

Coronary artery fistula with giant coronary aneurysm and high output heart failure



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Introduction

Coronary artery fistulas are anomalous communication between coronary arteries and a cardiac chamber or vascular structure. **Coronary artery aneurysm** is defined as dilatation of coronary artery exceeding 50% of the reference vessel diameter, and is termed giant if its diameter exceeds the reference vessel diameter by greater than 4 times or if they are more than 8mm in diameter.

This case describes an elderly woman, with incidental finding of coronary artery fistulas with giant aneurysms up to 5.6cm in size on transthoracic echocardiogram and was found to be associated with high output heart failure.

Case Presentation

A 75 year old female with history of hypertension, hyperlipidemia and schizophrenia was first admitted for COVID-19 infection in *May 2023*. There were cystic lesions over near right ventricular outflow tract (RVOT) along with small amount of pericardial effusion on bedside echocardiography. She was arranged with a follow up transthoracic echocardiogram (TTE) and was discharged.

Formal TTE was performed in *July 2023*. Multiple cystic lesions were found within the pericardial space next to the RVOT and right ventricle (RV). Colour flow and continuous wave (CW) doppler showed turbulent flow between these cystic structures and pulmonary artery, suggesting presence of communications. **Coronary fistulation with giant aneurysm was suspected.** Computed tomography (CT) coronary angiogram was arranged.

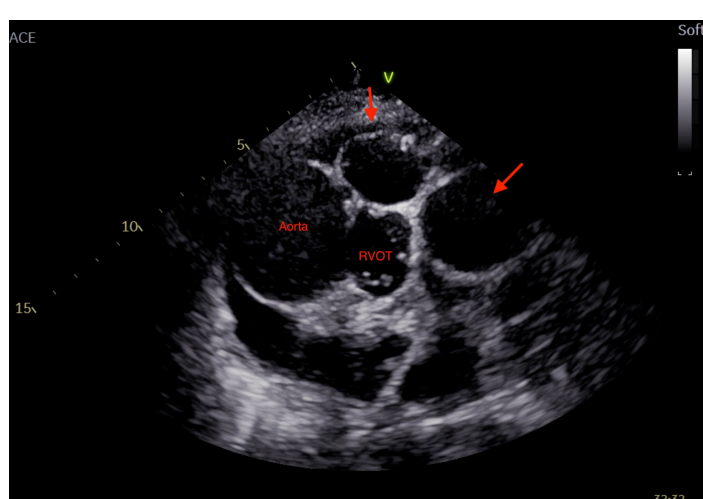


Figure 1. 2 giant coronary aneurysms located next to the RVOT in parasternal short axis view (PSAX)

