Challenging Primary Percutaneous Coronary Intervention in an Anomalous Left Circumflex Artery

ABSTRACT

Congenital coronary anomalies are **infrequently identified** in patients undergoing diagnostic coronary angiography. **These** anomalies present **challenges** in **timely identification** of the anomalous artery and **complicate** the **engagement** of the **affected** vessel. **This** case report **discusses** a **56-year-old** male patient **who** presented with **an** acute inferior wall myocardial infarction. **Upon** undergoing a diagnostic coronary angiogram, a totally occluded left circumflex artery (LCx) was **discovered,** which **arose** anomalously from the right coronary **ostium.** Primary percutaneous coronary intervention (PCI) of the LCx could not be performed **using standard** guide catheters, necessitating the use of a **specialized** multipurpose guide catheter with balloon support. **This** case **underscores** the **importance** of **understanding** coronary anatomy and the anomalous origins of coronary arteries, as well as the **necessity** for **selecting** appropriate guiding catheters and coronary wires.

Key words : Anomalous LCx; Percutaneous coronary intervention; Multipurpose guide catheter

INTRODUCTION

Abnormal embryological development in the coronary buds at the aortic sinuses or vascular plexuses during early fetal growth leads to various coronary artery anomalies (CAA), with an incidence ranging from 0. 6% to 1. 5%. These anomalies can present a wide spectrum, ranging from complete asymptomatic cases to instances resulting in sudden cardiac death [1-3]. Variations in coronary arteries with an incidence of less than 1% are classified as coronary anomalies [3, 4]. One of the most prevalent coronary artery anomalies is the anomalous origin of the left circumflex (LCx) artery from the right sinus of Valsalva, with an incidence of 0. 48-0. 7% [5]. However, this anomaly typically holds minimal clinical significance and is often detected incidentally. The next most common anomaly is the origin of the LCx from the right coronary artery, reported at approximately 0. 3% [6]. Challenges may arise during selective cannulation of the LCx ostium prior to procedures such as coronary angiography, percutaneous coronary intervention, coronary artery surgery, and prosthetic valve replacement. These difficulties can complicate the diagnostic process and may necessitate the use of Computed Tomography-Coronary Angiography (CTCA) to accurately delineate coronary anatomy [7]. In a study conducted by Antopol and Kugel in 1993, the incidence of an anomalous left circumflex coronary artery, which mayoriginated from either the right sinus of Valsalva or the right coronary artery, was reported to be between 0.2% and 0.6%. Anomalous coronary arteries present significant challenges and technical difficulties for interventional cardiologists during percutaneous coronary interventions (PCI). According to the definition provided by Angelini, which encompasses myocardial bridges and coronary fistulas as prevalent coronary artery anomalies, the incidence increases to 5.64%. Typically,

Comment [ps1]: Of the coronary buds in the aortic sinuses

the anomalous left circumflex artery follows a posterior retroaortic trajectory before supplying the posterolateral aspect of the left ventricular myocardium. These anomalous vessels are particularly susceptible to atherosclerosis, especially in their retroaortic position, as noted in a study by R. Ilia conducted between 1995 and 1996. This report presents a rare case of acute inferior wall myocardial infarction (IWMI) that was encountered in the emergency department and subsequently underwent primary angioplasty for acute myocardial infarction (PAMI). During the coronary angiography, it was discovered that the ostium of the left circumflex artery was located in the right sinus of Valsalva. Percutaneous transluminal coronary angioplasty was performed on the left circumflex artery using a Multipurpose MPA1 catheter, resulting in favorable outcomes with TIMI III flow in the infarct-related artery, and the entire course was successfully delineated.

