

Angioplasty on an Infarct-related Anomalous Right Coronary Artery Arising from Posterior Coronary Sinus

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Abstract

Introduction: The objective of this case report was to illustrate the diagnostic and intervention approach of anomalous right coronary artery (RCA). **Clinical Picture:** A 60-year-old man presented with acute inferior myocardial infarction. Cardiac catheterisation revealed an anomalous RCA arising from the posterior coronary sinus as the infarct-related artery. **Treatment:** Ad hoc percutaneous coronary intervention with stent implantation was performed using a few technical modifications. **Outcome:** Good angiographic result was achieved within 90 minutes, with 260 mL of contrast used. **Conclusion:** A high index of suspicion and logical diagnostic and intervention approach are required for the proper management of anomalous RCA.

Ann Acad Med Singapore 2010;39:258-60

Key words: Acute myocardial infarction, Congenital coronary anomalies, Coronary interventions

Case Report

A 60-year-old chronic smoker had delayed presentation (>18 hours) of acute inferior myocardial infarction with electrocardiogram showing 1.0 mm ST-segment elevation in leads II, III, and aVF on admission to hospital. Subsequently, he developed sustained complete atrioventricular block with no ventricular escape which necessitated temporary pacing. His creatinine kinase level had already peaked (>3000 U/L); transthoracic echocardiography revealed impaired left ventricular function (ejection fraction 0.42) with inferoposterior hypokinesia. Early invasive strategy was adopted in view of his complaint of post-myocardial infarction angina.

Cardiac catheterisation was performed through right femoral approach. Left coronary angiography showed no significant coronary artery stenosis. However, the right coronary artery (RCA) could not be cannulated after struggling for 5 minutes; the possibility of anomalous RCA origin was raised. An angiographic approach suggested by Jim et al¹ was used. Contrast injection through a 6F Judkin Right 4 and Amplatz 1 diagnostic catheter inside the right and left coronary sinus, respectively, failed to unveil the RCA origin. The Amplatz 1 catheter was then used to search for any anomalous RCA originated from the anterior aortic wall also in vain. Finally, non-selective contrast injection toward the posterior coronary sinus detected some contrast

filling into the RCA. A 6F multi-purpose catheter pointing toward posterior direction under fluoroscopy at the angle of right anterior oblique 30° successfully cannulated the anomalous RCA ostium; there was a complete occlusion at the distal part of the RCA (Fig. 1). Left ventriculography revealed impaired left ventricular function with inferior hypokinesia.

Ad hoc coronary intervention was performed with a 7F multi-purpose guiding catheter which provided only a weak support. PT2 Light Support wire (Boston Scientific Corp. Miami, USA) coupled with FineCross (Terumo Corp., Tokyo, Japan) micro-catheter crossed the distal occlusion. Wire was then switched to extra-support wire (Abbott Vascular, Santa Clara, USA) through the micro-catheter lumen. The PT2 Light Support wire was used to wire the lesion again (double-wire) to provide additional support for subsequent passage of intervention equipments. The lesion was predilated with 2.0 mm and then 2.5 mm balloons at 14 atmospheres. Angiography revealed a recanalised dominant RCA with re-established coronary flow. Three Xience-V stents (Abbott Vascular, Santa Clara, USA) (3.0 x 28 mm, 2.75 x 28 mm, 2.5 x 28 mm) were implanted, in the form of full metal jacket, in the diseased distal RCA. The stents were post-dilated with a 3.0 x 15 mm non-compliance balloon at up to 20 atmospheres. The final angiographic result was excellent, with TIMI 3 flow (Fig. 2). The total

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procedure time was 88 minutes; and 260 mL of contrast has been used. The complete atrioventricular block resolved a few hours after the coronary intervention. Patient run an uncomplicated course and was discharged at day 3. A computed tomography (CT) arranged 2 months after the index procedure confirmed anomalous RCA origin arising from the posterior coronary sinus (Fig. 3). The anomalous RCA descended from posterior to anterior direction, eventually rejoined the original path at the atrioventricular groove (Fig. 4).

