# Optical frequency domain imaging vs. IVUS in PCI: the OPINION trial - one-year primary endpoint results

## Discussion 4 minutes

**Ron Waksman, MD, FACC, FSCAI,FESC**

Director, MedStar Cardiovascular Research Network. Associate Chief of Cardiology. Professor of Medicine, Georgetown University. MedStar Heart and Vascular Institute, Washington DC

# Potential conflicts of interest

**Speaker's name: Ron Waksman**

☑ **I have the following potential conflicts of interest to report:**

Consultant: ABBOTT VASCULAR, BIOTRONIK, BOSTON SCIENTIFIC, MEDTRONIC VASCULAR

Honorarium: ASTRAZENECA

Institutional grant/research support: ASTRAZENECA

*Can Invasive Imaging optimize acute stent results?*

# Imaging modalities to guide elective coronary interventions

- **IC Imaging (IVUS/OCT) leads to optimal PCI→ less complications, less stent thrombosis and improved outcomes.**

- **Meta-analyses and recent studies showed that IVUS guidance reduce incidence of MACE at follow up.**

- **Given the differences between OCT and IVUS imaging technologies it is not clear whether OCT guided PCI can achieve similar outcome as IVUS.**
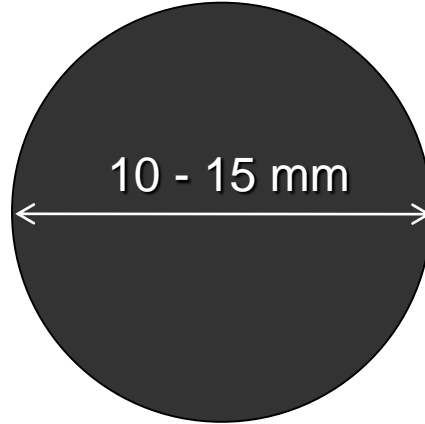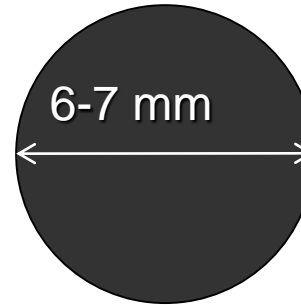
| | | IVUS | OCT | OFDI |
|---|---|---|---|---|
| Resolution | (axial) | 100 - 150 μm | 10 μm | 10 μm |
| | (lateral) | 150 - 300 μm | 25 - 40 μm | 25 - 40 μm |
| Size of imaging core | | 0.8 mm | 0.4 mm | 0.4 mm |
| Dynamic range | | 40 - 60 dB | 90 - 100 dB | 90 - 100 dB |
| Frame rate | | 30 frames/s | 15 frames/s | 400 frames/s |
| Scan area | | 10 - 15 mm | 6-7 mm | 6-7 mm |
| Max. penetration | | 4 - 8 mm | 1 – 1.5 mm | 1 – 1.5 mm |
| Blood clearing | | Not required | Required | Required |
| | Balloon Occlusion | | Required | Not required |
| | Flushing | | Required | Required |
| Pullback | | 0.5mm/s (no limit) | 1mm/s (35mm) | 30mm/s (90mm) |
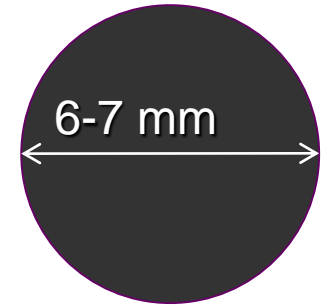
# IVUS Guidance PCI Superior to Angio

IVUS guidance in PCI is helpful to reduce subsequent stent thrombosis, restenosis, repeat revascularization, myocardial infarction, and cardiac death.



