How to Do PCI

QCA Guidance is Enough!

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IVUS in PCI Guidance

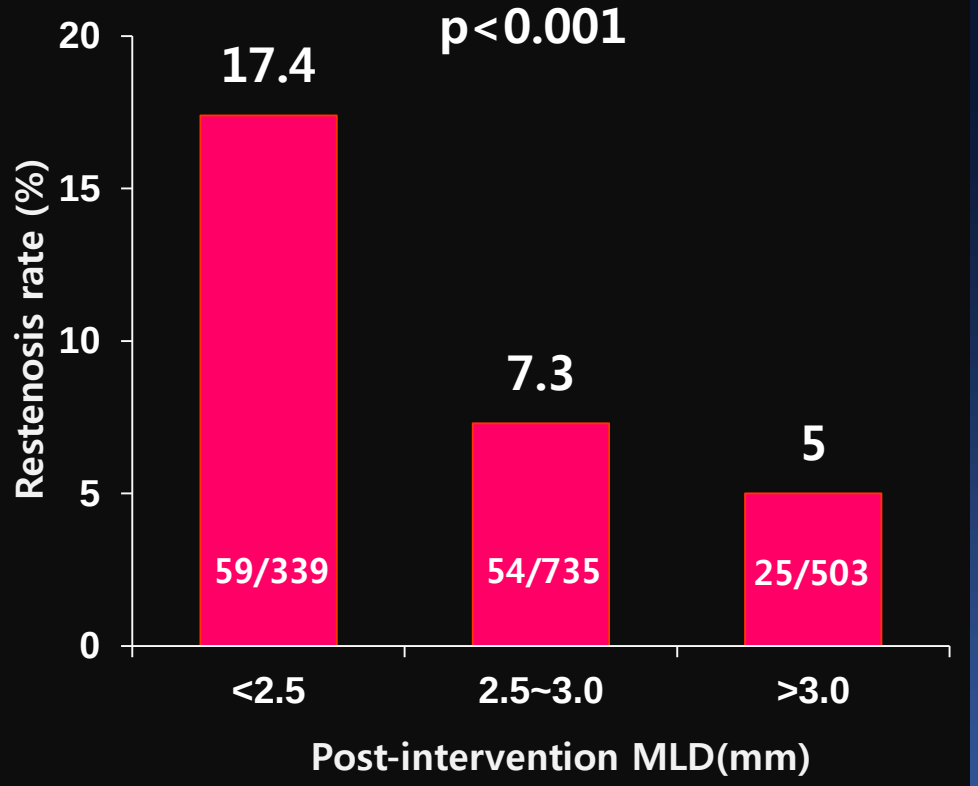
- **2011 ACC/AHA/SCAI Guideline**
  - may be considered for guidance of stent implantation, particularly in cases of left main coronary stenting (IIb)
  - to determine the mechanism of stent restenosis (IIa)

- **2014 ESC/EACTS Guideline**
  - selected patients to optimize stent implantation (IIaB)
  - to assess severity and optimize treatment of unprotected left main coronary artery disease (IIaB)

