

Surgical management of pulmonary aspergilloma: clinical experience with 77 cases

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Background/aim: This retrospective study evaluated the clinical presentation, underlying lung disease, surgical indications, technique, treatment outcomes, and postoperative complications of pulmonary aspergilloma.

Materials and methods: We evaluated 77 patients who underwent pulmonary resection of an aspergilloma at Atatürk Chest Diseases and Thoracic Surgery Research and Training Hospital between January 2000 and December 2013. The initial operations were 4 pneumonectomies, 24 lobectomies, 9 lobectomy plus myoplasties, 10 segmental resections, and 30 wedge resections. Six reoperations were carried out to deal with postoperative complications: 1 myoplasty, 2 completion lobectomies plus myoplasties, 2 myoplasties with rib resections, and 1 completion lobectomy.

Results: The subjects comprised 53 males (mean age: 44.26 (range: 10–73) years) and 24 females (mean age: 48.25 (range: 26–70) years). The most common indication for surgery was hemoptysis in 52 patients (67.53%). The most common underlying lung disease was tuberculosis in 37 patients (48.05%). Forty patients (51.94%) had a simple pulmonary aspergilloma and 37 (48.05%) had a complex pulmonary aspergilloma. Major complications occurred in 18 patients (23.37%). The postoperative mortality rate was 3.89%, with 3 patients dying.

Conclusion: Surgical resection of pulmonary aspergilloma is the best way to prevent recurrent hemoptysis with low morbidity and mortality.

Key words: Aspergilloma, surgery, complication

1. Introduction

Pulmonary aspergilloma is the most common human disease caused by saprophytic species of the genus *Aspergillus* (1,2). It involves the formation of a fungus ball or mycetoma. Antifungal agents are usually ineffective and a cure can be achieved only with surgical treatment (1,3,4). Patients with an aspergilloma require surgical treatment because there is a risk of sudden life-threatening hemoptysis, and alternative medical treatments are usually ineffective. However, the surgical indications remain controversial because of the high incidence of postoperative complications (1,5,6).

This retrospective study analyzed the clinical presentation, underlying lung disease, surgical indications, techniques, treatment outcomes, and postoperative complications of pulmonary aspergilloma.

2. Materials and methods

We operated on 77 patients for pulmonary aspergilloma between January 2000 and December 2013. The medical

records were reviewed to determine the patients' history, clinical presentation, underlying lung disease, indications for surgery, surgical procedures, and postoperative complications. The subjects included 53 males (mean age: 44.26 (range: 10–73) years) and 24 females (mean age: 48.25 (range: 26–70) years).

The patients were diagnosed based on history and radiological findings on a posteroanterior lung X-ray or computed tomography. We classified the lesions as simple pulmonary aspergilloma (SPA) if the lesion was well-localized, with a thin-walled cavity smaller than 5 cm and little or no surrounding atelectasis or consolidated areas. Lesions were classified as complex pulmonary aspergilloma (CPA) if they were well-localized, thin-walled cavities larger than 5 cm or with thick walls, and surrounded by parenchymal sequelae as disseminated consolidation and atelectasis resulting from underlying lung disease, such as bronchiectasis or tuberculosis in most cases (Figure 1) (7–11).