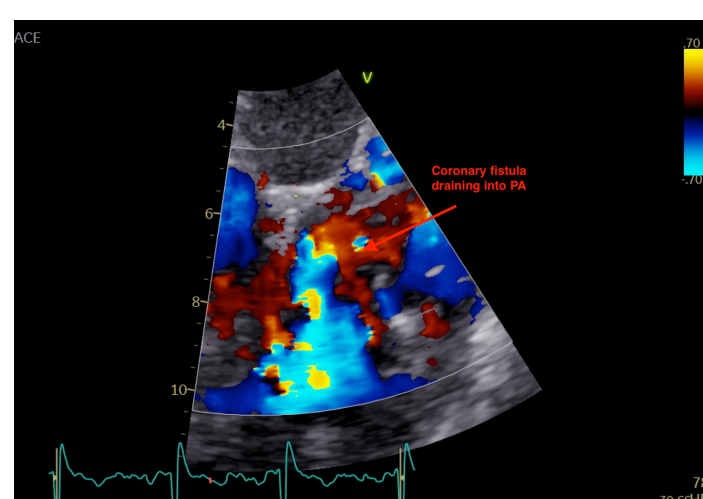


Figure 2. Colour flow showed turbulent flow between the coronary aneurysm and PA

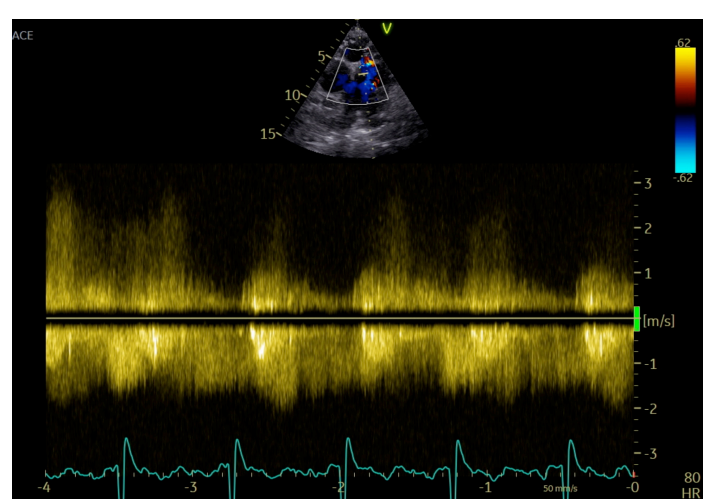


Figure 3. CW doppler showed continuous flow between coronary aneurysms with PA

This patient presented with shortness of breath and impending cardiac tamponade in *September 2023*.

Urgent CT aortogram was performed to rule out rupture of coronary aneurysm. CT confirmed the diagnosis of coronary fistula with aneurysmal formation. There were **multiple giant coronary artery aneurysms. The largest one measured 5.6cm x 4.5cm in size arising from the left anterior descending (LAD), with connection to the pulmonary artery (PA). The second largest aneurysm measured 3.1cm x 2.6cm in size arising also from the LAD and connecting to the pulmonary artery. There was also coronary fistula arising from RCA, connecting to the RVOT proximal to pulmonic valve.** No definite active contrast extravasation into the pericardial effusion is noted.

