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Original Article

Anaesthesia Section

Clinical Outcome in Patients with Pulmonary Aspergilloma Undergoing Lung Resection: A Retrospective Cohort Study

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ABSTRACT

Introduction: Pulmonary aspergilloma occurs due to colonisation of previously present lung cavities by *Aspergillus fumigatus*. Surgery is one of the prime modalities of treatment, but there is paucity of data, dearth of knowledge in literature. Therefore, this study was conducted to study clinical outcome in patients with pulmonary aspergilloma undergoing lung resection.

Aim: To find out clinical outcome, presentations and pre-existing lung diseases in patients with pulmonary aspergilloma.

Materials and Methods: The present retrospective cohort study was done in patients with pulmonary aspergilloma treated surgically between January 2018 and December 2024 in tertiary care centre. Clinical outcome was assessed in terms of morbidity using postoperative complications and mortality. Analysis was done using Chi-square test, Statistical Package for Social Sciences (SPSS) version 23.

Results: The total number of patients studied was 52. The mean age of study population was 42.7 years. In 46 (88.46%) the pre-existing lung disease was post tuberculous cavity followed by bronchiectasis in 4 (7.69%) and healed lung abscess in 2 (3.84%). Frank haemoptysis was the main presenting symptom in 47 patients (90.38%). Right upper lobe was involved in 34 (65.38%). Left upper lobe was involved in 16 (30.77%). Left lower lobe was involved in 1 (1.92%) and right middle lobe was involved in 1 (1.92%). Lobectomy was done in 51 (98.08%). Segmentectomy was done in 1 (1.92%). Bronchopleural fistula was the major complication seen in 7 (13.46%) followed by wound infection in 5 (9.61%) and empyema in 4 (7.69%). Statistically significant p-value (0.047) was found between postoperative complications and duration of hospital stay.

Conclusion: Surgical resection is the best modality of treatment for pulmonary Aspergilloma. We recommend early surgical resection for good outcome. Preoperative lung optimisation, meticulous surgical technique and good postoperative care with physiotherapy reduced the rate of complications.

Keywords: Bronchiectasis, Haemoptysis, Lobectomy, Lung abscess, Post tuberculous cavity

INTRODUCTION

Pulmonary aspergilloma is caused by saprophytic colonisation of *Aspergillus fumigatus* in previously present pulmonary cavities [1]. Inhalation of aspergillus spores is the route of entry. *Aspergillus fumigatus* are filamentous organisms, rapidly multiply in patients with pre-existing lung disease or in the presence of systemic immunodeficiency. Aspergillomas thrive in poorly drained and avascular lung cavity spaces. In developing countries like India, healed tuberculous cavities, bronchiectatic cavity and lung abscess cavity are the nidus for aspergillus. Cystic fibrosis, pneumoconiosis, post infarct pulmonary cavity, post radiation pulmonary cavity, sarcoidosis, are few other conditions which may lead to pulmonary aspergilloma. Recently Severe Acute Respiratory Syndrome (SARS)-CoV-2 pneumonitis has recently been identified as a cause of aspergilloma [2].

Higher incidence and prevalence are reported in Africa, the Western Pacific, and Southeast Asia [3]. In developed countries chronic obstructive pulmonary disease is the prime risk factor for aspergilloma. Interestingly, although invasive Aspergillus disease is more common in patients with primary or acquired immunodeficiency, the incidence is relatively uncommon in Human Immunodeficiency Virus (HIV) infected patients [4]. Traditionally, pulmonary aspergillosis was classified into three subcategories: 1) Pulmonary aspergilloma- formation of fungal ball in pre-existing lung cavity; 2) Invasive aspergillosis seen in immunocompromised patients; 3) Allergic Broncho Pulmonary Aspergillosis (ABPA) [5].

