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Case Report

Optimal Coronary Evaluation and Management of Patient with Shepherd`s Crook Right Coronary Artery

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ABSTRACT

Shepherd's crook deformity of right coronary artery is a unique condition of dramatic upturn with a near 180°C switch-back turn. It is a challenge for interventionist to perform percutaneous coronary intervention in case of severe tortuous artery with atherosclerosis. Many tips, techniques and devices have been developed to overcome technical issues. We present an interesting case of 64-year-old male with extreme tortuosity of RCA who had difficulty in assessing the lesion characteristics.

Key words: Tortuosity, Atherosclerosis, Percutaneous coronary intervention, Shepherd's crook, Fractional flow reserve.

INTRODUCTION

Shepherd's Crook Deformity of Right Coronary Artery (SCRCA) is a dramatic upturn of artery with a near 180°C switchback turn. The etiology of SCRCA is still unclear and the frequency of this condition is very rare. It is a challenge for interventionist to perform percutaneous coronary intervention(PCI) in case of severe tortuous artery with atherosclerosis. Many tips, techniques and devices have been developed to overcome various technical difficulties. We report an interesting case of 64-year-old male with extreme tortuosity of RCA who had a difficulty in assessing the target lesion.

CASE HISTORY

A 64-year-old male was presented with atypical chest pain. Electrocardiogram (ECG) showed normal sinus rhythm with T wave inversion in lead III and aVF. Coronary computed tomography showed severe stenosis with diffuse mixed plaques from mid to distal Right Coronary Artery (RCA). Three-dimensional image of proximal RCA showed acute angulation of the proximal portion mimicking shepherd`s crook (Figure 1). The exercise ECG stress test demonstrated positive result without chest pain which was stopped at minute 9:09 of the protocol due to a significant ST depression at precordial and inferior leads. Coronary Angiography (CAG) was performed and it revealed significant focal discrete stenosis at the mid segment of the RCA. RCA was extremely tortuous and angulated especially in the proximal and mid segments (Figure 2). A 6Fr XB RCA guide catheter was engaged into the RCA via trans-radial access. We tried to insert a 0.014" guidewire (BMW, Abbott) into the RCA with micro-catheter (Corsair, Asahi intech) support, but the wire could not reach to the distal RCA because of the proximal tortuosity and poor guide catheter backup (Figure 3A). A whole system was removed and change to an 8Fr AL1 guide catheter via trans-femoral approach. Another 0.014" guidewire (Sion, Asahi intech) was loaded in lower profile micro-catheter (Caravel, Asahi intech) which successfully passed into the tortuous vessel and we could exchange the guidewire to more stiff one (Grand Slam, Asahi intech). After removal of the micro-catheter while leaving the guidewire in the vessel, the patient complained of severe chest pain. His heart rate decreased below 50 per min and blood pressure dropped under 80/60 mmHg. ST-segment was elevated in inferior lead on monitor ECG (Figure 4, A: pre-CAG, B: after wire inserted). Blood flow was totally blocked at the proximal RCA on followed CAG (Figure 3B). A stiff guidewire strengthened the extremely angulated vessel and it made curved structure folded. Coronary flow was fully recovered after removal of the guidewire and the patient was relieved from the chest pain. Since we failed to pass intravascular ultrasound for lesion assessment due to vessel tortuosity, we chose Fractional Flow Reserve (FFR) test for alternative choice. As a next step, we changed the guiding catheter (Judkin right cathter, Cordis) followed by smooth manipulation of pressure wire (Pressure WireTMX, ST jude Medical) into RCA and succeeded passing through the critical lesion (Figure 5). Adenosine 140mcg/kg/min was infused until the coronary hyperemia was attained. The initial FFR value was 0.99 which declined to 0.90 after coronary hyperemia. As a further management, we decided to maintain optimal medical treatment.

DISCUSSION

Shepherd's crook deformity is an acute upturn with a near-180°C switchback turn which is usually considered hemodynamically nonsignificant course.[1] The etiology of SCRCA is still unclear.[2] The previous studies reported that this coronary variants are detected approximately 5% of total cases.[3] Coronary assessment of the lesions in SCRCA may bring up procedural challenges due to lack of back up for device passage. To overcome such hindrances, the precondition for procedural success are needed; better guiding support, flexible wires manipulation, and the ability to fix the catheter top in ostium of engaged RCA in a stable position. Tortuosity can be defined as two or more than 75°C angulation from proximal to the target lesion or at lead one angulation of 90°C or more.[4] Performing PCI in these intricate situations is associated

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Figure 1: 3-Dimensional coronary computed tomography (CT) showed upturn with a near-180°C switchback turn of proximal to mid portion of right coronary artery (RCA).

