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High risk sudden death patients with anomalous coronary arteries presented clinically with chest discomfort diagnosed by multi-detector computed tomographic angiography

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Cardiac catheterization and angiography is an important and common practice in the diagnosis of heart disease. There are about 5% of individuals undergoing this procedure and 1% to 2% general population have congenital anomalous coronary arteries (ACA) [1]. ACA may have critical impact to myocardial perfusion, inducing ischemia and resulting in left ventricular dysfunction and even sudden death. There are two primary congenital ACA, one is anomalous origin of the left coronary artery from the pulmonary artery which is usually benign; the other one is anomalous origin from aorta which is more complicated and may cause sudden death.

Chest pain or discomfort is an important clinical symptom presenting at the outpatient or emergency department, and coronary artery disease (CAD) presents with chest pain may be life threatening. Although cardiac catheterization is an important procedure in diagnosing CAD, it is impractical as a screening test due to its cost and invasiveness.

Computed tomography angiography (CTA) performed by multi-detector machine is the technology that allows rapid visualization of coronary arteries, which is especially helpful in those patients with ACA, who will have sudden death possibility; and initiates early intervention

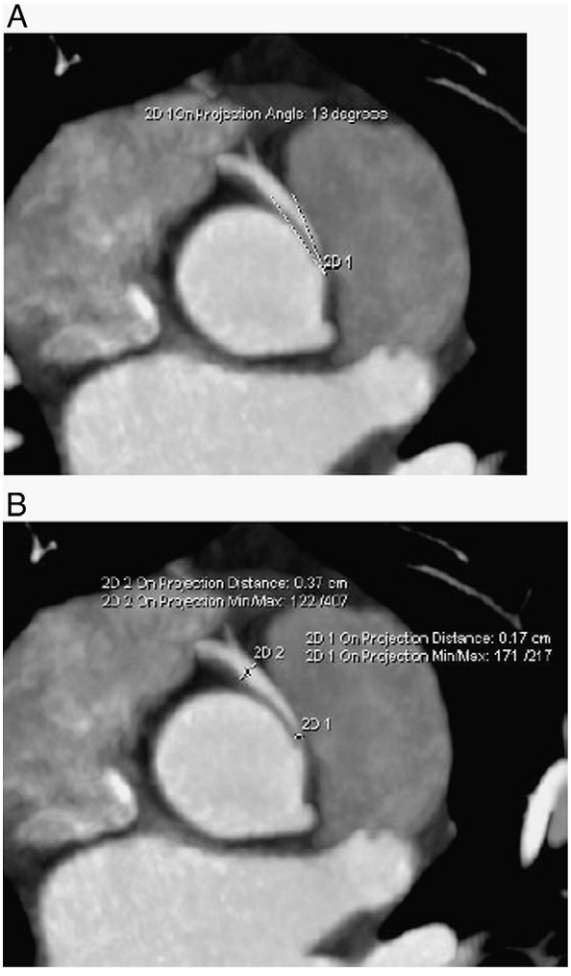

Fig. 1. (a) A takeoff angle was measured between the wall of the aorta and the first bending point of RCA on a multiplanar image that was a well-visualized takeoff portion of RCA. (b) The mean diameters at the narrowest portion of the orifice and the reference were measured at the proximal RCA outside the interarterial portion (1.5 cm from the orifice).

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such as percutaneous coronary intervention or surgical correction in order to prevent sudden death.

This study included patients presenting to the outpatient department from April, 2010 to May, 2011, with chest pain or discomfort received CTA examination.

All image acquisitions were performed by using a fast dual-source multi-detector computed tomography system (MDCT) (Somatom Definition Flash; Siemens Healthcare, Forchheim, Germany) with a collimation of $64\times2\times0.6$ mm and flying-focal spot, resulting in 2×128 sections.

No heart rate-modulating medications were administered for coronary angiography acquisitions. Patients received a 0.5 mg sublingual dose of nitroglycerin just before scanning initiation.

All coronary CTA were reconstructed using a single-segment reconstruction algorithm, resulting in temporal resolution of 75 ms, section thickness of 0.75 mm, and increment of 0.5 mm, and medium-to-smooth (B26f) convolution kernels. Retrospective reconstruction for this study was performed at two scanner-determined.

The proximal structures of anomalous right coronary artery (RCA) of the patients were evaluated for the location of the orifice, the takeoff angle, and the mean diameters of RCA at the orifice and the reference.

A takeoff angle was the angle at the takeoff of the coronary artery, which was measured between the wall of aorta and the first bending point of RCA on a multiplanar image that was a well-visualized takeoff portion of RCA (Fig. 1). We measured the mean diameters at the narrowest portion of the orifice and the reference measured at the proximal RCA outside the interarterial portion (1.5 cm from the orifice) (Fig. 1). The relative narrowing of the areas of RCA was calculated

$$[\text{narrowing ratio } = (1 - \textit{orifice} / \textit{reference}) \times 100\%]$$

The data were analysed by SPSS version 18.0, Pearson correlation coefficient was used. A p value <0.05 was statistically significant for all test.

