Case Report

Percutaneous Intervention in a Patient with a Single Coronary Artery Arising from the Right Coronary Sinus of Valsalva

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A single coronary artery (SCA) arising from the sinus of Valsalva and supplying the entire heart is a rare congenital anomaly. According to the modified Lipton's classification, R-1 is by far the most rare subtype of SCA, with an incidence of 0.0008% in patients undergoing coronary angiography. We present a case with an unreported anomaly, classified as Lipton R-I subtype, which initially followed the normal course of the right coronary artery. The posterior descending artery then proceeded as the distal and middle sections of the left anterior descending artery, while the posterolateral branch proceeded as the left circumflex artery and finally terminated as the proximal left anterior descending artery. The patient underwent percutaneous intervention in the posterolateral branch for an acute coronary syndrome.

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A single coronary artery (SCA), defined as a coronary artery that arises from the sinus of Valsalva and supplies the entire heart, is congenital and rare.[1-5] The majority of SCA anomalies are benign and asymptomatic; however, life-threatening symptoms, such as myocardial ischemia, arrhythmias, syncope, or sudden death, can occur in up to 20% of patients.[2] We report a patient with an isolated single right coronary artery, classified as Lipton R-I subtype, which was confirmed by 64-slice computed tomography and coronary angiography. Finally, the patient underwent successful percutaneous intervention for an acute coronary syndrome. This is the first report of this kind of anatomic anomaly.

Case presentation

A 75-year-old female, with a history of type-2 diabetes, hypercholesterolemia and hypertension, was admitted to our hospital because of typical chest pain on effort over one month. Cardiac examination and baseline electrocardiography were normal. Echocardiography revealed no hypokinesis of any ventricular walls, with an overall estimated ejection fraction of 65%. Laboratory tests did not show any significant alterations of cardiac biomarkers. The GRACE and TIMI risk scores of this patient were 96 and 3, respectively; she was diagnosed with acute coronary syndrome at low to intermediate risk of an adverse cardiac event. An initially optimal medical therapy was implemented. Meanwhile, since a delayed invasive approach was reasonable for a patient not at high risk, we recommended delayed invasive angiography;[6] however, the patient preferred conservative treatment. As multislice cardiac computed tomography (MSCT) could provide direct noninvasive visualization of coronary disease and the

