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Case Report

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Anomalous circumflex artery originating from the right coronary sinus as the culprit in acute inferior myocardial infarction*

Muhammed Karadeniz
Department of Cardiology, Faculty of Medicine, Kırıkkale University, Kırıkkale, Turkiye

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Corresponding Author: Muhammed Karadeniz, drkaradeniz36@gmail.com

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ABSTRACT

Coronary artery anomalies are rare congenital conditions that are usually detected incidentally during coronary angiography or post-mortem examinations. Although many variants are clinically asymptomatic, they can be fatal in some cases. In this article, we present a 35-year-old male patient who presented with acute inferior myocardial infarction causing complete atrioventricular block. Angiography revealed a rare coronary anomaly, the left circumflex artery originating from the right sinus of Valsalva. The lesion, caused by severe stenosis in the proximal segment of this anomalous vessel, was successfully treated with primary percutaneous coronary intervention. This case highlights the diagnostic and therapeutic challenges of such anatomic variations in the setting of acute coronary syndrome and reviews the current literature on interventional strategies.

Keywords: Coronary artery anomalies, myocardial infarction, percutaneous coronary intervention, circumflex artery, cardiac syncope

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INTRODUCTION

Coronary artery anomaly (CAA) is a rare condition that is detected during coronary angiography or during autopsy. Most of the cases with CAA's are asymptomatic, but anomalies such as left coronary artery, which is ectopic and between the aorta and pulmonary artery, may cause syncope, arrhythmias, myocardial ischemia and sudden cardiac death.[1] The majority of these variations follow a benign clinical course and remain quiescent throughout a patient's life. However, certain "malignant" anomalies, particularly those with an interarterial course between the aorta and pulmonary artery, are implicated in myocardial ischemia, life-threatening arrhythmias, and sudden cardiac death.

Among the CAAs, the anomalous origin of the left circumflex artery (LCx) from the right coronary sinus (RCS) or directly from the right coronary artery (RCA) is one of the more frequently encountered variants. Its prevalence is estimated to be between 0.3% and 0.7%.[2,3] Typically, the anomalous LCx follows a retroaortic path to reach the left atrioventricular groove. This posterior course is generally considered a "benign" variation, as it is not susceptible to dynamic compression during physical exertion. Despite this, the vessel itself remains vulnerable to atherosclerotic disease. When an acute coronary syndrome (ACS) develops in such a vessel, its anomalous origin can pose substantial diagnostic and therapeutic challenges for the interventional cardiologist.

In this article, we present a case of acute inferior myocardial infarction accompanied by A-V block originating from the Cx artery originating from the right sinus of Valsalva.

CASE

A 35-year-old male, with a notable history of smoking, was brougt to the emergency department with chest pain and syncope. Upon initial assessment, the patient was in cardiogenic shock. His vital signs were: blood pressure was 70/40 mm Hg, heart rate was 35 beats per minute with regular rhythm, respiratory rate was 20 breaths/min and body temperature was 36.8°C. A 12-lead electrocardiogram (ECG) revealed a 3 mm ST-segment elevation in the inferior leads and 2 mm ST-segment elevation in the lateral leads, consistent with an inferolateral myocardial infarction. The ECG also demonstrated a complete atrioventricular (A-V) block. An emergent bedside transthoracic echocardiogram was performed. This revealed severe hypokinesia of the inferolateral wall with a moderately reduced left ventricular ejection fraction.

Atropine 1 mg intravenously was administered for bradycardia, but no increase in heart rate was observed. Additionally, 300 mg aspirin and 600 mg clopidogrel peroral, intravenous 10.000 U unfractionated heparin

were administered. Given the diagnosis of ST-segment elevation myocardial infarction (STEMI) with high-risk features, the patient was immediately transferred to the cardiac catheterization laboratory for primary percutaneous coronary intervention (PCI).

The patient underwent diagnostic coronary angiography via the femoral approach and revealed normal left main coronary artery from the left aortic sinus and RCA from right aortic sinus. However, the Cx artery could not be visualized originating from its usual location (**Figure 1**). Subsequently, selective cannulation of the right coronary sinus demonstrated a diminitive RCA and also showed the anomalous origin of a dominant Cx artery from a separate ostium within the same sinus. The culprit of acute inferior MI was determined to be the anomalous Cx artery. And than using an Amplatz Right 2 (AR-1) guiding catheter, coaxial engagement was achieved. The lesion was crossed with a floppy-tipped guidewire, and primary PCI was performed. A 3.5x24 mm drug eluting stent (B Braun, Melsungen, Germany) was deployed at the stenotic site and post-dilated at 10 atmospheres, leading to the restoration of TIMI grade 3 flow (**Figure 2**). Post-stent implantation the patient's hemodynamic status improved dramatically post-procedure, and the A-V block resolved. He was monitored in the coronary care unit and was discharged two days later in stable condition. His discharge medication regimen included dual antiplatelet therapy with Aspirin 100 mg daily and Clopidogrel 75 mg daily, prescribed for a minimum of one year, along with high-intensity statin therapy.

