What Events Happened in the Imaging Field in 2023?

Lim Do Hyung, RT

Cardiovascular center, Incheon St. Mary's Hospital

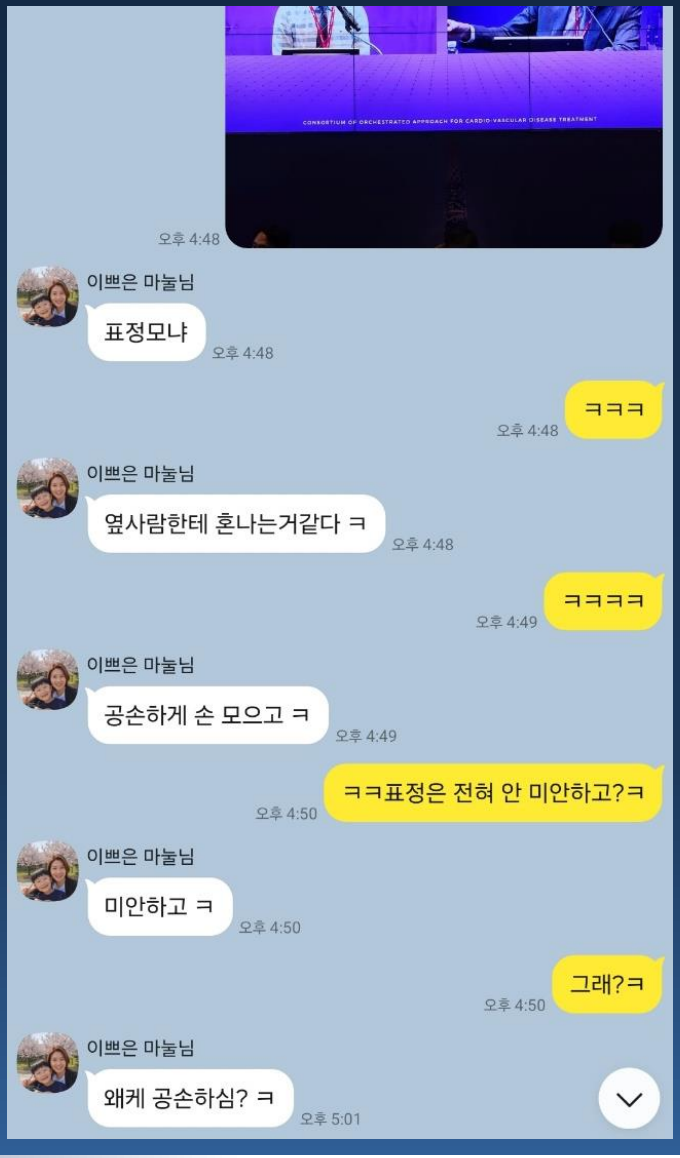
The Catholic University of Korea

Type of Intravascular imaging system

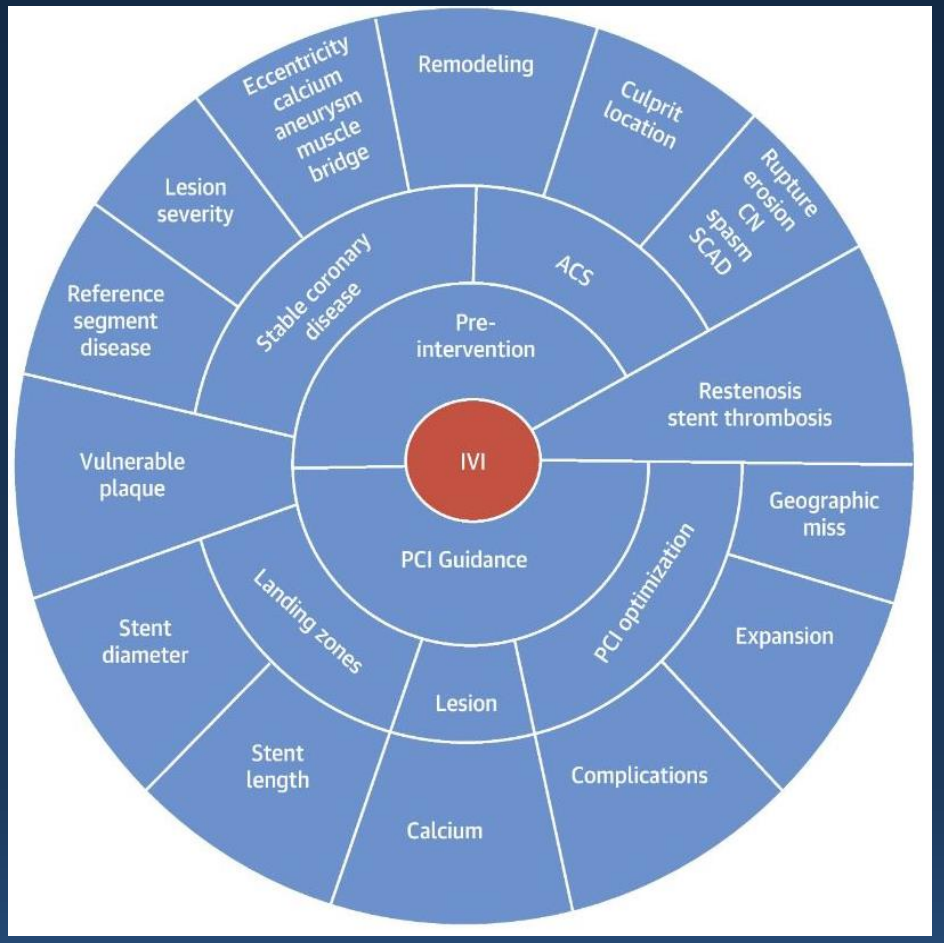
	IVUS	OCT
Energy source	Ultrasound	Near-infrared light
Wavelength, μm	35-80	1.3
Resolution, μm	40-200 (axial); 200-300 (lateral)	15-20 (axial); 20-40 (lateral)
Maximum scan diameter, mm	15	7
Tissue penetration, mm	10	1-2.5

JACC 2023-02-14, Volume 81, Issue 6, Pages 590-605
Frontiers in Cardiovascular Medicine May 2022 | Volume 9 | Article 878801

why is intravascular imaging?



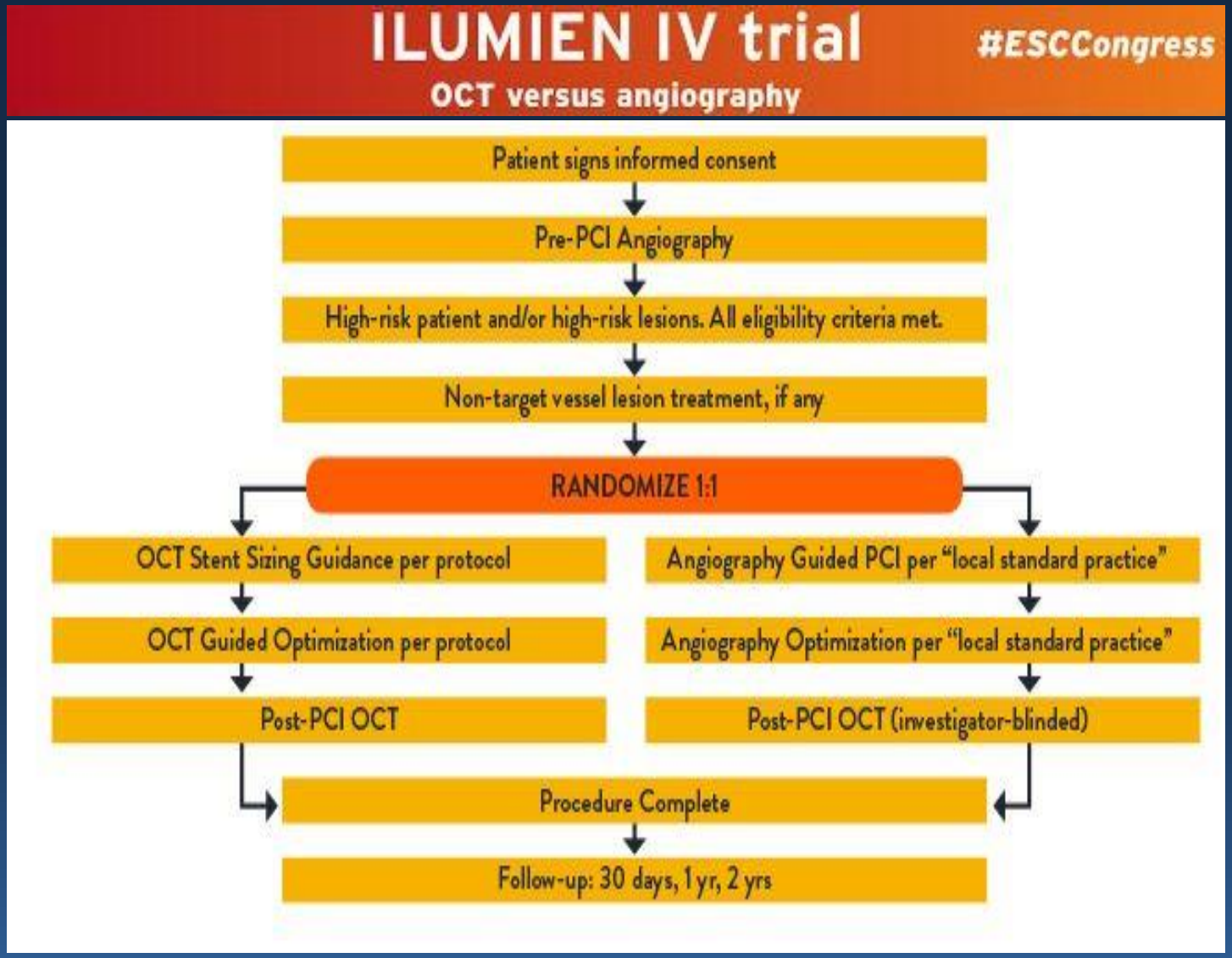
why is intravascular imaging?



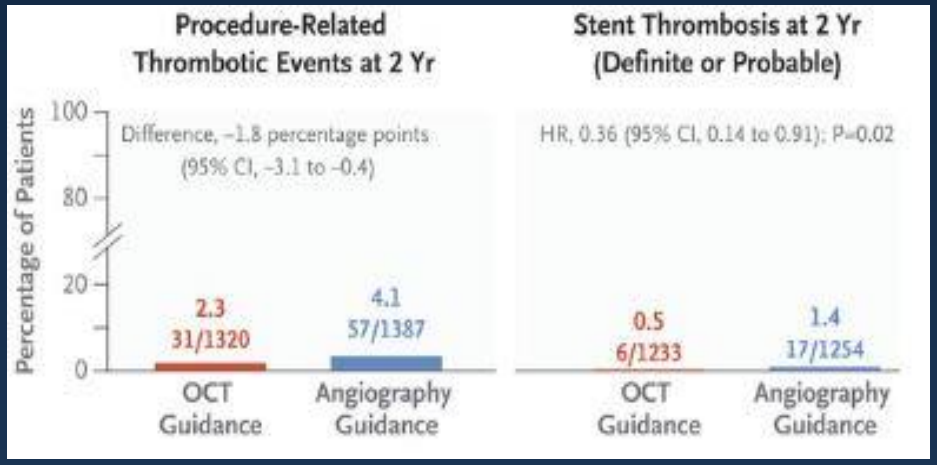
They provide tomographic or cross-sectional images of the Coronary that include the lumen, vessel wall, plaque burden, plaque composition and distribution, and even peri-vascular structures—information promised, but rarely provided angiographically.

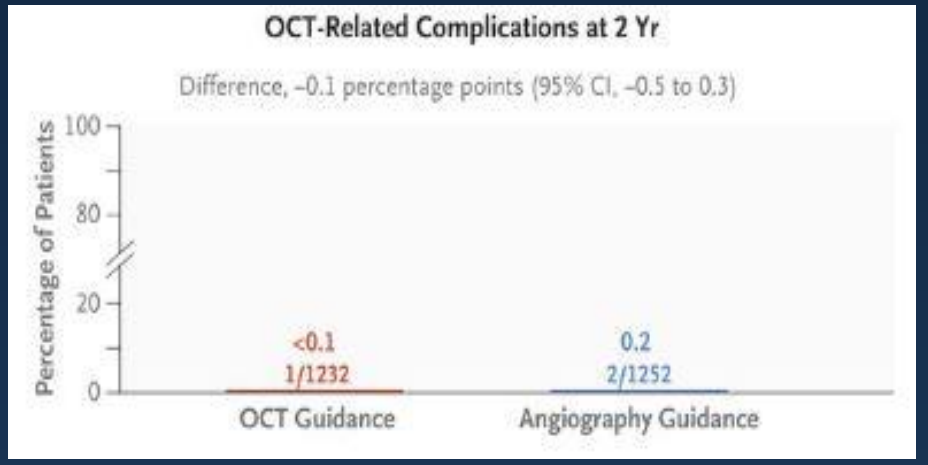
JACC cardiovasc imaging 2022 Oct;15(10):1799-1820.

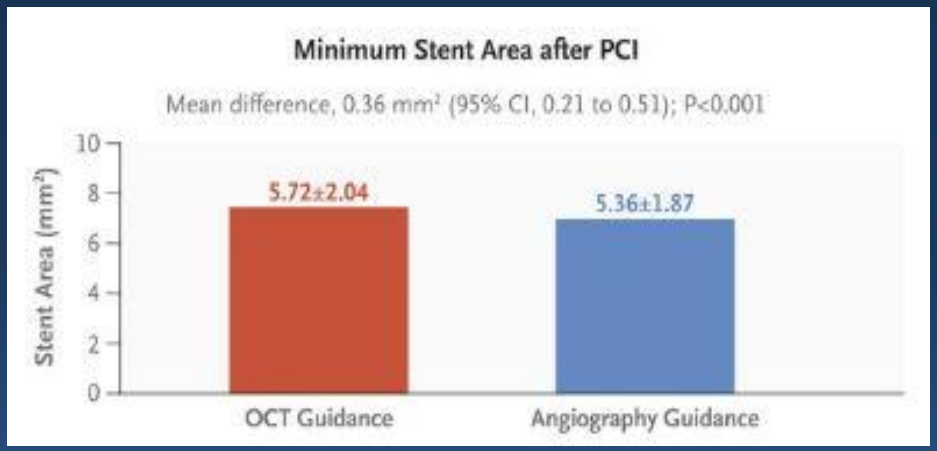
Intravascular imaging improved clinical outcomes?

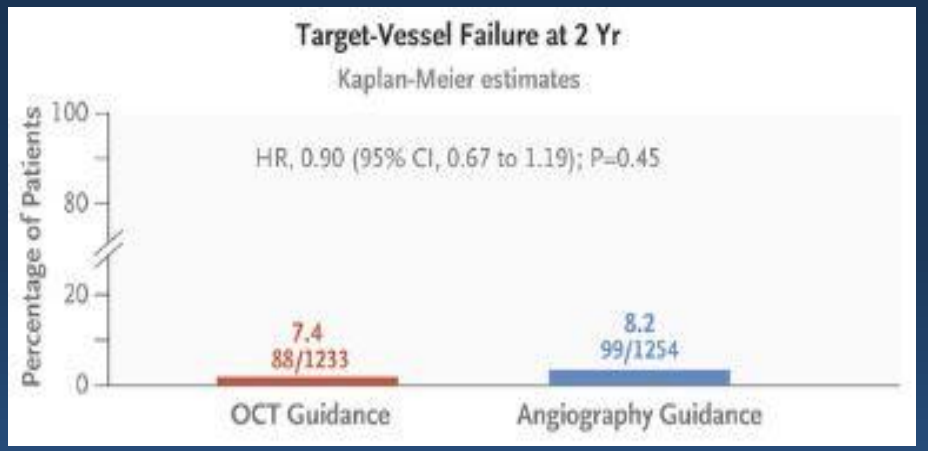


Intravascular imaging improved clinical outcomes?





