Case Report

Post-infarction Left Ventricular Pseudoaneurysm Treated with Percutaneous Transcatheter Occlusion: A Case Report

Isabela Galizzi Fae,[1] *Carolina Kuchenbecker Soares,*[1] *Ricardo Wang,*[1,2] *Gustavo Brandão de Oliveira,*[1] *Maria Carmo Pereira Nunes,*[1] *Glaucia Cristina da Silva,*[1] *Rochelle Coppo Militão Rausch,*[2] *Luiz Ricardo de Ataide Castro,*[1] *Anderson Ferreira Leite*[1]

Universidade Federal de Minas Gerais,[1] *Belo Horizonte, MG – Brazil*

Hospital das Clínicas da Universidade Federal de Minas Gerais,[2] *Belo Horizonte, MG – Brazill*

Abstract

Left ventricular pseudoaneurysm (LVPSA) is a rare complication after myocardial infarction (MI) with a significant risk of rupture if untreated. Given the elevated surgical risk in this context, alternative treatments are emerging. This case describes a percutaneous closure of an LVPSA after extensive MI with delayed revascularization.

History of presentation

A 57-year-old male patient sought medical attention at the Urgent Care Center of a Public Hospital in Brazil experiencing squeezing chest pain alongside sweating and dyspnea. His electrocardiogram showed extensive anterior ST-segment elevation with a right bundle-branch block.

The acute coronary syndrome (ACS) protocol and thrombolysis were performed without meeting reperfusion criteria. Rescue angioplasty was unavailable and, due to the COVID-19 pandemic, the patient could only be transferred to a referral hospital the next day. He was admitted to a quaternary hospital with hypertension and in Killip III. The high-sensitive cardiac troponin dosage was 442,000 ng/mL (the upper threshold was 12 ng/mL).

His angiogram revealed severe occlusion (90%) in the left anterior descending artery (LAD) ostium (Figure 1), moderate occlusion (40%) in the circumflex artery, and diffuse discrete atherosclerosis in other coronary arteries. Percutaneous coronary intervention with a pharmacological stent in the left main coronary artery (LMCA) towards LAD was performed.

Transthoracic echocardiogram (TTE) revealed a left ventricular ejection fraction (LVEF) of 38% with akinesia of the apex and mid anteroseptal wall, along with hypokinesia of the basal anteroseptal and inferoseptal walls. Moreover, there was an outpouching in the apical segment of the inferior LV wall with an abrupt transition from normal myocardium, suggesting left ventricular pseudoaneurysm (LVPSA) (Figure 2).

Past medical history

The patient's medical history included hypertension, dyslipidemia, obesity (body mass index of 37 kg/m^2), and family history of coronary heart disease.

Differential diagnosis

The most important differential diagnosis of LVPSA is true LV aneurysm, both mechanical complications after a transmural myocardial infarction (MI). While the former is an outpouching created by myocardial free wall rupture contained by the adjacent pericardium, the latter involves all layers of the LV wall. True LV aneurysm classically has wide necks and are often located in the apical wall, whereas LVPSA typically has narrow necks, are located in the inferior or lateral walls, and are associated with a pericardial enhancement in cardiac magnetic resonance (CMR)[1] imaging due to inflammation of the pericardium and adjacent structures.[2]

In true LV aneurysm, the dyskinetic and fibrotic area is generally resistant to rupture, with a 5-year survival of 71%

Figure 1 – *Angiogram showing severe occlusion in the LAD ostium (yellow arrow).*

Keywords

Myocardial Infarction; False Aneurysm; Percutaneous Coronary Intervention.

