Percutaneous Mitral Repair with MitraClip® as an Adjunct Therapy of Heart Failure

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Introduction

Mitral regurgitation (MR) is a very common valvular heart disease and a frequent finding in patients with advanced heart failure (HF), with an estimated prevalence of 1.7% of the US population, increasing with age, reaching 9.3% in those older than 75 years of age.

Mitral regurgitation (MR) is classified as primary (also known as organic) when it is due to degenerative abnormalities of the valve, chordae tendineae, papillary muscles and mitral annulus, and secondary (also known as functional), which occurs in the absence of organic disease of the mitral valve (VM), usually from the left ventricle with dysfunction. It is more common than the primary one and it is associated with a worse prognosis.[1]

Although surgery is the gold standard therapy for patients with primary mitral valve disease, its benefit to patients with MR secondary to ventricular dysfunction remains unclear.[2] These cases are often referred to isolated clinical management, presenting poor long-term prognosis.

We report two cases of a severe MR due to HF refractory to optimized medical treatment with high cardiovascular risk to perform mitral valve replacement treated with MitraClip® implant.

Case Report

Case 1

JQ, 81, male, with chronic obstructive pulmonary disease, stage 3 chronic renal failure, HF and atrial fibrillation (AF), reported fatigue and dyspnea at rest. Physical examination revealed blood pressure (BP) of 100 x 60 mmHg, heart rate (HR) of 68 bpm, in use of losartan 50 mg/day, metoprolol succinate 50 mg/day, amiodarone 200 mg/day, furosemide 40 mg/day, spironolactone 25 mg/day, rivaroxaban 15 mg/day, miflasona and indacaterol. Electrocardiogram (ECG) showed AF, QRS 90 ms, Holter with AF rhythm, and average HR of 70 bpm, 11494 ventricular premature beats, with 55 episodes of non-sustained ventricular tachycardia. Coronary angiography without injuries and magnetic resonance imaging without late enhancement. Transthoracic echocardiography (TTE) and transesophageal echocardiography (TEE) showed severe eccentric MR (4+/4) with retraction of the posterior leaflet and chordal rupture (segment P1). Left ventricular (LV) diastolic diameter measured 79 mm and systolic diameter 64 mm, left atrium (LA) 62 mm, with left ventricular ejection fraction (LVEF) by the Simpson method of 32%. Systolic pulmonary artery pressure (SPAP) was 57 mmHg (Figure 1).

After optimization of clinical treatment, the patient remained symptomatic, functional class (FC) IV, and due to STS score of 29% for morbidity and mortality in conventional surgery, after discussion with the Heart Team, MitraClip® implant was chosen.

The procedure was carried out in the catheterization laboratory. Puncture of the right femoral vein followed by transseptal puncture was performed to get access to the left atrium and to place the MitraClip® while guided by three-dimensional TEE. The MitraClip® was closed by capturing the segments A1 and P1 of the mitral valve cusps, reducing MR from 4+/4 to 2+/4, choosing to implant a second MitraClip® in segments A2 and P2, hence reducing MRI to 1+/4. The procedure time was 1 hour and 40 minutes (Figure 1).

The patient was discharged one week after the procedure, in functional class II, remaining under clinical follow-up of seven months.

Case 2

JB, 82, with dilated cardiomyopathy of hypertensive etiology, stage 4 chronic renal failure (CRF), with pacemaker implanted in 2011 due to sick sinus syndrome with multiple hospitalizations due to decompensated HF, requiring high doses of furosemide for clinical compensation. Physical examination showed BP 110 x 80 mmHg, HR 70 bpm, use of enalapril 40 mg/day, carvedilol 50 mg/day, furosemide 120 mg/day, spironolactone 25 mg/day, simvastatin 40 mg/day and warfarin. Complementary evaluation revealed pacemaker rhythm on ECG, coronary angiography without injuries and NT-proBNP of 13,155 pg/mL. TTE and TEE revealed mitral valve with severe central MR (4+/4) due to valve annulus dilatation and calcification of the posterior leaflet with

Keywords

Mitral Valve Insufficiency; Heart Failure; Aged, 80 and Over; Cardiac Catheterization; Decision Support Techniques; Risk Factors; Treatment Outcome.

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some reduction of mobility (Figure 2). LV diastolic diameter measured 75 mm and systolic diameter, 65 mm, with akinesis of the inferior wall and severe systolic dysfunction with LVEF of 28%, and severe dilation of the right chambers with right ventricular dysfunction, severe tricuspid insufficiency and PSAP of 55 mmHg.

