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Percutaneous Closure of Fistulous Tract from Right Coronary Artery to Right Atrium: A Case Report

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ABSTRACT

The coronary artery fistula is a rare form of left to right shunt that can lead to significant hemodynamic consequences if left untreated. The patient, a 10-year-old female, presented with symptoms of increasing dyspnea and palpitations over the past year. Diagnostic imaging, including transthoracic echocardiography and cardiac computed axial tomography, confirmed the presence of a fistulous connection between the right coronary artery and the right atrium. Given the patient's symptomatic presentation and the risk of complications, a decision was made to proceed with percutaneous closure. Using a catheter-based approach, the fistula was successfully occluded with a Amplatzer Vascular Plug II (AVP II), resulting in the resolution of symptoms and normalization of hemodynamic parameters. This case highlights the efficacy and safety of percutaneous intervention in managing coronary artery fistulas, particularly in pediatric patients, and underscores the importance of early diagnosis and treatment to prevent long-term sequelae.

KEYWORDS: Fistula, left-to-right shunt, right coronary artery, angiography, computed axial tomography

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I. INTRODUCTION

Coronary artery fistulas (CAFs) are rare vascular anomalies that involve abnormal connections between coronary artery and a cardiac chamber (CCF: coronary-cameral fistula) or great vessels (for example CPAF: coronary-pulmonary artery fistula) (1, 2). The incidence of CAFs is unknown because of the undiagnosed rate remains high (2), but there are estimations about coronary anomalies, that represents different populations with an incidence of 0.2-1.2%, where CAF represent 0.002% of the cases. (2, 3, 4). The clinical presentation of CAFs can vary significantly, ranging from asymptomatic findings to severe clinical manifestations such as heart failure, arrythmias, angina, infective endocarditis (5).

The pathophysiology of a CAF depends on the resistance of the fistulous connection and on the site of fistulous termination. Therefore, accurate imaging assessment of the origin and drainage site of CAFs is crucial (6). Diagnosis is often incidental, discovered during imaging studies conducted for other reasons, though symptomatic cases may prompt investigation (7). Management of CAFs depends on the symptoms, size of the fistula, and potential for complications. Historically, surgical intervention was the primary treatment, but with advances in interventional cardiology, percutaneous closure has emerged as a less invasive alternative, demonstrating promising outcomes (8).

II. CASE REPORT

A 10-year-old female patient, with no relevant perinatal history, diagnosed with psoriasis at 2 years of age under treatment with pimecrolimus. With a history of recurrent upper respiratory tract infections during childhood and a heart murmur detected by routine examination.

The patient remained asymptomatic until the age of 9, after which she developed progressive exertional dyspnea and palpitations. Consequently, a comprehensive evaluation was undertaken, including an echocardiogram, which revealed a chamber adjacent to the right ventricle.

This finding led to a chest CT scan, which identified a fistulous tract originating from the right coronary ostium and draining into the right atrium (figure 1). Given the presence of symptoms, it was decided to close the fistulous tract and percutaneous closure was proposed.

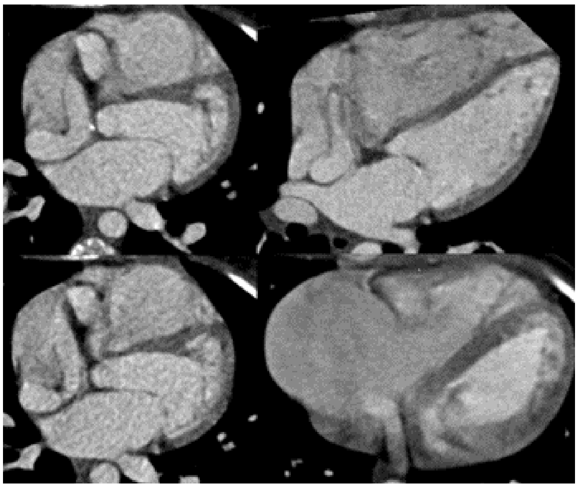

Figure 1. Chest CT scan showing fistulous tract between aorta and right atrium

The coronary angiography (figure 2) reveals a right coronary-atrial fistula, originating inferior to the right coronary ostium, with a shotgun-like origin, dilated with a diameter of 18 mm. A Venturi effect is observed when attempting selective cannulation. The fistula extends from the aortic root to the roof of the atrium, which it solely supplies, with intrafistula pressures of 50-10-30 mmHg, QP:QS of 2.2:1, a stretch diameter of 12 mm, and an angulation at the entry into the right atrium, creating a dynamic gradient.

