Navifocus WR IVUS is the promising imaging device for navigating the guide-wire into true lumen during CTO intervention: initial clinical experience
Case

Patient: 61 y.o. Male

Diagnosis: Old myocardial infarction (OMI) (anterior), effort angina

Target lesion: CTO lesions in the proximal and mid- left anterior descending (LAD)

Coronary risk factor: Diabetes, dyslipidemia

LVEF: 50 %, Cr: 0.70 mg/dl, Ergometer: ST depression in V3-6 1.0mm sagging pattern

Prior intervention:
Onset of OMI (anterior) was not clear. He suffered from chest pain on effort from Sep. 2010, and multi-detector-row computed tomography (MDCT) revealed CTO lesions in the proximal and mid-LAD and thrombus formation at apical area of left ventricle. Anticoagulant treatment with warfarin has been started.

In June 2012, MDCT revealed the disappearance of the thrombus. As he still suffered from chest pain on effort, he was admitted for PCI for the CTO lesions in the LAD in Nov. 2012.
PCI for Seg6-7 CTO on 11/1/2012

LAD was totally occluded from ostial lesion. There were 2 septal channels from PDA in the RCA.
Guide catheter: 8F SL SH

Under IVUS observation from High lateral branch, 1st-guide wire (Conquest-pro) was advanced into the LAD CTO lesion.

Parallel wire technique with Conquest-pro wire and GAIA 2nd-wire could not lead them into the distal true lumen beyond the distal end of proximal CTO lesion.
JR4 SH 7F retrograde guide catheter was inserted and retrograde SION wire could be passed through the distal septal channel.

Under IVUS observation, reverse CART with 2mm balloon lead the retrograde wire passage through CTO lesions, followed by externalization with RG-3 wire.
After externalization with RG-3 wire, Eagle eye IVUS showed that the guidewire was passed the true lumen at the proximal part of the CTO lesion.

As Eagle eye IVUS could not be passed through the middle part of LAD, POBA with 2mm balloon was performed at this part.
IVUS observation from LAD mid-distal

20MHz Eagle eye IVUS Volcano

Observation by using Eagle eye IVUS did not clearly show true and sub-intimal space in the mid-LAD.

40MHz View-IT Terumo

Observation by using View-IT IVUS clearly showed true and sub-intimal space in the mid-LAD.
View-IT IVUS had a small profile transducer (2.5F) but the long tip-to-transducer length (30mm), therefore the observation area was from the proximal to mid-LAD and the wire was passed through the sub-intima space in this area. I tried to enter the retrograde SION wire into true lumen under IVUS observation antegradely to preserve the branches, which was failed.
### Spec. of IVUSs and CTO-specific IVUS (Navifocus WR)

<table>
<thead>
<tr>
<th>Spec. of IVUS</th>
<th>Boston Atlantis SR Pro2</th>
<th>Volcano Revolution</th>
<th>Volcano Eagle eye</th>
<th>Terumo ViewIT</th>
<th>New Terumo Navifocus WR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency</td>
<td>40MHz</td>
<td>45MHz</td>
<td>20MHz</td>
<td>40MHz</td>
<td>40MHz</td>
</tr>
<tr>
<td>Profile at Imaging window</td>
<td>3.2Fr</td>
<td>3.2Fr</td>
<td>3.5Fr</td>
<td>2.5Fr</td>
<td>2.5Fr</td>
</tr>
<tr>
<td>Distance from Tip to transducer</td>
<td>26mm</td>
<td>28mm</td>
<td>10.5mm</td>
<td>30mm</td>
<td>9mm</td>
</tr>
</tbody>
</table>

**Navifocus WR for CTO intervention under IVUS observation from subintima**

- **Minimum vessel damage:** This device has a small profile transducer (2.5 Fr) with short tip-to-transducer length (9 mm) and can be inserted into the subintimal space with minimal vessel damage. Due to the long proximal monorail lumen 26 cm in length, this IVUS device can maintain good deliverability and pushability in CTO lesions despite the short tip-to-transducer length. Navifocus WR can also be inserted into a 7 Fr guide catheter with a Finecross GT microcatheter as the second guidewire.

- **Transfer from the direction of IVUS image to that of angiographic image for navigation of the second guidewire into the true lumen:** The double monorail lumen system maintains a fixed asymmetrical structure of proximal marker next to the transducer and the IVUS own guidewire, which can transfer the direction of the IVUS image to that of the angiographic image for navigation of the next guidewire into the true lumen accurately on both the IVUS image and angiographic image.
Compared to View-IT IVUS, Navifocus WR IVUS transducer could be advanced into more distal part of the LAD.
Navifocus WR IVUS clearly showed that retrograde wire entered into sub-intimal space just beyond the ostium of septal channel.
Retrograde wire was entered into the sub-intimal space just beyond the ostium of septal channel, which meant that it was almost impossible for the retrograde wire to be entered into the true lumen.

Therefore, I moved to use the proximal septal channel as the retrograde approach channel, but the retrograde wire was also entered into sub-intimal space just beyond the ostium of the septal channel because the connection of true lumen was also fractured from the ostium of septal channel in this area, which was clearly showed by inserted Navifocus WR IVUS.
Rotational angiography transfers the direction of IVUS image to that of angiographic image.

I moved to antegrade approach with Navifocus WR IVUS.

To transfer the direction of the IVUS image to that of the angiographic image, the following procedures were performed:

1) The IVUS transducer was placed at the transitional site of the true and subintimal spaces.
2) To perform accurate rotational angiography, the height and position of the bed were adjusted as the IVUS transducer was positioned at the center on the angiographic monitor at the lateral position of the X-ray system detector.
3) Rotational angiography was performed from RAO 45° CRA 30° to LAO 10° CAU 20°, which was orthogonal to the CTO lesion where the IVUS transducer was placed.
4) The detector direction where the proximal marker next to the IVUS transducer and the IVUS own guidewire coincided on the angiographic image was determined—in the present case, this detector direction was LAO 10° CAU 20°.
Rotational angiography

From RAO 45° CRA 30° to LAO 10° CAU 20°

At 40° rotation clockwise from LAO 10° CAU 20° on the IVUS image, i.e., at RAO 15° CRA 20° of the angiographic detector position, the IVUS transducer and the true lumen were maximally separated and the true lumen was located at the lower side of the proximal marker next to the IVUS transducer.
At CRA 20° RAO15° detector position, I angiographically advanced Conquest-pro wire with Finecross to the lower side of IVUS proximal marker and easily entered the wire into true lumen which was confirmed by Navifocus WR.

CRA 20° RAO15°
The Conquest-pro wire was advanced to distal LAD, but was reentered into sub-intimal space twice and was entered into true lumen again with Navifocus WR IVUS guidance. The Conquest-pro was finally advanced into LAD distal site throughout the true lumen.
Three drug-eluting stents were implanted. TIMI-3 flow was obtained and most of the septal channels’ flow was maintained.
Summary

Navifocus WR IVUS has a the small profile transducer with short tip-to-transducer length, which enables us to observe the more distal coronary site, and for IVUS guided antegrade approach, to advance it into sub-intimal space with minimum vessel damage for navigation of the second guidewire into the true lumen accurately both on the IVUS image and angiographic image.

Conclusion

Navifocus WR facilitates IVUS-guided wiring CTO intervention, which will improve the CTO success rate in addition to the current antegrade wiring technique and retrograde approach.