As the patient had a high STS score of 35.1% for morbidity and mortality, MitraClip® was implanted.

The same technique described in the previous case was adopted, using a single MitraClip® in the segments A2 and P2 with immediate MR reduction from 4+/4 to 1+/4+, creating a double mitral orifice (Figure 3). The procedure time was 1 hour and 15 minutes.

The patient was discharged three days after the procedure in FC I, discrete MR (Figure 4).

Discussion

Treatment of HF is intended to improve the patients' quality of life and symptoms, reduce hospitalizations and improve survival. The most effective therapies are drug treatment, cardiac resynchronization therapy, and coronary artery bypass grafting in patients with extensive ischemia and myocardial viability. In patients with severe HF and secondary MR refractory to conventional therapies, the range of options is smaller and should consider the surgical treatment of the mitral valve or even the use of ventricular assist devices and heart transplantation.

The current guidelines for surgery in secondary MR, according to the guidelines for valvular diseases of ACC/AHA 2014, have three recommendations: The first one states that MV surgery is reasonable for patients with chronic secondary and severe MR (stage C and D), who will undergo coronary artery bypass grafting or aortic valve replacement (Class IIa). The second one states that MV repair can be considered for patients with chronic moderate secondary MR (stage B) undergoing another cardiac surgery (FC IIb), and the third recommendation is that isolated mitral valve surgery may be considered for highly symptomatic patients (FC III to IV) with chronic severe secondary MR (D stage) who have persistent symptoms despite optimal medical treatment for HF (FC IIb).[2]

Similarly, the European guidelines (2012) recommend Class IIb for isolated mitral valve repair in cases of severe secondary MR, but only for low surgical risk patients with LVEF > 30%.[3]

If the surgical risk is considered prohibitive, the patient is referred to clinical treatment. It is estimated that about half of symptomatic patients with severe MR do not undergo surgery. For those patients without a good therapeutic option, mitral valve transcatheter repair becomes a viable therapeutic alternative, especially with the implant of MitraClip®.

The MitraClip® system is a new percutaneous device for treating mitral regurgitation, based on the Alfieri surgery, which consists in the central suture of the two mitral cusps, creating a double orifice valve. A less invasive way of doing this with a mechanical clip was developed through cardiac catheterization.

The MitraClip® transcatheter implant enables a less invasive approach to severe MR and it is supported by the EVEREST II study, which included 279 patients from 37 US and Canadian institutions, randomized (2:1) for MitraClip® or for conventional surgery. The average age of the patients in the MitraClip® group was 67, of whom 63% were men. The mean LVEF was 60% and 34% had AF. The main cause for recommending the procedure was degenerative (73%). Except for heart failure, more prevalent in the MitraClip® group (91% vs. 78% $p < 0.01$), all other clinical characteristics were similar between the groups. Comparing the treatments, 101 patients (62.7%) in the MitraClip® group reached primary composite endpoint compared with 66 patients (66.3%) in the surgical group ($p = 0.67$), even with similar mortality between the groups.[4]

In the TRAMI study with 1,064 patients treated with MitraClip in 20 German centers, average age was 75, 87% of patients presented FC III / IV and 69% presented LVEF < 50%. The main cause for presentation was the secondary (71%). Average STS score was 10% for mortality. Success was achieved in 95% of the patients with no deaths recorded and in the 3-month follow-up, 66% of patients were in FC I-II.[5]

The 2013 AHA guidelines for HF treatment define implant MitraClip® as Class IIb of recommendation for symptomatic patients with severe secondary MR despite optimized medical treatment after careful selection of candidates.[6]

Conclusion

MitraClip® was proven an innovative, effective and safe system for the treatment of severe MR with excellent results in these patients with functional MR, being another therapeutic strategy for patients with HF refractory to medical treatment.

Authors' contributions

Data acquisition: Grativvol OS; Manuscript drafting: Grativvol OS, Grativvol KM, Nogueira Jr. AP, Paula JET, Silva ACB; Critical revision of the manuscript for important intellectual content: Grativvol PS.

Potential Conflicts of Interest

There are no relevant conflicts of interest.

Sources of Funding

This study had no external funding sources.

Academic Association

This study is not associated with any graduate program.

