

Case report

Unexpected left ventricular free-wall rupture following an aortic catheter-valve implantation

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Abstract

Our experience with the Sapien trans-apical aortic valve (Edwards Lifesciences Inc., Irvine, CA, USA) has been straightforward without per-procedural mortality except in 1/16 consecutive cases who developed non-apical haemorrhage early after valve implantation. We describe the case of an 84-year-old female carrying a very high operative risk (logistic EuroScore of 44%), who underwent a trans-apical stent-valve implantation for severe and symptomatic aortic valve stenosis (23 mm). Due to massive blood loss, an emergency sternotomy and cannulation for cardiopulmonary bypass resuscitation were necessary to treat (without success) an unusual and unexpected subaortic left ventricular free-wall rupture that occurred few minutes after the stent-valve positioning and implantation. To the best of our knowledge, this is the first described case of a left ventricular free-wall rupture occurring after an otherwise non-complicated standard catheter-based aortic valve replacement.

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1. Introduction

The trans-apical aortic valve implantation (TA-AVI) is a valid alternative to the standard aortic valve replacement for patients requiring AVR, and carrying a high operative risk (logistic EuroScore >20%): together with the transfemoral approach (TF-AVI), the amount of stent-valve bio-prostheses implanted worldwide is increasing constantly. Nevertheless, it is well known that all new surgical procedures, approaches, devices and technologies carry a risk of unexpected complications intrinsically related to the procedure itself: complications following TA/TF-AVI (valve migration/malpositioning, vascular dissections and ruptures, embolisation, renal failure, strokes and bleeding from the cardiac apex) have already been described in the literature and, thanks to that, they are now predictable and treatable [1–4]. On the other hand, the transcatheter procedures are still new and some rare complications can still occur because of the very fragile patient's tissues or because of concomitant co-morbidities in the elderly and the very-high-risk patients. In a series of 16 consecutive TA-AVI with the Sapien device (Edwards Lifesciences Inc., Irvine, CA, USA), we report case 15, an unexpected and unpredicted life-

threatening rupture (tear) of the subaortic free wall of the left ventricle that occurred few minutes after the stent-valve deployment, during an otherwise uncomplicated TA-AVI procedure. To the best of our knowledge, a left ventricle free-wall rupture during a catheter-based aortic valve procedure has never been described before.

2. Case report

An 84-year-old female suffering from symptomatic aortic stenosis was scheduled for TA-AVI (15th from a series of 16 consecutive cases). Co-morbidities were severe respiratory disease (oxygen therapy at home), peripheral vascular disease (bilateral femoral and iliac artery stenosis/occlusion), pulmonary hypertension (60 mmHg of systolic pulmonary pressure), obesity, diabetes II and systemic hypertension. The preoperative echocardiogram (ECG) showed a stenosis with peak gradient of 70 mmHg, mean of 40 mmHg, surface area of 0.5 cm² and a severe concentric left ventricular hypertrophy with septal spur. The left ventricular function was preserved. The calculated logistic EuroScore was 44% and the patient accepted a TA-AVI procedure. A three-dimensional CTscan and a coronary angiogram were performed to identify the landmarks for the valve implantation and to calculate the perspective of aortic valve plane for the C-arm fluoroscopy pre-orientation (14° left and 10° cranial). The aortic annulus

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Fig. 1. The preoperative cardiac CT scan showed an aortic valve annulus diameter of 20 mm.

was heavily calcified and measured 20 mm diameter; coronary anomalies were not found (Fig. 1). The CT scan also showed an unexpected lipomatosis of the inter-atrial septum and confirmed the subaortic spur. Under general anaesthesia and in the operative theatre, we performed the TA-AVI procedure. We noted that trans-oesophageal echocardiogram (TEE) confirmed an aortic valve annulus of 19.5 mm; guide-wires/pigtails were inserted through a surgically exposed left subclavian artery (occluded femoral axes); the tissues in general and the cardiac apex in particular were very fragile (a double purse-string suture was performed very carefully); and we implanted a 23-mm Sapien valve (Edwards Lifesciences Inc., Irvine, CA, USA) in the ideal landing zone (for a 19.5–20 mm annulus, the oversize was 15%). During the procedure, the patient's vital signs and haemodynamics remained unchanged. Fluoroscopy and TEE confirmed the absence of a paravalvular leakage, a gradient of 6 mmHg and a patent coronary ostia (Fig. 2A and B). Few minutes later, the patient experienced a sudden severe hypotension with red fresh blood coming from the mini-thoracotomy. After having immediately established that the cardiac apex was not the source of the bleeding, we performed a sternotomy in emergency following a suspicion of ascending aorta rupture/dissection. Surprisingly, the ascending aorta was not damaged and, once the cardiopulmonary bypass (CPB) was established, we found a massive bleeding from a 4-cm-long longitudinal tear in the subaortic free wall of the left ventricle, just behind the left atrial appendage. After suturing the lesion with large pledgeted U-stitches, bleeding could be controlled; however, weaning from CPB was unsuccessful.