Among the 3190 cases received CTA, all of the 26 cases of ACA had chest pain or discomfort, and only 13 cases had abnormal ECG change of ST-T segment elevation. Of these 26 cases ACA, the proximal segments originated between the aorta and pulmonary artery, and the compressed coronaries had a stenotic rate between 34.4% and 82.3%. Twenty-four cases had stenosis ≧50% (92.3%), and 20 cases had stenosis ≧ 70% (76.9%) (Fig. 2). The average stenotic area was $71.9 \pm 12.6\%$.

The takeoff angles were variable (5–29 degrees; mean, 14.2 ± 4.7 degrees). The takeoff angle was less than or equal to 10° in 4 cases; 10° angle ≦15° in 14 cases and 15° angle ≦20° in 6 cases, and more than 20° in 2 cases.

The relative narrowing of the areas of RCA were negatively correlated with the takeoff angles ($R = 0.333$, $p = 0.097$; Fig. 3).

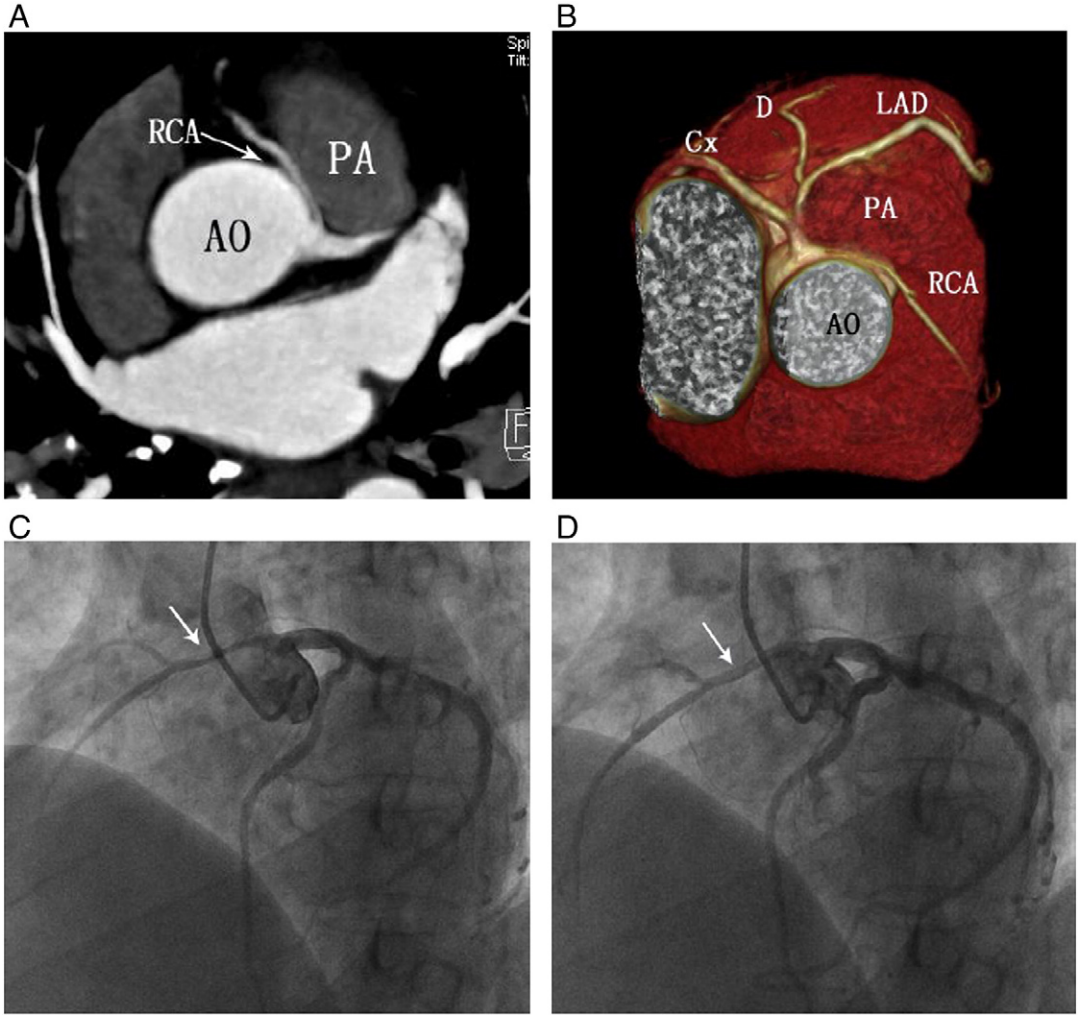

Fig. 2. This 56 year old female had an anomalous origin of RCA from the left coronary sinus. (a) Axial maximum intensity projection (MIP, thickness = 3 mm) images demonstrating the short interarterial course of RCA between the aorta and the PA (arrow). (b) 3D volumetric images demonstrating the anomalous origin of RCA from the left coronary sinus. (c, d) Selective right and left angiography showing the right coronary injection at the same time with proximal segment luminal narrowing (arrow) at the systolic phase (c) and without narrowing at the diastolic phase (d).

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