

## CASE REPORT

# Cardiac Computed Tomography Angiography for Imaging Coronary Arteriovenous Malformation: a Case Report

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**Background:** Coronary arteriovenous malformation is a rare congenital disease consisting mainly in a direct communication between a coronary artery and any one of the four cardiac chambers, coronary sinus, pulmonary arteries or veins. This disease can lead to various cardiovascular events, their severity depending on the degree of the malformation.

**Case report:** We present the case of a 56-year-old male patient, who was admitted to our institution with dyspnea, palpitation and chest pain, having a history of hypertension and hyperlipidemia, and an abnormal electrocardiogram. Physical examination did not reveal any alterations and the cardiac enzymes were in normal ranges. Cardiac computed tomography was performed before any other invasive studies, with a 64-row scanner (Somatom Sensation multislice 64 equipment, Siemens) after intravenous administration of non-ionic contrast material. CT scan revealed a large (2–2.5 mm) coronary fistula originating from the LAD to the main pulmonary artery, and multiple significant atherosclerotic coronary lesions. Coronary angiography confirmed the arteriovenous malformation between LAD and pulmonary artery, associated with three vascular coronary artery disease.

**Conclusions:** Cardiac computed tomography angiography can help for a non-invasive diagnosis of the coronary artery malformations, in the same time revealing anatomic details which can be particularly useful for choosing the appropriate management strategy (surgical planning, interventional treatment or optimum medical treatment).

**Keywords:** coronary arteriovenous malformation, atherosclerotic coronary lesions, computed tomography angiography

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## Introduction

Coronary arteriovenous malformation is a rare congenital disease consisting mainly in a direct communication between a coronary artery and any one of the four cardiac chambers, coronary sinus, pulmonary arteries or veins. This disease can lead to various cardiovascular events, their severity depending on the degree of the malformation [1]. The right coronary artery (RCA) is most commonly involved (55%), followed by the left anterior descending (LAD) (35%), and in 5% of cases the malformation originates from both coronary arteries. The predominant site of connections can be the right side of the heart (92%), followed by the right ventricle in 41%, the right atrium in 26%, the coronary sinus in 7%, the pulmonary artery in 17%, and superior vena cava in 1% of cases [2]. Most coronary artery fistulas are small and totally asymptomatic, being incidentally discovered and can resolve spontaneously, while the large arteriovenous fistula may present continuous precordial murmur, cardiomegaly, congestive heart failure (in older patients), dyspnea on exertion, fatigue (caused by the left-to-right shunt), angina, myocardial infarction, bacterial endocarditis, and palpitations [3].

## Material and methods

We present the case of a 56-year-old male patient, who was admitted to our institution with dyspnea, palpitation and chest pain, having a history of hypertension and hyperlipidemia. His electrocardiogram showed normal sinus rhythm with ST-T changes in the inferolateral leads (Figure 1).

Laboratory examination showed a normal blood count, cardiac enzymes within the normal ranges, hypercholesterolemia and hypertriglyceridemia (total cholesterol was 230 mg%, triglycerides were 275 mg%).

The patient was smoker and non-alcoholic beverage drinker.

His physical examination was normal, blood pressure was 125/60, heart rate 85 bpm, respiratory rate 16 cpm.

Echocardiography revealed a reduced LV ejection fraction (45%), a moderate mitral regurgitation and diastolic dysfunction.

Cardiac computed tomography was performed before any other invasive studies, with a 64-row scanner (Somatom Sensation multislice 64 equipment, Siemens) after intravenous administration of non-ionic contrast material, using the following scan parameters: 330 ms gantry rotation time, detector collimation 0.6 mm, tube voltage of 120 kV at a maximum current of 800 mAs, craniocaudal scan direction; with a dual phase administration of contrast media — injection of a bolus of 100 ml contrast me-

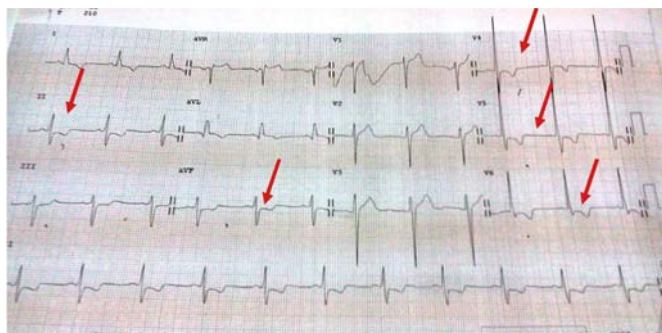


Fig. 1. Electrocardiogram showed ST, T changes in the inferolateral derivations

dia (iopromide 370 mg/ml) typically in an antecubital vein suitable for contrast administration, at a rate of 4.8 ml/sec, followed by administration of 100 ml saline at a rate of 4.4 ml/sec, and proceeded by administration of a short acting betablocker to achieve the desired heart rate.

