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Twin left circumflex arteries in a patient undergoing aortic valve replacement

A.Y. ANDREOU, S. THEODOROU, C. MAKRIDES, P.C. AVRAAMIDES

Department of Cardiology, Limassol General Hospital, Limassol, Pano Polemidia, Limassol, Cyprus

Abstract. – We present the case of a patient with severe symptomatic aortic valve (AV) stenosis in whom preoperative coronary angiography revealed two separate left circumflex (LCx) arteries, one arising from the left main coronary artery and the other from the right aortic sinus following thereafter a retroaortic course to the left. The pattern of LCx artery anatomy revealed was recognized as one of bilaterally arising twin LCx arteries that is a rare coronary anomaly with only 7 reported cases in the English literature. We discuss the importance of preoperative identification of this anomaly in patients undergoing AV surgery and describe simple clues in order to easily identify it.

Key Words:
Coronary angiography, Coronary artery anomalies, Anomalous left circumflex artery, Twin left circumflex arteries, Aortic valve surgery.

Introduction

In the largest angiographic series investigating coronary artery anomalies the incidence of an anomalous left circumflex (LCx) artery originating from either the right aortic sinus or the right coronary artery (RCA) has been reported to be 0.37%. It was the second most common anomaly after separate origin of the left anterior descending (LAD) and LCx arteries from the left aortic sinus and in all cases the anomalous LCx artery followed a retroaortic course[1]. Herein we present the case of a patient in whom angiography prior to aortic valve (AV) replacement revealed two LCx arteries originating bilaterally that is a rare coronary anomaly. We discuss the clinical significance of this anomaly during valve surgery and describe clues in order to easily identify it during angiography.

Case Report

A 69 year-old male patient with a history of arterial hypertension, hyperlipidemia, chronic atrial fibrillation and stent angioplasty to the LAD artery was referred for pre-operative coronary angiography because of severe symptomatic tricuspid AV stenosis. Transradial coronary angiography (Figure 1) revealed a normal left main coronary artery (LMCA) that divided into a mildly diseased LAD artery and a mildly diseased branch that coursed toward the obtuse margin supplying the basal, mid and distal-lateral left ventricular (LV) free wall, thereby, qualifying for the LCx artery. Selective RCA angiography showed a dominant, mildly diseased vessel. Aortography (Figure 1) performed as part of the preoperative evaluation was notable for an additional coronary artery suspected to be an aberrant LCx artery. The latter was confirmed by a right aortic sinus injection in the left anterior oblique projection. The vessel was mildly diseased, originated from the right aortic sinus adjacent to the RCA ostium and coursed just beneath the aortic root forming a caudal-posterior loop which characterizes a retroaortic trajectory, to reach its normal position in the left atrioventricular groove eventually supplying branches to the LV obtuse margin. The pattern of LCx artery anatomy revealed was recognized as one of twin LCx arteries. Of note, previous angiography did not reveal the aberrant LCx artery. The patient underwent successful surgical AV replacement.

Discussion

An aberrant LCx artery with origin from the right aortic sinus or the RCA is a very common anomaly and almost invariably the aberrant vessel follows a retroaortic course which is considered benign[1]. Therefore, this anomaly is unlikely to be of clinical significance in the absence of atherosclerosis unless there is concomitant valve disease requiring surgery. In patients undergoing isolated AV replacement, an aberrant retroaortic LCx artery is at risk of ligation or impingement by annular sutures, compression by a relatively large