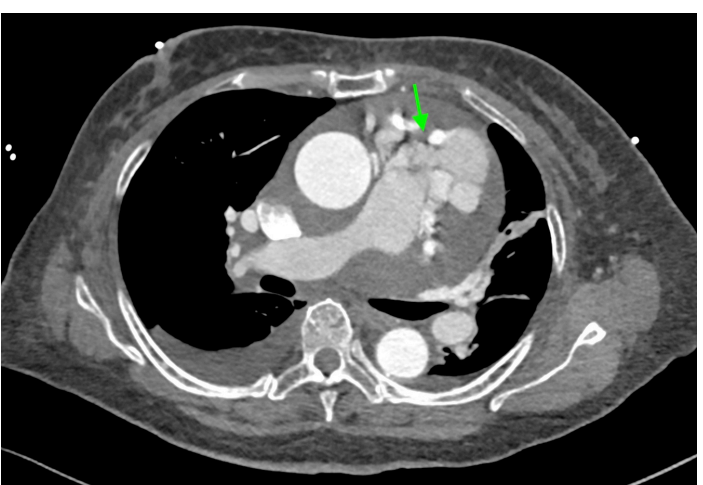


Figure 4. Communications between coronary aneurysm with PA

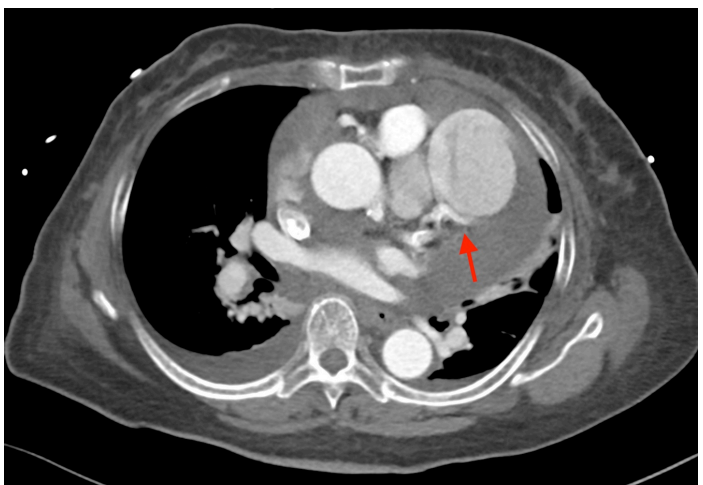


Figure 5. Coronary aneurysm arising from LAD

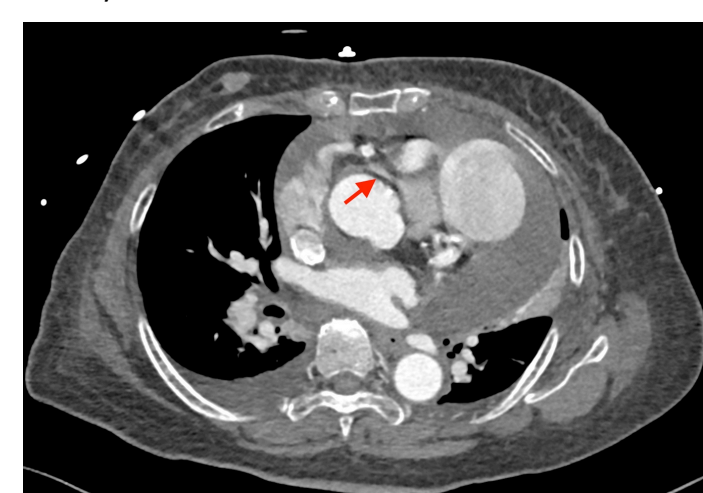


Figure 6. Coronary fistula arising from RCA to RVOT proximal to pulmonic valve

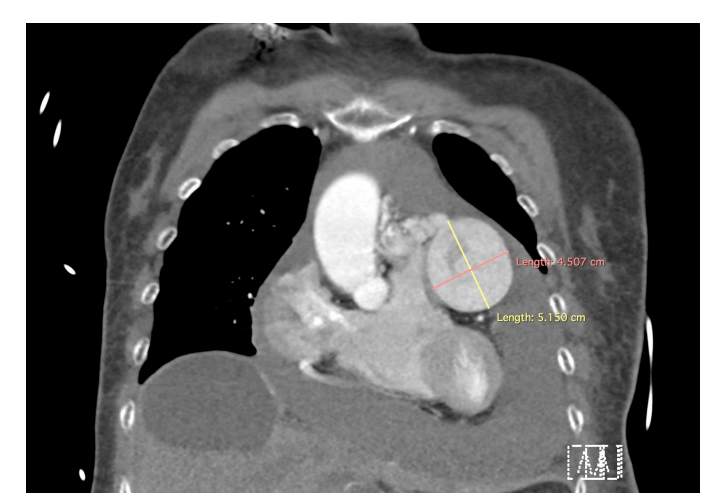


Figure 7. Giant aneurysm draining to PA

Pericardiocentesis was performed, with 2.8L blood-stained fluid yielded. Her heart failure symptom persisted despite drainage.

TTE was repeated, her **left ventricular systolic function was hyper-dynamic with estimated EF >70%**. Her cardiac output was high with calculated **cardiac output (CO) of 8.8L/min at heart rate (HR) 91bpm. The Qp:Qs ratio calculated was 1.36.** There was mild pulmonary hypertension with RVSP of 33.88 mmHg. It was suspected that her **high output heart failure was secondary to coronary artery fistulas.**

