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Complex Chronic Total Occlusion:Hybrid approach how to do it?

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Introduction

Chronic Total Occlusion (CTO) is defined as complete obstruction in a coronary artery with TIMI flow grade 0 of at least 3 months duration(1). CTO are diagnosed in 15-20% of patients undergoing coronary angiography(2). Percutaneous Coronary Intervention (PCI) involving CTO is challenging, complex, involves large volume of contrast, accessories and may yield suboptimal results.

The main reason for PCI failure in CTO procedure in inability to cross the lesion by a guide wire (3). There have been several technical refinements techniques like antegrade wiring, antegrade dissection and its re-entry, retrograde and antegrade dissection and reentrywith improved outcomes (4,5,6).

The report will describe step by step use of different crossing strategies and the rationale for the hybrid approach. The emphasis will be on how to proceed further in case of an initial failure. We report a case of multivessel coronary artery disease (CAD) where complex CTO of right coronary artery (RCA) was treated using a hybrid approach along with PCI to other vessels.

Case Report

A 43 years old male presented with exertional anginaand a positive treadmill stress test at moderate work. Diagnostic coronary angiography demonstrated a long segment CTO beginning from proximal segment to distal of RCA (Figure A, panel 1). The PDA and PLV segment were filling retrogradely via collaterals from left anterior descending artery (LAD) (Figure A, Panel c). Additionally, there was 70% lesion in mid LAD and short segment CTO of distal left circumflex. The options of coronary artery bypass graft surgery (CABG) and multivessel PCI were discussed with the patient and he opted for percutaneous revascularization.

Dual femoral arterial access was obtained using two 45-cm long 7 French sheaths, and unfractionated heparin 5000 units was administered, LAD lesion was stented first using a followed by PCI to distal LCx CTO. Dual angiography confirmed a long segment CTO of RCA (Figure A, Panel 1). The initial antegrade crossing attempt using a Fielder XT wire (Asahi Intec, Nagoya, Japan) through a Fine Cross^{TM} micro-catheter (Terumo, NJ, USA) was unsuccessful. The antegrade wire escalation to stiffer Gaia 2 was without any substantial progress beyond the mid segment. Next step was retrograde crossing, using Fielder XT guide wire through a Caravel micro-catheter (Asahi Intec) which successfully negotiated the septal

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collaterals of LAD and reached distal RCA. However, the Fielder XTguide wire failed to make further progress in the CTO segment and the Caravel micro catheter despite multiple attempts. At this stage, Fielder XT was placed in distalposterior descending artery (PDA) and to posterior left ventricular (PLV).In view of both antegrade and retrograde failure, antegrade approach was reattempted using a Conquest Pro 12 guidewire. The wire was initially subintimal but with repeated attempts and micro catheter support, it successfully crossed the CTO segment up to distal RCA. The anterograde and retrograde wires were kissing each other that confirming entry into the true lumen of the vessel.
The RCA lesion was sequential pre dilatation of RCA lesion using 1.25 x 15 mm, 2.0 x 15 mm and 3.0 x 12 mm on-complaint balloon was followed by deployment of stents (3.5 x 36 mm) in proximal LAD and (2.25 x 28 mm) in distal LCx were deployed at normal pressures from proximal to distal RCA followed by post dilatation.Final angiographic recordings revealed all stentsto be patent, with TIMI III flow.

Discussion

The primary aim of Chronic Total Occlusion PCI is to improve myocardial perfusion and reduce ischemia (7). As untreated CTO is the most common cause for incomplete revascularization by PCI that has been shown to be associated with worse outcomes (8). The survival advantage of successful PCI over unsuccessful has been reported by the first year post PCI and also to be maintained in long term follow-up.
There might be a plethora of possible reasons for failure of attempted CTO including greater patient and anatomical complexity as determined by a number of scoring system, in our case J-CTO score was 3 indicating very difficult CTO, but patient was not willing for surgery hence went ahead with PCI. Knowing the difficulties like availability of accessories, cost, inability to cross lesion, flurotime, pre-procedural planning and review angiogram was the most important step. The 'hybrid' approach has emerged through the experiences of North American operators in an effort to improve the success rates and optimize use of equipment and resources during CTO PCI (9). Basis of the 'hybrid' approach is that no single procedural crossing strategy should be pursued to exhaustion, but should be abandoned in favor of an alternative strategy if it is not successful during a reasonable amount of time. Usually there is no universal approach to tackling CTO lesion and a combination of techniques might be needed in an individual case. Antegrade approach is preferred as a first by most of operators. Antegrade wire escalation was attempted initially using a Fielder XT then escalated to moderate tip load wire like Gaia 2 and ultimately Conquest Pro 12 which failed after trying for 30 minutes. Since, interventional collaterals (CC2) were good so retrograde attempts were performed in our case, using both a 'surfing' and a contrast guided approach to crossing septal collaterals (8), were able to reach distal PDA &PLV but failed to cross distal stump. The reverse controlled antegrade and retrograde tracking and dissection technique is the most commonly used technique for retrograde crossing (10). Again, decided to go to antegrade approach with Conquest Pro 12, went sub-intimal. Ultimately true to true lumen connection was tried and succeeded. Antegrade and retrograde wire were kissing each other.
The fluoroscopy time used in this case was 120 min, which is higher than the mean fluoroscopy time in contemporary CTO crossing series (42–45 min) (11), reflecting the higher technical difficulty of crossing the lesion in this patient.
In summary, our case illustrates that CTO PCI interventions may require the use of multiple crossing strategy changes during the same procedure, as decided by procedural progress and advocated in the 'hybrid' approach to CTO PCI

Drawbacks

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PCI could have been performed using Imaging (IVUS/OCT), but cost was the main constrain followed by availability on that day.

Conclusion

- Our case illustrated the importance careful reviewing of angiogram, dual angiogram and planning.
- Importance of flexibiting white handing guide wire and catheter.
- Patience, persistence and preservance enable success.

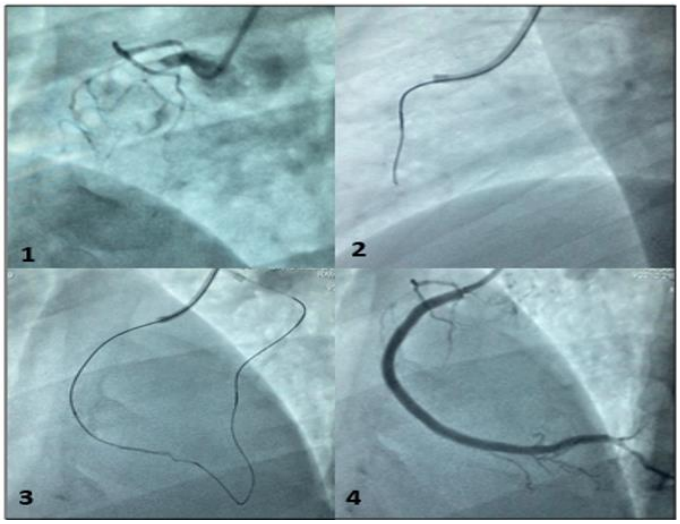

Figure: A Angiogram Images of Rca CTO Revascularisation

Figure: A Coronary angiography demonstrating

1. Chronic total occlusion of the proximal right coronary artery with bridging collaterals (arrow).
2. Antegrade wiring with conquest pro 12 with micro-catheter support reaching upto mid RCA.
3. Antegrade and retrograde wires with microcatheter support kissing each other.
4. Revascularised RCA CTO (Final result).

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