



TWO CULPRIT ARTERIES IN A CO-DOMINANT CARDIAC SYSTEM

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ABSTRACT

In a co-dominant cardiac system, the posterior descending artery arises from branches of both the right coronary artery and the left circumflex artery. In the event of ischemia from a culprit artery, the other branch supplies the myocardium. Here we aim to report a case of occlusion of branches of both sides in a co-dominant system and both of them being culprit arteries.

KEYWORDS : Myocardial Infarction, Co-dominant system, Culprit arteries, Obtuse Marginal artery, Posterolateral artery.

INTRODUCTION

Myocardial infarction is a life-threatening condition caused primarily by occlusion of the coronary arteries due to atheromatous plaque or thrombus. Cardiac dominance is determined by the vessel from which the posterior descending artery arises, either the right coronary artery or the left circumflex artery. If it arises from both the arteries it is known as a co-dominant system. In a co-dominant system, if one of the arteries is occluded, the other branch supplies and keeps the myocardium intact. We report a rare case of two culprit arteries in a co-dominant system. A 45-year-old male who presented with angina was diagnosed with inferior wall MI with ECG suggestive of RCA as the culprit artery. CAG revealed a co-dominant system with occlusion in the posterolateral branch of the RCA and the second obtuse marginal branch of LCX. PCI to the distal right coronary artery - posterolateral branch with plain old balloon angioplasty was done. Since the patient had persistent pain and new onset AV block, PCI to obtuse marginal 2 is also done immediately after which he improved hemodynamically. Only 10-20% of the population has a co-dominant system for whom the collateral from the other side gives blood supply in case of occlusion of one coronary artery. But in this case, symptoms persisted despite revascularization by opening the PLB making both the PLB and the OM2 culprit arteries.

CASE REPORT

A 45-year-old male who is hypertensive for six years presented to the emergency room with typical angina radiating to the left shoulder associated with profuse sweating and giddiness for twelve hours. He is neither an alcoholic nor a smoker. There was no family history of coronary artery disease. No symptoms and signs of heart failure were noted. On presentation he was afebrile, his pulse rate was 70 per minute, blood pressure was 140/80 mm/Hg, respiratory rate was 24 per minute, and was maintaining a saturation of 99% in ambient air. Systemic examination was unremarkable. The electrocardiogram showed normal sinus rhythm with a rate of 70 per min, ST-segment elevation were seen in leads II, III, and aVF with the ST uptake greater in lead III than in lead II suggesting the right coronary artery to be the culprit artery and ST-segment depression in leads I and aVL. The patient was diagnosed as inferior wall ST-segment elevation myocardial infarction and given a loading dose of tablet Aspirin 325mg per oral, tablet Clopidogrel 300mg per oral, tablet Atorvastatin 80mg per oral, and injection Heparin 5000U subcutaneously.

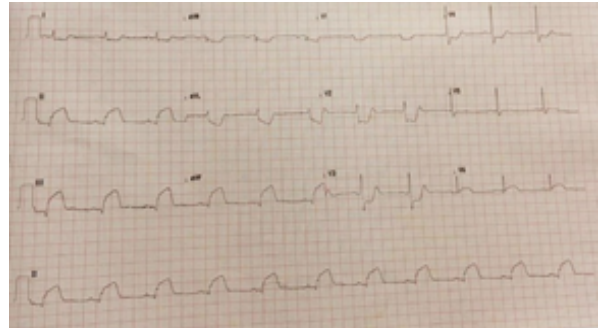


Figure 1: ECG showing Inferior Wall MI.

Routine lab investigations showed normal complete hemogram, metabolic panel, liver function tests, and urine analysis. 2D Echocardiography showed hypokinesia of mid and basal inferior and infero-septal regions and mild left ventricular systolic dysfunction with an ejection fraction of 48%. The patient was taken up for coronary angiogram which revealed a co-dominant system and occlusion in the posterolateral branch of the right coronary artery and the second obtuse marginal branch of the left circumflex artery.

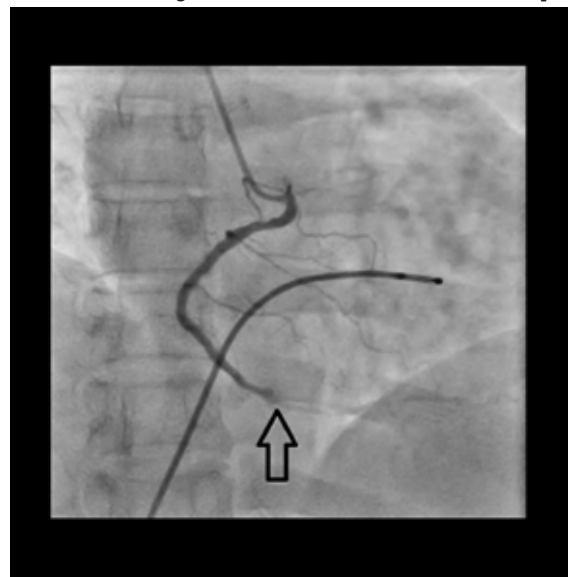


Figure 2: Occlusion of RCA in Coronary Angiogram.