Corresponding Author: Andreas Y. Andreou, MD; e-mail: y.andreas@yahoo.com

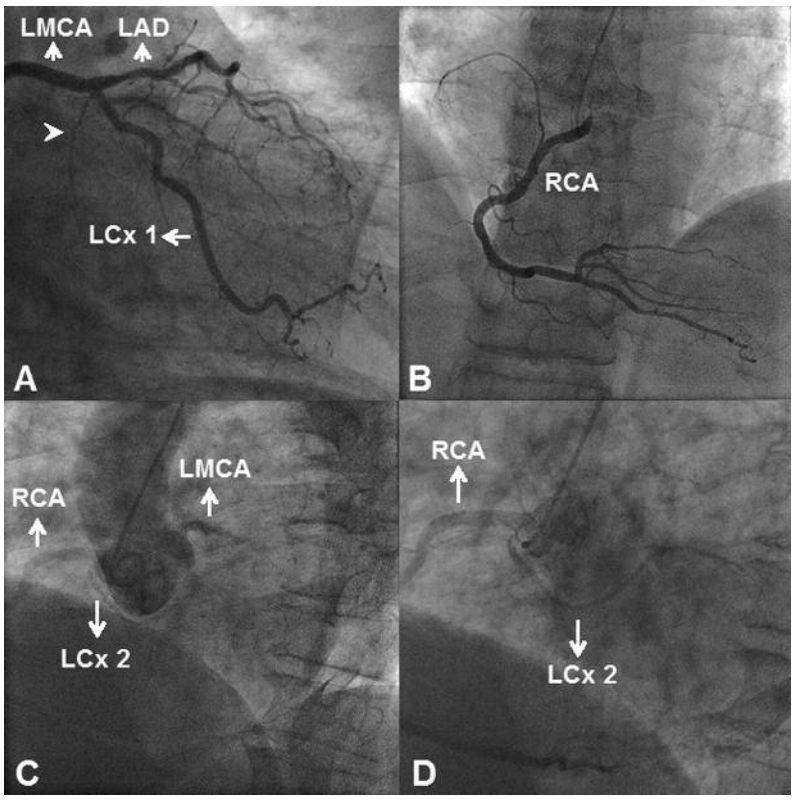

Figure 1. Coronary angiographic views: ***A,*** Left coronary artery angiogram in the right anterior oblique caudal projection displaying the bifurcation of the left main coronary artery (LMCA) into the left anterior descending (LAD) artery and a branch that courses toward the obtuse margin thereby qualifying for a left-sided left circumflex (LCx 1) artery. Note that beyond its very proximal part which is occupied by a small vessel (arrowhead), the left atrioventricular groove is devoid of the continuation of the LCx artery, leaving an avascular area in the posterior-lateral left ventricular wall. ***B,*** Selective angiogram of a dominant right coronary artery (RCA) in the posterior-anterior cranial projection. Note that no other vessel is seen arising from the ostial RCA or right aortic sinus. ***C,*** Aortogram in the left anterior oblique (LAO) projection. Note that in addition to the RCA, the right aortic sinus gives rise to another vessel that was recognized as a second LCx artery (LCx 2). ***D,*** Right aortic sinus injection in the LAO projection displaying the LCx 2 arising adjacent to the RCA ostium and coursing to the left forming a caudal-posterior loop which indicates a retroaortic trajectory.

sewing ring distorting the aortic root or compression against a calcified mitral or tricuspid annulus or a prosthetic mitral or tricuspid valve sewing or annulopasty ring[2-5]. Inadvertent suture ligation or compression of such an aberrant LCx artery by the prosthetic ring or a periannular hematoma has also been reported during isolated mitral valve replacement and mitral valve repair with an annuloplasty ring[2,4,6]. Depending on the severity of obstruction of the LCx artery, its dependent vascular territory, and the preoperative myocardial reserve, the iatrogenic vascular lesion produced may manifest as perioperative myocardial ischemia, infarction or even death. Sudden death late after AV replacement where an aberrant retroaortic LCx artery had been compressed by the sewing ring has been reported[2]. It is, therefore, imperative to detect this anomaly during preoperative coronary angiography to allow for a tailored surgical approach to prevent these complications. In case of AV replacement, injury to an aberrant retroaortic LCx artery during placement of annular sutures can be avoided by adequate mobilization of the vessel from the aortic annulus whereas implantation of a slightly undersized prosthesis helps prevent compression of the vessel by the prosthetic sewing ring[2-5].

There have been only 7 previously reported cases of bilaterally arising twin LCx arteries; one LCx artery arose from the LMCA and the other from the right aortic sinus (3 cases) or ostial RCA (4 cases) following thereafter a retroaortic course to the left[7-13]. This is the first report to describe this anomaly in a patient undergoing AV surgery. Herein selective RCA engagement prevented visualization of the right aortic sinus-connected LCx artery and if an aortogram had not been obtained we would have failed to detect it with risk of injury to it during subsequent AV replacement. Scrutiny of the left coronary angiogram revealed that beyond its very proximal part which was occupied by a small vessel, the left atrioventricular groove was devoid of the continuation of the LCx artery, leaving an avascular area in the posterior-lateral LV wall that is the sign of "nonperfused myocardium". The latter could have served as a clue to the presence of an aberrant LCx artery in our patient who had no history of myocardial infarction, echocardiographic wall motion abnormalities or collateral flow toward the LCx artery territory to suspect occlusion of the vessel. Yet, in similar cases where left ventriculography in the right anterior oblique view is available one may suspect the presence of such an aberrant LCx

artery by visualizing the "aortic root sign" that is a radiopaque "dot" posterior and caudal to the non-coronary aortic sinus being the aberrant LCx artery appearing in profile during its retroaortic course[14]. In such cases subselective RCA angiography can help visualize an aberrant LCx artery with origin from the ostium of the RCA or the right aortic sinus.

Conclusions

We have presented a case of twin LCx arteries comprised of a bilaterally connected vessel with retroaortic course of the right-sided LCx artery in a patient undergoing AV replacement. An aberrant retroaortic coronary artery has major implications during valve surgery therefore preoperative diagnosis of this anomaly is mandatory. This case highlights that because of a bilateral distribution of coronary flow to the LCx artery territory one may fail to recognize the sign of "nonperfused myocardium" and hence not suspect the presence of an aberrant LCx artery particularly if it arises independently from the right aortic sinus. Cardiologists must be vigilant to detect this anomaly in patients requiring valve surgery in which case cardiac surgeons must be able to adopt a modified surgical approach in order to prevent injury to the retroaortic right-sided LCx artery. They must be aware of and search for simple angiographic clues such as the sign of "nonperfused myocardium" and the "aortic root sign" so as not to inadvertently miss the aberrant retroaortic LCx artery.

Conflict of Interest

The Authors declare that there are no conflicts of interest.

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