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Anomalous Right Coronary Artery from the left aortic sinus: technical issues during revascularization

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Abstract
Anomalous origin of the right coronary artery (RCA) is reported in 1–2% of patients among diagnostic angiograms. Ectopic origin of right coronary artery from opposite sinus is one of the most common anomalies and they are generally benign, but at times may be malignant. We report a case of a 72-year-old male who underwent percutaneous coronary intervention for chronic stable angina who had critically diseased obtuse marginal branch, and anomalous right coronary artery (RCA) arising from left aortic sinus on coronary angiogram, and various technical challenges during the procedure. RCA was cannulated using Judkins left guiding catheter and revascularized by deployment of 2.75 x 18 mm Promus Premier Stent (everolimus eluting stent, Boston Scientific, USA) at 12 atm.

Keywords: Anomalous right coronary artery, Chronic stable angina, Judkins left guiding catheter

Introduction
Coronary arteries of anomalous origin are uncommon and encountered in 0.2–1.2% of patients undergoing percutaneous coronary intervention and represent a marked deviation of the normal anatomic pattern [1, 2]. An anomalous origin of the right coronary artery (RCA) from the left aortic sinus has been reported in 6–27% of patients with coronary anomalies as it varies in various angiographic series of consecutive patients from various centres. The unusual location and course of this anomaly poses a considerable technical challenge during revascularization. Therefore, the selection of an appropriate guiding catheter is crucial to ensure selective angiography, proper assessment of lesion characteristics, and facilitate successful delivery of hardwares in order to avoid complications.

Case report
A 72-year old male smoker presented with exertional angina — Canadian Cardiovascular System (CCS) class III for past three years with recent worsening despite guideline directed
medical treatment. He was receiving aspirin — 75 mg, metoprolol — 200 mg, atorvastatin — 20 mg, and ramipril — 5 mg daily. His physical examination and biochemistry were all unremarkable. Electrocardiogram revealed mild ST-T changes in precordial leads. Echocardiography revealed mild concentric hypertrophy of left ventricle, grade-II diastolic dysfunction with normal ejection fraction (EF = 55%). His tread mill test was strongly positive for reversible ischaemia. His coronary angiography, which was performed at a different hospital, showed discrete eccentric lesion with 90% stenosis in large obtuse marginal branch (OM) of left circumflex artery, and mid part of ectopically arising right coronary artery (RCA) from left aortic sinus respectively (Fig. 1A, B). He attended our outdoor department for revascularization. Percutaneous coronary revascularization was performed through transfemoral route after proper consent. OM was stented by deploying 3 x 28 mm Xience Prime stent at 13 atm pressure (everolimus eluting stent; Abott, USA) achieving TIMI III flow using 6F extra backup guiding catheter (EBU, Medtronic, USA) (Fig. 2A). As RCA had an anomalous origin, cannulating it using different guiding catheters like Amplatz left (AL) — 1, 2, Voda left, Amplatz right (AR) — 1, 2, and Multipurpose (MP) failed. We then chose Judkins left (JL)-3.5 and pushed to left sinus (Fig. 3A). As RCA was arising anteriorly, we manoeuvred it clockwise which brought it close to its ostia (Fig. 3B). When it was little pulled up, and manoeuvred in same fashion, it cannulated the ostia of RCA (Fig. 4A). It was wired with runthrough wire (Terumo, Japan). Lesion was predilated with 2.5 x 10 mm sapphire balloon (Orbus Neisch; PRC) (Fig. 4B), and stented with 2.75 x 18 mm Promus Premier stent (everolimus eluting stent, Boston Scientific, USA) at 12 atm pressure achieving TIMI III flow (Fig. 2B). Multidetector coronary computer tomography angiogram (MDCT) showed the anomalous RCA arising from left coronary sinus near left main ostium (Fig. 5, 6). He was discharged on the third day with aspirin — 75 mg/day, clopidogrel — 75 mg/day, atorvastatin — 40 mg/day, metoprolol — 200 mg/day and ramipril — 5 mg/day. Patient is doing excellent since then with regular follow-up at our institute.

