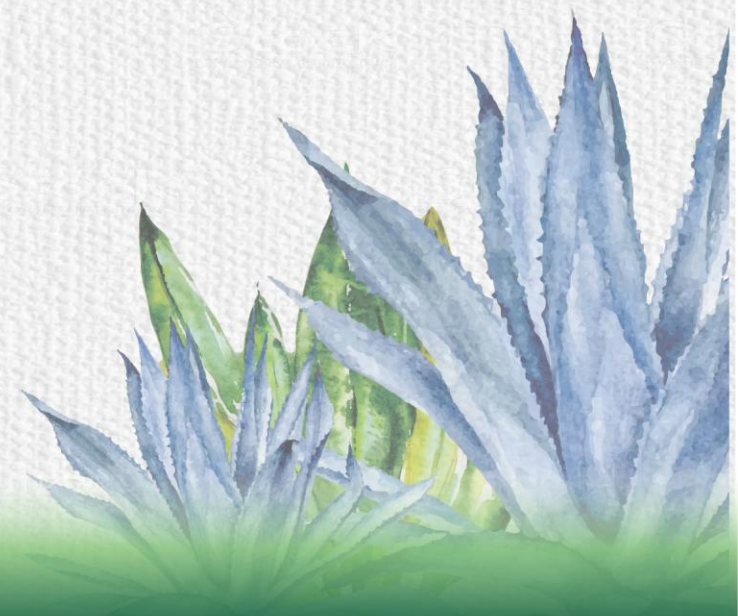


11:10-11:30 Room B1 y B2

Learning Case and Technique Reviews - Non-LM Bifurcation Disease. Step-by-step

Stankovic Goran, MD, PhD
University Clinical Center of Serbia
Belgrade, Serbia



Goran Stankovic, MD, PhD

I have the following financial relationships

Speaker's Bureau :

Medtronic

Terumo

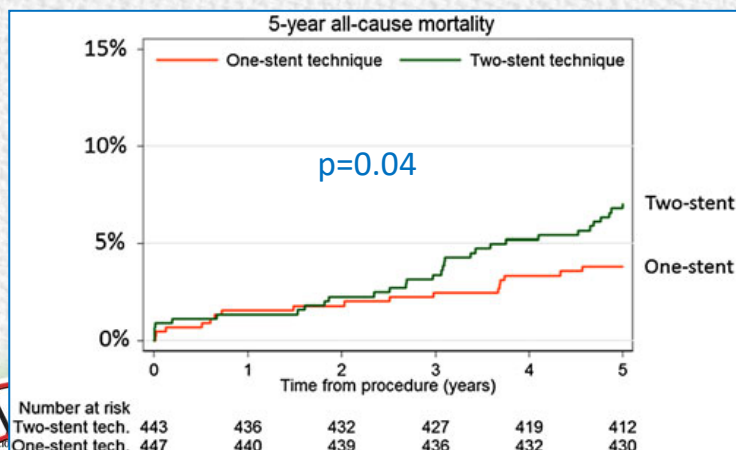
Boston Scientific

Abbott Vascular

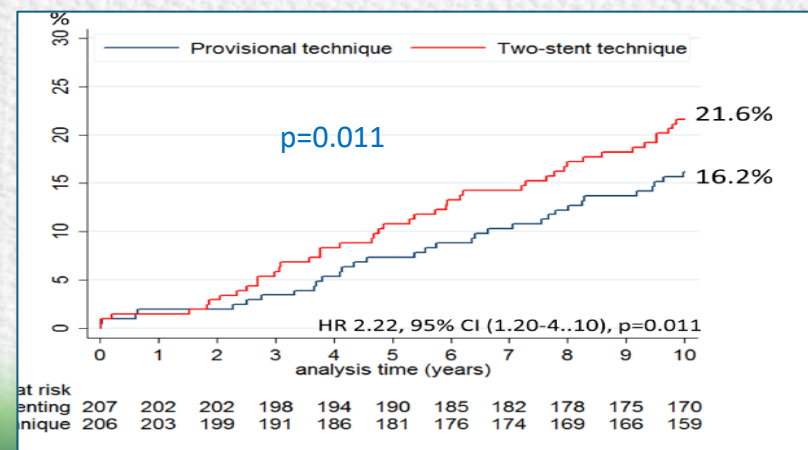


Background: 1 vs. 2-stents trials

- Many trials have shown lack of benefit associated with systematic two-stent strategies for bifurcations
 - NORDIC, BBC ONE, BBK, CACTUS etc....
- Even in patients with larger, true bifurcations
 - EBC TWO
- Outcomes may be worse with systematic dual stenting:



