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CASE REPORT

Prosthetic valve endocarditis 7 months after transcatheter aortic valve implantation diagnosed with 3D TEE

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Abstract Transcatheter aortic valve implantation (TAVI) was introduced as an alternative treatment for patients with severe symptomatic aortic stenosis for whom surgery would be high-risk. Prosthetic aortic valve endocarditis is a serious complication of surgical AVR (SAVR) with high morbidity and mortality. According to recent cases, post-TAVI prosthetic valve endocarditis (PVE) seems to occur very rarely. We present the case of a 75-year-old woman who underwent TAVI (Edwards Saphien XT) with an uneventful postoperative stay. She was diagnosed with endocarditis using three dimensional (3D) echocardiography on the TAVI device 7 months later and she subsequently underwent surgical aortic valve replacement. Little experience of the interpretation of transoesophageal echocardiography (TEE) and the clinical course and effectiveness of treatment strategies in post-TAVI endocarditis exists. We report a case of PVE in a TAVI patient which was diagnosed with three-dimensional transoesophageal echocardiography (3DTEE).

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1. Introduction

Transcatheter aortic valve implantation (TAVI) has evolved into an alternative to surgical aortic valve replacement (SAVR) for patients with high or prohibitive surgical risks who have severe aortic stenosis.[1] Since transcatheter aortic valve replacement (TAVR) was first successfully performed in 2002, the number of patients treated continues to exponentially increase. Recent advances in the available TAVI devices may make "complex" procedures feasible.[2]

In addition to significant comorbidities, TAVI patients are typically frail and have impaired mobility. These factors may render them more prone to infections, including endocarditis. However, experience with transcatheter prosthetic valve endocarditis (TPVE) remains limited, and the current guidelines do not include any specific provisions for TPVE.[3,4]

In this case presentation, we discuss the potentially growing problem of complications related to transcatheter valve implantation.

2. Case report

A 75-year-old woman with a significant history of RCA stenosis and symptomatic severe aortic stenosis presented to the emergency department with angina and New York Heart Association Class IV dyspnoea. She had been previously refused for conventional aortic valve replacement due to her high-risk profile. The patient's estimated operative risk was significantly high due to multiple comorbidities that included advanced age, atrial fibrillation, arterial hypertension, pulmonary hypertension and coronary artery disease.

A transthoracic echocardiogram (TTE) revealed severe aortic stenosis (mean gradient: 49 mmHg; AVA: 0.9 cm^2), mild aortic and mitral regurgitation, and an ejection fraction (EF) of 50% and pulmonary hypertension (pulmonary artery systolic pressure: 37 mm/Hg) were also noted. The aortic annulus diameter was measured at 21 mm with TEE.

The possibility of operative mortality was calculated to be 11.5% according to the scoring of the Society of Thoracic Surgeons (STS). Our institutional 'Heart Team' voted for TAVI, and she underwent an initially uneventful transfemoral implantation of a 26-mm Sapien XT® (Edwards Lifesciences, Irvine, CA) aortic bioprosthesis.

Prophylactic antibiotics and anticoagulation medication were administered before and during the procedure. First-generation cephalosporin was chosen as a prophylactic and administered during the hospital stay and until 1 week after discharge.

The TAVI procedure was applied in a catheterization laboratory under general anaesthesia with TEE guidance. Percutaneous access was achieved and closure was performed with a Prostar® XL (ProStar ™ XL10Fr, Abbott Vascular, Abbott Park, IL, USA) device. After the aortic valve was crossed, valvuloplasty at a pace of 200/min was performed using a 20-mm x 40-mm balloon, and a 26-mm Edwards — Saphien XT valve was then implanted. No additional complications were observed.

The transthoracic echocardiography was repeated after the procedure. A mild paravalvular leak was present, and the functions of the implanted aortic valve were good (average gradient: 11 mmHg). The pulmonary artery systolic pressure (PASP) was 25 mmHg. The TAVR was associated with a decrease in the PASP.

The patient was discharged on the 10th day following the procedure. The follow-up TTEs, which were performed at 1 month, 3 months and 6 months after discharge, revealed no changes in aortic valve function.

