Diagnosis of Variants of Single Right Coronary Trunk Using 64 Multidetector Computed Tomography

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ABSTRACT

Single coronary anomalies are one of the rarest variants of coronary anatomy. Widespread use of coronary CT angiography has made it possible to diagnose these variants with increasing incidence. We report two cases of single right coronary trunk with different anatomic course of the left coronary artery; one anterior to the main pulmonary artery and the second between the main pulmonary artery and ascending aorta and then coursing within the interventricular septum.

CASE REPORT

Introduction:

Mutidetector CT (MDCT) coronary angiography is a well established technique for the evaluation of coronary arteries and their variants. The MDCT technique is highly effective at demonstrating the origin and course of the anomalous artery, and high resolution images of its relationship to other crucial vessels (1). Using this technique, we identified two patients with a single coronary trunk arising from the right coronary cusp supplying the entire myocardium.

Case Reports:

The first patient is a 56 year old Caucasian male with a history of intermittent atrial fibrillation. He had no history of myocardial infarction or angina. The patient had a normal electrocardiogram (ECG) and treadmill stress test three years earlier and was taking no medications at the time of the cardiac multidetector CT (MDCT). The patient's blood pressure was within normal range and he was slightly bradycardic with a heart rate at 52 beats per minute. Cardiac CT was requested to evaluate for coronary artery disease. MDCT coronary angiography was performed on a 64 slice scanner (Toshiba Aquilion, Tustin, CA) using routine injection protocol described (2).

The CT demonstrated a large single coronary artery trunk arising from the right coronary cusp. The trunk immediately bifurcated into right and left coronary arteries. The right coronary artery continued as a dominant vessel giving rise to posterior descending and posterolateral arteries. Moving anterior to the main pulmonary trunk and then following the course of the left atrioventricular groove, the left coronary branch gave rise to a small anterior descending artery and multiple marginal branches supplying the anterior, anterolateral and lateral walls of the left ventricle. No significant coronary artery stenosis was seen.

The second patient is an asymptomatic 52 year old male with no history of coronary artery disease. He requested coronary angiography as a volunteer. ECG was normal. Similar to our first patient, CT angiogram demonstrated a large single coronary trunk arising from the right coronary cusp. However, the left coronary artery, in its proximal segment (4 cm), showed an abnormal course between the main pulmonary artery and ascending aorta and then within the infundibular septum before exit to the surface of the left ventricle. It then branched into the anterior descending, diagonals, and left circumflex arteries.

In both patients, at the level of the aortic valve, three cusps were identified.

DISCUSSION

Case reports describing similar anatomical variants of a single coronary trunk arising from the right coronary cusp have been published, but these variants were diagnosed with invasive coronary angiography (3,4).

Isolated coronary artery anomalies are relatively rare, arising in about 1% of patients without other congenital cardiac malformations (4). Single coronary anomalies are one of the rarest varieties, with incidence of absence of left main coronary ostium at 0.05%-0.4% of this selected population (6,7,8). Some assert that the absence of the left ostium, or anomalies in the origin of the left coronary artery are primarily related to congenital malformation of the aortic valve, while others claim that obstruction of the left ostium occurs by fusion of the left aortic cusp to the aortic wall (9,10).

In patients with absence of the left coronary ostium, there are four variations in the initial course of the LAD arising from the RCA: anterior, interarterial, septal, and rarely posterior (retroaortic) (11-13). In the anterior variant, the most common of the three, the LAD courses anterior to the right ventricular infundibulum and in the septal variant, within the ventricular septum beneath the right ventricular infundibulum. The interarterial type can be life-threatening as the LAD courses between the aorta and the main pulmonary trunk (14). Because a left main artery arising from the right coronary is supplying a large area of the myocardium, this anomaly is associated with increased incidence of symptoms including angina pectoris, myocardial infarction, arrhythmias, syncope, and congestive heart failure (15). It is also associated with increased risk of sudden death, secondary to decreased coronary flow reserve and other anatomical variants, including compression of the artery by the pulmonary trunk or aortic wall (16). The septal type is a largely benign variant and has yet to be associated with sudden death (11). Our two case reports represent two variants, the anterior variant in shown in the first patient and the septal variant in the second patient. However, both patients reported no symptoms related to their coronary anomaly.

Since patients with anomalous coronary arteries are generally younger and may require follow up CT scans after diagnosis, the benefits of the CT scan should be weighted against the risks of radiation exposure (17,18). Low-dose coronary CTA with prospective ECG-gating appears to be a better option for the follow up examination to reduce total radiation dose (19) Coronary MR angiography can also be used as an alternative method to diagnose abnormal origin of the coronary arteries (20).

