IVUS-Guided Rewiring: Step by Step Approach

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Careful analysis of angiogram / CCTA

Proximal cap ambiguity
- Yes: IVUS guided entry
- No: Consider use of CrossBoss as primary crossing strategy

Poor quality distal vessel or bifurcation at distal cap
- Yes: Interventional collaterals present
- No: Antegrade wire based approach

If suitable re-entry zone
- Dissection Reentry (Stingray System)
- Parallel wiring

Consider primary use of KWT / dissection re-entry
- Ambiguous course in CTO
- Tortuous CTO segment
- Heavy calcification
- Consider secondary use of KWT / dissection re-entry
- Length > 20 mm
- Previous failed attempt

IVUS guided wiring / LAST

Consider stopping if > 3 hours, 3.7 x eGFR ml contrast, Air Kerma > 5 Gy unless procedure well advanced
The summary of IVUS-Guided Re-Wiring in the Antegrade Approach: When
- The algorithm from AP-CTO club and my experiences-

If the angiographic guided antegrade wiring is failed, you should select retrograde approach, dissection reentry or IVUS guided re-wiring in this order.

1. **Retrograde approach**: If interventional collaterals present.

2. **Dissection reentry**: If there is the suitable re-entry zone.

3. **IVUS guided re-wiring**: You should consider whether the IVUS can be inserted into the CTO body and there is the chance of intentional re-wiring such as not tortuous and/or not heavy calcified lesion.
IVUS-guided Re-wiring

Requiring experience and skill

- Last option in antegrade (and/or retrograde) approach

- Must understand 3-D anatomy and connection between devices
IVUS guided rewiring technique is one of the CTO rewiring techniques.

- First wire
- Second wire
- Intimal space
- Hard tissue
- Rewiring point
- Contrast
- Subintimal first wire
- ‘Parallel wire technique’
- ‘IVUS guided rewiring technique’
IVUS-Guided Re-Wiring in the Antegrade Approach: How

Commercial IVUSs

<table>
<thead>
<tr>
<th>Spec. of IVUS</th>
<th>Boston OptiCross</th>
<th>Volcano Revolution</th>
<th>Volcano Eagle eye</th>
<th>Acist HDi</th>
<th>Terumo AltaView</th>
<th>Terumo Navifocus WR</th>
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<tbody>
<tr>
<td>Frequency Profile at Imaging window</td>
<td>40MHz</td>
<td>45MHz</td>
<td>20MHz</td>
<td>40/60MHz</td>
<td>40/60MHz</td>
<td>40MHz</td>
</tr>
<tr>
<td>Distance from Tip to transducer</td>
<td>2.6Fr</td>
<td>3.2Fr</td>
<td>3.5Fr</td>
<td>2.5Fr</td>
<td>2.6Fr</td>
<td>2.5Fr</td>
</tr>
<tr>
<td></td>
<td>20mm</td>
<td>28mm</td>
<td>10.5/2mm</td>
<td>20mm</td>
<td>22mm</td>
<td>9mm</td>
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IVUS-guided re-wiring: **IVUS observation from the subintimal space.**

[Diagram showing IVUS observation from the subintimal space with labels for True lumen, CTO, 2nd-GW, and IVUS subintima.]
Basics of IVUS-guided rewiring

1. Understanding plaque distribution on angiography
   IVUS guided rewiring is always performed on angio screen…
   Linkage between angio and IVUS findings is needed.

2. How can we link these findings?
   Angiographic view is 2D, however, coronary arteries are 3D.
Fundamental Questions of IVUS-guided rewiring

1. Where we have to insert?

2. Which direction we have to insert?
Q: Where we have to insert?
A: We have to insert from intima space.

O.K.
We can confirm where is starting point of subintima space using IVUS.

No.
Very difficult to insertion from subintima space
Due to hard wall between intima and subintima and vacant space of subintima.
Q: Which direction we have to insert?
A: We can confirm the direction by side branch and wire bias.

Using side branch

Using wire bias

Diagonal branch

Subintima

Intima

Diagonal branch

Wire

Transducer

Center of IVUS
1. Major branch guided.
Passed through CTO wire to Dx subintima space.

Switched to IVUS re-wiring procedure.
Opened by 1.5mm balloon for insertion IVUS
Where we have to insertion:
Between blue arrow (Proximal part of subintima)

Which direction:
Between Dx and septal, RV direction
Tips:
- Rotational angio is beneficial for recognizing of anatomy, especially using wire bias.
- Usually we need stiff wire as second wire. i.e. Miracle12, Gaia3, Conquest family.
2. Probe-wire guided.

Tips:
- Rotational angio is beneficial for recognizing of anatomy, especially using wire bias.
- Usually we need stiff wire as second wire. i.e. Miracle12, Gaia3, Conquest family.
Probe and wire are in the same line in RAO and is separately located from the wire in LAO.
Next landmark is the first wire.

Intimal space is epicardial (right)-sided in RAO and in the same line in LAO.
IVUS from subintimal wire
LCX CTO case
1. Identification of the entry.
2. Identification of intimal direction.
IVUS guided rewiring

- Guiding catheter
  - ≥ 8Fr (some IVUS catheters are available 7Fr system. Terumo, BS)

- Linkage angiographic finding with IVUS is important.

- Side branch and wire bias are useful for understanding plaque distribution.

- Rewiring should be started at the entry of sub-intimal space to get true lumen.

- Re-entry from sub-intimal space to true lumen is usually very difficult.
This technique is also effective in bailout of guiding catheter injury.
After failure of retrograde XT–R direct crossing, we rewired SION antegrade under IVUS guidance.
IVUS guided rewiring technique is effective not only in CTO procedure, but also bailout procedure of vessel injury.
Conclusions

• In the modern approach for CTO intervention, use of IVUS may be helpful and last resort in CTO intervention.

• There are largely fundamental techniques,

  During antegrade approach
  - IVUS-guided proximal cap identification and penetration
  - IVUS-guided rewiring technique, in the case of first wire in the false lumen (should be done before false lumen is enlarged)

  During stent optimization

• It needs some time and efforts to get used to execute.
• Three dimensional recognition is important in this strategy.
Thank You For Your Attention
Bailout case
After ‘rewired’ wire could not track the bent, we progressed the wire distally to stretch it.
Gaia1 manipulation, down in RAO view and left in LAO view.