The patient was readmitted to our institution at seven months due to acute congestive heart failure and palpitation. Her body temperature was normal (36.8°C), the white blood cell count (WBC) was 7.2/μl, the C reactive protein (CRP) level was elevated (12.2 mg/dl), and there was no peripheral stigma of infective endocarditis or embolic phenomena. An increased aortic valve gradient (mean gradient: 37 mmHg) and mild aortic regurgitation were observed on TTE (Fig. 1). The pulmonary artery systolic pressure (PASP) was 40 mmHg. Two-dimensional TEE has

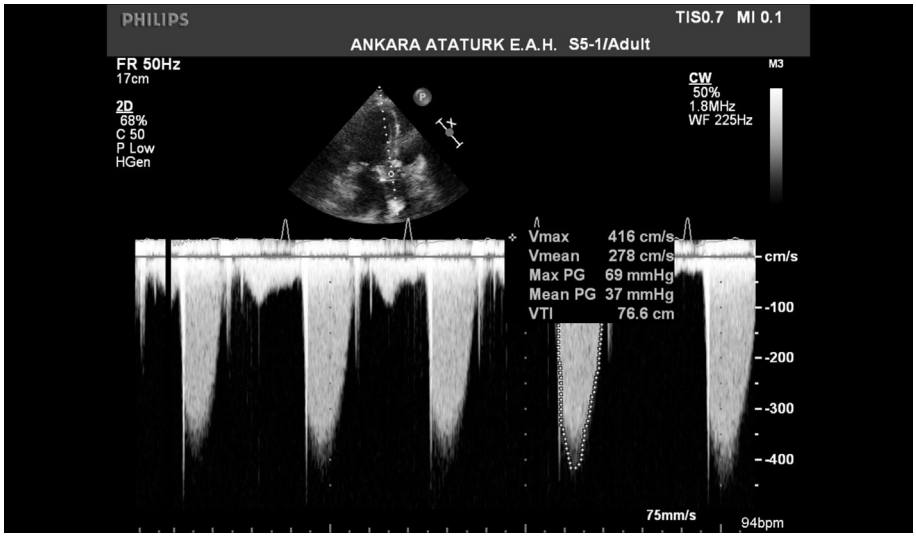

Figure 1 Increased aortic valve gradient on TTE.

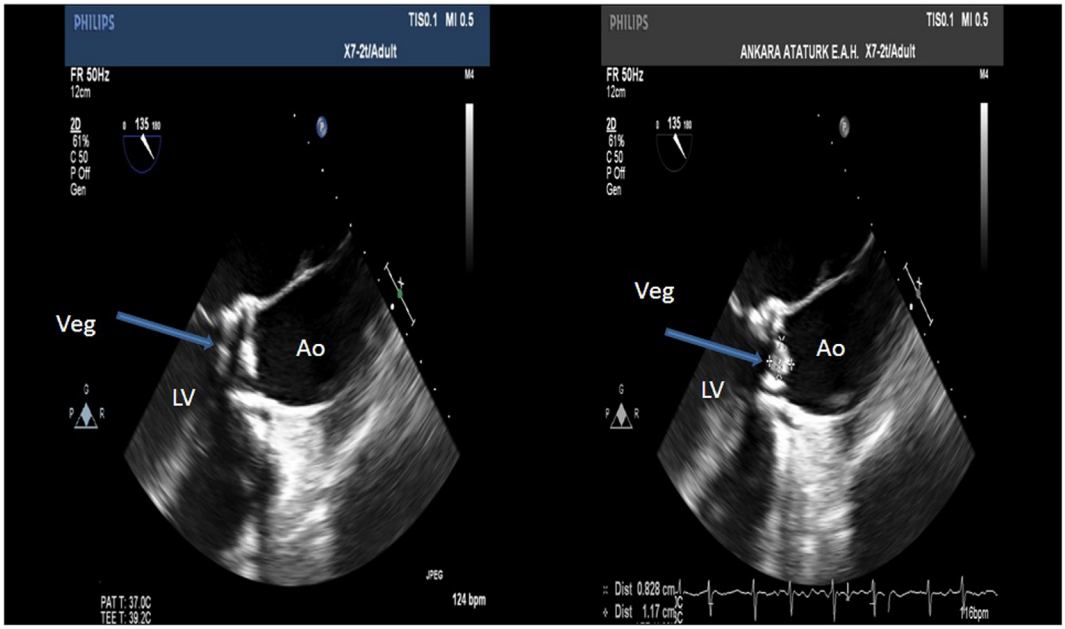

Figure 2 2D TEE image displaying the oscillating structure (10*7 mm) on the right coronary cusp of the aortic valve that was suggestive of vegetation during systole and diastole. Arrow pointing right: vegetation (Veg), Ao: aorta, LV: left ventricle.

raised doubts about the mass on the prosthetic valve, and 3D TEE revealed a large, accessory, oscillating structure (10*7 mm) on the right coronary cusp of the aortic valve that was suggestive of vegetation (Figs. 2,3, and 4). Six blood cultures were immediately taken, and two were positive for Enterococcus faecium. The patient was tested for antimicrobial susceptibility to select the optimal therapy. Treatment with i.v. antibiotics (i.e., gentamycin, ampicillin/sulbactam and rifampicin) was initiated. After one week of antibiotherapy, control TEEs (2D-3D) were performed and revealed no reduction in the vegetation and no decrease in the aortic valve mean gradient.