*Witzenbichler, et al., Circulation. 2014;129:463-470*

# IVUS VERSUS Angio



**Meta-Analysis of 20 DES Studies (n=29,068)**

Compared with angiographic guidance, IVUS-guided DES implantation was associated with reduced rates of:
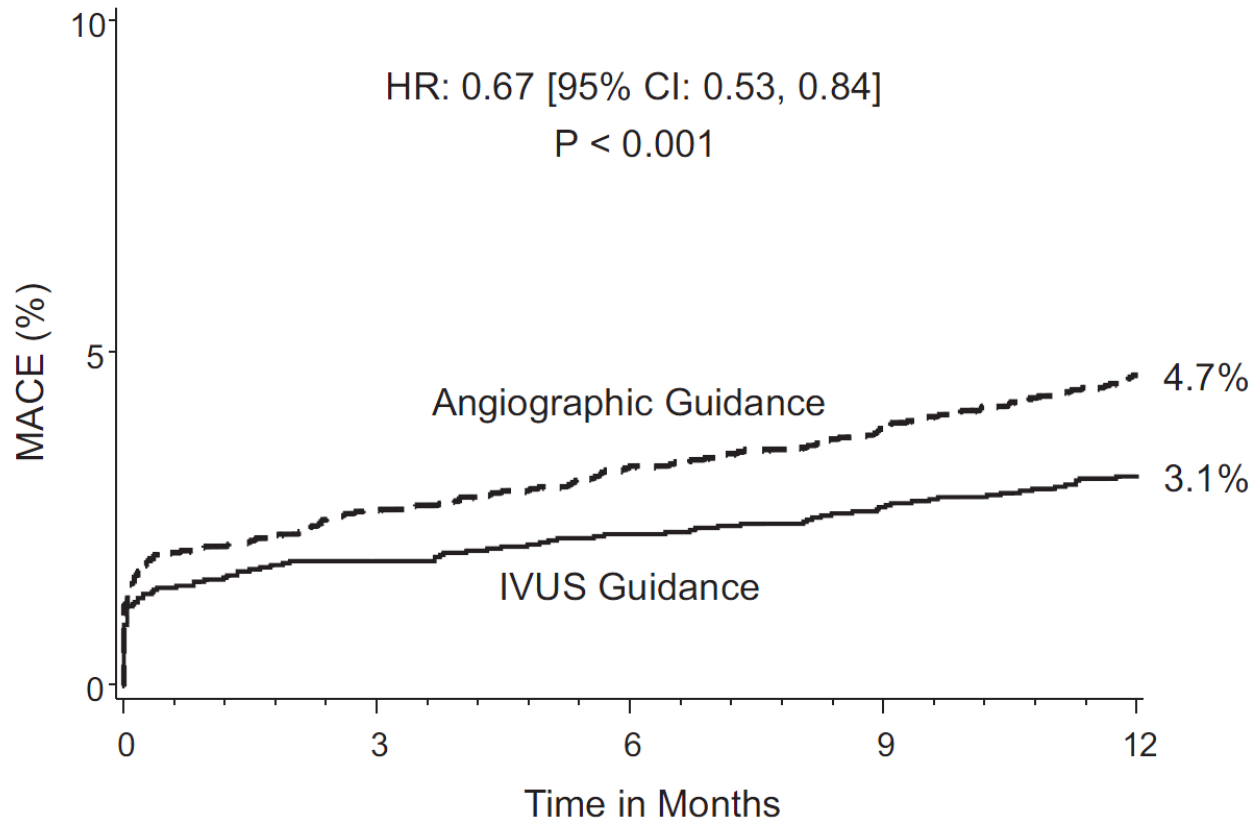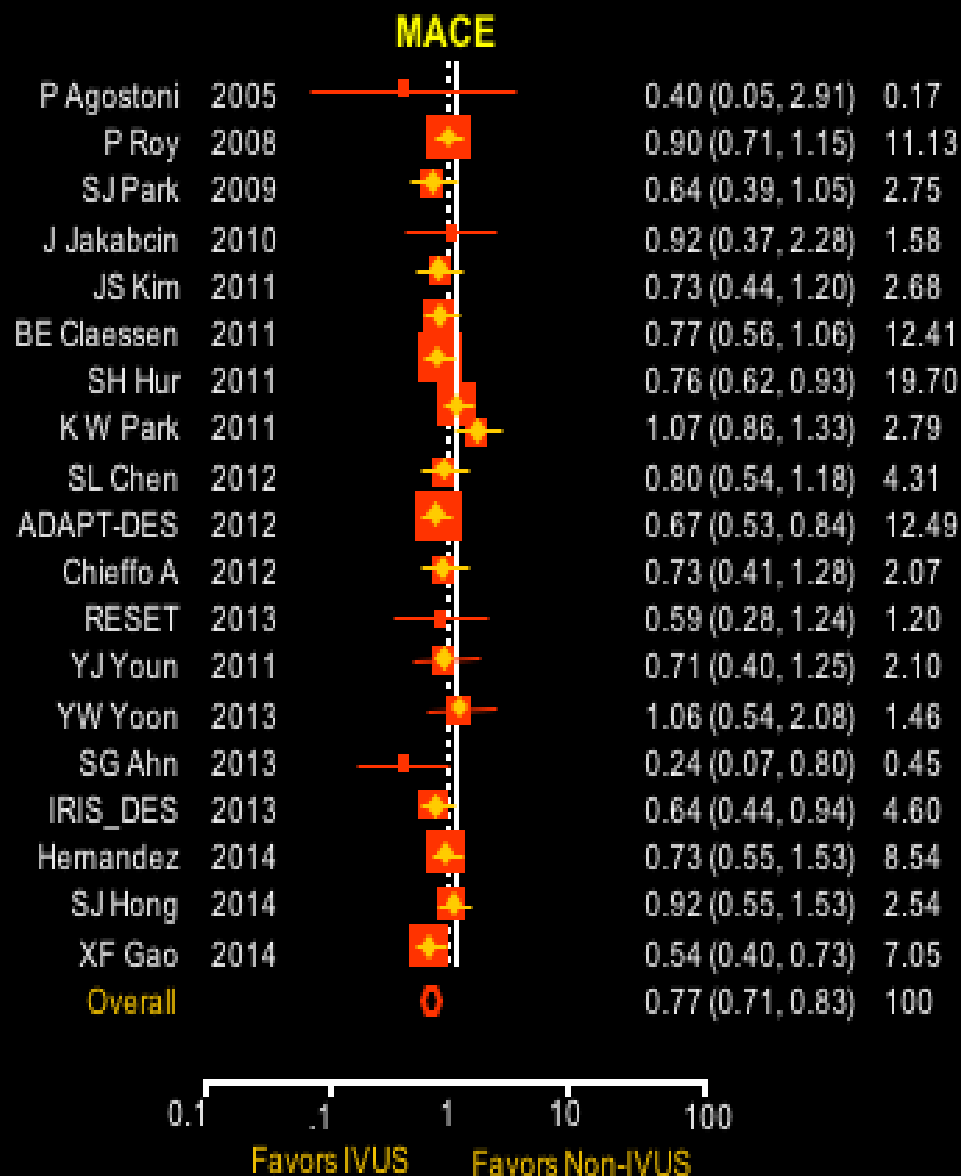
- Death
  HR 0.62 (0.54-0.71), p<0.001

