Case Report

Concurrent Transcatheter Aortic Valve Replacement and Leadless Pacemaker Implantation in a Patient With Aortic Stenosis and Tachycardia-Bradycardia Syndrome

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We present a patient with symptomatic severe aortic stenosis and atrial fibrillation complicated by tachycardia-bradycardia syndrome, deemed too high-risk for surgical valve replacement and referred for transcatheter aortic valve replacement. We show that concurrent implantation of a leadless pacemaker system can be performed successfully with minimal additional risk to the patient, and also, that it can be used to rapidly pace the ventricles to assist in balloon valvuloplasty and prosthetic aortic valve deployment.

RÉSUMÉ

Nous présentons le cas d'un patient ayant une sténose aortique symptomatique grave et une fibrillation auriculaire compliquée par un syndrome tachycardie-bradycardie, jugé comme présentant un risque trop élevé pour être candidat à un remplacement valvulaire chirurgical, et orienté pour subir un remplacement valvulaire aortique par cathéter. Nous démontrons que l'implantation concomitante d'un système de stimulateur cardiaque sans fil peut être réalisée avec succès tout en entraînant un risque additionnel minime pour le patient, et que celui-ci peut être utilisé pour stimuler rapidement les ventricules afin de faciliter la valvuloplastie par ballonnet et le déploiement de la prothèse valvulaire aortique.

Transcatheter aortic valve replacement (TAVR) is a minimally invasive treatment strategy for patients with severe symptomatic aortic stenosis, and has now been shown to be a noninferior alternative to surgical valve replacement across all patient risk groups.^{1,2}

Leadless right ventricular pacing is a relatively new development that is being considered increasingly as an alternative to traditional transvenous pacing. Although no head-to-head data exist, current literature suggests comparable periprocedural complication rates.³ Factoring the implanter learning curve, the leadless pacing system has the potential to greatly reduce major complications typically associated with transvenous pacing lead insertion, such as sepsis, perforation,

tricuspid regurgitation, and lead dislodgement. The Micra transcatheter pacemaker (Medtronic, Minneapolis, MN) is one such leadless device that has been shown to be safe, and noninferior to traditional transvenous pacing through post-approval and real-world data.⁴ Its major obstacles remain its limitation to single-chamber pacing, and cost, which is estimated to be 4 times that of a conventional transvenous pacemaker.³

We present a patient with severe symptomatic aortic stenosis and evidence of tachycardia-bradycardia syndrome, deemed too high-risk for surgical valve replacement, who ultimately underwent transcatheter intervention. Although there has been a previous report of concurrent deployment of a leadless pacemaker and TAVR in a single procedure,⁵ this case to our knowledge is the first time when a leadless pacemaker has been implanted first, and then immediately used to rapidly pace the ventricles and assist in successful deployment of TAVR.

Case

Our case is of an 88-year-old man who presented to our unit with syncope on a background of severe aortic stenosis

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Ethics Statement: This case report complies with ethical standards and deidentifies personal information to maintain confidentiality.

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See page 551 for disclosure information.

Novel Teaching Points

- Concurrent implantation of a leadless pacemaker system during TAVR is safe and feasible in select patients with an indication for single-chamber pacing.
- Concurrent implantation of a leadless pacemaker with TAVR can prevent a second procedure in patients with indications for single-chamber pacing.
- A leadless pacemaker system may be used to rapidly pace the ventricles during balloon valvuloplasty before prosthetic valve deployment.

and newly diagnosed persistent atrial fibrillation complicated by tachycardia-bradycardia syndrome. He was a retired accountant who lived alone and was independent with his activities of daily living. Other comorbidities included ischemic heart disease with previous coronary artery bypass grafting, type 2 diabetes mellitus, hypertension, and hyperlipidaemia. His most recent echocardiogram revealed a mean aortic valve gradient of 40, with preserved left ventricular function, and moderate to severe tricuspid regurgitation.

Before the procedure, a coronary angiogram was performed, which showed native diffuse triple vessel disease, with patent bypass grafts.

