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CASE REPORT

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Prevalence of coronary artery anomalies in 295 coronary computed tomography angiographies performed in Angola: Challenges and difficulties

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Abstract

The present article describes the prevalence of coronary artery anomalies (CAAs) in patients undergoing coronary CT angiography at a private clinic in Luanda, Angola, and the clinical and angiotomographic characteristics of the two patients with CAAs. These anomalies are uncommon and constitute a significant challenge in resource-poor countries.

KEYWORDS

Angola, coronary artery anomalies, CT angiography

1 | INTRODUCTION

Coronary artery anomalies (CAAs) are relatively infrequent but clinically relevant pathologies.[1] Most patients with CAAs are asymptomatic, and the diagnosis is often an incidental finding on coronary angiography or computed tomography (CT). Its clinical significance depends on several factors, including the origin and course of the artery and the area of the perfused myocardium. When present, symptoms are due to myocardial ischemia and may include angina, arrhythmia, syncope, myocardial infarction, or sudden death. Diagnosis is essential for proper treatment.[1,2] The present article aims to estimate the prevalence of CAAs in a population of patients undergoing coronary CT angiography in a private clinic in Luanda, Angola, and to describe the clinical and imaging findings of patients with CAAs. The authors, regarding these two clinical cases, review the literature briefly.

2 | METHODOLOGY

We performed an observational and retrospective cohort study that included all patients who underwent coronary CT angiography at Clinica Medical Center, in Luanda, Angola, from October 2019 to October 2022. Coronary CT angiography was performed using a multidetector computed tomography scanner of 64 slices (Somatom

Perspective; Siemens, Erlagen, Germany) with the following parameters: tube voltage 100–120 kV, collimation 64 mm × 0.6 mm, and temporal resolution 0.185 s. The exams were performed with prospective electrocardiographic gating. The acquisition was performed with 3 mm slices, followed by reconstruction for a slice thickness of 0.75 mm.

The study population consisted of all users who underwent coronary CT angiography and had their data included in the Clinic Medical Center database in the period mentioned above. Demographic and clinical variables, coronary calcium score, and presence or absence of coronary disease were analyzed.

3 | RESULTS

Of the 295 patients undergoing coronary CT angiography, nine were excluded because images were not acquired because they had a calcium score > 700; eight patients were excluded because they had previous revascularization (surgical or percutaneous) in the context of atherosclerotic coronary artery disease. One patient was also excluded due to incomplete data concerning cardiovascular risk factors. Of the remaining 277 patients, two (0.72%) had CAAs, which are presented below.

3.1 | Clinical Case 1

A male patient, 58 years old, with a history of arterial hypertension, and dyslipidemia, medicated with antihypertensive and hypolipidemic drugs, denying other risk factors for CAD, went to the cardiology consultation with complaints of atypical chest pain over the last 2 years.

On admission, the physical examination revealed a patient with a supine blood pressure of 160/95 mmHg. The remaining physical examination was unremarkable. The laboratory tests were normal, except for the cholesterol, which was 226 mg/dl. Additionally, a 12-lead-ECG revealed sinus rhythm and heart rate of 54 bpm, left anterior hemiblock, and nonspecific ventricular repolarization changes. Chest radiography showed no significant changes. The 24-hour Holter ECG revealed a sinus rhythm, a minimum heart rate of 42 beats/min and a maximum of 97 beats/min, five isolated ventricular extrasystoles, and 16 isolated supraventricular extrasystoles. No significant pauses or changes in atrioventricular conduction, or significant changes in ventricular repolarization, were seen. Transthoracic echocardiography revealed a normal left ventricular systolic function (LVEF = 62%) and a type I diastolic dysfunction. The exercise test was inconclusive.

Considering the intermediate probability of coronary disease (CD) and the inconclusive result of the stress test, the patient underwent coronary CT angiography, which revealed right dominance; zero coronary calcium score, and an anomalous origin of the right coronary artery in the left sinus of Valsalva. The right coronary artery has an interarterial course and an angle at its origin of around 30° but without other high-risk features (slit-like orifice and intramural path in the aorta) (Figure 1). No atherosclerotic lesions were identified in the vessels observed. The patient remains on medical therapy with antihypertensive, lipid-lowering, and antianginal drugs. We also advise the patient not to do strenuous exercise.

3.2 | Clinical case 2

A female patient, 63 years old, with a history of arterial hypertension, diabetes mellitus, and dyslipidemia medicated with antihypertensive, oral antidiabetic, and hypolipidemic drugs, denying other risk factors for coronary disease, sought a cardiology consultation with complaints of retrosternal pain and tightness, triggered by the effort relieved with rest.

