Images in Cardiology

Single Right Coronary Artery Supplying the Entire Heart

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A 60-year-old man with hypertension, hyperlipidemia, and noninsulin-dependent diabetes had been followed for bicuspid aortic valve disease. Transthoracic echocardiography revealed severe bicuspid aortic valve stenosis with mean and peak transvalvular gradients of 57 mm Hg and 80 mm Hg, respectively.

He recently became symptomatic and was put forth for surgical consideration. Preoperative angiography demonstrated that the left anterior descending (LAD) artery arose from the right coronary artery (RCA) (Fig. 1A). This vessel traversed to the anterior interventricular groove and provided normal LAD circulation. The left circumflex (LCX) artery was a continuation of the ongoing posterolateral artery and proceeded superiorly along the posterior interventricular groove providing the obtuse marginal vessels (Fig. 1B and C).

Coronary computed tomography confirmed that the entire coronary circulation arose from the RCA with the LAD originating from the RCA (Fig. 1D). The single coronary artery branched into 2 vessels, one taking a course similar to an RCA and the other becoming the LAD. The RCA branch traveled posteriorly along the atrioventricular groove, bifurcating into the posterolateral artery and an ongoing left coronary system along the left atrioventricular groove in the expected location of the LCX providing the marginal branches (Fig. 1E and F).

At surgery, antegrade cardioplegia was given via the aortic root once to achieve cardiac arrest. The stenotic bicuspid aortic valve was replaced with a biological valve. The RCA and adjacent LAD orifices were seen at a reasonable height above the aortic annulus, permitting standard supra-annular valve implantation. Because the LAD was not running in the aortic wall, there was no surgical revision to any coronary artery. However, the course of

Novel Teaching Point

- We should assess coronary artery anatomy before aortic valve replacement, particularly if an aortic root procedure is contemplated.

this artery would have surgical implications if aortic root procedures, such as a Bentall, an aortic valve-sparing root, or a Ross procedure, had been contemplated. These procedures require mobilization and reimplantation of the coronary ostia, which may have been challenging in this case. His subsequent postoperative course was uneventful.

A single coronary artery is an extremely rare congenital coronary artery anomaly in which only 1 coronary artery arises from the aorta to supply the entire heart. The prevalence is 0.02% to 0.06% based on angiography.¹ This variance may be associated with congenital heart diseases and an increased risk of sudden death due to decreased myocardial perfusion.² The relationship between bicuspid aortic valves and single coronary artery is unclear; however, a case report has been published.³

We have reported a rare case of bicuspid aortic valve stenosis associated with a coronary anomaly. Although routine aortic valve replacement was performed uneventfully in this case, the need for a more complicated root procedure (due to aneurysm, dissection, infection, or desire for a pulmonary autograft) would have been complicated by this anomaly. Because the entire coronary circulation is dependent on a single coronary orifice, any complications related to coronary reimplantation would have been poorly tolerated. This case illustrates the need for preoperative coronary angiography in patients undergoing aortic valve surgery, particularly if a root procedure is being contemplated.

Received for publication January 5, 2020. Accepted January 27, 2020.

Ethics Statement: This article conforms to the research ethics principles of the University Health Network.

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See page 186 for disclosure information.

Funding Sources

The authors have no funding sources to declare.

Disclosures

The authors have no conflicts of interest to disclose.

Figure 1. The left anterior descending (LAD) artery arises from the right coronary artery (RCA). An **arrow** indicates an origin of the LAD from the RCA (A). This vessel traverses to the anterior interventricular groove and provides normal LAD circulation. The left circumflex (LCX) artery is a continuation of the ongoing posterolateral artery and proceeds superiorly along the posterior interventricular groove providing the obtuse marginal vessels (B, C). Computed tomography shows that the LAD originates from the RCA. An **arrow** indicates the origin of the LAD from the RCA (D). The entire coronary circulation comes from the right coronary sinus (E, F). The RCA travels posterior along the atrioventricular groove bifurcating into the posterolateral artery and an ongoing left coronary system along the left atrioventricular groove in the expected location of the LCX providing the marginal branches. PIV, posterior interventricular; PLA, posterolateral artery.

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