After discussion in a multidisciplinary Heart Team meeting, because of perceived surgical risk, it was decided to pursue a TAVR, with a 29-mm Evolut R valve (Medtronic). Furthermore, because of his underlying persistent atrial fibrillation with tachycardia-bradycardia syndrome, and high risk of complete atrioventricular conduction block after self-expanding TAVR, it was believed he would also benefit from single-chamber permanent pacing. A novel solution was to consider single-chamber leadless pacemaker implantation concurrently, because this would avoid the necessity for a secondary procedure, and also avoid transvenous complications and worsening of the patient's tricuspid regurgitation. Furthermore, it could be used immediately to pace the ventricle and allow deployment of the prosthetic valve. After careful consideration and discussions with the patient and family, this strategy was mutually agreed upon.

As mentioned, it was decided to insert the Micra leadless pacemaker first, and hence avoid the use of a separate dedicated temporary pacing wire for the TAVR. This was achieved through the 27-French Micra introducer device in the left

Figure 1. Case image series. (A) and (B) Fluoroscopic acquisition of the initial deployment of the Micra leadless pacemaker device (Medtronic, Minneapolis, MN) in the right ventricle. (C) and (D) Fluoroscopic acquisition of the deployment of the Evolut R self-expanding transcatheter aortic valve (Medtronic), using the Micra leadless system to rapidly pace the ventricle.

femoral vein (Fig. 1). Next, the 29-mm self-expanding Evolut R valve was deployed using the right femoral artery with an 18 French sheath (Fig. 1). This involved predilation of the native aortic valve with balloon valvuloplasty and rapid pacing at 130 beats per minute using the Micra leadless pacemaker. The Evolut R valve was then deployed with pacing at 110 beats per minute using the Micra. Postdeployment echocardiography revealed a moderate perivalvular leak, and the valve implant was postdilated with a 25-mm balloon with rapid pacing at 170 beats per minute. The aortic valve was then reevaluated with the patient under general anaesthesia with transoesophageal echocardiography, which showed trivial regurgitation. Hemostasis was achieved with the Perclose ProGlide suture closure system (Abbott Laboratories, Abbott Park, IL). Intravenous cephazolin was administered every 8 hours for the next 24 hours, and anticoagulation with rivaroxaban was resumed 72 hours later. The patient was discharged to a rehabilitation unit 48 hours later with a good clinical response at 1 month follow-up.

Discussion

We have shown that concurrent implantation of the Micra leadless pacemaker system during TAVR can be performed successfully with minimal additional risk to the patient, and also, that it can be used to rapidly pace the ventricles to assist in balloon valvuloplasty and prosthetic valve deployment. Furthermore, atrioventricular conduction block is a known complication of TAVR because of the proximity of the aortic valve to the atrioventricular node. Current data estimate the 30-day risk of requiring a permanent pacemaker at 8.5% for balloon-expanding valves,¹ and 17.4% for self-expanding valves,² and this risk is further magnified in patients with a baseline conduction abnormality, such as in the patient we have presented. However, the limitations of using a leadless pacing system such as the Micra includes restriction to single-chamber asynchronous pacing, and a limit of rapid pacing to 170 beats per minute, and is thus an appealing alternative in patients with persistent or permanent atrial fibrillation.

We present an innovative planned strategy of leadless pacemaker insertion and concurrent TAVR in a patient with

severe aortic stenosis and atrial fibrillation with tachycardia-bradycardia syndrome. Despite recently proven efficacy and safety across all patient groups with severe aortic stenosis, those selected for TAVR remain mostly geriatric patients with considerable comorbidities and frailty. Many patients often have underlying conduction abnormalities and are high risk for complete atrioventricular block and potential downstream syncope or sudden cardiac death. Thus, a simultaneous implantation of a leadless pacemaker in such select patients has several potential advantages. Periprocedurally, it avoids the need for a temporary pacing wire, and long-term, it negates the need for a second procedure and minimizes transvenous lead-related complications, particularly in an elderly patient group with persistent or permanent atrial fibrillation and no indication for dual-chamber pacing.

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Disclosures

The authors have no conflicts of interest to disclose.

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