

# Fungus ball: Clinical presentation, diagnosis and treatment in 31 cases

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## Abstract

**Background:** Clinical presentation, diagnosis and treatment, and outcome of pulmonary Fungus ball have been known to depend on the underlying lung disease. We described clinical findings, diagnosis and results of surgical treatment of Fungus ball.

**Methods:** From 1992 to 2005, we operated 31 patients with aspergilloma. Among them, 18 were male with a median age of 52 (30 to 70 years). 11 were afflicted with simple aspergiolloma and the rest with complex aspergiolloma.

**Results:** Hemoptysis and cough were the most complaints. Diagnostic tools were CXR and CT scan. Tuberculosis and Bronchiectasis were the most common underlying lung diseases. 39 procedures were performed in the patients. The most common surgical procedures were Lobectomy, wedge resection and closed tube cavernostomy with amphotericin installation in the cavity. The most common postoperative complications in the complex type were bronchopleural fistula, empyema and persistent space. Intraoperative mortality occurred in two cases because of bleeding during one to four year follow-up. Eight patients died because of sepsis and respiratory failure.

**Conclusions:** Because of the underlying lung disease, postoperative complications and mortality rate were high especially in complex aspergiolloma. However, surgery is the approach of choice in these patients. In high-risk patients, tube cavernostomy could be helpful.

**Keywords:** Aspergilloma; Fungi; Tube cavernostomy; Lobotomy

## Introduction

Aspergilloma refers to the disease caused by a ball of fungal mycelia which can occur within a cavity, usually within the parenchyma of the lung or another organ such as the kidney or brain.<sup>1,2</sup> The fungal ball is composed of fungal hyphae, inflammatory cell, and fibrin, mucous and amorphous debris within a pulmonary cavity. The usual species of *Aspergillus* recovering from such lesions is *Aspergillus fumigatus*.<sup>1,2</sup> Occasionally, fungus ball is associated with other filamentous fungi, such as *Fusarium* and *Pseudallescheria*. Other manifestations of *Aspergil-*

*lus* infection include invasive aspergillosis and allergic bronchopulmonary aspergillosis.<sup>1</sup> Since Belcher and Pulmmer, aspergilloma has been classified into simple and complex types.<sup>2</sup> Surgical resection in complex types has been reported with high mortality and morbidity.<sup>3-5</sup> In cases of simple aspergilloma, the risk of hemoptysis is present but the surgical risk is minimal. Therefore, in the complex type, resection should be recommended only in low-risk patients due to a potentially high level of surgical complications.<sup>6</sup> In high risk patients cavernostomy with muscle transposition may be used.<sup>7</sup> In patients with HIV-infection, pulmonary aspergilloma has developed following *Pneumocystis carini* pneumonia.<sup>3</sup> There are controversies on diagnosis and treatment of the aspergilloma.<sup>7</sup> Owing to these controversial problems, we will describe the diagnosis and surgical treatment of aspergilloma, and clinical manifestation, complication and outcome of treatment.

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## Materials and Methods

Between 1992-2005, 39 surgical procedures were performed on 31 patients with pulmonary Fungus ball in Razi University hospital and Aria private hospital in Rasht, Iran. The diagnosis of Fungus ball was made on the basis of clinical findings and imaging such as CT scan. Bronchoscopy (FOB or rigid with BAL) was done in 15 patients but was not diagnostic. The medical records of all patients including preoperative symptoms and signs, CXR, C.T SCAN findings, diagnostic studies, indication of surgery, surgical procedure, postoperative complications, mortalities, and short and long-term follow-up status were retrospectively reviewed.

## Results

The sample included 19 men and 12 women with a median age of 52 years (30 to 70 years). The main signs and symptoms were cough and hemoptysis (Table 1). The right upper lobe was the most common anatomy location site of involvement (Table 2). Among them, eleven patients suffered from simple aspergillum and 20 from complex aspergilloma. The surgical procedures included lobectomy, pneumonectomy, segmentectomy, wedge resection, and open cavernostomy. Closed tube cavernostomy with amphotericin injection in cavity was performed in 13 patients because of poor respiratory function reserve. The procedures performed are displayed in Table 3. The most common postoperative complications were bronchofistula and empyema (Table 4). Pathologic findings after the operation were old tuberculosis in 16 patients, bronchectasis in 10, emphysema bulla in 1, sarcoidosis in 2, squamous carcinoma of lung in 1, and interlobar pulmonary sequestration in 1 patient. Hospital mortality occurred in two patients because of hemorrhagic shock and sepsis. Both patients were in the complex group. During one to four years follow-up, 8 patients died because of respiratory failure and sepsis. All the deaths were in the complex type. Symptoms and signs in the complex group were severe. In the simple group, all the symptoms subdued. In 8 patients suffering from the complex type, symptoms significantly and in 4 patients moderately improved. Postoperative complications prevailed in the complex type. Recurrence happened in three patients in the complex group and was managed by close tube cavernostomy and amphotericin installation in cavity.

