IVUS Guided LM Bifurcation Treatment

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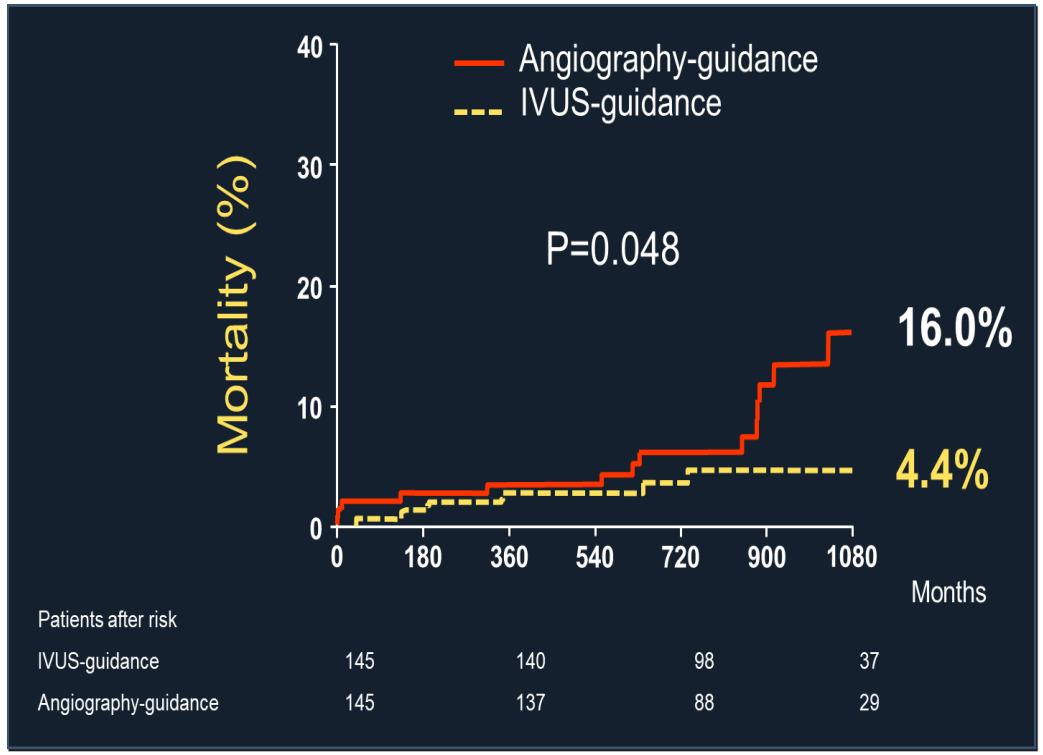
LM Bifurcation: What We Knew - Imaging

MAINCOMPARE Registry



Park SJ et al, Circulation Cardiovasc Interv. 2009;2(3):167-77

OCTOBER Trial

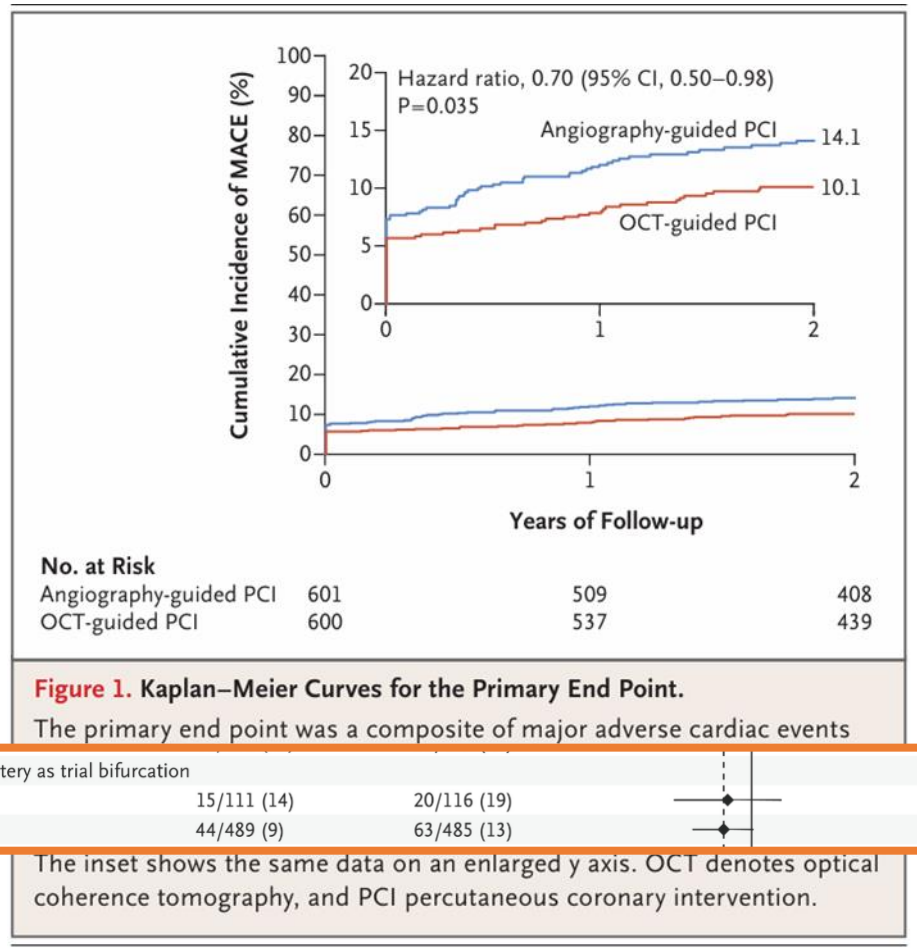


Figure 1. Kaplan–Meier Curves for the Primary End Point.

The primary end point was a composite of major adverse cardiac events

The inset shows the same data on an enlarged y axis. OCT denotes optical coherence tomography, and PCI percutaneous coronary intervention.

N.R. Holm et al. N Engl J Med 2023;389:1477-87

Guideline Recommendations on Imaging-Guidance for LM PCI

2024 ESC Guidelines for the Management of Chronic Coronary Syndromes

- Intracoronary imaging guidance by **IVUS** or **OCT** is recommended for performing PCI on anatomically complex lesions, in particular **left main stem**, true bifurcations and long lesions.

I **A**

- When ICA is indicated, IVUS should be considered to evaluate the severity of **intermediate stenoses of left main stem** prior to revascularization.

IIa **B**

Guideline Recommendations on Imaging-Guidance for LM PCI

2025 ACC/AHA Guidelines for the Management of Acute Coronary Syndromes

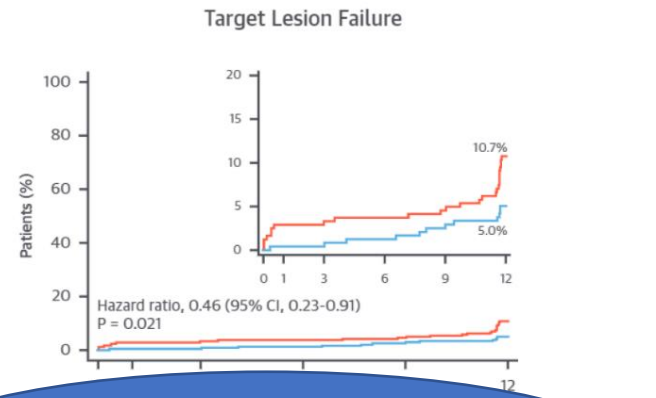
Recommendation for Use of Intracoronary Imaging Referenced studies that support recommendation are summarized in the Evidence Table.		
COR	**LOE**	**Recommendation**
1	**A**	1. In patients with ACS undergoing coronary stent implantation in left main artery or in complex lesions, intracoronary imaging with intravascular ultrasound (IVUS) or optical coherence tomography (OCT) is recommended for procedural guidance to reduce ischemic events.*[1–11]

*Adapted from the "2021 ACC/AHA/SCAI Guideline for Coronary Artery Revascularization."[12]

LM Bifurcation: What I Understand

Select LM Bifurcation Strategy Wisely

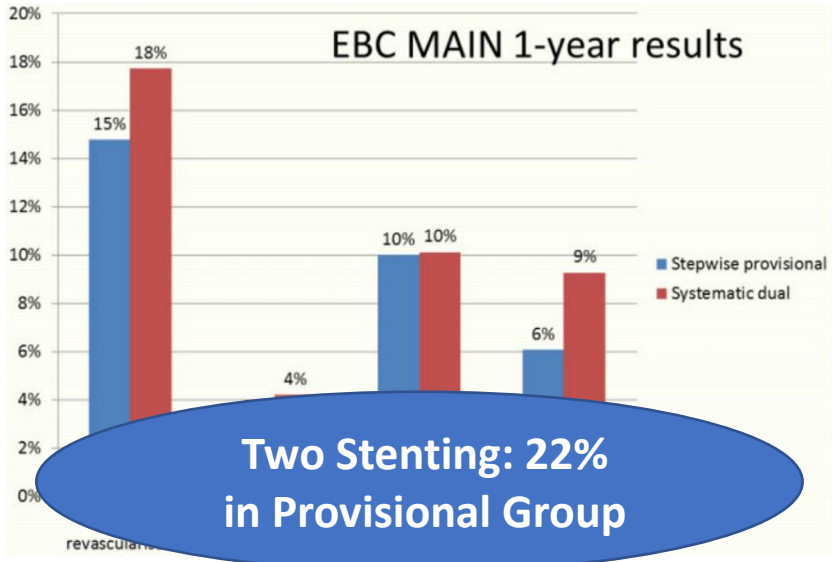
DK-CRUSH V Trial Favored DK-CRUSH



Two Stenting: 47%
in Provisional Group

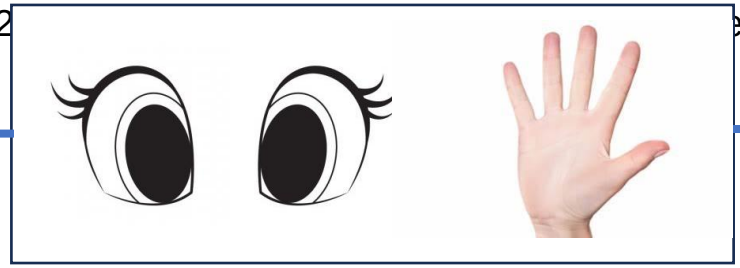
J Am Coll Cardiol 2017;70:2

EBC-MAIN Trial Favored One-Stenting



Two Stenting: 22%
in Provisional Group

eart Journal (2021) 42, 3829–3839

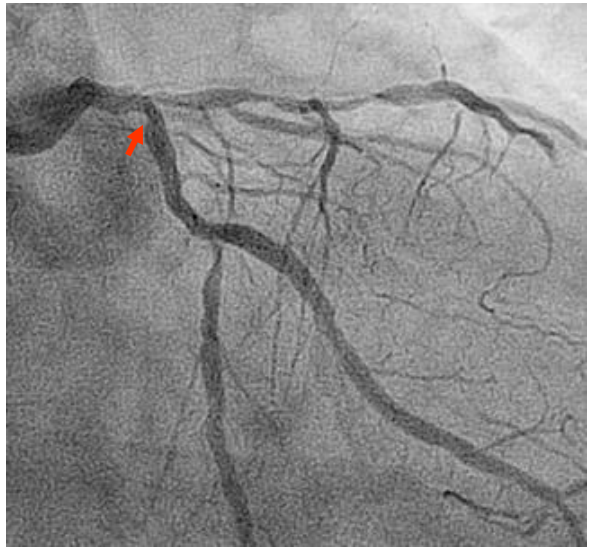


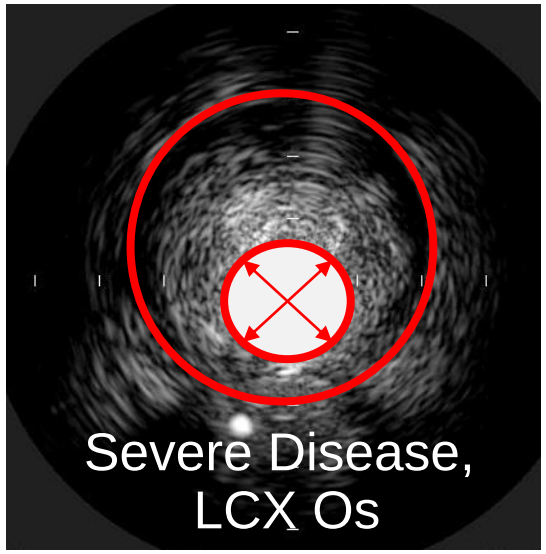
The (Angiographic) DEFINITION Criteria

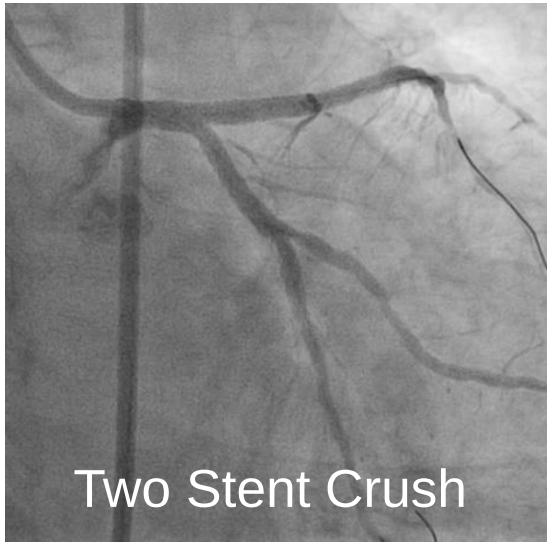
Major criteria	Minor criteria
For left main distal bifurcation lesions 1. SB lesion length ≥10 mm AND 2. SB diameter stenosis ≥70%	Moderate to severe calcification
	Multiple lesions
	Bifurcation angle <45° or >70°
For non-left main distal bifurcation lesions 3. SB lesion length ≥10 mm AND 4. SB diameter stenosis ≥90%	Main vessel reference vessel diameter <2.5 mm
	Thrombus-containing lesions
	Main vessel lesion length ≥25 mm
Complex coronary bifurcation lesions = 1 major criterion + any 2 minor criteria	
SB: side branch	