TEACHING POINT

MDCT is a fast, noninvasive technique to demonstrate coronary anomalies and differentiate life threatening from benign variants.

ABBREVIATIONS

AA = ascending aorta
RVOT = right ventricular outflow tract
LAD = left anterior descending artery
LCA = left coronary artery
RCA = right coronary artery
MPA = main pulmonary artery
LCX = left circumflex artery
MDCT = multidetector computed tomography
ECG = electrocardiogram
CTA = computed tomography angiography

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FIGURES

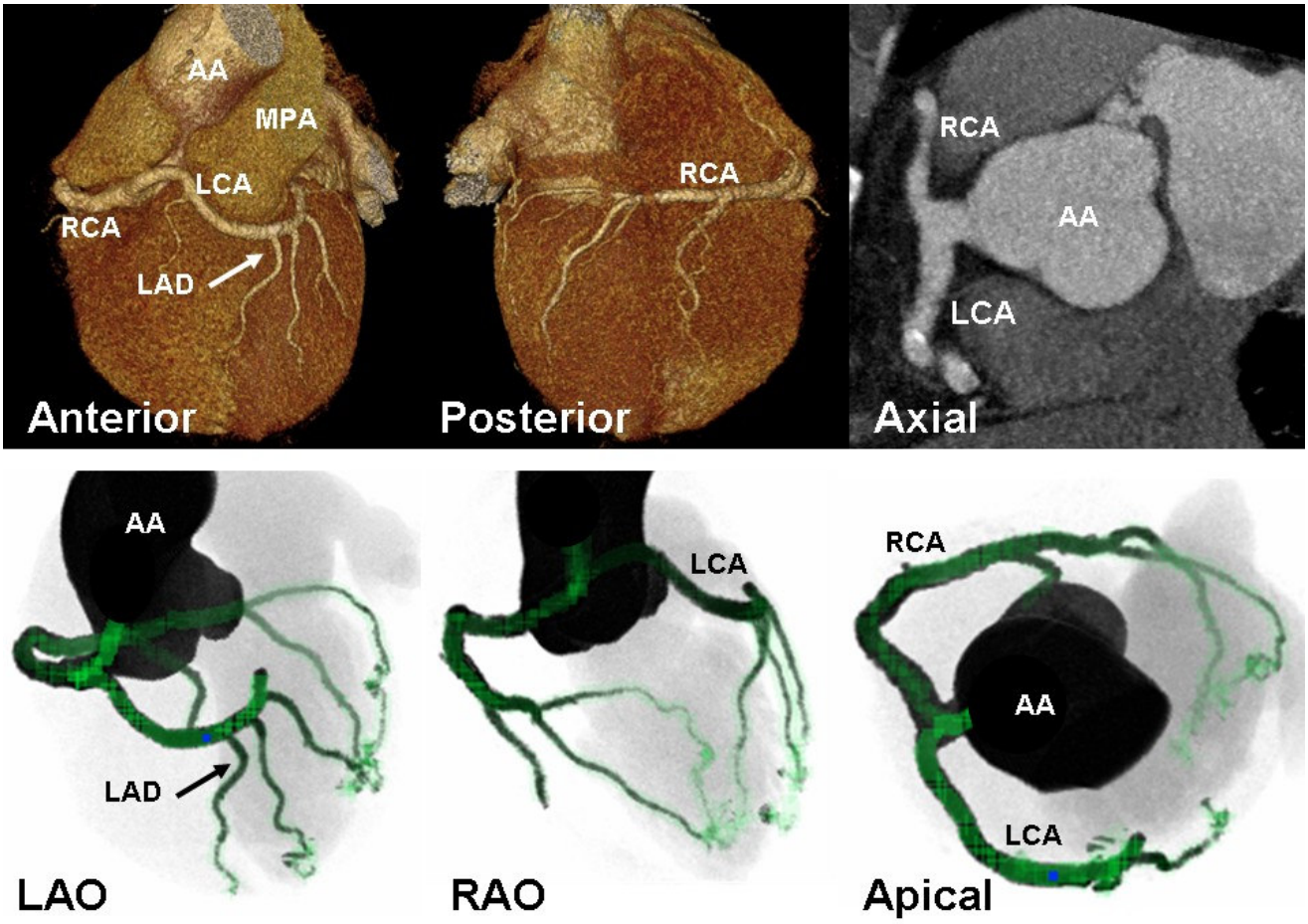

Figure 1: Case#1(anterior variant), CT coronary angiography demonstrates a single coronary artery arising from the right coronary cusp bifurcating into the RCA and LCA. The RCA is the dominant artery. The left circumflex artery is continuation of the LCA in the atrioventricular groove and the LAD is a branch of the LCA. Three dimensional volume rendered and axial images are shown in upper row and maximum intensity angiographic projections in lower row.