- MACE
  HR 0.77 (0.0.71-0.83), p<0.001

- Stent thrombosis
  HR 0.59 (0.47-0.73), p<0.001

Zhang Y et al.
BMC Cardiovasc Dis 2015;15:153

**MACE**

| | | | |
|---|---|---|---|
| P Agostoni | 2005 | 0.40 (0.05, 2.91) | 0.17 |
| P Roy | 2008 | 0.90 (0.71, 1.15) | 11.13 |
| SJ Park | 2009 | 0.64 (0.39, 1.05) | 2.75 |
| J Jakabcin | 2010 | 0.92 (0.37, 2.28) | 1.58 |
| JS Kim | 2011 | 0.73 (0.44, 1.20) | 2.68 |
| BE Claessen | 2011 | 0.77 (0.56, 1.06) | 12.41 |
| SH Hur | 2011 | 0.76 (0.62, 0.93) | 19.70 |
| K W Park | 2011 | 1.07 (0.86, 1.33) | 2.79 |
| SL Chen | 2012 | 0.80 (0.54, 1.18) | 4.31 |
| ADAPT-DES | 2012 | 0.67 (0.53, 0.84) | 12.49 |
| Chieffo A | 2012 | 0.73 (0.41, 1.28) | 2.07 |
| RESET | 2013 | 0.59 (0.28, 1.24) | 1.20 |
| YJ Youn | 2011 | 0.71 (0.40, 1.25) | 2.10 |
| YW Yoon | 2013 | 1.06 (0.54, 2.08) | 1.46 |
| SG Ahn | 2013 | 0.24 (0.07, 0.80) | 0.45 |
| IRIS_DES | 2013 | 0.64 (0.44, 0.94) | 4.60 |
| Hernandez | 2014 | 0.73 (0.55, 1.53) | 8.54 |
| SJ Hong | 2014 | 0.92 (0.55, 1.53) | 2.54 |
| XF Gao | 2014 | 0.54 (0.40, 0.73) | 7.05 |
| Overall | | 0.77 (0.71, 0.83) | 100 |

0.1    .1    1    10    100

Favors IVUS    Favors Non-IVUS

# OCT versus IVUS From Two different studies

| | OCT n=286 from ILUMIEN I | IVUS n=286 from ADAPT-DES | P value |
|---|---|---|---|
| Stent expansion, % | 72.8 (63.3–81.3) | 70.6 (62.3–78.8) | 0.29 |
| Mean stent expansion, % | 89.6 (79.7–98.1) | 86.2 (76.6–94.1) | 0.17 |
| Significant malapposition | 4 (1.4%) | 2 (0.7%) | 0.69 |
| Edge dissection (length ≥3mm) | 7 (2.4%) | 3 (1.0%) | 0.29 |
| Significant tissue protrusion | 10 (3.5%) | 6 (2.1%) | 0.45 |