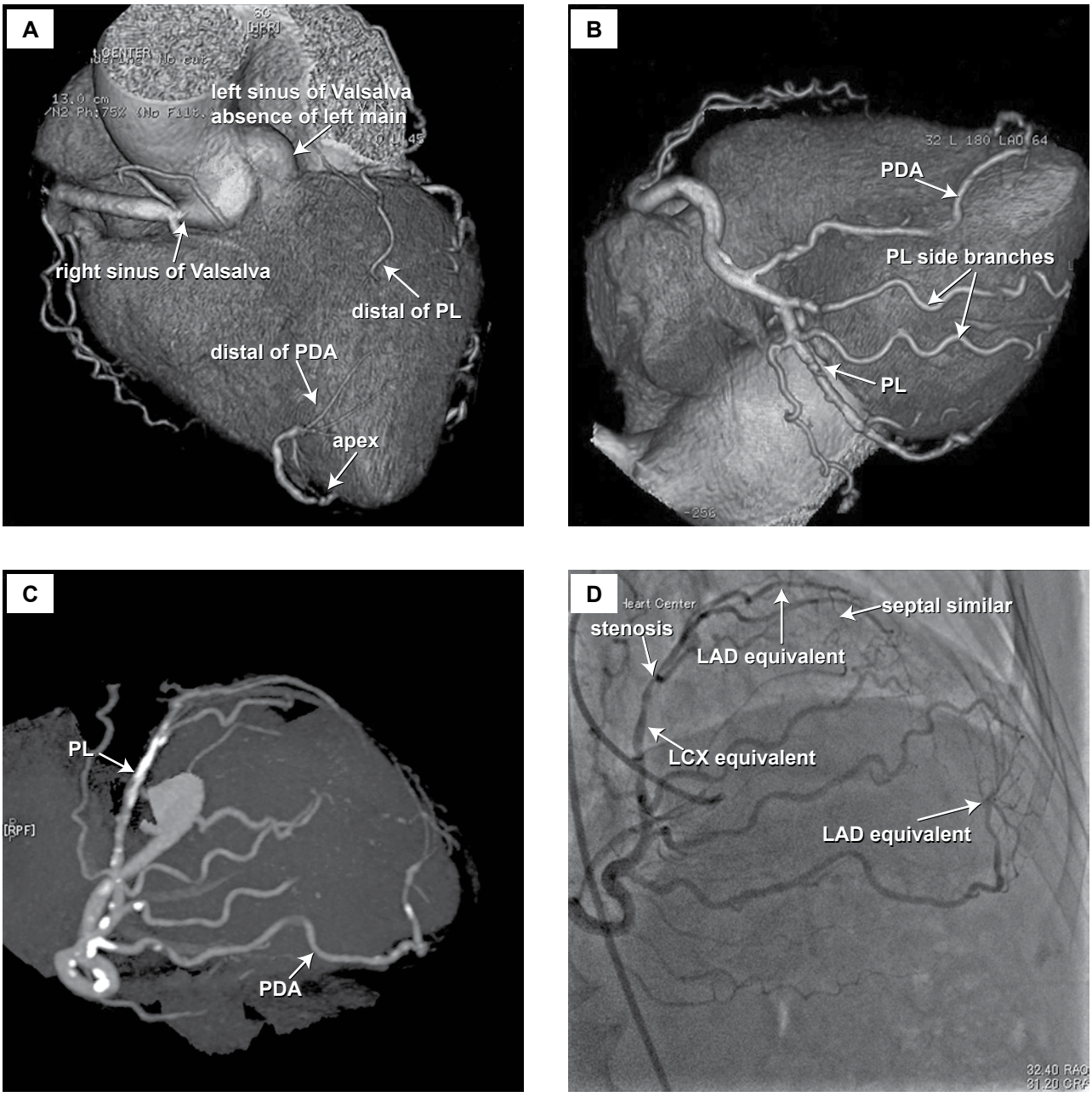

Figure 1. Multislice cardiac computed tomography and angiography images show the isolated single right coronary artery and the total course of the right coronary artery; a moderate stenosis is identified in the middle posterolateral branch. LAD – left anterior descending; LCX – left circumflex; PDA – posterior descending artery; PL – posterolateral branch.

assessment of coronary stenosis, a cardiac MSCT examination (Light speed VCT, GE) was performed two days after admission, which revealed the absence of a left coronary ostium, with an isolated single right coronary artery (RCA) arising from the right sinus of Valsalva (Figure 1A). Initially, the RCA coursed down the right posterior atrioventricular groove normally, giving rise to the posterolateral (PL) branch and the posterior descending artery (PDA). Then, the PL branch crossed the crux into the left posterior atrioventricular groove, as the left circumflex artery, and gave several side branches to supply the left atrium, posterolateral and lateral walls of the left ventricle. Finally, the distal PL descended into the anterior interventricular groove, as the proximal left anterior descending artery, to supply the upper anterior wall

of the left ventricle (Figure 1A-C). The distal part of the PDA crossed the apex of the left ventricle and ascended into the anterior interventricular groove as the distal and middle left anterior descending artery, which finally terminated with numerous small branches to supply the apex and most of the anterior wall of the left ventricle (Figure 1A-C).

There was a severe calcified, intermediate lesion in the middle trunk of the PL branch (Figure 1C). We determined that the PL branch was the culprit artery responsible for the acute coronary syndrome. Thus, we again recommended angiography with the intent to perform revascularization. Finally, the patient consented to our suggestion on the seventh day of admission.

Coronary angiography confirmed the MSCT findings; moreover, the PL lesion seemed more significant than when identified by cardiac MSCT (Figure 1D). Intravascular ultrasound subsequently showed a significant stenosis caused by mixed plaques in the

