Percutaneous dilatation of right inferior pulmonary vein stenosis following single-lung transplant

Muhammad I. Mohamed Mydin*, Patrick A. Calvert, David P. Jenkins and Jasvir Parmar

Department of Cardiothoracic Transplantation, Papworth Hospital, Cambridge, UK

* Corresponding author. Department of Cardiac Surgery, St Thomas' Hospital, Westminster Bridge Road, London SE1 7EH, UK. Tel: +44-792-00096571; Fax: +442071887622; e-mail: izanee.mydin@gmail.com (M.I. Mohamed Mydin).

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Abstract

We present a 62-year old male who underwent right single-lung transplantation. An autologous pericardial rim was constructed at implantation, as there was insufficient donor atrial cuff. The patient was discharged home but deteriorated over 12 months resulting in oxygen dependency. Computed tomography scan showed stenosis of the right inferior pulmonary vein. The patient underwent pulmonary vein angioplasty under general anaesthesia in September 2007, which was successful and resulted in significant improvement in clinical status. However, his symptoms recurred 2 months later and a second attempt at angioplasty failed. He died 6 weeks later.

Keywords: Vein restenosis • Anastomosis • Lung transplantation

CASE REPORT

We present the case of a 62-year old man who underwent right single-lung transplantation for usual interstitial pneumonitis (UIP) on 31 August 2006. The UIP was associated with 'SS' phenotype of alpha-1 antitrypsin deficiency. The patient had both physiological and radiographical findings, consistent with a mixed restrictive and obstructive pattern. His only significant medical history was osteoporosis, secondary to steroid usage.

Right single-lung transplantation was performed on cardiopulmonary bypass as the patient had moderate pulmonary hypertension. The donor lung was found to have a deficient left atrial cuff with six small vein orifices and minimal atrial cuff tissue infero-posteriorly. This was repaired using an autologous pericardial patch with 4/0 prolene to create suitable rim for anastomosis to the recipient left atrium. This neo-cuff subsequently formed three quarters of the circumference of the anastomosis with the donor LA forming the other quarter (Figs. 1 and 2). At the end of the procedure, good drainage was confirmed by transoesophageal echocardiogram (TOE), and the patient came off bypass easily with good gas exchange.

Early postoperative recovery was uncomplicated. He was started on a calcineurine inhibitor, mycophenolate mofetil and prophylaxis for *Pneumocystis Carinii* Pneumonia (PCP)/cytomegalovirus (CMV). Over the following 12 months, the patient's respiratory function deteriorated and he became bed-bound and oxygen dependent. He was treated for CMV pneumonitis and aspergillosis. Computed tomography (CT) scanning demonstrated a stenosis at the level of the right inferior pulmonary vein (RIPV) where the vessel measured 2 mm in diameter. The CT scan also demonstrated areas of pulmonary venous infarction upstream of the stenosis. In view of his clinical state, he was considered to be too high risk for surgical intervention.

It was, therefore, decided to attempt percutaneous dilatation of the stenosed RIPV. This was performed under general anaesthesia (GA) with TOE and fluoroscopic guidance. Access was gained to the right atrium via the right femoral vein and trans-septal puncture was performed with a Brockenbrough Needle (Medtronic, MA) and a 9F-Preface sheath (Biosense Webster, CA). Access to the RIPV from the trans-septal puncture was difficult and, ultimately, the RIPV was cannulated by passing the 9F trans-septal sheath over an Inoue left atrial guidewire (Toray International America Inc., Houston, TX).

A 7F-multi-purpose guide-catheter (Cordis, Galway, Ireland) was then passed into the RIPV, and the stenosis was crossed with a 0.014-inch balanced middle weight coronary guidewire. There was a mean pressure gradient across the stenosis of 7 mmHg (mean pressure = 22 mmHg distal to the stenosis and mean pressure = 14 mmHg proximal to the stenosis). The stenosis measured 2 mm on CT, so we dilated the narrowing with a 4 mm non-compliant balloon (Mercury NC, Abbott Vascular, IL) at 6 atm. This resulted in a reduction in the trans-stenosis gradient from 8 to 1 mmHg. Unfortunately, there were technical issues regarding the availability of appropriately sized stents, and, therefore, the patient did not undergo stenting. He made an excellent recovery and was discharged home 4 days later.

The patient was soon weaned from oxygen and was able to walk, resulting in a significantly better quality of life. Unfortunately, after 2 months, his symptoms recurred and repeat CT scanning demonstrated a recurrence of the RIPV stenosis. We planned a further attempt at dilatation of the RIPV with a larger balloon and implantation of a stent under GA. Unfortunately, he was unable to tolerate the procedure and this was abandoned. He died 6 weeks later in his local district general hospital.

DISCUSSION

This is a report on managing a rare complication following lung transplantation using percutaneous techniques. Although the therapeutic effect was short lived, it did provide a significant improvement in the clinical status of the patient. We speculate that this late anastomotic stenosis is due to fibrosis and shrinkage of the pericardial repair of the anastomosis.

Vascular stenoses following lung transplantation, particularly pulmonary vein stenoses, are rare; hence, the literature available is sparse. Treatment options include reconstruction of the anastomosis, re-transplantation or percutaneous angioplasty.

One technique that appears superior to other methods of reconstruction is the sutureless pericardial marsupialization [1, 2]. Yun *et al.* report no incidence of restenosis in his group of 11 patients with 10 patients alive at a median follow-up of 18 months [1].

Figure 1: Illustration of pericardial neo-cuff.

Non-surgical methods include pulmonary angioplasty $\pm$ stenting, especially for high-risk patients [3]. Successful pulmonary angioplasty and stenting of pulmonary artery stenosis has been reported and has led to improvement in the patients' respiratory perfusion.

Clark *et al.* report on one patient who underwent angioplasty and stenting of pulmonary vein stenosis following lung transplantation who remained well for 21 months post procedure [3].

Similarly, Zimmerman *et al.* report one patient who had an iatrogenic pulmonary vein stricture, following single-lung transplantation [4]. The patient underwent pulmonary vein stenting and remained well at 6-month follow-up.

The most common symptoms heralding pulmonary vein stenosis in PVI patients is dyspnoea, cough, pleuritic pain and haemoptysis. The lack of pain in our patient may be related to the denervated donor lung. The dramatic improvement in symptoms is similar to that reported in the literature.

Recent reviews of the literature support early intervention in patients with pulmonary vein stenosis and support the usage of CT and magnetic resonance imaging in making the diagnosis [4]. Meticulous surgical technique during both the retrieval of the donor lung (ensuring an adequate atrial cuff for anastomosis) and the implantation is essential. Additionally, intraoperative TOE during lung transplantation allows immediate evaluation of pulmonary vein and pulmonary artery anastomoses and enables immediate surgical correction [5].

CONCLUSION

Our experience and that in the literature suggest that pulmonary vein dilatation and stenting is a viable therapeutic option to help relieve symptoms of this disabling complication of lung transplantation in patients deemed high risk for reoperation.

Figure 2: Illustration of the pericardial neo-cuff reconstruction (posterior view).

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