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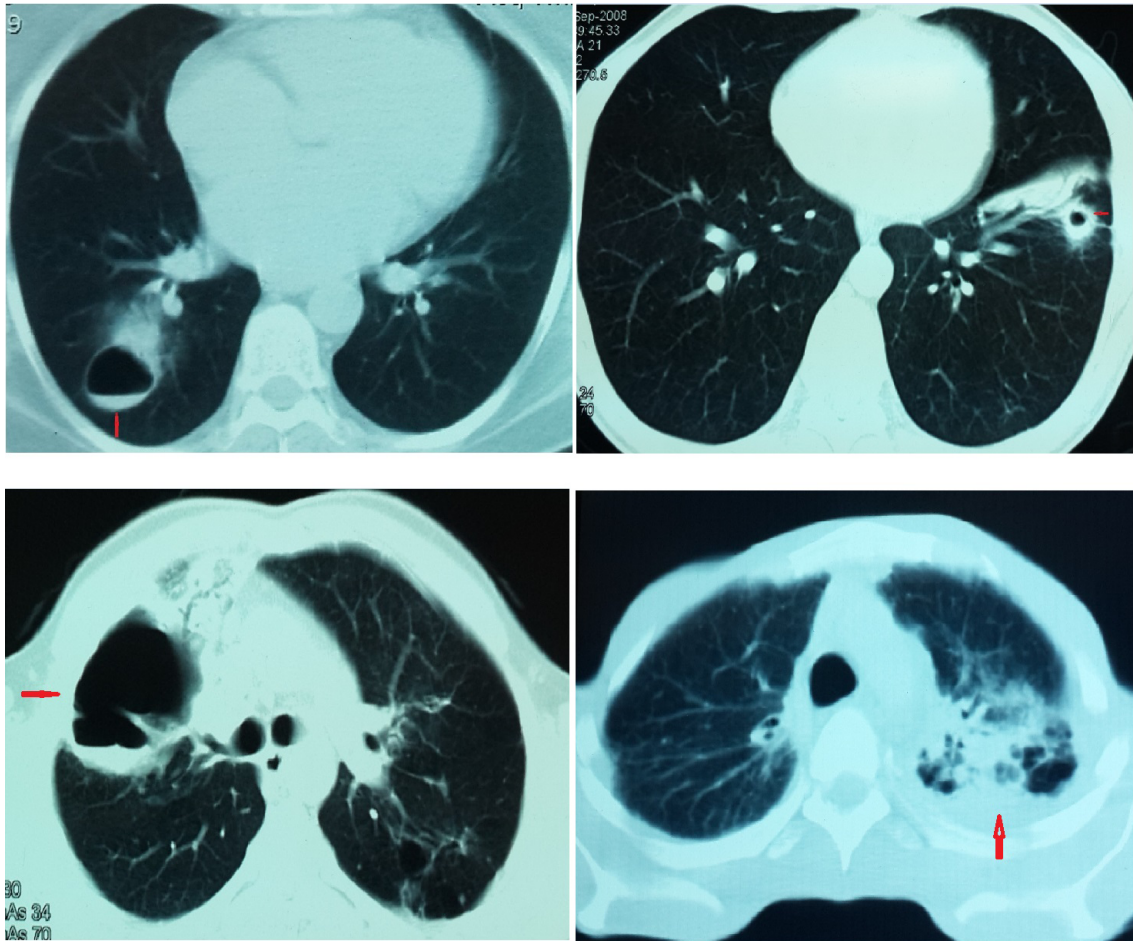


Figure 1. Computed tomography (CT) images of 2 cases of SPA and CPA.

The degree of hemoptysis was categorized by the amount of blood lost in 24 h as major hemoptysis if the volume lost exceeded 250 mL and minor hemoptysis if the volume lost was less than 250 mL or the sputum was stained with blood.

3. Results

Forty patients (51.94%) had SPA and 37 (48.05%) had CPA. The most common underlying lung disease was tuberculosis in 37 patients (48.05%), 19 with SPA and 18 with CPA. Bronchiectasis was the underlying lung disease in 10 patients (12.98%), 7 with SPA and 3 with CPA. Six patients had chronic obstructive lung disease (7.79%), 2 with SPA and 4 with CPA. One patient with CPA also had a hydatid cyst (1.29%). Twenty-three patients had no underlying lung disease (Table 1).

The most common presenting symptom and indication for surgery was hemoptysis (67.53%; 52 patients, 43 with minor hemoptysis and 9 with major hemoptysis). Of the patients with major hemoptysis, 4 had SPA and 5 had CPA; of those with minor hemoptysis, 33 had SPA and 10 had

CPA. Another symptom was chronic cough in 17 patients (22.07%; 17), 5 with SPA and 12 with CPA. Seven patients presented with chest pain; 4 had SPA and 3 had CPA. One patient with CPA presented with chronic abundant sputum expectoration (Table 2).

