

Takotsubo Syndrome After Percutaneous Mitral Valve Repair With Mitraclip®: A Case Report

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Introduction

Takotsubo syndrome (TTS), also known as stress cardiomyopathy or broken heart syndrome, is a condition whose pathophysiology is not well established, but which results from multiple factors that act synergistically in a setting of stress perception and cardiocirculatory response.¹ It was first described in 1990, and the disproportionate and excessive increase in serum catecholamines is known to play a central role in its pathogenesis by favoring the occurrence of complications. Although rare, TTS deserves attention due to its inherent risk of decompensated heart function.^{2,3}

Case report

An 83-year-old man was referred for elective mitral valve repair after multiple hospitalizations for cardiac decompensation, characterized mainly by dyspnea at rest (New York Heart Association [NYHA] functional class [FC] IV). He had significant mitral regurgitation (MR) due to partial rupture of pretendinous cords of the posterior leaflet (P2 segment) and mild myxomatous degeneration (Figure 1). After discussion with the Heart Team, percutaneous mitral valve repair with Mitraclip® was indicated.

The patient's past medical history included systemic arterial hypertension, diabetes, chronic atrial fibrillation with oral anticoagulant therapy, pulmonary hypertension with a pulmonary artery systolic pressure of 52 mmHg, and anxiety disorder. Furthermore, coronary artery disease was detected during preoperative catheterization, and percutaneous transluminal angioplasty of the proximal third of the left anterior descending (LAD) artery was performed after identification of a type A lesion (70%), followed by stenting (Figure 2).

Mitraclip® implantation was performed via the right femoral vein. After transeptal puncture guided by three-dimensional transesophageal echocardiography, the delivery catheter was advanced across the septum. Two clips were implanted: the first

was placed at the A2-P2 segment, and the other was placed lateral to the first (Figure 3). After the procedure, mild MR was identified, with a mean transmitral gradient (TMG) of 5.8 mm Hg in the orifice with the greatest TMG. There were **no** complications during the procedure.

On postoperative day 3, the patient developed hyperactive delirium, dyspnea requiring oxygen therapy, and tight, continuous, intense chest pain (not radiating). On physical examination, the patient presented confusion, mucocutaneous pallor, diaphoresis, tachypnea, and an oxygen saturation of 98% on 2 lpm of oxygen by nasal cannula. No adventitious sounds were detected on respiratory auscultation. His blood pressure was 150/70 mm Hg and heart rate was 109 bpm, with an irregular heart rhythm. The peripheral pulses were palpable and symmetric.

Electrocardiography (ECG) revealed symmetrically inverted peaked T-waves in the anterolateral leads, and laboratory tests showed an elevated high-sensitivity cardiac troponin level (73.8 ng/mL; reference range < 14 ng/mL), suggesting non ST-elevation acute coronary syndrome (ACS).

A transthoracic echocardiogram (TTE) revealed significantly reduced left ventricular ejection fraction (LVEF) – from 51% to 25% (Simpson) – and significant apical hypokinesia as well as in the mid-anterior, mid-anteroseptal, and mid-anterolateral walls.

In view of the complementary exams, an emergency coronary cineangiography was performed, which ruled out significant coronary lesions and revealed a patent stent in the LAD artery, but with increased systolic volume due to extensive anterior, inferior, and apical akinesia (sparing only the base) on ventriculography (Figure 4).

Because of absence of thrombotic lesions on angiography, the patient remained hospitalized and receiving clinical treatment. On postoperative day 4, troponin levels were significantly reduced to 24.3 ng/mL. The patient was clinically improved and discharged from hospital.

One year after the intervention, the patient remained clinically stable (NYHA FC II). Control TTE showed LVEF recovery to 61% (Simpson), moderate MR, and mild stenosis (TMG 4.0 mm Hg and peak gradient (Gp) 17.0 mm Hg), with normal segmental LV contractility (Figure 5).

In view of the foregoing, a diagnostic hypothesis of TTS secondary to Mitraclip® implantation was made, based on dynamic changes in ECG and echocardiography, elevation of markers of myocardial necrosis, apical “ballooning”, and hyperkinesia of basal segments on ventriculography, with no evidence of coronary artery obstruction on coronary cineangiography despite recent stent implantation at the LAD artery, in a setting of postoperative stress.

