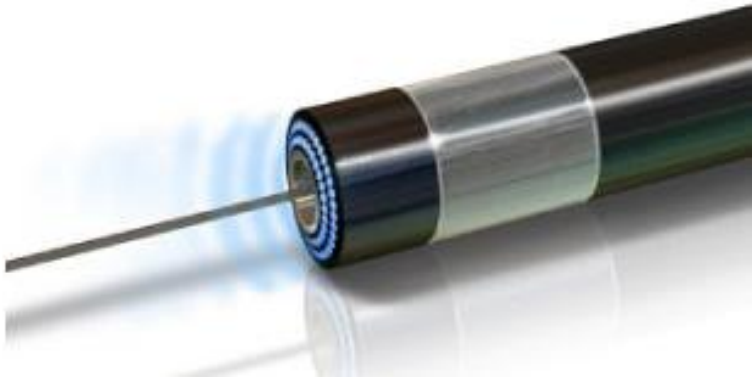
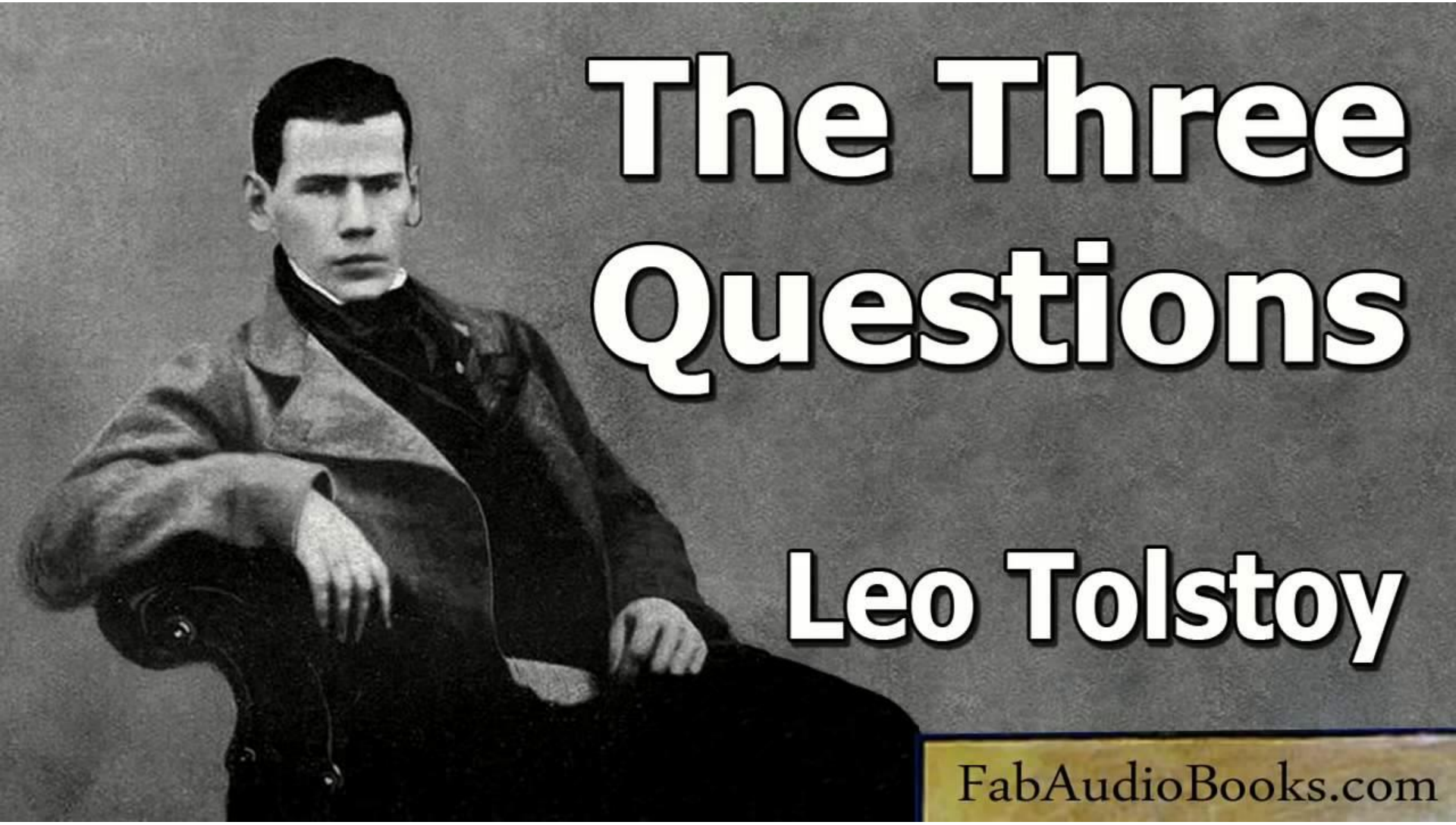
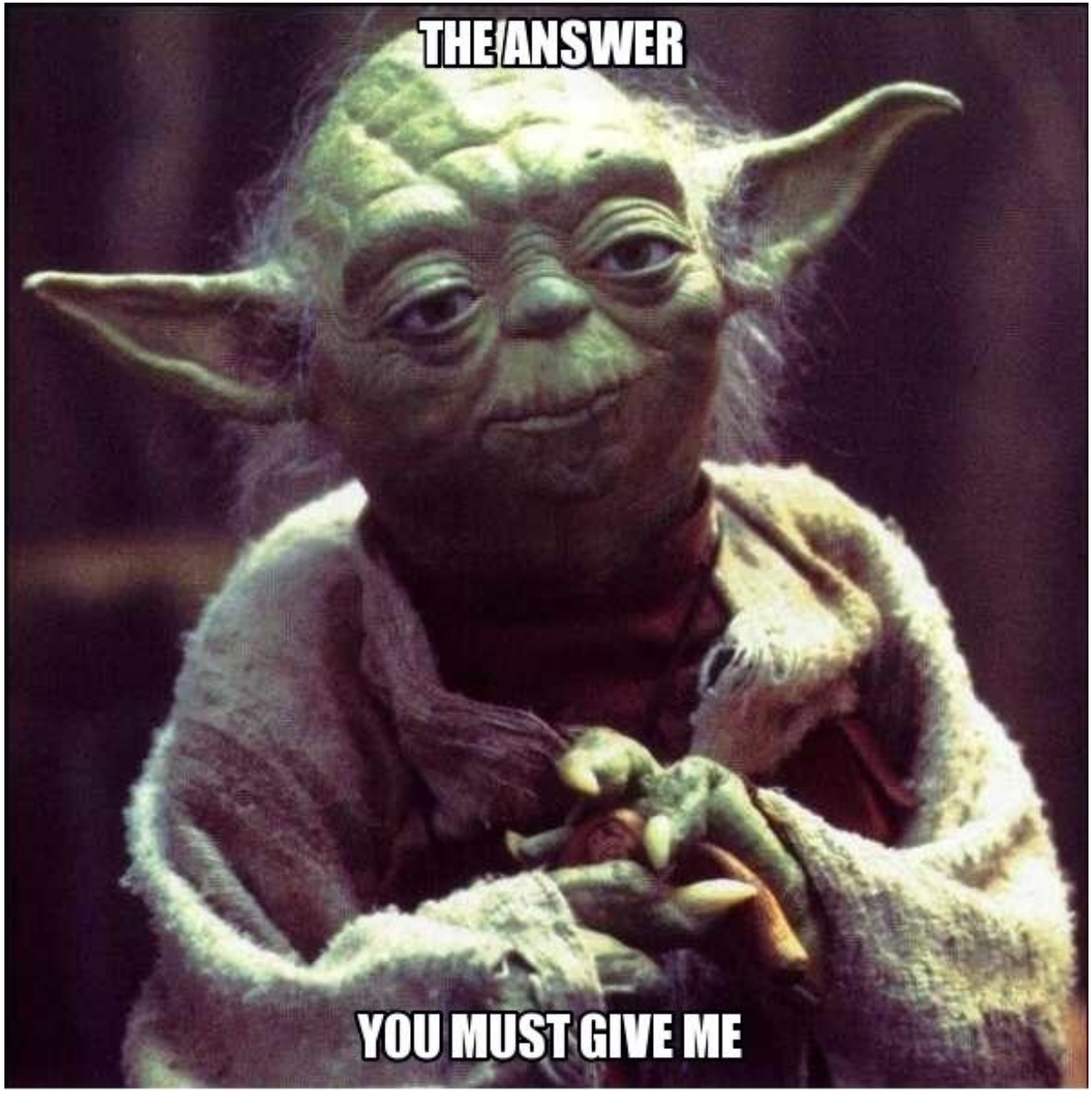
Excimer Laser Coronary Angioplasty (ELCA) Re-appreciated



Yamashita T, MD, PhD, FACC

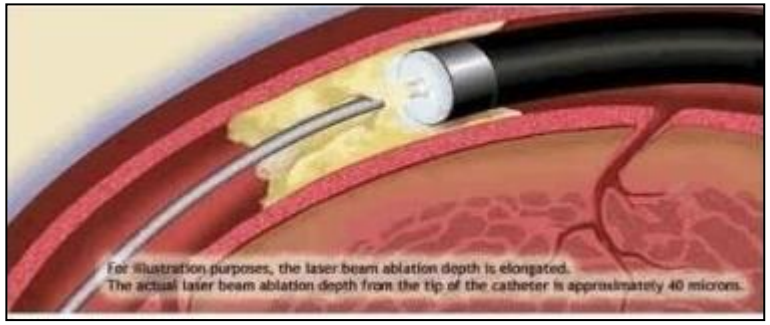
Vice-Chairman
Cardiology
CV Ctr Hokkaido Ohno Hospital
Sapporo, JAPAN




THE ANSWER
YOU MUST GIVE ME

Question 1

Have you ever performed Excimer Laser Coronary Angioplasty (ELCA)?

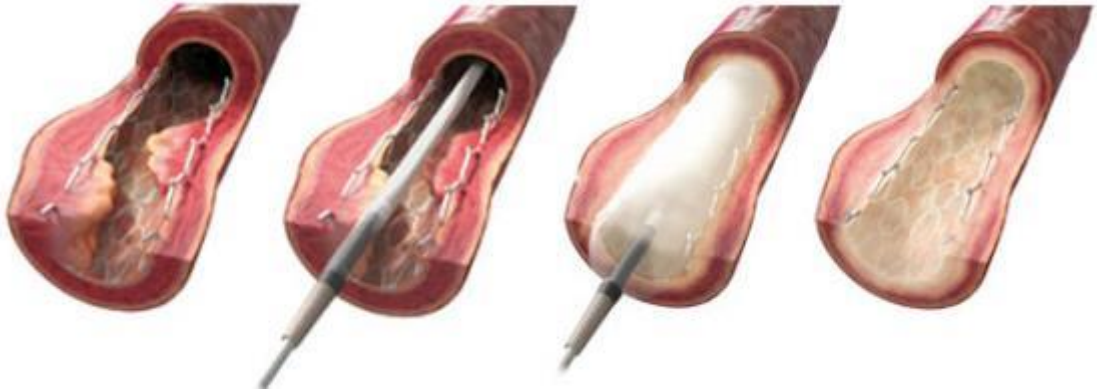


Question 2

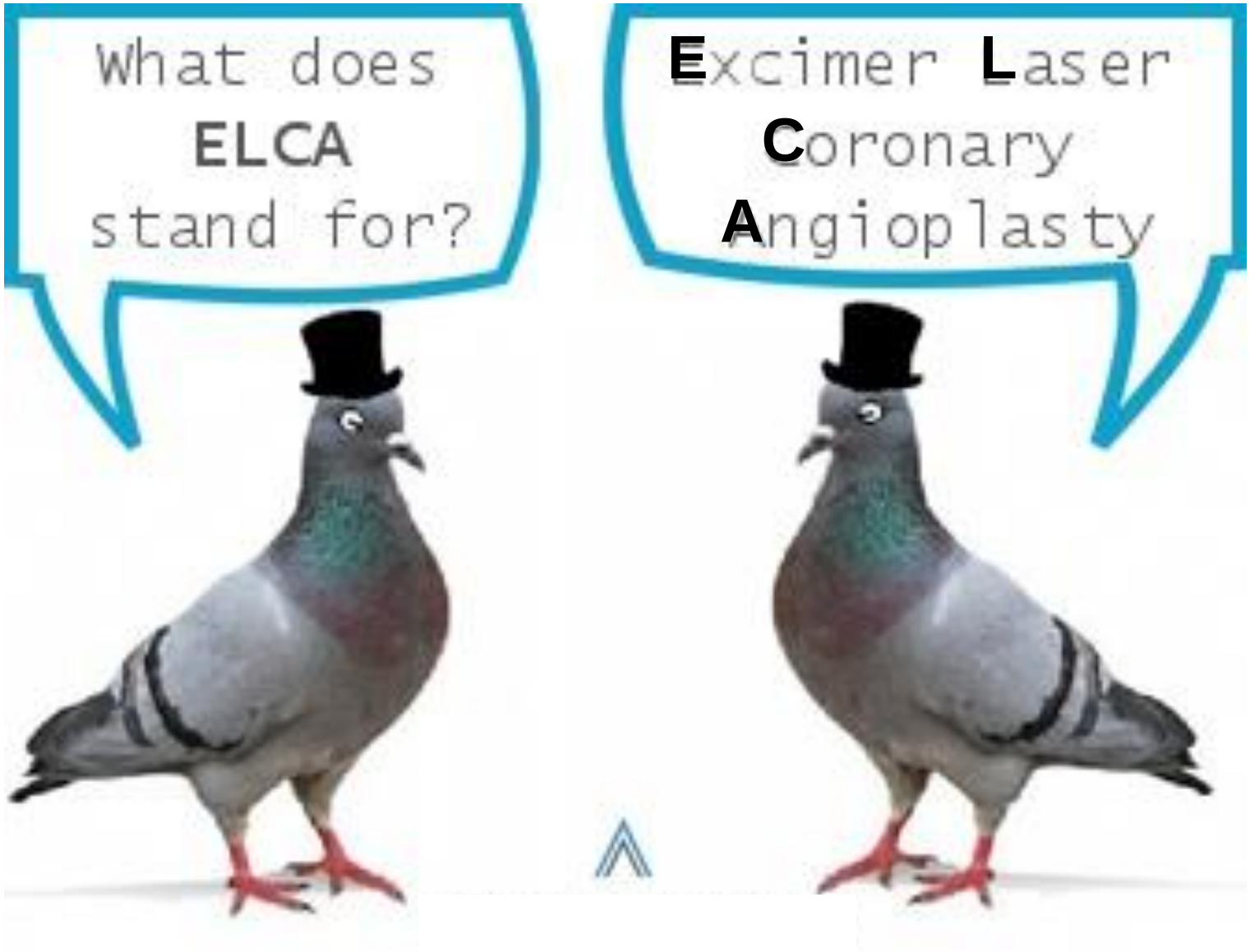
Do you think Excimer Laser Coronary Angioplasty (ELCA) is a lame duck?

Question 3

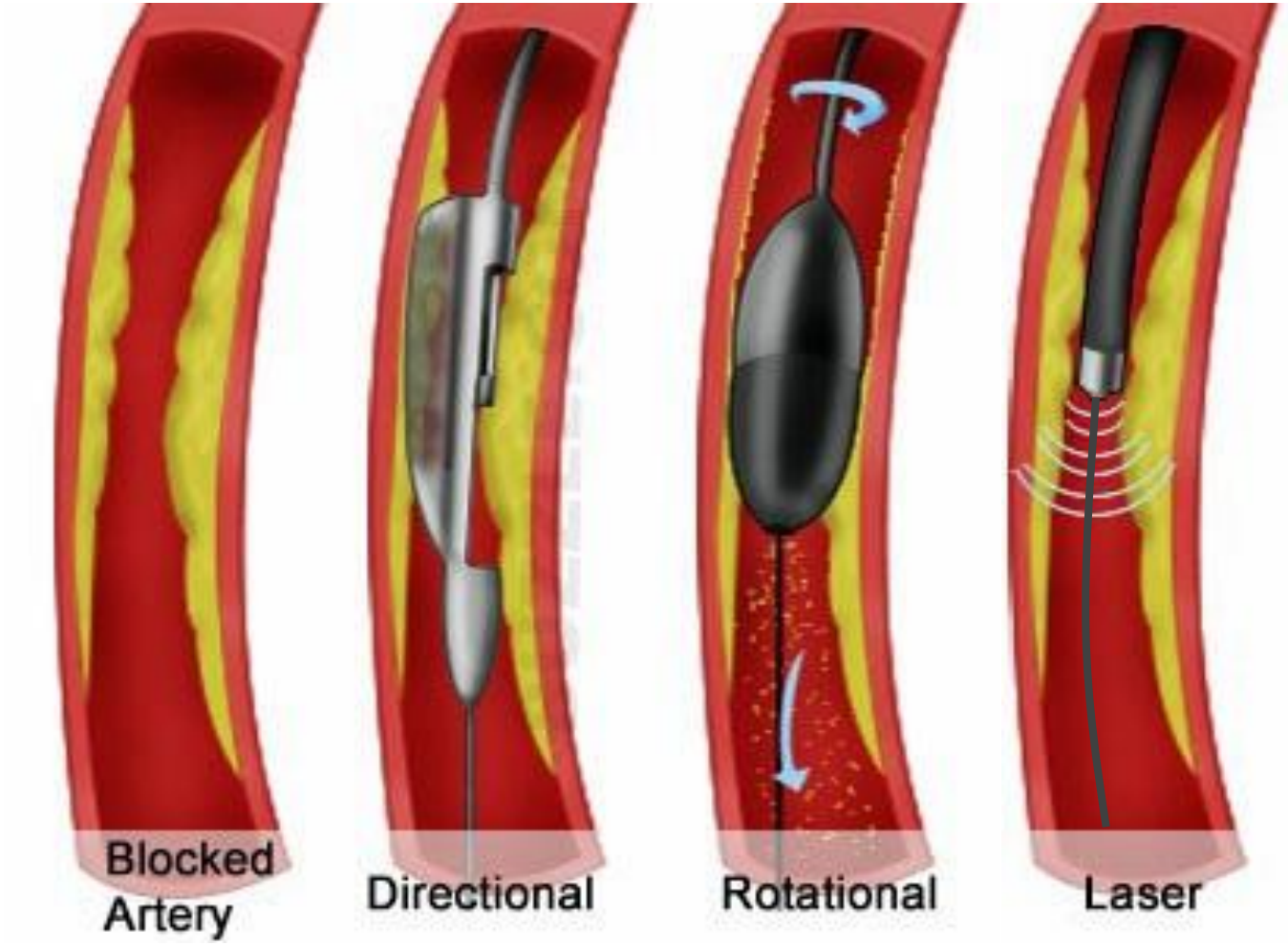
Do you think DES-ISR can be best treated by drug-coated balloons (DCB)?



ELCA?


