New findings from OCT, PCI-guidance and evaluation of vulnerable plaque

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Long Pullback Survey-mode (S-mode)

By S-mode, able to scan coronary of 75mm length with one pull back. (almost 1/2~ 2/3 of one vessel).

- Useful for pre-PCI lesion assessment to select the stent landing zone.
- Useful for three vessel scanning for unstable plaque detection.
High-density Pullback (HD-mode)

By HD-mode, 3D reconstruction image can be obtained.

- Useful for assessment of coronary morphology, or stent strut configuration especially in bifurcation lesion.
Automated Lumen Profile

This shows mean diameter in every frame in long axis view.

- Operator can easily determine stent size and length according to the lumen profile display.
Number of catheterization in our hospital 2012.10.01～2013.09.30

<table>
<thead>
<tr>
<th>Type</th>
<th>NO</th>
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<tr>
<td>CAG</td>
<td>1074</td>
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<tr>
<td>PCI</td>
<td>451</td>
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<tr>
<td>OCT</td>
<td>353</td>
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<tr>
<td>IVUS</td>
<td>77</td>
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<tr>
<td>others</td>
<td>21</td>
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</table>

OCT-guided PCI 78.3%
To get clear OCT image

Power injector is useful

Flow rate

RCA: 2.5～4.0ml/sec
LCA: 3.0～4.0ml/sec

Volume limit

Flow rate x 4 sec (10～16ml)
To minimize contrast volume in OCT procedure

• Do simultaneous procedure of angiography and OCT image acquisition.

• Stop contrast injection if the OCT lens just cross the lesion of interest.

• To evaluate stent expansion, OCT scanning without flushing is useful.
OCT is Useful for PCI guide especially in

1. Bifurcation stenting

2. Rotablation for calcified lesion

3. Guide for ACS PCI
OCT is Useful for PCI guide especially in

1. Bifurcation stentning
2. Rotablation for calcified lesion
3. Guide for ACS PCI

OCT 3D reconstruction is useful to guide PCI in bifurcation lesion
How should we treat for bifurcation lesion

For bifurcation, most of the lesions should be finished with single stenting with KBT. Otherwise, culotte or T-stenting. In these lesions, stent full expansion, well apposition with side branch orifice opening is important.
The case of single stenting with KBT

If the GW cross the side branch proximally, jailed struts remain at carina.

If the GW cross distally, jailed struts shift to opposite site of side branch.

GW should cross the side branch distally, close to the carina.
A case of single stenting with KBT OCT 3D reconstruction guide
Pre PCI

Stent implantation and GW re-cross to Dx
A Lumen Profile:
Area: 4.53 mm²
Mean Diameter: 2.40 mm
Min: 2.35 mm  Max: 2.46 mm
3-D OCT shows GW crossing proximal part of the link

After bigger size POBA GW can cross distal part of the link
3-D OCT images after KBT showing wide open D2.
3-D reconstruction OCT image is useful to make sure the GW recrossing point after stenting resulting in optimal kissing balloon technique.

This procedure should be applied to stenting to bifurcation involving major side branch.
OCT is Useful for PCI guide especially in

1. Bifurcation stenting
2. Rotablation for calcified lesion
3. Guide for ACS PCI

OCT can show the thickness of calcium
If the ablation area is not enough, even the crack is made, stent will not well expand and sometimes becomes irregular shape.
If the ablation area is not enough and all circular thick calcium remains, stent should not be implanted. Further bigger size rotablation recommended.
If the ablation area is wide enough, stent will well expand.
OCT can show the thickness of calcium and is useful for rotablation guide
OCT is Useful for PCI guide especially in

1. Bifurcation stenting
2. Rotablation for calcified lesion
3. Guide for ACS PCI
62 y.o. Male
Syncope during car driving

At ER

Blood Examination
WBC 16500

GOT 87 U/L
LDH 442 U/L
CPK 493 U/L
Pre-PCI
OCT scanning to LCX
OCT scanning to LAD
LAD
In this case, LAD lesion must be a culprit lesion of ACS.

OCT is useful to determine the culprit lesion of ACS.
In autopsy studies, at least 25% of thrombotic coronary occlusions are caused by plaque erosion without disruption of the fibrous cap. This lesion may not require stent implantation.
OCT–based diagnosis and management of STEMI associated with intact fibrous cap.


