Percutaneous intervention in a patient with a rare single coronary artery from the left coronary sinus of valsava

Jian Dai, Osamu Katoh[1], Eisho Kyo[1], Xun Jie Zhou

Departments of Cardiology, Yue Yang Hospital of Integrated Traditional Chinese and Western Medicine, Shanghai University of Traditional Chinese Medicine, Shanghai, China, [1]Cardiology, Kusatsu Heart Center, Shiga, Japan

A single coronary artery (SCA) arising from the sinus of Valsalva and supplying the entire heart is a rare congenital anomaly. According to modified Lipton's classification, L-1 subtype is a most rare type of SCA. We presented a case classified as L-I subtype, in which initially left main divided into the left anterior descending and circumflex arteries normally; then, the second septal artery proceeded as the proximal right coronary artery, the distal circumflex artery proceeded as the middle and distal right coronary artery. The patient finally underwent percutaneous intervention in the left anterior descending artery owing to a stable angina.

Key words: Coronary angiography, multi detector computed tomography, single coronary artery

INTRODUCTION

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] Majority of SCA anomalies are benign and asymptomatic. However, life-threatening symptom can occur in minor of patients.[2] We report a patient with an isolated SCA classified as Lipton L-I subtype. Finally, the patient underwent percutaneous intervention owing to a stable angina. Moreover, this is an extremely rare kind of anatomy anomaly.

CASE REPORT

A 66-year-old male with history of diabetes, hypercholesterolemia and hypertension was referred to our heart center complaining of acute chest pain. The baseline electrocardiography [Figure 1a] and cardiac examination were normal. Echocardiography revealed no hypo kinesis of all ventricular walls with ejection fraction of 70%. Laboratory tests did not show any significant alterations of cardiac biomarkers. He was considered with probably stable angina.

A 64-slice coronary computed tomography (MSCT, GE, USA) was performed two days after admission, which revealed an absence of the right coronary ostium with an isolated single left coronary artery arising from the left sinus of valsalva [Figure 1b]. Initially the left main trunk divided into the left anterior descending (LAD) and left circumflex (LCX) arteries normally. At the proximal second septal artery, it divided into two side branches, one branch crossed the right anterior ventricle and climbed up as the conus branch; then, descended into the anterior right atrioventricular groove as the proximal right coronary artery (RCA); the other branch proceeded to the right anterior ventricle as the right ventricular branch [Figure 1b and c]. The distal LCX proceeded into the left posterior atrioventricular groove to the crux of the heart, after giving off the posterior descending artery (PDA) in the posterior interventricular groove, proceed into the right posterior atrioventricular groove as the distal RCA; and then ascended into the right anterior atrioventricular groove as the middle RCA, this RCA gave off a side branch to the acute margin of the right ventricle as the acute marginal artery [Figure 1c and d]. There was a severe calcified, diffuse lesion in the proximal and middle LAD, which covered the ostia of the second septal and second diagonal arteries.

Thus, the patient was diagnosed with coronary disease and SCA; following a written informed consent, the patient was subjected to percutaneous revascularization of the LAD.

The patient underwent coronary angiography eight days after admission, which confirmed the findings of MSCT [Figure 2a]. Intravascular ultrasound (40 MHz, Boston, USA) subsequently showed a significant diffuse lesion in the proximal and middle LAD [Figure 2b]; there was no stenosis at the ostia of the second septal and diagonal arteries. Two stents (Cypher select stents, 3.0 × 33 and 3.5 × 18 mm, Cordis, USA) were implanted in the LAD; final kissing balloon was performed between the LAD and second diagonal artery due to plaque shifting, final intravascular ultrasound (IVUS) checking and angiography showed a circular stent expansion with complete apposition of the stent strut to the vessel wall [Figure 2c and d]. After discharge, the patient received dual anti-platelet therapy (aspirin 100 mg/day, clopidogrel 75 mg/day) for 12 months, and then did not have any symptoms in 4-year follow-up; one year follow-up of angiography showed no restenosis in stent [Figure 3].

DISCUSSION

SCA is a rare coronary artery anomaly, particularly in the absence of structural heart disease.[1-5] According to modified Lipton's classification of SCA, Yamanaka *et al.*, reported that the incidence of L-1 subtype was 0.016% in patients undergoing coronary angiography.[2]

The case we present is classified as Lipton L-I subtype, the second septal branch proceeds as the proximal RCA, and the distal LCX proceeds as the middle and distal RCA. To the best of our knowledge, this kind of anomaly is extremely rare.

In general, the most convenient examination for suspected coronary anomaly is exercise stress testing; however, this test can be negative or give conflicting results.[5,6] On the other hand, cardiac MSCT allows in identifying comprehensive characterizations of coronary artery anomaly and may be useful to gain accurate insight into the culprit artery;[7-9] this test is not necessary when the diagnosis and therapeutic approach are clearly established by coronary angiography. Coronary angiography is commonly used as the standard method to detect coronary artery anomaly;[5] if we fail to visualize the origin and total course of a coronary artery anomaly accurately, cardiac MSCT examination may be useful to better identify the accurate coronary anatomy; moreover, if necessary, it could guide the intervention therapy. Finally, cardiac magnetic resonance imaging provides 3-dimensional image and patient could avoid exposure to radiation; but it is not an universal application due to economic and technical reasons.

