

Treatment of Fibrothorax Using Intrapleural Tissue Plasminogen Activator

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Pleural fluid collections are routinely drained following open heart surgery. The presence of undrained pleural fluid, whether inflammatory, infectious, or hemorrhagic, can cause fibrothorax.¹ Fibrothorax results when a thick fibrin peel forms, covering the pleural surfaces. This peel restricts normal lung movement during the respiratory cycle, resulting in impaired lung function.² The only treatment of fibrothorax with lung entrapment that has been proven effective is surgical decortication, which involves stripping the peel from the surface of the lung and chest wall. This procedure is associated with significant morbidity and mortality, especially in debilitated patients who are poor surgical candidates.²

Tissue plasminogen activator (TPA) is a recombinant protein that activates plasmin, a natural thrombolytic. TPA has been successfully used to recanalize acutely thrombosed arteries in the heart and brain, limiting the damage from myocardial infarction and stroke.³

This case report describes the first use of TPA as an intrapleural fibrinolytic to successfully treat fibrothorax. This nonsurgical treatment for fibrothorax may reduce morbidity and mortality, especially in poor surgical candidates. It may also shorten hospital stay and reduce associated medical costs.

CASE PRESENTATION

An 82-year-old man underwent 2-vessel, off-pump coronary artery bypass grafting. His postoperative recovery was complicated by a large, right-sided pleural effusion. Ultrasound-guided right thoracentesis was performed, and 1100 mL of serosanguinous fluid was removed. The patient was discharged home. Within 2 weeks, the patient underwent a right thoracentesis as an outpatient to drain a recurrent effusion. Again, approximately 1100 mL of fluid was removed. A postprocedure chest radiograph revealed a residual loculated hydropneumothorax, and the patient was readmitted. Despite placement of a chest tube, the pneumothorax failed to completely resolve, because

the lung was partially trapped. The chest tube was removed and the patient was discharged. He was subsequently readmitted 1 week later with a presumed empyema. Computed tomography (CT) confirmed a loculated recurrent right-sided pleural effusion. The patient was treated empirically with antibiotics, and underwent a CT-guided right thoracentesis. Because of significant intrapleural adhesions, less than 20 mL of fluid was aspirated. Fluid analysis was consistent with a complex parapneumonic effusion. A pigtail catheter was placed under CT guidance. To enhance drainage, TPA (Activase, Genentech, Inc, South San Francisco, CA) 5 mg in a 20-mL sterile saline solution was instilled through the catheter into the intrapleural space. After 5 hours of dwell time, the catheter was connected to a closed water suction drainage system, and 220 mL of bloody fluid was recovered. TPA instillations were given once daily for 1 week. Repeat chest CT after 1 week of treatment revealed a residual hydropneumothorax and a 5 mm- to 7 mm-thick fibrin peel involving both pleural surfaces (**Figure 1**). TPA instillation was increased to 3 times per day, with 4-hour dwell times. A repeat chest CT 48 hours later demonstrated partial expansion of the lung. This course of treatment was continued for 15 days.

A repeat chest CT on day 10 of the increased treatment regimen revealed considerable improvement, with no residual hydropneumothorax and only mild residual pleural thickening (**Figure 2**). The catheter was removed after 15 days of treatment, and the patient was discharged home. Since discharge, the patient continues to do well and has not required rehospitalization for this condition.

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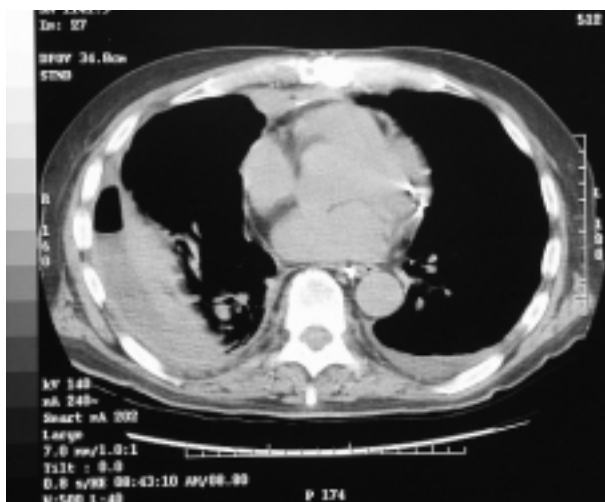


Figure 1. Chest computed tomographic scan of the case patient, demonstrating fibrin peel and loculated right hydro-pneumothorax.

