



CHIRURGIE THORACIQUE / THORACIC SURGERY

THORACIC PLOMBAGE PROCEDURE FOR TUBERCULOSIS/ASPERGILLOSIS ABSCESS CAVITY. CLINICAL CASE REPORT.

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Summary : The current incidence and prevalence of thoracic tuberculosis remains a major global challenge. Surgery has decreased markedly given the success of medical treatment. Lung resection remains the preferred technique for parenchymal disease. However, plombage collapse surgery, though abandoned secondary to long term complications, may be a reasonable approach in selected cases, especially TB cavities with Aspergillus contamination and hemoptysis.

Key words : Lung – Tuberculosis – Aspergilloma - Surgery.

Résumé: L'incidence actuelle et la fréquence de tuberculose thoracique restent un défi mondial majeur. La chirurgie a donné place aux succès du traitement médical. La résection du poumon reste la technique préférée pour la maladie parenchymateuse. Cependant, le plombage par la collapsothérapie, quoiqu'abandonnée à cause de ses complications à long terme, peut être une approche raisonnable dans des cas sélectionnés, particulièrement devant des cavernes tuberculeuses associées à une contamination aspergillaise et à une hémoptysie

Mots clés : Poumon – Tuberculose – Aspergillose – Chirurgie

Introduction

Tuberculosis (TB) remains a major global medical challenge and concern (1). Of the world population of over 7 billion people, approximately one third or 1.7 billion are estimated to be infected with *Mycobacterium tuberculosis*. In 2011, there were an estimated 8.7 million new cases of TB (13% co-infected with HIV), mostly in developing countries or emerging economies, and 1.4 million people died from TB. This is especially true in Vietnam with an annual incidence of new active TB cases of 180,000, a prevalence of 290,000 cases, and an annual mortality of 30,000 (2).

Medical treatment is the mainstay of therapy and very effective. However, surgery remains an adjunctive modality in complex cases with sequelae, especially parenchymal destruction, and persistent TB cavitory disease with secondary Aspergilloma. Over 10% of aspergillomas occur in chronic TB cavities (3). Resection is preferred, but collapse procedures are an alternative for patients with decreased pulmonary function or prohibitive comorbidity. Plombage collapse is no longer routinely employed, but should be considered in certain situations, especially in countries where more complex and sophisticated procedures, including modified or staged thoracoplasty, muscle flaps, cavernostomy, or tissue expander devices, are not available, feasible, or affordable.

Case Report

An 81 year old Vietnamese male patient presented with continuous increasing recurrent hemoptysis of 6 month duration, a background of successfully treated tuberculosis status post-left upper lobectomy 20 years prior, and COPD*. Chest-Ray revealed a large fungal lung mass in the left upper lobe (figure 1).

* COPD: Chronic obstructive pulmonary disease



Figure 1 : PA Chest X-Ray with Aspergilloma cavity in left upper chest.

Chest CT scan confirmed a large fungal lung mass occupying the left upper chest and the lung fields revealed diffuse bilateral emphysematous changes (figure 2).



Figure 2 : CT scan with discrete left upper chest Aspergilloma cavity mycetoma.

Pulmonary lung function showed an FEV₁* of 31%, and FEV₁/FVC* 71%. Other laboratories were in normal range, and there was no sputum evidence of active TB. The patient underwent a plombage procedure because of the anticipated difficult surgical technique for fungal lung abscess resection, cavernostomy, or completion pneumonectomy, and relative contraindication of general anesthesia for a prolonged operation due to decreased pulmonary function.

* FEV₁/FVC : Forced Expiratory Volume / Forced Vital Capacity

Operative Procedure

The patient, with general one lung anesthesia, and placed in the right lateral decubitus position, underwent a left posterolateral thoracotomy on 4 October, 2012. Chest ribs 2-6 were exposed, dissected subperiosteally, and the extra pleural space developed (figure 3).

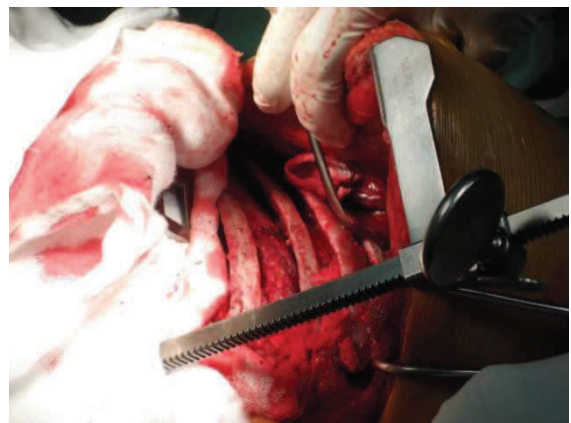


Figure 3 : With left scapular retraction, the left upper ribs are exposed through a left posterolateral chest approach

The fungal mass was palpated and opened. The semi-solid brown contents were evacuated (figure 4), and the space irrigated with 10% diluted betadine solution. No active bleeding or air leaks were uncounted.



