

Pulmonary aspergilloma management: 5 years of experience from a tertiary hospital

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Abstract

Introduction: Pulmonary aspergilloma (PA) is a chronic lung infection. Lobectomy is the recommended surgical modality. However, recent studies have suggested that wedge resection may be better than lobectomy.

Aim: We compared short-term complications and mortality according to surgical methods in pulmonary aspergilloma.

Material and methods: In this study, we analyzed the patients diagnosed with PA in the period 2015–2019 at a tertiary hospital. We obtained the data about the age, gender, smoking history, symptoms, radiological findings, operation technique, complications, length of hospital stay, and mortality from the electronic patient files. Then we compared short-term complications and mortality according to surgical methods in PA.

Results: Of a total of 27 PA patients, 22 (81.5%) were male, with a mean age of 48.1 ±15.6 years. The most common symptom was dyspnea (48.1%). Nineteen (70.0%) of the patients had wedge resection and 6 (22.3%) of the patients had a lobectomy. Prolonged air leak and empyema were the most common postoperative complications. Prolonged air leak was significantly more common in lobectomy than in wedge resection ($p = 0.046$). There was no significant difference in other complications, hospital stay length, intensive care unit stay length or mortality between lobectomy and wedge resection.

Conclusions: Wedge resection can be safely performed in aspergilloma. Prolonged air leak was less common in wedge resection than in lobectomy.

Key words: aspergillosis, surgical technique, complication.

Introduction

Pulmonary aspergillosis (PA) is the general name of lung disease caused by species of the genus *Aspergillus*. It is the most common type of infection of the lung caused by *Aspergillus* species [1]. It occurs in healed tuberculosis cavities [2]. However, an underlying lung disease is not always necessary for the development of PA. In the current practice, surgery is the leading treatment option [3, 4]. Due to the high mortality and morbidity rates in PA surgery, the most appropriate operation approach should be determined on a case-by-case basis.

Lobectomy is the preferred operation modality. But, it may not be applicable in all cases, especially if the patient's pulmonary reserve is not sufficient or if there are extended adhesions. Chest surgeons are generally concerned about disruption of the cavity and distribution of the fungi into the pleural space in wedge resection. However, an algorithm for the management of PA has not been developed so far [3, 4].

Aim

In this study, we compared short-term complications and mortality according to surgical methods in pulmonary aspergilloma.

Material and methods

We analyzed a total of 27 patients with PA, confirmed histopathologically between January 2015 and December 2019. We obtained the data about the patients (age, gender, smoking history, symptoms, underlying diseases, radiological findings, operation modalities, length of hospital/intensive care unit stay, complications, and mortality) from the medical electronic files. As in the classification of aspergilloma by Belcher and Plummer, we classified a single isolated cavitory lesion with thin walls surrounded by normal lung parenchyma as simple aspergilloma. We classified thick-walled cavitory lesions surrounded by fibrotic pulmonary tissue, with vascular adhesions and accompanied by thickened pleura, as complex aspergilloma [5–7].

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We compared the complications, length of hospital stay, length of stay in the intensive care unit, and mortality rates of patients who underwent wedge resection with those who underwent lobectomy.

Ethical issues

We obtained ethical approval for the study from the Clinical Research Ethics Committee of Akdeniz University Faculty of Medicine (decision no: KAEK-355).

Statistical analysis

Statistical analysis of the data was performed using the SPSS 22.0 program package. Descriptive statistics for categorical variables were reported as number (*n*) and percentage (%) and for continuous variables as mean \pm standard deviation (SD). Differences of means between two independent groups were examined with the Mann-Whitney *U* test. Relationships of two independent categorical variables were interpreted by χ^2 analysis or Student's *t*-test. In all analyses, a value of $p \leq 0.05$ was considered statistically significant.

Results

We analyzed a total of 27 patients who were diagnosed surgically between 2015 and 2019 in Akdeniz University Hospital, Department of Chest Diseases and Thoracic Surgery. Of the 27 patients, 22 (81.5%) were male and 5 (18.5%) were female with a mean age of 48.1 ± 15.6 (range 21 to 84) years (Table I).

