Sublobar Resection for Pulmonary Aspergilloma: A Safe Alternative to Lobectomy

Ping Yuan, MD, Jin-Lin Cao, MD, Sha Huang, MD, Chong Zhang, MD, Fei-Chao Bao, MD, Ye-Ji Hu, MD, Wang Lv, PhD, and Jian Hu, MD, PhD

Department of Thoracic Surgery, The First Affiliated Hospital, School of Medicine, Zhejiang University, Hangzhou, China

Background. **This study was performed to evaluate the effectiveness of sublobar resection for the treatment of pulmonary aspergilloma compared with lobectomy.**

Methods. **Patients with pulmonary aspergilloma who underwent lobectomy or sublobar resection in our department between March 2007 and December 2015 were retrospectively reviewed. Data were collected for patient demographic characteristics, medical history, preoperative investigations, perioperative findings, postoperative conditions, and recurrence status. Propensity-matched comparative analyses were performed to adjust for potential differences of patients' baseline characteristics between the groups.**

Results. **A total of 96 patients underwent lobectomy, 46 patients underwent attempted sublobar resection. The median follow-up time is 53 months. No recurrence was found in either group. Three patients (3.1%) in the lobectomy group required reoperation for bleeding. The patients who underwent sublobar resection had less underlying lung disease ($p = 0.031$), smaller lesions ($p = 0.033$), and were more likely to have been treated with video-assisted thoracic surgery ($p < 0.001$). These differences were eliminated by propensity score matching (46 pairs were successfully matched). Comparative analyses in matched groups demonstrate that there was no marked difference in the volume and duration of chest drainage or the length of postoperative hospital stay. However, the patients with sublobar resection had shorter operation time ($p = 0.004$), less blood loss ($p = 0.042$), and less postoperative complication ($p = 0.048$).**

Conclusions. **Sublobar resection performed for small simple pulmonary aspergilloma and selected complex pulmonary aspergilloma has a low recurrence rate and confers perioperative advantages compared with lobectomy.**

(Ann Thorac Surg 2017;103:1788–94)

Pulmonary aspergilloma (PA) is the most prevalent form of infection caused by *Aspergillus* in patients with or without underlying lung disease. It usually forms from the saprophytic colonization of preexisting pulmonary cavities by inhaled *Aspergillus fumigatus* which produce a fungus ball or mycetoma [1–3]. Surgical resection of both simple and complex aspergillomas is a definitive treatment option for patients with adequate pulmonary function [4–8]. Because of the infectious nature of aspergilloma, the success of surgical procedures depends on the ability to fully resect the lesion without spillage of fungal elements into the pleural space [9]. Although complete lobectomy or more aggressive procedures will lead to substantial loss of normal lung parenchyma, we are still inclined to choose those procedures to avoid possible recurrence [10].

Lesser resection such as wedge resection and segmentectomy have low rate of perioperative morbidity and can preserve more pulmonary function than anatomic lobectomy [11, 12] and in many cases allows for greater applicability of minimally invasive techniques [13]. Thus, we should always keep the priority of pulmonary-saving procedures in treating certain benign disease, even for malignant lung disease [14–16]. The prevalence of patients who underwent sublobar resection for PA has varied among previous studies (8% to 45.5%) [1, 2, 4–7]. Although researchers have reported that wedge excision can be performed when the aspergilloma is sufficiently small and located at the periphery of the healthy lung [17, 18], there is no proven benefit of sublobar resection for PA which is able to offer perioperative and long-term outcomes preferable to those of anatomic lobectomy.

In this study, we compared the perioperative data of a series of PA patients who underwent sublobar resection with patients who underwent lobectomy after propensity matching. The primary goal of this investigation was to determine whether sublobar resection confers an overall advantage over lobectomy in terms of intraoperative and postoperative outcomes; the second goal was to determine whether the patients who underwent sublobar resection were exposed to a higher risk of recurrence.

Accepted for publication Jan 3, 2017.

Address correspondence to Dr Hu, Department of Thoracic surgery, The First Affiliated Hospital, School of Medicine, Zhejiang University, No 79 Qingchun Rd, Hangzhou, 310003, China; email: dr_hujian@zju.edu.cn.

Published by Elsevier Inc.

0003-4975/$36.00
http://dx.doi.org/10.1016/j.athoracsur.2017.01.007

Patients and Methods

Patients and Surgical Procedure

This study analyzed consecutive patients undergoing surgical treatment for PA at the First Affiliated Hospital of Zhejiang University between March 2007 and December 2015. The study protocol was approved by the Institutional Review Board of the First Affiliated Hospital of Zhejiang University. The need for informed consent from the patients was waived because of the study's retrospective design.