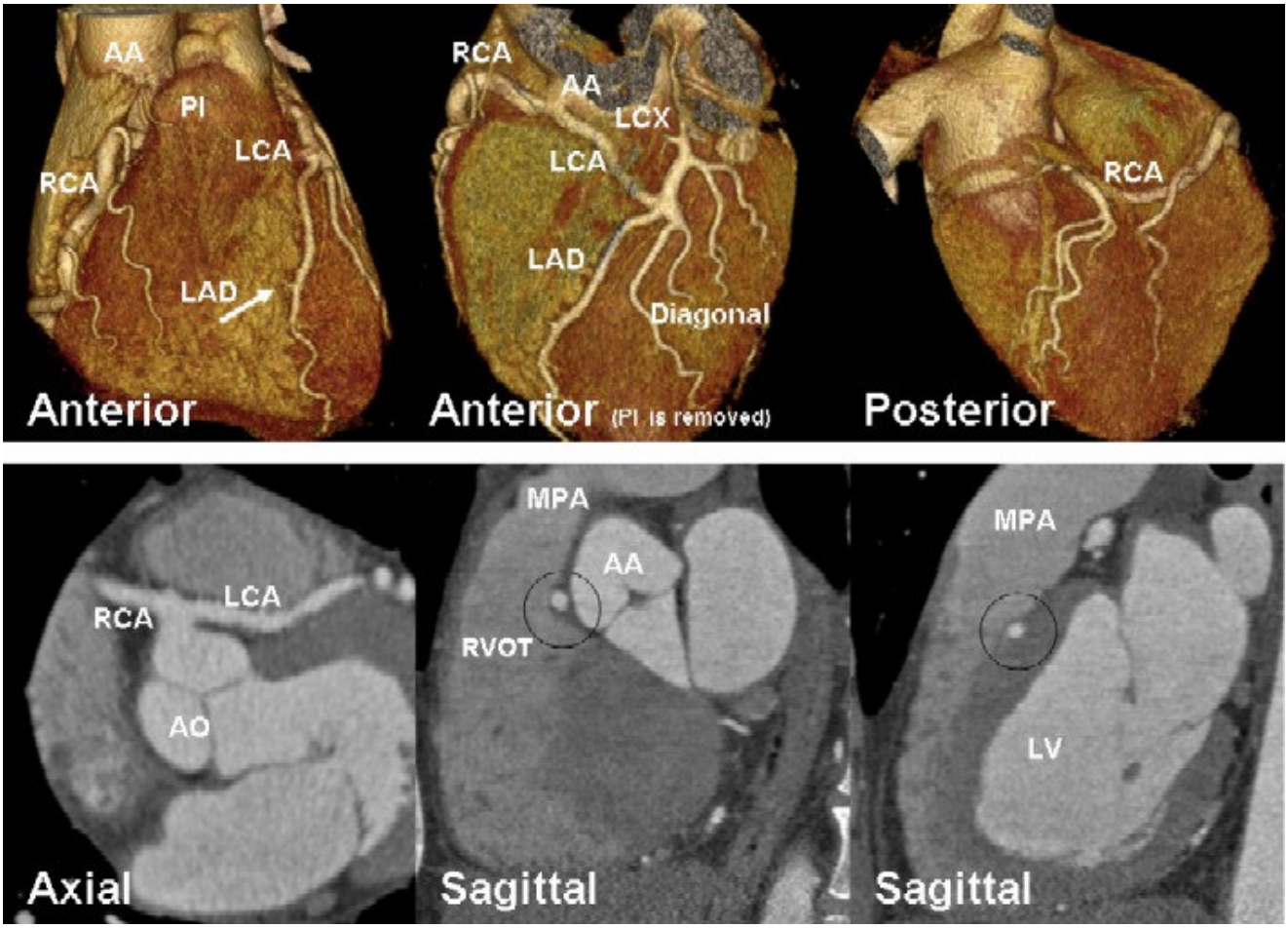

Figure 2: Case#2 (septal variant), CT coronary angiography demonstrates a single coronary trunk arising from the right coronary cusp. Shortly after its take off, the trunk bifurcate into the RCA and LCA. The RCA is again the dominant artery. The left coronary artery demonstrates abnormal course between the pulmonary infundibulum (PI) and AA and then within the infundibular septum (circles) before trifurcating into the LAD, diagonal (ramus) and the LCX. The left circumflex artery is continuation of the LCA in the atrioventricular groove and the LAD is a branch of the LCA. Diagonal branches are evident. Three dimensional volume rendered images are shown in upper row and axial and sagittal projections in lower row.

KEYWORDS

Coronary artery anomalies, coronary angiography, cardiac CT, coronary CT, chest pain

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