The initial operations comprised 24 lobectomies, 4 pneumonectomies, 9 lobectomies plus myoplasties, 10 segmental resections, and 30 wedge resections. Lobectomies were performed in 24 patients (31.16%), 16 with CPA and 8 with SPA. The 4 patients undergoing pneumonectomies (5.19%) had CPA. Segmental resection was performed in 10 patients (12.98%), 6 with SPA and 4 with CPA. Thirty patients (38.96%) required wedge resection, 22 with SPA and 8 with CPA (Table 3).

Major complications occurred in 18 patients (23.37%) and included repeated hemoptysis ($n = 2$), prolonged air leak with or without empyema ($n = 6$), persistent pleural space problems with or without empyema ($n = 6$), wound infections ($n = 3$), and bronchopleural fistula ($n = 1$). The postoperative mortality was 3.89% ($n = 3$) (Table 4). The reoperations to deal with postoperative complications

Table 1. Underlying lung diseases

Underlying diseases				
Type	Tuberculosis	Bronchiectasis	Bullose emhysema	Cyst hidatid
SPA	19	7	2	-
CPA	18	3	4	1
Total	37	10	6	1

Table 2. Presenting symptoms and indications for surgery.

Symptoms					
Type	Major hemoptysis	Minor hemoptysis	Cough	Chest pain	Abundant sputum
SPA	4	33	5	4	-
CPA	5	10	12	3	1
Total	9	43	17	7	1

Table 3. The initial operations performed.

Operation type					
Type	Pneumonectomy	Lobectomy	Lobectomy + myoplasty	Segmentectomy	Wedge resection
SPA	-	8	1	6	22
CPA	4	16	8	4	8
Total	4	24	9	10	30

Table 4. The postoperative complications.

Complications						
Type	Prolonged air leak	Space	Broncopleural fistula	Wound infection	Hemoptysis	Exitus
SPA	5	5	-	1	-	-
CPA	1	1	1	2	2	3
Total	6	6	1	3	2	3

included 1 myoplasty, 1 completion lobectomy, 2 myoplasties with costal resections, and 2 lobectomies plus myoplasties. No postoperative complications were observed after the reoperations. Postoperative early mortality occurred in 3 patients.

4. Discussion

Aspergillus is a genus of saprophytic fungi that occur widely in nature. These species reproduce by forming conidia, and airway contamination is usually via inhalation. A pulmonary aspergilloma is the most common form of

human disease caused by *Aspergillus* and involves the formation of a fungus ball or mycetoma (1,2,12–14). The mass consists of viable or dead fungal elements, mucus, blood, cell remnants, and inflammatory cells partially occupying a cavity in communication with the airways or in ectatic bronchi (1,3).

Pulmonary aspergillomas generally form in preexisting pulmonary cavities caused by various diseases, such as lung cancer, cystic fibrosis, abscesses, bullous emphysema, cysts, hydatid cysts, and tuberculosis (1,2,7,15,16). Old chronic tuberculosis cavities remain the most frequent

underlying focus of disease, present in 13–89% of cases (2). In our series, tuberculosis was the most common underlying disease, present in 37 patients (Table 1). In the literature some authors reported that there was not any underlying lung disease identified in 12%–25% of cases (7,8,11). In our series, underlying lung disease was not identified in 23 patients (29%), higher than the rate reported in the literature.

The clinical picture of aspergilloma ranges from incidental radiological findings to life-threatening hemoptysis, cough, dyspnea, and general weakness that can be explained by an underlying lung disease rather than aspergilloma (1,3). The most common symptom is hemoptysis, as in our series (Table 2). In some series, the incidence of hemoptysis in patients with aspergilloma ranged from 50% to 83% (1,2,7,17–19). In our series, 52 (67.53%) patients had hemoptysis, 43 with minor hemoptysis and 9 with major hemoptysis.

