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Percutaneous closure of a giant left ventricular pseudoaneurysm using an Amplatzer muscular VSD occluder in a high-risk patient with recurrent heart failure following multiple myocardial infarctions

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Background: Left ventricular pseudoaneurysm (LVPA) is a rare and potentially fatal complication of myocardial infarction (MI), with mortality reaching 48% in untreated patients. While surgical repair has been the conventional therapy, perioperative mortality of 10%–36% renders it prohibitive in patients with multiple comorbidities. Percutaneous transcatheter closure has emerged as a life-saving alternative for high-risk surgical candidates.

Case report: A 75-year-old male with prior coronary artery bypass grafting (2010) and two subsequent myocardial infarctions (2019 and 2020) treated with percutaneous coronary intervention presented with refractory decompensated heart failure, massive left pleural effusion, and markedly elevated NT-proBNP (7,172 pg/mL). Cardiac magnetic resonance imaging revealed a giant LVPA (61 mm × 28 mm; end-diastolic volume 55 mL) arising from the lateral-to-posterolateral wall, with transmural late gadolinium enhancement confirming a post-infarction etiology. After multidisciplinary heart-team consensus, percutaneous transcatheter closure was performed via a transfemoral retrograde approach under transesophageal echocardiographic guidance using a 16 mm Amplatzer Muscular VSD Occluder. The procedure was uncomplicated, with no significant residual flow. The patient was discharged on postoperative day 2. At 3-month follow-up, he was in NYHA class I–II with marked symptomatic improvement, NT-proBNP reduction to ~500 pg/mL, and no residual flow.

Conclusions: Percutaneous transcatheter closure with an Amplatzer Muscular VSD Occluder is a feasible, safe, and life-saving therapeutic option in selected high-risk patients with post-infarction LVPA presenting with refractory heart failure.

KEYWORDS

aneurysm, false, heart failure, heart ventricles, post myocardial infarction, VSD occluder device

Introduction

Left ventricular pseudoaneurysm (LVPA) is a rare mechanical complication that occurs when free-wall rupture is contained by adherent pericardium or fibrous tissue rather than resulting in fatal hemopericardium. Acute myocardial infarction (MI) accounts for the majority of cases, with a reported incidence of 0.2%–0.5% (1). Untreated LVPA carries a 30%–45% risk of rupture within the first year and a mortality of up to 48% (1), while surgical repair is associated with perioperative mortality of 10%–36%, particularly in patients with multiple comorbidities and prior cardiac surgery (2–4).

Since the first description by Clift et al. in 2004, percutaneous transcatheter closure has emerged as a life-saving alternative for high-risk surgical candidates (5). Reported devices include Amplatzer Septal Occluders, Muscular VSD Occluders, Vascular Plugs, Duct Occluders, and embolization coils, with selection guided by orifice morphology and pseudoaneurysm location (6–12). We describe the successful percutaneous closure of a giant post-infarction LVPA using a 16 mm Amplatzer Muscular VSD Occluder in an elderly patient with refractory

decompensated heart failure following multiple myocardial infarctions and prior coronary artery bypass surgery.

Case report

A 75-year-old male was admitted with progressive orthopnea, paroxysmal nocturnal dyspnea, and recurrent acute pulmonary edema despite optimized heart-failure therapy. His cardiovascular history included an inferior MI with three-vessel coronary artery bypass grafting in 2010; a posterolateral MI in 2019 treated with percutaneous coronary intervention to the saphenous vein graft to the circumflex artery (3 mm × 23 mm drug-eluting stent); and an inferior MI in 2020 treated with intervention on the saphenous vein graft to the right coronary artery (4 mm × 28 mm bare-metal stent, selected to allow a shorter duration of dual antiplatelet therapy in the context of concomitant oral anticoagulation for atrial fibrillation). Comorbidities included long-standing hypertension and chronic kidney disease.