Prognosis of individuals with isolated SCA anomaly is uncertain; the incidence of life threatening symptom is
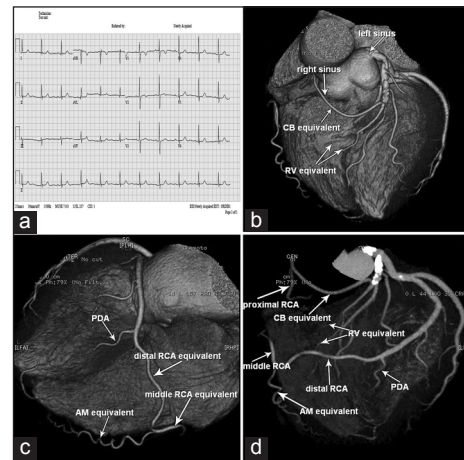

Figure 1: (a) Electrocardiography is normal. (b) VR image shows a branch of the second septal artery proceeds as the proximal RCA. RCA: right coronary artery, VR: Volume rendering. (c) VR image shows the distal circumflex artery proceeds as the distal and middle RCA. (d) Maximum intensity projection shows the total course of the left coronary artery
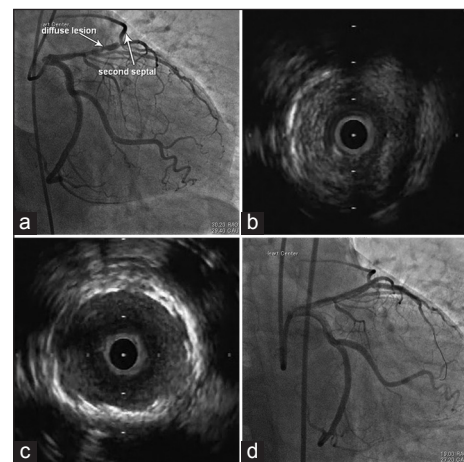

Figure 2: (a) Angiography shows a diffuse lesion in the LAD. (b) IVUS image shows a large mix plaque in middle LAD. (c) IVUS image shows the final result after stenting. (d) Angiography shows the final result after stenting
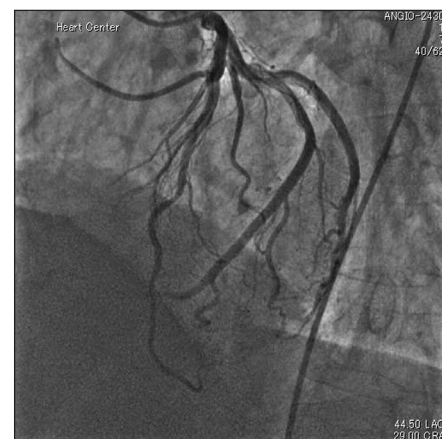

Figure 3: 1-year follow-up of angiography shows no restenosis in the stents

very low.[6] Due to no established treatment guidelines, revascularization would be considered only in those patients with documented ischemia. There are several probable

mechanisms of myocardial ischemia in SCA.[5,10] Significant stenosis of the LAD was the mechanism of ischemia in this case.

Generally, performing intervention of a SCA is challenging and technically difficult since a severe complication may be catastrophic. It requires a proper selection of instruments and adequate expertise of the operator to perform the intervention. Fortunately, in this case, due to the ostium of the SCA with large diameter, a usual 7F JL 4.0 guiding catheter (Cordis, USA) could provide better coaxial support and avoid damage to the ostial left main; additionally, the lesion without endangering the left main made it suitable for percutaneous approach; however, as a true trifurcation lesion, the second septal and diagonal arteries were at a high risk of acute occlusion, especially acute occlusion of the septal artery would result in the acute anteroseptal and inferior walls myocardial infarction; thus, it was more important for us to pre-wire two side branches. Moreover, identifying compromise of the ostial diagonal artery after stenting and then performing kissing balloon between the LAD and diagonal artery was another key issue.

CONCLUSION

We present a rare case of SCA, treated with percutaneous intervention in the middle LAD. However, a definitive standardization treatment for those patients is difficult; each case should be treated individually, according to the anatomical variations.

REFERENCES

1. Walsh R, Nielsen JC, Ko HH, Sanz J, Srivastava S, Parness IA, *et al*. Imaging of congenital coronary artery anomalies. Pediatr Radiol 2011;41:1526-35.
2. Yamanaka O, Hobbs RE. Coronary artery anomalies in 126,595 patients undergoing coronary arteriography. Cathet Cardiovasc Diagn 1990;21:28-40.
3. Arteaga RB, Tronolone J, Mandawat M. Single coronary ostium-A right coronary artery arising from the main coronary artery. J Invasive Cardiol 2006;18:E241-3.
4. Frommelt PC. Congenital coronary artery abnormalities predisposing to sudden cardiac death. Pacing Clin Electrophysiol 2009;32:S63-6.
5. Angelini P, Velasco JA, Flamm S. Coronary anomalies: Incidence, pathophysiology, and clinical relevance. Circulation 2002;105:2449-54.
6. Morphet JA. Congenital coronary artery anomalies: Diagnosable, premortem? J Am Coll Cardiol 2001;38:1587-8.
7. Shriki JE, Shinbane JS, Rashid MA, Hindoyan A, Withey JG, DeFrance A, *et al*. Identifying, characterizing, and classifying congenital anomalies of the coronary arteries. Radiographics 2012;32:453-68.
8. Tariq R, Kureshi SB, Siddiqui UT, Ahmed R. Congenital anomalies of coronary arteries: Diagnosis with 64 slice multidetector CT. Eur J Radiol 2012;81:1790-7.
9. Benedek T, Gyöngyösi M, Benedek I. Multislice computed tomographic coronary angiography for quantitative assessment of culprit lesions in acute coronary syndromes. Can J Cardiol 2013;29:364-71.
10. Angelini P. Coronary artery anomalies: An entity in search of an identity. Circulation 2007;115:1296-305.