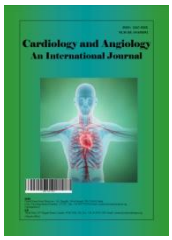

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Cardiac Tamponade during Transcatheter Aortic Valve Implantation (TAVI)

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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Case Report

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ABSTRACT

Transcatheter aortic valve implantation (TAVI) is a new minimally invasive procedure for symptomatic patients with severe aortic stenosis and surgical high-risk.
Numerous technical improvements have been developed to simplify the procedure and reduce the incidence of complications. Temporary pacing of the right ventricle remains mandatory to ensure transient hypotension and low cardiac output while performing predilation of the aortic annulus and accurately position and deploy the valve. Temporary pacing is also crucial as a backup pacing device if complete atrioventricular block develops after TAVI. Implanting a temporary pacing wire requires additional venous vascular access and a pacing lead, both of which may generate complications.
Cardiac tamponade during TAVI is a rare complication. We present the case of a cardiac tamponade during TAVI probably due to right ventricular perforation associated with pacing. We report some measures to avoid such complications and improve the TAVI procedure.

Keywords: Complication of TAVI; cardiac tamponade; right ventricle; pacing.

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1. INTRODUCTION

Transcatheter aortic valve implantation (TAVI) is a new approach for the treatment of severe aortic stenosis [1,2]. It has become a widely accepted treatment strategy for patients with severe aortic stenosis who are not eligible for surgical valve replacement because of their high-risk profiles [3].

This report presents the successful treatment course of a patient who developed cardiac tamponade during the temporary pacing for TAVI.

2. PRESENTATION OF CASE

An 85-year-old woman with a history of breast cancer, pulmonary embolism and hypertension was admitted to our department for acute heart failure. Her symptoms included chest discomfort and orthopnea with New York Heart Association NYHA functional class III. Chest radiography revealed normal cardiac silhouette with marked calcification over the aortic annulus. Her ECG showed sinus rhythm, narrow QRS complex and electric signs of LV hypertrophy (Fig. 1). Her transthoracic echocardiography showed severe aortic stenosis: aortic valve area AVA= 0,6 cm^2; Mean Gd= 46mmHg ; Peak aortic jet velocity Vmax= 4.34m/s (Fig. 2). The Logistic European System for Cardiac Operative Risk Evaluation (EuroSCORE) and the Society of Thoracic Surgeons (STS) score predicted respectively a risk of mortality of 6.21 % and 8.54%. The computed tomography CT-scan was favorable for TAVI (Fig. 3). The decision of the heart team was TAVI because of the patient's advanced age and high surgical risk.

During common femoral artery cannulation with ProGlide vascular closure devices (Abbott Vascular Devices, CA, USA), a temporary pacing wire (Pacel bipolar pacing catheter, St. Jude Medical, MN, USA) was inserted in the right ventricular via the right femoral vein by making an ultrasound-guided puncture. A 26-mm self-expandable valve (CoreValve EVOLUT R, Medtronic) was deployed under rapid pacing at a rate of 140 beats/min (Fig. 3). Transthoracic echocardiography (TTE) note significant aortic regurgitation due to an inferior suboptimal deployment of the valve seen in the angiographic control. Post-dilation using a 22 mm balloon under rapid pacing at 140 bpm was performed (Fig. 4).

After post dilation, the patient's hemodynamic status crushed dramatically. A transthoracic echocardiography was performed showing a major pericardial effusion with compression of the right ventricular wall. Considering cardiac tamponade, emergency pericardiocentesis was performed. Approximately 460 ml of blood was aspirated immediately, and a drainage tube was placed in the pericardial cavity. The patient's hemodynamic status stabilized and her blood pressure quickly became normal. The cause of cardiac tamponade was attributable to perforation of the right ventricle while the temporary pacing of the right ventricle. Her control transthoracic echocardiogram (TTE) 24 hours after showed TAVI valve: Vmax 1.9 m/sec, mean gradient 8 mm Hg and no pericardial effusion. the drainage tube was removed. the patient recovered well without sequelae.

