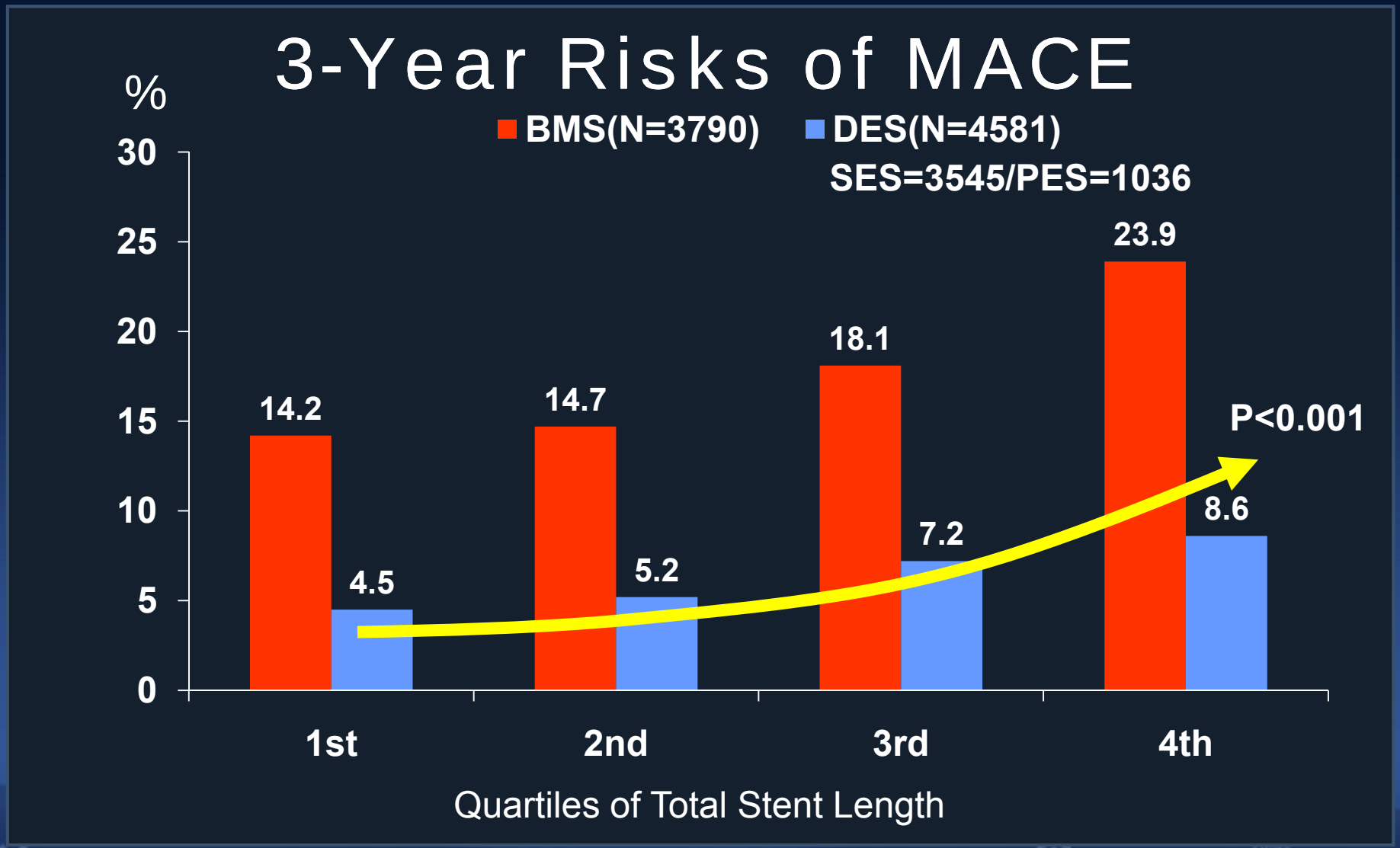
Long Lesion Treatment Lesson From Large Registry

IRIS-DES Registry

Jung-Min Ahn, MD.

University of Ulsan College of Medicine, Heart Institute, Asan Medical Center, Seoul, Korea

Long Lesion Outcomes In DES era

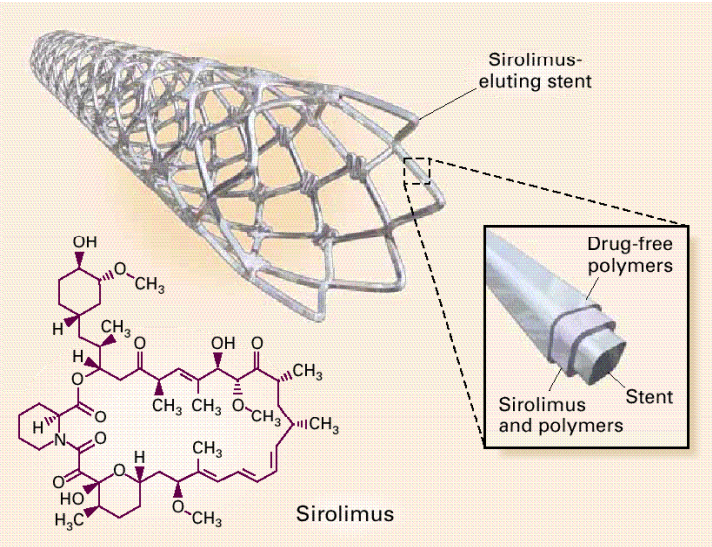


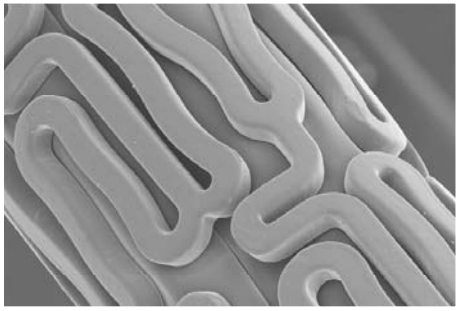
*Data from ASAN PCI registry (Year 1997-2006)

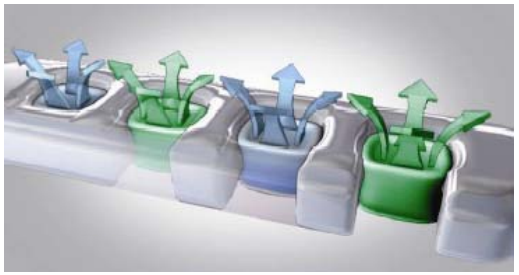
CardioVascular Research Foundation
UNIVERSITY OF ULSAN COLLEGE MEDICINE
ASAN Medical Center

Drug-Eluting Stents

2002	2004	2006	2008	2010
Cypher	Taxus (Liberte)	Pico Elite	Xience V	Xience Prime LL, SV
Taxus (Express)	Endeavor	Coroflex Please	Promus	Promus Element
			Endeavor	Resolute Integrity
			Resolute	Biomatrix
				Nobori
				Nevo
				Genous







Evaluation of Effectiveness and Safety of the First, Second, and New Drug-Eluting Stents in Routine Clinical Practice;

IRIS-DES Registry

Consecutive PCI patients receiving New DES without a mixture of other DES

Prospective Enrollment

DESSIAN Registry	K-XIENCE Registry	IRIS-ELEMENT Registry	IRIS-NOBORI Registry	IRIS-BIOMATRIX Registry	IRIS-GENOUS Registry	IRIS-PRIME Registry	IRIS-RESOLUTE Registry	IRIS-CILOTAX Registry
CYPHER (N=3,600)	XIENCE (N=3,000)	PROMUS ELEMENT (N=3,000)	NOBORI (N=2,000)	BIOMATRIX (N=1,000)	GENOUS STEMI (N=1,000)	XIENCE-PRIME (N=2,000)	RESOLUTE INTEGRITY (N=1,000)	CILOTAX (N=1,000)

Clinical follow-up at 1-, 6-, and 12-months, and annually up to 5 years

*Primary end point: Composite of Death, MI, and TVR at 12-months

CardioVascular Research Foundation

UNIVERSITY OF ULSAN COLLEGE MEDICINE

ASAN Medical Center

Evaluation of Effectiveness and Safety of the First, Second, and New Drug-Eluting Stents in Routine Clinical Practice;

IRIS-DES Registry

A total of ***6,166*** Consecutive PCI patients receiving New DES without a mixture of other DES

Prospective Enrollment Between April 1, 2008, and June 30, 2010

DESSIAN Registry

Cypher Select (N=3,081)

K-XIENCE Registry

XIENCE V (N=3,085)

Clinical follow-up at 1-, 6-, and 12-months, and annually up to 5 years

*Primary end point: Composite of Death, MI, and TVR at 12-months

IRIS-DES Registry

Inclusion Criteria

- Patients receiving Cypher or Xience stents
- ***No limitation of clinical or lesion characteristics***
- Agreement to the study protocol and informed consent

Limited Exclusion Criteria

- Patients with a mixture of other DESs
- Terminal illness with life expectancy < 1 year
- Patients with cardiogenic shock