- Matched for 4 potential confounders: the presence of moderate or severe angiographic calcification; angiographic lesion length and reference vessel diameter; and whether proximal and/or distal) were available for calculation of stent expansion (an OCT lesion with both references was matched with a corresponding IVUS lesion with both references, and an OCT lesion with only a proximal or distal reference was matched with a corresponding IVUS lesion with only a proximal or distal reference)
- In multivariable analysis including the entire cohort (n=940) adjusted by age, prior MI, lesion length, reference vessel diameter, bifurcation lesion, tortuosity, calcification, LAD location, reference availability by imaging, stent expansion = 78.8% (63.3, 81.3) vs 70.6% (62.3, 78.8), p=0.84

# *The Data with OCT guided PCI on clinical outcome is somewhat limited*

## IVUS/OCT in ESC guideline 2014

| Recommendations | Class | Level |
|---|---|---|
| **IVUS** in selected patients to optimize stent implantation. | **IIa** | **B** |
| **OCT** in selected patients to optimize stent implantation. | **IIb** | **C** |

# The OPINION study

- OPNION is the largest randomized study comparing OCT versus IVUS guided PCI with angio and clinical follow-up

*Does OCT is non-inferior to IVUS to guide PCI with DES?*

- Should the OPNION study results impact the ESC guidelines to equate OCT to IVUS ?
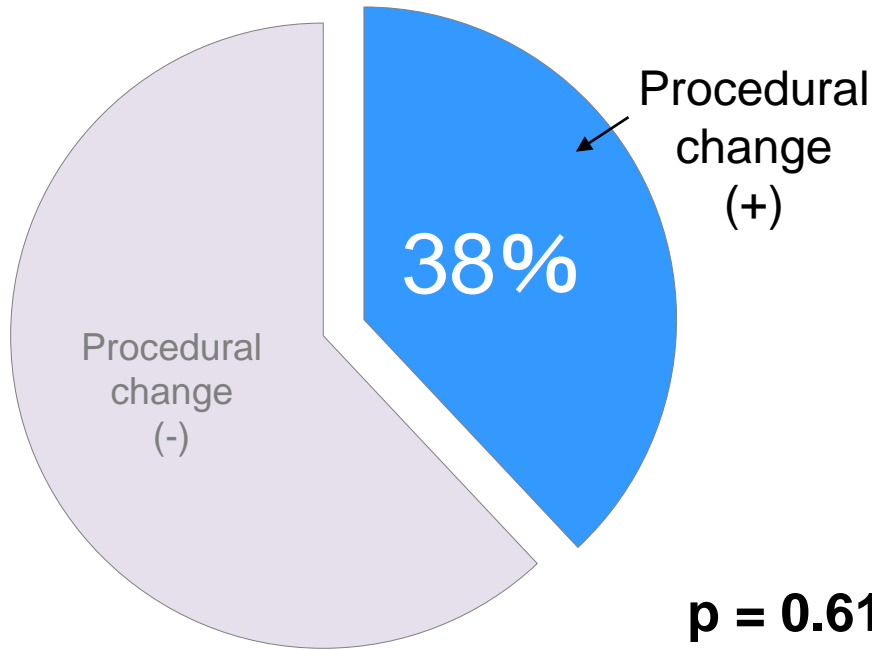
# Study Strengths

- The largest study comparing head to head OCT versus IVUS
- Multicenter, single country (Japan), prospective randomized clinical trial
- Nearly complete pre and post stenting imaging for all lesions
- Angiographic follow-up at 8 months and clinical follow-up at 12 months
- Independent core labs
- Minimizing confounders that can bias the results only one DES stent type

# Study Limitations

- Missing opportunity to add an angio guided PCI arm to the study to establish the superiority of invasive imaging over angio guided PCI

- Different methodology to evaluate reference vessel and stent diameter by OCT and IVUS

- Lack of information for the reason of change pre versus post procedure.

- Relatively stable population with low event rate.

- Study Underpowered to detect clinical differences for low event rate with the NOBORI DES.

# Procedural change by OFDI/IVUS

## OFDI guidance



38%

Procedural change (+)

Procedural change (-)

## IVUS guidance

36%

Procedural change (+)