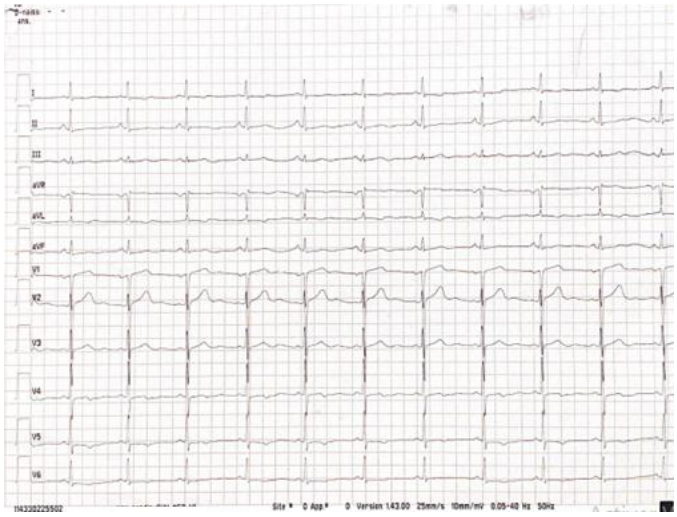

Fig. 1. Patient ECG

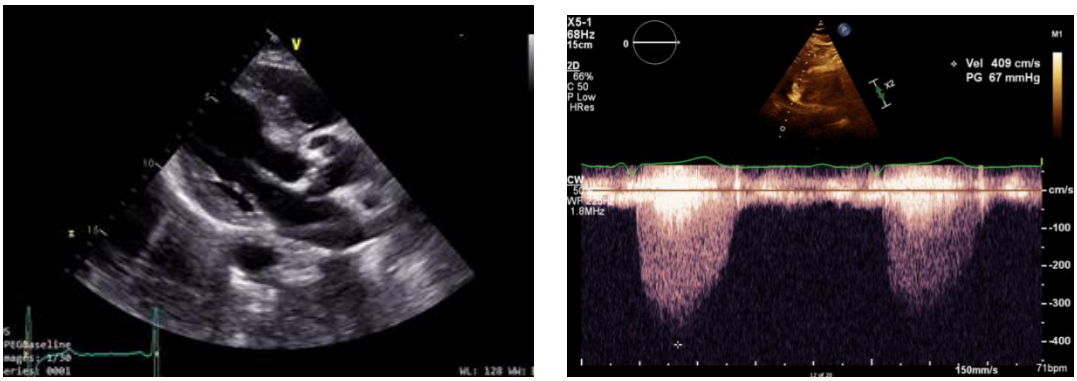

Fig. 2. Patient TTE showing sever aortic stenosis

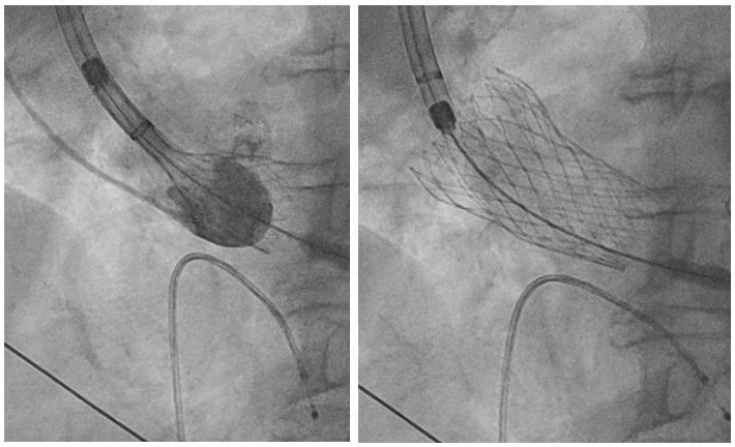

Fig. 3. 26mm self-expandable valve deployment

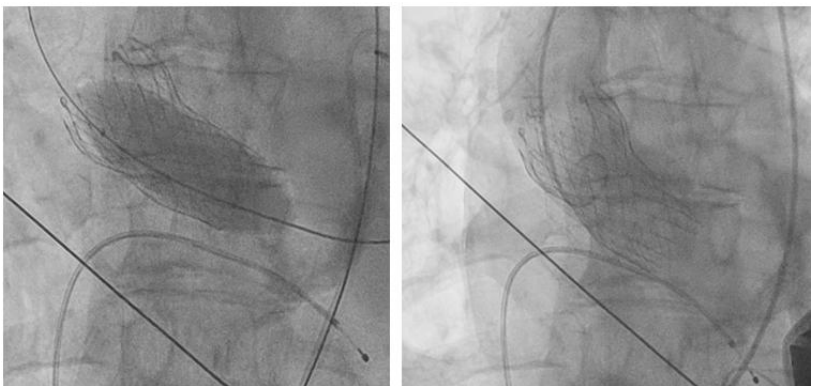

Fig. 4. Post- dilation of the valve with a 22mm balloon

3. DISCUSSION

The emergence of TAVI provides a feasible, low-risk alternative for frail and older patients who are considered poor candidates for surgery. The placement of a temporary pacing wire is considered a routine in most transcatheter valve procedures to facilitate controlled or rapid ventricular pacing during balloon expansion or valve deployment. Compared with SAVR, TAVI has the drawback of higher rates of conduction disturbance and permanent pacemaker implantation (17% in TAVI vs. 5% in SAVR) [4, 5].

The temporary pacing wire is typically kept in place after TAVI and may be removed several days later if no subsequent conduction

disturbance occurs. Traditionally, many institutions leave the RV pacing wire in situ for 24 hours, especially in patients receiving self-expandable valves, owing to the risk of late complete atrioventricular (AV) block. This approach is no longer required because of decreased occurrence of AV block associated with the new generation of valves, improved implantation technique, and frequent late (after over 24 hours) AV block development.

Direct LV pacing through stiff guidewire is an alternative to RV pacing. Meier and Rutishauser[12] first reported on the use of guidewires for pacing during cardiac procedures in 1985. They described a LV pacing technique with the 0.035-inch wire used in a series of 10 patients undergoing diagnostic cardiac catheterization. This method was used in several cases of aortic valvuloplasty in both adult and pediatric patients and subsequently neglected [6,7]. Since then, the use of TAVI has rapidly expanded, procedures have been gradually simplified and become safer and less invasive. Meanwhile, this strategy has been reported only in a few publications [8,9,10,11,12]. A randomized EASY TAVI (Direct Left Ventricular Rapid Pacing via the Valve Delivery Guide-wire in TAVR) trial comparing LV guidewire