Case Report

Percutaneous Coronary Intervention in Patients with Anomalous Origin of Coronary Artery

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Percutaneous coronary intervention in patients with anomalous origin of right coronary artery from left sinus of Valsalva was performed in Central Chest Institute during 2005-2009. The diagnosis of this type of congenital anomaly is always difficult, since it requires high operator's consideration and experience. Standard catheter curve desired for general coronary angiography is also not suitable for the abnormal origin of artery, especially when coronary intervention is to be performed. The authors report a series of these anomalous coronary patients with atherosclerotic disease who underwent transcatheter coronary intervention using Extra Backup left coronary guiding catheters, which help cannulation of the anomalous ostium and enhance the operation success.

Keywords: *Coronary anomalies, Angioplasty, Percutaneous coronary intervention*

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Anomalous origin of coronary artery from opposite sinus of Valsalva (ACAOS) is a rare congenital condition which is found occasionally during coronary investigation procedure. Literature review has reported the incidence from 0.2-2.0%[1] in patients underwent coronary angiogram. Anomalous right coronary artery from left sinus is more common than left coronary artery from right sinus[2] and less related to malignant clinical event.

The nature of atherosclerotic disease in anomalous artery is not different from normal artery, so as the treatment. However, percutaneous coronary intervention (PCI) in unusual coronary origin may encounter with difficulty on guiding selection, since most catheters are designed for better support at normal coronary orifice. The authors report a series of percutaneous coronary intervention in patients with anomalous origin of right coronary from left sinus performed in Central Chest Institute during 2005-2009.

Case Report

Case 1

A 69 year-old female, known case of chronic obstructive pulmonary disease (COPD) and old pulmonary tuberculosis, presented with acute coronary syndrome. After both COPD and angina were well controlled, coronary angiography showed borderline lesion at mid LAD and significant diffuse atherosclerotic lesion in right coronary artery (RCA) which originated from left sinus of Valsalva. PCI of RCA was scheduled a couple months later due to poor control of underlying COPD. The RCA was partially engaged with a 7-French extra-backup catheter (Terumo BL3) and then a Whisper wire (Abbott Vascular) was sent into the RCA. Carefully and gradually clockwise torque maneuver with assistance of the PCI wire support was required to seat the catheter tip more coaxially. After the guiding catheter was well engaged, PCI was done using a 2.5 x 15 mm balloon predilatation at mid and distal RCA lesions. The distal RCA lesion was stented with 2.75 x 14 mm and 3.0 x 24 mm Endeavor RX stents (Medtronic) while the mid RCA lesion was stented with a 3.5 x 18 mm Endeavor RX stent. Post stent angiogram revealed distal-edge dissection of distal RCA stent, which was corrected by a 2.5 x 12 mm Endeavor RX stent into posterolateral (PL) branch (Fig. 1). She was discharged on the following day without procedure related complication.

Repeated coronary angiogram was done 6 months later due to recurrent angina, revealed focal in-stent restenosis (ISR) of distal RCA stents and progression of proximal RCA lesion. Balloon angio-

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plasty was done for ISR and the proximal RCA lesion was stented with a 3.5 x 18 mm Endeavor RX stent. Her symptom did not improve; she still had recurrent angina and exacerbation of COPD. Repeated coronary angiogram was done again 3 months after the second PCI procedure but showed no significant lesion. Later, she was recommended to continue conservative treatment. She died of sudden death 2 years later; neither necropsy nor autopsy was done.

Case 2

A 61 year-old man presented with angina on exertion for 1 year. His coronary risk factors included diabetes mellitus, hypertension, hypercholesterolemia, and ex-smoker. Coronary angiogram revealed non-significant lesions in the left coronary artery but failed to identify the right coronary artery. Multi-slide computerize tomography (MSCT) showed anomalous origin of right coronary artery from left sinus with multiple stenotic lesions. He was referred to our center for PCI. The anomalous right coronary was unable to cannulate with Amplatz AL1 (Boston Scientific) catheter due to its anterior and caudal take off. A 7 French Extra-Backup (EBU) 3.0 catheter (Launcher, Medtronic) was partially seated at the RCA ostium and a 0.014″ Rinato wire (Asahi) was crossed into RCA to support catheter manipulation until proper seated into the ostium (Fig. 2). However, when pushing the catheter against the opposite aortic wall to enhance support, the catheter itself caused aortic regurgitation and low cardiac output. Retrieval of catheter alternative with pushing to change catheter support was mandatory during the operation. The mid RCA lesion was predilated with a 2.5 x 15 mm Ryujin balloon (Terumo) and subsequently stented with a 2.75 x 14 mm Xience V stent (Abbott Vascular). He was discharged a day after PCI and was free of angina at one year follow-up.