On admission, the electrocardiogram showed atrial fibrillation with a ventricular rate of 44 bpm, inferior Q waves, and anterior

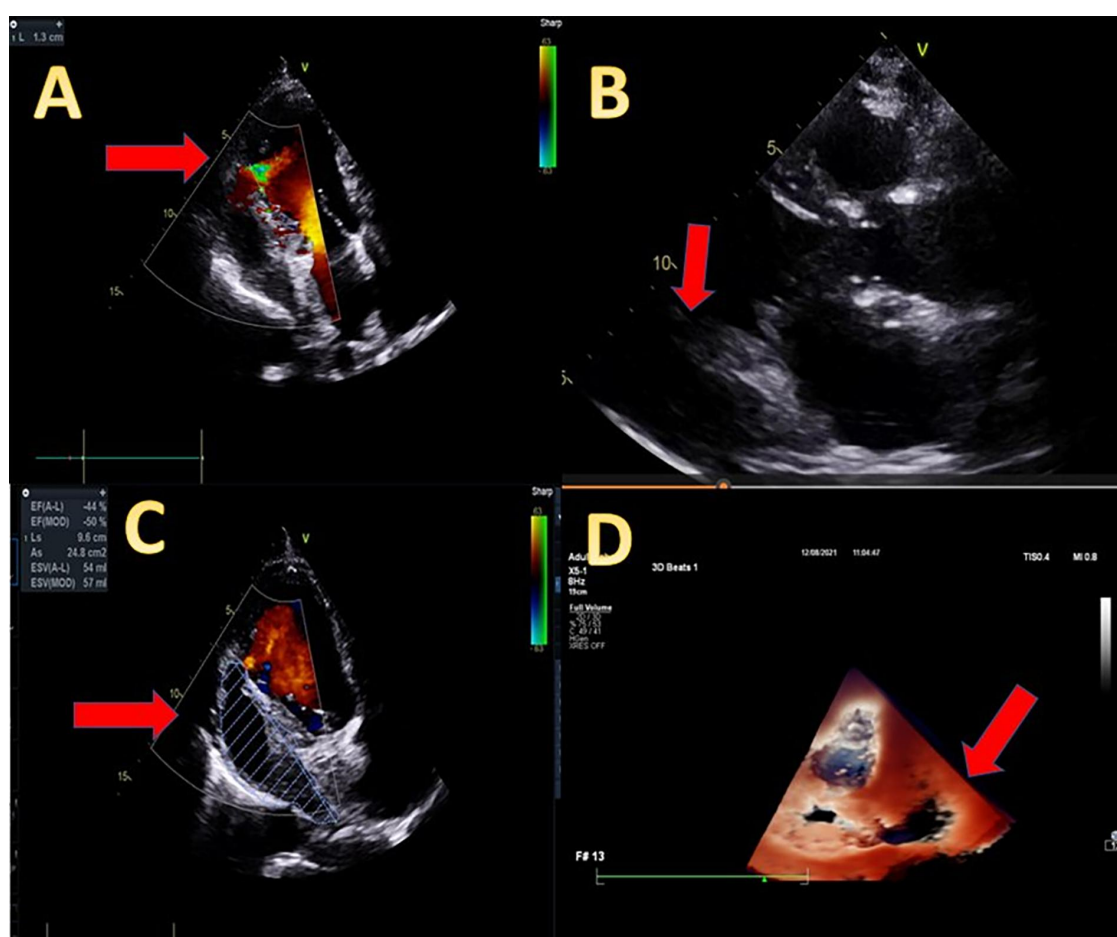


FIGURE 1

Pre-procedural transthoracic echocardiographic assessment of the left ventricular pseudoaneurysm. **A**, Apical view with color Doppler demonstrates the high-velocity flow jet (red arrow) traversing the narrow neck into the pseudoaneurysmal cavity, with an orifice diameter of 1.3 cm. **B**, Two-dimensional imaging shows the pseudoaneurysmal sac (red arrow) located adjacent to the lateral-to-posterolateral wall of the left ventricle. **C**, Quantitative volumetric analysis of the pseudoaneurysmal cavity (red arrow) reveals an end-systolic volume of 54–57 mL and a long-axis dimension of 9.6 cm, with active dynamic emptying-and-filling between cardiac cycles. **D**, Three-dimensional volume-rendered image (red arrow) provides spatial appreciation of the pseudoaneurysm geometry.

ST-segment depression. The chest radiograph demonstrated massive left-sided pleural effusion. Laboratory results were as follows: serum creatinine 1.5 mg/dL (estimated glomerular filtration rate 40 mL/min/1.73 m²), hemoglobin 10.5 g/dL, and N-terminal pro-B-type natriuretic peptide (NT-proBNP) 7,172 pg/mL. Outpatient medications included perindopril, spironolactone, furosemide, sotalol, rivaroxaban, and clopidogrel.

