Surgical Treatment of Pulmonary Aspergilloma: A Series of 72 Cases

Himanshu Pratap1, R.K. Dewan1, L. Singh1, S. Gill1 and S. Vaddadi2

Departments of Thoracic Surgery1 and Pulmonary Medicine2, LRS Institute of Tuberculosis and Respiratory Diseases, New Delhi, India

ABSTRACT

Background. The objective of this study was to evaluate the immediate and long term result of resectional surgery in pulmonary aspergilloma.

Methods. Seventy-two patients who underwent pulmonary resectional surgery for symptomatic aspergilloma between 1990 to 2002 were studied. Seventy-nine definitive operations were carried out, including one bilateral lobectomy for recurrent lesions and six thoracoplasties to deal with post-operative complications, besides 21 pneumonectomies and 51 lobectomies. There were 10 bilobectomies as well, included in the lobectomy group.

Results. At a mean follow-up of 3.5 years, there were two post-operative deaths and a few complications occurred in 20 cases translating into a morbidity of 28.57% and a mortality of 2.77 percent. Major complications included were persistent air leak, persistent pleural space, empyema, bronchopleural fistula and massive haemorrhage. All events were seen in cases of complex aspergilloma; cases of simple aspergillomas had an uneventful course.

Conclusions. Surgery offers definitive and long term symptom-free survival in cases of pulmonary aspergilloma at a negligible risk; though almost one-third of those undergoing surgery develop some complications, these are largely manageable. [Indian J Chest Dis Allied Sci 2007; 49: 23-27]

Key words: Aspergilloma, Pulmonary, Tuberculosis, Surgery.

INTRODUCTION

Pulmonary aspergilloma, the so-called fungus ball or mycetoma, is a clinical syndrome of worldwide presence and represents one of the many manifestations of human disease due to the fungus Aspergillus. These include asymptomatic inconsequential presence in healthy hosts, chronic necrotising aspergillosis in patients with chronic lung disease, invasive aspergillosis in immunocompromised hosts and allergic bronchopulmonary aspergillosis in asthmatics.1 The term aspergilloma refers to colonisation of pre-existing lung cavities with the Aspergillus fungus, most commonly the fumigatus species, and the lesion itself consists of a tangled mass of fungal hyphae, fibrin, epithelial cells, mucus, debris and blood cells.2 Tubercular lesions are the most common cause of such cavities although aspergillomas may occur within cavities of diverse aetiologies including sarcoidosis, bronchiectasis, cysts and bullae, neoplasms, ankylosing spondylitis, Wegener’s granulomatosis, and pulmonary infarction.1 Though the natural history of such a lesion is not completely understood, it has the propensity to cause recurrent and severe haemoptysis; besides, when super infected, the illness runs a distressing and protracted course.3

Pulmonary aspergilloma is the only surgically relevant manifestation of Aspergillus infection and though known for a century- and-a-half now, controversy still surrounds its optimal management.1-3 The controversy surrounds the surgical management stems from the perceived threat of morbidity and mortality consequent to surgery and it has led to recommendations of surgery only as a last resort,5 or restricted to symptomatic cases only6,7 or an option for all cases to preempt massive haemoptysis.8-10 In this paper we are presenting a series of 72 cases of pulmonary aspergilloma treated surgically at our centre over the last 12 years, to evaluate our indications and results.

MATERIAL AND METHODS

During a 12-year period from 1990 to 2002, 72 patients underwent surgery for pulmonary aspergilloma at LRS Institute of Tuberculosis and Respiratory Diseases in the...
Department of Thoracic Surgery. The patient’s records were retrieved and 72 consecutive cases were studied with reference to clinical profile, radiological findings, indications of surgery, surgical procedures used and short- and long-term post-operative outcomes. There were 47 male and 25 female patients in the age group of 26 to 58 years (mean 32 years).

