

Diagnosis and percutaneous coronary intervention of an anomalous right coronary artery originating from the middle of the left anterior descending artery: a case report

Journal of International Medical Research
48(2) 1–7

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DOI: 10.1177/0300060519896709

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Abstract

A single left coronary artery is a very rare anomaly in which only the left coronary artery arises from the aortic trunk by a single coronary ostium and supplies the entire heart. The present report is one of the few describing a patient with an anomalous right coronary artery originating from the middle of the left anterior descending artery. The patient presented with acute myocardial infarction with the culprit lesion on the left circumflex artery. Multivessel angioplasty was successfully performed in a two-step approach: the first for the culprit lesion and the second on the anomalous coronary artery. Decisions about treatment modalities for an anomalous coronary artery should be made only after considering the patient's clinical characteristics and performing additional imaging diagnostics with a clearly defined coronary anatomy.

Keywords

Anomaly, acute coronary syndrome, angiography, right coronary artery, left anterior descending artery, case report

Date received: 14 September 2019; accepted: 3 December 2019

Introduction

A coronary artery anomaly may be an anomaly of vessel origin or unusual vessel number, an intrinsic coronary arterial

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anatomy, or an anomaly of vessel course and termination.¹ Coronary artery anomalies are rare findings in the general population, with an incidence of no more than 1%.² Such anomalies are often associated with other congenital heart diseases, but some patients may have a single anomaly with a mostly asymptomatic nature. The reported incidence of a single coronary artery is 0.066%.³ A very rare variety of a single coronary artery is an anomalous right coronary artery (RCA) that originates from the left anterior descending artery (LAD) and traverses anteriorly, posteriorly, or between the aorta and pulmonary trunk; this anomaly is termed a single left coronary artery. Only 10 such cases have been reported in the medical literature to date.⁴

Limited information is available about the clinical presentation, degree of atherosclerosis, and effect on overall survival in series of patients with single left coronary artery anomalies. According to the literature, most patients with such an anomaly are asymptomatic and have no predisposition to develop coronary atherosclerosis.⁵ However, a few of these cases involved percutaneous coronary intervention (PCI) of such an artery, indicating that this anomaly might impact the atherosclerosis burden and impair the coronary artery blood flow.

We herein report a rare case of an anomalous RCA originating from the middle of the LAD with significant proximal stenosis and summarize the angiographic findings, radiological features, and treatment modalities.

Case report

A 61-year-old woman with hypertension, type 2 diabetes mellitus, and dyslipidemia was referred from the emergency medical service with acute coronary syndrome and a 6-hour history of chest pain. At presentation to the emergency department, she still had ongoing chest pain with propagation to

the left arm, a heart rate of 79 bpm, and a blood pressure of 170/100 mmHg.

The patient underwent a thorough physical examination and electrocardiogram. Acetylsalicylic acid (300 mg), clopidogrel (600 mg), an analgesic, a gastroprotectant, a sublingual angiotensin-converting enzyme inhibitor, and intravenous Ringer's solution (500 mL) were administered within 5 minutes of taking the patient's history and performing the examination. A local host-nation emergency medical service arrived at the Clinic of Cardiology with PCI facilities approximately 30 minutes after presentation.

The patient had a 6-year history of two atherosclerotic risk factors, namely arterial hypertension and type 2 diabetes mellitus, which were being treated with antihypertensives (enalapril and a thiazide diuretic) and oral hypoglycemics (a biguanide/sulfonylurea combination), respectively. She had no other complaints, concomitant diseases, or known allergic reactions, and she had never smoked or ingested alcohol.

With the exception of slightly pale skin, the patient's physical examination findings were normal at presentation to the Clinic of Cardiology after transfer from the emergency department. She had a slightly increased blood pressure at 140/85 mmHg and ongoing angina. The electrocardiogram showed sinus rhythm, a heart rate of 69 bpm, a QS configuration in D3 and aVF with discrete elevation of 0.5 mm in the same leads, significant ST depression in V2 to V4, and a negative T wave in V5 to V6 (Figure 1).

The patient was given oral atorvastatin (80 mg), intravenous low-molecular-weight heparin (enoxaparin [30 mg]), and glucose-insulin-potassium solution (5% glucose [500 mL] + fast-acting insulin [16 U] + 7.4% potassium chloride solution [40 mL]). She was then sent to the coronary unit.

