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Case Report

Reconstruction of Right Ventricular Outflow Tract During Lung Transplant

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ABSTRACT

Lung transplant candidates with significant severe pulmonary artery dilation and concomitant pulmonary valve disease present a unique technical challenge. Right Ventricular Outflow Tract (RVOT) replacement at the time of double lung transplant is a feasible and safe option in this population. Reconstruction can be carried out using either the RVOT from the lung donor or a valve homograft conduit.

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Introduction

A severely dilated pulmonary artery poses a technical challenge at the time of lung transplant. Normal caliber donor pulmonary arteries create significant size mismatch and can be associated with significant pulmonary regurgitation. (Figure 1) Although rare, right ventricular outflow tract (RVOT) reconstruction at the time of lung transplantation can be a solution in patients with preserved right heart function. Reports describe using donor aorta or donor main pulmonary artery distal to the pulmonic valve; however, they do not address the issue of pulmonary insufficiency [1-3]. For the first time, we describe RVOT reconstruction at the time of lung transplant using a valved donor RVOT in two separate patients.

Patient 1

A 64-year-old woman was diagnosed with moderate primary pulmonary hypertension. She had severe pulmonary regurgitation and developed aneurysmal dilatations of the left (11x12 cm) and main (6 cm) pulmonary arteries (PA). (Figure 2) Given the severe annular dilation and the associated pulmonary regurgitation, the decision was made to replace the pulmonary valve at time of lung transplant.

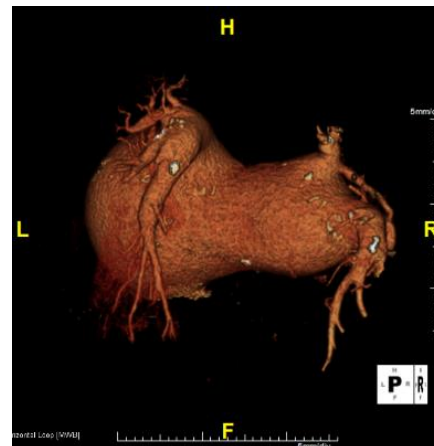


Figure 1: A 3-D CT reconstruction showing a massive aneurysmal main and left pulmonary artery at the time of surgical evaluation.

The patient underwent bilateral lung transplantation with RVOT reconstruction utilizing donor lungs procured en bloc with the donor RVOT, including the pulmonary valve. The donor's heart had extensive coronary artery disease and was deemed not suitable for donation.

Using a clamshell approach, cardiopulmonary bypass without cardiac arrest was instituted via aorta-bicaval cannulation. Both diseased lungs

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were explanted. The aneurysmal main and branched PAs were mobilized, and the left PA was resected. On the back table, the donor right PA was divided, leaving the left PA in continuity with the main PA. The RVOT was trimmed in the fashion of a homograft, leaving a rim of muscle beneath the intact pulmonary valve. The left donor lung with valved autograft was placed into the recipient's chest cavity. The bronchial and left atrial anastomoses were performed in the usual manner. The homograft was then anastomosed onto the recipient RVOT at the level of the excised pulmonic valve leaflets. After adequate venting, the left lung was reperfused in a controlled manner. The right donor lung was then implanted using an intrapericardial right PA anastomosis, with the remainder of the lung being sewn in and reperfused the usual fashion. The one-month postoperative echocardiogram showed a normal functioning donor pulmonary valve and RVOT flow that was free of obstruction. The patient remained alive and intervention-free at three years.

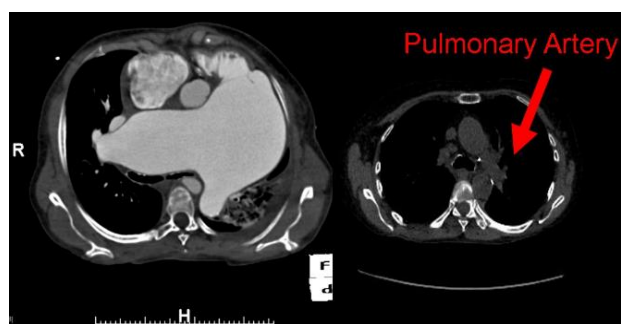


Figure 2: Patient one. (Left) CTA showing a massive aneurysmal main and left (11 cm x 12 cm) PA before bilateral lung transplantation. (Right) Postoperatively, the main PA and branch PAs are of normal caliber without and evidence of disease.

Patient 2

A 41-year-old woman with PA stenosis status post Tetralogy of Fallot repair as a child then went on to develop bronchiolitis obliterans secondary to rheumatic lung disease and required a lung transplant. Echocardiogram revealed preserved right ventricular function and moderate pulmonary regurgitation (peak transvalvular gradient of 44 mmHg). The aneurysmal RVOT measured 3.6 x 4.9 cm and was heavily calcified (Figure 3). Cardiac catheterization showed mild pulmonary hypertension.