CASE REPORT

A 56-year-old male, a smoker with a history of hypertension, presented with sudden onset chest pain 2 hours prior to arrival. The chest pain was retrosternal, radiating to the upper abdomen, and accompanied by sweating and discomfort. Upon examination, his pulse rate was 96/min and blood pressure measured 110/66 mm Hg. The ECG revealed ST elevation in leads II, III, and AVf, along with reciprocal ST depression in leads I and aVL. Transthoracic echocardiography indicated hypokinesia of the posterior and lateral walls, mild mitral regurgitation, and a visual ejection fraction of 45%. The patient was scheduled for Primary PCI and received antiplatelet treatment (Aspirin 300 mg and Ticagrelor 180 mg), a statin (Rosuvastatin 40 mg), and a heparin bolus of 5000 IU before being taken to the cardiac catheterization lab for Coronary Angiography. A 5F TIG (Terumo) diagnostic catheter was employed for the procedure. The Left Coronary Angiogram showed a normal Left Anterior Descending Artery (LAD) and its diagonal branches, as well as a normal Ramus vessel (Figure 1). Selective left main coronary artery (LMCA) and non-selective left cusp views did not demonstrate the left circumflex artery; however, in the LAO caudal view, a distal left circumflex artery (LCx) was observed filling via collaterals from the LAD. The right coronary artery (RCA) was engaged with the 5F TIG and displayed a non-dominant, small-caliber RCA, with the LCx still not visualized. A slight pullback of the TIG catheter with counterclockwise rotation revealed an anomalous left circumflex artery arising from the RCA ostium with a downward course and proximal 100% thrombotic occlusion (Figure 2). The patient was then scheduled for Primary PCI of the LCx after obtaining written informed consent.

A 6F femoral access was established, followed by the administration of an additional 5,000 IU of intravenous heparin. A 6F JR3.5 guiding catheter (Medtronic) was employed to cannulate the anomalous left circumflex artery (LCx), but this attempt did not achieve coaxial access. The JR guidewire was successfully navigating the right coronary artery (RCA) but disengaged when attempting to rotate counterclockwise towards the LCx. Subsequently, a 6F multi-purpose (MP) guiding catheter (Boston Scientific) was utilized, which successfully provided adequate coaxial access and backup support to the LCx. An attempt was made to cross the proximal occlusion using a 0.014 hydrophilic guidewire (Fielder FC, ASAHI); however, this was unsuccessful due to proximal tortuosity. Therefore, a 2.0 x 10 mm balloon (Sapphire, Orbus Neich) was employed, and with the assistance of the balloon, the guidewire successfully traversed the lesion and was positioned in the left posterior descending artery. Following this, the balloon was gently advanced through the thrombosed lesions, resulting in

the recovery of blood clots associated with the LCx myocardial infarction, achieving a Thrombolysis in Myocardial Infarction (TIMI) II flow. This was accomplished at a pressure of 12 atmospheres with the LCx being closely monitored (Fig. 5). A SAPHIR SAPPHIRE BALL NC 3.0 x 12 mm balloon (Orbus Neich) was then utilized at 14 atmospheres to facilitate post-dilation and restore TIMI III flow in the LCx (Fig. 6). The patient was subsequently transferred to intensive cardiac care services, where they recovered without complications and were discharged on the second day. Following a two-month post-percutaneous coronary intervention (PCI) follow-up, the patient reported a positive health status.

DISCUSSION

Anomalous coronary arteries, although uncommon, pose significant technical challenges during percutaneous coronary interventions. While the incidence of coronary artery anomalies is considerably lower than that of acquired coronary artery diseases, they can profoundly affect premature cardiac morbidity and myocardial perfusion, potentially leading to myocardial ischemia or sudden death. Procedural success relies on the angiographic understanding of their origin and trajectory, as well as the careful selection of hardware to ensure guide catheter stability. Some coronary artery anomalies are illustrated in Table 1.

