Anomalous left main from right coronary artery who presented with NSTEMI

Asim Mohammed Waleed Aldorrah1, Mosa Mohammad Abbadi2, Mohsen Jaber Alotayfi3*, Mohammed Nasser Asiri3

ABSTRACT

Background: Coronary artery anomalies (CAAs) are found in 0.9%-1.3% of patients undergoing coronary angiography. The most common CAAs are anomalies of origin, specifically having a separate left circumflex (LCX) and left anterior descending (LAD) origin with an incidence of 0.41%. Based on the 12-lead standard electrocardiography (ECG) recording, patients are divided into ST elevation myocardial infarction or non-ST-elevation acute myocardial infarction (NSTEMI).

Case presentation: Here, we present our case of a 90 years old male patient who presented with non-STEMI and was found to have an anomalous origin of LAD and LCX from the right coronary artery (RCA). The patient was admitted to the critical care unit as a case of NSTEMI and started on anti-ischemic therapy.

Conclusion: Our patient had two coronary anomalies detected: an LCX artery originating from the RCA, and an anomalous LAD originating from the RCA. The ECG showed NSTEMI.

Keywords: Coronary artery anomalies, anomalous left circumflex, left anterior descending, non-ST-elevation acute myocardial infarction.

Background

Coronary artery anomalies (CAAs) are found in 0.9%-1.3% of patients undergoing coronary angiography [1,2]. The most common CAAs are anomalies of origin, specifically having a separate left circumflex (LCX) and left anterior descending (LAD) origin with an incidence of 0.41% [3]. The second most commonly described anomaly is the origin of LCX from the main right coronary artery (RCA) with a reported incidence of 0.37% [4,5]. Despite being rare in the general population, CAAs are the second most common cause of sudden cardiac death among young athletes [4].

Based on the 12-lead standard electrocardiography (ECG) recording, patients are divided into ST elevation myocardial infarction (STEMI) or non-ST-elevation acute myocardial infarction (NSTEMI) [5]. An ST-segment elevation is not seen on the 12-lead standard ECG in up to 60% of patients in LCX-related acute myocardial infarction (MI). Therefore, the patients will not be categorized as having STEMI but NSTEMI instead which can possibly lead to an unwarranted delay in therapeutic decisions, especially reperfusion therapy [6].

Here we present our case of a 90 years old male patient who presented with Non-STEMI and was found to have an anomalous origin of LAD and LCX from RCA.

Case Report

A 90-year-old male who has past medical history of hypertension, controlled on ramipril, physically active before presentation, presented to our hospital with recurrent episodes of exertional chest pain, radiating to the back and left shoulder and relieved by rest for 1 week before presentation. His initial examination was normal and the workup in the emergency department showed ECG sinus rhythm, ST segment depression in II, III, aVF (Figure 1), and troponin I was raised 0.28 (normal range: 0.01-0.023 ng/ml). The next day, the patient underwent cardiac catheterization at which point his LAD and LCX were discovered (Figures 2 and 3). The patient was admitted to CCU as a case of NSTEMI and started on anti-ischemic therapy, the decision was...
Anomalous left main from right coronary artery who presented with NSTEMI

to manage him with an early invasive strategy with serial ECG (Figure 4) and troponin monitoring, and angiography and coronary angiogram to be done the next morning (Figures 5 and 6).

**Discussion**

According to invasive angiography, the incidence of CAAs ranges from 0.78% to 1.3%, while coronary computed tomographic (CT) imaging reports a range of 0.99% to 5.8% [7,8]. The varying ways in which “normal variants” and “anomalous” arteries are defined are probably to blame for the large variation in incidence. The most typical CAA has an incidence of 0.41% and independent LCX and LAD origins. The LCX emerging from the RCA (0.37%) is the second most frequent anomaly [4,9]. In a contemporary population undergoing primary percutaneous coronary intervention and receiving contemporary coronary care, there are few published data on outcomes following MI stratified by infarct vessel LAD, RCA, and LCX) rather than ECG patterns [10]. Our case is a 90 years old male,

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**Figure 1.** A 12-lead electrocardiograph showing ST depression in lead II, III, and AVF and also 2:1 AV block.

**Figure 2.** Angiogram prior to cardiac catheterization showed abnormal findings.

**Figure 3.** Coronary angiogram prior to cardiac catheterization reveals the patient’s LAD and LCX originating from RCA.

