Case Report

Percutaneous coronary Intervention for ostial occlusion lesion of an anomalous right coronary artery

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Abstract  Ostial lesions present many challenges for percutaneous coronary intervention (PCI). Coronary anomaly will further increase difficulties in performing PCI for the patient. We present such a case as ostial occlusion of an right coronary artery with high takeoff. A 77-year-old male was referred to our institution with a diagnosis of non-ST elevated acute myocardial infarction. Selective coronary angiography and nonselective ascending aortography could not identify the origin of the right coronary artery. Multi-slices computed tomography showed RCA ostial totally occluded. A successful PCI was performed and a perfect final result was achieved utilized with many tips and tricks, including “buddy wire” technique and “focused-force” angioplasty [Geriatr Cardiol 2009; 6:189-192].

Key words  ostial lesions; high takeoff; percutaneous coronary intervention; buddy wire; focused-force angioplasty

Introduction

Generally, lesions located within 3 mm of the origin of a vessel are recognized as ostial lesions, but some authors consider lesions up to 5 mm from the origin as ostial lesions.1-3 Ostial lesions have been recognized as a challenge from multiple perspectives for percutaneous coronary intervention (PCI). Firstly, ostial lesions are most likely to be associated with suboptimal angiographic results due to lesion rigidity and recoil.4-7 Secondly, exact stent positioning is a main problem in performing PCI.8-10 Thirdly, difficulties in the placement of a guiding catheter and poor back-up support are other factors that may affect the final result.6-9 Ostial occlusion involved with an anomalous coronary artery is extremely rare, and may further increase difficulties in performing PCI for the patient. We present such a case with ostial occlusion of right coronary artery with high takeoff.

Case Report

A 77-year-old male was referred to our institution for progressive deterioration of chest pain for 3 months and unstable episodes for 5 days. The initial electrocardiogram (ECG) showed an atrioventricular junctional escape rhythm with a ventricular heart rate of 45 beats per minute and ST depression in II, III and aVF leads. A 2-dimensional echocardiogram demonstrated normal left ventricular function, with an ejection fraction of 73%. Laboratory tests demonstrated elevated troponin I (TnI) levels of 7.36 ng/mL (normal range, <0.05 ng/ml). There was no past history of hypertension, diabetes mellitus and hyperlipidemia. A diagnosis of non-ST elevated acute myocardial infarction (NSTEMI) was made based on the ischemic symptoms, ST depression and elevated TnI.

Selective transradial coronary angiography revealed a 70% stenosis at the middle segment of left anterior descending artery (LAD) and a 60%-70% stenosis at the distal segment of left circumflex artery (LCX) (Fig.1-A). Multiple attempts with different diagnostic catheters failed to engage the right coronary artery (RCA) in its usual position, and nonselective ascending aortography could not identify the origin of the right coronary artery too (Figure 1-B). Then a 64-slices computed tomography (MSCT) was performed to observe the complete coronary tree. The result showed a 75% stenosis at the middle segment of LAD, 75% stenosis at the distal segment of LCX, and RCA ostial total occlusion. The segment distal to the completely occluded RCA was visualized through collateral circulation. Meanwhile, MSCT revealed the RCA was originating from the upper part of right Valsalva sinus with high takeoff and coursing downward (Fig.2). After discussion with the patient and his family regarding the risk of revascularization and the possibility of requiring single-vessel bypass surgery, the patient refused the surgical solution and the informed consent was obtained for PCI. Then a decision was made to perform a transfemoral PCI for the infarction-related artery, the RCA.

After many unsuccessful attempts of selective engagement of the anomalous vessel using different guiding catheters, adequate cannulation and good support were finally achieved with a 6F Judkins right 5 (JR5) guiding catheter (GC) (Cordis Corp., Miami, Florida). An Amplatz GC was
not tried due to the risk of injuring or dissecting such critical ostial disease. With a clockwise rotation, the tip of the JR5 catheter engaged the ostium of the anomalous right coronary artery and allowed advancement of a 0.014 inch BMW guidewire (Guidant Corp., Indianapolis, Indiana). There were 4 large side branches seen arising from the proximal segment of RCA. GC manipulation was performed not only by the push-pull method, but also by using counterclockwise rotation to slide it superiorly in the aorta and clockwise to reapproximate it to the ostium.

