Defining Anatomic Variants of the Coronary Artery in Taiwanese Subjects Using 64-Multidetector-Row Computed Tomography

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The newly developed 64-multidetector-row computed tomography (MDCT) prompted us to evaluate coronary angiography using this noninvasive method. We reviewed 281 images of MDCT coronary angiography in Taiwanese. The origins of the coronary arteries were identified from the luminal aspect of the aorta. We described them as seen from the aortic sinus looking toward the cardiac ventricle. The sinus facing the left ventricle was designated sinus 1, and that facing the right ventricle was designated sinus 2. Anatomic variants of the coronary artery were divided into five types according to the structure of the left anterior descending artery, right coronary artery, and left circumflex artery. Of the 281 patients, 275 (97.9%) had the type I variant in which the right coronary artery originated from sinus 2. MDCT provides advantages in defining anatomic variation and helps in the planning of clinical therapy or surgery. [*J Formos Med Assoc* 2007;106(10):883–886]

Key Words: computed tomography, coronary angiography, coronary vessels

A variety of cardiac disorders, such as myocardial infarction, can cause sudden cardiac death.[1] Detection and visualization of anatomic variants of the coronary artery play key roles in the golden time of treating patients at risk for sudden cardiac death. Conventional coronary angiography is the standard for assessing coronary artery disease. However, this procedure is invasive and can cause serious adverse events.[2] Although magnetic resonance imaging and electron-beam computed tomography (CT) have been investigated for noninvasive coronary imaging, both have substantial limitations in providing reliable visualization of the coronary arteries.[3,4] Recent advances in 64-multidetector-row computed tomography (MDCT) prompted us to evaluate its clinical potential in noninvasive coronary angiography.[5] As compared with conventional coronary angiography, it is more comfortable and only requires a single breath-hold to scan the entire chest. Our aim was to assess variations in coronary artery anatomy among Taiwanese individuals using this newly developed 64-MDCT coronary angiography.

Material and Methods

We reviewed images obtained from 281 patients (188 men, 93 women; mean age, 58.4 years) who underwent 64-MDCT angiography of the coronary

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artery between September 2005 and February 2006. All CT scans were performed using a 64-MDCT scanner with a 0.35-s rotation time (Volume Computed Tomography Light Speed CT/I; GE Medical Systems, Milwaukee, WI, USA). The origins of the coronary arteries were identified from the luminal aspect of the aorta. We described them as seen from the aortic sinus looking toward the cardiac ventricle. The sinus facing the left ventricle was designated sinus 1, and the sinus facing the right ventricle was designated sinus 2. Anatomic variants of the coronary artery were divided into five types according to the structure of the left anterior descending artery, right coronary artery, and left circumflex artery. Two radiologists performed a blinded consensus review of these characteristics of the coronary artery.

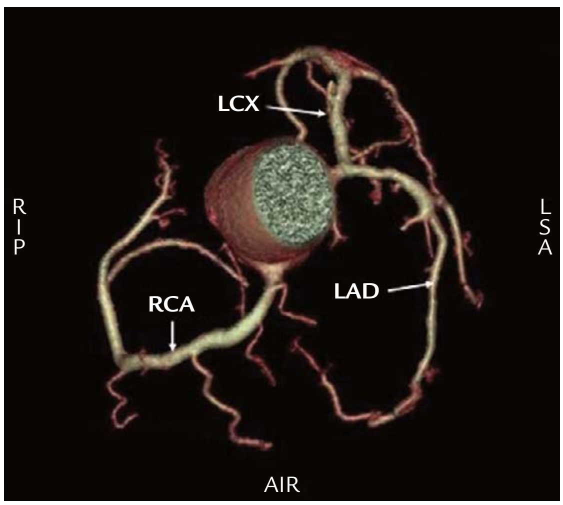

Figure 1. Type I coronary artery anatomic variant as shown on 64-multidetector-row computed tomography. The right coronary artery (RCA) originates from sinus 2. The left anterior descending artery (LAD) and left circumflex artery (LCX) originate from sinus 1.

Results

Of the 281 patients, 275 (97.9%) had type I, two (0.7%) had type II, one (0.4%) had type III, two (0.7%) had type IV, and one (0.4%) had type V. Only the most common type in Taiwanese and two rare types are shown in Figures 1–3.

