

# Primary Percutaneous Coronary Intervention in an Anomalous Left Circumflex Artery: Search for the Hidden Culprit

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## ABSTRACT

Congenital coronary anomalies are rarely detected in patients undergoing diagnostic coronary angiography. They pose a challenge in delay to identify the anomalous artery as well as difficulty in engaging the anomalous vessel. The present case report was of 56-years-old male patient presented with acute onset of chest pain. On evaluation, his electrocardiogram was suggestive of ST segment elevation in inferior leads. He underwent diagnostic coronary angiogram which revealed totally occluded Left Circumflex Artery (LCx) arising anomalously from right coronary ostium. Primary Percutaneous Coronary Intervention (PCI) of LCx could not be performed with routine guide catheters necessitating the use of special multipurpose guide catheter with balloon support. The case highlights the need for the knowledge of coronary anatomy and anomalous origins of coronary arteries and the selection of appropriate guiding catheters and coronary wires.

**Keywords:** Aberrant origin, Coronary artery, Multipurpose guiding catheter

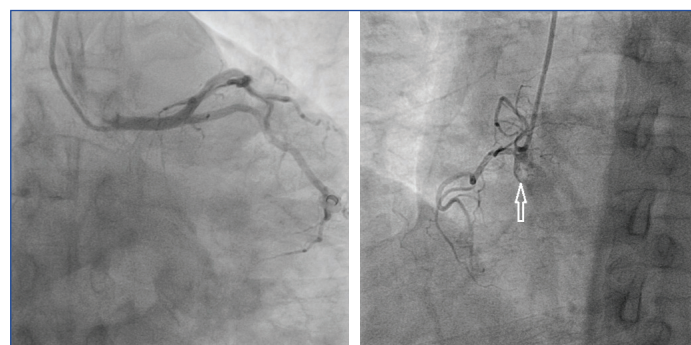
## CASE REPORT

A 56-year-old male presented with complaints of sudden onset of chest pain 2 hours prior to presentation. He was a known case of hypertension and a chronic smoker. The chest pain was retrosternal, radiating to the upper abdomen and associated with sweating and uneasiness. At the time of presentation, his pulse rate was 96 beats/min with blood pressure of 110/66 mmHg. His electrocardiogram showed ST segment elevation in II, III, and augmented Vector Foot (aVF) and reciprocal ST depression in I and augmented Vector Left (aVL). Transthoracic echocardiography showed posterior and lateral wall hypokinesia with mild mitral regurgitation and visual ejection fraction of 45%.

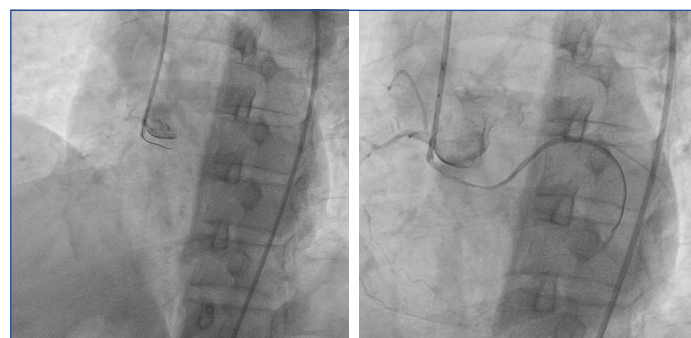
The patient was planned for primary Percutaneous Coronary Intervention (PCI) and was loaded with antiplatelets (aspirin 300 mg and ticagrelor 180 mg) and statin (rosuvastatin 40 mg) and a bolus of 5000 IU of heparin was given and taken to the cardiac catheterization lab for Coronary Angiography (CAG). CAG was done with 5F TIG (Terumo) diagnostic catheter. Left coronary angiogram revealed normal Left Anterior Descending Artery (LAD) and its diagonal branches and a normal ramus vessel [Table/Fig-1]. Selective Left Main Coronary Artery (LMCA) and non selective left cusp shoot failed to show a LCx, however, in Left Anterior Oblique (LAO) LCx was seen to fill from collaterals from LAD. The Right Coronary Artery (RCA) was hooked with the 5F TIG and showed a non dominant small caliber RCA and LCx was still not visualised. Slight pullback of the TIG catheter with counter clockwise rotation showed an anomalous arising LCx from RCA ostium with downward course and proximal 100% thrombotic occlusion [Table/Fig-2]. The patient was planned for primary PCI of LCx and after written informed consent was taken for the same.

