IVUS for Complex PCI: Secret Pearls from the Expert

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Conflict of Interest

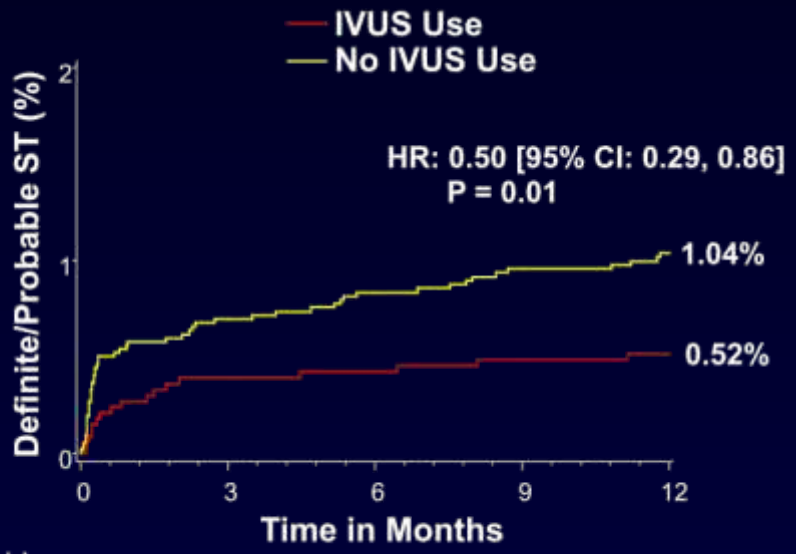
- I have nothing to disclose

Benefits from IVUS-guided PCI

- Left main
- Bifurcation
- Diffuse long lesion
- Calcified lesion
- Chronic total occlusion
- Chronic kidney disease

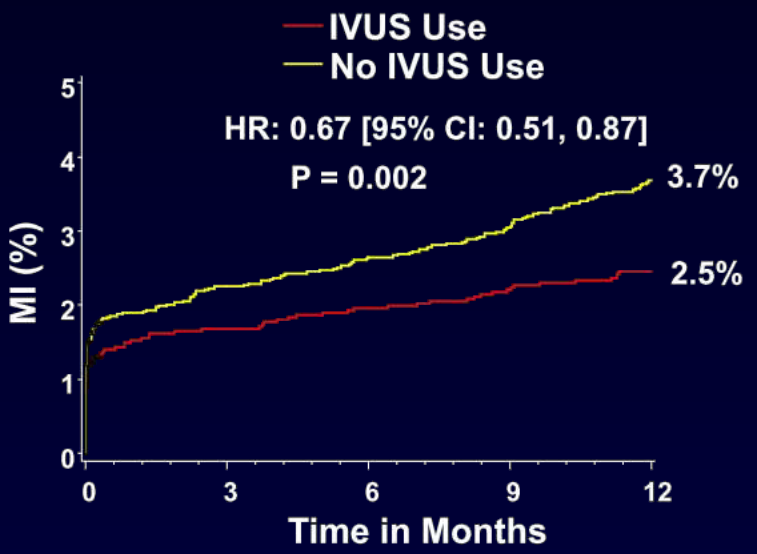
ADAPT-DES substudy (n=8,583 pts, IVUS=3,349 pts and no IVUS=5,234 pts

Definite/Probable Stent Thrombosis



Number at risk:					
IVUS Use	3349	3251	3221	3197	3023
No IVUS Use	5234	5015	4978	4938	4585