The mean age of the male patients was significantly higher than the mean age of the female patients (respectively, 51.5 ± 15.0 and 33.4 ± 7.8 , $p = 0.016$). 87.5% of patients had chronic cigarette exposure, of whom 62.5% were ex-smokers and 25% were current smokers. The mean smoking amount was 35.5 ± 17 pack-years. The most common symptom in our study was dyspnea (48.1%), followed by purulent sputum (40.7%) and hemoptysis (33.3%).

The most common aspergilloma localization was the upper lobe of the right lung (55.6%). It occupied the entire upper lobe in two of the patients. 55.6% of the patients had complex aspergilloma while 44.4% had simple aspergilloma. 33.3% of the patients had been operated on for a solitary pulmonary nodule and were diagnosed with aspergilloma. The others were associated with an underlying disease such as cavitation. The most common reason for the cavitation was tuberculosis (Table II). Bronchogenic cyst, pneumatocele, and emphysema were observed in 6 patients. 32.0% of the cavities were < 2 cm in diameter. 16.0% of the cavities were more than 5 cm in diameter.

Twenty-five (92.6%) of the patients had open surgery while only 2 (%) underwent bronchoscopic intervention as they were medically inoperable. Wedge resection and lobectomy were the most common open surgical procedures (Table III).

22.2% of the patients had a lobectomy. While the forced expiratory volume (FEV1) level of patients who underwent lobectomy was 2.80 ± 0.82 , it was lower in patients who un-

Table I. Demographic characteristics of the patients with pulmonary aspergilloma

Features	N	%
Gender:		
Female	5	18.5
Male	22	81.5
Age:		
≤ 35	7	25.9
36–45	6	22.2
46–55	4	14.8
56–65	7	25.9
> 65	3	11.1
Type:		
Simple	12	44.4
Complex	15	55.6

Table II. Distribution of some features of cases

Features	Male <i>n</i>	Female <i>n</i>	Total	
			<i>n</i>	%
Symptoms:				
Dyspnea	11	2	13	48.1
Purulent sputum	9	2	11	40.7
Hemoptysis	7	2	9	33.3
Incidental	3	2	5	18.5
Chest pain	2	0	2	7.4
Location:				
Upper right	12	3	15	55.6
Upper left	7	0	7	25.9
Right median	3	1	4	14.8
Lower right	3	0	3	11.1
Lower left	0	1	1	3.7
Etiology:				
Pulmonary nodule	8	1	9	33.3
Tuberculosis	7	0	7	25.9
Bronchogenic cyst, sequestration, pneumatocele emphysema	6	0	6	22.2
Bronchiectasis	1	2	3	11.1
Other pulmonary cavities	3	2	5	18.5
Cavity size:				
< 2 cm	7	1	8	32.0
2–3 cm	7	1	8	32.0
4–5 cm	2	2	4	16.0
> 5 cm	5	0	5	20.0

Table III. Applied surgical methods in cases

Applied treatment methods	<i>n</i>	%
Wedge resection	17	63.0
Lobectomy	6	22.2
Wedge resection + decortication	1	3.7
Wedge resection + bronchoscopy	1	3.7
Bronchoscopy	2	7.4

Table IV. Comparison of postoperative complications in wedge resection and lobectomy

Variable	Lobectomy		Wedge resection		P-value
	n	%	n	%	
Post-op. complication:					
Prolonged air leak	5	83.3	7	36.8	0.046
Empyema	4	66.7	5	26.3	0.072
RBC transfusion need	2	33.3	4	21.1	0.053
Hemothorax	3	50.0	3	15.8	0.087
Mortality	2	33.3	2	10.5	0.184
No	1	16.7	11	57.9	0.078
Intensive care unit stay [days]:					
1	0	0	2	10.5	0.898
2	1	16.7	7	36.8	0.355
3	2	33.3	3	15.8	0.348
4+	3	50.0	7	36.8	0.566
Hospital stay [days]:					
≤ 7	0	0	5	26.3	0.288
8–14	2	33.3	7	36.8	0.875
15–28	2	33.3	3	15.8	0.348
≥ 29	2	33.3	4	21.0	0.539
Antibiotic use period [days]:					
≤ 3	0	0	8	42.1	0.129
4–7	2	33.3	5	26.3	0.738
8–14	1	16.7	2	10.5	0.686
> 14	3	50.0	4	21.1	0.168
Total	6	100.0	19	100.0	