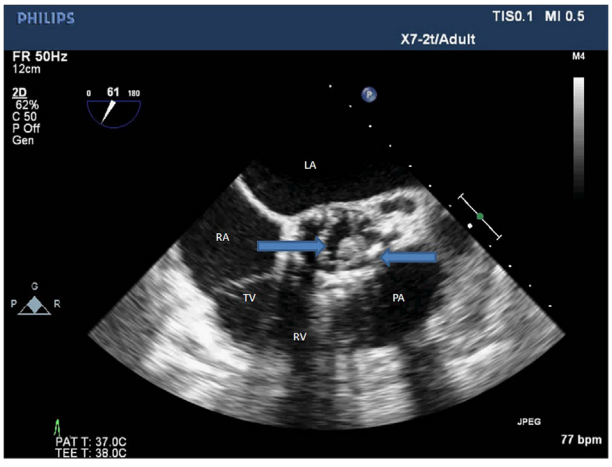

Figure 3 2D transoesophageal echocardiogram from the mid-oesophageal AV short axis view. Arrow pointing right: aortic valve (AV), arrow pointing left: vegetation (Veg), TV: tricuspid valve, RV: right ventricle, RA: right atrium, PA: pulmonary artery, LA: left atrium.

Our heart team made the decision for surgery because the patient did not respond to the antibiotherapy and exhibited continuous hemodynamic instability. Cardiopulmonary bypass was established in a standard fashion. Cardiac arrest was obtained with antegrade and retrograde cardioplegia. Vegetation was observed on the TAVI valve and resected (Fig. 5). A 21-mm Edwards bioprosthetic valve was reimplanted. The cardiopulmonary bypass was terminated uneventfully with inotropic support. However, on the first postoperative day, haemodynamic instability, including rhythm disturbances, occurred and necessitated intra-aortic balloon pump insertion. Nevertheless, the patient died despite all the supportive and surgical management.

3. Discussion

Aortic valve sclerosis is present in 20—30% of individuals over 65 years and 48% of those aged 85 years or older.[5] Twenty-five to thirty-five percent of those with severe aortic stenosis who require SAVR cannot be operated on.[6] Transcatheter aortic valve replacement is a novel procedure that is used for patients with severe symptomatic aortic stenosis and a high surgical risk.

Infectious prosthetic valve endocarditis is known as a catastrophic complication that occurs in 0.3—1% of patients following SAVR,[7] and the in-hospital mortality reaches 30%. Although TAVI is generally a relatively safe procedure, heart teams must be prepared to tackle potential obstacles.[8] The lifelong prevalence of infective endocarditis (IE) is approximately 10% to 15% across all cases, and the morbidity and mortality rates are high.[9,10]

The microorganisms that are most commonly responsible for infective endocarditis are coagulase-negative staphylococci (52%), enterococci (8%), Streptococcus viridans

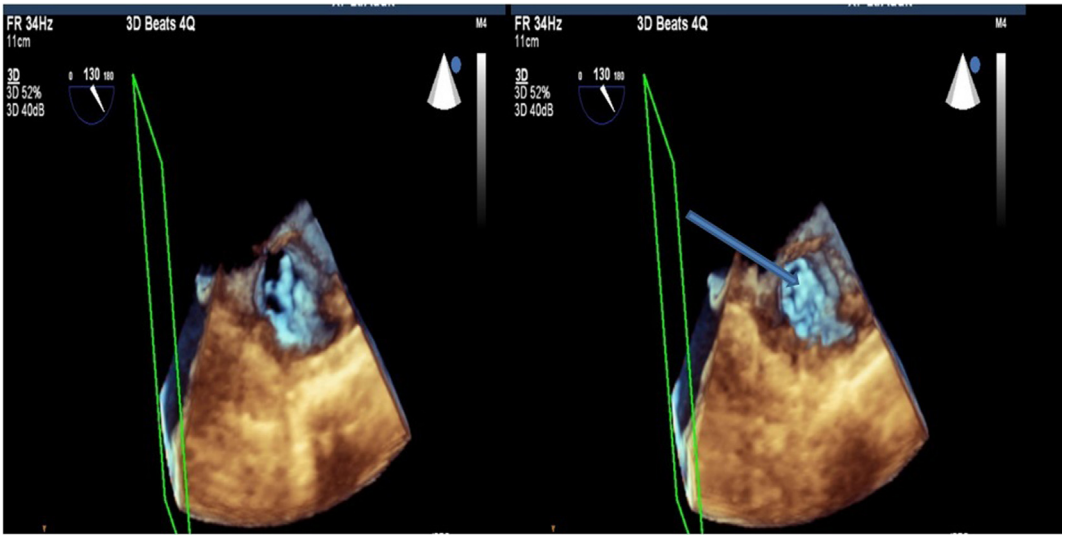

Figure 4 Assessment of the aortic prosthesis vegetation with the help of three-dimensional (3D) transoesophageal echocardiography (TEE).