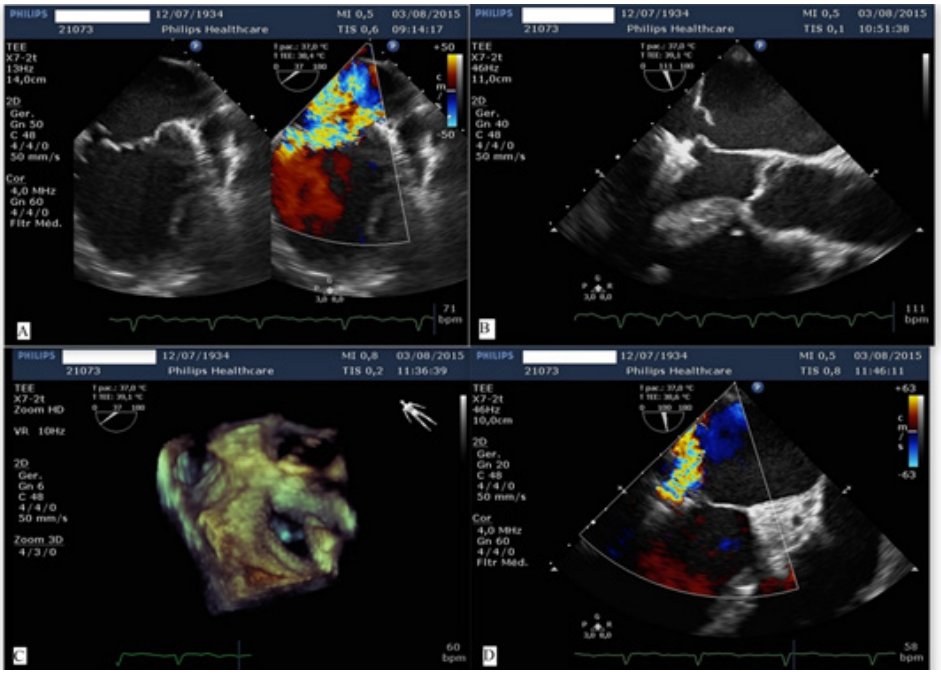

Figure 1 – *Case 1 - A: TEE revealing severe pre-procedure MR; B: TEE guiding the MitraClip implant; C: 3D TEE with MitraClip image; D: Residual MR after MitraClip.*

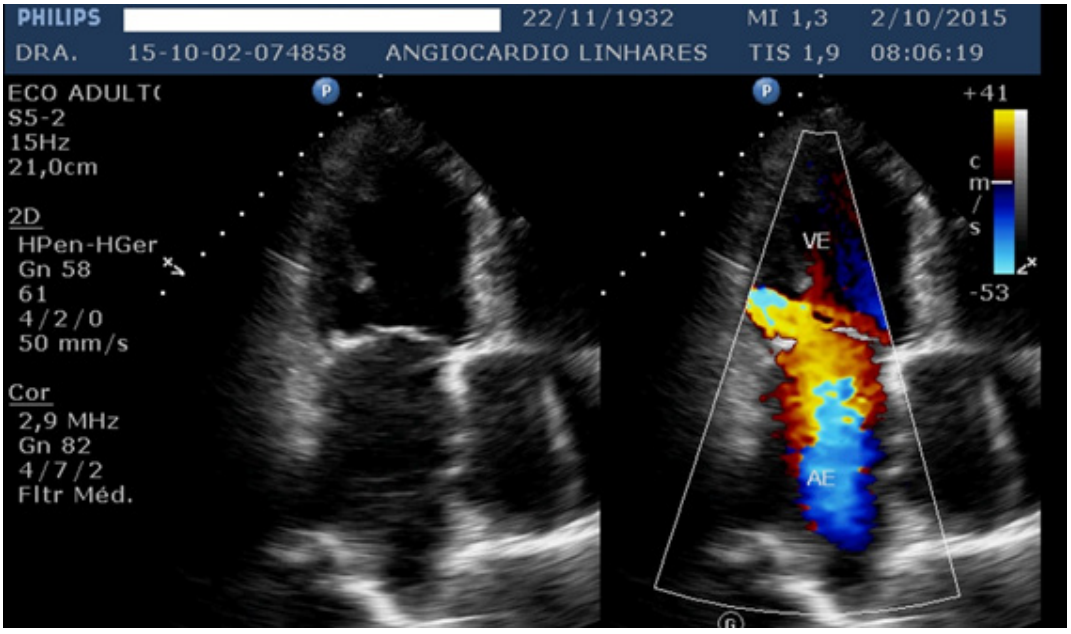

Figure 2 – *Case 2 - TTE showing severe pre-procedure central mitral regurgitation.*

