Anomalous origin of the right coronary artery arising from the left anterior descending artery in a case with single coronary artery anomaly: multi-detector computer tomography imaging

Tek koroner arter anomalisi olan ön inen koroner arterden köken alan sağ koroner arter olgusu: Çok kesitli bilgisayarlı tomografi bulguları

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Introduction

A variety of cardiac disorders can cause sudden cardiac death. The detection and visualization of structural anatomic cardiac abnormalities is a key in the management of patients at risk for sudden cardiac death (1). In this report, we present an interesting case of isolated single coronary artery and anomalous origin of the right coronary artery (RCA) that originated from the left anterior descending artery (LAD).

Case Report

We report a 51-year-old man with a history of smoking and a strong family history of premature coronary artery disease. He had history of intermittent chest pain associated with left arm pain and dyspnea for a few years. The physical examination revealed grade 2/6 holosystolic murmur at the lower left sternal border. His blood pressure was 130/80 mmHg, and heart rate was 75 beats per minute. His electrocardiogram (ECG) showed no evidence of ischemia. Because of strong family history of premature coronary artery disease, cardiac catheterization was performed. Coronary angiography revealed a single coronary artery, which arose from the left sinus of Valsalva. In order to demonstrate this congenital anomaly and vascular structures in detail, multi-detector computed tomography (MDCT) was performed using 16-detector-row CT scanner (Aquillon; Toshiba Medical Systems, Tokyo, Japan). Scans were obtained at a 0.5-mm collimation, 1.0-mm slice thickness and with a 1.0-mm reconstruction interval. In addition to the traditional axial images, all the other available techniques (multiplanar reconstructions (MPR), maximum intensity projection (MIP) and 3D volume rendering (3D VR) images were used for the assessment of the coronary artery anatomies. The 3D VR anterior view image (Fig. 1) showed that the left main coronary artery (LMCA) had a short segment, and the LAD and circumflex artery (Cx) were originating from this short segment. On the axial MIP image (Fig. 2), the RCA originated from the middle segment of the LAD. On this image, the thinner caliper of RCA was seen clearly. The right lateral 3D VR reformation (Fig. 3) showed that there was no branch originating from the right sinus of Valsalva and also confirmed the origin of the RCA from the LAD. Left ventricular hypertrophy was also associated with these findings. The patient was followed-up.

Discussion

Coronary artery anomalies occur at least in 0.3–1.2% of the population (2). An isolated single coronary artery only occurs in about 0.024% of the population (3). Although they are mainly asymptomatic, some coronary anomalies may cause sudden cardiac death or other symptoms of myocardial ischemia, especially in young adults. Congenital abnormalities associated with myocardial ischemia are coronary artery fistula, the LAD originating from the pulmonary artery, anomalous origin of the LAD from the RCA or the right coronary sinus
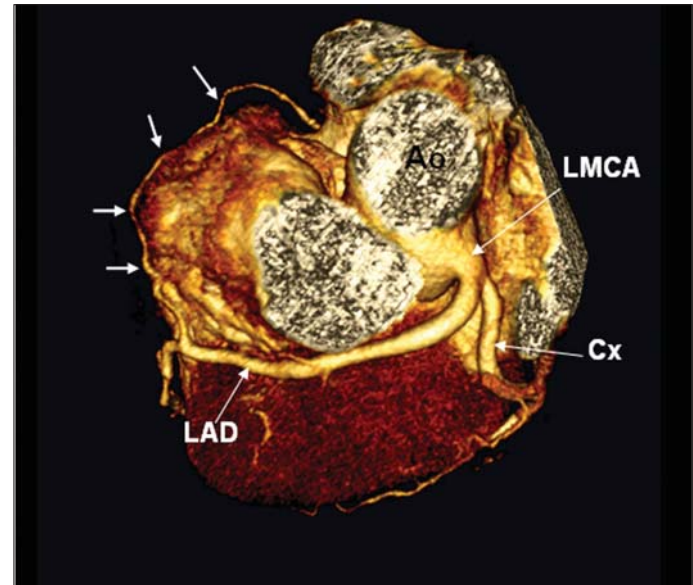

Figure 1. Three-dimensional volume-rendered anterior view reformation shows the presence of rudimentary left main coronary artery and the origin of the left anterior descending coronary artery and circumflex artery from this location

