EDITORIAL

Two Mechanisms of Coronary Stenosis and Two Treatment Strategies in a Single Coronary Artery

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S hikuma, et al. reported a complex percutaneous coronary intervention (PCI) in a patient with a single coronary artery from the right sinus of Valsalva.10 Additionally, the first case of a single coronary artery diagnosed by coronary angiography/arteriography was reported in 1967.11 Lipton, et al. summarized the systematic classification criteria of these anomalies.3 For example, a Group I [Right (R) I/Left (L) I] solitary vessel follows the course of either a normal right or left coronary artery, and anastomoses with the other side of an artery in the atrioventricular groove. A Group II (RII/LII) coronary artery arises from either the right or left sinus of Valsalva, and the opposite artery bifurcates in and runs across the base of the heart. Certain RII/LII arteries run anterior to the pulmonary trunk (PT) [RII-anterior to the great vessels (A)/LII-A], while the others run between the aorta and the PT [RII-between the great vessels (B)/LII-B] or posterior to the aortic root [RII-posterior to the great vessels (P)/LII-P]. The Group III (RIII) vessel originates from the right sinus and branches into trifurcate courses. The left anterior descending branch courses between the PT and the aorta, while the left circumflex branch runs posterior to the aorta (Figure).

One of the biggest studies regarding coronary artery anomalies was conducted by Yamanaka and Hobbs in 1990.4 Using coronary arteriography, they found that 1.3% of the patients (1,686 out of 126,595) exhibited coronary artery anomalies, including 0.044% of the patients (56 out of 126,595) with a single coronary artery.12 Type LI and RII were found more frequently than the other subtypes.13 In addition, they suggested subtypes that were novel to Lipton’s criteria,3 including sepal types (RII-S/LII-S) and combined types (RII-C/LII-C).14

Although the process of coronary artery development is not fully understood,3 embryologists have come to a consensus that the primitive coronary vascular plexus develops in the epicardium before it grows into the aortic root from the peritruncal ring.15 A single coronary artery and certain other coronary anomalies with both abnormally arising and normally formed peripheral vessels should, therefore, occur in the connecting phase to the sinuses of Valsalva. The Tbx1 gene,7 vascular endothelial growth factor pathways,8 CXCL12/CXCR4 axis,9 and other factors have been suggested to be involved with coronary artery rooting. However, whether or not coronary malformation is preventable remains unknown.

Patients with types RII-B/LII-B and RIII have coronary vessels that run between the PT and the aorta, and the compression from the two large vessels sometimes causes angina symptoms, even without atherosclerosis, which consequently requires coronary artery bypass grafting (CABG). Eckart, et al. reported that in 21 out of 126 young military recruits (18 to 35 years old) with nontraumatic sudden death who underwent autopsies, coronary anomalies accounted for the deaths in those cases in which the left coronary arteries arose from the right sinus and ran between the PT and the aorta; but the authors did not distinguish between single coronary artery and ectopic coronary origins.16 However, Yamanaka, et al. pointed out several patients with type RI single coronary arteries or ectopic coronary arteries, like types RII-A, RII-P, or LII-P, which led to nonatherosclerotic angina. This suggests another unknown pathophysiology, even if compression by the great vessels did not exist.17

Atherosclerotic changes in coronary anomalies could occur via altered hydrodynamic parameters, like wall shear stress, which can lead to endothelial injury. Konta and Beti reported that the pattern of coronary artery movement affected the severity of the atherosclerotic lesions.18 They emphasized a compression type of movement in which a segmental length of the vessel is shortened without vertical deviation of the artery. This movement type has been seen frequently in several specific sites, including an ostial obtuse marginal branch. Shikuma, et al. also found the angina culprit lesion in the obtuse marginal branch.19 The partial restriction of the coronary artery movement caused by out of the ordinary development might reinforce harmful compression in another site, and it may result in a higher rate of atheroscle-
Classification of the angiographic types of single coronary arteries and the basic strategies for revascularization for coronary stenosis. Those patients with types RII-B/LII-B and RIII exhibit a coronary artery that runs between the great vessels. In these types, the compression of a coronary artery from the great arteries results in a mechanical coronary stenosis. In order to repair this stenosis, a CABG is currently recommended. Even in the other types of segments, atherosclerotic stenosis can occur. In particular, those coronary vessels with a compression type of movement in which a segmental length of the vessel is shortened without a vertical deviation of the artery tend to be associated with atherosclerotic stenosis. This stenosis can be repaired by PCI.

Disclosures

Conflicts of interest: None.

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