Overall, 79 definitive surgical procedures were carried out, including six thoracoplasties to deal with post-operative complications but in one patient bilateral lobectomy was done for recurrent disease. All the cases were operated under general anaesthesia, with double-lumen endotracheal tubes in situ for adequate isolation and selective ventilation, through standard posterolateral thoracotomy. Considerable adhesions were seen in all of our cases and significant intraoperative haemorrhage occurred despite liberal use of electrocautery. In four cases, we had to resect portions of 3rd and 4th ribs when densely adherent to the lesions and in two cases we had to resort to intrapericardial ligation of pulmonary vessels as the extra pericardial hilum was unapproachable. In most of the cases we developed the extra pleural plane between the parietal pleura and chest wall to dissect along the endothoracic fascia, but the apical region nevertheless demanded considerable patience and, despite best efforts, in one patient massive intraoperative haemorrhage led to death shortly after the operation.

RESULTS

Clinical Profiles

The patients were largely admitted for the evaluation of haemoptysis, some cases complained of chronic productive cough, while a few cases had suffered from fever, chest pain and dyspnoea. The severity of haemoptysis was categorised as moderate, severe and massive depending upon whether the amount of bleeding over a 24-hour period was less than 150 ml, 150 to 300 ml or more than 300 ml respectively. The clinical and radiological presentation of the cases are summarised in the table.

Radiological findings and other diagnostic methods

During evaluation, the diagnosis of aspergilloma was made primarily on the radiological examination showing “fungus-ball” on plain chest radiograph and demonstration of lung parenchymal cavity with free ball-lesion on computerised tomography (Figures 1-3). The aspergillomas were classified into two sub-groups, viz. simple aspergilloma (thin-walled cavity; no parenchymal/pleural disease) and complex aspergilloma (thick-walled cavity; associated parenchymal/pleural disease) for prognostic purpose.

Table. Clinical and radiological features of the cases

<table>
<thead>
<tr>
<th>A. Clinical Presentation</th>
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<tbody>
<tr>
<td>Haemoptysis</td>
<td>47 (65.28%)</td>
</tr>
<tr>
<td>Moderate</td>
<td>20</td>
</tr>
<tr>
<td>Severe</td>
<td>15</td>
</tr>
<tr>
<td>Massive</td>
<td>12</td>
</tr>
<tr>
<td>Chronic productive cough</td>
<td>17 (23.61%)</td>
</tr>
<tr>
<td>Fever, chest pain, dyspnoea</td>
<td>08 (11.11%)</td>
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<table>
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<tr>
<th>B. Radiological Presentation</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>(a) Appearance</td>
<td></td>
</tr>
<tr>
<td>Destroyed one lung with aspergilloma shown on CECT</td>
<td>21</td>
</tr>
<tr>
<td>Cavitatory lesion with air crescent sign</td>
<td>42</td>
</tr>
<tr>
<td>Localised bronchiectatic lesion with aspergilloma shown on CECT</td>
<td>09</td>
</tr>
<tr>
<td>(b) Location</td>
<td></td>
</tr>
<tr>
<td>Right destroyed lung</td>
<td>14</td>
</tr>
<tr>
<td>Left destroyed lung</td>
<td>07</td>
</tr>
<tr>
<td>Left upper lobar lesion</td>
<td>20</td>
</tr>
<tr>
<td>Right upper lobar lesion</td>
<td>18</td>
</tr>
<tr>
<td>Left lower lobar lesion</td>
<td>12</td>
</tr>
</tbody>
</table>

Figure 1. Chest radiograph (PA view) demonstrating classical air crescent sign in right upper zone of lung.

There were eight cases of simple aspergillomas while the rest were complex lesions. Complex aspergilloma may be part of chronic necrotising pulmonary aspergillosis as its clinical symptoms may progress to a severe form.17 Radiological findings in relevant cases are presented in the table. Fiberoptic bronchoscopy was performed in 42 cases and aspergillus species was documented in 16 such cases. In all cases immunoelectrophoreses on agar gel were requested to
demonstrate the presence of precipitating antibodies. Positive serological results were obtained in 59 cases.