MI



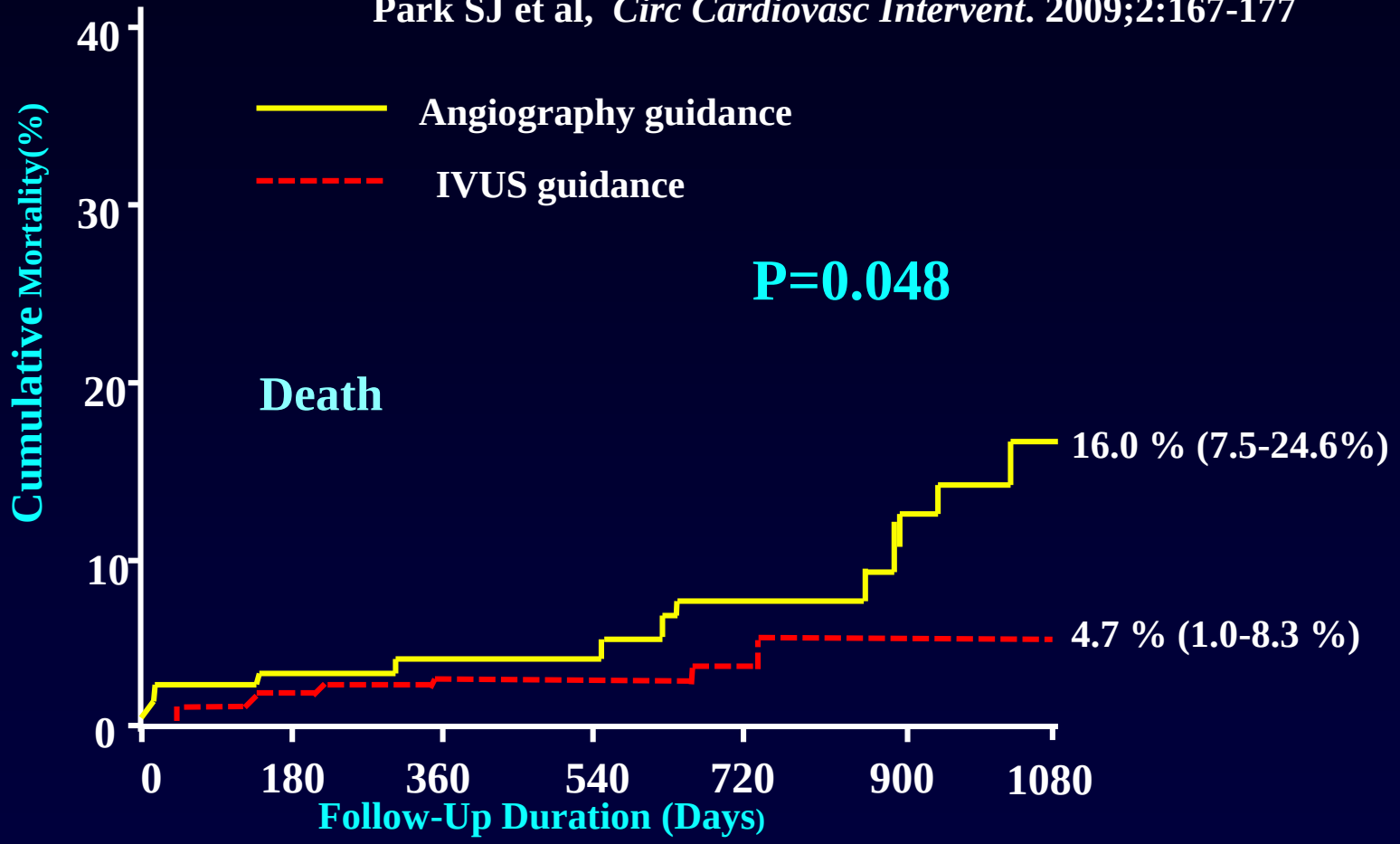
Number at risk:					
IVUS Use	3349	3209	3171	3141	2969
No IVUS Use	5234	4932	4882	4830	4460

IVUS guidance during DES PCI may result in less stent thrombosis as well as fewer myocardial infarctions and MACEs

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

MAIN-COMPARE registry: 3-year mortality
(145 propensity matched pairs)