We anticipated significant difficulty in passing equipment with an occluded lesion and poor back-up support during the procedure. Therefore, a second BMW “buddy wire” was passed into the acute marginal artery of RCA (Fig. 1-C). The reason of using the buddy wire was dual: first for back-up support, and second as an instrument for “focused-force” angioplasty for this occluded lesion. A 1.5mm×15mm Ruyjin balloon (Terumo Corp., Tokyo, Japan) was inflated to 16-20 atmospheres (atm) at the lesion and into the aorto-ostial junction of the RCA (Fig. 1-D). This improved the lumen diameter slightly, although there was still severe elastic recoil. Sudden high-pressure dilatation with a larger balloon may lead to RCA dissection, or even worse, retrograde aortic dissection due to the aorto-ostial junction plaque disruption. A 2.0mm×20mm SafeCut dual wire “focused-force” balloon (OrbusNeich Medical Co., Ltd., Shenzhen, China) was inflated to 6 atm, followed by another inflation to 8 atm and finally 12 atm at the very ostium (Fig. 1-E). Next, a Cypher 3.0mm×18mm drug eluting stent (Cordis Corp., Miami, Florida) was placed, with 1-2mm hanging out into the aorta (Fig. 1-F). When we tried to withdraw the buddy wire, the stability of the GC was compromised, with the guidewire prolapsing further into the aorta, thus this buddy wire was left in place. The stent was deployed at 14 atm initially, with good positioning and complete ostial coverage. The buddy wire was then removed with relative ease. The stent balloon was then pulled back 1 mm and inflated to 18-20 atm to flare the stent struts into the aorta and to ensure good apposition of the stent. An excellent result was obtained, with complete ostial coverage (Fig. 1-G, 1-H). And no dissection or large side branches occlusion were found. Before the procedure, aspirin and clopidogrel were prescribed.
with a loading dose of 300mg and 600mg, respectively. During the procedure, 10,000 U unfractionated heparin was used. And after the procedure, aspirin (100mg qd) and clopidogrel (75mg qd) were prescribed for long-term use, clopidogrel for 2 years at least. The procedure time was about 1 hour, with 120 ml of contrast used. Most of the resources were employed identifying the best diagnostic and guiding catheters. After the procedure, no angina recurred again. The patient had an uneventful hospital course and was discharged after 5 days.

Discussion

Normally 60%-78% of right coronary ostia are situated in the lower part of the Valsalva sinus, commonly referred as “low takeoff”; and the rest (22%-40%) right coronary ostium are at the upper part of right Valsalva sinus, which is referred as “high takeoff”.13-15 RCA with high takeoff is not necessary harmful to the patient, but may increase the difficulties in performing a CAG or PCI procedure.6 Coronary ostial stenosis is a complex lesion with an incidence of 0.13%-0.25% in symptomatic patients.1 Ostial lesions present many challenges for percutaneous intervention.2-4,10 Coronary dissection, poor guide backup, lesion rigidity and calcification, elastic recoil and angiographic restenosis represent only some of the difficulties of percutaneous intervention of ostial lesions. Ostial occlusion of a right coronary artery with high takeoff is a most rare occurrence, which increases the difficulties in performing a CAG or PCI procedure markedly. Many tips and tricks as well as special carefulness are necessary to complete the procedure in such a patient.

Usually, selective or nonselective CAG can easily identify the anomalous origin of the coronary artery. But for the present case of right coronary ostial occlusion, it is difficult to find the ostia by CAG. In such situation, MSCT or magnetic resonance imaging (MRI) may be more helpful to localize the orifice and the course of the occluded coronary artery.17 Accordingly, absence of RCA in a coronary angiogram may suggest the possibility of a coronary anomaly or ostial occlusion, especially when main branches can not be opacified by selective contrast medium injection. The choice of therapy strategy in ostial lesions has conventionally been coronary artery bypass grafting (CABG) or surgical patch aorto-coronary ostioplasty.18-20 There were concerns with a surgical approach in our patient. Apart from the very old age of the patient, the essentiality of single-vessel bypass surgery was doubted. More important, the patient and his family refused the surgical solution.

