Transcatheter aortic valve replacement in a patient with severe aortic regurgitation following left ventricular assist device implantation

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DOI: 10.33963/KP.a2022.0217

Received:
August 29, 2022

Accepted:
September 8, 2022

Early publication date:
September 15, 2022

Left ventricular assist devices (LVAD) are used as a bridge to heart transplant or "destination" therapy in patients with end-stage congestive heart failure (HF) [1]. However, LVAD support may induce hemodynamic and structural variations in the aortic root that may result in aortic regurgitation (AR) in even 30% of patients [2]. Severe AR in patients with LVAD leads to decompensated HF due to the constant loop of flow between the ascending aorta and the LVAD, resulting in poor cardiac output despite apparent normal device function.

A 55-year-old female was admitted due to cardiac decompensation — class IV of the New York Heart Association (NYHA) Functional Classification. At admission, she presented with hypotension, massive leg edema, and ascites despite optimal medical treatment. An electrocardiogram showed sinus rhythm of 80 bpm and left bundle branch block. On transthoracic echocardiogram (TTE), the systolic function of the left ventricle was severely reduced with ejection fraction (LVEF) of 15%, and, additionally, severe AR was found (Figure 1A). The patient had undergone implantation of an implantable cardioverter defibrillator (ICD) and LVAD (HeartWare, Medtronic, Dublin, Ireland) 3 years before admission. The level of NT-proBNP was elevated up to 8149 pg/ml. The initial treatment was focused on intravenous diuretic therapy, fluid intake reduction, and vasoconstrictors (noradrenaline, dobutamine, and milrinone) infusion. Nonetheless, AR remained still severe despite

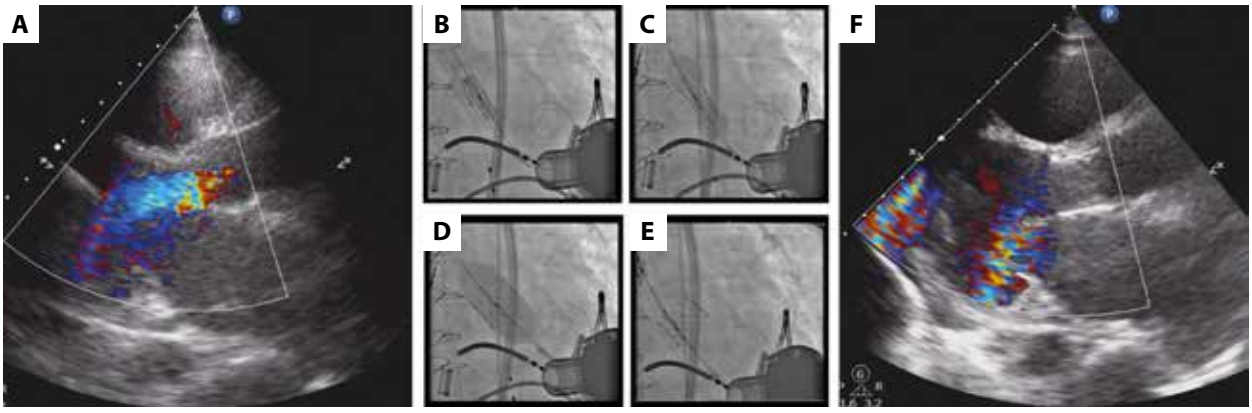

Figure 1. **A.** Severe aortic regurgitation imaged by transthoracic echocardiography. **B–E.** Transcatheter aortic valve implantation in fluoroscopy showing the balloon-expandable prosthesis (Edwards S3 23 mm plus 1.5 cm^3) positioning and deployment. **F.** Postprocedural transthoracic echocardiography assessment showing no AR and the optimal transcatheter heart valve position

treatment, so the case was discussed with the Heart Team and the patient was scheduled for urgent transcatheter aortic valve implantation (TAVI). A computed tomography scan showed favorable anatomy in terms of the non-calcified aortic valve and peripheral access. The TAVI procedure was performed in analgosedation using femoral access and TTE guidance. A 23-mm Edwards Sapien S3 valve (Edwards Lifesciences, Irvine, CA, US) was advanced over an Amplatz Ultra-Stiff wire (Cook Medical, Bloomington, IN, US) and positioned within the aortic annulus (Figure 1B–E). Aortic root injections were performed. With rapid pacing, the valve was deployed with repeated aortic root injections. The valve was observed in this position for ca. 5 minutes to check for its eventual migration into the left ventricle. Just before valve implantation, the LVAD flow rate was slowed. Over ca. 5 minutes, the LVAD flow rate was ramped up to baseline rotations with continuous observation under echocardiography and cine angiography. The procedure was uneventful, the implanted valve was stable with no perivalvular regurgitation and no coronary obstruction (Figure 1F). The patient was discharged with NYHA II symptoms, and LVEF remained unchanged. After six months, the patient presented with NYHA II symptoms, and no major cardiovascular events occurred.

Patients with LVADs and severe AR are high-risk candidates for surgical aortic valve replacement due to end-stage HF and frequent medical comorbidities. TAVI can be considered in these patients as a less risky intervention leading to an immediate and significant improvement in cardiac hemodynamics. However, it is important to recognize the anatomic challenges due to inadequate calcification for anchoring the prosthesis. Annular dilation and high flow rates in the ascending aorta from the LVAD outflow cannula [3] significantly increase the risk of inadequate sealing, valve embolization, and significant residual PVL.

Article information

Conflict of interest: None declared.

Funding: None.

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