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Case Report

Mechanical prosthetic mitral valve obstruction: Pannus or thrombus? A case report ☆☆☆

Raid Faraj, MD^{a,b,*}, Thierno Hamidou Diallo, MD^{a,b}, Hassan Dib, MD^{a,c},
 Mohamed Sarsari, MD^{a,b}, Raynatou Diafarou, MD^{a,b}, Jamila Zarzur, PhD^{a,b},
 Mohamed Cherti, PhD^{a,b}

^a Mohammed V University, Rabat, Morocco

^b Cardiology B department, Ibn Sina university hospital center, Rabat, Morocco

^c Cardiology Center, Mohammed V Military Instruction Hospital of Rabat, Morocco

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ABSTRACT

Substitution of a defective heart valve with a prosthetic heart valve turns the native disease for prosthesis-related complications. One of the most serious and dreaded complications is prosthetic valve obstruction. It is either the result of a thrombus or pannus formation. For the evaluation of prosthetic valve obstruction, transthoracic echography and fluoroscopy provide functional information but may not provide information about the etiology of the obstruction, unlike multidetector computed tomography (MDCT) which allows a more precise etiological diagnosis to guide the therapeutic attitude. Here, we report a case of a mechanical prosthetic mitral valve obstruction in a 45-year-old patient in whom the diagnosis of pannus was retained on the basis of clinical, biological, and imaging data. The differentiation between thrombus and pannus is crucial because it conditions the therapeutic attitude. Advanced imaging specially MDCT options should be considered whenever mechanical prosthesis valve obstruction is suspected.

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Introduction

Heart valve disease affects more than 100 million people worldwide and is a growing health problem due to the high incidence of degenerative heart valve disease in the elderly and rheumatic heart valve disease in developing countries.

Valve replacement remains the only definitive treatment for most patients with severe valve disease [1]. Prosthetic valve obstruction is a rare but potentially serious complication because it is associated with significant mortality and morbidity. Thrombus and pannus are the most common causes [2]. In clinical practice, the differentiation between thrombus and pannus is crucial because it conditions the treatment.

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* Corresponding author.

E-mail address: farajraid95@gmail.com (R. Faraj).

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Fig. 1 – (A, B) Transesophageal echocardiogram findings: blocked leaflets (white arrow) with a small, dense, hyperechogenic, immobile mass, tightly attached to the auricular surface of the prosthesis (white asterisk). (C) Increased gradient across the mitral valve prosthesis (27 mmHg). (D) CT scan confirming the diagnosis of pannus (black arrow).

Obstructive thrombosis appears earlier between the implantation of the prosthesis and the onset of symptoms, most often due to a defect in anticoagulation and requires urgent treatment with thrombolysis, whereas pannus appears later and requires surgical treatment [3]. The diagnosis of certainty of these 2 entities remains a challenge because of the similarity of the clinical presentation, as well as the fact that they are sometimes associated [4]. The indication for fibrinolysis in case of prosthesis obstruction must be carefully chosen because it is associated with potentially serious adverse effects, notably intracranial hemorrhage. Its failure may delay surgery, thus increasing the risk of mortality. Therefore, identification of the exact cause of the obstruction is of paramount importance in management [5]. For these reasons, patients with prosthesis obstruction require multimodal imaging including fluoroscopy, transthoracic, transesophageal echocardiograms and multidetector computed tomography for differentiation between these 2 entities.

Our paper was written according to the CARE guidelines [6].

Case presentation

A 45-year-old patient with no cardiovascular risk factors, who benefited, 3 years earlier, from a mechanical prosthesis in

mitral position (bi-leaflet prosthesis) for severe rheumatic mitral stenosis, presented with resting dyspnea and asthenia. Initial examination showed sinus tachycardia with a blood pressure of 91/60 mmHg. The closing click of the prosthetic valve was decreased on auscultation. She was taking acenocoumarol previously with an admission international normalized ratio of 7.2. Transthoracic echocardiogram and transesophageal echocardiogram found a completely blocked leaflet with a small, dense, hyperechogenic, immobile mass, tightly attached to the disk plane with a centripetal growth (Figs. 1A and B). The gradient across the mitral valve prosthesis was considerably increased and mitral pressure half-life was pathologic (PHT at 200 ms) (Fig. 1C). At this stage, mechanical mitral prosthesis obstruction caused by thrombosis, a pannus or even the combination of the 2 was evoked.

