3D Transesophageal Echo in Percutaneous Correction of Paraprosthetic Regurgitation

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Introduction

About 210,000 valve replacement surgeries are performed annually worldwide. Paraprosthetic regurgitations are a complication that can happen, especially in mechanical prostheses and reoperations, reaching a prevalence of 10 to 15% in follow-up studies[1].

Surgical treatment remains the first choice, especially when there are significant symptoms and hemolysis. However, due to high perioperative mortality (6-14%)[2,3], percutaneous techniques for correction of paraprosthetic regurgitation have been developed, although there are not yet specific occlusion devices.

Real time three-dimensional transesophageal echocardiography (3DTEECHO) plays a fundamental role in the procedure since diagnosis, quantification of regurgitation, location and measurements of the regurgitant orifice, guiding in real-time the implantation of percutaneous prostheses.

The initial experience of our service is four cases of occlusion of mitral paraprosthetic regurgitation percutaneously. Although we have not achieved complete resolution of regurgitation in three cases (two remained with moderate regurgitation and one with discreet regurgitation), it is worth noting that the procedures were conducted without complications and all patients improved functional class after implantation. In order to discuss the role of echocardiography this context, we describe a case where the complete occlusion of the paraprosthetic defect was achieved after implantation of the devices.

Case Report

Male patient, aged 76, assisted in August 2010, complaining of progressive dyspnea on exertion for two years, which had worsened one month before, accompanied by episodes of presyncope. The patient was diagnosed with severe aortic stenosis and, in January 2011, he underwent surgery for aortic valve replacement with a bioprosthesis and was discharged on the seventh postoperative day, which was uneventful.

In April 2011, he was hospitalized with fever, dysarthria and ejection systolic murmur in the aortic area. The hypothesis of infective endocarditis was confirmed by transesophageal echocardiography that showed an image of an abscess near the anterior annulus and prosthetic vegetations, and severe mitral regurgitation and mild left ventricular systolic dysfunction. Blood cultures were positive for *S. aureus* and brain computed tomography scan showed left front hypodense lesion (probably septic embolism). The patient received treatment with vancomycin, gentamicin and rifampicin. He underwent further surgery with implantation of bioprostheses in aortic and mitral positions. He was discharged after two months of hospitalization.

After four months, the patient underwent transthoracic echocardiography that revealed bioprostheses with anatomically normal leaflets and the presence of severe mitral paraprosthetic regurgitation. This finding was confirmed by 3DTEECHO, which found the location of the leak and measured the dimensions of the defect (Figure 1A).

Due to the high surgical risk, percutaneous correction of the paraprosthetic regurgitation was chosen on November 30, 2011. The procedure was performed under general anesthesia and started with the puncture of the right femoral vein and left femoral artery. Subsequently, transseptal puncture was performed with the aid of echocardiography, which helped find the catheter in position in order to allow access to the mitral valve. Paraprosthetic regurgitation was then found by 3DTEECHO and measured in its length and diameter to plan the number and size of devices to be deployed. Subsequently, the interventionist tried to cross the defect assisted by 3DTEECHO. At this time, the echocardiography was crucial, since the natural tendency of the catheter is to cross the prosthesis through its center hole. Once the catheterization of the defect was confirmed by 3DTEECHO, two therapeutic catheters were separately introduced and two Amplatzer™ Vascular Plugs III were implanted. 3DTEECHO guided as to the correct position and release of the prostheses. At the end, it was demonstrated that the paraprosthetic regurgitation had completely disappeared (Figure 1B). The procedure was uneventful. The patient was extubated in the catheterization laboratory and remained under observation for about two hours and taken to the infirmary.

Keywords

Echocardiography, Transesophageal; Echocardiography, Three-Dimensional; Heart Valves / surgery; Heart Valve Prosthesis.