DISCUSSION

Pleural fluid collections following open-heart surgery are commonly the result of undrained hemothorax. Intrapleural blood irritates the pleural surfaces, causing inflammation. As a result, a serous inflammatory transudate accumulates within the intrapleural space, increasing the effusion and compressing the lung, causing atelectasis. If the fluid remains undrained, fibrin is excreted into the intrapleural space as the inflammatory fluid becomes exudative. As the fibrin organizes, intrapleural adhesions form that loculate the fluid. Fibrin deposition occurs on the visceral pleura, creating a thick peel that encases the involved lung. This peel restricts lung expansion on inspiration, causing further atelectasis and compromising pulmonary function.⁴

When lung entrapment results from fibrothorax, decortication, a surgical procedure that strips the inflammatory peel from the pleural surfaces, is the only effective way of releasing the trapped lung and improving pulmonary and chest wall mechanics.⁵ Removing the inflammatory peel that is adherent to the pleura can cause multiple tears in the lung surface, resulting in bleeding and air leakage, the most common causes of postoperative morbidity. Contamination of the intrapleural space may occur secondarily, leading to infection, another source of morbidity. Because the procedure requires single-lung ventilation and is associated with significant blood loss and lung trauma, perioperative mortality averages 5%. This type of surgery is an unattractive option for debilitated patients who are poor surgical candidates.⁶

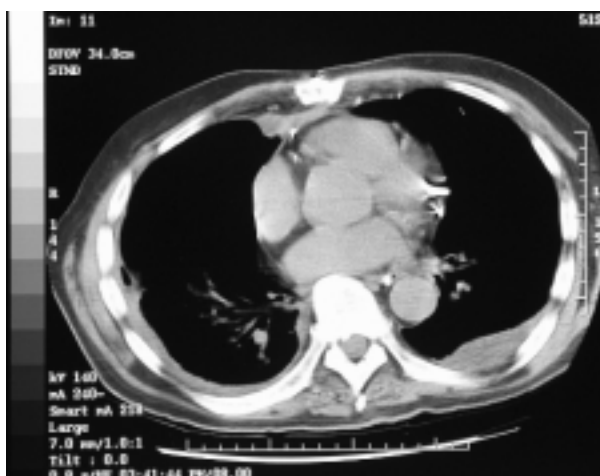


Figure 2. Chest computed tomographic scan of the case patient, demonstrating resolution of the right hydro-pneumothorax.

Because of the significant complications associated with decortication, other methods of treating fibrothorax are needed. The use of intrapleural fibrinolytics for the successful treatment of empyema was first reported in 1949.⁷ More recently, other investigators have demonstrated efficacy of intrapleural fibrinolytics in the treatment of complicated pleural fluid collections.^{8,9} Their use for the treatment of fibrothorax, however, has not been described. This case report represents the first description of the use of intrapleural TPA for treatment of fibrothorax. TPA was selected because urokinase had been removed from the market by the FDA; subsequently, streptokinase supplies became limited.

CONCLUSION

The first use of TPA as an intrapleural fibrinolytic to successfully treat postcardiotomy fibrothorax is described. The patient, who was quite debilitated and a poor surgical candidate, was able to avoid decortication. We believe that the use of TPA represents a promising treatment option, especially in patients who are poor surgical risks. TPA may shorten hospital stays and reduce associated medical costs. **HP**

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