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A rare coronary artery anomaly: duplication of right coronary artery with separate ostium on 64-row multidetector computed tomography

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ABSTRACT Coronary artery anomalies are rare, and their incidence varies from 0.6% to 1.3%. Conventional angiography is a commonly used modality for the assessment of coronary artery anomalies, but it may not identify and define the anatomy of anomalous arteries due to the complexity of the course and three-dimensional orientation of the arteries. We present a rare case of duplicated right coronary artery (RCA) with separate ostium on 64-row multidetector computed tomography (MDCT). MDCT is better than conventional angiography in cases where selective catheterisation of either a single artery or ostium during catheter angiography has resulted in missing an important vessel. So far, 13 cases of duplicated RCA have been reported in the literature, and the features on MDCT were described only in three cases.

Keywords: coronary artery anomaly, duplication, multidetector computed tomography, separate ostium, right coronary artery
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INTRODUCTION

Coronary artery anomalies are observed in less than 1% of patients undergoing catheter coronary angiography and in approximately 0.3% on autopsy. The majority (4%–15%) are seen in young people presenting with sudden death.[1-3] Coronary artery anomalies are classified into benign and malignant (or dangerous type).[4] Like most other coronary anomalies, duplication of the right coronary artery (RCA) with a separate ostium is a benign entity with no haemodynamic significance. Due to its extreme rarity, the true incidence of double RCA is not known.[5] Since double RCA has two separate ostia, it is important to have knowledge about the anatomical detail and ectopic opening of the coronary artery prior to intervention for proper management. If the anomaly goes undetected during angiography and there is associated atherosclerotic disease, it may lead to ineffective treatment. Due to the high spatial and temporal resolution of multidetector computed tomography (MDCT), ectopic origin and course of anomalous arteries can be demonstrated confidently. We report a rare case of double RCA with separate ostium on 64-row MDCT.

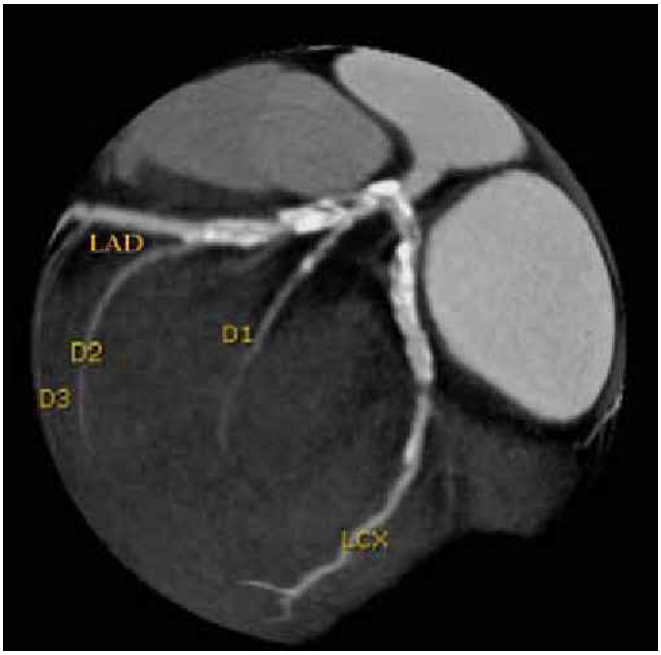

Fig. 1 Globe MIP coronary CT angiography image of the left coronary artery (LAD) and its diagonal branches shows their course and atherosclerotic involvement. LCX: left circumflex artery

CASE REPORT

A 45-year-old, known hypertensive man on antihypertensives presented with exertional chest discomfort. He underwent a treadmill test (TMT), which showed changes in ST segment that suggested ischaemic pain. Echocardiography was normal. He was advised CT coronary angiography to assess the coronary artery status. MDCT angiography displaying a three-dimensional globe view showed the left coronary artery taking origin from the left sinus of Valsalva and dividing into the left anterior descending artery (LAD) and left circumflex artery (LCX), which were normal in course. Both the arteries showed severe atherosclerotic changes (Fig. 1).