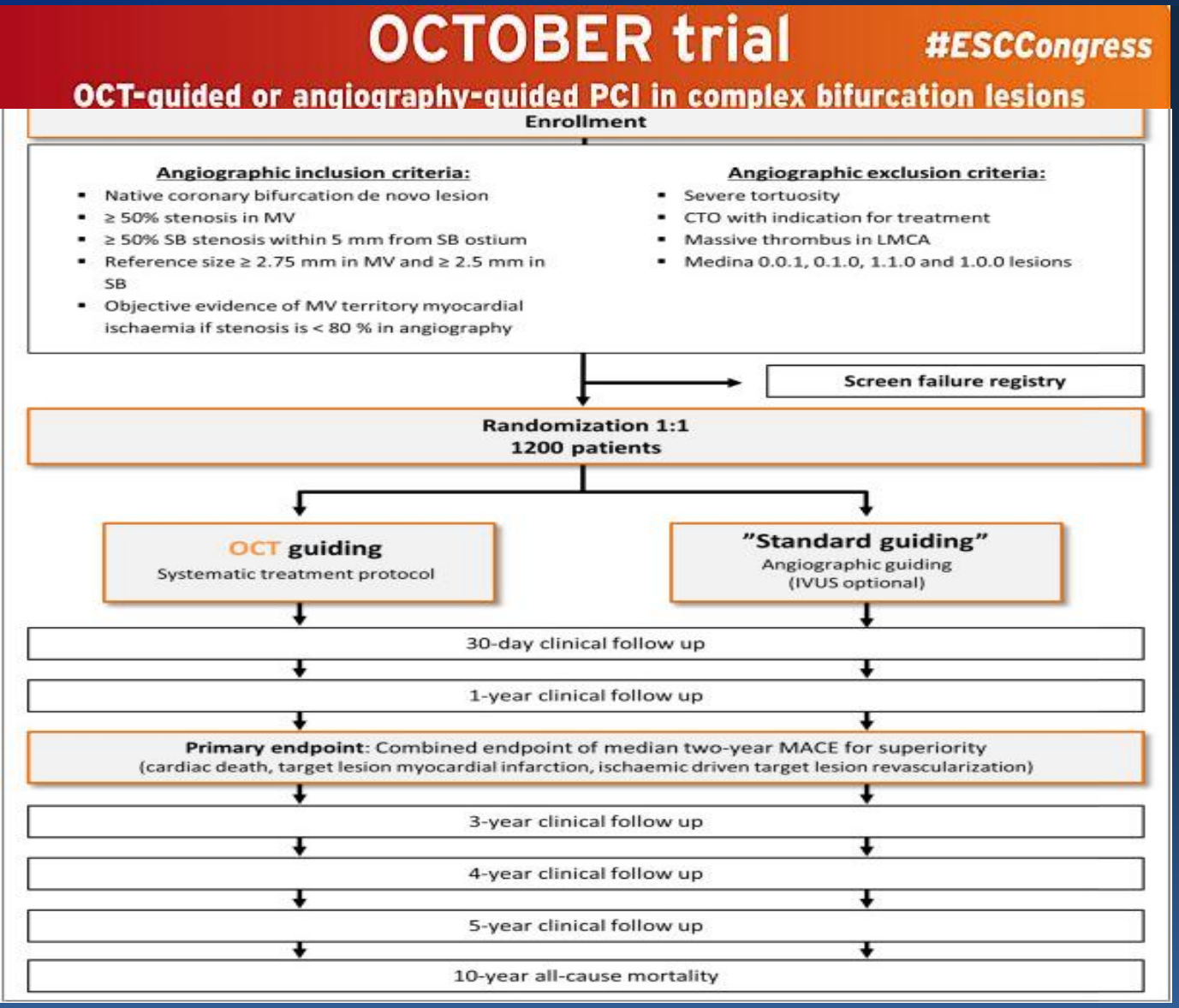




Conclusion

Optical coherence tomography (OCT)-guided percutaneous coronary intervention (PCI) leads to a larger minimum stent area but does not reduce the 2-year rate of target vessel failure compared with angiography-guided PCI.

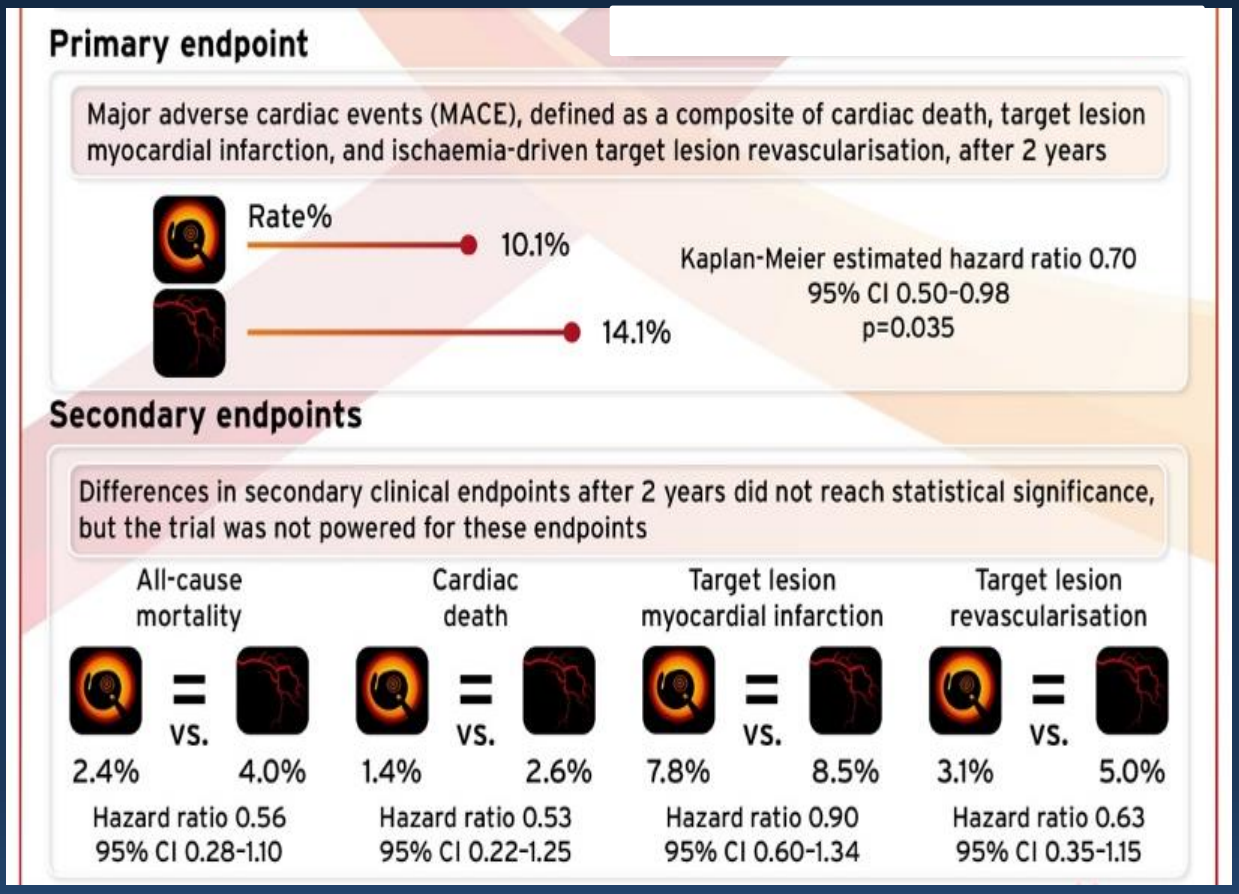
Intravascular imaging improved clinical outcomes?



Intravascular imaging improved clinical outcomes?

Characteristic	Total (N=1201)	OCT-Guided PCI (N=600)	Angiography-Guided PCI (N=601)
Median no. of diseased vessels (IQR)	2 (2–2)	2 (2–2)	2 (2–2)
Median no. of lesions to be treated (IQR)	1 (1–1)	1 (1–1)	1 (1–1)
Trial bifurcation vessels — no. of patients (%)			
LMCA–LAD–LCx	227 (18.9)	111 (18.5)	116 (19.3)
LAD-D	847 (70.5)	425 (70.8)	422 (70.2)
LCx–OM	111 (9.2)	55 (9.2)	56 (9.3)
RCA–PDA–PLA	16 (1.3)	9 (1.5)	7 (1.2)
Main-vessel treatment, median total stent length (IQR) — mm	36 (24–50)	38 (28–51)	33 (23–48)
Side-branch treatment			
Side branch stented — no. of patients/total no. (%)	770/1198 (64.3)	388/597 (65.0)	382/601 (63.6)
Median total stent length (IQR) — mm	23 (15–28)	23 (15–28)	23 (15–28)
Median total balloons (IQR) — no.	7 (5–9)	7 (5–10)	6 (5–9)
Largest balloon diameter — mm	4.1±0.02	4.2±0.03	4.0±0.02
Secondary lesions treated — no. of patients (%)	231 (19.2)	106 (17.7)	125 (20.8)

Intravascular imaging improved clinical outcomes?

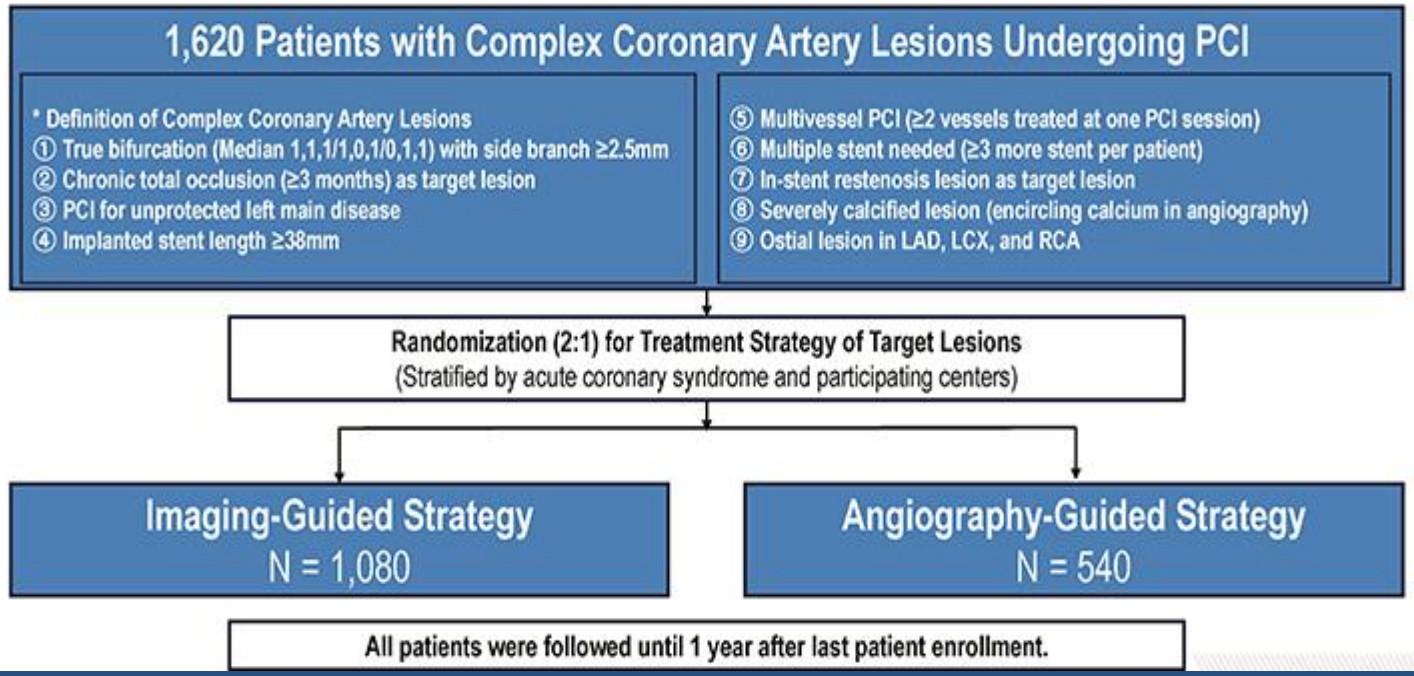


Conclusion

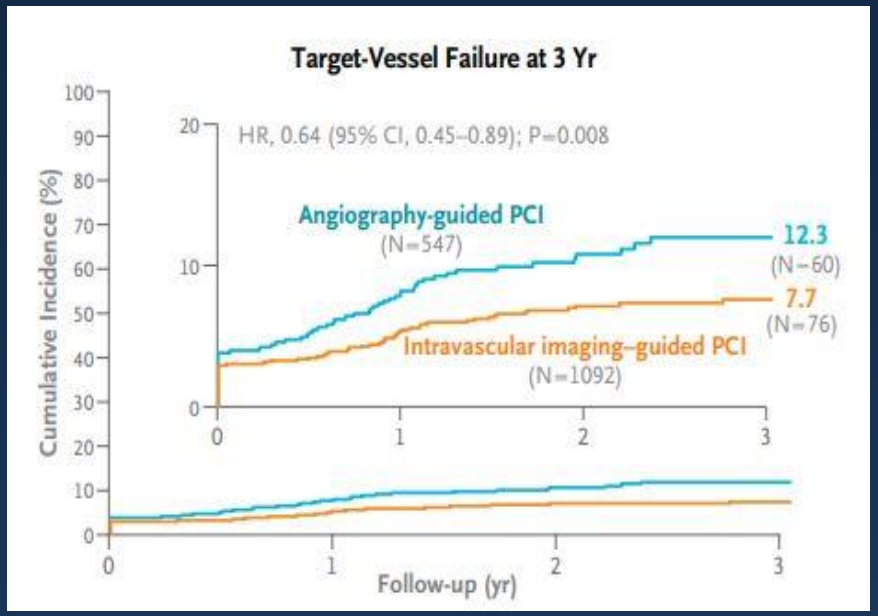
In patients with complex bifurcation lesions, optical coherence tomography (OCT)-guided percutaneous coronary intervention (PCI) is associated with better outcomes after 2 years than angiography-guided PCI.

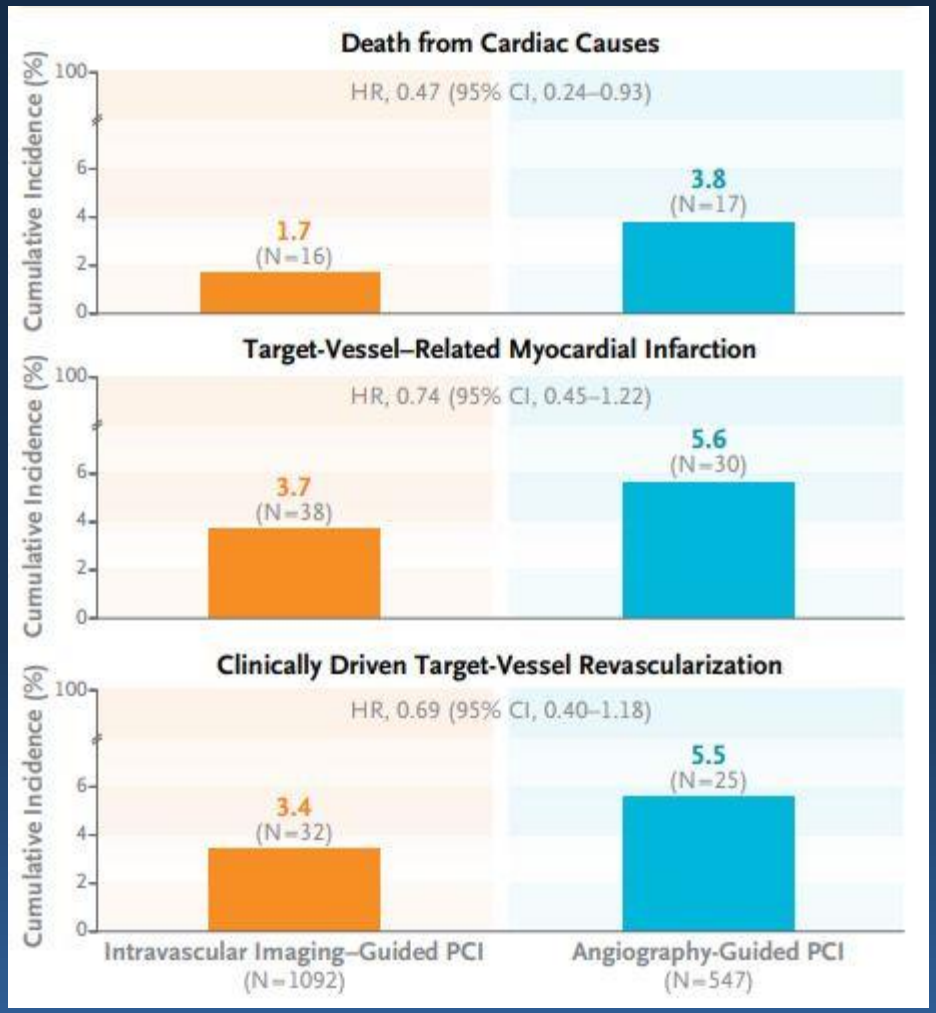
Intravascular imaging improved clinical outcomes?

