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Case Report

Percutaneous coronary intervention in chronic total occlusion of anomalous right coronary artery: an onerous journey

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Abstract: Chronic total occlusion (CTO) of coronary artery is a subset where cardiologists confront technical challenges most of the time during percutaneous coronary intervention (PCI). They experience an additional impediment when CTO intervention is performed in presence of anomalous coronary artery. Here we report a 58 years old gentleman with Diabetes mellitus and hypertension who admitted with Canadian Cardiovascular Society class III angina for 5 months. Coronary angiography revealed dual vessel coronary artery disease with CTO of right coronary artery (RCA) originating from left sinus of Valsalva. PCI with stenting has been done successfully to RCA lesion. Patient got relieved of angina after PCI and remains stable clinically since then.

Keywords: Chronic total occlusion, percutaneous coronary intervention, anomalous

Introduction

Coronary artery anomalies are very rare, origin of right coronary artery (RCA) from left sinus of Valsalva (LSOV) is found in 0.92% patients undergoing coronary angiography [1]. Percutaneous coronary intervention (PCI) of anomalous coronary artery is no doubt an arduous job especially in presence of chronic total occlusion (CTO) because of technical complexities associated with it at every step, from engaging the coronary ostium to delivery of hardware through the vessel [2]. Only few cases reported in the literature where CTO intervention was done in anomalous RCA origin. Here we present a case where PCI has been done successfully in presence of CTO of RCA originating from left coronary cusp. The purpose of the reporting this case to highlight the techniques used to have successful PCI.

Case report

A 58 years old gentleman presented with Canadian Cardiovascular Society (CCS) class III angina for last 5 months. This was not associated with any shortness of breath, palpitation, pedal oedema or syncope. He was a known diabetic and hypertensive for last 6 years. Complete blood count, serum creatinine and electrolytes were normal but low density lipoprotein (LDL) was 110. Electrocardiogram and echocardiogram were normal, Treadmill test was positive for inducible myocardial ischemia. He was put on medical management before doing coronary angiogram which included clopidogrel, atorvastatin, telmisartan, metoprolol, nicorandil, ranolazine and antidiabetic drugs. Coronary angiography was performed via right radial access with 5F TIG diagnostic catheter revealing double vessel coronary artery disease with mid RCA-CTO and retrograde flow from left anterior descending artery (collateral filling: Rentrop grade 2) and J-CTO score of 0 (**Figure 1A-C**). We proceeded for PCI of RCA-CTO with antegrade wire escalation strategy. Right femoral access was taken with 6F sheath. We tried to engage RCA ostium with several guide catheters like Judkins left 3.5, Amplatz left 1/2, TIG and ultimately after several attempts we could engage the RCA ostium with 6F XB 4. It was not possible to cross the mid RCA lesion by Fielder XT-A (ASAHI INTECC) with 1.8 F FineCross MG microcatheter (TERUMO) support. The lesion was crossed with Gaia second (ASAHI INTECC) followed by microcatheter

