Computed Tomography Angiography as a Complementary Diagnostic Method in Coronary Artery Anomalies: Case Report

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Introduction

Anomalies of the coronary arteries are rare diseases and range from 0.17% in autopsy studies and 1.3% in angiographic series[1,2]. These anomalies are usually asymptomatic, but some anatomical changes are potentially serious and may lead to significant myocardial ischemia followed by AMI or sudden death. These events are the scariest ones and are usually preceded by physical activity in about 81% of the cases[2-4].

Some pathophysiological mechanisms are proposed to explain myocardial ischemia, AMI and sudden death in patients with anomalies of the coronary arteries: the anomalous coronary artery originating from an acute twisted angle in the aorta; narrowing in the coronary ostium secondary to the anomalous anatomy; compression of the anomalous coronary artery over its path between the aorta and the pulmonary trunk during exercise; and spasm of the anomalous coronary artery possibly as a result of endothelial injury. The coronary segments with anomalous pathway are not more susceptible to atherosclerosis than the normal segments in the same individual[4].

We report the case of an anomalous circumflex coronary artery originating from the right sinus of Valsalva, evidenced by coronary angiography conducted to investigate ischemia documented by typical chest pain associated with high markers of myocardial necrosis. The case turns out to be relevant because the myocardial ischemia occurred at rest in a patient with coronary artery anomaly whose benign outcome was expected.

Case Report

Male patient, 41, white, university professor, sought emergency assistance with a history of having woken up by a very strong burning unprecedented chest pain irradiating to the left arm, lasting longer than 30 minutes. The patient presented no risk factors for early coronary artery disease.

On physical examination, the patient was in good general condition, flushed and hydrated, clean lungs, regular heart rate with two sounds, heart rate of 76 bpm, clean systole and diastole, blood pressure of 130/80 mmHg. The other devices did not reveal any significant abnormalities.

Electrocardiogram on admission revealed sinus rhythm, delayed conduction in the right bundle of His and unspecific abnormalities of ventricular repolarization on the lower wall. Elevation of myocardial necrosis markers was documented: CKMB mass (ΔT6hs) = 58.60 ng.ml^{-1} and Troponin I (ΔT12hs) = 13.83 ng.ml^{-1}, defining the diagnosis of AMI without ST-segment elevation. Coronary angiography found no significant coronary atherosclerosis. The circumflex artery, however, showed anomalous origin of the right sinus of Valsalva with marked tortuosity in its proximal third (Figure 1).

Transthoracic echocardiography performed during hospitalization showed no abnormality in segmental mobility and global systolic performance estimated by left ventricular ejection fraction was normal. Cardiac magnetic resonance imaging, which could improve the accuracy of segmental mobility analysis in the area affected, and could rule out other causes, was not performed.

Coronary angiography was requested to evaluate the angle in the origin and the proximal course of the anomalous circumflex artery, as well as its relationship with the bottom vessels. The test showed circumflex coronary artery originating from an oblique angle in the right coronary sinus and retroaortic path between the left atrium and the aorta without the presence of atherosclerotic plaques or luminal narrowing (Figure 2).

After three-dimensional analysis of the anatomical aspects of the angle at the origin and in the proximal course favored by computed tomography angiography which showed a favorable anatomy, expectant management was chosen for the anomaly of the circumflex artery and clinical treatment for AMI without ST-segment elevation. From this perspective, and in view of the inability to rule out coronary vasospasm, the patient was treated with calcium channel blocker, nitrate, statin and antiplatelet drugs. The patient is clinically followed up on a quarterly basis and showed no recurrence of angina symptoms after 15 months of follow-up.

Discussion

Diagnosis of abnormalities of the coronary arteries is a challenge because the patients are often asymptomatic with normal physical examination. These patients remain without symptoms for a long period of their lives and the most common reasons why they are referred for medical care are acute chest syndromes or atypical pain[1].

A wide variety of these anomalies has been identified and can be grouped as follows: anomalous origin of the left coronary artery from the pulmonary trunk; anomalous origin

Keywords

Cardiovascular abnormalities; Myocardial ischemia; Coronary vessel anomalies; Coronary angiography; Tomography X-Ray computed.