Intravascular Imaging–Guided or Angiography-Guided Complex PCI



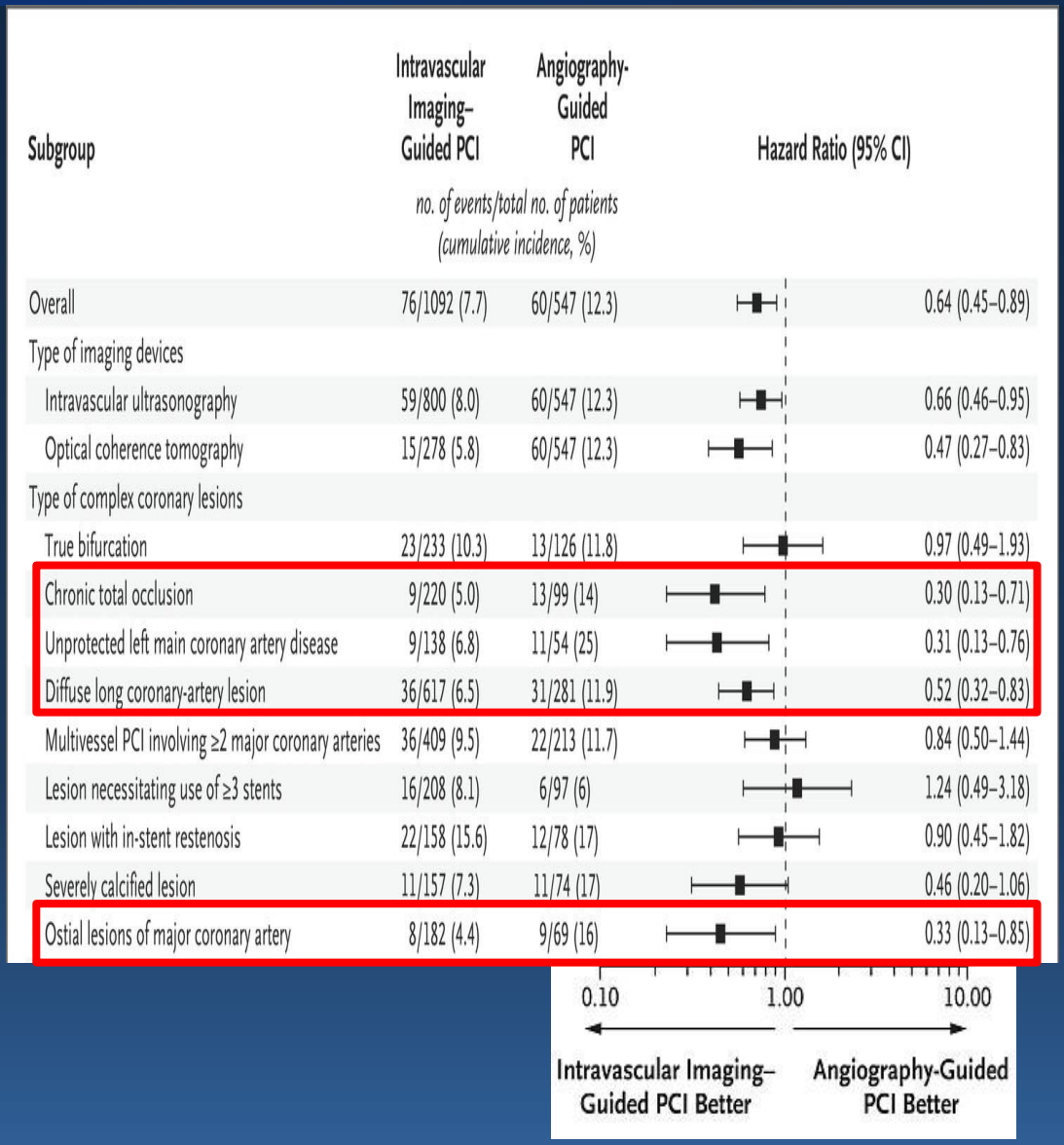
Intravascular imaging improved clinical outcomes?





N Engl J Med 2023;388:1668-1679

Intravascular imaging improved clinical outcomes?

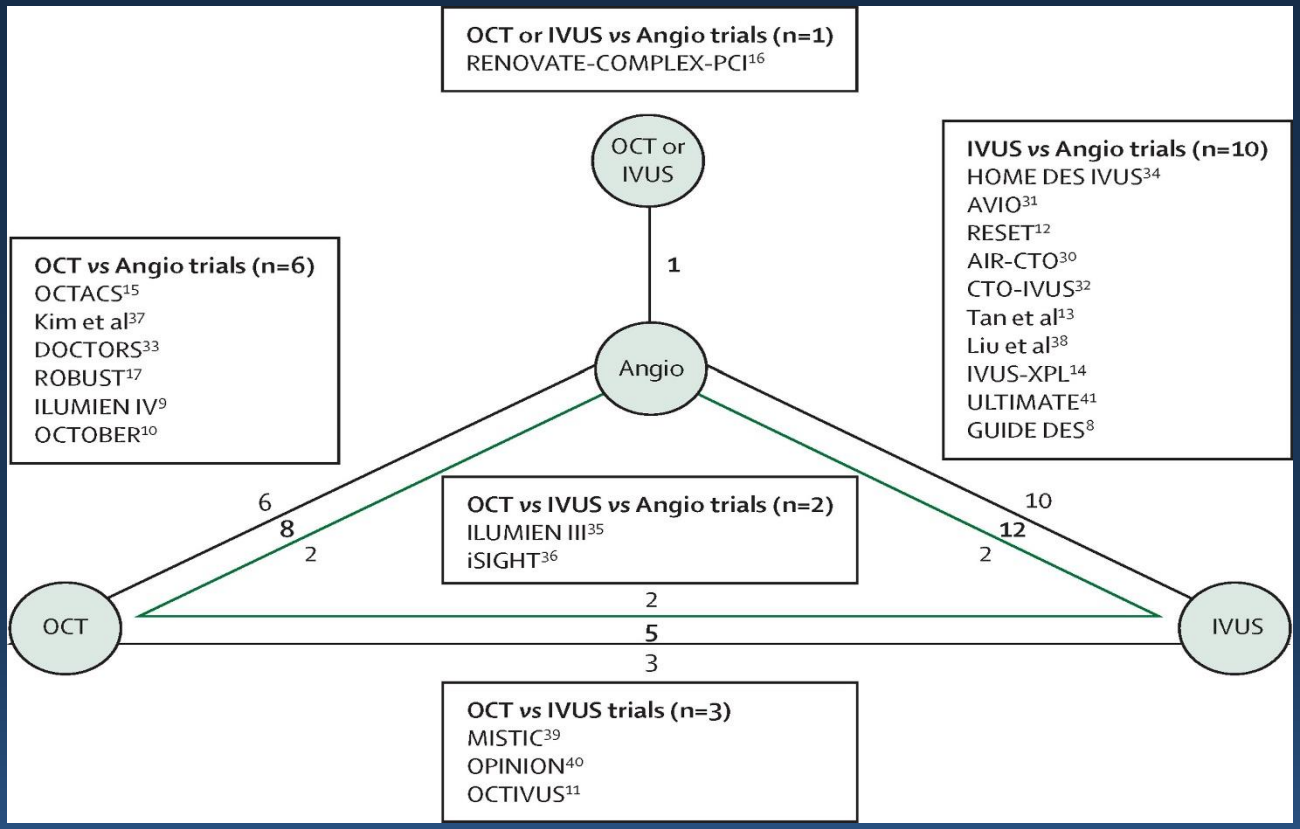


Subgroup	Intravascular Imaging–Guided PCI	Angiography-Guided PCI	Hazard Ratio (95% CI)
	no. of events/total no. of patients (cumulative incidence, %)		
Overall	76/1092 (7.7)	60/547 (12.3)	0.64 (0.45–0.89)
Type of imaging devices			
Intravascular ultrasonography	59/800 (8.0)	60/547 (12.3)	0.66 (0.46–0.95)
Optical coherence tomography	15/278 (5.8)	60/547 (12.3)	0.47 (0.27–0.83)
Type of complex coronary lesions			
True bifurcation	23/233 (10.3)	13/126 (11.8)	0.97 (0.49–1.93)
Chronic total occlusion	9/220 (5.0)	13/99 (14)	0.30 (0.13–0.71)
Unprotected left main coronary artery disease	9/138 (6.8)	11/54 (25)	0.31 (0.13–0.76)
Diffuse long coronary-artery lesion	36/617 (6.5)	31/281 (11.9)	0.52 (0.32–0.83)
Multivessel PCI involving ≥2 major coronary arteries	36/409 (9.5)	22/213 (11.7)	0.84 (0.50–1.44)
Lesion necessitating use of ≥3 stents	16/208 (8.1)	6/97 (6)	1.24 (0.49–3.18)
Lesion with in-stent restenosis	22/158 (15.6)	12/78 (17)	0.90 (0.45–1.82)
Severely calcified lesion	11/157 (7.3)	11/74 (17)	0.46 (0.20–1.06)
Ostial lesions of major coronary artery	8/182 (4.4)	9/69 (16)	0.33 (0.13–0.85)

N Engl J Med 2023;388:1668-1679

Intravascular imaging improved clinical outcomes?

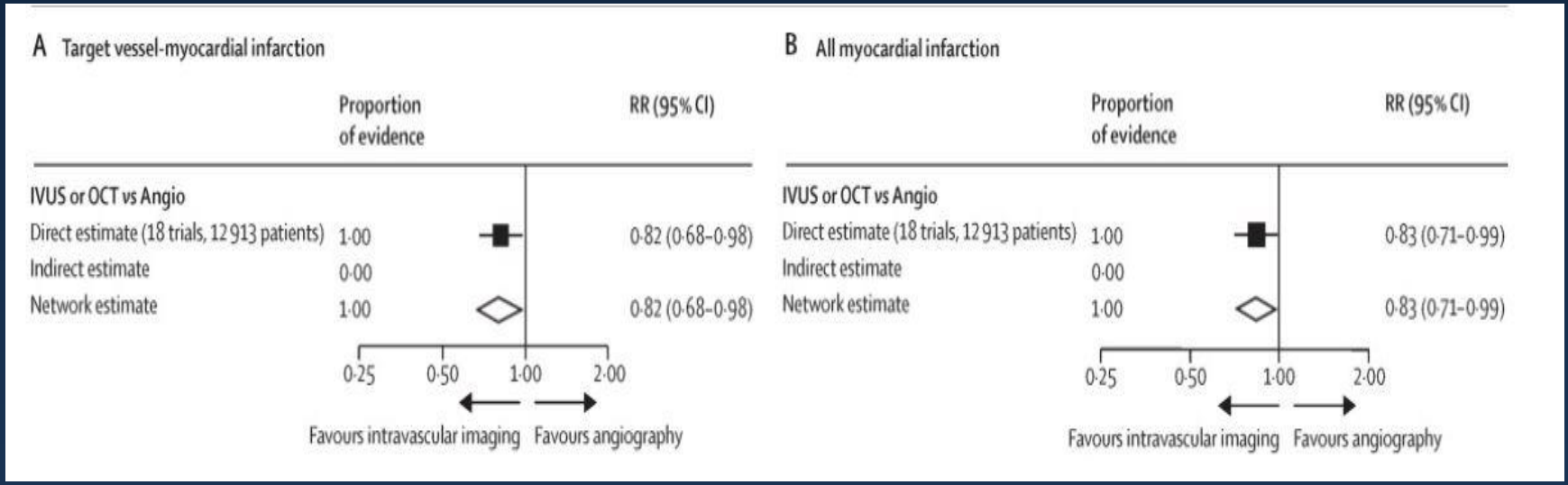
Intravascular imaging-guided coronary drug-eluting stent implantation: an updated network meta-analysis

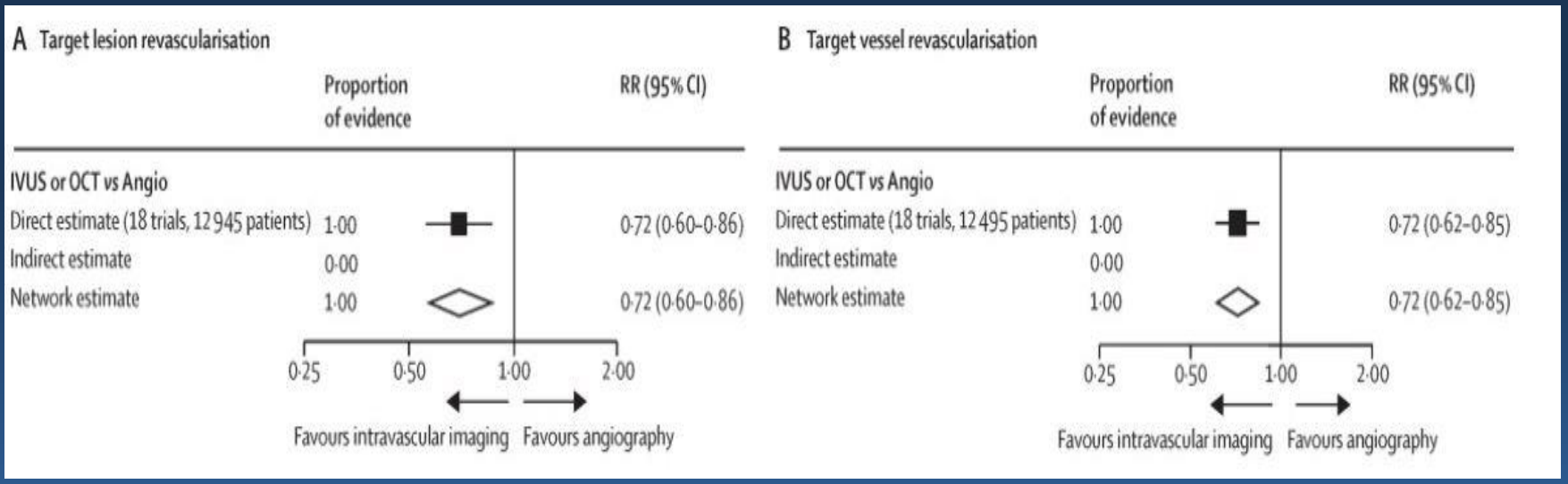


22 RCT trial, 15,964 patient enrolled

Lancet 2024; 403: 824–37

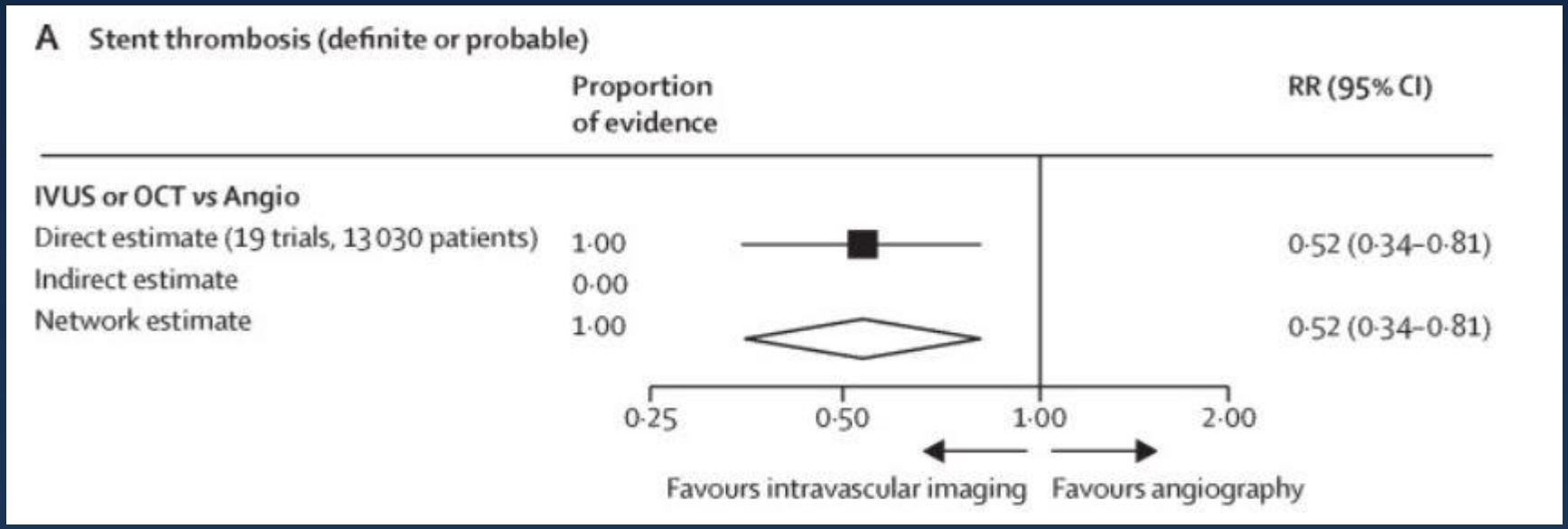
Intravascular imaging improved clinical outcomes?





