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IMAGING

IMAGING VIGNETTE: CLINICAL VIGNETTE

Multimodality Imaging of Bi-Coronary and Aortic to Pulmonary Fistulas With Saccular Aneurysms

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ABSTRACT

A 69-year-old man had fistulas arising from the left main, conus and aortic arch complicated by 2 saccular aneurysms with one draining into the pulmonic trunk seen during computed tomography and invasive angiography. These were treated conservatively but required repeat computed tomography and cardiac magnetic resonance imaging 2 years later for new heart failure. (J Am Coll Cardiol Case Rep 2024;29:102276) © 2024 The Authors. Published by Elsevier on behalf of the American College of Cardiology Foundation. This is an open access article under the CC BY-NC-ND license (http://creativecommons.org/licenses/by-nc-nd/4.0/).

A 69-year-old man underwent coronary computed tomography angiogram (CCTA) for chest pain evaluation. There was minimal stenosis in the left anterior descending and circumflex arteries. The distal right coronary artery (RCA) was sub-totally occluded (Supplemental Figure 1). An RCA conus branch gave off a fistula with a 6 × 6 mm saccular aneurysm. The fistula continued left laterally to form a 15 × 12 mm saccular aneurysm lateral to the pulmonic trunk (**Figure 1A**). Another fistula from the proximal left main joining this aneurysm was seen (**Figure 1B**). The aneurysm drains into the pulmonic trunk (**Figure 1C**).

Transthoracic echocardiogram showed normal biventricular sizes, preserved left ventricular ejection fraction, and no evidence of pulmonary hypertension. After a Heart Team discussion, percutaneous coronary intervention of the RCA stenosis was performed, with resolution of chest pain. The fistulas, which were also observed during invasive angiography (**Figures 1A and 1B**), were conservatively managed.

Approximately 24 months later, the patient developed breathlessness and lower limb edema. Transthoracic echocardiogram showed a left ventricular ejection fraction of 45%. CCTA with extended field of view (FOV) showed stable aneurysm dimensions and another fistula from the infero-posterior aortic arch surface communicating with the fistula from the left main (**Figure 1D**). The RCA stent was patent with no obstructive coronary artery disease elsewhere. Cardiac magnetic resonance showed normal biventricular sizes and a pulmonary to aortic flow ratio of 1.1. There was subendocardial delayed enhancement in the mid inferior left ventricular segment. The provisional diagnosis was heart failure with mildly reduced ejection fraction secondary to a possible silent percutaneous coronary intervention-related myocardial infarction. The patient improved with diuresis and was asymptomatic at the time of writing (3 years from initial diagnosis).

Coronary to pulmonary artery fistula (CPAF) occurs in <1% of patients undergoing CCTA.[1] Fistulas commonly arise from either the left anterior descending artery or RCA conus. Combined bi-coronary and aortic origins are extremely rare. CPAF occurs due to failed involution of pulmonary sinus anlages that connect with

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ABBREVIATIONS AND ACRONYMS

CCTA = coronary computed tomography angiogram

CPAF = coronary to pulmonary artery fistula

FOV = field of view

RCA = right coronary artery

anlages from the aortic sinus, which eventually form coronary arteries.[2] Fistulas can form in coronary segments proximal to stenotic arteries due to increased pressure gradient.[3] Although our patient had severe RCA stenosis, this mechanism is unlikely the cause, as the fistula originated from the conus that was separate from the RCA. CPAFs can cause ischemia from coronary steal as well as pulmonary hypertension and congestive cardiac failure from left-to-right shunt.[2] Coronary aneurysms are seen in almost 50% of cases and may spontaneously rupture.[1]

Although more CPAFs are being detected due to increasing CCTA use, small CPAFs can be missed as preferential attention is usually given to native coronaries.[1] The aortic-pulmonary fistula was not fully appreciated on our initial scan due to the limited FOV in conventional CCTA. Similarly, the full extent of the fistula was not visualized during invasive angiography. Our case highlights the complementary role of various modalities for evaluation of this rare CPAF and associated complications. The extended FOV CCTA revealed the fistula origin, course, and drainage, and showed stable aneurysm sizes. In addition to myocardial tissue characterization for cardiomyopathy evaluation, the nonsignificant intracardiac shunt fraction and normal chamber sizes seen on CMR further supported continued nonsurgical management for the CPAF despite the patient's congestive cardiac failure presentation.