Aspergilloma is a fungal ball, consisting of matted fungal hyphae, fibrin and inflammatory cells [1]. Aspergilloma is a freely moving fungal ball inside the pulmonary cavity, which produce fungal toxin that erodes the vessels and produces haemoptysis [3]. Patients may present with cough, productive sputum, wheezing, weight loss, malaise, chest pain, breathing difficulty and life threatening haemoptysis [3]. Direct invasion of aspergillus on the capillaries of cavity wall, mechanical damage to the exposed vessels in the cavity, release of endotoxin from organism are the possible explanation for haemoptysis [5].

Fungal ball with air crescent sign is the characteristic feature seen in chest X-ray and Computed Tomography (CT) scan [3]. Pulmonary aspergilloma can be diagnosed with characteristic radiographic findings, serological tests for Aspergillus-specific immunoglobulin-G antibodies, and fungal cultures from bronchoalveolar lavage [5].

Pulmonary aspergilloma is a rare and challenging lung disease that can be complicated by other respiratory problems [6]. The overlapping clinical features, make diagnosis and management challenging. The unpredictable course and limited clinical data further complicate effective management of pulmonary aspergilloma. The existence of small case series in the literature, with non-availability of large, prospective, randomised studies makes the management difficult [1,2,6]. As antifungal agents are not effective inside the cavitary structures of the lungs, surgery is the primary modality of treatment. Underlying pulmonary pathology, dense intra-pleural adhesions, intraoperative bleeding and postoperative pulmonary complications makes anaesthesia and surgery for aspergilloma risky and challenging [7]. Recent experience with triazole and echinocandin therapy has demonstrated therapeutic benefits in patients deemed inoperable [8].

The aim of the surgery was to relieve the patient from symptoms and prevent haemoptysis. The aim of the this study was, to analyse clinical outcome in patients with pulmonary aspergilloma who underwent surgery. Clinical outcome was assessed in terms of morbidity (postoperative complications) and mortality. The secondary objective of the study was, to analyse the clinical presentations and pre-existing lung diseases that predisposed to pulmonary aspergilloma.

MATERIALS AND METHODS

The present retrospective cohort study, conducted in karpagam hospital (a Tertiary Care Medical College and Hospital), Coimbatore, Tamil Nadu, India, during January 2025, from data of patients with pulmonary aspergilloma, who were treated surgically between January 2018 and December 2024.

Inclusion criteria: All patients with age less than 70 years of age, radiologically confirmed diagnosis of pulmonary aspergilloma, good cardiac and lung function and a normal coagulation profile was included and underwent surgery. A total of 52 patients was included and all underwent surgery.

Exclusion criteria: Patients with age more 70 years, Chronic Kidney Disease (CKD), poor cardiac and lung function, patients with extensive parenchymal disease and those with coagulation disorders were excluded. A total of seven patients were excluded.

Study Procedure

Details about age, sex, presenting symptoms, predisposing lung disease, involved area of lung was collected and analysed. Preoperatively all patients underwent a complete haemogram, chest X-ray, High Resolution Computed Tomography (HRCT) thorax, renal function test, liver function test, coagulation profile, Pulmonary function test and 2 Dimensional Echo Cardiography (2D ECHO). Preoperative preparation includes cessation of smoking, improvement in nutritional status, pulmonary optimisation and a short course of antibiotics. Details about type of anaesthesia, methods of lung isolation, type of surgical procedure, intraoperative and postoperative complications, length of hospital stay, mortality were collected.

Anaesthesia and operative technique: All 52 patients underwent general anaesthesia for thoracotomy. Double lumen endobronchial tube was used for lung isolation in 41 (78.85%). In 11 (21.15%), it was not possible to position double lumen endobronchial tube. In these 11 patients intubation was done with single lumen endotracheal tube, lung isolation was done with bronchial blocker. Thoracic epidural catheter was placed before induction of anaesthesia in 42 patients for postoperative pain management. After anaesthesia patients was positioned in to lateral thoracotomy position. Posterolateral thoracotomy incision was made. Segmentectomy/lobectomy was done according to the size and location of the lesion. At the end of the procedure, anaesthesiologist was asked to inflate the lung to check for any air leak from bronchial stump. Removed segment/lobe was sent for histopathological examination. After extubation, patients were sent to Intensive Care Unit (ICU) for further management.

