SCIENTIFIC LETTER

SURGICAL IMPLANTATION OF TRANSCATHETER BALLOON EXPANDABLE PROSTHESIS IN MITRAL POSITION: A CASE WITH SEVERE CALCIFIED MITRAL ANNULUS

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ABSTRACT

We present the case of a female patient with mitral valve disease with severe stenosis and moderate insufficiency but with a calcified mitral annulus that compromised the anterior leaflet and mitral valve apparatus and multiple comorbidities. An inverted balloon expandable bioprosthesis was implanted in the mitral position without complications. The patient was discharged on the fifth postoperative day. The clinical and echocardiographic control performed one month later was satisfactory.

Keywords: *mitral annulus, annular calcification, prosthesis.*

Received: 06/25/2024 ***Accepted: 08/05/2024*** ***https://doi.org/10.55200/raccv.v22.n3.0078***

INTRODUCTION

Calcification of the mitral annulus (CAM) is a chronic degenerative process. When severe, it is usually accompanied by stenosis and mitral insufficiency. Although its frequency has been low in past decades, it has been increasing given the larger elderly population in society, the use of radiotherapy, and arterial hypertension.

The therapeutic offer for severe ASC is minimal; surgery implies a very high risk of surgical mortality and morbidity and mortality. The intense calcification of the mitral apparatus and the distorted geometry of the left ventricle limit therapeutic options with transcatheter and minimally invasive surgery. When severe stenosis is present, and the patient is not a candidate for percutaneous valvuloplasty, they are usually excluded from a surgical or transcatheter procedure.

CLINICAL CASE

A 78-year-old female patient, 1.45 cm tall and weighing 43 kg, with a history of insulin-requiring diabetes and non-dialytic renal failure, was admitted to the emergency service with dyspnea in functional class IV and mitral valve disease with severe stenosis and moderate insufficiency. The echocardiogram confirms the diagnosis and shows that the mitral annulus and subvalvular apparatus are very calcified, with an ejection fraction of 54% and a left ventricular diastolic diameter of 56 mm. Cardiac angiotomography showed a calcified mitral annulus, which compromised 80% of the mitral perimeter and the subvalvular apparatus. The 32 mm high sclerocalcified anterior leaflet (*Figure 1*) and the left ventricular outflow tract with a diameter of 20 mm were also observed. The mean mitral transvalvular gradient is 14 mmHg, with a pulmonary artery systolic pressure of 45 mmHg. A cine-coronary angiography was performed, which showed no evidence of coronary artery disease, and left dominance was observed. The case was presented in a clinical-surgical session, and it was decided that mitral valve surgery should be performed. Given the high surgical risk, with Euro score II of 14.72% and STS score of 13.9%, the dense subvalvular calcification, the anterior leaflet's height, and the outflow tract's diameter, the transcatheter approach was not considered.

TECHNIQUE

A median sternotomy was performed, with aortic arterial cannulation and venous cannulation in the caval veins, isolated by umbilical tapes. After achieving adequate anticoagulation, extracorporeal circulation was started, with aortic clamping and administration of cardioplegia via anterograde route (Custodiol™, 2 liters). In cardiac arrest, we performed a left atriotomy parallel to Soondergard's groove, atrial, mitral, and mitral subvalvular exploration. We positioned silk sutures 1 to 5 clockwise and fixed them to the pericardium for better mitral exposure. We exposed the anterior leaflet and performed a partial section of the anterior leaflet, trying to leave a circumferential foramen without touching the mitral annulus. We also resected the first-order chordae tendineae of the residual anterior and posterior leaflet; we did not resect the calcified abutment. We performed mitral residual foramen sizing with Edwards Perimount Magna Ease mitral valve tester™ 25 mm and, under direct vision, implantation of an Edwards Sapiens 3 balloon-expandable prosthesis™ (size 23), mounted in reverse, with nominal volume (*Figures 2* and *3*). After the saline leak test, there was no perivalvular leak. We performed left atriorrhaphy, and extracorporeal circulation was suspended. The clamping time was 45 minutes; the extracorporeal circulation time was 53 minutes.

The patient evolved favorably and was discharged on postoperative day 6 without complications. One month later, she did not present dyspnea in the clinical control and ambulated freely. Echocardiographic control showed an ejection fraction of 65%, normofunctional valve prosthesis without a periprosthetic leak, and a mean transprosthetic gradient of 3.4 mmHg.

