

## Anomalous Origin of the Right Coronary Artery from the Left Coronary Sinus

Shi-Min Yuan, MD; Salis Tager, MD; Ehud Raanani, MD

Surgical treatment for the anomalous origin of the right coronary artery from the left coronary sinus remains a topic of debate. A 61-year-old male patient, presenting with a single episode of chest pain, was diagnosed with anomalous origin of the right coronary artery from the left coronary sinus. The patient underwent right internal mammary artery coronary bypass surgery without ligating the proximal right coronary artery. Postoperatively, his condition remained uncomplicated and asymptomatic. Sudden death rate is high even in asymptomatic patients therefore the condition be subjected to surgical treatment after diagnosis. (*Chang Gung Med J* 2009;32:455-8)

**Key words:** computerized tomographic angiography, coronary artery anomaly, coronary artery bypass grafting

The anomalous origin of the right coronary artery (RCA) from the left coronary sinus coursing between the aorta and the pulmonary trunk is a rare congenital anomaly.<sup>(1)</sup> It may remain asymptomatic and identified incidentally by angiography, during cardiac operation, or at autopsy, whereas some cause major cardiac events, even in the absence of coronary atherosclerosis.<sup>(1,2)</sup>

### CASE REPORT

A 61-year-old male patient was admitted to the Department of Cardiac and Thoracic Surgery for the treatment of anomalous RCA. He had his first episode of typical precordial chest pain at rest four months earlier. The pain was aggravated by deep inspiration, lasted for several minutes, and relieved without therapy. He was referred to the Chest Pain Unit. An electrocardiogram showed normal sinus rhythm without any evidence of ischemic changes. The blood cardiac troponin was negative. He was

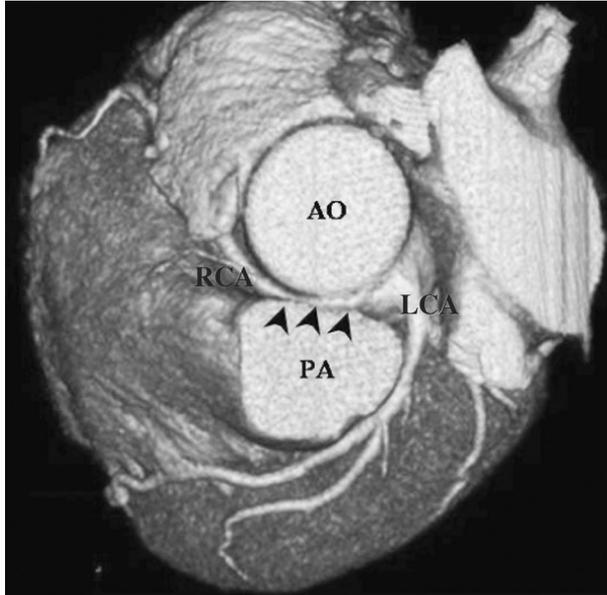
subjected to a computerized tomographic angiography, and was diagnosed with anomalous origin of RCA from the left coronary sinus (Fig. 1). After the single episode of chest pain, he remained asymptomatic. His medical history showed that he was a non-smoker with no significant indicators for diabetes mellitus, hypertension, or hyperlipidemia. On admission, a physical examination revealed that his vital signs were within normal limits. No cardiac murmur or pulmonary râles were audible. Electrocardiogram was normal. The diagnosis of anomalous origin of RCA from the left coronary sinus was confirmed. On 30 April 2007, he underwent an elective operation under cardiopulmonary bypass with mild hypothermia and cardioplegic arrest. In situ semi-skeletonized right internal mammary artery was harvested and bypassed to the proximal portion of the RCA. The patient was weaned from the pump without any complications. The cardiopulmonary bypass time was 29 min, and the crossclamp time was 23 min. His postoperative

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From the Department of Cardiac and Thoracic Surgery, The Chaim Sheba Medical Center, Tel Hashomer, Israel.

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Correspondence to: Dr. Ehud Raanani, Department of Cardiac and Thoracic Surgery, The Chaim Sheba Medical Center, Tel Hashomer 52621, Israel. Tel.: 972-3-5302710; Fax: 972-3-5302410; E-mail: ehud.raanani@sheba.health.gov.il



**Fig. 1** An axial view of three dimensional reconstruction of computerized tomography of the heart showed the anomalous RCA shared the same ostium with the left coronary system, with its attenuated proximal portion (arrow heads) passing between the aorta and pulmonary trunk. The left coronary system was patent. Abbreviations used: AO: aorta; LCA: left coronary artery; PA: pulmonary artery; RCA: right coronary artery.

course was uncomplicated. He was extubated five hours after the operation. The Intensive Care Unit stay was 15 hours, and he was discharged on the 5th postoperative day. He remained asymptomatic at the 3-month follow-up.

