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Acute STEMI in a Single Coronary Artery Type R-III: Focus on Diagnosis and Treatment of a Rare Variant.

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ABSTRACT

A 61 year-old-man on treatment for type II diabetes mellitus presented to the emergency with rest angina. Electrocardiogram and troponin T were suggestive of an acute inferior wall myocardial infarction and the patient was taken up for primary percutaneous intervention (PCI) immediately. When the ostium of the left coronary artery couldn't be located on angiogram, aortography was done and revealed a common trunk arising from the right coronal sinus giving rise to the right coronary artery, an anomalous left coronary artery and an anomalous left circumflex artery. The anomalous branches were however not the culprit artery and the thrombus in the mid RCA responsible for the myocardial infarction was stented. MDCT done later proved the coronary artery anomaly to be of Type RIII with a dangerous inter-arterial course of the left anterior descending. The case report discussed the diagnostic modalities for accurate diagnosis and management options for this variant

Keywords: Anomalous Coronary Artery, Single coronary Artery Type R III

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INTRODUCTION

A single right coronary artery with an inter-arterial course of the left anterior descending artery (LAD) is an extremely rare coronary anomaly with a prevalence of less than 0.004%.[1] While some variants of anomalous coronary artery are benign, this variant may be associated with sudden cardiac death in young individuals and symptoms of ischemic heart disease in adults.[2] We write this article to reiterate the need for an MDCT in cases of coronary artery anomaly to accurately determine the type of anomaly and in turn the possibility of clinical repercussions. Moreover, in case of older age group the treatment of an anomalous coronary artery with an inter-arterial course is still a matter of debate

Case Report

A 61-year-old man, on treatment for Type 2 diabetes mellitus for 12 years, visited the emergency department with complaints of chest pain accompanied with diaphoresis since 6 hours. There was no significant family history and the patient denied smoking or any addictions. The general physical examination was unremarkable with a blood pressure of 110/90mmHg in the right arm in supine position and a pulse rate of 66 beats per minute. Systemic examination was normal.

The initial electrocardiogram showed 3 mm of ST-segment elevation in leads II, III and aVF with reciprocal changes and Troponin T level was elevated, consistent with STEMI

In view of an ST elevation MI, the patient was planned for a primary percutaneous intervention (PCI) after loading with 325 mg of aspirin and 180 mg of ticagrelor. At first, we tried to perform a left coronary angiography with a Judkins left 6 French catheter, but we could not find the orifice of the left coronary artery (LCA). On aortography the left anterior descending (LAD), the left circumflex (LCx) and the right coronary artery (RCA) were seen to arise from a common trunk originating from the right coronary sinus. A 6 French Judkins Right guiding catheter was engaged into the ostium of the right coronary artery. Coronary Angiogram revealed a 100% occlusion of the mid RCA (Figure 1). The lesion was crossed with a 0.014 hydrophilic coated floppy guide wire. After thrombus aspiration, an everolimus-eluting stent (3.0 mm×23 mm) was implanted over the lesion (Figure 2). The angiographic appearance was good, with TIMI 3 flow (Figure 3). During the procedure the patient ad intermittent complete heart block for a temporary pacemaker was inserted. The post procedure hospital stay was uneventful and a 64-sliced multi-detector computed tomography done during this period to delineate the anatomy of the anomalous coronary artery showed the LAD, the LCx and the RCA branching off at a common point from a short common trunk arising from a single ostium from the right sinus of Valsalva (Figure 4,5). The patient remained asymptomatic and was discharged on aspirin, ticagrelor, ramipril and atorvastatin. The patient was doing well at 2 months of follow-up, he was advised perfusion study to demonstrate ischemia in the non-culprit vessel, however, he declined further investigation as he had been asymptomatic since

Figure 1: Coronary angiogram in LAO caudal (left anterior oblique) view with arrow showing right coronary artery mid 100 % occlusion. Also left anterior descending artery and left circumflex artery arising from right sinus of valsalva(indicated by arrows)

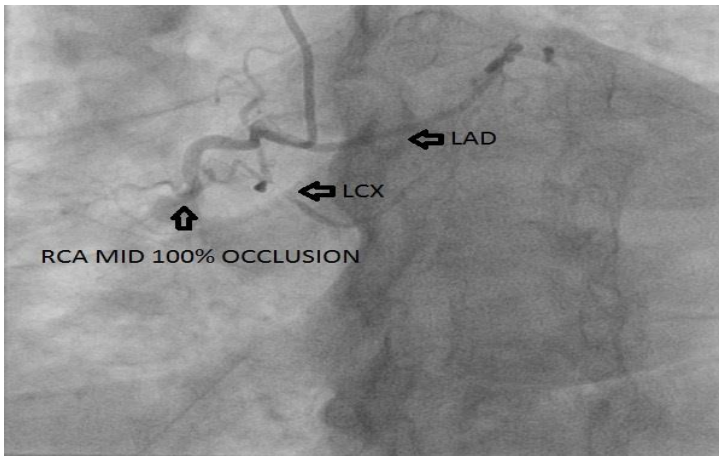

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Figure 2: Coronary angiogram in LAO cranial (left anterior oblique) view showing drug eluting stent (DES) in right coronary artery.

