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An unusual case of coronary artery fistula to the pulmonary artery, diagnosed with 64-MDCT coronary angiography

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Abstract This report describes a case of complex coronary–pulmonary artery fistula with one feeding vessel from the proximal part of the right coronary. The complex anatomy of the fistula was shown in detail by multidetector computed tomography using multiplanar reconstruction and 3D volume rendering techniques.

Traditionally, conventional angiography has been used for the diagnosis of coronary anomalies. With more frequent use of 64-row multi-detector computed tomography (CT) in chest and cardiac imaging, the number of incidentally found coronary artery fistulas has been increasing.

1. Introduction

Coronary–pulmonary artery fistula is an uncommon cardiac anomaly that can originate from any of the three major coronary arteries and drain into all cardiac chambers and great vessels, usually congenital. Most coronary–pulmonary artery fistulas are clinically and hemodynamically insignificant and are usually found incidentally.

Traditionally, conventional angiography has been used for the diagnosis of coronary anomalies. With more frequent use of 64-row multi-detector computed tomography (CT) in chest and cardiac imaging, the number of incidentally found coronary artery fistulas has been increasing (Fig. 1–5).

2. Case report

A 49-year-old woman was referred to the Chest Diseases Hospital for CT coronary Angiography. She had a history of subtle chest pain and arrhythmia. Creatine kinase level was normal. Chest radiography was unremarkable.

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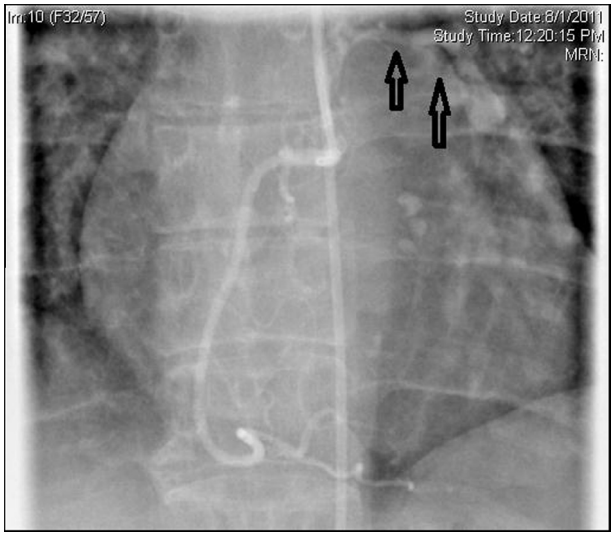

Fig. 1 Conventional coronary angiography showing fistula arising from the proximal RCA to the main pulmonary artery.

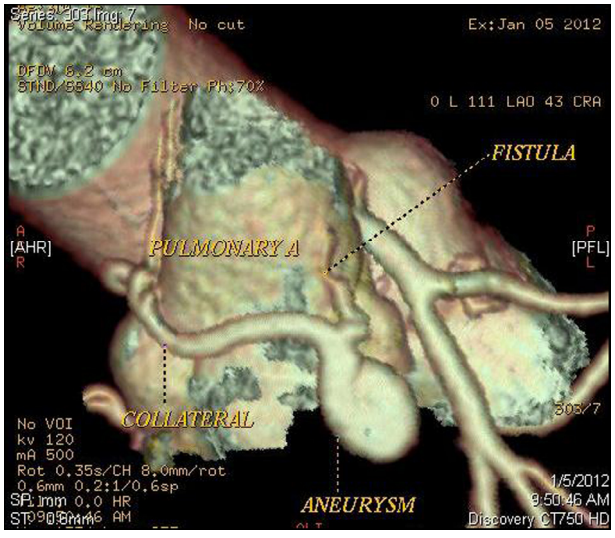

Fig. 2 MDCT coronary angiography oblique VR image LAO with zooming showing coronary fistula arising from the proximal RCA to the main pulmonary artery.

