

## Treatment of Fungal Empyema Combined with Osteoradionecrosis by Thoracoplasty and Myocutaneous Flap Transposition

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We report the rare case of a 58-year-old woman who was diagnosed with fungal empyema thoracis combined with osteoradionecrosis. After 32 months of home care followed by open window thoracostomy, thoracoplasty with serratus anterior muscle transposition and a latissimus dorsi myocutaneous flap was performed successfully. Although thoracoplasty is now rarely indicated, it is still the treatment of choice for the complete obliteration of thoracic spaces.

**Key words:** 1. Empyema, fungal  
2. Osteoradionecrosis  
3. Thoracoplasty

### Case report

A 58-year-old woman presented with fever, cough, and purulent sputum. The patient had a history of pulmonary tuberculosis (TB) treatment 30 years previously and right breast cancer treated by a right modified radical mastectomy followed by postoperative concurrent chemo-radiation therapy 20 years before. A computed tomography (CT) scan showed patchy consolidation and decreased lung volume on the right side, suggesting superimposed pneumonia on a destroyed lung caused by TB or radiation pneumonitis. Broad-spectrum antibiotic treatment was effective and the patient recovered uneventfully.

Eight months later, a chest wall fistula developed on the right anterior chest (Fig. 1A). She presented with dyspnea (grade 4 on the modified Medical Research Council dyspnea scale) and severe pulmo-

nary dysfunction with a restrictive pattern (forced vital capacity [FVC], 34%; forced expiratory volume in 1 second [FEV1], 39%; FEV1/FVC, 87%) was documented in the pulmonary function test. Empyema thoracis and a chest wall defect with osteoradionecrosis of the sternum, clavicle, and ribs were noted on the CT scan (Fig. 1B). Results of a bacterial culture study, an acid-fast bacillus smear, and a TB polymerase chain reaction examination were negative. Fungal hyphae morphologically consistent with aspergillosis were found in the chest wall biopsy, and *Aspergillus fumigatus* was identified by fungal culture. After starting intravenous antifungal agents (200 mg of voriconazole every 12 hours), the patient's acute septic condition improved and an open window thoracostomy (OWT) was performed under general anesthesia. The lung was covered with dense fibrous peel and the pleural cavity was filled with necrotic

Received: January 5, 2018, Revised: March 7, 2018, Accepted: March 12, 2018, Published online: August 5, 2018

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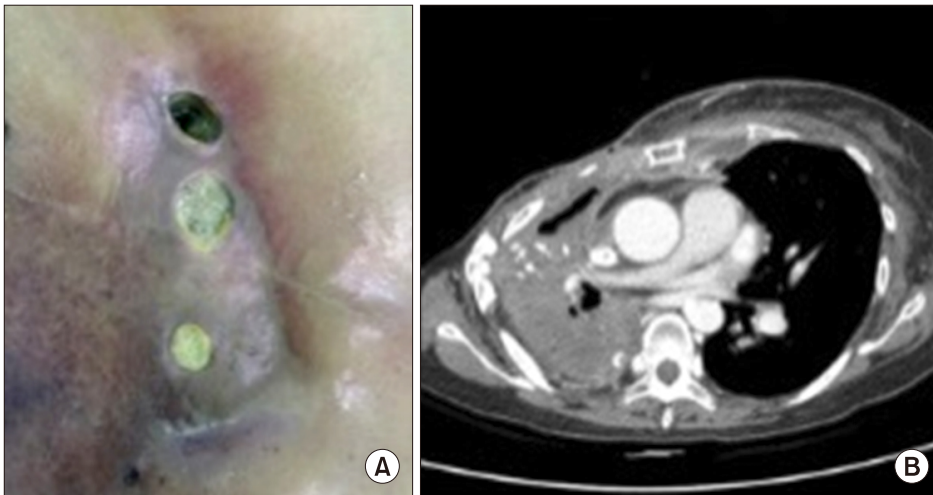


Fig. 1. (A) The fistula that developed on the anterior chest wall. (B) Empyema thoracis and a chest wall defect with osteoradionecrosis were detected on a computed tomography scan.