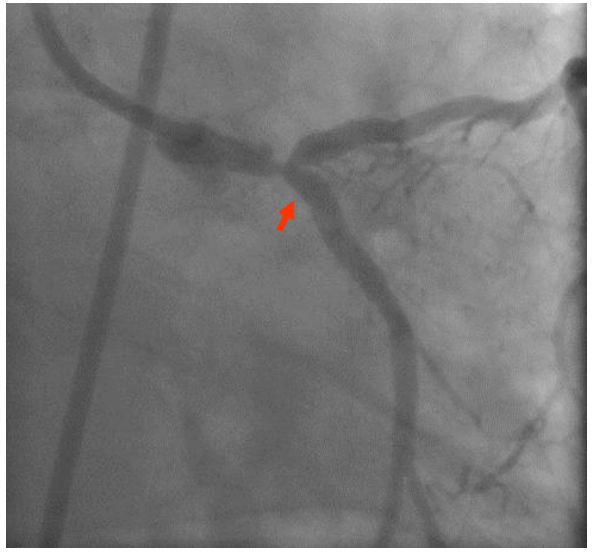
LCX Ostial Disease (By IVUS) Determines Strategy

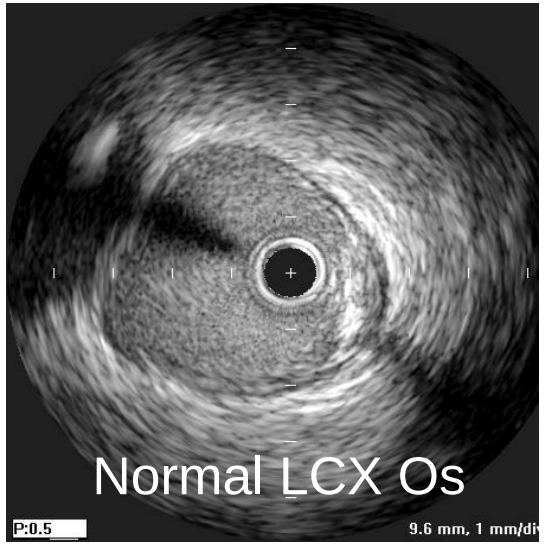
Conventional Thought (Then What Number?)

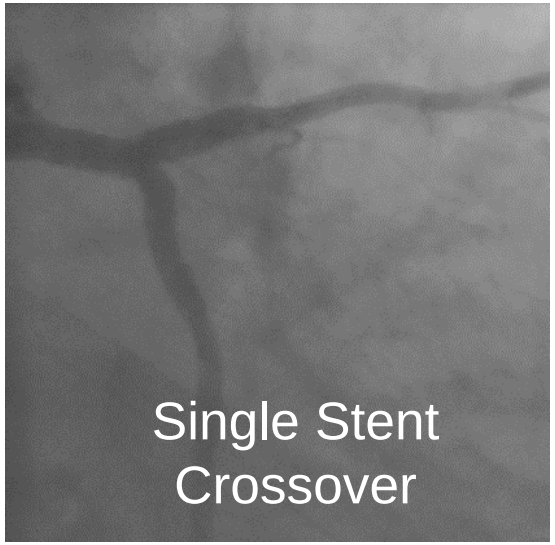












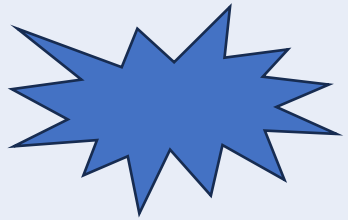
Imaging Based Decision for LM Bifurcation Treatment

LM Bifurcation

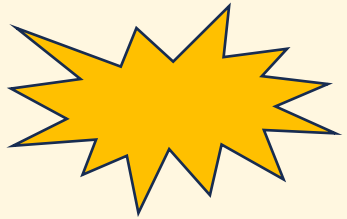
- **PCI**
  - D
    - **Provisional Stenting** → **Stent Optimization**
    - **Two Stent Technique** → **Stent Optimization**
- **CABG**

LM IPD Metaanalysis by Sabatine MS
Lancet. 2021;398(10318):2247-2257

- SYNTAX
- PRECOMBAT
- NOBLE
- EXCEL

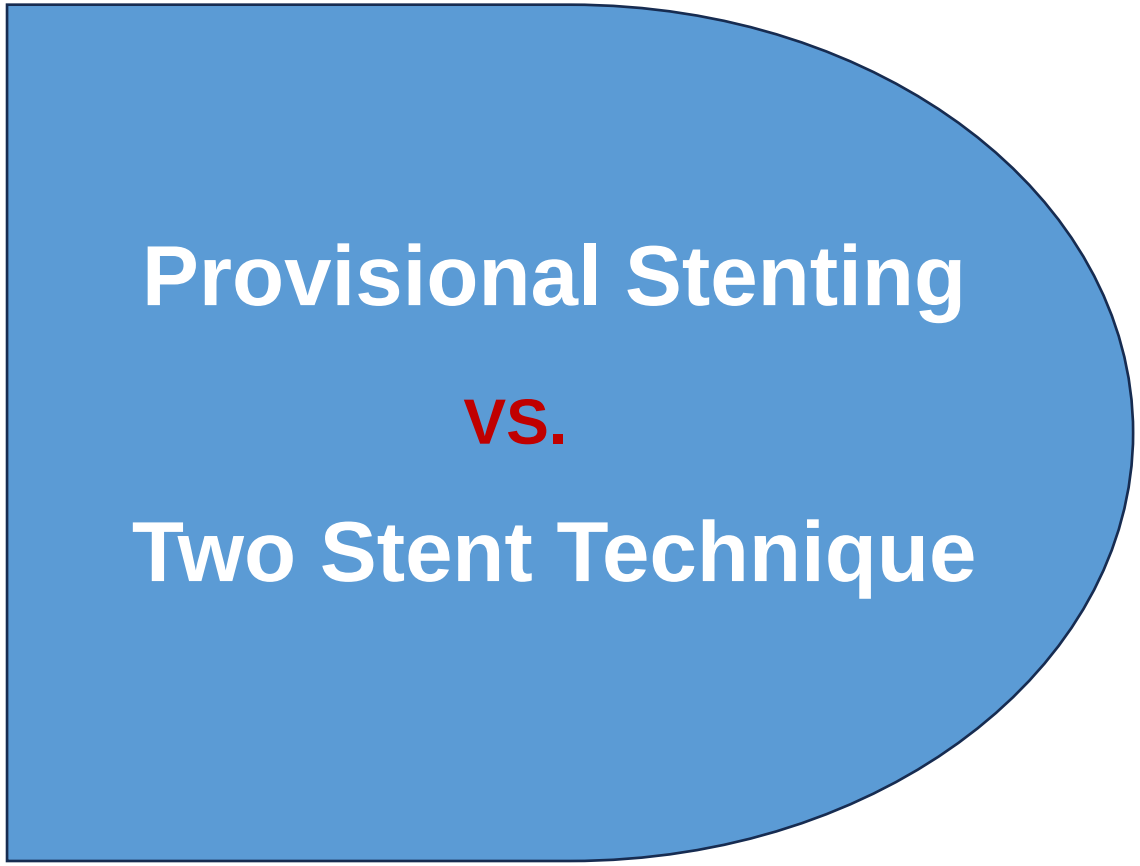


- DK-CRUSH
- EBC MAIN
- ***Unpublished Data From ASAN MAIN***

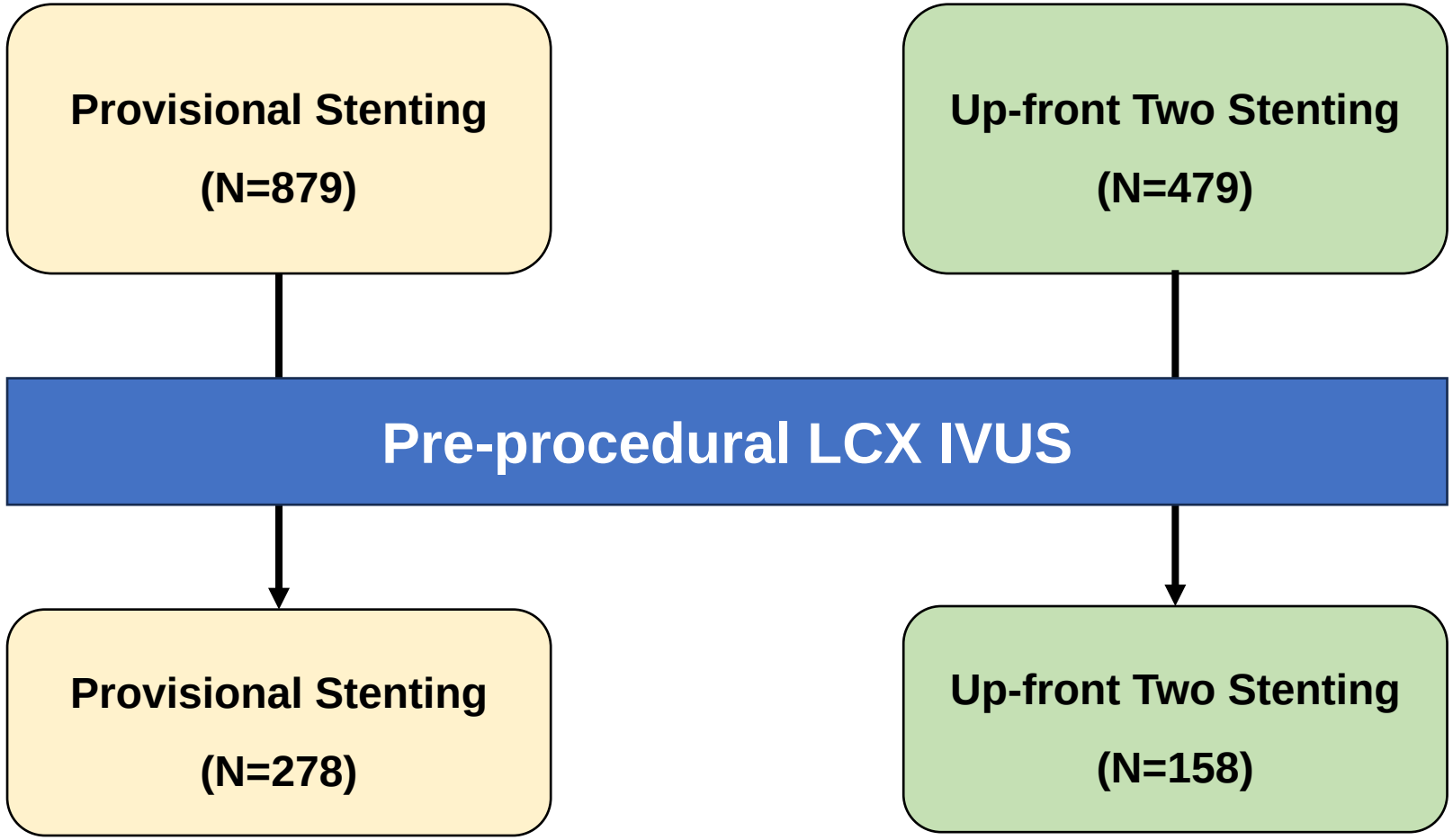


- **One Stenting:**
  Revision in EuroIntervention
- **Two Stenting:**
  Circ Cardiovasc Interv. 2024;17(1):e013006.