Postoperative care: Thoracic epidural analgesia was used in 42 cases (80.77%). In remaining cases parenteral analgesics was used for postoperative analgesia. On the first postoperative day, all patients received chest physiotherapy and all patients were encouraged to do incentive spirometry. Chest drains were removed after satisfactory lung expansion on chest X-ray.

STATISTICAL ANALYSIS

Analysis was done using Chi-square test, SPSS version 23. A p-value of ≤0.05 considered as statistically significant.

RESULTS

Gender and age wise distribution of the study patients is shown in [Table/Fig-1]. The mean age of study population was 42.7 years with the youngest being 25 years and the oldest being 64 years [Table/Fig-1]. The predisposing lung disease was post tuberculous cavity in 46 (88.46%) followed by bronchiectasis in 4 (7.69%) and healed lung abscess cavity in 2 (3.84%) [Table/Fig-2]. All 46 patients with post tuberculous cavity had completed their course of anti-tubercular treatment before surgery.

Age group (years)	Male	Female
25-35	10	3
36-45	14	8
46-55	6	2
56-65	7	2
Total	37	15

[Table/Fig-1]: Gender and agewise distribution of disease.

Underlying lung pathology	Number of patients
Post tuberculous cavity	46 (88.46%)
Bronchiectasis	4 (7.69%)
Lung abscess	2 (3.84%)

[Table/Fig-2]: Predisposing pulmonary disease.

Frank haemoptysis was the most common presenting symptom in 47 (90.38%). Other presenting symptoms were streaky haemoptysis in 42 (80.77%) followed by Dyspnoea in 39 (75.00%) and chest pain in 14 (26.92%) [Table/Fig-3].

Presenting symptom	Number of patients
Frank haemoptysis	47 (90.38%)
Streaky haemoptysis	42 (80.77%)
Dyspnoea	39 (75.00%)
Chest pain	14 (26.92%)

[Table/Fig-3]: Presenting symptom of patients with pulmonary aspergilloma.

In most patients, chest X ray was helpful in initial diagnosis, which revealed a cavitary lesion in the lung with hyperdense material inside. In all patients CT scan was diagnostic, showing the cavity with freely moving fungal ball and characteristic air crescent sign. CT scan was also helpful in locating the diseased segment/lobe of lung and in assessment of rest of lung parenchyma.

In 34 (65.38%) right upper lobe was involved. In 16 (30.77%) left upper lobe was involved. Right middle lobe was involved in 1 (1.92%) and left lower lobe was involved in 1 (1.92%) [Table/Fig-4]. Lobectomy was done in 51 (98.08%). Segmentectomy was done in 1 (1.92%) [Table/Fig-5].

Location	Number of patients
Right upper lobe	34 (65.38%)
Left upper lobe	16 (30.77%)
Right middle lobe	1 (1.92%)
Left lower lobe	1 (1.92%)

[Table/Fig-4]: Location of pulmonary aspergilloma.

Procedure	Number of patients
Right upper lobectomy	34 (65.38%)
Left upper lobectomy	16 (30.77%)
Left lower lobectomy	1 (1.92%)
Segmentectomy	1 (1.92%)

[Table/Fig-5]: Surgical procedure.

In the present study, bronchopleural fistula was the major complication seen in 7 (13.46%) followed by wound infection and empyema in 5 (9.61%) and 4 (7.69%) patients respectively. Three patients (5.77%) developed pneumonia. One patient

(1.92%) was re-explored for severe postoperative bleeding and 1 (1.92%) succumbed to death due to septic shock. No major intraoperative complications were seen, except for severe bleeding in two patients [Table/Fig-6]. Analysis of the postoperative complications with duration of hospital stay is presented in [Table/Fig-6]. Statistically significant p-value (0.047) was found between postoperative complications and duration of hospital stay.