Anomalies of origin
• High take off • Multiple ostia • Single coronary artery
Anomalous origin of coronary artery from pulmonary artery
Origin of coronary artery or branch from opposite or non coronary sinus and an anomalous
• Retroaortic • Interarterial • Prepulmonic • Septal or subpulmonic course
Anomalies of course
• Myocardial bridging • Duplication of arteries • Anomalies of termination • Coronary artery fistula • Coronary arcade
Extra cardiac termination

Table 1. Coronary artery anomalies

The classification of anomalous origins of coronary arteries or their branches from the opposite or non-coronary sinus can be categorized into four distinct patterns: (a) the right coronary artery (RCA) originating from the left coronary sinus, (b) the left coronary artery (LCA) arising from the right coronary sinus, (c) the left anterior descending artery (LAD) or

left circumflex artery (LCx) originating from the right coronary sinus, and (d) the LCA or RCA, or a branch of either, originating from the non-coronary sinus.

Coronary arteries may arise from any of the sinuses and can exhibit various epicardial courses, which are influenced by the spatial relationship of the anomalous vessel with the pulmonary trunk and aorta. The types of courses include: (a) interarterial (i.e., situated between the pulmonary artery and aorta), (b) retroaortic, (c) prepulmonic, and (d) septal or subpulmonic.

Among these courses, the interarterial course is associated with a higher risk of sudden cardiac death, while the other courses are generally considered benign. Therefore, the clinical implications of these anomalies and their respective courses are significant for various cardiac interventions.

In the case we reported, the patient presented with an acute inferior and lateral wall myocardial infarction. Coronary angiography revealed an anomalous left circumflex artery (LCx) originating from the right coronary artery (RCA) with a retroaortic course and an acute total occlusion in the proximal segment. The anomalous retroaortic course is particularly susceptible to atherosclerosis. In the context of acute myocardial infarction accompanied by significant coronary obstructive disease, the extensive distribution area of the vessel underscores the necessity for prompt recognition of the anomaly through angiographic demonstration, followed by appropriate treatment. In our case, the coronary artery anomaly was quickly identified angiographically and was managed with primary percutaneous coronary intervention (PCI), during which a drug-eluting stent was successfully implanted in the proximal LCx.

CONCLUSION

It is important for the operator to have knowledge of anomalous origin of arteries and selection of appropriate guiding catheter for successful PCI.

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IMAGES

Figure 1 : Left Coronary Angiogram showing LAD and Ramus arising from Left main and absence of LCx from left main coronary artery

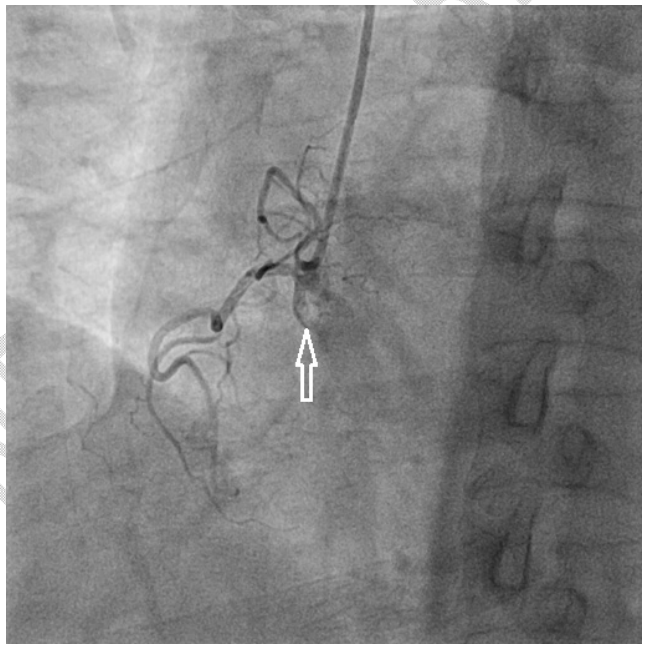

Figure 2 : Right coronary injection showing non dominant RCA and anomalous origin of Lcx from RCA osteum with 100% thrombotic occlusion(showing by arrow)