What does ELCA stand for?
Excimer Laser Coronary Angioplasty

Atherectomy Devices



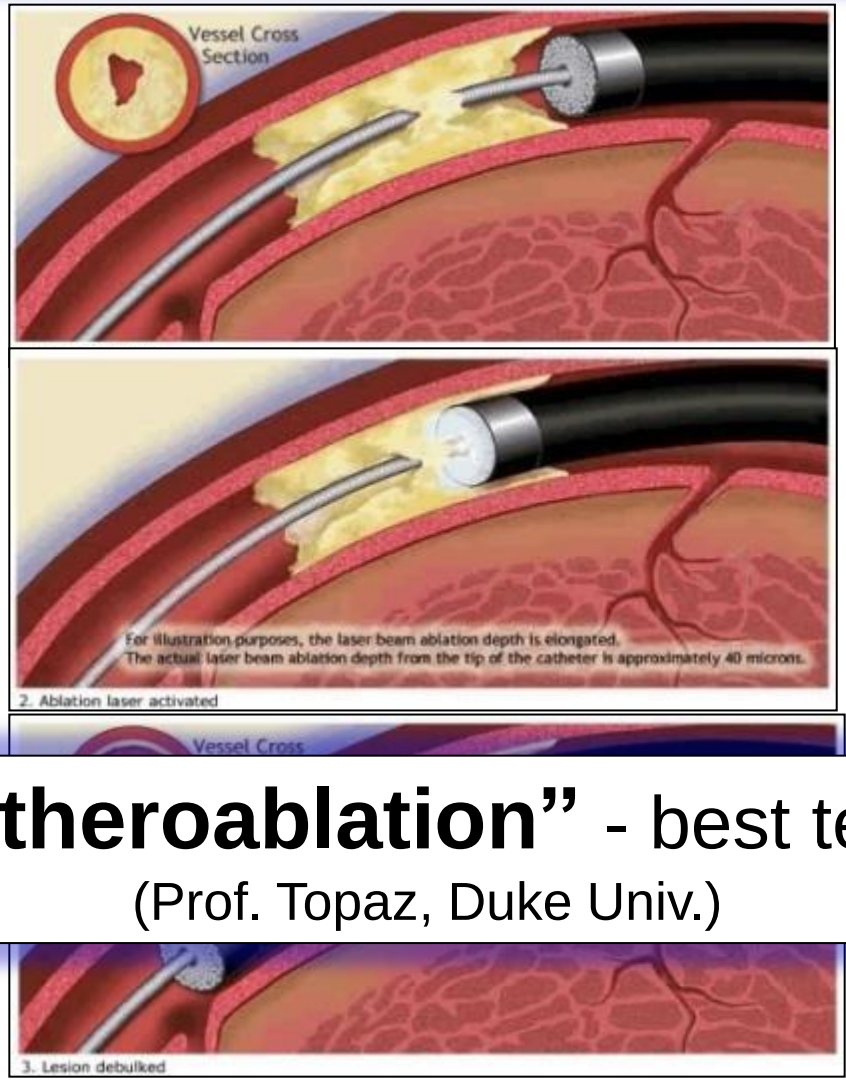
Emitted laser energy interacts with material just in front - ≤0.035mm

Effect

Ablate

Vaporize

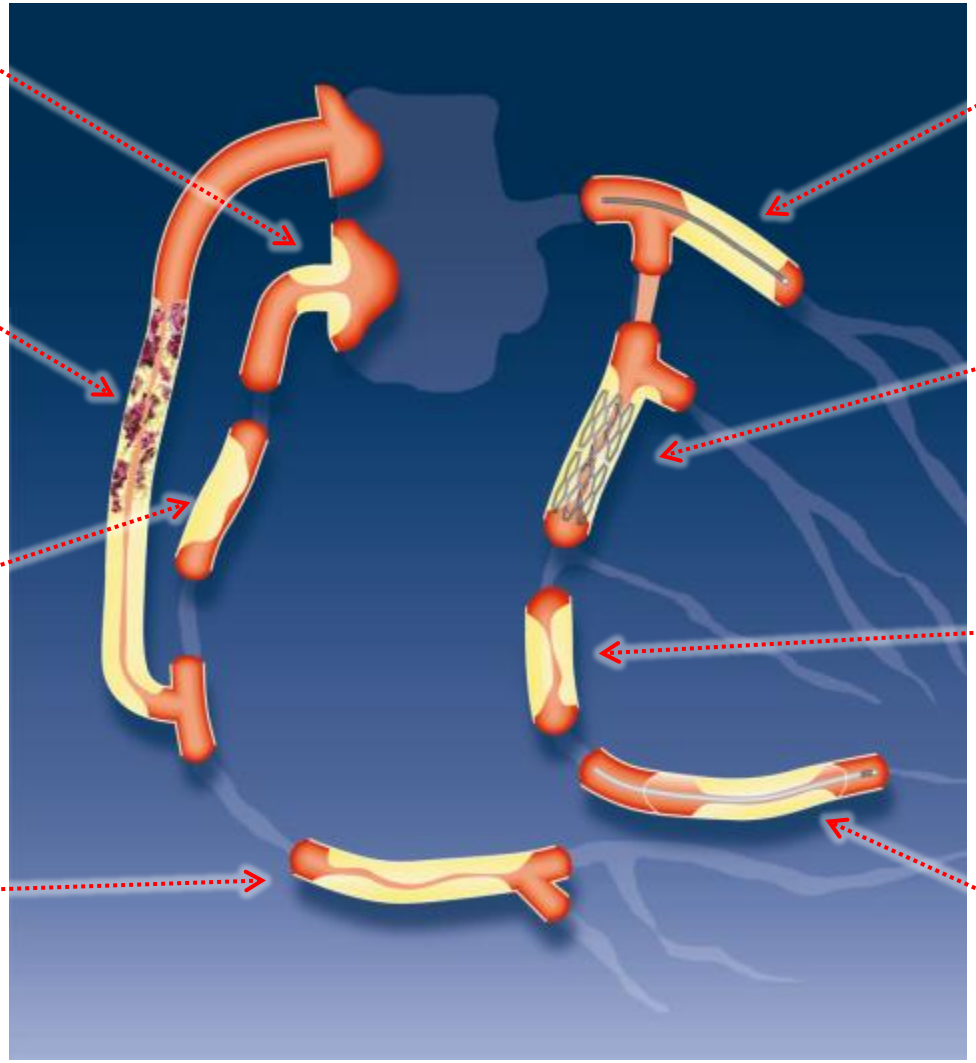
Atherectomize



“Atheroablation” - best term

(Prof. Topaz, Duke Univ.)

ELCA - FDA Approval (Mar 24, 1993)



- Ostial
- SVGs
- Eccentric
- Long (>20mm)
- Total Occlusion
- ISR*
- Moderately Calcified
- Balloon Refractory

*: approved in 2001

Acute Complications of Excimer Laser Coronary Angioplasty: A Detailed Analysis of Multicenter Results

JACC Vol. 23, No. 6
May 1994:1305–13

ANDREAS BAUMBACH, MD, JOHN A. BITTL, MD, FACC,* ECKART FLECK, MD,†
HERBERT J. GESCHWIND, MD, FACC,‡ TIMOTHY A. SANBORN, MD, FACC,§
JAMES E. TCHENG, MD, FACC,‖ KARL R. KARSCH, MD, FACC, AND THE COINVESTIGATORS OF THE U.S. AND EUROPEAN PERCUTANEOUS EXCIMER LASER CORONARY ANGIOPLASTY (PELCA) REGISTRIES

Tübingen and Berlin, Germany; Boston, Massachusetts; Paris, France; New York, New York; Durham, North Carolina

Complication	Overall Incidence	
	No.	%
Dissection	351	22.0
Severe dissection	64	4.0
Vasospasm	97	6.1
Filling defects	76	4.8
Reclosure	97	6.1
Embolization	36	2.3
Perforation	38	2.4
Aneurysm formation	5	0.3
Arrhythmia*	11	0.7
Non-Q wave MI	36	2.3
Q wave MI	16	1.0
CABG	49	3.1
Death	11	0.7

Acute Complications of Excimer Laser Coronary Angioplasty: A Detailed Analysis of Multicenter Results

JACC Vol. 23, No. 6
May 1994:1305–13

ANDREAS BAUMBACH, MD, JOHN A. BITTL, MD, FACC,* ECKART FLECK, MD,†
HERBERT J. GESCHWIND, MD, FACC,‡ TIMOTHY A. SANBORN, MD, FACC,§
JAMES E. TCHENG, MD, FACC,‖ KARL R. KARSCH, MD, FACC, AND THE COINVESTIGATORS OF THE U.S. AND EUROPEAN PERCUTANEOUS EXCIMER LASER CORONARY ANGIOPLASTY (PELCA) REGISTRIES

Tübingen and Berlin, Germany; Boston, Massachusetts; Paris, France; New York, New York; Durham, North Carolina

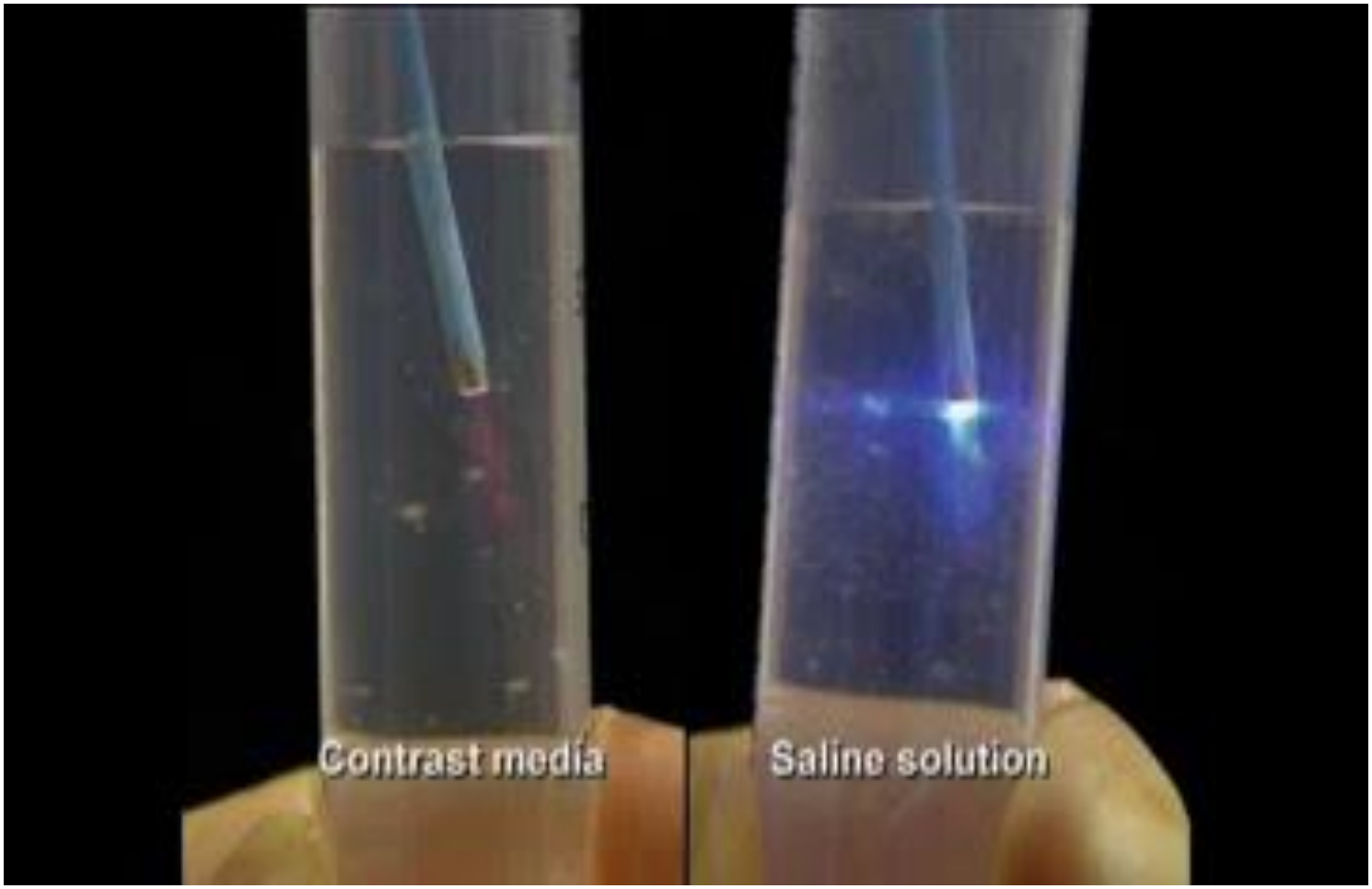
Complication	Overall Incidence	
	No.	%
Dissection	351	22.0
Severe dissection	64	4.0
Vasospasm	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	36	2.3
Perforation	38	2.4
Aneurysm formation	5	0.3
Arrhythmia*	[illegible]	[illegible]
[illegible]	16	1.0
CABG	49	3.1
Death	11	0.7

? High complication rate

! Unexpected criminal

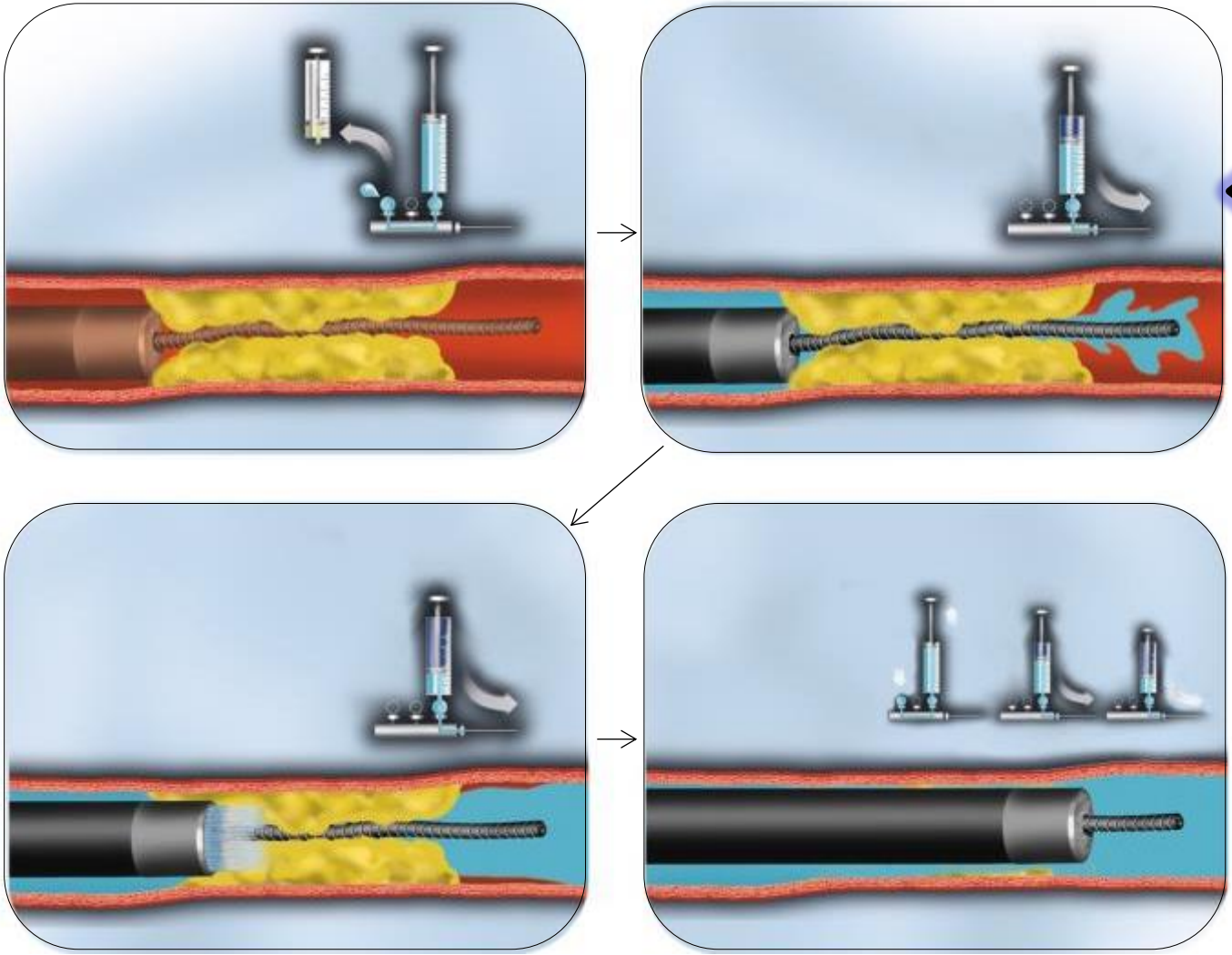
Excimer Laser: Contrast vs. Saline

↳ Interaction ↲



"Excessive bubble collapse→Shock waves→Over-injury"

Intracoronary Saline Infusion



- Saline infusion
- No contrast
- No blood

Safe & Efficacious ablation

Effect of Intracoronary Saline Infusion on Dissection During Excimer Laser Coronary Angioplasty: A Randomized Trial

JACC Vol. 26, No. 5
November 1, 1995:1264–9

LAWRENCE I. DECKELBAUM, MD, FACC, MADHU K. NATARAJAN, MD,*
JOHN A. BITTL, MD, FACC,† KATE ROHLFS, RN, JOHN SCOTT, BS,
ROBERT CHISHOLM, MD, FACC,* KIMBERLEY A. BOWMAN, RN,*
BRADLEY H. STRAUSS, MD, PHD,* FOR THE PERCUTANEOUS EXCIMER LASER CORONARY ANGIOPLASTY (PELCA) INVESTIGATORS

New Haven, Connecticut; Toronto, Ontario, Canada; and Boston, Massachusetts

Dissection Grade	Blood Group (n = 34)	Saline Group (n = 30)
0 (none)	21 (62%)	20 (67%)
1 (small)	5 (15%)	8 (27%)
2 (moderate)	4 (12%)	1 (3%)
3 (large)	1 (3%)	1 (3%)
4 (large)	0	0
5 (occlusion)	3 (8%)	0
Mean (±SE)	0.91 ± 0.26	0.43 ± 0.13

77%

94%

23%

6%

Excimer Laser Angioplasty in Acute Myocardial Infarction (The CARMEL Multicenter Trial)

On Topaz, MD, Douglas Ebersole, MD, Tony Das, MD, Edwin L. Alderman, MD, Hooman Madyoon, MD, Kishor Vora, MD, John D. Baker, MD, David Hilton, MD, and Johannes B. Dahm, MD

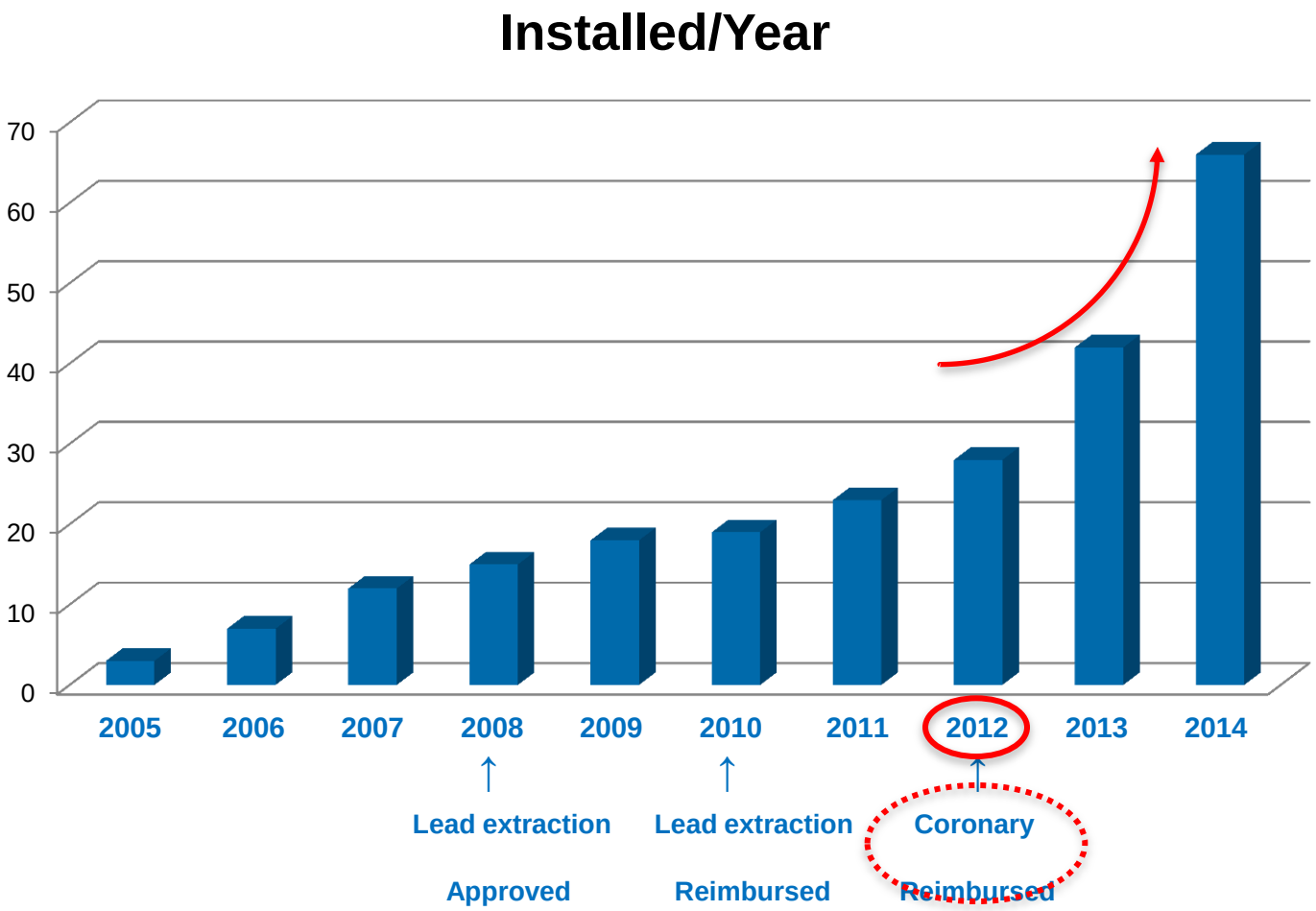
(Am J Cardiol 2004;93:694–701)

TABLE 4 Complications

Death	6 (4%)
Emergency bypass surgery	0
Neurologic damage	0
Perforation	1 (0.6%)
Guidewire-induced	0
Laser-induced	0
Balloon-induced	1 (0.6%)
Dissection	12 (8%)
Major (NHLBI type C or D)	7 (5%)
Guidewire-induced	2 (1.4%)
Laser-induced	4 (3%)
Balloon-induced	1 (0.6%)
Minor (NHLBI type B)	5 (3%)
Guidewire-induced	
Laser-induced	
Balloon-induced	1 (0.6%)
	3 (2%)
	1 (0.6%)
Stent-induced	1 (0.6%)
Balloon-induced	1 (0.6%)
No reflow	4 (3%)
Laser-induced	1 (0.6%)
Stent-induced	2 (1.4%)
TEC-induced	1 (0.6%)
Late thrombosis	2 (1.4%)
Bleeding (groin, 3; GI, 1)	4 (3%)

ELCA highly re-appreciated!