Echocardiography revealed hypertrophy of the left ventricle, ankylosis of the inferoposterior wall, and a left ventricular ejection fraction of 49%. Laboratory examination

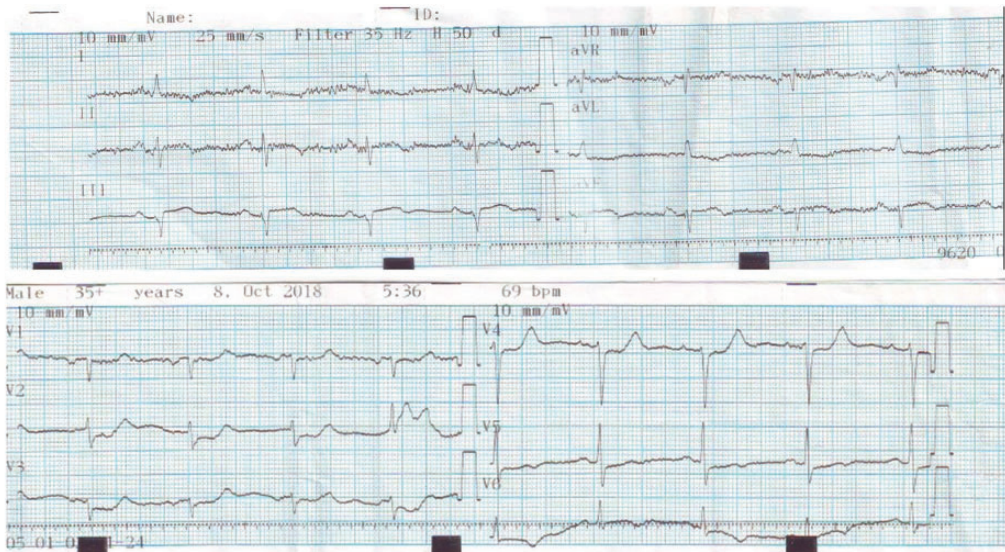


Figure 1. Electrocardiogram of the patient at admission.

revealed a high serum creatine kinase-MB concentration (204.4 U/L; reference range, 0.0–24.0 U/L) and high-sensitivity cardiac troponin I concentration (3.97 ng/mL; reference range, 0.000–0.040), poor glucose regulation, dyslipidemia with high serum triglycerides (3.43 mmol/L), and a moderate increase in the serum total cholesterol (7.43 mmol/L) and low-density lipoprotein cholesterol (4.6 mmol/L) concentrations.

Emergency coronary angiography showed a normal left main coronary artery, LAD, and diagonal branches. The dominant left circumflex artery showed an occlusion of the ostial obtuse marginal branch (OM1). The angiogram revealed an anomalous origin of the RCA from the midportion of the LAD shortly after the second septal perforator, with morphology and distal branches similar to those of the normal RCA. The aberrant minor RCA also had significant proximal stenosis (70%). No right coronary ostium was present in the right coronary sinus.

PCI on OM1 was performed, and a 7-French extra-back-up guiding catheter

was deployed via right femoral access. After passing the occlusion with a guide wire (SION blue wire, x705700p; Asahi Intecc Co., Ltd., Seto, Aichi, Japan), predilatation was performed with a balloon dilation catheter (Sprinter Legend, 2.5 × 15 mm; Medtronic, Dublin, Ireland) at 16 atm. In the absence of a drug-eluting stent, we successfully deployed a bare metal stent (Multi-Link Vision, 2.75 × 15 mm; Guidant, Indianapolis, IN, USA) at 12 atm with a good angiographic result and Thrombolysis In Myocardial Infarction (TIMI) 3 flow.

The patient was discharged with the recommendation to undergo optimal medical therapy (acetylsalicylic acid, clopidogrel, a long-acting oral nitrate, an angiotensin-converting enzyme inhibitor, a proton pump inhibitor, and a statin). She was planned to undergo multislice computed tomography (MSCT) of the coronary artery and PCI of the RCA after imaging diagnostics.

Three months later, the patient was admitted to the coronary unit for the second PCI. She had no angina or cardiovascular disorders. Her general laboratory

findings were normal. A routinely performed Multiplate test (Roche Diagnostics, Basel, Switzerland) showed good inhibition of aggregation on the ADPtest, ASPItest, and TRAPtest. MSCT (Figure 2) and coronary angiography revealed a “single left” coronary artery with an RCA originating from the LAD and a pre-pulmonary course, with no right artery at the coronary sinus (Figures 3 and 4).

The significant stenosis despite the lack of angina reconfirmed the indication for PCI of the anomalous RCA. The proximal aberrant RCA stenosis was easily crossed by a guide wire (SION blue wire, x705700p; Asahi Intecc Co., Ltd.). After predilatation, a drug-eluting stent (Orsiro, 2.25 × 22 mm; Biotronik, Berlin, Germany) was successfully deployed at 12 atm into the proximal part of the anomalous RCA with final flow of TIMI 3. During the same procedure, significant 90% in-stent stenosis of OMI was treated with a drug-eluting balloon (Pantera Lux, 3.0 × 20 mm; Biotronik) at 18 atm. After post-dilatation with a non-compliant balloon (Falcon Bravo, 3.5 × 15 mm; Medtronic) at 18 atm, the procedure was ended with TIMI 3 flow (Figure 5).

