Sequential redo-bilateral lung transplantation in recipient with prior heart-lung transplantation with tracheal anastomosis

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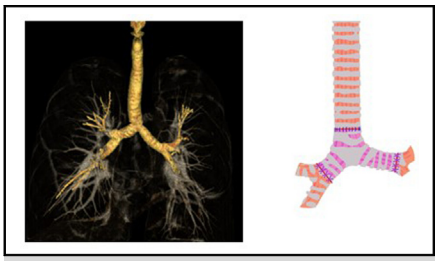

Airway anastomoses postoperative 3-dimensional rendering with illustration.

CENTRAL MESSAGE

Redo lung transplantation with donor-to-donor bronchial anastomosis is feasible after an en bloc heart-lung transplantation with tracheal anastomosis.

Redo lung transplantation for chronic lung allograft dysfunction (CLAD) is technically complex. Unfortunately, CLAD remains the primary cause of long-term graft failure and mortality after lung transplantation with redo transplantation as the only therapy. Experience demonstrates increased surgical complication after previous cardiothoracic surgery[1] with decreased survival after redo lung transplantation;[2] however, few investigations discuss the complexities of redo lung transplantation after a heart-lung transplant. We present the following case report of lung transplantation after prior en bloc heart-lung transplant. The subject of this case report gave informed consent for nonidentifiable images, radiographs, and content to be published for educational purposes. Per the institution, Institutional Review Board approval was not required.

CASE REPORT

The patient is a 22-year-old man with en bloc heart-lung transplant 17 years previously for pulmonary arterial hypertension. He presented with bronchiolitis obliterans syndrome phenotype CLAD. Cardiac allograft function was preserved with no evidence of chronic vasculopathy. He had pulmonary multidrug-resistant *Lomentospora prolificans* infection. Before listing, he underwent a 6-month antifungal regimen with negative sputum cultures and evidence of sensitivity to investigational antifungals that were available postoperatively. He was listed with a lung allocation score of 45.8 (Figure 1, *A* and *B*) and spent 36 days on the waitlist before a suitable donor was identified.

Surgical Approach

The patient underwent redo-bilateral sternothoracotomy with use of the prior incisional scar. To control for fungal contamination, we removed both lungs simultaneously under cardiopulmonary bypass support with a single-lumen endotracheal tube. Cardiopulmonary bypass configuration was a 20F EOPA (Medtronic) aortic cannulation and a multi-stage 24F drainage cannula in the right femoral vein and 20F single stage in the superior vena cava Y-connected for venous drainage. There were dense adhesions to the chest wall and diaphragm. Once the lungs were removed, the chest cavities and airways were irrigated extensively with antifungal solutions. Pump suction and cell salvage were avoided. To avoid cardiac arrest, the prior tracheal anastomosis was left intact, and we performed sequential bilateral lung transplantation with donor-to-donor bronchus anastomoses (Figure 2). Our airway technique uses an absorbable suture with a running membranous stitch and interrupted figure-of-8 sutures for cartilaginous alignment. There was excellent arterial vascularization of prior donor bronchi on visual inspection. There was increased difficulty with the pulmonary artery anastomoses given the quality of the tissue, but hilar dissection was not particularly challenging given the prior en bloc implantation with limited