Behan et al EHJ 2016



Terje Steigen at EBC 2017



STEPWISE PROVISIONAL VERSUS SYSTEMATIC CULOTTE FOR TRUE NON-LEFT MAIN BIFURCATION LESIONS: EBC TWO study

EBC TWO compared provisional and culotte strategies

Kissing balloon-inflation routine, T-stent if required

Second generation drug-eluting stents

SB diameter $\geq 2.5\text{mm}$, SB lesion length $\geq 5\text{mm}$

200 patients recruited in Europe from 2011-2014

16% side branch stenting in provisional cohort

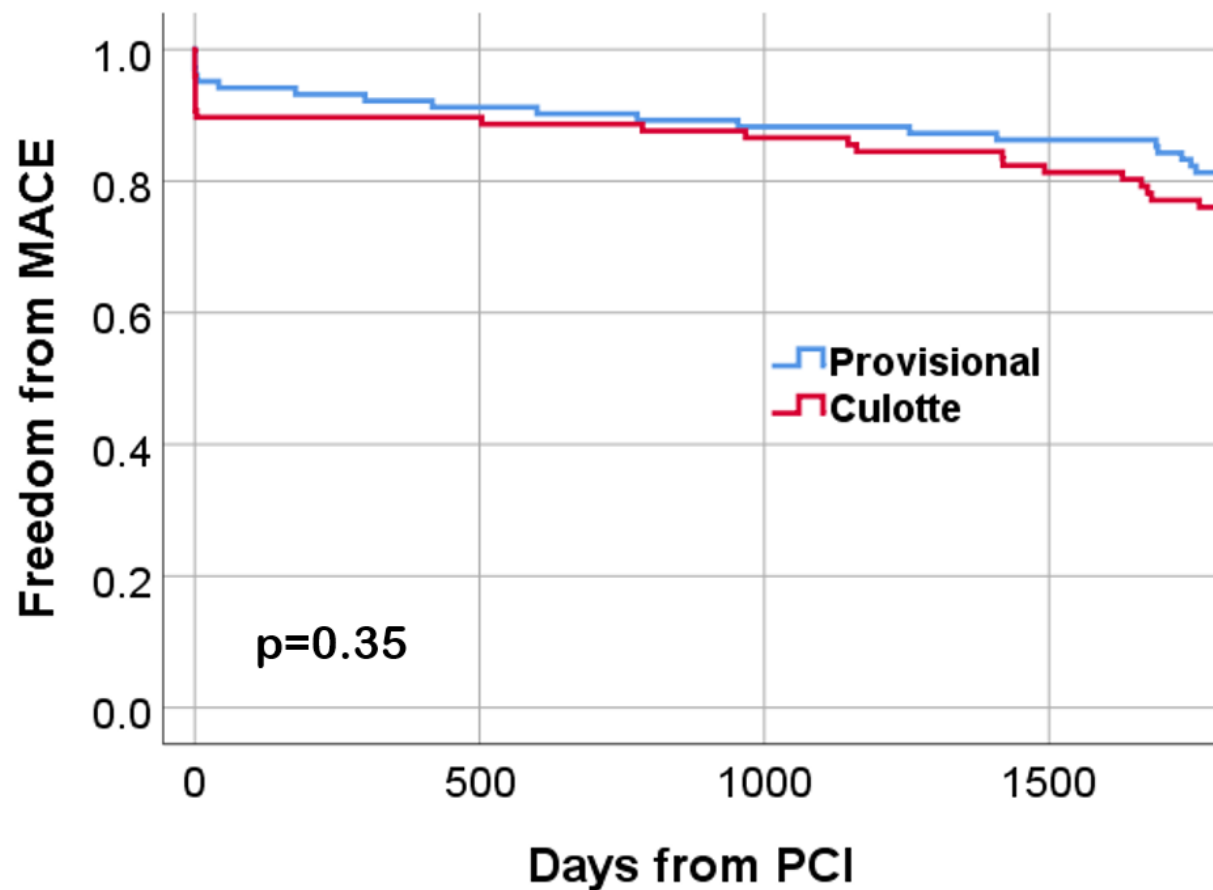
Less procedural time, radiation and cost