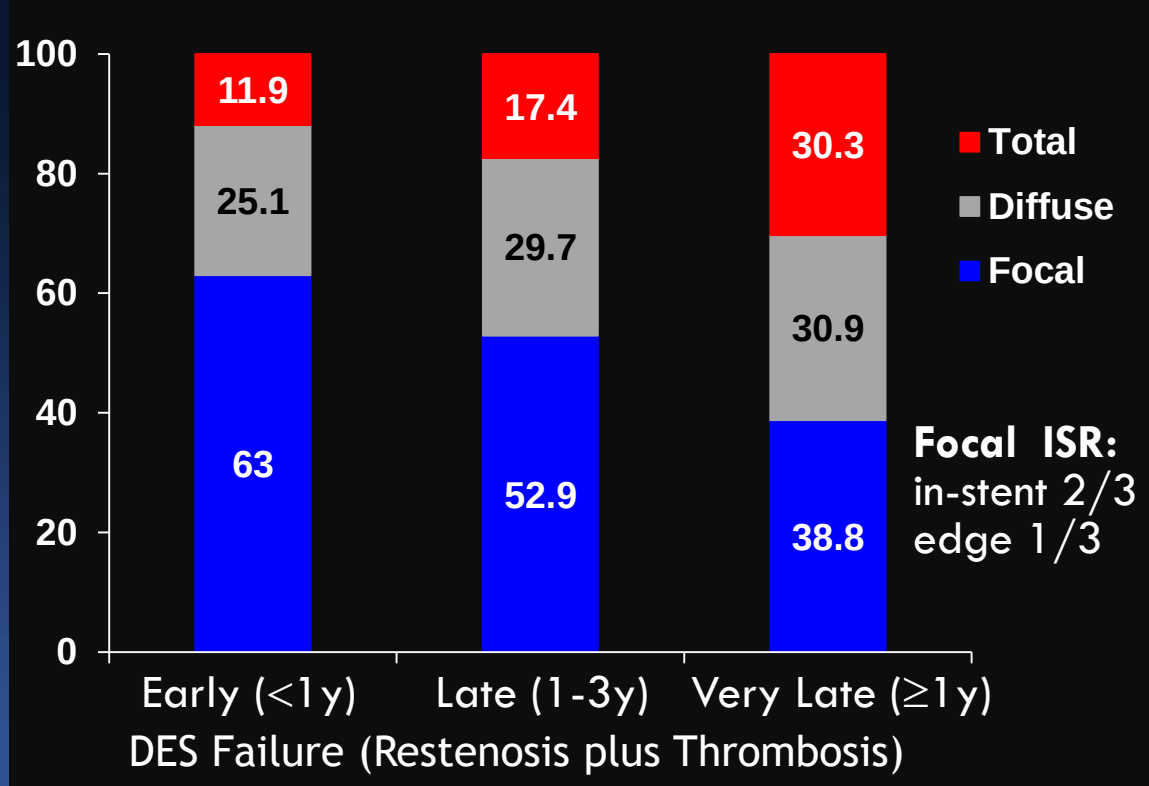
Presentation

- Why DES Failure ?
- Trials for PCI Guidance
- Issues & Solutions

Patterns & Predictors of ISR After DES Implantation

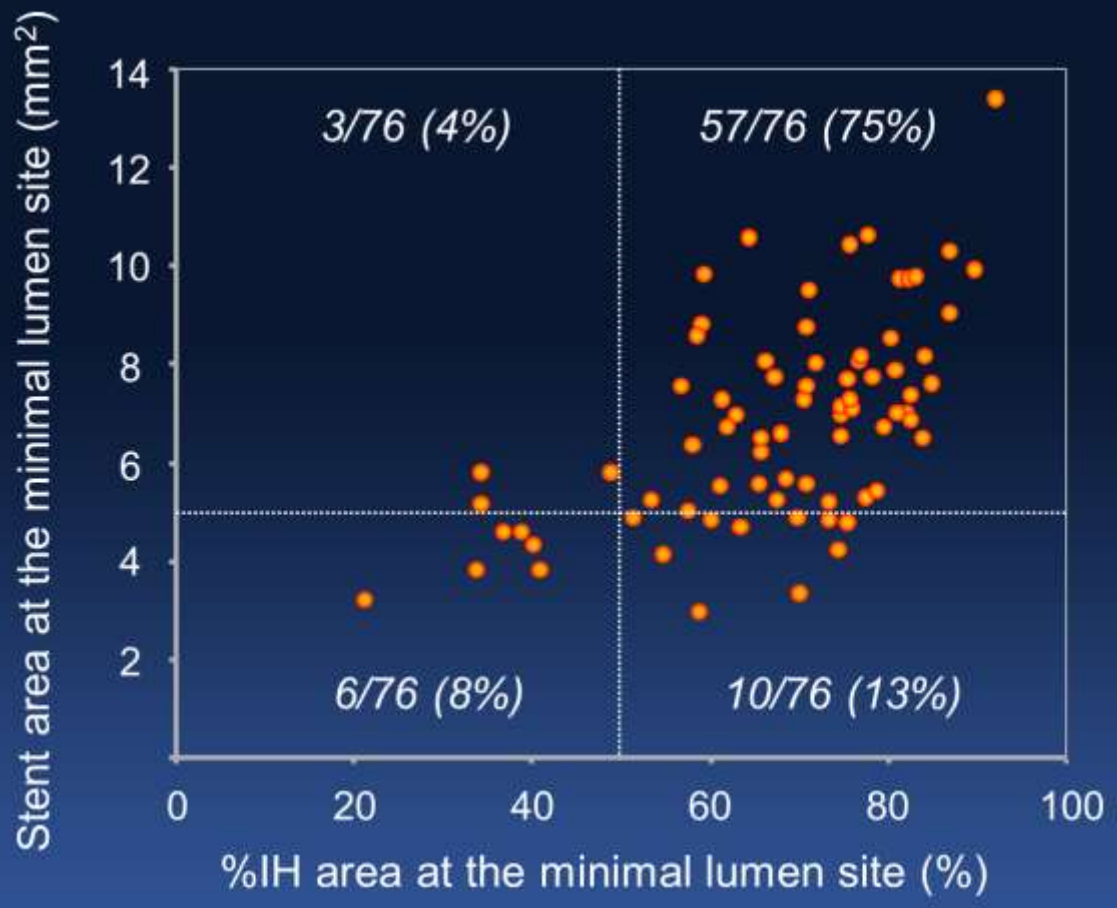


Lee CW, et al. Am J Cardiol 2006;97:506 –11



Lee CW et al, Catheter CI 2015;85:515-21

Mechanism of DES Restenosis



MLA site was located at mid portion in 59%, within 5 mm from the proximal stent edge in 22%, and within 5 mm from the distal stent edge in 19%

Of the IVUS-defined ISR, 42% had stent under-expansion & 93% had IH area >50% of stent.

Because IH was not preventable, interventionists should focus on correction of stent under-expansion during the procedure.

Even bigger, even better:
The risk of target lesion failure decrease for every mm increases.

Kang SJ et al, Circ Cardiovasc Interv 2011;4:9-14

Summary

- Post-intervention MLD & edge problems are key predictors of TLF after DES implantation.
- Achieving a greater stent area without edge problems may decrease the risk of TLF after DES implantation.