Procedural change (-)
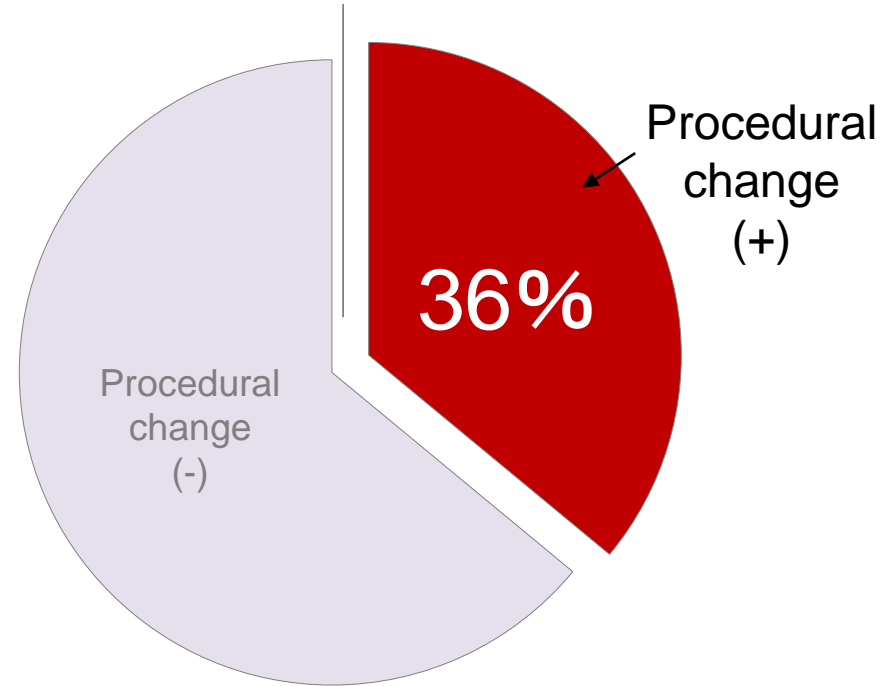
**p = 0.611**

Pre-dilatation: Balloon size/pressure up (11% vs. 10%)

Rotablator, Cutting balloon (3% vs. 4%)

Distal protection (4% vs. 3%)

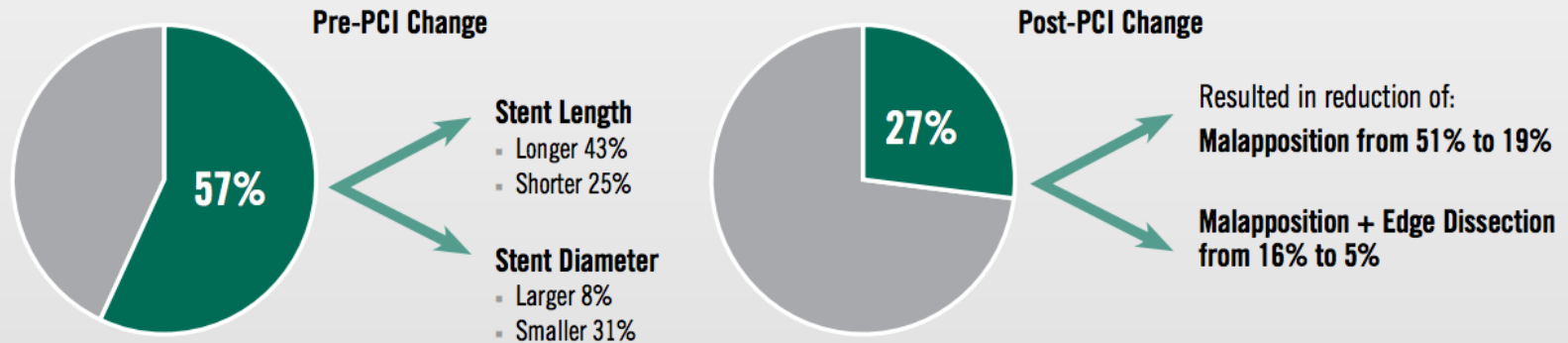Post-dilatation: Balloon size/pressure up (31% vs. 28%)

Additional stent (4% vs. 3%)

Others (1% vs. 2%)

