

Primary Percutaneous Coronary Intervention of an Anomalous Left Main Trunk Originating from the Right Coronary Artery during Acute Myocardial Infarction

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Abstract

In 1.5 - 2.0% of patients with acute myocardial infarction (AMI) referred for primary percutaneous coronary intervention (PCI), left main trunk (LMT) is identified as the culprit vessel [1,2]. Although comparative data with urgent surgical revascularization are lacking, PCI at the time of diagnostic coronarography study is the most frequently accepted treatment in this setting [1-4]. Among the congenital coronary anomalies, an anomalous origin of the LMT from the right sinus of Valsalva is very uncommon [5,6]. We describe a 49 year old patient with lateral AMI referred for primary PCI in which an anomalous LMT originating from the proximal right coronary artery (RCA) proved to be the infarct-related artery. Direct stenting was used to successfully treat this vessel. The subsequent clinical course during hospitalization was uneventful, and the patient was discharged alive.

Keywords: Acute Myocardial Infarction; Anomalous Coronary Artery; Coronary Stent; Left Main Coronary Artery; Primary Angioplasty

Introduction and Case Report

A 49-year-old male presented to the emergency room with 90 minutes history of recent-onset angina and dyspnea. The patient had a history of dyslipidemia and a family history of coronary artery disease. His vital signs on admission to the emergency room were as follows: blood pressure, 120/80 mmHg; pulse rate, 95 beats per minute and respiratory rate, 20 breaths per minute. Physical examination was normal. Electrocardiography showed ST and T wave changes consistent with lateral ST elevation myocardial infarction.

The patient was referred urgently to the cardiac catheterization laboratory for primary PCI, the first-choice reperfusion therapy for AMI at our institution. He was prepared in the usual sterile fashion. A 6 French (F) sheath was placed in his right femoral artery using a modified Seldinger technique. As part of our protocol, the non-infarct related artery (RCA) was catheterized first. A diagnostic Judkins Right (JR4) was introduced. The diagnostic imaging of the right coronary artery showed a large, dominant and ectatic vessel with a 40% stenosis in its mid segment. The RCA provides a large posterior descending artery (PDA) and two large posterolateral branches (Figure 1). The diagnostic angiogram of the RCA showed an anomalous take-off of the left coronary artery from the proximal RCA (Figure 2). This was a totally anomalous take-off of the left main from the RCA supplying both the left anterior descending artery (LAD) and the circumflex (Figure 3). A diagnostic angiogram of the left coronary cusp showed no take-off of any coronaries at that cusp (Figure 4). The proximal

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portion of the left main that was taking off from the RCA had evidence of a 99% thrombotic lesion with thrombolysis in myocardial infarction (TIMI) I-II flow in that vessel. Decision was to intervene on that culprit lesion. The ostium of the RCA was cannulated with a 6F guiding Amplatz Right (AR1) catheter. The lesion was crossed with a 0.014", 190 cm Balance Middle Weight (BMW) wire (Figure 5). It was pre-dilated with a 2.0 X 20 mm Extensor balloon at 14 atmosphere (atm) of pressure with improvement in flow, followed by stenting with a 3.0 X 8 mm Orsiro stent DES (drug eluting stent) deployed at 17 atm of pressure with an excellent angiographic result (Figure 6 and 7). There was transient TIMI-II flow following stenting which improved to TIMI-III flow following a total of 2 mg Adenosine intra-coronary (Figure 8-10). The patient was pre-medicated with 5000 units of unfractionated Heparin and 600 mg of clopidogrel. He was started on Tirofiban before crossing the lesion.



Figure 1: Right heart catheterization. Large dominant and ectatic vessel. 40% mid segment stenosis. RCA provides large PDA (posterior descending artery) and 2 large PL (posterior lateral) branches. Anomalous take off of left main LM from RCA (right coronary artery), supplying both LAD (Left anterior descending) and CX (circumflex). 99% thrombotic lesion in proximal LM (left main). TIMI (I to II flow).



Figure 2: Diagnostic angiography of RCA: (right coronary artery). The proximal LM (left main) thrombotic lesion is clear estimated to be 99% stenotic.



Figure 3: Diagnostic angiography of RCA. The anomalous takeoff of LM from RCA with 99% thrombotic lesion of proximal LM.

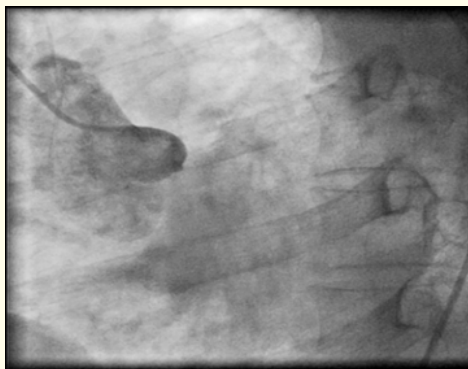


Figure 4: A diagnostic angiogram of the left coronary cusp showed no take-off of any coronaries at that cusp.