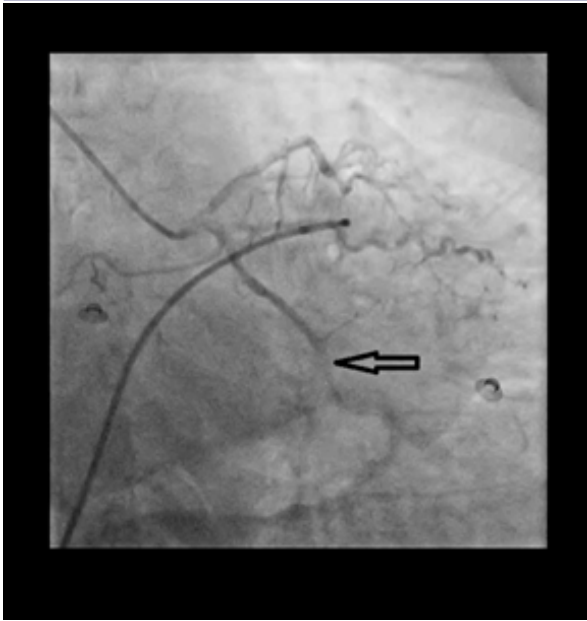


Figure 3: Occlusion of LCX in Coronary Angiogram.

As the ECG was suggestive of RCA as the culprit artery, percutaneous coronary intervention to the posterolateral branch of the distal right coronary artery was done. An anomalous right coronary artery was engaged with a 6F MPA guide using 0.014 x 180 cm sion blue guide wire with 2.0 x 10mm raiden PTCA balloon support with which the lesion was predilated serially at high atmosphere pressure. Check CAG revealed a well-yielded lesion with TIMI III flow, minimal residual thrombus, and no dissection flap. The caliber of the vessel was less than 2mm, hence stenting was deferred.

There was an improvement in chest pain, hence further intervention was deferred, and was planned to shift the patient to the Cardiac Intensive Care Unit. But again the patient developed crescendo chest pain with transient high AV block. Check angiogram showed a patent PLB. So it was decided to open up the occluded second obtuse marginal artery as well in the same sitting.

Through the right radial artery approach, the left main coronary was hooked and the left circumflex – obtuse marginal 2 branch was wired with sion blue guide wire and parked distally. The lesion was predilated with raiden PTCA balloon at rated burst pressure which yielded well. Check CAG revealed another ostial lesion in the inferior division of the second obtuse marginal, astride the previously occluded OM2 region. The second obtuse marginal inferior division was wired with another cougar xt guide wire and parked distally. It was predilated with raiden PTCA balloon at high pressures serially. Check CAG revealed well-yielded lesions in both the divisions of OM2, no dissection flap with TIMI III and residual dense thrombus, but again the caliber of the vessel was less than 2 mm, hence stenting was deferred. Post-procedure the patient had complete resolution of chest pain and ECG changes. The post-procedure period was uneventful and the patient was discharged asymptomatic and in a hemodynamically stable state.

DISCUSSION

Cardiac dominance refers to which coronary artery branch supplies the inferior wall and is classified as left, right, or codominant¹. Because it extends along the posterior interventricular sulcus to the apex of the heart, the posterior descending artery (PDA) is also known as the posterior interventricular artery. The posterior descending artery supplies blood to the posterior part of the interventricular

septum, including the posterior and inferior wall of the left ventricle². The vessel arises most frequently from the right coronary artery (right dominant), the left circumflex artery (left dominant), or both (codominant). In case reports, physiologic variants such as an origin from the left anterior descending artery, referred to as the super-dominant system, have been described³. About 70% and 80% of the population has a dominant right heart, with the posterior descending artery coming from the right coronary artery. Between 5% and 10% of the population is left heart dominant, with the PDA fed by the left circumflex artery, and between 10% and 20% is codominant, with the PDA supplied by both the left circumflex and right coronary arteries⁴. The atrioventricular node is perfused by small branches of the dominant artery⁵.

When the left circumflex artery undergoes stenosis or occlusion as a result of atheromatous plaque formation or thrombosis in a patient who is left heart dominant, depending on the severity, he may develop posterior interventricular septal ischemia or infarction⁶. However, in a patient with codominant coronary circulation, a stenotic lesion to the left circumflex artery may result in diminished perfusion to the posterior interventricular septum but continues to receive blood from the right coronary artery, minimizing the risk of infarction. Despite this theory, case reports have shown that both left dominant and co-dominant systems have higher incidences of in-hospital mortality compared to right dominant patients^{7,8}.

This collateral circulation may be sufficient to bypass the occlusion and provide the cardiac muscle with enough oxygenated blood to thrive and recover. But in this case, there is an occlusion in the branches of both the right coronary artery and the left circumflex artery. Hence the possibility of complete ischemia and infarct even in a co-dominant system should always be considered.

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