Study Outcomes

Primary End Points

- Major cardiac adverse events (MACE); a composite of death, non-fatal MI, or TVR at 12 months post procedure

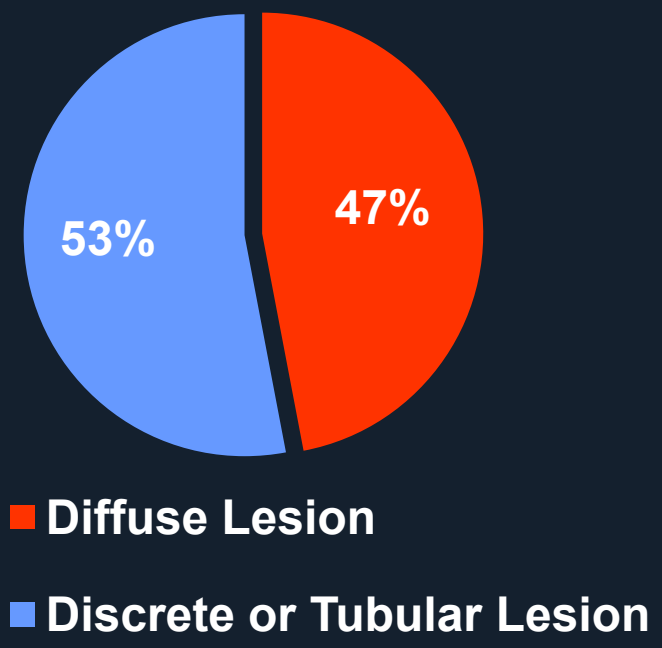
Secondary End Points

- Death
- MI
- Composite of death or MI
- TVR
- Stent thrombosis (ARC criteria)
- Procedural success