Lancet 2024; 403: 824–37

Intravascular imaging improved clinical outcomes?



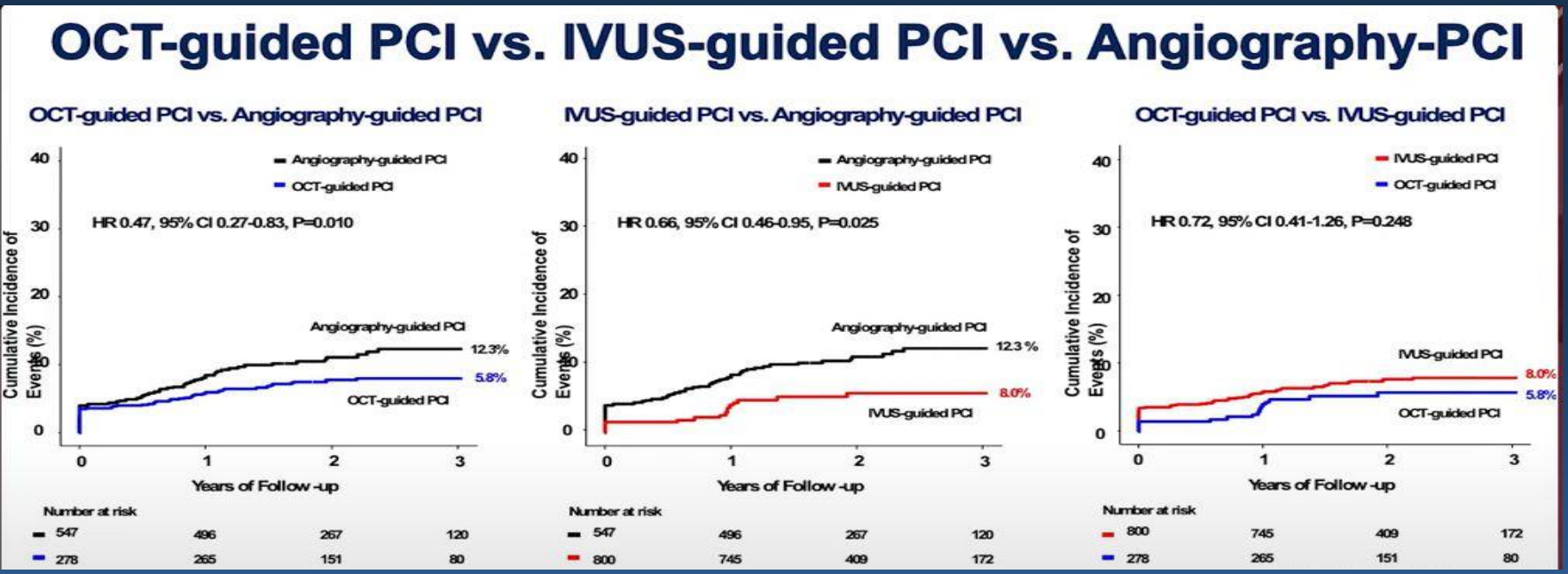
Intravascular-imaging-guided PCI improves clinical outcomes compared with angiography-guided PCI in patients.

Lancet 2024; 403: 824–37

Which is better IVUS or OCT?

➢RENOVATE-COMPLEX PCI trial

Procedural characteristics			
Total no. of target lesions treated	1.5±0.7	1.5±0.7	1.5±0.7
Intravascular imaging device used — no./total no. (%)‡	1091/1639 (66.6)	1078/1092 (98.7)	13/547 (2.4)
Intravascular ultrasonography	813/1091 (74.5)	800/1078 (74.2)	13/13 (100)
Optical coherence tomography	278/1091 (25.5)	278/1078 (25.8)	0/13

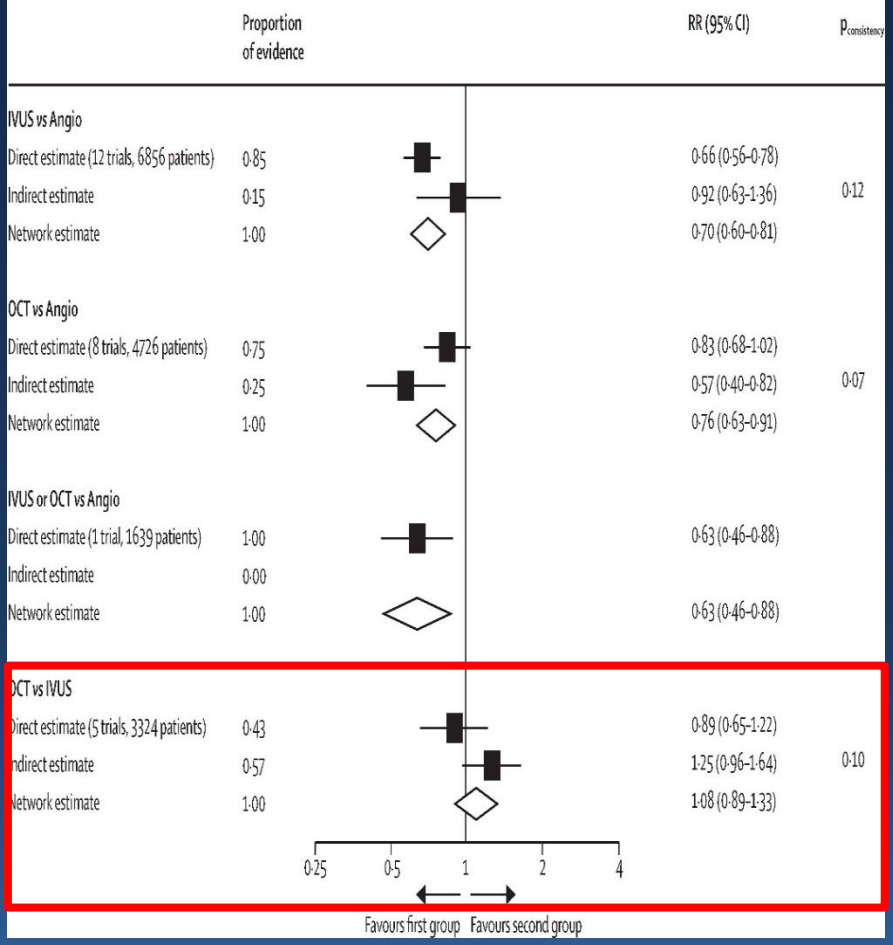


Source: Presentation by Joo-Yong Hahn, (Seoul, South Korea) at ACC 2023

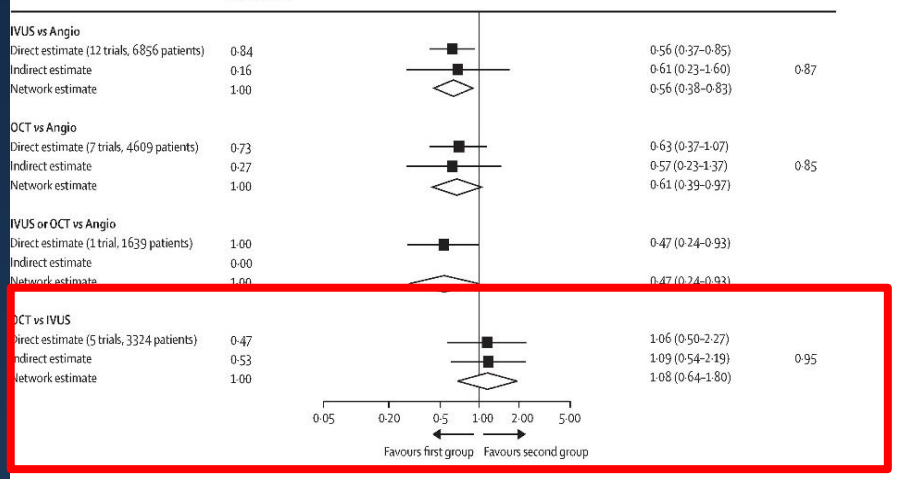
Which is better IVUS or OCT?

Intravascular imaging-guided coronary drug-eluting stent implantation: an updated network meta-analysis

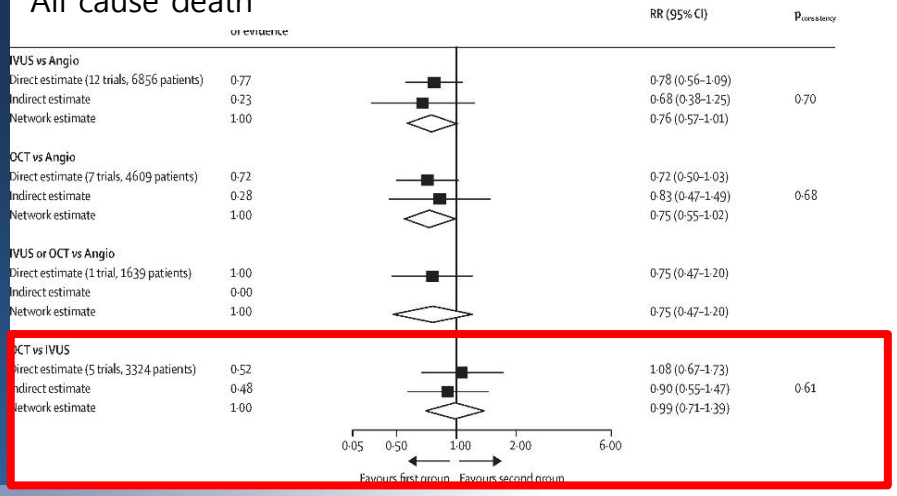
Target lesion failure



Cardiac death



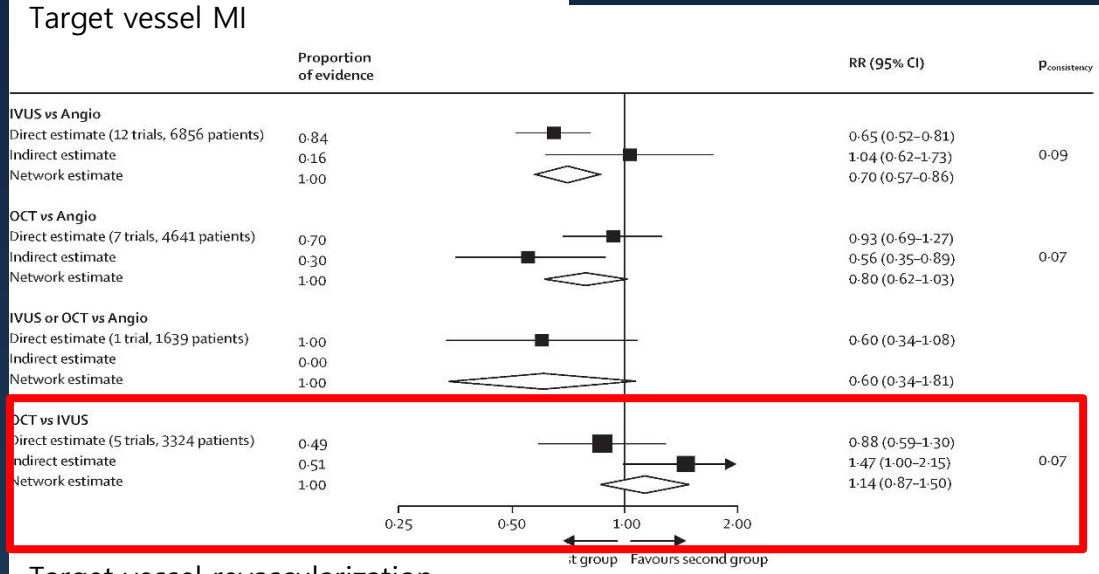
All cause death



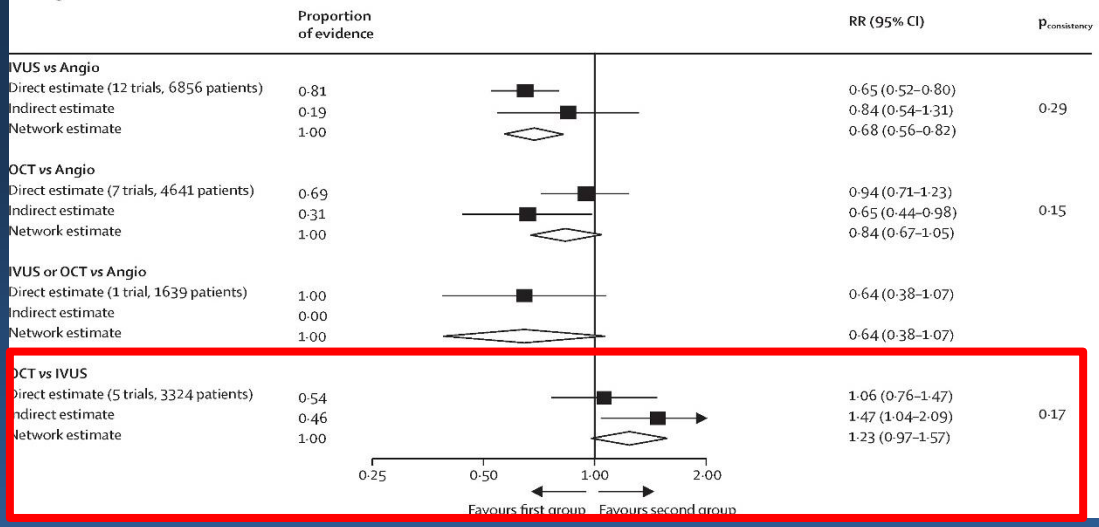
Lancet 2024; 403: 824–37

which is better IVUS or OCT?