DISCUSSION

Calcification of the mitral annulus is mainly characterized by annular calcification with greater or lesser involvement of the leaflets and chordae tendineae. Its etiology still needs to be fully understood. However, it is known to have a chronic evolution, where calcium phosphate deposits are triggered by hormonal and inflammatory processes, chronic kidney disease, and bone degeneration, among other factors[1]. This pathology has a high surgical morbimortality when surgical intervention is required due to mitral stenosis or insufficiency. In the Framingham study, an incidence of 8.5% was found in post-mortem studies and 2.8% in echocardiographic studies[2,3]. In 30% of patients with mitral disease and indication for intervention, the transcatheter option becomes vitally essential; in this scenario, four possibilities arise: implantation on the native mitral bioprosthesis, prosthetic ring and ring, and the calcified mitral ring. In the United States, in 2019, of the total 1120 procedures performed, 75%

were valve-on-valve (ViV), 15% on prosthetic mitral ring (ViRing), and 10% were on CAM[4].

The preoperative assessment of these patients is of great importance because, when correctly performed, it allows us to choose the best possible therapy. The study of multimodal imaging with particular emphasis on three-dimensional tomographic reconstruction would enable us to simulate both transcatheter and hybrid procedures and even minimally invasive surgical techniques[5,6].

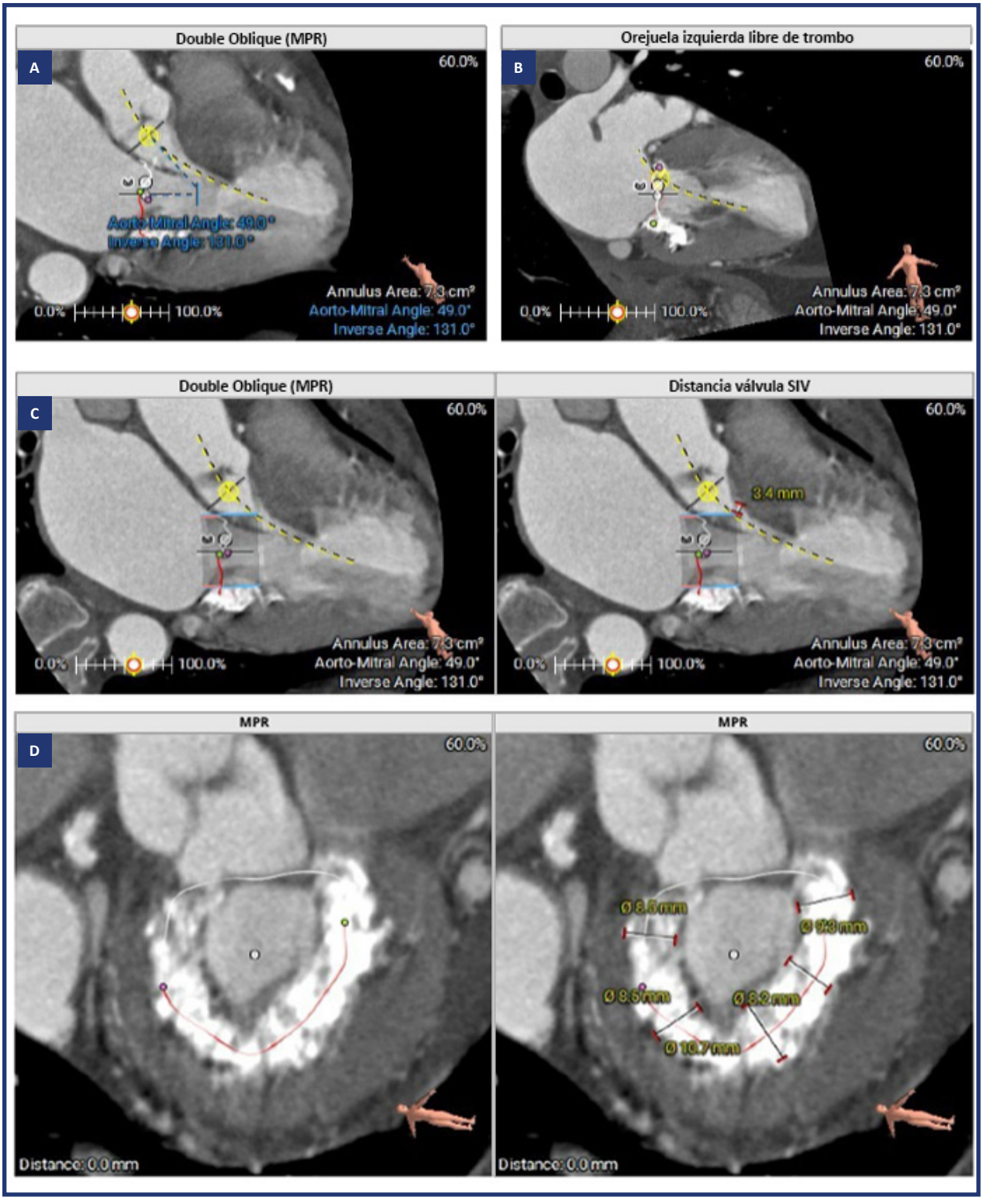

FIGURE 1. Contrast tomography reconstructed in multiple planes. **A.** Parallel to the left ventricular outflow tract. **B.** Relationship with the left atrial appendage. **C.** Mitro-aortic relationship and veloseptal-ventricular distance. **D.** Reconstruction of the mitral annulus (calcification of 80%).

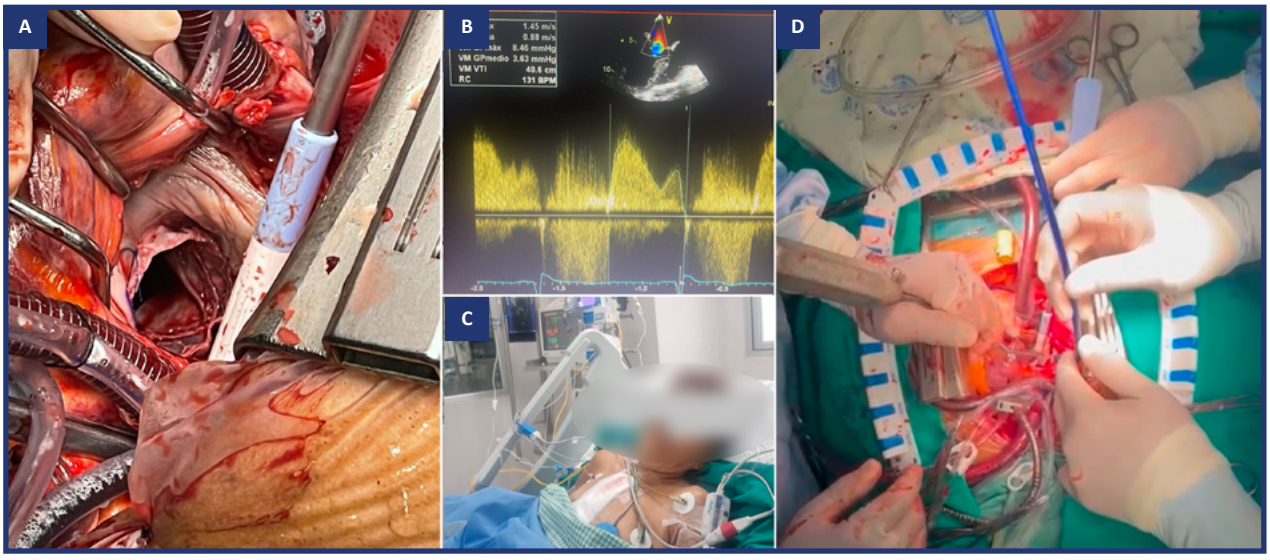

FIGURE 2. **A.** Balloon expandable valve already implanted. **B.** Residual trans-prosthetic gradient. **C.** Patient in the first hour after surgery (early recovery technique or fast track). **D.** Balloon valve implantation maneuver expandable balloon valve.