Ao- Aorta, Cx- circumflex artery LAD- left anterior descending artery LMCA- left main coronary artery, arrows: right coronary artery
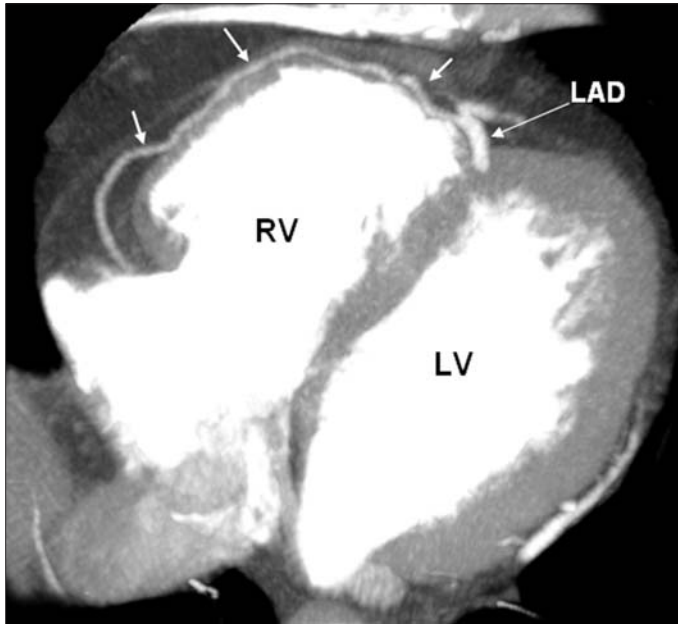
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Figure 2. Axial MIP image shows thinner caliper and the origin of the right coronary artery

LAD -left anterior descending artery, LV - left ventricle, RV - right ventricle, arrows: right coronary artery
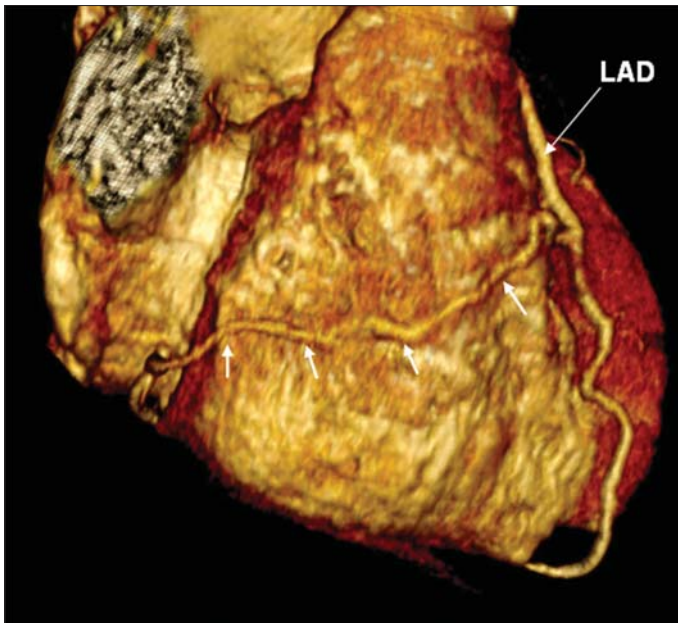

Figure 3. Right lateral three-dimensional volume-rendered image shows absence of a branch originating from the right sinus of Valsalva

LAD - left anterior descending artery, arrows: right coronary artery

and anomalous origin of the RCA from the LAD or the left coronary sinus. The anomalous origin of the RCA is a rare condition, but has clinical importance because nonfatal or fatal myocardial infarction and sudden death occur in up to 30% of patients (4).

The ectopic origin of the RCA from the LAD artery, a subgroup of single coronary artery, is relatively rare and more benign than other types of anomalous origin of the RCAs (5). The causes of myocardial ischemia in this anomaly remain unclear, but the acute angle take-off and kinking of the RCA as it arises from the LAD, flap-like closure of the abnormal coronary orifice, compression of the RCA when it courses within the aortic wall or between the aorta and the pulmonary artery, and spasm of the anomalous RCA have been thought to be the possible mechanisms (6). In our case, the RCA was not originating from the right sinus of Valsalva and was not coursing in the right atrioventricular groove. However, there was an ectopic coronary artery originated from the LAD and coursed toward the RCA territory. In our case, the RCA did not course between the aorta and the pulmonary artery.

The future development in the MDCT hardware which will provide higher spatial resolution and allow motion analysis during the whole cardiac cycle would be more informative for the evaluation of the mechanisms by which myocardial ischemia is provoked in patients with an anomalous origin of the RCA.

Conclusion

For diagnosis of coronary artery anomalies and treatment planning, it is important to know the distribution of major arteries and the extent of compensatory perfusion. MDCT, with especially 3D VR and MIP techniques, provides us with a high quality and accurate modality to observe and diagnose coronary anomalies. The origin and course of all the anomalous coronary arteries were observed clearly with a high average diagnostic image quality.

References

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