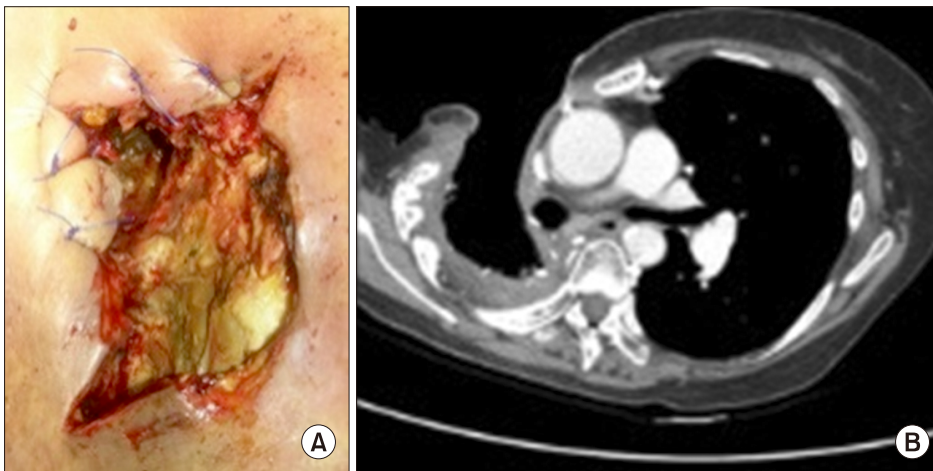
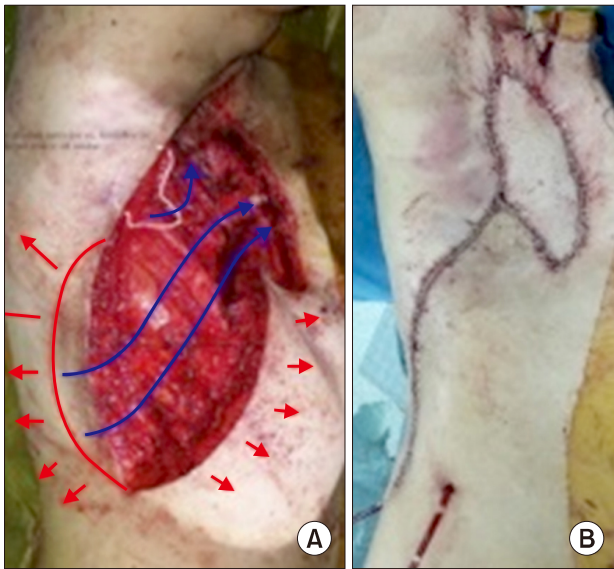


Fig. 2. (A) Debridement of the infected tissue with an OWT was performed. (B) After daily irrigation and debridement post-OWT, aeration in the right lower lobe improved on computed tomography. OWT, open window thoracostomy.

tissue. Micro-air bubbles suggesting alveolar air leakage appeared during positive-pressure ventilation. Cautious debridement and massive saline irrigation were performed. An Eloesser window was made by partially resecting the infected portions of the second, third, and fourth ribs and costal cartilage (Fig. 2A). After cautious daily irrigation and debridement, the patient's general condition, pulmonary function, and localized infection improved. The patient was discharged on postoperative day 30 (Fig. 2B). An oral antifungal agent (200 mg of voriconazole every 12 hours) was maintained for 1 year in an outpatient setting.

