Transcatheter Aortic Valve Implantation in a Lung Transplant Recipient
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Transcatheter aortic valve implantation is a feasible therapeutic option for selected patients with severe aortic stenosis and high or prohibitive risk for standard surgery. Lung transplant recipients are often considered high-risk patients for heart surgery because of their specific transplant-associated characteristics and comorbidities. We report a case of successful transfemoral transcatheter aortic valve replacement in a lung transplant recipient with a symptomatic severe aortic stenosis, severe left ventricular dysfunction, and end-stage renal failure 9 years after bilateral lung transplantation.


Long-term survival of lung transplant recipients has continually improved over the years through optimized patient selection, surgical technique, postoperative management, and immunosuppressive protocols [1]. Consequently, an increasing number of transplant survivors are seen in whom cardiovascular diseases, including aortic stenosis (AS), develop owing to a combination of preexisting risk factors, age and immunosuppressive drug toxicity with consecutive metabolic syndrome and chronic renal failure [2].

Symptomatic severe AS carries a poor prognosis with medical treatment alone [3], and although surgical aortic valve replacement (SAVR) is feasible and has been reported after lung transplantation [4], it is performed rarely. An alternative to traditional SAVR for non-operable or high-risk patients with severe, symptomatic AS is transcatheter aortic valve implantation (TAVI) [3]. TAVI has been reported in heart and kidney transplant recipients [5–7], but literature on successful minimally invasive procedures of aortic valve replacement for lung transplant recipients who cannot undergo open heart surgery is still scarce.

In 2004, a 64-year-old patient underwent double-lung transplantation for chronic obstructive pulmonary disease performed with cardiopulmonary bypass through a clamshell incision. His posttransplant course with a standard immunosuppressive regimen (prednisone, tacrolimus, mycophenolate) was complicated by four episodes of minor cellular graft rejections, chronic thrombopenia (60 g/L), atrial fibrillation, and a stenosis of the left main bronchus requiring stenting. Impaired bronchociliary clearance led to multiple pulmonary infections necessitating repetitive bronchoscopic removal of secretion and nocturnal noninvasive ventilation to prevent bronchial collapse of the chronically colonized airways (Pseudomonas aeruginosa and methicillin-resistant Staphylococcus aureus [MRSA]). Over the years the patient required hemodialysis for calcineurin inhibitor-associated end stage renal failure, and in 2008, a moderate aortic stenosis was diagnosed. The stenosis was progressive to a severe low-flow, low-gradient AS (mean gradient 22 mm Hg, aortic valve area 0.8 cm²) with a severely reduced left ventricular systolic ejection fraction (LVEF) of 25% in 2010. Myocardial contractile reserve was abolished in a stress test. Despite a formal indication for SAVR, surgery was not performed because of the prohibitively high risk of our patient’s multiple morbidities. At that time, the AS did not cause obvious additional symptoms to the preexisting limitation of exercise tolerance (New York Heart Association class III) secondary to the reduced pulmonary function and myopathy associated with chronic immunosuppression.

In March 2013, however, the patient became progressively symptomatic with hypotensive episodes during hemodialysis endangering its continuation. At that time, 9 years after the lung transplantation, pulmonary function was stable without infection, a forced expiratory volume in 1 second of 1.7 L (60% of the best posttransplantation value) and oxygen use of 1 L/min nocturnally only. Open heart surgery was again declined, and the technical feasibility of TAVI was evaluated. Considering the history of lung transplantation and multiple pleural adhesions, a transfemoral approach was considered the less invasive procedure. The bioprosthesis was implanted successfully under local anesthesia using a 31-mm Medtronic CoreValve (Minneapolis, MN) self-expanding aortic bioprosthesis without relevant residual aortic insufficiency (Fig 1). The preprocedural preparation and post-procedural care included the protocol for TAVI patients with additional antifungal prophylaxis covering MRSA and Pseudomonas aeruginosa, close monitoring of lung function and the maintained immunosuppression, bronchoscopy to remove secretions from the stent as needed, and continued hemodialysis. The immediate postprocedural course was complicated by a minor vascular event with bleeding at the right femoral access...
site due to incomplete closure of the suture-based closure system. The bleeding was successfully treated by implanting a covered stent in the common femoral artery and transfusion of platelet and erythrocyte concentrates. Otherwise, the clinical course was uneventful, and the patient was discharged on day 13 after the intervention.

Echocardiographic reevaluation 5 weeks and 6 months after TAVI demonstrated a stable LVEF of 25% and a properly functioning bioprosthesis (aortic valve area 2.6 cm², mean gradient 4 mm Hg with mild paraprosthetic aortic regurgitation). Dyspnea improved to New York Heart Association class II with stable pulmonary function. Hemodialysis could be continued without symptoms. To date, 10 months after the procedure the patient remains stable.

Comment

To our knowledge, this is the first reported case of successful TAVI in a lung transplant recipient. Lung transplant recipients are often high-risk patients for open heart surgery and given the history of lung transplantation, immunosuppressive therapy, severely reduced cardiac output, impaired hematological, renal, and pulmonary function as well as the chronic colonization with *Pseudomonas aeruginosa* and MRSA, our patient was clearly not a candidate for SAVR. The decision for TAVI as the procedure with the most favorable risk-benefit ratio was based individually on an interdisciplinary discussion considering the absence of a valuable alternative therapeutic option and the poor prognosis of medical treatment only. TAVI can be beneficial even if the cardiac function is already severely impaired [8], and the main reason for TAVI in the described case was the goal of symptomatic improvement and restoration of the patient’s quality of life to the level before the AS became a life-threatening condition. That was achieved as hemodialysis could be continued without relevant hypotensive episodes and the New York Heart Association functional status improved. In our patient, an improvement of the LVEF was not the primary objective of the TAVI and was not necessarily expected, as the LVEF was already reduced at the time of diagnosis without improvement in a stress echocardiography.

With improved long-term survival after lung transplantation, increasing numbers of lung transplantations, and increasing age of transplant recipients [1], the issue of cardiovascular disease–related morbidity and mortality in lung transplant recipients is becoming more important. Management of severe AS in lung transplant patients has to be adapted to the individual's posttransplant status and if open heart surgery is not possible, minimally invasive procedures can be an alternative. This case report demonstrates that TAVI was feasible for an extremely high-risk patient with a history of lung transplantation, and resulted in a favorable midterm clinical outcome.

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References