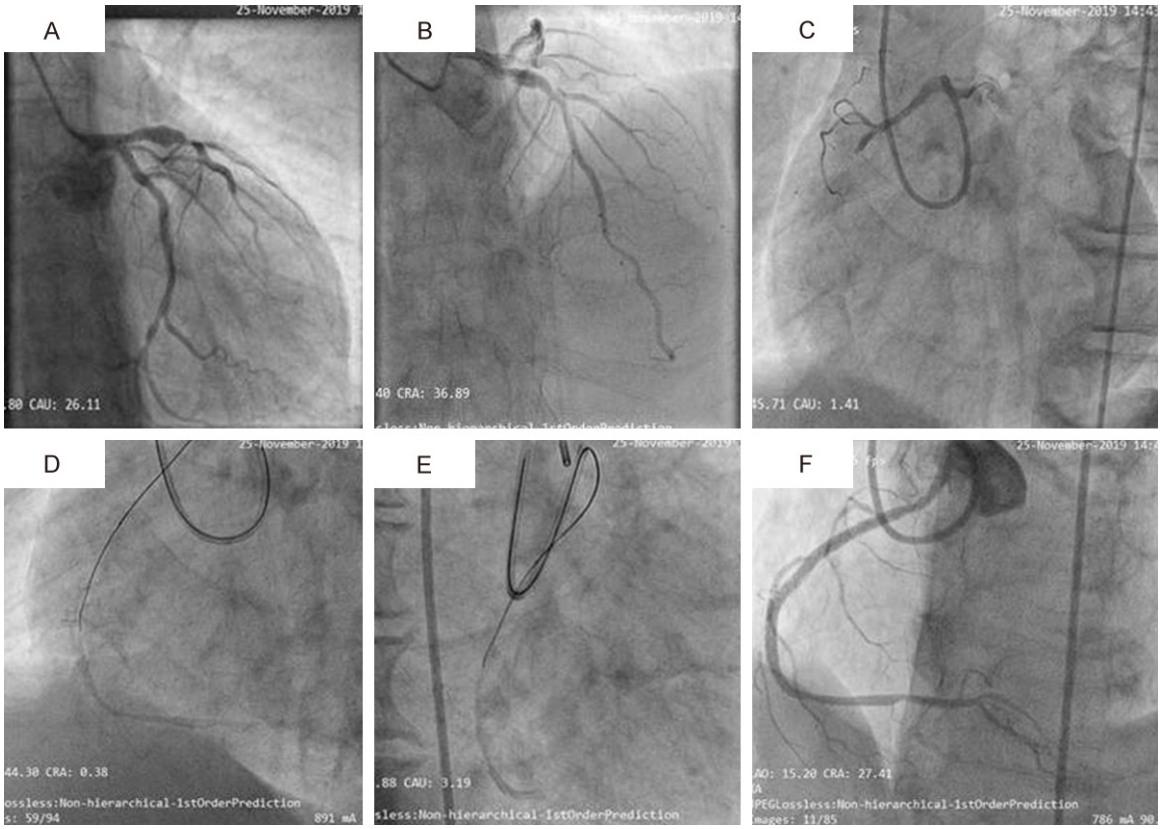

Figure 1. A and B: 30-40% diameter stenosis of distal Left circumflex artery. Ostioproximal and mid Left anterior descending artery disease (maximum diameter stenosis 50-60%) with ectasia of proximal part. C: Total occlusion from mid RCA with retrograde flow from left system. D and E: Lesion is crossed with Gaia 2 guidewire with Finecross microcatheter support and guidewire position is checked with contralateral injection. F: Final view showing distal TIMI III flow after deployment of 2 stents.

advancement across the lesion and guide wire position was checked with contralateral injection in LMCA engaged with 5F TIG, introduced through right radial access (**Figure 1D** and **1E**). Gaia second was exchanged with Sion blue (ASAHI INTECC) and guidewire is parked in posterior left ventricular (PLV) branch of RCA with sequential predilatation of the lesion using Mozek 1.5 mm × 12 mm (MERIL VASCULAR INTERVENTION) and Maverick 2.5 mm × 15 mm balloon (Boston Scientific). Mid to distal RCA is stented with Tetrilimus 3 mm × 40 mm (SMT) at 12 atm pressure, another Tetrilimus 3 mm × 20 mm (SMT) at 12 atm pressure is also deployed at proximal to mid RCA keeping an overlap of around 3 mm between stents. Post dilatation was done subsequently and TIMI-III was achieved in RCA (**Figure 1F**). Unfractionated heparin was used 12000 IU and Activated clotting time was 250-300 seconds. He was treated with dual antiplatelet therapy (aspirin & clopidogrel), rosuvastatin (40 mg), beta blocker, angiotensin receptor blocker and antidiabetic medications. There was no complication seen during or after the procedure. Patient became symptom free dramatically after the procedure and remains clinically stable for last 8 months.