Case 3

An 85 year-old female was referred to our center due to non-ST elevation myocardial infarction (NSTEMI) with congestive heart failure and complicated by pneumonia. Her underlying illness included hypertension and hypercholesterolemia. Echocardiogram showed mild impaired left ventricular systolic function with inferior wall hypokinesia. After heart failure and pneumonia were treated, coronary angiography was performed. The coronary artery was right dominant system with anomalous origin of RCA from left sinus. Left coronary artery showed non-significant lesion, but right coronary artery revealed 70% stenosis at mid portion. Several guiding catheters failed to engage the RCA ostium, except a 6-French EBU3.0 gave the closest contact to the RCA ostium. A Rinato wire was successfully sent into RCA and crossed the lesion. After predilatation with a 2.5 x 15 mm Ryujin balloon the mid RCA lesion was successfully stented with a 2.5 x 15 mm Xience V stent (Fig. 3). She was discharged two days after the procedure and was lost to follow-up.

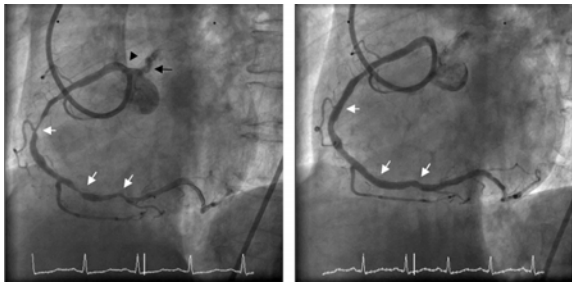

Fig. 1 Anomalous origin of right coronary artery (RCA) from left sinus of Valsalva in case 1 compared before and after coronary intervention. Origin of RCA (black arrow head) was close to Left main coronary artery (black arrow). Lesions in RCA are labeled with white arrows

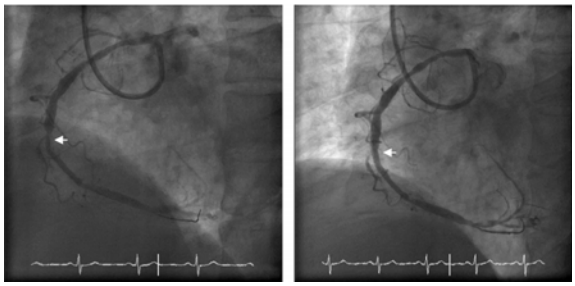

Fig. 2 Anomalous origin of right coronary artery (RCA) from left sinus in case 2 compared before and after coronary intervention

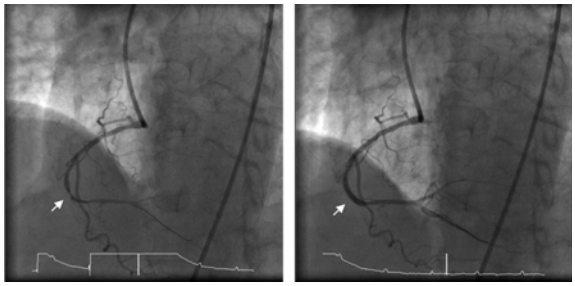

Fig. 3 Anomalous origin of right coronary artery (RCA) from left sinus in case 3 compared before and after coronary intervention

