INTRODUCTION

Pulmonary aspergilloma (PA), a colonizing fungal disease of pulmonary cavities, is seen with increasing frequency in Karachi and Sindh. Its true prevalence in the local population is not known. It is caused by Aspergillus fumigatus which colonizes pre-existing lung cavities and forms a fungus ball or aspergilloma.1 Healed tuberculous, bronchiectatic cavities or cavities formed due to hydatid cyst2 or chronic lung disease, such as sarcoidosis, are fertile ground for the formation and growth of PA. In Eastern countries, 80% of Aspergilloma are found in tuberculous cavities and according to a large survey, conducted by British Tuberculosis Association, it occurred in 12% of healed tuberculosis patients.3 Interestingly, PA has been reported in patients without chronic lung disease.4

According to Daly et al., PA is classified as simple or complex.5 Simple aspergilloma is a thin walled localized cavity with little or no surrounding parenchymal disease, while complex aspergilloma is a thick walled cavity associated with gross evidence of parenchymal disease. Once a PA is established, antifungal agents fail to effectively control the growth of the fungal mass and hemoptysis.6 Surgical resection effectively controls symptoms of hemoptysis. Due to the sudden risk of massive, life threatening hemoptysis, patients with PA should undergo surgical resection.7,8 The risk of post operative complications and death is significant in patients with complex aspergilloma with thick walled cavities, pulmonary fibrosis and a low pulmonary reserve.7

The purpose of this study was to compare simple and complex aspergilloma lung in terms of the frequency of symptoms and postoperative outcome (morbidity and mortality).

ABSTRACT

Objective: To compare the clinical presentation and results of pulmonary resection in simple and complex aspergilloma of the lung.

Study Design: Observational study.

Place and Duration of Study: The Department of Thoracic Surgery, Jinnah Postgraduate Medical Centre, Karachi, from January 2003 to December 2008.

Methodology: Fifty-one adult patients with unilateral aspergilloma lung were included in this study. Patients were divided into two groups: A (simple aspergilloma-SA, n=14) and B (complex aspergilloma-CA, n=37), based on the radiological and operative characteristics of the cavitatory lesion and the presence or absence of extensive adhesions with the chest wall. Suitability for resection was assessed with arterial gases, pulmonary function tests and echocardiogram. Results were compared using Fishers exact test.

Results: Recurrent hemoptysis was the predominant symptom in both the groups. Exertional dyspnea (A=21.4%; B=56.8%; p=0.03), chest pain (A=21.4%; B=59.5%; p=0.027), cough (A=35.7%; B=70.3%; p < 0.05) and postoperative complications like residual pleural space A=14.2%; B=54%; p=0.013) and pleural collection (A=7.1%; B=37.8%; p=0.041) were predominant in group B. Lobectomy was the most common procedure performed in group B (A=28.6%; B=59.5%), while wedge excision was performed in the majority of patients in group A (A=42.9%; B=29.7%). Recurrence of aspergilloma was seen in 3 patients (8.1%) in group B only. Total number of early and late complications in SA and CA were 7, and 60, respectively. Early mortality was 8.1% and 0.0% in group A and group B, respectively (p=0.552). The overall mortality was 5.4%.

Conclusion: Symptoms were more frequently associated with CA as compared to SA. Surgery for CA was associated with low mortality but significant morbidity, whereas SA had low postoperative morbidity and no mortality.

Key words: Aspergilloma. Hemoptysis. Pulmonary resection. Complex aspergilloma. Lobectomy.

Clinical Profile and Postoperative Outcome in Patients with Simple and Complex Aspergilloma of Lung

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Pulmonary aspergillomas

Aspergillus organisms were histologically confirmed on all resected specimens. Massive hemoptysis was defined as a loss of 200 ml or more of fresh blood in 24 hours.\(^8\)

Massive hemoptysis was a common symptom in both groups, mainly hemoptysis and the findings on serial chest X-rays.

The patients in both groups were followed up in the outpatient department for a mean duration of 27 months. There was only one patient in group A, who presented with hemoptysis but it responded to anti-biotic therapy. There was only one patient in group A, who presented with hemoptysis but it responded to anti-biotic therapy. Uncontrolled diabetes mellitus was present in 20 (39.2%) patients (A=5; B=15), coagulopathies were seen in 17 (33.3%) patients (A=2; B=15), chronic obstructive lung disease was seen in 10 (19.6%) patients (A=2; B=8) and 4 (7.8%) patients (A=0; B=4) were on long-term steroid use.

