hematological diseases makes post-operative bone marrow transplantation and chemotherapy possible. Surgery should be considered preferentially if there is a hematological disease. Thoracoscopic surgery, which allows for an early postoperative recovery, is a promising option.

This report describes our experience with 3-port access VATS for pulmonary aspergillosis in a small series of cases. The safety and efficacy of VATS for pulmonary aspergillosis needs to be further analyzed using a larger study group. Considering our experience, VATS can be safely applied to SA and CA without infiltration of the hilum, but the application of VATS in the case of CA close to the hilum or CA in patients after mediastinal lymph node dissection needs careful consideration, because dissection of the vessels and bronchi is remarkably difficult. For the present, we consider a pneumonectomy by VATS to be inapplicable. However, it is obviously important to quickly convert to a thoracotomy whenever facing intraoperative difficulty.

In conclusion, VATS for pulmonary aspergillosis, if applicable, might not be inferior to open surgery with respect to safety and efficacy. SA, in particular, is considered to be a good indication for VATS.

### References


