



Case Report

Anomalous left anterior descending artery diagnosed on pulmonary artery computed tomography

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ABSTRACT

Typically, the left anterior descending artery (LAD) and left circumflex artery (LCX) arise from the left main coronary artery.

However, uncommon coronary anomalies may be found in clinical practice. This case presents with a rare finding where the LAD originates from the right coronary artery (RCA) separately from the LCX and takes an interarterial pathway to reach its perfusion territory.

A 49-year-old Hispanic female with hypertension and diabetes mellitus presented to the emergency department with a 7-day history of chest pain. She denied nausea, diaphoresis, syncope, or other symptoms. A grade 3 out of 6 systolic murmur was noted on physical examination. Computed tomography of the pulmonary arteries (CTPA) revealed that the patient had no left main coronary artery. The patient's LAD arose from the proximal RCA and took an inter-arterial course. Subsequent coronary catheterization showed no stenosis of the coronary arterial system. The patient's chest pain subsided during the course of her admission and she was deemed stable for discharge with close cardiology follow up.

In general, coronary artery anomalies are an uncommon finding in clinical practice. However, it is important to realize the different pathways of coronary artery anomalies because those with the inter-arterial subtype, such as our patient, may result in sudden cardiac death. All cases of clinically suspected inter-arterial coronary artery anomalies are recommended to undergo imaging studies to help visualize anatomic features as a guide for further management. This case represents the first reported diagnosis of this type of anomalous coronary artery on CTPA.

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1. Introduction

A coronary anomaly in which the left anterior descending artery (LAD) and left circumflex (LCX) arise from separate origins of the right side of the heart is an uncommon finding in clinical practice. This case presents a rare anatomical finding on computed tomography of the pulmonary arteries (CTPA) where the LAD originates from the right coronary artery (RCA) and takes an inter-arterial pathway.

2. Case report

A 49-year-old Hispanic female with hypertension and diabetes mellitus presented to the emergency department (ED) with a 7-day history of sharp and stabbing chest pain. The pain was located left of the sternal border and radiated down her left arm. She reported stress,

which appeared to exacerbate the pain. She denied nausea, diaphoresis, syncope, or other symptoms.

Physical examination revealed no signs of acute distress. Vital signs were normal. Cardiovascular examination revealed a grade 3 out of 6 systolic murmur heard loudest over the left upper sternal border. Breath sounds were clear and equal bilaterally. No other notable abnormalities were found.

Workup in the ED revealed a complete blood count, comprehensive metabolic panel, and troponin that were unremarkable. Electrocardiogram (ECG) showed normal sinus rhythm with no ST segment or T wave abnormalities. Chest X-ray did not show any acute cardiopulmonary abnormalities. CTPA was performed to assess for pulmonary embolism. It revealed that the patient's left coronary artery appeared to arise from the right cusp near the RCA (Fig. 1). The LCX was not well delineated. Cardiothoracic surgery was consulted and recommended a CT coronary angiogram (Fig. 2), which showed that the patient had no left main coronary artery. The patient's LAD was small in caliber and arose from the proximal RCA just distal to its origin. The LCX arose separately from the LAD, originating from the right cusp. The LAD took an inter-arterial course between the right ventricular outflow tract and

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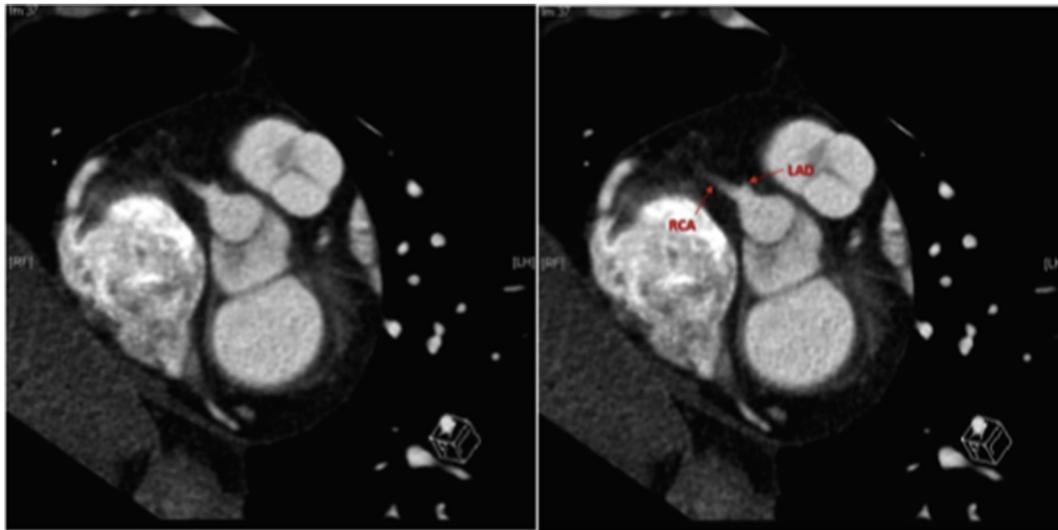


Fig. 1. CT pulmonary angiogram showing left coronary artery arising from right cusp near the right coronary artery.

the aortic root, and travelled intramurally towards the right ventricular outflow tract for approximately 3.5 cm. Subsequent coronary catheterization showed no stenosis of the coronary arterial system. Troponins were trended during admission and remained negative. Serial ECGs remained reassuring throughout her visit. The patient's chest pain subsided during the course of her admission and she was deemed stable for discharge with close cardiology follow up.