Transthoracic echocardiography revealed a left ventricular ejection fraction (LVEF) of 40%, akinesis of the inferolateral and posterolateral walls, moderate mitral regurgitation, and a large saccular cavity arising from the lateral wall and communicating with the ventricle through a narrow neck (Figure 1). Quantitative analysis of the pseudoaneurysmal cavity demonstrated an end-systolic volume of 54–57 mL and a long-axis dimension of 9.6 cm, with active dynamic emptying-and-filling between systole and diastole, reflecting substantial blood sequestration from the effective left ventricular stroke volume. Cardiac magnetic resonance imaging (3.0T) confirmed a giant pseudoaneurysm arising from the mid-lateral wall through a 12 mm × 7 mm orifice, extending along the posterolateral wall, with cavity dimensions of 61 mm × 28 mm

and end-diastolic volume of 55 mL (Figure 2B). Late gadolinium enhancement demonstrated transmural fibrosis in the left anterior descending and circumflex artery territories, confirming a post-infarction etiology. The LVEF on cardiac MRI was 28%; the discrepancy with the echocardiographic estimate likely reflects pseudoaneurysmal blood pooling. Periprocedural transesophageal echocardiography (TEE), including three-dimensional imaging, reconfirmed the diagnosis with an orifice of 13 mm × 9 mm and characteristic to-and-fro Doppler flow (Supplementary Video S1). Coronary angiography demonstrated patency of the bypass grafts.

Given the prohibitive surgical risk—advanced age, prior median sternotomy, decompensated heart failure, depressed ventricular function, chronic kidney disease, anemia, and atrial fibrillation—the multidisciplinary heart team selected percutaneous transcatheter closure. Written informed consent was obtained, including acknowledgment of off-label device use.

The procedure was performed under general anesthesia with continuous TEE guidance. Vascular access was obtained via the right common femoral artery (8 F sheath). Following retrograde left ventriculography (Figure 2A), the pseudoaneurysmal orifice