Correspondência: Isabela Galizzi Fae •
Hospital das Clinicas da Universidade Federal de Minas Gerais. Av Prof Alfredo Balena, 110. CEP: 30130-100. Bairro Santa Efigênia, Belo Horizonte MG – Brasil
E-mail: isabela.galizzi@gmail.com
Artigo recebido em 18/03/2024; revisado em 18/03/2024; aceito em 18/03/2024.
Editor responsável pela revisão: Marcelo Tavares

DOI: https://doi.org/10.36660/abcimg.20240024i

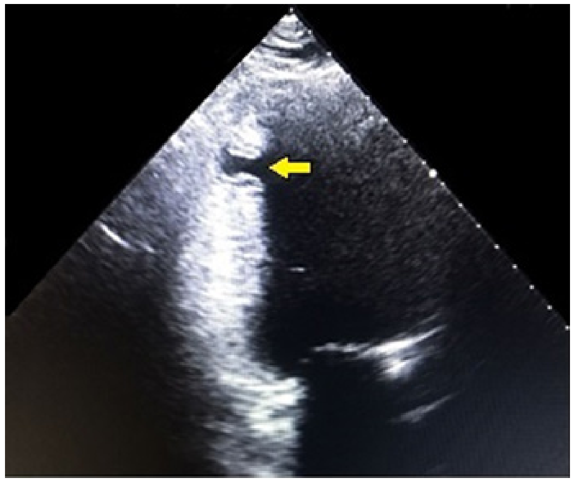

Figure 2 – *TTE showing an outpouching in myocardial wall, suggesting LVPSA (yellow arrow)*

if treated conservatively.[3] In contrast, LVPSA carries a higher risk of rupture, requiring rapid intervention.[4]

Investigation

Cardiac computerized tomography angiography (CCTA) and CMR (Figure 3) were performed to confirm the diagnosis of LV pseudoaneurysm, distinguish it from true aneurysm, and evaluate anatomy for planning intervention.

The CCTA revealed a patent stent in LMCA towards LAD and a myocardial thinning in the apical segment of the inferior wall. In CMR, there was an extended area of transmural late gadolinium enhancement and an LVPSA with neck dimensions of 0.924 cm x 1.150 cm x 1.481 cm in length, width, and depth, respectively (Figure 4).

Management

The patient's preoperative risk was moderate to high (Euroescore II 7,2%). He had recently suffered extensive MI with late reperfusion and developed heart failure with reduced LVEF and functional class NYHA III. Thus, surgical repair was dismissed, and he underwent percutaneous transcatheter closure with a prosthesis used for atrial septal defect closure (Amplatzer), guided by TTE. The prosthesis was successfully implanted, with TTE and ventriculography showing no flow inside LVPSA orifice after the procedure (Figures 5 and 6).

Discussion

LVPSA is a rare complication after MI, with a reported incidence of 0.2 to 0.3% of cases,[1] which carries a high risk of rupture if left untreated (30–45% of the cases).[4,5] The main risk factors for its development are older age, hypertension, poor collateral circulation, late presentation of MI, and delayed revascularization.[5]

The clinical presentation is highly nonspecific.[5] The most common symptoms are chest pain, heart failure, and arrhythmia, although more than 10% are asymptomatic.[4,5] A murmur is detected in around 70% of the cases.[3-5] Electrocardiogram usually shows nonspecific ST-segment alterations and 20% have ST-segment elevation.[5,6]

Ventricular angiography was considered the 'gold standard' for the diagnosis,[3] but it is invasive, time-consuming, and carries a risk of LVPSA rupture due to LV catheter entrapment.[6]

TTE is the first tool nowadays and the pathognomonic feature is a narrow neck at the site of rupture with an abrupt transition from normal myocardium to aneurysmatic scar tissue.[5] Continuous and turbulent flow signals can be seen in color Doppler through the neck of the cavity of LVPSA.[4,6]

CCTA and CMR are the preferred methods, offering enhanced spatial resolution, precise tissue definition, and the ability to differentiate between myocardium, scar tissue, and pericardium.[6] A retrospective study with preoperative CCTA or CMR revealed that myocardial cut-off sign, defined as a >50% decrease in aneurysm sac wall thickness measured at 1 cm from the aneurysm neck, was 91% sensitive and 97% specific to distinguish LVPSA from true aneurysm.[2]

Surgery is considered the first-line treatment for LVPSA[2] and consists of aneurysmectomy and patch closure. Nevertheless, it still carries a high risk of mortality, ranging between 10 to 29%.[3,6]

In 2004, Clift *et al.* performed the first percutaneous device closure of a pseudoaneurysm with an Amplatzer occluder in a high-risk patient.[5] Since then, several case reports described the successful adoption of a variety of closure devices, including Amplatzer septal occluder, ventricular septal defect occluder, and coils,[5] all guided by TTE.[7]

