RIGHT CORONARY ARTERY ORIGINATING FROM LEFT ANTERIOR DESCENDING ARTERY: A RARE VARIANT OF SINGLE CORONARY ARTERY DETECTED ON CT CORONARY ANGIOGRAPHY

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ABSTRACT

Background: A single coronary artery (SCA) is a rare anomaly encountered using conventional coronary angiography. A right coronary artery (RCA) originating from a left anterior descending artery (LAD) is a rare subtype of SCA. Only a few cases are described in published literature.

Case presentation: We described this anomaly in a 55-year-old male who presented with angina pectoris. The anomalous RCA was suspected by conventional coronary angiogram and was confirmed by computed tomography (CT) coronary angiography. Using CT, we demonstrated the course of the abnormal vessel and its relation to the main vessel. We also detected the presence of plaque, which caused luminal stenosis of the proximal LAD, which may cause global ischaemia.

Conclusion: We concluded that although conventional coronary angiography is an important diagnostic method, new non-invasive methods such as CT coronary angiography can be a better screening tool to detect and characterise coronary anomalies.

Keywords: Anomalous right coronary artery; Single coronary artery; CT coronary angiography

INTRODUCTION

Single coronary artery (SCA) is a rare anomaly encountered only in 0.031% of the population. The right coronary artery (RCA) originates from the left anterior descending artery (LAD), an extremely rare SCA variant. Only about 30 cases of the anomalies are reported in previous literature (1-3). Until the development of multidetector computed tomography, coronary artery anomalies were mainly evaluated by invasive conventional coronary angiography (4, 5). We describe a case of a very rare variant of SCA in which an anomalous RCA arises from the mid-LAD. This anomaly was detected during a routine coronary angiogram and then confirmed on computed tomography (CT) coronary angiography.

CASE PRESENTATION

A 54-year-old Malay ex-smoker with underlying type

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2 diabetes mellitus presented to the emergency department with a one-day history of dull aching left-sided chest pain, which was aggravated by physical activity. Upon arrival, he was hemodynamically stable. An electrocardiogram (ECG) revealed atrial fibrillation with a heart rate of 110. No acute ischaemic changes were present. An echo showed good left ventricular function with an ejection fraction of 70%. A serial blood test showed raised creatine kinase-MB (CKMB). He was treated as angina pectoris with atrial fibrillation, and a coronary angiogram was scheduled.

Coronary angiography showed a single coronary ostium with the left main coronary artery bifurcates to the LAD and the left circumflex artery (LCX) (**Supplementary material 1**). There was a mild proximal LAD disease. Multiple aortic root injections confirmed the absence of a conventional RCA originating from the anterior coronary sinus.

CT coronary angiography showed a single left main coronary artery (LMCA) originating from the left coronary cusp. The LMCA demonstrates a normal course and divides into the LAD and LCX. The LAD courses inferiorly within the anterior interventricular groove. There is mild stenosis at the proximal aspect of the left LAD – CAD-RADS 2 with a mild plaque burden (P1) according to the 2022 Coronary Artery Disease – Reporting and Data System (CAD-RADS 2.0)(**Figure 1**). The anomalous RCA originates from the mid-portion of LAD. This RCA courses laterally and anteriorly to the pulmonary trunk. It runs into the right atrioventricular groove and gives rise to a posterior descending artery (PDA) distally, indicating a right dominant system (**Figure 2, Supplementary material 2**).

DISCUSSION

Coronary artery anomalies can be defined as a coronary pattern or feature encountered in less than 1% of the population (1). SCA is a rare coronary anomaly in which the RCA and the LMCA arise from a single aortic sinus. It was first described in 1903, and several cases of SCA have been reported. In a recent retrospective study by Turkmen et al. that included 215140 patients undergoing coronary angiography, only 67 patients were detected to have this anomaly (0.031%) (1, 3).

The origin of an anomalous RCA may be from the left sinus of Valsalva, posterior sinus of Valsalva, ascending aorta, pulmonary artery, left ventricle, LMCA, LCX or LAD. RCA arising from the LAD is an extremely rare SCA variant occurring in approximately 0.024%-0.066% of the general population undergoing coronary angiography (2). Several authors have attempted to classify coronary artery anomalies. However, no single classification is widely accepted. In a recent review, Villa et al. suggest a classification based on anatomical features. The anomalies of origin are divided into anomalies of origin from the pulmonary artery and anomalies of origin from the aorta. SCA falls into anomalies of origin from the aorta, further classified into SCA origin from the left sinus of Valsalva and SCA origin from the right sinus of Valsalva (1). The anomaly encountered in our patient was not described in this classification. The closest category that our patients' coronary anatomy represented was that of the LIIA anomaly.

Coronary angiography has traditionally been the gold standard in detecting coronary artery disease and coronary artery anomalies. A non-invasive method such as CT coronary angiography produces comparable results. It has been shown that CTA coronary sensitivity in visualising abnormal vessels is 100% (4).