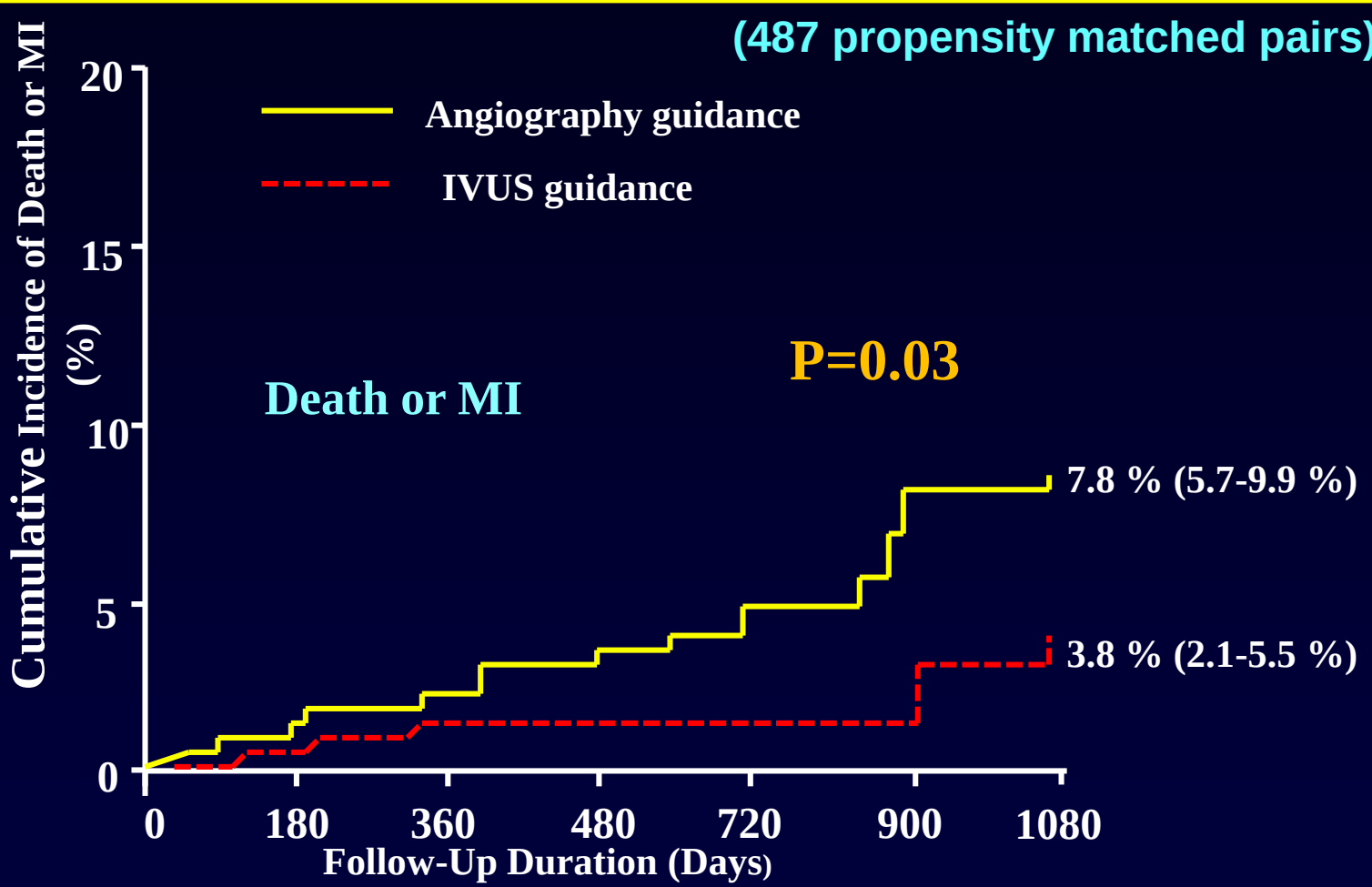
Park SJ et al, *Circ Cardiovasc Intervent.* 2009;2:167-177



Patients at risk				
IVUS-guidance	145	140	98	37
Angiography-guidance	145	137	88	29

Impact of IVUS-Guidance on 3-Year Clinical Outcomes: DES for Bifurcation Lesions from a Korean multi-center bifurcation registry

(487 propensity matched pairs)



Patients at risk				
IVUS-guidance	487	467	281	118
Angiography-guidance	487	469	346	124

Kim JS, Hong MK, et al. *Am Heart J* 2011;161:180-187

2014 ESC/EACTS Guidelines on myocardial revascularization

Recommendations	Class[a]	Level[b]	Ref.[c]
FFR to identify haemodynamically relevant coronary lesion(s) in stable patients when evidence of ischaemia is not available.	I	A	
FFR-guided PCI in patients with multivessel disease.	IIa	B	
IVUS in selected patients to optimize stent implantation.	IIa	B	702,703,706
IVUS to assess severity and optimize treatment of unprotected left main lesions.	IIa	B	705
IVUS or OCT to assess mechanisms of stent failure.	IIa	C	
OCT in selected patients to optimize stent implantation.	IIb	C	