On admission, the physical examination revealed an obese patient (BMI = 31.2) with a supine blood pressure of 150/75 mmHg. The remaining physical examination was unremarkable. Additionally, a 12-lead-ECG revealed sinus rhythm and complete left bundle branch block (LBBB). Chest radiography was normal. Ambulatory blood pressure measurement suggested systolic–diastolic hypertension in both periods. Holter ECG revealed a sinus rhythm, mean heart rate of 66 beats/min, and rare isolated ventricular and supraventricular extrasystoles. No significant pauses or changes in atrioventricular conduction, or disturbances of intraventricular conduction, were seen. Transthoracic echocardiography revealed a dilated left ventricle, with a left ventricular ejection fraction (LVEF) of 37%. Renal ultrasound revealed topical kidneys of normal dimensions with preserved parenchyma-sinus differentiation.

Taking into account the moderate to high probability of CD and the presence of LBBB, which contraindicates the performance of a conventional exercise test, the patient underwent coronary computed tomography angiography, which revealed left dominance; zero coronary calcium score, and an anomalous origin of the left coronary artery in the right sinus of Valsalva. The common trunk of the left coronary artery is long and has a retroinfundibular course until it emerges in the middle 1/3 of the anterior interventricular sulcus, where it gives rise to the anterior descending artery, an intermediate branch, and an ascending branch corresponding to the circumflex artery

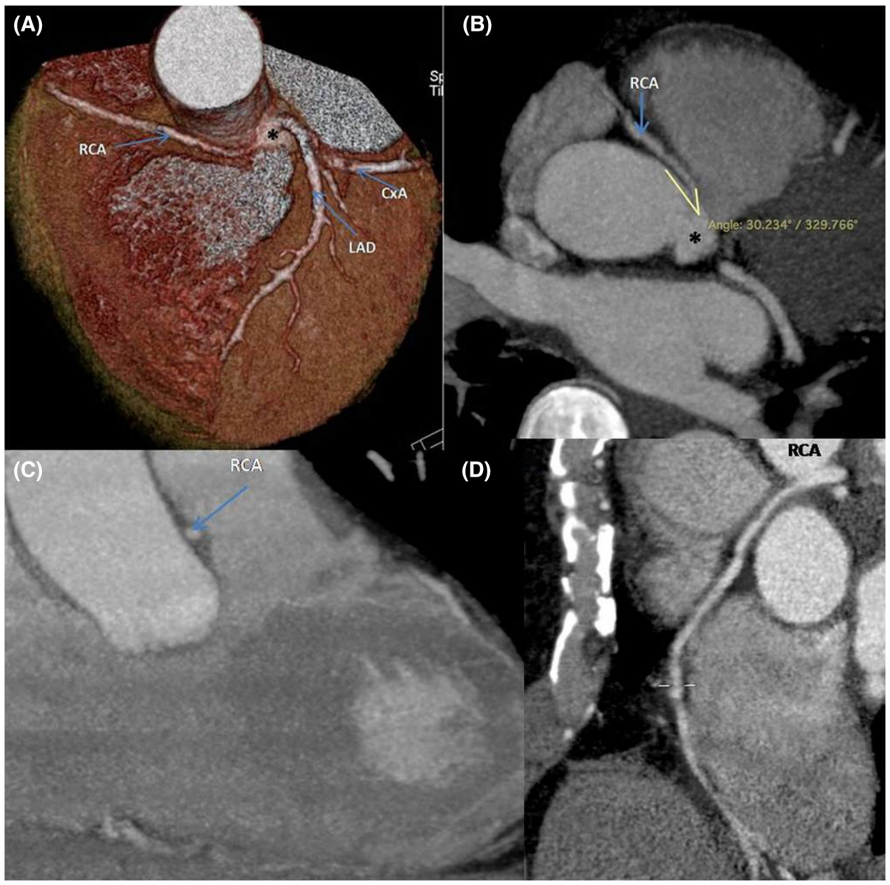

FIGURE 1 Anomalous origin of the RCA in the left coronary sinus (asterisk) that courses between the aorta and the pulmonary artery. Three-dimensional volume rendering reconstruction (A). In the axial view, (B) the angle angle at its origin is around 30° and the shape of the ostium of RCA is normal (C). No reduction of the coronary lumen is observed during the entire course of the vessel (D). *Left coronary sinus (asterisk), RCA - right coronary artery, CxA - circumflex artery. LAD – left anterior descending artery.

