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ANOMALOUS ORIGIN OF THE RIGHT CORONARY ARTERY FROM THE LEFT MAIN CORONARY ARTERY IN A PATIENT WITH NON-SPECIFIC CHEST PAIN

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ABSTRACT

Anomalous origin of the coronary arteries is a rare congenital condition that can present as non-specific chest pain or shortness of breath or remain asymptomatic. Early identification is critical as certain variants are linked with a high risk of sudden cardiac death. Here, we report the case of a 53-year-old female with hypertension, hypothyroidism, obesity (class II) and a history of intermittent chest pain radiating to the left arm for two years. A cardiology workup including ECG, cardiac enzymes, echocardiography and CT coronary angiography revealed an anomalous origin of the right coronary artery (RCA) arising from the left main coronary artery (LMCA) with no haemodynamically significant narrowing. This case highlights the significance of advanced imaging techniques in evaluating atypical chest pain, which can reveal critical congenital anomalies of the coronary arteries. Although this anomaly was not associated with ischaemia in our patient, its recognition is vital for appropriate management and risk stratification.

KEYWORDS

Right coronary artery, coronary anomalies, left main coronary artery, congenital heart disease

LEARNING POINTS

- Advanced imaging techniques are important in evaluating atypical chest pain, which can reveal critical congenital anomalies of the coronary arteries.
- CT coronary angiography remains an essential tool for diagnosis and risk assessment.
- Although the right coronary artery was not associated with ischaemia in this case, continued monitoring and cardiovascular risk factor management are essential for long-term prognosis.

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INTRODUCTION/BACKGROUND

Congenital coronary artery anomalies (CAAs) include a variety of congenital disorders characterised by abnormal origins or pathways of the three major epicardial coronary arteries. CAAs are known to be a significant cause of sudden cardiac death in young athletes, and the increasing use of both invasive and non-invasive coronary imaging techniques has heightened awareness of these anomalies in the adult population[1]. While relatively rare, CAAs have an estimated prevalence of approximately 0.24 to 1.3% in the general population[2]. Notably, anomalous origins of coronary arteries from the aorta occur in about 0.1 to 0.3% of individuals and are characterised by irregularities in the origin, trajectory, quantity or dimensions of either the left coronary artery or the right coronary artery (RCA)[3].

In cases of anomalous aortic origin of the right coronary artery (AAORCA) arising from the left coronary sinus, the aberrant artery may emerge from a distinct ostium or share an orifice with another coronary artery. Typically, this configuration follows an intramural pathway within the aortic wall, located adjacent to the pulmonary artery, and is referred to as an interatrial course[4]. AAORCA can manifest in three distinct configurations: (i) a high interatrial course situated between the aorta and the pulmonary artery; (ii) a hypoplastic anomalous orifice defined by a shorter interatrial course; or (iii) a low interatrial course located between the aorta and the right ventricular outflow tract. Research indicates that patients with a high interatrial course face significantly higher rates of angina, sudden cardiac death and other major adverse cardiac events[5].

One particularly rare anomaly is the anomalous origin of the RCA from the LMCA[6,7]. While such anomalies are infrequent, they can have substantial clinical implications, presenting symptoms that range from chest pain and shortness of breath to syncope, palpitations or even sudden cardiac death. In some cases, these anomalies may be asymptomatic and go unnoticed[1,5,8,9]. They are often discovered incidentally during imaging studies, highlighting the critical role of diagnostic imaging in identifying CAAs, especially in patients presenting with non-specific chest pain. Early detection of these anomalies is crucial, as certain variants are potentially linked with an increased risk of sudden cardiac death[10].

CASE DESCRIPTION

A 53-year-old female with a history of hypothyroidism, hypertension and class II obesity presented with intermittent chest pain which she had for two years. The pain was located on the left side of the chest, pricking in nature, radiating to the left arm and moderate in severity. It was associated with shortness of breath while lying down and during prolonged walking, with no identifiable aggravating or relieving factors. On physical examination, her blood pressure was 146/69 mmHg, pulse rate was 66 beats per minute, and no murmurs were appreciated on cardiac auscultation. Laboratory tests showed cardiac enzymes within normal limits, and an electrocardiogram (ECG) revealed normal sinus rhythm. Transthoracic echocardiography (TTE) demonstrated normal biventricular systolic and valvular function. However, computed tomography (CT) coronary angiography detected an anomalous origin of the RCA arising from the LMCA, with left-dominant circulation *(Fig. 1)*. Adequate opacification of the RCA, LMCA, left anterior descending and left circumflex arteries and their branches was noted without any significant atherosclerosis, narrowing or haemodynamic compromise. Minimal atherosclerotic changes were identified in the ascending aorta, and the cardiac chambers were within normal limits.