Number of Laser Console in JAPAN



DES-ISR

“Optimal treatment for DES-ISR is still controversial”

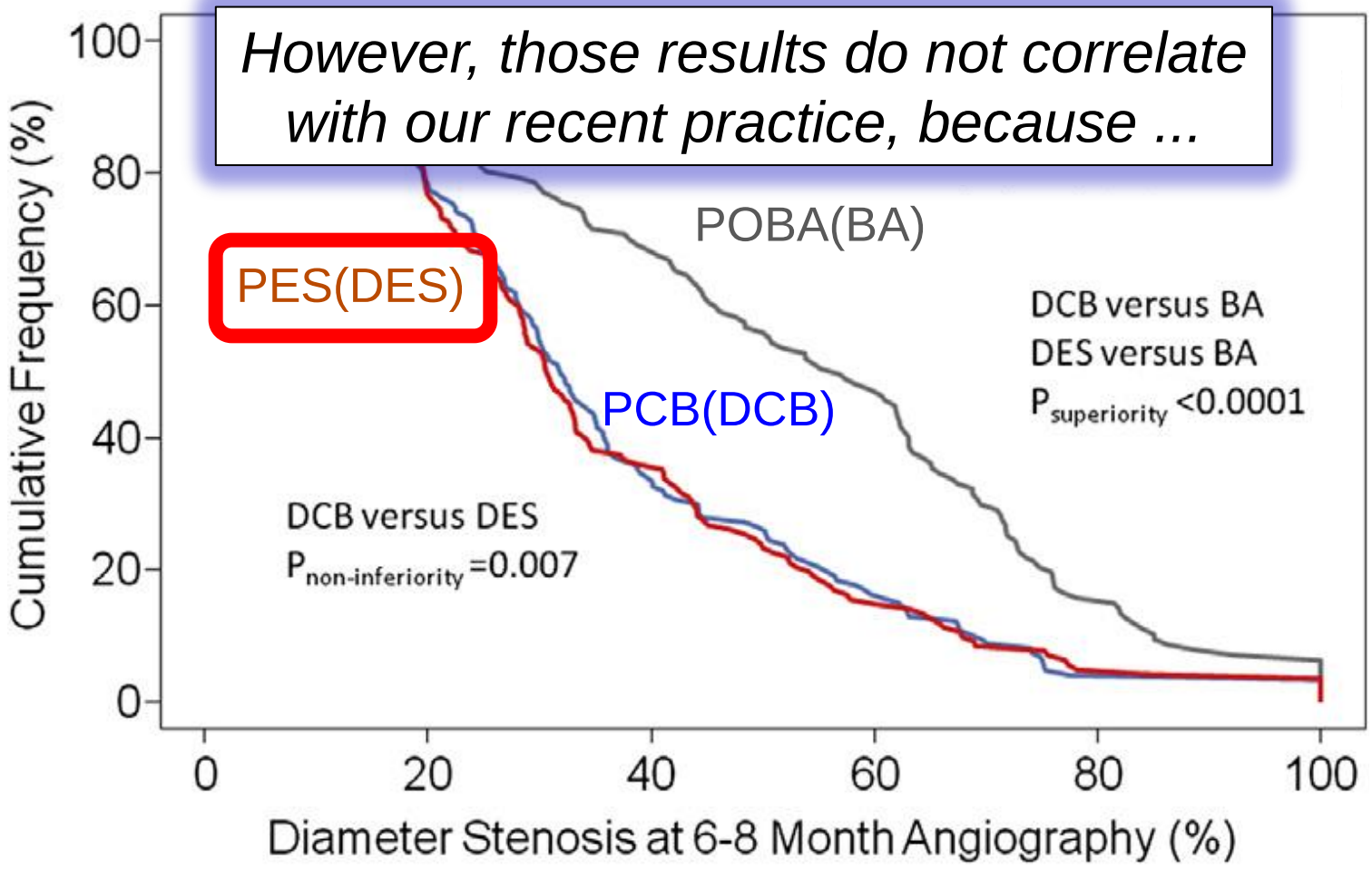
Current Treatment of In-Stent Restenosis

Fernando Alfonso, MD, PHD,* Robert A. Byrne, MB, BCH, PHD,†‡ Fernando Rivero, MD,* Adnan Kastrati, MD†‡

Madrid, Spain; and Munich, Germany

(J Am Coll Cardiol 2014;63:2659–73)

However, those results do not correlate with our recent practice, because ...



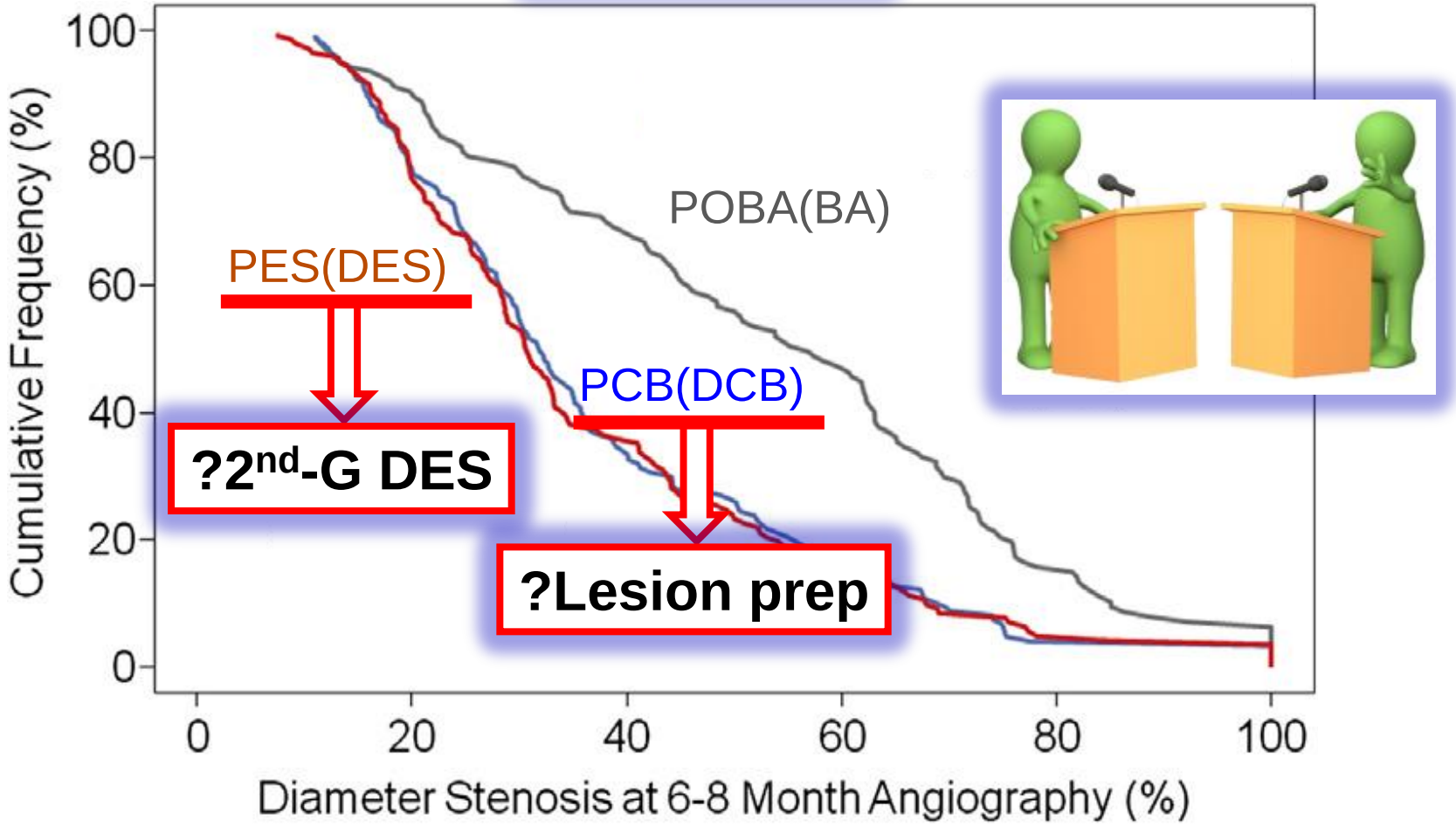
Currently in our daily practice...

# of In-Stent Restenosis

Robert A. Byrne, MB BCh, PhD,†‡ Fernando Rivero, MD,*
Adnan Kastrati, MD†‡
Madrid, Spain; and Munich, Germany

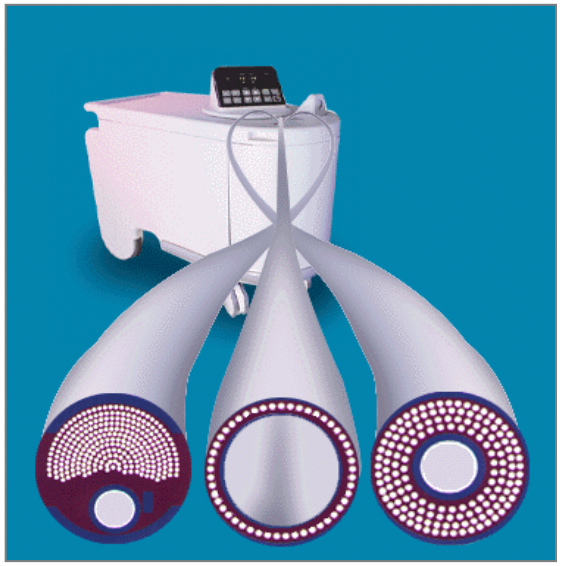
(J Am Coll Cardiol 2014;63:2659–73)

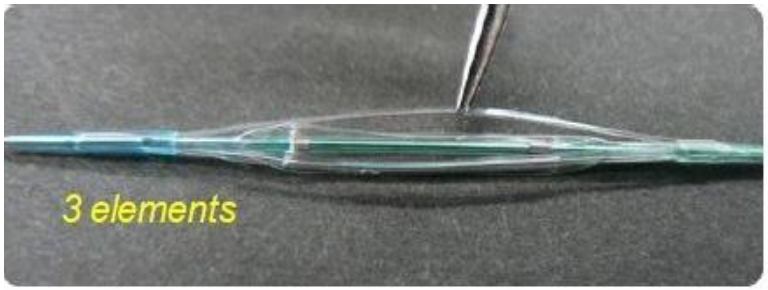
?DES-ISR

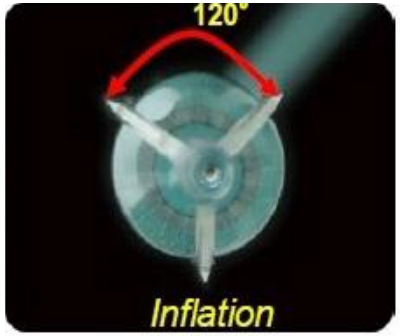


ELCA-NSE-DCB for DES-ISR

- ELCA Debulks Neointima -

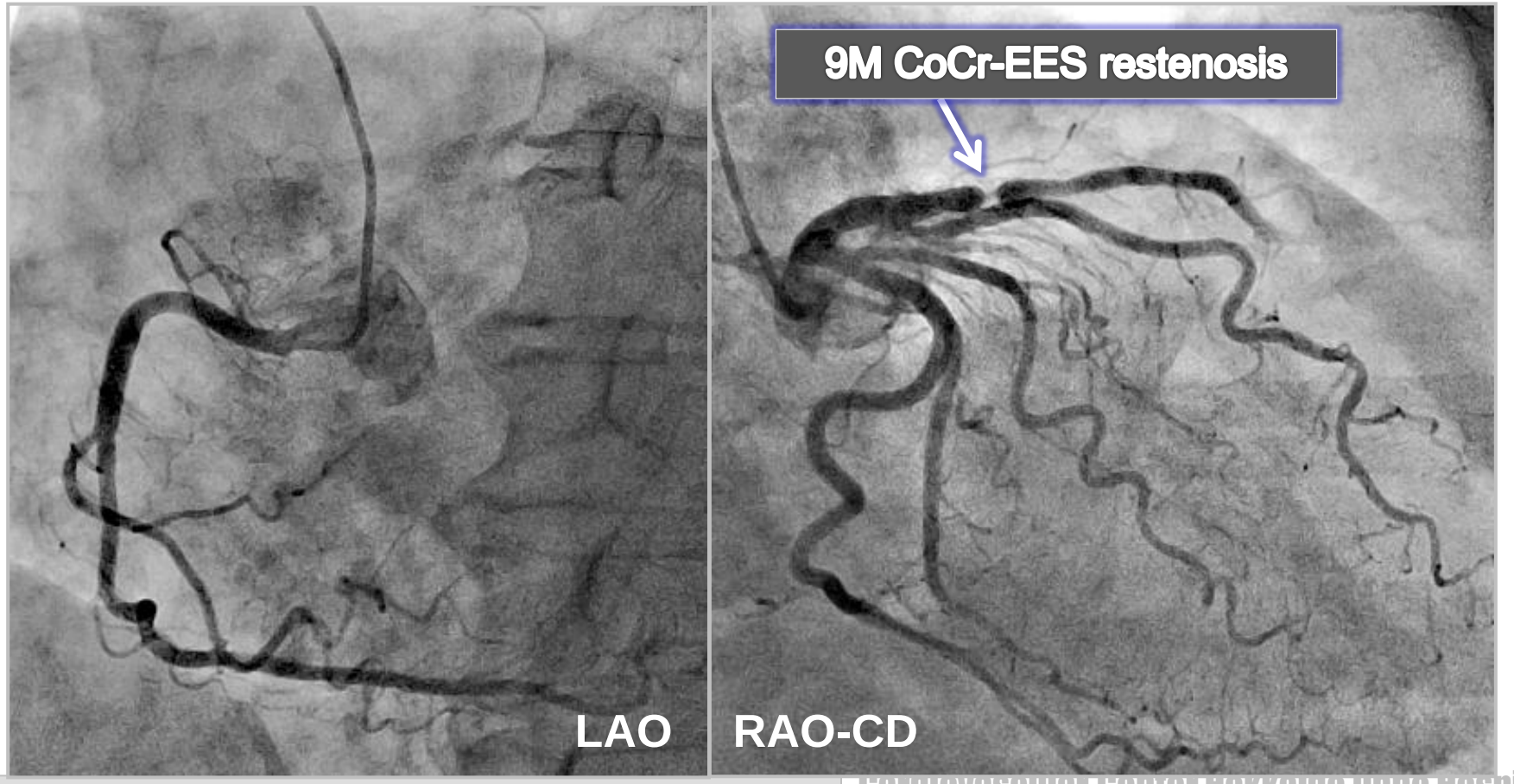




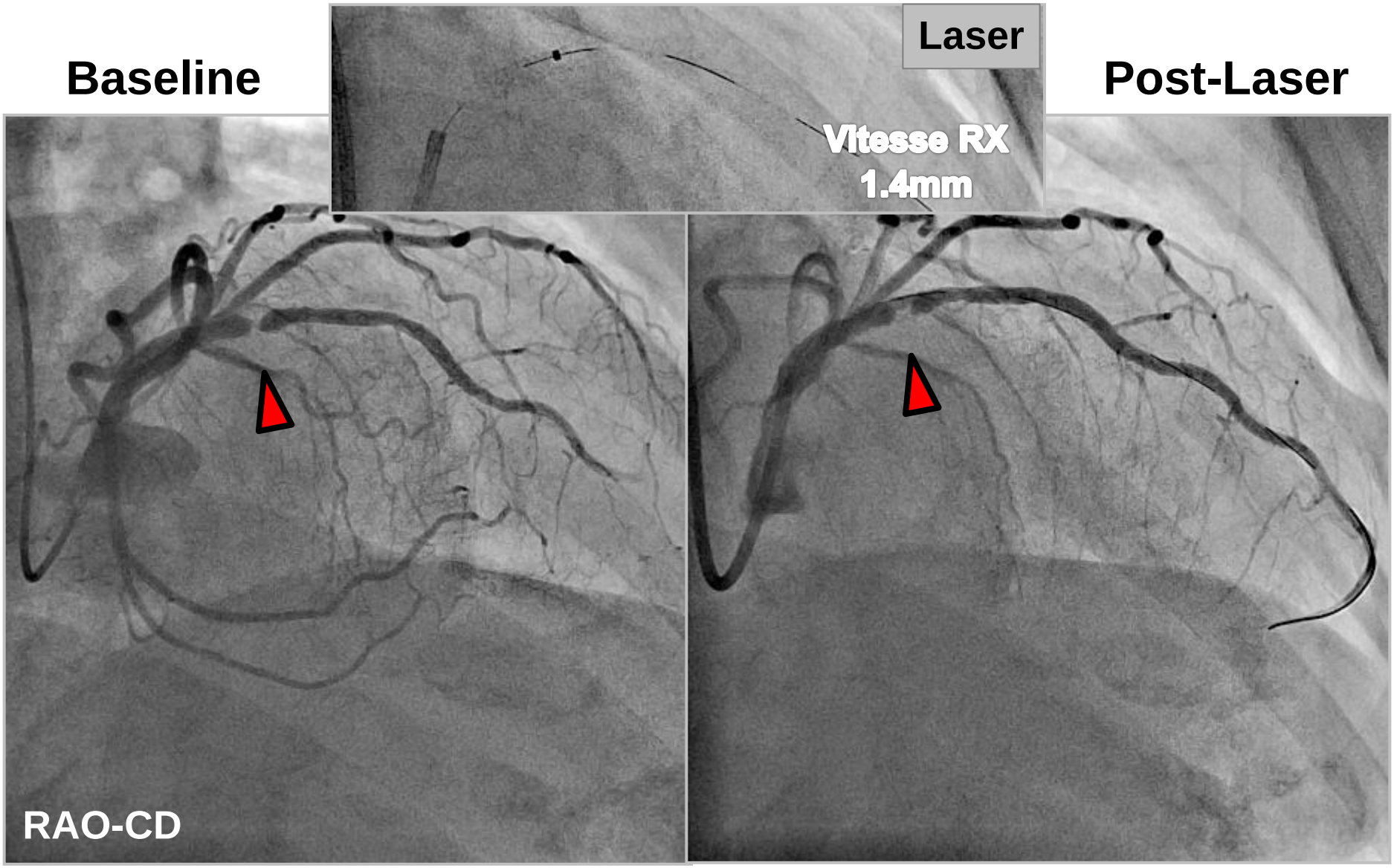


EAP recurrence from DES-ISR@9M

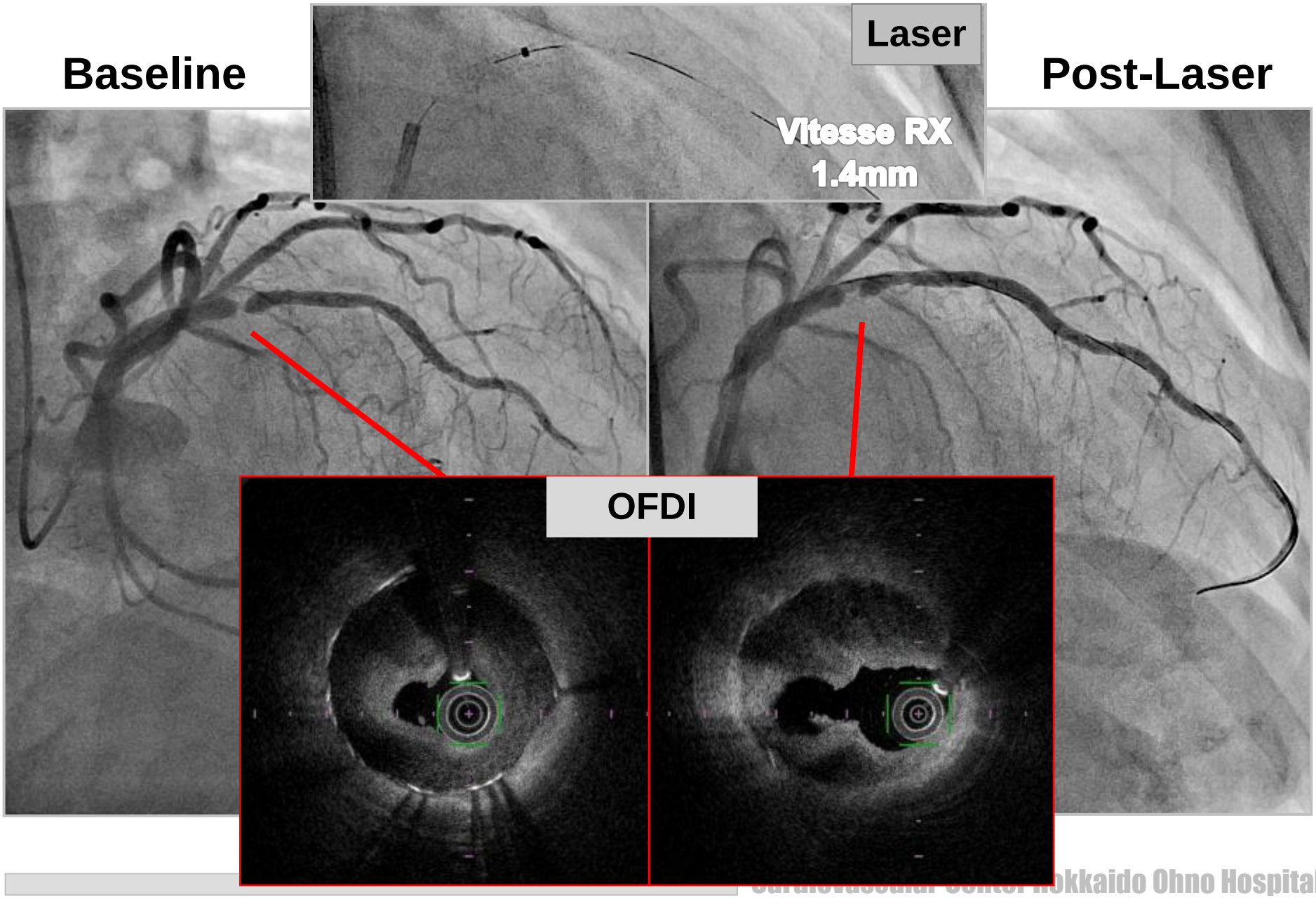
- A 79-yo female presented with exertional chest discomfort recurrence.
- Stress perfusion scan showed anterior wall ischemia.
- She had undergone CoCr-EES implantation 9 months previously.
- Risk factors – HT and DLp