Given the technical complexity of the percutaneous approach, preoperative evaluation is mandatory to establish the appropriate device selection and access route. Size, morphology, localization, length, depth of the neck, and neighboring anatomical structures are essential to define whether the transcatheter closure is feasible.[6] Therefore, this approach is particularly useful for smaller lesions, high surgical risk, and those requiring a redo cardiac surgery.[4]

Contraindications to percutaneous transcatheter closure are left atrial thrombus, active endocarditis, and/or the unfavorable anatomy to catheter intervention.[7] Complications include but are not limited to bleeding, hematoma, infection, embolism of the closure device, arrhythmia, stroke, and/or death.[7]

Follow-up

The patient was discharged after twenty-one days of his admission with dyspnea NYHA II and good recovery. Although TTEs after discharge presented LVEF of 26% despite optimized medical therapy, the patient was followed periodically without any clinical deterioration. After seven months of ambulatory follow-up, the patient had a sudden cardiac death (SCD) while sleeping and a necropsy could not be performed to establish the cause of death. The Heart Team raised the hypotheses of prosthesis embolism with rupture of LVPSA, new ACS, or ventricular tachycardia (VT). Although embolism can be fatal, it is usually an early complication after prosthesis implantation. Sudden cardiac arrest due to stent thrombosis or stenosis in