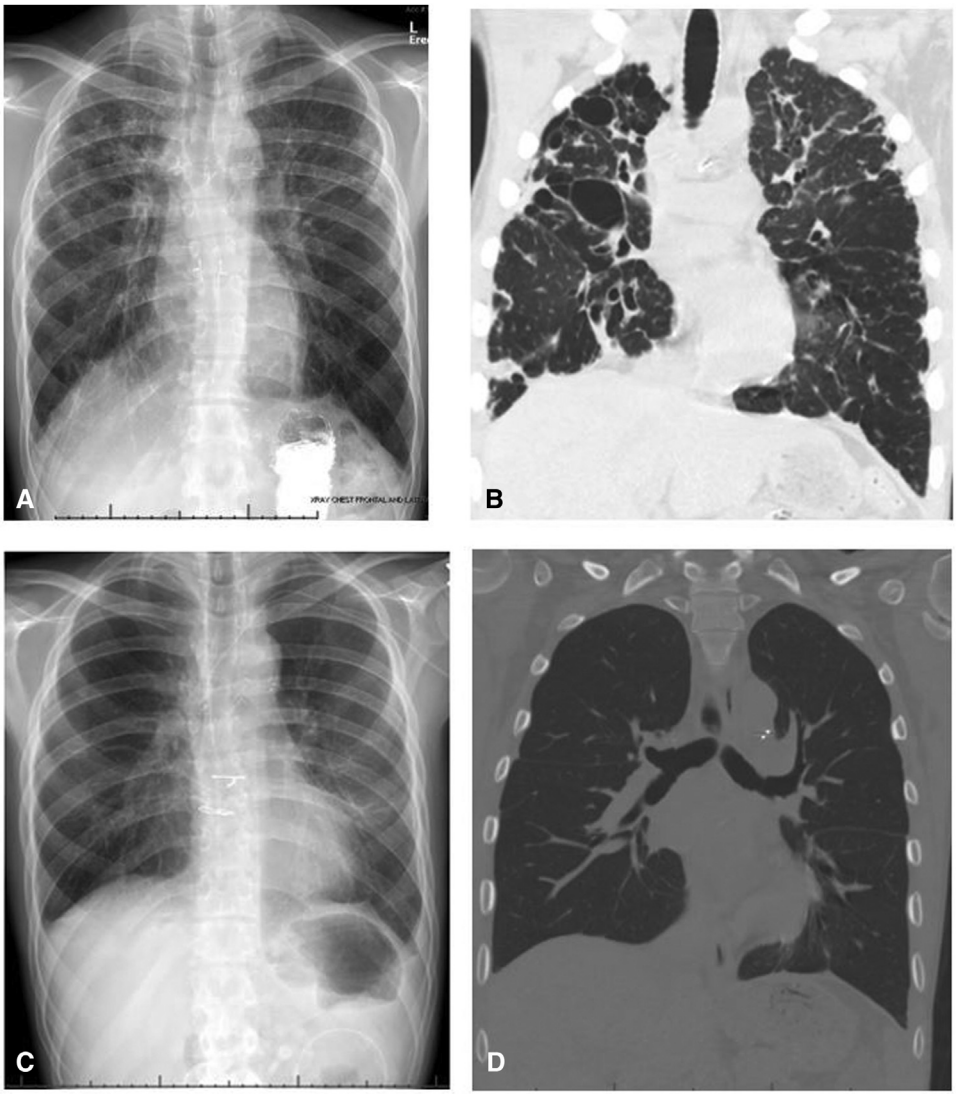

FIGURE 1. Radiographic imaging pre- and post-transplant. A, Chest radiograph at the time of listing. B, Coronal chest computed tomography at the time of listing. C, Discharge chest radiograph. D, Coronal chest computed tomography 3 months after transplant.

FIGURE 2. Postoperative 3D Rendering of Trachea and Bilateral Bronchi with no evidence of Stenosis; and Illustration demonstrating donor-to-donor anastomotic technique.