Keywords

Takotsubo Cardiomyopathy; Mitral Valve Insufficiency; Case Reports

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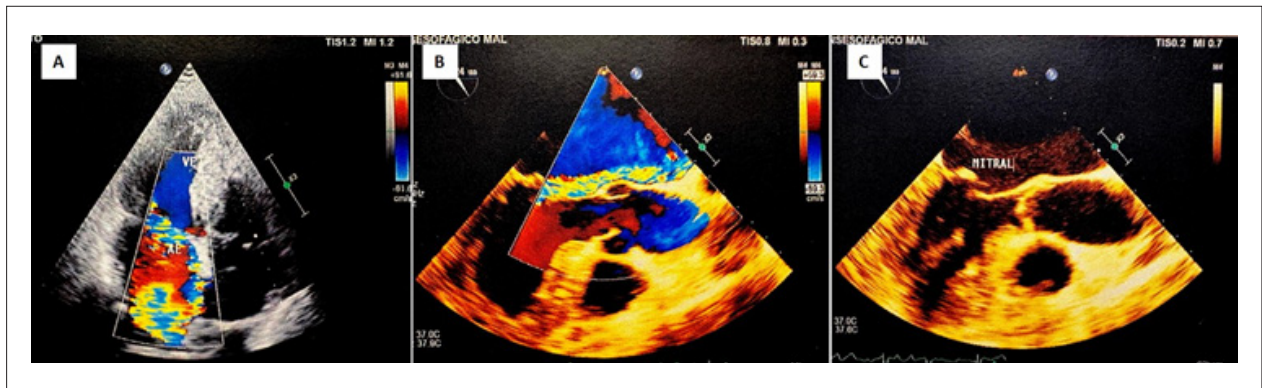


Figure 1 – Preoperative transesophageal echocardiography. (A) and (B): Significant eccentric MR. (C): Mitral valve prolapse with myxomatous degeneration and partial rupture of pretendinous cords (flail) of the posterior leaflet (P2 segment).

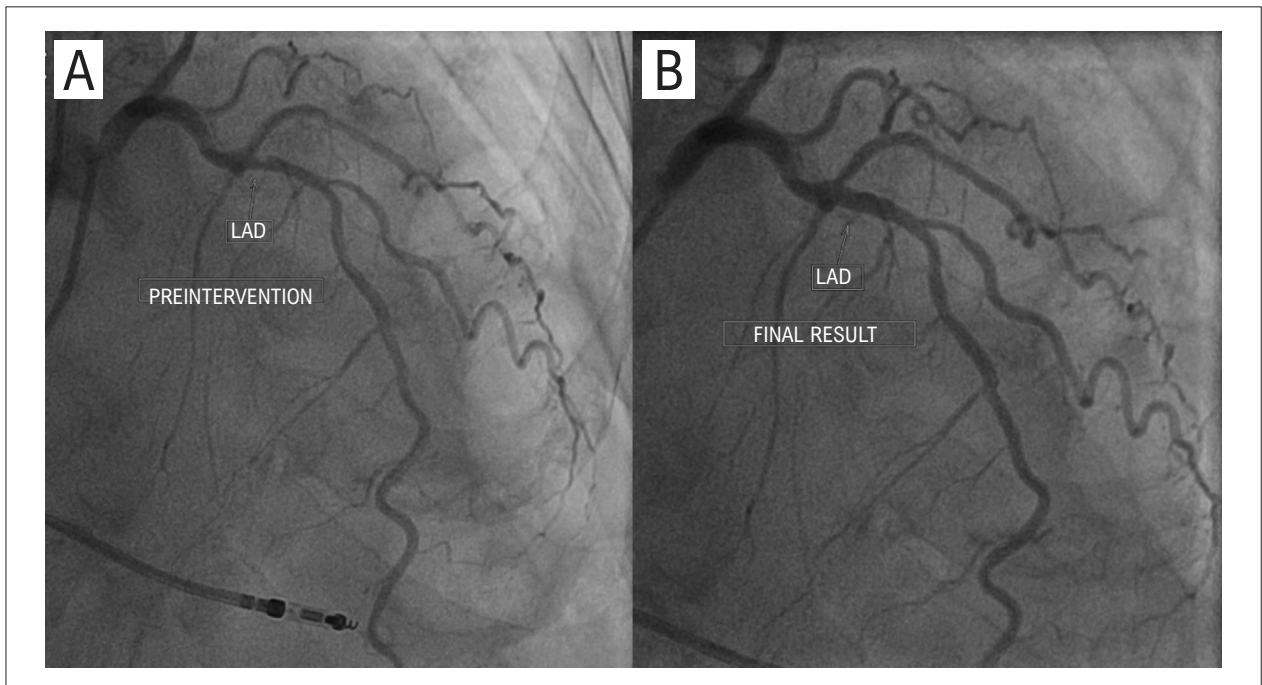


Figure 2 – Coronary cineangiography. (A): Type A lesion (70%) of the proximal third of the LAD artery; (B): Angioplasty of the LAD artery with everolimus-eluting stent (3.0 x 8.0 mm).

Discussion

This case report draws attention to the presumed correlation between TTS secondary to percutaneous Mitraclip® implantation and mitral valve repair in an older male patient at very high cardiovascular risk.