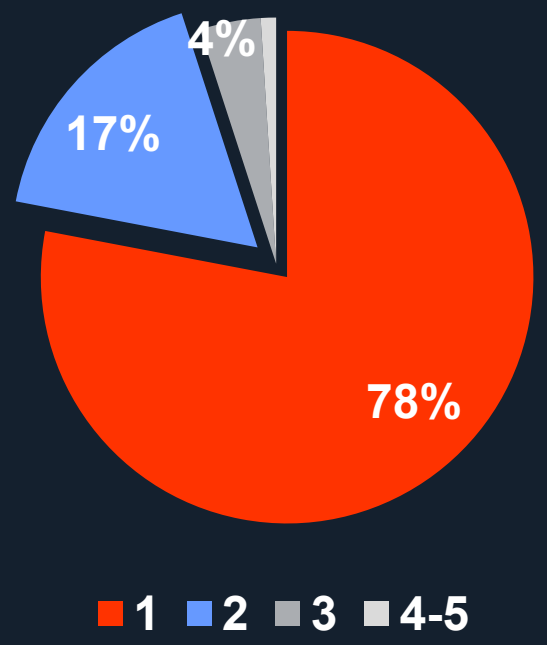
Incidence

6166 patients 8823 lesions

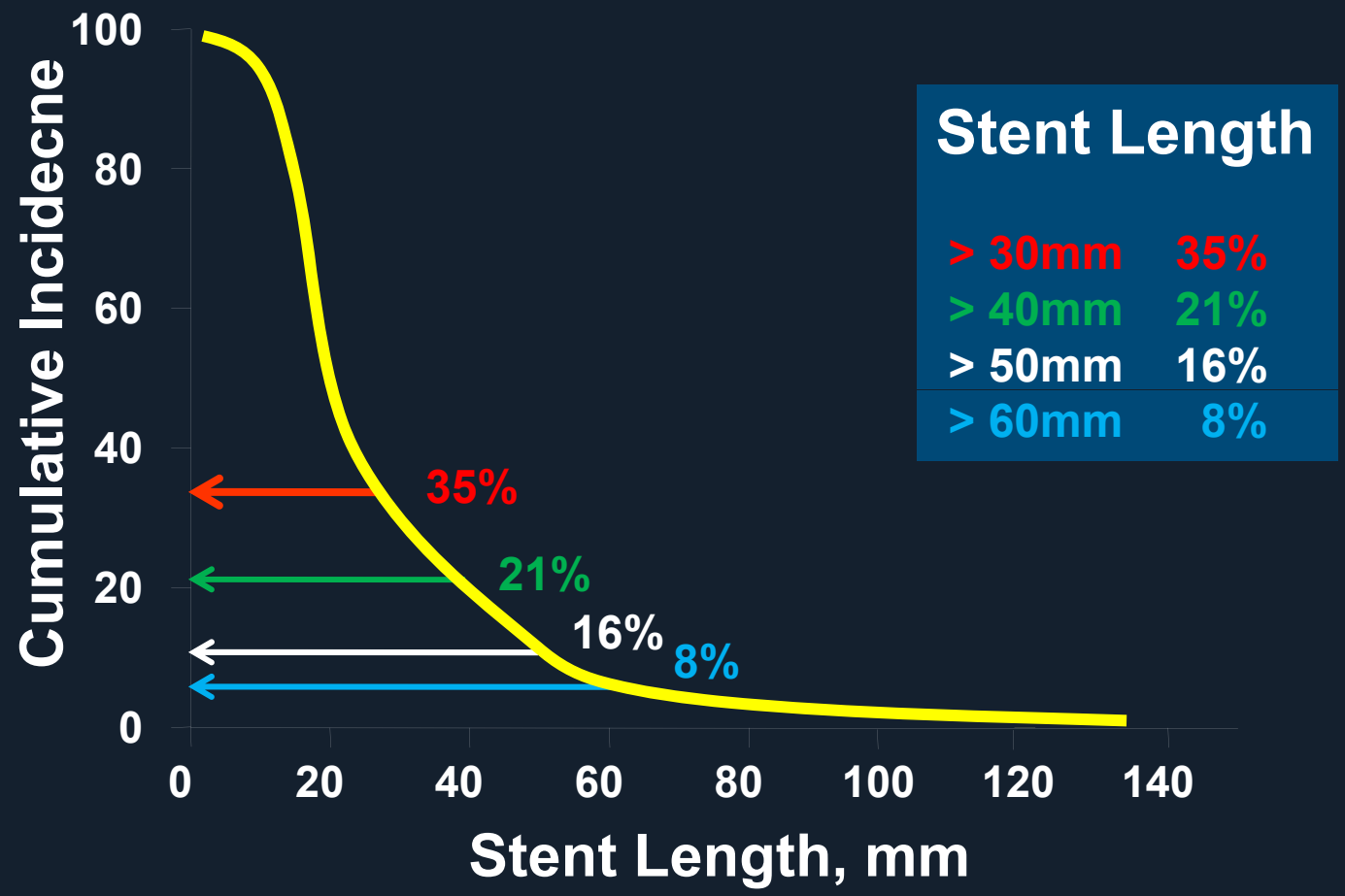
Lesion Length



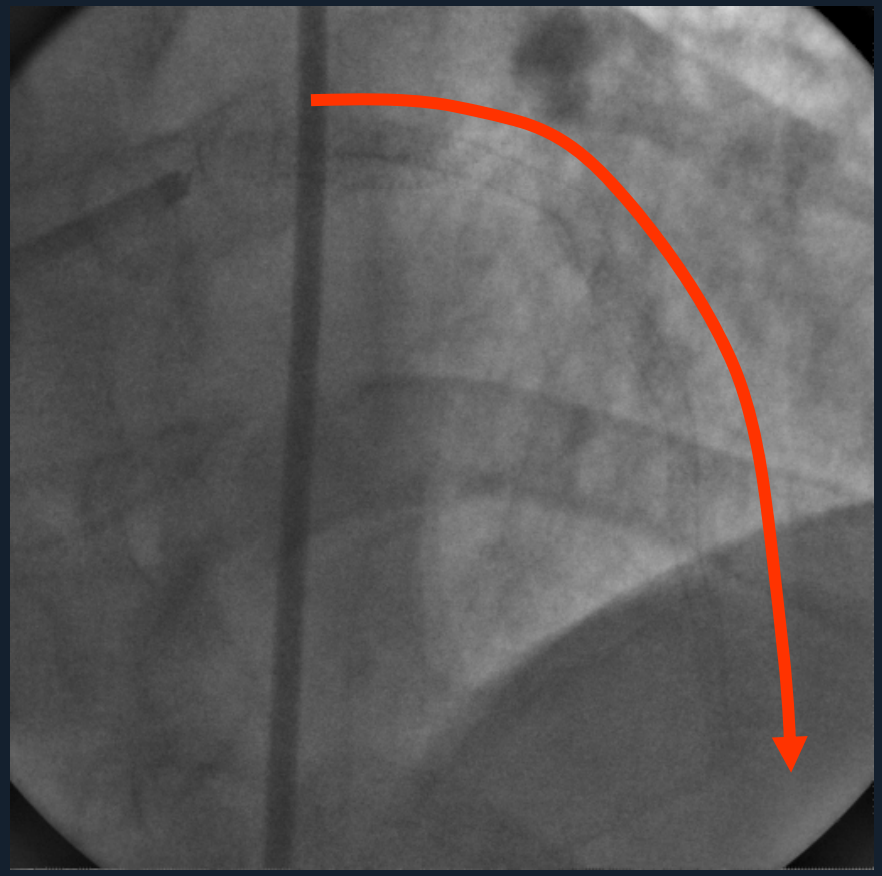
Number of Stent/Lesion



Distribution of Stent Length

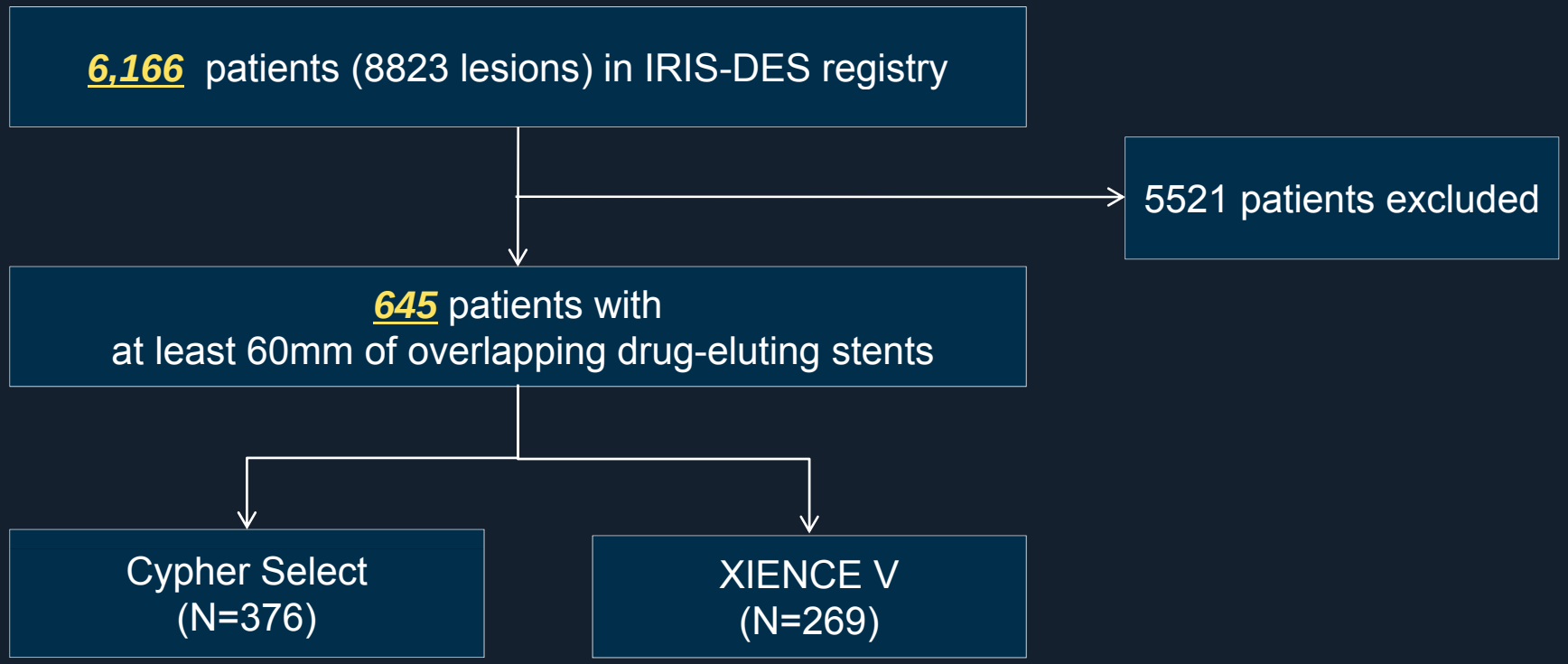


Diffuse Long Lesion



"Full Metal Jacket"

- ≥ 60mm of overlapping stent length



"Full Metal Jacket"

Primary Endpoints: MACE

- Death, MI (Peri-procedural or Spontaneous) or TVR

Secondary Endpoints

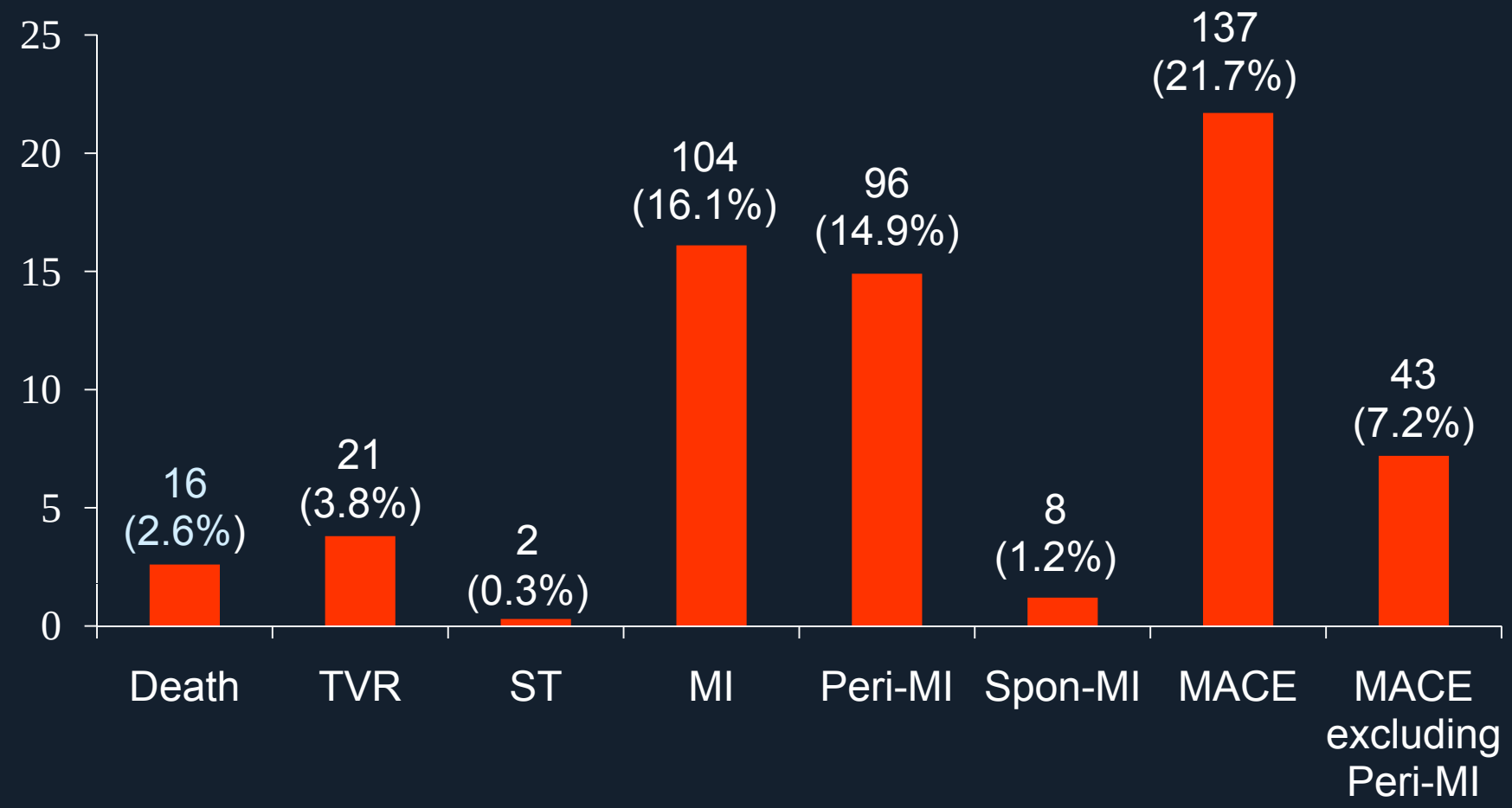
- Death
- MI
  - Peri-procedural MI: new QMI or CKMB/TnI > 3 times UNL
  - Spontaneous MI: any enzyme elevation
- TVR
- Stent thrombosis

"Full Metal Jacket"

Characteristics	All (N=645)	EES (N=269)	SES (N=376)	P value
Age	63.7±10.1	65.5±9.6	62.3±10.2	<0.001
Male sex	470 (30.9)	199 (74.0)	271 (72.1)	0.65
Diabetes mellitus	262 (40.6)	116 (43.1)	146 (38.8)	0.29
Hypertension	410 (63.6)	179 (66.5)	231 (61.4)	0.21
Hyperlipidemia	345 (53.5)	149 (55.4)	196 (52.1)	0.42
Current smoker	170 (26.4)	62 (23.0)	108 (28.7)	0.12
Total obstruction	140 (21.7)	57 (21.2)	83 (22.1)	0.85
Left main disease	136 (21.1)	86 (32.0)	50 (13.3)	<0.001
Bifurcation disease	389 (60.3)	192 (71.4)	197 (52.4)	<0.001
No. of stents per patient	3.5±1.2	4.0±1.2	3.1±1.1	<0.001
No. of stents at target lesion	2.7±0.7	3.1±0.5	2.4±0.6	<0.001
Stent length per patient, mm	95.3±29.4	101.1±30.9	91.2±27.5	<0.001
Stent length at target lesion, mm	76.3±14.8	80.4±14.3	73.4±14.4	<0.001
Intravascular ultrasound guidance	470 (72.9)	202 (75.1)	268 (71.3)	0.28