A 6F Femoral access was obtained and an additional 5000 IU heparin was given intravenous (i.v) and 6F Judkins Right (JR) 3.5 (Medtronic) Guiding catheter was used to cannulate the anomalous LCx, but it failed to obtain coaxial access. The JR Guide would cannulate the RCA and get unhooked on counter-clockwise rotation to the LCx. A 6F MP (Multi-Purpose, Boston Scientific) Guiding Catheter was taken and it gained good coaxial access with backup support to the LCx. The proximal occlusion was attempted to be crossed with 0.014 hydrophilic wire (Fielder FC, ASAHI) but it failed to negotiate due to the proximal tortuosity, hence a 2.0x10 mm compliant balloon (Sapphire, Orbus Neich) was

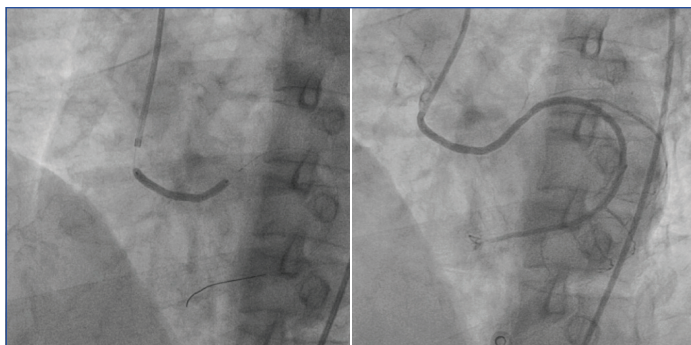
taken [Table/Fig-3] and with balloon support the wire managed to cross the lesion and was parked in the left posterior descending artery. Gentle dottering of the balloon across the thrombotic lesion was done after which Thrombolysis in Myocardial Infarction (TIMI) II flow was restored in the LCx [Table/Fig-4]. Intracoronary nicorandil was administered followed by 2.75x32 mm Promus Premier (Boston Scientific) Drug-Eluting Stent was implanted in the proximal LCx at 12 atm [Table/Fig-5]. Post dilatation was done with a 3.0x12 mm Sapphire NC Balloon (Orbus Neich) at 14 atm and TIMI III flow was restored in the LCx [Table/Fig-6].



**[Table/Fig-1]:** Left coronary angiogram showing left anterior descending artery and ramus artery arising from left main and absence of Left Circumflex Artery (LCx) from Left Main Coronary Artery (LMCA); **[Table/Fig-2]:** Right coronary injection showing non dominant right coronary artery and anomalous origin of left circumflex from right coronary artery ostium with 100% thrombotic occlusion (showing by arrow). (Images from left to right)



**[Table/Fig-3]:** Balloon supported Percutaneous Transluminal Coronary Angioplasty (PTCA) wire negotiated across tortuous and occluded Left Circumflex Artery (LCx); **[Table/Fig-4]:** Thrombolysis In Myocardial Infarction (TIMI) II flow restored in artery after balloon dottering and Intra Coronary Nicorandil injection. (Images from left to right)



**[Table/Fig-5]:** Stent implanted in proximal Left Circumflex Artery (LCx);

**[Table/Fig-6]:** Thrombolysis In Myocardial Infarction (TIMI) II flow restored in anomalous Left Circumflex Artery (LCx) post stent implantation. (Images from left to right)

The patient was shifted to the Intensive Cardiac Care Unit and had an uneventful recovery and was discharged on the second day. The patient has completed two months of post PCI follow-up and is doing fine.

## DISCUSSION

Abnormal embryological development in the coronary buds on the aortic sinuses or vascular plexus in early foetal growth results in various Coronary Artery Anomalies (CAA) whose incidence is from 0.6% to 1.5%, which can range over a wide spectrum, with being totally asymptomatic on one extreme to causing sudden cardiac death at the other extreme [1-3]. Coronary artery variations with incidence less than 1% are termed as coronary anomalies [3]. The anomalous origin of the LCx artery from the right sinus of Valsalva is one of the most common CAA, with a reported incidence of 0.48-0.7% [4], however this anomaly offers very less clinical significance and most often incidentally detected. The next common anomaly is origin of LCx from RCA which has a reported incidence of 0.3% [5]. During selective cannulation of the ostium of LCx before coronary angiogram, PCI, coronary artery surgery and prosthetic valve replacement, difficulties may occur in the diagnostic procedure and even may obviate the need of Computed Tomography-Coronary Angiography (CTCA) of coronaries to delineate the coronary anatomy [6].

