



Case Report

Percutaneous coronary intervention with anomalous origin of right coronary artery: case reports and literature review

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Abstract

Percutaneous coronary intervention (PCI) in an anomalous right coronary artery (RCA) can be technically difficult because selective cannulation of the vessel may not be easy. We thereby present two cases with unstable angina pectoris of anomalous originated RCA. The PCI were successfully performed in two patients with a special guiding wire manipulating skill which we called “gone with the flow” combined with balloon anchoring technology, providing excellent angiographic visualization and sound guide support for stent delivery throughout the procedure without severe cardiovascular adverse effects. Our primary data suggested that PCI for geriatric patients with an anomalous origin of RCA accompanied by severe atherosclerotic lesions might also be a safe, available, and feasible strategy.

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1 Introduction

An anomalous origin of right coronary artery (RCA) is not an exceedingly rare congenital anomaly. According to our knowledge, thus far, there rarely has been case reports concerning the usefulness of percutaneous coronary intervention (PCI) for coexistent anomalous origin of coronary artery and atherosclerotic lesion in geriatrics. Detailed information about such situations has therefore remained rather scanty.^[1-4] Thus, we described here two cases of unstable angina pectoris whose culprit lesions were located at the site of anomalous RCA and were successfully treated with PCI. Additionally, the tips and trick of PCI in the treatment of patients with anomalous origin of RCA were also introduced based on relevant literatures and our experience.

2 Cases Report

2.1 Case 1

A 75 year-old male presented to the hospital with com-

plaints of spontaneous substernal chest pain for three weeks. He has a prior history of tobacco abuse and intractable hypertension but denied diabetes. Upon admission, he was strikingly hypertensive (190/100 mmHg) with a regular heart rate of 89 beats per minute. He showed clear consciousness and other physical examinations documented normal findings. The electrocardiogram at admission revealed striking depression of the ST segment in leads II, III, aVF and mild depression of ST segment in V2-V5. His echocardiography showed no obvious abnormal motion of ventricular wall. The lab analyses, such as troponin and the remaining cardiac enzymes, lipid profiles, fast blood glucose (FBG) and oral glucose tolerance test (OGTT), were negative. According to the results of the above examinations, he was diagnosed as having an unstable angina pectoris. The patient received conventional medicine preconditioning before the earlier invasive assessment, such as dual anti-platelet therapy (aspirin 100 mg/d and clopidogrel 300 mg once and thereafter at a dose of 75 mg/d); and the remaining therapy which included statin, nitrate, nicardipine, metoprolol succinate and perindopril, an angiotensin converting enzyme inhibitor (ACEI). He was referred to the catheterization laboratory for coronary angiography (CAG) through the access of the right femoral artery. The selective cannulation of the left coronary artery simultaneously revealed significant stenoses of the left anterior descending coronary (LAD) and an aberrant origin of the RCA from the left coronary sinus (LCS) near the left main trunk. We manipulated the Judkins left 4.0 cm curve catheter to engage

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the aberrant RCA selectively without difficulty and revealed a 99% lesion in the mid-portion of the right coronary artery (Figure 1A). Subsequently, PCI was performed painstakingly with use of a 6 French (Fr) Judkins left 4.0 cm guiding catheter (Cordis, USA), which failed to provide adequate support and was badly coaxiality due to the anomalous anatomic originate of RCA. We advanced a 0.014 inch BMW guide wire (Guidant, USA) “gone with the flow” and manipulated it to the distal-RCA pre-dilated with a 2.0–20 mm Ryujin balloon catheter (TERUMO, Japan). During the process of balloon pre-dilated, the operator utilized the anchoring force of the expansion balloon to lead the guide catheter to the appropriate place, but failed to complete the process of delivering the stent to the lesions. Therefore, we

advanced two WHISPER (Cordis, USA) guide wires into the distal-LAD aimed to augmented the anchoring force. Finally, stent installment was accomplished with a 3.0–13 mm Partner coronary stent (Lepu, China) delivered at 18 atm. The result was a remaining stenosis of less than 10% (Figure 1B). The operational time of this case was 55 min and the dosage of contrast agent was 85 mL. The patient underwent an uneventful hospital course and was discharged the following day after the successful PCI for his LAD lesions. There was also no dissection, thrombus, perioperative myocardial infarction, heart failure, stroke or death during the PCI procedure. The subject remained free from MACE during an outpatient follow-up period of 18 months.