CTA coronary has multiple benefits besides non-invasiveness, including providing 3D information, high spatial resolution, and rapid examination time. It is superior in identifying the course of potentially malignant course – inter-arterial, in which the coronary artery passes between the aorta and the main pulmonary artery. In our case, the anomalous RCA has a benign course as it passes anterior to the pulmonary artery. It also can detect other high-risk anatomic features such as slit-like ostium, proximal narrowing of the vessel, intra-mural course and acute take-off angle. The prevalence of coronary anomalies is also higher on CTA coronary than on conventional coronary angiograms (4-6).

Because of its invasiveness, radiation exposure, and inability to characterise non-coronary cardiac anatomy, conventional coronary angiography in coronary artery anomalies should only be used to complement non-invasive imaging (6).

CONCLUSION

Anomalous RCA originating from the LAD is a rare

entity. We report an interesting case of the RCA originating from the mid-LAD, which was confirmed using CT coronary angiography. When combined with other non-invasive imaging such as cardiac magnetic resonance imaging or nuclear and hybrid imaging to detect high-risk physiologic consequences of coronary anomalies, CT coronary angiography is a better choice than conventional angiography as a screening tool.

STATEMENT OF ETHICS

Informed consent was obtained from the patients to publish the case report and the accompanying images.

CONFLICT OF INTEREST

The authors have no known conflict of interest to disclose.

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The authors received no funding from any party for this scientific work.