Pre-existing Lesions

The underlying pathological lesions responsible for the fungal growth were tubercular cavities in 61 cases (84.72%) while bronchiectatic cavities contained aspergillus in nine cases and old pyogenic lung abscess was the culprit in the remaining two cases.

Indications and Types of Surgery

The patients were evaluated and surgery was offered. The extent of surgery was determined by the degree of involvement of the parenchyma and functional reserve of the patient. In all, 21 pneumonectomies and 51 lobectomies were performed; in 10 of the right upper lobe lesions bilobectomies were done, by removing both the right upper and middle lobes, due to presence of adhesions.

Spirometric threshold of resectional surgery was primarily based on forced vital capacity, forced expiratory volume in one second (FEV₁) and maximum voluntary ventilation along the usual guidelines and thoracotomy was offered so long as predicted post-operative FEV₁ exceeded 40 percent. The resected specimens were routinely sent for histopathology and fungal culture and confirmation of diagnoses was thus obtained. In this series, the average blood loss during surgery was 850 ml (350-2000 ml) during pneumonectomy and 550 ml (200-1500 ml) during lobectomy. The mean quantity drained over first 24 hours was 600 ml (500-1000 ml) after lobectomy and 800 ml (500-1200 ml) after pneumonectomy. Massive haemorrhage was defined as a blood loss exceeding 1500 ml over 24 hours.

Post-operative Course

Post-operative course was uneventful in 50 out of 70 cases. Two patients died, while complications developed in 20 cases; thus morbidity rate in this series was 28.6 percent. All the complications were observed in cases of complex aspergilloma only. Post-operative courses were complicated in lobectomy cases, by persistent air leak exceeding 10 days in five cases and persistent pleural space in three of the pneumonectomy cases converting into empyemas. Massive haemorrhage occurred in three lobectomy and two pneumonectomy cases. Air leaks responded to prolonged tube drainage in three cases and two patients required thoracoplasty. Empyemas were managed with thoracostomy and local irrigation and resolved over one to three months. Post pneumonectomy empyemas were managed by thoracostomy and irrigation initially and secondary thoracoplasty after the patient regained reasonable health. Persistent pleural spaces reflected insufficient compensatory hyperinflation of the remaining pulmonary parenchyma. These in the absence of air leak or pleural space infection did not require treatment and were managed conservatively. However, in one case, thoracoplasty was performed. Thus, overall, six thoracoplasties were performed preceded by thoracostomy in three post-pneumonectomy cases. Massive haemorrhages were treated with blood transfusion and volume replacement.

Overall there were two deaths, one due to massive intraoperative bleed and the other due to non-resolving pneumonia on 15th post-operative day, leading on to respiratory failure and death.

Follow-up was completed in 59 cases for a mean period of 3.5 years, and in the 12 to 40 years range we encountered two recurrences. One patient who had a lobectomy earlier, was treated with contralateral lobectomy and the other is being managed conservatively for mild episodic haemoptysis, who refused for surgery.
DISCUSSION

Aspergillus fumigatus, the commonest agent of aspergilloma, is a saprophytic fungus ubiquitously present over dead and decaying surfaces. In healthy hosts, it produces no disease. When it colonizes a pre-existing pulmonary cavity, mycetoma or aspergilloma forms. Natural history of aspergilloma varies from a stable lesion to progression and even spontaneous regression is reported in about 5% cases. Predicted mortality due to aspergilloma is reported at a rate of 6% per annum. A definitive diagnosis is established by histopathological examination and culture of the involved tissue but is largely entertained on the basis of characteristic radiological demonstration of fungal ball. Sputum isolation has doubtful specificity given frequent airway colonisation.

Serological diagnosis has reasonably good sensitivity and specificity but has limited clinical importance in a typical scenario. In our series, as is usually the case, radiology formed the basis of diagnosis. In addition, culture of the resected specimen was always obtained. Aspergilloma manifests either as an incidental radiological finding or causes haemoptysis that can be massive, or recurrent and, indeed, fatal and reportedly complicates 50% to 80% of cases. In our series it formed the basis of treatment in over 65% cases as also reported earlier. Underlying postulated mechanisms of haemoptysis include erosion of vascular cyst wall by the movement of ball, elaboration of trypsin-like substance or endotoxins by the fungus, type III antigen-antibody reaction or the underlying lung disease itself. The bleeding is commonly from the bronchial arteries and frequently remits on its own. Very rare instances of first episode fatal bleed have been reported and are presumed to occur from intercostal vessels.