**Table 1:** Present signs and symptoms of 31 patients with fungus ball

Characteristics	Simple Aspergilloma (11 patients)	Complex Aspergilloma (20 patients)
Hemoptysis	5	15
Blood-tinged sputum	4	11
Cough/Sputum	6	12
Dyspnea	4	16
Fever	1	8

\*One patient may have one to three signs and symptoms

**Table 2:** Location of pulmonary fungus ball in 31 patients

Location	Number of Patients
Right upper lobe	14
Left upper lobe	6
Right lower lobe and middle lobe	3
Right upper and middle lobe	8
Left lower lobe	2
Right upper and left upper lobe	6
Total	39

**Table 3:** 39 Procedures was performed on 31 patients with fungus ball

Procedure	Simple Aspergilloma (11 procedures)	Complex Aspergilloma (20 procedures)
Lobectomy, Wedge resection	6	11
Segmentectomy, Wedge resection	4	2
Open cavernostomy, Wedge resection	0	5
Pneumonectomy	0	3
Close tube cavernostomy and amphotriosisin	1	7

**Table 4:** Postoperative complications in 31 patients

Complications	Simple Fungus Ball (11 patients)	Complex Fungus Ball (20 patients)
Residual pleural space	0	2
Prolonged air leak	1	2
Hemorrhage	0	0
Bronchopleural fistula& empyema	0	5
Empyema	0	2
Wound infection	1	2

\*One to three complications may happen

*Fungous ball* is classified into two types, simple and complex.<sup>1-3</sup> The simple type develops into isolated thin-walled cysts lined by ciliated epithelium while the surrounding lung is normal. The complex type develops into cavities formed by gross disease in the surrounding lung tissue. Our series showed that 20 of the patients had an underlying lung aspergilloma which may involve the kidneys and brain.<sup>3,6</sup> Old tuberculosis were the most common underlying lung disease.<sup>4</sup> In our cases, TB was the most common underlying lung disease. It has been reported that the most common symptom associated with aspergilloma is hemoptysis, as in our series. About 20 of our patients had hemoptysis and 16 blood-tinged sputums. Less common symptoms include chronic cough with sputum, malaise, weight loss, and dyspnea fever.<sup>3,6</sup> Our data also showed similar results. The apical portion of the upper lobes and superior segment of the lower lobes were the most common sites of disease in our study, which seem to reflect an association with pulmonary tuberculosis.<sup>1</sup> It has been shown that a significant portion of the patients with complex type of aspergilloma is also immunosuppressed.<sup>4</sup> However, in our study we did not identify any patient showing evidence of immunosuppression. Chest radiography is useful in demonstrating the presence of a mass within a cavity. Typically, there is a solid mass surrounded by a radiolucent crescent (crescent sign, Monod's sign).<sup>1</sup> Historically, the lesions have been more frequently located in the upper lobes of the lungs, reflecting the predisposition of tuberculosis to cavitate in these areas.<sup>7,8</sup> Computed tomographic (CT) scan of the lungs can be used to demonstrate a cavity. Magnetic resonance imaging (MRI) findings are particularly informative and can be used in cases where better resolution of the pathology is required.<sup>7</sup> When treatment is required, surgery has generally been considered to be the mainstay of therapy for aspergilloma.<sup>9-15</sup> Antifungal therapy is not usually required for the treatment of aspergilloma. The main indication for medical therapy has been that the patient is not fit for surgical intervention or there is concern about concomitant tissue invasion by the fungus.<sup>16-20</sup> Itraconazole has been used with some reduction in the size of the fungus ball, especially in Europe and Japan, and has been shown to penetrate into the aspergilloma.<sup>16-20</sup> We did not use Itraconazole. Topical instillation of amphotericin B has been performed in other cases where medical therapy was required, either to control continued fungal growth or to try to limit the effects of the space occupying lesion.<sup>16-18</sup>

