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Tips & Tricks in CTO intervention

- Planned procedure … Not “ad hoc” procedure.
- Don’t schedule it in a busy day.
- Proper diagnostic angiogram that visualize clearly the vessel beyond the CTO segment.
- GC with strong backup support, with 7 – 8 Fr.
- Bilateral angiography is essential from the start.
- Patient comfort: Like: sedation, oxygen, urinary catheter.
**Tips & Tricks in CTO intervention**

- Heparin anticoagulation with frequent monitoring to the ACT that must be kept at:
  - * 300-350
  - or * 200-250 in the presence of IIb/IIIa antagonists

- Use perpendicular views with every advancement to the wire in the CTO segment.

- Don't inject antegradely after dissecting the vessel and depend on retrograd injection.

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**CTO: Predictors of Outcome**

<table>
<thead>
<tr>
<th>Procedural Success</th>
<th>Procedural Failure</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Functional occlusion</td>
<td>- Total occlusion</td>
</tr>
<tr>
<td>- Occlusion &lt;12 wks</td>
<td>- Occlusion &gt; 12 wks</td>
</tr>
<tr>
<td>- Length &lt;15 mm</td>
<td>- Length &gt;15 mm</td>
</tr>
<tr>
<td>- Tapered stump</td>
<td>- Abrupt cut-off</td>
</tr>
<tr>
<td>- No branch at occl site</td>
<td>- Side branch present</td>
</tr>
<tr>
<td>- No bridge collaterals</td>
<td>- Bridge collaterals</td>
</tr>
<tr>
<td>- No / mild Calcium</td>
<td>- Heavy calcification</td>
</tr>
<tr>
<td>- Straight lesion</td>
<td>- Tortuosity</td>
</tr>
</tbody>
</table>
Material for antegrade CTO PCI

- Guiding catheter.
- Guidewires
- Microcatheters
- CTO balloons (Rx or OTW)
- Stents (DES)
- IVUS
- Extra support tools (Mother-and-child catheters, anchor balloon)
- Complication gear (covered stents, coils, pericardiocentesis set, snares)
GC is the first key to success.

It is important to provide maximum support for wire crossing and subsequent devices advancement, using coaxial orientation, good stability and optimal back-up force of the GC.

GC size depends on the access rout, and the techniques and devices to be used.

Guiding Catheters frequently used in CTO-PCI:

- For the LC arteries the extra backup shapes as XB, EBU, AL are the preferred.
- For the RCA most operators would select routinely AL1 and less frequently the XBRCA and the All-Right catheters.
II – PTCA Wires for CTO

Wires Used to cross the micro-channels:
- FielderFC: (Slippery soft wire).
- Fielder XT, XTA, XTR: (Tapered tip).
- Runthrough Hypercoat.
- Sion – blue.
- Whisper LS.

Wires Used to cross the CTO:
- Miracle 3, 4, 5, 6, 12.
- Pilot 50, 150, 200.
- Conquest 9.
- Conquest pro 12.
- Gia 1st, 2nd, 3rd.
- Progress 40, 80, 120, 140, 200.
- Proveia 12 – 15.
## CTO Guidewires

<table>
<thead>
<tr>
<th>Spring-coil</th>
<th>Polymer-jacket</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soft</td>
<td></td>
</tr>
<tr>
<td>Sion, Sion blue Prowater, BMW</td>
<td>Fielder FC, Sion Black Fielder XT-A/R <em>(tapered)</em></td>
</tr>
<tr>
<td>Stiff</td>
<td></td>
</tr>
<tr>
<td>Miracle, Ultimate bros3 Gaia <em>(tapered)</em> Conquest Pro <em>(tapered)</em></td>
<td>Pilot 150/200</td>
</tr>
</tbody>
</table>

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### Special shaping of the wire tip

- **Penetration from subintimal space**
  - 2° bend 10-15° @ 3-6mm
  - Work as a navigator to orient tip

- **Penetration of proximal or distal fibrous cap**
  - 1° bend of 30-45° 1-2mm from tip
  - Find softest part
Guide wire negotiation inside the CTO:

- Drilling CTO
- Penetration Distal cap
- Sliding Channel tracking

Drilling Strategy

- Wire advanced with rapid rotational tip and gentle probing
- In case of discrete entry point.
- Ineffective with Blunt entry and heavily calcific lesions.
- Start with MOD stiffness – progressive increase in

![Diagram of controlled drilling (90 degree arc)]
Penetration

- Technique: Pushing stiff wire slowly & gradually with minimum rotation to target direction
- Useful for blunt, heavily calcific or resistant lesions
- Not suitable for CTO with tortuous angulated or bridging

### How to verify distal wire position in true lumen?

- Wire behaviour (sudden freedom of wire tip).
- Wire passing to two opposite branches.
- Contralateral injection (at least in perpendicular projections).
- Distal aspiration (microcatheter)
- Distal injection (microcatheter)
- IVUS
III - Guidewire-Support Devices

- **Microcatheters** e.g: Fine cross 130, 150 cm.