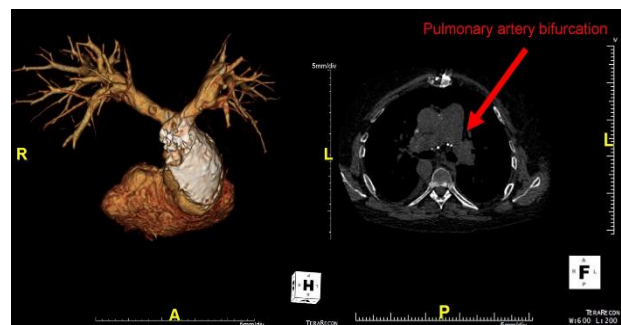


Figure 3: Patient two. (Left) CT scan showing calcified RVOT patch and narrowed branched PAs before lung transplantation. (Right) Postoperative CT demonstrates no residual stenosis or calcification of main or branch pulmonary arteries.

Using a clamshell approach, cardiopulmonary bypass was instituted via aorta-bicaval cannulation without cardiac arrest. The lungs were excised bilaterally. The previous RVOT patch and pulmonary valve (PV) were removed due to extensive calcification. The monocusp PV was not amenable to repair. The RVOT was reconstructed in the following order: first, a 26 mm valved pulmonary arterial homograft was attached to the native PA bifurcation using a running suture. The valved pulmonary homograft was sewn to the RVOT at the level of the natural PV. The remaining anterior RVOT defect was repaired with a bovine pericardial gusset. After repair, the PA and left PA diameters measured 14 mm and 16 mm, respectively. The infundibular bands within the RVOT were divided prior to attachment of the homograft to the RVOT. The left donor lung was then placed in the recipient's chest cavity, and the bronchial, left PA and left atrial anastomoses were performed in the usual manner. Extra care was taken to adequately vent the PA, and the lung was reperfused in a controlled fashion. The right donor lung was then implanted in standard fashion.

Her one-month echocardiogram showed normal pulmonary valve mobility and transvalvular gradient. Both patients were discharged on room air and are alive and well at three years with normal imaging.

Comments

Having an aneurysmal pulmonary artery appears to be an indication for RVOT reconstruction at the time of lung transplantation [1-3]. In case one, the native donor RVOT and pulmonic valve were utilized over cryopreserved homografts due to concerns regarding PV durability [4]. In case two, we report the first successful RVOT reconstruction at the time of lung transplant in an adult patient with a prior repaired Tetralogy of Fallot. Lung transplantation in adults with congenital heart disease is technically challenging due to complex anatomy resulting from multiple corrective and palliative procedures [5]. As the congenital adult population being referred for lung transplantation grows, technical guidance for RVOT reconstruction at the time of transplantation becomes increasingly important.

RVOT reconstruction with a valved RVOT homograft is a technically efficient and effective procedure that provides good functional results. It should be considered as a surgical option in a lung transplant recipient with RVOT stenosis and preserved right ventricular function. From our experience, if the donor heart is not procured, then it is preferred that the donor RVOT, pulmonary valve, and lungs be procured en bloc for transplantation. In the non-sensitized recipient (e.g., low panel reactive antibodies), a valved homograft can serve as a secondary technique for lung transplantation with RVOT reconstruction.

Conflicts of Interest

None.

Funding

None.

REFERENCES

1. Force SD, Lau CL, Moazami N, Trulock EP, Patterson GA (2003) Bilateral lung transplantation and pulmonary artery reconstruction in a patient with chronic obstructive pulmonary disease and a giant pulmonary artery aneurysm. *J Thorac Cardiovasc Surg* 126: 864-866. [[Crossref](#)]
2. Noda M, Okada Y, Saiki Y, Sado T, Hoshikawa Y et al. (2013) Reconstruction of pulmonary artery with donor aorta and autopericardium in lung transplantation. *Ann Thorac Surg* 96: e17-e19. [[Crossref](#)]
3. Wekerle T, Klepetko W, Taghavi S, Birsan T (1998) Lung transplantation for primary pulmonary hypertension and giant pulmonary artery aneurysm. *Ann Thorac Surg* 65: 825-827. [[Crossref](#)]
4. Mitchell RN, Jonas RA, Schoen FJ (1998) Pathology of explanted cryopreserved allograft heart valves: comparison with aortic valves from orthotopic heart transplants. *J Thorac Cardiovasc Surg* 115: 118-127. [[Crossref](#)]
5. McGlothlin D, De Marco T (2011) Transplantation in adults with congenital heart disease. *Prog Cardiovasc Dis* 53: 312-323. [[Crossref](#)]