derwent wedge resection (1.24 ± 0.42) (*p* = 0.06). Forced vital capacity (FVC) levels were similarly lower in those who underwent wedge resection. While the FVC was 3.21 ± 0.73 in patients with lobectomy, it was 1.64 ± 0.56 in patients with wedge resection (*p* = 0.06).

The mean intensive care unit stay was 3.9 ± 3.0 days (median 3 days) and hospital stay was 32.6 ± 48.9 days (median: 12 days). The mean length of stay in hospital of female patients was shorter than that of male patients (*p* < 0.05). The mean length of stay in the intensive care unit of female patients (1.8 ± 0.8 days) was shorter than that of male patients (4.4 ± 3.1 days) (*p* < 0.05). Prolonged air leak (%) and empyema (%) were the most common postoperative complications. Prolonged air leak was significantly more common in lobectomy than in wedge resection (*p* = 0.046). No other significant difference was present in complications between lobectomy and wedge resection. There was no significant difference in hospital stay length, intensive care unit stay length and mortality between lobectomy and wedge resection either. The postoperative complications in wedge resection and lobectomy are shown in Table IV.

A total of 6 patients died after the operation and 4 of them died during the early period while 2 of them died later. Two of the patients who died were the patients who under-

went bronchoscopy. These patients were very old and had serious comorbidities. Thus, they had undergone bronchoscopic intervention instead of surgery. Empyema had developed in 50% of the patients who died. The other 3 patients' death was associated with serious comorbidities such as sarcomatoid carcinoma, cardiac arrhythmia, and heart attack.

Discussion

In this study, we observed that PA was more common in men than women. Most of the patients had complex PA and the most common symptom was dyspnea. PA was mostly localized in the right lung and upper lobe of the right lung. Tuberculosis was the most common underlying pathology. The cavities were generally 1–2 cm in diameter. The most common postoperative complications were prolonged air leak and empyema. Both of them were more common in cases with wedge resection. However, there was no significant difference in hospital stay length, intensive care unit stay length, and mortality between lobectomy and wedge resection. So, wedge resection can be safely performed in cases where lobectomy is not possible.

A gender difference has been reported in the previous studies with PA [8, 9]. In a study with the highest number of PA patients (*n* = 256), it was reported that 58% of the patients were male and the mean age was 45 years old [10]. In other studies, the prevalence of men with PA was reported as 56.7% and 72.7% [7, 8]. In a study with 26 PA patients from Turkey, the majority of the patients were male also and the mean age was 41.5 years old [11]. Like the previous research, male gender was more common (81.5%) in our study also. The reason why PA is more common in men than women is not known.

Patients with PA are generally asymptomatic [12]. Cough, dyspnea, malaise, weight loss, and hemoptysis may be present [5, 8, 12]. In a study from the USA, the prevalence of asymptomatic patients was 15%. Hemoptysis (55%) was the second most frequent following symptoms related to underlying lung disease (78%) [8]. Hemoptysis was also reported as a frequent symptom in a study from Turkey [11]. In our study, no one was asymptomatic, and the most common symptom was dyspnea (48%), followed by purulent sputum and hemoptysis. There are differences between the results of studies in this respect. This difference in symptom distribution may be related to underlying lung disease. Delays in the diagnosis of aspergilloma may also be contributing to this.

In our study, tuberculosis was the most common underlying lung disease. We do not know the exact prevalence of tuberculosis in patients with PA, but tuberculosis has been reported at much higher rates before [10, 11, 13, 14]. The prevalence reported in one of these studies was as high as 71–85% [10, 11]. A more similar tuberculosis prevalence rate (32%) to our study was reported in a study conducted in the USA [8]. The reason for this high variability in prevalence may be differences in TB vaccination rates. Inability to access health services and low income may be other factors affecting the underlying disease.

