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Case report

Transcatheter mitral valve repair with MitraClip® enabling single lung transplantation: A case report

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ABSTRACT

Post-capillary hypertension resulting from mitral regurgitation is typically considered a contraindication for single lung transplantation due to heightened risks of primary graft dysfunction. This case report highlights a 66-year-old COPD patient with severe mitral regurgitation who was deemed ineligible for surgical mitral replacement. As an alternative, transcatheter mitral valve replacement was successfully performed, resulting in the normalization of pulmonary artery pressures. Consequently, the patient became eligible for single lung transplantation, which was conducted successfully in the subsequent months. Eighteen months post-lung transplantation, the patient now experiences a normal functional status and excellent lung function. In conclusion, transcatheter mitral valve replacement appears to be a safe alternative to surgery for normalizing post-capillary pulmonary hypertension in patients with chronic respiratory diseases. This approach could potentially facilitate lung transplantation (LTx) in eligible candidates.

1. Introduction

Over the past few decades, lung transplantation (LTx) has emerged as the standard therapy for specific patients suffering from end-stage lung diseases such as chronic obstructive pulmonary disease (COPD), pulmonary fibrosis, or cystic fibrosis [1]. In severe cases of COPD characterized by both heterogeneous emphysema and hyperinflation, lung volume reduction surgery (LVRS) may serve as an alternative treatment to LTx or act as a bridge to transplantation. However, the contraindications for each intervention may vary, and patients undergoing LVRS as a bridge to transplantation should undergo screening for LTx before LVRS [2].

In the present original case report, pulmonary hypertension (PH) due to mitral regurgitation was initially considered a contraindication to LTx in a COPD patient with a history of LVRS. Transcatheter mitral valve repair (TMVr) successfully normalized pulmonary pressure, enabling the realization of a single LTx.

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2. Case presentation

A 64-year-old patient was followed at our center for COPD, classified as GOLD stage III/B. He was referred for a LVRS. In addition to his respiratory condition, his medical history included systemic hypertension and septic arthritis of the right knee five years prior. Following a comprehensive evaluation, the patient underwent thoracoscopic unilateral right LVRS. Unfortunately, he developed persistent air leaks postoperatively, which continued despite prolonged chest drainage. These complications necessitated a surgical pleurodesis with the application of a sealant patch. Regrettably, the patient showed neither clinical nor functional improvement after the LVRS. On the contrary, he reported worsening dyspnea. His pulmonary function tests revealed no significant change in FEV1 (1160 mL pre-LVRS vs. 1190 mL post-LVRS). Furthermore, his performance on the 6-min walk test declined (226 m vs. 336 m pre-LVRS), and his BODE index worsened from 6/10 pre-LVRS to 8/10 post-LVRS.

He was subsequently referred for LTx. However, due to his history of surgical pleurodesis and his age (over 65 years at the time of referral), he was considered eligible only for a single LTx, as per local recipient selection criteria, given the increased risk of perioperative bleeding. The pre-transplant evaluation identified post-capillary PH (see Table 1). This was attributed to severe primary mitral regurgitation with a flail leaflet, likely due to chordal rupture, as showed by transesophageal echocardiography (see Video 1). This condition was considered a contraindication for LTx due to the elevated risk of primary graft dysfunction (PGD), particularly in the context of an anticipated single LTx [3,4]. A timeline of events is provided in Fig. 1.

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Following a multidisciplinary evaluation, the patient was deemed ineligible for surgical mitral replacement due to his underlying respiratory condition. As an alternative, the indication for percutaneous MitraClip® G4 XTW TMVr was retained. The patient underwent the procedure, that was successfully performed without complications. Two months post-procedure, follow-up right heart catheterization demonstrated improved mean pulmonary artery pressure (mPAP) and pulmonary capillary wedge pressure (PCWP), effectively lifting the previous contraindication to lung transplantation (see Table 1).

Three months later, at the age of 66, the patient was listed for lung transplantation after a thorough reevaluation of his medical record. Six months after TMVr, he underwent a single left lung transplant. The intraoperative period was uneventful, and he was discharged from the ICU on day 6 and from the hospital on day 16. In the subsequent months, the patient demonstrated positive clinical and pulmonary function improvements, with a baseline post-LTx FEV1 of 2705 mL (80 % of predicted values). During the first year post-LTx, he only presented with an episode of acute prostatitis, which was successfully managed with a 21-day course of antibiotics.