# Ilumien I



**CLINICAL HIGHLIGHTS FROM ILUMIEN I**[1]

**#1** OCT impacted PCI procedures in **65%** of patients either pre-PCI and/or post-PCI.

**Pre-PCI Change**

57%

**Stent Length**
- Longer 43%
- Shorter 25%

**Stent Diameter**
- Larger 8%
- Smaller 31%

**Post-PCI Change**

27%

Resulted in reduction of:
**Malapposition from 51% to 19%**

**Malapposition + Edge Dissection from 16% to 5%**

**#2** Use of OCT guidance pre- and post-PCI was associated with **reduced rates of MI.**

**1-Year MI (ARC)**

No Pre-PCI Change, or Post-PCI Optimization, Based on OCT (n = 137)
**12.1%**

OCT-Driven Pre-PCI Change and Post-PCI Optimization Made (n = 65)
**0%**

0   3   6   9   12   15
**Percent**

# Points for Discussion
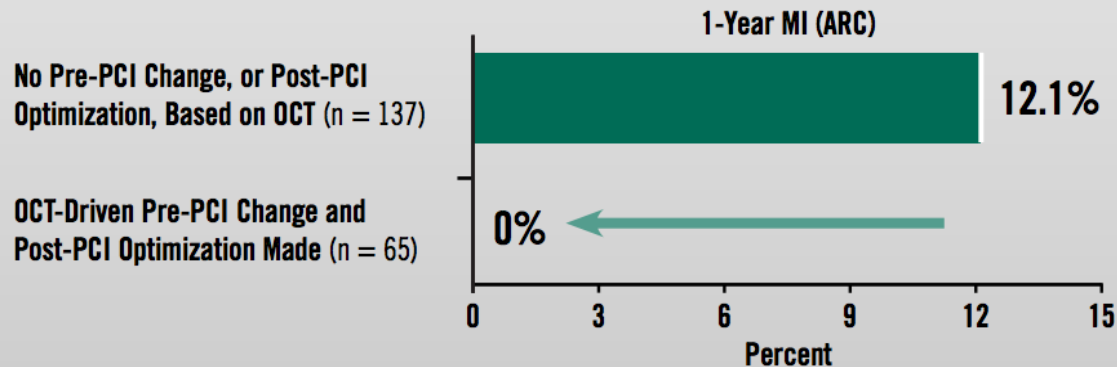
| | OFDI | IVUS | *p*-value |
|---|---|---|---|
| **Patients Characteristics** | | | |
| Stable AP | 88% | 87% | 0.672 |
| ACS | 12% | 13% | 0.595 |
| **Lesion Characteristics** | | | |
| Heavy calcification | 7% | 13% | 0.009 |
| **Procedural** | | | |
| Stent diameter, mm | 2.92 ± 0.38 | 3.00 ± 0.37 | 0.007 |
| Total contrast volume, ml | 164 ± 66 | 138 ± 56 | < 0.001 |
| **Clinical Outcome** | | | |
| Stroke | 4 (1.0%) | 1 (0.2%) | 0.374 |

# Target vessel failure (TVF)-free survival curves

TVF = composite of cardiac death, target vessel-related MI and clinically-driven TVR