The clinical records of all patients were collected and reviewed for demographic characteristics, medical history, preoperative investigations, intraoperative data, and postoperative course. Aspergilloma was confirmed by pathologic examination in all specimens from resected lungs. The types of aspergilloma were classified retrospectively on the basis of the findings of a computed tomographic scan and the report of Belcher and Plummer [19]: simple PAs were isolated within thin-walled cavities with no surrounding parenchymal disease, whereas complex PAs arose in thick cavities formed within grossly abnormal lung. Lesion size was defined as the maximum diameter of the pulmonary cavity where the fungal ball was located. Patients with a junior high school education or above were defined as educated, others were classified as uneducated. Severe pleural adhesion was defined as an area of adhesion that occupied more than 60% of the visceral pleura adjacent surface to the lung.

Generally, patients with adequate cardiopulmonary reserve capacity and localized PA lesion manifested by computed tomography were candidates for thoracotomy or video-assisted thoracoscopic surgery (VATS). We take wedge resection as the priority if the lesion met the following criteria: (1) localized unilateral PA, (2) less than 3 cm in size, (3) locates in outer one-third of the peripheral lung, and (4) a safe resection margin greater than 1 cm can be achieved. Segmentectomy is performed if it was difficult to preserve the sufficient margin by a wedge resection. Lobectomies were performed for patients with overlapped or more extensive disease.

Patients were placed in the lateral decubitus position, and all procedures were conducted under general anesthesia with single-lung ventilation. Conventional posterolateral serratus divided thoracotomies were performed in the open procedures. In general, lesion and all major pulmonary vessels and bronchi in the affected lobe were resected using endoscopic staplers. If more than one stapler was used, the lung wounds and the junction of the stapler line are reinforced by sutures using 4-0Prolene (Ethicon, Somerville, NJ). Before closing, the cavity was rinsed by 2 L of 0.5% povidone-iodine, and one or two chest tubes were placed at the end of the procedure, depending on hemorrhage level of each patient. The tubes were removed if it showed no air leak and the daily output was less than 200 mL. Patients were then discharged from the hospital if there was no main complication and no obvious pneumothorax or chest fluid by roentgenograms. All patients were told to take fluconazole (50 mg once daily) or voriconazole (200 mg twice daily) for 2 weeks.

Follow-Up

Follow-up data were obtained from the outpatient clinic chart reviews or by telephone calls to patients or families. The end point of follow-up was April 2016. The end points of the analysis included the incidence of disease recurrence, disease-free survival, and overall survival. Recurrence was defined as PA relapse within the same or other lobe of the lung confirmed by histologic or radiographic methods, or recurrent hemoptysis as the indication for another operation. The disease-free survival rate was defined from the time of operation until the first diagnosis of disease recurrence or the last follow-up. The overall survival rate was defined from the time of operation until death or last follow-up.

Statistical Analysis

We used propensity scoring matches before comparing the two cohorts (lobectomy and sublobar resection). The match is generated in a 1-to-1 fashion using all available clinical data. The variables for the propensity score matching were shown in Tables 1 and 2. Independent t tests were used for continuous variables and are summarized by median and range. Categorical data were summarized with frequencies and percentages and were compared using a χ_2 test. All p values were two-sided; statistical significance was assumed for p values of less than 0.05. All analyses were performed using IBM statistics SPSS version 24.0 (SPSS Inc, Chicago, IL).

Results

Baseline Characteristics

Between March 2007 and December 2015, a total of 142 patients with PA were diagnosed in our department. Among them, 96 patients underwent lobectomy, and 46 underwent sublobar resection, including 3 patients who underwent segmentectomy and 43 who underwent wedge resection. After matching was performed, 46 patients from the 96 patients for lobectomy were selected and compared with the sublobar resection group.

The baseline demographic characteristics and perioperative clinical characteristics between the two groups are shown in Tables 1 and 2. Patients who underwent sublobar resection tended to have less underlying lung disease ($p = 0.031$; Table 2), smaller lesions ($p = 0.033$; Table 1), and were more likely to be treated with VATS ($p < 0.001$; Table 1). After matching by propensity score, these differences were eliminated (Tables 1 and 2).

Surgical Procedure

Three patients in the lobectomy group were returned to the operating room for emergent re-open for postoperative thoracic bleeding (Table 3); the amount of blood loss was approximately 1000 mL for each patient. In 1 patient, the main bleeding source was an intercostal cauterized vessel that had ruptured as a result of coughing. The other 2 patients were returned to the operating room for multiple bloody exudations in the pleura. These 2 patients underwent adhesion lysis for severe pleural