



Complex pulmonary aspergilloma treated with single stage cavernostomy and myoplasty

Cengiz Gebitekin^a, A. Sami Bayram^{a,*}, Selcuk Akin^b

^aDepartment of Thoracic Surgery, School of Medicine, Uludag University, GKDC-ABD, 16059 Bursa, Turkey

^bDepartment of Plastic Surgery, School of Medicine, Uludag University, Bursa, Turkey

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Abstract

Objective: Complex pulmonary aspergilloma (CPA) following pulmonary tuberculosis may lead to massive and fatal hemoptysis. Pulmonary resection, as initial therapy, carries high morbidity and mortality. Resection is contraindicated in patients with compromised lung function (FEV1 < 40%) and in those with bilateral disease. We reviewed the results of patients undergoing single stage cavernostomy and myoplasty as an alternative therapy in patients with normal and compromised lung function. **Methods:** Patients suffering from recurrent massive hemoptysis (600 ml/24 h or > 150 ml/h) due to CPA were selected for single stage cavernostomy and myoplasty. We performed rib resection, cavernostomy, closure of the bronchial openings and total/partial obliteration of the cavity with a muscle flap as a single stage technique in patients with CPA regardless of pulmonary function or bilateral disease. Patients began oral Itracanzole two weeks prior to surgery and continued for 3 months post-operatively. **Results:** Three women and four men (median age 38 years; range 24-59 years) with CPA were evaluated. Four patients had either bilateral disease or compromised lung function. Pectoralis major muscle was used for the myoplasty in five and trapezius or latissimus dorsi in the other two patients. The median number of bronchial fistulae closed during the surgery was six (range 2-12). Blood loss was minimal (median 227 ml). Two patients underwent successful re-exploration for significant air leak. The median hospital stay was 9 days (6-27days). Six patients are alive and hemoptysis free (median follow-up 57.2 months). **Conclusions:** Cavernostomy and myoplasty as a single stage technique is safe and reliable in the management of patients with complex pulmonary aspergilloma. Morbidity is low even in patients with compromised lung function or bilateral disease.

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Keywords: Complex pulmonary aspergilloma; Myoplasty; Surgery; Tuberculosis

1. Introduction

Complex pulmonary aspergilloma (CPA) is defined as a thick wall cavity surrounded by diseased lung and containing a fungus ball. CPA complicating pulmonary tuberculosis often leads to massive hemoptysis. Aspergilloma can develop in cavities caused by necrotizing infections, radiotherapy and occasionally cavitating lung cancers. Pulmonary resection is a preferred curative treatment but carries a high morbidity and mortality. Resection is usually contraindicated in patients with compromised lung function and/or bilateral disease. Alternative palliative procedures such as cavernostomy, bronchial artery embolisation or intracavitary Amphotericin B instillation are often performed. Although Daly [1] advocated cavernostomy and myoplasty as appropriate therapy in the management of CPA, controversy still exists concerning the optimum medical or surgical treatment of CPA in higher risk patients, such as

those with FEV1 < 40% or bilateral disease. We evaluated single stage cavernostomy and myoplasty in patients with normal or compromised lung function and/or bilateral disease.

2. Materials and methods

In total, nine patients suffering from massive hemoptysis (600 ml/24 h or > 150 ml/h), due to CPA were referred to our center for surgical treatment between March 1997 and September 2004, however, seven patients were selected for the procedure. One patient refused surgery and the other selected for the embolization of the bronchial artery because of poor general condition. The location of the cavity was in the apical region in all cases, in the anterior part in five cases and in the posterior in the other two. Four patients (4/7) had severely compromised lung function, FEV1 < 40% and two patients suffered from bilateral cavities (Fig. 1). Computed tomography (CT) confirmed a thick walled cavity containing a fungus ball surrounded by a crescent of air and a diseased lung parenchyma (Fig. 2). All patients had more than one episode of massive hemoptysis prior to surgery.

* Corresponding author. Tel.: +90 224 4429166; fax: +90 224 4428698.
E-mail address: cgebitekin@uludag.edu.tr (A. Sami Bayram).

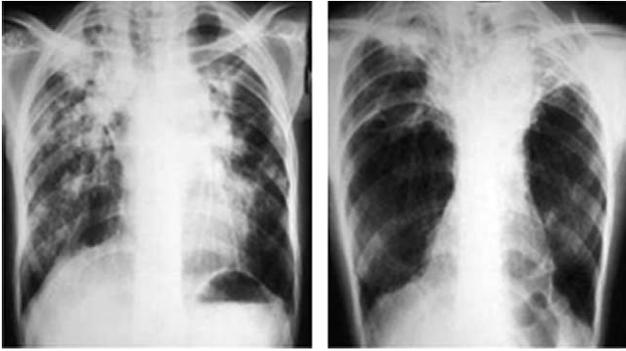


Fig. 1. Bilateral disease causing severely compromised pulmonary function, left: case 5, right: case 4.