Level of Evidence is B

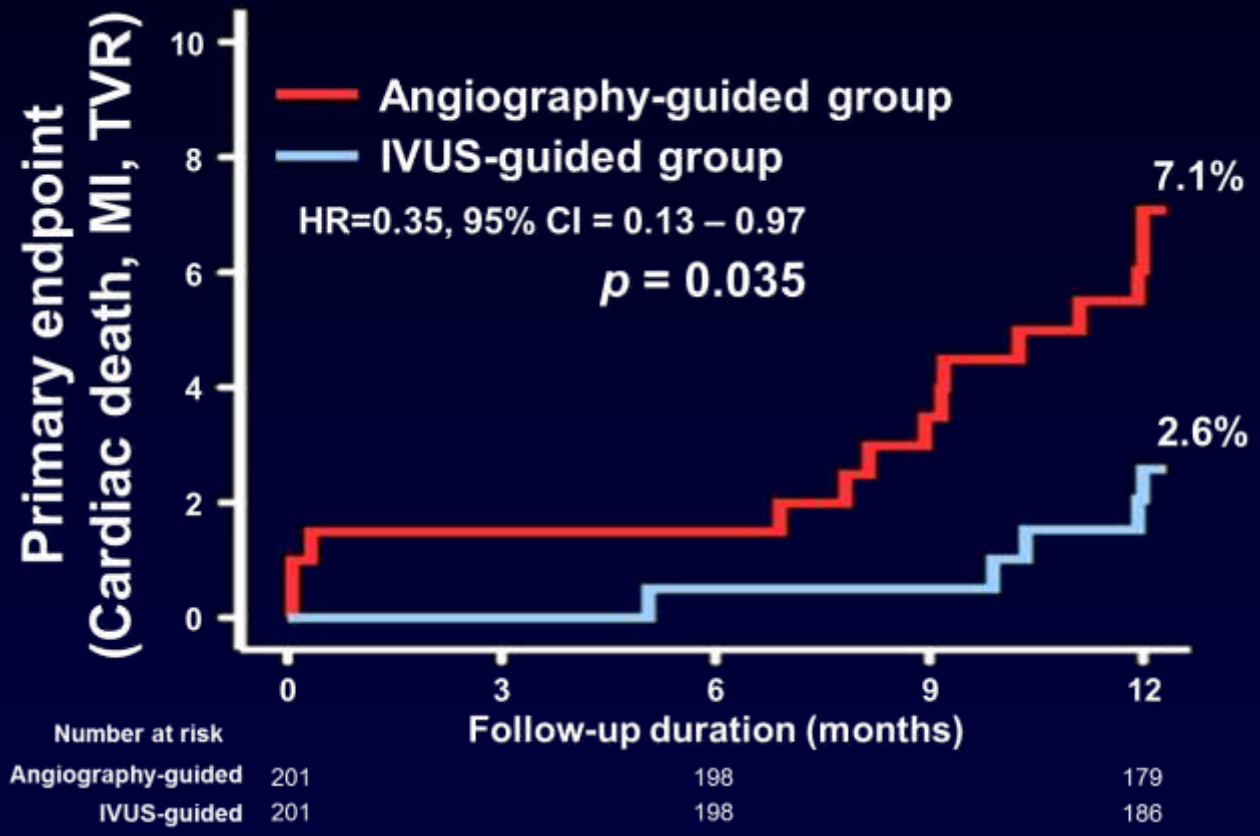
Clinical usefulness of IVUS, 2014

?

IVUS usage during PCI

Improved clinical outcomes

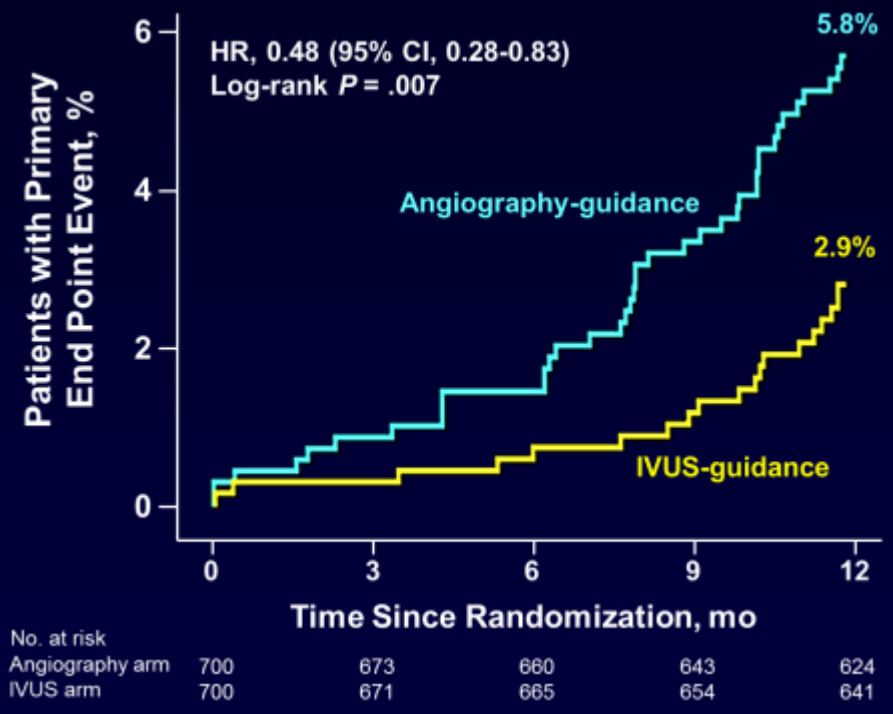
Chronic total occlusion: CTO-IVUS randomized trial