Figure 5: 6 French guiding AR1 (Amplatz right) catheter engaged right coronary cusp. Then, (0.014"-190 cm BMW (Balance middle weight) wire crossed the proximal LM lesion successfully.

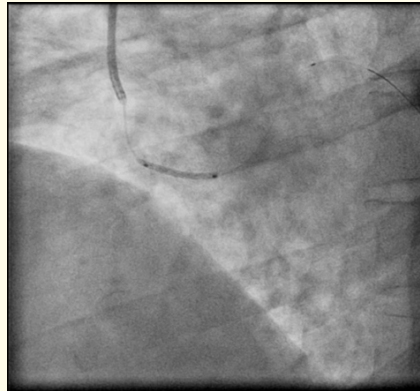


Figure 6: After crossing the proximal LM lesion with BMW wire and successfully. The lesion was pre-dilated with a 2.0 x 20 mm extensor balloon at 14 atmospheres of pressure with improvement in flow.

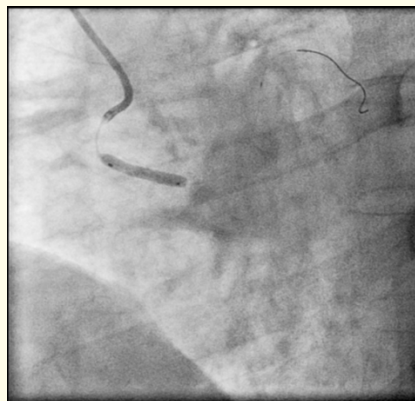


Figure 7: The proximal LAD Lesion was stented with a 3.0 x 8 mm M-L vision stent deployed at 17 atmospheres of pressure with an excellent angiographic result.



Figure 8: The anomalous proximal LM shows TIMI III flow, before removing the BMW wire.



Figure 9

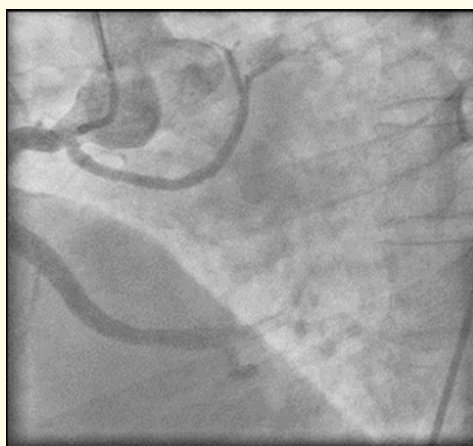


Figure 10

Figure 9 and 10: Different view of RCA, showing the TIMI III flow in left main circulation.

After the procedure, chest pain disappeared and the electrocardiogram (ST-segment deviation) returned to normal. The subsequent clinical course during hospitalization was uneventful, without recurrent ischemia or heart failure. An echocardiographic study showed only distal anterior akinesia with moderately depressed left ventricular ejection fraction (EF), estimated EF (35 - 39%). After 48 hours patient underwent 64 multidetector-row computed tomography (MDCT) to define the course of the left main coronary artery (LCA). MDCT clearly demonstrated that the LCA arises from the inferior aspect of the RCA approximately 1 cm beyond its origin. A stent is seen in its proximal segment with good opacification of the stent lumen. This vessel courses between the aortic cusps and the left atrium and gives rise to the LAD and circumflex arteries which are relatively small vessels showing no significant plaque formation (Figure 11-13).

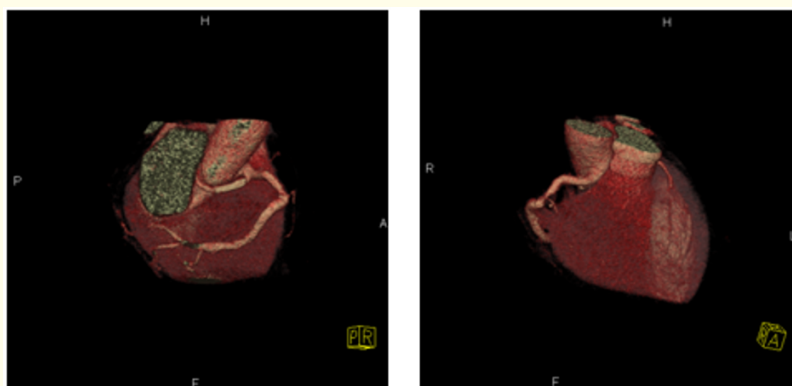


Figure 11



Figure 12

Figure 11 and 12: 64 multidetector-row computed tomography (MDCT) demonstrates the LCA (left coronary artery) arises from the inferior aspect of the RCA approximately 1 cm beyond its origin. A stent is shown in LM with good opacification of the stent lumen. This vessel passes between the aortic cusps and the left atrium and gives rise to LAD and circumflex arteries which are small vessels.



