ΚΛΙΝΙΚΗ ΧΡΗΣΗ OCT

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Διευθύντρια ΕΣΥ
Β´ Καρδιολογικό τμήμα
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Potential conflicts of interest

Speaker’s name: Konstantina Bouki

I do not have any potential conflict of interest
OCT technology

- Rapid exchange (Rx) imaging catheter (Dragonfly)
- Flush Media Clearance
- Fast acquisition: 7.5 – 5.4cm pullback in 3.0 – 2.1 seconds
<table>
<thead>
<tr>
<th>Specifications</th>
<th>FD-OCT</th>
<th>IVUS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Axial scans per second</td>
<td>~50,000 -100,000</td>
<td></td>
</tr>
<tr>
<td>Lines per frame</td>
<td>~500-1000</td>
<td></td>
</tr>
<tr>
<td>Max. frame rate</td>
<td>100-200 fps</td>
<td>30</td>
</tr>
<tr>
<td>Max. Pullback speed</td>
<td>20-40 mm/s</td>
<td>1 mm/s</td>
</tr>
<tr>
<td>Wave Length</td>
<td>1.3μm</td>
<td>35-80μm</td>
</tr>
<tr>
<td>Axial resolution</td>
<td>10-15μm</td>
<td>150μm</td>
</tr>
<tr>
<td>Lateral Resolution</td>
<td>40-90μm</td>
<td>250μm</td>
</tr>
<tr>
<td>Tissue penetration</td>
<td>2-3.5 mm</td>
<td>7 mm</td>
</tr>
<tr>
<td>Scan diameter (FOV)</td>
<td>~10 mm</td>
<td>15 mm</td>
</tr>
<tr>
<td>Balloon occlusion</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Catheter Size (mm)</td>
<td>0.8 – 1 mm</td>
<td>1 mm</td>
</tr>
</tbody>
</table>
2. Assess plaque composition
3. Identify reference segments
4. Choose stent size

5. Determine expansion/MSA
6. Rule out geographical miss

7. Determine apposition
8. Identify edge dissections
9. Identify tissue protrusion
10. Identify mechanisms of stent failure
Pre-PCI  OCT imaging
PCI strategy planning

Plaque rupture

Thrombus

Calcified Plaque

Necrotic core-rich Fibroatheroma

Minimum Lumen Area, Reference Lumen Area and Diameters, Lesion Length
What is the culprit?
Definite erosion

Probable erosion

Calcified nodule

Plaque rupture

J Am Coll Cardiol 2013;62:1748–58
Case example 1: male, 65 yrs old, smoker with non-STEMI.
RCA non significant lesions
OCT imaging of LAD

- Rupture
- Calcium nodule
- TCFA
Choose stent size

Lesion length = 13 mm

Distal RLD = 3.0 mm

Proximal RLD = 3.15 mm
OCT imaging of stent deployment
PCI LAD

Diagonal ostium

Struts

MSA=7.75mm² > 90% mean RLA
Distal stent edge

Proximal stent edge

Post PCI

OCT Imaging

Malapposition
CLI-OPCI II Study JACC Int 2015

Edge dissection.
Width > 200 μ

Stent malapposition.
Distance > 500 μ

Thrombus. Thickness > 500 μ

Absence of residual stenosis adjacent to stent endings (MLA < 4.5 mm²) in presence of plaque

Underexpansion

In-stent MLA < 4.5 mm² or < 60% of the average
CLI-OPCI II Study
Prati et al. JACC Int. 2015

929 pts (989 lesions) in CLI-OPI II registry
MACE (death, MI, ST, or TLR in 12.2%) @ 1 yr

Independent predictors of MACE were in-stent MLA < 4.5mm²,
proximal or distal reference narrowing, or distal edge dissection.
Baseline OCT and 1 year follow-up (900 stents in 786 patients)

<table>
<thead>
<tr>
<th>Independent predictors of 1 year events</th>
<th>Device oriented clinical events</th>
<th>TLR</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>OR</td>
<td>P-value</td>
</tr>
<tr>
<td>Age, years</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male gender</td>
<td>3.13</td>
<td>0.068</td>
</tr>
<tr>
<td>BMS</td>
<td>1.75</td>
<td>0.005</td>
</tr>
<tr>
<td>Irregular protrusion</td>
<td>2.64</td>
<td>0.003</td>
</tr>
<tr>
<td>Small MSA</td>
<td>2.54</td>
<td>0.012</td>
</tr>
</tbody>
</table>

