Intrathoracic muscle flap transposition in the treatment of fibrocavernous tuberculosis

Yau-Lin Tseng*, Ming-Ho Wu, Mu-Yen Lin, Wu-Wei Lai
Department of Surgery, National Cheng Kung University Hospital, College of Medicine, National Cheng Kung University, No 138, Sheng-Li Road, Tainan, Taiwan

Received 17 April 2000; received in revised form 18 August 2000; accepted 25 September 2000

Abstract

Background and objective: Conventionally, pulmonary resection with thoracoplasty is used to treat fibrocavernous complication of pulmonary tuberculosis. This operation is usually bloody, time-consuming with complicated postoperative course. To prevent massive blood loss and preserved pulmonary function, a more simplified operative procedure, cavernostomy combined intrathoracic muscle flap transposition was used and the outcome was evaluated in this study. Design: Retrospective review. Methodology: Between December 1989 and June 1996, a total of ten patients with fibrocavernous pulmonary tuberculosis were managed using cavernostomy combined with intrathoracic muscle flap transposition. Five of them had concomitant aspergilloma within the cavity while three had multiple drug resistant pulmonary tuberculosis. The muscle flap was used to plombage the cavity and reinforce the closure of bronchopleural fistula after cavernostomy. Results: Six postoperative complications occurred in five patients, including reformation of cavity (2), bronchopleurocutaneous fistulae (3), and postoperative bleeding (1). The success or failure of intrathoracic muscle flap transposition on patients with fibrocavernous tuberculosis was significantly correlated with the size of the cavity (194.0 ± 11.2 vs. 283.0 ± 44.6 cm³, P = 0.016) and the number of bronchopleural fistulae (1.6 ± 0.4 vs. 4.0 ± 0.4, P = 0.008). There was no operative death and in long term follow-up, there was no recurrence of hemoptysis or deterioration of pulmonary function in the successful group of patients. Conclusions: Cavernostomy combined with intrathoracic muscle flap transposition can be used to treat well-selected fibrocavernous pulmonary tuberculosis patients, except on patients with large size cavity, multiple bronchopleural fistulae or multiple drug resistance tuberculosis. © 2000 Elsevier Science B.V. All rights reserved.

Keywords: Bronchopleural fistula; Intrathoracic muscle flap transposition; Tuberculosis

1. Introduction

The management of pulmonary tuberculosis with fibrocavernous lesions is still a great challenge to most thoracic surgeons [1,2]. These cavitary lesions, associated with lobar parenchymal destroy, severe adhesion of pleural space and interlobar fissure, and chronic peribronchial lymph nodes inflammation with dense adhesion to the vessel and bronchus of destroyed lung makes surgical resection difficult and dangerous with resultant large dead space following resection. Traditionally, these were treated with lobar resection concomitant with thoracoplasty. This procedure is usually bloody, time-consuming with complicated postoperative course. To prevent massive blood loss and preserve pulmonary function, a more simplified operative procedure was applied for these patients. As early as 1911, muscle flap was used by Abrashanoff to close a broncho-pleural fistula [3]. Since then, muscle flaps have been used extensively to obliterate thoracic dead spaces or to close bronchial fistula and was used to treat patients with postlobectomy or post-pneumonectomy empyema as a single stage procedure [4] during the late 1970s or early1980s. Due to some similarity of fibrocavern and post-resectional empyma with bronchopleural fistula, cavernostomy combined with intrathoracic muscle flap transposition (IMFT) was used in our institution to treat the patients with fibrocavernous pulmonary tuberculosis from 1989–1996 and our outcome is evaluated in this study.

2. Materials and methods

2.1. Selection of the patients

Inclusion criteria of patients with fibrocavernous tuberculosis in this study include the following: first, presence of chronic thickened cavity wall with dense adhesion to the upper pleural cavity after upper lobar parenchymal destru-
tion with the parietal pleura as its roof and lateral wall. Second, patients with symptoms of repeated or massive hemoptysis (>600 ml blood/day). Third, the cavity was the only lesion that possibly caused the symptom. Fourth, patient had understood and agreed to receive such procedure. Patients with suspicion of Rasmussens aneurysm within the cavitary lesion by CT scan were excluded from this study.

