

# ACUTE BIOPROSTHETIC MITRAL VALVE THROMBOSIS DURING VENOARTERIAL EXTRACORPOREAL MEMBRANE

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## Abstract

Bioprosthetic valve thrombosis is a rare complication. Left atrial dilatation, atrial fibrillation, hypercoagulability and low cardiac output are known risk factors. We report the case of a patient undergoing a bioprosthetic mitral valve replacement who required postoperative circulatory support with extracorporeal membrane oxygenation and presented acute bioprosthetic valve thrombosis. Some aspects regarding pathogenesis, diagnosis and treatment are discussed.

## INTRODUCTION

Acute bioprosthetic valve thrombosis in patients on venoarterial extracorporeal membrane oxygenation support (VA-ECMO) for postcardiotomy shock is an infrequent complication described in bioprosthetic valves implanted in aortic, mitral and pulmonic position.<sup>1</sup> Pathogenesis has been related to insufficient anticoagulant treatment, reduced trans-prosthetic flow and blood stasis in heart chambers due to inappropriate ventricular emptying during systole.<sup>2</sup>

We report the case of a patient undergoing a bioprosthetic mitral valve replacement who required postoperative circulatory support with VA-ECMO and presented acute bioprosthetic valve thrombosis.

## CASE REPORT

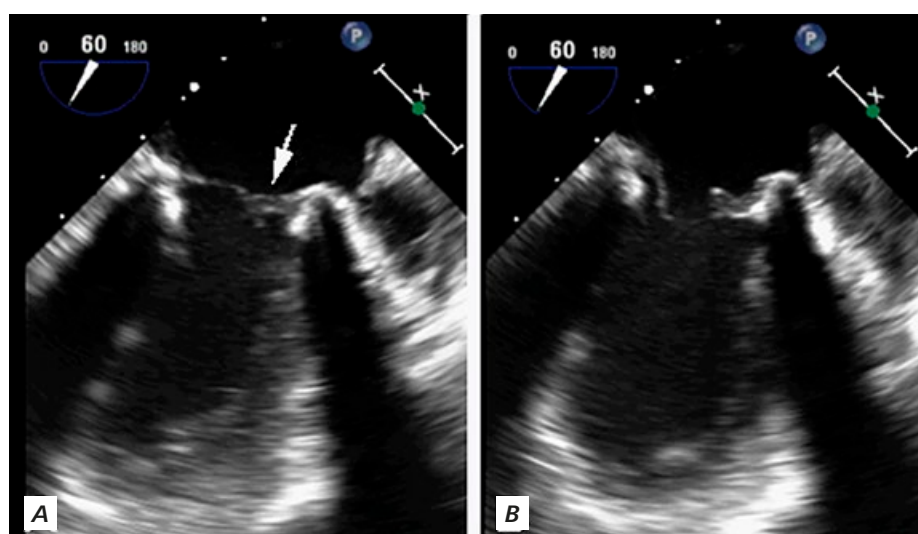
A woman was diagnosed with rectal carcinoma in 2014, at the age of 55 years. After surgical resection, she received postoperative radiotherapy and chemotherapy. In 2015, she presented with mitral valve endocarditis due to *E. faecalis* and underwent mitral valve replacement with a mechanical prosthesis. The postoperative course was favourable. In 2018, she was diagnosed with pulmonary adenocarcinoma. After surgical resection, postoperative chemotherapy was given. Six months later she was admitted because of cardiogenic shock. Transesophageal echocardiogram (TEE) showed a prosthetic mitral valve thrombosis with a mean/maximum trans-prosthetic gradient of 30/44.8

mmHg. Dilation and severe systolic dysfunction of the right ventricle were observed.

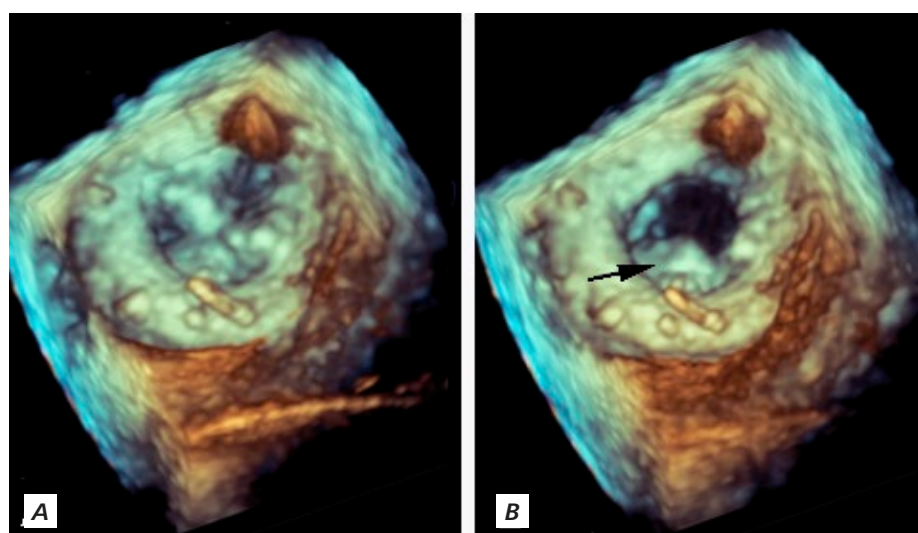
The patient was referred for an emergent mitral intervention. The mechanical prosthesis was replaced by a bioprosthesis. A TEE performed at the end of the operation showed normal left ventricle and bioprosthesis but systolic dysfunction of the right ventricle. Weaning of cardiopulmonary bypass required high doses of inotropic drugs and therefore a VA-ECMO with right subclavian artery and right femoral vein cannulation was implanted. The absence of clots and diffuse bleeding forced the administration of protamine, plasma, fibrinogen, platelets and recombinant factor VIIa, allowing sternal closure and transfer to the postoperative care unit.