Pre-operative pulmonary function tests showed a mean FEV1 of 2.44±0.34 litre in group A, whereas it was 2.31±0.27 litre in group B. Data for PFTs in 19 patients, 2 in group A and 17 in group B, could not be obtained due to massive hemoptysis.

Table II shows the various surgical resections performed. As can be seen lobectomy was the commonest procedure performed in both the groups. Postoperative morbidity was seen more frequently in patients with complex aspergilloma. There were 7 complications in group A, compared to group B in which 60 complications were seen (Table III). The most frequently seen complication in group B was post-resectional residual space (p=0.013) and residual collection (p=0.041).

Underlying pulmonary disease was tuberculosis in 41 (80.4%) patients (A=11; B=30), bronchiectasis in 8 (15.7%) patients (A=3 and B=5) being the next. In 2 (3.9%) patients no underlying cause could be identified.

**RESULTS**

Demographic characteristics and clinical features of the two groups are shown in Table I. The predominant symptom in both groups was recurrent hemoptysis. Statistically significant differences in the two groups were found in frequencies of dyspnea, massive hemoptysis, chest pain and cough.

Table I: Demographic characteristics and clinical features of patients A and B in groups.

<table>
<thead>
<tr>
<th>Clinical feature</th>
<th>Group A (n=14)</th>
<th>Group B (n=37)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>32.57±9.77(SD)</td>
<td>32.22±10.06(SD)</td>
<td>0.715</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>10</td>
<td>29</td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>4</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>Recurrent hemoptysis</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(85.7%)</td>
<td>35 (94.6%)</td>
<td>0.30</td>
<td></td>
</tr>
<tr>
<td>Dyspnea on exertion</td>
<td>3 (21.4%)</td>
<td>21 (56.8%)</td>
<td>0.03</td>
</tr>
<tr>
<td>Massive hemoptysis</td>
<td>2 (14.2%)</td>
<td>17 (46%)</td>
<td>0.05</td>
</tr>
<tr>
<td>Chest pain</td>
<td>3 (21.4%)</td>
<td>22 (59.5%)</td>
<td>0.027</td>
</tr>
<tr>
<td>Cough</td>
<td>5 (35.7%)</td>
<td>26 (70.3%)</td>
<td>0.05</td>
</tr>
</tbody>
</table>

Underlying pulmonary disease was tuberculosis in 41 (80.4%) patients (A=11; B=30), bronchiectasis in 8 (15.7%) patients (A=3 and B=5) being the next. In 2 (3.9%) patients no underlying cause could be identified.

Uncontrolled diabetes mellitus was present in 20 (39.2%) patients (A=5; B=15), coagulopathies were seen in 17 (33.3%) patients (A=2; B=15), chronic obstructive lung disease was seen in 10 (19.6%) patients (A=2; B=8) and 4 (7.8%) patients (A=0; B=4) were on long-term steroid use.

Pre-operative pulmonary function tests showed a mean FEV1 of 2.44±0.34 litre in group A, whereas it was 2.31±0.27 litre in group B. Data for PFTs in 19 patients, 2 in group A and 17 in group B, could not be obtained due to massive hemoptysis.

Table II: Types of pulmonary resections performed in group A and B.

<table>
<thead>
<tr>
<th>Surgical procedure</th>
<th>Group A (n=14)</th>
<th>Group B (n=37)</th>
<th>Total (n=51)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lobectomy</td>
<td>4 (28.6%)</td>
<td>22 (59.5%)</td>
<td>26 (51%)</td>
<td>0.049</td>
</tr>
<tr>
<td>Wedge excision</td>
<td>6 (42.9%)</td>
<td>11 (29.7%)</td>
<td>17 (33.3%)</td>
<td>0.50</td>
</tr>
<tr>
<td>Segmentectomy</td>
<td>3 (21.4%)</td>
<td>3 (8.1%)</td>
<td>6 (11.8%)</td>
<td>0.327</td>
</tr>
<tr>
<td>Biolobectomy</td>
<td>1 (7.1%)</td>
<td>1 (2.7%)</td>
<td>2 (3.9%)</td>
<td>0.478</td>
</tr>
</tbody>
</table>

Total 14 (100%) 37 (100%) 51 (100%) -

Table III: Postoperative complications in group A and B.