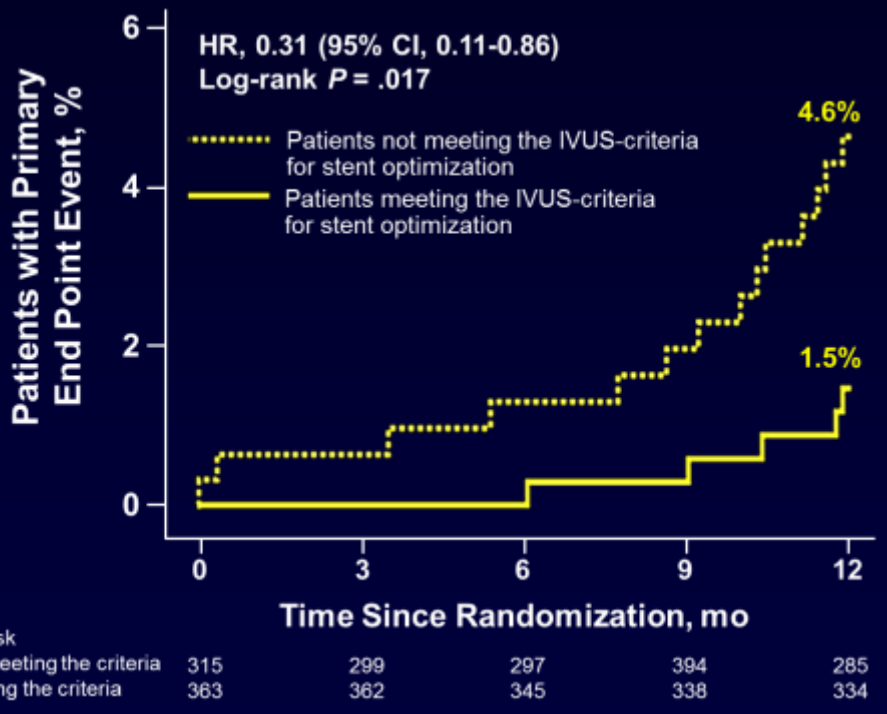


Kim BK, Jang Y et al, *Circ Cardiovasc Interv*. 2015;8:e002592

Diffuse long lesion: IVUS-XPL randomized trial

MACE: Cardiac death, MI, or TLR at 1 year





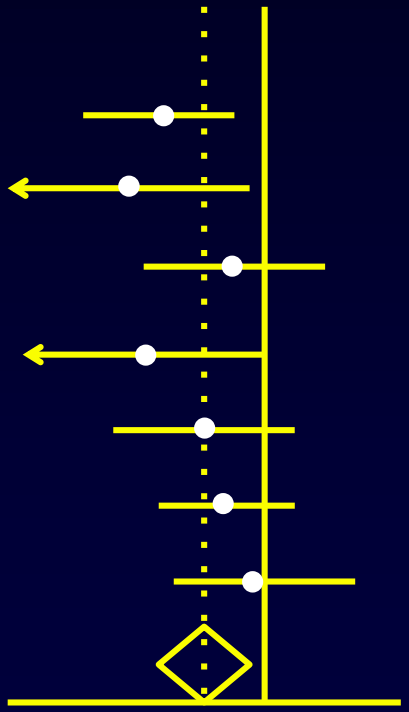
Hong SJ, Hong MK (corresponding author), et al. *JAMA* 2015;314:2155-63

Meta-analysis of 7 randomized trials: IVUS vs. angio -guided (first and next-generation) DES implantation

Event: cardiac death, MI, TLR

Study-level meta-analysis

Study	Year	OR	Events: IVUS	Events: Angio
IVUS-XPL	2015	0.49	19/700	39/700
CTO-IVUS	2015	0.37	5/201	14/201
AIR-CTO	2015	0.82	25/115	29/115
Tan et al	2015	0.42	8/61	17/62
Kim et al (RESET)	2013	0.60	12/269	20/274
AVIO	2013	0.67	24/142	33/142
HOME DES IVUS	2010	0.91	11/105	12/105
Overall		0.60	104/1593	164/1599