Between December 1989 and June 1996, ten patients with fibrocavernous pulmonary tuberculosis were treated by cavernostomy combined with IMFT at the National Cheng Kung University Hospital, Tainan, Taiwan. There were seven males and three females. The average age of the patients was 58.7 years (29–71 years) with history of pulmonary tuberculosis ranging from 2–25 years (average 12.3 years). Eight patients had right upper and two had left upper lobe cavities. Five patients were associated with the presence of aspergilloma. Three patients had proven multiple drug resistant pulmonary tuberculosis (MDRTB) prior to operation. Clinical manifestations were recurrent or massive hemoptysis in all patients. All ten patients received cavernostomy and IMFT and were divided into two groups based on the outcome: successful on group A (N = 5) and failed on group B (N = 5). Additional operative procedures, thoracoplasty (N = 1) and decortication (N = 1) was performed due to complications. The muscle flaps used include Pectoralis major (N = 7), Serratus anterior (N = 3), Latissimus dorsi (N = 1), and Omentum (N = 1).

2.2. Preoperative studies and management

Standard chest radiography was studied in all patients. Computed tomography of the chest was obtained to assess the size and extent of fibrous cavern, the relationship between the lesions and pulmonary vessels and the potential function of remaining lung parenchyma. Sputum were smeared for acid-fast bacilli and cultured for bacteria, fungi, and tuberculous bacilli. Pulmonary function tests, including forced vital capacity (FVC), forced expiratory volume in first second (FEV1.0), residual volume, functional residual capacity, and total lung capacity were documented before operation, if conditions permit.

Preoperatively, all patients with positive sputum acid-fast bacilli received anti-tuberculous chemotherapy (isoniazid, ethambutol, and rifampicin) for at least 3 months, or until the negative conversion of the sputum. Multiple drug resistant tuberculosis was defined as tuberculous bacilli resistant to at least two of three anti-tuberculous drugs (isoniazid, ethambutol, and rifampicin) based on sputum culture sensitivity result. Three patients with MDRTB received anti-tuberculous treatments for 6 months to 1 year (median of 9.3 months), before surgery.

2.3. Technical considerations

The IMFT was done as an elective procedure if the patients condition permitted. Choice of muscle flap was determined by the location of cavity. When the majority of cavity were near the anterior chest wall, the pectoralis major muscle was chosen and the thoracotomy wound was performed anteriorly, along the anterior axillary fold, to expose the muscle. Otherwise, latissimus dorsi or serratus anterior muscle was used and was preserved before the pleural cavity was opened.

The content of the cavity was evacuated and cultured for bacteria, fungus and tubercles bacilli. Decortication of all pleural adhesion was not done. Only the cavity was debrided and B–P fistulae were carefully identified. The tissue surrounding each fistula was debrided meticulously and freshened and closed with 3–0 or 4–0 monofilament absorbable sutures (Maxon, Davis and Geck). The muscle flap was transposed into the cavity, usually from the 2nd or 3rd intercostal space with partial resection of the rib, to plombage the cavity and re-inforce the sutures of the fistula.

2.4. Postoperative care

Anti-TB drugs (rifampicin) were administered immediately following operation until the final diagnosis of surgical specimen was reported and continued for at least 1 year after operation if the surgical specimens positive for tuberculosis. Prophylactic second-generation cephalosporine and aminoglycoside were also given for prevention of infection. Additional usage of antibiotics was based on the final results of culture and sensitivity tests. Following surgery, one or two chest tubes were placed in the cavity with continued low-pressure suction (−10 cm H2O). An additional closed drainage device was placed within the space of the muscle flap and removed when the daily amount of drainage was less than 30 ml.