All tests to search active tuberculosis were negative in all patients undergoing surgery.

A selected muscle flap, pectoralis major, latissimus dorsi, or trapezius, was chosen according to the location of the cavity and prepared prior to partial rib resection for myoplasty. Cavernostomy was performed and the fungus ball has been removed via partial rib resection. The specific area of rib overlying the cavity was partially resected to gain access for the myoplasty and to avoid contamination of the pleural cavity. Partial resection of one rib only was wide enough for myoplasty in all cases. All bronchial openings were located with high-pressure ventilation and closed



Fig. 2. CT appearance of aspergilloma in case 1: up, and case 6: dawn (white arrow—fungus ball).

directly using 3/0 Vicryl (Ethicon, Inc., USA) sutures. Tiny pieces of Gore-Tex patches was used to buttress fistula closures owing to fragile cavity wall. The cavity was irrigated with Amphotericin-B, and partial or complete obliteration of the cavity was achieved using the muscle flap prepared prior to cavernostomy. Two 16F catheters were placed into the cavity and muscle bed and removed on fifth post-operative day unless air leak was persistent. All patients were extubated at the end of the procedure. Itracanzole (200 mg twice daily) was started two weeks prior to surgery and continued for 3 months following hospital discharge. All patients were followed up at 3-month intervals. Computed tomography of the chest is performed annually in order to detect early recurrence.

3. Results

Seven patients (four men and three women) underwent cavernostomy and myoplasty for CPA in a single hospital between March 1997 and September 2004. Cavitating tuberculosis preceded CPA in five patients, radiation induced cavity with aspergilloma in one and necrotising aspergillus pneumonia in the other. Patient characteristics and the location of the aspergilloma are shown in Table 1. The mean age was 38 years (range 24-59 years) and the median FEV1 was 1.4 l—39% of predicted (ranged 0.56-1.67 l/21-82%; Table 1).

An anterior approach and cavernostomy was used in five patients and a posterolateral approach in two. The median number of bronchial fistulae closed during surgery was six (range 2-12). Gore-Tex fabric was used to buttress the suture line in only one patient due to fragile cavity wall. The Pectoralis Major muscle was the most commonly used muscle for myoplasty. The median blood loss was 227 ml (ranged 95-347 ml). Partial or complete obliteration of the cavity was achieved in all patients (Fig. 3).

Two patients were successfully re-explored for massive air leak from an occult bronchial fistula (post-operative day 2 and 8, respectively). There was no 30-day or in-hospital mortality. The median hospital stay was 9 days (range 6-15). One patient died 3 months after successful cavernostomy and myoplasty. All other six patients are alive and well without symptoms or recurrence at a mean follow-up of 57.2 months (range 18-83 months) (Fig. 4).

4. Discussion

Aspergillus fumigatus has a low pathogenicity for humans, and invasive infection does not occur unless without immunosuppression from debilitating illness or immunosuppression therapy. Pulmonary aspergilloma occurs in pre-existing cavities which are colonized by the fungus, producing a tangled mass often referred to as a fungus ball or mycetoma. Many patients with aspergilloma have underlying disorders or associated predisposing risk factors such as tuberculosis, necrotizing pneumonia, radiation, etc. In our series and others [1-5], pulmonary tuberculosis was the most common underlying predisposing factor for CPA. In a large

Table 1
Patient characteristics

Case no	Sex	Age	Location	Predisposing factor	Previous surgery	FEV1, L (%)	Muscle used	Recurrence
1	Male	59	RLL	NAP	Bilobectomy	1.67 (45)	Pectoralis major	No
2	Female	34	LLL	Tuberculosis	No	0.98 (32)	Pectoralis major	No
3	Male	40	RUL	Tuberculosis	No	1.4 (82)	Latissimus dorsi	No
4	Female	24	RUL and LUL	Bilateral tuberculosis	No	0.56 (21)	Trapezius	No
5	Female	37	RUL and LUL	Bilateral tuberculosis	No	0.56 (22)	Pectoralis major	Died
6	Male	38	RUL	Bilateral tuberculosis	No	1.64 (39)	Pectoralis major	No
7	Male	39	LLL	Radiation	Upper lobectomy	1.6 (47)	Pectoralis major	No

RUL, right upper lobe; RLL, right lower lobe; LUL, left upper lobe; LLL, left lower lobe; NAP, necrotising aspergillus pneumonia.

series of 84 patients written by Babatasi et al. [6], the most common underlying disease was tuberculosis in 52% of the patients. Surgical management is required to avoid or treat fatal hemoptysis from vascular erosion. However, lung resection is generally contraindicated in these patients with poor lung function and in those with bilateral disease [7-10]. Cavernostomy and single stage myoplasty has been advocated and used by Daly et al. [1], as a secondary method for the treatment of post-operative complications in three patients.