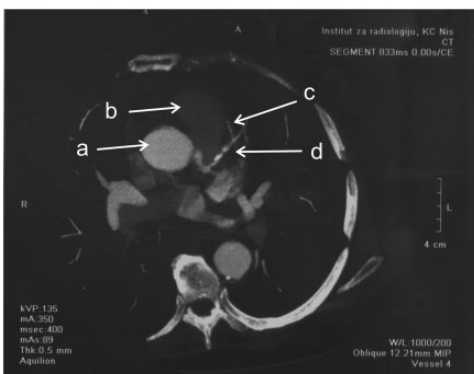


Figure 2. Multislice computed tomography showing a single left coronary artery. (a) Aorta. (b) Pulmonary artery. (c) Anomalous right coronary artery. (d) Proximal left anterior descending artery.

The total contrast volume was 300 mL and the total fluoroscopy time was 11.8 minutes. The patient was discharged 2 days later with no problems, and dual antiplatelet

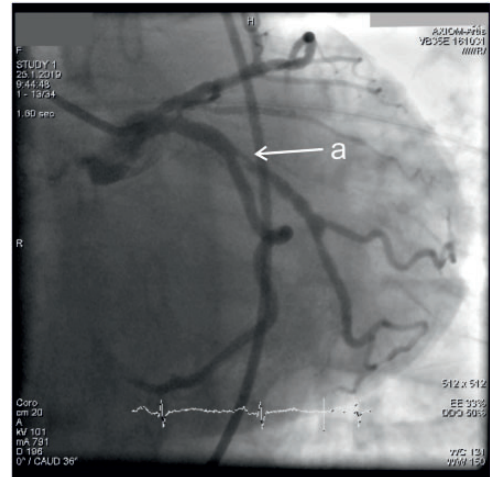


Figure 3. Coronary angiography showing in-stent stenosis of the ostial obtuse marginal branch. (a) In-stent stenosis of the ostial obtuse marginal branch.

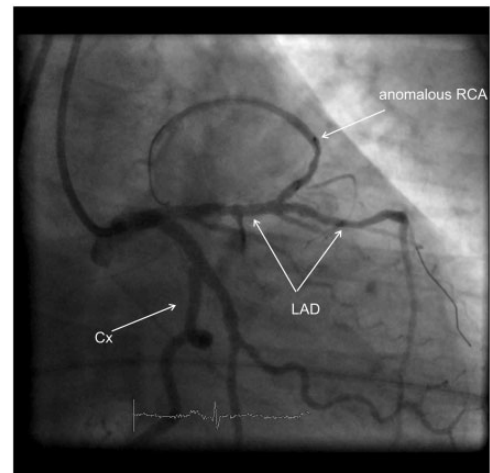


Figure 4. Coronary angiography showing a single left coronary artery with an undeployed stent in the anomalous right coronary artery. RCA, right coronary artery; LAD, left anterior descending artery; Cx, circumflex artery.

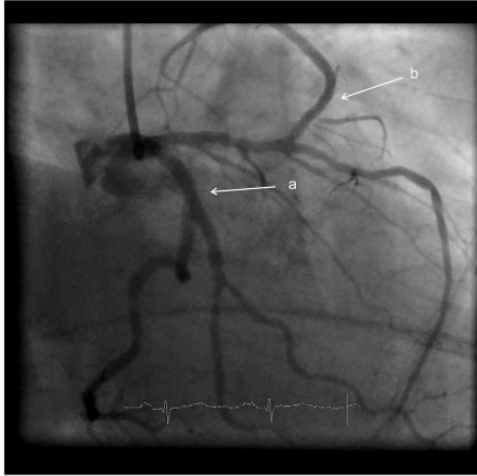


Figure 5. Coronary angiography with final result of right coronary artery and ostial obtuse marginal branch. (a) Ostial obtuse marginal branch after balloon dilatation. (b) Right coronary artery after stenting.

therapy (acetylsalicylic acid + clopidogrel) was prescribed for at least 12 months.

Because the MSCT showed only the proximal part of the anomalous RCA, we repeated the MSCT in 6 months. The patient was clinically well and asymptomatic at the 6-month follow-up. The new MSCT examination confirmed the pre-pulmonary position of the aberrant RCA and showed the stent in the proximal part of this artery (Figures 6 and 7).

The patient provided written consent for the intervention and for the use of her medical data for scientific research and publication. This report was approved by the institutional review board of Clinical Center Nis.

