

Complex coronary artery fistula

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History

A 67-year-old female patient, suffering from an acute onset of chest pain, dyspnea and unconsciousness after an emotional event 2 hours earlier, was presented to the emergency department. Clinical laboratory tests and an electrocardiogram (ECG) showed no significant abnormalities. An echocardiography revealed a dilated and tortuous left coronary artery (LCA) with a suspicious thrombotic aneurysm and a fistula to the main pulmonary artery (MPA). The patient's medical history was unremarkable except for a controlled hypertension over the past 5 years and a left hip replacement surgery 3 years ago. A coronary CT angiography (cCTA) was requested for further evaluation.

Diagnosis

cCTA images showed an anomalous anterior connection between the proximal right coronary artery (RCA) and the left main coronary artery (LM). The anomaly was significantly entangled, tortuous and dilated with multiple aneurysmal changes. The largest of these was hypodense in the images, with significantly less peripheral contrast filling, suggesting a thrombotic formation. Three fistulas originated therefrom – the first, measuring 1 cm in diameter, drained into the MPA from the left; the second, coursing behind the MPA with a bulbous change at the entrance, connected posteriorly to the aortic arch and finally the third, passing the MPA as well as the aortic arch left-anteriorly and joining the proximal left subclavian artery (LSA). The origins and the branches of the RCA and the LCA appeared to be normal. The innominate artery (IA)

was moderately ectatic before it bifurcated into the right carotid artery and the right subclavian artery (RSA). The RSA coursed behind the right carotid artery with a normal caliber. The CT findings suggested a complex coronary artery fistula (CAF).

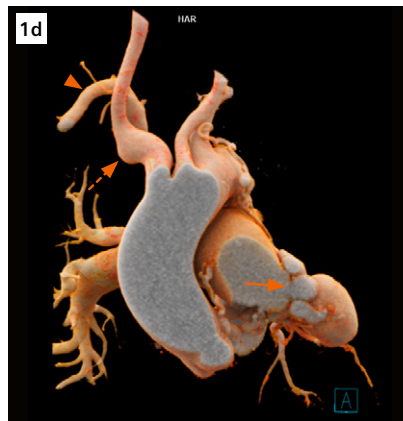
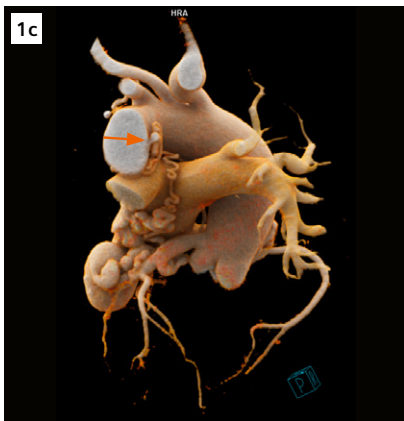
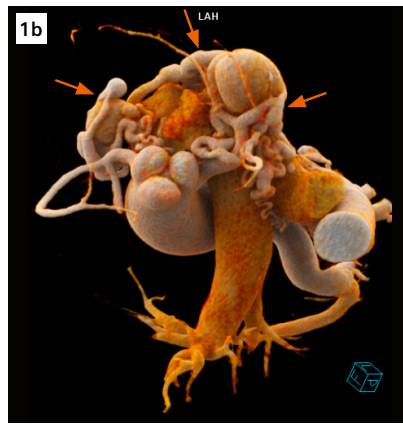
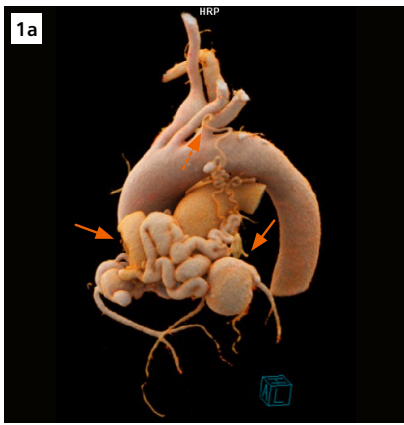
Comments