Decision for LM Bifurcation Strategy



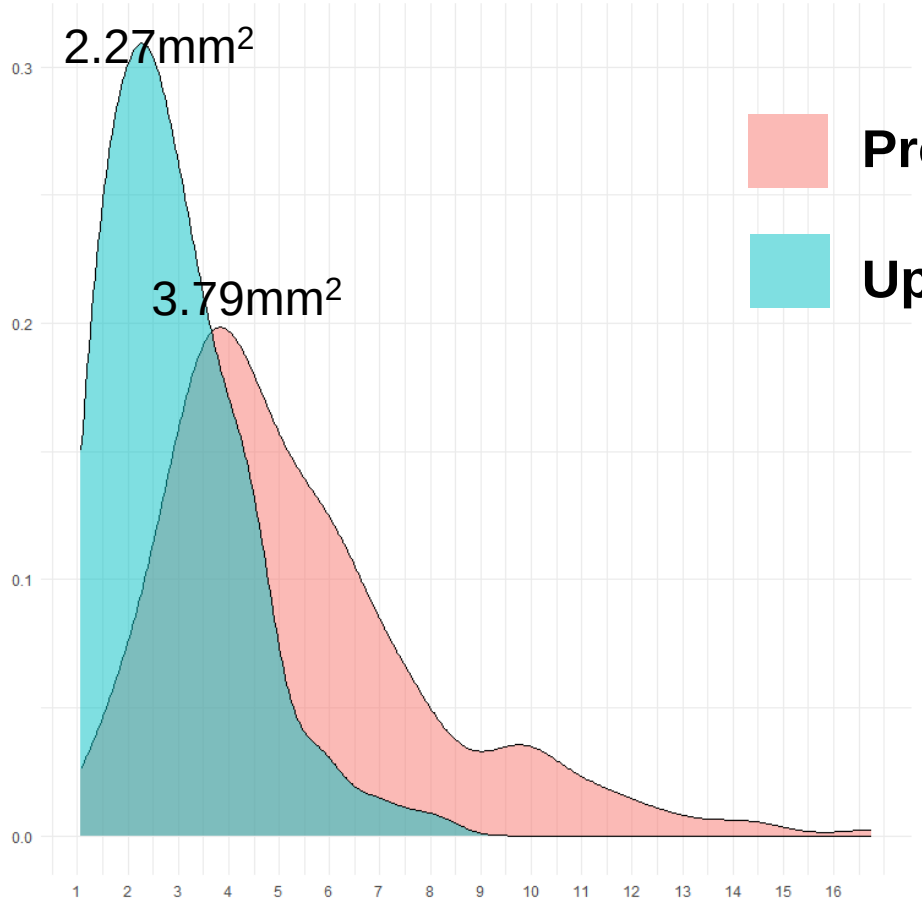
ASAN MAIN Registry



Unpublished Data From ASAN MAIN Registry

Distribution of LCx Ostial MLA and PB

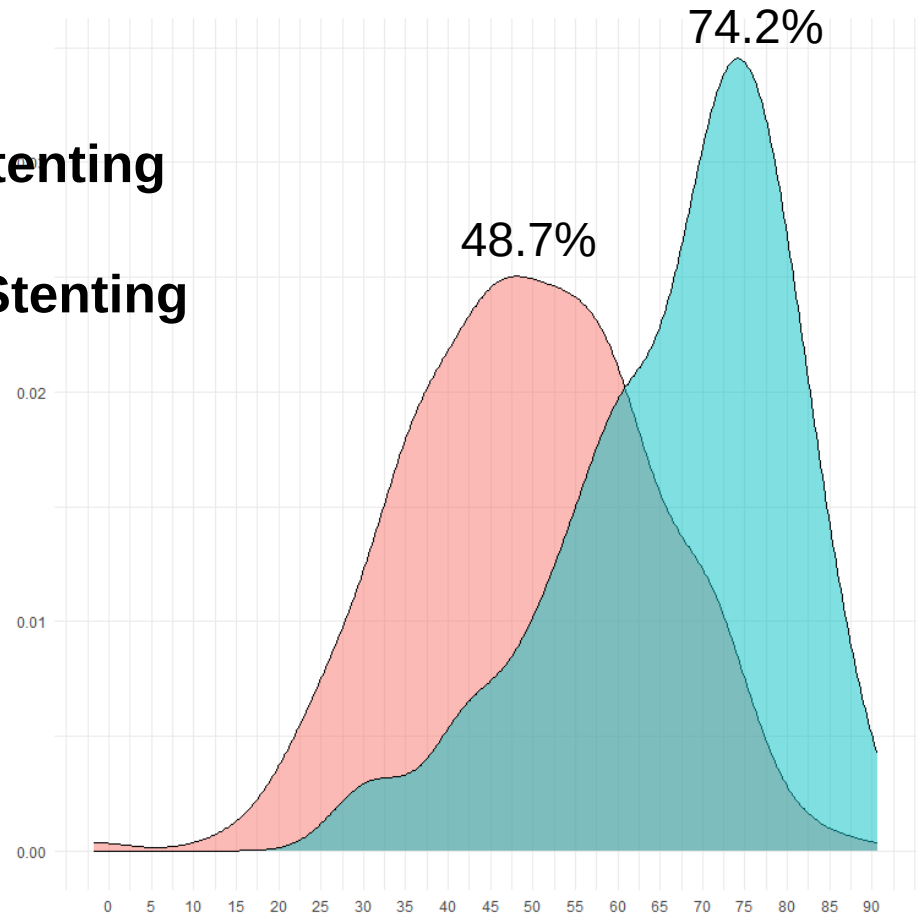
Minimal lumen area



Provisioanl Stenting

Upfront Two Stenting

Plaque burden



Acute Procedural Complications after One Stenting

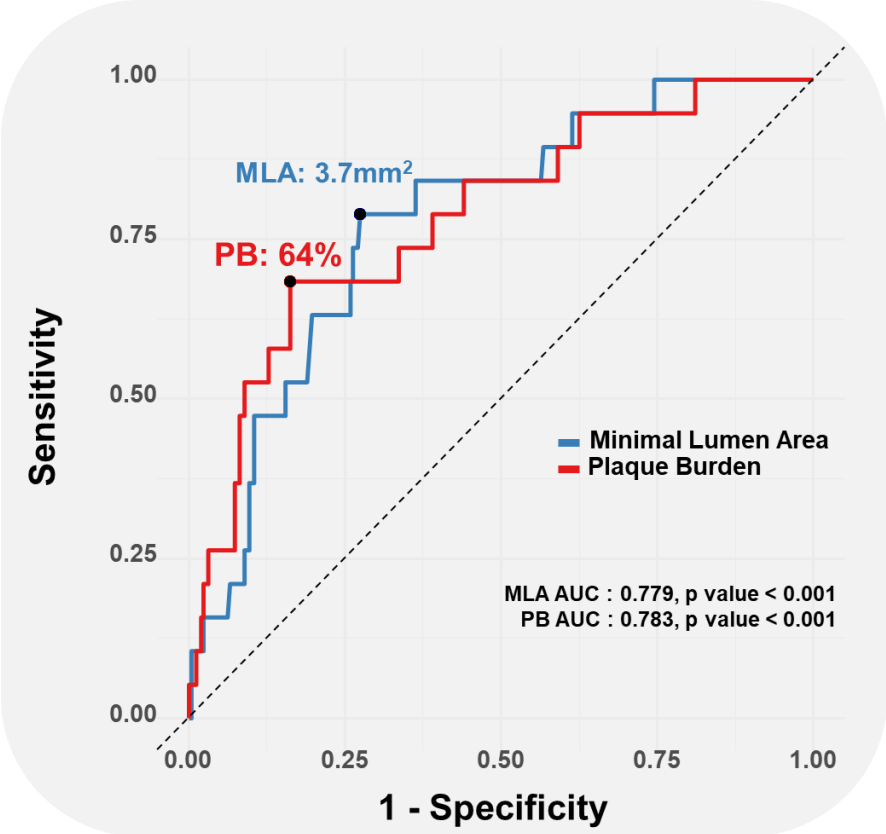
6.8%

N=19/278

- Bail-out Stenting (N=0)
- Kissing Balloon (N=19)
- POBA (N=1)
- LCX TIMI flow <3 (N=1)
- LCX Ostium Diameter Stenosis > 90% (N=12)
- LCX Closure (N=1)
- LCX Dissection (N=0)
- LCX FFR ≤ 0.80 (N=3)

**Multiple events*

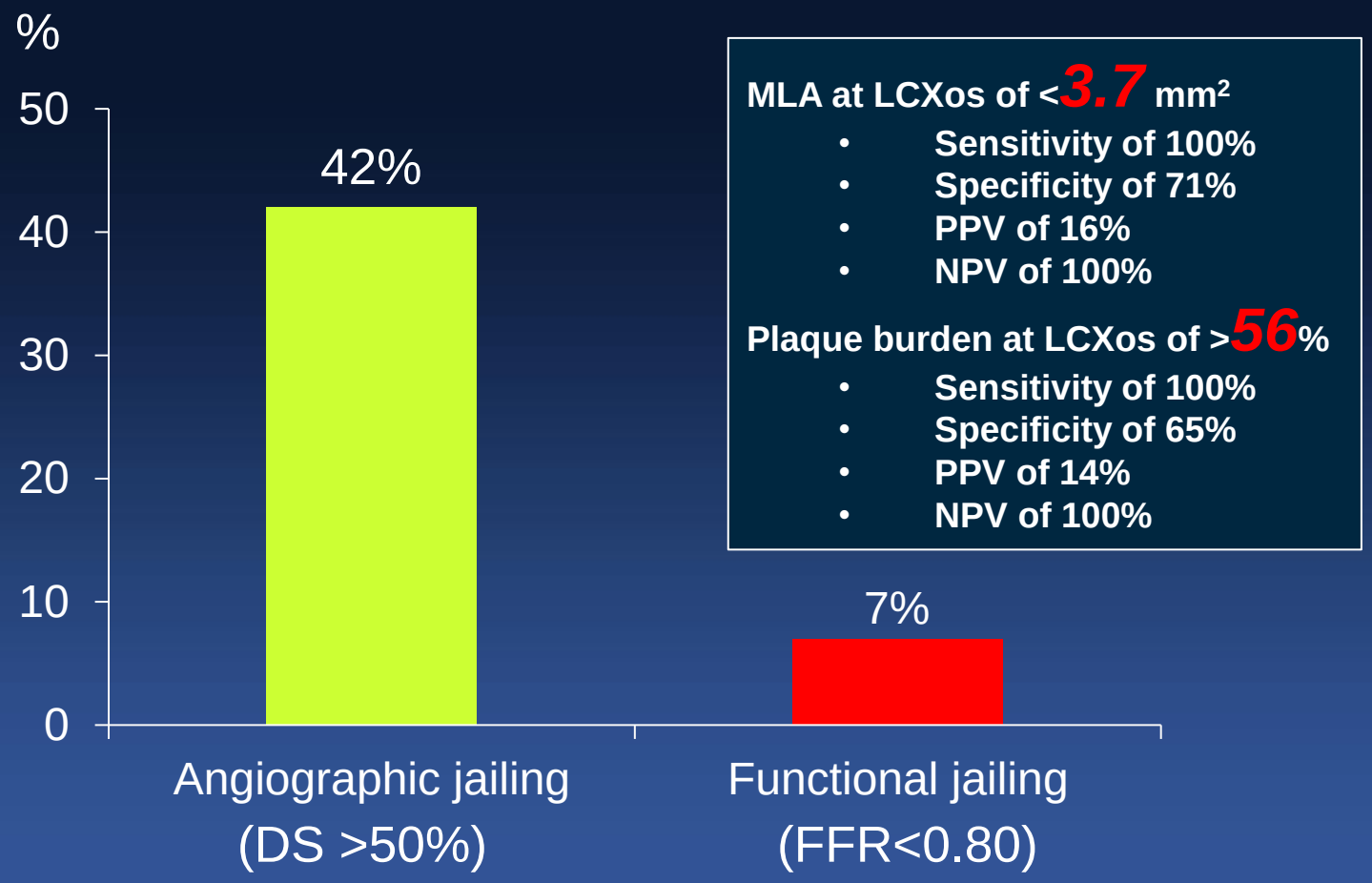
MLA 3.7mm², PB 64%



LCx ostial DS, LM bifurcation angle, and LCx lesion length *was not associated with the incidence of acute procedural complications*

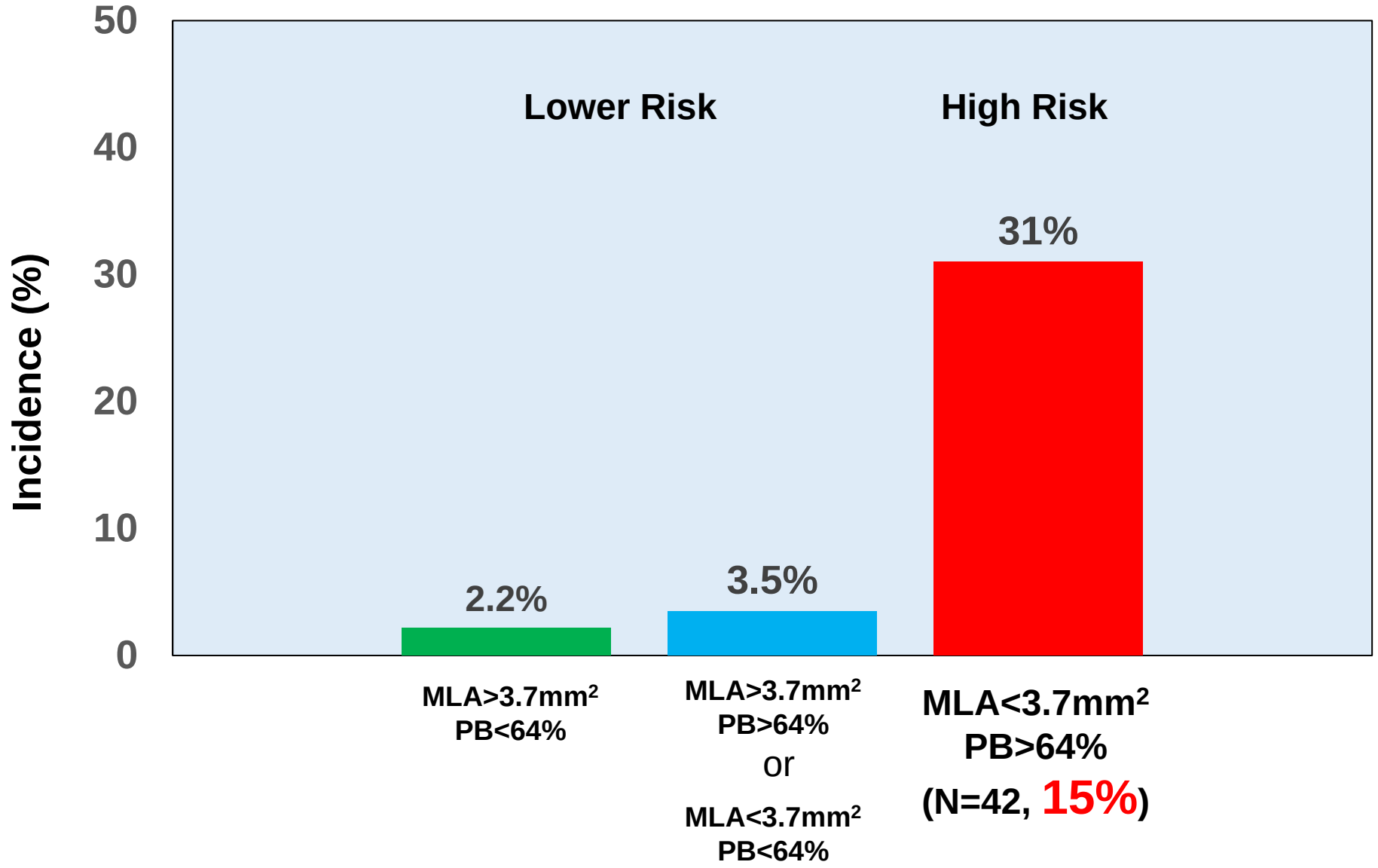
Unpublished Data From ASAN MAIN Registry

Functionally Significant LCX Jailing
After Stent Crossover (LCX ostial DS<50%)

