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Percutaneous coronary intervention for ostial lesions of the left main stem in a patient with congenital single left coronary artery: A case report

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Abstract

BACKGROUND

Single coronary artery (SCA) originating from a solitary ostium in the aorta and perfusing the entire myocardium is a very rare congenital anomaly of the coronary artery. Furthermore, a right coronary artery (RCA) arising from the mid segment of the left anterior descending artery (LAD) is an extremely uncommon variation of SCA.

CASE SUMMARY

A 76-year-old woman presented a 5-mo history of exertional angina. Selective coronary angiography revealed an SCA, with severe ostial stenosis that originated from the left sinus of Valsalva and bifurcated normally into the LAD and circumflex coronary artery. In addition, an anomalous RCA originated from the mid segment of the LAD as a separate branch. Successful balloon angioplasty and stenting for the SCA ostial stenosis were performed on the patient.

CONCLUSION

Percutaneous coronary intervention (PCI) of the main trunk for SCA is very similar to PCI of an unprotected left main coronary artery. Although technical difficulties and risks do exist, PCI for severe ostial stenosis of the main trunk is safe and efficacious in selected SCA patients.

Key words: Coronary anomaly; Single coronary artery; Left main coronary artery; Percutaneous coronary intervention; Case report

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Core tip: The right coronary artery arising from the mid segment of the left anterior

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descending artery is an extremely uncommon variation of single coronary artery (SCA). In this report, a 76 year-old female presented a 5-month history of exertional angina. Selective coronary angiography revealed an SCA, with severe ostial stenosis. Successful balloon angioplasty and stenting for the SCA ostial stenosis were performed on this case. Although technical difficulties and definite risk do exist, percutaneous coronary intervention for severe ostial stenosis of main trunk is safe and efficacious in selected SCA cases.

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INTRODUCTION

Single coronary artery (SCA) that originates from a single ostium in the aortic trunk and perfuses the entire myocardium is an extremely rare congenital anomaly of the coronary artery. The incidence of SCA ranges from 0.016% to 0.066% in the patient population undergoing coronary angiography^[1-3]. Myocardial perfusion could be affected in patients with different SCA subtypes, such as SCA arising ectopically from the right aortic sinus and passing between the aorta and pulmonary artery before dividing into the left anterior descending artery (LAD) and left circumflex artery, slit-like ostium due to an acute angle of SCA, or those complicated with proximal atherosclerotic stenosis^[4-6]. Coronary artery ostioplasty and bypass grafting are recommended as the first-line revascularization therapeutic strategy for these subtypes of SCA which can cause serious, even fatal, consequences^[7,8]. In this case report, a patient with SCA, combined with severe ostial lesions of the left main coronary artery (LM) and significant stenosis of the left anterior descending artery (LAD), was successfully treated by percutaneous coronary intervention (PCI).

CASE PRESENTATION

Chief complaints

A 76-year-old woman with a medical history of hypertension and hypercholesterolemia was admitted with progressive angina over five months.

Examinations of the patient

Electrocardiography showed non-specific ST-T abnormalities. The transthoracic echocardiography findings were normal for left ventricular performance without segmental hypokinesis. Diagnostic coronary angiography performed *via* the transfemoral approach showed that the LM, which normally originates from the left sinus of the Valsalva, had a 95% ostial calcified stenosis and slight shaft lesion. The LM branched into the normal left circumflex artery and the LAD with a diffuse lesion (70%-99%) in its mid segment with delayed distal flow. An anomalous branch without significant lesions arose from the mid-portion of the LAD and perfused the notional area of the right coronary artery (RCA) (**Figure 1**). The LAD wrapped around the apex, had an extended length, and then supplied to the posterior and inferior wall. Aortography revealed a blunt right and noncoronary sinus without any stumps (**Figure 2**).

FINAL DIAGNOSIS

The patient was diagnosed with coronary atherosclerotic heart disease with unstable angina; essential hypertension and hypercholesterolemia; and congenital SCA anomaly with branching of the RCA originating from the LAD, complicated with ostial LM lesions and a mid-segment stenosis of the LAD.

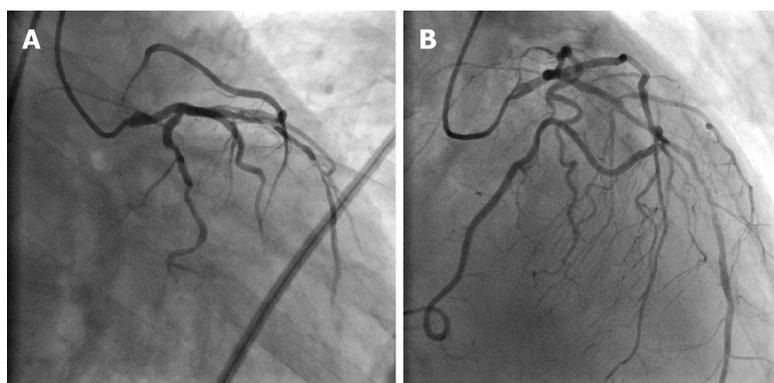


Figure 1 Coronary angiograms. A: Left anterior oblique caudal view; B: Right anterior oblique cranial view. The coronary angiograms show the left main coronary artery with severe ostial stenosis and left anterior descending artery (LAD) with a diffuse lesion in the mid segment and right coronary artery from the midportion of the LAD.