12-month outcomes reported in 2016

MACE not significantly different between provisional and culotte cohorts
(7.7% vs 10.3%, $p=0.53$)

EBC TWO: 5-year follow-up

All-cause mortality, MI or TVR



Provisional 18.4% vs Culotte 23.7%

HR 0.75 (95% CI 0.41-1.38)

Routine culotte did not improve 5-year MACE beyond provisional stenting in non-left main true bifurcation lesions

Only 16% provisional patients required SB stent



The EBC Ethos of treatment for bifurcation

- Keep it simple and safe;
- Limit the numbers of stents;
- Respect the original bifurcation anatomy and try to reproduce it;
- Aim for well apposed and well expanded stents, with limited overlap;
- The *provisional SB stenting* strategy is the “standard” approach for treatment of the vast majority of bifurcation lesions, *including the left main*;



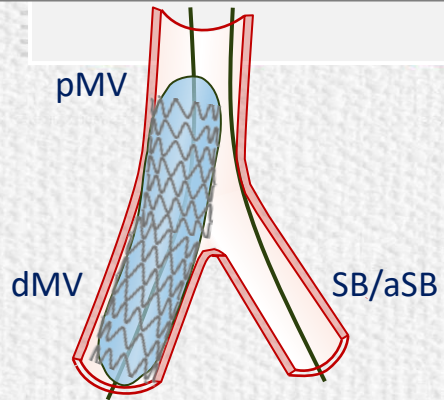
Stepwise provisional non-LM bifurcation PCI

How it applies to everyday practice

- Wire both vessels
- Predilate the “main” branch
- Consider use of IVUS/OCT and cutting/scoring/rota/IVL
- Stent “main” vessel according to distal diameter
- **POT in MV** along stented length (**mandatory step**)
- Rewire SB
- Optional kiss for large SB (optional POT-KISS-POT)
 - If you need to do more...
- Optional 2nd stent (with mandatory kiss)