- Irregular protrusion = protrusion of material with an irregular surface (>100 microns) into the lumen between stent struts.
- Small MSA defined by ROC analysis = 5.0mm² for DES (AUC=0.63) and 5.6mm² for BMS (AUC=0.59)
- Neither edge dissection nor acute malapposition nor relative stent underexpansion predicted events at 1 year of follow-up

Studies on percutaneous coronary interventions with OCT guidance

CLI-OPCI. *Euroint 2012*

IIlumien I. *Eur Heart J 2015*

IIlumien II. *JACC Int 2015*

Opinion. *Eur Heart J 2017*

Doctors. *Circulation 2016*

IIlumien III. *Lancet 2017*
The OPINION study

- Multicenter noninferiority study.
- 800 patients randomized.
- OCT guided PCI using DES with resorbable polymer vs IVUS-guided PCI at 42 centers in Japan.
- FU angiography at 8 months.
- Primary endpoint: target vessel failure at 12 months FU.

Takashi Akasaka, MD, PhD, of Wakayama Medical University (Wakayama, Japan),

PCR 2016
Optical frequency domain imaging vs. intravascular ultrasound in percutaneous coronary intervention (OPINION trial): one-year angiographic and clinical results

Takashi Kubo^1, Toshiro Shinke^2, Takayuki Okamura^3, Kiyoshi Hibi^4,
Primary Endpoint

Final post-PCI MSA by OCT

OCT 5.79 mm² [4.54, 7.34]
IVUS 5.89 mm² [4.67, 7.80]

97.5% one-sided CI: [-0.70, -]

Angiography
5.49 mm² [4.39, 6.59]

P_{noninferiority} = 0.001
P_{superiority} = 0.12

OCT better
IVUS better
NI margin
## Secondary Endpoints

<table>
<thead>
<tr>
<th></th>
<th>OCT (n=140)</th>
<th>IVUS (n=135)</th>
<th>Angio (n=140)</th>
<th>(P) OCT vs IVUS</th>
<th>(P) OCT vs Angio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimal stent area, mm(^2)</td>
<td>5.79 [4.54, 7.34]</td>
<td>5.89 [4.67, 7.80]</td>
<td>5.49 [4.39, 6.59]</td>
<td>0.42</td>
<td>0.12</td>
</tr>
<tr>
<td>Min stent expansion, %</td>
<td>88 ± 17</td>
<td>87 ± 16</td>
<td>83 ± 13</td>
<td>0.77</td>
<td>0.02</td>
</tr>
<tr>
<td>Mean stent expansion, %</td>
<td>106 [98, 120]</td>
<td>106 [97, 117]</td>
<td>101 [92, 110]</td>
<td>0.63</td>
<td>0.001</td>
</tr>
</tbody>
</table>

### Expansion

- Optimal (>95%) | 26% | 25% | 17% | 0.84 | 0.07 |
- Acceptable (90 - <95%) | 16% | 12% | 3.7% | 0.42 | 0.0008 |
- Unacceptable (<90%) | 59% | 63% | 79% | 0.45 | 0.0002 |
The efficacy of OCT-guided PCI with the ILUMIEN III stent optimization protocol to improve event-free survival after DES will be evaluated in the upcoming large-scale, randomized pivotal ILUMIEN IV trial.
OCT imaging post-PCI

Identify mechanisms of stent failure

UNDERSTANDING, PREVENTING AND TREATING STENT FAILURE
Prestige study
Circulation 2017
September
Mecha
isms
of
BVS
throm
bosis

Underexpansion or scaffold shrinkage
Neoatherosclerosis
Malapposition
Others
Scaffold discontinuity

18%
11%
11%
42%
18%
Case example 2: ACS in a female, 85 yrs old and PCI in Left Main one year before
Intravascular imaging using FD-OCT Neoatheromatosis.
Stent underexpansion in the distal LM-
Neoatheromatosis

LMCA MSA=6,01mm²

LMCA CSA=8,75mm²
Angiographic post – PCI result
LAD ostium

Stent
CSA=6.57mm²

Carina LM

Stent
CSA=8.43mm²

LM above carina

Stent
CSA=14.32mm²

LM proximal

Stent
CSA=16.28mm²
Conclusions

- OCT has emerged as an exciting and powerful intravascular imaging modality.
- OCT is able to provide immediate in-vivo information about the mechanism of ACS, stent failure, and can guide coronary interventions.
- Large, randomized studies are warranted to definitely elucidate the clinical role of OCT and its cost-effectiveness.