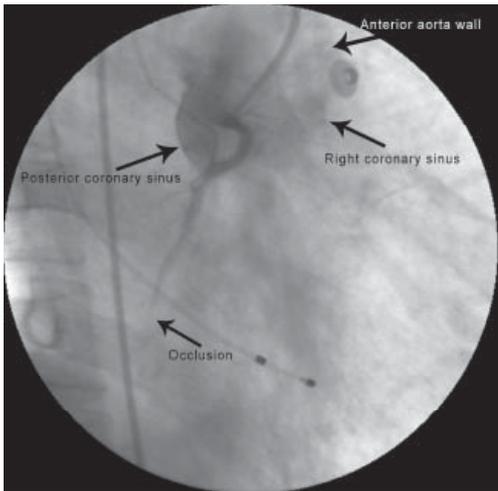


Fig. 1. Right anterior oblique view. The right coronary artery seems to be arising from the posterior coronary sinus.

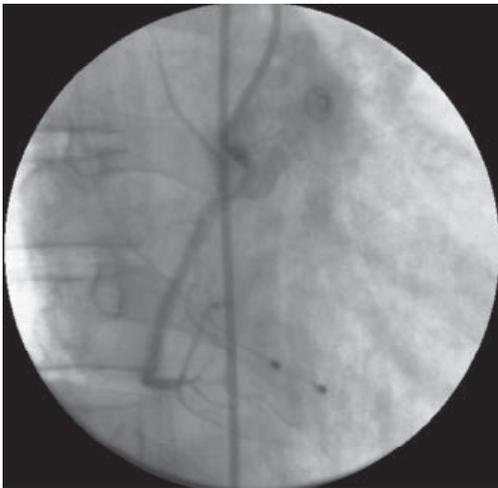


Fig. 2. The final angiogram after intervention.

Discussion

Coronary arteries of anomalous origin were found in about 1% of patients undergoing coronary angiography.^{1,2} Clinically, only the “interarterial” variant receives much attention because of its association with myocardial ischaemia, malignant ventricular arrhythmia and sudden

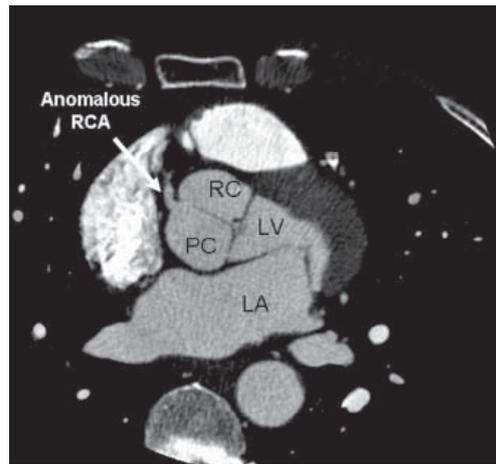


Fig. 3. Computed tomography confirms the right coronary artery is arising from the posterior coronary sinus. LA: left atrium; LV: left ventricle; PC: posterior coronary sinus; RC: right coronary sinus; RCA: right coronary artery.

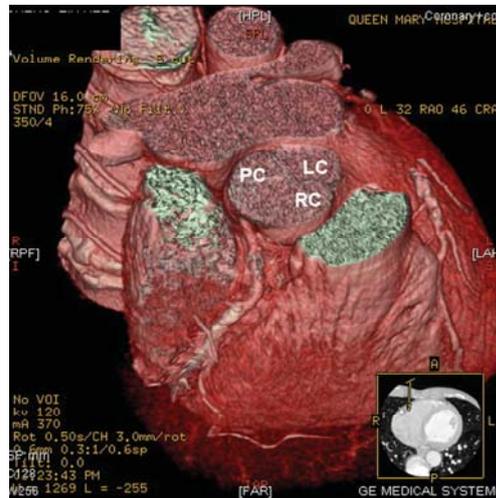


Fig. 4. 3D-computed tomography reconstruction displaying the course of the anomalous right coronary artery. LC: left coronary sinus; PC: posterior coronary sinus; RC: right coronary sinus.