Cannulation of the right coronary artery was performed, and it was left protected with a Whisper coronary guide. Subsequently, the fistula cannulation was performed with a hydrophilic guide, leaving a path from the aorta to the right atrium. A 6 Fr snare endovascular catheter was used, and an arteriovenous loop was performed (figure 3). It was ascended with a retrograde technique. The guide was placed in the right atrium and was attached to the aorta.

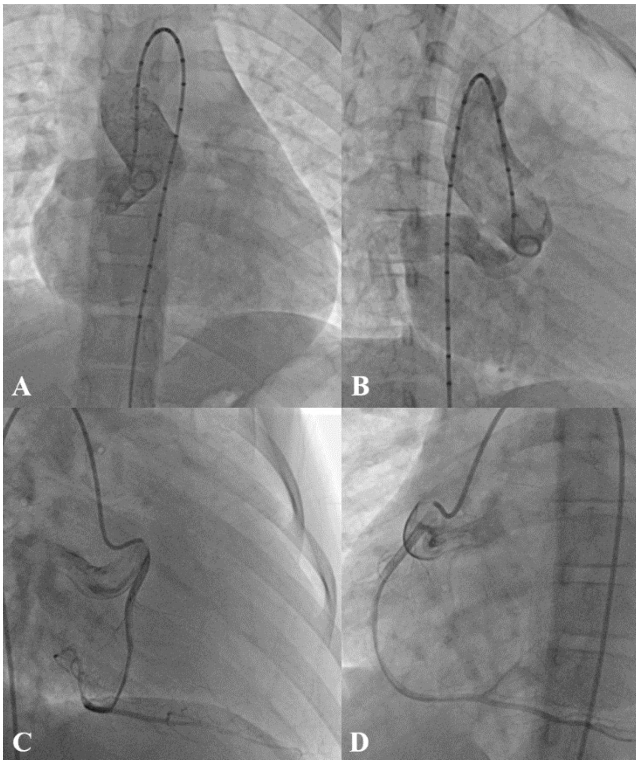

Figure 2. *A.* Coronary angiography reveals an aneurysmal fistula originating just below the right coronary ostium. *B.* Lateral angiographic projection showing the distal portion of the coronary artery fistula (CAF). *C.* Simultaneous coronary angiography demonstrates a close relationship between the CAF and the right coronary artery (RCA) ostium. *D.* Lateral angiographic view of the RCA and CAF.

Subsequently, a 14 mm Amplatzer Vascular Plug II (AVP-II) device was advanced, deployed at the origin of the fistula, and then retracted to completely occlude it (figure 4). A control angiography was performed, showing no contrast medium passing into the right heart cavities, no changes in the electrocardiogram, and a control coronary angiography revealing no right coronary occlusion nor secondary compressions, thus concluding the procedure. The following pressures were recorded: mean pulmonary artery trunk pressure of 31 mmHg, aortic pressure of 63 mmHg, and QP:QS >2.2:1, with pulmonary arteriolar resistances <1 Wood unit.

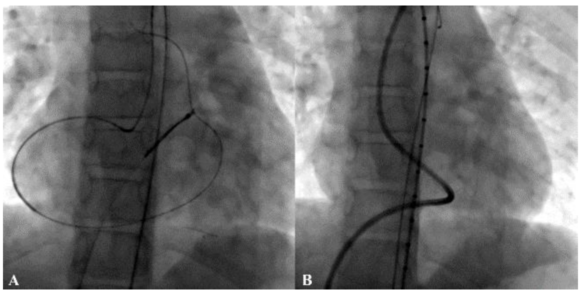

Figure 3. *A.* Arteriovenous loop by snare endovascular catheter. *B.* Retrograde rising of venous catheter.