The chronology of 3 years before the appearance of signs suggestive of obstruction, the weak relationship with the value of international normalized ratio, the mitral position of the mass, as well as the other morphologic criteria (small and immobile mass, involving mostly the ring with growth beneath disc) were suggestive of pannus diagnosis. Because of the possible combination of both, cardiac CT scan was performed; it revealed a 5 mm hypodense valve outgrowth on the atrial side with an attenuation value > 200 Hounsfield unit, suggestive of isolated pannus (Fig. 1D).

Finally, the patient was directed urgently to the cardiovascular surgery department for mechanical mitral prosthesis replacement with a good follow-up.

Discussion

The overall incidence of prosthetic obstruction varies between 0.5% and 6.0% depending on the location of the prosthetic valve replacement [2]. Although less frequent than thrombus, pannus can also develop on a mechanical prosthesis. It is secondary to a biological reaction to the prosthetic material, resulting in fibroblast and collagen proliferation with infiltration of endothelial cells, myofibroblasts and chronic inflammatory cells leading to fibrinous growth around the prosthetic ring [4]. In clinical practice, the differentiation between thrombus and pannus is crucial because it conditions the therapeutic attitude. Obstructive thrombosis appears earlier between the implantation of the prosthesis and the onset of symptoms, most often in relation to a defect in anticoagulation and requires urgent treatment with thrombolysis, whereas pannus appears later as in our case [7]. However, these parameters are not sufficient to differentiate between thrombus and pannus. For this reason, patients with prosthesis obstruction require further investigation including noninvasive imaging for differentiation between the 2 entities. Transthoracic echocardiography is the first-line examination and allows the evaluation of the hemodynamic characteristics of the prosthetic valve; an increase in the gradient and a decrease in the valve area may alert to a possible obstruction. In our case, the gradient across the mitral valve prosthesis was estimated at 27 mmHg in the absence of a high-output state. On the other hand, its ability to visualize a thrombus or a pannus can be altered by the presence of acoustic shadow or by characteristics related to the patient, notably the size or the existence of an underlying pulmonary pathology. Fluoroscopy allows to appreciate the valvular motion but does not differentiate between thrombus and pannus. Transesophageal echocardiogram allows a better evaluation of the prosthesis; the presence of mobile masses with a decrease in ultrasound intensity points to a thrombus. It complements transthoracic echocardiogram by visualizing the left atrial portion of a mitral prosthesis [7,8]. In a meta-analysis by Kim et al. [8], cardiac CT was the most sensitive (88%) for detecting subprosthetic masses. This could be explained by its high spatial resolution but also by the fact that it is less affected by metallic objects. On the other hand, for the diagnosis of thrombus, transesophageal echocardiogram was more sensitive (75%) than CT (45%) but less specific. A prospective study by Gündüz et al. [9] suggests that CT is a useful tool for the differential diagnosis between thrombus and pannus. They demonstrated that high attenuation ($UH \geq 145$) was in favor of thrombus, whereas low attenuation was rather suggestive of thrombosis. They even suggested that high attenuation (≥ 90 HU) was associated with less efficient fibrinolysis.

Although cardiac multidetector computed tomography allows more precise differentiation between a thrombus and a pannus, it also provides information about the structure of the valve prosthesis and its function. Its combination with

the electrocardiogram allows to evaluate the movement of the leaflets in systole and diastole [10].

In addition, it is important to emphasize that single-energy CT can sometimes be insufficient for the evaluation of prosthetic valves and their dysfunction owing to streak artifacts and poor contrast-to-noise ratio when the tension of the tube used is higher. That is why dual-energy CT plays an important role in overcoming these problems by providing reconstructed monoenergetic and iodine-only images tools to improve the visualization of prosthetic heart valve (PHV). This technique uses 2 X-ray acquisition spectra to differentiate the molecules composing the body tissues on the basis of their atomic number [11].

Conclusion

Pannus-related prosthetic valve dysfunction is a rare but serious cardiac disorder. Cardiologists should not hesitate to use advanced imaging techniques whenever there is doubt between the diagnosis of pannus and thrombus because the subsequent management depends on it.

Availability of data and materials

Data sharing is not applicable to this article as no datasets were generated or analyzed during the current study.

Patient consent

Written informed consent was obtained from the patient for publication of this case report and accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal on request.

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