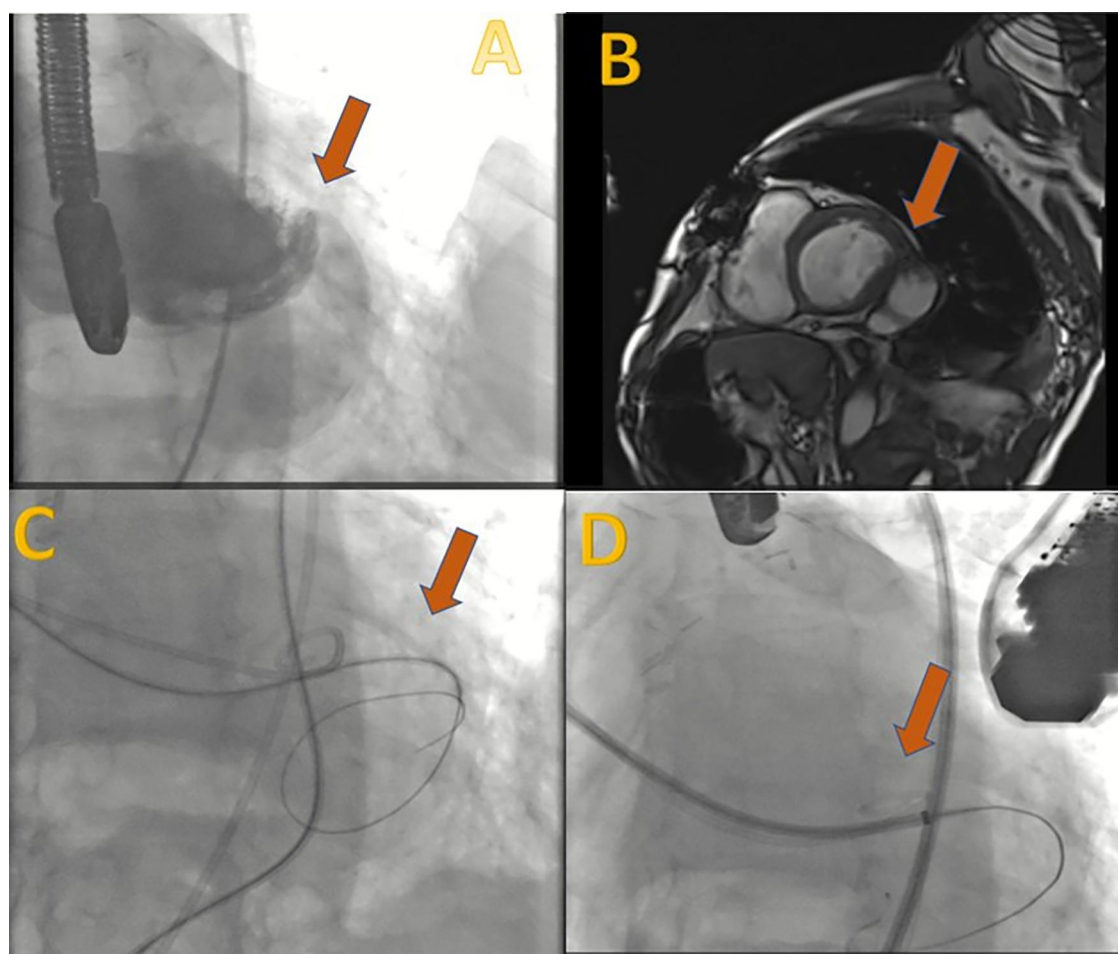


FIGURE 2

Pre-procedural imaging and initial procedural steps. **A**, Pre-procedural left ventriculography demonstrates contrast opacification of the pseudoaneurysmal cavity (red arrow) through a narrow neck arising from the lateral wall. **B**, Cardiac magnetic resonance imaging confirms the giant pseudoaneurysm (red arrow) arising from the lateral-to-posterolateral wall. **C**, Intraprocedural fluoroscopy shows retrograde crossing of the orifice with a 0.035-inch guidewire (red arrow) advanced into the pseudoaneurysmal cavity. **D**, After exchange for a stiff support wire, an 8 F Flexor introducer sheath (red arrow) is advanced across the orifice into the pseudoaneurysmal lumen.

was crossed with a 0.035-inch hydrophilic polymeric jacketed, J-tip guidewire (GlideWire, Terumo, Tokyo, Japan) (Figure 2C). An 8 F, 80 cm Flexor introducer sheath (Cook Medical, Bloomington, IN, USA) was then advanced into the cavity (Figure 2D). The Flexor sheath was specifically chosen at this stage for its superior kink-resistance and robust backup support to safely navigate the angulated neck. A 16 mm Amplatzer Muscular VSD Occluder (Abbott, Plymouth, MN, USA) was selected on the basis of orifice morphology, providing an oversize ratio of approximately 1.23–1.78 in accordance with the published recommendation of 1.2–2.0. The device was deployed across the orifice through an 8 F TorqVue delivery system: the distal disc was first unsheathed within the pseudoaneurysmal cavity (Figure 3A), followed by deployment of the proximal disc on the ventricular side, sandwiching the orifice between the two retention discs (Figure 3B). After confirmation of stable positioning, the device was released from the delivery cable (Figure 3C, Supplementary Video S2). Final left ventriculography confirmed proper apposition with no contrast extravasation into the pseudoaneurysmal cavity (Figures 3D, 4A), only minimal clinically insignificant residual flow, and no procedural complications.

The patient was extubated immediately, discharged on postoperative day 2, and continued on rivaroxaban for atrial fibrillation. At 1- and 3-month follow-up, he reported marked symptomatic improvement, with functional capacity improving

from NYHA class IV to NYHA class I–II. Repeat echocardiography demonstrated stable device position with no residual flow into the pseudoaneurysmal sac and progressive thrombosis of the cavity (Figure 4B). NT-proBNP decreased to approximately 500 pg/mL, and there were no recurrent heart-failure hospitalizations. The patient remains alive and clinically stable.

Discussion

Post-infarction LVPA most commonly arises from the inferior or inferolateral walls and may present with heart failure, chest pain, or dyspnea, although approximately 10% of patients are asymptomatic (1, 2). Our patient's presentation was dominated by refractory decompensated heart failure, with markedly elevated NT-proBNP and massive pleural effusion—a phenotype that highlights the significant hemodynamic burden imposed by a large pseudoaneurysmal cavity sequestering blood from the effective left ventricular stroke volume.