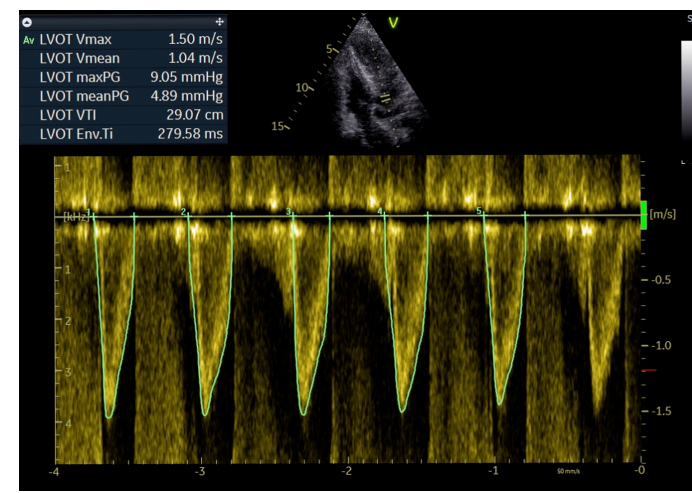


Figure 8. LVOT VTI

Discussion

This elderly patient was incidental found to have coronary artery fistulas with giant aneurysms, complicated with high output heart failure.

Coronary artery fistulas are the most commonly congenital. They can also be acquired from trauma or invasive cardiac procedures. Our patient had no history of surgery or trauma. Upon review, in a plain CT thorax in 2014 also showed similar aneurysms. Coronary artery fistula is a rare condition with prevalence of 0.9% among the general population. The most common type of fistula was coronary to pulmonary artery with prevalence of 76.8% in a study.¹ The other types include coronary to bronchial artery fistula and cardiac chamber fistula.

Symptoms of coronary artery fistula depends on the site of origin and termination, length and size of the fistula. Most coronary fistulas are small and asymptomatic, however, they can become hemodynamically significant over time causing symptoms, 63% of congenital coronary artery fistula become symptomatic over the age of 20.²

Clinical presentations include:

- (1) Myocardial ischaemia through coronary “steal”
- (2) Congestive heart failure
- (3) Thrombosis of fistula
- (4) Aneurysm formation or rupture

Our patient had multiple coronary artery-to-pulmonary fistulas, resulting in **left-to-right shunt. Her Qp:Qs ratio was 1.36, and was likely to be underestimated.** Our patient has multiple coronary fistulas inserting proximally and distally to the pulmonic valve respectively. The Qp is contributed by the coronary fistula inserted into RVOT proximal to pulmonic valve, while the Qs is contributed by coronary fistulas inserted distal to pulmonic valve into PA. Her calculated **CO was 8.8L/min.** Both suggesting that the coronary artery fistulas were of hemodynamically significance.

High cardiac output state is defined as a resting cardiac output greater than 8L/min. The **coronary artery-to-pulmonary fistulas** cause an left-to-right shunt bypassing the systemic circulation, resulting in compensatory increase in stroke volume and total plasma volume to maintain systemic perfusion.

Coronary artery fistula is a rare cause of high output heart failure. The most common etiologies were obesity (31%), liver disease (23%), arteriovenous shunts (23%) and lung disease (16%)⁴ Other causes of high output state including hyperthyroidism, cirrhosis, sepsis, anaemia had been excluded in our patient.

Coronary artery aneurysm is rare, the incidence in most recent studies is reported to be 1.5-5%.³ Rupture can result in cardiac tamponade and sudden death. The etiology of pericardial effusion in our patient remained uncertain but concealed rupture is one of the differential diagnosis.

In view of the significant hemodynamic effects, presence of giant coronary aneurysms and presence of heart failure symptoms, our patient was indicated for closure of the coronary artery fistulas. Treatment modalities include surgical repair or trans-catheter embolization. However, our patient declined cardiac catheterization and invasive treatment.

Conclusions

Coronary artery fistula is a rare condition. It can cause significant hemodynamic consequences, as in our patient who suffered from high output heart failure. Our patient remained asymptomatic for decades, but was picked up incidentally on TTE.

TTE provides important functional assessment of the coronary artery fistula. TTE has low sensitivity in picking up small fistulas. Our patient had multiple giant aneurysms that are large enough to be visualized in TTE. CT angiogram provides excellent details regarding the origin, drainage site, size and course of the coronary artery fistulas. Multi-mortality imaging is crucial in arriving diagnosis and guiding management.

References

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