Discussion

We have herein described a patient with a culprit lesion of OM1 in acute myocardial infarction and proximal stenosis of an anomalous RCA originating from the middle of the LAD. Her condition was successfully treated with primary PCI on

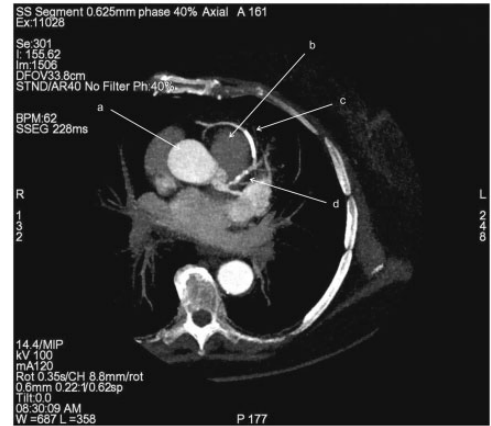


Figure 6. New multislice computed tomography confirming the pre-pulmonary position of the aberrant right coronary artery. (a) Aorta. (b) Pulmonary artery. (c) Pre-pulmonary course of anomalous right coronary artery. (d) Left anterior descending artery.

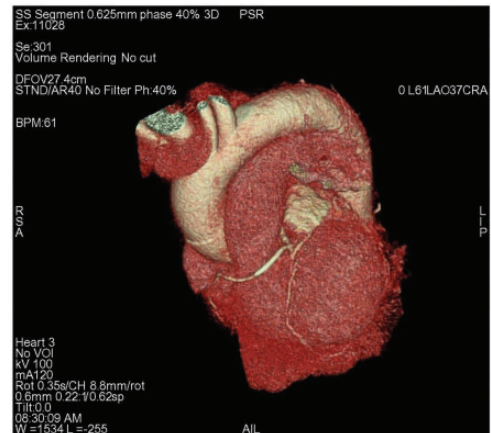


Figure 7. New multislice computed tomography showing the stent in the proximal part of the right coronary artery.

OM1. A single left coronary artery can cause sudden cardiac death, exertional angina, and nonatheromatous angina pectoris (MSCT assessment).⁶

A single coronary artery is an extremely rare coronary artery anomaly characterized

by a single coronary artery arising from the aorta to fulfill the entire myocardial blood requirement. Interestingly, few papers have described a “single left” coronary artery with the RCA originating from the LAD;⁷ however, there are many reports of a separate small artery originating from the right coronary sinus that was most probably a right atrial branch. This was seen in neither our patient (Figure 6) nor in the few cases described previously.⁸

Three varieties of the RCA origin have been described. In a few cases, the RCA arose from the proximal LAD.⁹ In our case and the case described by Venkata et al.,¹⁰ it arose from the middle of the LAD and from the distal left circumflex artery.^{11,12} All varieties presented with cardiovascular risk factors and ischemic coronary artery disease, and all were described in middle-aged and older people who underwent coronary angiography. Atherosclerotic disease was proven in some patients and was successfully resolved by PCI.^{10,12} In our case, PCI was performed because of a significant atherosclerotic lesion and not solely because the vessel had an anomalous origin and pre-pulmonary course; it had largely a benign course.

The present case illustrates that this type of anomaly has a good prognosis and enables relatively good coronary perfusion with a pre-pulmonary course, which is in line with the results from two large registries in the United States and Italy.¹³ However, cases in which the RCA coursed between the great arteries with a risk of myocardial ischemia and sudden cardiac death have also been reported.¹⁴ Performing PCI in a patient with a single coronary artery is challenging and technically difficult because any arising complication may be catastrophic. Thus, MSCT is a useful method to examine the anatomy and direction of the aberrant artery before any PCI procedure is performed. Assessment of the anomalous coronary origin via cardiac MSCT has been

shown to be more accurate and beneficial than X-ray angiography in detecting and characterizing the anomalous coronary artery.¹⁵ Additionally, studies that used 16-slice acquisition have reported sensitivities of 83% to 98% and specificities of 96% to 98% for coronary artery stenosis.¹⁶

Conclusion

This is one of the few reports of a patient with an anomalous RCA originating from the middle of the LAD, incidentally discovered during the primary PCI and successfully stented in a second procedure after performing MSCT. Decisions about the optimal treatment modality for an anomalous coronary artery should be made after considering the patient’s clinical characteristics and additional imaging diagnostics with a clearly defined coronary anatomy.

Declaration of conflicting interest

The authors declare that there is no conflict of interest.

Funding

This work was supported by projects of the Ministry of Education, Science and Technological Development of the Republic of Serbia (Nos. 41018 and 43012).

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