IVUS better Angio better

Islam Y. Elgendy et al. *Circ Cardiovasc Interv*. 2016;9:e003700

IVUS-XPL: Randomized Trial

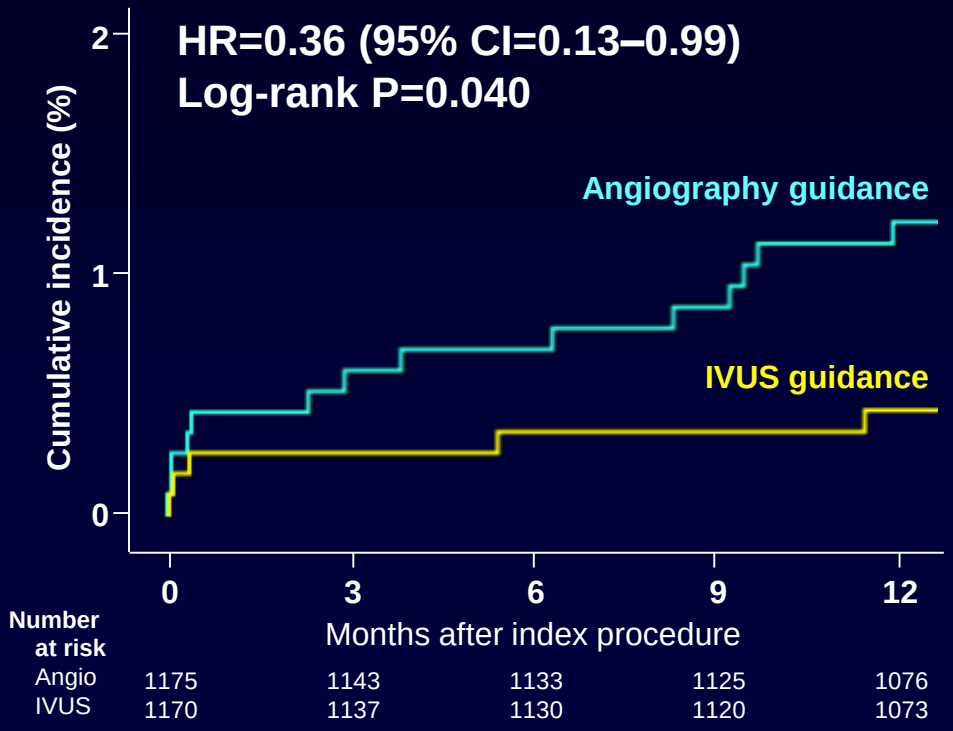
	IVUS-guidance (n=700)	Angiography-guidance (n=700)	Hazard ratio (95% CI)	Log-Rank *P* value
Primary End Point				
MACE	19 (2.9%)	39 (5.8%)	0.48 (0.28–0.83)	.007
Secondary End Point				
Cardiac death	3 (0.4%)	5 (0.7%)	0.60 (0.14-2.52)	.48
Target lesion related MI	0	1 (0.1%)	-	.32
Ischemia-driven TLR	17 (2.5%)	33 (5.0%)	0.51 (0.28-0.91)	.02
Stent thrombosis	2 (0.3%)	2 (0.3%)	1.00 (0.14-7.10)	1.00
Acute	1 (0.1%)	1 (0.1%)	-	-
Sub-acute	1 (0.1%)	0	-	-
Late	0	1 (0.1%)	-	-

Hong SJ, Kim BK, Hong MK, et al. JAMA 2015;314:2155-63

Meta-analysis with Individual Patient-Level Data from 2,345 Randomized Patients with second-generation DES (RESET Long, CTO IVUS and IVUS XPL)

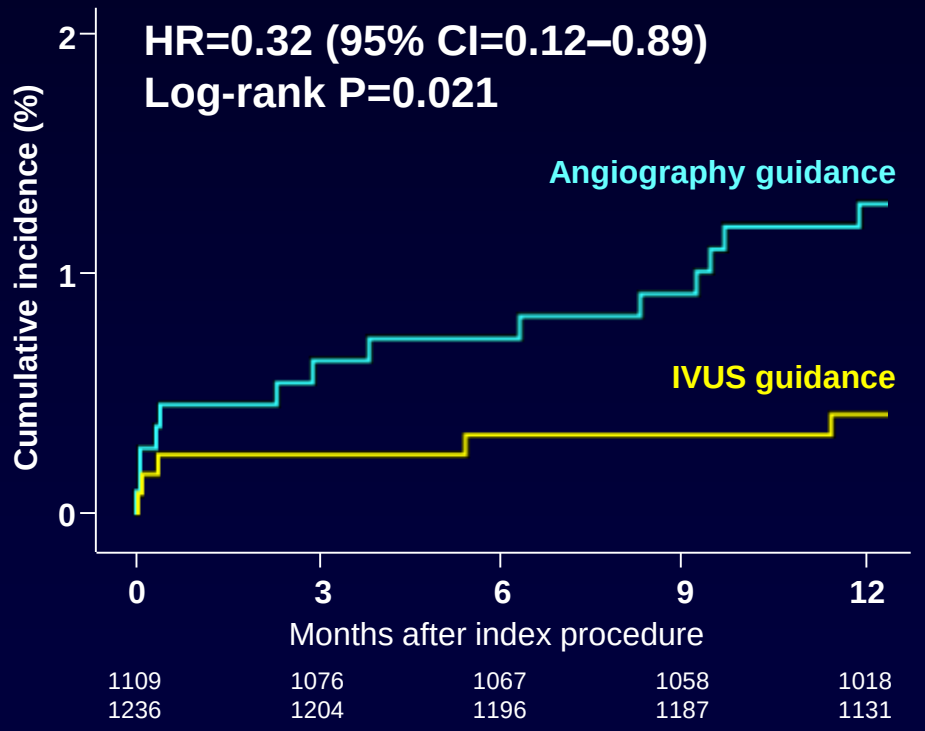
Hard events of MACE (cardiac death, MI, or stent thrombosis)