The role of intravenously administered lipid formulations of amphotericin B is not known, but we used intracavitary amphotericin B in 8 patients. A group in France reported the use of CT-guided intracavitary instillation of amphotericin paste in 40 inoperable cases of hemoptysis due to aspergilloma. The aspergilloma apparently disappeared in 23 cases and the cavity in three.<sup>16</sup> The main indication for surgery is recurrent hemoptysis. The major mode of therapy for aspergilloma has been surgical resection of the cavity and removal of the fungal ball.<sup>9-15</sup> Lobectomy is the most commonly employed procedure, although segmentectomy is sometimes adequate, and pneumonectomy is occasionally required.<sup>14</sup> Embolization of pertinent arteries has also been successful in decreasing clinically significant bleeding in selected cases.<sup>19,20</sup> Selection of patients for surgery depends on the balance between the risk of disease (massive hemoptysis or empyema) and of surgery.<sup>13-15</sup> In our series, we did resection in all cases of simple type of aspergilloma because the risk of hemoptysis is minimal. However, because of a higher surgical risk in the complex type, we carefully evaluated the patients and only recommended surgery for low-risk cases. In the high-risk patients, we recommend open cavernostomy with muscle flap transposition or closed tube cavernostomy with amphotripcin installation in the cavern. We did not perform bronchial artery embolization because we did not have this facility. In a comparative study on medical and resection therapy, Jewkes and colleagues found a 5 year survival in 65% of cases undergoing medical therapy and in 75% of patients undergoing resection with minor hemoptysis.<sup>21</sup> However, for patients with recurrent or a single major bleeding, the 5-year survival was 41% in medical and 84% in resection treatment group.<sup>9,10,16,17,25</sup> In our study, overall survival was 65%, being lower than that in other studies. Operation in the complex type is very difficult, because of the dense fibrosis around the cavity, obliteration of pleural space and fissure, enlarged, and tortuous bronchial artery. Diseased pulmonary parenchyma surrounding the lesion inflammatory fibrosis of the pulmonary parenchyma and pleura may cause the remaining lung to be unable to fully expand to fill the pleural space after resection.<sup>13-19</sup> In the patients with the complex type, various postoperative complications occurred with prolonged air leaks and residual space, empyema, bronchopleural fistula and wound infection. All complications were treated by conservative management. It has been suggested that various approaches, including

a pleural tent, pneumopertinum, decortication, muscle flap, omental transposition, or in rare conditions, and thoracoplasty should be considered after resection.<sup>15,20,22</sup> However, we did muscle transposition in two patients with latissimosdoris muscle. Mortality and long-term survival after resection depend on the patient's selection and underlying disease. The average reported operative mortality ranges from 0% to 43%.<sup>15-19,25</sup> Daly and associates reported resection, treating 53 patients with aspergilloma. Their study showed a 23% rate of operative mortality with the majority of deaths happening in patients with complex type (34%) versus (5%) in simple type.<sup>24</sup> Postoperative morbidity was also significantly higher in the cases of complex type (78% versus 33% in simple type), and this could be the result of widespread pulmonary disease and the secondary bacterial infection.<sup>25,26</sup> During follow-up, we had no mortality in the simple type and 40% mortality in the complex type. The underlying pulmonary condition is an important factor in determining the outcome because most

deaths are caused by chronic failure caused by pneumonia.<sup>2,20,25</sup> Patients with simple type disease seem to have good results of survival comparable to general population.<sup>24,25</sup>

The long-term outcome and survival of the complex type have been reported to be poor because of the underlying lung disease.<sup>25</sup> In our study, long-term survival in the simple type was better than that in the complex type. Recurrence of Fungous ball has been reported in 7% of patients after resection.<sup>26</sup> In our study, recurrence occurred in 3 patients. Therefore, careful long-term follow-up is recommended. In conclusion, owing to high risk of hemoptosis, surgery is indicated in all patients with Fungus ball. In the complex type, the patient must be carefully evaluated and surgical resection is recommended only for low-risk patients. In the high-risk patients, minimal approaches such as tube cavernostomy might be helpful, but in the simple type radical surgery is the best treatment with good outcome.

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