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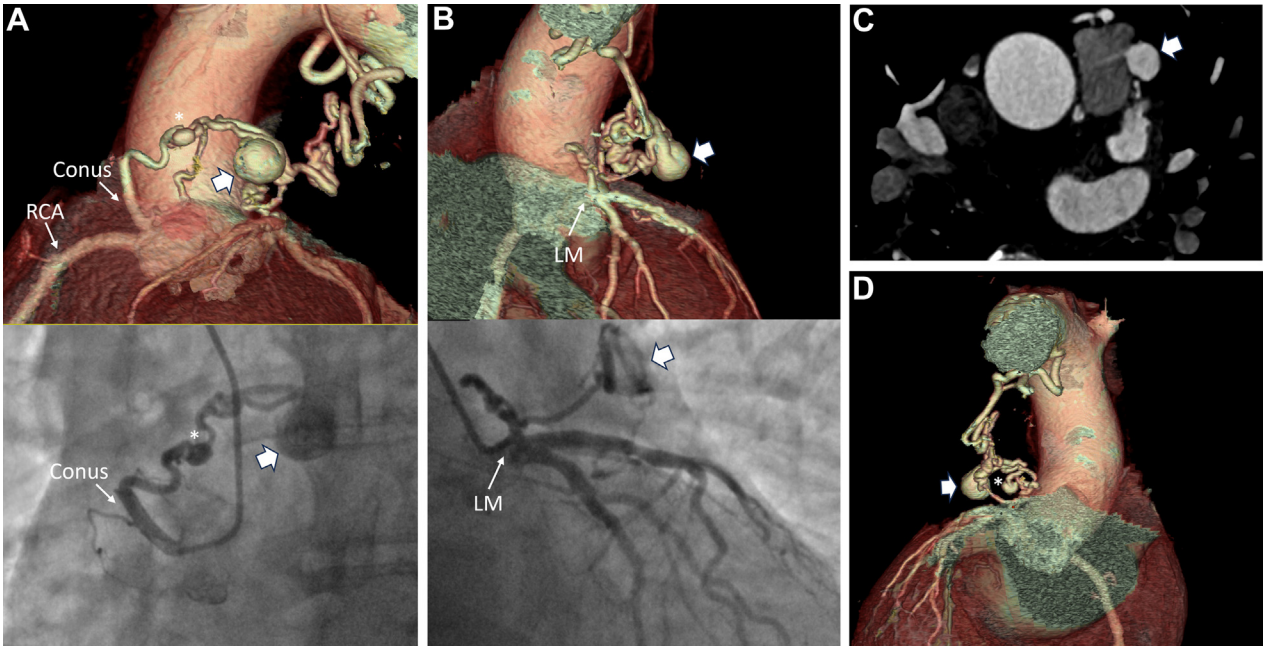
FIGURE 1 Multimodality Imaging of Bi-Coronary and Aortic Arch to Pulmonary Artery Fistula



(A) Volume-rendered computed tomography (CT) and corresponding invasive angiography images showing the fistula arising from the right coronary artery (RCA) forming the smaller (asterisk) and larger (arrowhead) aneurysms. (B) Volume-rendered CT and corresponding invasive angiography images showing the fistula arising from the left main (LM) forming the larger (arrowhead) aneurysm. (C) Axial CT image showing a jet of contrast draining from the larger aneurysm (arrowhead) into the pulmonic trunk. (D) Posterior view volume-rendered CT image showing the fistula arising from the inferior-posterior aspect of the aortic arch extending inferiorly to join the rest of the fistula network. The smaller (asterisk) and larger (arrowhead) aneurysms can also been seen.

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KEY WORDS coronary aneurysm, coronary to pulmonary artery fistula

APPENDIX For a supplemental figure, please see the online version of this paper.