## DISCUSSION

The incidence of anomalous RCA originating from the left sinus is 0.13%.<sup>(3)</sup> Among patients with first time cardiac catheterization, this anomaly accounts for up to 1.6%.<sup>(4)</sup> The anomaly is increasingly reported with the development of cardiac imaging techniques.

Most patients with an anomalous RCA are young and otherwise healthy.<sup>(5)</sup> It is well established that an anomalous origin of RCA could lead to angina pectoris, myocardial infarction, or sudden death, in the absence of atherosclerosis, which usually occurs during or after exercise, particularly in young athletes.<sup>(6)</sup> The mechanisms of anomalous origin of

coronary artery in association with cardiac events remain unclear. Proposed predisposing factors include slit-like ostium, acute take-off at its origin, and impinged or spastic intramural proximal portion, which, in turn, is predisposed to accelerated atherosclerosis.<sup>(7,8)</sup>

Kragel and Roberts<sup>(9)</sup> categorized anomalous RCA from the left sinus into four types: RCA arises, A, from within the left sinus; B, from above the left sinus; C, directly above the commissure between the left and right cusps; and D, from a common ostium with the left main coronary artery, which straddles the left sinus and the commissure between the left and right cusps. Type D was proved to be of the least incidence accounting for 2/25 (8%) of all four types. The ostial shape was discovered to be a determinant of clinical significance, showing that 42% slit-like vs. 29% round shaped ostium were fetal. As for the coronary dominance, none of the patients were of clinical significance when left circumflex was dominant, however, the anomaly would be a primary cause of death if both left circumflex and RCA were hypoplastic.

Some patients with an anomalous RCA remained asymptomatic,<sup>(10)</sup> while the present patient presented with only a single episode of chest pain. It is uncertain whether this single episode was a result of or irrelevant to the anomalous RCA, which led to screening by tomographic angiography. The first 1.5 cm of the coronary artery to the aortic wall angled less than 45° with an acute take-off. A take-off angle of 33° has been noted in such a patient,<sup>(11)</sup> and a sharp bend at the origin of the anomalous RCA like the present case has been demonstrated as well.<sup>(12)</sup>

Conservative therapy as limited exercise and drug therapy (nitrates, calcium or beta blockers, or antiarrhythmic drugs) was proposed. Symptoms were relieved in 69.2%.<sup>(13)</sup> Interventional method with coronary stents is only indicated in selected patients with significant atherosclerosis disease in the anomalous vessel.<sup>(5,14)</sup>

Surgical strategy of choice for the anomalous RCA is quite controversial. Multiple options were advocated including coronary artery bypass, coronary reimplantation, and unroofing of the intramural segment (also termed as ostioplasty).<sup>(1)</sup> This anomaly has been treated by saphenous vein graft bypass since the 1980's.<sup>(15)</sup> De Lello et al.<sup>(16)</sup> proposed that

the preferred treatment was to anastomose the left internal mammary artery to the very proximal RCA, or RCA reimplantation to the aorta. However, whether to ligate a patent anomalous RCA challenges the cardiac surgeons because of disputes related to potential competitive flow.<sup>(6,12)</sup> A coronary artery bypass grafting without ligating the anomalous RCA has been advocated as a surgical strategy of choice for over a decade.<sup>(17)</sup> Some patients with a patent RCA did not show any competitive flow.<sup>(6)</sup> Coronary reimplantation has been attempted in anomalous RCA types A and C in a few patients.<sup>(18)</sup> Nevertheless, coronary excision and reimplantation may cause a neo-ostial distortion thus lead to eventual coronary artery bypass.<sup>(10)</sup>

The unroofing technique was proposed by Mustafa et al.<sup>(19)</sup> in 1981, and was applied as the procedure of preference by many surgeons. However, this approach often necessitates takedown and reattachment of the intercoronary commissure results in aortic valve dysfunction.<sup>(10)</sup> Flow in the intramural segment may be another shortcoming of this procedure, the unroofing plus internal mammary coronary artery bypass is an alternative surgical method.<sup>(10)</sup>

The diagnosis of the present patient was an anomalous origin of RCA from the left coronary sinus type D according the classification of Kragel and Roberts.<sup>(9)</sup> It seems that an anomalous RCA sharing a common ostium presents an even higher cardiac risk. The coronary artery bypass has the advantage of obviating the need to mobilize the aortic wall and intercoronary commissure. However, this will leave the slit-like orifice untreated hence tying-off the proximal RCA has been advocated by some reports, which might eventually compromise the native coronary artery.<sup>(10)</sup> Therefore, the proximal RCA was left untouched in the present patient.

Sudden death rate is high even in asymptomatic patients therefore the condition be subjected to surgical treatment after diagnosis. In particular, coronary artery bypass is a safe and promising procedure at a current era.

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