Thoracoplasty for Postpneumonectomy Empyema Associated with Bronchopleural Fistula: A Case Series

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Abstract

Keywords

- ▶ thoracoplasty
- ▶ empyema
- ▶ bronchopleural
- ▶ fistula

Thoracoplasty is a historical procedure, initially devised for the treatment of refractory tuberculous empyema. Advances in medical treatments have nearly eliminated the need for this surgical procedure in pulmonary tuberculosis and it is rarely performed or taught in modern day surgical practice. However, few indications still exist, most prominently, in the treatment of postpneumonectomy refractory empyema often but not always associated with a bronchopleural fistula. In this case report, we present two cases of postpneumonectomy refractory empyema treated by thoracoplasty with long-term follow-up.

Thoracoplasty is a historical procedure, initially devised for the treatment of pulmonary tuberculosis and its complications. Due to the radical nature of the procedure and the development of effective chemotherapeutic agents to treat tuberculosis, thoracoplasty began to lose its appeal in the 1940s. Thoracoplasty is considered to be a mutilating surgery, causing significant functional limitation to patients secondary to scoliosis and other musculoskeletal deformities. For this reason, newer surgical techniques such as muscle flap or omental flap reduced the use of thoracoplasty. Today, thoracoplasty is a widely forgotten procedure indicated only in the management of nontuberculous infected pleural space infections. In this case report, we present the long-term follow-up of two cases of postpneumonectomy empyema treated by thoracoplasty.

Case 1

Mr. A is a 59-year-old man who was found to have an enlarging lung lesion in May 2005. Staging procedure and computed tomography-guided needle biopsy were performed which revealed stage IIIa nonsquamous cell lung

cancer. The patient underwent neoadjuvant chemoradiation followed by a left pneumonectomy. The patient presented to the cardiothoracic surgery clinic in December 2005 with respiratory symptoms and was found to have an empty left hemithorax by chest X-ray, as seen in ►Fig. 1, and was found to have a microperforation at the bronchial stump by bronchoscopy associated with a pneumonia, for which he was treated with antibiotics with resolution of symptoms. The patient was found to have brain metastases in May 2006 and underwent craniotomy with tumor removal and radiation. The patient was admitted in October 2006 secondary to frank hemoptysis associated with cough and shortness of breath. A diagnosis of postpneumonectomy empyema with bronchopleural fistula was made. Consideration was given to the use of a muscle flap or omental flap closure of the pleural space; however, due to minimal muscle mass and chronic cachexia, the patient underwent thoracoplasty with closure of the bronchopleural fistula. The patient tolerated the procedure well, had an uneventful postsurgical recovery, and continues to follow-up in the cardiothoracic surgery clinic. The patient is free of recurrence to date and is not functionally limited despite his thoracic deformity, as seen in ►Fig. 2.

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Fig. 1 Preoperative chest X-ray demonstrating incomplete opacification of left hemithorax secondary to drop in pleural fluid levels.

Case 2

Mr. B is a 62-year-old man with a history of chronic obstructive pulmonary disease who presented in May 2002 complaining of worsening shortness of breath. The patient was found to have an atelectatic lobe on the left lung. The patient underwent bronchoscopy at which time a large polypoid tumor was seen protruding out of the left upper lobe and covering the lower lobe orifice. Pathologic evaluation revealed a carcinoid tumor and the patient subsequently underwent a left pneumonectomy. The patient developed an early multiloculated postpneumonectomy empyema that was nonresponsive to drainage and antibiotic therapy. The patient underwent reinforcement of the bronchial stump with intercostal muscle followed by thoracoplasty with resection of ribs three through nine. Neither muscle flap nor pedicled omental flap obliteration of pleural space was pursued due to low body mass index. The patient was discharged home after an uncomplicated postoperative course

Fig. 2 Chest X-ray status post-left thoracoplasty showing collapse of left chest wall with complete obliteration of pleural space.

Fig. 3 Chest X-ray status postthoracoplasty showing left-sided thoracic deformity with normal right lung expansion.

and continues to follow-up in the cardiothoracic surgery clinic. Although he has a physical deformity, as seen in ►Fig. 3, the patient is not functionally limited in any manner.