Log-rank P = 0.833

— OFDI-guided PCI
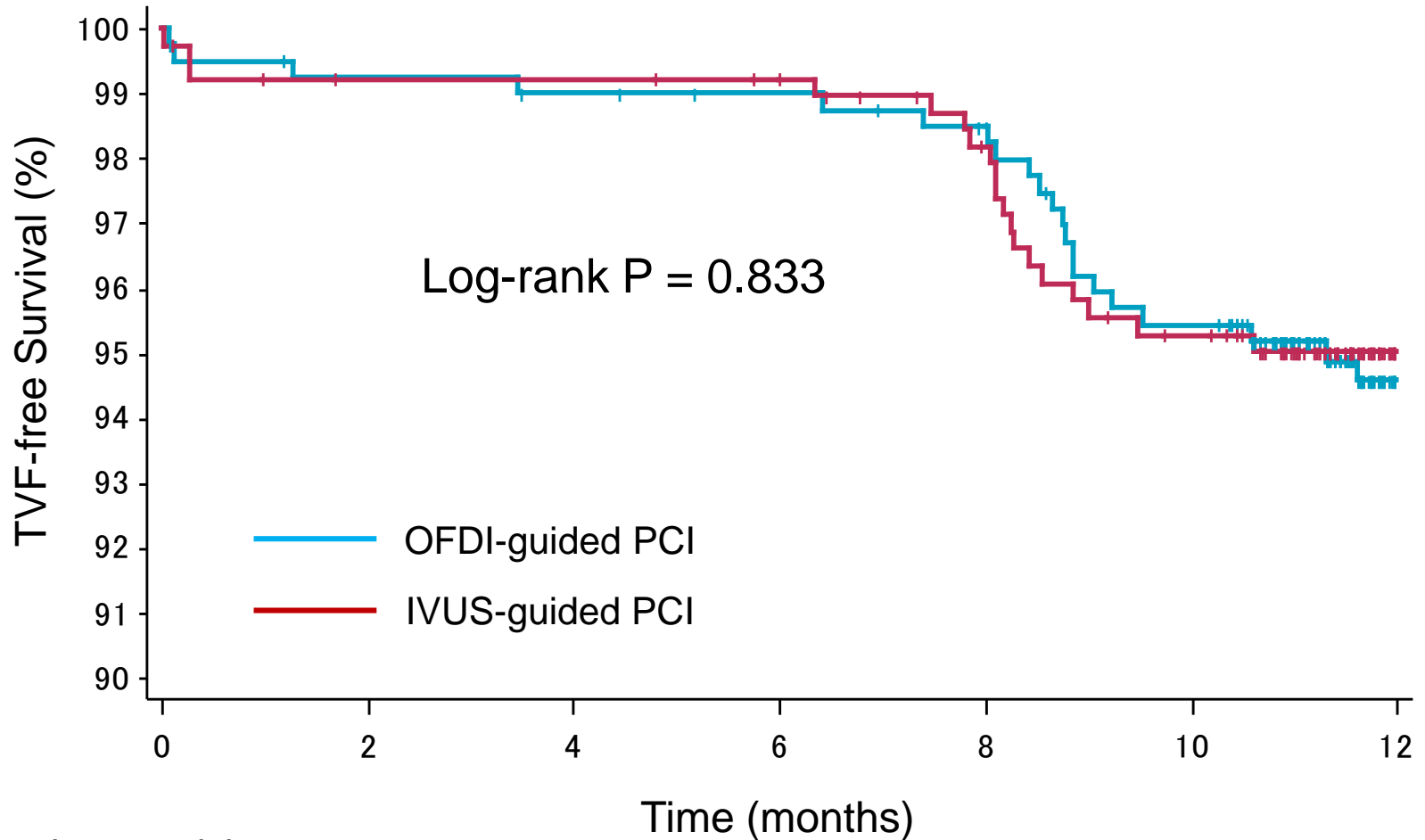
— IVUS-guided PCI

No. of patients at risk

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| OFDI-guided PCI | 401 | 396 | 394 | 392 | 387 | 374 | 265 |
| IVUS-guided PCI | 390 | 384 | 384 | 381 | 373 | 360 | 285 |

# Similar results to Angio Guided PCI



**Nobori BES vs. EES: COMPARE II**

Smits P presented at EuroPCR 2014

**MACE (cardiac death, MI, TVR)**

RR: 1.04 (0.82 – 1.31)
P = 0.76

11.0 %

RR: 1.07 (0.76 – 1.52)
P = 0.69

5.2 %

10.7 %

4.8 %

$P_{logrank} = 0.73$

- BES
- EES

Cumulative incidence (%)

Days since initial procedure
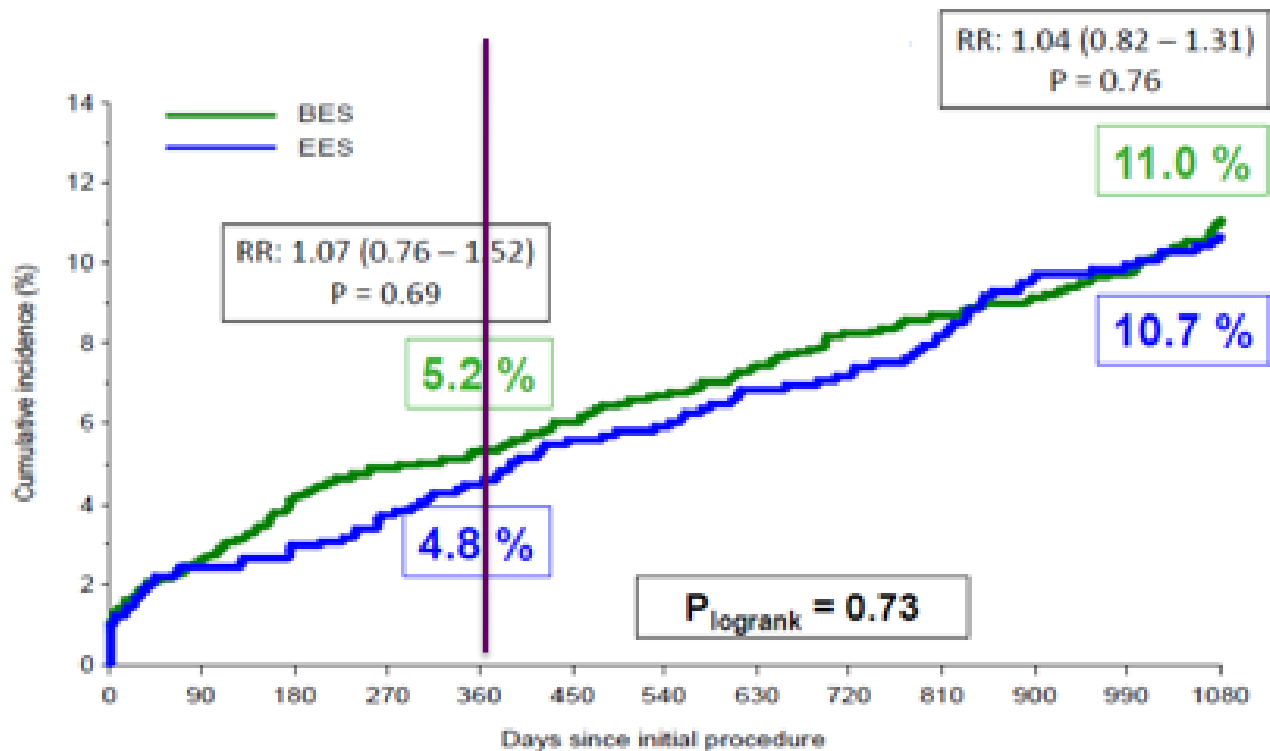
# ILUMIEN III Trial Design