Figure 4 : Necrotic debris is removed from the opened abscess cavity.

The thick walled abscess cavity was closed with absorbable surgery. Four ping-pong balls were placed beneath the 5th and 6th ribs into the extra pleural space to compress the adjacent closed abscess cavity (figures 5, 6).

The wound was closed in layers with two (2) chest tubes placed in the sub muscular space. The patient was extubated in the operating room, and remained stable with no dyspnea or recurrent hemoptysis. The postoperative course was uneventful, with no bleeding, air leak, or exacerbation of COPD. The chest tubes were removed on the 3rd post-operative day. The pathological specimen confirmed an *Aspergillus fumigatus* lung abscess. The patient received no TB or fungal medication either pre-operatively or post-operatively. Follow up Chest-Xray and CT Scan were obtained 6 weeks following hospital discharge (figures 7-10).



Figure 5 : Ping pong balls are manually inserted between the ribs into the extrapleural subperiosteal space.

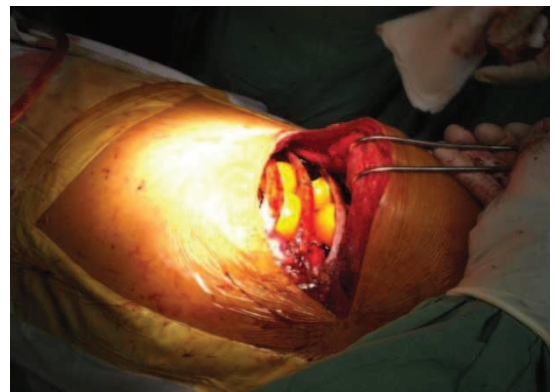


Figure 6 : Four ping pong balls in the created space compressing the closed collapsed evacuated abscess cavity.



Figure 7 : Chest-Xray showing plombage ping pong ball compression of the closed evacuated cavity.



Figure 8 : Closer view of collapsed cavity.



Figure 9 : Healing left postero-lateral chest incision at 6 weeks.

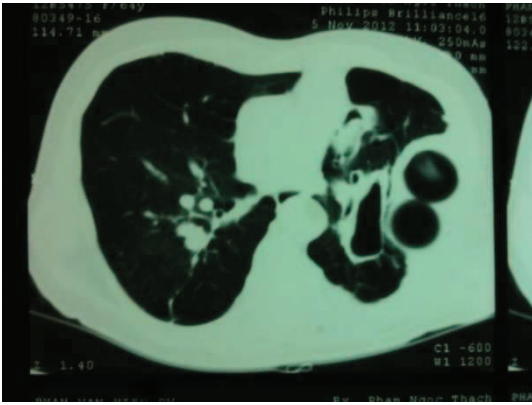


Figure 10 : CT Scan at 6 weeks with collapsed cavity.

The PFTS* remained unchanged. At 6-8 months the patient will undergo removal of the plombage ping pong balls.

* PFTS : Pulmonary Function Tests

Discussion

Currently, medical management is the mainstay treatment for active TB disease. Up through the mid-1950's surgery was the primary treatment (1). The history of surgery, especially collapse techniques, for thoracic TB began in the late 1800's (4). Artificial pneumothorax was introduced. The rationale was to collapse the involved TB lung cavity by introducing air into the pleural space. This would allow the lung to rest by creating an anaerobic closed space environment. By the 1940's, subsequent reinjections of air were being done each year to maintain the collapsed lung, as well as pneumoperitoneum. These techniques were often combined with phrenicotomy (crushing or surgical division of the phrenic nerve) leading to ipsilateral paralysis of the diaphragm. Subsequently, thoracoplasty was introduced. This enabled the chest wall to be pushed toward the mediastinum, thus collapsing the upper lobe. This was more definitive and permanent but usually required 1-3 staged operations. Morbidity was significant with postoperative pain, respiratory embarrassment, and chest wall deformity.