"Full Metal Jacket"

2-Year Clinical Outcomes in All Pts



"Full Metal Jacket"

Independent Predictors of Death/Spontaneous MI/TVR

Variables	Hazard Ratio	95% CI	P value
Peri-Myocardial Infarction	3.3	0.78 – 13.6	0.10
Previous CHF	7.15	2.73 – 18.7	<0.001
Previous CVA	3.34	1.59 – 7.03	0.001
Clinical presentation			0.029
Stable angina	Reference		
Unstable angina	1.09	0.51 – 2.29	0.831
NSTEMI	2.98	1.29 – 6.91	0.017
STEMI	3.17	1.17 – 8.56	0.023

“Full Metal Jacket”

2-Year MACE
SES versus EES

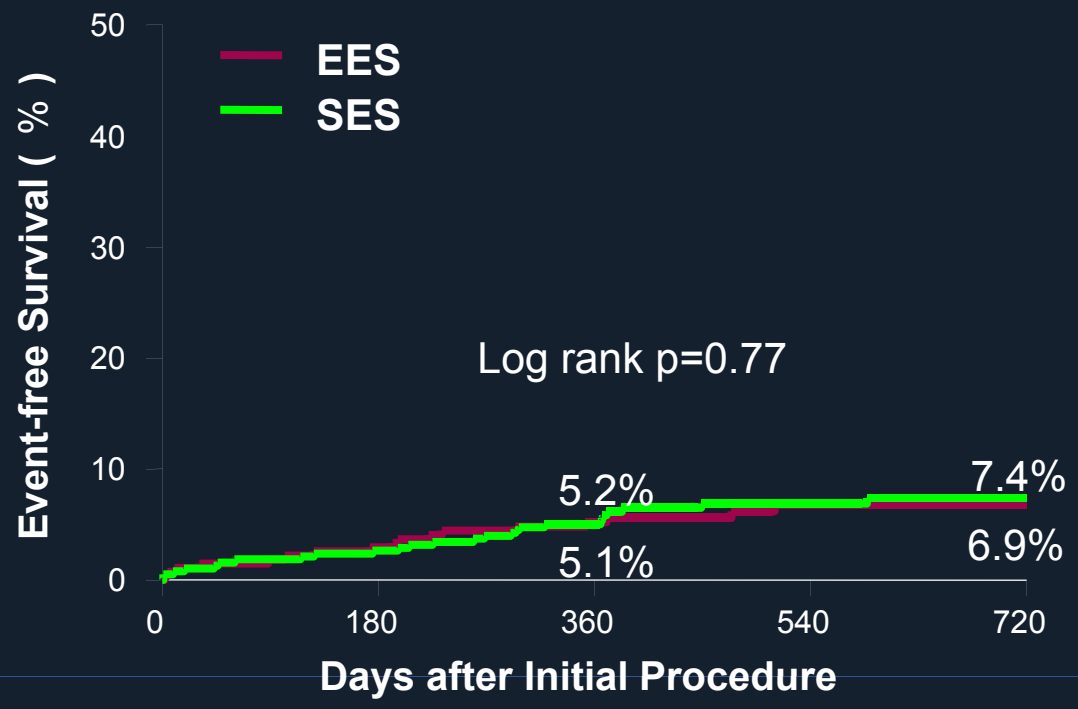
Characteristics	All (N=645)	EES (N=269)	SES (N=376)	P value
Left main disease	136 (21.1)	86 (32.0)	50 (13.3)	<0.001
Bifurcation disease	389 (60.3)	192 (71.4)	197 (52.4)	<0.001
No. of stents per patient	3.5±1.2	4.0±1.2	3.1±1.1	<0.001
No. of stents at target lesion	2.7±0.7	3.1±0.5	2.4±0.6	<0.001
Stent length per patient, mm	95.3±29.4	101.1±30.9	91.2±27.5	<0.001
Stent length at target lesion, mm	76.3±14.8	80.4±14.3	73.4±14.4	<0.001

0 180 360 540 720

Days after Initial Procedure

"Full Metal Jacket"

2-Year MACE excluding Peri-MI SES versus EES

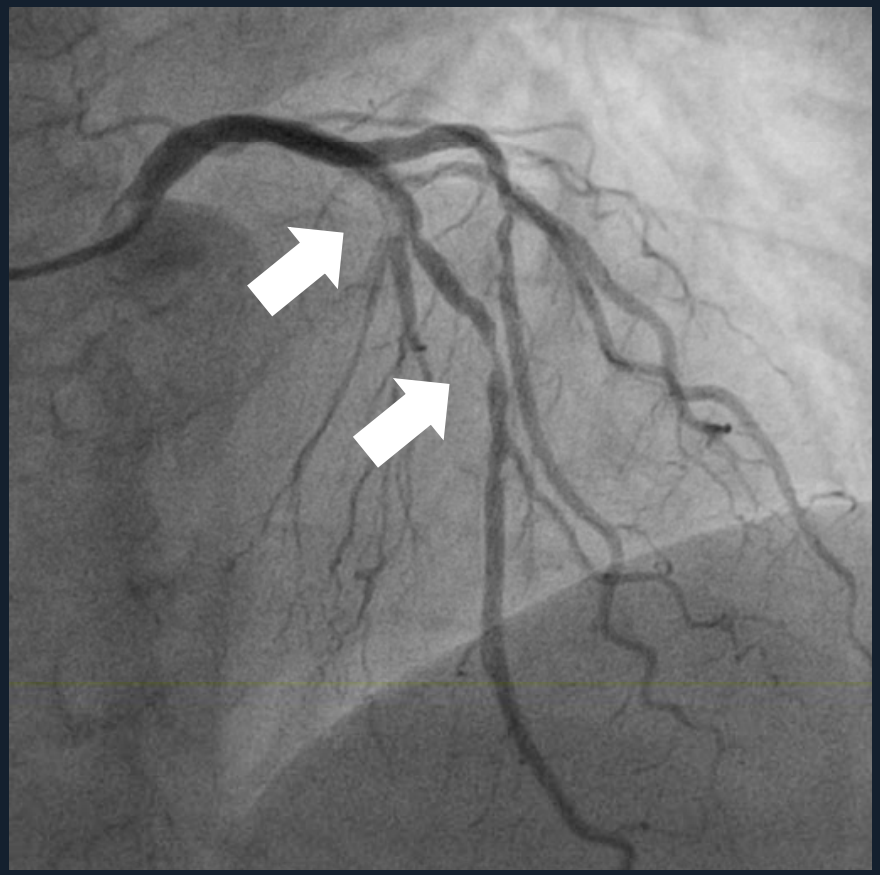


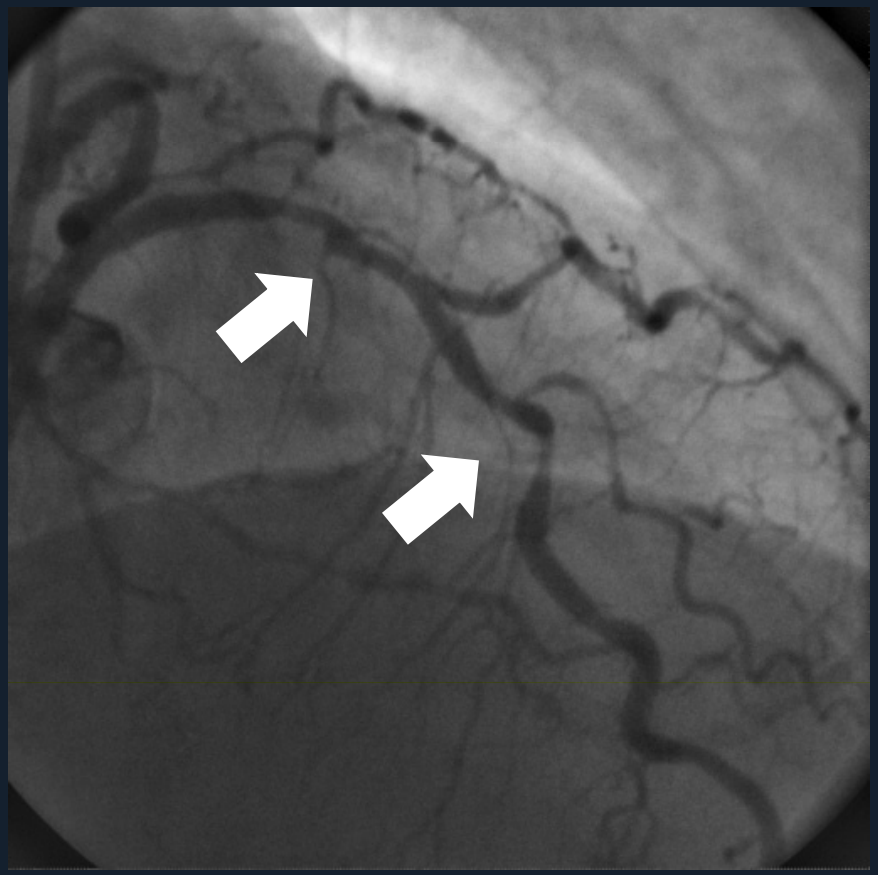
Summary

- For diffuse long coronary stenosis, very long stent implantation using contemporary drug eluting stents appears safe and effective
- Both SES and EES are equally safe and effective.
- However, peri-procedural MI was frequently occurred, but was not associated with hard clinical outcomes.