Studies have shown that catecholamines play a central role in the pathogenesis of TTS.² Other aspects that may be related to TTS include macro and microvascular endothelial dysfunction, vasospasm, and calcium overload in myocytes, which cause disorders of ventricular contraction and function, mostly affecting postmenopausal women.^{1,3}

Clinical characteristics are usually similar to those of ACS. Patients present with chest pain, dyspnea, acute

heart failure, abnormal ECG (such as ST segment elevation or depression or T wave inversion), and increased serum troponin. However, these ACS patients do not present troponin peaks, as would be expected in cases of acute myocardial infarction (AMI), nor obstructive lesions that justify the severe contractility deficit observed in TTS. Although rare, TTS is a differential diagnosis of ACS, which may be underdiagnosed given the higher prevalence of AMI due to obstructive coronary artery disease in the general population.¹⁻⁴

Coronary angiography combined with ventriculography is considered the gold standard for TTS diagnosis. It shows apical akinesia of the LV with normal contractility of the base, which creates a “balloon” appearance in its apical

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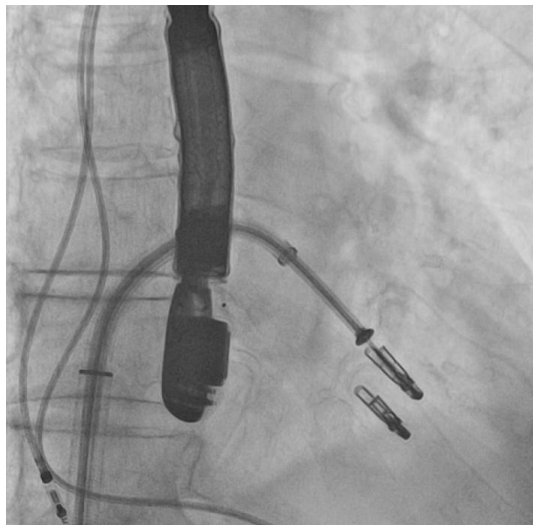


Figura 3 – Percutaneous Mitraclip® NT implantation.

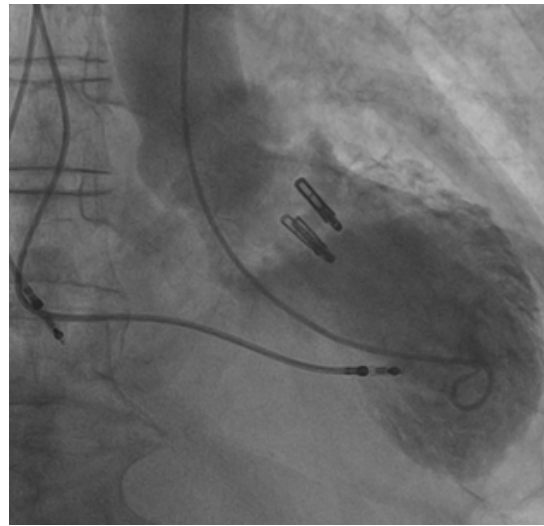


Figura 4 – Ventriculography during systole on the third day after Mitraclip® implantation

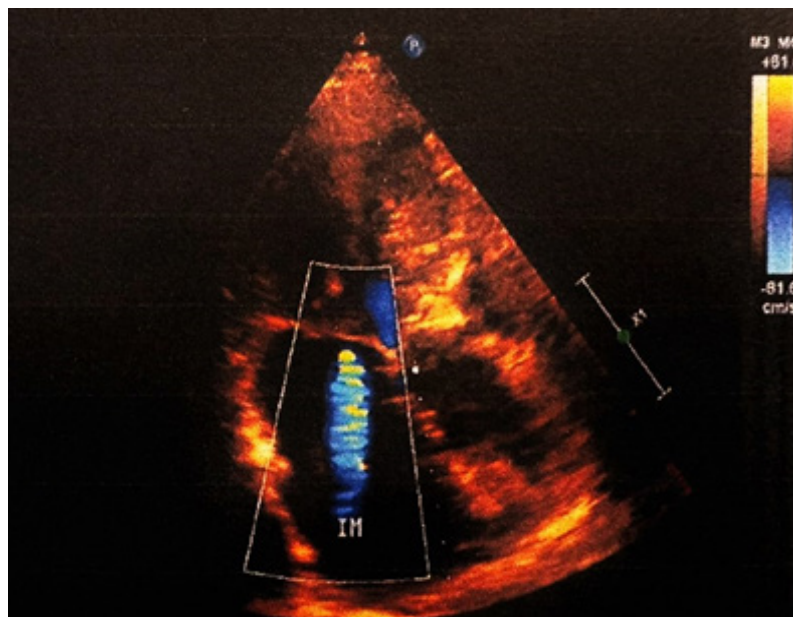


Figure 5 – TTE 1 year after Mitraclip® implantation showing moderate MR.