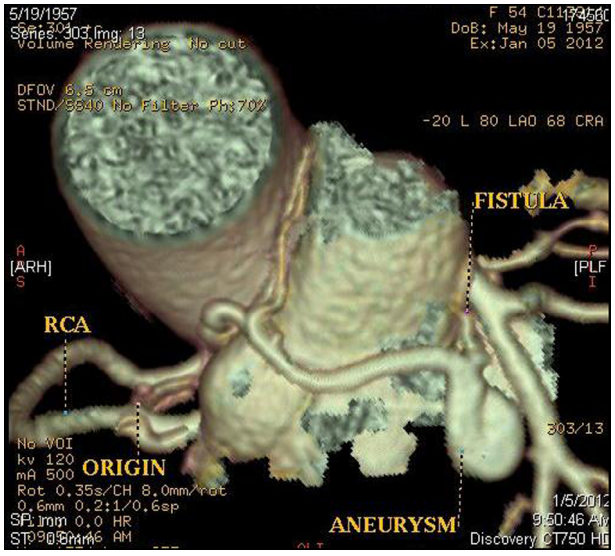

Fig. 3 MDCT coronary angiography VR image LAO different angles show coronary fistula arising from the proximal RCA to the main pulmonary artery.

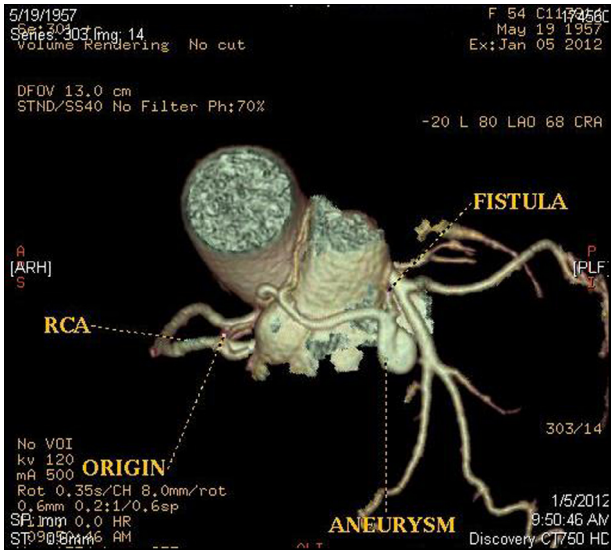

Fig. 4 MDCT coronary angiography VR image LAO with less zooming showing coronary fistula arising from the proximal RCA to the main pulmonary artery.

CT coronary angiography was performed using a 64-slice MDCT scanner (GE light speed machine). Imaging parameters of 120 kV, 250 mAs, and 0.5-mm slice collimation were preset for the scan. Given the patient's heart rate was between 65–70 beats per minute and was electrocardiogram gated (ECG gated), the CT scanner could automatically optimize the scanning parameters for the examination. In this case, gantry rotation speed at 0.4 s per revolution and a helical pitch of 3.2 were applied. A multisegment reconstruction algorithm was also selected automatically, which effectively improved the temporal resolution to 116 ms from the 200 ms, if a half-reconstruction algorithm was to be used.

The examination was performed using a single breath-hold technique to cover 120 mm from the cardiac outflow tract to the apex of the heart within a total scanning time of about 10 s. A total of 100 mL of nonionic water-soluble iodinated contrast medium at 370 mg I/mL concentration followed by 30 mL of normal saline IV was administered at a rate of 4 mL/s. An automated contrast medium tracing program was applied to trigger the scan when the attenuation at the ascending aorta reached 180 H. Prospective ECG-gated multi-segment reconstruction was performed at a 0.4-mm interval (i.e., 20% overlapping), with a predefined temporal offset at 70% R–R wave interval (at diastole) of each cardiac cycle to demonstrate the anomaly, using multi-planar reconstruction and different 3D reconstruction techniques. Processing was performed via a commercial workstation using a 3D visualization software (GE). Reconstruction was done at every 10% of R–R intervals from phase 40 to 80% of cardiac cycles.