The patient was discharged asymptomatic. In the follow up scheduled at 6 months, the patient showed improvement in functional class, absence of cardiovascular symptoms, and complete resolution of the clinical condition.

III. DISCUSSION

The causes of CAFs are either congenital or acquired (9). During fetal development, sinusoids nourish the primitive myocardium, wich is connected to the primitive tubular heart. Later in adulthood, sinusoids normally become obliterated into the thebesian vessels and cappilaries. Persistent sinusoids that fail to regress may contribute to a fistulous communication between the coronary arteries and cardiac chambers (10).

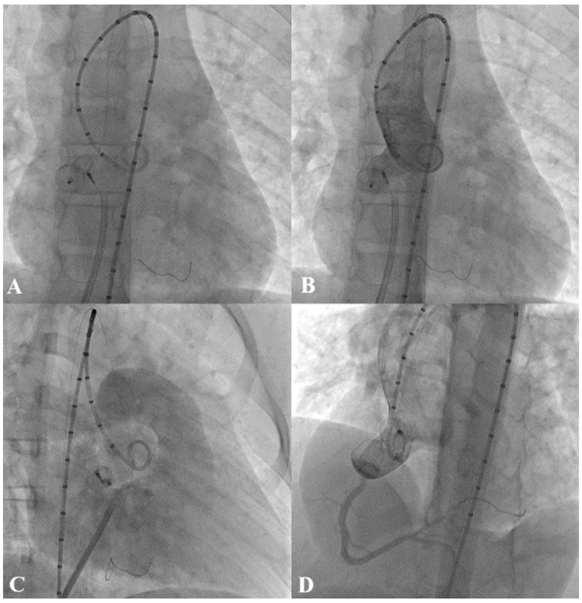

Figure 4. *A.* AVP-II deployment in distal ostium on superior aspect of the right atrium *B.* Left-sided contrast injection showing no contrast medium passing. *C.* Right-sided contrast injection showing no contrast medium passing. *D.* Non-selective RCA angiography showing no coronary occlusion/compression.

Coronary cameral fistulas commonly originate from the RCA (55%), the LAD (35%), or both arteries(11). The most involved chamber is the right ventricle (41%), followed by the right atrium (26%) and the left atrium and left ventricle (3-5%). Coronary cameral fistulas are classified into arterioluminal (direct communication with the cardiac chamber) and arteriosinusoidal (indirect communication through a cardiac sinusoidal network) subtypes (6).

With arterioluminal cameral fistulas, constant high blood flow through coronary arteries may lead to aneurysmal dilatation of these vessels (12).

AVPs are the most used occluders for CAFs in clinical practice. The Amplatzer devices are made of braided nitinol mesh with interlocking struts. The device is attached a 155-cm stainless steel cable that allows device repositioning before final release. The device accelerates fibrin-mediated thrombogenesis by minimizing floow through the Nitinol mesh (13).

The AV loop technique can be used in distal fistulas (such as this clinical case report), crossing from the arterial side, but the catheter is delivered from the venous side to minimize trauma to fistula.

CONCLUSIONS

The case presented highlights the importance of accurate diagnosis and timely intervention in managing symptomatic CAFs. The use of percutaneous closure, specifically with the Amplatzer Vascular Plug II (AVP-II) device, demonstrates a viable and less invasive alternative to surgical correction, offering promising outcomes in the treatment of coronary-atrial fistulas. This case not only underscores the effectiveness of the AV loop technique in achieving successful closure of distal fistulas but also emphasizes the importance of individualized patient management. Continued follow-up is crucial to monitor for any potential recurrence or complications, ensuring long-term patient stability and improved quality of life. The favorable outcome in this case reinforces the role of advanced interventional techniques in the evolving landscape of cardiology.

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