Treatment of complicated pulmonary aspergillomas with cavernostomy and muscle flap: interest of concomitant limited thoracoplasty

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Abstract

Objective: Lung resection for complex aspergilloma (CA) carries high morbidity and mortality and remains controversial in high-risk patients. Cavernostomy followed by muscle-flap plombage has been recommended for patients considered unfit for resection, but subsequent muscle-flap atrophy may be a main cause of failure. We reviewed the place of a limited thoracoplasty in association with that procedure. Methods: Five patients complaining of haemoptysis related to CA were denied lung resection because of bilateral lung destruction (n = 1), and required completion pneumonectomy (previous lobectomy for cancer followed by adjuvant radiation therapy, n = 4). We analysed the data concerning the alternative surgical procedures performed and their immediate and late results. Results: The surgery consisted in cavernostomy, removal of the fungus ball, cavity obliteration with the most directly available muscle flaps (rhomboid muscle n = 2, trapezius and rhomboid n = 2, serratus major and subscapular n = 1). A limited thoracoplasty ranging from 2 to 5 portions of rib (mean resected rib portions n = 3.4) was performed in addition to this procedure. The postoperative course was uneventful. All patients are still alive (mean follow-up 3 years; range: 1—6 years) and faring well without thoracoplasty-related aftereffect, complication related to muscle-flap disuse atrophy nor recurrence of the disease. Conclusion: Cavernostomy followed by muscle transposition has been reported to provide encouraging results. Combining a limited thoracoplasty during the same operation is a simple, safe and well-tolerated procedure regularly achieving good results, and thus deserving consideration.

Keywords: Aspergilloma; Myoplasty; Thoracoplasty; Pneumonectomy; Haemoptysis

1. Introduction

Aspergilloma (fungus ball, mycetoma) is the clinical form of Aspergillus developing in patients with pre-existing pulmonary cavities or areas of infarction or necrosis. It is classified into two categories: simplex and complex [1]. Simplex aspergilloma develops in cavities surrounded by normal lung and pleura, whereas complex aspergilloma (CA) develops in cavities formed by gross disease in the surrounding lung tissue (such as chronic tuberculosis and chronic lung abscess), with the lung most often entrapped within thick and fibrotic pleura. Surgical resection is recommended because of the dramatic risk of life-threatening haemoptysis, but carries significant morbidity and mortality rates, particularly when patients undergo a pneumonectomy [2]. Thoracoplasty was performed as a last resort in particularly debilitated patients but did not gain a large spread [3,4]. Daly and colleagues [5] advocated cavernostomy and myoplasty as appropriate therapy, but muscle-flap disuse atrophy has been described as a cause of failure [6,7]. We reviewed the effectiveness of a combined procedure, with a limited thoracoplasty, in achieving cure in highly at-risk patients exhibiting a complicated CA.

2. Patients and methods

Between January 2002 and December 2007, 28 patients underwent a pulmonary resection for an aspergilloma at the Georges Pompidou European Hospital in Paris, France. Over the same period, five consecutive patients for whom a pulmonary resection was denied, were treated by a limited thoracomyoplasty: they form the basis of this report. We retrospectively reviewed the hospital records. There were three males and two females. The average age of the patients was 60 years (range: 47—85). Aspergilloma complicated tuberculosis sequelae in one patient and localised pulmonary necrosis induced by adjuvant radiation therapy following lobectomy for cancer in four. Preoperative work-up included standard chest radiography, computed tomodensitography of the chest, fibroptic bronchoscopy and pulmonary function tests.
tests when conditions permitted. Sputa were smeared for acid fast bacilli, and cultured for bacteria and tuberculosis bacilli, with negative results.

The procedure was performed through a posterolateral incision which was extended vertically upwards to provide adequate exposure of the upper ribs when necessary. The directly available extrathoracic muscles (mainly trapezius and rhomboid) were dissected free on their vascular pedicle and developed as muscle flaps: none of them was divided during the procedure. Excision of the ribs was done subperiostally: the first two ribs resected were those overlying the cavity, either pleural or pulmonary, so as to localise and to open it: its content was evacuated and subsequently cultured for bacteria and tuberculosis bacilli, but only demonstrated *Aspergillus fumigatus*. The excision of the surrounding ribs was pursued under control so as to provide sufficient collapse of the cavity. The cavity was filled by the previously dissected muscle flaps so as to also buttress the bronchial fistulae, and drained by a Monaldi Chest tube (Porges, Le Plessis Robinson, France) during 3 weeks. Appropriate perioperative antibiotics and prophylactic low-dose heparin sodium therapy were routinely employed. The postoperative management of patients included the application of compression pads to the chest wall, maintained for a few days and physical therapy to ensure good bronchial clearance, pain relief and shoulder mobility. The variables that were analysed concerned the indications of the procedure, the extent of the thoracoplasty, the used muscle flaps, the postoperative period, the immediate and the long-term results. The patients were followed up by the thoracic surgeons of the department and by the practitioners of the referring medical departments, and this study received the consent of our hospital board.