Discussion

Thoracoplasty is a historical procedure with limited indications in modern day surgical practice. Before 1890, thoracoplasty, rib resection, and collapse therapy were used primarily for the treatment of recurrent empyema. In the early 1900s, the technique of thoracoplasty was applied to the management of pulmonary tuberculosis as a means of partially collapsing the thoracic wall to obliterate pleural spaces. With the establishment of medical management of pulmonary tuberculosis and the advent of effective medications, surgical management of tuberculosis saw a sharp decline. Today, thoracoplasty is indicated as the last step in the management of postpneumonectomy and lobectomy empyemas and rarely in refractory primary empyemas.

The original procedure of thoracoplasty, indicating decostalization of the thorax over an empyema site, is often referred to as the Estlander thoracoplasty. Later variations such as Andrews thoracoplasty and Schede thoracoplasty gained popularity even though they have very different cosmetic, functional, and morbidity outcomes. Andrews thoracoplasty involves rib resection, drainage of the pleural space followed by tethering of the decostalized chest wall to the mediastinum over a bronchopleural fistula. Schede thoracoplasty on the other hand is far more disfiguring and involved a large lateral u-shaped incision followed by subperiosteal rib resection, and is indicated in the presence of thickened and fibrotic endothoracic fascial layers. Andrews thoracoplasty is more commonly performed since anatomic conditions warranting. Schedes thoracoplasty is rarely seen in postpneumonectomy or primary empyema conditions.¹

Although relatively uncommon, postresection empyema is a serious complication of thoracic surgery and carries a mortality rate between 5 and 25%. Postpneumonectomy

empyema typically occurs at a rate between 2 and 16%, and a rate between 80 and 100% of cases is a result of a bronchopleural fistula.^{2,3} The fundamental principles of postpneumonectomy empyema involve initial control of infection by drainage followed by fistula closure to prevent aspiration related infection seeding and lastly pleural space obliteration for those cases which are refractory to less invasive methods.

In current practice, infected pleural space after pneumonectomy is initially treated by chest tube drainage and antibiotic administration. Success rates for this technique as an initial management ranging from 67 to 74% have been reported.³ For refractory cases, more invasive techniques such as the Claggett procedure, modified Claggett procedure, or open window thoracostomy (OWT) may be required. The Claggett procedure involves drainage of the infected pleural space, irrigation with antibiotic solution, followed by the filling of the entire hemithorax with antibiotic solution. Success rates for this procedure of 100% have been reported when reoperation was within 12 hours of empyema formation.³ Others have reported a success rate of 84% with a recurrence rate as high as 38.5%.⁴ Furthermore, a mortality rate as high as 25% is associated with this procedure.⁵

The modified Claggett procedure also involves filling the pleural space with antibiotic solution accompanied by closure of a bronchopleural fistula by muscle flap. Success rates as high as 80 to 100% have been reported, while the attending mortality is similar if slightly improved compared with the Claggett procedure.² A newer technique, OWT has proven to be very useful in the management of postpneumonectomy empyemas.⁶⁻⁸ Significant advantages of this procedure are the ability to perform it safely in unstable patients as well as the reduced morbidity when compared with thoracoplasty. Also, when combined with a thoracoplasty, it provides a complete clearance and obliteration of infected pleural space.

With an overall mortality rate of 4.3 to 5%, thoracoplasty is considered to be a safe yet disfiguring procedure.³ Success rates for thoracoplasty as high as 91% have been reported.^{9,10} Muscle flap has been reported to be successful 100% of the time.¹ The higher success rate is explained by the increased amount of material available to fill the problematic pleural space. Thoracomyoplasty and omental flap are effective procedures but are largely dependent on the patient's muscle or fat bulk being sufficient to completely fill the pleural space.

Given the cachexia associated with lung cancer, limited muscle or fat mass is a frequently encountered limitation to performing the aforementioned procedures and served as the primary reason why thoracoplasty was performed in the two cases presented.

Given the lack of limitations in functional status of the patients in both cases despite obvious thoracic deformities, we believe thoracoplasty should remain in surgeons' armamentarium to treat infected pleural space that is refractory to medical and less invasive surgical therapies. Although there is a considerable volume of literature describing long-term musculoskeletal complications resulting from thoracoplasty, our experience shows that when used in patients who have completed physical development, scoliosis and its related functional limitations may not be as common or severe as they are thought to be.

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