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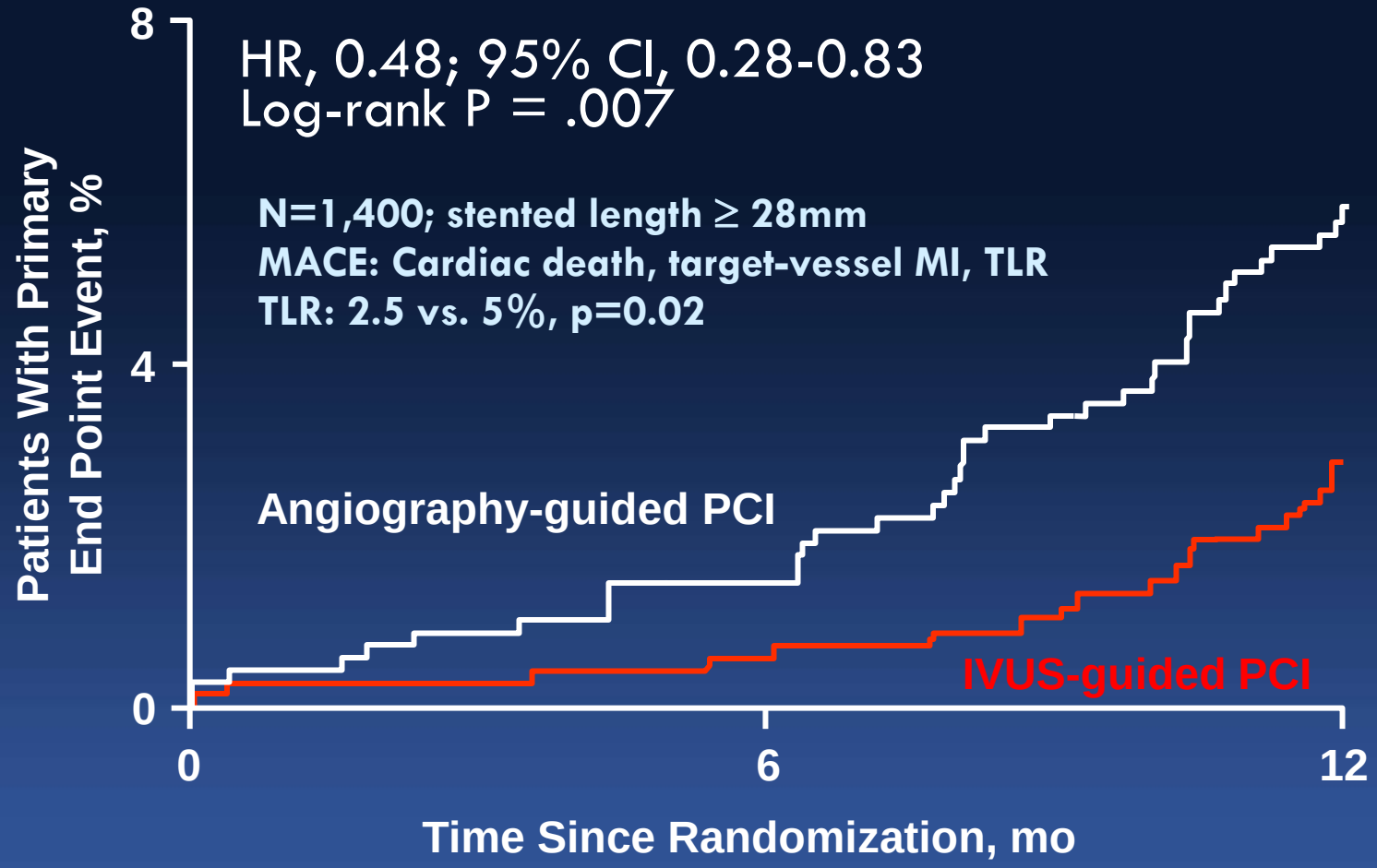
IVUS- vs. Angio-Guided PCI: 8 RCTS

Trials	Number	Lesions	Angio	Post-dil	1°endpoint	Results	P-value
HOME DES IVUS	105/105	Complex	No	24/0	MACE	11/12%	NS
AVIO	142/142	Complex	Operator	88/68	Post-MLD	2.7/2.5mm	0.002
RESET	269/274	Long	Visual	55/45	MACE	HR 0.59	0.16
Tan et al	61/62	LM	No	23/9	MACE	13/21%	0.031
AIR-CTO	115/115	CTO	Visual	NA	Late loss	0.28/0.46	0.025
CTO-IVUS	201/201	CTO	No	51/41	C Death	–	0.16
IVUS-XPL	700/700	Long	Visual	76/57	TLF	HR 0.48	0.007
Zhang et al	42/42	Small	Visual	NA	Post-MLD	2.8/2.5mm	<0.001

1) Catheter Cardiovasc Interv 2010;75:578-83. 2) Am Heart J 2013;165:65-72. 3) JACC Cardiovasc Interv 2013;6:369-76.
4) Saudi Med J 2015;36:549-53. 5) EuroIntervention 2015;10:1409-17. 6) Circ Cardiovasc Interv 2015;8:e002592.
7) JAMA 2015;314:2155-63. 8) J Clin Invasive Cardiol 2016;3:2-8.

