Successful Transcatheter Closure of a Coronary Fistula in a 76-Year-Old Woman

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Abstract

Coronary artery fistula (CAF) is a rare but potentially life-threatening anomaly. Transcatheter closure has emerged as a less invasive alternative to surgery. We report the case of a 76-year-old Han Chinese woman presenting with intermittent chest tightness and effort intolerance. Coronary computed tomography angiography (CCTA) revealed a large fistula originating from the left circumflex artery (LCx), draining into the superior vena cava (SVC) and partially into the pulmonary artery (PA). The patient underwent successful transcatheter closure with two Amplatzer™ Vascular Plug-4 (AVP-4) devices. Despite transient post-procedural ischemic symptoms, her condition stabilized with dual antiplatelet and anticoagulant therapy. This case highlights the importance of individualized interventional planning in complex CAFs and the role of vigilant post-procedural surveillance to manage ischemic complications.

Keywords: coronary artery fistula, AVP-4, transcatheter closure, coronary steal, left circumflex artery, case report

Introduction

Coronary artery fistula (CAF) is an anomalous communication between a coronary artery and a cardiac chamber or great vessel, most commonly congenital but occasionally acquired. While many CAFs remain asymptomatic, larger fistulas can lead to myocardial ischemia through the "coronary steal" phenomenon, resulting in heart failure, arrhythmia, or even sudden death. Treatment options include surgical ligation or percutaneous closure, with the latter increasingly favored for anatomically suitable cases. Notably, small CAFs often close spontaneously over time and can therefore be managed conservatively with regular follow-up.[1,2] By contrast, medium to large fistulas may progressively enlarge, particularly in pediatric and young adult populations.[3] These

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larger fistulas are frequently associated with proximal coronary artery dilation, reflecting long-standing high-volume shunt flow. The first transcatheter closure of a CAF was reported by Reidy et al. in 1983 using a detachable balloon technique.[4] Since then, significant advancements in catheter-based technologies—including the development of detachable coils and vascular occlusion devices—have expanded therapeutic options and improved procedural outcomes.[5] The primary goal of closure is to interrupt flow within the body of the fistula. Here, we present a complex case of a left circumflex artery-to-superior vena cava CAF successfully managed with transcatheter closure using AVP-4 devices.

Case Presentation

A 76-year-old woman presented following several weeks of intermittent chest tightness and progressive effort intolerance. She denied fever, tearing chest pain, or abdominal discomfort. Her medical history included diabetes mellitus, hypertension, bilateral vestibular hypofunction, and gastric ulcers. She had no known allergies except for sulfonamides and no history of smoking, alcohol consumption, or betel nut use. On physical examination, a grade III soft systolic murmur and coarse bilateral breath sounds were noted. Electrocardiography (ECG) revealed sinus bradycardia without acute ischemic changes, and chest radiography (CXR) showed cardiomegaly with signs of pulmonary congestion. Due to persistent chest tightness, coronary computed tomography angiography (CCTA) was arranged (Figure 1A). The report, performed one month prior to admission, revealed a coronary artery fistula originating from the left circumflex artery (LCx), draining primarily into the superior vena cava (SVC), with a minor communication to the pulmonary artery (PA). Transthoracic echocardiography (TTE) (Figure 1B) revealed Doppler flow converging toward the pulmonary artery. Given the large coronary artery fistula seen on CCTA, coronary angiography was performed. The findings confirmed the presence of an LCx-to-SVC fistula (Figure 1C-E), with preserved flow in the left anterior descending artery (LAD) (Figure 1C-E) and a patent right coronary artery (RCA) (Figure 1F). After multidisciplinary heart team consultation, a transcatheter closure approach was selected. A 3.5/7 Fr guiding catheter was used to engage the left coronary artery. A 4.0 × 15 mm anchor balloon was employed to facilitate distal advancement of the extension guiding catheter for optimal support. A 7.0/12.5 mm Amplatzer™ Vascular Plug-4 (AVP-4, Abbott Structural Heart, St. Paul, Minnesota) was deployed at the distal tip of the guiding catheter (Figure 1G, 1H; white arrow). Residual flow was noted; therefore, a second 8.0/13.5 mm AVP-4 was deployed more proximally (Figure 1I; white arrow). Over the following 10 minutes, fistular flow was significantly reduced. The final flow velocity was lower than that in the LAD (Figure 1J). Shortly after the procedure, the patient experienced worsening chest pain and dizziness. ECG revealed diffuse ST depression (V2-V6) with T-wave inversion, suggestive of lateral wall ischemia. Clopidogrel 75 mg once daily, apixaban 2.5 mg twice daily, and antianginal agents were prescribed. Her symptoms subsequently stabilized.