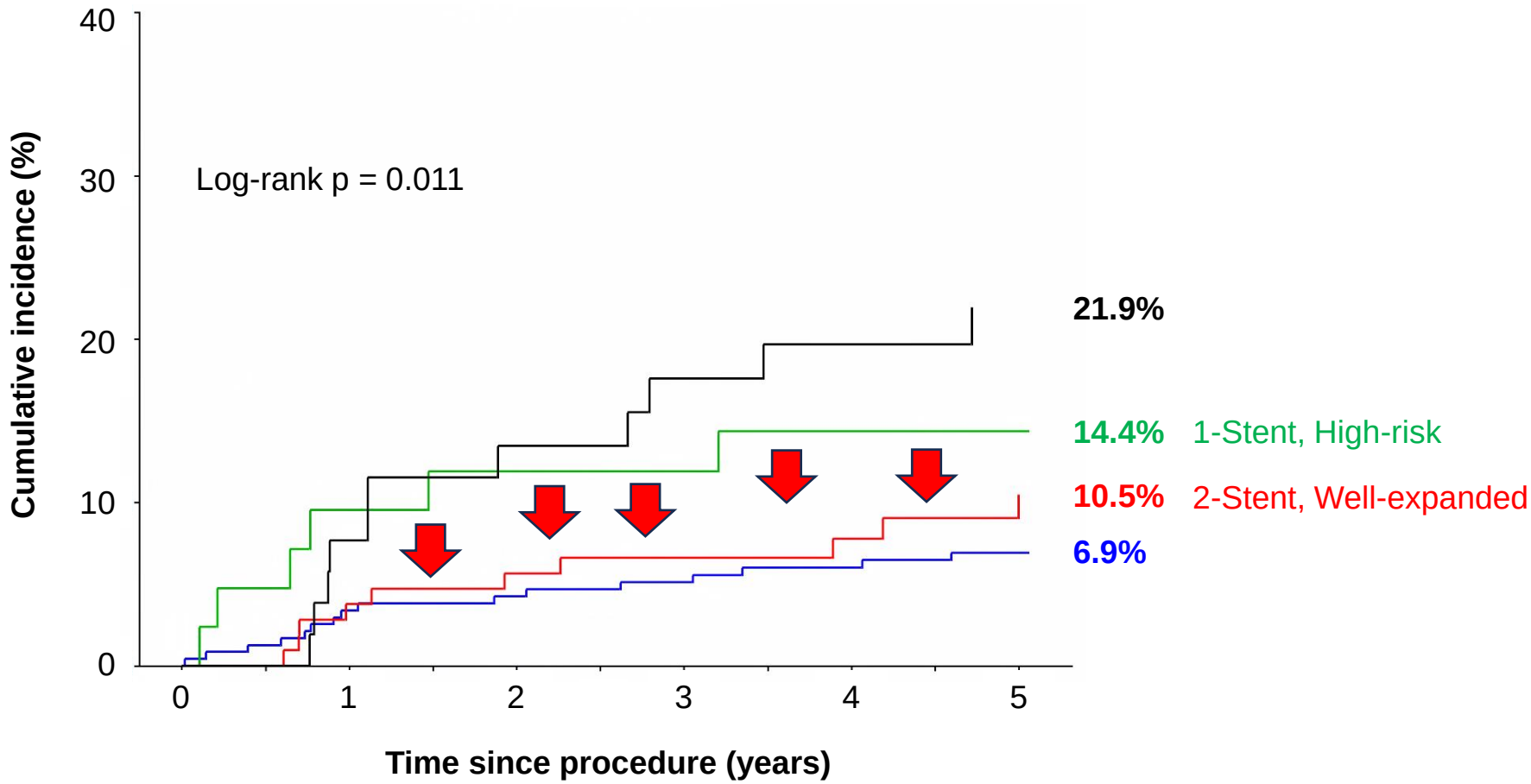


Kang SJ, Catheterization and Cardiovascular Interventions. 2014;83(4):545-52.

Acute Procedural Complications after One Stenting



Major Adverse Cardiac Events



No. at risk

2stent, under-expanded	52	48	45	40	36	35
1stent, high-risk	42	38	37	36	33	32
2stent, well-expanded	106	102	100	93	78	64
1stent, lower-risk	236	228	221	215	208	198

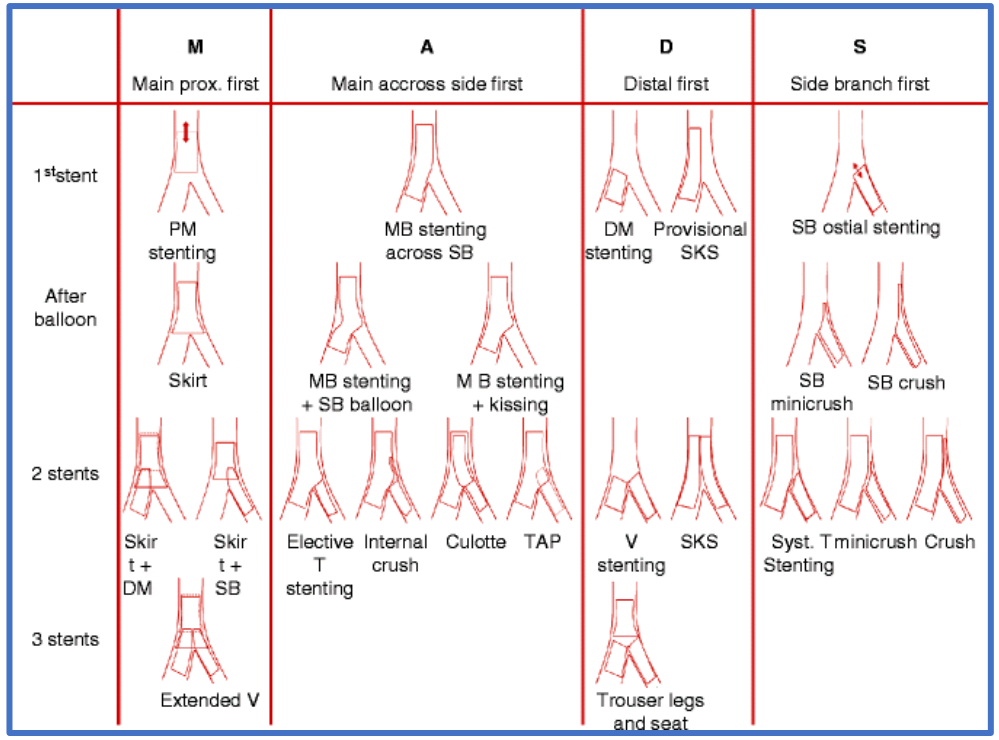
Decision for LM Bifurcation Strategy

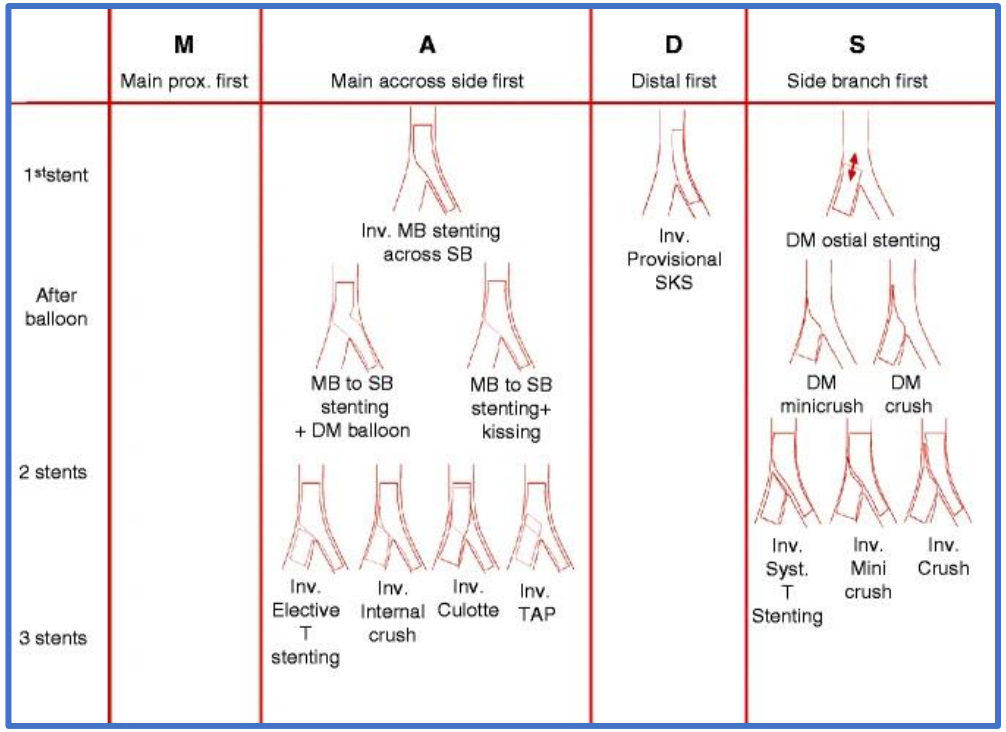
MLA <3.7mm^2 and PB> 64% → **Two Stent Technique**

VS.

MLA >3.7mm^2 or PB< 64% → **Provisional Stenting**

Which Stent Strategy? Many Techniques



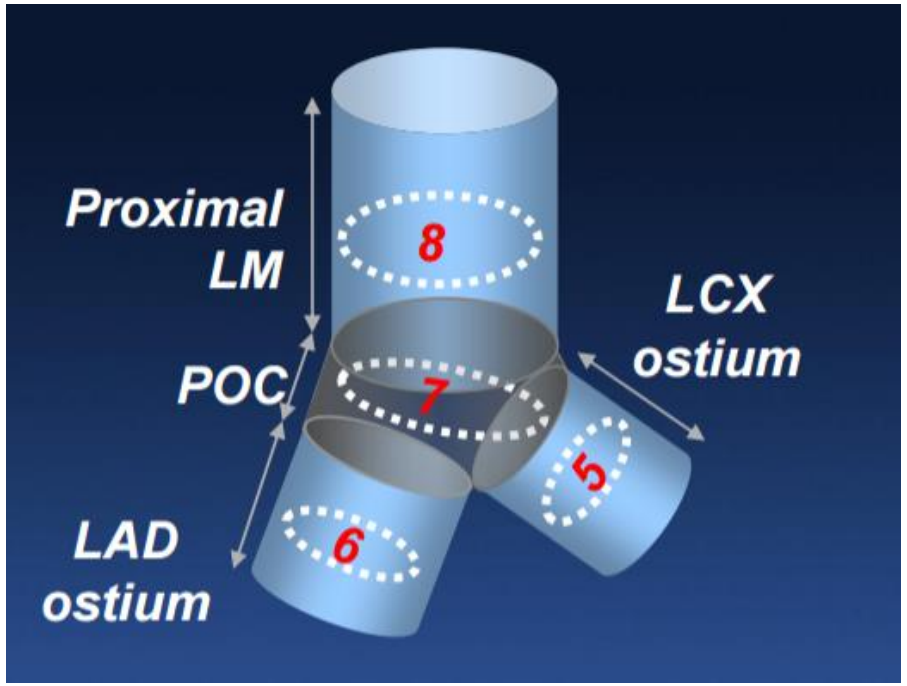


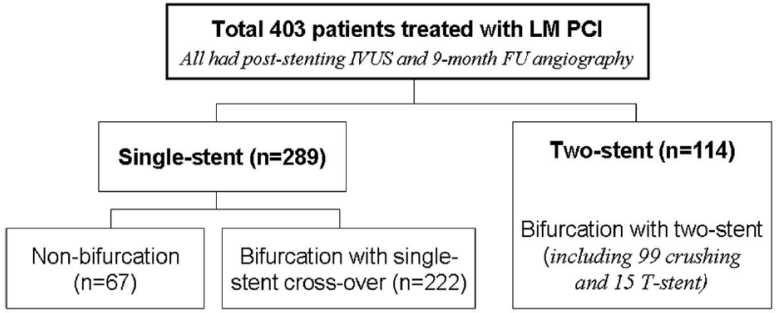
Treatment of Coronary Artery Bifurcation Lesions

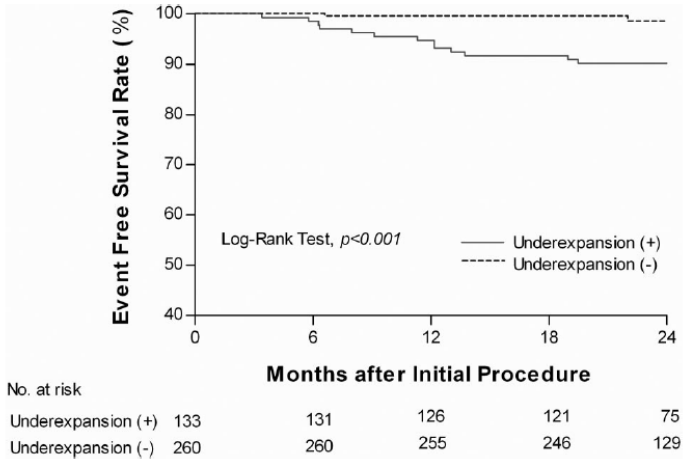
How to Optimize LM Stenting ?

