Pleural Space Complications Associated with Lung Transplantation

Andrew Arndt, MD, Daniel J. Boffa, MD*

KEYWORDS

• Lung transplantation • Pleural space complications • Hemothorax • Chylothorax

KEY POINTS

- Despite decreasing operative mortality, lung transplantation continues to carry significant risk of pleural space complications.
- In addition to addressing pleural space disease, it is important to evaluate for other complications that could be driving the pleural process (eg, rejection, bronchopleural fistula, pulmonary vein stenosis).
- Pleural space complications are associated with a compromise in short-term survival. Therefore, attempts should be made to prevent pleural space complications and minimize their impact should they develop.

INTRODUCTION

Lung transplantation represents a life-saving option for a variety of end-stage lung diseases. Despite the magnitude of anatomic manipulation and the fragility of the patient population, the procedures have become progressively safer over time, with operative mortalities decreasing from 19% to 10% over the past 2 decades.[1–3] Perioperative morbidity, however, remains high. Pleural space complications are particularly common, occurring in 22% to 34% of patients.[4,5] Pleural complications include a constellation of hemorrhagic, infectious, inflammatory, or other processes that result in the accumulation of fluid, debris, and air within the pleural space. The impact on pleural complications on allograft function and overall patient recovery can be significant, particularly in the setting of persistently borderline cardiopulmonary reserve. Although surgeons have greatly advanced the care of pleural space complications in the general thoracic patient population, lung transplant recipients are typically more fragile and their postoperative course is generally more tenuous than most general thoracic patients. In addition, the need for immunosuppression renders the management of pleural complications particularly challenging in this population.

OVERVIEW OF POSTTRANSPLANT PLEURAL SPACE COMPLICATIONS

Several factors predispose lung transplant recipients to the development of pleural space complications, perhaps most notably pleural space abnormalities that predate the transplant. For example, the pathologic conditions responsible for the end-stage lung disease can often result in infectious or inflammatory changes in the pleural space. Furthermore, procedures to diagnose the end-stage lung disease (ie, wedge biopsy), as well as procedures to treat complications of end-stage lung disease (eg, pleurodesis for pneumothorax), may result in the fusion of the visceral and parietal pleura. Explanation of the diseased lungs in the setting of pleural symphysis can result

Disclosures: None.
Thoracic Surgery, Yale New Haven Hospital, New Heaven, CT 06510, USA
* Corresponding author.
E-mail address: daniel.boffa@yale.edu

Thorac Surg Clin 25 (2015) 87–95
http://dx.doi.org/10.1016/j.thorsurg.2014.09.005
1547-4127/15/$ – see front matter

in significant trauma to the soft tissue of the inner chest cavity (increasing risk of postoperative hemorrhage), as well as spillage of contaminated material from the diseased lung into the pleural space (increasing risk of pleural space infections). One surgical series noted pleural alteration in 54% of patients preoperatively (pleural thickening, most commonly, but also calcification, pneumothorax, and pleural effusion).[5] For the sake of this article, pleural complications are organized into following categories: hemothorax, chylothorax, air leak or pneumothorax, recurrent effusion, empyema, trapped lung, and chronic pleural complications (fibrothorax).

Hemothorax

The accumulation of a hemothorax after lung transplantation is concerning for both active blood loss, as well as pleural space complication. The merits of blood conservation seem to apply to nearly every category of major surgical procedures; therefore, early reoperation to minimize blood transfusion after lung transplantation is justifiable. The surgeon must balance the risks of reoperation with the probability of spontaneous cessation as well as the likelihood of finding a surgically addressable source (as opposed to diffuse chest wall oozing or bleeding that reflects an incompletely corrected coagulopathy). To this end, several steps can be taken to minimize the risks of perioperative bleeding. The raw surface oozing often reflects vascular adhesions between the native lung and chest wall. Although a meticulous dissection at the time of pulmonary explant must be balanced against ischemia time for the allograft, a dissection does not have to be slow to be hemostatic. Blunt dissection should be avoided in areas of vascular adhesions, in favor of cautery. In areas of particularly dense adhesions, the LigaSure (Covidien, Norwalk, CT) can be useful, or even stapling off a slip of adherent lung (and potentially returning to this area to excise residual native lung once the lung has been removed or after the new lung has been placed). If the patient is going to go on cardiopulmonary bypass, it is advisable to dissect the native lung and obtain hemostasis before fully anticoagulating. On completion of anastomoses, persistent raw surface oozing can be addressed using the argon beam coagulator. Early recognition of the potential need for this step can save several minutes at the end of the case waiting for the Argon beam to be set up. Raw surface oozing may also be addressed by applying topical hemostatic agents, such as Surgicel, Gelfoam or thrombin, Surgiflo, Floseal, and other agents. There are little published data on the safety of using these agents around a transplanted lung, and they likely have a similar risk profile as in the general thoracic population. If the patient is perceived to be at particular risk for oozing, it would be worth ensuring the chest is adequately drained with large-bore chest tubes, in hopes of preventing the accumulation of clotted blood (see later discussion).

Residual hemothorax (not associated with active blood loss) is identified in up to 15% of lung transplant recipients, potentially being more common when cardiopulmonary bypass is used.[4,5] Retained blood in the pleural space could extrinsically compromise ventilation of the transplanted lung as well as serve as a nidus for infection or potentially lead to chronic pleural space complications (eg, trapped lung, fibrothorax). Hospital mortality seems to be higher in patients that develop hemothorax, but it is difficult to isolate this outcome variable as the sole driver of operative mortality.[5,6]

Evacuation of a hemothorax can be attempted by large-bore tube thoracostomy, yet the blood is often clotted and does not drain well. However, safe and successful instillation of thrombolytics has been described in the transplant population.[7] In the event of failure of tube thoracostomy and thrombolytics, reoperation to evacuate a residual hemothorax can often be accomplished safely by video-assisted thoracoscopic surgery (VATS).

Chylothorax

Chylothorax is an infrequent complication following lung transplantation, occurring in less than 1% of lung transplant recipients.[4,5] The diagnosis of chylothorax generally requires the patient to be undergoing enteric feeding and is suggested by a transition to milky colored pleural effluent. The presence of chylomicrons or a triglyceride level greater than 110 mg/dL in the pleural fluid is diagnostic for chylothorax.[8] The consequences of chylothorax among lung transplant patients mirror those in other patients and include malnutrition, electrolyte abnormalities, and immune suppression from the ongoing loss of lymphatic fluid.[9] The immunosuppressive effects are of particular importance in this population and may lead to a need for immunosuppressant dose adjustment.[10]

Typically a trial of bowel rest is initiated to evaluate for spontaneous resolution of chyle leak. During this time period the patient may require total parenteral nutrition (TPN) for nutritional support, depending on the duration of bowel rest. Despite the known immunosuppressive effects of TPN,[11] it has been used without apparent adverse results in lung transplant patients.[9] Other nutritional