3. Results

The main characteristics of the patients are shown in Table 1.

One patient presented with a haemoptysis due to an aspergilloma located in a fibro-cavernous lesion of the right upper lobe, and associated with bilateral lung parenchyma destruction and lung function impairment contraindicating any pulmonary resection. He underwent the resection of ribs two to four, cavernostomy, removal of the fungus ball and the cavity being filled with the rhomboid muscle. The post-operative course was uneventful and he is still faring well with a good result (4-year follow-up, Fig. 1).

The four other patients had already undergone a lobectomy, and the aspergillosis disease was located in the operated hemithorax:

- Surgery was required for haemoptysis from a fungal cavity of the remaining lobe in three patients. Completion pneumonectomy was denied because of poor lung function ($n = 1$), age (85 years) ($n = 1$) and diaphragm prosthetic replacement ($n = 1$), and also because the risks of this operation appeared still more important after radiation therapy. The procedure included cavernostomy, removal of the fungus ball, cavity obliteration with the trapezius and the rhomboid muscle ($n = 2$), or the rhomboid muscle alone ($n = 1$), and a limited thoracoplasty (Table 1). A partial scapulectomy was performed in one patient to prevent scapula entrapment within the inferior portion of the chest wall. The three patients recovered without postoperative complication and are still faring well.
- Surgery was indicated for intrapleural aspergilloma in one patient. An empyema necessitatis related to aspergillosis occurred 3 years after a left upper lobectomy with chest wall parietectomy and prosthetic replacement for a T3N1 non-small-cell lung cancer, completed by adjuvant radiation therapy. The prosthesis was removed and a limited thoracoplasty permitted to elapse the residual cavity after it was filled with the serratus major, the subscapular muscle (freed by inferior partial scapulectomy), and the paravertebral muscle mass. The postoperative course was

### Table 1

<table>
<thead>
<tr>
<th>Gender</th>
<th>Age</th>
<th>History</th>
<th>Aetiology</th>
<th>FEV1/PaO₂ (%/mmHg)</th>
<th>Side</th>
<th>Ribs</th>
<th>Muscle</th>
<th>Hospital stay</th>
<th>Follow-up</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>66</td>
<td>&gt;10 y</td>
<td>Tuberculosis</td>
<td>54/70</td>
<td>Right</td>
<td>1–3</td>
<td>Rhomboid</td>
<td>37 days</td>
<td>4 y</td>
</tr>
<tr>
<td>Female</td>
<td>48</td>
<td>8 y</td>
<td>Cervix c.</td>
<td>84/91</td>
<td>Left</td>
<td>1–4</td>
<td>Rhomboid</td>
<td>8 days</td>
<td>6 y</td>
</tr>
<tr>
<td>Female</td>
<td>85</td>
<td>4 y</td>
<td>Lung c. rp</td>
<td>93/75</td>
<td>Left</td>
<td>2–4</td>
<td>Trapezius rhombid</td>
<td>23 days</td>
<td>1 y</td>
</tr>
<tr>
<td>Male</td>
<td>72</td>
<td>3 y</td>
<td>Lung c. rp; Pleur asp</td>
<td>68/49</td>
<td>Left</td>
<td>2–6</td>
<td>Serratus subscap. paravert.</td>
<td>28 days</td>
<td>2 y</td>
</tr>
<tr>
<td>Male</td>
<td>53</td>
<td>2.5 y</td>
<td>Lung c. rp</td>
<td>61/101</td>
<td>Left</td>
<td>3–4</td>
<td>Trapezius rhombid</td>
<td>22 days</td>
<td>1 y</td>
</tr>
</tbody>
</table>

*: metastasis invading the diaphragm; y: years; subscap: subscapular; paravert: paravertebral; c.: cancer; rp: radiation pneumonitis; and pleur asp: pleural aspergillosis. All patients are alive at follow-up.
uneventful and the patient is still alive and faring well (2-year follow-up).