TREATMENT

Based on these findings, surgical treatment was advised for the patient. However, she refused coronary artery bypass grafting and instead accepted PCI. A 6F Judkin's left 4 guiding catheter was used to engage the main trunk and an intra-aortic vacant guide wire was placed to prevent a decrease in blood pressure in the coronary artery. After balloon pre-dilatation of the lesion around the LM and LAD, two sirolimus-eluting stents (2.5 mm × 33 mm and 3.0 mm × 33 mm) were placed at the middle LAD and then a 3.5 mm × 18 mm sirolimus-eluting stent at the ostial and shaft of the single coronary trunk was successfully deployed. Balloon post-dilatations of the entire stented segment were performed per standard procedure. The final angiographic results were satisfactory as demonstrated by thrombolysis in myocardial infarction grade 3 flow (Figure 3). The collaterals from the RCA and left circumflex artery were still visible.

OUTCOME AND FOLLOW-UP

Postoperatively, the patient was treated with guideline-directed medical therapy, which included aspirin, clopidogrel, irbesartan, and atorvastatin. The patient was followed at 6-mo intervals. No myocardial ischemia symptoms, changes in electrocardiography, cardiac dysfunction, or adverse cardiac events were noted during the three-year follow-up period.

DISCUSSION

SCA is a rare congenital anomaly of the coronary artery and is usually found by coronary angiography or necropsy. An SCA may arise with a single ostium from either the left Valsalva sinus or the right sinus. This causes confusion on where to cannulate another coronary artery ostium upon coronary angiography. Multislice computed tomography and magnetic resonance imaging can also aid in the diagnosis of SCA^[4,9,10]. Multislice computed tomography may be superior to conventional selective coronary angiography in confirming and visualizing the origin, course, and termination of the SCA. Magnetic resonance coronary angiography, without radiation and contrast medium, has advantages in providing the spatial position of SCA^[11,12].

Lipton *et al*^[13] originally classified these coronary variations based on the site of origin, anatomical distribution, and course of the branches. Type L or R describes SCA that arises from the sinus of Valsalva and divides them into class I-III. Class I denotes SCA following the normal left or right course. In class II, an anomalous artery arises from the proximal part of the normally located opposite coronary artery and crosses at the base of the heart as a large transverse trunk to supply the contralateral coronary artery. Class III represents the LAD and the circumflex artery originating separately from the proximal part of the normal RCA. In classes II and III, based on the relationship between the anomalous coronary artery, the aorta, and the pulmonary artery, the "A" refers to the anomalous artery passing anterior to the pulmonary artery, and "B" refers to it coursing between the aorta and pulmonary artery, while

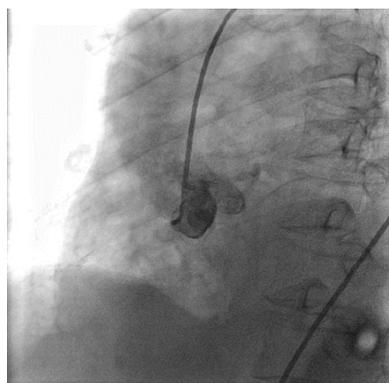


Figure 2 Aortography (left anterior oblique view) reveals a blunt right and noncoronary sinus without coronary origin.

“P” refers to it passing posterior to the large vessels. Yamanaka *et al*^[2] and Shirani *et al*^[14] modified the classification to describe the origin and course of these coronary anomalies. The anomalous origin of the RCA arose from the midportion of LAD in our patient, which is an extremely rare variation of SCA and does not fall under any subtype of Lipton's classification^[15,16]. This kind of congenital anomaly generally remains asymptomatic. However, the origin of the anomalies and the course of the coronary artery are heterogeneous variations of clinical presentations and consequences^[17].

CONCLUSION

There has been no consensus regarding the risk for atherosclerosis in patients with SCA. However, the myocardial ischemia symptoms in our patient were caused apparently by atherosclerotic stenosis of the LM and LAD, and not the anomaly itself. Unprotected LM stenosis has been traditionally treated using coronary artery bypass grafting. Improvements in drug-eluting stents and techniques have led to increased use of PCI on unprotected LM^[18,19]. Results from randomized clinical trials and registries have confirmed that PCI of the LM lesion is safe and efficacious in selected patients with low or intermediate angiographic risk scores^[20,21]. However the PCI procedure for the main trunk ostial lesion of SCA is still a technical challenge for surgeons and may be of high risk. Stenting on the shaft and distal lesions of the LM have been described previously only in three patients^[22-24]. However, this report is the first to describe PCI for severe ostial main stem stenosis and SCA with an anomalous origin of the RCA arising from the LAD.

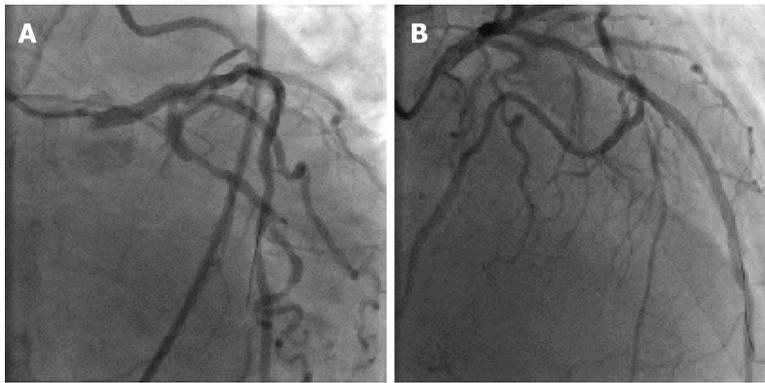


Figure 3 Coronary angiograms after percutaneous coronary intervention. A: Caudal view; B: Right anterior oblique cranial view. The images show excellent stent expansion and no dissection in the left main coronary artery ostia, the mid segment of left anterior descending artery, and right coronary artery with thrombolysis in myocardial infarction grade 3 flow.

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