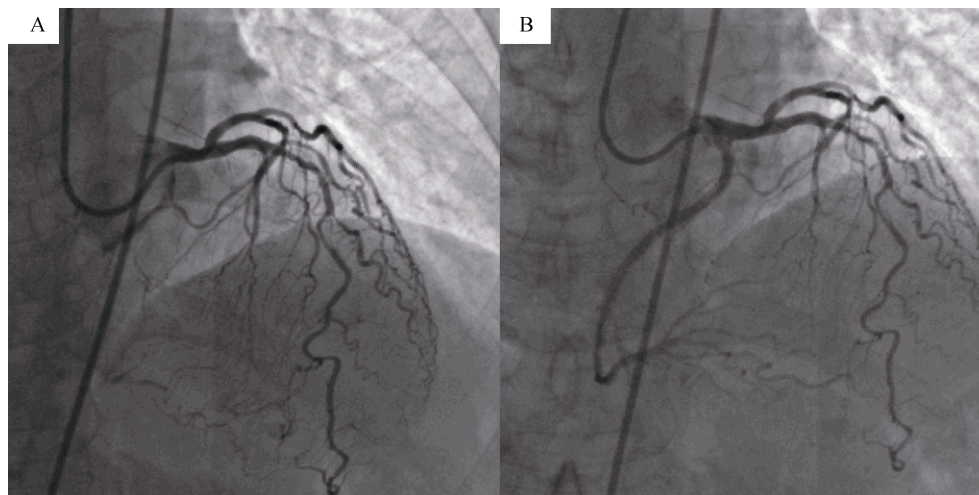


Figure 1. Imagings of selective coronary angiography of pre- and post-procedures for case 1. (A): CAG image of case 4 displayed the anomalous RCA originates from left coronary sinus adjacent to left main trunk and occlusion of mid-RCA; (B): Image of case 4 post-PCI indicated series implanted with a 3.0–13 mm and a 3.0–18 mm DES at the remained lesion of mid- RCA after the occlusion of RCA had been resolved. CAG: coronary angiography; PCI: percutaneous coronary intervention; RCA: right coronary artery.

2.2 Case 2

A 68-year-old male presented to the hospital with complaints of exertional substernal chest pain for three months duration. His symptoms were worsened on laboring for five days. He has a history of tobacco abuse and hypertension, but denied a prior medical history of diabetes. On admission, he was mildly hypertensive (150/70 mmHg) with a regular rhythm of 70 beats per minute. Cardiac auscultation was unremarkable. The electrocardiogram at admission revealed mild depression of the ST segment in leads II, III, aVF and marked by an exercising test. His echocardiography showed no obvious abnormal motion of ventricular wall. The report of lab analyses, such as troponin and the remaining cardiac enzymes, blood lipoids and FBG were negative. According to the results of the above examinations, he was diagnosed as having an unstable angina pectoris. The patient received

conventional medicine preconditioning before the invasive angiography such as dual antiplatelet therapy (aspirin 100 mg/d and clopidogrel 300 mg once and thereafter at a dose of 75 mg/d); and the remaining therapy which included statin, nitrate and perindopril. A selective coronary angiography (CAG) with access through the right femoral artery was performed. The image of CAG revealed insignificant stenoses of the left coronary, but the wandering position of the RCA ostium. Selective cannulation of the RCA could not be achieved with either a Judkins right 3.5, or a 4.0 cm curve diagnostic catheter. Nonselective imaging of the ascending aorta revealed an aberrant origin of the RCA from antetheca of the aortic wall. Therefore, an Amplatzer left 0.75 cm curve catheter was selectively manipulated into the aberrant RCA and revealed an 85% lesion in the proximal RCA (Figure 2A). Subsequently, PCI was performed with a 6 Fr Amplatzer left 0.75 cm guiding catheter