Echocardiography is the first-line imaging modality, with characteristic findings of a saccular cavity, narrow neck, neck-to-cavity diameter ratio less than 0.5, and bidirectional Doppler flow (1). However, in the setting of a large pseudoaneurysm, echocardiographic estimation of LVEF may overestimate true

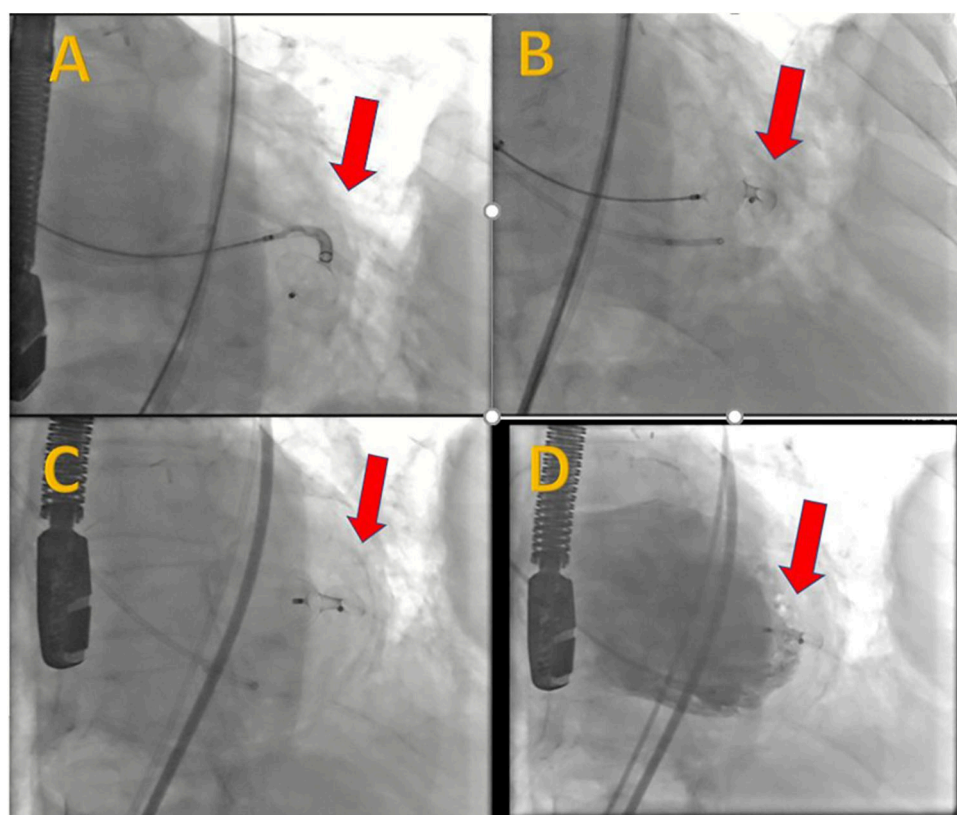


FIGURE 3

Sequential steps of device deployment. **A**, The distal disc of the Amplatzer Muscular VSD Occluder (red arrow) is unsheathed within the pseudoaneurysmal cavity. **B**, The proximal disc (red arrow) is opened on the ventricular side, sandwiching the orifice between the two retention discs. **C**, The device (red arrow) is released from the delivery cable, demonstrating stable positioning across the orifice. **D**, Final left ventriculography confirms successful closure with no contrast extravasation into the pseudoaneurysmal cavity (red arrow).

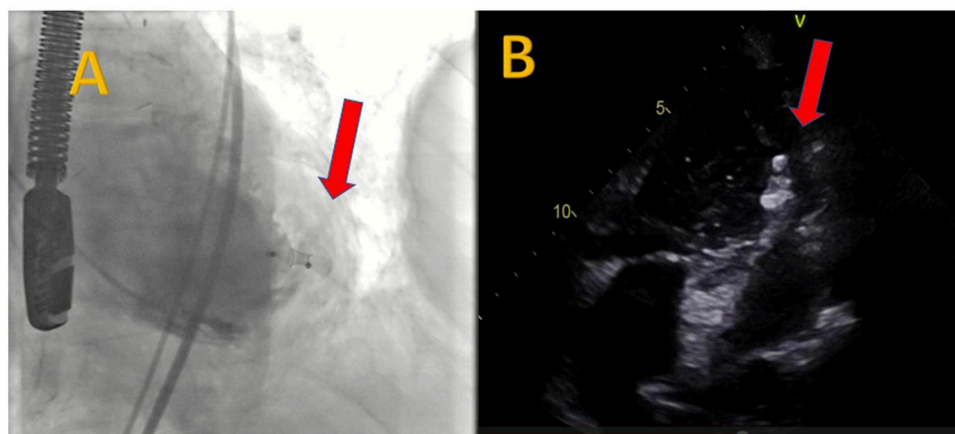


FIGURE 4

Post-procedural assessment confirming successful closure. **A**, Fluoroscopy after device deployment demonstrates the Amplatzer Muscular VSD Occluder (red arrow) in stable position across the orifice with no contrast extravasation. **B**, Post-procedural transthoracic echocardiography shows the device (red arrow) in stable position with progressive thrombosis of the pseudoaneurysmal sac and absence of residual flow.