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Case Report

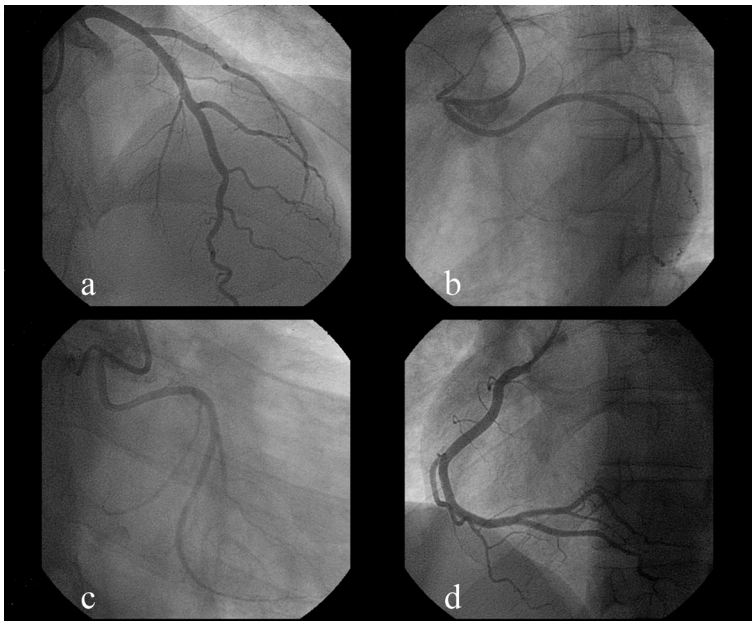

Figure1 – *Coronary angiography images.* A: *Anterior descending artery in cranial projection, of large caliber, around the apex, absence of obstructive atherosclerotic lesions.* B: *Circumflex artery in left anterior oblique projection, of moderate caliber, anomalous origin of the right sinus of Valsalva, absence of obstructive atherosclerotic lesions.* C: *Circumflex artery in caudal projection, showing marked tortuosity in the proximal third.* D: *Coronary artery in left anterior oblique projection, large caliber, irrigates part of the posterior wall of the left ventricle, absence of obstructive atherosclerotic lesions.*

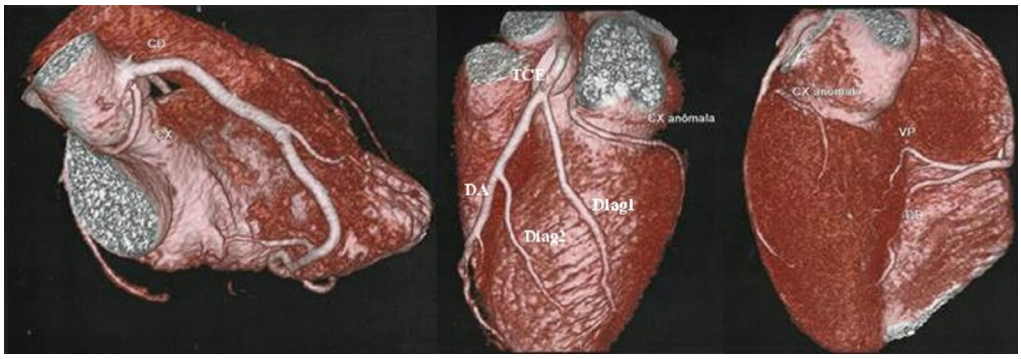

Figure 2 – *Multislice computed tomography images and 3D reconstructions. CD: right coronary artery; CX: circumflex artery; TCE: left main coronary artery; DA: anterior descending artery; Diag 1: 1st diagonal branch; Diag 2: 2nd diagonal branch; VP: posterior ventricular branch and PD: posterior descending branch.* A: *coronary artery originating from the right sinus of Valsalva and no luminal reduction; anomalous circumflex artery originating in oblique angle in the right sinus of Valsalva and retroaortic course.* **B:** *left coronary trunk originating from the left sinus of Valsalva exclusively originating the anterior descending artery, both with no luminal reduction; anomalous circumflex artery emerging between the aorta and the left atrium running through the left coronary sulcus without luminal narrowing.* C: *anomalous circumflex artery in its distal path and right coronary artery originating in the posterior ventricular and posterior descending branches.*

of a coronary artery in the opposite sinus of Valsalva; atresia of the left coronary artery; myocardial bridges and fistulas of coronary arteries[5,6].

From these anomalies, the most common anatomy is the situation where the circumflex artery arises from the right sinus of Valsalva, as in the present case, or from the right coronary artery (incidence of 0.37%-0.6%)[7,8]. The second most observed anomaly is the right coronary artery originating from the left sinus of Valsalva. Less common, but more relevant from a pathophysiological perspective, is the left coronary artery originating from the right sinus of Valsalva[8].

Regarding the associated clinical outcomes, the groups most closely associated with myocardial infarction, ischemia, ventricular tachycardia or sudden death are the anomalous origin of the left coronary artery from the pulmonary artery and arteriovenous fistulas of large coronary arteries. Other anomalies are rarely associated with symptoms or sudden death[9].

Conventionally, arteriography is the gold standard for diagnosing coronary artery diseases[7]. The identification of abnormal arteries, however, is often difficult using conventional arteriography. Considering that the origin and the proximal course of anomalous coronary arteries

are the main predictors of severity, computed tomography angiography of the coronary arteries is currently the ideal imaging tool for diagnosing and defining the anomalies of the coronary arteries and is particularly essential to clarify the relationship between them and the great vessels and the correct position of the ostium[1].

In this study, the presence of an abnormality of the circumflex coronary artery originating from an oblique angle in the right sinus of Valsalva and the retroaortic course between the left atrium and the aorta, as described above, is considered a benign condition with no association with larger clinical outcomes. A causal relationship between the anomaly of the circumflex artery and the IAM presented by the patient cannot be established. However, the coronary angiography showed no significant atherosclerotic disease or evidence of vasospasm to justify such acute coronary syndrome.

Authors' contributions

Data acquisition: Marini MB, Magno HLM; data analysis and interpretation: Marini MB, Magno HLM; manuscript drafting: Marini MB, Magno HLM, De Santi GL; critical revision of the manuscript for important intellectual content: De Santi GL.

Potential Conflicts of Interest

There are no relevant conflicts of interest.

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Academic Association

This study is not associated with any graduate program.

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