Exposure of Difficult Left Hilum in Bilateral Sequential Lung Transplantation

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Left hilar exposure can be challenging during bilateral sequential lung transplantation, particularly in patients with idiopathic pulmonary fibrosis due to the overlying heart and limited space. We describe a cost-effective technique that has been used in off-pump cardiopulmonary bypass to retract the heart away from the left hilum, without causing hemodynamic instability, thereby allowing implantation of the left lung without the use of cardiopulmonary bypass.


Bilateral sequential lung transplantation is the preferred operation for all indications, and data from the International Society for the Heart and Lung Transplantation Registry report that 74% of the lung transplants performed are bilateral [1]. Since the introduction of the lung allocation score in the United States in 2005, a significant increase has occurred in the number of idiopathic pulmonary fibrosis (IPF) patients receiving a lung transplant. By 2010, the proportion of IPF recipients (28.3%) was almost similar to that of chronic obstructive pulmonary disease (28.8%) [1].

Institutional preferences for patients with IPF vary for single vs bilateral lung transplant and also for the use of cardiopulmonary bypass during the procedure. Whether a double-lung transplant is superior compared with a single-lung transplant for IPF [2,3] and whether routine use of cardiopulmonary bypass is beneficial [4] is not clear.

Our institutional policy is to offer a double-lung transplant to all IPF patients aged younger than 65 years. For patients older than 65 years, we offer a single-lung transplant in the absence of pulmonary hypertension. Whenever feasible, we try to avoid cardiopulmonary bypass during bilateral sequential lung transplantation. However, we electively use cardiopulmonary bypass when the recipient has severe pulmonary hypertension or requires a concomitant cardiac procedure.

The left hilar exposure can be difficult due to the overlying heart, especially in patients with IPF and occasionally in cystic fibrosis. Mechanical retraction of the heart to expose the left hilum can cause significant hemodynamic instability, which may necessitate the use of cardiopulmonary bypass. However, heart retraction devices have been described that prevent such hemodynamic instability and the subsequent use of cardiopulmonary bypass [5]. In this report we describe a technique that was originally used for off-pump cardiopulmonary bypass operations [6]. We have adapted this low-cost technique to retract the heart during bilateral sequential lung transplantation to provide excellent left hilar exposure without hemodynamic instability.

Technique

We routinely use the clamshell incision for bilateral sequential lung transplantation. To adequately expose the left hilum for the left lung transplant, we first open the pericardium using an inverted Y-shaped incision, with longer extension on the left toward the apex to expose the heart. By 2010, the proportion of IPF recipients (28.3%) was almost similar to that of chronic obstructive pulmonary disease recipients (28.8%) [1].

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With the heart lifted out of the pericardial sac, the stitch with the episiotomy pack is snared down using a red rubber catheter to the pericardium. The suture with the snare is then clamped to the inferior aspect of the incision, and tension is placed on the 2 folded ends of the episiotomy pack. One end of the episiotomy pack is clamped to the drapes on the superior aspect of the incision, and the other end is clamped to the drapes on the inferior aspect. This maneuver reflects the heart out of the pericardial sac and exposes the left hilum. Figure 1A shows an animated view of the hilum when the heart is retracted, and Figure 1B shows the placement of the stitch in the pericardium. Figure 2 is an intraoperative photograph shows the exposed left hilum using the technique described.
Once the hilum is exposed and the hilar vessels are dissected, a left pneumonectomy is performed, and the donor lung is implanted using standard techniques to anastomose the bronchus, pulmonary artery, and venous cuff, in that order. The allograft is reinflated, and air is removed at the venous end of the anastomosis. Once hemostasis is confirmed, the stay suture and the snare are released and the heart is returned to the pericardial sac.

We use the mean arterial pressure, the pulmonary arterial pressures, and cerebral somatic measurements during the procedure to assess the hemodynamic compromise that might result from the retraction of the heart. In our experience, the hemodynamic instability is minimal, transient, and usually stabilizes within 2 to 3 minutes of retraction.

Using this technique to expose the left hilum, we have performed 5 bilateral lung transplants in IPF recipients and were able to complete the transplants without cardiopulmonary bypass in 3 of the 5 recipients. Elevated pulmonary pressure with strain on the right ventricle was present in 1 recipient, thus requiring the use of bypass for the implantation of the left lung. We have now started using this technique even in IPF patients with severe pulmonary hypertension (n = 1) to facilitate dissection of the left hilum, before going on bypass, to minimize time on cardiopulmonary bypass.

Comment

In cases where the use of cardiopulmonary bypass is required solely to decompress the left heart and provide exposure of the left hilum, this technique provides excellent exposure without hemodynamic instability and prevents the need for cardiopulmonary bypass. The use of the Urchin retractor has been described for a similar purpose; however, the cost of the device is significantly higher ($685) compared with the cost of the episiotomy pack, suture, and a red rubber catheter ($11). In addition, the suction used to stabilize the heart using the Urchin device can cause more hemodynamic instability than mere displacement of the heart using our technique. This technique can be used in all bilateral lung transplants to provide excellent left hilar exposure, thereby freeing the assistant from retracting the heart during the anastomoses.

References