- **Over-the-wire (OTW) balloon catheter**.

- **Corsair (Channel dilator0r)**: 130, 150 cm.

- **5Fr Heartrail guiding catheter** (using as Mother-Child technique).
Microcatheters

• Thin entry profile (1.8F)
• Inner Tungsten braiding
• Outer braiding of stainless steel (8 thinner and 2 thicker wires)
• Excellent pushability
• Do not turn more than 10 times the same direction!

Complications

Be aware of complications, anticipate and know rescue material!
CTO crossing techniques

- **SINGLE WIRE**
  - Direct crossing

- **DOUBLE WIRE**:
  - Parallel wiring
  - Seesaw wiring
  - Subintimal tracking and reentry
  - IVUS guided approach
Initially, a soft hydrophilic, tapered wire (e.g. Fielder XT-A, Asahi Intecc) is chosen with the aim of seeking out microchannels to traverse the CTO in the intimal space.

Non-hydrophilic wires with increasing penetration force (e.g. Miracle 3, 4.5, 6, 12 & Gia 1st, 2nd, 3rd Asahi Intecc) are used as needed in fibrous CTO segments for loose tissue tracking or intimal plaque tracking.

Gradual escalation of wire tip load aims to traverse the CTO with the safest wire, reducing...
Main purpose: - Using the first wire as a marker and obstructing the entry of the false channel

The second wire redirected to another channel based on the visual and tactile feedback.
Seesaw wire technique

- Seesaw wiring involves the use of two microcatheters and two wires.
- It has the advantage of avoiding the need for complex exchange of OTW microcatheters.
- The wires can be reshaped and their roles switched promptly.
- Operator is able to move each of the two wires.

Seesaw Wiring

These guide wires can exchange their roles each other very easily.
STAR – Uncontrolled.

LAST - Somewhat controlled.

STAR Technique

• Subintimal Tracking And Rentry Technique

Used when attempts to cross through the intimal plaque failed.

Hydrophilic wire pushed through subintimal dissection plane distal to the distal cap.

When pushed distal to occlusion, the angle of the wire tip is increased and directed to true lumen.

High chance of perforation.
Dissection/reentry techniques

The STAR and MiniSTAR techniques
(Subintimal Tracking And Reentry)
LAST technique

- Limited Antegrade Subintimal Tracking

Cross Boss catheter

- Metal OTW micro catheter with rounded tip to prevent vessel exit
- Device rotated rapidly in either direction using fast spin
- Can advance through the CTO without a wire in the lead
- Subintimal position - true lumen reentry performed
- Smaller subadventitial space – less likely to accumulate blood
Stingray balloon & guide wire

1mm flat balloon with 3 exit ports connected to the same lumen

Distal exit port – for balloon positioning

Uses guide wire with extreme tapered tip (0.0025) for reentry

Distal true lumen entry confirmed by contralateral injection

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Dissection/Reentry: CrossBoss and Stingray

**CrossBoss® Catheter**

1. **CrossBoss Catheter**: is designed to quickly and safely deliver a guidewire via true lumen or subintimal pathways

2. **Stingray System (catheter and guidewire)**: is designed to accurately target and re-enter the true lumen from a subintimal position

3. **Stingray Guidewire**: distal probe is designed for exit port selection and re-entry into the vessel true lumen
IVUS guided wiring

- IVUS guided proximal cap penetration may be used when an occlusion is flushed with a large side branch.
- If the wire enters a false lumen after the distal cap, the IVUS can be advanced over this wire to investigate the distal true lumen and to assess favorable reentry location the other wire.
Other Techniques Help the Antegrade CTO

Anchoring Wire technique

- This involves placing a second support wire in a side branch proximal to the occlusion to increase support from the guiding catheter.

- The balloon anchoring technique involves inflating an appropriately sized balloon in the side branch to stabilize the guide and increase guide support.

- The disadvantages with these methods include the risk of injury to the side branch and ischaemia if the side branch supplies a large myocardial territory.
Anchor Technique Using OTW Balloon
**Side branch technique**

- If the side branch is just in front of proximal cap and the wire slipping all the time to the side branch
- Pass guide wire with a balloon into side branch.
- Inflation of the balloon will lead to distortion of geometry of the proximal cap.
- Enables guide wire to advance into true lumen

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**Summary**

- Take enough time to plan your strategy, schedule enough time for your procedure
- General wire escalation algorithms: 1. soft polymeric wire, 2. stiff spring coil wire
- Know your material and use it (microcatheters, wires)!
- STAR and MiniSTAR only as bailout options
- Be safe! (radiation, contrast agents)
- Anticipate complications and have rescue gear ready
Thank You