CAFs are abnormal communications of coronary arteries whereby venous circuits bypass the normal capillaries within the myocardium. Occasionally, a CAF may involve entangled blood vessels with multiple fistulous structures. This is classified as complex CAF. [1] This case presents a very rare anomaly – the RCA and the LM, while maintaining normal coronary branches, join each other through an anomalous connection derived proximally. Three CAFs originate therefrom. cCTA has emerged as the noninvasive alternative modality of choice for the assessment of such complex anomalies, due to the high spatial and temporal resolution and short acquisition time, granted especially by a dual source CT (DSCT). An ultra-fast Turbo Flash mode, applied in this case, completed the entire heart scan in just 0.37 second in free breathing. Furthermore, cinematic volume rendering technique (cVRT) facilitates three-dimensional lifelike demonstration and yields excellent anatomic details including the origin, course and drainage site of the CAFs. Knowledge of these characteristics is crucial for therapeutic planning. Although most affected patients are asymptomatic, CAFs can alter coronary hemodynamic parameters causing serious complications including heart failure and myocardial

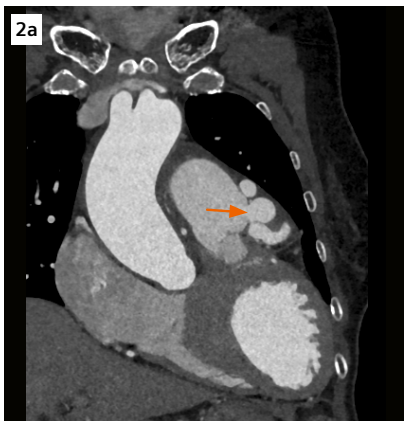
infarction. Therefore, in symptomatic cases, surgical ligation or percutaneous transcatheter closure is often recommended. cCTA plays an important role in preprocedural evaluation and follow-up. ●

Examination Protocol

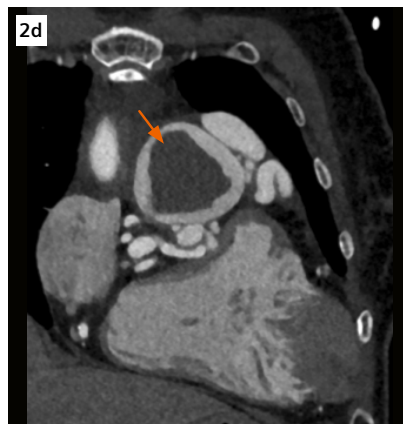
Scanner	SOMATOM Force
Scan area	Neck and Heart
Scan mode	Turbo Flash mode
Scan length	278.5 mm
Scan direction	Cranio-caudal
Scan time	0.37 s
Tube voltage	90 kV
Effective mAs	526 mAs
Dose modulation	CARE Dose4D
CTDI _{vol}	3.7 mGy
DLP	118.7 mGy*cm
Rotation time	0.25 s
Pitch	3.2
Slice collimation	192 x 0.6 mm
Slice width	0.75 mm
Reconstruction increment	0.5 mm
Reconstruction kernel	Bv40
Heart rate	52 bpm
Contrast	350 mg/mL
Volume	40 mL + 40 mL saline
Flow rate	3.5 mL/s
Start delay	23 s (Test bolus)



1 cVRT images show an anomaly (Figs. 1a and 1b, arrows) that is significantly entangled, tortuous and dilated with multiple aneurysmal changes, connecting the proximal RCA and the LM anteriorly. Three fistulas originate therefrom – draining into the MPA (Fig. 1d, arrow), connecting to the aortic arch (Fig. 1c, arrow), and joining the LSA (Fig. 1a, dotted arrow). The IA is moderately ectatic at its bifurcation (Fig. 1d, dotted arrow), and the RSA (Fig. 1d, arrowhead) courses behind the right carotid artery.



2 MPR images show three fistulas - draining into the MPA (Fig. 2a, arrow), joining the LSA (Fig. 2b, arrow), and connecting to the aortic arch (Fig. 2c, arrow). An aneurysmal change with thrombotic formation (Fig. 2d, arrow) is also seen.



References

- [1] Gabin Yun, et al. Coronary Artery Fistulas: Pathophysiology, Imaging Findings, and Management. *RadioGraphics* 2018; 38:688–703.

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