Electrocardiographic gated tube current modulation was applied to reduce radiation exposure. After scan completion, multiphasic reconstruction of MSCT scans was performed at 40, 50, 60, 70 and 80% of the R-to-R interval. All MSCTA images were evaluated on 3D image analysis workstation (Leonardo, the syngo post-processing workplace, Siemens). The post-processing image reconstruction algorithms used for interpretation included two-dimensional (2D) axial, or three-dimensional (3D) maximal intensity projection (MIP), multiplanar reconstructions (MPR), curved multiplanar (cMPR) analysis and volume rendered technique (VRT).

## Results

CT scan revealed a large (2–2.5 mm) coronary fistula from the LAD to the main pulmonary artery, and multiple significant atherosclerotic coronary lesions (Figure 2). The patient was diagnosed as having an unstable angina pectoris.

Conventional coronary angiography confirmed that the patient have an arteriovenous malformation, between LAD and pulmonary artery, and three vascular lesions. Left anterior descending artery was occluded in the distal segment, circumflex artery showed a 65% stenosis, and right coronary artery showed a subocclusive stenosis in the distal segment (Figure 3).

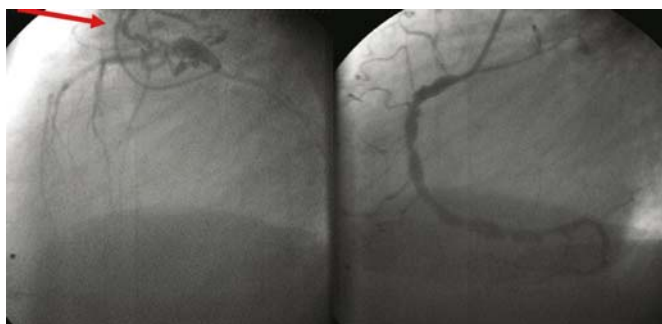


Fig. 3. Conventional coronary angiography with arteriovenous malformation, between LAD and pulmonary artery, and three vascular lesions

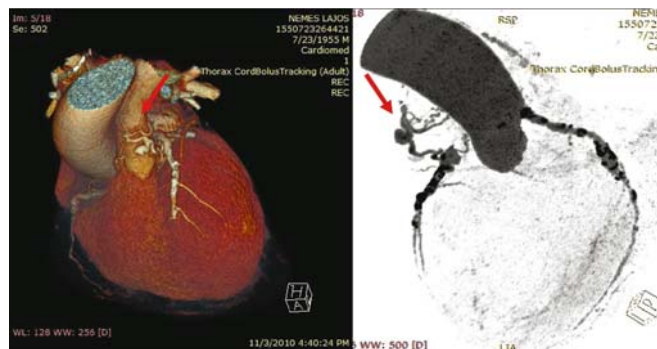


Fig. 2. Three-dimensional multislice computed tomographic image showing a coronary fistula using VRT (A) and angiographic view (B)

The patient underwent percutaneous transluminal coronary angioplasty with stent implantation on the distal segment of the right coronary artery followed by medical treatment, with good evolution. No surgical or interventional treatment was recommended for coronary fistula.

## Discussion

Coronary artery fistula is an unusual vascular anomaly that communicates between one of the coronary arteries and a great vessel or cardiac chamber. The first reported case of a coronary artery fistula was in 1865 by Krause, and its prevalence is of 0.1% to 0.2% in the adult population referred for cardiac catheterization.

Clinical presentations are variable depending on the type of fistula, shunt volume, site of the drainage, and presence of other cardiac conditions. Small fistulas remain clinically silent, and the myocardial blood supply is not compromised enough to cause symptoms. Coronary artery steal phenomenon may reduce myocardial perfusion in case of large fistulas, leading to ischaemic modifications in the myocardial segments perfused by the involved coronary artery [4,5], via a pathophysiologic mechanism related to the diastolic pressure gradient and runoff from the high-pressure coronary vasculature to a low-pressure receiving cavity.

Many complications can be encountered, such as cardiac failure (owing to left to right shunting), myocardial ischemia or infarction (owing to coronary steal phenomenon) or bacterial endocarditis. Surgical intervention, direct epicardial or endocardial ligations and transcatheter embolizations are the main therapeutic methods for closure of the coronary artery fistula [6,7].

We report the case of a 56-year-old man with coronary artery fistula to pulmonary artery and significant coronary lesions, which were diagnosed on 64-slice coronary CT and reconfirmed by coronary catheter angiography. For this patient with significant coronary lesions and coronary fistula, the coronary steal could be a clinically relevant mechanism. The treatment chosen in this case was percutaneous transluminal coronary angioplasty with stent implantation in the distal segment

of the right coronary artery, with good evolution during follow-up.

### Conclusions

Cardiac computed tomography angiography can help for a non-invasive diagnosis of the coronary artery malformations, in the same time revealing anatomic details which can be particularly useful for choosing the appropriate management strategy (surgical planning, interventional treatment or optimum medical treatment).

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