Target vessel MI

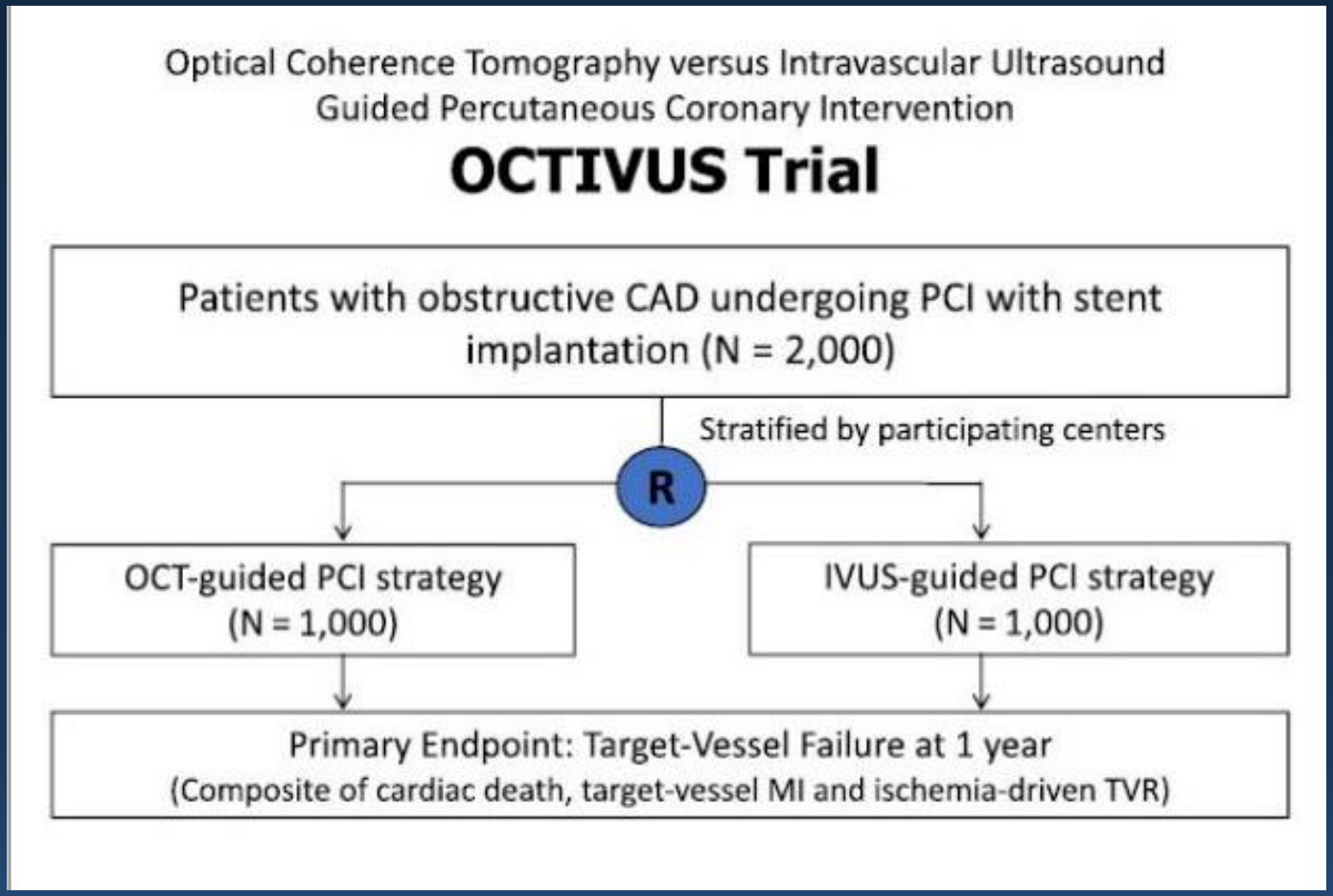


Target vessel revascularization



Lancet 2024; 403: 824–37

which is better IVUS or OCT?



which is better IVUS or OCT?

Primary endpoint

Composite of death from cardiac causes, target vessel myocardial infarction or ischaemia-driven target vessel revascularisation at 1 year, which was powered for noninferiority of the OCT group as compared with the IVUS group (noninferiority margin, 3.1 percentage points)

Rate%

2.5%

3.1%

risk difference, −0.6 percentage points
upper boundary of the one-sided
97.5% CI 0.97; p<0.001 for noninferiority

Safety endpoints

Incidence of contrast-induced nephropathy was similar

=

1.4%

1.5%

Incidence of major procedural complications was lower with

vs.

p=0.048

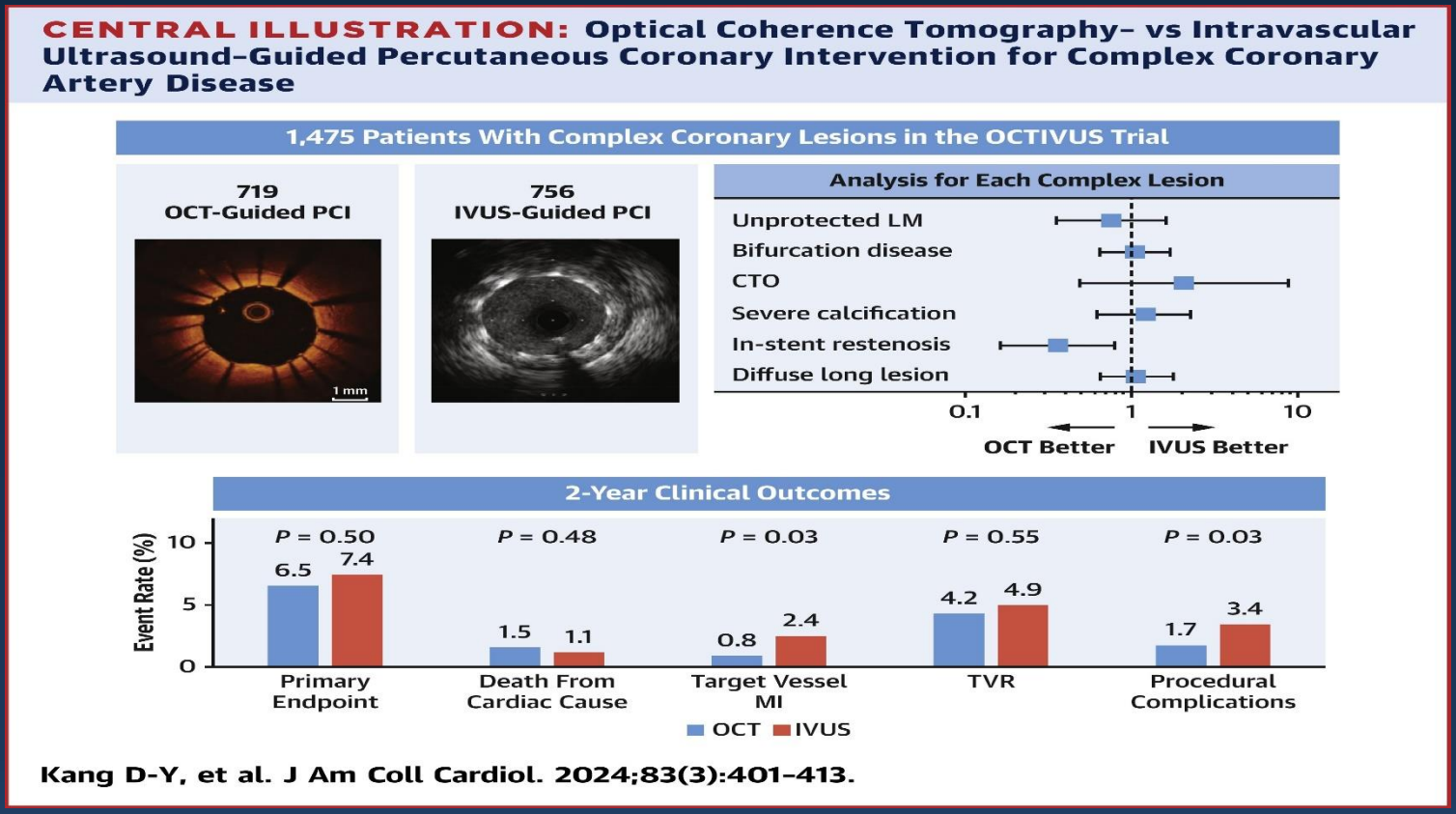
2.2%

3.7%

Conclusion

Optical coherence tomography (OCT) is non-inferior to intravascular ultrasound (IVUS) for guiding percutaneous coronary intervention (PCI) in patients with diverse coronary artery lesions.

which is better IVUS or OCT?

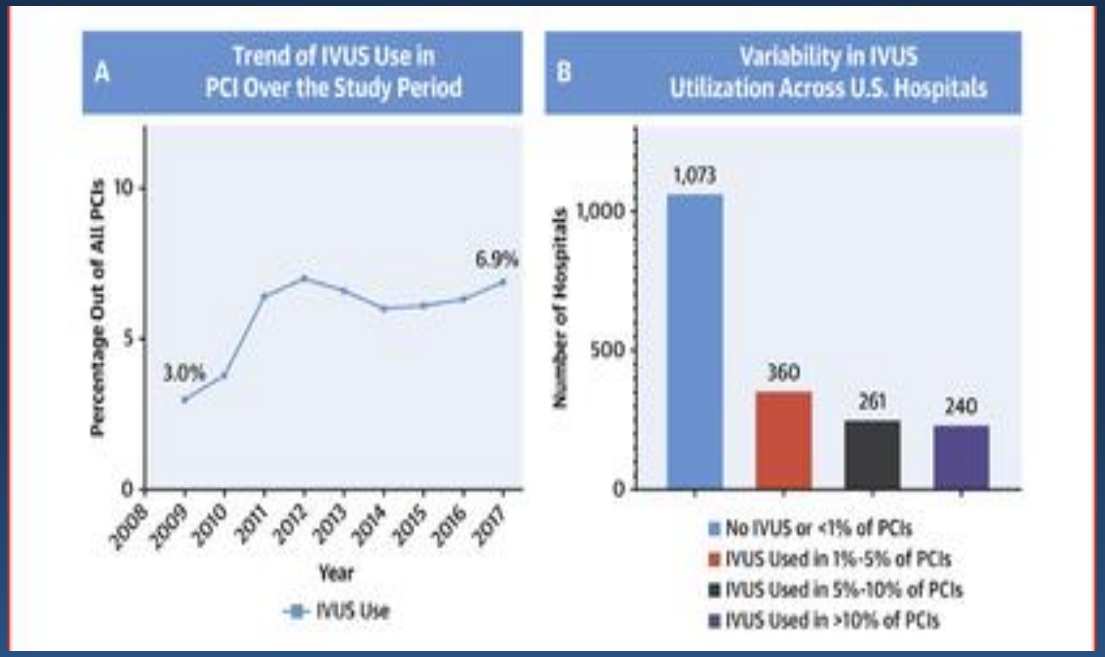


Compared with angiography guidance, intravascular imaging guidance of coronary stent implantation with OCT or intravascular ultrasound enhances both the safety and effectiveness of PCI.

JACC 2024-01-23, Volume 83, Issue 3, Pages 401-413
Lancet 2024; 403: 824–37

Limitation: Intravascular Imaging guided PCI

	2014 K-PCI (n=44,967)	2016 K-PCI (n=48,823)
Use of IVUS, n(%)	12,846(28.6)	13,418(27.5)



JACC: Cardiovascular Interventions
Volume 13, Issue 16, 24 August 2020, Pages 1880-1890

Limitation: Intravascular Imaging guided PCI

- Longer-procedure time
- Procedure-oriented complications:
  No reflow, iatrogenic coronary dissection, and distal embolization
- Higher cost

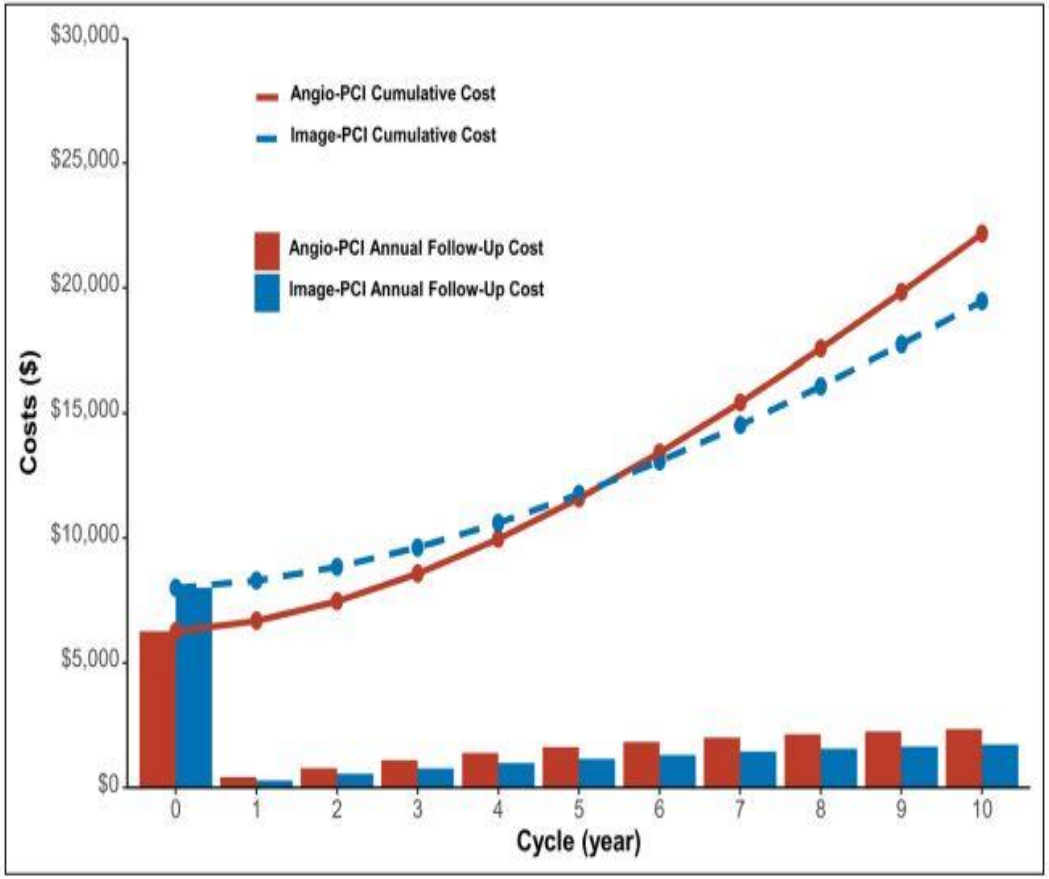
Limitation: Intravascular Imaging guided PCI

- Longer-procedure time
- Procedure-oriented complications:
  No reflow, iatrogenic coronary dissection, and distal embolization
- Higher cost

Cost Effectiveness

Cost-Effectiveness of Intravascular Imaging-Guided Complex PCI: Prespecified Analysis of RENOVATE-COMPLEX-PCI Trial

Transition probability	RENOVATE-COMPLEX-PCI HR (95% CI)	Meta-analysis of 20 trials OR (95% CI)
Death		
All-cause death after PCI	Probability in image-PCI: 0.021; Angio-PCI: 0.035	0.90 (0.69–1.17)
	0.71 (0.44–1.15)	
All-cause death after MI	Probability in image-PCI: 0.213; Angio-PCI: 0.300	0.90 (0.69–1.17)
	0.71 (0.44–1.15)	
Spontaneous MI	Probability in image-PCI: 0.007; Angio-PCI: 0.015	0.79 (0.63–0.99)
	0.66 (0.23–1.90)	
Target vessel revascularization	Probability in image-PCI: 0.016; Angio-PCI: 0.028	0.61 (0.52–0.72)
	0.69 (0.40–1.18)	
Cost, $*		
Medical cost at index hospitalization	Image-PCI: 8005 (6352–8998); Angio-PCI: 6269 (4594–7337)	
Medical cost at event		
Death from any cause	9235 (7543–10928)[26]	
Spontaneous MI	7338 (7111–7564)[26]	
Target vessel revascularization	7292 (6988–7595)[26]	