Most high-risk patients with CPA and some degree of hemoptysis may undergo palliative procedures such as cavernostomy [6,11], intracavitary Amphotericin-B [12] or bronchial artery occlusion [13,14]. Embolization of the bronchial artery has been carried out either pre-operatively, in order to reduce peri-operative bleeding [11], or to stop massive bleeding in inoperable cases with a success rate of

40% [14]. Percutaneous instillation of Amphotericin-B has also been tried to treat aspergilloma and to control massive bleeding in patients with compromised lung function or bilateral disease. Giron et al. [9], treated 40 patients with Amphotericin-B paste and achieved the cessation of bleeding in all cases and negative aspergillus serum tests in 26 cases (follow-up time 6-28 months) Rumbak et al. [10], have also used potassium iodide in patients with FEV1 < 50% and massive hemoptysis. They achieved cessation of bleeding in 72 h in all patients.

In patient with CPA treatment following tuberculosis, dense pleural adhesions, indurated hilar structures and diseased lung parenchyma cause higher mortality rates than standard pulmonary resection (4.5-44%) [1-5]. Significant post-operative morbidity includes excessive hemorrhage, prolonged air leak, residual pleural space, bronchopleural fistula and empyema in up to 60% of the cases [1,6]. Oakley et al. [7], reported 17 resections and seven cavernostomies for aspergilloma with a 30-day mortality rate only 5% in the resection group and 28.6% in the cavernostomy group. Cavernostomy, when performed in high-risk patients, carries higher morbidity and mortality.

It is crucial to ensure that all bronchial openings are closed completely during the surgery [16] and prior to irrigating the cavity with Amphotericin-B solution, as scleroscent. One patient developed pneumonitis from local bronchial mucosal inflammation from intrabronchial Amphotericin-B.

Two patients required re-exploration due to massive air leak from missed bronchial openings. To assess for completeness of bronchial closure, 50 cm of H₂O pressure was applied during the closure and air leaks were assessed under saline irrigation.

Patients with sufficient lung function undergo resection of the lung, however, patients with poor lung function have

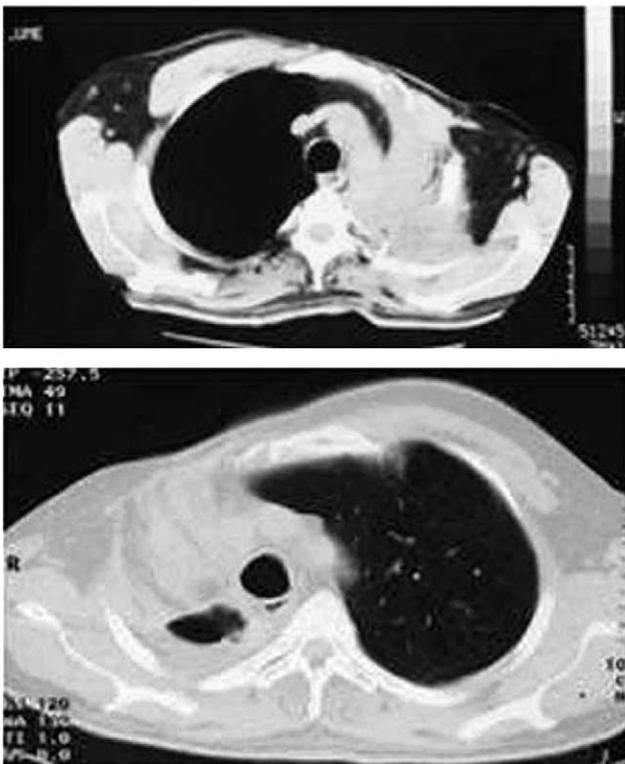


Fig. 3. Partial, case 1: down, and complete obliteration, case 7: up, of the cavity with myoplasty.

