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Case Report

Trans-catheter aortic valve implantation without contrast using the Lotus mechanically-expanded heart valve

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ABSTRACT

Trans-catheter aortic valve implantation (TAVI) has become an established treatment for inoperable and high-surgical risk patients with severe, symptomatic aortic stenosis (AS). Post-procedural acute kidney injury (AKI) is a frequent complication following TAVI and is associated with increased mortality. Patients with pre-existing chronic renal impairment are at particularly high risk. The etiology of post-TAVI AKI is multi-factorial, but the principal procedural issues are contrast-induced nephropathy, and renal hypoperfusion secondary to intra-procedural hypotension. We report a case of a TAVI in an 80-year-old patient with severe AS and significant chronic kidney disease (CKD), which was carried out without the use of contrast and with minimal procedural hypotension.

Pre-procedural imaging was carried out using 3D trans-esophageal echocardiography (TEE) rather than computed tomography (CT) to avoid contrast administration. The Lotus valve (Boston Scientific, Marlborough, MA, USA) was chosen due to a number of design features which minimize both the need for contrast injection and procedural hypotension during valve positioning and deployment. The procedure was carried out successfully and produced an excellent result with no decline in renal function. We believe that the approach of using TEE and the mechanically-expanded Lotus valve illustrates an important therapeutic approach in patients with severe CKD.

<**Learning objective:** Post-procedural acute kidney injury (AKI) is a frequent complication following trans-catheter aortic valve implantation (TAVI), and is associated with increased mortality. The principal procedural issues are contrast-induced nephropathy and intra-procedural hypotension. Our case report demonstrates how TAVI can be performed with zero contrast and minimization of procedural hypotension, facilitated by the use of trans-esophageal echocardiography and the mechanically-expanded Lotus valve. This approach should only be used in exceptional circumstances, but can be particularly relevant for patients with pre-existing chronic renal impairment, who are at increased risk of post-TAVI AKI.>

Introduction

Trans-catheter aortic valve implantation (TAVI) has become an established treatment for inoperable and high-surgical risk patients with severe, symptomatic aortic stenosis (AS). The initial promise borne out of results from seminal clinical trials has been substantiated by data from numerous real-world registries, and the number of TAVI procedures continues to increase annually. Post-procedural acute kidney injury (AKI) remains an area of concern, since it occurs in up to 20% of procedures and is associated with increased mortality [1]. A correlation between baseline renal function and AKI has been demonstrated, and as such patients with pre-existing chronic renal impairment are at particularly high risk [2].

The etiology of post-TAVI AKI is multi-factorial, but the principal procedural issues are contrast-induced nephropathy, and renal hypoperfusion secondary to intra-procedural hypotension [2]. Standard TAVI technique requires contrast for aortic root angiography during valve deployment, and to assess function of the implanted valve. Additional contrast may be used to optimize vascular access and confirm hemostasis. Significant hypotension is

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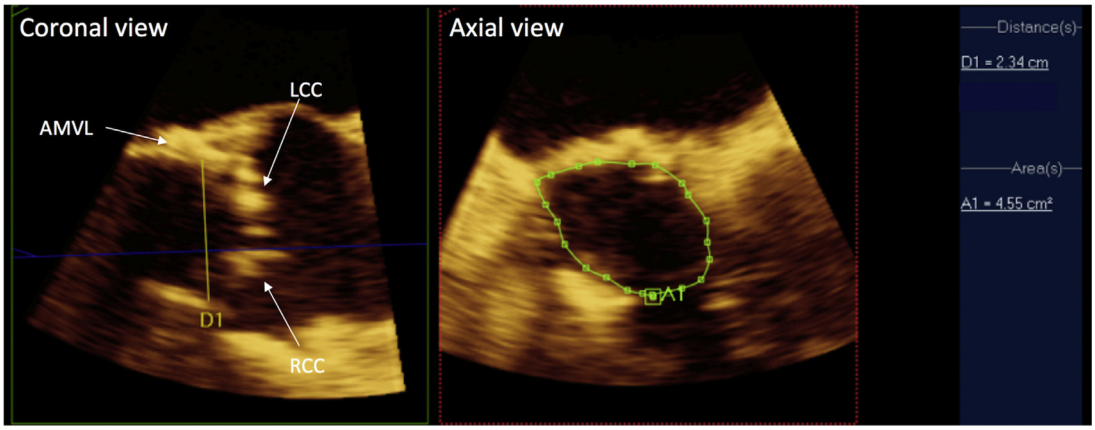