death.³⁻⁶ Indeed, coronary artery anomalies are the second most common cause of non-trauma deaths in young athletes.⁶ In particular, left coronary artery from the right coronary sinus runs a higher risk than RCA from the left coronary sinus, albeit the latter is more prevalent.^{4,5} In older population, atherosclerotic coronary artery disease is increasingly recognised in anomalous coronary arteries. One article reported the association of anomalous RCA with the onset of significant atherosclerosis at younger age.⁷ Yip et al⁸ found that the incidence of infarct-related anomalous RCA is higher in patients who underwent primary angioplasty; thus, early recognition and precise cannulation are important for early mechanical reperfusion in this scenario. The incidences of anomalous RCA origin are summarised in Table 1.^{1,2,9,10} Anomalous RCA from the posterior sinus is

Table 1. A Summary of the Incidences of Anomalous Origin of Right Coronary Artery from Literatures

Anomalous right coronary artery origin	Incidence in population
Left coronary sinus	0.107% ¹ ; 0.17% ⁹ ; 0.92% ²
Posterior coronary sinus	0.003% ¹
Ascending aorta	0.15% ¹
Pulmonary artery (ALCAPA)	0.002% ¹
Single left coronary artery (no right coronary artery)	0.025% ¹ ; 0.066% ¹⁰

Table 2. Causes of Failed Cannulation of Right Coronary Artery

Coronary causes	Non-coronary causes
<i>Abnormal take-off</i>	Very tortuous aorta
Superior take-off	Grossly dilated aortic root
Inferior-take-off	Severe aortic stenosis (high-velocity jet of blood destabilises catheter position)
<i>Abnormal position of ostium within right sinus</i>	
Usually anterior displacement	
<i>Abnormal origin from different sinus</i>	
Left sinus	
Posterior sinus	
<i>Abnormal origin from aortic wall</i>	
<i>Single left coronary artery</i>	

exceedingly rare, found in 0.003% of general population and 0.24% among coronary artery anomalies.¹ This is the first case report of percutaneous coronary intervention (PCI) on this anomalous artery subset. In general, PCI of anomalous coronary artery is met with 2 major problems: (1) early recognition and cannulation, and (2) poor guiding catheter support during intervention.

Failure to precisely cannulate RCA ostium is a common cardiac laboratory problem encountered by inexperienced cardiologists. The cause can either be due to coronary or non-coronary ones (Table 2). In light of the scarcity of this anomaly, a high index of suspicion and a systematic approach is mandatory. Jim et al¹¹ had described an easy and logical flowchart to tackle the problem: right coronary sinus injection (rule out abnormal orientation and anterior origin from right sinus), left coronary sinus injection (rule out anomalous origin from left sinus), and followed by aortography (diagnoses anomalous origin from posterior coronary sinus or anterior aortic wall and single coronary artery). By using this approach, the anomalous RCA ostium could be precisely cannulated within 15 minutes in this patient with minimum usage of contrast.

The ostia of anomalous coronary arteries are difficult to reach with guiding catheters designed for normal coronary anatomy. Moreover, the ectopic ostium is usually juxtacommissural, and the proximal course of the anomalous artery is tangential to the aortic wall.¹² These anatomical features prevent the institution of coaxiality of guiding catheters. In anomalous RCA origin arising from posterior coronary sinus (this patient), the multi-purpose guiding catheter was hanging from anterior aortic wall to barely reach the posterior located RCA ostium; the catheter was not really co-axial and easily back out upon meeting resistance. Several technical modifications were taken in this case to increase the guiding catheter support: maximising the size of guiding catheter (7F), using microcatheter as wire support during wire works, switching to a more stiff wire, double wiring, adequate balloon predilatation and lesion preparation, more trackable and deliverable stents.

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