LM IVUS MSA Criteria (“5-6-7-8”)

Asan Medical Center Criteria



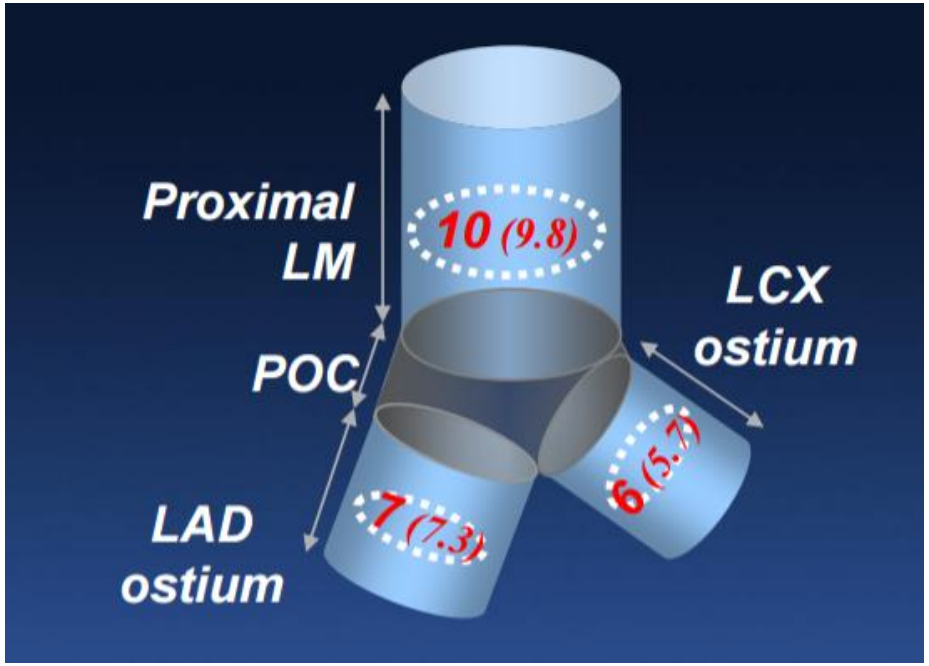




Kang SJ, et al. Circ Cardiovasc Interv 2011;4:562-9

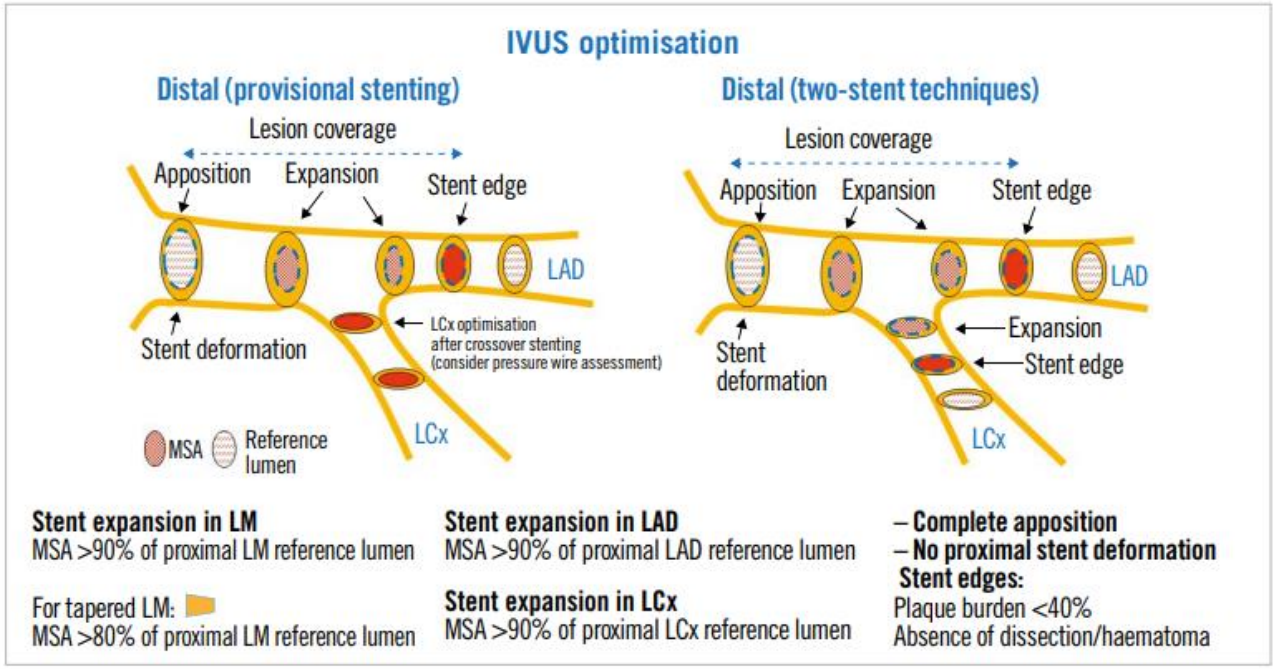
LM IVUS MSA Criteria

EXCEL Criteria



EXCEL Trial Analysis
A. Maehara TCT 2018

Spain Registry Criteria



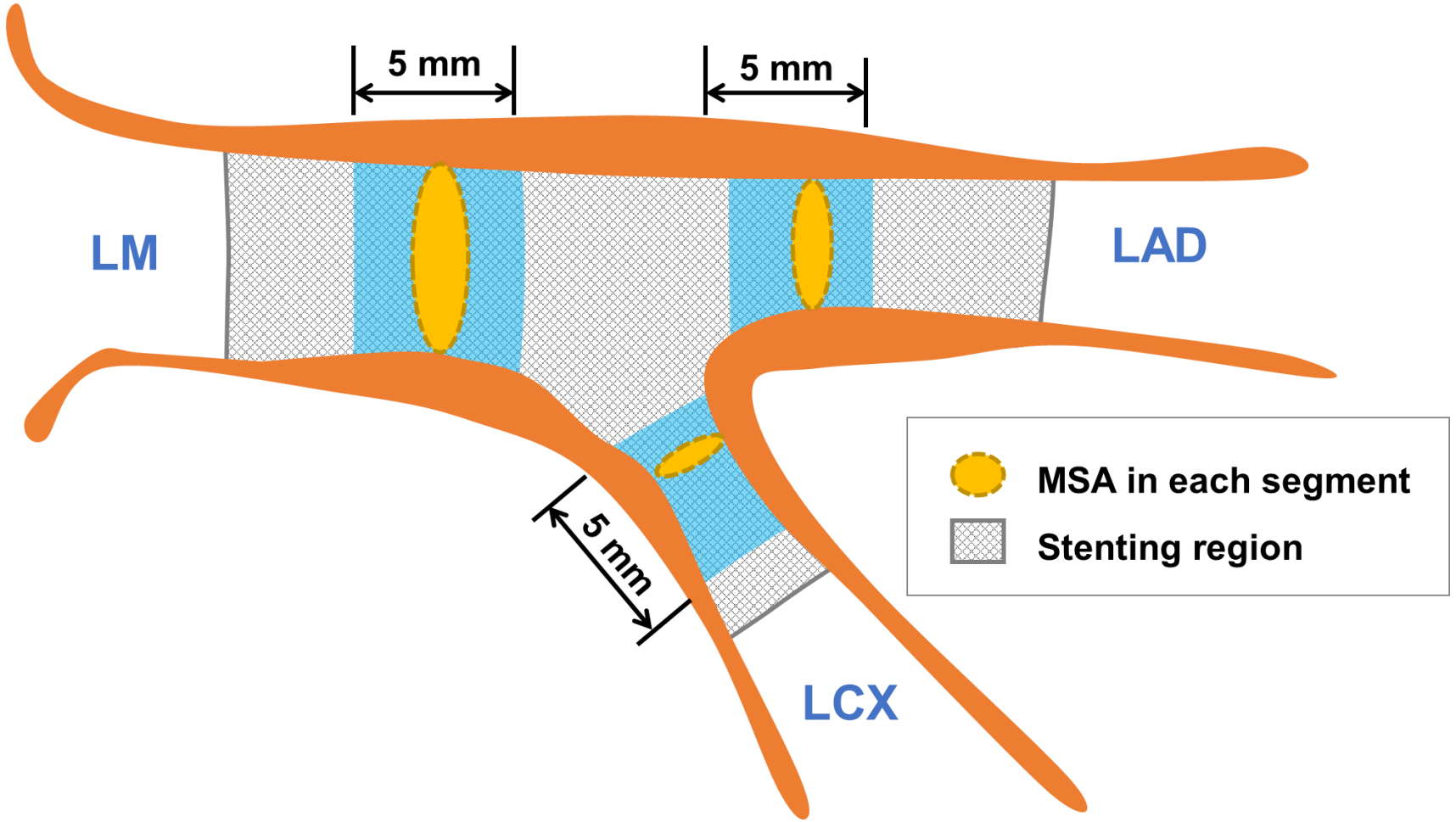
EuroIntervention. 2020 Jun 25;16(3):210-217

- How to Optimize the LM Stent Results?

Two Stenting

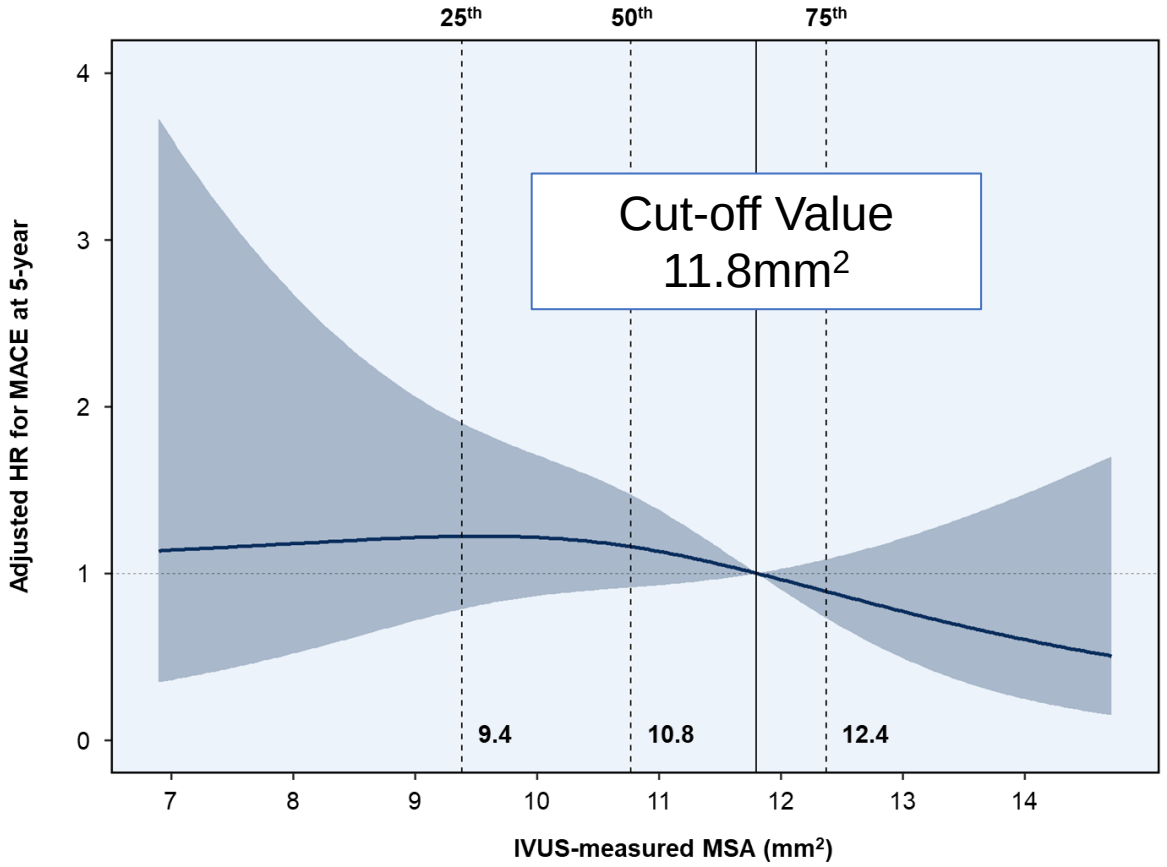
Circ Cardiovasc Interv. 2024 Jan;17(1):e013006.