Less complicated collapse methods evolved. Plombage (bird age procedure) (extra periosteal or extra-pleural pneumonolysis) (Latin word "plumbum" for lead) was a less morbid surgical method (4, 5). It became the most common procedure from 1948-1955 (5). It involved insertion of an inert substance into the pleural space to compress or collapse the adjacent involved lung parenchyma lung TB or persistent primary TB/ secondary Aspergillus cavity despite specific anti-mycobacterial drug therapy. This obliterated or suppressed the major focus of

bacillary growth and the source of hemoptysis. Over 29 different agents have been inserted over the years into the created space (4). Examples included air, fat, solid paraffin wax packs, fiberglass, Polystan sponges, Lucite spheres (translucent methyl methacrylate balls with a diameter about 2.5 cm), plastic ping pong balls, oil (olive, vegetable, or mineral), silk, gelatin, bone, gauze, balloons, or rubber bags or sheeting (4). With advances in drug therapy, the complications associated with plombage, and success with resection, the Plombage procedures declined. However, it was also established that the plombage material should be subsequently removed on a routine basis. However, this was not strictly adhered to and long term complications approaching 16% resulted. These included erosion of major blood vessels, infection, fistula formation to adjacent structures (bronchus, aorta, esophagus or skin), neoplasms, migration, or breakdown of the collapsed space with subsequent contamination of the extra pleural space (5). Even if the plomb was removed, there remained the challenge of the persistent space that would eventually fill with fluid or require a modified thoracoplasty to obliterate the extra periosteal space. The procedure lost favor and was abandoned. It was also recommended that long term patients with previous plombage procedure should undergo redo surgery to remove the "plomb", be they symptomatic or not (4, 5).

Subsequently, surgical resection evolved as the recommended approach for parenchymal destruction or chronic complex cavities, especially those contaminated with Aspergillosis.

Given the challenges with complex cavities, extensive surgical resection, persistent residual spaces, and severe comorbidity collapse therapy may play an increased role in selected patients. In addition, collapse therapy may better preserve the unilateral non infected residual parenchyma (6).

The plombage collapse procedure is performed through a postero-lateral thoracotomy incision and carried through the anterior stratus, trapezius and rhomboid muscles. The scapula is retracted upward. The technique involves creating a cavity beneath the ribs by dissecting the costal periosteum and intercostal muscles off the ribs to create an extra pleural space in the upper part of the chest cavity, and filling this space with inert material. The inserted material would force the adjacent portion of the lung to collapse (4, 5). Plombage can be performed as a single localized procedure, and does not cause respiratory paradox. Additionally, the advantages include

preserved lung function, and avoidance of thoracic wall and vertebral body deformities. Also, the tough fibrous layer of parietal pleura, periosteum, and intercostal muscles were postulated to prevent erosion of the underlying lung by the plombage material (5).

Recently, Jauvashome et al. (7) summarized the contemporary advantages of this procedure: (1) applicable to poor risk patients; (2) preserved lung function; (3) applicable to bilateral disease; (4) decreased hospital stay; and (5) reduced post-operative complications. In their series, seven patients underwent collapse therapy with polystyrene sphere plombage for pulmonary disease caused by multidrug-resistant mycobacteria. All patients were pretreated priortosurgery, and were considered poor candidates for resection because of extensive disease or decreased pulmonary functional. Six patients had active disease pre-operatively. Collapse therapy with insertion of six to 18 spheres resulted in long-term bacteriological conversion in six patients. There were no postoperative complications or deaths (7). They also stressed using only enough plombs to collapse the underlying cavity, and removing the plombs as soon as the plombage became unnecessary to maintain the collapse. This usually occurred after an average of 3 to 5 months. Plombs were removed in four of their patients with no need for thoracoplasty. The remaining space filled spontaneously with no re-expansion of the underlying cavities.

An alternate strategy would be to consider the initial extra-pleural plombage with asilastic expander as the plomb rather than ping pong balls (6). The Perthese tissue expander (Perthese [Laboratory Pérouse Implant, Bornel, France) is an inflatable silicon elastomer pouch that is connected via silicon tubing to a remote internal valve (6). The valve is made-up of a self-sealing silicon filling port in the shape of a hemispherical dome. The implant is fitted with a stainless steel connector enabling the tubing length to be adapted to a given situation. The design of the expander with a flexible membrane allows it to conform to the extra-pleural cavity. This results in an efficient crushing to cause a better distribution of the pressure on the compressed cavity. The accessible valves of the expanders also allow future new filling of the expanders if there is need for additional compression of the cavity. When removed, the mild reaction secondary to silicon prosthesis allows easier removal of the device(s).

