

## Original Research Article

# Pulmonary Aspergilloma Surgery Analysis and Results of a Series of 69 Cases

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**Abstract:** Pulmonary aspergilloma is an infectious human disease caused by colonization of a pre-existing cavity in the lung by a fungus of the genus *Aspergillus*. The spores are transmitted through the air, without contagiousness between people and germinate in a cavity to form a “mycelial” ball. The disease can go unnoticed, especially in the early phases, but is often complicated by hemoptysis of variable abundance which can even be dramatic. Surgery is the treatment to stop the progression of the disease, but this surgery is burdened with significant morbidity and mortality. We report a study of 69 patients operated on for pulmonary aspergilloma. Our results in terms of better quality of life and prevention of complications are acceptable at the cost of reduced morbidity.

**Keywords:** Aspergilloma, hemoptysis, surgery, complications.

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## INTRODUCTION

Pulmonary aspergilloma is due to colonization by *Aspergillus* of a pre-existing pulmonary cavity, most often a sequela of pulmonary tuberculosis, due to a reduction in local immunity, a modification of the mucosa and the presence of a drainage bronchus.

*Aspergillus*, a very widespread ubiquitous and saprophytic fungus which contaminates humans generally via the respiratory route, exceptionally via the skin or digestive route and will be responsible for significant changes in local structures with hyper-vascularization, sometimes a source of dramatic hemoptysis [1].

The prognosis is linked to the terrain in which aspergillus disease is established but above all to the precocity of the diagnosis, morbidity being not negligible, progress is being made every day in terms of improving survival and quality of life.

The treatment is essentially surgical, however the technique remains delicate due to pleural adhesions and inflammatory changes at the hilum [2], and the results are burdened by significant morbidity and mortality.

Despite the high surgical risk, surgery remains the only way to stop the natural progression of the disease which often leads to complications including fatal massive hemoptysis and the acute invasive form of which the prognosis is much worse [3-5].

The choice of the most appropriate technique depends on the compliance of the residual lung tissue [6, 7].

The aim of our work is to evaluate the results of a series of 69 patients operated on at our department for pulmonary aspergilloma.

## PATIENTS AND METHODS

This is a retrospective descriptive and analytical study including 69 patients who received, between January 1, 2018 and December 31, 2022, surgical treatment for pulmonary aspergilloma.

All patients underwent a complete clinical examination, chest X-ray and chest CT scan before admission. Bronchial fibroscopy was performed in 56 patients and aspergillus serology in 53 cases.

We retained all the observations in which the diagnosis of aspergilloma was suggested based on the clinical, radiological, biological signs and confirmed by the anatomopathological study of the surgical specimen.

We differentiated simple aspergillomas from complex aspergillomas, according to the clinico-radiological criteria of Daly [8] and Belcher [9]: patients with simple aspergillomas are often asymptomatic with good general, respiratory and nutritional status. On radiology, the cavity is thin-walled and without associated pleuro-parenchymal abnormalities.

Conversely, patients with complex aspergilloma often have a poor general and nutritional state. They are usually symptomatic, with hemoptysis at the forefront, followed by bronchorrhea.

Radiologically, complex aspergilloma is characterized by a parenchymal excavation with thick edges, associated with peri-lesional pulmonary fibrosis and pachypleuritis.

We studied the clinical data of the patients (age, sex, history, revealing signs, etiologies), the imaging data, and finally the data of the surgical intervention and its results. The average duration of patient follow-up was 2 years.

## RESULTS

Our study made it possible to collect 69 cases of aspergillomas treated surgically in the thoracic surgery department. Forty-four patients belong to the male gender (63.77%) and twenty-five to the female gender (36.23%). Their age ranges from 15 to 69 years, with an average age of 39.8 years.

In fifty-five cases (79.71%), the clinical history highlights a history of treated pulmonary tuberculosis. In the rest of the cases, the aspergilloma was grafted into a pre-existing lung cavity of hydatid origin in five cases (7.25%), dilatation of the bronchi in three cases (4.35%), a lung abscess in two cases (2.90%), an emphysema bubble in a single case (1.45%) and finally three patients (4.35%) presented aspergilloma without underlying pathology found.

Hemoptysis was the main revealing sign where it was reported by 37 patients, it was abundant in 5 patients, one of whom required emergency surgical treatment. Bronchorrhea was also a frequent reason for consultation observed in 23.18% of patients; the general condition was altered in 4 cases. The rest of the symptoms were shared between dyspnea, chest pain and chronic cough. The attack was asymptomatic and radiologically discovered in 7.25% of cases.

Radiologically, the characteristic appearance of the so-called bell image was found in 53.62% (Fig1). The other radiological aspects observed were an excavated

opacity in 28.99%, a dense opacity in 10.14%, an interstitial syndrome in 2.90%, and finally a destroyed lung in 4.35% of cases.