**ILUMIEN III TRIAL DESIGN AND METHODS**

Adapted from ILUMIEN III Clinical Investigation Plan[3]

Prospective, post-market, international, multi-center, randomized

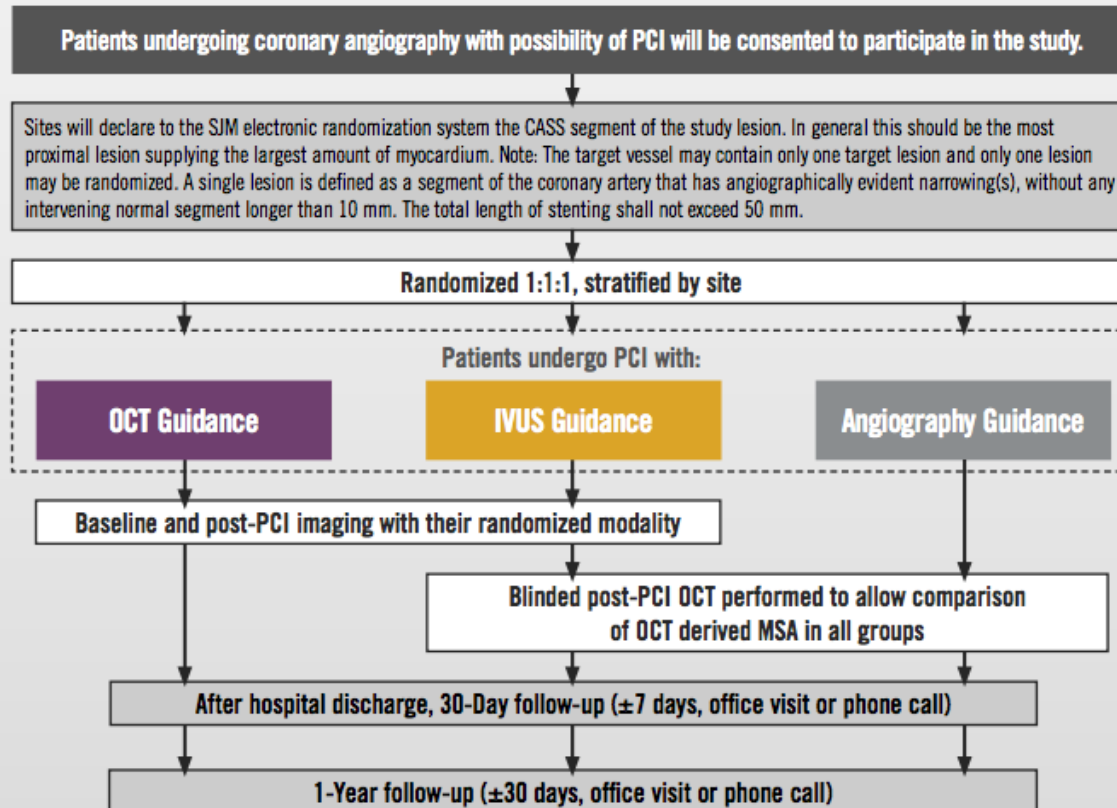Patients undergoing coronary angiography with possibility of PCI will be consented to participate in the study.

Sites will declare to the SJM electronic randomization system the CASS segment of the study lesion. In general this should be the most proximal lesion supplying the largest amount of myocardium. Note: The target vessel may contain only one target lesion and only one lesion may be randomized. A single lesion is defined as a segment of the coronary artery that has angiographically evident narrowing(s), without any intervening normal segment longer than 10 mm. The total length of stenting shall not exceed 50 mm.

Randomized 1:1:1, stratified by site

Patients undergo PCI with:

| OCT Guidance | IVUS Guidance | Angiography Guidance |

Baseline and post-PCI imaging with their randomized modality

Blinded post-PCI OCT performed to allow comparison of OCT derived MSA in all groups

After hospital discharge, 30-Day follow-up (±7 days, office visit or phone call)

1-Year follow-up (±30 days, office visit or phone call)

# My Humble Opinion on OPINION

- OPINION was a well executed study, met the endpoints that OCT is non-inferior to IVUS as invasive imaging tool to guide PCI. Therefore, update of the guidelines should be considered.

- Concerns remains for the use of OCT with the volume of contrast, especially in patients with borderline renal function.

- The risk for increase in stroke should be studies carefully.

- We will have to await for the ILLUMIEN III study results to prove superiority of invasive imaging versus angio guided PCI, and corroboration of the OPINION results in more heterogenic population