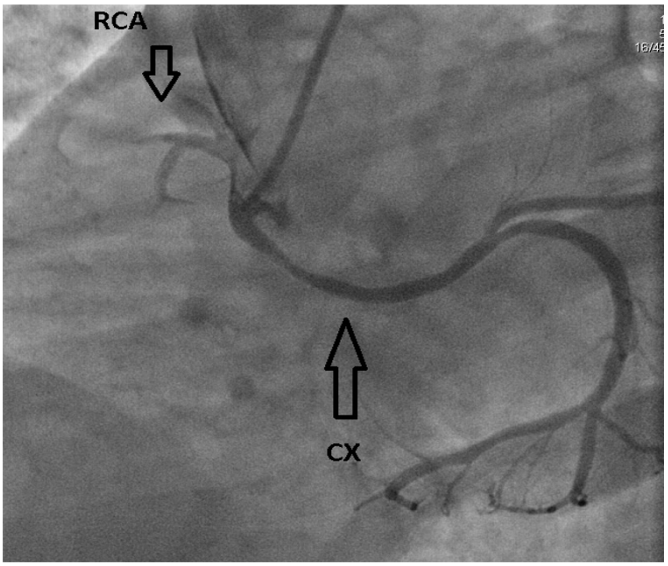

Figure 1. Selective angiogram of the right coronary sinus demonstrating the anomalous origin of the left circumflex artery (culprit vessel, pre-intervention with stenosis indicated by arrow)
RCA: Right coronary artery, Cx: Circumflex

DISCUSSION

This case highlights the successful management of a life-threatening STEMI occurring in a patient with a rare, generally benign, coronary anomaly.[4] The anomalous origin of the LCx from the RCS does not inherently predispose the artery to a higher incidence of atherosclerosis.[5] However, its presence make diagnosis and intervention difficult during STEMI. The primary diagnostic challenge arises when the

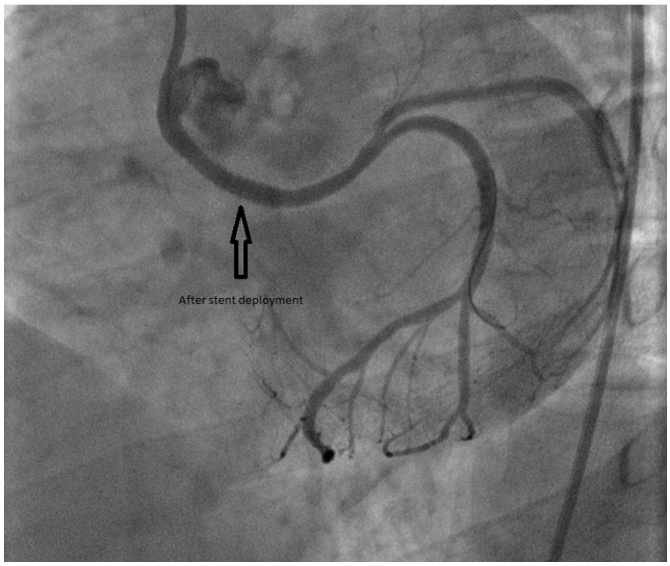

Figure 2. The successful post-stent deployment result with restored blood flow

LCx is not seen during left coronary system angiography. In the emergent setting of a STEMI, this can lead to confusion and delays. The angiographic finding of an "empty" circumflex sulcus, coupled with ECG evidence of lateral wall ischemia, should immediately raise the suspicion of an anomalous origin from the right sinus or RCA. Prompt and systematic interrogation of the RCS is therefore crucial to identify the vessel and the culprit lesion.

From a therapeutic standpoint, PCI of anomalous coronary arteries is fraught with technical difficulties. The abnormal osteal orientation of the vessel often prevent coaxial alignment of standard guiding catheters, which is essential for backup support.[6] The retroaortic course can also create unusual tortuosity, complicating the advancement of guidewires, balloons, and stent delivery systems.[7] The selection of an appropriate guiding catheter is paramount. While Judkins right catheters may be attempted, catheters with alternative shapes, such as the Amplatz or multipurpose configurations, are often required to successfully engage the anomalous ostium, as was demonstrated in our case. The favorable outcome in our patient underscores that despite these formidable technical challenges, primary PCI remains the gold-standard reperfusion strategy for STEMI, even in the complex coronary anatomy. In case of the anomaly, coupled with a versatile inventory of catheters and an experienced operator's skill, is essential for procedural success.

CONCLUSION

As a result, while the anomalous LCx from the RCS is a hemodynamically benign variant, its potential to develop atherosclerosis makes it a critical consideration in patients with ACS. Interventional cardiologists must be cognizant of this anatomical variation and prepared to adapt their angiographic and interventional techniques to ensure timely and effective coronary revascularization.

ETHICAL DECLARATIONS

Informed Consent

The patient signed and free and informed consent form.

Referee Evaluation Process
Externally peer-reviewed.

Conflict of Interest Statement
The authors have no conflicts of interest to declare.

Financial Disclosure
The authors declared that this study has received no financial support.

Author Contributions
All of the authors declare that they have all participated in the design, execution, and analysis of the paper, and that they have approved the final version.

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