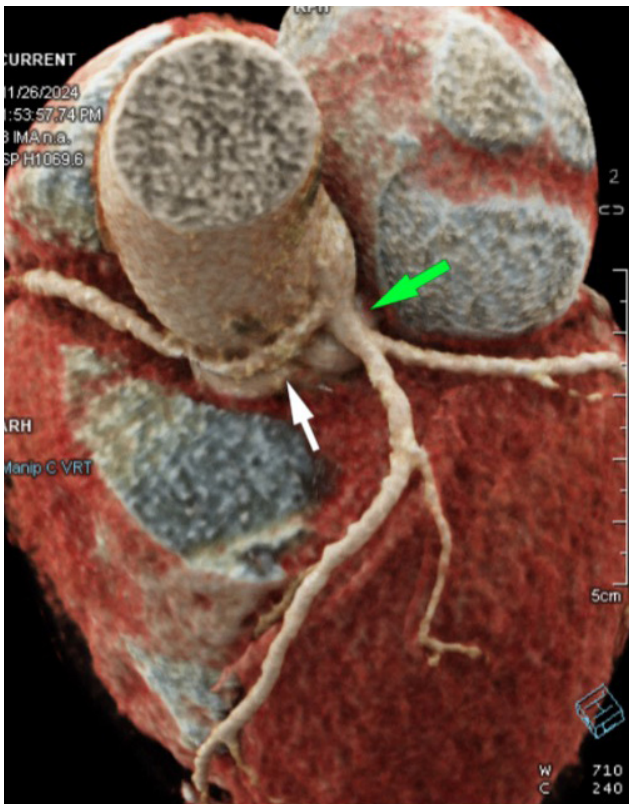


Figure 1. A 3D cinematic rendering of the coronary arteries and the heart. The RCA (white arrow) and the LM (green arrow) are arising from the left coronary sinus. The RCA is passing anterior to the aorta, coursing between the aorta and the pulmonary trunk (artery), which was trimmed from this view.

DISCUSSION

CAAs are rare but clinically significant due to their potential association with ischaemic events and sudden cardiac death. Anomalous origin of the RCA from the LMCA is an infrequent congenital anomaly that can present with non-specific symptoms such as chest pain and dyspnoea.

The anomalous course of the RCA may lead to compression during physical exertion, altered flow dynamics and ischaemia, particularly if the RCA traverses between the aorta and pulmonary artery (intra-arterial course) *(Fig. 2 and 3)*. However, in this case, no haemodynamically significant narrowing or ischaemia was identified.

CT coronary angiography remains the gold standard for diagnosing CAAs due to its high spatial resolution and non-

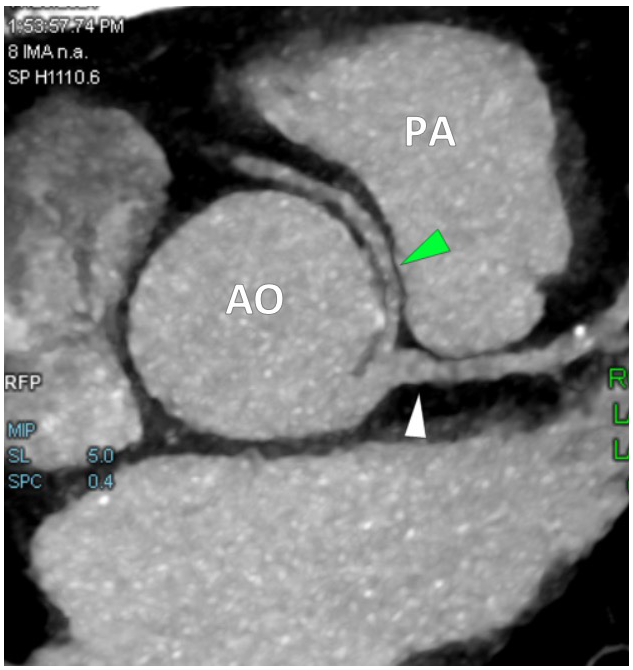
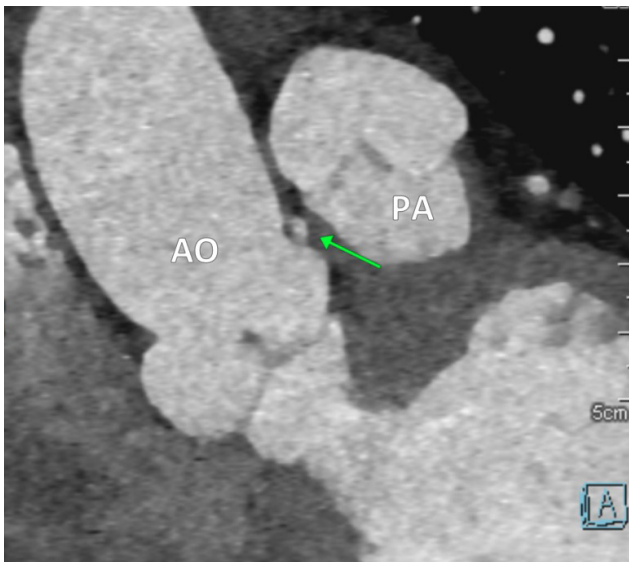


Figure 2. Axial maximum intensity projection image of the coronary arteries at the aortic root level. The LM (white arrow) and the RCA (green arrow) are arising from the same left coronary sinus. The RCA is passing between the aorta and the pulmonary trunk (artery). Abbreviations: AO, aorta; PA, pulmonary trunk (artery).



Abbreviations: AO, aorta; PA, pulmonary trunk (artery).

Figure 3. Coronal image of the coronary arteries. The RCA (green arrow) is passing between the aorta and the pulmonary trunk (artery).

invasive nature. This modality can delineate coronary artery origins, courses and potential compressions. In our patient, CT imaging accurately identified the RCA originating from the LMCA without stenosis or high-risk intra-arterial compression.

Recent studies emphasise the role of advanced imaging and the need for individualised management[8]. Surgical intervention, such as re-implantation or unroofing of the anomalous artery, is reserved for symptomatic patients with high-risk anatomy. Management depends on the presence of symptoms, ischaemia or high-risk anatomy (e.g. intra-arterial course). Asymptomatic patients with no ischaemia can be managed conservatively with risk factor modification. Our patient, despite her symptoms, had no ischaemic findings; thus, conservative management and regular follow-up were recommended.

CONCLUSION

This case highlights the significance of considering CAAs in patients presenting with non-specific chest pain. CT coronary angiography remains an essential tool for diagnosis and risk assessment. Although our patient's RCA anomaly was not associated with ischaemia, continued monitoring and cardiovascular risk factor management are essential for her long-term prognosis.

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