Anomalous Origin of the Right Coronary Artery from the Left Anterior Descending Artery: A Rare Angiographic Finding

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Abstract

The right coronary artery originating from the left coronary system is an extremely rare variation of the single coronary artery anomaly in which the prognosis is usually benign provided that the anomalous vessel does not cross between the aorta and the pulmonary artery. The clinical significance of coronary anomalies is usually determined by underlying anatomic features of the wrong coronary origin and/or coronary atherosclerosis. Although coronary angiography is an important diagnostic method, new non-invasive methods such as coronary computed tomography angiography and cardiac magnetic resonance imaging have important roles to play in characterizing this coronary anomaly. It should be noted that the management strategy of these patients may vary based on clinical presentation, anatomic details and additional findings. We describe a case of a man with occasionally detected right coronary artery originating from the left coronary system, treated with coronary artery by-pass because of critical two vessel disease. The anomalous right coronary artery was surprisingly untouched from atherosclerotic lesions.

Keywords: Anomalous right coronary artery; Angiography; Therapy

Introduction

An 81 year-old male patient was admitted to our hospital complaining of dyspnea. His medical history consisted of hypertension and hyperlipidemia. On admission, the ECG and Troponin T levels were normal. A transthoracic echocardiography showed a left ventricle dilatation (tele-diastolic volume was 214 ml) with severe depression of ejection fraction (EF 25%) and akinesia of anterior wall and hypokinesia of infero-lateral wall. Cardiac catheterization was performed. Cannulation of the left main coronary artery (LMCA) displayed normal courses of the LMCA, co-dominant left circumflex (LCX) with proximal subocclusive stenosis, an anomalous non stenotic right coronary artery (RCA) originating from the mid-tract of left anterior descending artery (LDA) and a LDA with calcified occlusion shortly after the origin of RCA (figures 1, 2). Attempts to cannulate the RCA with the right Judkins catheter were unsuccessful. The aortography confirmed that no vessel originated from the right sinus of Valsalva. Computed tomography with contrast of the coronary arteries delineated the course of the anomalous right coronary artery (figure 3), arising from the mid portion of the left anterior descending artery (LDA), and crosses anterior to the pulmonary artery (PA) before reaching the right atrioventricular groove.

The patient was referred for by-pass surgery intervention because of the severity of calcified lesions and the unfavourable anatomy.
Discussion

Coronary artery anomalies (CAAs) are defined as variants of the normal coronary artery. CAAs are found in 0.6% to 5.6% of patients undergoing diagnostic coronary angiography and in approximately 1% of routine autopsy examinations. The commonest CAA is a separate origin of the LDA and LCX, with an incidence of 0.41%, followed by the LCX arising from the RCA, with an incidence of 0.37%. The incidence of anomalous RCA originating from the left coronary system ranges from 0.1% to 0.9% [1]. The origin of an anomalous RCA may be from the left sinus of Valsalva, the posterior sinus of Valsalva, the ascending aorta, the pulmonary artery (PA), the left ventricle, the LMCA, the LCX or the LDA. A report by Kaul et al. [2] identified that three different anomalous arteries originating from the mid LDA corresponded with the district of RCA. Cases of anomalous RCA from the LDA have only been rarely reported in the literature: we were able to find just under 30 cases related to this specific anomaly in PubMed [3]. The RCA originating from the LDA is an extremely rare variation of isolated single coronary artery, which is a very rare congenital anomaly appearing in approximately 0.024–0.066% of the general population undergoing coronary angiography [4]. In these cases, one coronary artery stems from a single coronary ostium from the aortic trunk that nourishes the entire myocardium. It is well known that CAAs is commonly associated with other congenital cardiovascular anomalies such as transposition of the great vessels, coronary arteriovenous fistula, bicuspid aortic valve, and tetralogy of Fallot [5]. There is no consensus as to the clinical significance of coronary anomalies. The prognosis of anomalous RCA from the LDA is usually benign, and does not interfere with coronary perfusion. However, if an abnormal coronary artery crosses between the PA and the aorta, myocardial ischemia and sudden death may occur [6]. The clinical relevance of this coronary anomaly may be due to underlying coronary atherosclerosis. It has been proposed that abnormal origin and course of anomalous coronary arteries could make them more prone to atherosclerosis [7]. Coronary atherosclerosis or stenosis requiring medical, percutaneous or surgical revascularization has been observed in about 40% of reported cases. Several potential mechanisms have been proposed to explain myocardial ischemia and sudden death in patients with CAAs: i) spasm of the anomalous coronary artery, possibly as a result of endothelial injury or ischemia caused by its long distance of traveling; ii) the acute angle of take off of the anomalous vessel; iii) slit-like orifice; iv) intramural course of the anomalous vessel; and v) compression of the anomalous artery between the pulmonary and aortic trunks, particularly during or immediately after exercise, which leads to expansion of the aortic root and pulmonary trunk, creating external coronary artery expression and possibly increasing the pre-existing angulations of the coronary artery take off, with a reduction in the luminal diameter in the proximal portion of the anomalous coronary artery [9].

The clinical significance and risk of a coronary anomaly usually depend on the place and course of the wrong coronary artery origin, and the degree and localization of the culprit stenotic or atherosclerotic lesion [9-10].

Conclusions

Treatment for a coronary anomaly may be medical, percutaneous and/or surgical. Some difficulties may be encountered such as frequent catheter exchanges before finding the best-fitting catheter and guidewire, giving rise to increased fluoroscopic time and a greater amount of contrast agent used during coronary angiography and/or percutaneous coronary intervention (PCI) by reason of different anatomical structures in these patients. Cardiovascular surgery is of vital importance in the therapy of a coronary anomaly of a patient who cannot be effectively treated by PCI. In our case, the marked calcifications and a LDA occlusion in the mid-tract were fundamental for the indication of by-pass therapy.

The most curious and important fact of this case is also that the anomalous RCA was the unique vessel free of atherosclerosis problems and, conversely, the LDA and LCX were, respectively, occluded and suboccluded from atherosclerotic plaques. The anomalous RCA arising from the mid portion of the left anterior descending artery (LDA), crossed anterior to the pulmonary artery (PA) before reaching the right atrioventricular groove. Therefore, here it was absent the possibility of a compression of the anomalous artery between the pulmonary and aortic trunks, particularly during or immediately after exercise.

In conclusion, patients with a coronary vessel anomaly, an angiographic study such as conventional and coronary CT should be performed. The management strategy of these patients may vary, based on clinical presentation, anatomical details and additional findings.

References


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