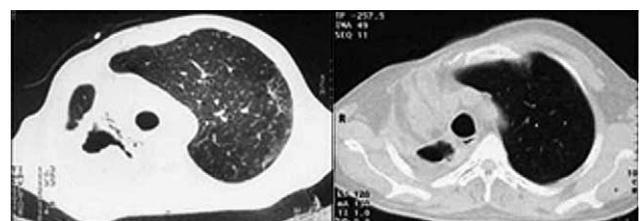


Fig. 4. Case 1, pre-operative CT: left, post-operative CT: right.

greater morbidity and mortality [4,15]. Babatasi et al. [6] observed 68% complication rate in their series of 85 patients with normal vital capacity and FEV/VC ratio. Our results confirm cavernostomy and myoplasty as effective therapy for CPA with hemoptysis; none of our patients presented with recurrent hemoptysis after successful treatment of their CPA. Pectoralis major muscle was our primary choice because of anterior placement of the cavities and easy protection of blood supply, as latissimus dorsi or trapezius muscle may atrophy [7]. Complete obliteration may not be completely achieved in response to the biological variability of these complex cavities. Cavernostomy, closure of bronchial fistulae, irrigation with Amphotericin-B, and myoplasty provides good initial therapy and prevents recurrence of the disease. Ono et al. [17] performed eight cavernostomies and muscle transposition with thoracoplasty in three cases and experienced recurrences 19 and 29 months after the operation.

5. Conclusion

We safely performed single stage cavernostomy and myoplasty for treatment of seven patients with complex pulmonary aspergilloma. We achieved complete eradication of aspergilloma in these complex patients. Low morbidity without mortality was achieved even in patients with bilateral disease and/or severely compromised lung function, however, active tuberculosis has to be ruled out in such cases. The success of this technique depends upon adequate drainage, and an obliterated sterile space from a muscle flap with an efficient blood supply. This may be an alternative technique to resection in patients with CPA and compromised lung function.

References

- [1] Daly RC, Pairolero PC, Piehler JM. Pulmonary aspergilloma. Results of surgical treatment. *J Thorac Cardiovasc Surg* 1986;92:981-8.
- [2] Battaglini JW, Murray GF, Keagy BA. Surgical management of symptomatic pulmonary aspergilloma. *Ann Thorac Surg* 1985;39:512-6.
- [3] Jewkes J, Kay PH, Paneth M. Pulmonary aspergilloma: analysis of prognosis in relation to haemoptysis and survey of treatment. *Thorax* 1983;38:572-8.
- [4] Karas A, Hankins JR, Attar S. Pulmonary aspergilloma. An analysis of 41 patients. *Ann Thorac Surg* 1976;22:1-7.
- [5] Massard G, Roeslin N, Wihlm JM. Pleuropulmonary aspergilloma: clinical spectrum and results of surgical treatment. *Ann Thorac Surg* 1992;54:1159-64.
- [6] Babatasi G, Massetti M, Chapelier A, Fadel E, Macchiarini P, Khayat A, Darthevelle P. Surgical treatment of pulmonary aspergilloma: current outcome. *J Thorac Cardiovasc Surg* 2000;119:906-12.
- [7] Oakley RE, Mario P, Goldstraw P. Indications and outcome of surgery for pulmonary aspergilloma. *Thorax* 1997;52:813-5.
- [8] Faulkner SL, Vernon R, Brown PP. Hemoptysis and pulmonary aspergilloma: operative versus nonoperative treatment. *Ann Thorac Surg* 1978;25:389-92.
- [9] Giron J, Poey C, Fajadet P. CT-guided percutaneous treatment of inoperable pulmonary aspergillomas: a study of 40 cases. *Eur J Radiol* 1998;28:235-42.
- [10] Rumbak M, Kohler G, Eastridge C. Topical treatment of life threatening haemoptysis from aspergillomas. *Thorax* 1996;51:253-5.
- [11] Regnard JF, Icard P, Nicolosi M. Aspergilloma: a series of 89 surgical cases. *Ann Thorac Surg* 2000;69:898-903.
- [12] Lee KS, Kim HT, Kim H. Treatment of hemoptysis in patients with cavitary aspergilloma. *Am J Roentgenol* 1993;161:727-31.
- [13] MacErlan DP, Gray BJ, FitzGerald MX. Bronchial artery embolization in the control of massive haemoptysis. *Br J Radiol* 1979;52:558-61.
- [14] Currie DC, Prendergast CM, Pearson MC. Audit of bronchial artery embolisation in a specialist respiratory centre. *Qual Health Care* 1992;1:94-7.
- [15] Chen JC, Chang YL, Luh SP. Surgical treatment for pulmonary aspergilloma: 28 year experience. *Thorax* 1997;52:810813.
- [16] Tseng YL, Wu MH, Lin MY. Intrathoracic muscle flap treatment of fibrocavernous tuberculosis. *Eur J Cardiovasc Surg* 2002;21:918-23.
- [17] Ono N, Sato K, Yokomise H, Tamura K. Surgical management of pulmonary aspergilloma. Role of single-stage cavernostomy with muscle transposition. *Jpn J Thorac Cardiovasc Surg* 2000;48(1):56-9.