

Single Coronary Artery as Cause of Non-Atherosomatous Angina Pectoris: Multidetector Computed Tomography Assessment

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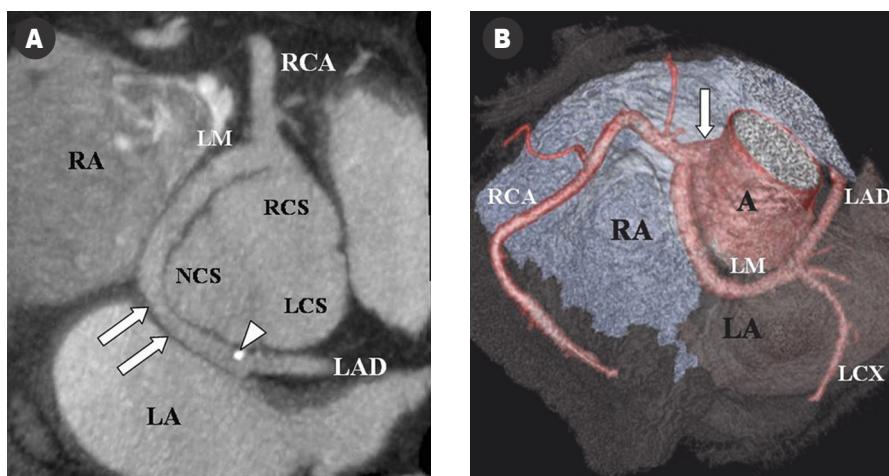
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Congenital coronary anomalies are uncommon but may cause sudden cardiac death or other cardiac symptoms such as angina, syncope, congestive heart failure and myocardial infarction, especially in young healthy subjects. Conventional coronary angiography is an invasive and expensive procedure and cannot provide three-dimensional data on the anomalous vessel. Coronary computed tomographic angiography has been reported to be useful for non-invasive congenital coronary artery evaluation. We report the CCTA findings in a patient with single coronary stem as a cause of non-atherosclerosis new-onset angina pectoris.

Patient Description

A 52 year old man with hypertension and hyperlipidemia was referred to our institute for CCTA because of progressive angina and dyspnea on exertion (Canadian Cardiovascular Society class II–III, New York Heart Association functional class II) that had recently appeared. His physical examination was unremarkable. Electrocardiogram, chest X-ray and transthoracic echocardiography were normal. His positive stress test showed anterolateral ischemia. Nuclear scanning demonstrated a reversible anterolateral perfusion defect consistent with myocardial ischemia. CCTA was performed by using 64-row Multidetector CT scanner (GE Healthcare, Milwaukee, USA), with retrospective ECG triggering after intravenous administration of iodinated contrast material (The following scanning param-



Coronary CT angiography in a 52 year old man with single coronary artery.

[A] Axial thick slab maximum intensity projection (MIP) image shows single coronary artery originating from the right coronary sinus (RCS) and dividing into right coronary artery (RCA) and left main coronary artery (LM). The RCA courses normally through the right atrioventricular groove. The LM is elongated and courses dorsally between the aortic root and both right and left atrium (RA, LA) before bifurcating into the left anterior descending (LAD) and the left circumflex (LCX) arteries. Large arrows indicate a mild segmental narrowing of the LM due to external compression. A small eccentric calcified plaque is observed (arrowhead) in the distal LM causing no stenosis. No coronary artery arising from the left coronary sinus (LCS). NCS = non-coronary sinus.

[B] Cardiac transparency 3D MDCT image shows a single coronary artery (arrow) arising from the right coronary sinus and the anomalous left main artery (LM) course and detailed anatomic relationship. A = aorta, LAD = left anterior descending artery, LA = left atrium, LCX = left circumflex, RA = right atrium, RCA = right coronary artery.

eters were applied: detector collimation 64 x 0.625 mm, kVp 120, mAs 400–500, pitch 0.23, gantry rotation time 0.35 sec, slice thickness 0.6 mm). CCTA revealed a single coronary stem originating from the right coronary sinus, which divided into right coronary artery and left main coronary artery. The RCA showed a normal course through the right atrioventricular groove, while the elongated LMCA had a dorsal course, inferoposterior to the RCS and then between the aortic root and left atrium before bifurcating into the left anterior descending and left circumflex arteries. In addition, a small eccentric calcified plaque was observed in the LMCA without any luminal reduction. The

CCTA = coronary computed tomographic angiography

RCA = right coronary artery
LMCA = left main coronary artery

RCA, LAD and LCX had normal diameter and were free of atherosomatous changes. On the other hand, the entrapped LMCA segment (between the aortic root and the left atrium) showed diverse narrowing in both diastolic and systolic phases. The coronary tree, course of the aberrant vessel and its relationship to surrounding cardiac structures were visualized by the use of maximum intensity projection and 3D volume rendered reconstruction images [Figures A and B]. Taking into consideration the repeated episodes of chest pain, the patient is now a candidate for surgical treatment.

Comment

Isolated single coronary artery is a rare congenital anomaly, occurring in about 0.024–0.04% of the population [1]. When the entire coronary system originates from a single ostium (solitary coronary ostium) the anomalous artery takes one of four aberrant pathways to reach its proper vascular territory: anterior to the right ventricular

LAD = left anterior descending artery

LCX = left circumflex artery

MDCT = multidetector CT

outflow tract ("anterior free wall course"), posterior to the aortic root ("retroaortic course"), between the aortic root and the pulmonary artery ("interarterial course"), and within the interventricular septum ("septal course"). The interarterial ("malignant") type may be associated with a high risk of exercise-induced ischemia, myocardial infarction or sudden death [2]. Our patient exhibited progressive angina and myocardial ischemia on his stress test despite the retroaortic course of the left main artery and the absence of significant atherosclerotic stenosis on CCTA. Symptoms in such patients may be induced by dynamically squeezing the left main segment traveling between the aortic root and the left atrium, especially during exercise or other stress. Cardiac arrhythmias, particularly those of ventricular origin, or syncope may also be presenting features. Therapeutic options of symptomatic patients include coronary artery bypass surgery and coronary re-implantation. However, no established guidelines are available for the treatment of single coronary artery without concomitant atherosclerotic stenosis or other congenital heart disease.

In conclusion, CCTA using MDCT is a non-invasive 3D imaging modality that provides an excellent overview of the cardiac structures and the complex vascular anatomy. Knowledge of the CT appearances and understanding the clinical significance of this anomaly are essential for making the correct diagnosis and planning a future cardiovascular therapeutic approach.

References

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We must learn to regard people less in the light of what they do or omit to do, and more in the light of what they suffer

Dietrich Bonhoeffer (1906-1945), German Lutheran pastor and writer who belonged to the German Resistance movement against Nazism and was involved in plots planned by members of the Abwehr (the German Military Intelligence Office) to assassinate Adolf Hitler. He was arrested in March 1943, imprisoned, and eventually hanged just before the end of war.