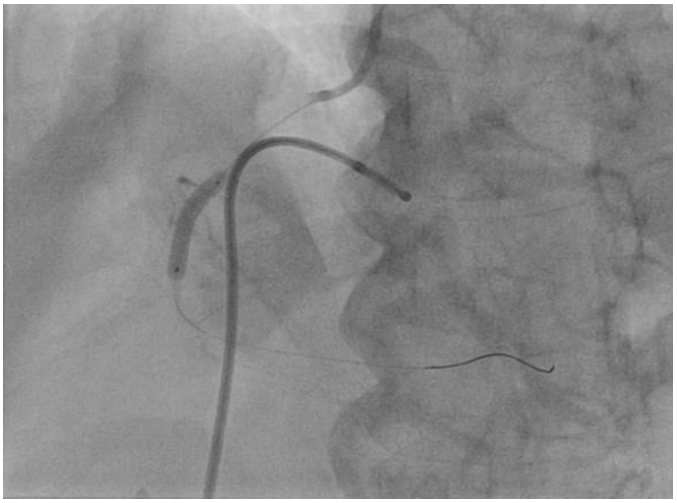

Figure 3: Coronary angiogram in LAO cranial (left anterior oblique) view showing TIMI III grade flow in right coronary artery after deployment of DES

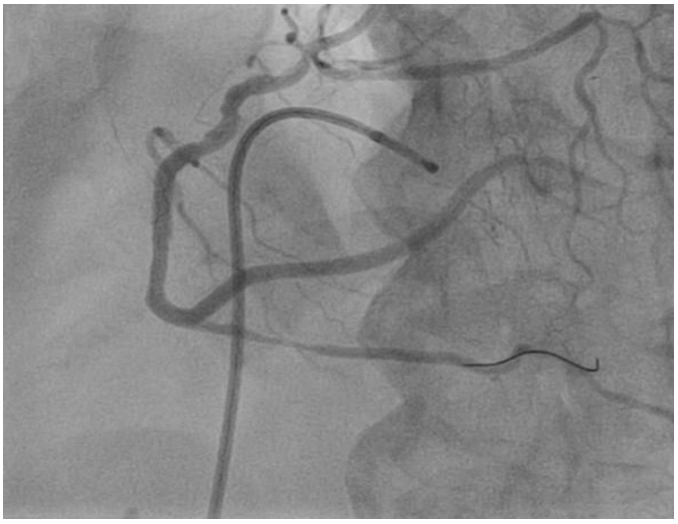

Figure 4: CT shows the inter arterial course of the left anterior descending artery between the aorta and the pulmonary trunk

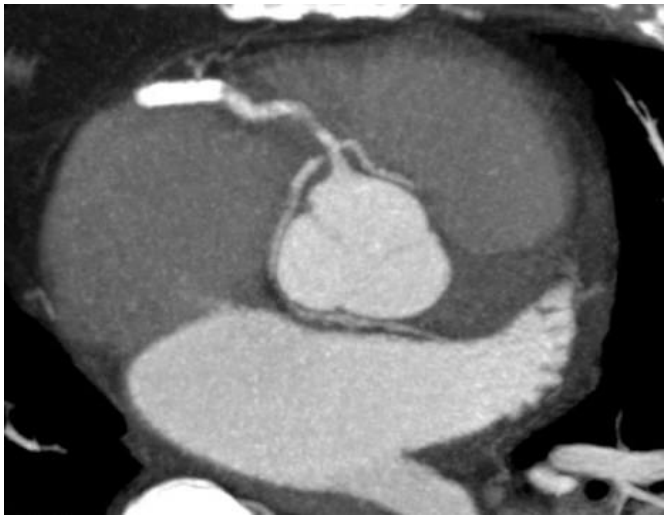

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Figure 5:64 slice MDCT shows the right coronary artery, left circumflex artery and left anterior descending artery arise from a common trunk arising from the right coronary sinus of Valsalva

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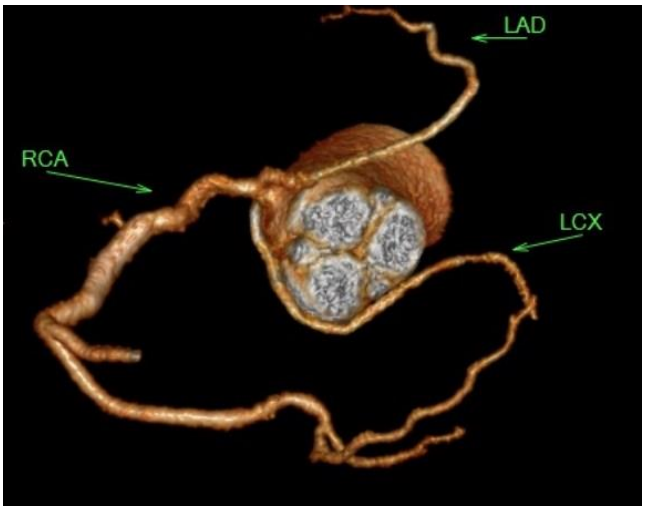

