

CrossingHou Tee Lu¹Waye Young Lau¹, Vicknesan Kulasingham¹, Gurudevan Mahadevan¹¹ Cardiology department, Sultanah Aminah Hospital, Malaysia**Clinical history and physician examination**

A 55-year-old male was hospitalized because of angina and decompensated heart failure. His risk factor include diabetes mellitus, hypertension and ex-smoker. The HR was 80/min and BP was 114/63 mmHg. He was on oral aspirin 100mgod, metformin 500mgbd, atorvastatin 40mgod, ezetimide 10 mg od, Entresto 50mgod BD, spironolactone 12.5mgod, bisoprolol 1.25mgod, empagliflozin 12.5 mg od

Tests prior to catheterization

Hb: 13.8 g/dl, ALT: 24 U/L AST: 19 U/L, urea: 7.7 mmol/l Na: 130 mmol/l K:4.2 mmol/l Creatinine: 101 umol/l, Glucose: 6.2 mmol/l, TC: 5.5 mmol/l LDL: 3.1 mmol/l TG: 2.42 mmol/l FT4: 15.9 pmol/l, and the cardio biomarkers were normal

ECG: T wave inversion V4- V6

CXR showed cardiomegaly

Echocardiography showed Impaired LVEF 40%, dilated left ventricle, mild tricuspid regurgitation, hypokinesia inferior and inferoseptal walls

Diagnostic Coronary Angiography

Coronary angiogram: The left main trunk (LMT), left anterior descending (LAD), left circumflex and diagonal arteries were normal.

The right coronary artery was a dominant artery and proximal RCA was a long complete total occlusion receiving collateral from septal collateral

J CTO score: 2

Procedure

The right femoral and right radial arteries were accessed. A 7 Fr EBU 3.5 guiding catheter (GC) was used to engage the left main trunk (LMT). A primary retrograde approach was selected because of the ambiguous proximal cap, long CTO lesion length, and the distal cap being located immediately proximal to the posterior left ventricular (PLV)/posterior descending artery (PDA) bifurcation.

The septal collateral was successfully crossed using a SUOH 03 guidewire, and a Corsair Pro XS 150 cm microcatheter (MC) was advanced into the right PDA and positioned at the distal CTO cap.

The antegrade preparation was challenging. The right coronary artery (RCA) originated high and superiorly. A 7 Fr AL 0.75 guiding catheter was initially used to engage the RCA but provided inadequate support because of poor stability. It was subsequently exchanged for a 7 Fr AL 1.0 guiding catheter.

For antegrade proximal cap puncture, a Finecross 130 cm microcatheter was used with sequential wire escalation from a Fielder XTA to GAIA Next 1 and GAIA Next 3. However, all attempts failed because the wires repeatedly prolapsed owing to inadequate guide support. An angulated microcatheter (SuperCross 120) was then used. Escalation to a Conquest Pro 12 g guidewire successfully penetrated the proximal cap, but the wire encountered significant resistance and could not be advanced further.

For the retrograde approach, the distal cap was punctured successfully, and an Ultimate Bros 3 (UB3) guidewire crossed the CTO body. At this stage, because of the long lesion length and ambiguous vessel course, the optimal retrograde wire escalation strategy remained uncertain. Therefore, an antegrade knuckle wire using a Gladius MG was advanced to facilitate connection with the retrograde wire.

Intravascular ultrasound (IVUS) demonstrated that both the antegrade and retrograde guidewires remained within the intimal space from the proximal to the mid RCA.

Based on the IVUS findings, the next strategy was retrograde wire externalization into the antegrade guiding catheter. Multiple attempts were made to externalize the retrograde UB3 using different wire tip angulations, angiographic projections, guiding catheter adjustments, predilatation with a 2.5 × 15 mm non-compliant balloon, and a guide extension catheter. Despite these maneuvers, wire externalization was unsuccessful. The UB3 was subsequently exchanged for a GAIA Next 1 guidewire, which was successfully advanced into the ascending aorta.

A decision was then made to perform wire snaring. After IVUS confirmed that the guidewire remained within the true lumen, the GAIA next 1 was advanced into the aortic arch to provide additional support for advancing the retrograde Corsair Pro XS microcatheter into the aorta. The GAIA Next 1 was then exchanged for an RG3 externalization wire. The RG3 was successfully snared using a SumiSnare (an improvised snare system) through a guide extension catheter and a JR 4.0 guiding catheter.

Following successful externalization, IVUS confirmed that the guidewire remained within the true lumen after predilatation with a small balloon. The distal RCA to PDA was treated with a 3.5 × 48 mm everolimus-eluting stent (EES), followed by implantation of a 3.5 × 48 mm EES in the mid RCA and a 4.0 × 28 mm EES at the ostial RCA. Final optimization was performed with post-dilatation using 4.0 mm and 4.5 × 15 mm non-compliant balloons.

Conclusions

Our case demonstrates a stepwise approach to overcoming difficult wire externalization following successful retrograde CTO crossing. Intravascular ultrasound (IVUS) provides valuable information regarding the location of both antegrade and retrograde guidewires when wire connection is challenging. IVUS enables differentiation between intraplaque and extraplaque guidewire positions, thereby facilitating appropriate strategy selection and successful retrograde wire externalization.