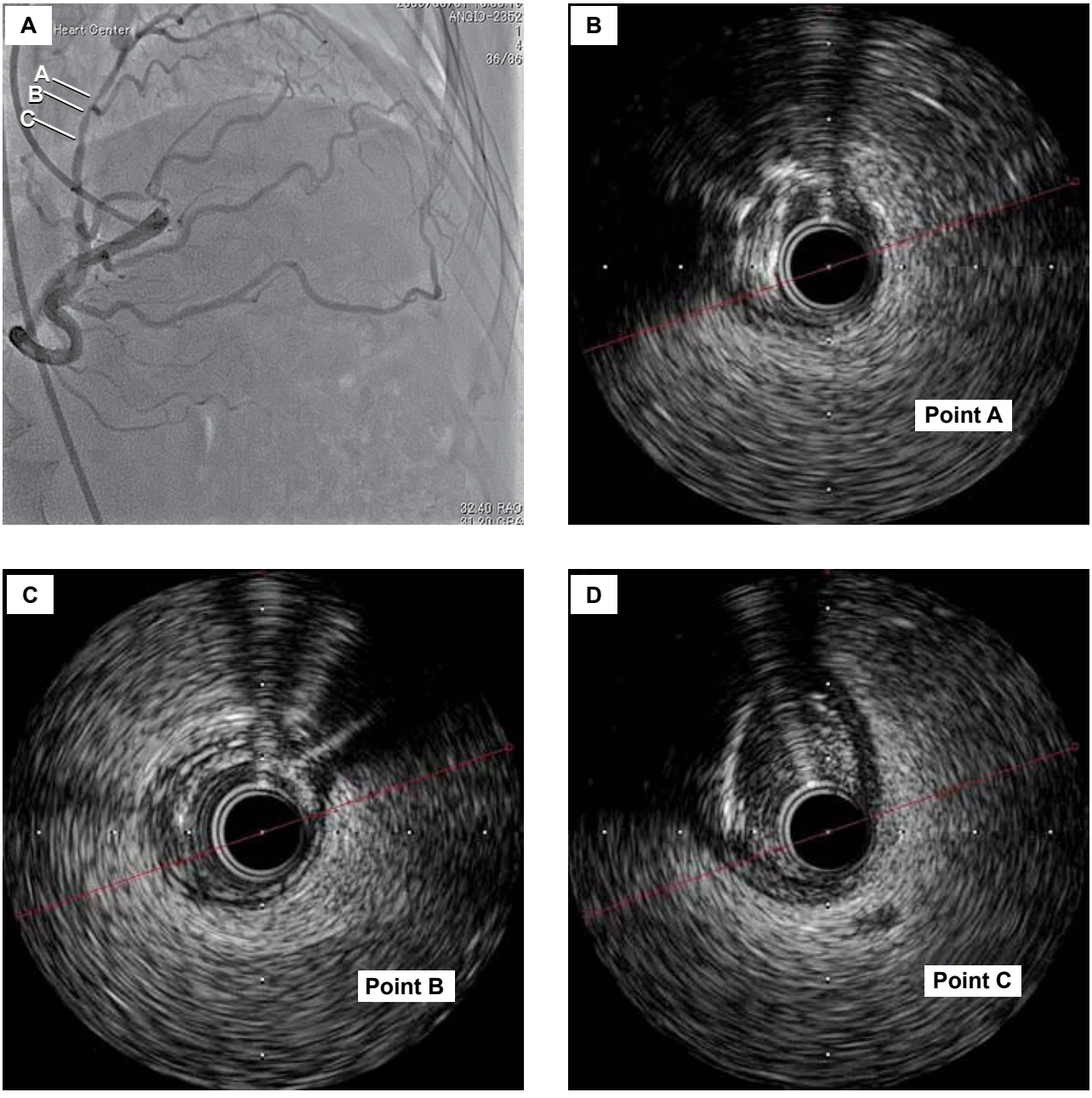

Figure 2. Intravascular ultrasound images showing eccentric calcified plaque located at the distal lesion (Point A); eccentric fibrous plaque located at the middle lesion (Point B); eccentric soft plaque located at the proximal lesion (Point C).