Fig. 1. 3D transesophageal echocardiography was used in order to measure annulus size and guide the selection of an appropriately sized valve prosthesis. Multi-planar reformatting was used in order to generate coronal, axial, and sagittal views as shown.
AMVL, anterior mitral valve leaflet; LCC, left coronary cusp; RCC, right coronary cusp.

common even during uncomplicated TAVI due to the potential need for rapid pacing during pre-dilatation and valve implantation, as well as transient loss of cardiac output during valve deployment. The Lotus valve (Boston Scientific, Marlborough, MA, USA) has a number of design features which minimize both the need for contrast injection and procedural hypotension during valve positioning and deployment. As such, it may offer particular advantages in patients at increased risk of AKI. We report a case of TAVI with the Lotus valve in a patient with severe chronic kidney disease (CKD), which was carried out without the use of contrast and with minimal procedural hypotension.

Case report

An 80-year-old male presented with New York Heart Association (NYHA) class 3 dyspnea and was found to have severe AS with a bicuspid valve. Echocardiography demonstrated good left ventricular systolic function, and coronary angiography was unremarkable. The major co-morbidity was severe CKD with a creatinine level of 4.6 mg/dL, and an estimated glomerular filtration rate (eGFR) of 12 mL/min/1.73 m^2. The etiology of the renal impairment was unknown, and there was no immediate plan for the patient to be commenced on renal replacement therapy. The patient was deemed high risk for surgical aortic valve replacement by the multidisciplinary heart team, and TAVI was thought to present the best treatment option.

Pre-procedural anatomical assessment, including annulus sizing, was undertaken via 3D trans-esophageal echocardiography (TEE) rather than computed tomography (CT) to avoid contrast administration. Additionally, vascular ultrasound of the femoral and iliac arteries was carried out in order to ensure that the 20Fr femoral sheath could be accommodated. Based on TEE measurements, a 27-mm Lotus valve was selected (Fig. 1). Prior to the procedure pre-hydration was administered, with 1000 mL of 0.9% saline given over 12 h. The procedural strategy was to minimize renal injury due to hypotension or contrast exposure. Consequently, general anesthesia was used to allow TEE-guidance of valve implantation and assessment of valve function. Femoral artery puncture was performed with ultrasound guidance. A marker pigtail catheter was placed in the non-coronary sinus and was used as a fixed guide to aid in the positioning of the Lotus valve (Fig. 2A). The valve was crossed with a standard straight 0.035″ wire via an AL1 catheter. Given the heavy calcification and bicuspid anatomy, pre-dilatation was performed with a 22-mm Loma Vista True balloon (Loma Vista, Burlingame, CA, USA), which is a non-compliant balloon with very rapid inflation and deflation to

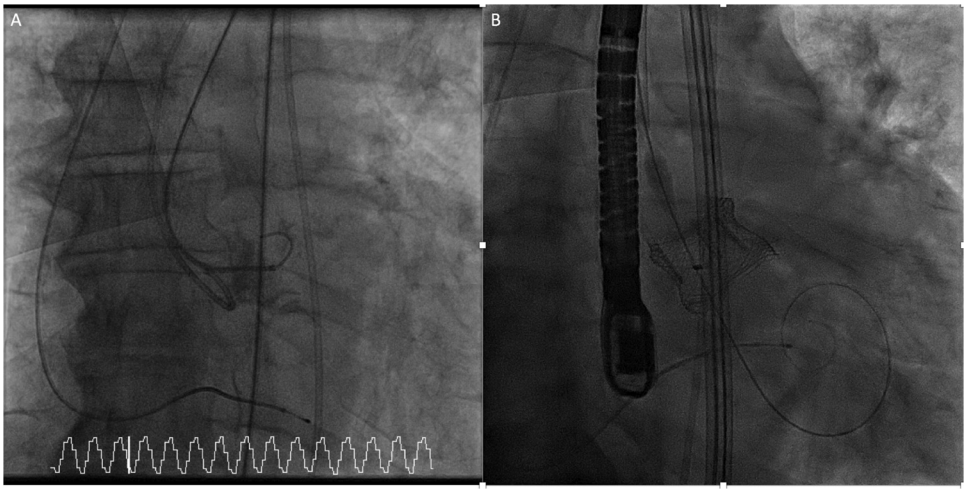

Fig. 2. (A) A pigtail catheter, positioned in the non-coronary sinus without use of contrast, as well as the heavy calcification of the aortic valve was used to aid in the positioning of the Lotus valve. (B) The Lotus valve in situ following deployment.

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