Comparison in usefulness for CTO intervention between the 40-MHz IVUS and 20-MHz IVUS.

CARDIOVASCULAR CENTER, SAKURABASHI WATANABE HOSPITAL

Backgrounds

- The major reason of percutaneous coronary intervention (PCI) failure for chronic total occlusion (CTO) lesions is the advancement of a guidewire into the subintimal space.

- When the guidewire is advanced into the subintimal space, it is sometimes difficult for the guidewire to be reentered to the true lumen. In this situation, intravascular ultrasound (IVUS) guided wiring is useful for the other guidewire to be led visually into the true lumen by observing with the IVUS which is advanced into the subintimal space.
### Spec. of commercial IVUSs

<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>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Frequency</strong></td>
<td>40MHz</td>
<td>45MHz</td>
<td>20MHz</td>
<td>40MHz</td>
</tr>
<tr>
<td><strong>Profile at Imaging Window</strong></td>
<td>3.2Fr</td>
<td>3.2Fr</td>
<td>3.5Fr</td>
<td>2.4Fr</td>
</tr>
<tr>
<td><strong>Profile at Proximal shaft</strong></td>
<td>3.6Fr</td>
<td>3.5Fr</td>
<td>2.9Fr</td>
<td>3.2Fr</td>
</tr>
<tr>
<td><strong>Distance from Tip to transducer</strong></td>
<td>26mm</td>
<td>28mm</td>
<td>10.5mm</td>
<td>30mm</td>
</tr>
</tbody>
</table>

**Electronic scan type**
- Eagle Eye Platinum

**Mechanical scan type**
- ViewIT
- Atlantis SR pro2, Revolution
Objective

We compared the usefulness for CTO intervention between the 40-MHz IVUS and 20-MHz IVUS.

<table>
<thead>
<tr>
<th></th>
<th>Eagle Eye (Volcano)</th>
<th>View IT (Terumo)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Frequency</strong></td>
<td>Solid state (20MHz)</td>
<td>Mechanical (38~43MHz)</td>
</tr>
<tr>
<td><strong>Distance from Tip to transducer</strong></td>
<td><strong>10.5mm</strong></td>
<td><strong>30mm</strong></td>
</tr>
<tr>
<td><strong>Profile at Imaging Window</strong></td>
<td><strong>3.5 Fr.</strong></td>
<td><strong>2.4 Fr.</strong></td>
</tr>
<tr>
<td><strong>GW artifact</strong></td>
<td><strong>No</strong></td>
<td><strong>Yes</strong></td>
</tr>
</tbody>
</table>
Case 1

Patient: Male 71 y.o. Male

Diagnosis: Stable angina pectoris

Target lesion: #14 100%

Coronary risk factor: Hypertension, Dyslipidemia
CAG showed the abrupt type of CTO in the distal portion of the LCX.

Approach: right femoral artery, Guide-catheter: Heart Rail II BL3.5SH 7Fr.
XT-R was advanced with Corsair microcatheter.
The guidewire could not be passed through the CTO lesion. Therefore 20-MHz IVUS (Eagle Eye) was used to observe the proximal lumen, but it could not clearly identify whether the mass was the true lumen or eccentric plaque.
Fielder FC wire was used and advanced to the distal part of the LCX.
The lesion was dilated with a 1.5mm diameter balloon to perform IVUS examination.
As 20-MHz IVUS could not clearly show the lumen information, we used 40-MHz IVUS, which clearly showed the true lumen.
Comparison of the IVUS images between the 20-MHz IVUS and the 40-MHz IVUS (View-IT).
By observing from subintimal space with the View-IT IVUS, the next guidewire (Conquest-pro wire) was got into the true lumen. Drug eluting stent was implanted and TIMI-3 flow was obtained.
Case 2

**Patient:** Male 61 y.o. Male

**Diagnosis:** Old Myocardial Infarction, Stable angina pectoris

**Target lesion:** #4AV 100%

**Coronary risk factor:** Hypertension, Dyslipidemia

**Prior intervention:**

PCI to #4AV 100% CTO was failed because the guidewires were got into subintimal space.
CAG showed the abrupt type of CTO in the distal portion of the RCA.
The GAIA second wire with Corsair microcatheter was passed the CTO lesion.
To observe the CTO lumen, we inserted 20-MHz IVUS (Eagle Eye), which could not clearly showed but speculated that the guidewire might have entered into the subintimal space.
<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>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 IVUS has a small profile transducer (2.5F) with short length of tip to transducer (9mm) and can be inserted into a 7F guide catheter with Finecross microcatheter (Terumo Corp.).
- **Coincidence of direction of images between IVUS and angiogram:** An asymmetrical structure of proximal marker area can coincide IVUS image with angiographic image for navigating of the next guide-wire into the true lumen under IVUS observation from sub-intimal space.
As 20-MHz IVUS could not clearly show the lumen information, we used 40-MHz IVUS (Navifocus WR) for detection of true lumen and guidance of the next guidewire into true lumen.
The next guidewire (Conquest-pro wire) was entered into true lumen, which was confirmed by Navifocus WR IVUS.
Two drug eluting stents were implanted and TIMI-3 flow was obtained.
**Summery**

- Compared to the 20-MHz IVUS, the 40-MHz IVUS could clearly show the true lumen and subintimal space in the CTO lesion.

- The transducer parts of the ViewIT and Navifocus WR IVUS are low profile (2.5Fr in diameter), therefore the true lumen compression is minimized during wire manipulation by observing with the IVUS which is advanced into the subintimal space.
Conclusion

From visual point, the 40-MHz IVUS is better for navigating the next guide-wire into the true lumen under the IVUS observation from sub-intimal space.