IVUS-XPL Randomized Clinical Trial



Among patients requiring long coronary stent implantation, the use of IVUS-guided everolimus-eluting stent implantation, compared with angiography-guided stent implantation, resulted in a significantly lower rate of MACE

JAMA2015:314:2155-63

IVUS-XPL: What Makes the Difference?

Angiography-guided:
- stent size & length by visual estimation,
- post-dilation if residual DS ≥30% by visual estimation

IVUSU-guided: decisions according to IVUS findings

Differences in key parameters:
- adjunctive post-dilation: 76% vs. 57%, p<0.001
- final balloon size: 3.14 vs. 3.04mm, p<0.001
- final MLD: 2.64 vs. 2.56mm, p<0.001
- residual diameter stenosis: 12.79 vs. 13.74%, p=0.04

Limitations of Previous Studies

The key determinant of the device failure is not imaging-guidance itself but suboptimal results.

Looking at angiography guidance:

- Smaller stent: Angiography guidance was based on visual estimation, often leading to choose undersized stents.
- Stent underexpansion: High pressure post-dilatation was not routinely used, leading to inadequate stent expansion.

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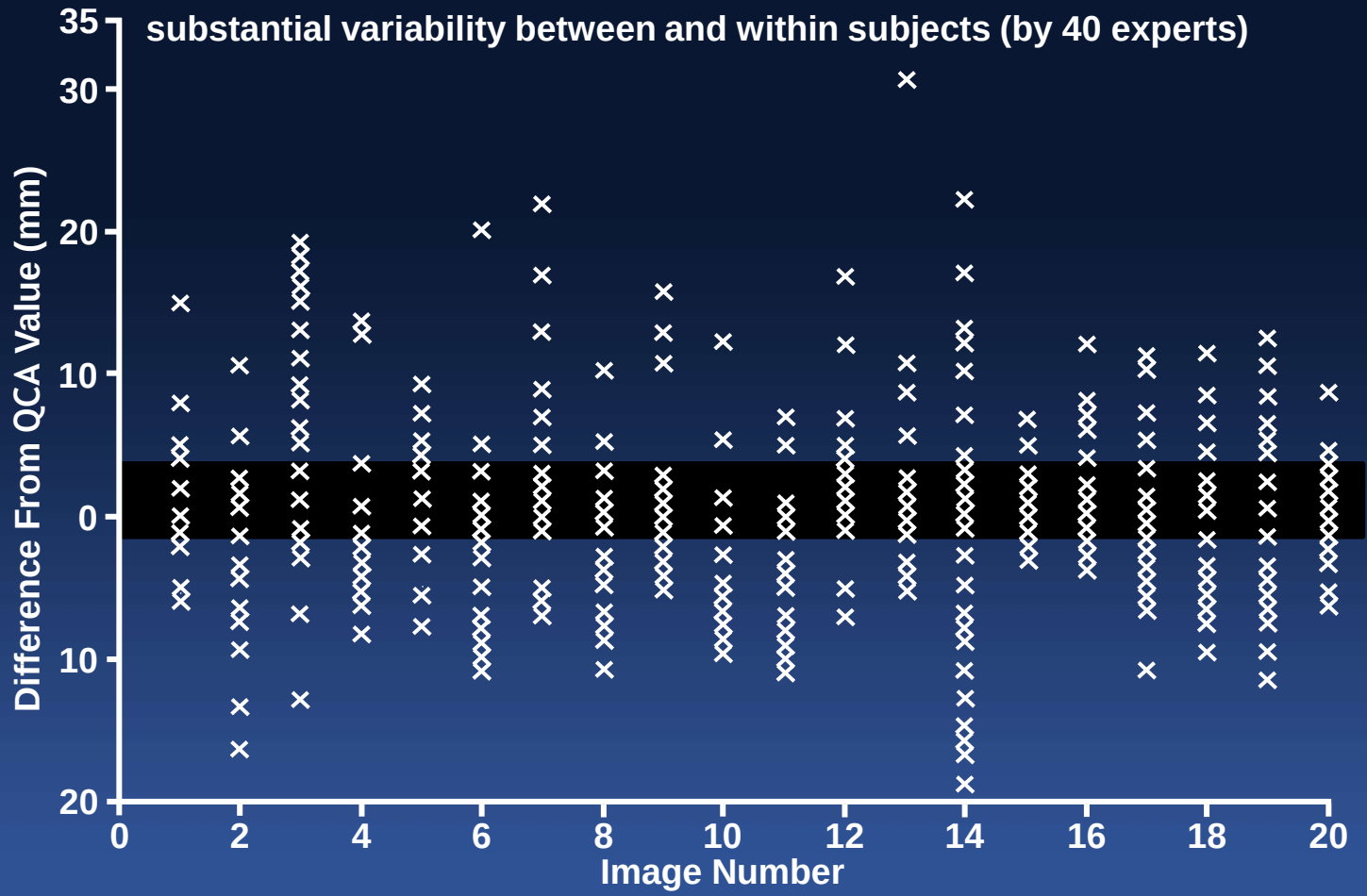
Visual Estimation