The infection of the pleural cavity and the general condition of the patient improved gradually. We decided that the wound status and the patient's condition were suitable for extensive definitive surgery

32 months after the initial operation, and we planned to perform thoracoplasty with latissimus dorsi (LD) myocutaneous flap transposition. The patient was placed in the left lateral decubitus position, small amounts of necrotic tissue around the Eloesser window were excised, and the skin margin was trimmed. An LD myocutaneous flap was prepared by a plastic surgeon (Fig. 3A). Thoracoplasty was conducted by resecting the first to the seventh ribs, including the heads of the ribs, and the chest wall fully collapsed. The serratus anterior (SA) muscle was harvested and myopexy was carried out at the apex of the thoracic cavity to prevent any potential residual dead space. Finally, the anterior chest wall soft tissue defect was reconstructed using the LD myocutaneous flap (Fig. 3B). The antifungal agent was no longer used after the final procedure. There were no sig-



**Fig. 3.** (A) Necrotic tissue and skin were removed and a LD myocutaneous flap was prepared. (B) Thoracoplasty with the LD myocutaneous flap, combined with intrathoracic serratus anterior muscle transposition, was performed. LD, latissimus dorsi.

nificant complications after surgery except minimal skin necrosis at the distal tip of the LD myocutaneous flap, which healed spontaneously within 1 month. The patient was discharged on postoperative day 17. Two years after the second operation, the patient is able to perform activities of daily living without recurrence of the infection.

## Discussion

Fungal empyema thoracis caused by *Aspergillus* species is a very rare and fatal disease, generally occurring after rupture of an aspergilloma or as a complication of preexisting chronic empyema. Predisposing factors for fungal empyema are chronic use of broad-spectrum antibiotics, the presence of intravascular devices, hyperalimentation, and immunocompromised status, which can be associated with malignancy, chemotherapy, infection, or chronic illness. Because more than 50% of the causative organisms are not documented by bacterial culture studies, fungal infection should be suspected if a patient's clinical symptoms worsen despite antibiotic treatment and if the patient has predisposing factors. Biopsy, as done in our case, should be considered to confirm the fungal infection [1].

There is no established standard therapy for *Aspergillus* empyema thoracis. A combination of antifungal agents, including voriconazole, has been recommended, and the effects of intrapleural instillation of antifungal agents have been reported in several case studies. Multidisciplinary treatments, such as antifungal agents together with early surgical interventions, are helpful for optimizing outcomes [1,2]. If fungal empyema is combined with soft tissue invasion, as in our case, early surgical interventions such as the extensive debridement of necrotic tissue should be performed to improve the outcome [2]. The present patient was diagnosed with fungal empyema thoracis caused by *Aspergillus fumigatus*, combined with a skin defect resulting from osteoradionecrosis. Debridement of the infected tissue and early OWT, combined with antifungal medications, resulted in the successful and immediate control of signs and symptoms that pointed to an acute septic condition.

The basic principle of the surgical management of empyema thoracis is local infection control by complete evacuation of the contents of the infected space. However, it is difficult to achieve local control without eliminating the pleural dead space [3]. Thoracoplasty, alone or with intrathoracic muscle flap transposition, is a good option for obliterating the problematic space. Many surgeons are reluctant to perform thoracoplasty because it is a highly invasive procedure resulting in chronic pain and deformity of the chest wall. Nonetheless, thoracoplasty remains an excellent therapeutic option for post-resectional empyema or primary empyema, especially when the pleural dead space is too large to be filled via muscle transposition or when a bronchopulmonary fistula is persistent. Some researchers have claimed that thoracoplasty is associated with a higher success rate and a lower mortality rate than other procedures. They have also demonstrated a relatively low incidence of complications, such as chronic pain, scoliosis, and progressive pulmonary insufficiency [4-6]. We performed thoracoplasty in the present case to obliterate the dead space along with LD myocutaneous flap reconstruction for complete coverage of the chest wall soft tissue defect. In order to address the possibility of unobliterated dead space at the apex of the thoracic cavity, we performed an additional intrathoracic myopexy using the SA muscle.

There was no dead space and the patient's recovery was uneventful except for minimal skin necrosis at the tip of the skin of the LD myocutaneous flap. The patient has been infection-free for 2 years after definitive surgery.

In conclusion, early surgical interventions should be considered for managing fungal empyema thoracis, especially when associated with a combined infection in the chest wall. Thoracoplasty is an excellent therapeutic option for obliterating residual spaces and for the definitive treatment of fungal empyema.

### Conflict of interest

No potential conflict of interest relevant to this article was reported.

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