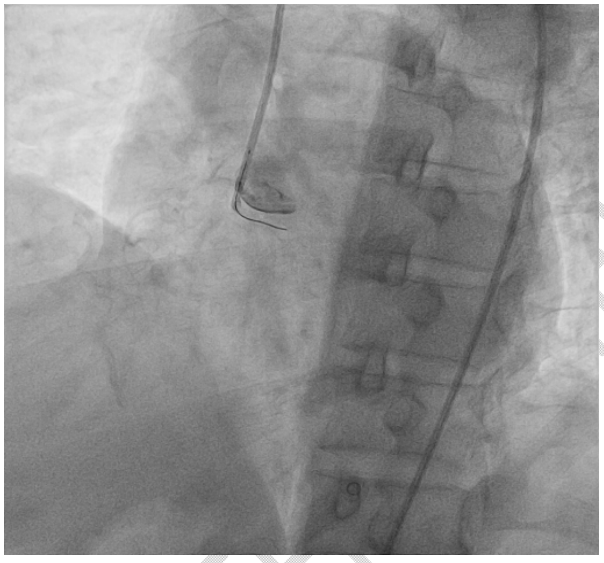

Figure 3: Balloon supported PTCA wire negotiated accrosstortous and occluded Lcx

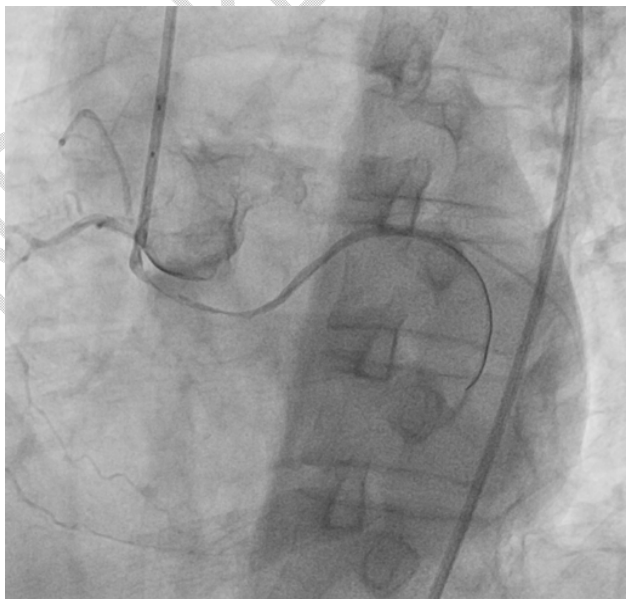

Figure 4: TIMI II flow restored in artery after balloon dottering and Intra Coronary Nicorandil injection

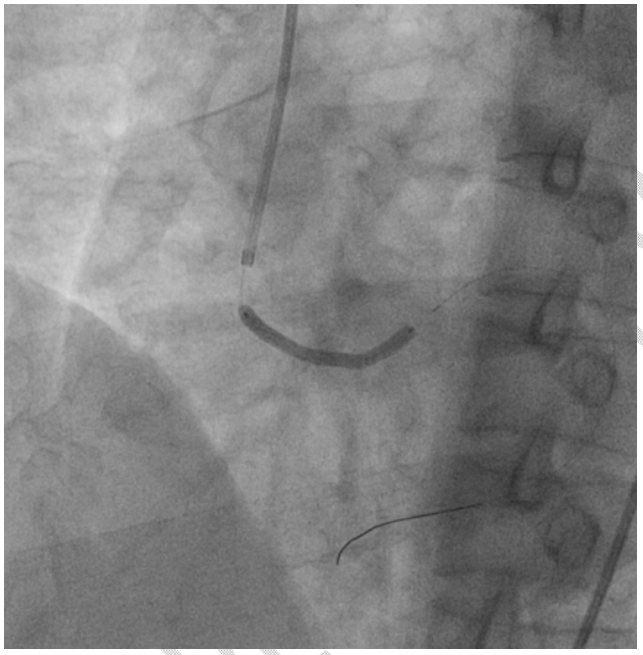

Figure 5: Stent implanted in proximal Lcx

Figure 6: TIMI III flow restored in anomalous Lcx artery post stent implantation