In clinical practice, PCI most commonly relies on visual estimation by physicians. Sizing by visual estimation, however, has well-known limitations with high variability & inaccuracy, which is affected by magnification, screen size, and etc.

QCA Guidance
for IVUS-Like Results

- Design by angio (shoulder to shoulder)
  creating harmony with reference vessels
- Sizing by QCA (fine edge-tunning)
  target size (adjusted QCA)=RVD + 5-10% of RVD
- Finish by 3D (dilate, dilate & one more dilate)
  minimal residual diameter stenosis <10% by QCA

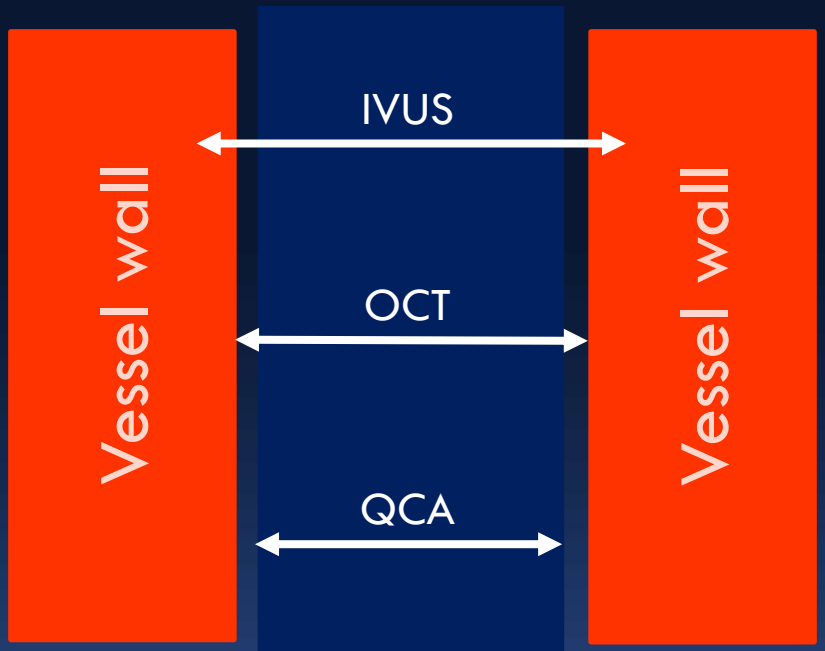
Design by Angiogram

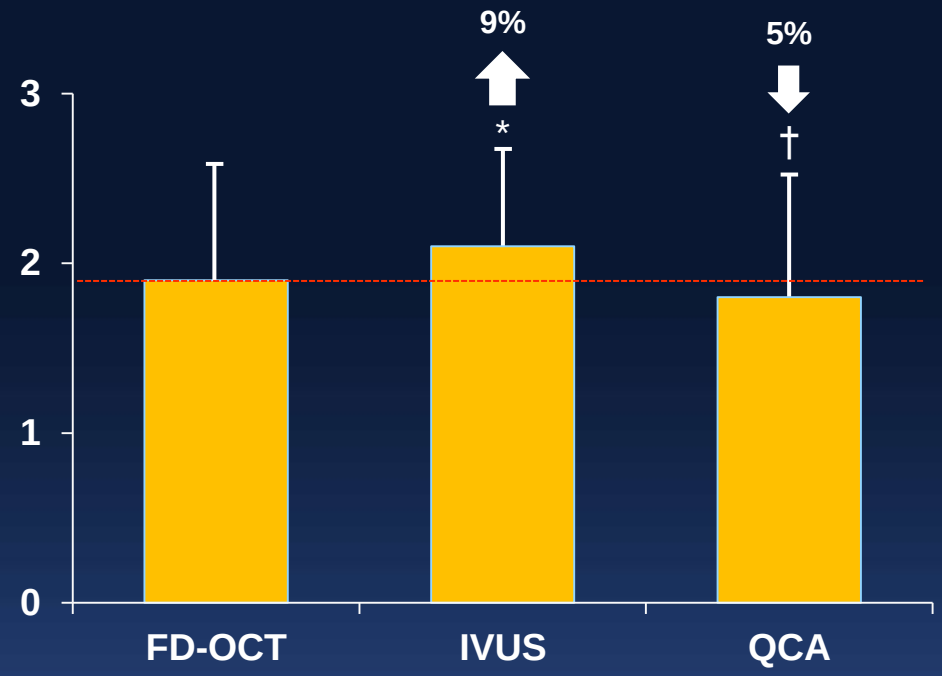
Start with best angiograms

Take CAG after nitroglycerin (250-500μg) injection

1. Landing zone
   - shoulder to shoulder (normal or normal looking areas)
   - poor zones: sharp turning points, bending or milking areas
2. Lesion length
   - short lesions: by non-inflated balloon (15, or 20mm)
   - long lesions: by radiopaque distal tip of the guide wire (30mm)
3. Reference vessel diameter by QCA

Sizing by Dynamic QCA





QCA underestimate the lumen dimension compared to OCT (real value), requiring oversize corrections. Siemens on-line QCA by automatic calibration: error<1.5%

1. get reference vessel diameter (RVD), by on-line QCA
2. stent selection & deployment, by balloon inflation up to target size
   - ≤3.5mm by QCA: target size = distal RVD +~10% of distal RVD
   - 3.5-4.0 by QCA: target size = distal RVD +(5-10% of distal RVD)
   - ≥4.0 by QCA: target size = distal RVD + ~5% of distal RVD

J Am Coll Cardiol Img 2016;9:1011-13 J Am Coll Cardiol Img 2013;6:1095-104

Finish by Post-dilation

The best time to invest: All patients begin to lose lumen area after achieving peak lumen area by post-dilation.