In general, if the RCA is a high takeoff and downward couring, an ordinary JR GC is not appropriate. In such patients, we use an Amplatz left (AL) or JR GC with a long tip.11 But in this case, an AL GC was not tried due to the risk of injuring or dissecting. If an AL GC was selected, a helpful tip is to choose one with a side hole so that the tip of the catheter may be deep-seated to obtain firmer support. Using the left anterior oblique (LAO) view, rotate the tip of the GC clockwise in the right Valsalva sinus, move the GC close to the ostium so that the GC is co-axially aligned with the vessel, and engage the ostium. If ostial stenosis is too severe to engage the catheter, or the GC becomes wedged, adjust the direction of the tip so that the GC can be co-axially aligned with the vessel near the ostium, and set the catheter firmly and as close to the ostium as possible. It is necessary to be careful not to engage it forcefully. There are no particular rules for the selection of guidewires; however, guidewires with a hard shaft are recommended if extra support is necessary.11 The buddy wire or the second 0.014-inch wire alongside the primary wire for advancing equipment is a very useful, and often simply tool to accomplish technically challenging procedures.21 The buddy wire can be used to reduce balloon slippage (“melon seeding”) during dilatation of in-stent restenotic lesions and to supplement inadequate guide catheter backup. It is also useful in procedures in vessels with significant tortuosity/angulation, where it aids in distal stent delivery and also helps to cross a proximal stent or calcified segment.22 When manipulating the guidewire, it is important to avoid the GC deep-seated and causing the ostium occluded. The GC should be suspended near the ostium after the guidewire advances to the distal segment. As the ostial lesions consist of a large amount of elastic fibers, elastic recoil occurs readily. Therefore, conventional balloon angioplasty alone is often not sufficient. “Focused-force” angioplasty may be much helpful.23,24 “Focused-force” angioplasty essentially utilizes a device such as the Cutting Balloon, dual wire “focused-force” balloon or a buddy wire to apply the force of the expanding balloon along the planes of the blades or the wire alongside the inflated balloon in a concentrated manner to achieve controlled plaque dissection for resistant or calcified lesions and to prevent balloon slippage.25 For highly calcified lesions, a rotablator is indicated. The efficacy of rotational atherectomy with adjunctive stenting for ostial RCA stenosis has been documented in previous studies. With the advent of stenting, restenosis rates as low as 16% have been reported with bare-metal stent placement in ostial lesions.25 A small, nonrandomized, prospective study showed that use of paclitaxel eluting stents for all ostial coronary lesions (including RCA, left main and vein graft) was feasible and associated with favorable angiographic results.26 A main problem in implementing coronary stents is to determine the exact positioning for the stent. If situated too proximally, stent protrusion into the aortic lumen interferes with aortic blood flow and hastens further aortic catheterization. If situated too distally, the desired aim of scaffolding the ostial lesion is missed. In addition, there is the potential to compromise the lumen and subject the patient to a higher incidence of sub-acute stent thrombosis or restenosis, as well
as a high risk for dissection, acute closure or rupture. In general, the stent is placed with 1-2 mm hanging out into the aorta. The stent was then deployed with good positioning and complete ostial coverage. At last, the stent balloon or a noncompliant balloon was used to flare the stent struts into the aorta and to ensure good apposition of the stent.

Conclusions

In conclusion, we report a most rare case of ostial occlusion of a right coronary artery with high takeoff, which presents many challenges for percutaneous intervention. A successful PCI was performed and a perfect final result was achieved by using many tips and tricks, including “buddy wire” technique and “focused-force” angioplasty. And we can learn a lot from this case.

References