Volume-rendered image demonstrated two RCAs of almost same calibre arising from right the sinus of Valsalva (Fig. 2), with two separate ostia. Both the ostia were at the same level and placed adjacent to each other. One of these two arteries, measuring 3.4 mm in diameter, traversed in the native course of the RCA and gave rise to the posterior descending artery (PDA),

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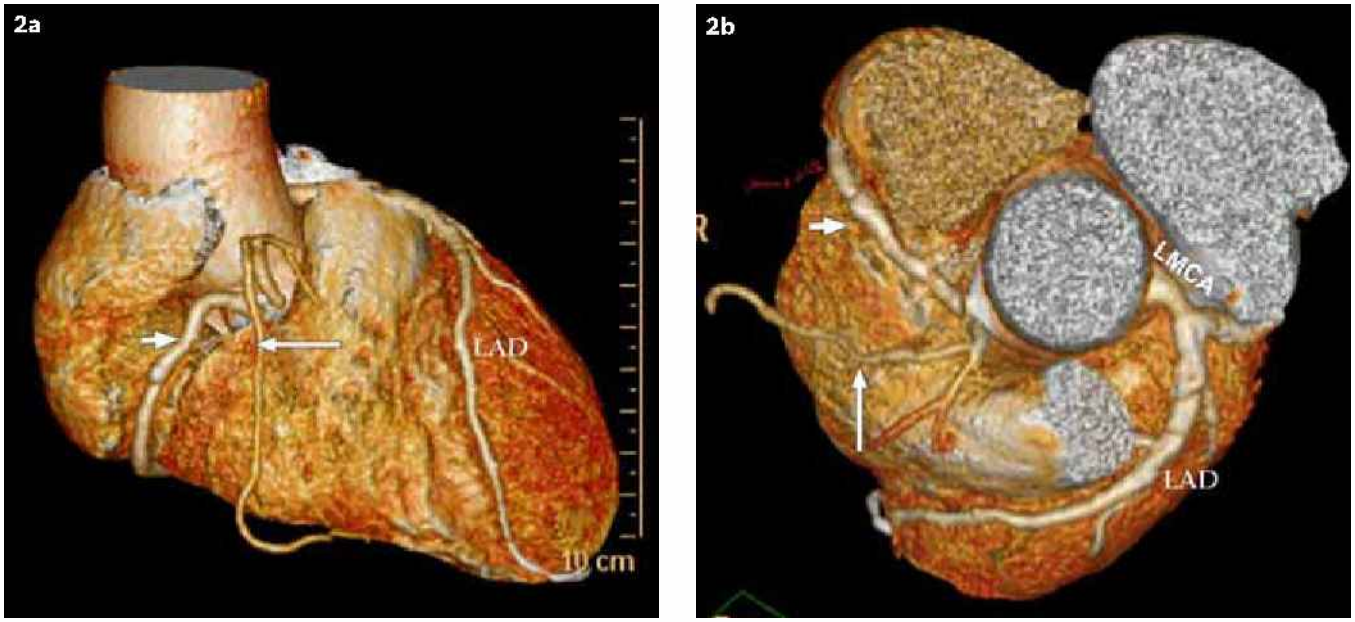

Fig. 2 (a & b) 3D volume-rendered images show two arteries arising from the right sinus of Valsalva with two separate ostia, one traversing in AV groove (arrowhead) and the other along the anterior surface of the ventricle (arrow). LMCA: left main coronary artery; LAD: left anterior descending artery

reaching till the apex. There were atherosclerotic plaques and calcification (Fig. 3), with approximately 80% stenosis in the mid-segment. Sinoatrial nodal branch was arising from it, but the acute marginal artery did not originate from it. The other artery, which measured 3.2 mm in diameter, traversed in the course of the acute marginal branch of the RCA along the anterolateral surface of the right ventricle and reached almost up to the base of the heart. Although it also showed atherosclerotic changes, there was no significant stenosis. A few small branches were seen arising from it, one of which was a conus artery.

The left main coronary artery arose from the left sinus of Valsalva and bifurcated into LAD and LCX. Both of these arteries took a normal course and showed severe atherosclerotic changes, with calcified and soft plaques causing more than 80% stenosis in the proximal and mid segments. The coronary arterial system showed a very high calcium scoring. There were no other associated anomalies of the valvular or coronary arterial system. In this case, no catheter angiography was done, as the patient was not willing to undergo revascularisation.