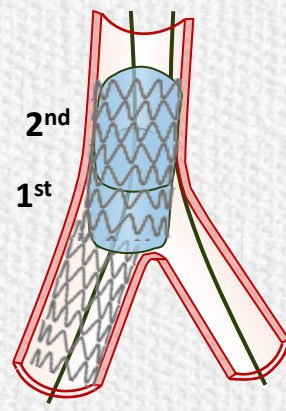


Step 1

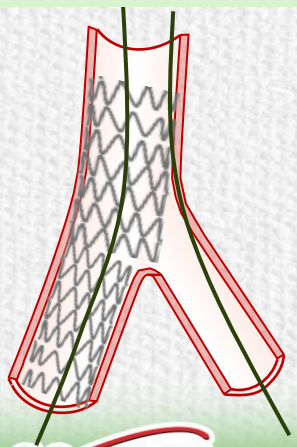


MV stenting
sized according to
distal MV (dMV) diameter

Step 2



optimal result in the
MV and acceptable in
SB/aSB

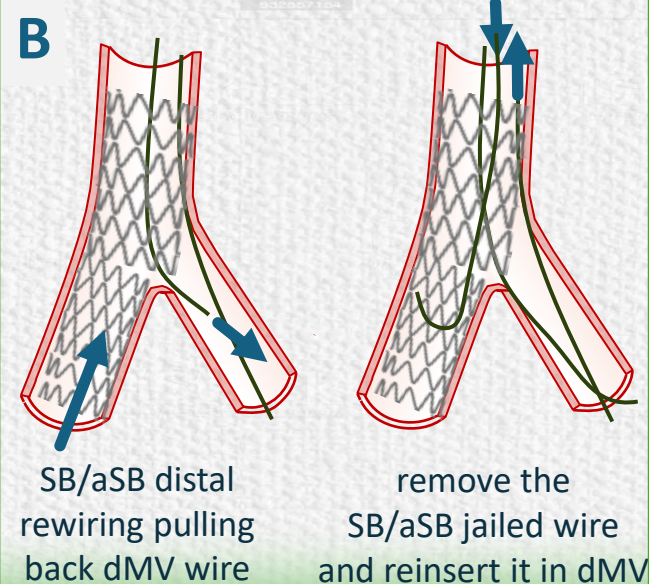
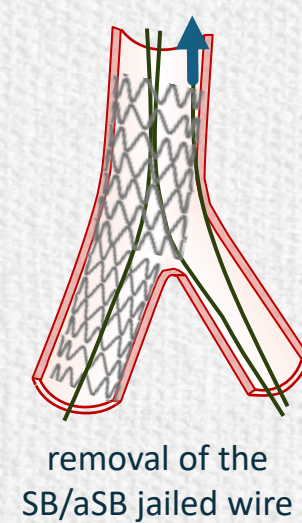
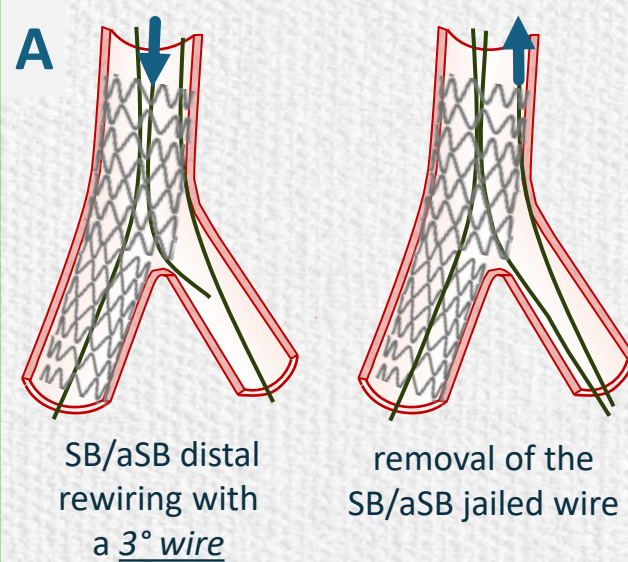


procedure end

SB/aSB is
compromised and deserves
further
intervention

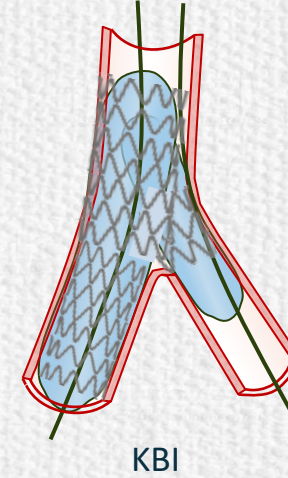
systematic KB (i.e., LM)