Out of 52 patients 41 (78.85%) were extubated in the operating room itself, 11 (21.15%) needed postoperative ventilation for six hours. The median duration of hospital stay was 29 and 13 days in patients with and without postoperative complications, respectively [Table/Fig-6]. There is no association between type of surgery and duration of hospital stay. Patients who developed postoperative complications, had a prolonged hospital stay.

Complications	Number of patients	
Bronchopleural fistula	7 (13.46%)	
Wound infection	5 (9.61%)	
Empyema	4 (7.69%)	
Pneumonia	3 (5.77%)	
Major bleeding	1 (1.92%)	
Death	1 (1.92%)	
Grand total		**Duration of hospital stay (Median)**
No complication	31 (59.61%)	13 days
Morbidity (Postop complication)	20 (38.46%)	29 days
Mortality	1 (1.92%)	11 days
Duration of hospital stay		**Number of patients**
<14 days		28 (53.85%)
15 to 21 days		8 (15.38%)
22 to 28 days		12 (23.08%)
>28 days		4 (7.69%)

[Table/Fig-6]: Postop complications and duration of hospital stay.

DISCUSSION

Aspergillus fumigatus is a saprophytic fungus. Aspergilloma is colonisation of *aspergillus fumigatus* in the pre-existing pulmonary cavity. Tuberculosis, bronchiectasis, sarcoidosis, histoplasmosis, lung abscess, bronchogenic cyst, cavitating lung carcinoma are the common causes for cavitary lesion of lungs. In the present study, healed tuberculous cavity associated with 46 (88.46%) patients of aspergilloma. In developing countries like India, the prevalence of pulmonary tuberculosis is 36% in general population [9].

In the current study 47 (90.38%) had hemoptysis. In studies done by Tashiro M et al., and Tadesse TM et al., similar findings were recorded [10,11]. Bleeding usually occurs due to the erosion of bronchial arteries and it stops spontaneously. Bronchial artery embolisation can be attempted for patients with life threatening haemoptysis [12]. In the current study no patients had life threatening haemoptysis.

The best treatment for pulmonary aspergilloma is resection of involved area [13]. Segmentectomy done in one case in current study. Segmentectomy can be done in selected cases. Segmentectomy may associated with high incidence of air leak. Segmentectomy may cause disruption of the aspergilloma cavity and may lead to pleural seeding of fungus. Segmentectomy best suitable for peripherally located lesions [14].

In the current study, 51 (98.08%) underwent lobectomy, only one patient had segmentectomy. Pneumonectomy is indicated only in aspergilloma with destroyed lung. Lobectomy is the procedure of choice. In the current study no patients underwent Video Assisted Thoracoscopic Surgery (VATS). One study, suggested VATS for simple aspergilloma [15].

In the current study no patients underwent cavernostomy. In a study by Cesar JM et al., it was concluded that older patients with severe preoperative respiratory malfunction and peripheral pulmonary aspergilloma, or lesions accessible by pneumotomy with pleural adhesions should be submitted to cavernostomy [16]. Some reports are published about intracavity injection of amphotericin B, but long-term outcome of this procedure is unknown [17,18]. Bleeding due to adhesiolysis is one of the common problem encountered intraoperatively [7].

In the current study, the most common postoperative complication was bronchopleural fistula which is in comparison with the earlier studies [7,14]. Mortality in aspergilloma surgery reported from 0 to 22% [19,20]. In the current study, mortality rate is 1.92%. In studies done by Kim YT et al., and Pihlajamaa K et al., the mortality rate was 5.9% and 9.7%, respectively [20,21].

Limitation(s)

It was a retrospective cohort study. More prospective studies in large number are needed to overcome the gap in literature.

CONCLUSION(S)

Although many treatment options are available, surgery remains the best modality of treatment for pulmonary aspergilloma. We recommend early surgical resection for pulmonary aspergilloma. Among surgeries lobectomy is the procedure of choice for localised aspergilloma. Lobectomy has a favorable outcome in terms of postoperative complications as compared to other surgical procedures. We recommend good preoperative lung optimisation, meticulous surgical technique and good postoperative care with chest physiotherapy for better outcomes.

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