Published in final edited form as:

Ann Thorac Surg. 2014 October ; 98(4): 1493–1495. doi:10.1016/j.athoracsur.2013.12.092.

Exposure of Difficult Left Hilum in Bilateral Sequential Lung Transplantation

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Abstract

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. In this manuscript 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 use of cardiopulmonary bypass.

Keywords

Lung; Transplantation (lung); Surgery; incisions; exposure; techniques

Bilateral sequential lung transplantation is the preferred operation for all indications and data from the International Society for the Heart & Lung Transplantation (ISHLT) registry report shows that 74% of the lung transplants performed are bilateral (1). Since the introduction of the lung allocation score (LAS) in the United States in 2005, there has been a significant increase 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 recipients (28.8%) (1). For patients with IPF, institutional preferences vary with regards to single versus bilateral lung transplant and also for the use of cardiopulmonary bypass during the procedure. It is not entirely clear whether the double lung transplant is superior compared to the single lung transplant for IPF (2, 3) and whether routine use of cardiopulmonary bypass is beneficial (4). Our institutional policy is to offer a double lung transplant to all IPF patients less than 65 years of age. For patients older than 65 years, we offer 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 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 manuscript we describe a technique that was originally used for off-pump cardiopulmonary bypass surgery (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 towards the apex to expose the heart. We then place two pericardial stay sutures (2-0 silk) on the right pericardial edge. The heart is then gently lifted to expose the posterior pericardium. A stitch is placed in the oblique sinus (0-ethibond suture) and the suture is then passed through a folded episiotomy pack at its double-folded end. 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. Tension is then placed on the two 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 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 the 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 showing 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 the standard techniques to anastomose the bronchus, pulmonary artery and venous cuff in that order. The allograft is re-inflated and de-airing is done 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. During the procedure we use the mean arterial pressure, the pulmonary arterial pressures and cerebral somenetics 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 2-3 minutes of retraction.

Using this technique to expose the left hilum we have performed 5 bilateral lung transplants in IPF recipients. We were able to complete the transplants without cardiopulmonary bypass in 3 of the 5 recipients. In one of the recipient, after implantation of the right lung, the patient had elevated pulmonary pressure with strain on the right ventricle, 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 prior to going on bypass to minimize time on cardiopulmonary bypass.

Discussion

In cases where the use of cardiopulmonary bypass is required solely to decompress the left heart and provide exposure of the left hilum, the aforementioned technique provides excellent exposure without hemodynamic instability, preventing 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 to the use 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 up the assistant from retracting the heart during the anastomoses.

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Figure 1.

A) Animated figure showing the view of the left hilum after retraction of the heart using the retraction technique described. This provides excellent exposure of the left hilum without hemodynamic instability and relieves the assistant surgeon from mechanically retracting the heart (A=pulmonary artery, B=Left main bronchus, V=Pulmonary veins). B) Site of the suture placement in the oblique sinus and its relations to the pulmonary veins.

Figure 2. Intraoperative picture showing retraction of the heart away from the left hilum. The native left lung has not been removed yet and the retraction provides excellent exposure of the left hilum for the pneumonectomy as well as the implantation without hemodynamic instability.