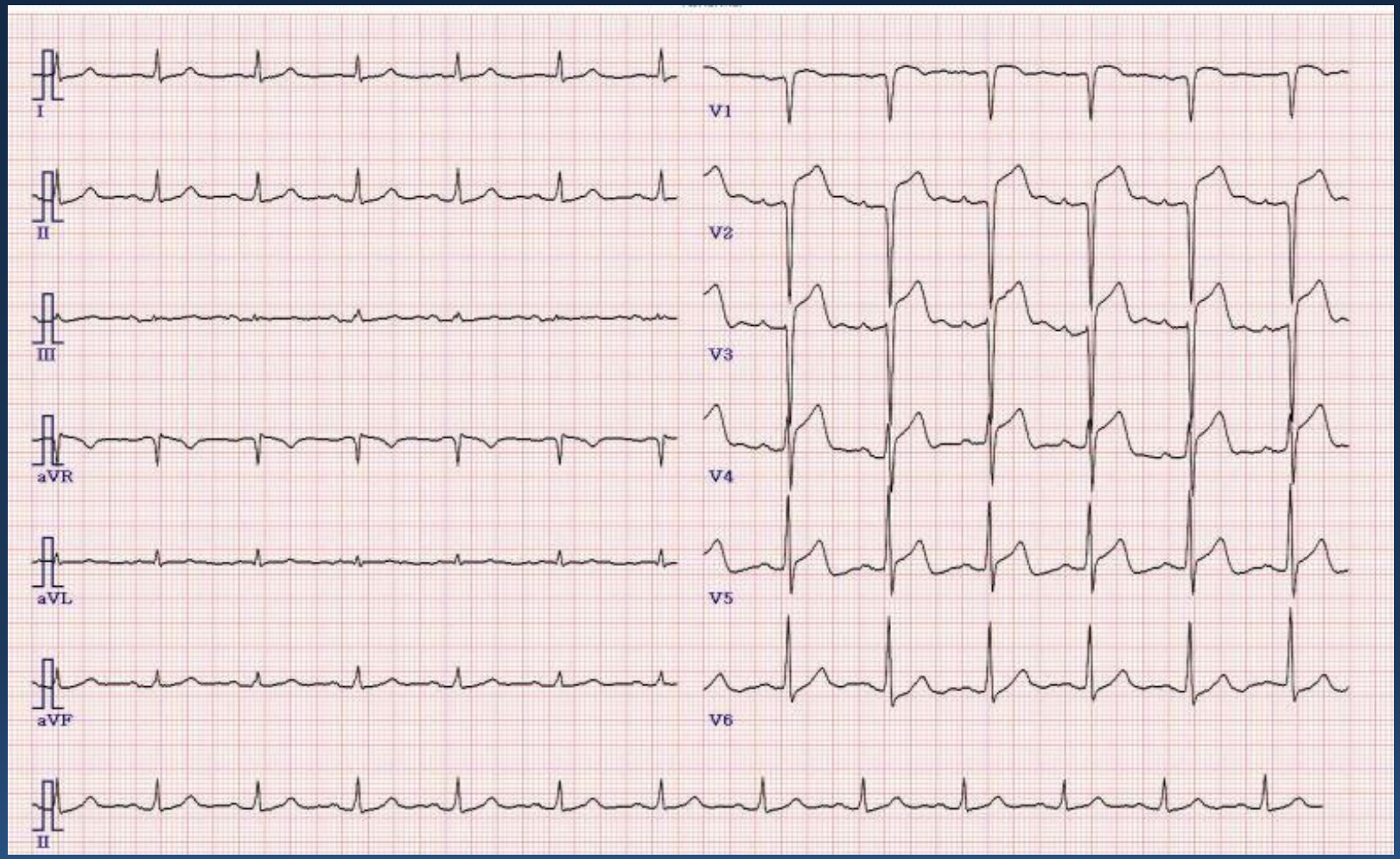


Circ Cardiovasc Qual Outcomes. 2024;17:e010230
TCTMD

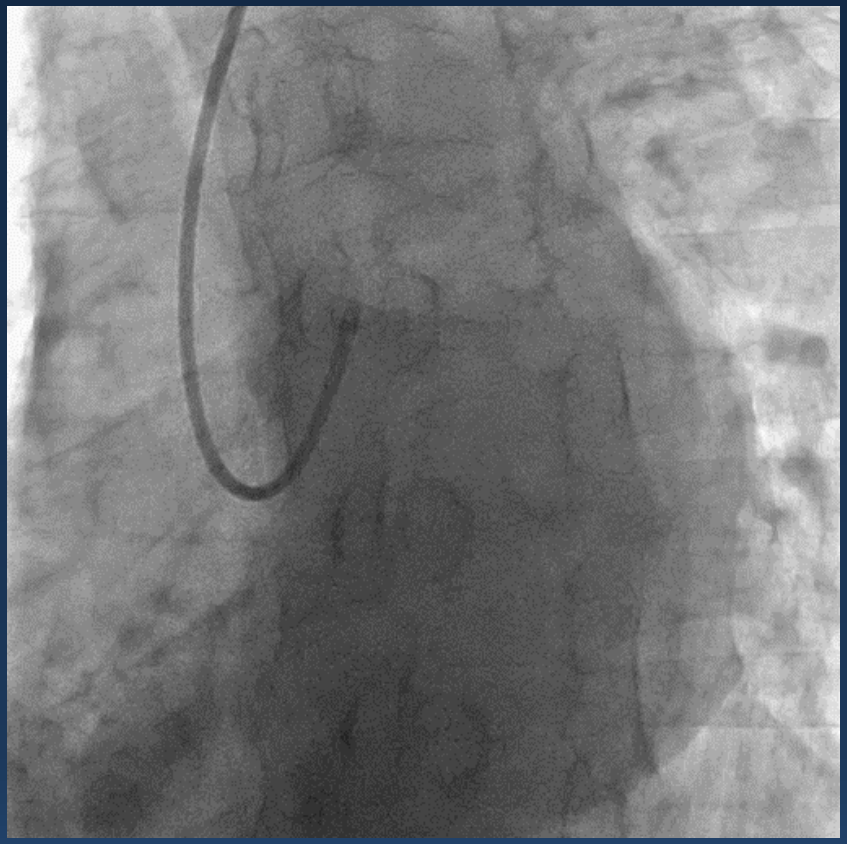
CASE

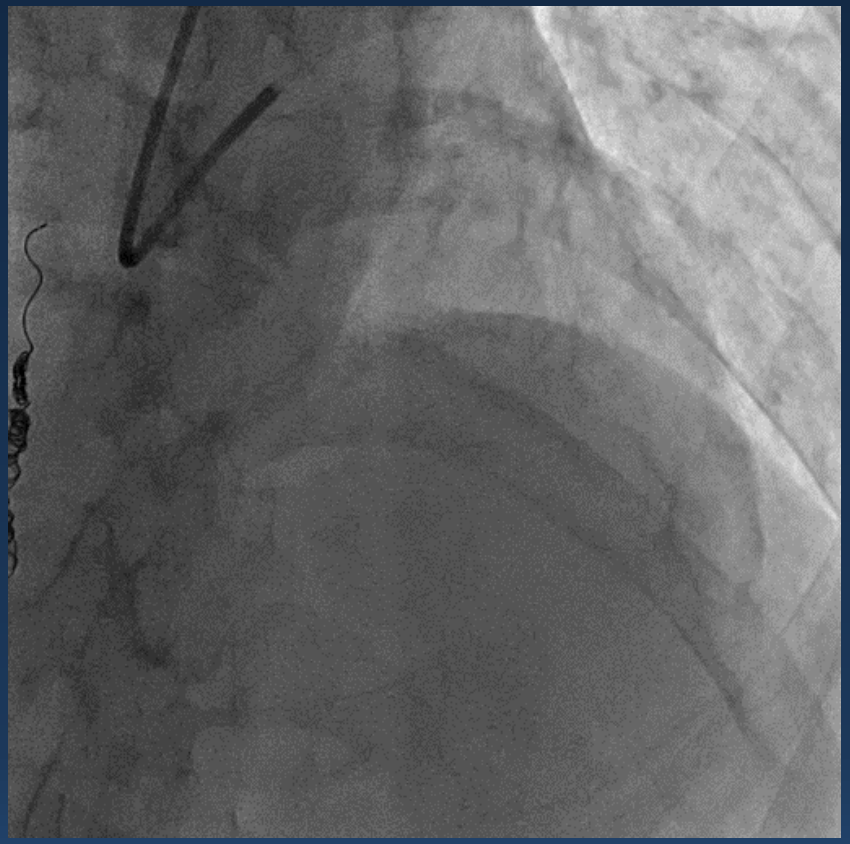
- Male / 66
- C/C: Chest pain
- PHx : DM/HTN(+/+)
- Current smoker(+)