According to the clinical-radiological criteria of Daly [8] or Belcher [9], 10 patients (14.50%) presented a complex aspergilloma, while 59 patients (85.50%) presented a simple aspergilloma.

The damage was unilateral in the majority of cases 94.20% (including 70.71% on the right) and bilateral in 5.80% of cases. A completely destroyed lung was noted in 3 patients. Aspergillus serology was performed in 53 patients returning positive in 69.84%.

Bronchoscopy revealed an inflammatory mucosa in the majority of cases 46.38%. The origin of the bleeding was identified in 5 patients, two of whom had a bilateral form, thus allowing the choice of the first operated side, but in no case did it allow direct visualization of the aspergillus nose.

All patients were operated on under general anesthesia, with selective intubation. Thoracotomy was the approach in all patients. The surgical procedure consisted of a lobectomy in the majority of cases (84.06%).

34 right upper lobectomies, 15 left upper lobectomies, 6 right lower lobectomies, and 3 left lower lobectomies. Bi-lobectomy was indicated in 5 patients. Two patients underwent multiple segmental resections and three patients with a destroyed lung underwent pneumonectomy. Thoracoplasty was performed in a single case for bilateral aspergilloma with retraction of the upper and middle lobe.

The average duration of drainage was 9 days; the drain was maintained for more than 10 days in 5 cases. It involved prolonged bubbling in 3 cases and 2 cases of suppuration. The average value of blood loss over the first 24 hours was 850 ml, with extremes ranging from 350 to 1700 ml. Bleeding greater than 1500 ml was observed in 2 patients who required emergency surgical revision. Hemothorax was noted in 5 patients (7.25%), three of whom required re-operation for pleural removal. Re-expansion defects were observed in 5 patients (7.25%), 3 patients (4.35%) presented with prolonged blistering and 2 patients (2.90%) with empyema.

Post-operative outcomes were uneventful for 52 patients (75.36%). The duration of hospitalization exceeded 30 days for 2 patients (2.90%); the average length of stay was 11 days, with extremes ranging from 7 to 37 days.

Intra and postoperative mortality was nil. The diagnosis of aspergilloma was confirmed in all our patients by the histopathological study of the surgical specimen.

## DISCUSSION

The first definition of the genus *Aspergillus* was made by Micheli in 1729. Finding a great resemblance between these molds the bottle brush (*aspergillus* in Latin), liturgical instrument for sprinkling holy water [10].

Aspergilloma is an infectious human lung disease caused by colonization of a cavity by *aspergillus*, most commonly *Aspergillus fumigatus*. The spores are transmitted through the air, without contagiousness between people. The first surgical resection of an aspergilloma was performed by Gerstl in 1948 [11].

Aspergilloma often occurs in adults, more frequently in men, and in patients who already have a history of pulmonary tuberculosis. In our series the tuberculous origin of the *aspergillus* cavity was found in 79.71% of cases, this has been noted in most of the published international series [6, 12-15], especially in endemic areas.

Other cavities such as those of the hydatid cyst, bronchial dilatations, pulmonary abscesses or emphysema can be colonized by *aspergillus*, but sometimes aspergilloma occurs without underlying pulmonary pathology, which is what we observed in 4.35% of patients in our series [16, 17].

Like its main cause, aspergilloma occurs in the upper lobe, more frequently in the right upper lobe according to several studies [18, 19]. In our series, aspergilloma occupied the right upper lobe in 70.71%. The lesions are more often unilateral, the bilateral form is rarely found in 5.80% of cases.

Hemoptysis is the dominant clinical sign in aspergilloma, (53.62%) in our series. It is the same in other series where this rate oscillated between 44 [14, 20] to 100% [12, 13]. The abundance of hemoptysis is variable and sometimes even dramatic; we noted in our series a case of cataclysmic hemoptysis which led to emergency surgical intervention after initiating filling and transfusion measures. It has thus been demonstrated that the occurrence of massive and fatal hemoptysis punctuates the course of a patient suffering from aspergilloma in 20% of cases [2, 3, 21].

The radiological appearance of pulmonary Aspergilloma is very variable, ranging from the very evocative "bell" image found in 53.62% of cases to the appearance of destroyed *aspergillus* lung observed in 3 patients (4.35%). The chest image has no specificity and several diagnoses can be considered.

Therapeutically, studies [22-24] have shown that surgery should be considered for all patients with aspergilloma, even asymptomatic patients whose ventilatory function allows pulmonary resection, since surgical treatment not only allows to resolve symptoms,

but also increases patient survival by stopping the progression of the disease [2]. Likewise, the progressive increase in the *aspergillus* nose accentuates neovascularization and parietal and scissural adhesions, making the procedure more delicate and hemorrhagic.