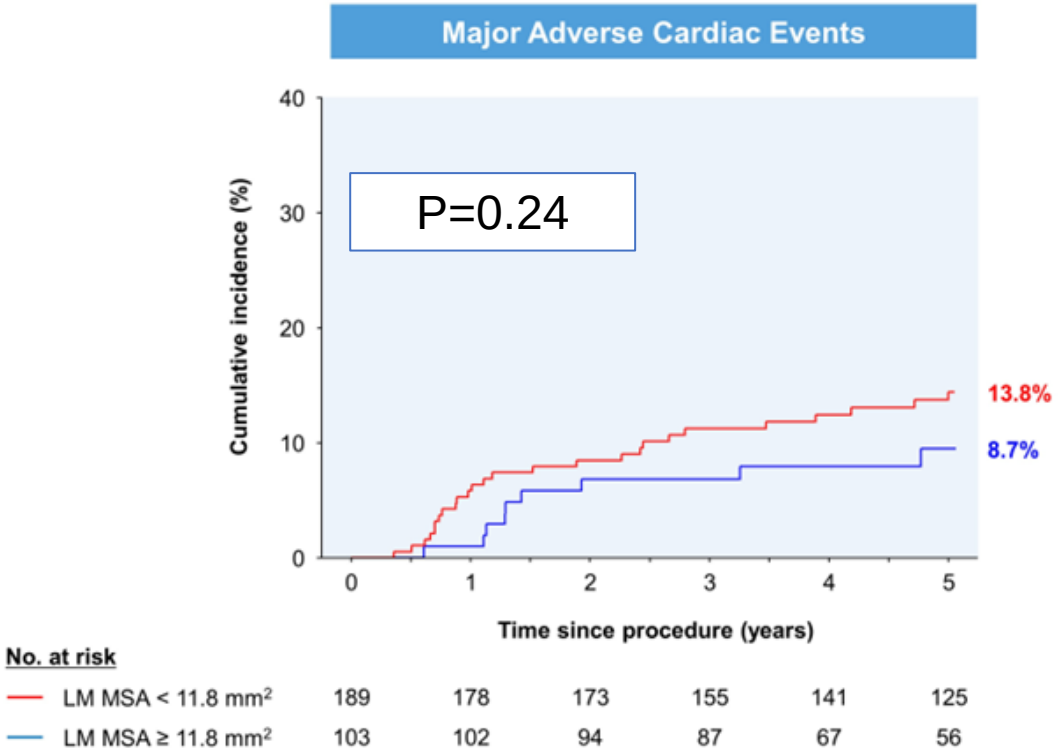
The MSA measurement of Two-stenting



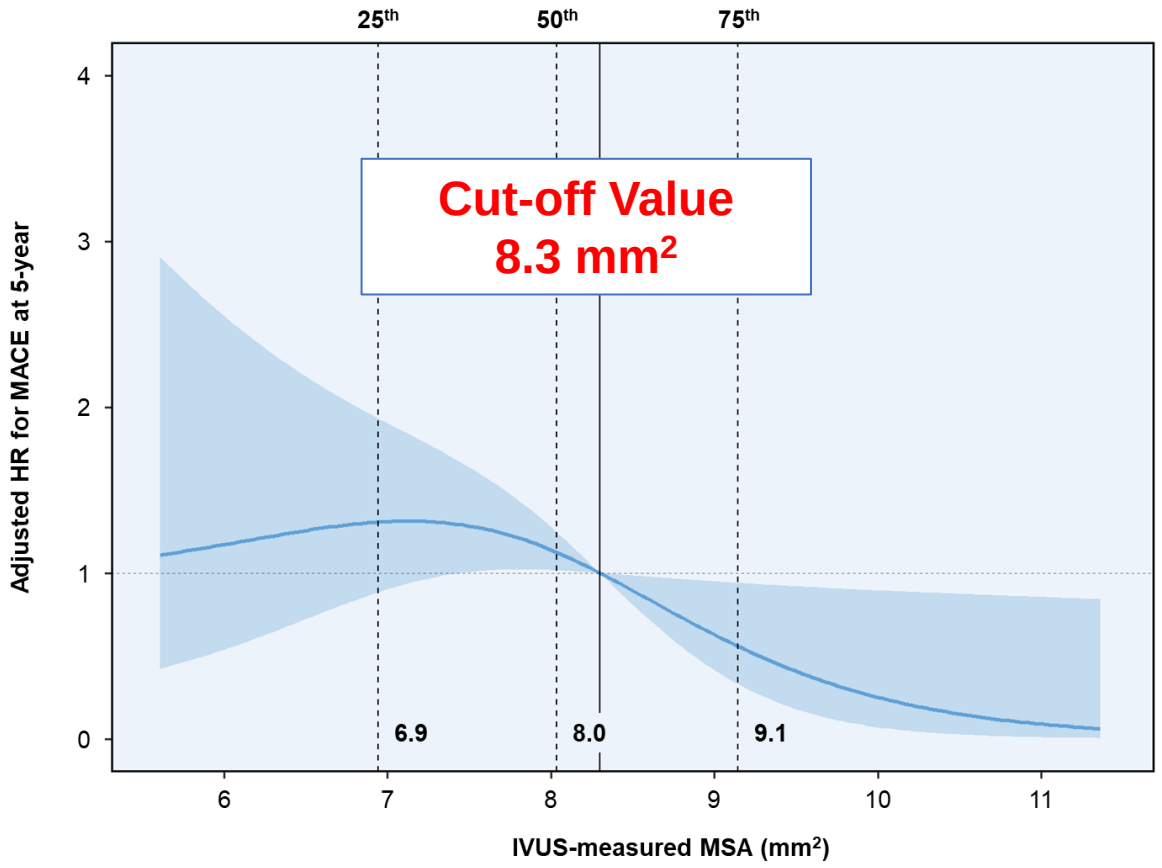
Circ Cardiovasc Interv. 2024 Jan;17(1):e013006.

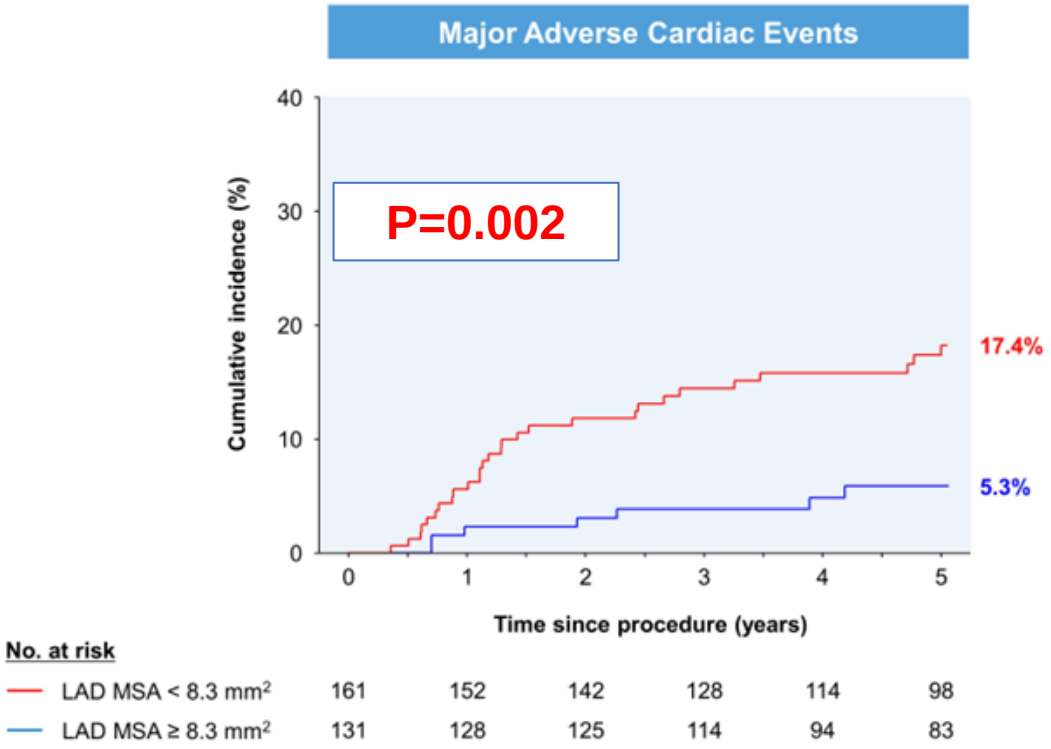
Distal LM MSA and MACE at 5 Years



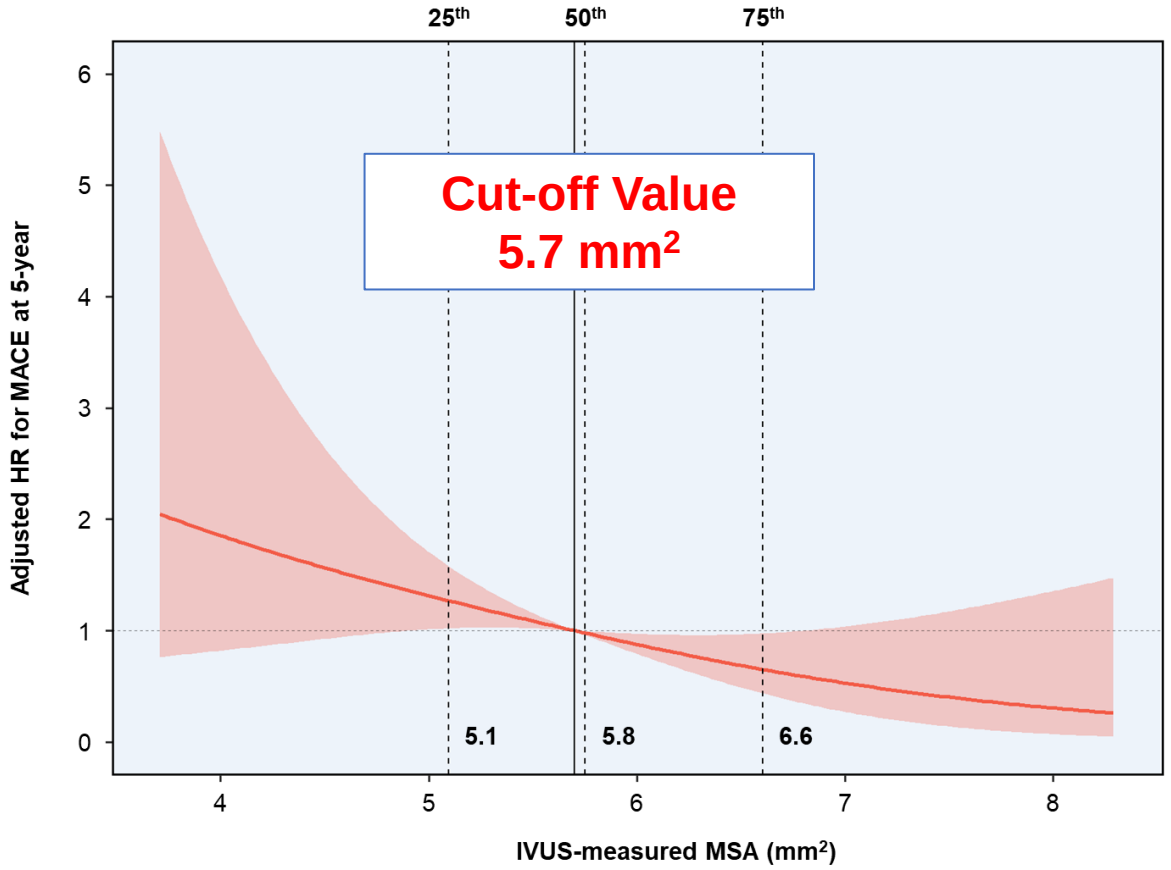


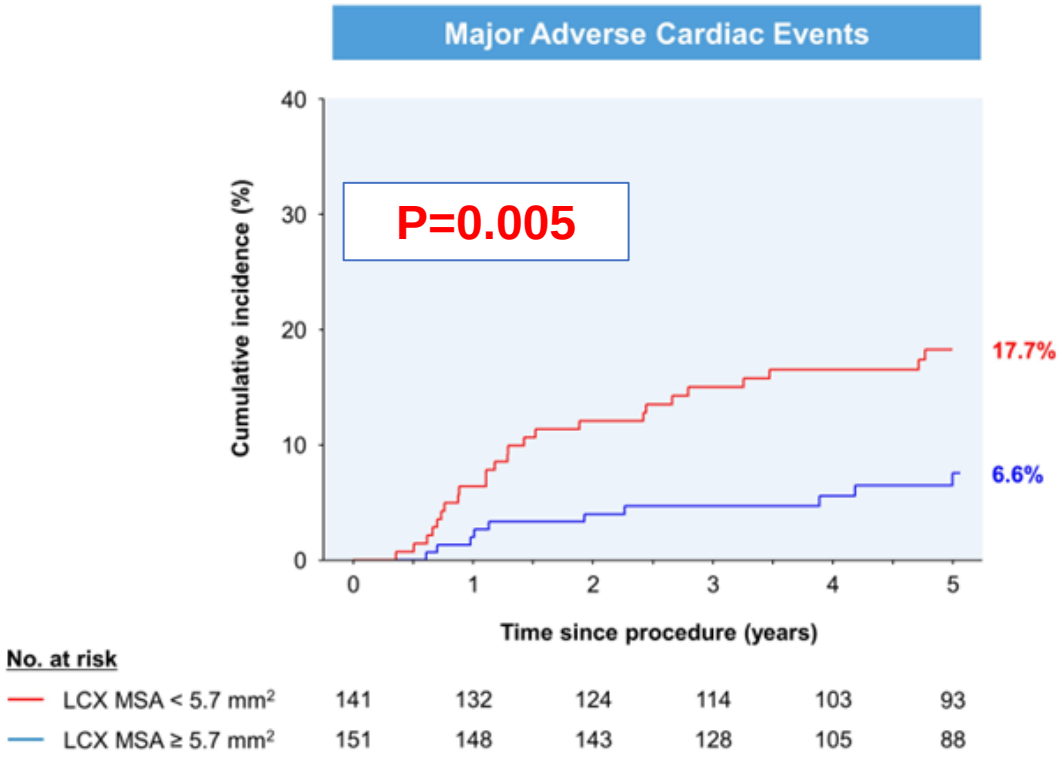
LAD Ostial MSA and MACE at 5 Years





LCX Ostial MSA and MACE at 5 Years

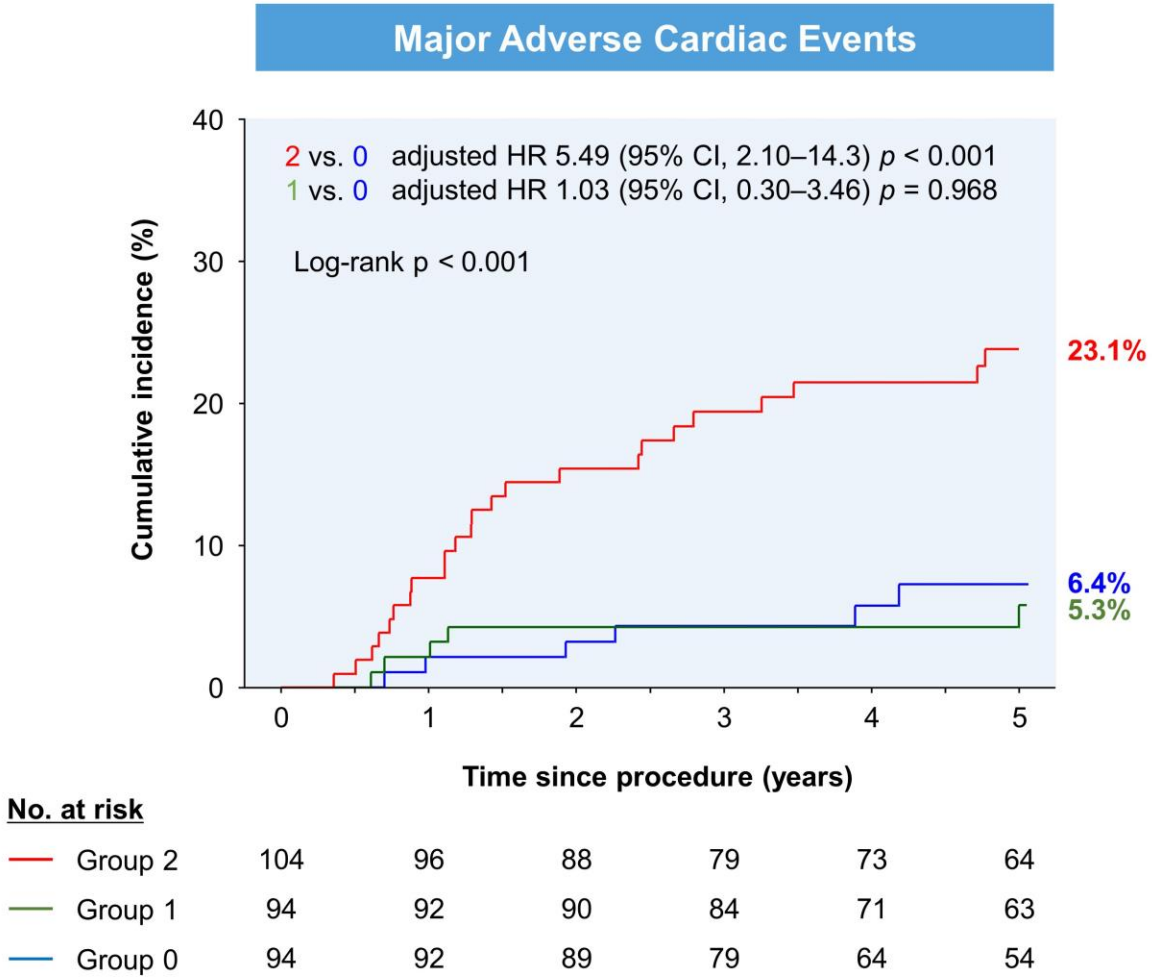




No. at risk

LCX MSA < 5.7 mm²	141	132	124	114	103	93
LCX MSA ≥ 5.7 mm²	151	148	143	128	105	88