CASE



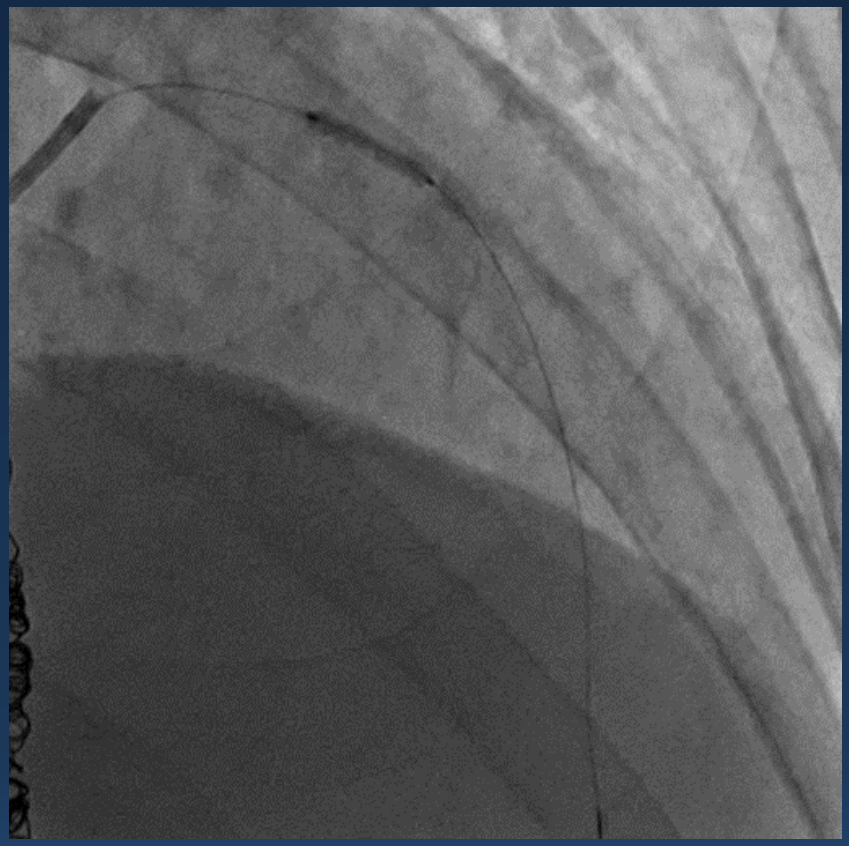
CASE

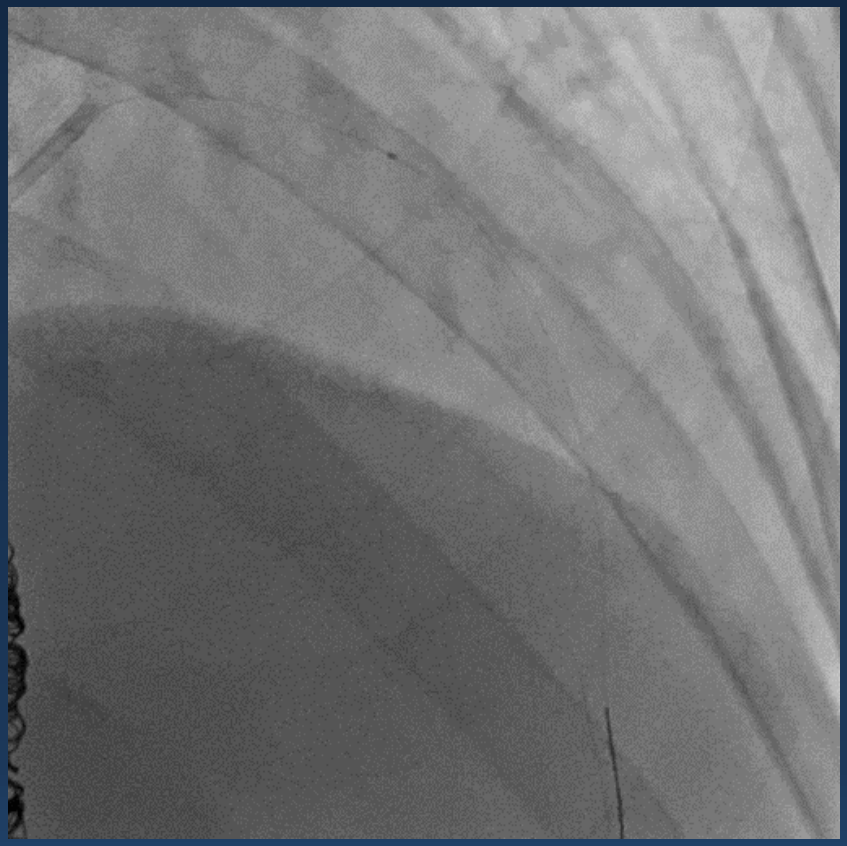




Left main : 50% stenosis
LAD : pLAD Total occlusion, TIMI 0

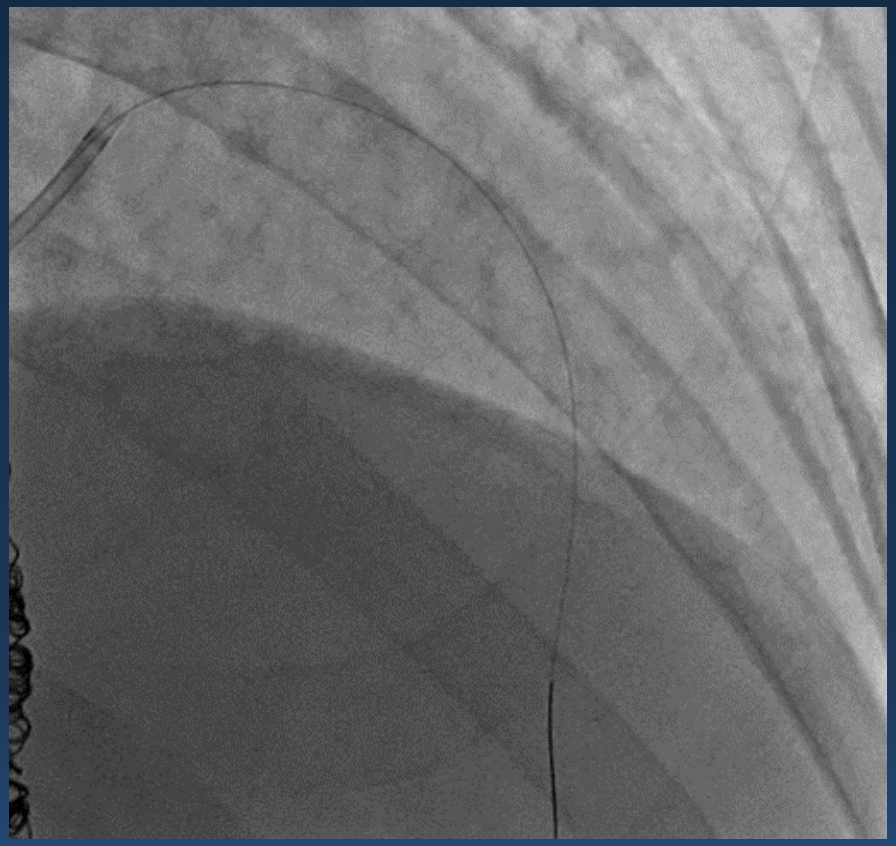
CASE



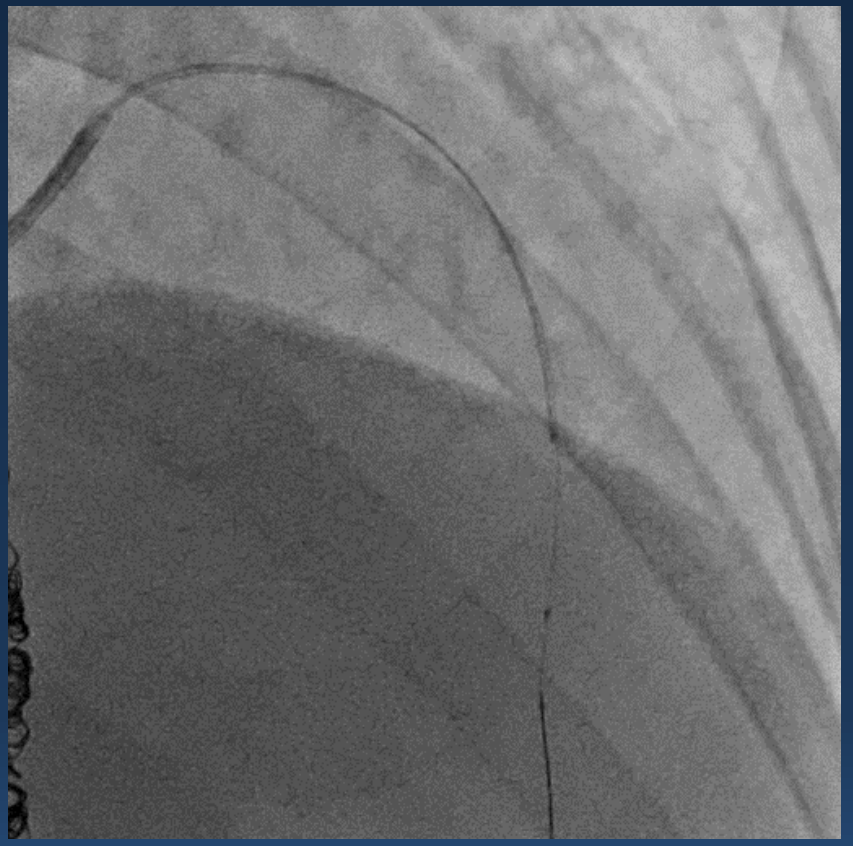


2.5/15mm Semi compliant balloon
Thrombus aspiration
Abciximab IC injection

CASE

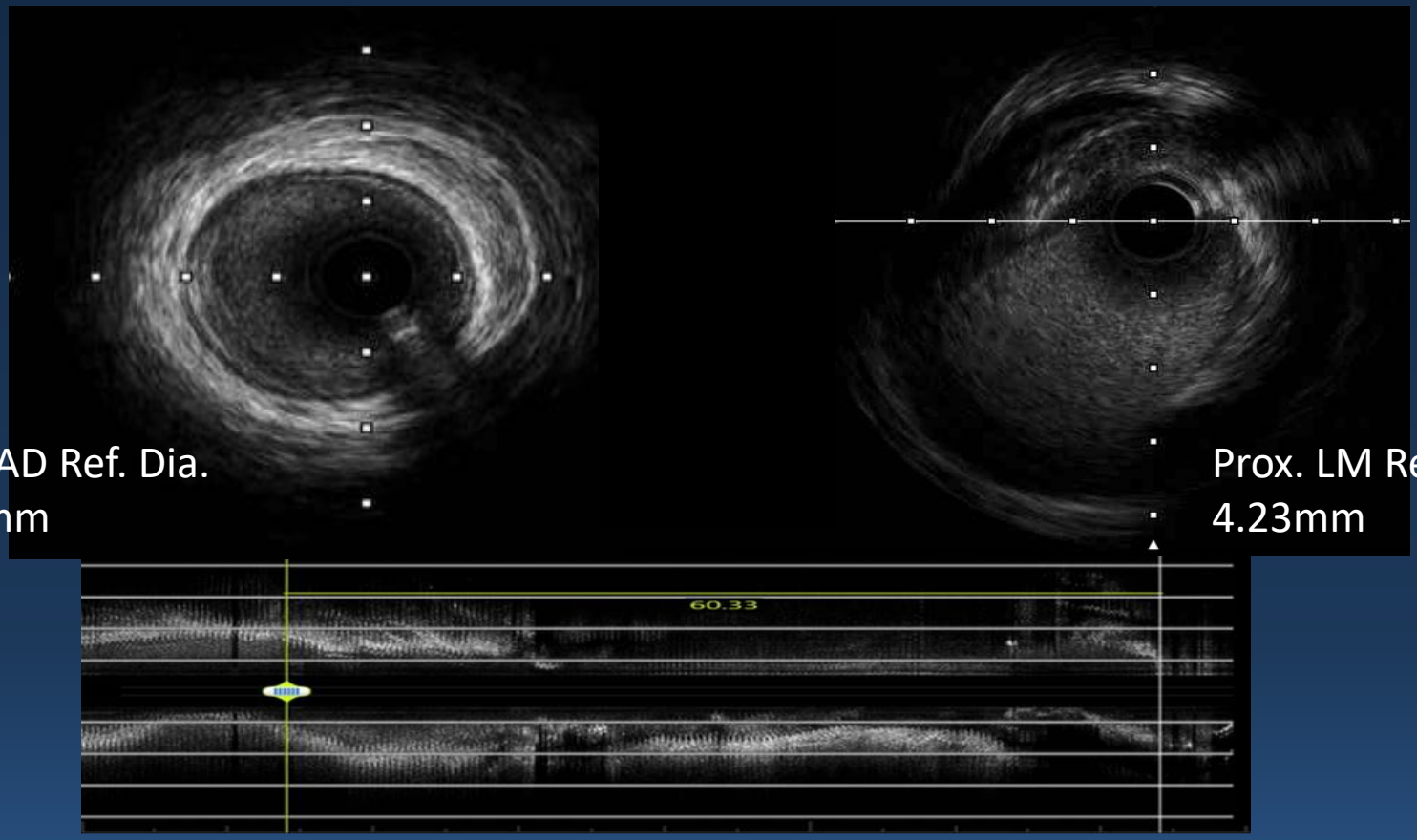


Diffuse LAD+LM lesion



IVUS

CASE

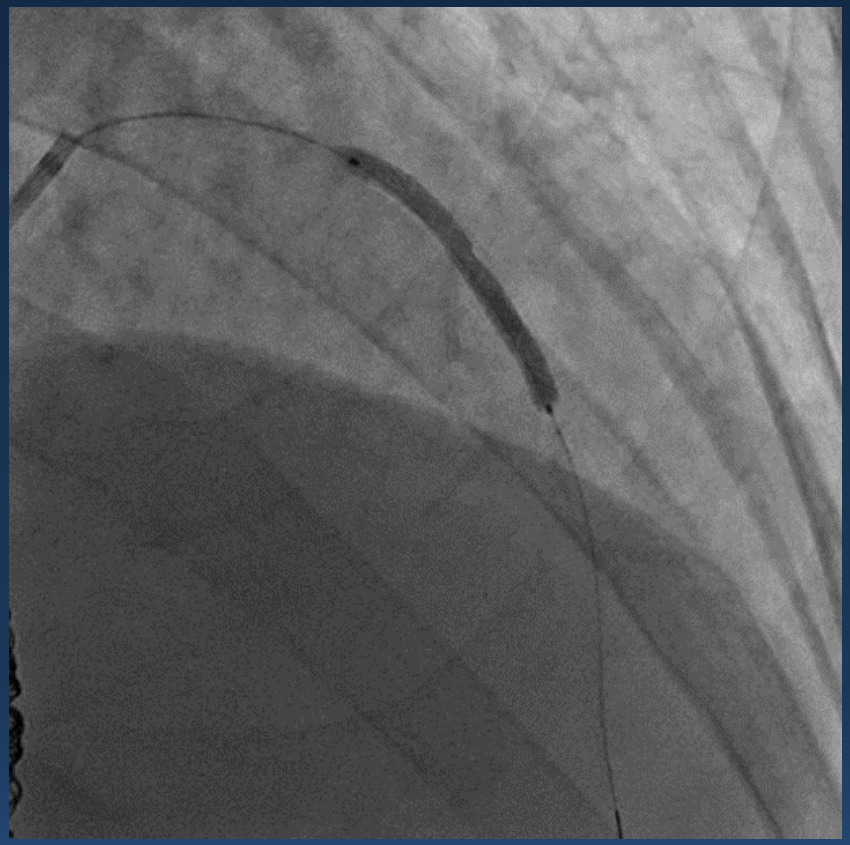


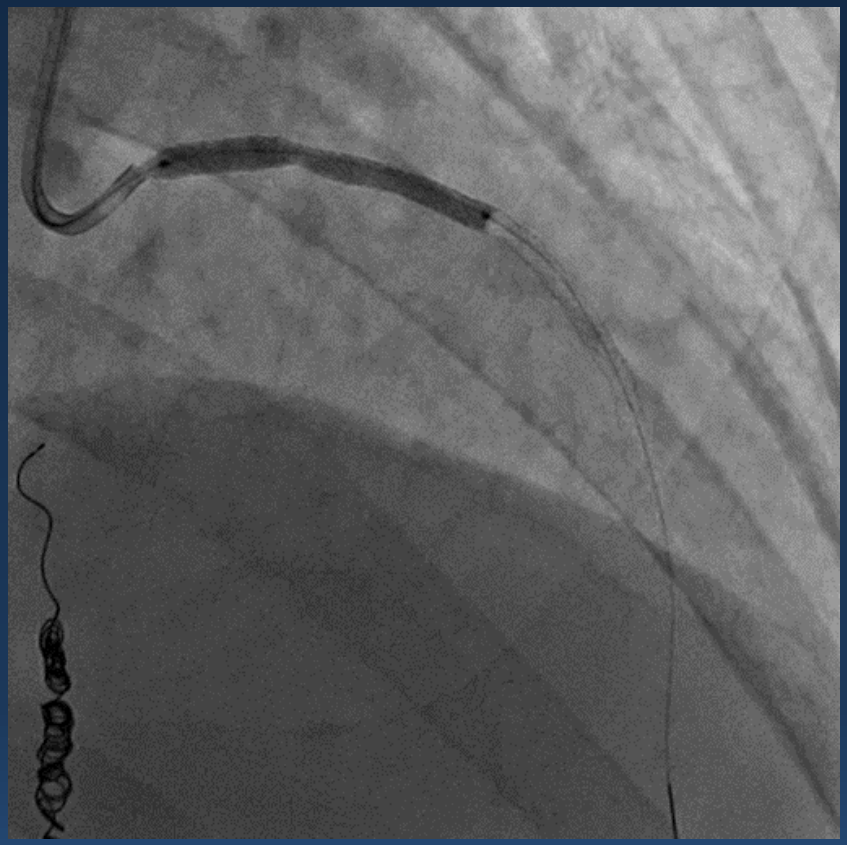
Dis. LAD Ref. Dia.
3.14mm

Prox. LM Ref. Dia.
4.23mm

Length : 60.33mm

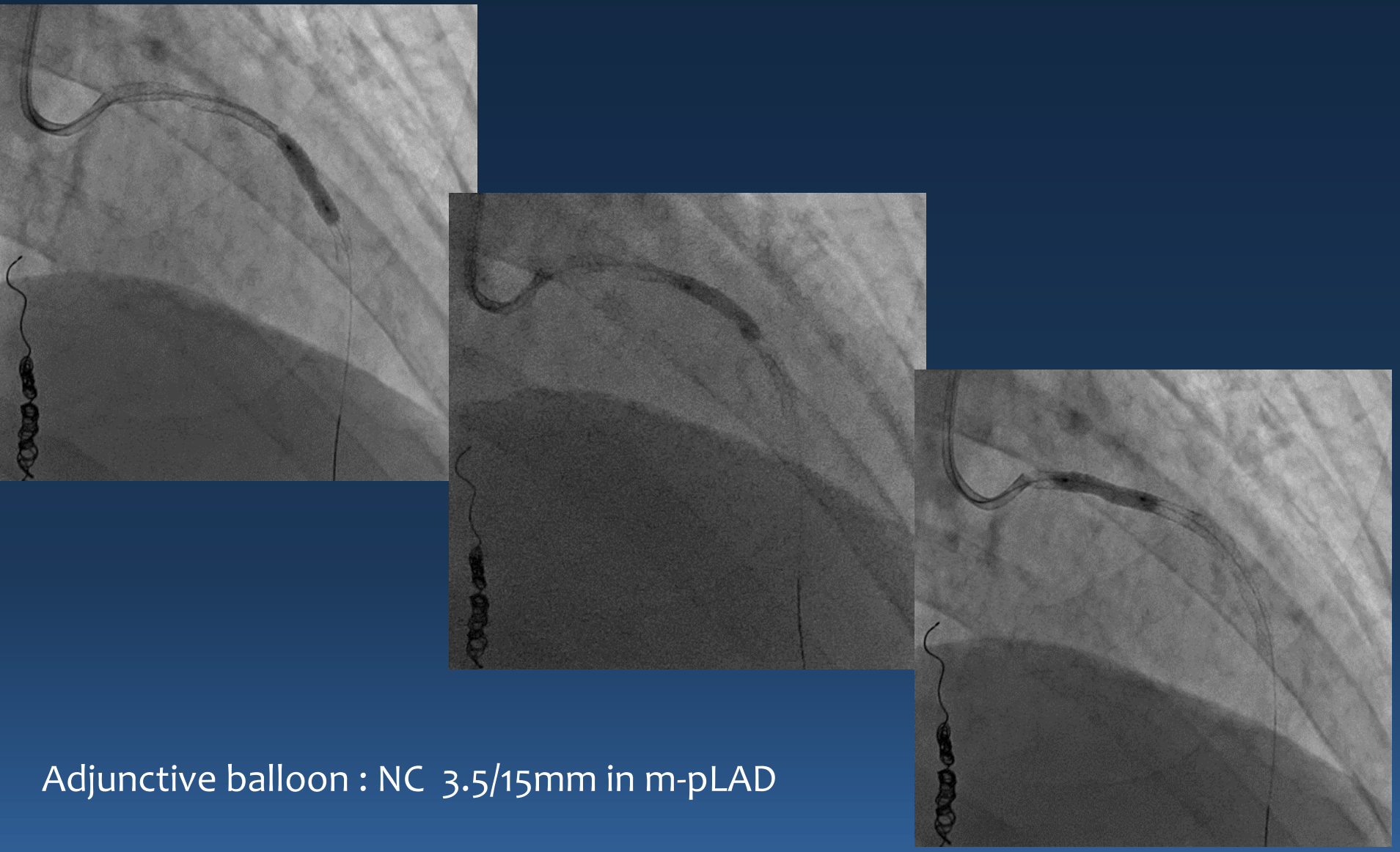
CASE





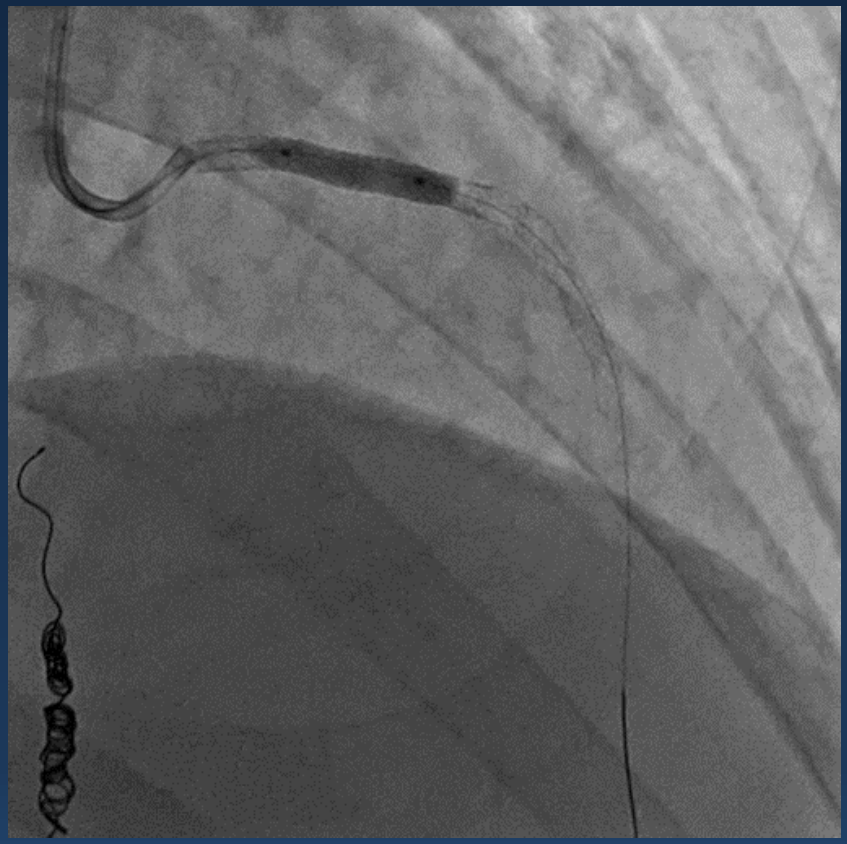
DES 3.0/32mm + DES 4.0/32mm in mLAD to LM