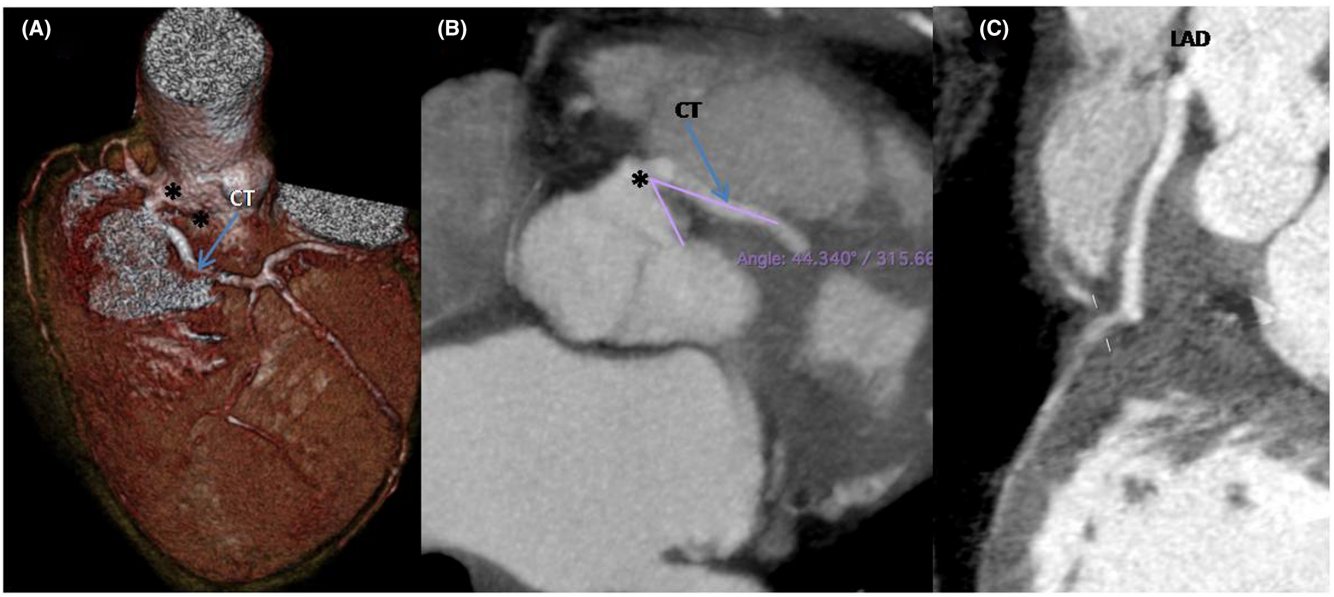

FIGURE 2 Anomalous origin of the LCA in the right coronary sinus (asterisk). Three-dimensional volumetric reconstruction (A). In the axial view, (B) the angle at its origin is 47° and the shape of the ostium of the common trunk is normal, The common trunk is long and has a retroinfundibular course until it emerges in the middle 1/3 of the anterior interventricular sulcus where it gives rise to the left anterior descending artery, an intermediate branch and an ascending branch corresponding to the circumflex artery. No reduction of the coronary lumen is observed during the entire course of the vessel (C). CT - Common trunk.

(Figure 2). A rudimentary right coronary artery arises also from the right coronary sinus. No atherosclerotic lesions were identified in the vessels observed. To define the best therapeutic approach, the patient was referred to perform myocardial perfusion scintigraphy, remaining under medical therapy until the present date.

4 | DISCUSSION

CAAs can be found in 0.3% to 5.6% of the population.[1] The classification proposed by Angelini, initially in 1989 and later updated, is currently one of the most used and divides CAAs into (1) origin and course anomalies; (2) intrinsic anomalies; (3) termination anomalies; and (4) anomalous anastomotic vessels.[3] Another classification divides AACs into hemodynamically significant and non-hemodynamically significant. Those classified as hemodynamically significant include (1) anomalies of origin with an intraarterial course; (2) anomalous origin in the pulmonary artery; (3) atresia; (4) inborn fistulas.[4]

In turn, in cases of the anomalous location of the coronary ostium in an improper sinus (right coronary artery (RCA) arising from the left anterior sinus or left coronary artery (LCA) arising from the right anterior sinus), the anomalous course may be (1) posterior atrioventricular or retrocardiac sulcus; (2) retroaortic; (3) between the aorta and the pulmonary artery (intramural); (4) intraseptal; (5) anterior to the pulmonary outlet; (6) posteroanterior interventricular groove.[3]

Regarding the anatomical findings of the coronary tree found on coronary CT angiography, the first patient is a typical case of anomalous origin of the right coronary artery, in the left sinus of Valsalva. The right coronary artery has an interarterial course and an angle at its origin of around 30°, but no other high-risk features (slit-like orifice and intramural course in the aorta). The second patient is a case of anomalous origin of the left coronary artery in the right sinus of Valsalva. with a long common trunk with a retroinfundibilar course.

The clinical picture of CAAs depends on several factors, including the origin and course of the artery and the area of the perfused myocardium. When present, symptoms are due to myocardial ischemia and may include atypical anginal chest pain, arrhythmia, syncope, myocardial infarction, or sudden death.[2,5] The latter occurs especially in young people in the context of strenuous physical exercise.