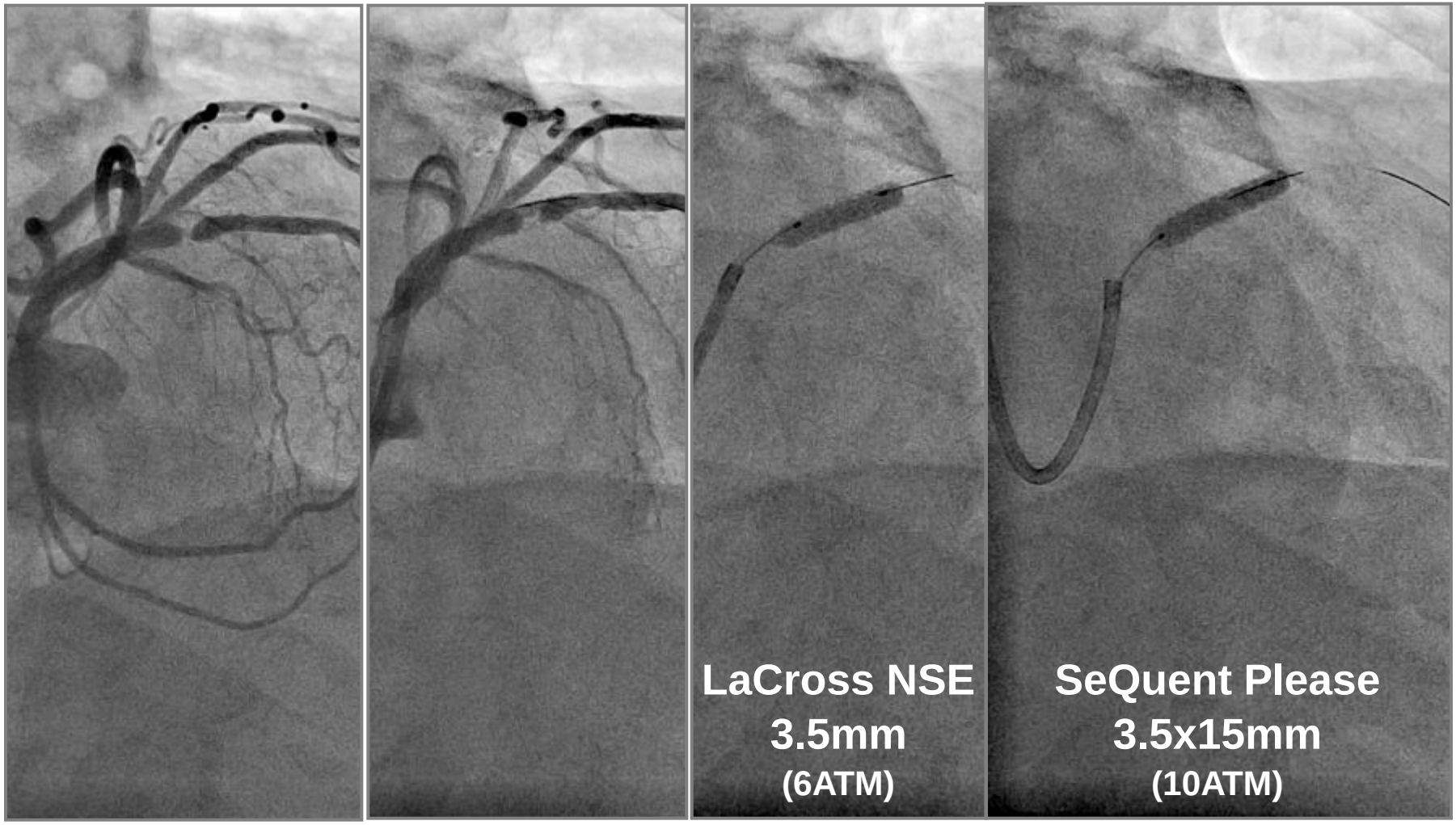
In-Xience restenosis @ 9M



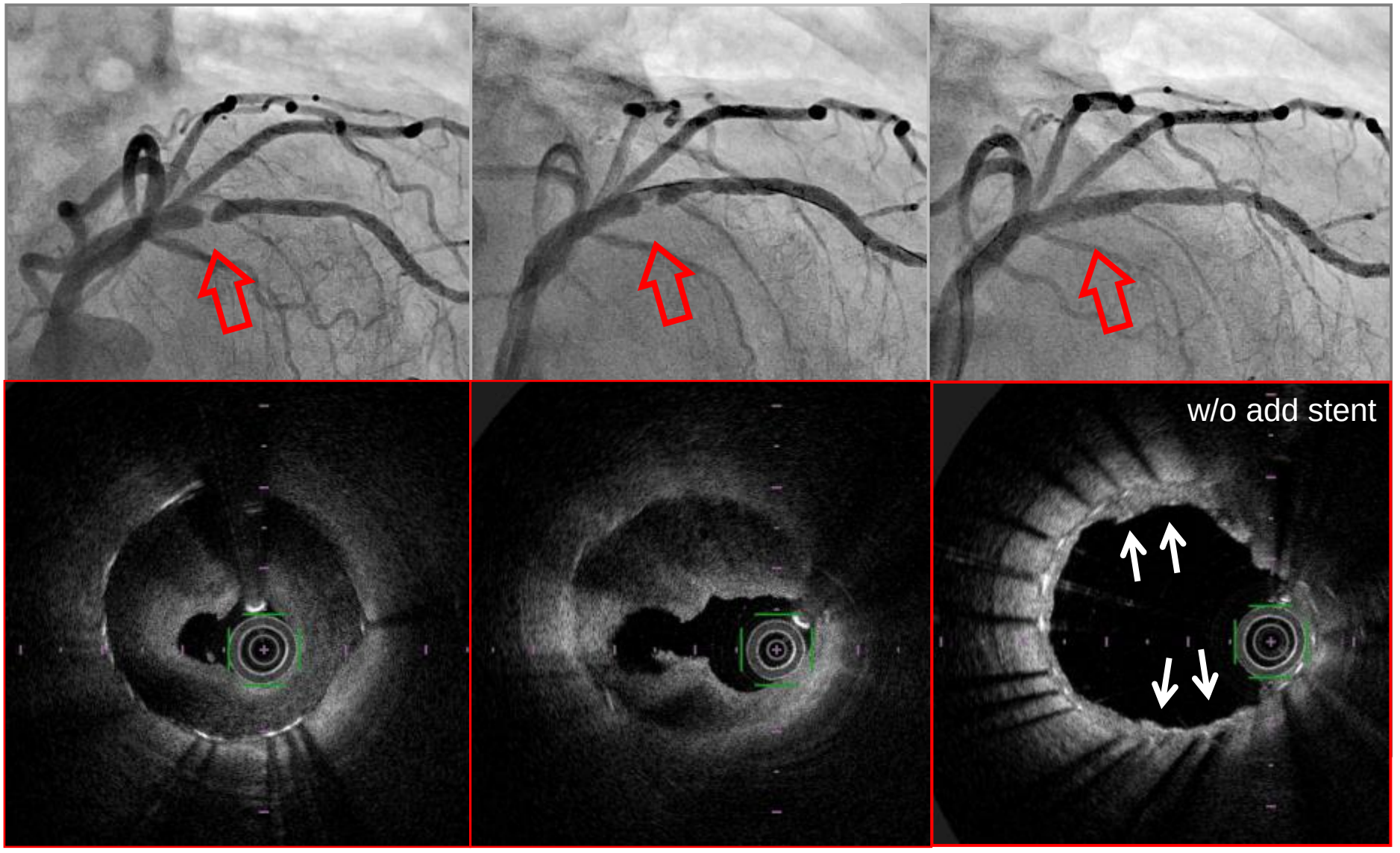
In-Xience restenosis @ 9M



In-Xience restenosis @ 9M

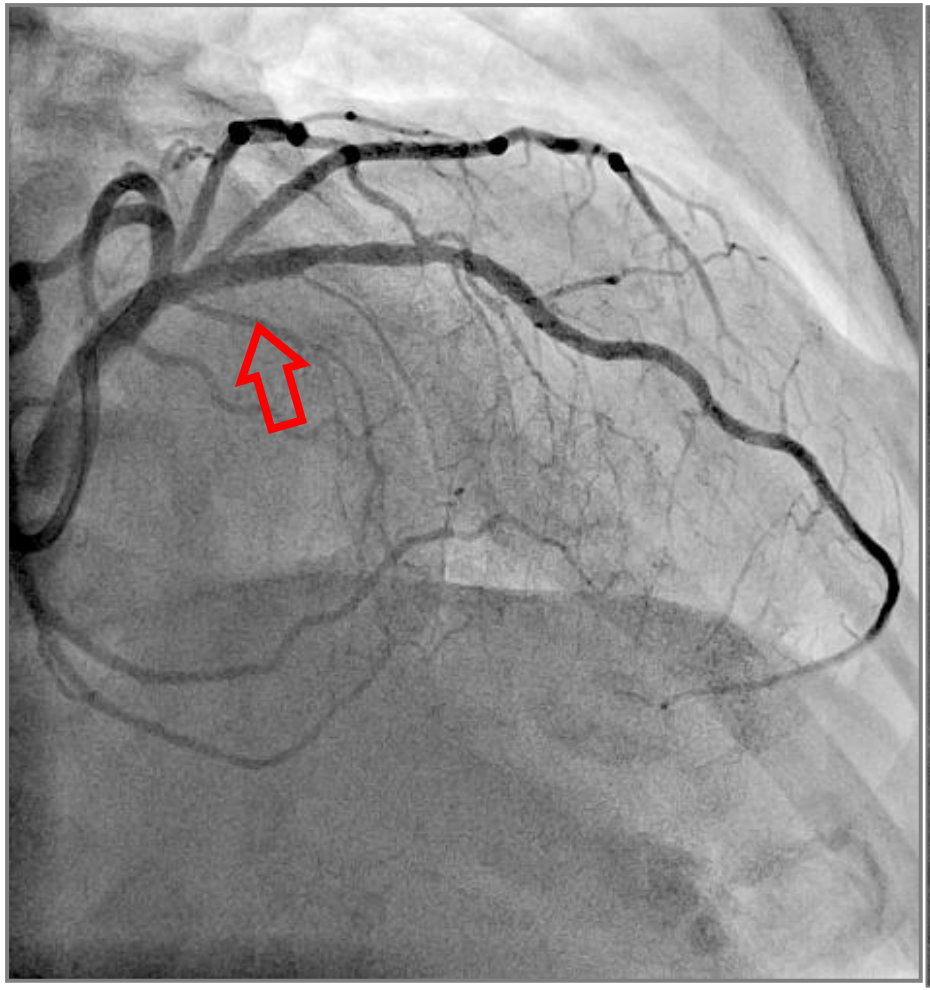


Antecedent laser debulking before DCB

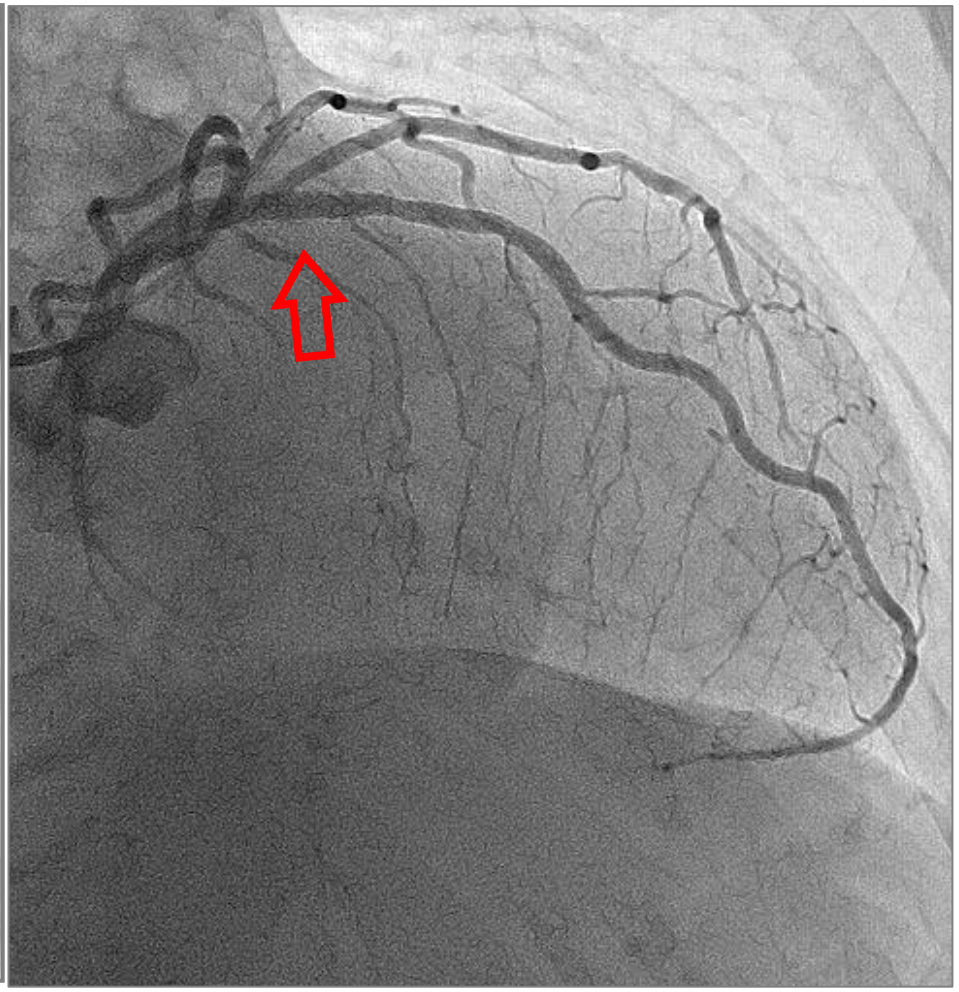


Follow-Up CAG

ELCA-NSE-DCB



6-Month



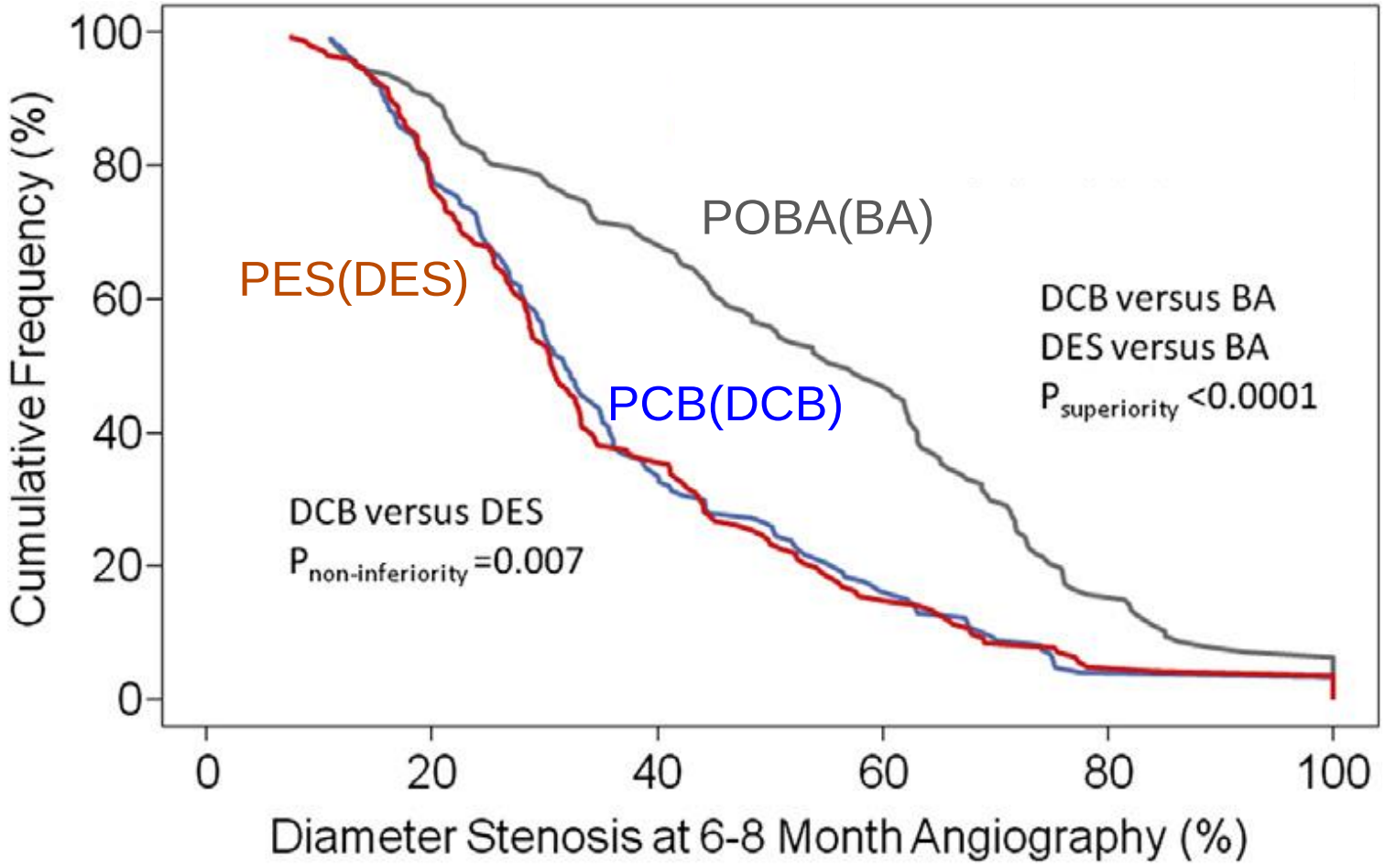
Discussion

Current Treatment of In-Stent Restenosis

Fernando Alfonso, MD, PHD,* Robert A. Byrne, MB, BCH, PHD,†‡ Fernando Rivero, MD,* Adnan Kastrati, MD†‡

Madrid, Spain; and Munich, Germany

(J Am Coll Cardiol 2014;63:2659–73)



Current Treatment of In-Stent Restenosis

Fernando Alfonso, MD, PHD,* Robert A. Byrne, MB, BCH, PHD,†‡ Fernando Rivero, MD,* Adnan Kastrati, MD†‡

Madrid, Spain; and Munich, Germany

(J Am Coll Cardiol 2014;63:2659–73)

Open Issues in DCB for ISR remain

? DCB proves comparable to repeat stenting with 2nd-G DES for DES-ISR

? Efficacy of DCB can be further improved by lesion preparation with a scoring or cutting balloon

Current Treatment of In-Stent Restenosis

Fernando Alfonso, MD, PHD,* Robert A. Byrne, MB, BCH, PHD,†‡ Fernando Rivero, MD,* Adnan Kastrati, MD†‡

Madrid, Spain; and Munich, Germany

(J Am Coll Cardiol 2014;63:2659–73)

Open Issues in DCB for ISR remain

? DCB proves comparable to repeat stenting with 2nd-G DES for DES-ISR

→ RIBS-IV *… TCT 2014*

? Efficacy of DCB can be further improved by lesion preparation with a scoring or cutting balloon

→ ISAR-DESIRE 4 *… TCT 2015!*

A Prospective, Randomized Trial of PEB vs EES in Patients With Coronary ISR of DES:

The RIBS IV Clinical Trial

Fernando Alfonso MD, PhD, FESC
Hospital Universitario "La Princesa" Madrid. Spain
On Behalf of the RIBS IV Investigators

JACC VOL. 66, NO. 1, 2015
JULY 7, 2015:23–33
JOURNAL OF THE AMERICAN COLLEGE OF CARDIOLOGY

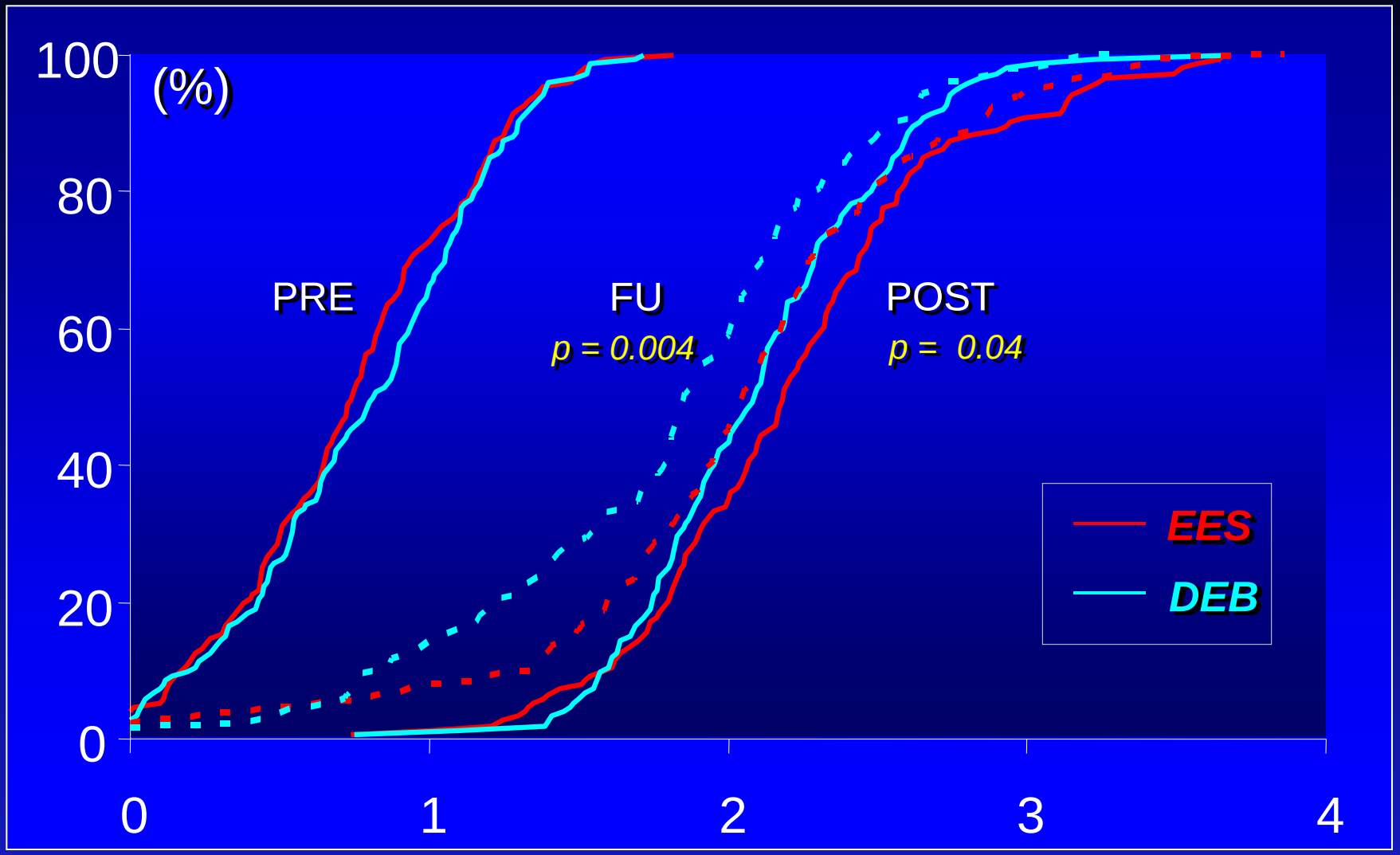
PUBLISHED BY ELSEVIER INC.
http://dx.doi.org/10.1016/j.jacc.2015.04.063