(5%), gram-negative organisms (6%), and fungi (10%) in cases of prosthetic valve endocarditis and S. viridans, S. aureus, Staphyloccocus epidermidis and Enteroccoci in cases of native valve endocarditis.[11]

The recommendations regarding PVE diagnosis and management are well established[12]; however, no such information is available regarding transcatheter aortic valve replacement infective endocarditis (TAVRIE). The definitive incidence of TAVRIE is unclear because this condition has currently been reported in only a few case reports.[13,14] In the PARTNER trial,[15] which is the largest randomised trial that has compared TAVI and SAVR in high-risk patients, the incidence of endocarditis was reported; the incidences of prosthesis infections at 30 days (0 in the TAVI patients and one in the surgical cohort) and one year (2 (1.1%) in the TAVI group) were low compared with the 3 surgically implanted valve infections.[1]

Little is known about the microbiological profile of TAVRIE. Staphylococcus aureus is the leading cause of both early and late onset surgical PVE. The ''typical'' microorganisms that are responsible for TAVRIE are not necessarily identical to those that are responsible for SAVR. Only one of the reported cases of IE after TAVR was due to *Staphylococcus aureus*, which is the most common pathogen in IE after SAVR. The microbiological profile of TAVRIE may be different from the surgical counterpart. Enterococci are the predominant species in the normal flora found on the skin of the groin and are intrinsically resistant to cephalosporins.

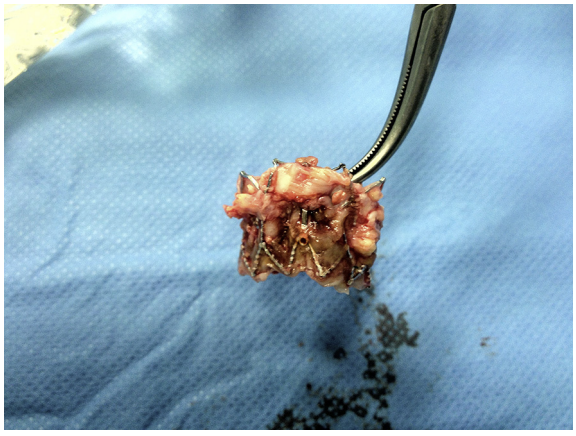

Figure 5 Image of the resected TAVI valve.

The Duke criteria remain the gold standard for the diagnosis of IE in patients who have undergone TAVR, and exact criteria and definitions have yet to be established.

The relatively new 3DTEE technology allows for detailed 3D assessments of the cardiac structures.[16,17] Real-time 3D transoesophageal echocardiography (3DTEE) has the potential to provide 3D information about intracardiac masses and will provide important advances in the knowledge of infective endocarditis in the future. 3DTEE is an important tool for fine-tuning a suspected diagnosis for both medical and surgical decision making when 2D echocardiography is not completely clear.

It is important to diagnose IE early and provide prompt and definitive treatment.[7] The treatment of choice for IE after TAVR cannot be dictated according to conventional guidelines, and until further data are available, case-by-case decisions based on clinical judgment or confirmed infectious diagnoses should be undertaken. Larger series and longer follow-ups must be reported to determine the frequency of this complication, the microorganisms that are responsible for it, and its appropriate treatment.

Cases of IE are managed either conservatively with antibiotics and/or surgery, and the overall prognosis is poor. Enterococcal PVE is often complicated by periprosthetic dehiscence, annular abscesses or fistulas. In these cases, if antibiotic treatment fails, an early surgical intervention should be considered. Until further evidence is presented, IE after TAVR should be managed according to SAVR guidelines with modifications as needed on a case-by-case basis. While surgical intervention can be life-saving even in elderly patients with SPVE, it may not be a feasible treatment option for the majority of TPVE patients.[18]

Antibiotic prophylaxis is, essential and strict sterile conditions during TAVI are crucial, but the choice of prophylactic antibiotics may influence the prevalence of pathogens and the timing of infection. This supposition has not been evaluated in the TAVR literature. Antibiotic prophylaxis suitable for sternotomy may not be the best choice for the transfemoral approach. There may be concerns that a non-surgical environment might imply less stringent hygienic and sterile precautions and thereby increase the risk of procedure-related and prosthetic infections, especially in this highly vulnerable patient group.[3]

In conclusion, TAVI candidates are probably at higher risk for all postoperative complications due to their comorbidities and advanced age, which should remind us that these patients are at very high risk for redo SAVR. Moreover, this report emphasized the importance of real-time 3DTEE in suspected TAVRIE cases when 2D echocardiography is not completely clear because real-time 3DTEE might add prognostic information for decision-making.

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