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Original Research Article

Diagnosis of anomalous origin and course of coronary arteries using non-contrast cardiac CT scan and detection features

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KEYWORDS:
Coronary artery anomaly;
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Coronary CT angiography;
Coronary calcium scan;
Noncontrast cardiac CT;
Diagnostic test;
Detection features

BACKGROUND: Anomalous origin and course of coronary arteries (AOCA) is a potential cause of sudden cardiac death. Coronary CT angiography (coronary CTA) enables detailed 3-dimensional visualization of AOCA. Data are limited about the diagnostic performance of noncontrast cardiac CT obtained during coronary calcium scan for detecting AOCA.

OBJECTIVE: We assessed the feasibility of using noncontrast cardiac CT for detecting AOCA.

METHODS: Participants had noncontrast cardiac CT and coronary CTA performed (2005–2010). Cases had AOCA as diagnosed with coronary CTA. Controls were without AOCA. Noncontrast cardiac CT images were independently evaluated for AOCA by a cardiologist and a radiologist blinded to prior AOCA diagnosis. Detection features to assist AOCA diagnosis on noncontrast cardiac CT were evaluated.

RESULTS: The study enrolled 54 cases and 155 controls. Sensitivity and specificity for detecting AOCA were 82% (95% CI, 69%–90%) and 90% (95% CI, 85%–94%) for observer 1, respectively, and 82% (95% CI, 69%–90%) and 85% (95% CI, 79%–90%) for observer 2, respectively. Average sensitivity and specificity were 82% and 88%, respectively. Interobserver agreement (Cohen κ) was $\kappa = 0.65$ (95% CI, 0.53-0.76). Inability to visualize the right coronary artery (RCA) origin at the right sinus significantly predicted RCA anomaly. Inability to visualize the left main coronary artery branching point into the left anterior descending coronary artery and the left circumflex coronary artery significantly predicted left coronary artery anomaly.

CONCLUSION: Noncontrast cardiac CT in conjunction with detection features has the potential for use in the diagnosis of AOCA. A prospective study is needed for validation and to determine the modality's accuracy for detecting AOCA.

Conflict of interest: The authors report no conflicts of interest.

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Introduction

Coronary artery anomaly (CAA) refers to anatomical variations of the coronary artery that are present in a small percentage of the population.[1] The reported prevalence ranges from 0.5% in an autopsy series[2] to 0.7%–2.4% in a cardiac imaging series.[3–6] Only limited data are available on the prevalence of CAA in Asian populations.[7] An anatomically based classification scheme for CAA was devised by Angelini et al,[6] and that scheme was used in this study. The scheme divides CAA into 4 main groups: anomalous origin and course of coronary arteries (AOCA), intrinsic anomalies of the coronary artery, anomalous termination, and anomalous anastomotic vessels.

Although many people with CAA will not experience complications during their lifetime, a significant fraction will present for medical attention with a serious first presentation, such as myocardial infarction or sudden cardiac death (SCD).[8] Certain types of CAA have been noted to confer a higher risk of SCD. These are mainly the AOCA, in particular those with nonaortic origin or those with origin from the opposite sinus and interarterial course.[9,10] CAA has been shown to be the second most common cause of SCD among persons who engage in intense physical exercise, such as elite athletes or military recruits.[11] In these populations, up to 30% of SCDs are attributable to CAA, compared with approximately 1% in the general population.[12,13] As such, it would be desirable to develop a noninvasive, low-risk, and low-cost detection technique that enables early diagnosis, especially in high-risk populations.

For decades, the diagnosis of CAA has been limited to postmortem autopsy or invasive coronary catheterization angiography. The relatively recent development of noninvasive cardiac computed tomography (cardiac CT) imaging enables better visualization of the coronary artery anatomy, displaying its origin, course, and termination in 3-dimensional images.[14] One of the currently accepted

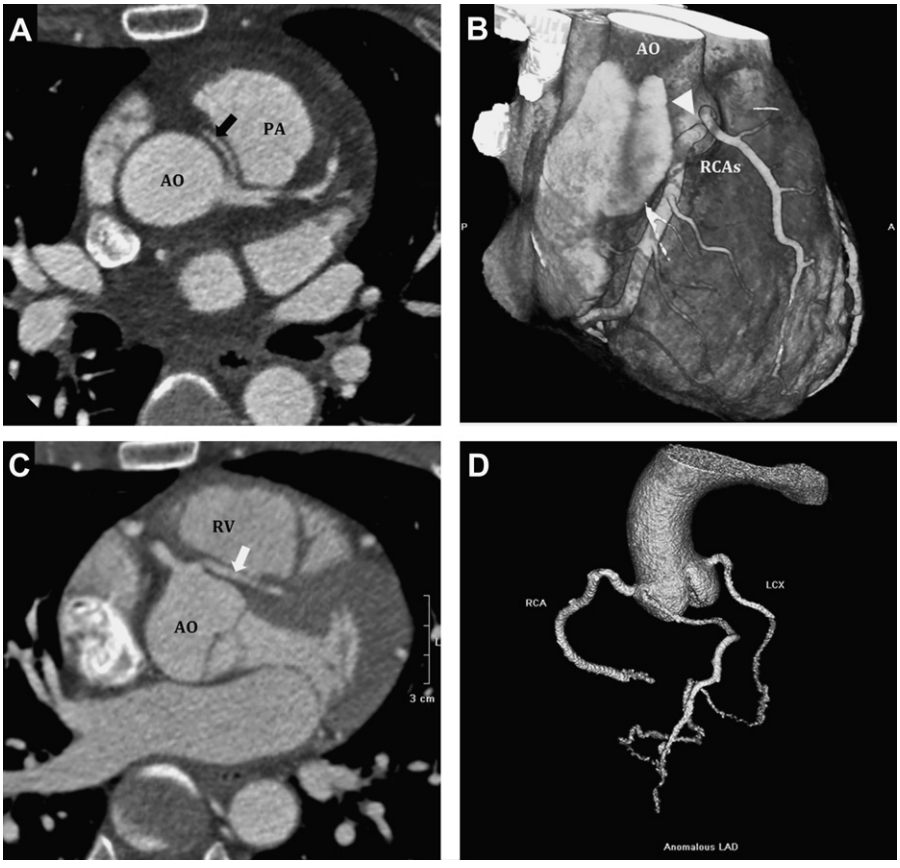

Figure 1 Anomalous origin and course of coronary arteries (AOCA). (**A**) Anomalous right coronary artery (RCA). The anomalous RCA originated from the left sinus of Valsalva and coursed interarterially in between the aorta (AO) and the pulmonary artery (PA). Interarterial course of anomalous coronary artery is potentially malignant, with an increased risk of sudden cardiac death. (**B**) RCA duplication. Two vessels can be seen to independently arise from the right sinus of Valsalva, supplying RCA territory. (**C**) Anomalous left anterior descending artery (LAD). The anomalous LAD originated from the right sinus of Valsalva and took a transseptal (subpulmonic) course to reach the LAD territory. (**D**) Three-dimensional reconstruction of the anomalous LAD. The anomalous LAD can be clearly seen to arise from the right sinus of Valsalva. The left circumflex coronary artery (LCX) originated independently from the left sinus of Valsalva. RV, right ventricle.