At present more than ten (10) plombage procedures are performed annually at our hospital. Over 50 operations have been

performed over the past 6 years, with >70% having the plomb successfully removed. During the 3-year period (2007-2009), 33 patients with hemoptysis caused by cavitary aspergilloma with FEV1, FVC below 40% was treated with plombage technique at our hospital. The mean operative time was 2.3 hours, with operative blood loss less than 300ml. The mean duration of hospital stay postoperatively was 2.5 days (2-4). At 12 months follow-up: 1 patient had persistent hemoptysis, and by CT Scan 4 cases had a persistent fungal cavity. 96.9 % of the patients had a good outcome. One patient died postoperatively on the 10th post-operative day secondary to respiratory failure (8). As noted, it is stressed that the plomb be removed at 6-12 months from the initial Plombage. An example is a 63 year old male who underwent a left sided lower chest plombage for a cavitary Aspergilloma. The initial postoperative CT is contrasted with the plomb removal at 8 months (figures 11-12).



Figure 11 : Another patient with plombage of right lower Aspergilloma cavity.

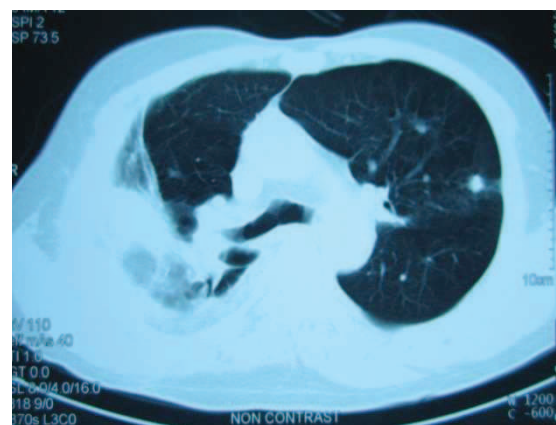


Figure 12 : Same patient in figure 11 with removal of plomb from right lower chest after 8 months showing collapse and obliteration of chest space.

The celluloid ping pong ball currently used was invented in 1900. These ping-pong balls are typically made of celluloid from the nitration of cellulose from cotton (9). The official regulations of table tennis say that the ball must be made of celluloid or a similar plastic substance. It must be 40 millimeters in diameter, weigh 2.7 grams, and be white or orange. The sterilization process used at our center is summarized in table I.

Table I : Sterilization process

| Used | period |
|--|--------------------|
| Cidex(activated dialdehydesolution) bath | bath x 60 minutes. |
| 10% Formaldehyde gas exposure | x 1 week |
| UV light exposure | x 12-24 hours |
| 10 % povidene bath | X 30-60 minutes |

Ethylene Oxide Gas sterilization is not available.

Aspergillomas occur in >10% of residual TB cavities >2.5 cm in diameter (4). The most frequent complication is hemoptysis. Bronchial artery embolization is the most common intervention used for control of recurrent or massive hemoptysis. Antifungal therapy is of limited utility because of the lack of a blood supply (10). Specific drug therapy for invasive aspergillosis includes voriconazole, itraconazole, posaconazole, caspofungin, micafungin, oramphotericin B. However these drugs are not effective or recommended for cavitary Aspergilloma (10). Surgical resection is the recommended treatment for cavitary Aspergilloma (10-12). This includes resection or cavernostomy, with or without concomitant myoplasty. These surgical interventions are often limited by severe co-morbidities and poor lung function. Percutaneous intracavitary instillation of antifungals, and video-assisted thoracic surgery (VATS), have been proposed in selective patients (9, 13). Grima et al. (9) point out that cavernostomy with myoplasty may develop muscle-flap disuse atrophy and subsequent failure. They advocate this combined procedure, along with a limited thoracoplasty. A less radical approach is reported by Ichinose et al. (14). They reviewed their experience with VATS for pulmonary cavitary aspergilloma. The patients (n=20) were aged 62±12 years, and eight (40%) were aged 70 years or more. The disease types were simple aspergilloma (SA) in six patients and complex aspergilloma (CA) in 14. The surgical procedures performed were lobectomy in 14 patients, segmentectomy in two, and wedge resection in

four. There was one death. The 5-year survival rate was 89%. Both of these procedures demonstrate the spectrum of approaches, along with plombage for cavitary Aspergilloma.

In summary, the plombage procedure may play an increased role in selected cases, being mindful that the plomb should be removed when the symptoms are relieved and the cavity remains closed or obliterated. This would negate the long term complications previously reported in the literature.

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