Case report

Severe intraprosthetic regurgitation by immobile leaflet after trans-catheter aortic valve implantation

Nawwar Al-Attara,*, Dominique Himbertb, Alec Vahanianb, Patrick Natafa

a Department of Cardiac Surgery, AP-HP , Bichat Hospital, University Paris 7, Paris, France
b Department of Cardiology, AP-HP , Bichat Hospital, University Paris 7, Paris, France

Received 16 June 2010; received in revised form 2 August 2010; accepted 5 August 2010; Available online 16 September 2010

Abstract

Aortic regurgitation mainly in the form of paravalvular leaks is a frequent complication of trans-catheter aortic valve implantation (TAVI). We describe a case of an 86-year-old woman with severe aortic stenosis, who underwent trans-apical TAVI with a 23-mm Edwards—SAPIEN valve. Immediately post-implantation, severe intravalvular leak was observed on trans-esophageal echocardiogram (TEE) due to an immobile cusp associated with left-ventricular distension and cardiovascular collapse. Despite successfully treating the leak with the implantation of a second valve of the same diameter within the first one, the hemodynamic status remained unstable. Peripheral extracorporeal membrane oxygenation (ECMO) was established but resulted in a fatal outcome due to intractable heart failure.

1. Introduction

1.1. Case report

An 86-year-old woman with severe symptomatic aortic stenosis (AS) was admitted with pulmonary edema. She had chronic obstructive airway disease (forced expiratory volume in 1 s (FEV1) = 56% and FEV1/vital capacity (VC) = 77%), permanent atrial fibrillation, pulmonary hypertension, Bence-Jones proteinuria, history of stroke, and meningioma without signs of compression. Echocardiography demonstrated a mean aortic gradient of 61 mm Hg, valve area of 0.30 cm² m⁻², and left-ventricular (LV) ejection fraction of 50%. The predicted mortality calculated by the European System for Cardiac Operative Risk Evaluation (EuroSCORE) was 29%. Given the high surgical risk, the patient was considered for trans-apical TAVI. Access to the LV apex was obtained through a left anterior minithoracotomy. Both the femoral artery and vein were catheterized prior to the implantation [1]. The aortic annulus was measured 20 mm by trans-esophageal echocardiogram (TEE); accordingly, a 23-mm balloon-expandable Edwards—SAPIEN valve was implanted. Positioning of the valve was determined by TEE and angiography with guidance by real-time imaging for cardiac navigation (C-THV, Paieon Medical, Israel) and was considered satisfactory. However, a severe intravalvular leak was observed on TEE (Fig. 1, Video 1) associated with cardiovascular collapse and severe LV dilatation; this persisted despite attempts to reposition the cusp with the catheter and after retrieval of the guidewire. Intravenous injection of positive inotropic medication and vasoconstrictors also failed to improve the hemodynamic status. Immediately, cardiac massage was initiated followed by the implantation of a second valve by another 23-mm valve. Following this valve-in-valve implantation, angiography and TEE study showed complete disappearance of the aortic regurgitation (AR), and no paravalvular leak. However, the patient failed to improve her hemodynamic status and an arteriovenous ECMO was immediately set up through the femoral vessels, employing the in situ catheters. Despite circulatory assistance, the LV remained globally akinetic and the patient died a few hours after the procedure.

2. Discussion

Temporary intravalvular regurgitation during the procedure is commonly observed due to pressure of the stiff guidewire on the cusps inducing valve incompetence. Removal of the guidewire resolves the problem [2]. More enduring leaks having been described in several registries regardless of the type of prosthesis or approach for TAVI.
While the registries do not differentiate between intra- and paravalvular leaks, their mechanisms are different. Stent distortion, low implantation, incomplete deployment, and presence of a highly calcified aorta have been incriminated, and the need for a second valve tended to be more frequent in these situations. In The French Aortic National CoreValve and Edwards (FRANCE) registry, 9.5% of all patients implanted with either the Sapien trans-catheter valve or the CoreValve bioprosthesis (Medtronic Inc., Minneapolis, MN, USA) had paravalvular leaks of grade 2 or more [3]. The management, in most cases, consists of balloon re-dilation and, if ineffective, implantation of a second valve in the valve. In the Edwards SAPIEN Aortic Bioprosthesis European Outcome (SOURCE) Registry, including 574 trans-apical TAVI procedures, AR > grade 2+ was observed in 13 patients (2.3%) of which 11 had a valve-in-valve treatment. Postoperative AR > grade 2+ was a major risk factor for 30-day mortality in this series [4]. The Multicenter Canadian Experience reported the need for second valve implantation in nine procedures out of a total of 345 procedures (2.6%) because of valve embolization, valve malposition, and/or severe post-implantation regurgitation [5].

We describe a case of severe intravalvular leak due to an immobile cusp (Video 2). The mechanism of this complication is unclear. All leaflets were mobile prior to crimping of the valve on the balloon. Irregular deployment of the prosthesis inside the aortic annulus can lead to taunting of a leaflet on an elongated axis of the valve, rendering it immobile. This has already been described in stented surgical bioprosthesis due to deformation of the stent at the time of implantation [6]. In TAVI, however, this geometric explanation is only true when stent expansion is not circular after deployment, which was not the case in this patient. We hypothesize that hooking of the leaflet on the stent at the time of crimping is the cause of the valve’s immobility (Fig. 2) after deployment, giving rise to an eccentric regurgitant jet into the LV. Despite being cost-intensive, the most effective management of severe intravalvular leaks is insertion of a second valve in the valve. While the second valve is being prepared, a catheter could be employed to mobilize the frozen cusp but should not delay valve-in-valve insertion, if unsuccessful. To insert the second valve in a timely manner, the introducing sheath should be kept inside the LV until TEE confirms the absence of significant leaks. When the leak is associated with severe hemodynamic disturbances, circulatory support can be provided in the form of a heart-lung or ECMO machine. Placing sheaths into the femoral artery and vein at the beginning of the procedure allows for immediate establishment of extracorporeal circulation in case of the need for a bailout strategy [7].

References


Appendix A. Supplementary data

Supplementary data associated with this article can be found, in the online version, at doi:10.1016/j.ejcts.2010.08.007.