A Prospective Randomized Trial of Drug-Eluting Balloons Versus Everolimus-Eluting Stents in Patients With In-Stent Restenosis of Drug-Eluting Stents

The RIBS IV Randomized Clinical Trial

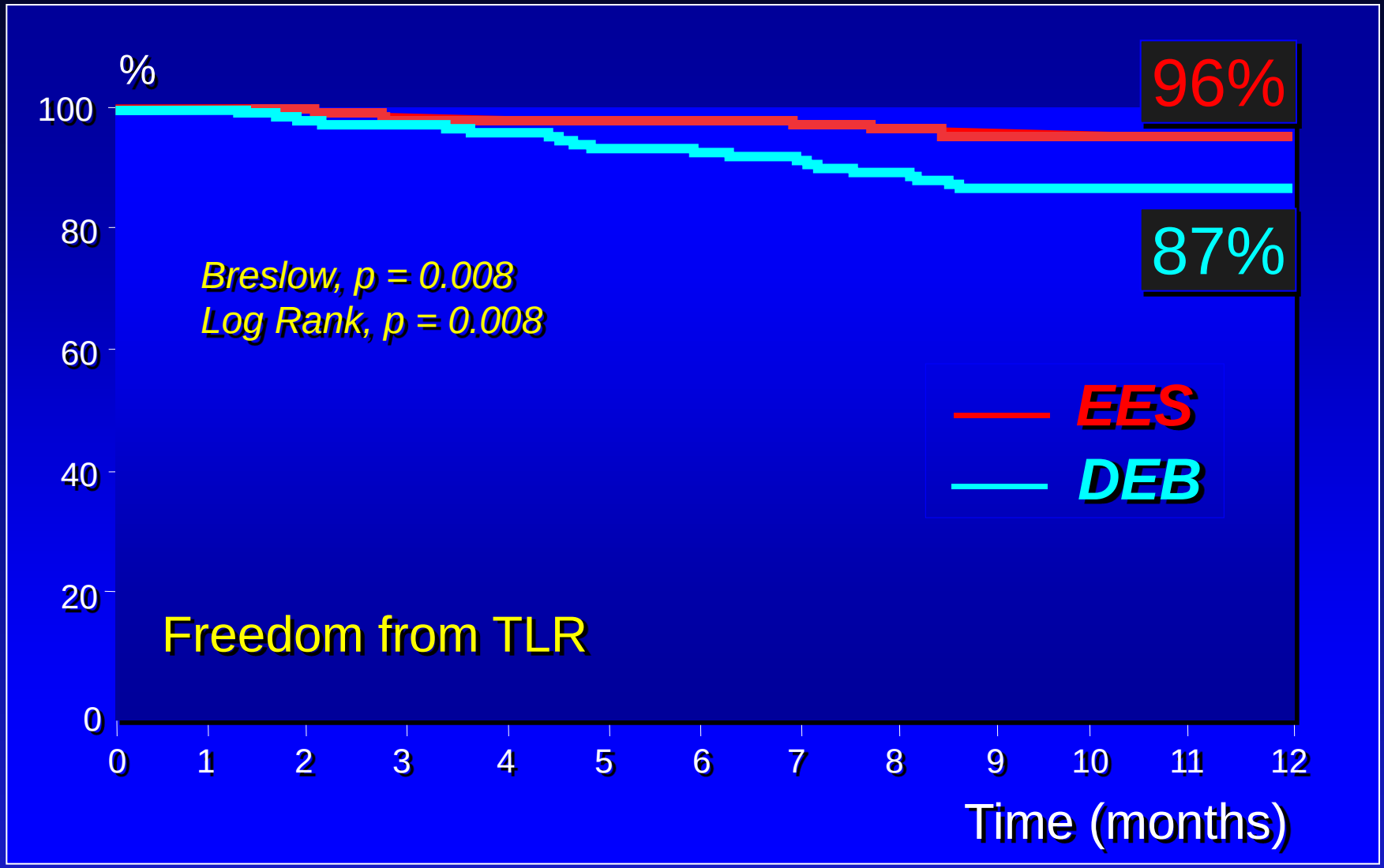
Fernando Alfonso, MD,* María Jose Pérez-Vizcayno, MD,† Alberto Cárdenas, MD,† Bruno García del Blanco, MD,‡ Arturo García-Touchard, MD,§ José Ramón López-Minguéz, MD,‖ Amparo Benedicto, MD,* Mónica Masotti, MD,¶ Javier Zueco, MD,# Andrés Iñiguez, MD,** Maite Velázquez, MD,†† Raúl Moreno, MD,‡‡ Vicente Mainar, MD,§§ Antonio Domínguez, MD,‖‖ Francisco Pomar, MD,¶¶ Rafael Melgares, MD,## Fernando Rivero, MD,* Pilar Jiménez-Quevedo, MD,† Nieves Gonzalo, MD,† Cristina Fernández, MD,† Carlos Macaya, MD,† for the RIBS IV Study Investigators (under the auspices of the Interventional Cardiology Working Group of the Spanish Society of Cardiology)

Cumulative Frequency Distribution Curves



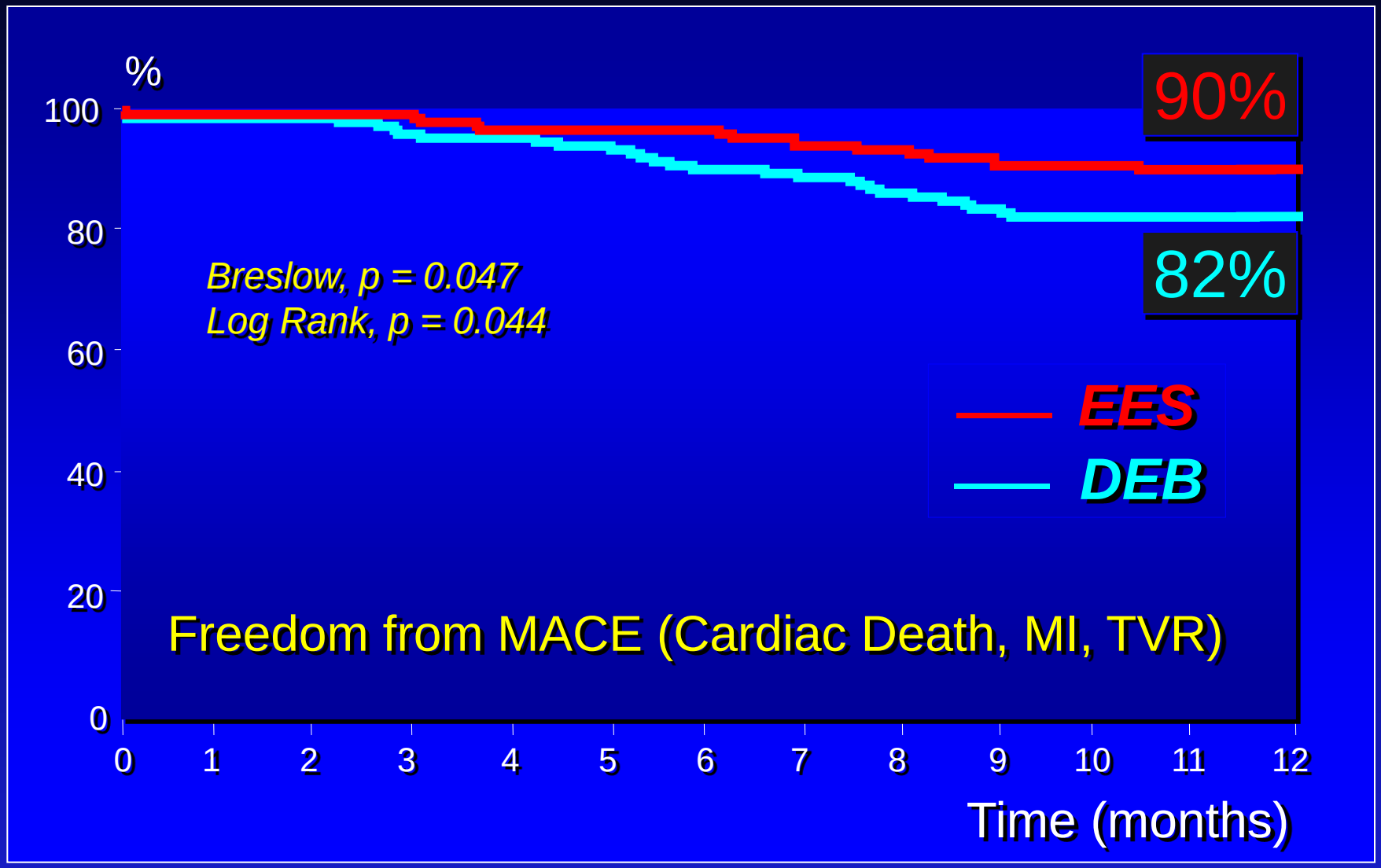
Clinical Follow-up:

1 Year FU 309 P (100%); FU Time 360±35 days



Clinical Follow-up:

1 Year FU 309 P (100%); FU Time 360±35 days

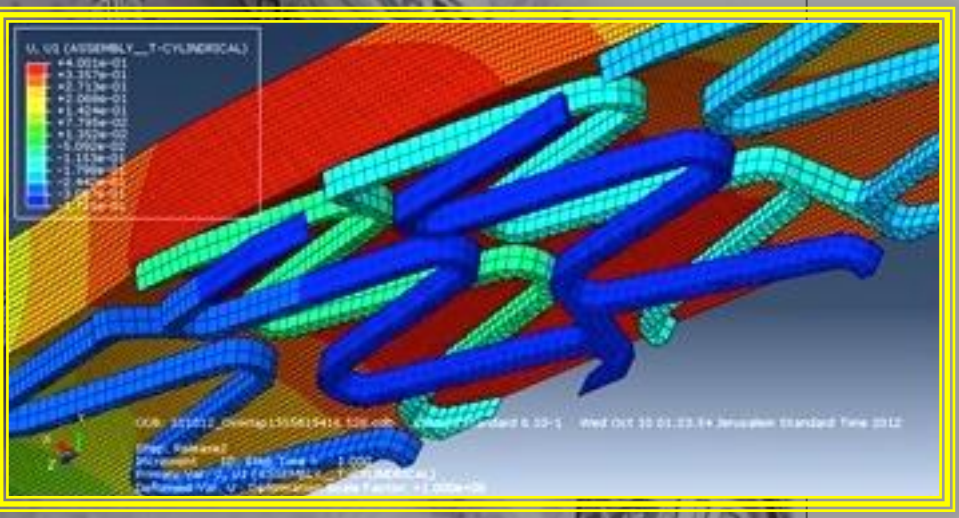


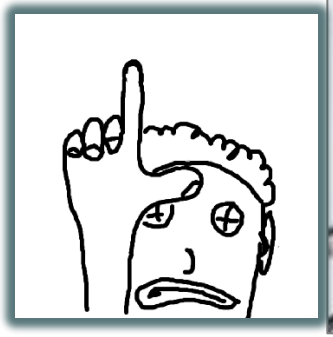
DES-ISR

Xience PRIME

Everolimus Eluting Coronary Stent System

A New Standard in
DES Safety and Efficacy.





Current Treatment of In-Stent Restenosis

Fernando Alfonso, MD, PHD,* Robert A. Byrne, MB, BCH, PHD,†‡ Fernando Rivero, MD,* Adnan Kastrati, MD†‡

Madrid, Spain; and Munich, Germany

(J Am Coll Cardiol 2014;63:2659–73)

DCB preferred over DES

- ✓ Already multiple metal layers
- ✓ With large side branch
- ✓ High bleeding risk undergoing prolonged DAPT

⇩

? Debulk-DCB

Current Treatment of In-Stent Restenosis

Fernando Alfonso, MD, PHD,* Robert A. Byrne, MB, BCH, PHD,†‡ Fernando Rivero, MD,* Adnan Kastrati, MD†‡

Madrid, Spain; and Munich, Germany

(J Am Coll Cardiol 2014;63:2659–73)

Open Issues in DCB for ISR remain

? DCB proves comparable to repeat stenting with 2nd-G DES for DES-ISR

→ RIBS-IV … *TCT 2014*

? Efficacy of DCB can be further improved by lesion preparation with a **scoring or cutting balloon**

→ ISAR-DESIRE 4 … *TCT 2015!*

Study Objective

To compare the anti-restenotic efficacy of:

Scoring balloon pre-dilation before paclitaxel-coated balloon therapy

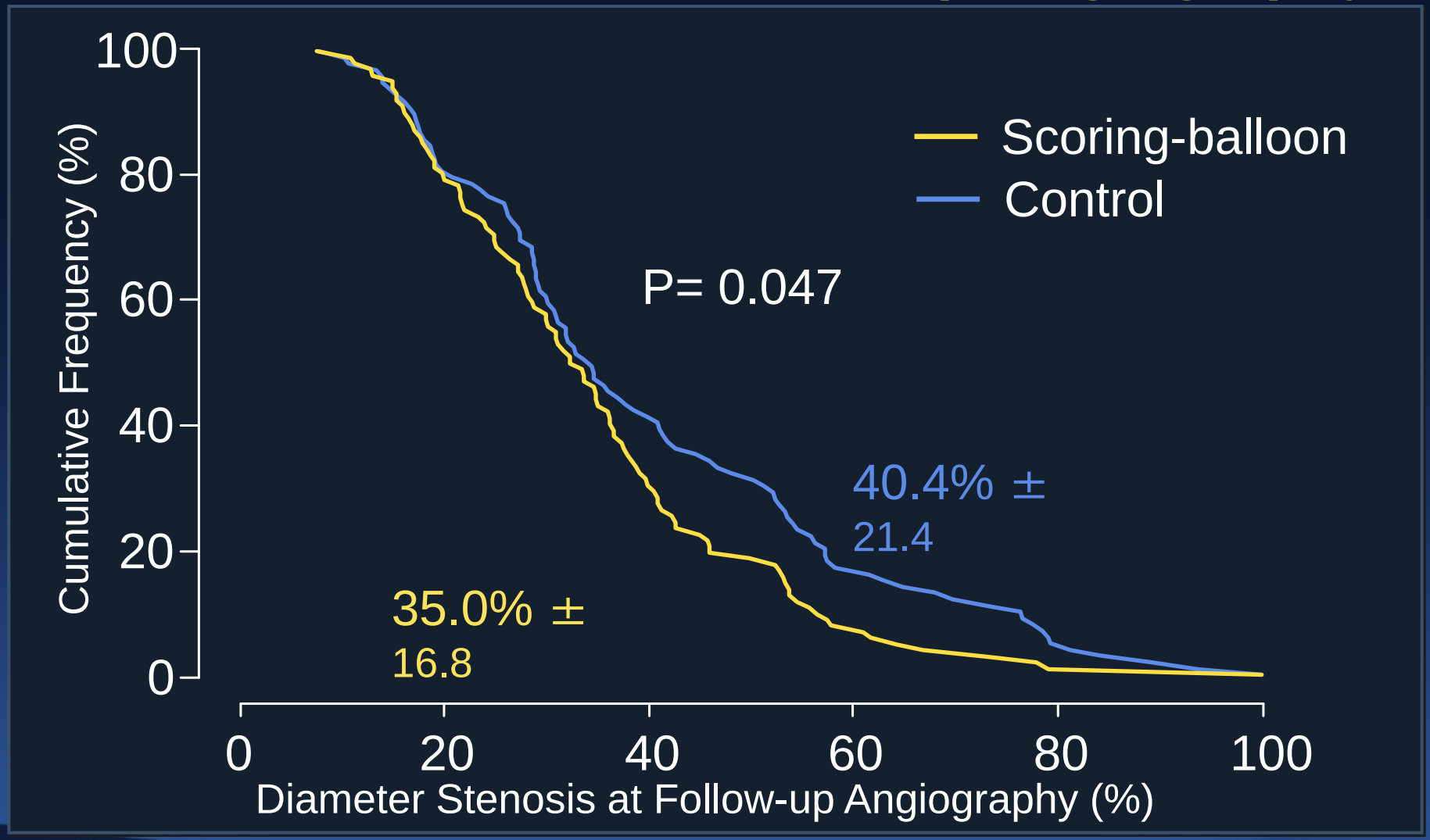
Versus

Standard balloon pre-dilation before paclitaxel-coated balloon therapy

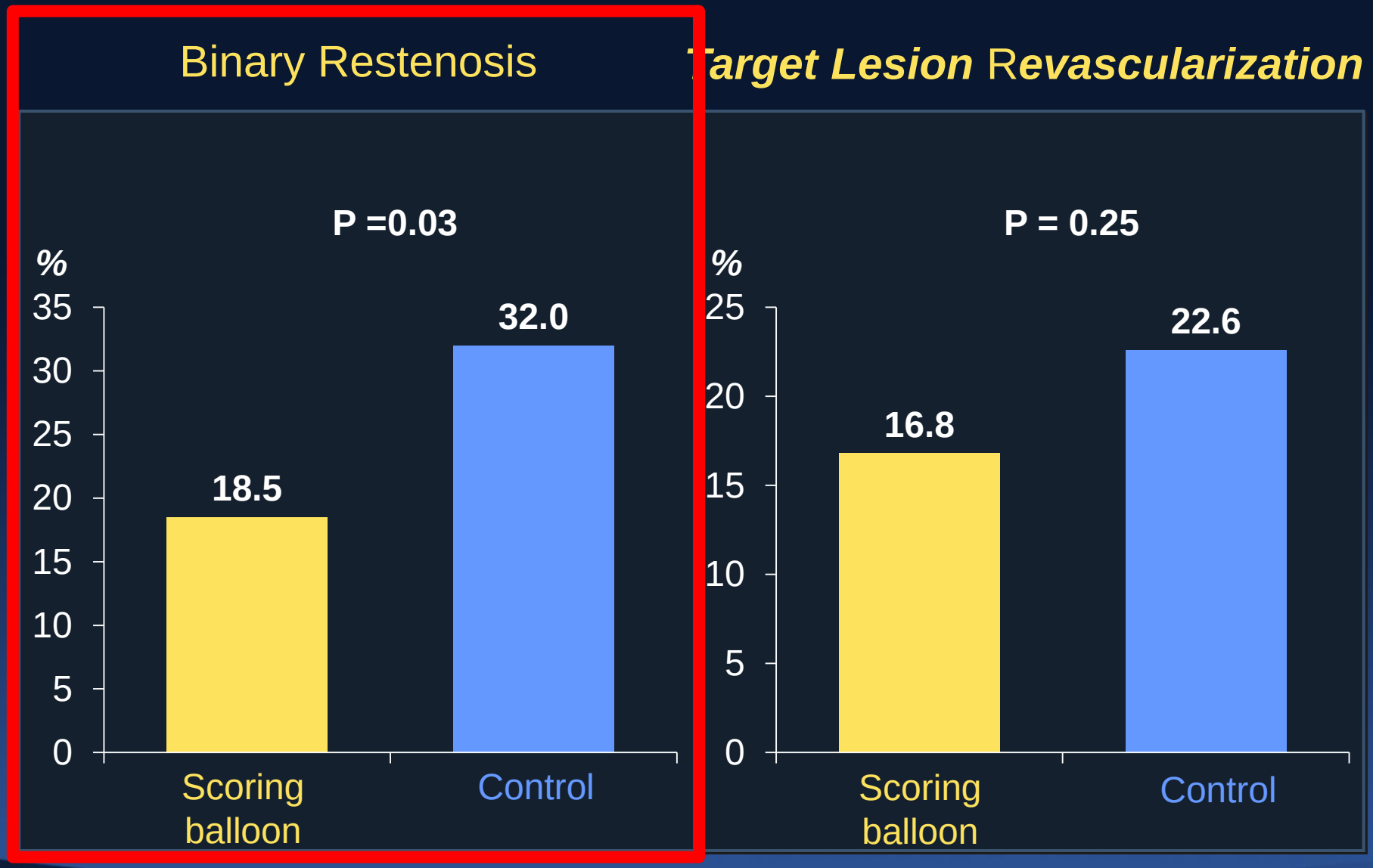
in patients with *limus*-DES restenosis

Primary Endpoint

Diameter Stenosis at Follow-up Angiography



Secondary Endpoint

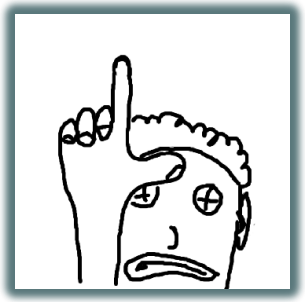


Conclusions

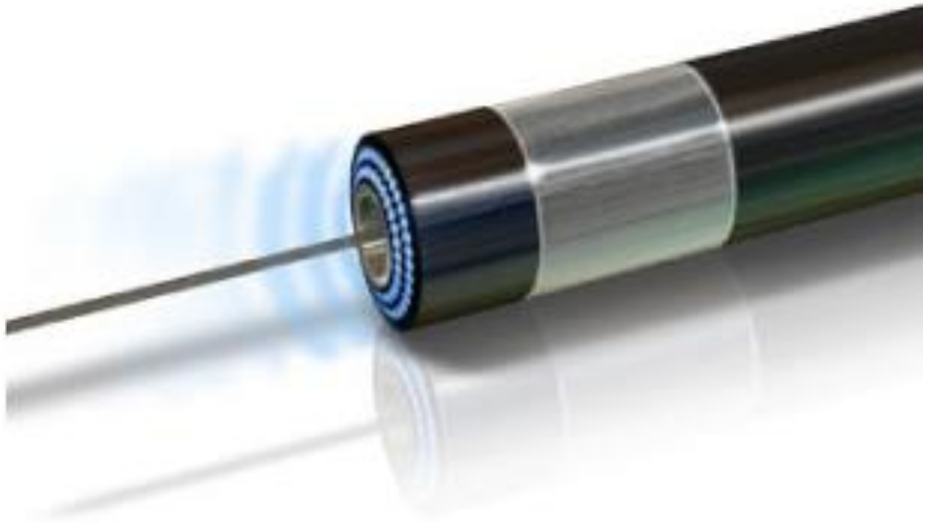
In patients presenting with DES restenosis…