1. Edge tuning, up to target size (0<tapering index <10%*)

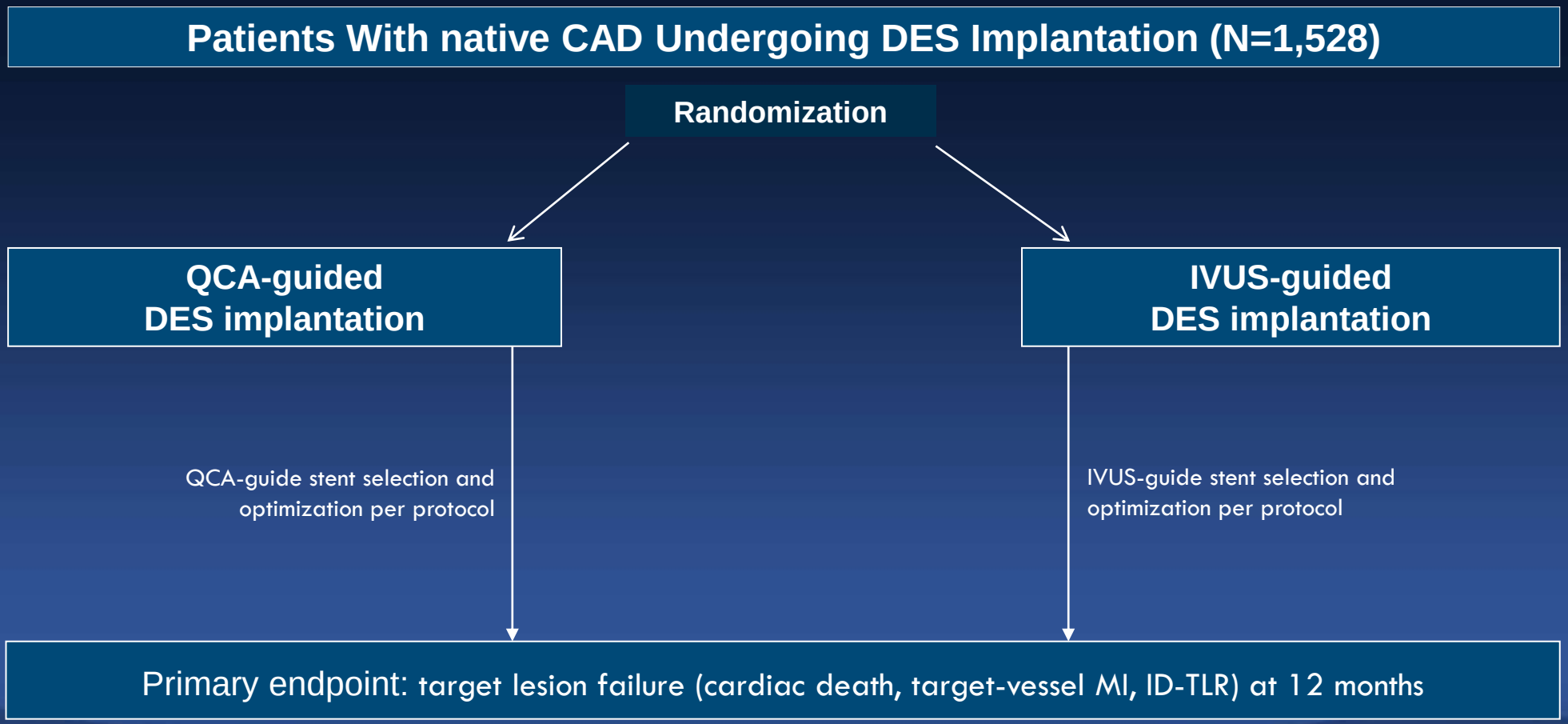
   A smooth taped transition:
   - golden ratio tapering = ~3% by QCA or visual estimation
   - Stent edge under-expansion: one more tuning up to target size+~0.2mm

2. In-stent tuning, up to (target size plus ~0.2mm)

   to minimize residual stenosis (0% by visual estimation, <10% by QCA)

*Tapering index = (stent edge MLD – reference MLD)/stent edge MLD×100
reference MLD: reference vessel size within 2.5mm from the stent margin

Quantitative Coronary Angiography versus Intravascular Ultrasound *GUID*anc*E* for *D*rug-*E*luting *S*tent Implantation: GUIDE–DES trial



Summary

IVUS guidance*:

- a limited impact on PCI outcome
- no reimbursement of IVUS worldwide, except Japan
- IVUS penetration: Japan 80%, Korea 23%, USA 15%, EU5%, China 4%, India 1%

QCA guidance:

- available at every catheterization laboratory
- quick and easy without additional cost
- a reliable time-honored method

*Selective use of IVUS:
IVUS-guided wiring for CTO intervention, or evaluation of ambiguous lesions (haziness) and PCI complications (dissection, hematoma, thrombosis)

Together QCA

Think values first!

Thanks.