2.5. Statistical analysis

All data were expressed as mean ± SEM. Differences between the means of these groups were analyzed using Mann–Whitney U test. The level of significance was set at P < 0.05.

3. Results

The clinical and laboratory findings of patients in groups A (N = 5) and B (N = 5) are summarized in Table 1. In group A, cavity size ranged from 150–210 cm³ with one or two fistula while in group B, cavity size ranged from 216–420 cm³ with three to six fistula. Statistically, group B patients had a significantly larger size of cavity (283.0 ± 44.6 vs. 194.0 ± 11.2 cm³, P = 0.016), more fistula (4.0 ± 0.4 vs. 1.6 ± 0.4, P = 0.008) and longer duration of chest tube drainage (35.4 ± 8.8 vs. 6.8 ± 1.3 days, P = 0.016). The length of endotracheal intubation with ventilatory support was 0.9 ± 0.2 days with average stay in ICU of 1.9 ± 0.3 days. All three patients with MDRTB preoperatively were in group B. Five patients had concomi-
tast aspergilloma within the cavity, four in group A and one in group B.

3.1. Operative complications

A total of six postoperative complications developed in this study (50%), including persistence of the cavitary lesions (N = 2), bronchopleurocutaneous fistula (B–P–C fistula) (N = 3) and postoperative bleeding (N = 1). Despite repeated operative procedures, with or without a second IMFT, B–P–C fistula was successful closed in only one of the three patients. One patient with fibro cavernous tuberculous combined with invasive aspergillosis, despite receiving 500 mg of amphotericin B preoperatively had chest tube drainage of B–P fistula for half a year following surgery and a persistent cavity occurred on his left upper pleural cavity following removal of chest tube. One patient with bleeding underwent emergency hemostasis and reinforcement of bronchopleural fistula. However, the right upper pleural cavity lesion persisted. In three patients with preoperative diagnosis of open tuberculosis, positive tuberculous bacilli in the sputum persisted postoperatively.

3.2. Long-term follow-up

There was no operative death. Seven of the ten patients continue to be evaluated by our hospital. Five patients in group A had no recurrence of hemoptysis or deterioration of pulmonary function with a median 6.25 year follow-up. One patient with invasive aspergillosis was asymptomatic without recurrence of fungus ball within the reformed cavity in a 3 year follow-up. One patient, who had B–P–C fistula closure after repeat surgery, was also free of hemoptysis but had exertional dyspnea due to moderate obstructive ventilatory failure. Of the three patients who were lost to follow up, one had recurrence of B–P–C fistula, who refused further operation and was still positive for sputum tuberculosis 2.5 years after surgery. One patient with persistent cavity died 8 years following surgery of unknown etiology (death on arrival) while the other one with B–P–C fistula died of respiratory failure 5 years after surgery.

4. Discussion

The intrathoracic muscle flap has excellent blood supply, can reach any location in the pleural cavity and is an ideal tissue to plombage the empyema space and reinforce the repair of bronchopleural fistula [4,5]. How to effectively mobilize different muscle flaps for those purposes have been detailed by Mathes and Nahai, and many others since 1982 [6,7]. The six basic principles for complete flap closure of postsurgical empyema [2] as described by Miller et al. [4] are still widely applied today.

During the period of 1989–1996, cavernostomy and IMFT was used in our institution as a primary surgical treatment modality to obliterate the cavity and reinforce the fistula closure in patients with fibro cavernous PTB in order to avoid massive oozing of blood from the chest wall and injury to the pulmonary artery during dissection of the dense and thick tuberculous fibrocaverns. Most of our patients had poor pulmonary function, multiple bronchopleural fistulae and severe pleural adhesion. According to the literature [1,2], lung resection was feasible in only 10–12% of patients because severe pleural and interlobar adhesions and the incidence of B–P fistula following surgery may be as high as 30–35.2% in patients with positive sputum tuberculosis at the time of surgery, polymicrobial contamination, diabetes and prior chest wall irradiation [8,9]. In our study, there was no surgical mortality but the complication rate was higher than previously reported, despite most of our patients having some of the factors mentioned above. Five factors that have affected the
outcome of group A and B in our study include:

1. The number of bronchopleural fistulae in the fibrocavernous lesions: The edges of these fistulae were often fragile, necrotic, and bled easily with a tendency to reoccur during the early postoperative period. In our series, three patients had reoccurrence of air leakage from chest tube on the 7th, 10th, and 12th postoperative day. If the number of fistulae was one or two, the IMFT appeared effective.