Figure 4: (A) Resting electrocardiogram obtained before coronary angiography. (B) Electrocardiogram taken during the flow blockage in proximal RCA due to wire.

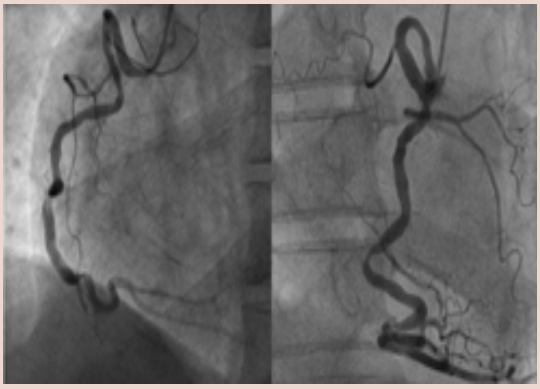

Figure 2: Coronary angiography revealed shepherd's crook shaped RCA which match with coronary CT finding.

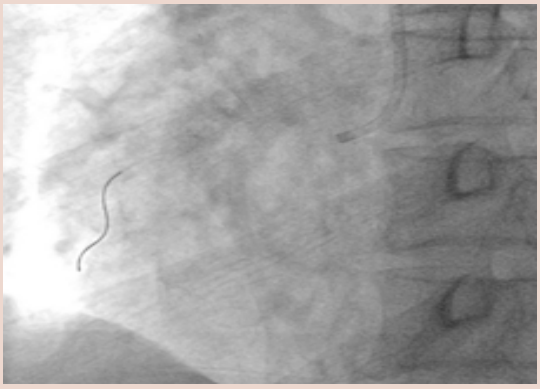

Figure 5: Fractional flow reserve (FFR) test performed in RCA.

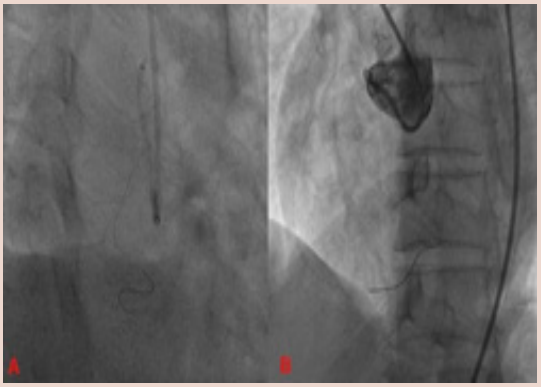

Figure 3: A) Wiring using 0.014" guidewire into the RCA with micro-catheter support. However, failed to reach the distal RCA due to poor guide catheter backup. (B) We successfully passed guidewire with micro-catheter support after changing guide catheter for better support. After switching wire to more stiff wire, proximal RCA flow was blocked with sudden chest pain.

with lower rate of success (70-85%) and higher rate of complications (Up to 15%).[4] In complex cases, Judkin right catheter may not be the fine choice due to lack of support. Amplatz left catheters and XB catheters may serve better support for complex PCI but it need coaxial alignment to prevent coronary artery dissection. Selection of coronary wires is also very important issue while performing PCI in the complex coronary lesions. Soft wires usually are not allowed passing through tortuous lesions with calcification; therefore, we tend to use harder wires to mitigate the tortuous slopes. However, in our case, it brought about the total obstruction due to accordion effect of coronary artery. According to the previous study, transient iatrogenic occlusions with balloons or stent may occur resulting in fatal arrhythmias and ischemia due to extreme tortuosity.[1] To overcome the problem, we went backward. We removed all system and waited until the patient recovered from transient ischemia. Shortly afterward, we changed the guidewire and the guiding catheter to softer ones for coronary assessment using FFR test. Through fastidious coronary evaluation, we could avoid unnecessary stent insertion which may lead to the better clinical outcome and may avoid complication.

ACKNOWLEDGEMENT

I would like to thanks all the participants of the case.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

ABBREVIATIONS

CAG: Coronary Angiography; **ECG:** Electrocardiography; **FFR:** Fractional Flow Reserve; **PCI:** Percutaneous Coronary Intervention; **RCA:** Right Coronary Artery; **SCRCA:** Shepherd's Crook Right Coronary Artery.

SUMMARY

Presence of the target lesion at the distal portion of extreme tortuosity may result in procedural challenge. It is important to avoid unnecessary stent insertion to obtain better procedural outcome and to avoid complication by assessing the lesion with functional study if it is possible.

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