Coronary Tandem Lesions

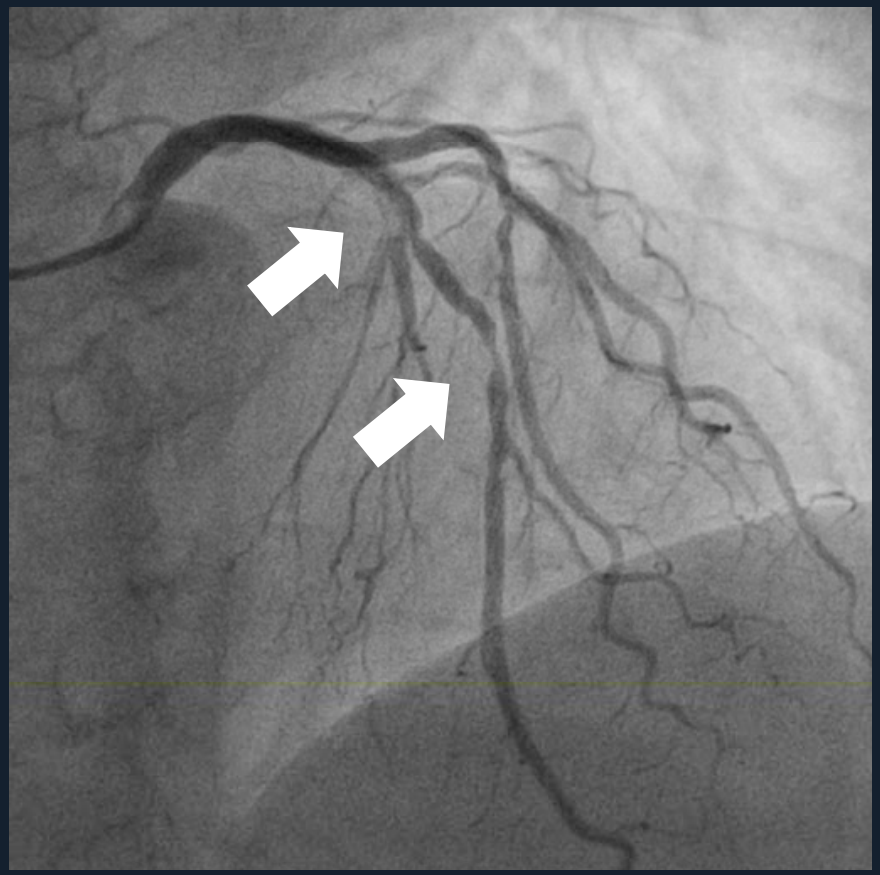
Multiple stenoses in series along one coronary artery

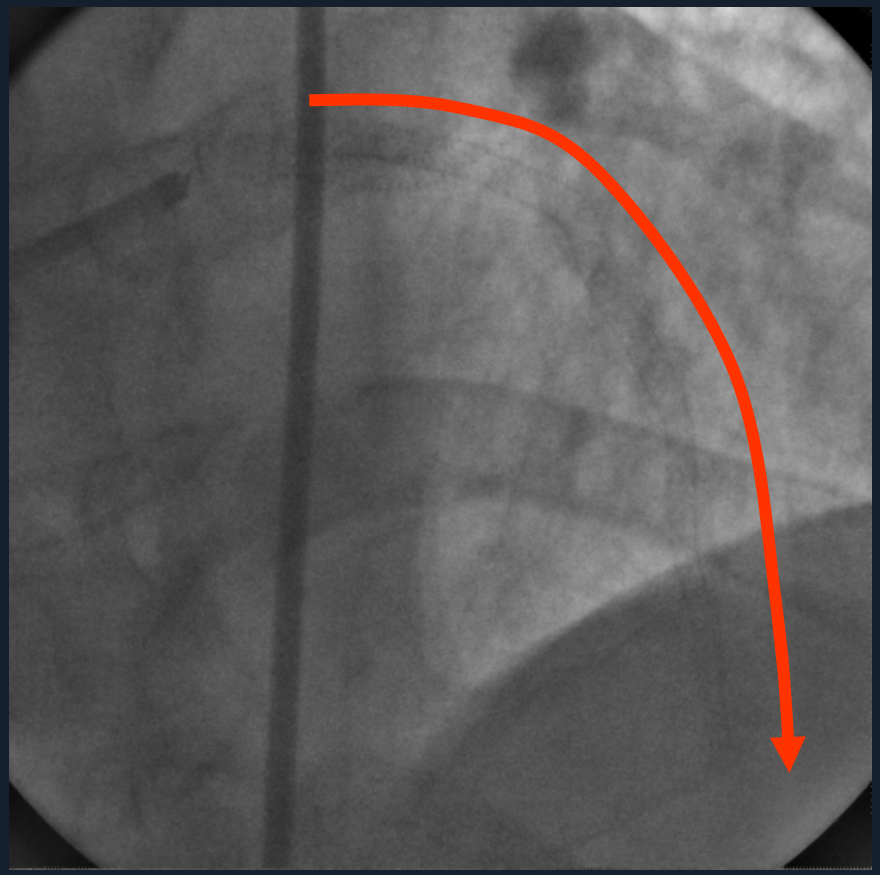




Coronary Tandem Lesions

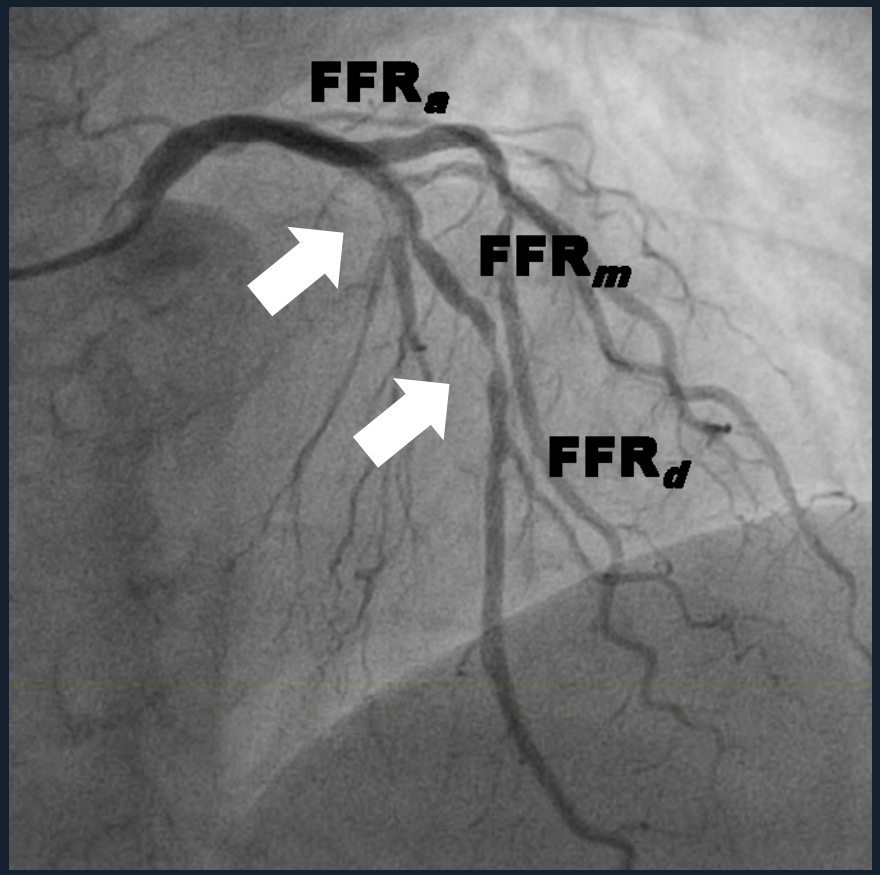
Multiple stenoses in series along one coronary artery