Incidence of Under-expansion of LM Segments and Outcomes



Both LAD and LCX Underexpansion

Either LAD and LCX Underexpansion

No LAD and LCX Underexpansion

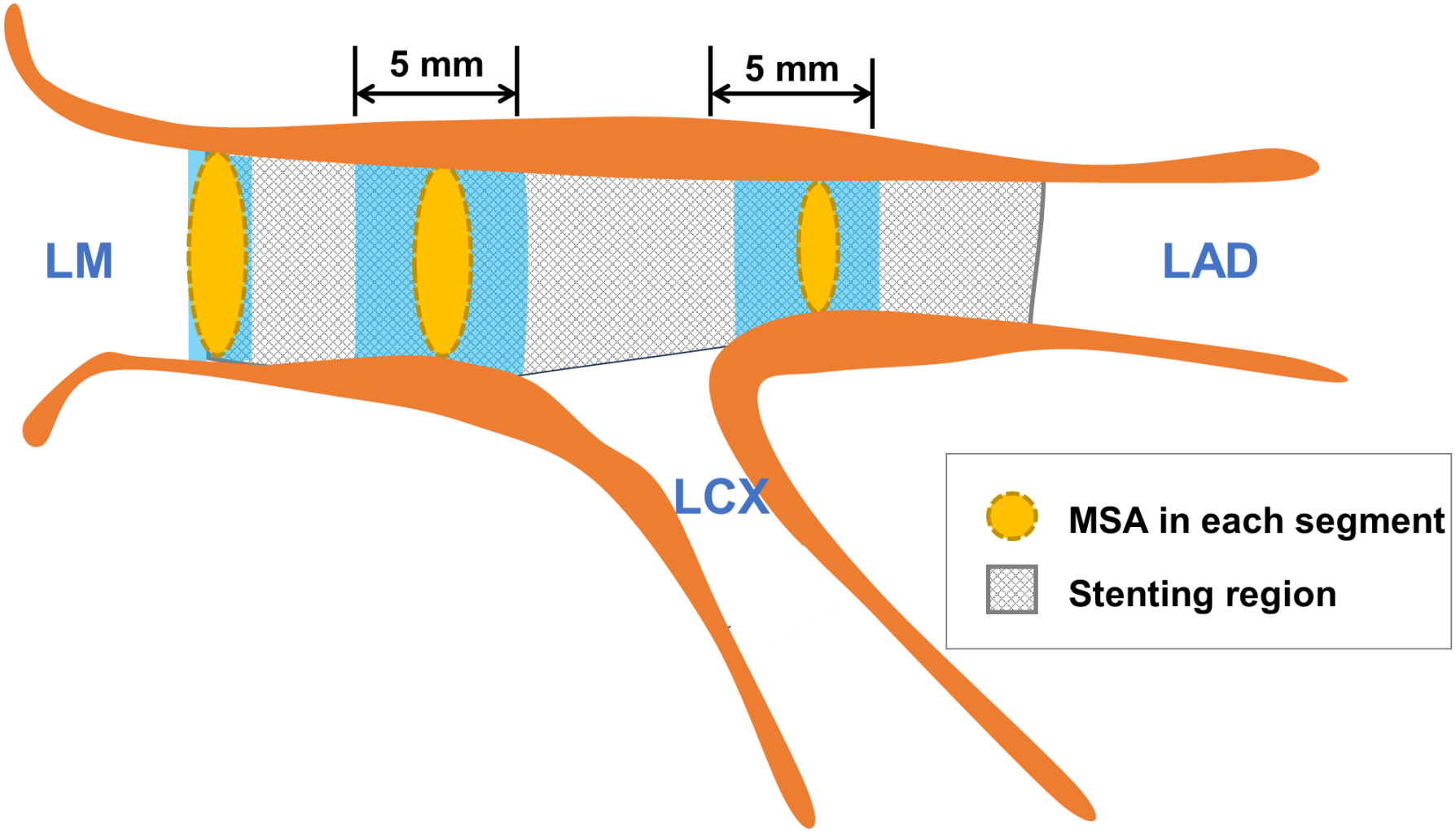
Circ Cardiovasc Interv. 2024 Jan;17(1):e013006.

- How to Optimize the LM Stent Results?