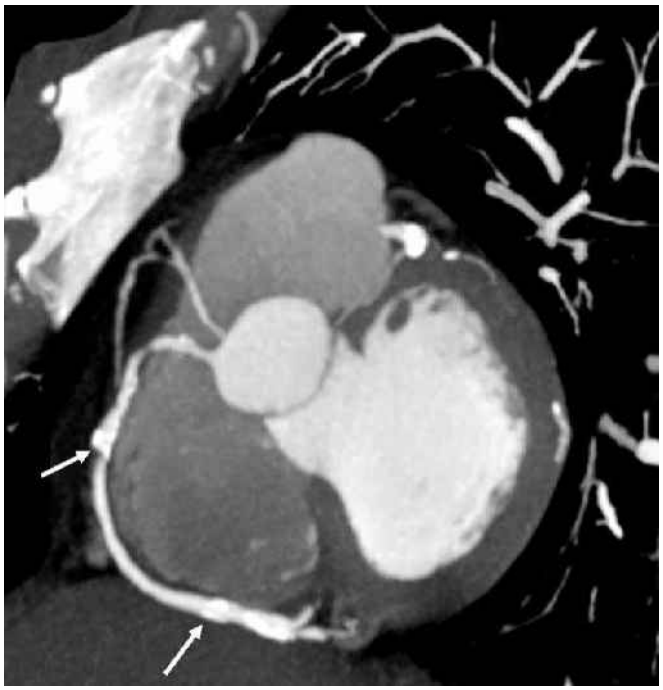

Fig. 3 MIP image of the double right coronary arteries shows atherosclerotic involvement of the native artery (arrows) and their course in relation to the cardiac chambers and atrioventricular groove.

DISCUSSION

Various classifications for coronary artery anomalies are given in the literature. Anomalies are basically classified into those of origin and course, intrinsic coronary arterial anatomy and coronary termination.[6] A majority of coronary artery anomalies are of origin or distribution, the most commonly reported variant being conus artery taking direct origin from the aorta or separate origin of the LAD and LCX, with a different ostium from the aorta.[7] Duplication of the LAD is reported more often (0.13%–1%) as compared to RCA duplication. The latter is benign in nature and has no reported haemodynamic significance. Double RCA can have a single ostium with a common short or long trunk, or it can have a separate ostium with two arteries arising separately, which can be missed during catheter angiography. It can be associated with other anomalies such as valvular heart disease. The incidence of duplicated RCA may not be accurate, as most of them have been reported in isolated case reports. Also, if both the RCAs are equally dominant, one may not look for an additional RCA, and deep intubation of the ostium may lead to obstruction of the proximally arising second RCA.[8]

Double RCA with two separate ostia is extremely uncommon.[5] So far, only three cases with duplication of RCA have been reported on MDCT.[5] Lemburg et al[9] reported the first case of a true double RCA on 16-slice MDCT. Coronary

angiography could not clearly distinguish whether it was a double RCA or a high takeoff of a large right ventricular branch, but MDCT was able to demonstrate the two separate ostia, thereby confirming true double RCA.[9] Karaosmanoglu et al[5] reported another case of duplicated RCA on 16-slice MDCT in a 50-year-old man with hyperlipidaemia, in which both the RCAs were of the same calibre and disease-free. No catheter angiography was done.[5]

In our case, there was double RCA with separate ostia arising from the right sinus of Valsalva. The RCA taking the native course was normal in calibre and showed atherosclerotic changes, while the other was almost similar in calibre with minimal atherosclerotic changes. MDCT could accurately demonstrate the number and location of the ostia, along with the atherosclerotic changes. If only one artery is catheterised during angiography, it may lead to a false-negative procedure, thereby missing the disease status of the other artery and leading to incomplete management and persistence of symptoms. In cases where both ostia are very close by or in cases with a short common trunk, both the arteries could have been visualised on catheter angiography. Catheter angiography in our case may have resulted in a false-negative test result, as both the ostia were separate and far away from each other. Therefore, detailed morphological delineation of the coronary arterial anatomy is important for optimal treatment planning. It is possible to illustrate the origin and level of the ostium using a three-dimensional orientation of arteries in volume-rendered images, giving pre-procedural guidance to the cardiologist in catheter angiography and in treatment, which is an important benefit of MDCT coronary angiography.[10] Capuñay et al have reported a case of double coronary arteries arising from two separate ostia on MDCT.[11] According to Srinivasan et al, MDCT could show 100% accuracy in demonstrating anomalies and their relation with mediastinal vessels irrespective of their complex anatomy.[6] Few of the cases reported previously had shown the co-existence of valvular anomalies.[7,12] In our case, no associated anomaly was found. Most reports have found a geographical variation of anomalies from oriental countries, chiefly Turkey.[3]

In conclusion, coronary anomalies must be documented before undertaking intervention to circumvent problems at some point during coronary intervention and cardiac surgery. MDCT could become a routine diagnostic tool for coronary artery anomalies related to origin or termination and for assessing disease status. It may also be a useful tool to guide interventional cardiologists.

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