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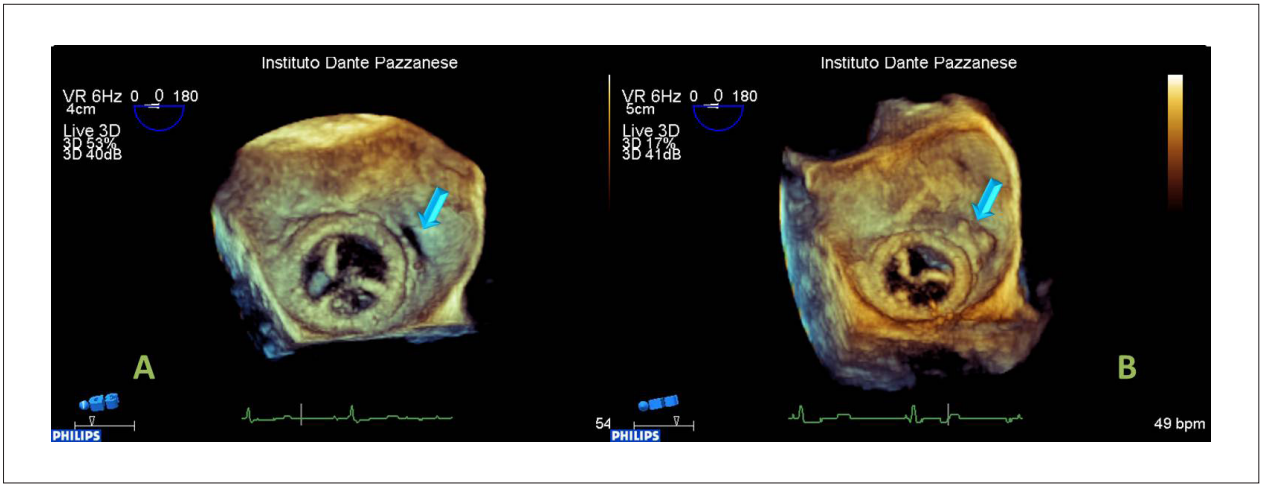

Figure 1 - *Image "A" shows, on 3DTEECHO, mitral paraprosthesis discontinuity before closing (arrow). In B, there are two devices (Amplatzer™ Vascular Plug III) completely occluding the defect.*

The patient underwent control transthoracic echocardiography after two days, which revealed normal bioprostheses and no mitral regurgitation. He was discharged on the same day.

Discussion

Worldwide experience with percutaneous correction of paraprosthetic regurgitation is still small. In a case series published in 2008, with 27 patients who underwent implantation of percutaneous devices, 30% showed a significant reduction in paraprosthetic regurgitation without any deaths or significant complications related to the procedure[4].

In 2011, Sorajja et al showed the results of the largest case series to date. Of the 126 patients that underwent percutaneous correction of paraprosthetic regurgitation, 76% left the catheterization laboratory without residual regurgitation or mild regurgitation. In this group, during follow-up of three years, survival free of surgery or cardiovascular death was 64%, while in the group with moderate/severe residual regurgitation, this survival was significantly lower (31%). There were no deaths during the procedure, but three deaths occurred within 30 days, in addition to two episodes of cerebrovascular accident[5].

3DTEECHO plays an essential role as an aid to the percutaneous treatment. Before the procedure, this type of echocardiography allows confirming the diagnosis, the severity of the defect, and assessing the likelihood of success by accurately placing the paraprosthetic regurgitation, which is of paramount importance, because the largest case series published showed that subsequent defects present a higher success rate after the procedure[6].

Furthermore, 3DTEECHO allows planning the number and size of the devices to be implanted by defining the size and shape of the defect, which is only possible by three-dimensional imaging. Note that after the release of the devices, because of the possibility of embolization, a new catheterization of the orifice is dangerous. Therefore, the interventionist needs to know in advance how many and which devices will be used to achieve complete occlusion.

During the procedure, 3DTEECHO helps guiding the catheter to cross the defect, because the two-dimensional angiographic image does not allow finding the leak and does not enable the interventionist to make sure whether the catheter is inside or outside the prosthetic ring. During release of the device, real time echocardiographic monitoring is necessary to monitor the complications that may occur, such as prosthesis migration and compression of adjacent structures. Finally, evaluation of the result at the catheterization laboratory through 3DTEECHO facilitates the patient's clinical follow-up immediately after implantation of occlusion devices.

It is worth mentioning that there are no percutaneous prostheses for the specific purpose of correcting paraprosthetic regurgitation that fit the "irregular anatomy" usually found in these cases. Therefore, the development of specific devices that can be visible on echocardiography will certainly provide the best results.

Anyway, percutaneous correction of paraprosthetic regurgitation in patients at high surgical risk seems to be a promising method as experience with images, with the devices and with the technique is gained. Interventionists, echocardiographers and surgeons are increasingly learning to work together in the so-called hybrid procedures. This seems to be a global trend, particularly for valve diseases.

Author contributions

Conception and design of the research: Le Bihan DCS, Toledo LMG, Barretto RBM, Esteves CA, Assef JE, Sousa AGMR; Acquisition of data: Le Bihan DCS, Toledo LMG, Barretto RBM, Esteves CA; Analysis and interpretation of the data: Le Bihan DCS, Toledo LMG, Barretto RBM, Esteves CA, Assef JE, Sousa AGMR; Writing of the manuscript: Le Bihan DCS, Toledo LMG, Assef JE; Critical revision of the manuscript for intellectual content: Le Bihan DCS, Toledo LMG, Assef JE, Sousa AGMR.

Potential Conflict of Interest

No potential conflict of interest relevant to this article was reported.

Study Association

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