Coronary Tandem Lesions

Multiple stenoses in series along one coronary artery



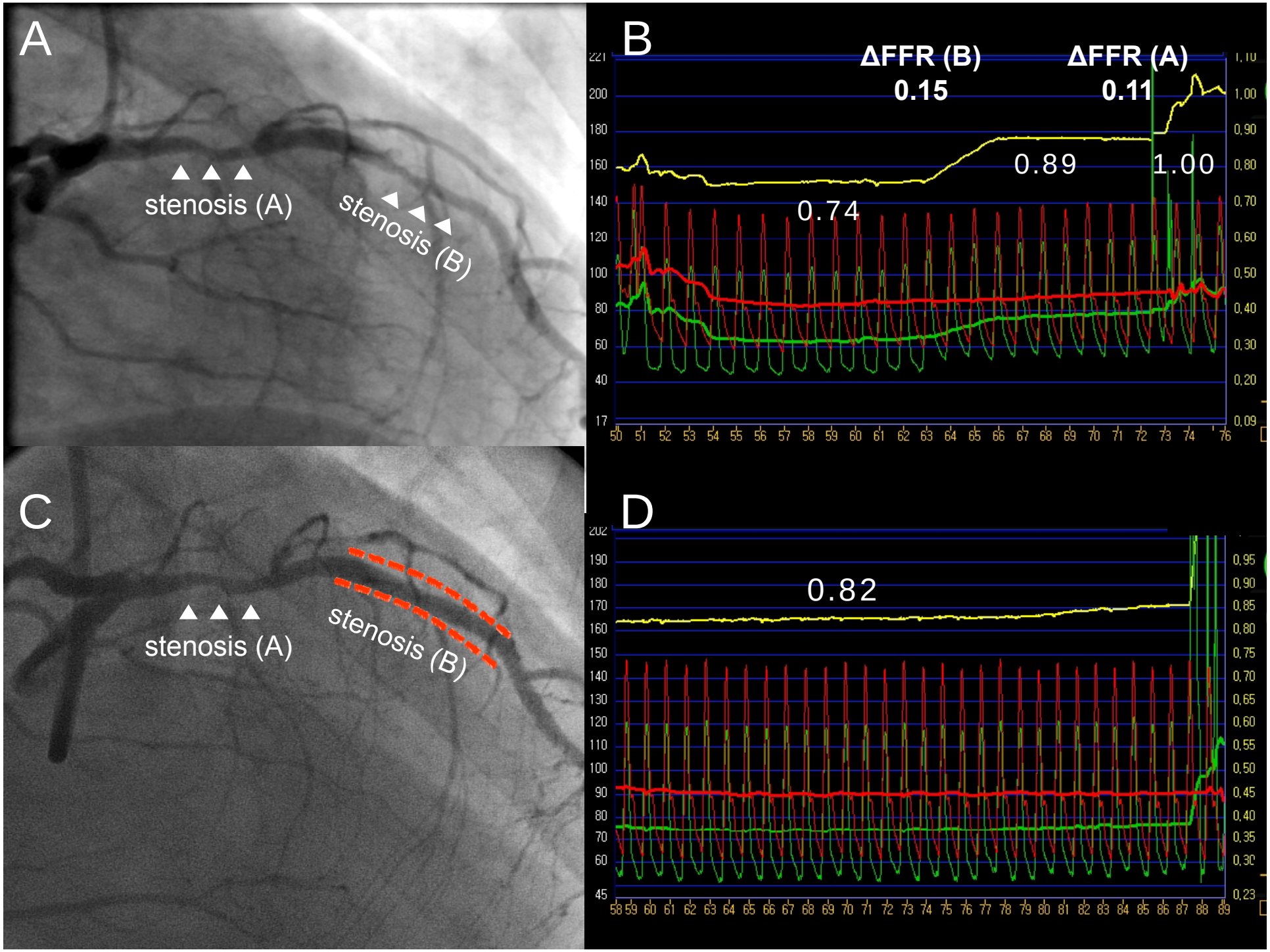
Rule of Big Delta

If FFRa-FFRm > FFRm-FFRd

→ **Proximal Lesion Tx First**

If FFRa-FFRm < FFRm-FFRd

→ **Distal Lesion Tx First**


A
stenosis (A)
stenosis (B)
B
ΔFFR (B)
0.15
ΔFFR (A)
0.11
0.89
1.00
0.74
C
stenosis (A)
stenosis (B)
D
0.82

According to the Rule of "Big Delta"

52 patients with coronary tandem lesion with FFR ≤0.80

↓

Prioritizing the treatment according to △FFR ("rule of big delta")

- 28 (53.8%) patients had only single-lesion Tx
- 28 (26.9%) lesions were deferred

Proximal stenosis treated only	Both stenoses treated	Distal stenosis treated only	Both stenoses treated
N=16	N=16	N=12	N=8

Park SJ Ahn JM et al JACC CI in Submission

Summary

- For functional lesion assessment of the coronary tandem lesions, ΔFFR is a useful index for determining the relative functional severity between the two stenoses.
- In this way, unnecessary stent implantation can be avoided with achieving favorable functional and clinical outcomes.

IVUS and Long Lesion

IVUS and Stent Length on Outcomes

- A single or overlapping stenting In *de novo* stenosis

6,166 patients in IRIS-DES registry

2922 patients excluded
- 2074 patients: multi-lesion /-vessel stenting
- 760 patients: Hx of PCI
- 58 patients: Hx of CABG
- 30 patients: ISR treatment

3,244 patients with a single or overlapping stenting In *de novo* coronary artery stenosis

Stent Length

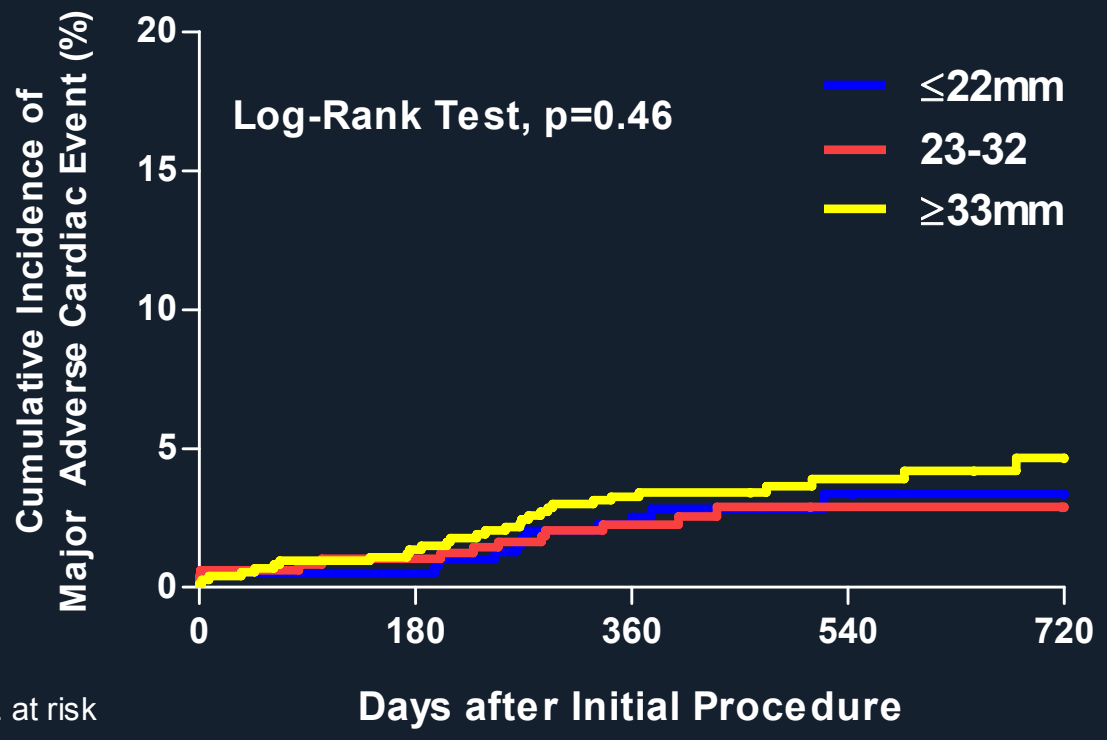
Characteristics	≤22mm (N=998)	23-32mm (N=1109)	≥33mm (N=1137)	P value
Age	62.6±10.9	62.7±11.1	63.5±10.8	0.12
Male sex	641 (64.2)	731 (65.9)	777 (68.3)	0.13
Diabetes mellitus	288 (28.9)	321 (28.9)	407 (35.8)	<0.001
Hypertension	586 (58.7)	652 (58.8)	697 (61.3)	0.37
Hyperlipidemia	336 (33.7)	375 (33.8)	482 (42.4)	<0.001
Current smoker	283 (28.4)	344 (31.0)	343 (30.2)	0.40
Total obstruction	99 (9.9)	164 (14.8)	157 (13.8)	0.002
Left main disease	49 (4.9)	25 (2.3)	100 (8.8)	<0.001
Bifurcation disease	139 (13.9)	195 (17.6)	496 (43.6)	<0.001
LVEF — %	60.6±10.2	59.4±10.2	58.9±9.4	<0.001
No. of stents per patient	1.00±0.03	1.02±0.13	1.83±0.77	<0.001
No. of stents at target lesion	16.8±2.0	25.3±2.5	49.5±18.4	<0.001
Stent length per patient, mm	3.24±0.45	3.21±0.43	3.13±0.31	<0.001
Intravascular ultrasound guidance	395 (39.6)	487 (43.9)	734 (64.6)	<0.001