Provisional Stenting

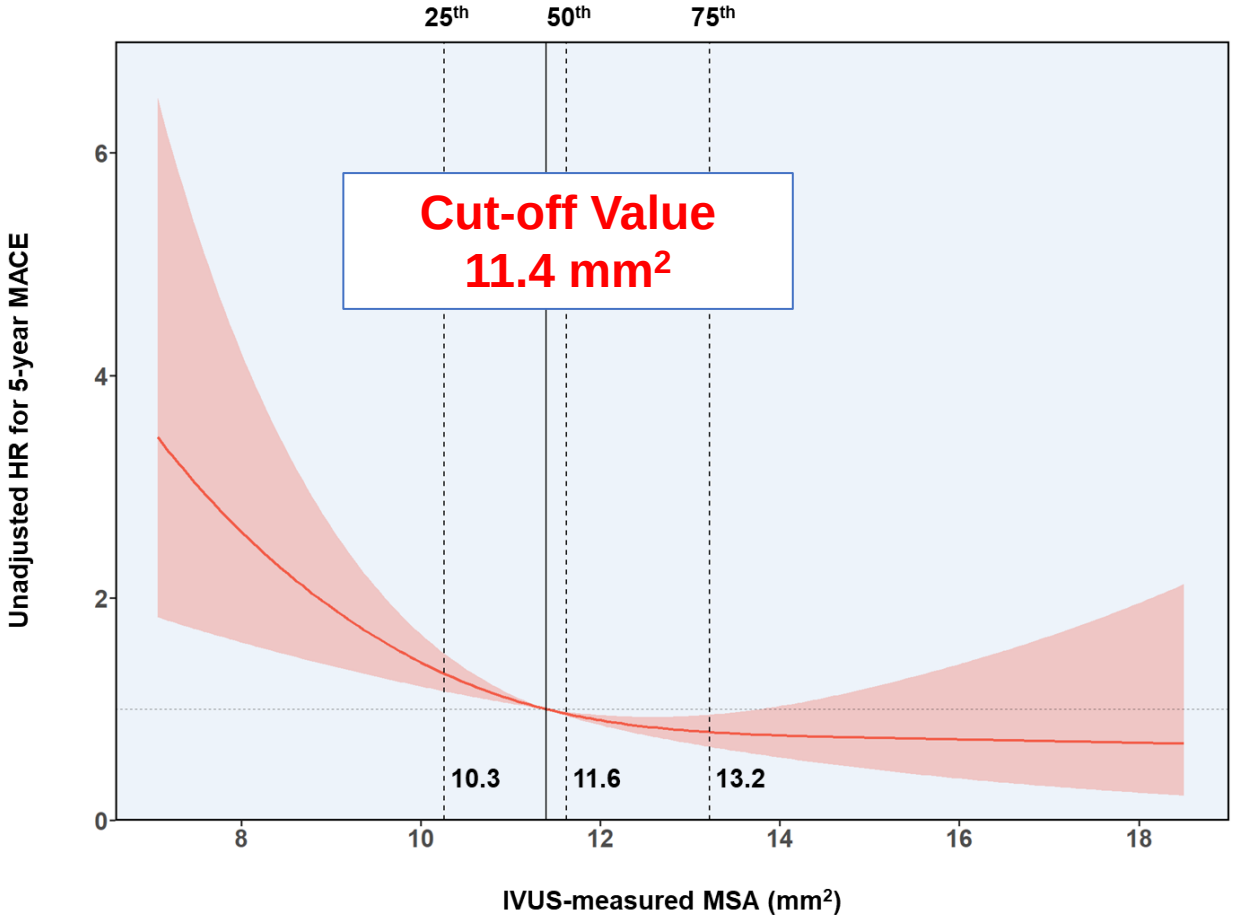
Revision in EuroIntervention

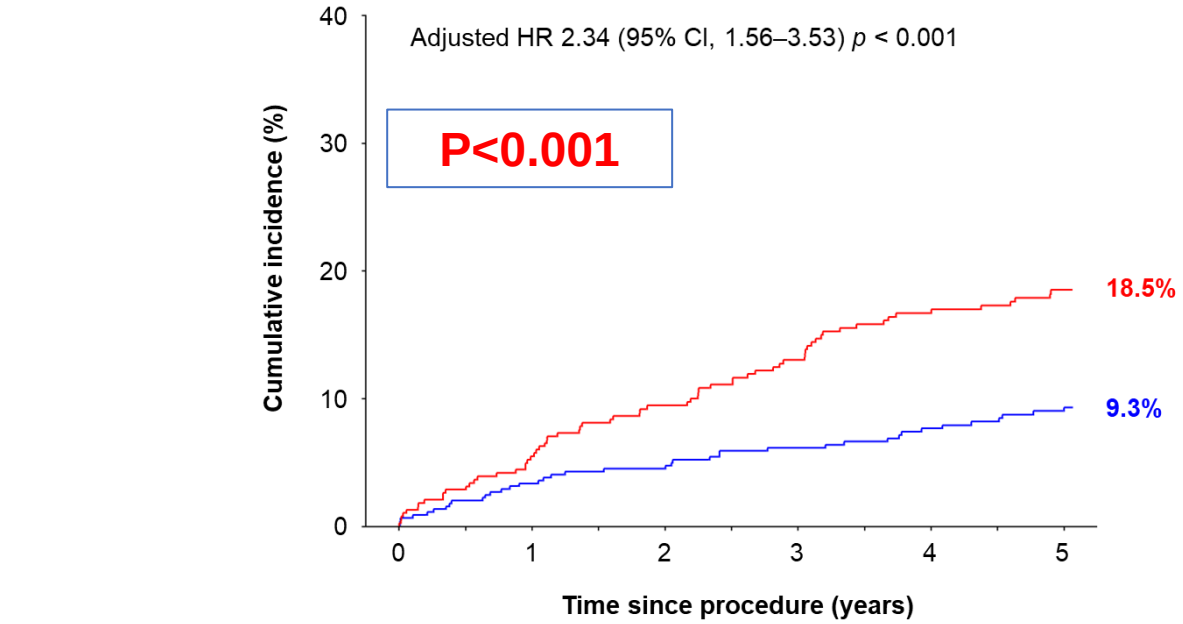
The MSA measurement of One-stenting



Revision in EuroIntervention

Proximal LM MSA and MACE at 5 Years



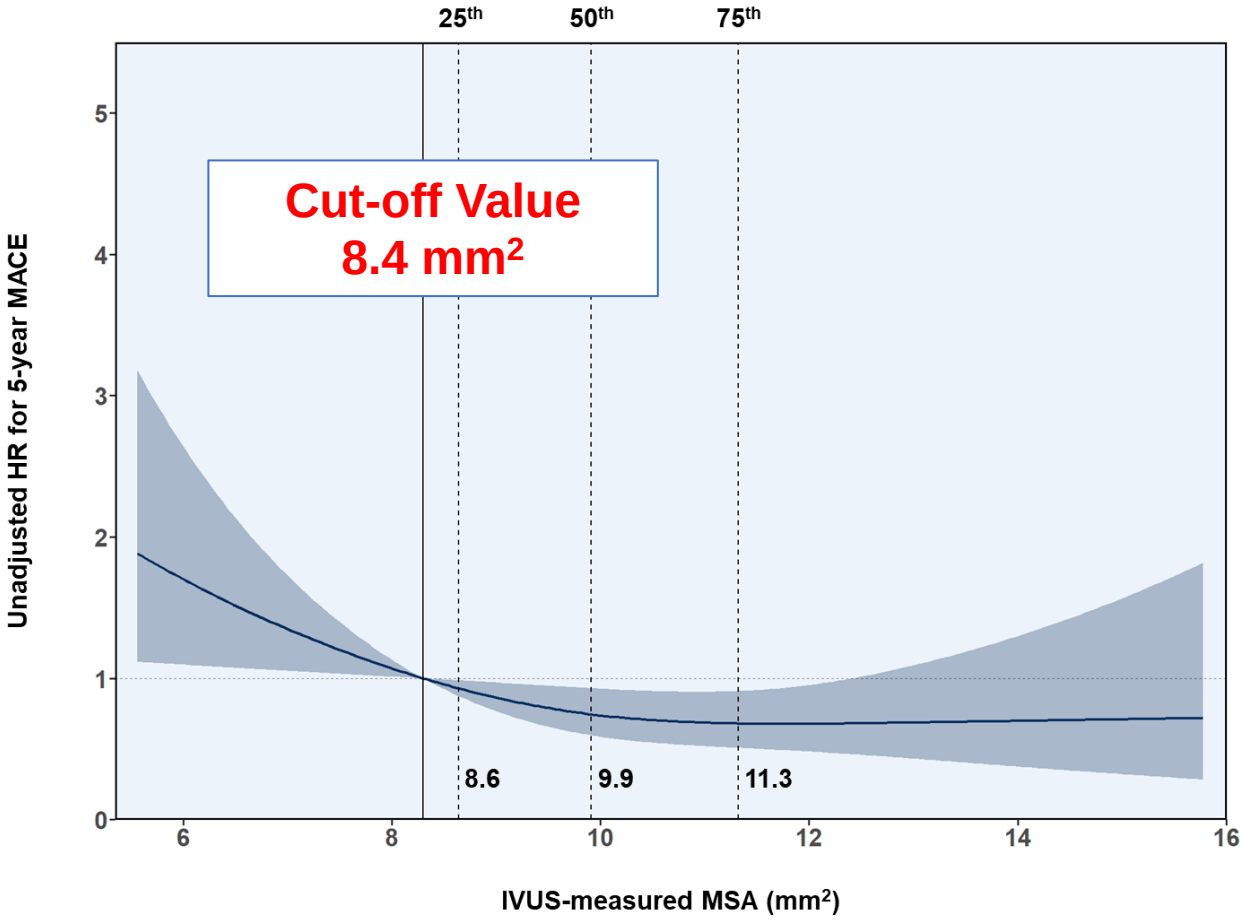


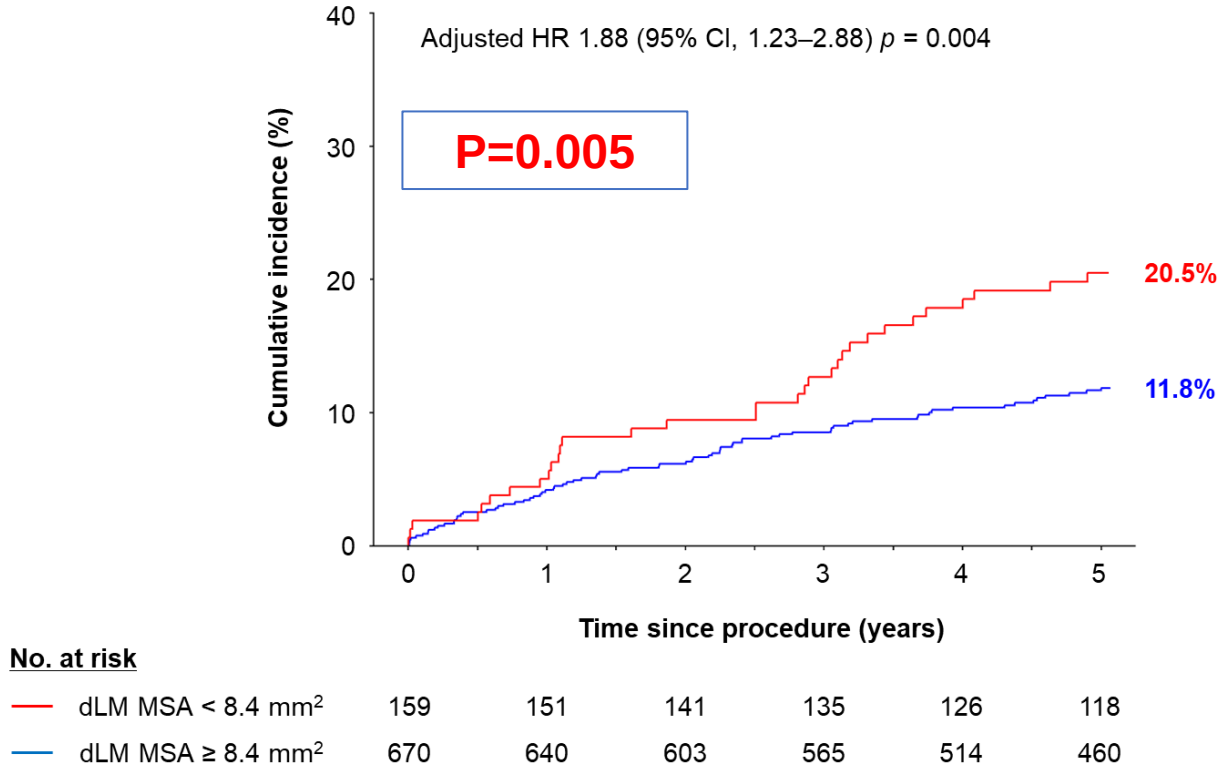
No. at risk

pLM MSA < 11.4 mm²	383	362	333	313	285	261
pLM MSA ≥ 11.4 mm²	446	429	411	387	355	317

Revision in EuroIntervention

Distal LM MSA and MACE at 5 Years



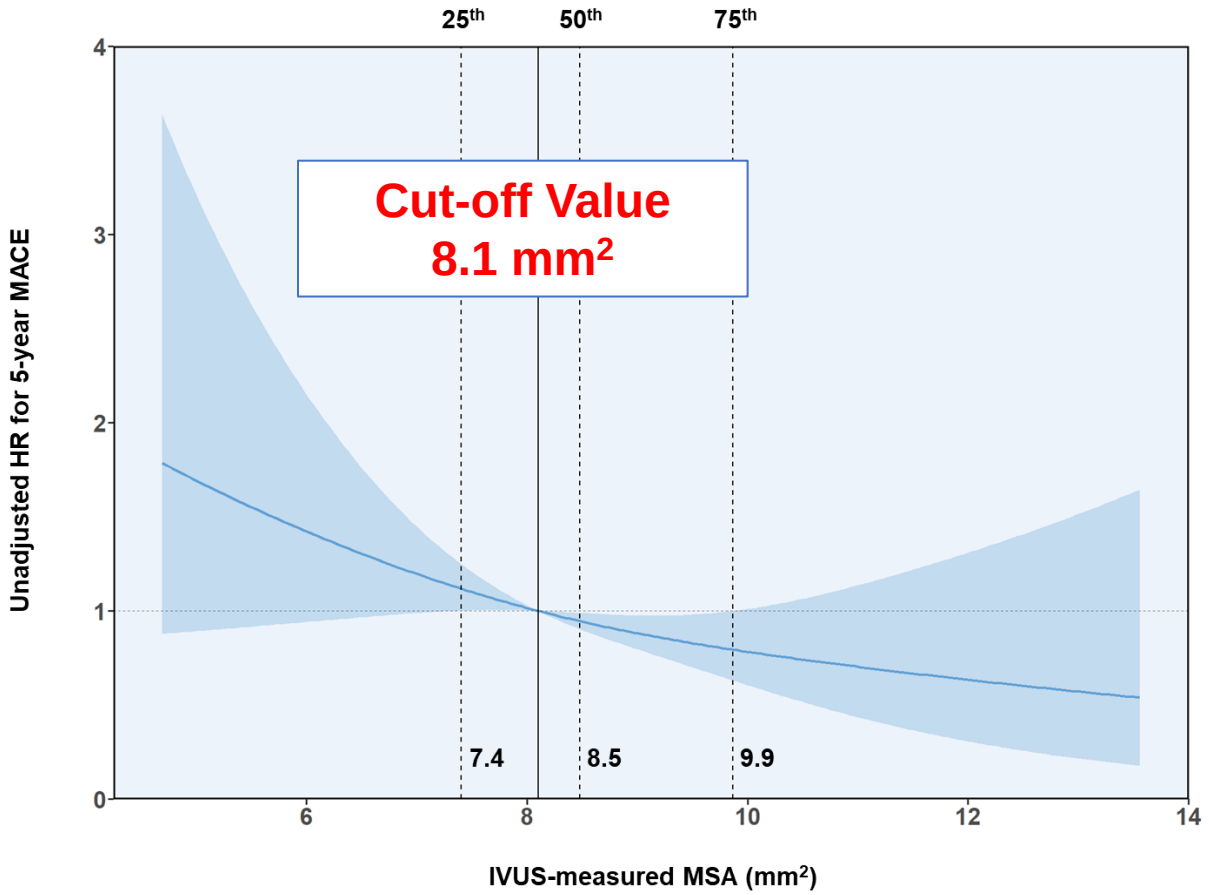


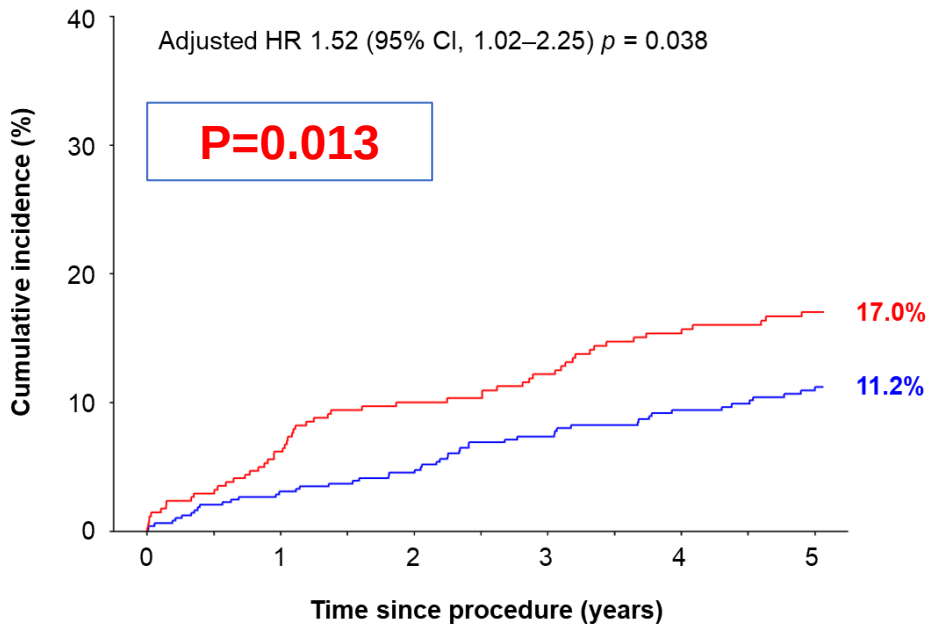
No. at risk

dLM MSA < 8.4 mm²	159	151	141	135	126	118
dLM MSA ≥ 8.4 mm²	670	640	603	565	514	460

Revision in EuroIntervention

Proximal LAD MSA and MACE at 5 Years



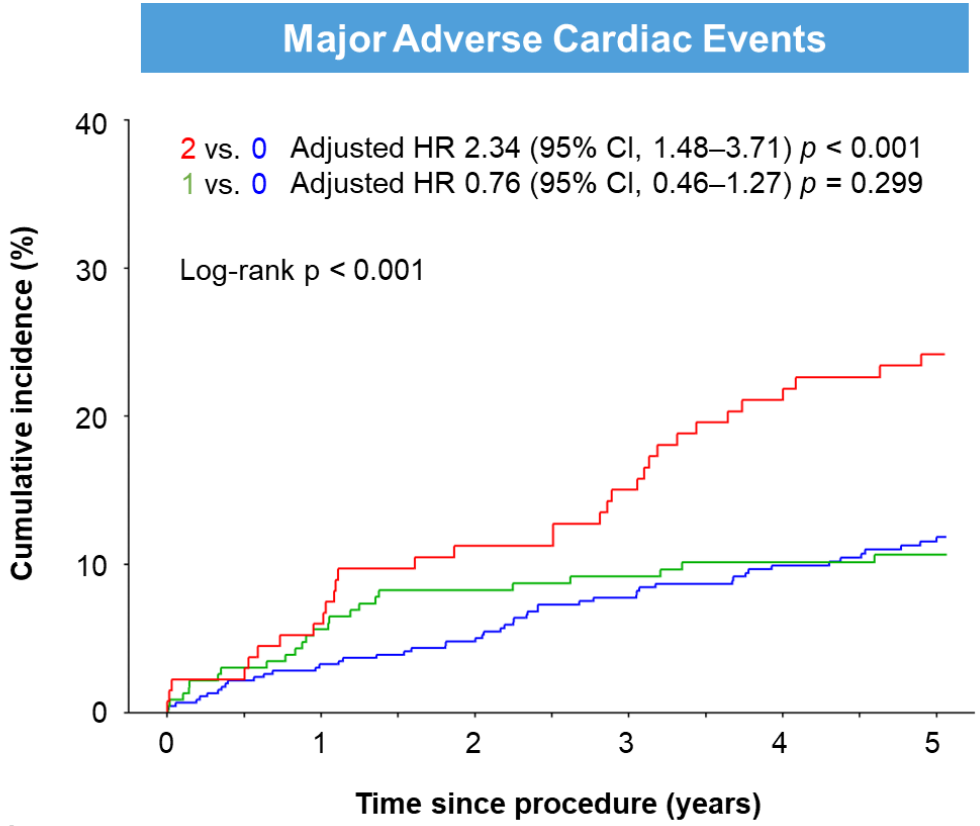


No. at risk

oLAD MSA < 8.1 mm²	341	319	296	280	261	244
oLAD MSA ≥ 8.1 mm²	488	472	448	420	379	334

Revision in EuroIntervention

Incidence of Under-expansion of LM Segments and Outcomes



No. at risk

Group 2	134	126	117	112	103	96
Group 1	232	218	203	191	181	170
Group 0	463	447	424	397	356	312

2 Segments Underexpansion

1 segment Underexpansion

No Underexpansion

Revision in EuroIntervention

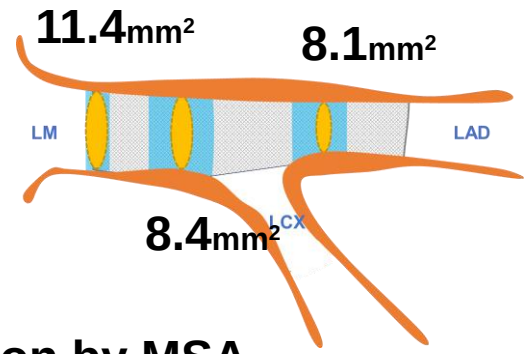
New Imaging Algorithm for LM Bifurcation Treatment

① **Look at the LCX ostium**

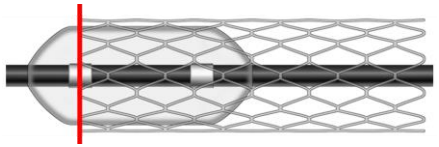
High Risk
- **Plaque Burden> 64%**
- **MLA< 3.7 mm²**

②

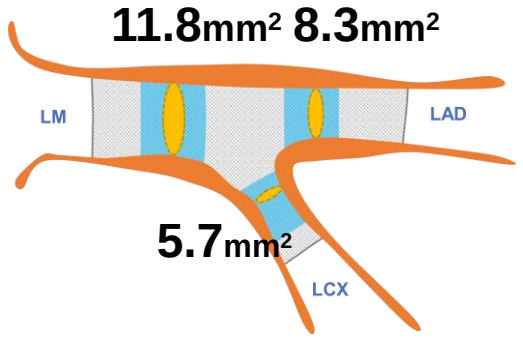
No → **Provisional Stenting**



③ **Stent Optimization by MSA**



Yes → **Upfront Two-Stenting**



- Apologies for many numbers: just benchmark, not absolute number.
- Chasing a target helps standardize procedures and improve outcomes.
- Just watching without action won't make a difference.