OCT-What we see, what we measure and where we need it?

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Potential conflicts of interest

Speaker’s name: Konstantina Bouki

I do not have any potential conflict of interest
OCT (FD-OCT/OFDI)
Normal Artery Topography

Adventitia

catheter

Media

Intima

Wire Artifact

IEL

EEL
FIBROUS PLAQUE

TCFA
CALCIFIED PLAQUE

CALCIUM NODULE
THROMBUS

RED THROMBUS

WHITE THROMBUS

1 mm

05:14:35 0001
01/20/2009

www.hcs.gr

70 ΧΡΟΝΙΑ ΚΑΡΔΙΟΛΟΓΙΑΣ (ΕΚΕ)
70 YEARS OF CARDIOLOGY (HSC)
PΑΝΕΛΛΗΝΙΟ ΚΑΡΔΙΟΛΟΓΙΚΟ ΣΥΝΕΔΡΙΟ
PANHELLENIC CONGRESS OF CARDIOLOGY
Good stent apposition and expansion

Stent edge dissection

Severe malapposition + underexpansion

Intra-stent thrombus

STENT EVALUATION
STENT- VESSEL WALL INTERACTION

Complete endothelialization

Extensive evaginations

Neoatheromatosis-Thrombus
What do we measure with OCT?
What do we measure?
Discrepancy between frequency domain optical coherence tomography and intravascular ultrasound in human coronary arteries and in a phantom in vitro coronary model.

International Journal of Cardiology 221 (2016) 860–866
FD-OCT in the evaluation of the left main coronary artery stenosis. Correlation with FFR.
Bouki et al. Eur Heart J. 2018

Left Main MLA<5.3mm\(^2\) predicts FFR ≤0.80 with:
- sensitivity=85%
- specificity=93%
- accuracy=90%

ROC Curve

AUC=0.93, p<0.00
Cut off=5.3mm\(^2\)
What do we measure?

- Distal reference area: 11.83 mm²
- Minimal lumen area: 7.06 mm²
- Proximal reference area: 8.23 mm²

- Stent expansion: 70.3%
- Stent underexpansion
- Edge dissection
- Stent malapposition
- Tissue prolapse
Expert consensus document on OCT for guiding PCI. Eurointervention 2018

Plaque burden <50% at stent edge and no lipid pool

Dissection
(<60°, flap limited to intima, <2 mm length)

No extensive protrusion

Malapposition
(axial distance <0.4 mm and <1 mm length)

Lumen

Ref dist.

MSA

Ref prox.

MSA > 5.5 mm² (IVUS) and > 4.5 mm² OCT

MSA/average reference lumen > 80%
Where to use OCT?
Where to use OCT

• To guide PCI
  (IIa  ESC Guidelines Myocardial Revascularization 2018)

• To identify mechanisms of stent failure
  (IIa  ESC Guidelines Myocardial  Revasc.)
Studies on percutaneous coronary interventions with OCT guidance

CLI-OPCI. Euroint 2012
Illumien I. Eur Heart J 2015
Illumien II. JACC Int 2015
Opinion. Eur Heart J 2017
Doctors. Circulation 2016
Illumien III. Lancet 2017
Clinical outcomes following intravascular imaging-guided vs. angiography-guided PCI. Meta-Analysis of 31 Studies and 17,882 patients
Buccheri et al. JACC:Cardiovasc. Interv. 2017

**MACE**

<table>
<thead>
<tr>
<th>Study</th>
<th>P-value</th>
<th>Odds Ratio (95% Crl)</th>
</tr>
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<tbody>
<tr>
<td>IVUS vs Angiography</td>
<td></td>
<td></td>
</tr>
<tr>
<td>direct</td>
<td></td>
<td>0.79 (0.67, 0.92)</td>
</tr>
<tr>
<td>indirect</td>
<td>0.8318</td>
<td>0.72 (0.30, 1.7)</td>
</tr>
<tr>
<td>network</td>
<td></td>
<td>0.79 (0.67, 0.91)</td>
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<tr>
<td>OCT/OFDI vs Angiography</td>
<td></td>
<td></td>
</tr>
<tr>
<td>direct</td>
<td></td>
<td>0.68 (0.47, 1.0)</td>
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<tr>
<td>indirect</td>
<td>0.9842</td>
<td>0.69 (0.30, 1.6)</td>
</tr>
<tr>
<td>network</td>
<td></td>
<td>0.69 (0.49, 0.98)</td>
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<tr>
<td>OCT/OFDI vs IVUS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>direct</td>
<td></td>
<td>1.0 (0.50, 2.0)</td>
</tr>
<tr>
<td>indirect</td>
<td>0.6106</td>
<td>0.81 (0.54, 1.3)</td>
</tr>
<tr>
<td>network</td>
<td></td>
<td>0.87 (0.61, 1.3)</td>
</tr>
</tbody>
</table>
Early restenosis was associated with MSA < 4.0 mm² while neoatherosclerosis contributed to late ISR.

Song et al. Euroinervention 2017
Clinical use of OCT: stent thrombosis

Raber et al. Eurointervention 2018

Early ST

Very late ST

Uncovered struts
- Uncovered struts: 64%
- BERN registry Circulation 2016

Malapposition
- Malapposition: 48%
- PESTO registry EHJ 2016

Underexpansion
- Underexpansion: 26%
- PRESTIGE registry Circulation 2017

Edge dissection
- Edge dissection: 19%

Malapposition
- Malapposition: 33%

Neointimal hyperplasia
- Neointimal hyperplasia: 30%

Uncovered struts
- Uncovered struts: 14%

Underexpansion
- Underexpansion: 14%

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BERN registry Circulation 2016
PESTO registry EHJ 2016
PRESTIGE registry Circulation 2017
Case example 1. Female, 70yrs old, with non-STEMI. PCI in LAD with a stent Resolute 2.75/22mm 6 months ago because of STEMI.

PCI RESULT 4/2017

New angiography 10/2017
OCT imaging of stent thrombosis in LAD

White thrombus

Stent underexpansion

MSA = 4.2 mm$^2$

Ca
OCT imaging of stent thrombosis in LAD
PCI result after implantation of a stent
Promus 3.0/20mm
OCT in LAD Post-PCI

Stent underexpansion

Ca

MSA = 3.8 mm²

Ca
Final result after post dilatation with non compliant balloon 3,5/15mm
OCT after final dilatation

Tissue protrusion

MSA = 6.2 mm²
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 plaque disruption, mode of stent failure, and can guide coronary interventions.
• Large, randomized studies are warranted to definitely elucidate the clinical role of OCT.