<table>
<thead>
<tr>
<th>Complication</th>
<th>Group A (n=14)</th>
<th>Group B (n=37)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Respiratory insufficiency</td>
<td>0 (0%)</td>
<td>2 (5.4%)</td>
<td>1.0</td>
</tr>
<tr>
<td>Hemorrhage leading to reoperation</td>
<td>0 (0%)</td>
<td>3 (8.1%)</td>
<td>0.552</td>
</tr>
<tr>
<td>Prolonged air leak (&gt; 7 days)</td>
<td>1 (7.1%)</td>
<td>8 (21.6%)</td>
<td>0.414</td>
</tr>
<tr>
<td>Bronchopleural fistula</td>
<td>0 (0%)</td>
<td>2 (5.4%)</td>
<td>1.0</td>
</tr>
<tr>
<td>Pleural collection</td>
<td>1 (7.1%)</td>
<td>14 (37.8%)</td>
<td>0.041</td>
</tr>
<tr>
<td>Pleural space</td>
<td>2 (14.2%)</td>
<td>20 (54.0%)</td>
<td>0.013</td>
</tr>
<tr>
<td>Empyema thoracic</td>
<td>1 (7.1%)</td>
<td>3 (8.1%)</td>
<td>1.5</td>
</tr>
<tr>
<td>Wound dehiscence</td>
<td>1 (14.3%)</td>
<td>2 (5.4%)</td>
<td>1.0</td>
</tr>
<tr>
<td>Recurrent hemoptysis</td>
<td>1 (7.1%)</td>
<td>3 (8.1%)</td>
<td>1.0</td>
</tr>
<tr>
<td>Recurrent aspergilloma</td>
<td>0 (0%)</td>
<td>3 (8.1%)</td>
<td>0.552</td>
</tr>
</tbody>
</table>

Total 7 60 -

Disability was also started.

Aspergillus disorders. Itraconazole (100 mg b.i.d) was also started.


due to massive hemoptysis. The diagnosis of pulmonary aspergilloma is classically based on radiography, supported by a history of recurrent or massive hemoptysis. Sputum cultures are

DISCUSSION

The diagnosis of pulmonary aspergilloma is classically based on radiography, supported by a history of recurrent or massive hemoptysis. Sputum cultures are
positive in 50% of cases only but serum IgG antibodies are positive in all cases.9 The classical picture of an intracavitory mass surrounded by an air crescent (Monad's sign) is diagnostic of a PA.4,10 This appearance has been given a variety of names including “Air Crescent”, Meniscus, Target, and Bulls eye.11 It is further supported by a CT scan which shows a mass shifting within a cavity or cyst on changes in the position of the patient.9,12 PA were classified as simple (SA) or complex (CA), based on radiological and operative findings as described by Belcher and Plummer.13

In this study, there was a high prevalence of previous pulmonary tuberculosis in both groups A (78.6%) and B (81%). Upper lobes or apical segments of the lower lobes were involved predominantly. Most patients with aspergilloma of the lung are likely to experience mild hemoptysis, but severe hemoptysis may occur, particularly in patients with underlying tuberculosis.9,15 Other authors have also seen a similar association of aspergilloma lung with previous tuberculosis. In another study, tuberculosis was the cause of cavitary lung disease with fungal ball in 89% of the cases.8,16

The most common symptom in both groups was recurrent hemoptysis. In other studies, the incidence of recurrent hemoptysis varied between 65-85%.5,16-19 Bleeding usually occurs from bronchial blood vessels lining the cavity (Rasmussen aneurysms), endotoxins with hemolytic properties released by the fungus, aflatoxins A and G120 and mechanical friction of the aspergilloma with the cavity wall blood vessels. The size of the aspergilloma or the presence of a warning sign does not correlate with the severity of hemoptysis.8,15,21 The incidence of severe or massive life threatening hemoptysis in a previous study22 was 10% which is lower than in the present study where the rate of severe hemoptysis of 14.2% and 46% in groups A and B, respectively was found. In another study from South Korea,7 somewhat similar rates for massive hemoptysis were seen, perhaps due to a similar nature of the underlying disease. Bleeding from these high pressure vessels is an emergency and is unlikely to stop spontaneously.23 In such circumstances a double lumen endotracheal tube must be available to prevent blood flooding contra-lateral lung and causing death by asphyxiation. Some authors have suggested prophylactic bronchial artery embolization to prevent an episode of life threatening hemoptysis and in preparation for elective surgery.8,9