Case 4

A 44 year-old male referred with recent anterior wall ST elevation myocardial infarction (STEMI) and subsequent congestive heart failure. Electrocardiogram showed sinus rhythm with QS wave and T wave inversion in V1-V4. After heart failure was treated, echocardiogram showed normal left ventricular systolic function with normal regional wall motion. Coronary angiography revealed anomalous origin of right coronary artery from left sinus with severe triple-vessel coronary artery disease. RCA was total occluded and received collateral from left anterior descending artery (LAD) which showed 80% stenosis at mid segment. PCI at RCA was done using a 7-French Amplatz AL1 guiding catheter. The catheter reached the RCA ostium but not well engaged. A Whisper wire with a Finecross microcatheter (Terumo) was sent into RCA successfully. Then the guiding catheter was slowly torqued to turn its tip coaxially engaged the RCA ostium for better support. Then the occlusion at mid RCA was crossed by Whisper wire and predilatation was done. Finally two drug eluting stents-3.0 x 33 mm and 3.0 x 18 mm Firebird (Microport)-were successfully deployed at mid to distal RCA (Fig. 4). He was discharged on the following day and scheduled for elective PCI at LAD and left circumflex artery (LCx). There after he was free of angina on 18-month follow-up after first PCI.

Case 5

A 76 year-old female experienced acute coronary syndrome a year ago when urgent coronary angiogram revealed triple vessel coronary artery disease. She underwent ad hoc PCI at LAD and LCx with drug-eluting stents but the subtotal occluded RCA showed anomalous origin from opposite sinus and left for medical treatment. Her underlying illness included diabetes mellitus, hypertension and hypercholesterolemia. Echocardiogram showed good LV systolic function with dyskinesia of anterior wall. Started PCI at RCA using a 6-French Extra-Backup (EBU) 3.0 guiding catheter but guiding catheter tip was too short to achieve adequate support. After replaced to a 6-French EBU 3.5 catheter, its tip was seated close to RCA ostium. A Rinato wire was crossed into RCA but failed to cross the subtotal occluded distal RCA, then guide wire was changed to Intermediate wire (Asahi) which successfully crossed the occlusion. The lesion was predilated with 1.25 x 15 mm Ryujin balloon and 2.0 x 20 mm Voyager balloon (Abbott Vascular) respectively. A 2.25 x 24 mm Taxus Liberte stent (Boston Scientific) was successfully deployed at the lesion and post dilatation at the proximal half of stent was done using a 2.5 x 15 mm Durastar non-compliance balloon (Cordis) (Fig. 5). She was discharged a day after PCI and clinical stable on one-year follow-up.

Case 6

A 51 year-old man presented with acute inferior wall STEMI. His risk factors included hypertension and current cigarette smoker. Emergency coronary angiogram showed total occlusion of distal LCx and non-significant LAD. RCA revealed anomalous origin from opposite sinus with 80% stenosis at mid RCA. Primary PCI was done at LCx lesion with a 4.0 x 18 mm Vision stent (Abbott Vascular). Elective PCI at RCA lesion was done 4 months later. Several guiding catheters included XBRCA (Cordis) and Amplatz AL1 failed to engage the RCA ostium. A 6 French EBU 3.0 gave the closest attachment to the RCA origin, where a Fielder FC wire (Asahi) was successfully sent into RCA and

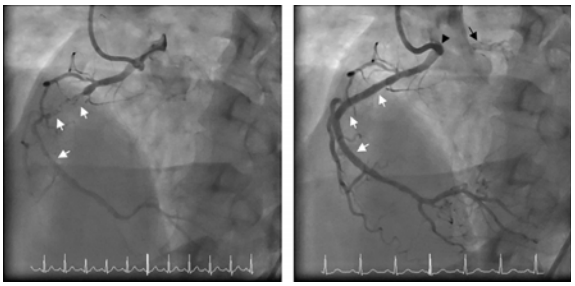

Fig. 4 Anomalous origin of right coronary artery (RCA) from left sinus in case 4 compared before and after coronary intervention. Two stents were deployed in mid RCA (white arrows). In this case, origin of RCA (black arrow head) was not very close to origin of left main coronary artery (black arrow)