Patients presenting to us, including those with severe haemoptysis, could all be managed conservatively with bed rest, antitussives, antifibrinolytics and blood transfusion. We did not encounter any fatal first bleed nor was any emergency surgery or arterial embolisation deemed necessary, though we generally operated such cases on a priority basis. Size and location of the lesion do not bear any relation to the severity of bleeding. It was noted that upper lobes of lungs were the favoured site of aspergillomas. Though Bennet first reported a case as long back as in 1842 and Gerstle and colleagues reported a lobectomy in 1947, the best treatment of aspergilloma has remained contentious.

Review of literature reveals that the major obstacle to acceptance of surgery as the treatment has been the high mortality and morbidity consequent to surgery. The surgery is the only definitive modality of treatment is now a well established and non-debatable issue. Drug therapy of aspergilloma has highly inconsistent and largely incomplete results though antifungal therapy has been used by various routes like oral, intravenous and, topical. We have not used antifungal treatment at our institution. However, according to some authors, “successful treatment of complex aspergilloma needs both surgery and perioperative drug therapy. At present amphotericin B (1.0–1.5 mgm/kg/day), 5-flucytosine (5FC, 100-150 mgm/kg/day), itraconazole (ITCZ, 200-400 mgm/day) and micafungin (MCFG, 150-300 mgm/day i.v.) are used. Recently caspofungin (CAP) has been utilised. Therefore, combination therapy has attracted increasing attention. Slowly growing aspergilloma may be kept under observation.

Bronchial artery embolisation is another modality that has similar dubious long-term effects and perhaps represents a temporising measure at best1 and we strongly feel that its use should be restricted to massive and haemodynamically significant bleeds, in surgical unfit cases or cases where surgery can not be offered or is rejected.

Surgery, not only offers symptomatic control but also confers survival advantage and is being used even in asymptomatic cases to preempt massive bleed and death. A marked decline in mortality and morbidity due to surgery has led to its greater acceptance in recent years. Procedural death has seen a significant decline from 07-23% to 1.5-04% of late. In our series, there were only two deaths. As respiratory failure tops the list of causes of post-operative deaths in various reports, judicious selection of cases and appraisal of respiratory functional reserve of the patient is important. Post-operative complications, however, still remain the Achilles’ heel of surgical management. The spectrum of complications noted in our series is similar to that reported in other series, with the difference that haemorrhage was ranked the highest in our series, perhaps due to the fact that most of our cases were complex aspergillomas and hence adhesions were present in all the cases.

Over the years the post-operative complications have also shown a downward trend, though not as steep as with the mortality. In 1997 Chen et al reported a morbidity of 17.9% whereas most recently Akbari et al have reported a complication rate of 26.1 percent. In various other reports in the last decade, complications have occurred in 20% to 30% cases. In the current series, the post-operative course was complicated in 28.6 percent. All the complications in our series were seen in complex aspergillomas. Simple aspergillomas have had no mortality and morbidity. This compares favourable with the series reported by Akbari et al. This is understandable, given the fact that, complications largely result from dense vascular adhesions or incomplete lung expansion.

In conclusion, we believe that surgery can be carried out to treat pulmonary aspergilloma with negligible mortality and acceptable morbidity. However, in the absence of definite knowledge regarding its natural history and, given the fact that morbidity remains a
nagging issue, resectional surgery should be advised judiciously and it may seem prudent to treat the consequences, rather than the presence of the lesion.

REFERENCES

Full text articles published in IJCDAS from July-September 2003 onwards can be accessed online on Internet through the following sites

V.P. Chest Institute’s site: http://www.vpci.org.in
Indmed's site: http://medind.nic.in

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