4. Discussion

It is commonly admitted that definitive treatment for symptomatic patients with aspergilloma consists in surgical removal of the infected lung. Surgery for patients with simple aspergilloma carries little risk, but surgery for CA is associated with a high incidence of complications [1,2,5,8]. Lobectomy is currently the most frequent procedure [1,2,5,8—10] and pneumonectomy is more rarely required. However, pneumonectomy heralds the highest incidence of dreadful complications. Among them, empyema and broncho-pleural fistula, a main cause of postoperative death, have been reported with a high frequency: 4 out of 5 [5], 5 out of 5 [6], 2 out of 7 [9] and 2 out of 10 [10]. The pneumonectomy should have been a completion pneumonectomy in the four patients we reported. Completion pneumonectomy represented five out of the nine pneumonectomies in the series of Daly and colleagues [5]. Actually, aspergilloma may represent from 3.6% [11,12] to 7.6% [13] of the indications of completion pneumonectomy and account for 23.3% [11], 26.3% [13] and 30.8% [12] of postoperative deaths.

Thoracoplasty is rarely indicated for CA [4], and was only reported anecdotally [3,14]. Actually, thoracoplasty is mainly performed to obliterate residual air spaces following lobectomy, either during the same operation [5,6,14], or more commonly as a secondary procedure [8—10,14]. Utley [15] reported two patients with aspergilloma complicating radiation pneumonitis after lobectomy for lung cancer who underwent a complete thoracoplasty (ribs one through eight) after completion pneumonectomy. When a surgical resection is deemed unfeasible, cavernostomy is commonly preferred to thoracoplasty. The first cavernostomy for aspergilloma was reported in 1968 by Henderson and Pearson [16]. Cavernostomy completed by irrigation with fungal agents was performed by Jewkes and colleagues [8] in nine patients, but the operation mortality was high. ‘Open’ cavernostomy represented 9.5%, 16.6% and 19.5% of patients operated on for CA (8 out of 84 [9], 12 out of 72 [17] and 17 out of 87 [10], respectively), and was sometimes closed by a muscle flap during a second operation (4 out of 8 [9] and 3 out of 17 [10]), after daily dressing changes with local application of amphotericin B of several months duration. Long-term results were seemingly good and the method was effective to prevent recurrence of haemoptysis, but performing the muscle transposition long after the cavernostomy may appear as an inconvenience.

Daly and colleagues [5] obliterated their cavernostomies with extrathoracic skeletal muscles in six patients, subsequently in three and during the same operation in three other patients with good results. El Oakley and colleagues [6] also performed a complementary myoplasty (latissimus dorsi) in two patients during the same operation, but the muscle flaps atrophied within a few weeks following the operation. Tseng and colleagues [7] also observed late failure after cavernostomy combined with intrathoracic muscle-flap transposition. The disuse muscle atrophy occurring in the first 5—6 weeks after transposition and the severe destruction caused by fibrosis and adhesions that prevented the surrounding lung to expand appeared to be responsible for partial cavity recurrence.

We believe that the immediate good results and the absence of late recurrence in our patients are related to the associated limited thoracoplasty: the cavity is, as usual, ‘unroofed’ by resecting the chest wall so as to permit the muscle to drop down into the cavity. The limited thoracoplasty performed around the chest wall resection required for the cavernostomy is followed by a progressively occurring retraction of the surrounding lung even when fibrotic that compensates for the recurring small cavity induced by atrophying disused muscle. Another advantage of combining a limited thoracoplasty with a myoplasty was to use the extrathoracic muscles directly available during the procedure, mainly rhomboid and trapezius muscle, and not to resort to major muscles such as pectoralis major and latissimus dorsi, so avoiding additional major dissection.

To conclude, symptomatic CA is a challenging therapeutic problem in case of high-risk patients for pulmonary resection. Cavernostomy followed by muscle transposition emerged as an alternative procedure providing encouraging results. Combining cavernostomy, muscle transposition and a limited thoracoplasty during the same operation may accelerate recovery and still ameliorate these results and for that reason is likely to deserve further consideration in the treatment of complicated pulmonary aspergillomas.

References