pacing with conventional RV lead pacing has been recently published [13]. The main findings of the trial were that the use of the LV guidewire for rapid ventricular pacing during TAVI with a balloon- expandable valve was safe and effective. It was associated with reduced procedure duration, fluoroscopy time, and cost compared with the use of conventional RV lead pacing. The EASY TAVI trial included only a highly selected group of patients undergoing balloon-expandable TAVI procedures.

Safely performed implantation of the temporary pacing wire is the best means of avoiding perforation of the ventricular wall during TAVI. According to previously published reports, right ventricle (RV) perforation may be completely avoided by pacing the septum rather than the apex or free wall of the RV [14,15]. The ideal pacing position over the septum of the right ventricular outflow tract should be confirmed to eliminate the risk by real-time transesophageal echocardiography or fluoroscopy during the procedure [16]. An excessively long pacing lead under tension should also be avoided because it may generate additional force leading to perforation [17,18].

Cardiac tamponade during TAVI is not frequent but is associated with high mortality rates especially when left-sided structures are involved [19].

Measures to avoid such complications as a learning point:

- Nonsystematic predilation
- Dilation with balloon not requiring pacing
- Pacing the septum rather than the apex or freewall of the RV
- Partial inflation of the balloon-tipped pacing lead
- Pacing through a left ventricular super-stiff wire

4. CONCLUSION

Careful monitoring of every detail during the perioperative period is key for substantially improving TAVI outcomes and avoid possible perioperative complications.

CONSENT AND ETHICAL APPROVAL

As per university standard guideline, participant consent and ethical approval have been collected and preserved by the authors

COMPETING INTERESTS

The authors declare that there are no conflicting interests with the manufacturers of the materials described. And they certify that the reported case aims to enrich scientific knowledge and not trigger litigious acts.

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