Physical examination is most often normal, unless there is an associated structural cardiac lesion. Thus, the diagnosis of these patients is a challenge.[6] Most CAAs are discovered incidentally during the diagnostic process in patients with suspected ischemic heart disease as in the cases reported herein.[7]

On the other hand, coronary CT angiography has become a first-line diagnostic method in the evaluation of patients with chest pain and an intermediate probability of coronary disease.[8] In both patients, the main complaint that motivated the cardiology consultation was chest pain; atypical in the first case and typically anginal in the second. In addition, both patients had two or more cardiovascular risk factors and an intermediate pretest probability of CD. The impossibility of demonstrating myocardial ischemia in the exercise test led to the performance of coronary CT angiography, which showed the diagnosis of CAAs.

Cardiac imaging plays an important role in the detection, categorization, and risk stratification of patients with CAAs. Conventional coronary angiography was once considered the gold standard in the diagnosis of CAAs. However, it is an invasive method that uses ionizing radiation[7,9] and does not provide a three-dimensional view.

With the evolution of imaging techniques, especially coronary CT angiography and magnetic resonance angiography (MRI), it has become possible to perform a three-dimensional evaluation of the origin and course of the coronary arteries. Currently, coronary CT angiography is the gold standard for the diagnosis of CAAs, and MR angiography is a second option.[7] MR angiography is also capable of providing additional information on myocardial perfusion and function, viability, and arterial flow without resorting to ionizing radiation,[6,9] its main limitation is the high cost and low availability, not being available in Angola.

Current guidelines on the management of adults with congenital heart disease suggest the use of ischemia-inducing tests when CAAs are an incidental finding or when their clinical significance cannot be fully extrapolated from anatomical studies.[7,10] However, no standardized protocol has been proposed to date to stratify CAA-related ischemia because only a few studies have addressed this topic.[9]

Physical exercise stress protocols mimic physiological conditions; therefore, they are considered the first choice to assess inducible ischemia. Treadmill exercise ECG is often the first test performed on individuals capable of running because of its cost-effectiveness and wide availability.[7] The treadmill stress test was performed in the first case; however, it was inconclusive. In the second case, the presence of LBBB contraindicated the examination.

Other myocardial ischemia-inducing tests recommended by the guidelines of the European Society of Cardiology (SEC) for the treatment of congenital heart diseases in adults, such as myocardial perfusion scintigraphy, echocardiography, or cardiac MRI, are not available in our environment, reflecting the difficulties existing in the diagnostic approach and therapeutic projection of these patients, especially concerning the second case that presents typical anginal complaints, an anomalous origin of the left coronary artery, in the right sinus of Valsalva, with a retroinfundibular course and LBBB on the ECG. This patient could benefit from surgical treatment (Class I, level of evidence C).

There are three forms of treatment for CAAs: (1) observation/drug treatment; (2) angioplasty with endoprosthesis placement; (3) surgical treatment.[5]

According to the most recent ESC recommendations for the treatment of congenital heart disease in adults, surgery is recommended in the following situations: (1) In patients with CAAs and typical angina symptoms who present with evidence of stress-induced myocardial ischemia in a compatible territory or high-risk anatomy. (Class I, level of evidence C); (2) In patients with anomalous left coronary artery origin in the pulmonary artery (Class I; level of evidence C); (3) In patients with anomalous right coronary artery origin in the pulmonary artery and complaints suggestive of myocardial ischemia (Class I; level of evidence C). Finally, surgery is not recommended in asymptomatic patients and in patients without myocardial ischemia and high-risk anatomy (Class III; level of evidence C).[10] On the other hand, in line with these recommendations, the identification of adult patients with CAAs who are at risk of sudden cardiac death and for whom surgery provides benefits in adulthood requires further research.[10]

The percutaneous option with a stent is reserved for selected cases. In patients with CAAs, but without evidence of ischemia, the management should be more conservative, with beta-blockers and lifestyle changes, to avoid strenuous physical exercises.[5]

In conclusion, coronary artery anomalies are uncommon pathologies and constitute a major diagnostic and therapeutic challenge that includes the characterization of the origin and course of the coronary artery, the existence of myocardial ischemia, and the decision to intervene "surgically", especially in countries with few resources.

AUTHOR CONTRIBUTIONS

Humberto Morais: Conceptualization; writing – original draft; writing – review and editing. **Preciosa Lourenço:** Data curation. **Carlos Martins:** Data curation. **Lorette Cardona:** Writing – review and editing. **Mauer A. A. Gonçalves:** Conceptualization; writing – review and editing.

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CONFLICT OF INTEREST

None.

DATA AVAILABILITY STATEMENT

Data available on request from the authors.

CONSENT

Written informed consent was obtained from the patients to publish this report following the journal's patient consent policy.

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