Abstract
After aspiration thrombectomy, OCT identified plaque erosion as the cause in 31 STEMI. 40% patients with subcritically occlusive plaque were treated with dual antiplatelet therapy without percutaneous revascularization (group 1), and the remaining 60% of patients underwent angioplasty and stenting (group 2). At a median follow-up of 753 days, all patients were asymptomatic, regardless of stent implantation.
These observations support an alternative treatment strategy for patients with acute coronary events. OCT-verified intact fibrous cap (or plaque erosion), where non-obstructive lesions might be managed without stenting.
Challenge to estimate the coronary plaque tissue characterization

1. Prediction of the stenosis progression, and future ACS events.

2. Evaluation of the treatment effect for vulnerable plaque.
Challenge to estimate the coronary plaque tissue characterization

1. prediction of the stenosis progression, and future ACS events.
2. evaluation of the treatment effect for vulnerable plaque.
Thin-cap fibroatheroma and microchannel findings in optical coherence tomography correlate with subsequent progression of coronary atheromatous plaques

Shiro Uemura*, Ken-ichi Ishigami, Tsunenari Soeda, Satoshi Okayama, Ji Hee Sung, Hitoshi Nakagawa, Satoshi Somekawa, Yukiji Takeda, Hiroyuki Kawata, Manabu Horii, and Yoshihiko Saito

European Heart Journal (2012) 33, 78–85
Figure 1 (A) Eccentric plaque distribution; (B) concave lumen shape; (C) intimal laceration; (D) ruptured plaque; (E) microchannel; (F) lipid pool; (G) thin fibrous cap covering lipid pool; (H) macrophage image; (I) calcium deposition; (J) thrombus formation.
Table 4 Association of 10 OCT–based plaque characteristics and subsequent progression

<table>
<thead>
<tr>
<th></th>
<th>OR (95% CI)</th>
<th>P-value</th>
</tr>
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<tbody>
<tr>
<td>Eccentric</td>
<td>3.30 (0.73–14.4)</td>
<td>0.230</td>
</tr>
<tr>
<td>Concave shape</td>
<td>3.83 (0.85–16.7)</td>
<td>0.160</td>
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<tr>
<td>Intimal laceration</td>
<td>10.20 (2.77–37.8)</td>
<td>0.001</td>
</tr>
<tr>
<td>Rupture</td>
<td>4.90 (0.78–31.23)</td>
<td>0.325</td>
</tr>
<tr>
<td>Microchannel</td>
<td>20.00 (4.78–82.6)</td>
<td>0.001</td>
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<tr>
<td>Lipid pool</td>
<td>2.16 (0.57–8.06)</td>
<td>0.222</td>
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<tr>
<td>TCFA</td>
<td>20.00 (4.78–82.6)</td>
<td>0.001</td>
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<tr>
<td>Macrophage</td>
<td>9.60 (2.60–35.6)</td>
<td>0.001</td>
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<tr>
<td>Calcium</td>
<td>1.33 (0.41–4.30)</td>
<td>0.890</td>
</tr>
<tr>
<td>Thrombus</td>
<td>12.00 (2.18–64.32)</td>
<td>0.002</td>
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</table>
OCT-based complex characteristics of TCFA and microchannel were the potential predictors of subsequent progression of non-significant coronary plaques and or future ACS events.
Challenge to estimate the coronary plaque tissue characterization

1. prediction of the stenosis progression, and future ACS events.
2. evaluation of the treatment effect for vulnerable plaque.

Statin+EPA may be effective for stabilizing vulnerable plaque.
Impact of EPA and statin therapy on coronary thin-cap fibroatheroma: Assessment by optical coherence tomography

Kobe University Graduate school of medicine

Ryo Nishio, Junya Shite, Toshiro Shinke, Hiromasa Otake,
Masayuki Nakagawa, Ryoji Nagoshi, Amane Kozuki,
Takumi Inoue, Hirotoshi Hariki, Tsuyoshi Osue, Yu Taniguchi,
Masamichi Iwasaki, Noritoshi Hiranuma,
Akihide Konishi, Hiroto Kinutani, Ken-ichi Hirata
Patients with untreated dyslipidemia (LDL > 100 mg/dl) who had non-culprit TCFA lesion detected by OCT

