Chapter 27

Lung Transplantation: Post-Operative ICU Management

Aaron M. Cheng  
University of Washington, USA

Michael S. Mulligan  
University of Washington, USA

Kei Togashi  
University of Washington, USA

ABSTRACT

Lung transplantation is a widely accepted surgical procedure for treatment of select patients suffering from end-stage lung disease. Recipients, however, require meticulous post-transplant care to preserve allograft lung function and to ensure optimal patient quality of life. In the post-operative period, these patients are predisposed to specific complications and pose unique considerations that clinicians caring for these patients in the intensive care setting should be familiar with managing. This chapter focuses on the early post-operative critical care management of the lung transplant recipient with specific emphasis on hemodynamic resuscitation; early lung graft dysfunction; and considerations regarding immunosuppression and infection. Non-pulmonary issues that affect the clinical care of these patients in the ICU setting are also discussed.

INTRODUCTION

Lung transplantation remains the primary treatment for qualified patients with non-malignant end-stage lung disease. The first single lung transplantation was successfully performed by Cooper and Patterson in Toronto in 1983, and in 1986, the first successful bilateral or double lung transplant procedure was performed.(Patterson, Cooper, Dark, & Jones, 1988; Patterson, Cooper, Goldman, et al., 1988; “Unilateral lung transplantation for pulmonary fibrosis. Toronto Lung Transplant Group,” 1986) Since, there has been a steady increase in the number of lung transplants performed worldwide with recent statistics from 2013 indicating that over 3600 procedures were performed annually in adult patients with end-
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stage lung disease. (Yusen et al., 2013) Nevertheless, due to organ donor shortage, the number of lung transplants performed remains proportionally small compared to the number of potential patients with end-stage lung disease who could benefit from transplantation.

The overwhelming majority of lung transplant recipients are adult patients in the age range of 50-65, although increasingly, select older patients (> 65) are being considered candidates for lung transplantation. (Abecassis et al., 2012; Mahidhara et al., 2008; Yusen et al., 2013) The procedure can be performed as single or double-lung transplants depending on the underlying lung disease and individual patient characteristics. For patients who have pulmonary sepsis, such as cystic fibrosis and bronchiectasis, bilateral lung transplantation is required due to concerns for recurrence of infectious pathogen if single lung transplant was to be selected. On the other hand, single lung transplantation can be successfully performed in patients with pulmonary fibrosis, chronic obstructive lung disease, and those with pulmonary hypertension. In most lung transplant centers, bilateral lung transplantation is performed when feasible, given its reported survival benefit over single lung transplantation. (Chang et al., 2007)

Overall, the median survival for patients who have undergone lung transplantation is 5.6 years with the median survival of those patients who survive beyond the first post-transplant year estimated to be 7.9 years (conditional median survival). The median survival for double lung transplant recipients is longer than those who receive single lung transplantation: 6.9 years vs. 4.6 years (conditional median survival, 9.6 years vs. 6.5 years). (Yusen et al., 2013) Despite the advances in care of transplant patients, however, survival after lung transplantation remains inferior to other solid organ transplantation due to the greater number of associated complications during the first year after transplantation. Consequently, meticulous attention to detail in the early post-operative phase is crucial to the success of the procedure and the long-term well-being of the recipient. This chapter focuses on aspects of critical care management of lung transplant recipients. A brief outline of the lung transplantation procedure will be introduced but the primary emphasis will be on critical care-related considerations in the early post-operative management of the lung allograft in these patients. Specific issues related to lung donor management and recipient-donor matching will not be covered.

OPERATIVE PROCEDURE

The lung transplant procedure can be performed through standard thoracic incisions. The contemporary double lung transplant procedure is performed through a bilateral transverse thoracosternotomy (clamshell incision), which provides the surgeon excellent exposure and access to the pulmonary hilum and both pleural spaces; bilateral anterior thoracotomies without dividing the sternum, or median sternotomy—the original double lung technique, have also been described and are currently applied. Single lung transplantation is usually performed through a posterolateral or anterolateral thoracotomy.

Cardiopulmonary bypass (CPB) is frequently utilized in the lung transplant procedure, and is usually performed through central cannulation, with the venous cannula inserted in the right atrium, and the arterial cannula inserted in the ascending artery, when required for double lung transplantation. The need for CPB depends upon intra-operative hemodynamic stability and oxygenation, and as such, patients with severe pulmonary hypertension and/or hypoxia are more likely to require CPB support. (de Hoyos et al., 1993; Szeto et al., 2002; Triantafillou et al., 1994) Pulmonary artery pressure will increase with hypoxia, hypercarbia, acidosis and when the pulmonary artery is clamped causing a dramatic decrease in the recipient’s cardiac output due to increase in after load of the right ventricle, prompting the need for