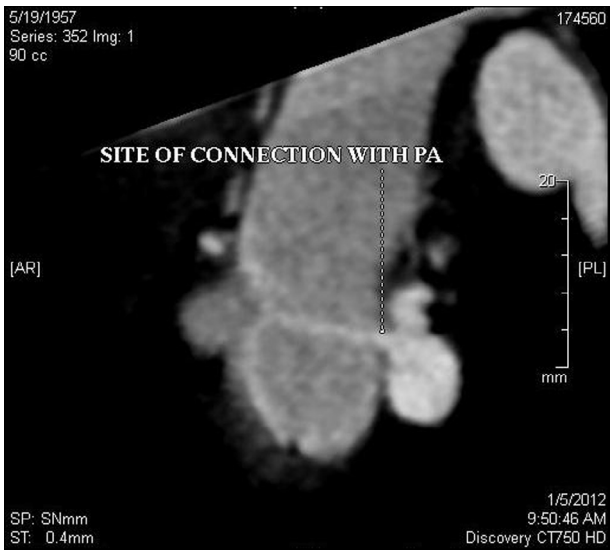

Fig. 5 MDCT coronary angiographic image view showing site of connection of the fistula arising from the proximal RCA to the main pulmonary artery.

The anatomy of the coronary artery–pulmonary artery fistula was complex but was well demonstrated after detailed analysis. The right coronary artery originates from the right coronary sinus, the left coronary artery originated from the left coronary sinus which bifurcates to LAD and LCx. There was right coronary dominance. The fistula was seen arising from the proximal RCA and courses horizontally anterior to the main PA till its left lateral aspect just above the pulmonary valve. Finally, it ended by joining to a 20-mm bulbous dilatation over the lateral aspect at the base of the main pulmonary artery before draining into the main pulmonary artery.

3. Discussion

CAF was described in 1865 by Krause (1). CAF can be congenital or acquired. The majority of CAFs reported are of the congenital form. The acquired CAF has rarely been discussed (2). CAF is a rare congenital anomaly, accounting for approximately 0.2–0.4% of congenital cardiac anomalies (3). CAFs have an estimated prevalence of 0.002% in the general population, but they are present in 0.05–0.25% of patients who undergo coronary angiography (4–7). There is no race or sex predilection for CAF (8).

Coronary fistulae may lead to serious complications, including myocardial ischemia, congestive heart failure, pulmonary hypertension and rupture of aneurysmal fistulae (9).

Coronary CTA is a relatively new imaging modality that has been used for non-invasive coronary artery imaging since 2000 (10). Prior to this earlier systems produced images that were of poor quality due to limitations with spatial and temporal resolution and image noise (11). With the introduction of multi-detector computed tomography (MDCT) many problems with image quality have been overcome (12). ECG-gated dual-tube 128-slice MDCT is capable of producing high quality images with the ECG-gated image reconstruction algorithms allowing phase-correlated image data sets (13). In this manner, Coronary CTA clearly delineates the cardiac chambers, the coronary arteries and coronary veins. It has been used as the technique of choice in demonstrating anomalous coronary artery anatomy and similarly is ideally suited to imaging patients with suspected coronary artery fistulae.

Reconstructed images demonstrated the anomalous vessels, their fistulous communications and the aneurysms, as well as the tortuous and dilated coronary arteries. The three-dimensional volume-rendered images provided an excellent depiction of the tortuous course of the fistulae, and the spatial relationships between the multiple aneurysms, fistulous communications, aorta, pulmonary arteries and the heart. The portion of the fistula draining into the main pulmonary artery could not be evaluated reliably by either CT or catheter angiography owing to the low pressure circulation within these fistulae, which caused decreased blood flow and marked attenuation of the caliber of the fistulae.

Conflict of interest

The authors declare no conflict of interest.

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