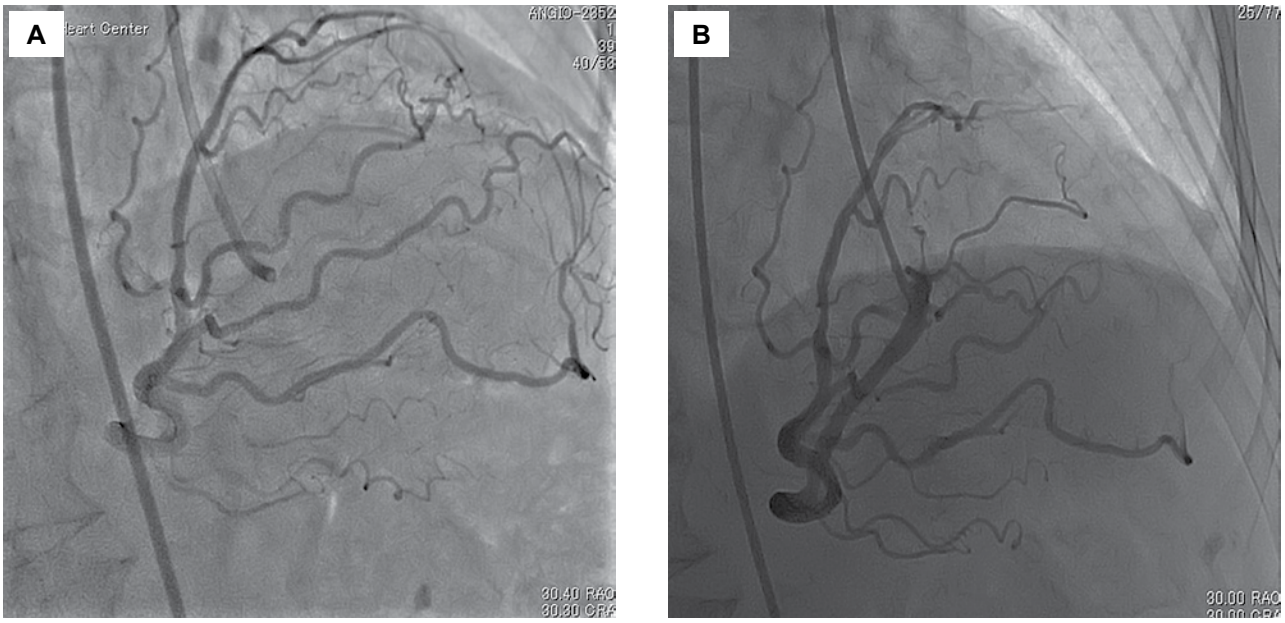

Figure 3. A: The result after stenting. B: One-year angiographic follow up shows no in-stent stenosis.

lumen of the PL trunk (Figure 2). Successful percutaneous coronary intervention in that segment was performed (3.0 × 18 mm Promus stent, Boston Scientific). The stent was post-dilated with a high-pressure balloon (3.0 × 14 mm Quantum Maverick Balloon, Boston Scientific). Angiography showed the final result (Figure 3A). After discharge, the patient was free of symptoms and 1-year follow-up coronary angiography showed no restenosis in the stent (Figure 3B).

Discussion

A single coronary artery (SCA) is a rare coronary artery anomaly, particularly in the absence of structural heart disease.1-5 According to the modified Lipton's classification of SCA, Yamanaka reported that the incidence of the R-I subtype was 0.0008% in a large series of 126,595 patients undergoing coronary angiography.[2]

The case we presented was classified as Lipton R-I subtype:[2-3] the RCA supplied the entire heart, initially following the normal course of the RCA, after which the PDA proceeded as the distal and middle left anterior descending artery, while the PL branch proceeded as the left circumflex artery and the proximal left anterior descending artery. To the best of our knowledge, this kind of anomaly has never been reported previously.

In general, the most convenient examination for a suspected coronary anomaly is exercise stress testing; however, this test can be negative or conflicting.[5,7] Cardiac MSCT can provide 3-dimensional images to identify the characteristics of coronary anomalies and coronary disease;[8-10] moreover, it may be useful for identifying the culprit artery and guiding the intervention strategy in such patients.[11] Coronary angiography is regarded as the standard method for the detection of coronary artery anomalies.[5] However, if it fails to visualize the origin or course of a coronary anomaly, cardiac MSCT may be useful for the better identification of the coronary anatomy.[10] Finally, cardiac magnetic resonance imaging can also provide 3-dimensional images; however, it is not universally available for economic and technical reasons.

The prognosis of individuals with an isolated SCA anomaly is uncertain; the incidence of life-threatening symptoms is very low and the therapeutic approach to ischemic symptoms is similar to that in the usual patient with ischemic heart disease.[7-8] As there are no established treatment guidelines, revascularization would be considered only in those patients with significant atherosclerotic changes and documented ischemia. There are several probable mechanisms of myocardial ischemia in SCA.[5,12-13] Significant stenosis of the PL branch caused by atherosclerotic plaque was the mechanism of ischemia in this case. A reasonable inference was the existence of multiple coronary risk factors; in addition, the in-

creasing flow in the RCA may accelerate the atherosclerotic process.

Conclusion

We present a unique case of a patient with an R-I subtype SCA, treated with percutaneous intervention in the PL. However, definitive standardization of treatment for these patients is difficult, given the low frequency and anatomical variations of the anomaly. Presently, each case should be treated individually, according to the anatomical variations.

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