Some surgeons agree that minor hemoptysis can be managed conservatively. After formation of the fungus ball, antifungal agents are usually ineffective and the natural dissolution of an aspergilloma with symptom resolution is extremely rare, so life-threatening hemoptysis is an important risk. Life-threatening hemoptysis is not predicted by the size or complexity of the lesion, forewarning minor hemoptysis, or the type of underlying disease (2–4,20–23). Therefore, patients with a diagnosis of aspergilloma should be treated surgically as soon as possible to avoid major complications. Most reports advocate surgery as the mainstay of treatment. Since surgical resection has the benefits of preventing hemoptysis and growth of the aspergilloma while preserving the lung parenchyma and eradicating the pyogenic component, greater life expectancy might result. Although a successful lobectomy for pulmonary aspergilloma was first described in 1948, surgical resection was once infrequent because of the high incidence of complications and mortality.

Subsequently, many studies have shown that pulmonary aspergilloma surgery has a low complication rate, and surgical resection is now accepted as the treatment for pulmonary aspergilloma (7,13,21,24,25).

Nevertheless, some authors still consider surgery controversial because of the high incidence of postoperative complications and mortality rates that range from 7% to 24.5% (1,6,19,26,27). Shirakusa et al. said that the greatest possible amount of healthy parenchyma must be spared because of the saprophytic character of the organism (17). Open thoracotomy and anatomical resection have become widely accepted as the main treatments for pulmonary aspergilloma in patients who are suitable candidates for surgery (12).

In our study, the operations comprised anatomical resections in 47 patients: lobectomy, $n = 24$, 31.16%; pneumonectomy, $n = 4$, 5.19%; lobectomy plus myoplasty, $n = 9$, 11.68%; segmental resection, $n = 10$, 12.98%; and wedge resection, $n = 30$, 38.96%. Of the 24 patients undergoing lobectomy, the underlying disease was tuberculosis in 14. In this group, only 5 patients had complications (20%) (1 prolonged air leak and empyema, 2 thoracic spaces, 1 major hemoptysis, and 1 wound infection) and none of them required reoperation. In 3 of these 5 patients with complications, the underlying disease was tuberculosis. The 2 patients with space complications did not require reoperations and were followed as a sterile space (Figure 2). No hemoptysis episodes that required reoperation occurred in any of the patients who underwent lobectomy. One patient with bullous emphysema had major hemoptysis resulting from a bronchopleural fistula and was treated medically. If the underlying disease is tuberculosis, we should take care to prevent space and prolonged air leak problems. Any judgment as to whether to reduce the thoracic cavity should be reserved for space problems. During a lobectomy, we should take precautions to prevent parenchymal air leaks, especially with underlying tuberculosis.

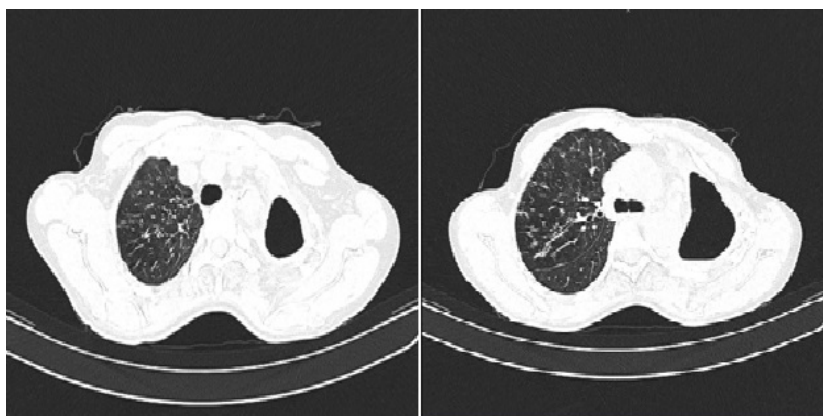


Figure 2. Sterile space complications that did not require reoperation.