Six months later, she was admitted for follow-up evaluation. Repeat TTE and CCTA confirmed stable positioning of the AVP-4 devices (Figure 2A), and angiography showed no residual flow in the LCx, with stable AVP-4 positions (Figure 2B; yellow arrow) and preserved LAD and RCA patency. CXR also demonstrated stable AVP-4 positions with no evidence of shunt or device migration (Figure 2C; red arrow). TTE showed no Doppler signal in the PA (indicating successful closure) (Figure 2D), mild pulmonary regurgitation, a right ventricular systolic pressure (RVSP) of 24.5 mmHg, and preserved left ventricular systolic function with an ejection fraction (LVEF) of 55%. The patient was discharged in stable condition, and continued follow-up in the outpatient department.

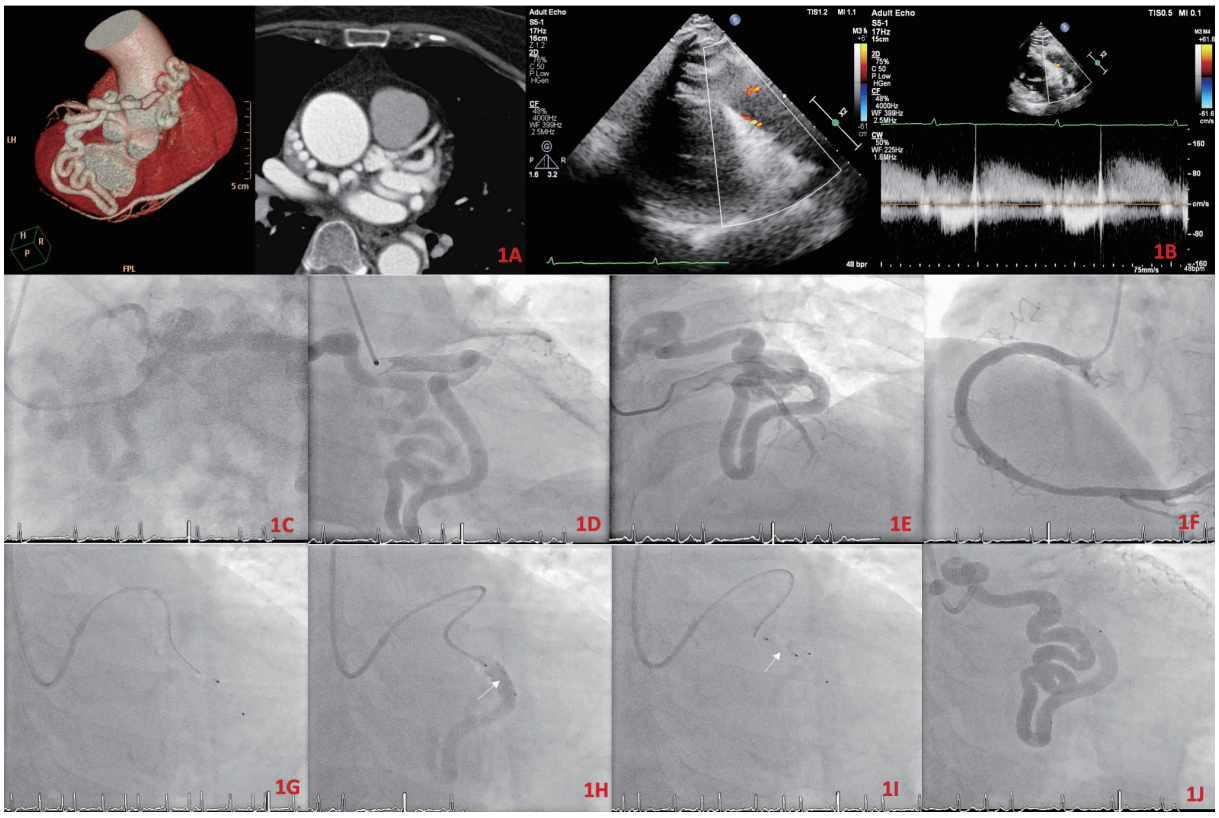

Figure 1A. Coronary CT showed coronary artery fistula originating from the left circumflex artery (LCx), draining primarily into the superior vena cava (SVC), with a minor communication to the pulmonary artery (PA).
Figure 1B. Echocardiography revealed turbulent, continuous flow entering the right heart or pulmonary artery with continuous high-velocity doppler signal.
Figure 1C. Contrast injection into the LCx-D visualizes early opacification of the dilated and tortuous fistulous vessel, confirming the presence of a coronary artery fistula.
Figure 1D. Contrast injection into the LCx-D visualizes early opacification of the dilated and tortuous fistulous vessel, confirming the presence of a coronary artery fistula.
Figure 1E. Contrast injection into the LCx-D visualizes early opacification of the dilated and tortuous fistulous vessel, confirming the presence of a coronary artery fistula.
Figure 1F. Patent RCA anatomy.
Figure 1G. Occlusion device is navigated into position along the tract.
Figure 1H. First 7.0/12.5 mm AVP-4 (white arrow).
Figure 1I. Second 8.0/13.5 mm AVP-4 (white arrow).
Figure 1J. Final flow velocity was less than that of the LAD.

Discussion

Coronary artery fistula (CAF) represents a rare but clinically significant anomaly with the potential to cause ischemic symptoms, chamber dilation, arrhythmia, and even heart failure. In the present case, we successfully performed transcatheter closure of a large left circumflex artery (LCx) to superior vena cava (SVC) fistula, using dual Amplatzer™ Vascular Plug IV (AVP-4) devices. This strategy achieved effective occlusion without protrusion into the parent