**Discussion**

The anomalous RCA from left aortic sinus comes out from antero-superior direction, the site of which may be the left sinus itself or directly from the left main coronary artery or its vicinity [3–5]. They can be cannulated by various diagnostic catheters like Judkins right (JR 3.5–4), Amplatz right (AR 1–2), unconventional Williams no-torque curves, or Tiger catheter to name a few. Rarely, they can be seen by non-selective sinus root injection in difficult cases as coaxial alignment is not required for diagnostic purpose.
While doing PCI of an anomalous RCA, certain factors need consideration such as configuration of the ostium, dimensions of the aortic root, the level of backup support, angle at takeoff, location and complexities of lesions, and the type of hardwares to be used. All of these should be sought in detail from basal angiogram to ensure adequate selection of equipment during intervention and to later enable the operator to exercise the appropriate caution during manipulations with guiding catheters, wires, and balloon catheters.

Data regarding successful percutaneous revascularization of anomalous RCA from left sinus are limited, and mostly derived from small case series [6–8]. RCA intervention using Amplatz guiding catheters although have excellent support but at the cost of risk of too deep intubation causing hemodynamic compromise and rarely ostial dissection, whereas using Judkins guiding catheters gives one the opportunity of easy manipulation although back-up support is little compromised sometimes.

In one of the largest series of anomalous RCA by Sarkar et al [9], they have used JL, JR, Q-curve, and Voda catheter for RCA cannulation depending on its anatomy. For angioplasty of an anomalous RCA originating from the left aortic sinus, we successfully utilized Judkins-type catheter, a result similar to as reported by Mooss et al [10].

It needs to be stressed that there exists a pronounced learning curve to approach type of cases as improper selection of guiding catheter may make things worse like increased fluoroscopy and procedure time to total failure. Furthermore, besides other anatomic factors, catheter selection for PCI is also influenced to a certain degree by operator preference, familiarity, and institutional availability. The Judkins catheter we have described, are commonly used and easily available in most cathlabs. Whereas each individual case may require a slightly different approach, we believe that the use of Judkins left guiding catheter provides a simple and effective solution to successfully engage the anomalous vessel with reduced expenditure of contrast agent and radiation exposure, thus increasing the likelihood of technical success.

Conflict of interest
None.

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References


**Figure legends**

**Figure 1.** Coronary angiogram showing discrete eccentric lesion with 90% stenosis (white arrow) in large obtuse marginal branch (OM) of left circumflex artery (A), and mid part of anomalous right coronary artery (RCA) from left aortic sinus respectively (B)

**Figure 2.** The obtuse marginal branch after being stented with 3x28 mm Xience Prime stent (everolimus eluting stent; Abott, USA); Anomalous RCA after being stented with 2.75 x 18 mm Promus Premier stent (everolimus eluting stent, Boston Scientific, USA)

**Figure 3.** Judkins left (JL) — 3.5 guiding catheter being gradually pushed and manoeuvred clockwise to bring it close the ostium of anteriorly arising RCA from left aortic sinus in antero-posterior view (A; B). RCA is also showing discrete eccentric, critical lesion in mid part (white arrow)

**Figure 4.** Left anterior oblique view showing Judkins left (JL) — 3.5 guiding catheter being gradually pushed and manoeuvred clockwise to bring its tip close the ostium. When little pulled, it successfully cannulated the RCA. It was wired (A) and lesion was predilated with 2.5 x 10 mm sapphire balloon (Orbus Neisch; PRC).

**Figure 5.** MDCT showing anomalously arising RCA from anterior surface of left sinus

**Figure 6.** Volume rendered reconstruction from inside aorta showing RCA ostium (horizontal red arrow) lying in close vicinity of base of left main trunk (vertical red arrow)