Cough, dyspnea on exertion and chest pain (Table I) were other significant symptoms seen in both groups although more common in group B. These were probably related to the extent and severity of the underlying lung disease process.

The benefit of surgery in PA is three fold - control of symptoms, prevention of recurrence and severe hemoptysis, and possibly prolonging survival.7 Yet it is not without morbidity and mortality with mortality rates as high as 25%.9 High rates of morbidity (upto 60%) were seen due to excessive postoperative bleeding, pleural space and collection and postoperative empyema thoracis. These high rates of mortality and morbidity restricted surgery to patients with severe disease. It was only recently that improved mortality rates were observed with better patient selection and preparation for surgery.24

Lobectomy for PA was reported by Gerstle and colleagues in 1947.15 Various types of surgical resection have been shown in Table II. Wedge excision was performed in peripheral lesions away from the hilum and lobectomies in more central lesions. There were more lobectomies performed in group B because of greater fibrosis and destruction of the parenchyma. In simple aspergilloma cases it was possible to conserve more lung tissue due to the localized nature of the disease. Mortality rates during surgery have declined to 1.5-4% from 7-23%.5,9 In this study, there was an overall mortality of 5.9%. Postoperative complications like bleeding and pleural dead space, mainly depended on the underlying pulmonary condition. Bleeding had been found to be dependent on the severity of pleural thickening and presence of vascular adhesions with the cavity wall. Troublesome postoperative bleeding was encountered in 3 patients. They required multiple units of blood transfusion and re-operation to control hemorrhage from thick vascular pleural adhesions. Thus postoperative blood loss amounted to 1133 ml on the average (1000-1200 ml).

Pleural dead space is dependent on the ability of the residual lung to expand and adhere with the chest wall. In patients with low Forced Vital Capacity it was possible to predict pleural dead space problems. It was also confirmed per operatively as the lung compliance was reduced in complex disease more often than in simple disease. Consequently, 14 patients developed significant residual collections requiring repeated ultrasound guided aspirations or occasionally re-intubation with a chest tube. This intervention led to empyema formation in 4 patients. Prolonged air leak was another significant complication, again secondary to inability of the lung to expand fully and obliterate the pleural space. All those patients were diagnosed with chronic obstructive pulmonary disease and had been on bronchodilators pre-operatively. They were managed with oral and inhalational broncho-dilation, mucolytics, nasotracheal suction, incentive spirometry and chest physiotherapy. Hospital stay was thus prolonged in patients with complex aspergilloma.

The patients who died had complex aspergilloma with moderately low FVCs due to pulmonary fibrosis. One patient died due to acute myocardial infarction and the
remaining two died due to respiratory failure. All 3 patients were diabetic and had multiple episodes of severe hemoptysis in the past. Most complications and all deaths were seen in group B. Simple aspergilloma had only 7 complications and no deaths (Table III). These results are in agreement with other studies.6, 25

On follow-up in 38 patients serial chest X-rays demonstrated gradual expansion of lung to obliterate the pleural space in most patients with complex aspergilloma.

During the follow-up period 3 patients in the complex aspergilloma group presented with recurrent hemoptysis and further investigations demonstrated a recurrence of aspergilloma. All of them had undergone a wedge resection as definitive treatment. Two patients have undergone a completion lobectomy to eradicate the disease and one is awaiting surgery.

CONCLUSION

Complex aspergilloma tends to be symptomatic than simple aspergilloma. Surgery for complex aspergilloma was associated with low mortality but significant morbidity, whereas those with simple aspergilloma had low postoperative morbidity and no mortality. Patients with CA should undergo thorough pre-operative evaluation and surgery should be advised judiciously.

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REFERENCES