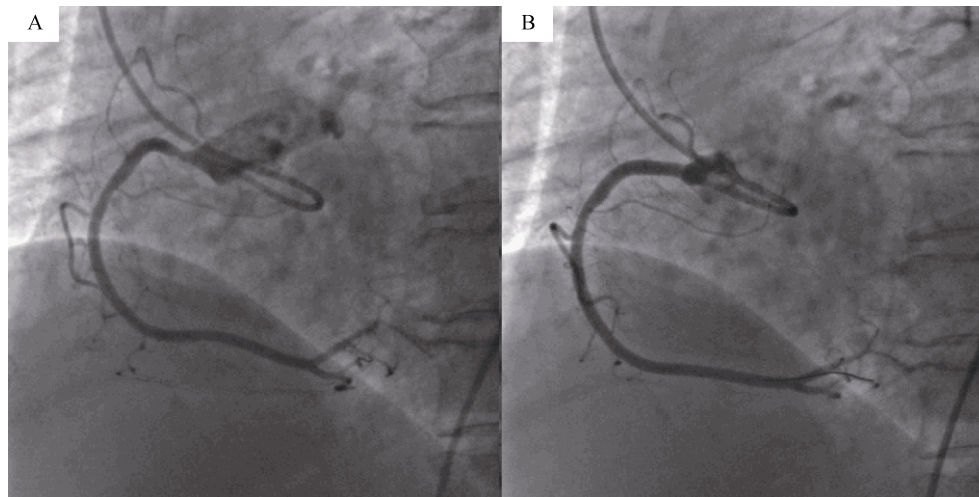


Figure 2. Imagings of selective coronary angiography of pre- and post-procedures for case 2. (A): CAG image of case 5 displayed the anomalous RCA originates from antetheca of aorta and local stenosis at proximal RCA. (B): Image of case 5 post-PCI indicated a 3.0–13 mm DES implanted at the remained lesion of proximal RCA and the existing stenosis had been resolved. CAG: coronary angiography; DES: drug eluting stent; RCA: right coronary artery.

(Medtronic, USA), which provided terrible coaxiality and support as a result of the anomalous anatomic originate of RCA ostium. We stepped a 0.014 inch BMW guide wire (Guidant, USA) “gone with the flow” and manipulated it to the distal-RCA predilated with a 2.5–15 mm Ryujin balloon catheter (TERUMO, Japan). Stent placement was accomplished with a 3.0–13 mm Partner drug eluting stent (Lepu, China) and delivered at 20 atm. The final result indicated insignificant remaining stenosis (Figure 2B). The patient was discharged on the second day of the procedures with continued dual antiplatelet therapy which included the daily regimen of aspirin 100 mg and clopidogrel 75 mg lasting for one year. There was also no dissection, thrombus, perioperative myocardial infarction, heart failure, stroke or death during the stent implanting procedure and he did not suffer from MACE during the follow-up period.

3 Discussion

A single anomalous origin of the coronary artery is a rare congenital coronary disease, which is often associated with myocardial ischemia and other congenital cardiac anomalies.^[5] Due to the difference in diagnostic criteria and ethnic background of the reporting population, the incidence of coronary artery of anomalous origin today ranges from 0.03% to 5.64%.^[6] The anomalous origin of the RCA is relatively more frequent with an approximate to 0.25% incidence.^[7] According to previous studies, the most common anatomic site of anomalous RCA originated mainly at four locations: LCS, antetheca of the aortic wall, supracrystal plane above the right coronary sinus (RCS) and left coro-

nary system.^[8-11] Data from radioactive imaging, necropsy and intravascular ultrasound studies have shown the possible association between the anatomic characteristics of anomalous RCA and worse clinical outcomes.^[11-13] The arrangement of vessels and whether complicated coronary atherosclerosis lesions and other heteromorphosis exist, markedly affect the development of the clinical course of related patients of anomalous origin of RCA due to its originating site.^[10,11,14] When RCA originated from the LCS, LCA or traveled between the aorta and the pulmonary artery, the subjects are more vulnerable to suffer from exertion related angina, myocardial infarction, cardiac arrhythmia, even syncope, sudden death and other adverse cardiovascular events.^[15,16] Due to coronary vasospasm and a long travel distance, myocardial ischemia can develop without definite stenosis in some subjects.^[17] Consequently, if a patient complains of chest pain, but does not show causative lesions in SCA, the above possibility should be considered. Nevertheless, as a result of its ectopic origin, the condition unavoidably leads to potential blood dynamics, pathological physiology changes, as well as the slim odds of RCA anomalous origin, but alone may inevitably accelerate the coronary atherosclerotic evolution.^[13,18,19] The two patients had more than one or three definite risk factors of CAD and no phenomenal cardiovascular symptoms before they visit physicians. This means that the heart attacks of the two individuals are preliminarily innocent of congenital RCA malformation and the two aspects are without direct relevance.