Nine patients underwent a lobectomy plus myoplasty, all of whom had tuberculosis (Figure 3). In this group, 1 patient had a prolonged air leak and empyema and 1 had a wound infection (22%) that did not require reoperation. Although the diagnosis was tuberculosis, the absence of space problems in all of the patients who underwent lobectomy and myoplasty is an important result. This also shows that we need to perform a myoplasty when faced with possible expansion problems in patients who undergo a lobectomy. When we consider the reoperation group, 5 myoplasties were performed in 6 patients. Therefore, we should consider performing a myoplasty to obviate the need for reoperation when postoperative expansion problems are expected to occur.

Ten patients had anatomical segmental resections, of whom 5 had tuberculosis. There were 2 complications: 1 patient had space complications (20%) and required reoperation (lobectomy plus myoplasty), and 1 had a wound infection. In addition, in this group, the problem of space resulting from expansion failure required reoperation. In these 43 patients, anatomical lobectomy and segmental resections were performed; only 9 patients had complications (20%), only 1 of whom required reoperation (2%). Thirty patients had wedge resections, and tuberculosis was the underlying disease in 9 of them. Nine of the 30 patients undergoing applied wedge resections had complications (30%) and 5 required reoperation (16%). Therefore, we think that compared with anatomic resections, wedge resections should never be preferred in terms of postoperative complications and the need for reoperation.

Five patients were operated on for destroyed lungs, of whom 4 had tuberculosis. The operations for these destroyed lungs were 3 left pneumonectomies, 1 right pneumonectomy, and 1 left upper lobectomy. In this group, 3 patients had complications and 3 had tuberculosis (75%): 1 patient died from empyema, 1 patient had

empyema and was treated with antibiotics and pleural lavage, and 1 patient had a wound infection. If the cause of a destroyed lung is tuberculosis, we must be careful to avoid complications.

In terms of complication types and the need for reoperation, 18 complications occurred (23.37%). Fifteen of these were related to parenchymal failure and 3 to wound infection (treated with antibiotics and then resutured). The 15 complications related to parenchymal failure included repeated hemoptysis ($n = 2$), prolonged air leak with empyema ($n = 6$), persistent pleural space problems with or without empyema ($n = 6$), and bronchopleural fistula ($n = 1$). Reoperation was needed in the patients with repeated hemoptysis and space complications. The reoperations included 1 myoplasty, 1 completion lobectomy, 2 myoplasties with costal resections, and 2 lobectomies plus myoplasties to deal with postoperative complications. No postoperative complications were observed after the reoperations. The other complications were corrected with medical treatments or chronic tube drainage.

Repeated hemoptysis was defined as a patient who was operated on for hemoptysis and then developed hemoptysis postoperatively. There were 2 patients in this group; 1 had SPA and 1 had CPA. In this group, the initial operations were wedge resections, but recurrences occurred (Figure 4) and both patients required reoperations; the post-reoperation pathology was also an aspergilloma. Prolonged air leaks were defined as those lasting more than 15 days; empyema occurred in some of these patients. There were 6 patients in this group, 5 with SPA and 1 with CPA, of whom 5 had tuberculosis. In 4 of the 5 patients with SPA the initial operations were wedge resections, and the other was lobectomy. In this group the patient with CPA had lobectomy plus myoplasty. In this group, none of the patients required reoperation; they were treated with antibiotics and pleural space lavage.