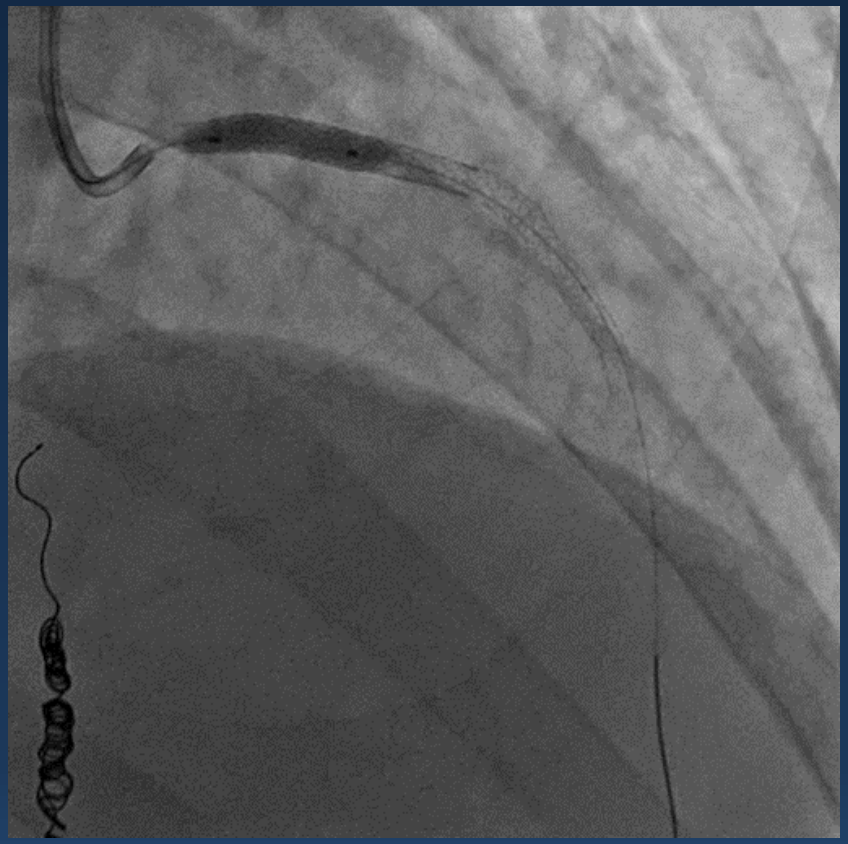
CASE



Adjunctive balloon : NC 3.5/15mm in m-pLAD

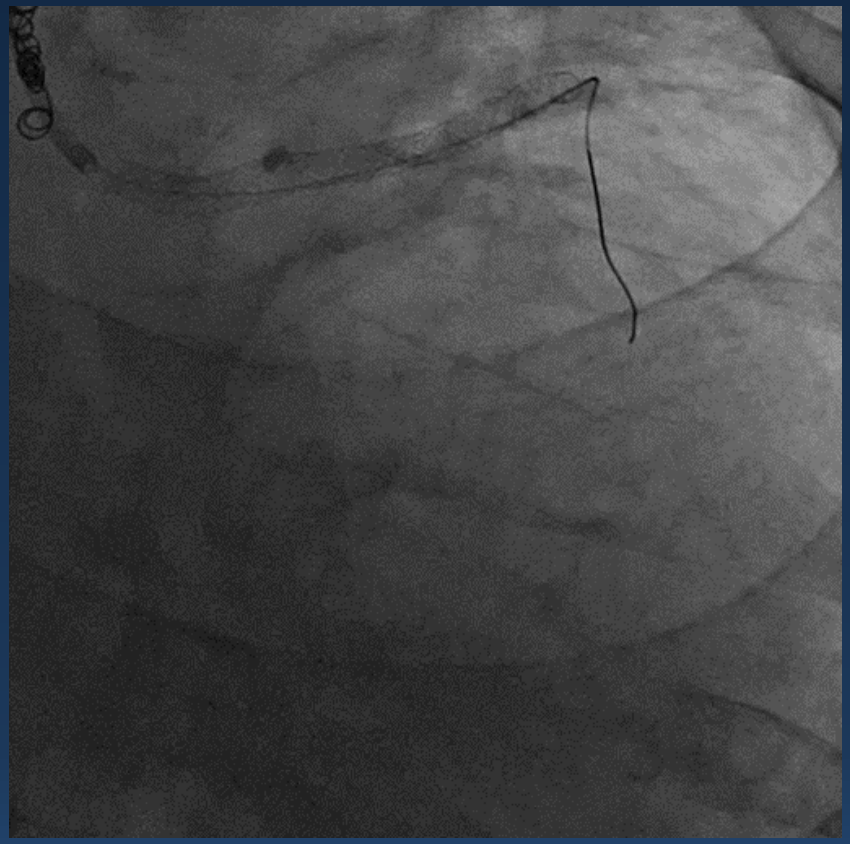
CASE

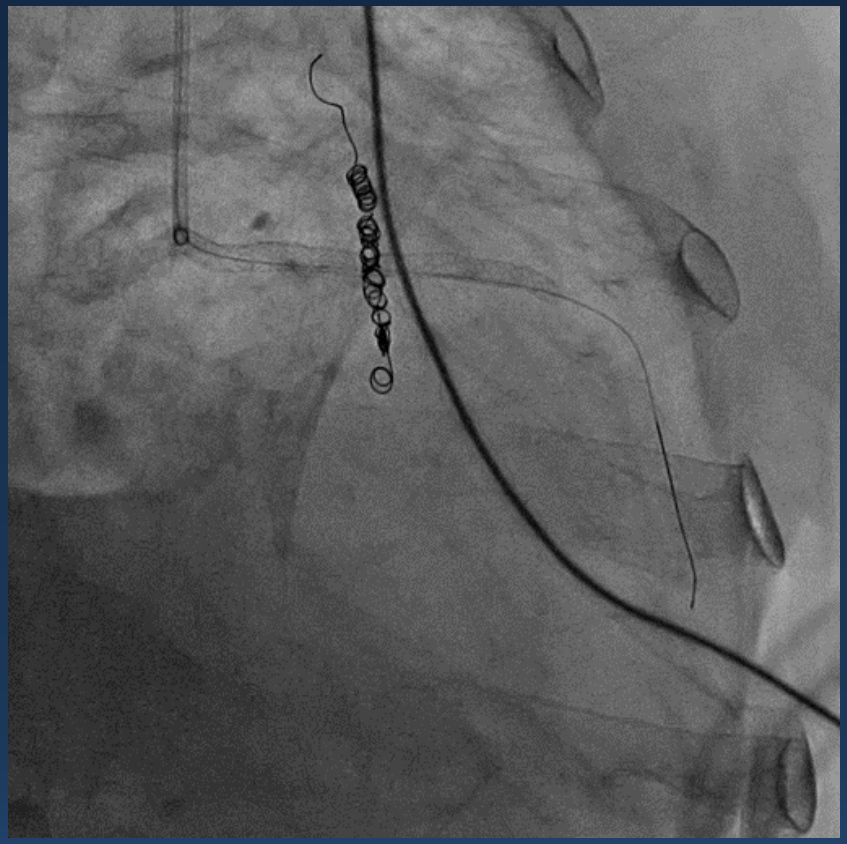




Adjunctive balloon : NC 4.0/15mm up 20 atm in pLAD to LM

CASE

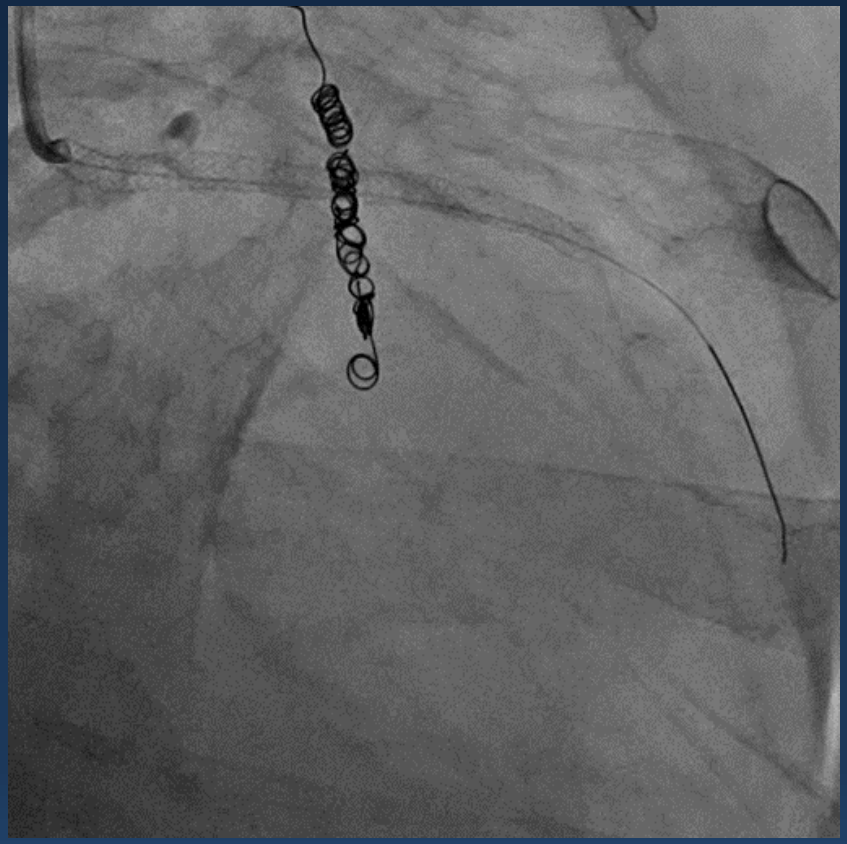




pLAD perforation (Ellis type III cavity spilling)

CASE

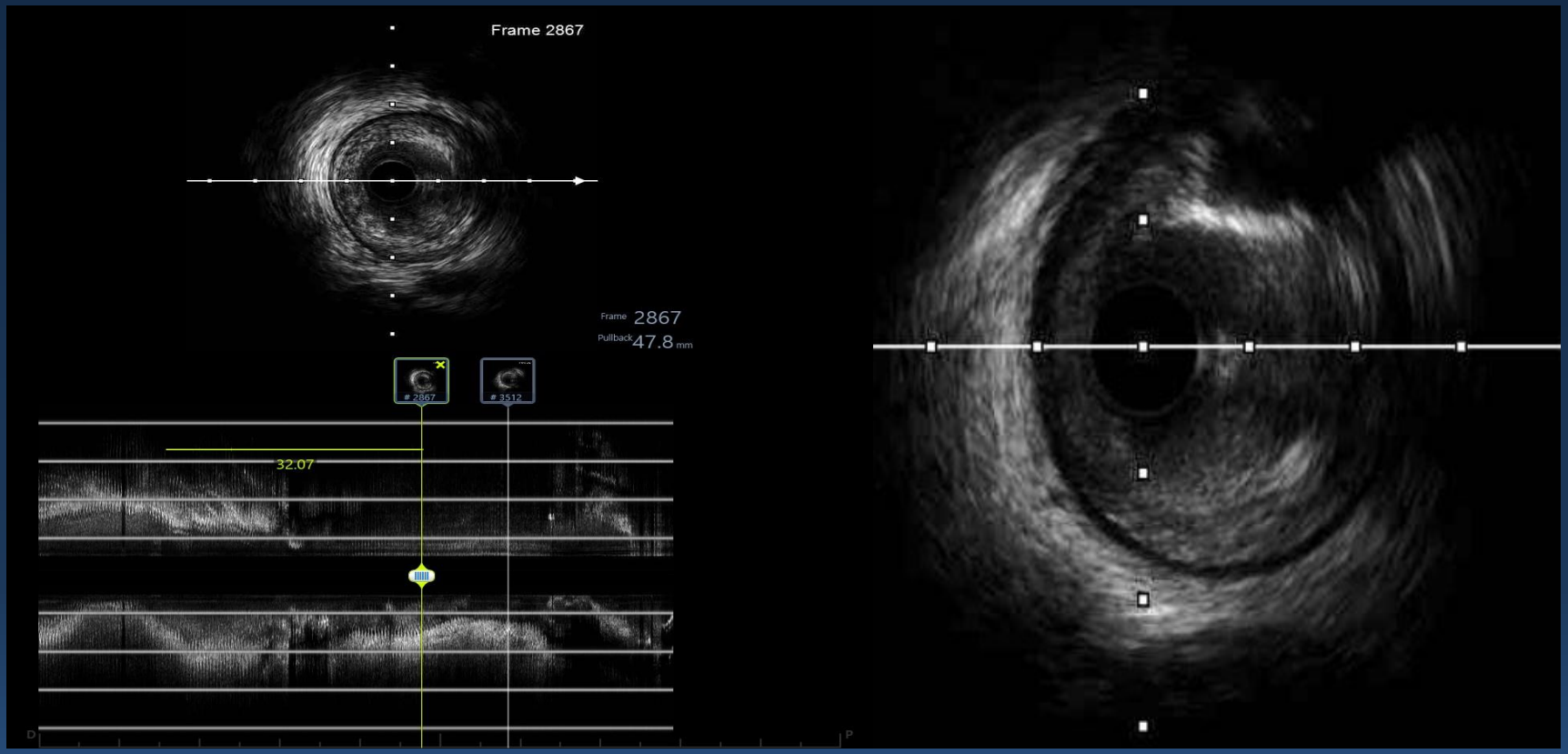
NC balloon 4.0/15mm
balloon tamponing



CS emergency op.

CASE

Oversizing of Stent & Adjunctive balloon
Ignore calcification

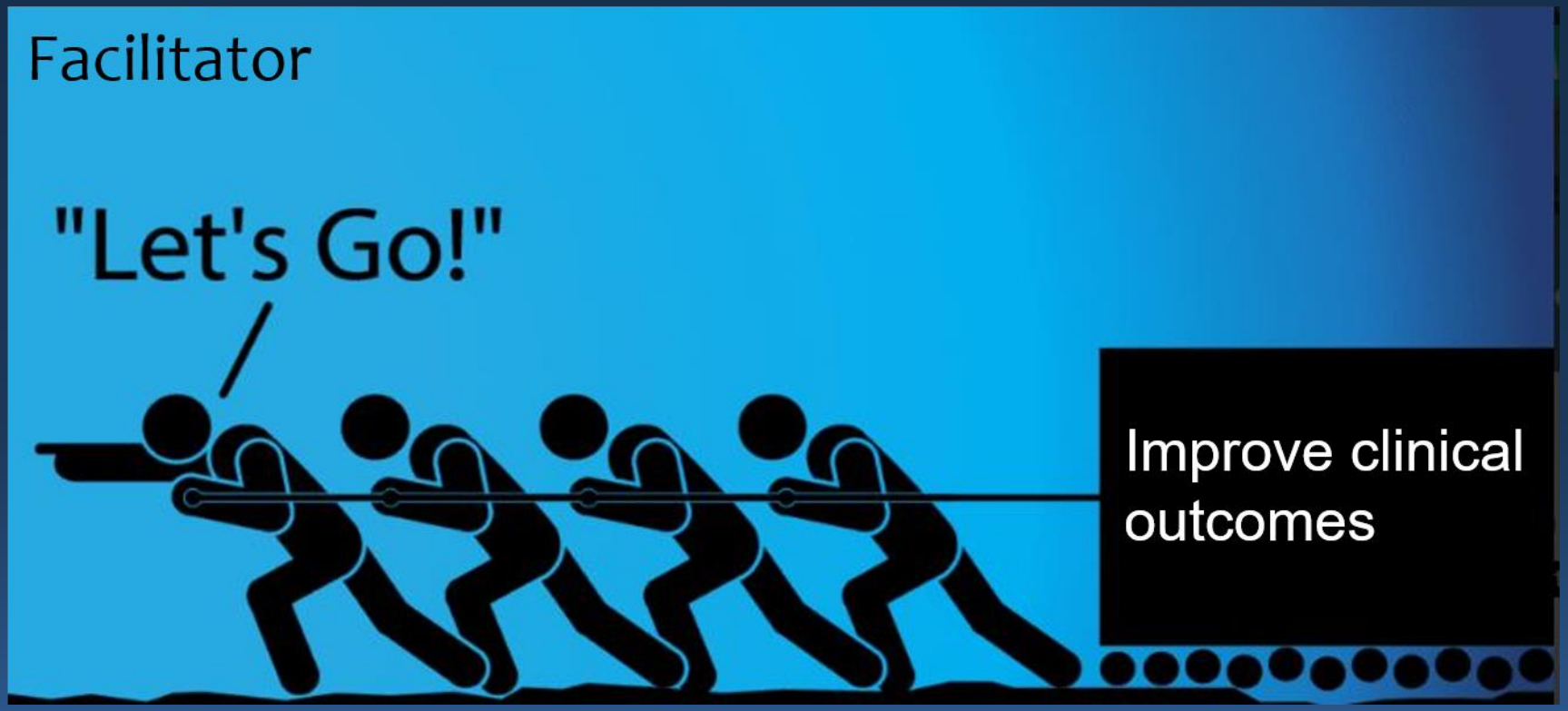


Overlap site~pLAD mean Ref. Dia. 3.6mm

Conclusion

- Intravascular-imaging improves clinical outcomes

-> Image **correct interpretation** **is an important**



THANK YOU FOR YOUR ATTENTION