Percutaneous coronary intervention in two patients with a solitary coronary artery from the right coronary sinus of Valsalva

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Two patients with a common coronary artery arising from the right sinus of Valsalva, who underwent coronary angiography and percutaneous coronary intervention following an acute coronary syndrome, are presented. The anatomic description based on previously published classification schemes is described. The clinical implications of this rare coronary anomaly and interventional considerations are addressed.

S
ingle coronary arteries arising from the right sinus of Valsalva (RSV) are exceedingly rare. Yamanaka et al. ascertained that of 126 595 patients undergoing coronary angiography, 1.15% had anomalies of origin and distribution, and of those, 0.017% had left main (LM) arteries arising from the RSV.1 In a smaller case series, this coronary anomaly was found in 0.19% of subjects.2

CASE 1
A 77-year-old female with a history of hypertension presented with chest pain that began 4 hours prior to arrival at the emergency department. Blood pressure on presentation was 164/108 and pulse was 90 bpm. Initial ECG revealed ST elevation involving leads V1-2, as well as I and AVL. There was a 2-mm ST depression in the inferolateral leads. A clot overlying a critical lesion in the proximal LM artery, and a 60-70% lesion immediately before the branching point of the LM. Percutaneous coronary intervention (PCI) was deferred, and the patient was kept on low molecular weight heparin and glycoprotein IIb/IIIa inhibitors for 48 h to reduce the clot burden in the LM artery. The follow-up procedure was delayed for 1 week due to the development of contrast-induced nephropathy, which eventually resolved. Coronary angiography via a right transfemoral approach, and using a Voda 3.5 guiding catheter (Boston Scientific) subsequently showed that the clot size was significantly smaller than initially estimated. Successful PCI of the proximal segment (3.0×15 Promus stent, Boston Scientific) and distal LM segment (3.0×23 Promus stent, Boston Scientific) was performed. Both stents were further dilated with a high-pressure balloon (3.5×8 Quantum Maverick Balloon, Boston Scientific) (Figure 1c). The patient was subsequently discharged home in stable condition.

CASE 2
A 47-year-old hypertensive male, with a history of ischemic heart disease and PCI to the mid RCA 9 years prior, presented with an inferior ST-segment elevation myocardial infarction (STEMI) with right ventricular involve-
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ment, for which he received reteplase, a plasminogen activator at his local hospital. He was then transferred to our center for coronary angiography. This was performed via a right transradial approach, and revealed a single coronary artery arising from the RSV. The common artery was short and gave rise to three separate arteries—the RCA, LCX, and the LAD (Figures 2a-b). The LAD was long and ran caudally and anteriorly, then most likely took an intramuscular course and gave rise to a small septal branch before continuing. The LCX coursed caudally and posterior to the aorta and the RCA originated anteriorly and rightward to the aorta. The proximal RCA contained a critical lesion that appeared hazy and seemed to be the culprit lesion. The previous stent in the mid RCA was patent. The LCX was small in caliber and contained a critical lesion in the proximal segment, at which point it was occluded just before dividing into the obtuse marginal branches. The proximal LAD was free of disease; however, the mid and distal segments exhibited diffuse disease and were small in caliber. A Judkin’s right 4 guiding catheter (Boston Scientific) was used to select the common artery, and direct stenting of the culprit lesion in the RCA was performed using a 3.0×18 Promus stent (Boston Scientific), which was high pressured using a 3.5×12 Quantum maverick balloon (Boston Scientific) with no complications.

Discussion

Ishikawa et al. described the anatomical varieties of single coronary arteries arising from the RSV based on the orientation of the proximal segment of the LM artery to the aorta and pulmonary artery. This anatomical description was further simplified by use of a simple method to rapidly identify the anatomical variety using the right and left anterior oblique view.

Applying the “Dot and Eye” method described by Harvey et al. to identify the anatomical variety, Case 1 is of the posterior variety as the LM passes posterior to the aortic root and caudally (Figure 1b). The contrast column in the LM artery is seen “on end” giving the appearance of a dot in the right anterior oblique (RAO) projection, suggesting that the LM artery is posterior to the aorta (Figure 1b).

Figure 1a. Left anterior oblique view of the common coronary artery and its branches.

Figure 1b. Right anterior oblique view of the common coronary artery and its branches with critical disease in the proximal LM artery.

Figure 1c. Left anterior oblique view of the common coronary artery, following PCI of the proximal and distal anomalous LM artery.
Case 2 involves a short common artery arising from the RSV and giving rise to three separate arteries. The LAD turns to the left and caudally, giving the appearance of the lower rim of an eye shape on an RAO projection (Figure 2b). In addition, a small septal branch arises shortly after originating from the common coronary artery, consistent with septal anatomical variety. The LCX origin, though arising from the RSV, follows a posterior and caudal course. This is confirmed by the origin of the contrast-filled proximal LCX appearing to be “on end” as a dot posterior to the aortic root on the RAO projection.

A common artery from the RSV then gives rise to three separate arteries, with the LAD artery following a very rare septal course that, to our knowledge, has not been well described previously, both from an anatomical and a prognostic standpoint.4

Proper identification of the course of the proximal LM has potentially important surgical implications. In both cases, the common artery and its branches encircle the aortic root, an important consideration when performing an aortic valve replacement due to potential direct injury to the common artery by sutures. Both coronary anomalies were classified as potentially serious anomalies1 and both patients presented with an acute coronary syndrome, yet they have not had any symptoms attributable to the coronary anomalies. Numerous reports have singled out LM coronary arteries arising from the RSV with the “interarterial” course as being the most serious anatomical variety, potentially leading to ischemic symptoms and, in some cases, sudden cardiac death.1,2,5 Given the rare nature of such coronary anomalies, no guidelines exist for the preferred method of revascularization, although surgical revascularization for the interarterial anatomical variety has been advocated due to the location of the LM artery, a position prone to mechanical compression by the two great arteries. In Case 1, PCI of the LM was performed using drug-eluting stents, and bypass surgery was not chosen because the LCX and LAD appeared small in caliber and therefore not optimal for grafting. As LM PCI with drug-eluting stents are gaining acceptance as a revascularization option, more cases involving anomalous LM arteries are expected to be treated percutaneously. There are, however, important considerations for treating LM arteries arising from a common coronary artery or in close proximity to the RCA. The area of the myocardium in jeopardy is far larger compared to the treatment of the LM artery arising alone from the left coronary cusp. Moreover, careful selection of the guiding catheter is important to avoid potential injury or dissections inflicted on the common artery. The choice of access is also important, for example, transradial approach performed in Case 2 may be unfavorable given that the guide is often influenced by breathing, potentially causing instability of the selecting guide causing injury to the common artery.

In conclusion, awareness of the position and course of the anomalous common artery may aid in predicting prognosis and choice of revascularization.

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