- **paclitaxel-coated balloon based strategies confirmed a high clinical safety profile out to 1 year**
- **neointimal modification with scoring-balloon significantly improves the angiographic antirestenotic efficacy of paclitaxel-coated balloon angioplasty**

Predilatation before DCB for DES-ISR



ISR: ELCA vs Cutting Balloon (w/o DCB)

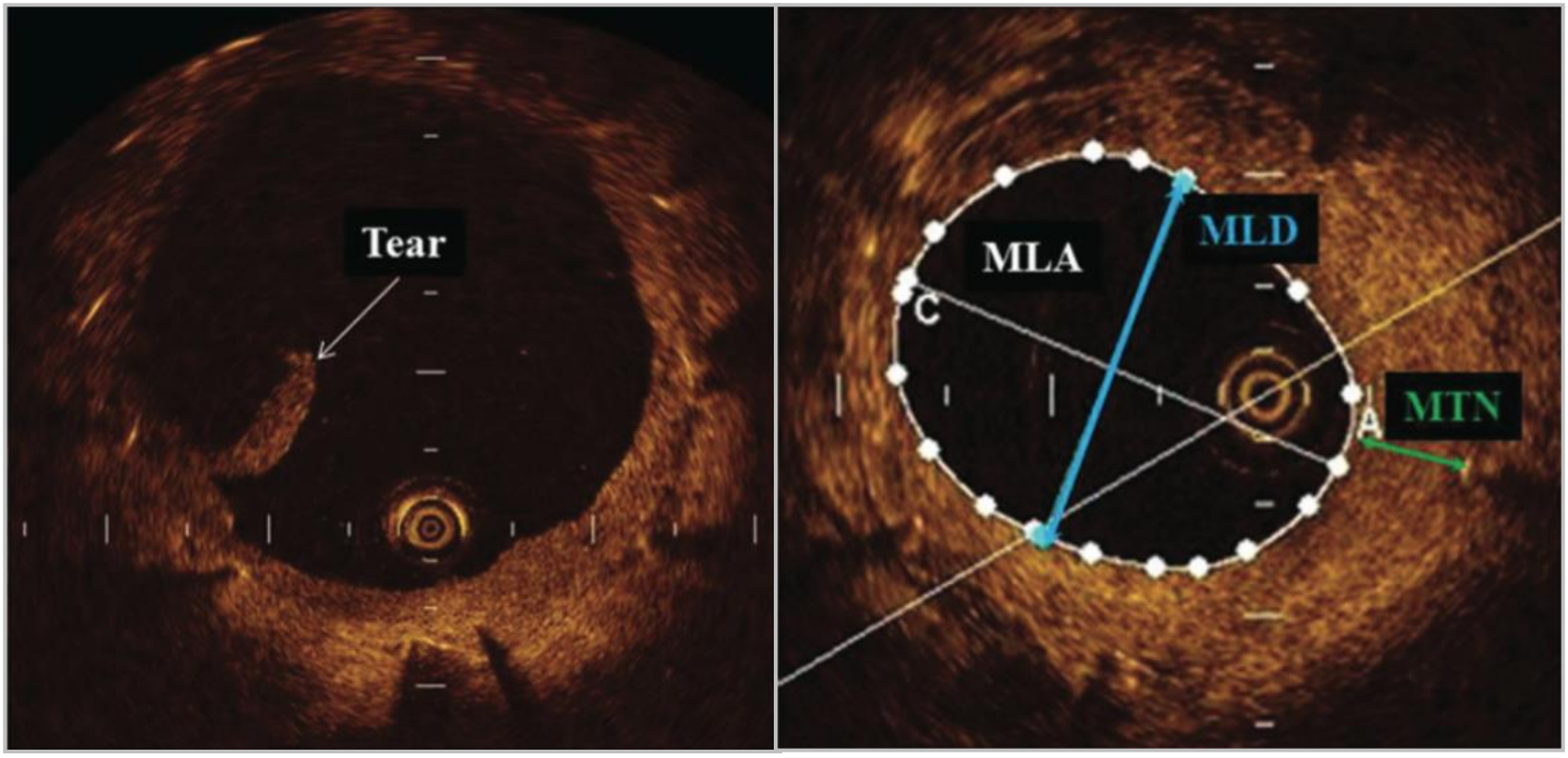


VS.

ISR: ELCA vs Cutting Balloon (w/o DCB)

Differences in optical coherence tomography findings and clinical outcomes between **Excimer Laser** and **cutting balloon** angioplasty for focal **in-stent restenosis** lesion

(Nishino M, et al. J Invas Cardiol 2012)



MTN: Maximum Thickness of Neointima

ISR: ELCA vs Cutting Balloon

Differences in optical coherence tomography findings and clinical outcomes between **Excimer Laser** and **cutting balloon** angioplasty for focal **in-stent restenosis** lesion

(Nishino M, et al. J Invas Cardiol 2012)

OCT Findings

	ELCA Group (n = 10)		CBA Group (n = 11)	P-Value
MTN (μm)	737.0 ± 125.6	>	656.7 ± 103.1	.088
Tear (n)	2.1 ± 1.1	<<	4.6 ± 1.7	.001
MLD (μm)	2187.8 ± 432.3	>	1915.8 ± 248.0	.079
MLA (mm^2)	6.5 ± 0.7	>>	5.1 ± 1.1	.004

ISR: ELCA vs Cutting Balloon

Differences in optical coherence tomography findings and clinical outcomes between **Excimer Laser** and **cutting balloon** angioplasty for focal **in-stent restenosis** lesion

(Nishino M, et al. J Invas Cardiol 2012)

QCA Results

	ELCA Group (n = 10)	CBA Group (n = 11)	P-Value
Immediately after intervention			
Minimal lumen diameter (mm)	2.40 ± 0.55	2.28 ± 0.43	.548
Diameter stenosis (%)	26.36 ± 12.79	21.28 ± 8.73	.594
Acute gain (mm)	1.64 ± 0.63	1.59 ± 0.55	.856
1-year follow-up			
Minimal lumen diameter (mm)	2.04 ± 0.64 >	1.37 ± 0.51	.116
Diameter stenosis (%)	37.26 ± 12.58 <<	54.05 ± 22.56	.049
Late loss (mm)	0.38 ± 036 <<	0.91 ± 0.76	.045

ISR: ELCA vs Cutting Balloon

Differences in optical coherence tomography findings and clinical outcomes between **Excimer Laser** and **cutting balloon** angioplasty for focal **in-stent restenosis** lesion

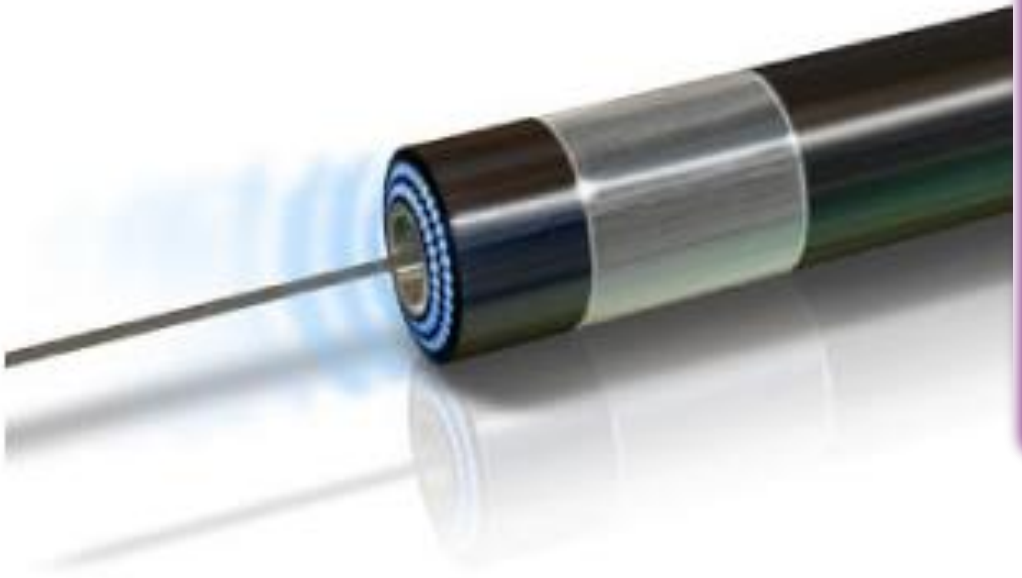
(Nishino M, et al. J Invas Cardiol 2012)

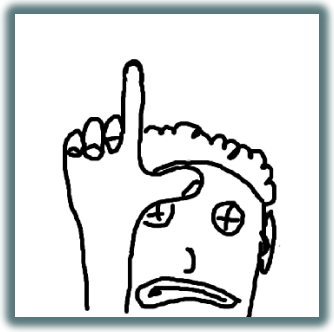
QCA Results

	ELCA Group	CBA Group	
Immediately after			
		± 0.43	.548
	26.36 ± 12.79	21.28 ± 8.73	.594
(mm)	1.64 ± 0.63	1.59 ± 0.55	.856
1-year follow-up			
Minimal lumen diameter (mm)	2.04 ± 0.64	1.37 ± 0.51	.116
Diameter stenosis (%)	37.26 ± 12.58	54.05 ± 22.56	.049
Late loss (mm)	0.38 ± 036	0.91 ± 0.76	.045

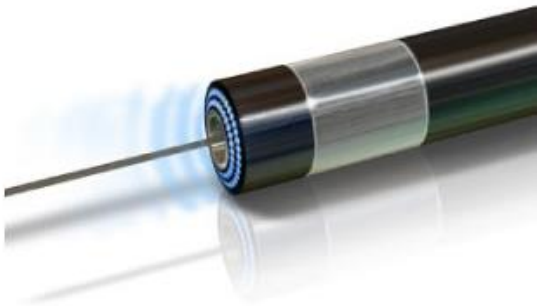
"OCT immediately after ELCA for ISR lesions revealed larger lumen area and smaller number of tears compared with CBA, which may support favorable effects of ELCA for focal ISR."

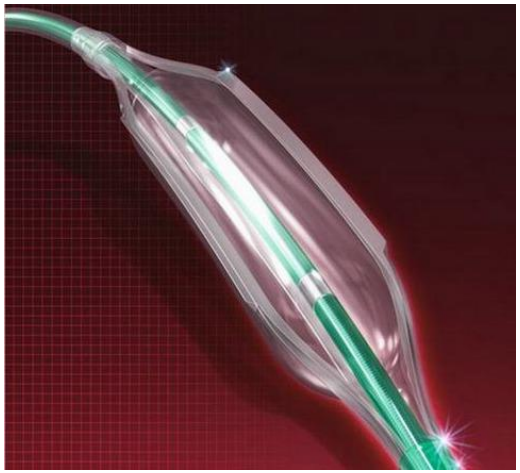
ISR: ELCA vs Cutting Balloon (w/o DCB)

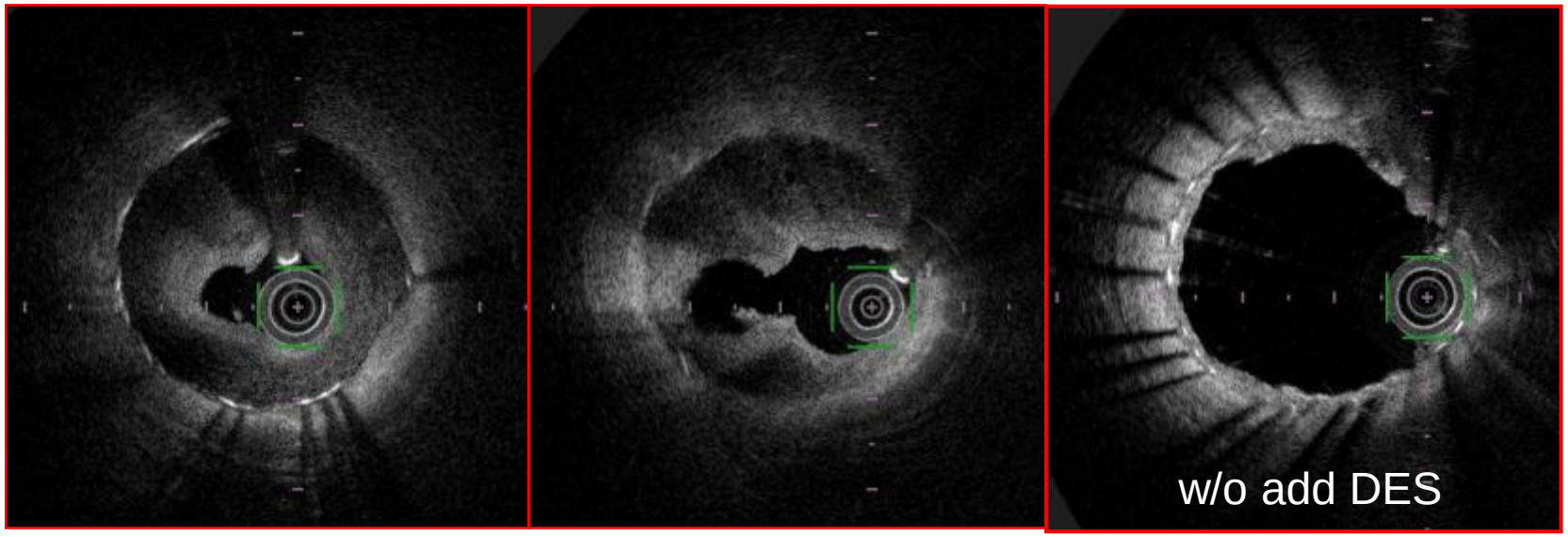




Treatment of DES-ISR







Baseline **ELCA** **ELCA-NSE-DCB**

Take-Home Message

I. After introducing a saline infusion method, ELCA was re-appreciated.

II. Optimal treatment for DES-ISR is still controversial.

III. ELCA-Scoring-DCB strategy is a solid option for improving the treatment of DES-ISR while avoiding additional DES implantation.

Live as if you were
to die tomorrow.
Learn as if you were
to live forever

Mahatma Gandhi

Additional Slides

OCT/OFDI
Neointima Characterization

Mechanisms of Postintervention and Nine-Month Luminal Enlargement After Treatment of Drug-Eluting In-Stent Restenosis With a Drug-Eluting Balloon

Seung-Yul Lee, MD[a], Myeong-Ki Hong, MD, PhD[a,b,*], Dong-Ho Shin, MD, MPH[a], Jung-Sun Kim, MD[a], Byeong-Keuk Kim, MD[a], Young-Guk Ko, MD[a], Donghoon Choi, MD[a], and Yangsoo Jang, MD[a,b]

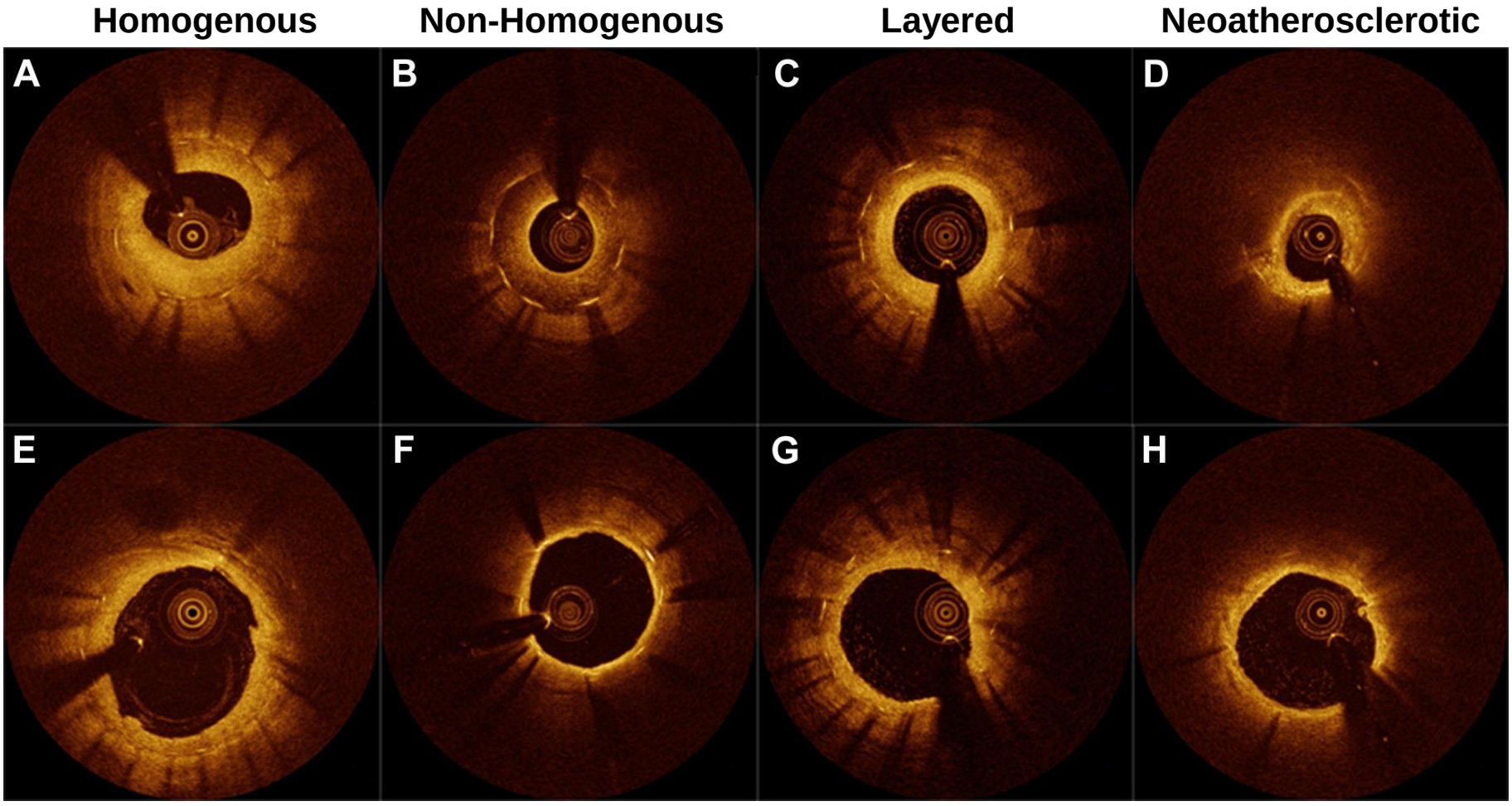
Using optical coherence tomography (OCT), the mechanisms of postintervention and 9-month luminal enlargement in drug-eluting stent in-stent restenosis (ISR) lesions treated with a drug-eluting balloon (DEB) were evaluated. A total of 42 patients with DEB-treated drug-eluting stent ISR lesions underwent serial OCT examination before intervention, after intervention, and at 9-month follow-up. Preintervention OCT-derived neointima was classified as either a homogeneous or nonhomogeneous pattern. Ten ISR lesions with homogeneous neointima were identified and compared with 32 ISR lesions with nonhomogeneous neointima. When comparing pre- and postintervention evaluations, changes in luminal cross-sectional area (CSA) were 3.4 mm^2 in ISR lesions with homogeneous neointima and 3.7 mm^2 in those with nonhomogeneous neointima, respectively ($p = 0.529$); changes in stent CSA were 2.5 mm^2 and 1.4 mm^2, respectively, $p = 0.004$; and changes in neointimal CSA were -0.9 mm^2 and -2.3 mm^2, respectively, $p = 0.001$. At 9-month follow-up, changes in luminal CSA were -2.0 mm^2 and -0.9 mm^2 in ISR lesions with homogeneous and nonhomogeneous neointima, respectively ($p = 0.021$); in stent CSA changed by -0.2 mm^2 in both groups ($p = 0.851$) and changes in neointimal CSA was 1.8 mm^2 and 0.7 mm^2, respectively ($p = 0.003$). At

In conclusion, the mechanism of postintervention luminal enlargement by DEB varied with the preintervention OCT-based neointimal characteristics. ISR lesions with homogeneous neointima determined by OCT were associated with greater subsequent regrowth of neointima after DEB treatment. (Am J Cardiol 2014;113:1468–1473)

Mechanisms of Postintervention and Nine-Month Luminal Enlargement After Treatment of Drug-Eluting In-Stent Restenosis With a Drug-Eluting Balloon

Seung-Yul Lee, MD[a], Myeong-Ki Hong, MD, PhD[a,b,*], Dong-Ho Shin, MD, MPH[a], Jung-Sun Kim, MD[a], Byeong-Keuk Kim, MD[a], Young-Guk Ko, MD[a], Donghoon Choi, MD[a], and Yangsoo Jang, MD[a,b]

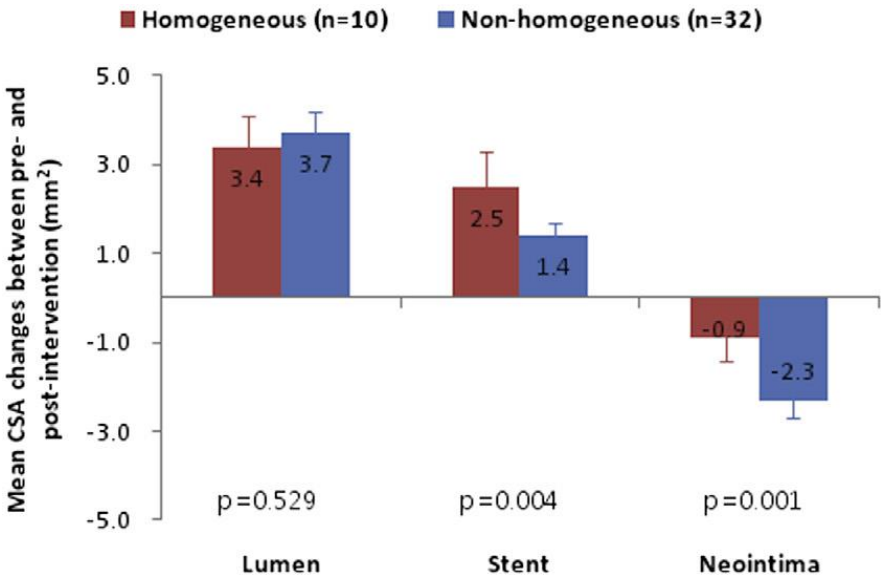
(Am J Cardiol 2014;113:1468–1473)