DISCUSSION

Coronary artery anomalies (CAA) are rare but increasingly diagnosed due to the widespread use of angiogram in evaluation of cardiac symptoms. The prevalence of CAA varies between 0.6-1.3% in various studies.[1,3] Often, the anomalous vessel is picked-up incidentally on angiogram done for evaluation of atherosclerotic cardiac disease, and is rarely the culprit vessel. However, while 80% of such anomalies are benign, some variants are notorious for producing clinical repercussions like syncope, arrhythmia, infarctions and sudden cardiac death.[1]

As per the classification of CAA described by Lipton, an isolated coronary artery arising from the right coronary sinus with RCA, LCX and LAD branching off separately from a common trunk and an inter-arterial course of LAD as in our patient is defined as RIII type.[4] It is a rare and dangerous variant with an incidence of about 0.004%.[1] In a study by American Armed Forces Institute of Pathology, among 1.6 million recruits who underwent military training, 21 of the 64 cardiac deaths were due to CAA, all being anomalous left artery arising from the opposite sinus.[5] The inter-arterial course (IAC) wherein the anomalous coronary artery traverses between the aorta and the pulmonary artery as seen in our patient, is associated with a high risk of sudden cardiac death and earns it the reputation of being malignant.[2]

Thought the sudden cardiac death has been postulated to result largely from the compression of the artery between the cardiac and pulmonary trunk, especially during vigorous exercise as the two trunks are distended, recent work by Angelini sheds light on other possible mechanisms like intramural intussusception of proximal ectopic artery at the aortic root wall. The intramural intussuscepted segment was seen to have a smaller lumen than the distal part of the vessel and the cross section of the intramural part of the vessel was seen to be ovoid and smaller with further decrease to critical stenosis during exertion.[6] The angle at which it exits the aorta is also believed to be a significant factor.

Manifestations of CAA in older individuals include chest pain, dyspnea, syncope or palpitations which are indistinguishable from those seen in atherosclerotic disease of the coronaries. Sudden cardiac death especially under heavy physical exertion is more commonly seen in younger individuals, perhaps due to progressive hardening of the aortic wall in adults.[7] Current modalities for recognition of CAA include conventional angiogram, cardiac computed tomography and magnetic resonance coronary angiography (MRA). Though many cases of anomalous coronary artery have been described on the basis of angiogram, most did not undergo an MDCT and hence, the accurate classification and in turn the risk assessment of such cases becomes difficult. Coronary angiogram identifies the anomaly correctly only in 53% of the cases.[8] MR angiography is superior to angiogram but has poor delineation of distal arterial course, artifacts and lower spatial resolution as compared to MDCT. Claustrophobia and the presence of sternal sutures and metal stents also limit its use, however, it is the preferred investigation when radiation is to be avoided. (*Class IIa, Level of evidence B*).[6] A 64 slice MDCT has a sensitivity of 86% and a specificity of 96% and this diagnostic accuracy

favors coronary CTA over MRA for symptomatic patients with an intermediate risk for CAD. *(Class I, Level of Evidence B).* [9,10] The noninvasive nature, excellent 3D reconstruction and spatial resolution, correlation with great vessels and cardiac structures make MDCT the preferred method for the diagnosis and a must for accurate classification and risk stratification and hence was the preferred investigation for our patient.

Current recommendations for the treatment of an inter-arterial variant (IAV) is in favour of surgical intervention such as bypass, reimplantation of the anomalous vessel and unroofing.[11] According to ACC/AHA surgical re-vascularization should be performed in cases of anomalous left main coronary artery coursing between the aorta and pulmonary artery, documented coronary ischemia due to compression of the inter-arterial course and anomalous origin of the RCA between aorta and pulmonary artery with evidence of ischemia. (*CLASS I, Level of Evidence: B*).[11]

However, in a study by Krasuski *et al,* 28 out of 54 patients with IAV who underwent surgery had no significant 10 year survival benefit.[12] Another study on clinical outcome of anomalous coronary artery by Taylor et al revealed no simple relation between the anomaly and the clinical outcome and found large, case to case heterogeneity.[13] Age greater than 30 was however associated with less incidence of sudden cardiac death. This may be explained by hardening of the aorta with age. The risk to benefit ratio of surgical intervention also played an important role in older-age-group with multiple co-morbidities. In our patient as the artery traversing between the aorta and the pulmonary trunk was the LAD and not the LMCA there was no absolute indication for surgical revascularization in the absence of ischemia in its territory. The patient was advised perfusion studies on follow-up to demonstrate myocardial ischemia, however, he was unwilling for further investigation. There is still a dearth of large scale series that could provide evidence to guide therapeutic approach in such cases and in light of case to case variability of anatomy and risk factors, each case may be treated as familiar yet unique.

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