ventricular function, as illustrated in our patient (40% on TTE vs. 28% on cardiac MRI). Cardiac magnetic resonance imaging provided definitive characterization in our case, including precise pseudoaneurysmal volume measurement, confirmation of post-infarction etiology through late gadolinium enhancement, and exclusion of intracavitary thrombus. With a maximal cavity dimension of 61 mm and a long-axis extent of 9.6 cm on echocardiography, the pseudoaneurysm qualified as giant, comparable to the largest cases in the percutaneous closure literature.

Although surgical repair has been the conventional treatment, redo cardiac surgery in patients with multiple comorbidities carries a prohibitive perioperative risk (2–4). Since the seminal series by Dudiy et al. (6), percutaneous closure has been increasingly reported, with several case series confirming feasibility and safety in carefully selected patients (8–12). Device selection should be individualized according to orifice size, neck length, and cavity morphology. We chose the standard Amplatzer Muscular VSD Occluder over the Post-Infarct (P.I.) model for several reasons: while the P.I. device offers a 10 mm waist suited for acute, edematous tissue, our patient's chronic fibrotic neck was perfectly accommodated by the 7 mm waist of the standard device, ensuring firm bilateral disc apposition without excess protrusion. Furthermore, its dual retention discs provide stable bilateral anchoring; the 8 F-compatible delivery system permits transfemoral retrograde delivery; and the 16 mm device achieved an oversize ratio within the recommended 1.2–2.0 range relative to the 13 mm × 9 mm orifice. The lateral-to-posterolateral location of the pseudoaneurysm was anatomically suited to retrograde wiring from the ventricular cavity, avoiding the need for transapical or transeptal access.

Our patient demonstrated marked clinical and biochemical improvement, with NT-proBNP reduction from 7,172 to approximately 500 pg/mL and improvement from NYHA class IV to I–II. By eliminating diastolic-systolic blood sequestration into the pseudoaneurysmal sac (an 8 mL difference between end-diastolic and end-systolic volumes on cardiac MRI in our

case), transcatheter closure restored effective forward stroke volume and addressed both the rupture risk and the hemodynamic burden. The principal limitations of this report are its single-case nature and relatively short follow-up; longer-term surveillance is needed to assess durability of closure and incidence of late complications.

Conclusions

Percutaneous transcatheter closure of post-infarction LVPA using an Amplatzer Muscular VSD Occluder is a feasible, safe, and effective therapeutic strategy in carefully selected high-risk surgical candidates. Multidisciplinary heart-team evaluation, multimodal imaging (including cardiac MRI), individualized device selection, and combined fluoroscopic and TEE procedural guidance are essential prerequisites for successful outcomes.

Data availability statement

The original contributions presented in the study are included in the article/[Supplementary Material](#), further inquiries can be directed to the corresponding author.

Ethics statement

Written informed consent was obtained from the individual(s) for the publication of any potentially identifiable images or data included in this article.

Author contributions

SC: Writing – review & editing, Writing – original draft. SS: Writing – original draft, Writing – review & editing. OO:

Writing – original draft, Writing – review & editing. TK: Writing – original draft, Writing – review & editing.

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Conflict of interest

The author(s) declared that this work was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Supplementary material

The Supplementary Material for this article can be found online at: <https://www.frontiersin.org/articles/10.3389/fcvm.2026.1879721/full#supplementary-material>

SUPPLEMENTARY VIDEO S1

Pre-procedural transesophageal echocardiography with color Doppler demonstrating the pathognomonic to-and-fro flow pattern across the narrow neck of the pseudoaneurysm, with systolic flow from the left ventricle into the cavity and diastolic flow back into the ventricle.

SUPPLEMENTARY VIDEO S2

Intraprocedural fluoroscopic cine recording of the Amplatzer Muscular VSD Occluder deployment, showing sequential unsheathing of the distal and proximal discs across the pseudoaneurysmal orifice, followed by post-deployment left ventriculography confirming successful closure with no contrast extravasation into the pseudoaneurysmal cavity.