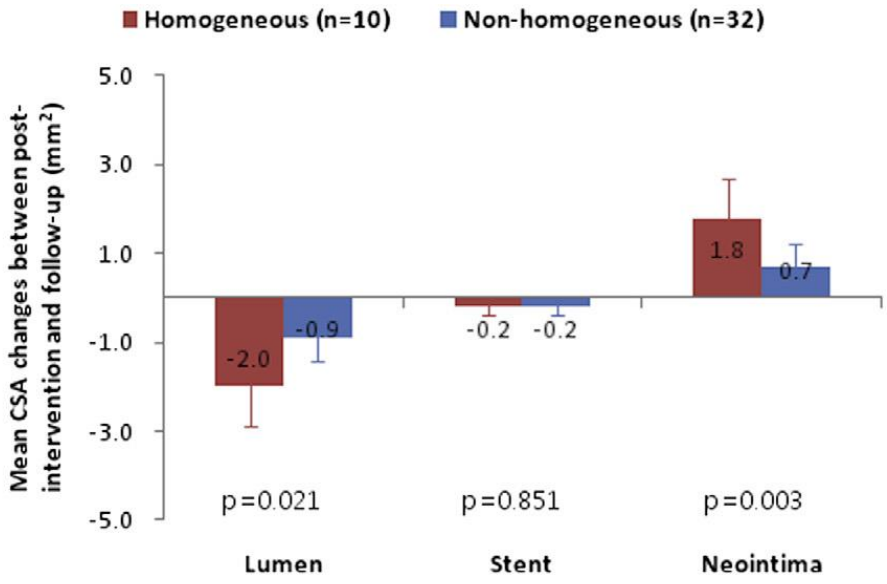


Mechanisms of Postintervention and Nine-Month Luminal Enlargement After Treatment of Drug-Eluting In-Stent Restenosis With a Drug-Eluting Balloon

Seung-Yul Lee, MD[a], Myeong-Ki Hong, MD, PhD[a,b,*], Dong-Ho Shin, MD, MPH[a], Jung-Sun Kim, MD[a], Byeong-Keuk Kim, MD[a], Young-Guk Ko, MD[a], Donghoon Choi, MD[a], and Yangsoo Jang, MD[a,b]

(Am J Cardiol 2014;113:1468−1473)

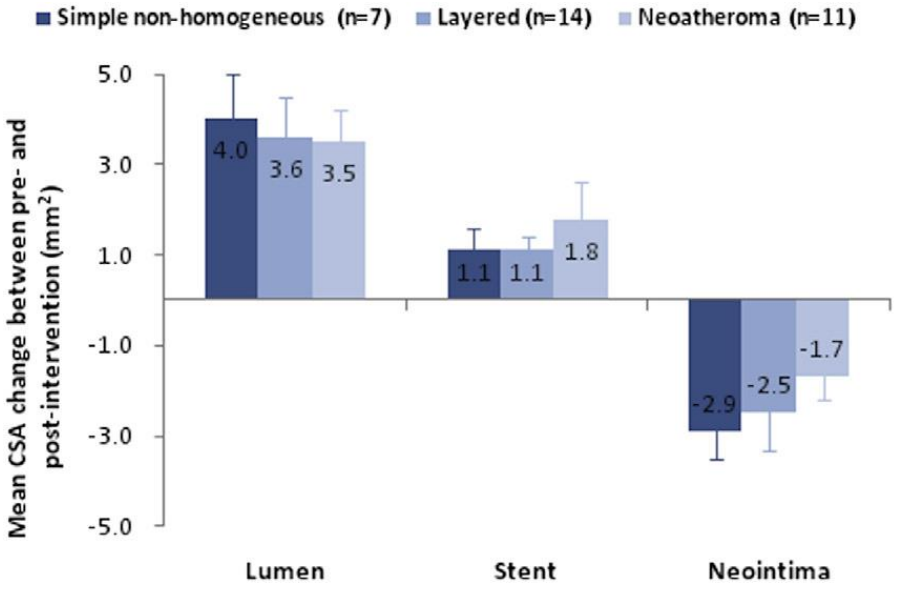


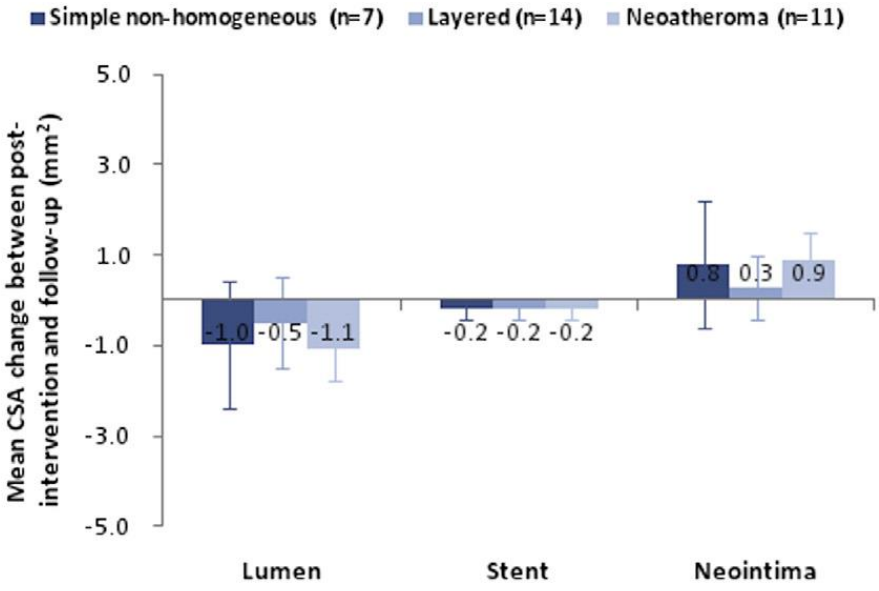


Mechanisms of Postintervention and Nine-Month Luminal Enlargement After Treatment of Drug-Eluting In-Stent Restenosis With a Drug-Eluting Balloon

Seung-Yul Lee, MD[a], Myeong-Ki Hong, MD, PhD[a,b,*], Dong-Ho Shin, MD, MPH[a], Jung-Sun Kim, MD[a], Byeong-Keuk Kim, MD[a], Young-Guk Ko, MD[a], Donghoon Choi, MD[a], and Yangsoo Jang, MD[a,b]

(Am J Cardiol 2014;113:1468−1473)

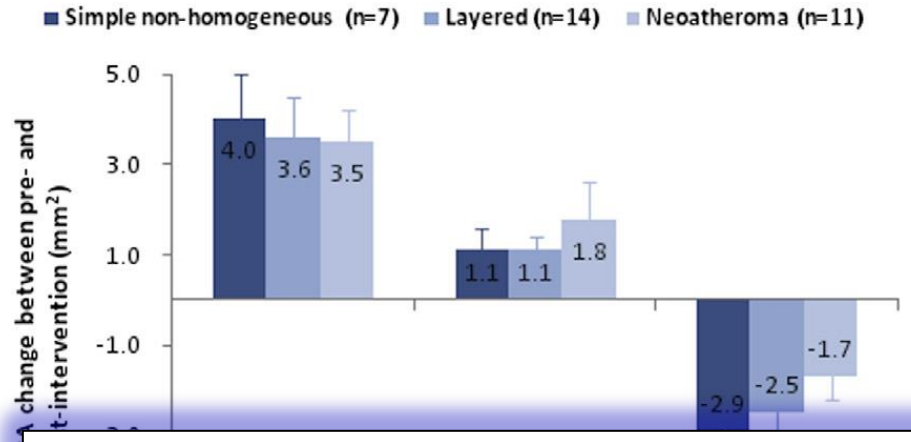


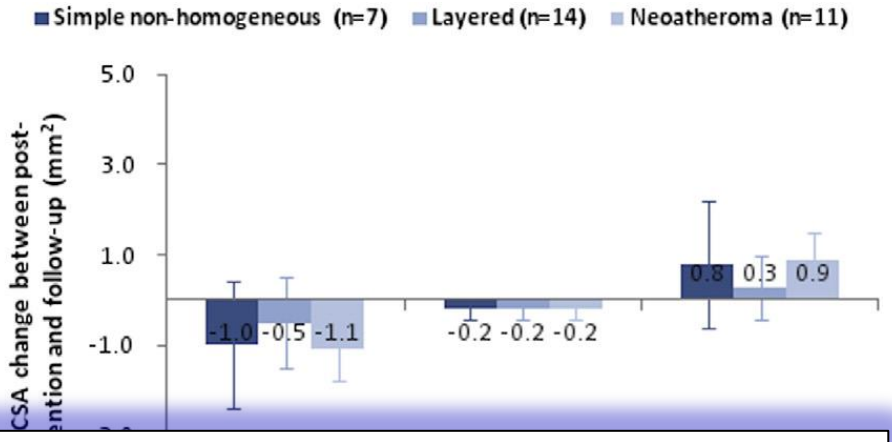


Mechanisms of Postintervention and Nine-Month Luminal Enlargement After Treatment of Drug-Eluting In-Stent Restenosis With a Drug-Eluting Balloon

Seung-Yul Lee, MD[a], Myeong-Ki Hong, MD, PhD[a,b,*], Dong-Ho Shin, MD, MPH[a], Jung-Sun Kim, MD[a], Byeong-Keuk Kim, MD[a], Young-Guk Ko, MD[a], Donghoon Choi, MD[a], and Yangsoo Jang, MD[a,b]

(Am J Cardiol 2014;113:1468−1473)





In conclusion, the mechanism of postintervention luminal enlargement by DEB varied with the preintervention OCT-based neointimal characteristics. ISR lesions with homogeneous neointima determined by OCT were associated with greater subsequent regrowth of neointima after DEB treatment. (Am J Cardiol 2014;113:1468−1473)

European Heart Journal – Cardiovascular Imaging (2014) 15, 307–315
doi:10.1093/ehjci/jet165

Association between tissue characteristics evaluated with optical coherence tomography and mid-term results after paclitaxel-coated balloon dilatation for in-stent restenosis lesions: a comparison with plain old balloon angioplasty

Takeshi Tada[1]*, Kazushige Kadota[1], Shingo Hosogi[2], Koshi Miyake[1], Hideo Amano[1], Michitaka Nakamura[1], Yu Izawa[1], Shunsuke Kubo[1], Tahei Ichinohe[1], Yusuke Hyoudou[1], Haruki Eguchi[1], Yuki Hayakawa[1], Suguru Otsuru[1], Daiji Hasegawa[1], Yoshikazu Shigemoto[1], Seiji Habara[1], Hiroyuki Tanaka[1], Yasushi Fuku[1], Harumi Kato[1], Tsuyoshi Goto[1], and Kazuaki Mitsudo[1]

[1]Department of Cardiovascular Medicine, Kurashiki Central Hospital, 1-1-1 Miwa, Kurashiki 710-8602, Japan; and [2]Department of Cardiovascular Medicine, Kochi Health Sciences Center, Kochi, Japan

Received 14 May 2013; revised 13 August 2013; accepted after revision 16 August 2013; online publish-ahead-of-print 15 September 2013

Conclusion Morphological assessment of ISR tissue using OCT might be useful for identifying ISR lesions favourable for PCB dilatation.

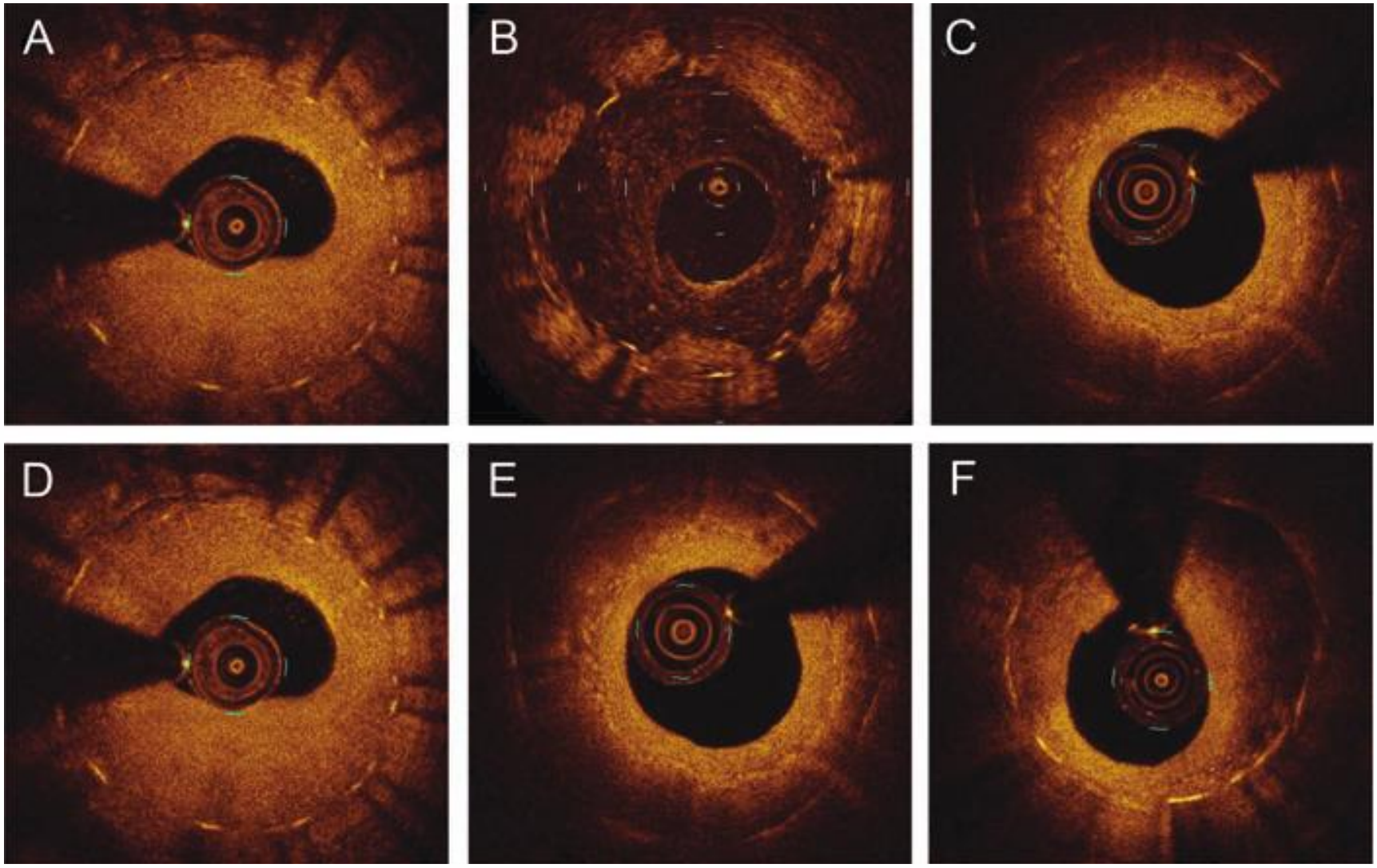


Figure 2 Representative cases with each tissue morphologies assessed with OCT. *A–C* Restenotic tissue structure; *A* homogeneous type; *B* heterogeneous type; *C* layered type; *D* and *E* restenotic tissue backscatter; *D* high type; *E* low type; *F* lipid-rich intima.

(Tada T, et al. EHJCVImg 2014;15:307-15)

Table 5 Association between restenotic tissue morphology and acute-/mid-term results

Tissue structure

	Homogeneous type			Heterogeneous type			Layered type		
	PCB ($n = 55$)	POBA ($n = 27$)	*P*-value	PCB ($n = 20$)	POBA ($n = 8$)	*P*-value	PCB ($n = 71$)	POBA ($n = 33$)	*P*-value
Acute gain, mm	1.14 ± 0.53	0.90 ± 0.56	0.060	1.25 ± 0.58	1.21 ± 0.38	0.885	1.20 ± 0.58	1.14 ± 0.60	0.597
Late loss, mm	0.25 ± 0.50	0.70 ± 0.58	0.000	0.45 ± 0.72	0.84 ± 0.85	0.234	0.23 ± 0.60	0.61 ± 0.69	0.005
Net gain, mm	0.90 ± 0.61	0.20 ± 0.67	0.000	0.80 ± 0.69	0.38 ± 0.98	0.208	0.98 ± 0.73	0.53 ± 0.63	0.003
ISR, *n* (%)	11 (20.0)	15 (55.6)	0.002	7 (35.0)	3 (37.5)	1.000	16 (22.5)	13 (39.4)	0.100
TLR, *n* (%)	7 (12.7)	10 (37.0)	0.019	5 (25.0)	3 (37.5)	0.651	14 (19.7)	12 (36.4)	0.089

PCB, paclitaxel-coated balloon; POBA, plain old balloon dilatation; ISR, in-stent restenosis; TLR, target lesions revascularization.

Tissue backscatter

High backscatter			Low backscatter		
PCB ($n = 81$)	POBA ($n = 40$)	*P*-value	PCB ($n = 65$)	POBA ($n = 28$)	*P*-value
1.12 ± 0.50	0.97 ± 0.58	0.139	1.26 ± 0.62	1.17 ± 0.54	0.476
0.23 ± 0.51	0.73 ± 0.70	0.000	0.31 ± 0.66	0.59 ± 0.62	0.059
0.90 ± 0.61	0.25 ± 0.67	0.000	0.96 ± 0.76	0.58 ± 0.70	0.027
16 (19.8)	21 (52.5)	0.000	18 (27.7)	10 (35.7)	0.467
11 (13.6)	17 (42.5)	0.001	15 (23.1)	8 (28.6)	0.606

Conclusion Morphological assessment of ISR tissue using OCT might be useful for identifying ISR lesions favourable for PCB dilatation.

European Heart Journal – Cardiovascular Imaging (2015) 16, 1101–1111
doi:10.1093/ehjci/jev031

Association between tissue characteristics assessed with optical coherence tomography and mid-term results after percutaneous coronary intervention for in-stent restenosis lesions: a comparison between balloon angioplasty, paclitaxel-coated balloon dilatation, and drug-eluting stent implantation

Takeshi Tada[1]*, Kazushige Kadota[1], Shingo Hosogi[2], Koshi Miyake[1], Masanobu Ohya[1], Hideo Amano[1], Yu Izawa[1], Takenori Kanazawa[1], Shunsuke Kubo[1], Tahei Ichinohe[1], Yusuke Hyoudou[1], Yuki Hayakawa[1], Mahmoud Mohamed Hassan Sabbah[3], Suguru Otsuru[1], Daiji Hasegawa[1], Seiji Habara[1], Hiroyuki Tanaka[1], Yasushi Fuku[1], Harumi Katoh[1], Tsuyoshi Goto[1], and Kazuaki Mitsudo[1]

Conclusion Morphological assessment of ISR tissue using OCT might suggest favourable types of PCI for ISR lesions.