Reoperation for bleeding was required twice, 24 and 72 hours after the procedure. The VA-ECMO provided an output of 3.8-4.2 l/min. The TEE performed 48 h after valve replacement showed adequate emptying of the left ventricle during systole. Thickening of one of the bioprosthetic leaflets due to echodense material consistent with thrombus, conditioning an opening limitation were observed (figures 1 and 2). Despite this finding, confirmed in subsequent TEE studies, it was decided not to anticoagulate the patient due to bleeding tendency and low platelet count.

The patient could be weaned from ECMO six days after valve replacement. Cardiac output and oxygenation were adequate but the echodense image on the bioprosthetic leaflet persisted on TEE examination. The calculated mean/maximum trans-prosthetic gradient was 7/14 mmHg. The postoperative evolution was favourable and the patient

**Figure 1**

Transesophageal echocardiography. (A) Thickening of one of the leaflets of the bioprosthesis (arrow) during systole. (B) The same view during diastole.

**Figure 2**

Three-dimensional transesophageal echocardiography. Ssurgeon's view. (A) Coaptation of the three leaflets during systole. (B) One of the bioprosthetic leaflets presents a reduced proper motion during diastole (arrow).

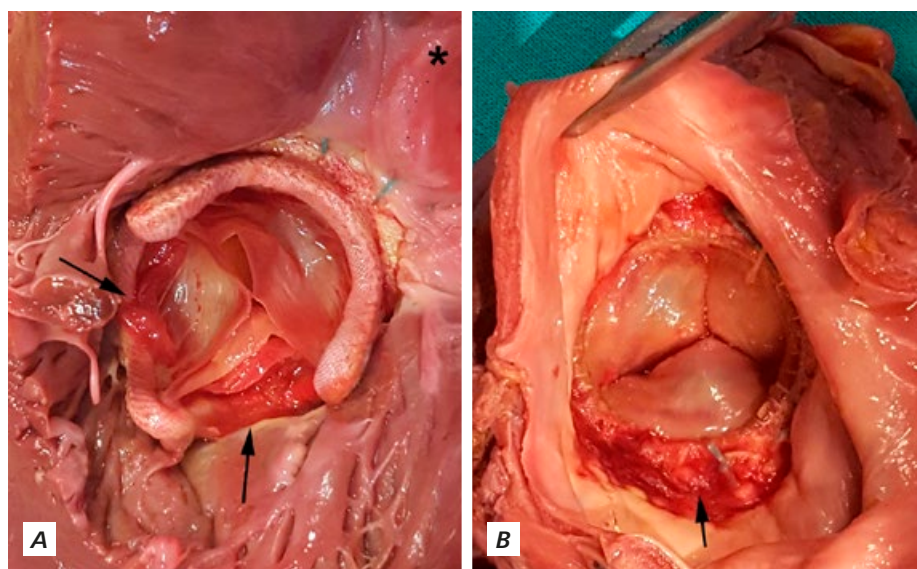
could be weaned from the mechanical ventilation 22 days after the intervention. A computed tomographic scan was performed due to increased bilirubin and confirmed the progression of tumor disease with metastatic involvement. It was decided to limit the therapeutic effort and the patient died 33 days after the intervention. In the necropsy study organized thrombus was observed on the ventricular surface of the bioprosthesis affecting the leaflets on the opposite side of the mitroaortic intervalvular fibrosa (figure 3). A thin layer of clot was identified on the atrial surface covering the prosthetic ring without affectation of the leaflets.

## DISCUSSION

Acute thrombosis of bioprosthetic mitral valve in patients with post-cardiotomy shock assisted with a

VA-ECMO is a complication that can be observed from 24 hours of support with ECMO.<sup>1</sup> Blood stasis and reduced transvalvular flow are well known factors that explain thrombosis.<sup>2</sup> In our case the prothrombotic state secondary to advanced neoplastic disease as well as the use of hemoderivatives and VIIa recombinant factor could predispose to this complication. Thrombus formation has been described on both the atrial and ventricular surface.<sup>2,5</sup> Thrombosed bioprostheses may behave as stenosis<sup>3,4</sup> or insufficiency.<sup>2</sup>

Suggested measures to prevent bioprosthetic thrombosis in patients under VA-ECMO include reducing blood stasis in the heart chambers, ensuring the ventricle is properly emptied and providing an adequate trans-mitral flow to avoid immobility of the bioprosthetic valve leaflets.<sup>2,3</sup> The use of intra-aortic balloon pump balloon and intraventricular assist devices has been suggested.<sup>2,3</sup>

**Figure 3**

Necropsy image. (A) Left ventricular side of the bioprosthesis. The leaflets are layered with thrombus (arrow). Mitroaortic intervalvular fibrosa (\*). (B) Atrial surface. The bioprosthetic ring is covered with a thin layer of clot (arrow).

A more intense anticoagulant treatment plays probably a secondary role,<sup>5</sup> although in our case the absence of anticoagulant treatment may have been decisive since we always observed adequate left systolic function with correct emptying of the ventricle and opening of the aortic valve.

Regarding the treatment of bioprosthetic thrombosis, the administration of fibrinolytic agents and anticoagulants,<sup>3</sup> percutaneous valvuloplasty<sup>3</sup> and open surgery<sup>2,3,4,5</sup> have been proposed depending on the clinical situation and the patient's comorbidities.

The case presented points out the need for a comprehensive TEE study since the beginning in all patients undergoing a prosthetic valve replacement who require postoperative ECMO support.

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