Discussion

Incidence of coronary artery anomalies is 5.6% in recent angiographic study [1]. Most of them are benign but some of them may result in potentially serious manifestations like: angina, myocardial infarction, heart failure, syncope, sudden cardiac death or arrhythmia even without coexistent atherosclerotic narrowing [2]. RCA originating from left sinus of Valsalva has some unique features. Firstly, coronary blood flow may be reduced in this aspect because of several factors: slit-like orifice of RCA, acute takeoff angle, luminal compromise of RCA contributed by intramural part as well as by the

Table 1. Comparison between our case with previously reported case of percutaneous coronary intervention of chronic total occlusion in anomalous right coronary artery

Cases	Age/sex	Technique used	Access taken	Origin of RCA	Guide catheter used
Yamada R et al. [7]	43 y/M	Retrograde	Femoral	Left sinus	EBU
Porwal SC et al. [13]	71 y/F	Antegrade	Femoral	Left sinus	IKARI
Kaneda H et al. [14]	66 y/M	Retrograde	Femoral	Left sinus	EBU
Fang HY et al. [15]	74 y/M	Antegrade	Radial	High anterior	AL 1
Senguttuvan NB [11]	49 y/M	Antegrade	Femoral	Left sinus	JL3
Our case	58 y/M	Antegrade	Femoral	Left sinus	XB

aortic valve commissure and it's inter-arterial course (between pulmonary artery and aorta) makes it more vulnerable to lateral compression. Exercise may potentiate the lateral compression offered by inter-arterial course, thus may culminate to SCD [3]. So, multi-detector computed tomography (MDCT) can provide an insight into the assessment of RCA originating from opposite cusp because coexistent atherosclerotic narrowing treated by PCI may not be sufficient enough to prevent ischemic events. Secondly, proximal part of anomalous RCA (ARCA) is prone to atherosclerotic plaque formation because of shear stress and endothelial dysfunction, though controversies exist for this theory [4].

However, several issues have made PCI in presence of ARCA-LSOV intrigued. Most important of all is selection of appropriate guide catheter to ensure adequate support and proper alignment so that delivery of the devices through it can be achieved without much hindrance. Several catheter trial rather than catheter selection depending on RCA ostial anatomy may be time consuming, may have more radiation exposure and risky specially when dealing with acute coronary syndrome. Uthayakumaran K et al. [5] and Sarkar K et al. [6] have suggested a very methodical approach. They took aortic root angiography in left anterior oblique (LAO 30-35°) view with JR 3.5 whenever they face difficulty in cannulating the RCA to identify the anatomical orientation of RCA ostium through femoral approach and classified them into 3 areas which expedited the selection of guide catheter. (1) Type A-ARCA origin just above left coronary artery ostium, guide catheter used: Judkin's Left 4/5; (2) Type B-ARCA origin just below left coronary artery ostium, guide catheter used: EBU (preferentially) or JL4; and (3) Type C-ARCA Origin is along imaginary plane through midline, guide catheter used: Amplatz Left ½ (preferentially) or JL 4 [5, 6].

Guide catheter selection is very crucial step but influenced by aortic size, operator expertise, availability. Several case reports have successfully performed PCI in case of CTO or acute coronary syndrome involving ARCA-LSOV [7-9], IKARI can also be used in such situation. To facilitate guide catheter engagement, balloon assisted guide catheter tracking can also be performed [10], another modification is to use guideliner (mother in child technique) to have good support [11]. Some reports have mentioned about use of oversized JL catheter to engage ARCA situated above the left coronary artery ostium but others have used undersized JL in similar situation [12]. In our case report we intubated the ARCA with XB4 and achieved a good back-up. We didn't perform MDCT in our patient during initial hospitalization though it is mandatory for risk stratification and further management strategy .So, RCA-LSOV stenosis can be managed properly with angioplasty but further risk stratification is required to improve prognosis. **Table 1** compared the previous reported case of CTO intervention in anomalous right coronary artery with our case. Among these 6 cases, two cases were performed through retrograde approach as they couldn't get stable guide position antegradely [7, 14]. Rest 4 cases were performed through antegrade approach [11, 13, 15]. Except one case, all other cases anomalous RCA was originating from left sinus and performed via femoral access.

Conclusion

Right coronary artery arising from opposite sinus of Valsalva is a risk factor for sudden cardiac death and prone to undergo atherosclerotic stenosis as well. Judicious use of guide catheter is the cornerstone of a successful PCI, MDCT assessment is required for risk stratification and further management.

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Disclosure of conflict of interest

None.

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