portion (“apical ballooning”), without evidence of obstructive coronary artery disease.¹

TTS treatment involves clinical support measures. Most cases progress with spontaneous and complete remission within days or weeks. However, the acute phase, which results from complications such as cardiogenic shock, arrhythmias, and cardiac arrest, may be more severe, with high morbidity and mortality rates.^{1,3}

From an epidemiological perspective, TTS is extremely rare. Despite conducting a comprehensive literature search, we found only one report of MitraClip®-related TTS, which occurred in 2020 in the United States. Similar to our case, it was observed in an older male patient and had a favorable clinical outcome.⁵ Another study described the case of a woman with TTS who underwent open surgery to correct severe MR triggered by an adverse reaction to protamine.⁶

MitraClip® implantation is less invasive than thoracotomy valve replacement for the treatment of severe MR. It is considered effective and safe in patients refractory to clinical treatment, with excellent results reported by the COAPT study and its 5-year follow-up, in addition to being an alternative treatment for those at high surgical risk or with contraindications to surgery.^{4,7,8} Despite being less invasive, the percutaneous technique may induce catecholamine release as a result of physical and emotional stress, as also happens in open surgery and hospitalization.² The case described in this report brings attention to the fact that TTS is a potential complication of percutaneous mitral valve repair with MitraClip®.

Author Contributions

Conception and design of the research: Souza AL, Prudente ML, Nogueira ACC, Gardenghi G; acquisition of data: Souza AL; analysis and interpretation of the data and writing of the manuscript: Souza AL, Prudente ML, Gardenghi G; critical revision of the manuscript for intellectual content: Souza AL, Prudente ML, Rodrigues D, Nogueira ACC, Gardenghi G.

References

1. Lyon AR, Citro R, Schneider B, Morel O, Ghadri JR, Templin C, et al. Pathophysiology of Takotsubo Syndrome: JACC State-of-the-Art Review. *J Am Coll Cardiol*. 2021;77(7):902-21. doi: 10.1016/j.jacc.2020.10.060.
2. Gariboldi V, Jop B, Grisoli D, Jaussaud N, Kerbaul F, Collart F. Takotsubo Syndrome After Mitral Valve Replacement for Acute Endocarditis. *Ann Thorac Surg*. 2011;91(3):e31-2. doi: 10.1016/j.athoracsur.2010.10.085.
3. Uribarri A, Núñez-Gil JJ, Conty DA, Vedia O, Almendro-Delia M, Duran Cambra A, et al. Short- and Long-Term Prognosis of Patients with Takotsubo Syndrome Based on Different Triggers: Importance of the Physical Nature. *J Am Heart Assoc*. 2019;8(24):e013701. doi: 10.1161/JAHA.119.013701.
4. Bonow RO, O'Gara PT, Adams DH, Badhwar V, Bavaria JE, Elmariah S, et al. 2020 Focused Update of the 2017 ACC Expert Consensus Decision Pathway on the Management of Mitral Regurgitation: a Report of the American College of Cardiology Solution Set Oversight Committee. *J Am Coll Cardiol*. 2020;75(17):2236-70. doi: 10.1016/j.jacc.2020.02.005.
5. Nomura T, Munehisa Y, Nakashima M, Matsumoto T. Takotsubo Syndrome Following MitraClip Procedure. *Eur Heart J Case Rep*. 2020;4(6):1-2. doi: 10.1093/ehjcr/ytaa384.
6. Li S, Koerner MM, El-Banayosy A, Soleimani B, Pae WE, Leuenberger UA. Takotsubo's Syndrome After Mitral Valve Repair and Rescue with Extracorporeal Membrane Oxygenation. *Ann Thorac Surg*. 2014;97(5):1777-8. doi: 10.1016/j.athoracsur.2013.08.032.
7. Sorajja P, Cavalcante JL, Gössl M. The Need for Transcatheter Mitral Valve Replacement. *J Am Coll Cardiol*. 2019;73(11):1247-9. doi: 10.1016/j.jacc.2018.11.062.
8. Stone GW, Abraham WT, Lindenfeld J, Kar S, Grayburn PA, Lim DS, et al. Five-Year Follow-Up After Transcatheter Repair of Secondary Mitral Regurgitation. *N Engl J Med*. 2023;388(22):2037-48. doi: 10.1056/NEJMoa2300213.

Potential Conflict of Interest

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

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There were no external funding sources for this study.

Study Association

This study is not associated with any thesis or dissertation work.

Ethics Approval and Consent to Participate

This study was approved by the Ethics Committee of the CEP/HUGO under the protocol number 85497418.2.0000.0033. All the procedures in this study were in accordance with the 1975 Helsinki Declaration, updated in 2013. Informed consent was obtained from all participants included in the study.



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