The surgical technique consists, after total liberation of the lung, the only guarantee of good pulmonary re-expansion, in an anatomical resection removing the nose and the residual cavity, ideally carrying out a lobectomy because it makes it possible to avoid the risk of recurrence, since the Tuberculosis can lead to sequelae lesions not yet identified radiologically. In our series we performed a lobectomy in 84.06% of cases. For Jean-Francois Regnard *et al.*, in a study carried out on 89 cases of mycotic tumor, lobectomy was performed in 37 cases and 100% of cases [25] for D. Vu [26].

We performed 5 bilobectomies, 2 for extension of lesions to the middle lobe, two for aspergilloma of the upper lobe associated with dilation of the bronchi of the middle lobe and in one case for technical reasons following an accidental injury of the middle lobar artery during of the dissection of the arterial X.

In our series, 3 patients (4.35%) had an *aspergillus* graft on a destroyed lung benefiting from a pneumonectomy, which remains a procedure of last resort, given the risk of empyema with or without fistula of the bronchial stump, and which requires extensive monitoring for its management [27]. A pneumonectomy may also be authorized urgently to ensure hemostasis, as in the case of a patient who presented with massive hemoptysis on a destroyed lung. Patients who developed aspergilloma after lobectomy and radiotherapy for lung cancer represent a particular subgroup. In these patients, totalization pneumonectomy should be considered a high-risk procedure [2].

In simple and localized forms, or for functional reasons, segmentectomy performed in two of our patients can constitute an alternative to lobectomy, but it must be said that segmentectomy is not without risks of prolonged air leaks and cavity residual.

In all cases and whatever the type of excision, it must be done without breaking into the cavity to avoid the risk of swarming, a source of infection and empyema.

Finally, a first-line thoracoplasty was performed in a single case for bilateral aspergilloma with retraction of the upper and middle lobe. Thoracoplasty can be considered as a therapeutic option in patients with severe comorbidities and unable to tolerate a more extensive resection procedure such as a lobectomy.

Aspergilloma surgery is one of the surgeries known to be delicate, especially due to its hemorrhagic risk, due to solid adhesions and the sometimes intimate

contact of the cavity with the vessels of the hilum associated with inflammation, making the dissection of the vessels very delicate even dangerous.

Pulmonary aspergilloma surgery is therefore not without complications: 66 to 74% for Massard *et al.*, [14, 20], 15% for Jewkes *et al.*, [3], and 78% for complex aspergilloma compared to 33% in cases of simple aspergilloma for Daly *et al.*, [8]. In our series the complication rate is around 24.64%.

At the forefront of post-operative complications, and in the same way in the majority of series, is bleeding. We noted active bleeding with drainage of more than 1500 cc of blood in the first 24 hours justifying immediate surgical revision. We also recorded 5 cases of postoperative hemothorax, 3 of which required surgical pleural removal. Analysis of the literature affirms the hemorrhagic nature of this surgery. Indeed, hemorrhage was observed in 56% of cases for Massard *et al.*, [14, 20], 75% for Personne *et al.*, [28] and only 7.5% for Jewkes *et al.*, [3]. Reoperation for hemothorax was necessary in 5.6% of cases in the study by Regnard *et al.*, [25].

A lack of pulmonary re-expansion was observed in five patients whose evolution was favorable after maintaining drainage and active physiotherapy; we did not perform secondary thoracoplasty. Reexpansion defects after lobectomy are the consequence of loss of elasticity of residual lung tissue and scar fibrosis.

Prolonged bubbling was recorded in three patients or 4.35% of cases; this rate varies from 2.86% for Ade [29] to 23.7% for Kurul [30].

Empyema most often occurs in the early postoperative phase, but can also occur delayed, sometimes after several years. In our series two patients 2.90% presented empyema one after lobectomy and the other after pneumonectomy. This is a serious complication that we controlled by pleural drainage with the establishment of an irrigation-washing system in the absence of associated bronchial fistula, with appropriate antibiotic therapy. The rate of empyema after aspergilloma surgery was found to be 2.27% for Kim [16] and 16.9% for Kurul [30].

In our series, there was no death occurring intraoperatively, during hospitalization, or during the 30 days following the operation. Postoperative mortality varies from 5 to 10% in the literature [23, 31].

## CONCLUSION

Surgery should be considered for all patients with aspergilloma, even asymptomatic ones, if the general and respiratory condition allows it in order to stop the progression of the disease.

Aspergilloma surgery can be considered a safe method offering good results in the short and medium term. However, this surgery is not without risks, particularly hemorrhagic and infectious risks.

**Conflict of Interest:** None

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