Until today, the treatment schedule of anomalous origin RCA complicated with CAD included drug conservative

therapy, PCI and surgical correction or/and coronary artery bypass graft (CABG), have failed to establish a widely accepted consensus,^[3,8,20,21] have failed to establish a widely accepted consensus due to great heterogeneity of the pathophysiological characteristics and clinical manifestations. Previous researches had indicated the subjects of RCA anomalous origin lived to adulthood but developed CAD and did not show supererogatory advantages from surgical correction.^[20,22] At the same time, although PCI for patients coexisting of anomalous origin of coronary artery and atherosclerotic stenosis is clinically still challenged to date, increasing numbers of cardiologists are actively attempting to these methods and have accumulated considerable experience and unique skills.^[23-25] Based on the practical experience of our center and a review of the relevant literature, some tips and tricks are summarized as follows:^[2,26,27]

First of all, how to ingeniously detect the anatomic site of anomalous RCA during CAG is vitally important. Selective cannulation of the RCA could be achieved with reference to multifactors such as the results of LCA angiography and occurrence frequency of anomalous RCA ostium. Any blinding operation will not only increase the dosage of the contrast agent, operation time, additional radioactive damage and increased possibility of coronary artery dissection or aortic dissection and other serious complications.^[27] Patients of anomalous RCA underwent selective PCI should go through a test of contrast enhanced CT angiography (CTA) to affirm originated sites, anatomic route and whether complicated with other congenital malformation, which accounts for almost 30% of sudden cardiac deaths in young adults and competitive athletes.^[28,29] Apart from the potential to identify malignant anatomic features, CTA has definitely great advantageous for the selection of therapy and auxiliary for PCI procedures.^[30-33]

Secondly, optimal selection and skillful manipulation of guide catheter is the key factor for successful PCI of anomalous RCA.^[34] Guide catheter selection should be appropriately referenced to the angiography catheter and based on the origin site of the RCA, anatomic ostium, lesion characteristics, vascular conditions, travel route, supporting requirement and other comprehensive considerations.^[35] Originated from the LCS or left coronary system, Judkins left guide catheter can match demands in most cases; Originated in the antetheca or suprasternal of the aortic wall above the coronary sinus, Amplatz left 0.75–1.0 cm curve guide catheter or Judkins left guide catheter reshaped according to the ostium posture before cannula will be manipulated.^[36] Although there were successful PCI case reports selecting a 3 DRC guide catheter, but most studies demonstrated that guide catheter with strong supportiveness,

sound back-up and better steering ability is more beneficial for PCI.^[2,26,36,37] The first case of the present study whose RCA ostium originates from LCS almost link to the ostium of left main trunk, we choose a 6 Fr Judkins left guide catheter, but it has bad coaxiality and repeatedly ran off from the RCA ostium. At last, we closed the procedure by anchoring two guiding wires of supreme supportiveness into the LCA aimed to augment the supportiveness of guide catheter.

Last but not least, manipulating skills must be credited for much during the PCI. Due to the anomalous anatomic originate of RCA, guide catheters are inevitably more difficult to be soundly coaxiality. Under this situation, operators should not painstakingly work overly hard your to pursuit an initially perfect coaxiality of the guide catheter. A wise method is that guiding the PCI wire "gone with the flow" and stepping it to the distal-RCA. During the process of balloon catheter pre-dilating, the operator should utilize the anchoring force of an inflating balloon catheter or multi-wire anchoring technology to lead the guide catheter to the appropriate place and complete the process of stent installment. Therefore, pre-dilation of a balloon catheter in PCI of anomalous origin coronary appears especially vital. Two cases described in the present study were routinely pre-dilated before delivering stents and utilized the balloon catheter anchoring technology to induce sound back-up and perfect coaxiality for guide catheter.

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