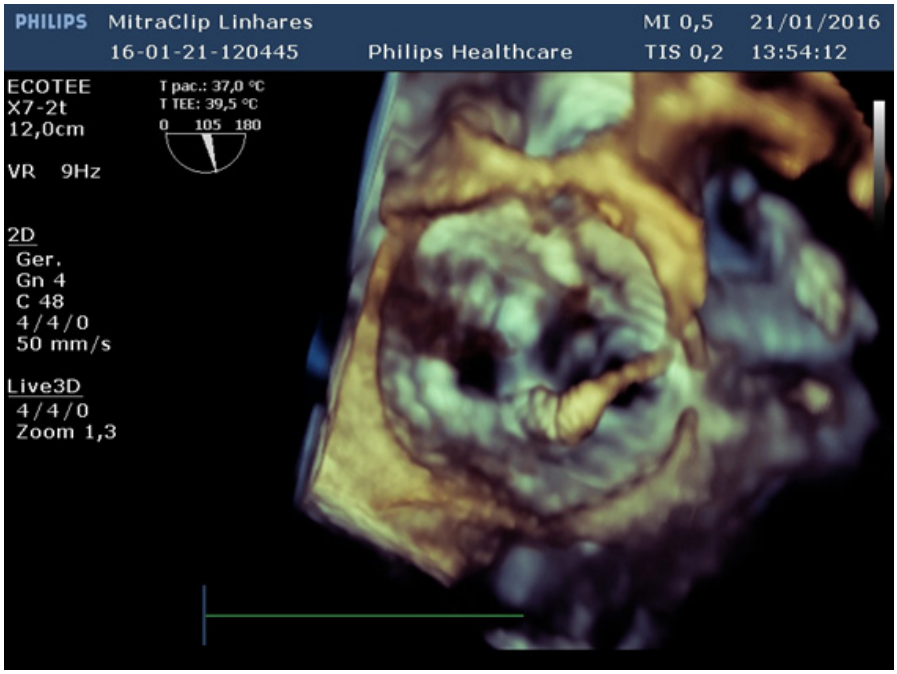

Figure 3 – *Case 2 - 3D TEE with dual orifice image of the mitral valve after MitraClip implant.*

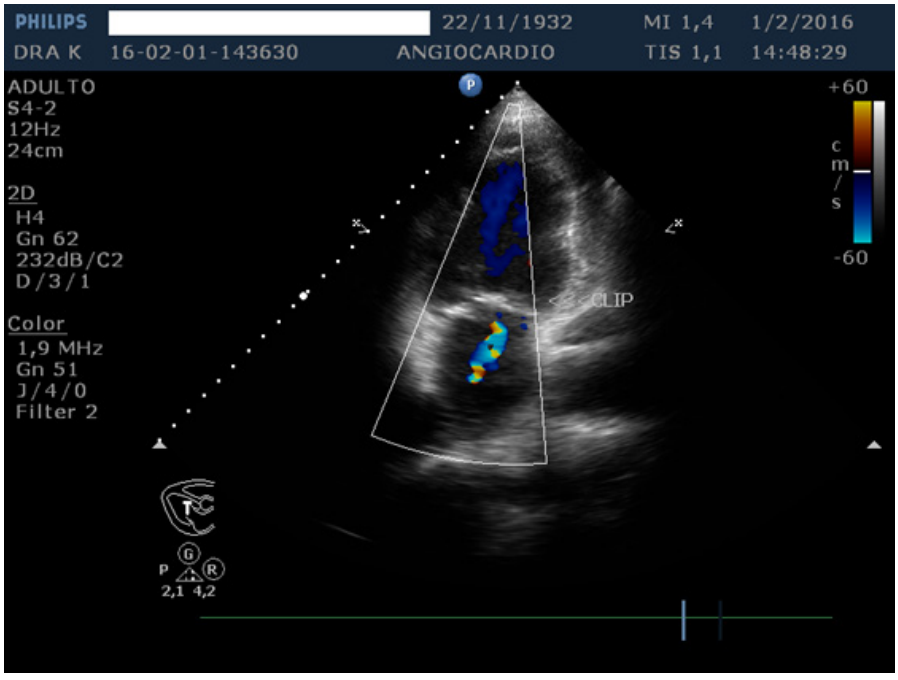

Figure 4 – *Case 2 - Mild mitral regurgitation after MitraClip implant.*

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