Discussion

Spiral MDCT with sub-millimeter collimation and retrospective electrocardiographically-gated image reconstruction permits noninvasive visualization of the coronary arteries and the detection of clinically significant coronary stenoses.[6]

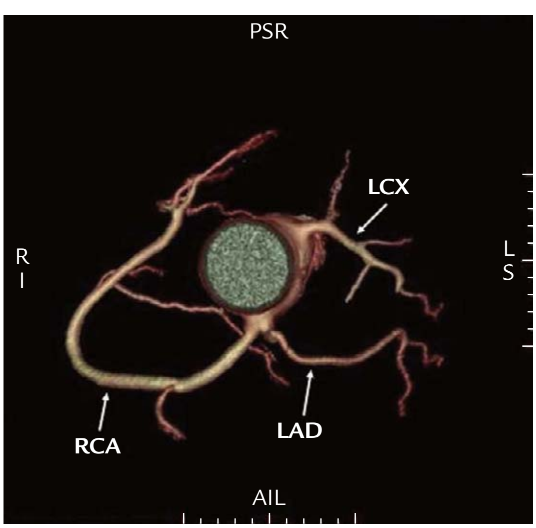

Figure 2. Type III coronary artery anatomic variant as shown on 64-multidetector-row computed tomography. The right coronary artery (RCA) and left anterior descending artery (LAD) originate from sinus 2. The left circumflex artery (LCX) originates from sinus 1.

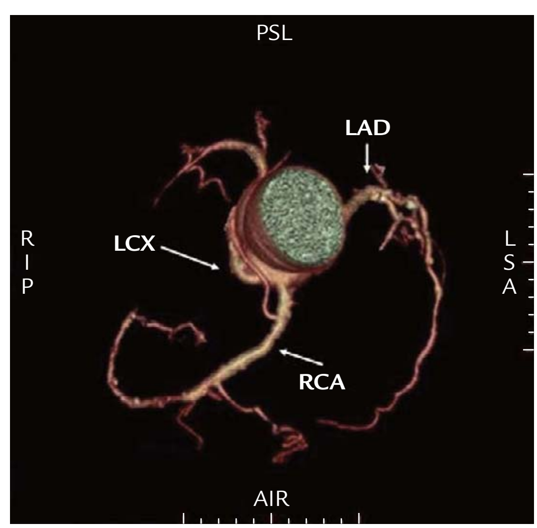

Figure 3. Type V coronary artery anatomic variant as shown on 64-multidetector-row computed tomography. The right coronary artery (RCA) and left circumflex artery (LCX) originate from sinus 2. The left anterior descending artery (LAD) originates from sinus 1.

There have been several studies demonstrating the ability of MDCT to depict congenital cardiac malformations.[7,8] Other investigators have also used 16-MDCT to detect and define coronary artery anomalies.[9] MDCT permits not only the detection of anomalies but also the delineation of their exact three-dimensional course. The advantages of 64-MDCT over 16-MDCT are shorter image acquisition time, and increased spatial and temporal resolution, based on the number of detectors.[9] Moreover, 64-MDCT readily depicts the proximal course of the coronary arteries and enables assessment of the luminal diameter, both of which constitute important information about the arteries.[10]

In our patients, the most common anatomic variant was type I, which accounted for 97.9%. In the Massoudy classification, 69.5% of patients had type I variants (same as our type I).[11] This difference suggests that anatomic variants of the coronary artery vary in the Taiwanese population compared with non-Taiwanese populations and that multiple variables may be involved. Therefore, the anatomic variants described in non-Taiwanese groups may not be applicable to the Taiwanese population.

MDCT with 64 detectors was effective for subtle discrimination between different types and provided excellent visualization of the coronary arteries. For example, type I was defined as a right coronary artery originating from sinus 2. However, some type I cases originated from the center of sinus 2, whereas others originated from the divergence of the centrality. Detailed discrimination of these differences allows surgeons to avoid surgical trauma to vascular grafts or important cardiovascular structures.[12] In addition, 64-MDCT is a powerful diagnostic tool in patients with abnormal cardiac conditions, such as those with failed cardiac catheterization, those with a structural anomaly of the coronary artery, or those with chest discomfort in the absence of clinical findings. Two groups of researchers evaluated the accuracy of 64-MDCT in detecting coronary stenoses in patients without known coronary artery disease, and both reported sensitivities, specificities, positive and negative predictive values of greater than 90%.[10,13]

In conclusion, 64-MDCT is a reliable method for cardiac examination. With its improved spatial and temporal resolution, 64-MDCT is likely to be a complementary study in the evaluation of coronary arteries and in diagnosing heart disease. Although anatomic variants of the coronary arteries can be subtle in Taiwanese subjects, 64-MDCT is able to depict their distinguishing features and is therefore helpful in surgical planning and clinical therapy.

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