During the one-year post-transplant evaluation, the cardiac ultrasound revealed minimal mitral regurgitation (see transthoracic echocardiography, videos 2 and 3), along with normal PCWP and mPAP at the right heart catheterization (Table 1).

3. Discussion

As a minimally invasive procedure, TMVr constitutes a well-recognized alternative to mitral valve replacement in patients with severe primary mitral regurgitation considered at prohibitive surgical risk [5,6]. Several replacement devices are now available, but MitraClip® was the first introduced in 2003 and studies demonstrated significant long-term reduction in mitral regurgitation post MitraClip® TMVr [7,8].

It has long been questioned whether PH favors the development of PGD following LTx, with studies providing conflicting results. In a multicenter prospective cohort study of 126 patients with idiopathic pulmonary fibrosis, it was found that higher mPAP in IPF candidates was associated with increased PGD rates [9]. Similarly, in a prospective multi-center cohort study of 1255 patients, PH was identified as an independent risk factor for PGD, along with other factors such as undergoing single LTx compared to bilateral LTx [10]. Notably, in this study PGD was significantly associated with 90-day and 1-year mortality. Regarding single LTx, a single-center retrospective cohort of 279 single LTx recipients suggested that pre-LTx mPAP did not influence PGD incidence [11]. However, these results were contradicted in a large retrospective study using the OPTN/UNOS registry [4]. By comparing 4,825 single and 7,567 bilateral LTx recipients based on the presence or absence of severe PH, the authors observed reduced survival in single (but not bilateral) LTx recipients with severe secondary PH. Considering these inconclusive results, we considered that our patient required mitral valve repair to undergo single LTx in improved safety conditions.

Table 1
Evolution of right heart catheterization values pre-TMVr, post-TMVr and post-LTx. a, atrial; CI, cardiac index; d, diastolic; LTx, lung transplantation; m, mean; PAP, pulmonary arterial pressure; PCWP, pulmonary capillary wedge pressure; PVR, peripheral vascular resistance; s, systolic; TMVr, transcatheter mitral valve repair; v, ventricular; WU, Wood units.

	Pre-TMVr	Post-TMVr	One year post-LTx
PAP (s/d/m, mmHg)	36/17/25	33/13/21	25/7/12
PCWP (a/v/m, mmHg)	16/17/14	8/10/7	6/4/4
PVR (WU)	2.29	3.55	2.25
CI (l/min/m^2)	2.51	2.01	1.76

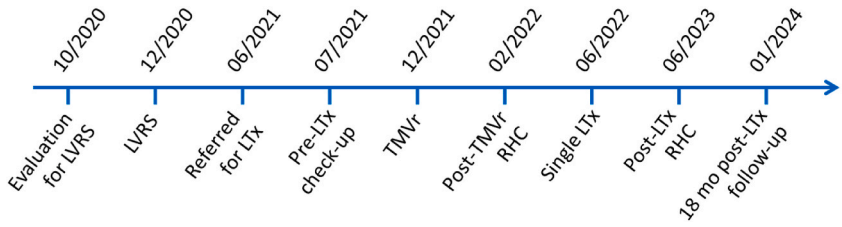

Fig. 1. Patient's history timeline.

4. Conclusion

In conclusion, lung transplant candidates with post-capillary PH caused by mitral regurgitation should be referred for valvular repair, even if their pulmonary condition prevents them from undergoing open-heart surgery, as percutaneous mitral valve repair constitutes a safe procedure allowing the normalization of post-capillary PH. In addition, COPD patients being evaluated for LVRS or endoscopic lung volume reduction should undergo an evaluation for lung transplant prior to any lung volume reduction procedure, as these procedures may deteriorate their respiratory status. Implementing this preventive strategy could help minimizing the delay in being listed for lung transplantation if the lung volume reduction fails to yield significant positive results.

CRediT authorship contribution statement

François M. Carlier: Writing – original draft, Supervision, Resources, Project administration, Investigation, Data curation, Conceptualization. **Michel Dumonceaux:** Resources. **Thomas Planté-Bordeneuve:** Writing – review & editing. **Patrick Evrard:** Writing – review & editing. **Eric Marchand:** Writing – review & editing. **Asmae Belhaj:** Resources. **Benoît Rondelet:** Resources. **Fabian Demeure:** Writing – review & editing.

Ethics approval

This case report was written in accordance with the Declaration of Helsinki and the CARE guidelines.

Consent for publication

The patient provided written informed consent for the publication of the current case report.

Data availability statement

Data will be made available on request.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Not applicable.

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