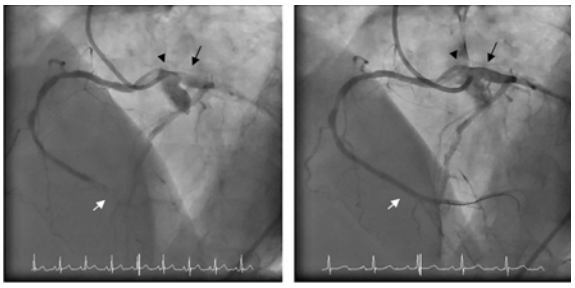

Fig. 5 Anomalous origin of right coronary artery (RCA) from left sinus in case 5 compared before and after coronary intervention. Origin of RCA (black arrow head) is adjacent to origin of left main coronary artery (black arrow). Total occlusion of distal RCA (white arrow) was successfully opened by transcatheter intervention

passed the lesion. The catheter system was torqued until it was stable enough for performing the entire course of PCI, including predilatation and stenting with two drug eluting stents-3.0 x 28 mm Xience V and 3.0 x 28 mm Promus (Boston Scientific) (Fig. 6). He was discharged on the following day and clinical stable on one-year follow-up.

Case 7

A 37 year-old male presented with chest discomfort for one year. He was known hypertension, dyslipoprotienemia and current cigarette smoker. Exercise stress test was positive at moderate workload. Coronary angiography showed minor disease in left coronary artery which gave collateral to right coronary artery. The right coronary origin was unable to identify by aortogram. MSCT showed high take off RCA approximately 1.5 cm above left coronary cusp. The proximal RCA course is between aortic root and pulmonary outflow tract. Complete stenosis of proximal RCA was noted by the MSCT scan. He was scheduled to repeat coronary angiogram which successfully cannulated the RCA ositum with a 6-French Amplatz AL1 catheter (Fig. 7). Angiogram showed total occlusion of proximal RCA with bridging collateral to mid RCA. However PCI of RCA failed to cross guide wire across the total occlusion. Repeated PCI one month later also failed to cross guide wire. His symptom was improved after optimal medical treatment and free of serious cardiac event on 18-month follow-up.

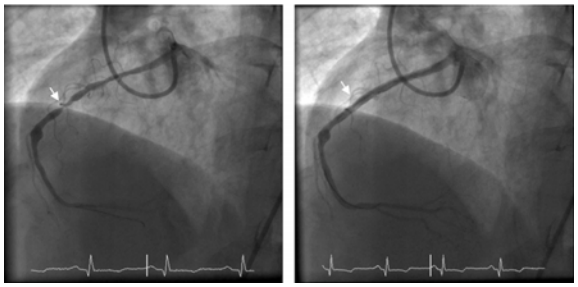

Fig. 6 Anomalous origin of right coronary artery (RCA) from left sinus in case 6 compared before and after coronary intervention

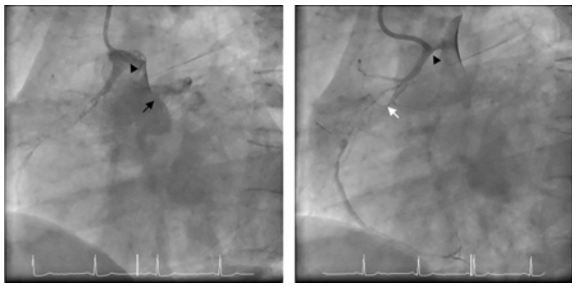

Fig. 7 Anomalous origin of right coronary artery (RCA) from left sinus in case 7. Origin of RCA (black arrow head) was also abnormal high take off compared to the origin of left main coronary artery (black arrow). Mid RCA (white arrow) was total occluded with bridging collateral to distal segment

Discussion

Anomalous coronary artery in the young age group can lead to serious ischemic events including myocardial infarction, or sudden cardiac death in absence of atherosclerotic change[3]. The incidence of sudden cardiac death seems to be less when patients grow older than 30 years of age[4]. No documented evidence showed relationship between coronary anomalies and obstructive coronary disease[5], as well as atherosclerosis. Patients who survive from serious cardiac events may develop atherosclerotic disease as in a normal population, especially in older age group. Management of atherosclerotic heart disease in these patients should follow standard treatment for coronary artery disease. Obstructive atherosclerotic lesions which did not respond to optimal medical treatment should be treated with coronary intervention-including percutaneous coronary intervention and bypass surgery.