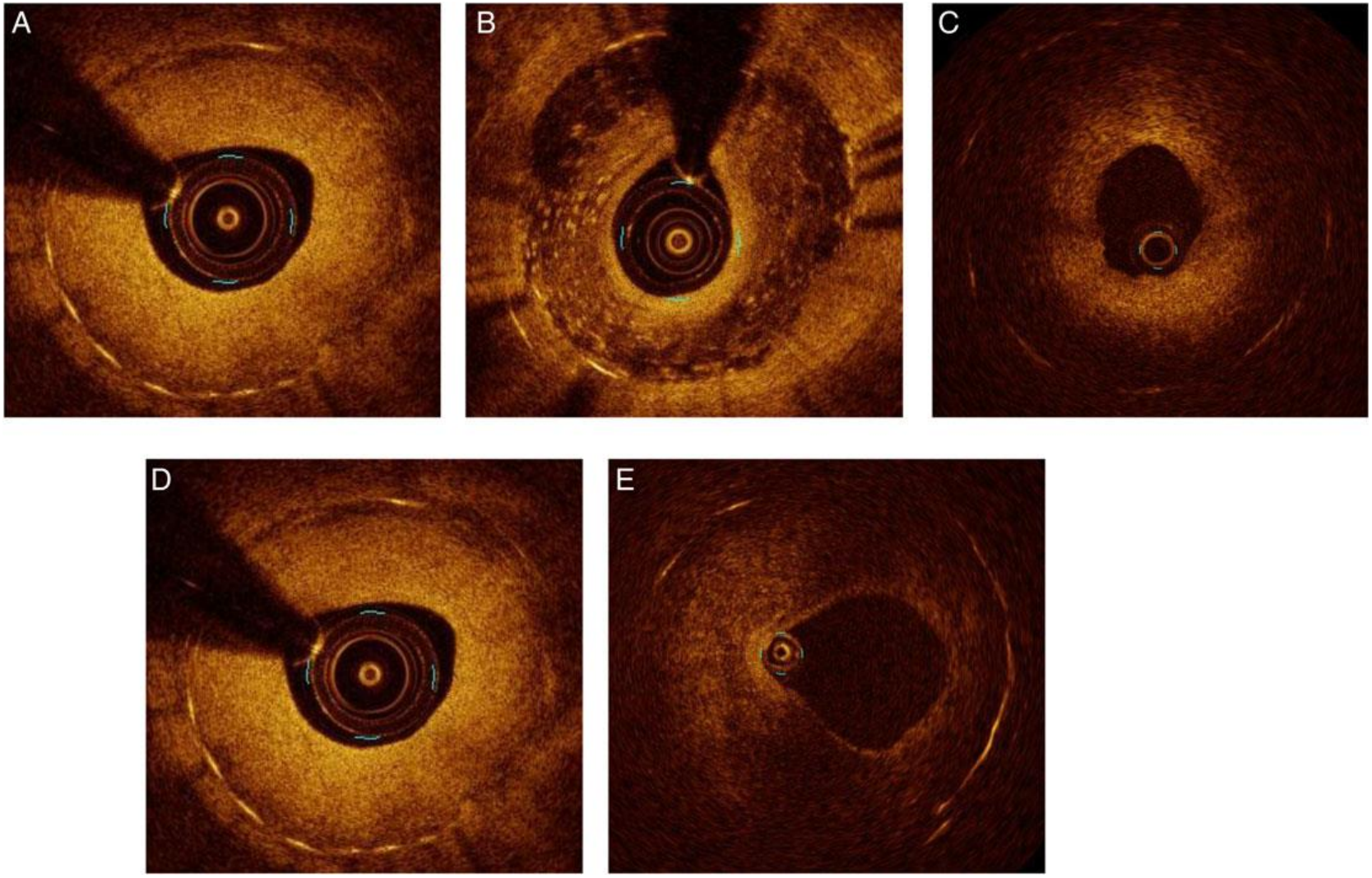
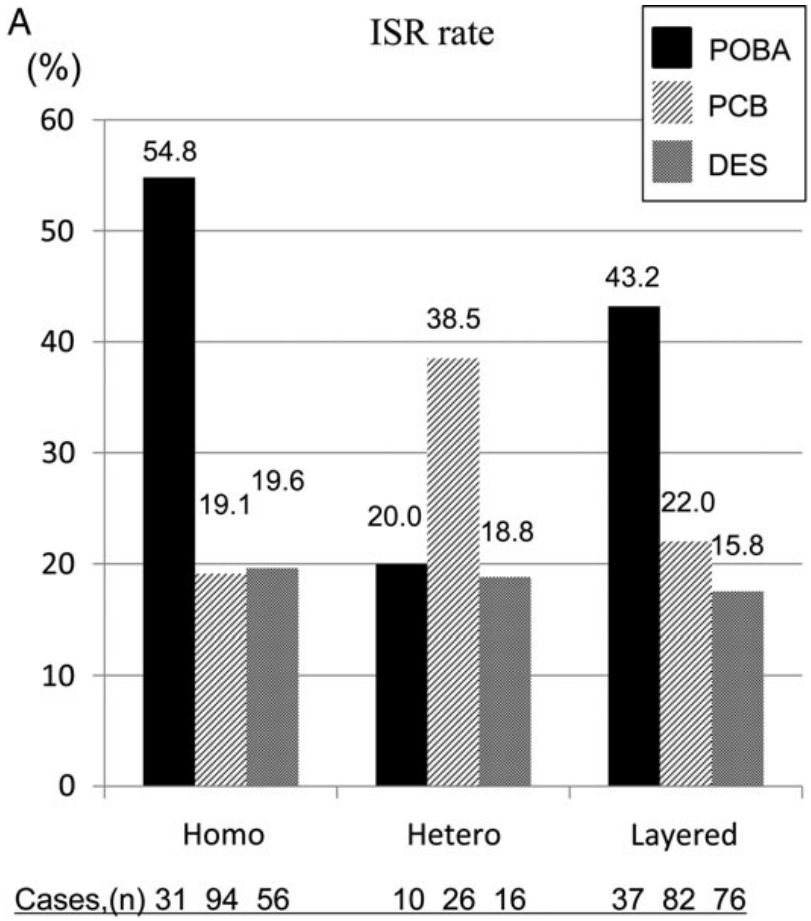
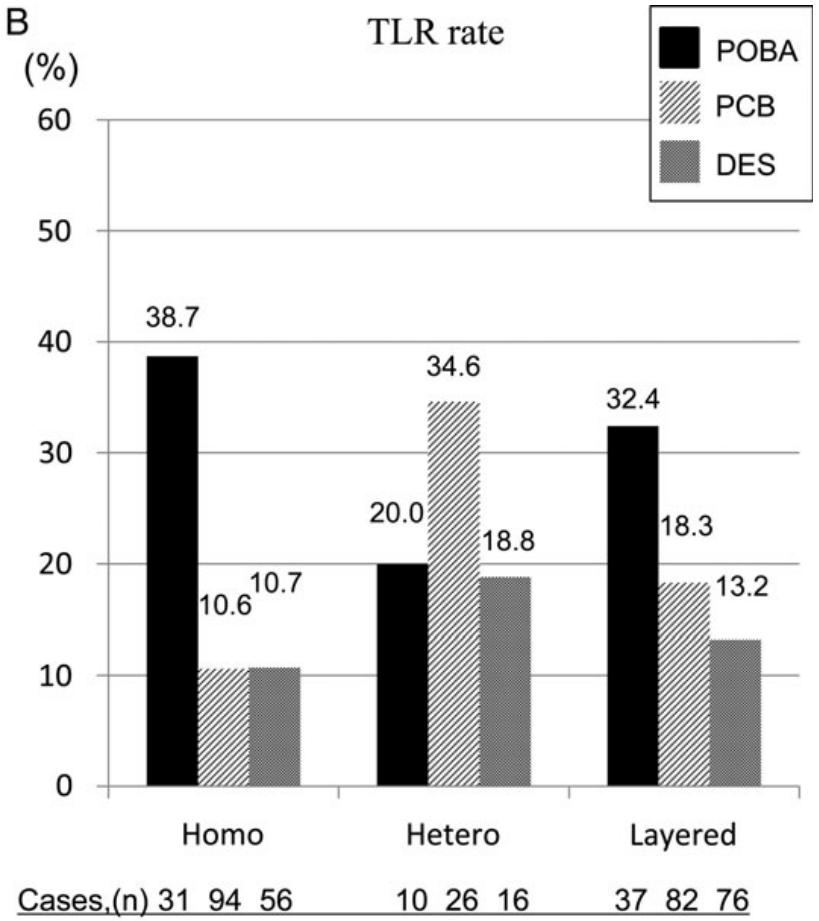


Figure 2 Representative cases with each tissue morphologies assessed with optical coherence tomography. (*A*–*C*) Restenotic tissue structure. (*A*) Homogeneous type; (*B*) Heterogeneous type; and (*C*) Layered type. (*D* and *E*) Restenotic tissue backscatter. (*D*) High type and (*E*) Low type.

(Tada T, et al. EHJCVImg 2015;16:1101-11)

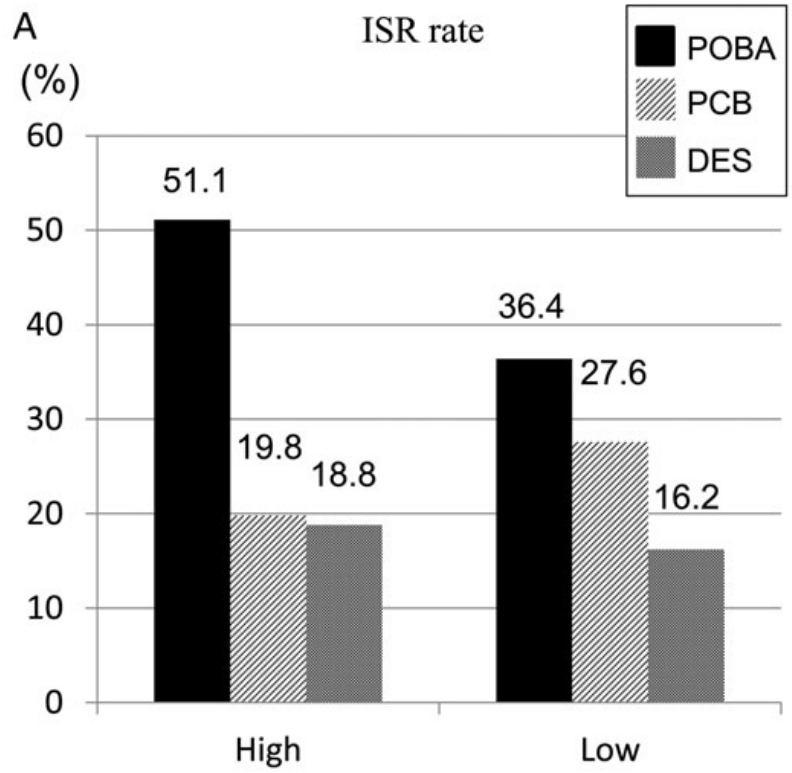


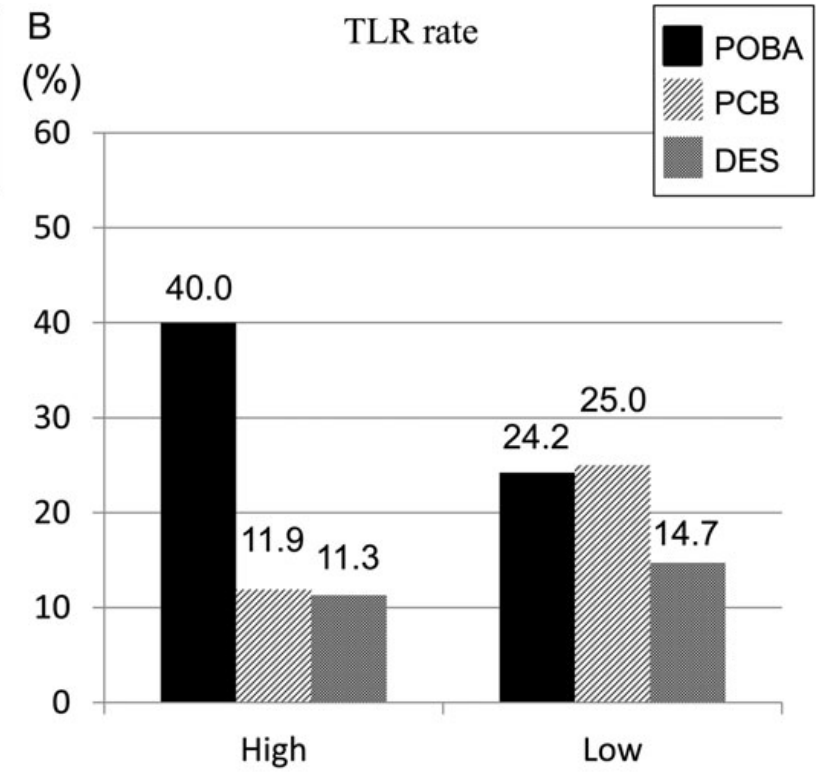


p value	Homo	Hetero	Layered
POBA vs. PCB	<0.001	0.438	0.027
POBA vs. DES	0.002	1.000	0.002
PCB vs. DES	1.000	0.303	0.417

p value	Homo	Hetero	Layered
POBA vs. PCB	<0.001	0.688	0.102
POBA vs. DES	0.005	1.000	0.022
PCB vs. DES	1.000	0.316	0.394

(Tada T, et al. EHJCVImg 2015;16:1101-11)

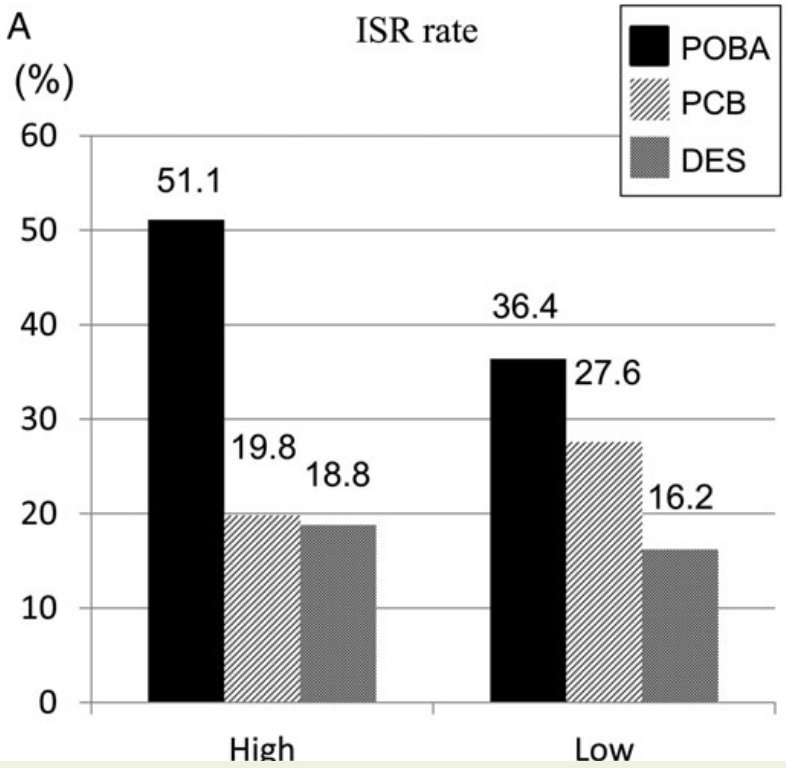


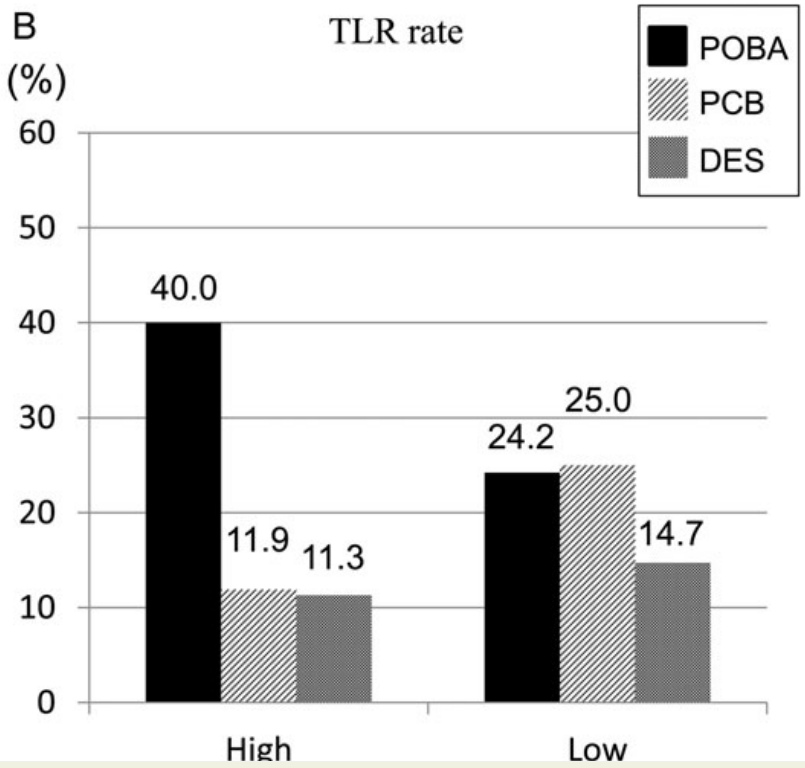


p value	High	Low
POBA vs. PCB	<0.001	0.373
POBA vs. DES	<0.001	0.041
PCB vs. DES	1.000	0.112

p value	High	Low
POBA vs. PCB	<0.001	1.000
POBA vs. DES	<0.001	0.274
PCB vs. DES	1.000	0.148

(Tada T, et al. EHJCVImg 2015;16:1101-11)





Conclusion

Morphological assessment of ISR tissue using OCT might suggest favourable types of PCI for ISR lesions.

p value	High	Low
POBA vs. PCB	<0.001	0.373
POBA vs. DES	<0.001	0.041
PCB vs. DES	1.000	0.112

p value	High	Low
POBA vs. PCB	<0.001	1.000
POBA vs. DES	<0.001	0.274
PCB vs. DES	1.000	0.148

(Tada T, et al. EHJCVImg 2015;16:1101-11)

Neointima Debulking
ELCA vs. Rtb

Treatment of In-Stent Restenosis With Excimer Laser Coronary Angioplasty Versus Rotational Atherectomy

Comparative Mechanisms and Results

Roxana Mehran, MD; George Dangas, MD, PhD; Gary S. Mintz, MD; Ron Waksman, MD; Alexandre Abizaid, MD; Lowell F. Satler, MD; Augusto D. Pichard, MD; Kenneth M. Kent, MD, PhD; Alexandra J. Lansky, MD; Gregg W. Stone, MD; Martin B. Leon, MD

Background—Atheroablation yields improved clinical results for balloon angioplasty (percutaneous transluminal coronary angioplasty, PTCA) in the treatment of diffuse in-stent restenosis (ISR).

Methods and Results—We compared the mechanisms and clinical results of excimer laser coronary angioplasty (ELCA) versus rotational atherectomy (RA), both followed by adjunct PTCA; 119 patients (158 ISR lesions) were treated with ELCA+PTCA and 130 patients (161 ISR lesions) were treated with RA+PTCA. Quantitative coronary angiographic and planar intravascular ultrasound (IVUS) measurements were performed routinely. In addition, volumetric IVUS analysis to compare the mechanisms of lumen enlargement was performed in 28 patients with 30 lesions (16 ELCA+PTCA, 14 RA+PTCA). There were no significant between-group differences in preintervention or final postintervention quantitative coronary angiographic or planar IVUS measurements of luminal dimensions. Angiographic success and major in-hospital complications with the 2 techniques were also similar. Volumetric IVUS analysis showed significantly greater reduction in intimal hyperplasia volume after RA than after ELCA (43 ± 14 versus 19 ± 10 mm^3, $P<0.001$) because of a significantly higher ablation efficiency ($90\pm10\%$ versus $76\pm12\%$, $P=0.004$). However, both interventional strategies had similar long-term clinical outcome; 1-year target lesion revascularization rate was 26% with ELCA+PTCA versus 28% with RA+PTCA (P=NS).

Conclusions—Despite certain differences in the mechanisms of lumen enlargement, both ELCA+PTCA and RA+PTCA can be used to treat diffuse ISR with similar clinical results. (***Circulation***. **2000;101:2484-2489.**)

Key Words: stents ■ restenosis ■ lasers ■ ablation ■ angioplasty ■ revascularization

Neointimal Debulking for ISR

TABLE 4. Volumetric IVUS Results

	ELCA+PTCA	RA+PTCA	*P*
No. of lesions	16	14	
Before intervention			
IH length, mm	17.1±10.4	19.5±11.9	NS
Stent volume, mm^3	140±25	148±30	NS
Lumen volume, mm^3	44±18	31±25	NS
IH volume, mm^3	96±23	123±33	NS
After atheroablation			
Stent volume, mm^3	140±25	148±29	NS
Lumen volume, mm^3	63±14*	72±13*	NS
IH volume, mm^3	77±20*	79±25*	NS
Change post−pre			
Change in stent volume, mm^3	0.5±0.2	0.5±0.3	NS
Change in lumen volume, mm^3	18±9	41±15	<0.001
Change in IH volume, mm^3	19±10	43±14	<0.001
Ablation efficiency, %	77±12	90±10	0.004
After adjunct PTCA			
Stent volume, mm^3	166±26†	174±23†	NS
Lumen volume, mm^3	114±26†	121±14†	NS
IH volume, mm^3	55±11†	52±9†	NS
Changes final−post			
Change in stent volume, mm^3	28±11	26±10	0.06
Change in lumen volume, mm^3	51±13	50±12	NS
Change in IH volume, mm^3	22±10	26±11	NS
Changes final−pre			
Change in stent volume, mm^3	28±11	26±8	NS
Change in lumen volume, mm^3	70±15	91±14	0.06
Change in IH volume, mm^3	40±13	71±15	0.001

(*Circulation*. 2000;101:2484-2489.)

Neointimal Debulking for ISR

TABLE 5. One-Year Follow-Up Results

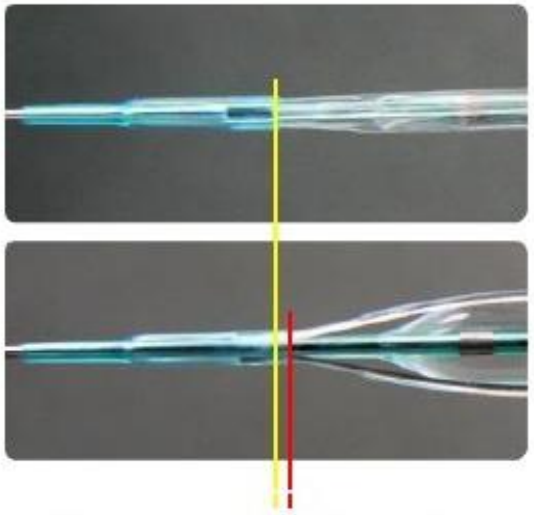
	ELCA+PTCA	RA+PTCA	*P*
Patients/lesions, n	119/158	130/161	
Death	10 (8)	6 (5)	NS
Q-wave myocardial infarction	1 (1)	2 (2)	NS
Repeat percutaneous intervention	38 (24)	42 (26)	NS
Coronary bypass surgery	5 (3)	3 (2)	NS
Overall target lesion revascularization	41 (26)	45 (28)	NS

Variables are n (%).

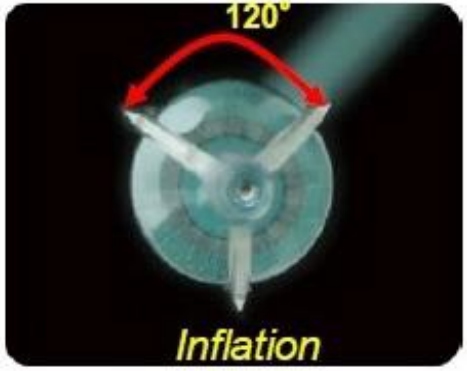
(*Circulation*. 2000;101:2484-2489.)

Lacrosse NSE

- The three elements are positioned 120 ° apart.
- The elements are attached proximally and distally only.
- The distal connection is designed to allow for movement during inflation and deflation.



The connection allows for flexibility during inflation.



(Ashida K, et al. Austin J Clin Cardiol 2014;1: 2)