Random assignment

EPA+Statin group
EPA1,800 mg/day
Rosuvastatin

Statin group
Rosuvastatin

Blood analysis and OCT examination were performed **Before and 9 months** after treatment.
<table>
<thead>
<tr>
<th></th>
<th>EPA+Statin group (n=13)</th>
<th>Statin group (n=12)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>EPA/AA</td>
<td>0.33±0.16</td>
<td>0.30±0.15</td>
<td>0.62</td>
</tr>
<tr>
<td>T-Cho (mg/dl)</td>
<td>211.3±40.2</td>
<td>203.4±41.7</td>
<td>0.64</td>
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<tr>
<td>HDL (mg/dl)</td>
<td>41.7±12.5</td>
<td>41.7±7.5</td>
<td>0.99</td>
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<tr>
<td>LDL (mg/dl)</td>
<td>140.3±36.7</td>
<td>134.9±37.4</td>
<td>0.72</td>
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<tr>
<td>hs-CRP (mg/dl)</td>
<td>0.23±0.19</td>
<td>0.26±0.15</td>
<td>0.67</td>
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<tr>
<td>PTX3 (mg/dl)</td>
<td>4.18±2.07</td>
<td>5.25±2.85</td>
<td>0.32</td>
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<tr>
<td></td>
<td>EPA+Statin group (n=13)</td>
<td>Statin group (n=12)</td>
<td>P value</td>
</tr>
<tr>
<td>----------------------</td>
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<tr>
<td>EPA/AA</td>
<td>1.27±0.62</td>
<td>0.49±0.36</td>
<td>0.006</td>
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<tr>
<td>T–Cho (mg/dl)</td>
<td>151.1±34.4</td>
<td>145.7±22.9</td>
<td>0.65</td>
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<tr>
<td>HDL (mg/dl)</td>
<td>46.7±9.4</td>
<td>44.1±9.9</td>
<td>0.51</td>
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<tr>
<td>LDL (mg/dl)</td>
<td>85.2±28.5</td>
<td>81.2±21.0</td>
<td>0.69</td>
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<tr>
<td>hs–CRP (mg/dl)</td>
<td>0.06±0.05</td>
<td>0.10±0.08</td>
<td>0.20</td>
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<tr>
<td>PTX3 (mg/dl)</td>
<td>2.70±1.27</td>
<td>4.47±0.59</td>
<td>0.02</td>
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Fibrous-cap thickness

Baseline

Follow-up

EPA+Statin group (n=20)

Statin group (n=21)

48.1 ± 75.0

47.6 ± 11.4

103.5 ± 30.7

68.6 ± 11.1

P=0.0001
Lipid arc

Baseline:
- Statin group (n=21): 165.5 ± 65.2
- EPA+Statin group (n=20): 160.3 ± 66.3

Follow-up:
- Statin group (n=21): 152.7 ± 51.3
- EPA+Statin group (n=20): 128.9 ± 47.8

P=0.14
Macrophages accumulation

- **Baseline**
  - EPA+Statin group (n=20): 71.4%
  - Statin group (n=21): 65.0%

- **Follow-up**
  - EPA+Statin group (n=20): 10.0%
  - Statin group (n=21): 42.9%

**P=0.03**
RCA (Rosuvastatin 2.5mg+EPA1800mg)

Before 9 month treatment
RCA (Rosuvastatin 2.5mg+EPA1800mg)

Before

After treatment
OCT may show the treatment effect in vulnerable plaque, increase in fibrous cap thickness, disappearance of macrophage accumulation, decrease in lipid contents.
Role of OCT

Useful for PCI guide especially in
1. Bifurcation stenting
2. Rotablation for calcified lesion
3. Guide for ACS PCI

Useful for coronary plaque tissue characterization
risk assessment for future ACS events
and evaluation of treatment effect
Thank you for your attention!
Single stenting (Nobori) to LMT–LAD First rewiring to LCX
First rewiring
Second rewiring
Post KBT
Comparison between ILUMIEN(C7) and ILUMIEN OPTIS(C8)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>ILUMIEN</th>
<th>ILUMIEN OPTIS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<td>Long Pullback S mode</td>
</tr>
<tr>
<td>Frame rate</td>
<td>100 frames/sec</td>
<td>180 frames/sec</td>
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<tr>
<td>Pull back speed</td>
<td>20 mm/sec</td>
<td>36 mm/sec</td>
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<tr>
<td>Frame interval</td>
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<td>5 frames/mm</td>
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<tr>
<td>Pull back length</td>
<td>54 mm</td>
<td>75 mm</td>
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<tr>
<td>Pull back time</td>
<td>2.7 sec</td>
<td>2.1 sec</td>
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