IVUS Utilization

Characteristics	IVUS (N=1616)	No IVUS (N=1628)	P value
Age	61.6±10.6	64.3±11.1	<0.001
Male sex	1115 (69.0)	1034 (63.5)	0.001
Diabetes mellitus	500 (30.9)	516 (31.7)	0.64
Hypertension	916 (56.7)	1019 (62.6)	0.001
Hyperlipidemia	645 (39.9)	548 (33.7)	<0.001
Current smoker	492 (30.4)	478 (29.4)	0.50
Total obstruction	154 (9.5)	266 (16.3)	<0.001
Left main disease	148 (9.2)	26 (1.6)	<0.001
Bifurcation disease	568 (35.1)	262 (16.1)	<0.001
LVEF— %	59.9±8.9	59.3±10.9	0.07
No. of stents at target lesion	1.44±0.71	1.16±0.43	<0.001
Stent length per patient, mm	35.5±20.4	26.9±13.3	<0.001
Stent length at target lesion, mm	3.28±0.38	3.10±0.39	<0.001

IVUS Utilization Modify the Stent Length Effect On Clinical Outcomes

PCI with IVUS

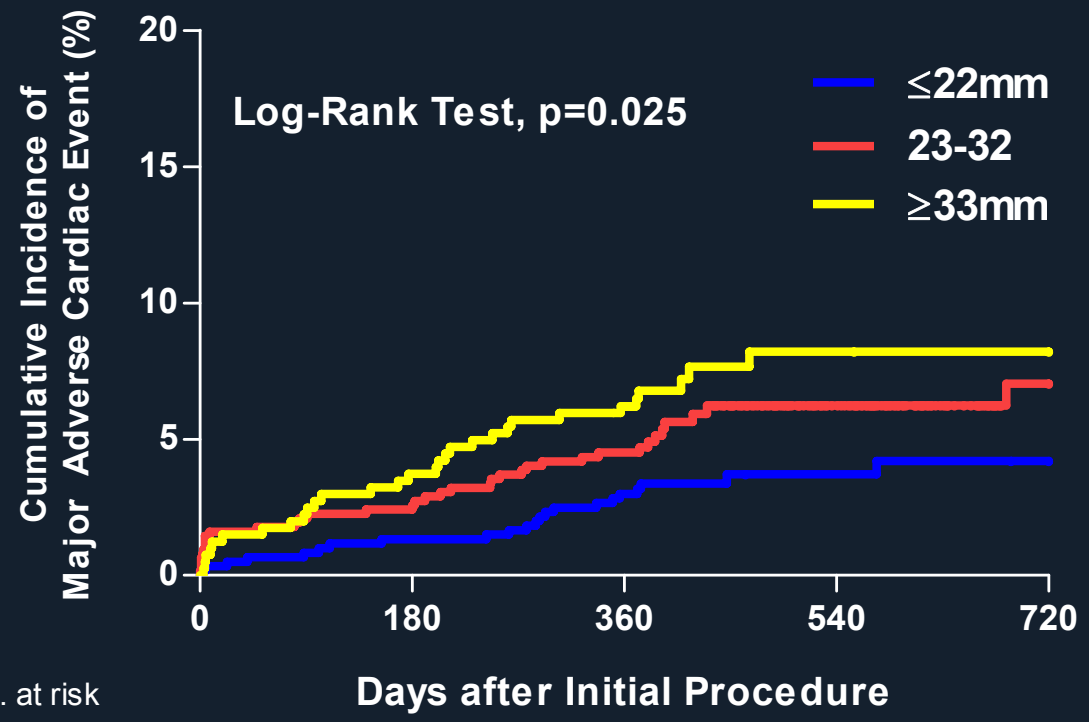


No. at risk					
≤22mm	395	393	386	169	55
23-32mm	487	482	476	221	72
≥33mm	734	724	709	355	116

Unpublished data from IRIS-DES Registry

IVUS Utilization Modify the Stent Length Effect On Clinical Outcomes

PCI without IVUS



No. at risk					
≤22mm	603	595	582	214	100
23-32mm	622	607	592	219	81
≥33mm	403	388	376	125	38

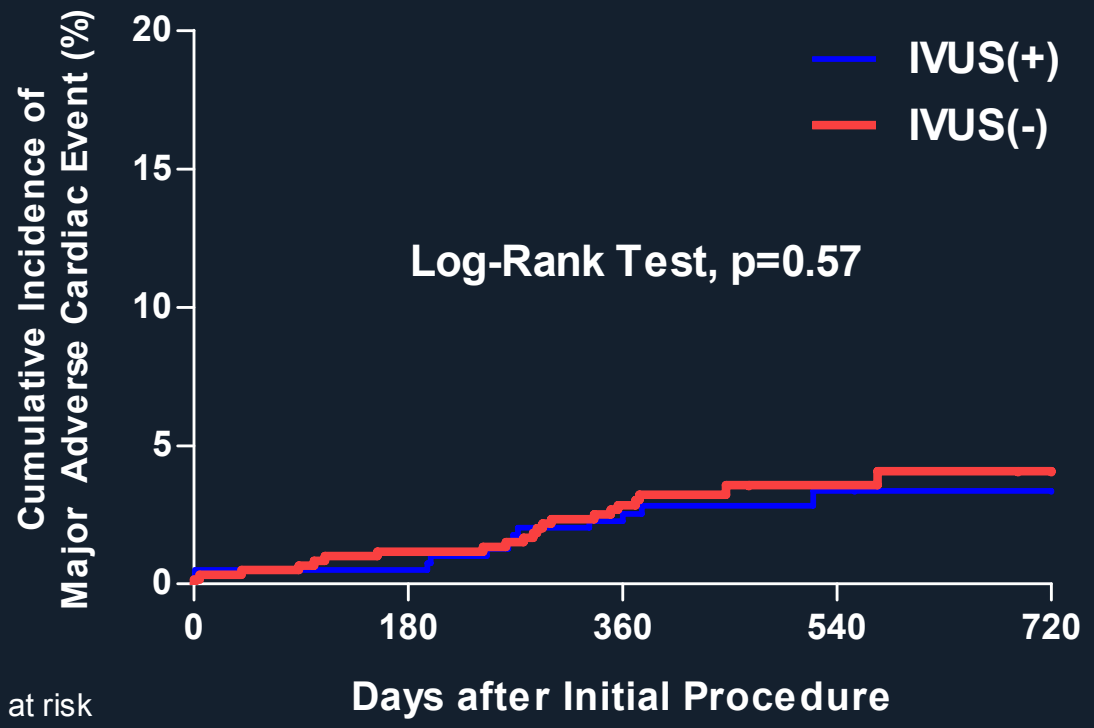
Unpublished data from IRIS-DES Registry

Adjusted Hazard Ratio for Clinical Outcomes

	IVUS (N=1616)		No IVUS (N=1628)	
	HR (95% CI)	P	HR (95% CI)	P
Death, MI, or TVR				
By 10-mm increase	1.08 (0.97-1.20)	0.16	1.13 (0.01-1.28)	0.042
Tertile				
≤22mm (N=998)	(reference)		(reference)	
23-32mm (N=1109)	0.89 (0.41-1.93)	0.77	1.62 (0.95-2.75)	0.075
≥33mm (N=1137)	1.05 (0.53-2.08)	0.89	1.98 (1.13-3.45)	0.017
Death or MI				
By 10-mm increase	1.11 (0.94-1.32)	0.22	1.18 (1.01-1.39)	0.035
Tertile				
≤22mm (N=998)	(reference)		(reference)	
23-32mm (N=1109)	1.03 (0.29-3.67)	0.96	2.08 (1.00-4.32)	0.051
≥33mm (N=1137)	1.52 (0.49-4.72)	0.47	2.96 (1.38-6.34)	0.005
TVR				
By 10-mm increase	1.10 (0.97-1.26)	0.15	1.13 (0.96-1.34)	0.14
Tertile				
≤22mm (N=998)	(reference)		(reference)	
23-32mm (N=1109)	0.81 (0.31-2.18)	0.69	1.33 (0.63-2.78)	0.46
≥33mm (N=1137)	0.88 (0.38-2.06)	0.77	1.50 (0.68-3.29)	0.32
ST, definite or probable				
By 10-mm increase	1.29 (0.66-2.52)	0.46	1.26 (0.94-1.68)	0.13
Tertile				
≤22mm (N=998)	(reference)		(reference)	
23-32mm (N=1109)	NA	NA	1.89 (0.30-11.97)	0.50
≥33mm (N=1137)	NA	NA	3.62 (0.63-20.69)	0.15