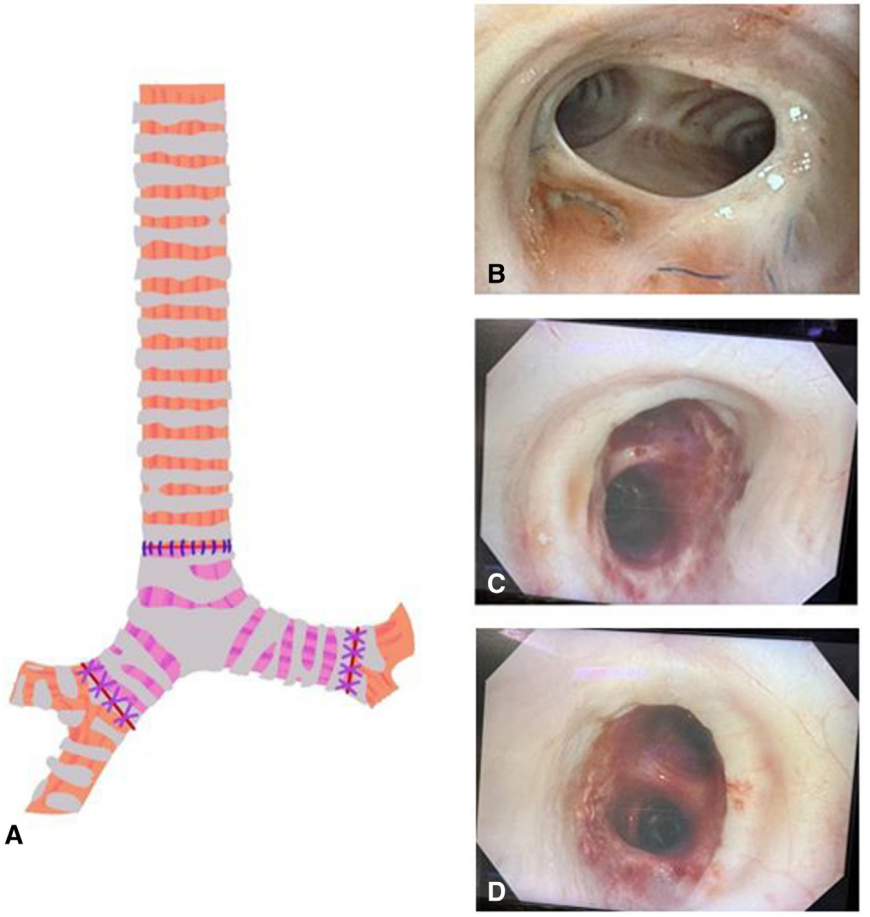

FIGURE 3. Donor-to-donor bronchial anastomosis with preservation of tracheal anastomosis in redo lung transplant after prior en bloc heart lung transplant. A, Illustration of intact tracheal anastomosis from prior en bloc lung transplant (*blue suture line*) with donor trachea in *pink* and donor-to-donor bronchial anastomoses (*pink/purple suture line*). B, Photograph of preserved tracheal anastomosis. C, Photograph of *right* donor-to-donor bronchial anastomosis. D, Photograph of *left* donor-to-donor bronchial anastomosis.

intervention in the hilum. The rest of the operation proceeded in standard fashion.

Postoperative Course

Primary graft dysfunction was grade 1 at all timepoints, and the recipient was extubated on postoperative day 1. The first transbronchial biopsy demonstrated moderate acute cellular rejection (ACR; A3B2), and bronchoalveolar lavage grew *Lomentospora prolificans*. Given no evidence of fungal pneumonia on clinical exam or chest imaging, a modified lower-dose steroid treatment was administered for ACR. There was no development of systemic or pulmonary fungal infection after steroids. Repeat biopsies demonstrated resolution of ACR, but fungal elements persisted for 1 month post-transplant. The patient was discharged on postoperative day 32 (Figure 1, *C* and *D*). There were no airway complications (Figure 3). His survival continues 1 year post-transplant.

DISCUSSION

Bronchial donor-to-donor anastomosis is feasible for redo lung transplant after en bloc heart lung transplantation with tracheal anastomosis. It avoids the necessity for cardiac arrest, reoperation in the mediastinum, and complications associated with tracheal anastomosis in lung transplant. Tracheal anastomotic vascularization after en bloc heart-lung transplant is supplied superiorly from the thyrocervical arteries, and commonly collateralization from atrial branches of the coronary artery circulation supplies the donor distal trachea.[3-5] In a small review of coronary angiograms after heart-lung transplant, 71% of recipients had collateral atrial branches to the distal trachea with the majority present by 1 year.[5] In the redo lung transplantation literature, a prolonged interval between transplants had an impact on survival with retransplantation less than 1 year having worse outcomes,[2] yet airway complications are not well addressed. Furthermore, there is no

consensus to evaluate for revascularization when performing redo transplantation. Each case needs to be considered individually. It may be reasonable to consider coronary angiography after en bloc heart-lung transplant to evaluate collateralization. Likewise, computed tomography angiography also can adequately evaluate bronchial arteries. We did not perform angiography to evaluate bronchial vascularization to avoid nephrotoxic effects of contrast in the setting of baseline renal dysfunction from prolonged calcineurin inhibitor use and prolonged interval between original and redo transplantation. The most common approach is direct visualization of bleeding of the bronchial stump during the operation and placement of a vascularized pedicle flap if there is concern for the vascularity of the anastomosis.

CONCLUSIONS

We demonstrate that donor-to-donor bronchial anastomosis is feasible after prior en bloc heart-lung transplantation. Prolonged interval between transplants, collateralization of vasculature, and surgical technique contributed to good airway outcomes. Preserving a functional heart and donor trachea, in the setting of CLAD only, improves the use of organs.

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