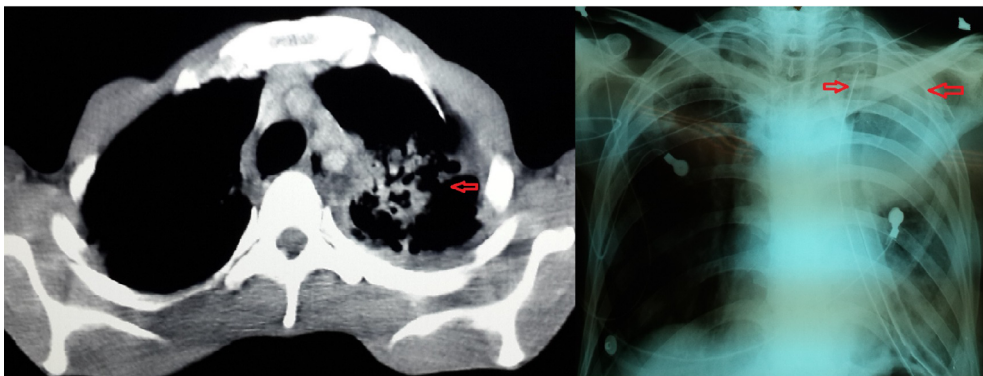


Figure 3. Preoperative CT image and postoperative chest X-ray of a patient who underwent a lobectomy plus myoplasty.

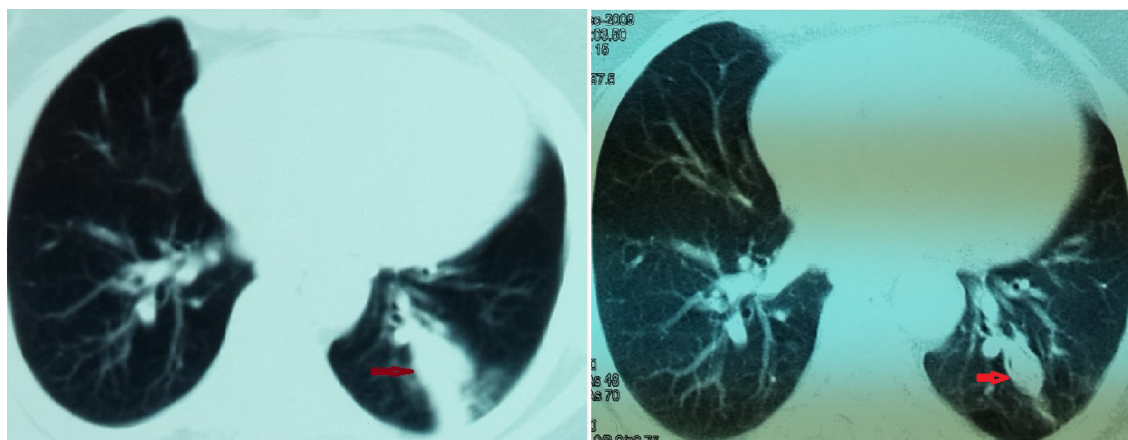


Figure 4. After an initial wedge resection, recurrence was observed at the same location.

A space problem occurs when the thoracic cavity is not completely filled with lung parenchyma, and empyema was seen in some of these patients. In this group, all of them had SPA and the first operation was a wedge resection in 3 patients, segmental resection in 1, and lobectomy in 2. The patients in this group who underwent initial wedge or segmental resections required reoperations. A wedge resection was the most common operation in patients subsequently developing both prolonged air leaks and space complications. In 9 of the 12 patients with prolonged air leaks or space complications, tuberculosis was the underlying disease. Tuberculosis was also the underlying disease in 2 of the 3 patients with wound infections.

Three patients (3.8%) died: 1 each from major hemoptysis, postoperative pneumonia, and empyema. The last 2 underwent a lobectomy plus myoplasty. The patient who died from hemoptysis had bilateral cavitory lesions and underwent a right upper lobectomy and myoplasty. The hemoptysis was major and occurred from the left side.

The patient who died from postoperative pneumonia had a left upper lobectomy and myoplasty. The last patient had a left pneumonectomy for a destroyed lung and died 1 month after the operation from empyema.

From this experience, we conclude that surgical resection for aspergilloma offers potential benefits with acceptably low morbidity and mortality rates in accordance with the literature. However, the surgical resections must consist of anatomical resections, such as lobectomy and segmentectomy. If the underlying disease is tuberculosis, space problems and prolonged air leak must be considered. Therefore, during the preoperative evaluation if parenchyma expansion failure and air leakage is expected, we recommend that the surgeon perform a myoplasty. In the treatment of aspergilloma, wedge resections should always be avoided because the postoperative complication rate is high and reoperation is required in all cases.

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