**Figure 4.** After catheterization 12-lead electrocardiograph showing improvement.
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Most CAAs do not have clinical significance or complications, but some (transseptal and interarterial) anomalies can lead to significant manifestations including heart failure, MI, angina, and arrhythmias [11]. The pathophysiology is not completely understood, but several mechanisms have been proposed that include interarterial coronaries coursing intramurally through the wall of the aorta resulting in their compression due to aortic pulsation, angulation of the anomalous vessel acting like a valve-like ostial ridge, spasm of the anomalous artery due to ischemia or endothelial injury caused by its long distance, acute angle of take-off that can kink or occlude during exercise causing coronary hypoperfusion, and the fact that an artery has abnormal origin and take-off makes it more prone for atherosclerosis [7,9,12].

The categorization of patients with acute coronary syndrome (ACS) into an ST-segment elevation or non-ST-segment elevation is an important step in order to rapidly triage patient’s candidates for primary reperfusion therapy. Understanding the pathophysiology of STEMI and NSTEMI gives the basic knowledge of the first treatment strategy in patients with ACS [13]. The differences in the pathophysiology of STEMI and NSTEMI consequently cause different therapeutic goals and approaches. In NSTEMI, the goal of antithrombotic therapy is to prevent further thrombosis and to allow endogenous fibrinolysis to dissolve the thrombus. Revascularization in NSTEMI is often required to increase blood flow and prevent reocclusion or recurrent ischemia. In contrast, in STEMI, the infarct-related artery is usually totally occluded. Immediate pharmacological or catheter-based reperfusion is the initial approach to restore normal coronary blood flow [13-15]. In our case, the patient was diagnosed as NSTEMI based on ECG recording which showed ST segment depression in leads II, III, and aVF.

Diagnosis of CAAs can be done by noninvasive imaging techniques such as echocardiography, coronary CT angiography, and mitral regurgitation imaging. Alternatively, they can also be diagnosed invasively by coronary angiography. While echocardiography has a limited role in adults, it has a good diagnostic benefit in children and adolescents (0-21 years of age) [16]. Previously, coronary angiography was the standard test to diagnose CAAs, but with advancement in imaging, ECG-gated coronary CT angiography was shown to be more sensitive in multiple studies [17,18]. While magnetic resonance imaging has less radiation exposure, it has a similar diagnostic accuracy in comparison with CT [8]. Cardiac troponins are biochemical markers of myocardial damage. Six increases in cardiac biomarkers, notably cardiac troponin (I or T), or the MB fraction of creatine kinase, signify myocardial injury leading to necrosis of myocardial cells. Elevated cardiac biomarkers in and of themselves do not indicate the underlying mechanism of injury and do not differentiate between ischemic or non-ischemic causes [16,17]. Regarding our patient, the troponin I level was high.

Treatment of CAAs is complex and can be challenging specifically with the anomalous origin of the coronary artery from the opposite sinus (ACAOS). The decision to treat is mainly made for ACAOS with an interarterial course. While some experts recommend treatment for left ACAOS for asymptomatic patients, others take into account the results of stress testing and age to decide on treatment. Ischemic symptoms will warrant treatment. Options include coronary artery bypass graft, coronary unroofing, reimplantation, or medical therapy [4,8]. Regarding our patient, he started on anti-ischemic therapy, the decision was to manage him with an early invasive strategy with serial ECG and troponin monitoring, and a coronary angiogram to be done the next morning.
Conclusion

Our patient had two coronary anomalies detected: an anomalous LCX artery arising from the RCA, and an anomalous LAD originating from the RCA. The ECG showed NSTEMI. To the best of our knowledge, this is the first case report to describe the above combination of coronary anomalies with NSTEMI in a single patient.

List of Abbreviations

ACS Acute coronary syndrome
STEMI ST elevation myocardial infarction

Conflict of interest

The authors declare that there is no conflict of interest regarding the publication of this case report.

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Consent for publication

Written informed consent was obtained from the patient.

Ethical approval

Ethical approval is not required at our institution to publish an anonymous case report.

Author details

Asim Mohammed Waleed Aldorrah1, Mosa Mohammad Abbadi2, Mohsen Jaber Alotayfi3, Mohsen Nasser Asiri3
1. Consultant Adult Cardiologist, Department of Cardiology, Prince Mohammed Bin Nasir Hospital, Jazan, KSA
2. Consultant Adult Cardiologist and Interventionist, Department of Cardiology, Prince Mohammed Bin Nasser Hospital, Jizan, KSA
3. Department of Internal Medicine, Jazan Medical Residency Training Program, Jazan, KSA

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