Different Impact of IVUS Utilization According to the Stent Length

Stent Length ≤22mm

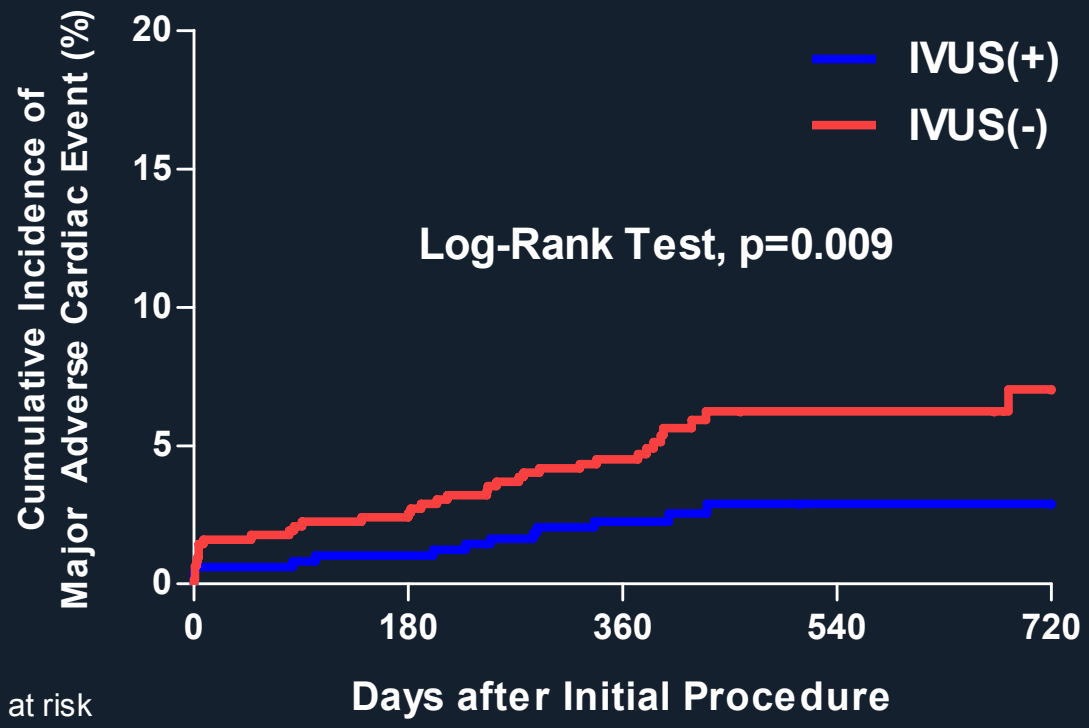


No. at risk					
IVUS(+)	395	393	386	169	55
IVUS(-)	603	595	582	214	100

Unpublished data from IRIS-DES Registry

Different Impact of IVUS Utilization According to the Stent Length

Stent Length 23-32mm

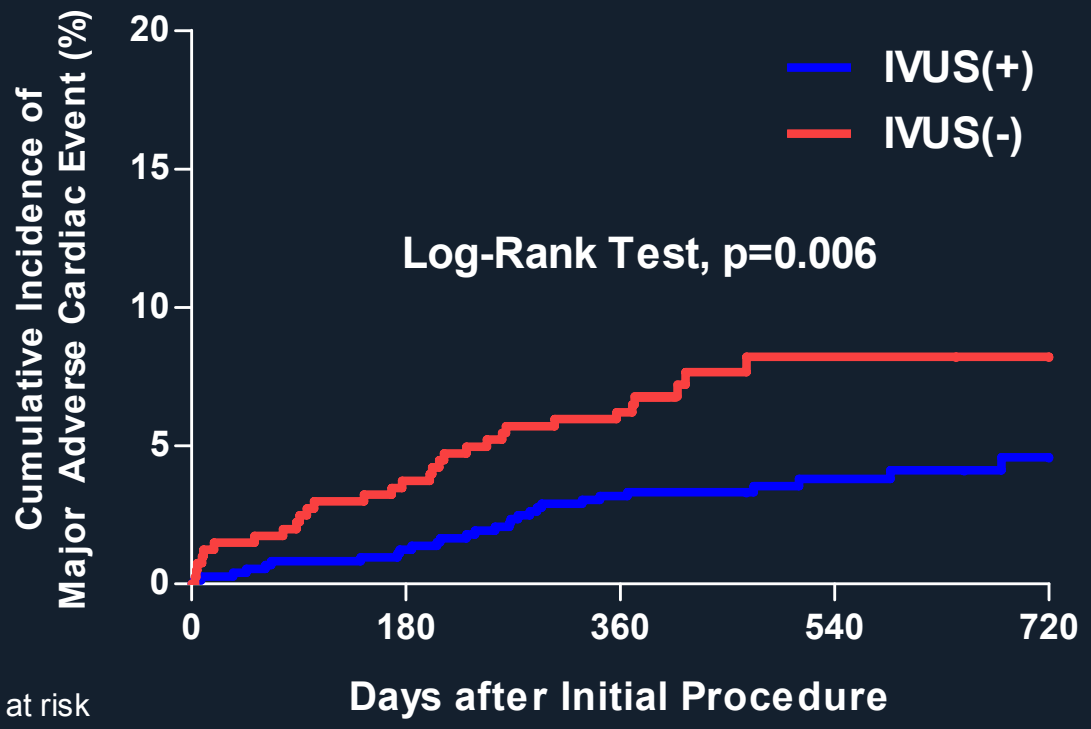


No. at risk					
IVUS(+)	487	482	476	221	72
IVUS(-)	622	607	592	219	81

Unpublished data from IRIS-DES Registry

Different Impact of IVUS Utilization According to the Stent Length

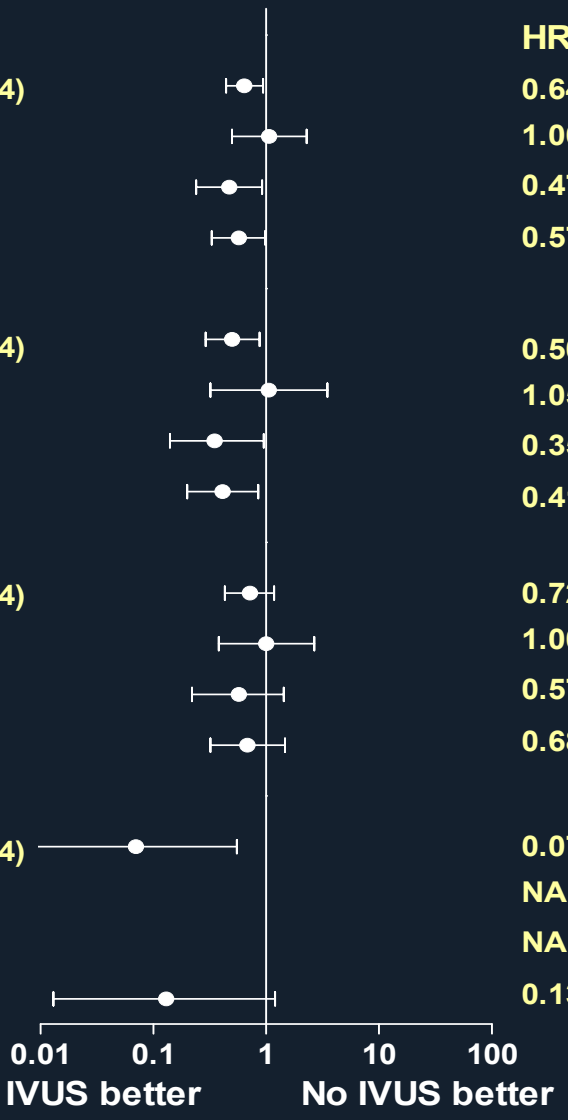
Stent Length ≥33mm



No. at risk					
IVUS(+)	734	724	709	355	116
IVUS(-)	403	388	376	125	38

Unpublished data from IRIS-DES Registry

Adjusted Hazard Ratio for Clinical Outcomes



	HR (95% CI)	P value
Death, MI, or TVR		
All Patients (N=3244)	0.64 (0.44-0.94)	0.021
≤ 22mm (N=998)	1.06 (0.50-2.28)	0.88
23-32mm (N=1109)	0.47 (0.24-0.92)	0.027
≥ 33mm (N=1137)	0.57 (0.33-0.98)	0.042
Death or MI		
All Patients (N=3244)	0.50 (0.29-0.87)	0.013
≤ 22mm (N=998)	1.05 (0.32-3.48)	0.94
23-32mm (N=1109)	0.35 (0.14-0.95)	0.038
≥ 33mm (N=1137)	0.41 (0.20-0.85)	0.017
TVR		
All Patients (N=3244)	0.72 (0.43-1.18)	0.19
≤ 22mm (N=998)	1.00 (0.38-2.67)	0.99
23-32mm (N=1109)	0.57 (0.22-1.43)	0.23
≥ 33mm (N=1137)	0.68 (0.32-1.47)	0.33
Stent thrombosis		
All Patients (N=3244)	0.07 (0.008-0.55)	0.012
≤ 22mm (N=998)	NA	NA
23-32mm (N=1109)	NA	NA
≥ 33mm (N=1137)	0.13 (0.013-1.20)	0.071

Unpublished data from IRIS-DES Registry

Conclusion

- In every day practice, long stent implantation for long coronary lesion was frequently performed.
- For diffuse long coronary stenosis, very long stent implantation using contemporary drug eluting stents appears safe and effective (2-year event rate: 7.2%).
- However, peri-procedural MI was frequently occurred (15%), but was not associated with hard clinical outcomes.

Conclusion

- When we used practical concept of ΔFFR in coronary tandem lesion, we can avoid the unnecessary stent implantation.

- IVUS utilization may attenuate the detrimental effect of the increase of implanted stent length, supporting the favor of IVUS utilization, particularly during PCI with the long stent implantation.