Intention-to treat analysis



Number at risk						
Angio	1175	1143	1133	1125	1076
IVUS	1170	1137	1130	1120	1073

Per-protocol analysis

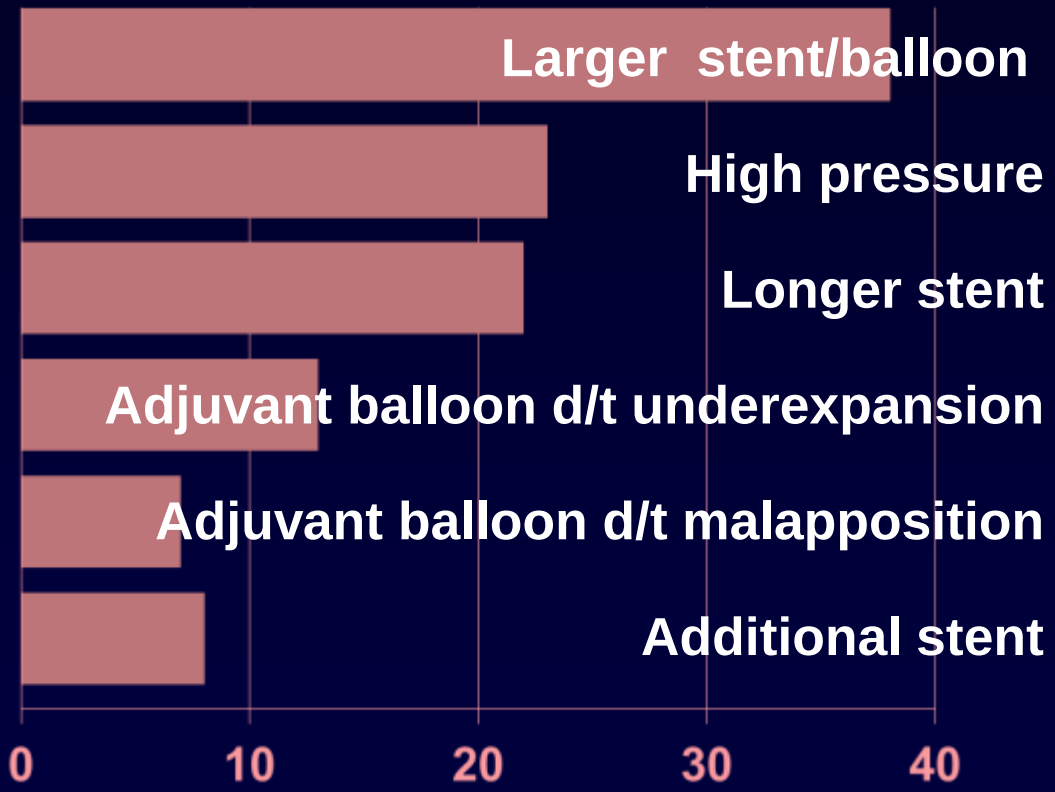


1109	1076	1067	1058	1018
1236	1204	1196	1187	1131

Shin DH, Hong MK (corresponding author), et al. *JACC Intv* 2016;9:2232-2239

How the IVUS information influenced the procedure? From ADAPT-DES Study

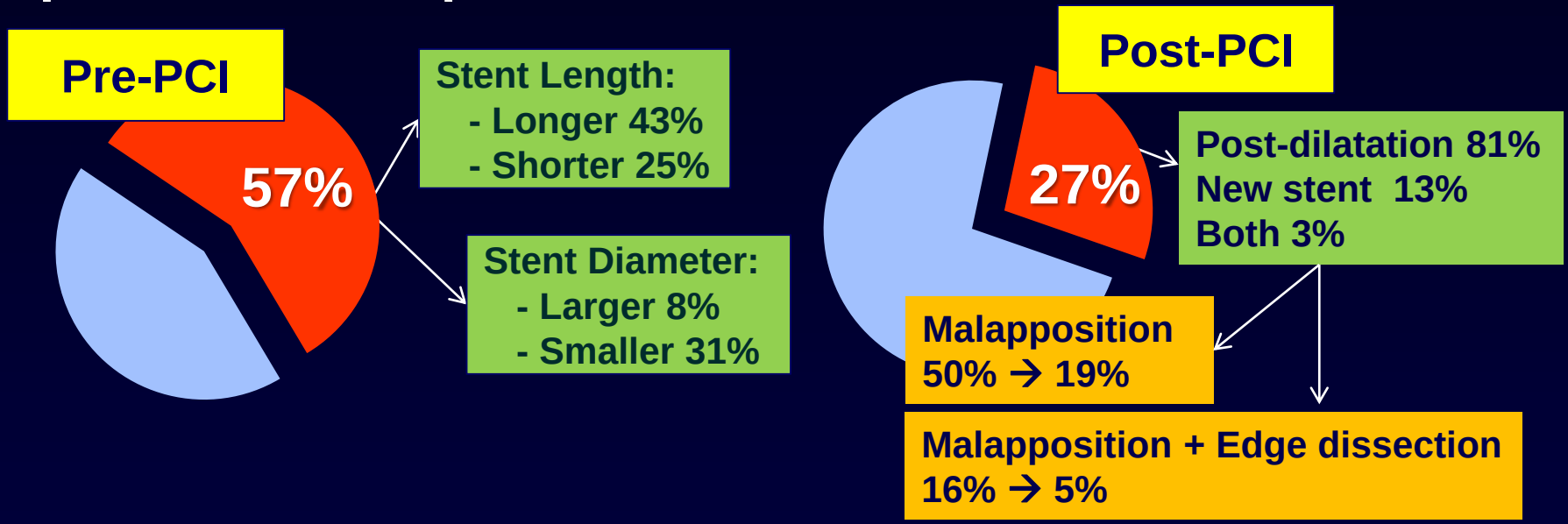
When IVUS was used, the operator was required to report the timing of IVUS imaging (eg, before intervention, after DES, after adjunct balloon inflation) and how the IVUS information influenced the procedure.



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

From ILUMEIN I Study

- OCT impacted on PCI procedure in **65% of pts** either pre-PCI and/or post-PCI



- **Post-PCI FFR** values were significantly different between optimization groups (lower in cases with pre- and post-PCI reaction to OCT) but no longer different after post-PCI stent optimization.
- **MACE events at 30 days** were low: death 0.25%, MI 7.7%, repeat PCI 1.7%, and stent thrombosis 0.25%

Wijns W, et al, Eur Heart J 2105:36:3346-55

2018 European expert consensus documents

Table 2 Recommendations on the adjunctive use of intravascular imaging for diagnostic evaluation of coronary artery disease, guidance and optimization of PCIs

- **Diagnostic assessment of coronary lesions**

Consensus opinion