Previous studies have shown that aspergilloma is usually solitary and localized to the upper lobe [9, 11, 14]. In our study, all cases were solitary. Aspergilloma developing in the small cavity may completely fill it. Thus, it may present as a solitary pulmonary nodule and mimic malignancy. The presence of a solitary pulmonary nodule, especially in the upper lobe, may further increase the suspicion of malignancy. The right lung was the most frequently involved site and the most frequently affected lobe was the right upper lobe in our study. Similarly, it has been reported that the most common aspergilloma localization in the lungs is the upper lobes. Previously reported upper lobe involvement rates were 78% and 88% [9, 11]. Right lung involvement was the most common localization of aspergilloma in these studies also. Aspergilloma was localized in the upper lobe in 81.5% and in the upper lobe of the right lung in 55.6% of the patients in our study. The majority of the patients (56%) had complex aspergilloma in our study. Complicated aspergilloma was present in 62.5% of the patients in a study from China and in 78.3% from the USA [8, 10]. The tendency to be localized and complex in the upper lobes may be due to the fact that PA usually develops in tuberculous cavities.

In a recent study, the authors recommended surgery for aspergilloma for patients with extensive symptoms (particularly persistent hemoptysis) for whom a smaller resection than pneumonectomy can be performed because the risk of postoperative complications is very high [15]. Anatomical resection is recommended as the surgical treatment of aspergilloma. Segmentectomy may result in disruption of the cavity and intrapleural release of the fungus [16]. Also, massive air leakage is more common in this method. Lobectomy has been the procedure of choice in pulmonary aspergilloma. However, adhesions or low pulmonary reserve may make lobectomy impossible. Pneumonectomy carries a high risk for empyema and bronchopleural fistula. Therefore, it is recommended in cases with a destroyed lung. In our study, we observed that wedge resection was performed more often than lobectomy. However, contrary to expectations, less prolonged air leakage and empyema occurred in wedge resection. Also, wedge resection did not provide the advantage of a shorter hospital stay. Mortality rates of wedge resection and lobectomy were similar. So, due to similar complications and mortality rates, wedge resection can be considered as an alternative to lobectomy in aspergilloma, especially if there are adhesions or low pulmonary reserves.

Wedge resection may potentially be better for patients treated for aspergilloma because this surgical modality has a lower risk of postoperative complications and better early outcomes. Yet, recurrence rates are quite high in PA surgery. It has been previously reported that it can recur in up to 5–26% of cases [1, 2]. Recurrence develops due to spread of the fungi to other parts of the lung during surgery. Inadequate resection is another reason for recurrence [1]. Recurrence risk may be higher in wedge resection. Wedge resection may often not be an appropriate option in PA surgery, as the aspergilloma is usually large and occu-

pies almost all of a lobe. However, wedge resection may be required in patients with very limited lung reserves and in patients with small aspergilloma. In order to reduce the recurrence risk in wedge resection, the surgeon should avoid excessive compression so that the cavity contents do not discharge into the bronchial system. Moreover, they should pay attention to the resection margins at a sufficient distance and consider the wedge resection as an option in PA surgery on a case-by-case basis.

Our study has a few limitations. It is a retrospective single center study. Our population is small in number and there is no control group. Additionally, the postoperative follow-up period may not be sufficient to evaluate the frequency of local recurrence after wedge resection and lobectomy. There is a need for more comprehensive studies investigating the complications in aspergilloma surgery and the selection of surgical methods.

Conclusions

Wedge resection can be performed in patients for whom lobectomy is impossible. It can be safely performed in aspergilloma because the complication and mortality rates are low. Wedge resection is an alternative to lobectomy in aspergilloma in the case of low pulmonary reserve or adhesions. Although our study, along with some studies, has shown this, there is a need for more comprehensive studies that can contribute to the selection of surgical methods in aspergilloma.

Disclosure

The authors report no conflict of interest.

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