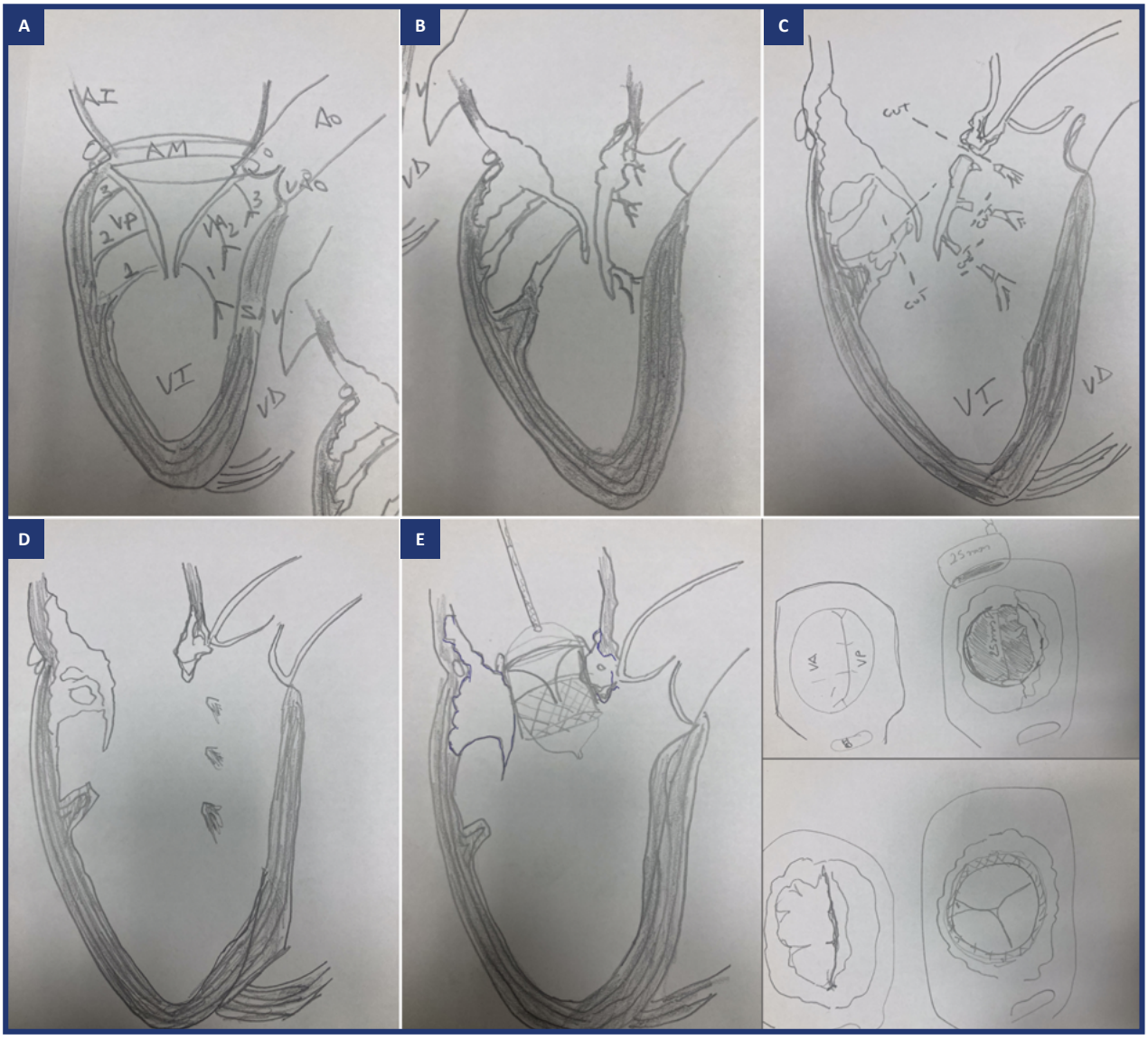

FIGURE 3. **A.** Relationship of mitral leaflets, chordae, and left ventricular outflow tract. **B.** Mitral-aortic relationship in a calcified mitral annulus. **C.** Partial resection of anterior mitral leaflet and first-order chordae in the fixed posterior leaflet. **D.** Mitral-aortic relationship after resection of the anterior mitral leaflet. **E.** Balloon expandable prosthesis implantation via the atrial route surgical.

CONCLUSION

In the case of the patient presented here, with severe stenosis with moderate insufficiency and calcification of at least 80% of the mitral annulus, leaflets, chordae, and papillary muscle, the possibility of offering a percutaneous transcatheter solution was considered. However, after considering that the long anterior leaflet (35 mm) was calcified, the left ventricular outflow tract measured 25 mm, and there was an intense fusion of first and second-order chordae, even with calcification of the papillary apex, the surgical approach by median sternotomy was chosen since it offered the possibility of controlled resection of the anterior leaflet and release of the subvalvular fusion of chordae tendineae.

Declarations

The authors declare no conflict of interest.

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