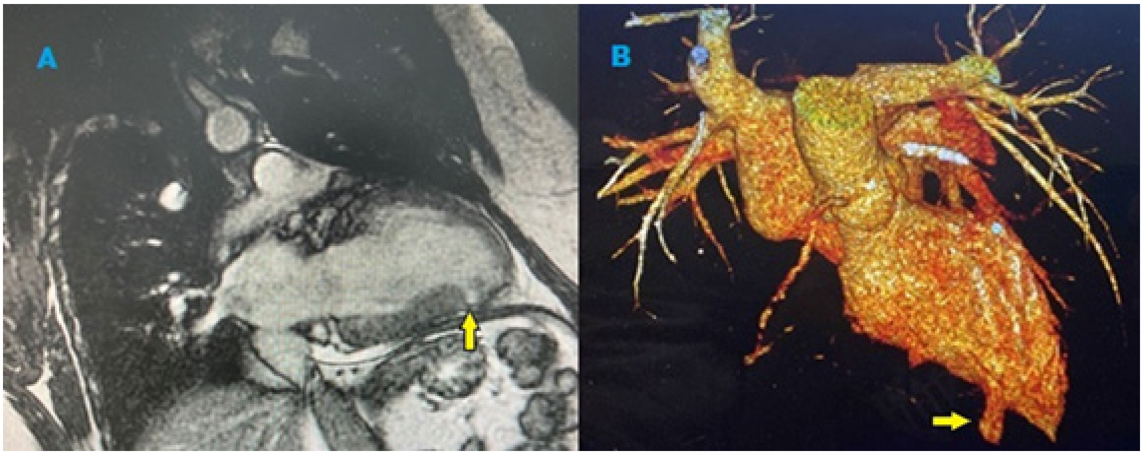

Figure 3 – *CMR (A) and CCTA (B) with LVPSA detached in yellow arrows.*

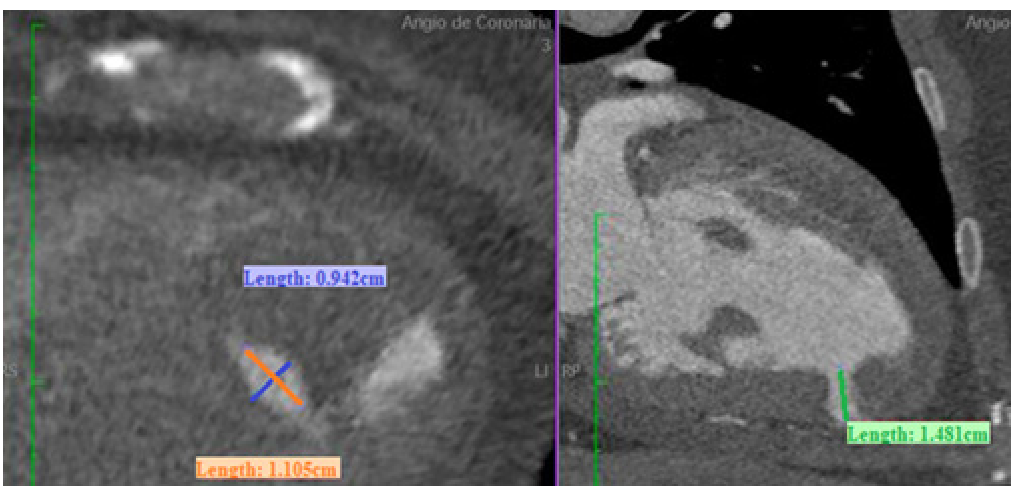

Figure 4 – *Pseudoaneurysm dimensions on CMR.*

ostial LAD carries a bad prognosis, leading to SCD. VT can happen due to the scar-reentry phenomenon in patients with reduced LVEF and is prevented by implantable cardioverter-defibrillator (ICD). The current patient could not afford to insert the device, although he was waiting for a judicialization process to implant primary prevention ICD, as the Brazilian public health system only provides ICD for secondary prevention in ischemic heart failure with low eject fraction.

Conclusion

In conclusion, LV pseudoaneurysm is a rare mechanical complication of MI and is prone to rupture and death if left untreated. Clinicians must be aware of this complication to raise diagnostic suspicion despite nonspecific symptoms. Although surgery is the treatment of choice, new alternatives are gaining importance, because of the elevated surgical mortality in patients with poor baseline conditions. Observational studies and case reports show that percutaneous transcatheter closure may be effective and less invasive approach. Nevertheless, randomized trials and longer observation are needed to clarify its safety at a long-term follow-up.

Author Contributions

Conception and design of the research: Fae IG, Soares CK, Nunes MC, Castro LRA, Leite AF; acquisition of data: Fae IG, Soares CK, Oliveira GB, Rausch RCM, Wang R, Silva GC;

Analysis and interpretation of the data: Fae IG, Wang R, Oliveira GB, Rausch RCM, Wang R, Nunes MC, Castro LRA, Leite AF; writing of the manuscript: Fae IG, Soares CK, Silva GC, Leite AF; critical revision of the manuscript for intellectual content: Fae IG, Wang R, Nunes MC, Silva GC, Castro LRA, Leite AF; assistance in obtaining and editing images: Soares CK.