2. The size of the cavern: IMFT appeared more likely to fail if the cavitory lesions were larger than 210 cm$^3$, regardless of which muscle flap was used. All types of muscle flap including Pectoralis major, Serratus anterior, Latissimus dorsi and Omentum, initially appeared to appropriately fill the cavity. However, disuse atrophy of the muscle occurred following transposition. This, combined with the failure of the remaining lung to expand from severe destruction, fibrosis, and adhesion was probably responsible for the late failure. In our series, two patients developed B–P–C fistula on 40th and 44th postoperative day, in which chest tubes were removed successfully without sign of air leakage initially on 10th and 14th postoperative day.

3. Patients with MDRTB were probably not suitable for this procedure, (Group B only- three of five patients). Multiple secondary procedures improve the outcome only in one of these patients. Since removal of heavy bacterial burden is essential in the treatment of MDRTB [8], intraoperative cavitory instillation of anti-tuberculous drugs followed by postoperative continuous instillation via chest tube might help in decreasing the bacterial load within the cavity. These drugs could also induce inflammatory reaction between muscle flap and cavity wall and hasten the adhesion which might improve the result of IMFT. The risk of drug irritation or bacterial spread to another portion of the lung is probably nil since the bronchopleural fistula is closed during operation. However, lobectomy or pneumonectomy, if possible, continues to be the treatment of choice for patients with MDRTB [10,11].

4. Aspergilloma within fibrocavernous tuberculosis often causes severe hemoptysis and needs to be resected [12–14]. In high risk patients, some authors use palliative procedures to evacuate it [15]. In our study, the presence of aspergilloma in the cavity didn’t appear to influence the outcome of IMFT. Grossly, all fungal material could be readily evacuated intra-operatively without major blood loss or technical difficulty. In cases of tuberculous cavity with aspergilloma treated by resection, it is safe not to administer anti-fungal regimen during the pre- and post-operative period and should be used only in case with invasive aspergillosis to minimize postoperative complication. One patient in this study had invasive aspergillosis involving both lungs and the empty old tuberculous cavity on left upper lobe. He was operated on after toxic sign and fungal infiltration on CXR subsided. Despite the reformation of cavity, there was no recurrence of fungal ball within the cavity for more than 3 years of a follow-up period.

5. In our patients, cavernostomy with IMFT appeared to be a less invasive procedure. The length of endotracheal intubation with ventilatory support was $0.9 \pm 0.2$ days with an average stay in ICU of $1.9 \pm 0.3$ days.

Based on the result of this study, cavernostomy with IMFT should be carried out on carefully selected fibrocavernous tuberculosis patients based on the following considerations. Firstly surgical intervention of patients with MDRTB probably should be deferred until the disease is medically controlled [16]. Secondly all bronchopleural fistulas should be carefully identified and closed intraoperatively with enforcement using muscle flap transposition and thirdly, the size of the cavity should be estimated preoperatively by computed tomography with cavities larger than 210 cm$^3$ probably needing alternative operative procedure. Chronicity of the cavity, poor pulmonary function tests, and recurrent hemoptysis are probably not contraindication for IMFT.

5. Conclusion

Based on this study, cavernostomy combined with intrathoracic muscle flap transposition, a less invasive procedure, can be used to treat well-selected fibrocavernous pulmonary tuberculosis patients, except in patients with large size cavity, multiple bronchopleural fistulae or multiple drug resistant tuberculosis.

References