In another study based on interventional cardiology described by Antopol W and Kugel MA the incidence of anomalous left circumflex coronary artery, arising either from right sinus of Valsalva or the RCA was 0.2% to 0.6% [7]. Anomalous coronary arteries offer significant and considerable challenges along with technical difficulties in the path of interventional cardiologists during PCI [8,9]. In a study by Angelini P in which they included myocardial bridges and coronary fistulas as common CAA, the incidence was upto 5.64% [10]. The anomalous LCx artery usually pursues a posterior retro-aortic course before supplying the posterolateral surface of the left ventricular myocardium. The anomalous vessels are more prone to atherosclerosis, especially in their retro aortic position [11].

In the present case, the patient presented with acute Inferior Wall Myocardial Infarction (IWMI) in the emergency and was taken up for Primary Angioplasty in acute Myocardial Infarction (PAMI) and during coronary angiography, the LCx was found to arise from RCA ostium. Previous described case reports of interventions in anomalous coronaries are mostly involving RCA and in those in anomalous LCx were done with JR catheter or AL1 (Amplatz Left) catheter [12,13]. In the present case, the anomalous LCx could not be cannulated coaxially with JR catheter and was not giving good guide support to pass the wire into the LCx. Hence, multipurpose guide catheter was used to maintain coaxial support with the downward direct origin of LCx. Percutaneous transluminal coronary angioplasty was done in the LCx with multipurpose MPA1 catheter. In order to get support to pass hardware through anomalous and tortuous vessels, various techniques like double wire or knuckle wire technique have been

described. In the index case, PTCA wire was negotiated past the lesion with balloon support.

Anomalous coronary arteries, though rare, present a technical challenge during PCI. Although the incidence of CAA is much less common than the incidence of acquired coronary artery diseases they have significant impact on premature cardiac morbidity and myocardial perfusion, which may further progress into myocardial ischaemia or sudden death [3]. Successful PCI procedure depends on knowledge of anomalous origin of coronary arteries, their course and appropriate selection of hardware [14,15]. Common CAA is shown in [Table/Fig-7].

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
<b>[Table/Fig-7]:</b> Coronary Artery Anomalies (CAA).

From above mentioned classification, anomalous origin of coronary artery or its branch from opposite or non coronary sinus classified into four different type of pattern:

- RCA originating from left coronary sinus
- Left main originating from right coronary sinus
- LAD or LCx originating from right coronary sinus
- LM or RCA originating from non coronary sinus.

A coronary artery arising from any of the sinuses may have one of the following epicardial course depending on its relationship with pulmonary trunk or aorta:

- Interarterial (i.e., runs between the pulmonary artery and aorta),
- Retroaortic
- Prepulmonic,
- septal or (subpulmonic) [15,16]

Among these the interarterial course is more prone to sudden cardiac death while the rest considered are benign [2,17,18]. So the clinical significance of anomalies and it's course is obvious for different cardiac interventions [6].

In the present case, patient had presented with acute inferior and lateral wall myocardial infarction but on CAG revealed anomalous arising LCx from RCA origin with retroaortic course with acute total occlusion in proximal segment. Anomalous retero-aortic course is more prone to atherosclerosis [19]. In the setting of acute Myocardial Infarction (MI) with significant obstructive coronary artery disease it is obligatory that the anomaly should be promptly recognised by angiography and treated accordingly [20]. In this case prompt coronary artery anomaly was angiographically recognised and managed with primary PCI with drug eluting stent implanted in proximal LCx.

## CONCLUSION(S)

Anomalous origin of coronary arteries may pose considerable difficulty in indentifying and engaging the culprit vessel in primary PCI. The resultant delay in reperfusion may lead to increased morbidity and mortality. Adequate knowledge of origin of anomalous coronaries and selection of appropriate guide catheters are essential for successful outcome in such cases.

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