Percutaneous coronary procedure in anomalous origin artery is challenging, even a diagnostic procedure. Since most catheters are designed for normal coronary anatomy, the curve and contour of catheters is not suitable to reach the abnormal arterial origin. In addition, the back up support of guiding catheters in angioplasty procedure is also not as good as in normal coronary artery. To achieve adequate catheter support for intervention, selection of guiding catheter coupled with meticulous catheter manipulation could place the tip close to the abnormal orifice[6]. Then a PCI guide wire sent into the artery will lead cannulation of catheter tip and ensure the catheter coaxial seating.

In most of the presented cases, Amplatz Left catheter failed to reach the anomalous orifice of RCA in the left sinus. Praharaj et al have reported use of Volda guiding catheter to cannulate this type of anomalous coronary in PCI procedure with excellent results[7]. The Extra Backup guiding catheter for left coronary artery, which has a shape similar to the Volda, is also suitable for PCI in the present situation. In this report, the authors successfully cannulated in 5 of 7 cases with Extra Backup guiding catheter. In two cases those using

Amplatz Left guiding catheter, the orifice of anomalous right artery was not very close to the normal left artery origin (case 4) or very high take off from the aortic cusp (case 7).

However, Extra Backup guiding catheter can cause aortic incompetence during the procedure, especially when it was pushed to enhance support. This can lead to hypotension, which sometimes is misdiagnosed. In case 2, the authors experienced this complication due to rather low origin of right anomalous artery, made the catheter seat very close to the aortic valve.

There are very few reports of long-term results of percutaneous intervention in anomalous artery with obstructive lesion. Most of the presented cases have good long term results except for one case whose symptom remained after successful PCI. Sohara et al have reported a case that abnormal perfusion scan remained even after good angiographic follow-up[8]. They suspected that myocardial ischemia may not be caused only by the occlusive lesion but also the abnormal anatomy which might disturb blood flow during exertion. This observation was also found after surgical treatment in symptomatic pediatric cases without obstructive lesion[9]. Since the mechanism of ischemia in ACAOS without obstructive lesion is not yet well understood, revascularization in these patients often yields 'less than ideal' result[10].

Conclusion

Percutaneous coronary intervention for obstructive lesion in anomalous right coronary origin from left sinus is feasible. The use of Extra Backup guiding catheter eases the cannulation of anomalous artery and helps support the transcatheter therapeutic procedure. The long term result for obstructive lesion was good in the majority of the present cases.

Potential conflicts of interest

None.

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รายงานการสวนหัวใจขยายหลอดเลือดในผู้ป่วยที่ทางออกของหลอดเลือดโคโรนารีย์ผิดปกติแต่กำเนิด

วิรัช เคหสุขเจริญ, สุดารัตน์ ตันสุภสวัสดิกุล, บุญจง แซ่จึง, ธรรมรัฐ ฉันทแดนสุวรรณ, วทัญญู ปลายเนตร

ได้รายงานการรักษาโรคหลอดเลือดแดงตีบตันที่เกิดในผู้ป่วยซึ่งมีทางออกของหลอดเลือดแดงโคโรนารีย์ผิดปกติแต่กำเนิด ชนิดหลอดเลือดโคโรนารีย์ข้างขวาออกทางซ้าย ในสถาบันโรคทรวงอกตั้งแต่ ปี พ.ศ. 2548 – 2552 ในกรณีที่ผู้ป่วยมีความผิดปกติโดยกำเนิดเช่นนี้มักตรวจหาหลอดเลือดโดยการสวนหัวใจได้ลำบาก เนื่องจากสายสวนที่ใช้เป็นมาตรฐานไม่สามารถสอดเข้าใกล้รอยเปิดของหลอดเลือดได้เช่นปกติ หากผู้ป่วยมีโรคหลอดเลือดแดงตีบตันร่วมด้วยแล้ว การรักษาด้วยการสวนหัวใจจะมีอุปสรรคยิ่งขึ้นรายงานนี้ได้รวบรวมผู้ป่วยที่พบพยาธิสภาพนี้และได้รับการรักษาด้วยการสวนหัวใจขยายหลอดเลือดโดยการใช้สายสวนชนิด Extra-support สำหรับหลอดเลือดแดงโคโรนารีย์ข้างซ้าย แทนสายสวนสำหรับหลอดเลือดฯข้างขวา ซึ่งช่วยให้การทำหัตถการสำเร็จได้มากขึ้น