DATA AVAILABILITY STATEMENT

No additional data than the one presented in this article was used

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FIGURE LEGENDS

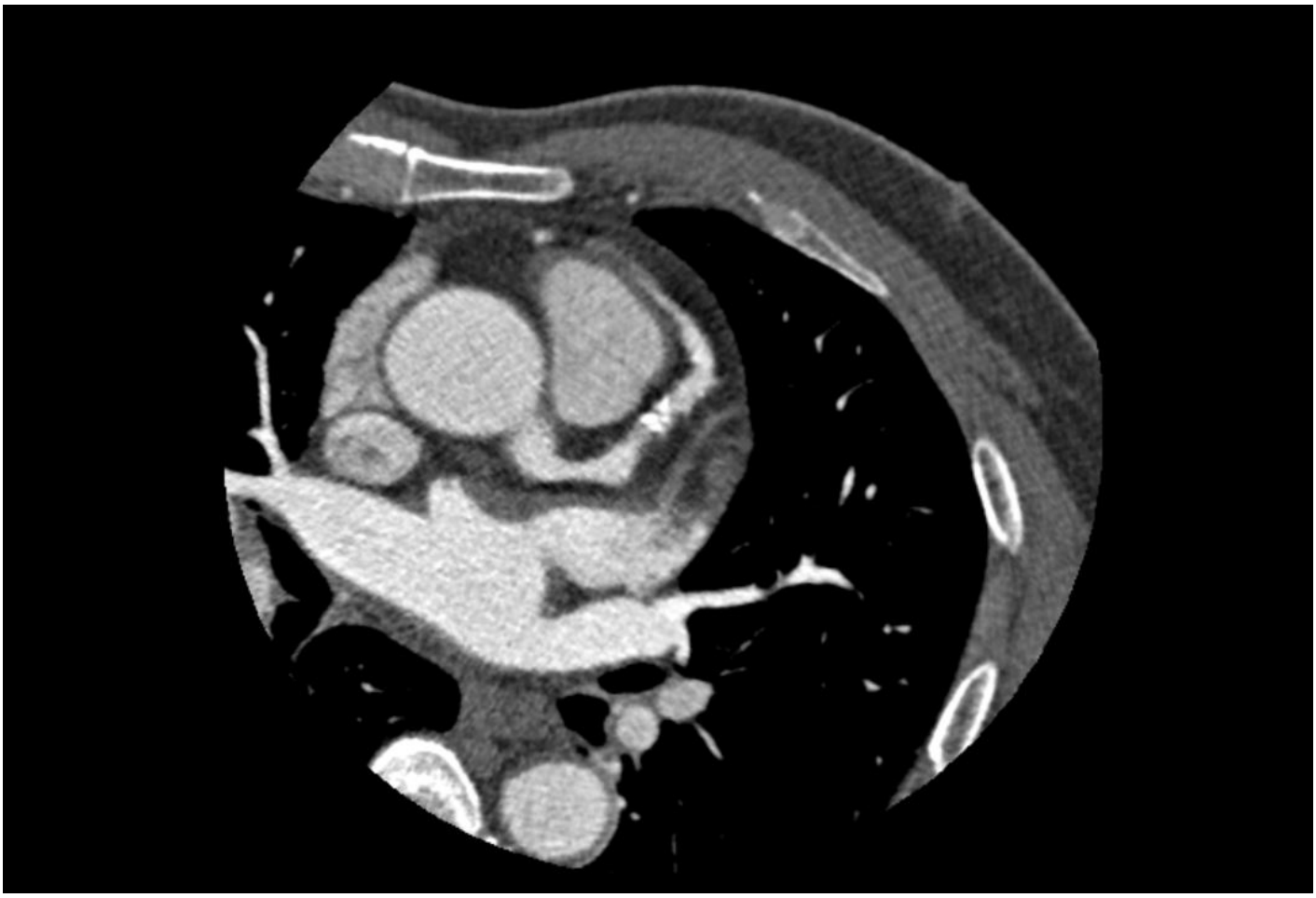

Figure 1: Mild coronary plaque (P1) within the proximal aspect of LAD with 25-49% stenosis (CAD-RADS 2).

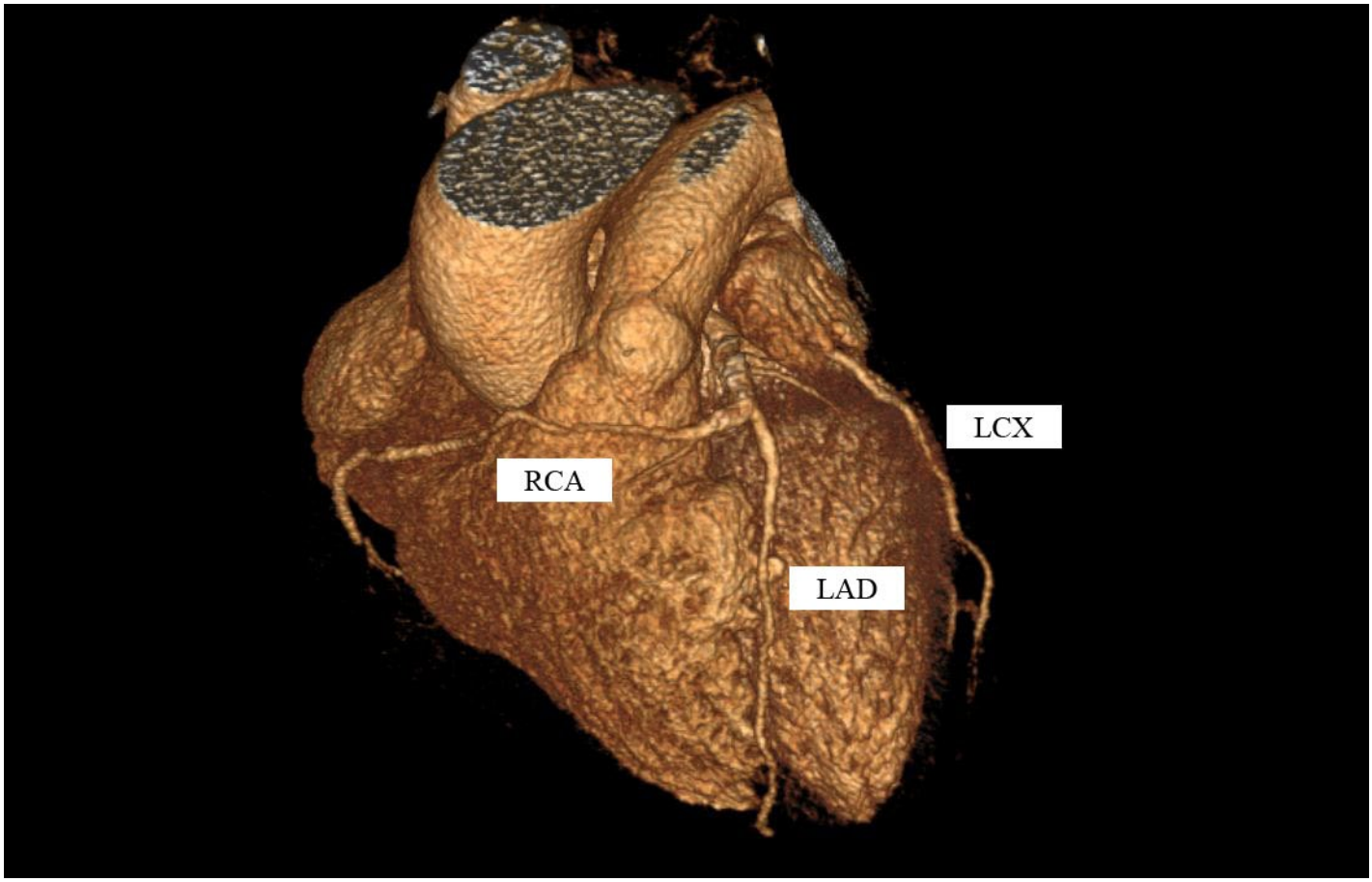

Figure 2: 3D reconstruction of CTA coronary shows anomalous RCA, which originates from the mid-portion of LAD and courses anterior to the pulmonary trunk into the right atrioventricular groove.