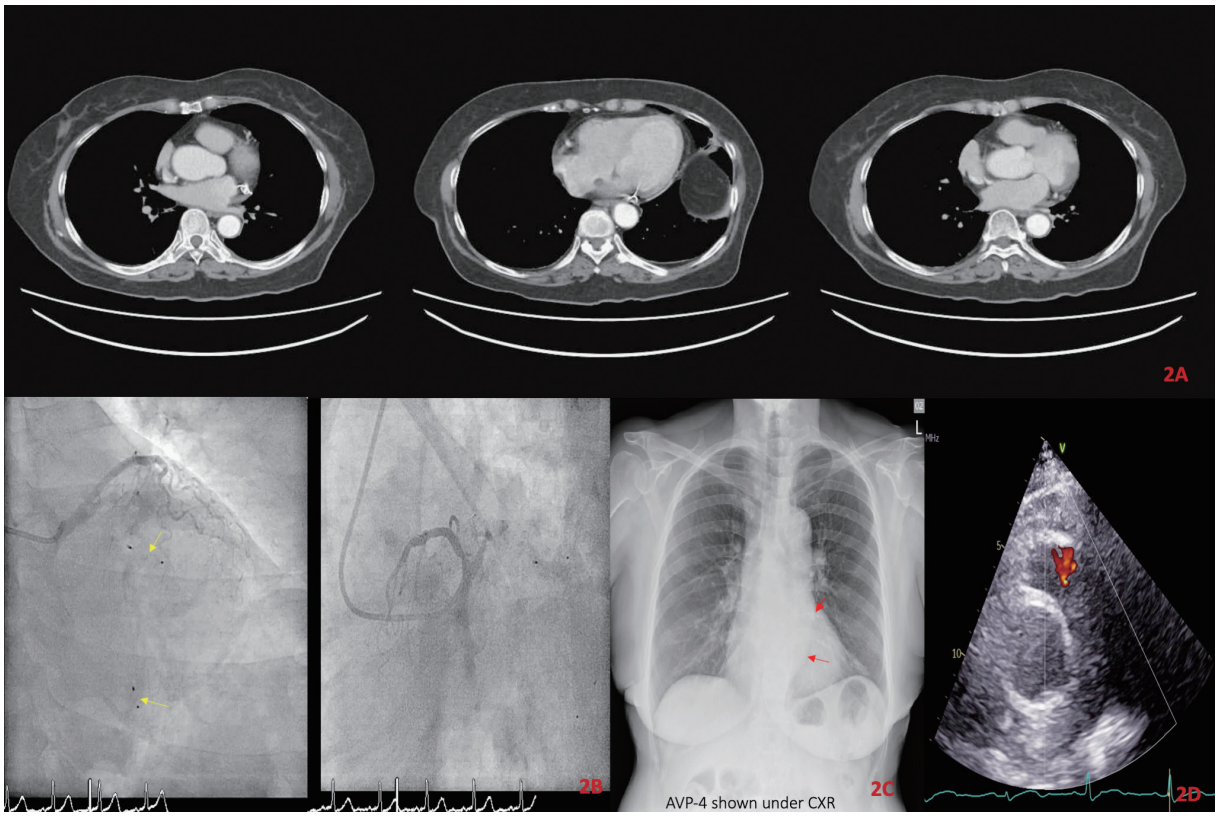

Figure 2A. Stable AVP-4 positions on imaging.
Figure 2B. No residual flow on LCx with stable AVP-4 positions and patent LAD flow.
Figure 2C. Stable AVP-4 positions on imaging (red arrow).
Figure 2D. Confirmation of no shunt or plug migration.

vessel, highlighting the precision and adaptability of the AVP-4 devices in managing tortuous or distal fistulas.[6,7]

The post-procedural ischemic symptoms observed in this patient were likely attributable to an abrupt hemodynamic shift following the elimination of the coronary steal phenomenon, resulting in a transient perfusion mismatch. This phenomenon is well-documented in the literature, particularly in the closure of large or distal CAFs with dilated proximal feeding arteries. As emphasized by Hijji et al.,[8] thrombus formation due to stagnant flow in aneurysmal segments post-closure poses a significant risk of myocardial infarction (MI), especially when the diameter of the proximal artery exceeds 10 mm. Although surgical closure with concomitant bypass has been recommended in such anatomies, our case demonstrates that, with careful planning and deep-seating techniques, percutaneous closure remains a viable and less invasive alternative. Key technical considerations in our procedure included deep engagement of the delivery catheter and deployment of the AVP-4 at a site distant from critical side branches. These maneuvers were essential to avoid device migration and to minimize the risk of compromised myocardial perfusion. The choice of the AVP-4, with its low-profile and flexible design, facilitated navigation through the tortuous anatomy and allowed stable anchoring.

Following expert consensus, we initiated short-term dual antiplatelet therapy combined with anticoagulation following the procedure to mitigate the thrombotic risk associated with abrupt flow cessation and device-induced stasis.

Early imaging surveillance is imperative to detect potential recanalization, residual flow, or thrombotic complications. While spontaneous recanalization rates appear low in imaging-based series, angiographic follow-ups suggest that delayed failures may be underreported. This case underscores the importance of individualized assessment and procedural planning in CAF closure, particularly for large, high-flow fistulas with distal terminations. With the increasing availability of versatile closure devices and advanced imaging modalities, transcatheter strategies can be safely extended to anatomically complex CAFs that were previously considered candidates for surgical intervention.

Conclusion

Coronary artery fistulas can remain silent for years only to present with ischemia and heart failure in the elderly. Transcatheter closure using AVP-4 is a safe and effective alternative to surgery, particularly in tortuous or distal anatomies. Comprehensive pre-procedural planning, meticulous device deployment, and vigilant post-operative care are key to successful outcomes.

Acknowledgments

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Conflict of Interest

The authors declare no conflicts of interest.

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