3. Discussion

Unexpected, unexplainable complications can occur during emerging surgical procedures. We describe a free-wall ventricular rupture following TA-AVI. Traditionally, the fragility of the cardiac apex is the most important cause of surgical bleeding during TA-AVI procedures, and it remains, despite all

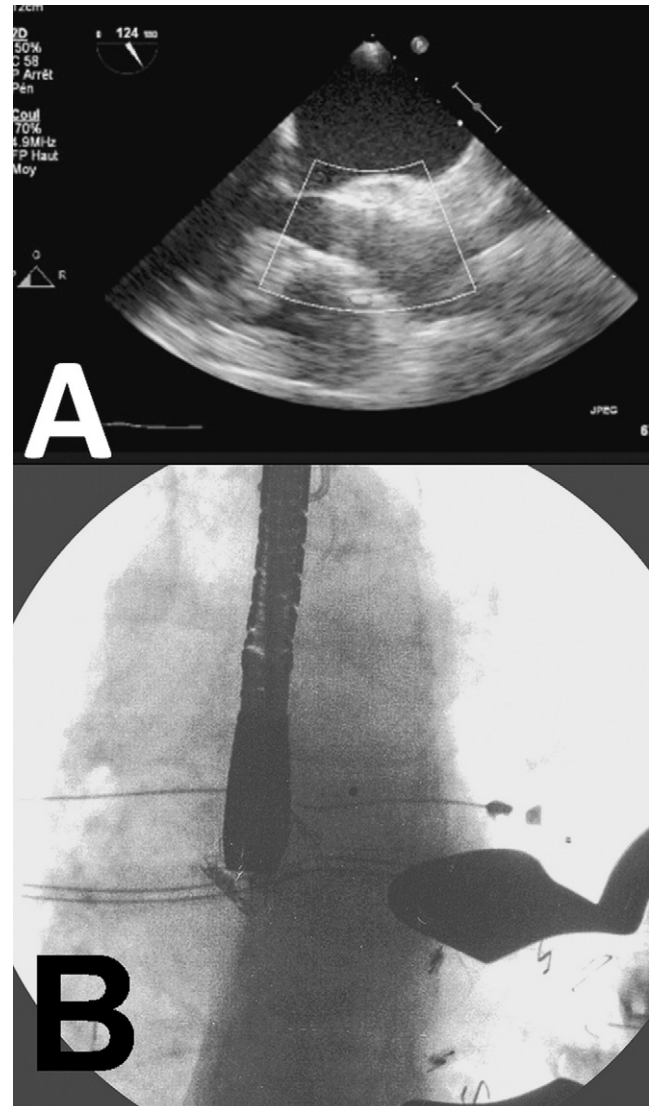


Fig. 2. Intraoperative images from the trans-oesophageal echocardiogram (A) and from the C-arm fluoroscopy (B) confirming the perfect stent-valve positioning and deployment in the ideal landing zone.

tentative efforts to prevent it (e.g., purse-string sutures, reinforced crossing U-stitches and sheets removal under rapid pacing), the most dreadful source of massive blood loss related to this approach [5,6]. Nevertheless, a new and unexpected source of bleeding seems to be the left ventricle free-wall rupture in the subaortic region, between the left descending coronary artery and the circumflex artery, that we experienced after the stent-valve deployment. A relatively small aortic valve annulus (19.5–20 mm) with a severe subaortic ventricular hypertrophy and spur, concomitant with very fragile tissues in a small elderly female patient, can be the predisposing factors at the origin of this unexpected problem; in particular, we believe that patients with long-lasting history of poor peripheral tissue oxygenation (e.g., chronic obstructive pulmonary disease (COPD)) or low cardiac output could carry an increased tissue fragility and can be at risk for such a complication. Moreover, the discrepancy between the aortic annulus and the stent-valve size has to be taken in account as a key factor; the traditional oversizing is around 10% and,

following our experience, it should probably not exceed 15% to reduce the stress against a fragile aortic wall with a little residual elasticity or against a fragile subaortic ventricular tissue. According to our experience, improvements in pre- and intra-operative cardiac imaging for measurements and assessment or a lower balloon inflation (oversize of 10–12% maximum) during the valve deployment could be helpful in prevention (in our series of 16 patients the mean aortic annulus was 22.37 ± 1.54 mm and the mean stent-valve size was 24.58 ± 1.55 mm with 9% oversizing, compared with 15% oversizing for this patient). This outcome confirms the importance of a CPB standby, and emphasises the role of cardiac surgeons acting during any trans-catheter procedure to guarantee emergency CPB re-animation and all possible attempts to treat uncommon and unpredictable tricky situations.

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