Angiographically unclear/ambiguous findings (e.g. dissection, thrombus, calcified nodule)

Assessment of left main stenosis

Complex bifurcation lesions

Suspected culprit lesion of ACS

- **PCI guidance and optimization**

RCT evidence

Long lesions

Chronic total occlusions

Consensus opinion

Patients with acute coronary syndromes

Left main coronary artery lesions

Two stents bifurcation

Implantation of bioresorbable scaffolds

Patients with renal dysfunction (IVUS)

- **Identification of mechanism of stent failure**

Restenosis

Stent thrombosis

Eur Heart J 2018;39:3281-3300

2018 ESC/EACTS Guidelines on myocardial revascularization

Recommendations on intravascular imaging for procedural optimization

Recommendations	Class[a]	Level[b]
IVUS or OCT should be considered in selected patients to optimize stent implantation.[603,612,651–653]	IIa	B
IVUS should be considered to optimize treatment of unprotected left main lesions.[35]	IIa	B

IVUS = intravascular ultrasound; OCT = optical coherence tomography.
[a]Class of recommendation.
[b]Level of evidence.

Eur Heart J 2018 (in press)

2014 ESC/EACTS Guidelines

IVUS in selected patients to optimize stent implantation.	IIa	B
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2018 ESC/EACTS Guidelines

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No change of recommendation to use IVUS in guideline

Secret Pearls

Just do IVUS in PCI for complex lesions.


Dreams will
come true