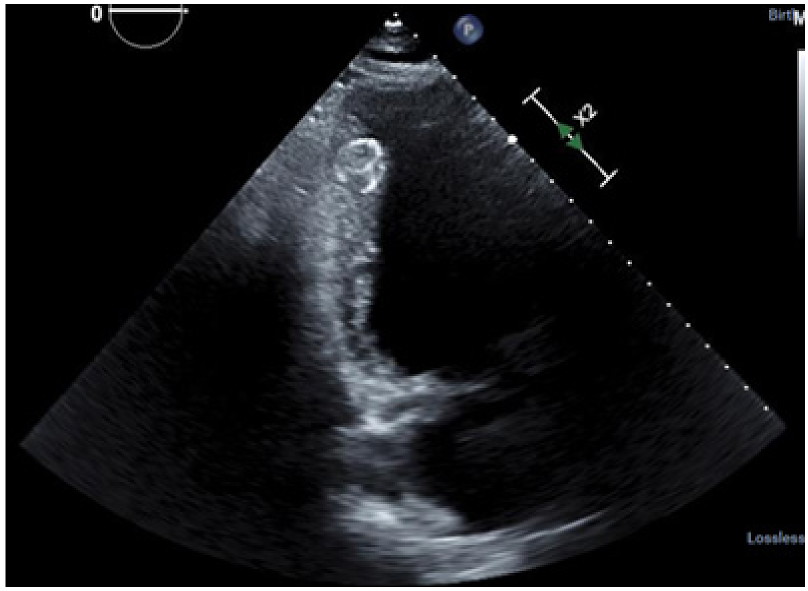

Figure 5 – *TTE after a well-positioned prosthesis occluding pseudoaneurysm.*

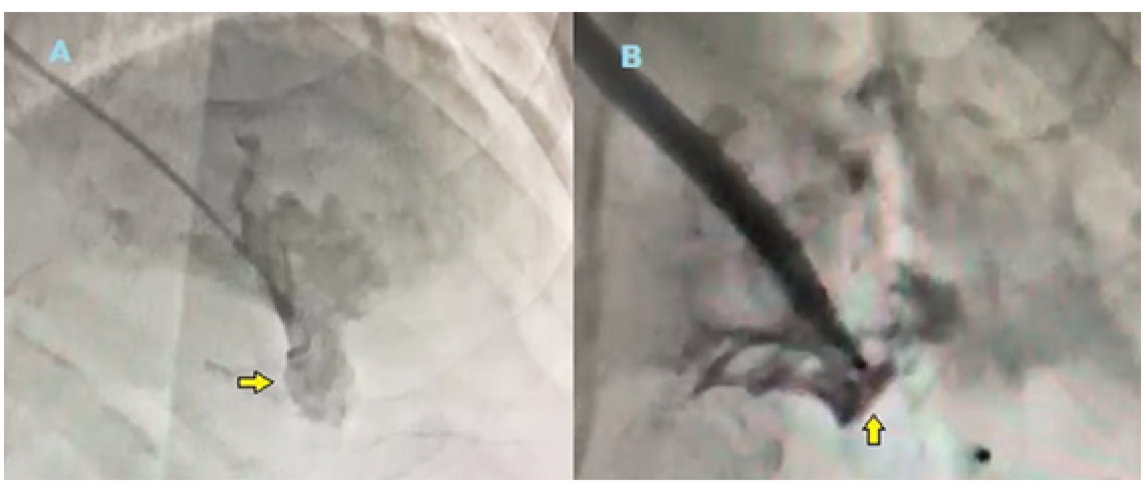

Figure 6 – *Ventriculography before (A) and after (B) percutaneous closure of pseudoaneurysm (yellow arrows).*

Potential Conflict of Interest

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

Sources of Funding

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 COEP da Faculdade de Medicina da UFMG under the protocol number CLM-91-2022. 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.

References

1. Sitta J, Howard CM. Left Ventricular Pseudoaneurysm: An Unexpected Finding. Radiol Case Rep. 2020;16(3):538-42. doi: 10.1016/j.radcr.2020.12.028.

2. Ballard DH, Jokerst C, Raptis CA, Pilgram TK, Woodard PK. Myocardial Cut-Off Sign is a Sensitive and Specific Cardiac Computed Tomography and Magnetic Resonance Imaging Sign to Distinguish Left Ventricular Pseudoaneurysms from True Aneurysms. J Thorac Imaging. 2022;37(1):58-65. doi: 10.1097/RTI.0000000000000525.

3. Holtackers RJ, Ter Bekke RMA, Bijvoet GP, Gommers S, Chiribiri A, Lorusso R. A Boolean Dilemma: True or False Aneurysm? JACC Case Rep. 2020;3(1):112-6. doi: 10.1016/j.jaccas.2020.09.055.

4. Scagliola R, Rosa GM, Seitun S. Cardiac Outpouchings: Definitions, Differential Diagnosis, and Therapeutic Approach. Cardiol Res Pract. 2021;2021:6792643. doi: 10.1155/2021/6792643.

5. Banisauskaite A, Velavan P, Hasleton J, Mediratta N, Arzanauskaite M, Binukrishnan S. Myocardial Rupture and Left Ventricular Pseudoaneurysm Due to Late STEMI Presentation During the COVID-19 Pandemic Lockdown: A Classical Case Report. Eur Heart J Case Rep. 2021;5(7):ytab253. doi: 10.1093/ehjcr/ytab253.

6. Torchio F, Garatti A, Ronco D, Matteucci M, Massimi G, Lorusso R. Left Ventricular Pseudoaneurysm: The Niche of Post-Infarction Mechanical Complications. Ann Cardiothorac Surg. 2022;11(3):290-8. doi: 10.21037/acs-2022-ami-25.

7. Brown KN, Singh R. Transcatheter Management of Left Ventricular Pseudoaneurysms. Treasure Island: StatPearls Publishing; 2023.