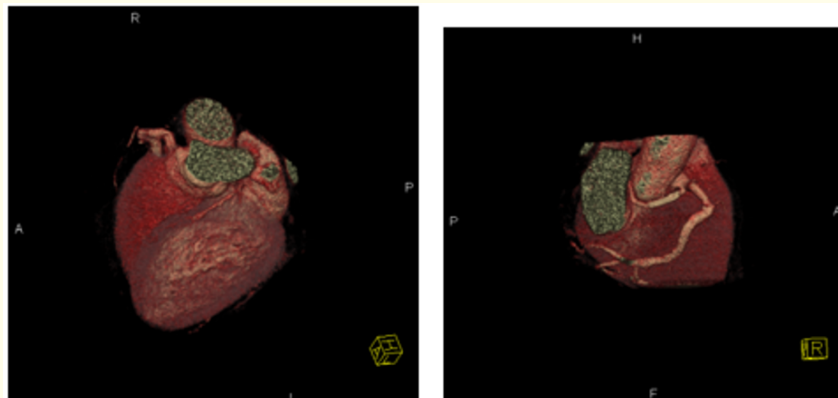


Figure 9: 64 MDCT demonstrating the course of Left main with stent deployment in its proximal segment with good opacification of the stent lumen.

Discussion

LMT is the infarct-related artery in approximately 1.5% of AMI patients referred for primary PCI [1,2] this frequency is increased in the presence of left bundle branch block [8] or cardiogenic shock [9]. Urgent coronary bypass grafting is associated with very high mortality in this setting [10] and PCI at the time of diagnostic coronariography is the preferred treatment modality in most centers [1-4]. However, despite the achievement of a successful coronary recanalization in most cases, the mortality rate in this challenging situation remains high, ranging from 50 - 69% [1-4]. This is mainly due to the very high frequency of cardiogenic shock at presentation, since the incidence of other complications is not increased [11].

An anomalous left coronary artery with origin in the right sinus of Valsalva may arise either from a common ostium with the right coronary artery or, from a separate ostium (@, @). Rarely, LMCA may arise from the proximal right coronary artery (so-called single coronary artery). As a result, LMCA may follow 4 distinct pathways (@):

1. An anterior free wall course, wherein the LMCA traverses the free wall of the right ventricle to the mid-ventricular septum, whereupon it gives rise to the left anterior descending and the circumflex artery.
2. A retroaortic course, wherein the LMCA traverses posteriorly around the aorta to its normal position on the anterior surface before giving rise to its branches.
3. An interarterial course, wherein the LMCA passes in between the aorta and pulmonary artery to its normal anterior position.
4. An intramyocardial or septal course, wherein the LMCA follows an intramyocardial course.

Of the aforementioned subtypes of anomalous LMCA, the interarterial type has received the most attention because of its association with sudden death. Other LMCA subtypes (anterior, posterior and septal) are thought to be at a low risk of adverse events and do not usually require surgery.

A case of primary PCI for an anomalous LMT originating from the RCA is presented herein.

The favorable clinical course of our patient after the procedure may be explained by the absence of cardiac failure and cardiogenic shock at admission, as well as the short time delay since symptom onset.

PCI of anomalous coronary arteries presents several technical challenges to interventional cardiologists. Choosing the best guiding catheter and other equipment is crucial to the technical success of the procedure. Usually, during PCI of lesions in single coronary arteries (common ostium for the RCA and LCA), it is difficult to choose the appropriate guiding catheter because of the unusual direction and tortuous angle of the coronary artery. Moreover, if a dissection develops after passing the guidewire or during the inflation of the balloon catheter, it may extend retrogradely, involving the origins of the LCA and RCA, and the consequences can be catastrophic. Fortunately, in our case, during the first attempt of PCI in the LCA, a dissection did not develop after balloon inflation.

This report suggests that in selected patients, a lesion in an LMT of anomalous origin may safely be treated with PCI. MDCT adds valuable information to coronary angiography in the topographic diagnosis of coronary anomaly [12]. This is of particular clinical relevance if the course of the anomalous coronary artery (either the left or right) between the aorta and pulmonary trunk is suspected, since this constellation is associated with an increased risk of sudden death [13,14].

Conclusion

Finally, since the infarct-related artery was patent with thrombus in the left main, and the patient was hemodynamically stable, other therapeutic approaches, such as coronary artery bypass grafting, thrombolysis and/or glycoprotein IIb/IIIa inhibitors, could have been considered instead of immediate PCI. However, we applied the latter because: 1) complete occlusion of the left main (if PCI was not applied) could have been potentially lethal; 2) we considered the procedure technically feasible; and 3) coronary stenting in thrombus-containing lesions is associated with very high immediate angiographic success [7].

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