3. Discussion

In normal cardiac anatomy, the LCX and LAD originate from the left main coronary artery. In our patient we see a coronary artery anomaly in which the LAD originates from the RCA and the LCX originates from the right cusp separately from the LAD. A coronary artery that arises from the contralateral aortic valve cusp may take on different pathways to reach its perfusion territory [1]. The different pathways determine the prognostic risks associated with each coronary artery anomaly [2].

Coronary artery anomalies are uncommon where the incidence is reported to be about 1% [1]. A separate origin of the LAD and LCX has an incidence of 0.41% and an origin of the left coronary artery from the contralateral aortic valve cusp has a prevalence up to 0.17% [1,3]. Specifically, our patient's LAD took the inter-arterial pathway between

the aortic and pulmonic valves to reach its perfusion territory. This pathway has a prevalence of only 0.03% making this specific case very rare [2].

Clinical manifestations of coronary artery anomalies range from asymptomatic to angina, myocardial infarction, syncope, dysrhythmia, and sudden cardiac death. Most coronary artery anomalies are clinically benign and do not significantly impact blood flow to the myocardium [4]. However, coronary arteries arising from the contralateral aortic valve cusp and subsequently taking an inter-arterial course may lead to sudden cardiac death. The intramural path within the aortic root wall that the inter-arterial coronary artery takes to reach its perfusion territory is hypothesized to result in a hypoplastic and narrower coronary vessel compared to normal anatomy. Such obstruction may lead to myocardial ischemia especially during periods of exertion or emotional stress where there is an increased demand for myocardial oxygen [4] (Table 1).

While a recent study indicates that the proximal coronary arteries can be well assessed in over half of CTPA, we found no reports of this abnormality diagnosed with this modality [5]. Current guidelines do not support universal screening tests for coronary artery anomalies in asymptomatic patients [6]. Due to the high risk of sudden cardiac

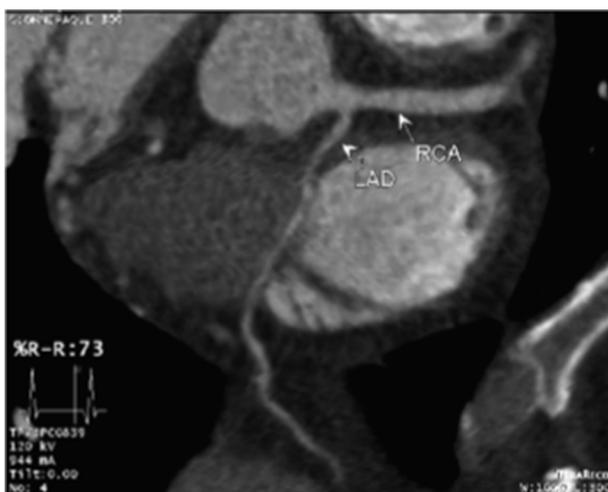


Fig. 2. CT coronary angiogram revealing small left anterior descending artery arising from proximal right coronary artery.

Table 1

Five common pathways a coronary artery that arises from the contralateral aortic valve cusp can take to reach its perfusion territory [1,3].

Anomaly type	Description of pathway	Prognosis & emergency department disposition
Pre-pulmonic	Anterior to the pulmonic valve.	Rarely causes clinically significant consequences. Stable for outpatient follow up.
Retro-aortic	Posterior to the aortic valve.	Rarely causes clinically significant consequences. Stable for outpatient follow up. Of note, may complicate any future aortic valve surgeries.
Inter-arterial	Between the aortic and pulmonic valves.	Increased risk for sudden cardiac death. Warrants admission for further evaluation and observation.
Trans-septal	Anteriorly and inferiorly through the interventricular septum, within the myocardium.	Rarely causes clinically significant consequences. Stable for outpatient follow up.
Retro-cardiac	Posterior to the mitral and tricuspid valves.	Rarely causes clinically significant consequences. Stable for outpatient follow up.

death among patients with the inter-arterial subtype, however, all cases of clinically suspected inter-arterial coronary artery anomaly are recommended to undergo imaging studies to help visualize anatomic features as a guide for further management [6]. Symptomatic patients with an inter-arterial subtype are recommended for surgical intervention to prevent sudden cardiac death [7]. Patients with a coronary artery anomaly without the inter-arterial subtype generally have a good prognosis [7]. Therefore, physicians are recommended to use the patient's clinical presentation, age, functional anatomy, and physiology as a guide for optimal management.

Declarations of interest

None.

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