Step 3

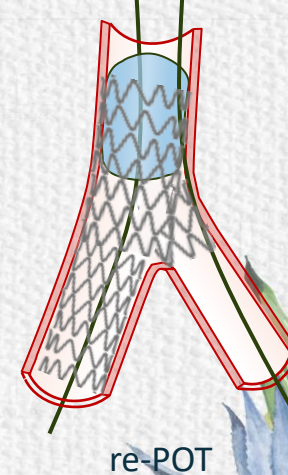


remove the
SB/aSB jailed wire
and reinsert it in dMV

Step 4



with or without

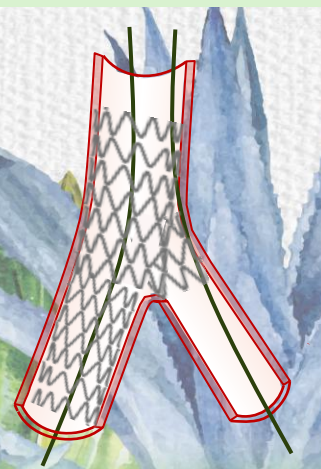


Step 5

Provisional
SB/aSB
stenting

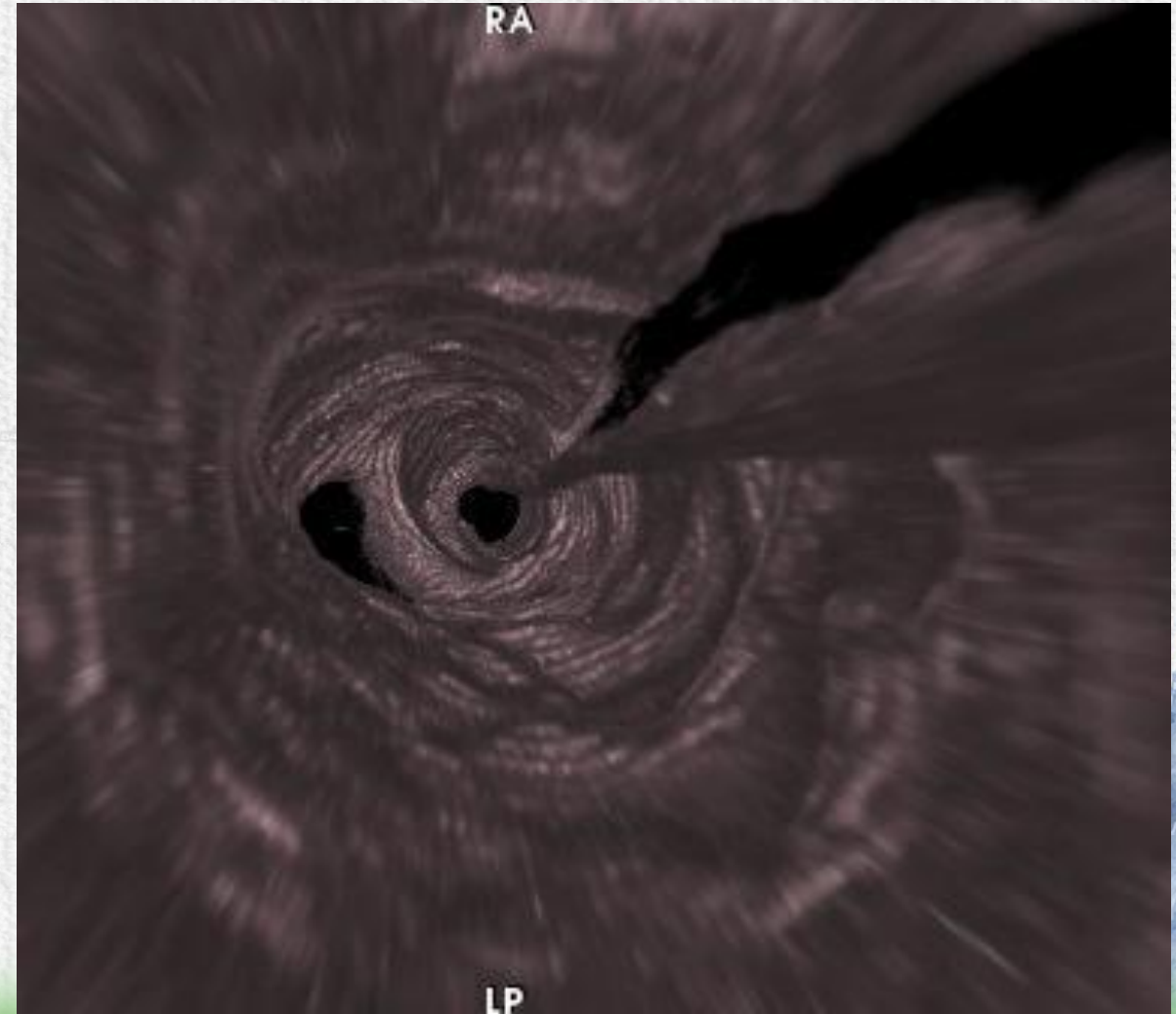
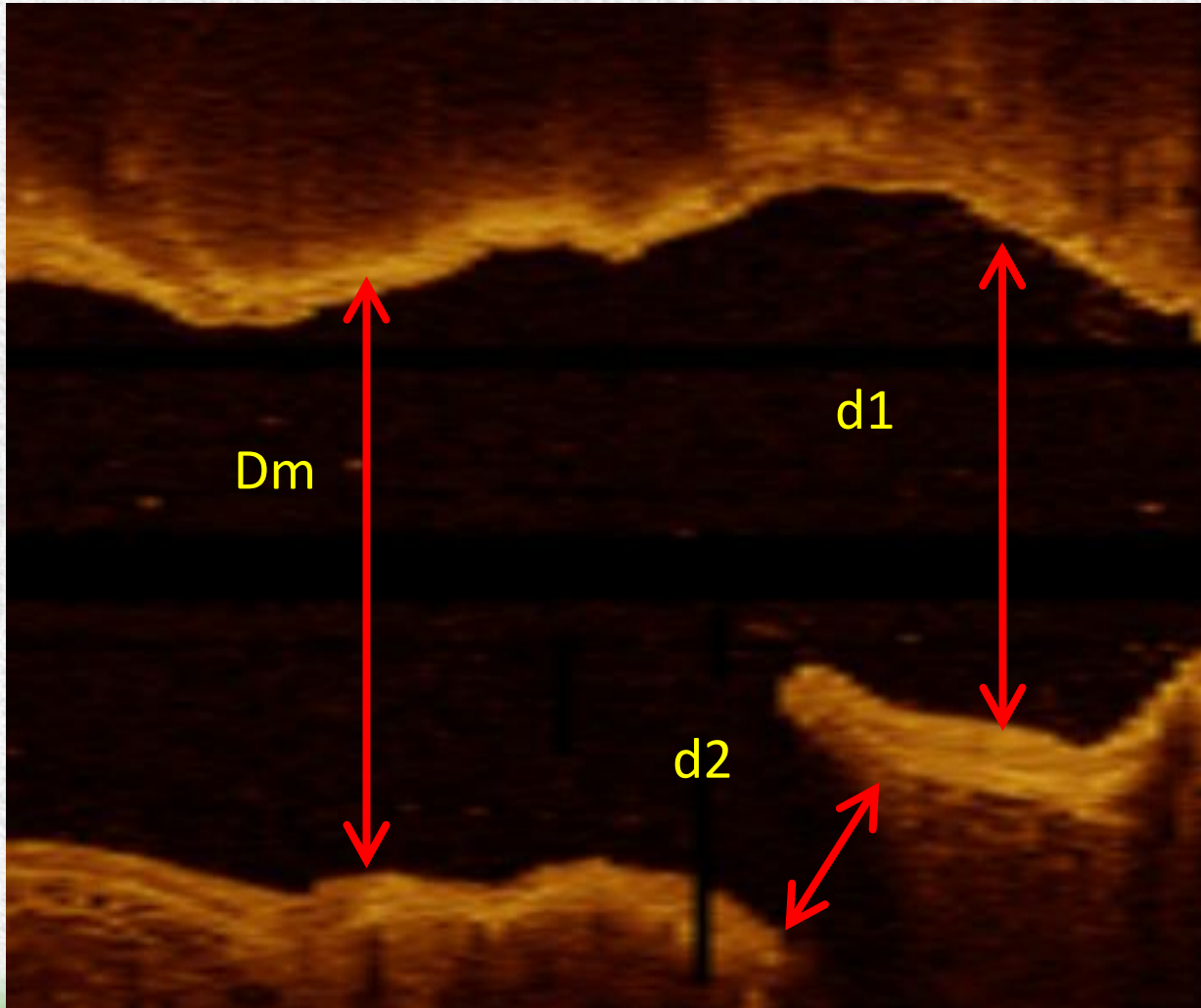
SB/aSB result after
ballooning not
acceptable

optimal result in the
MV and acceptable in
SB/aSB



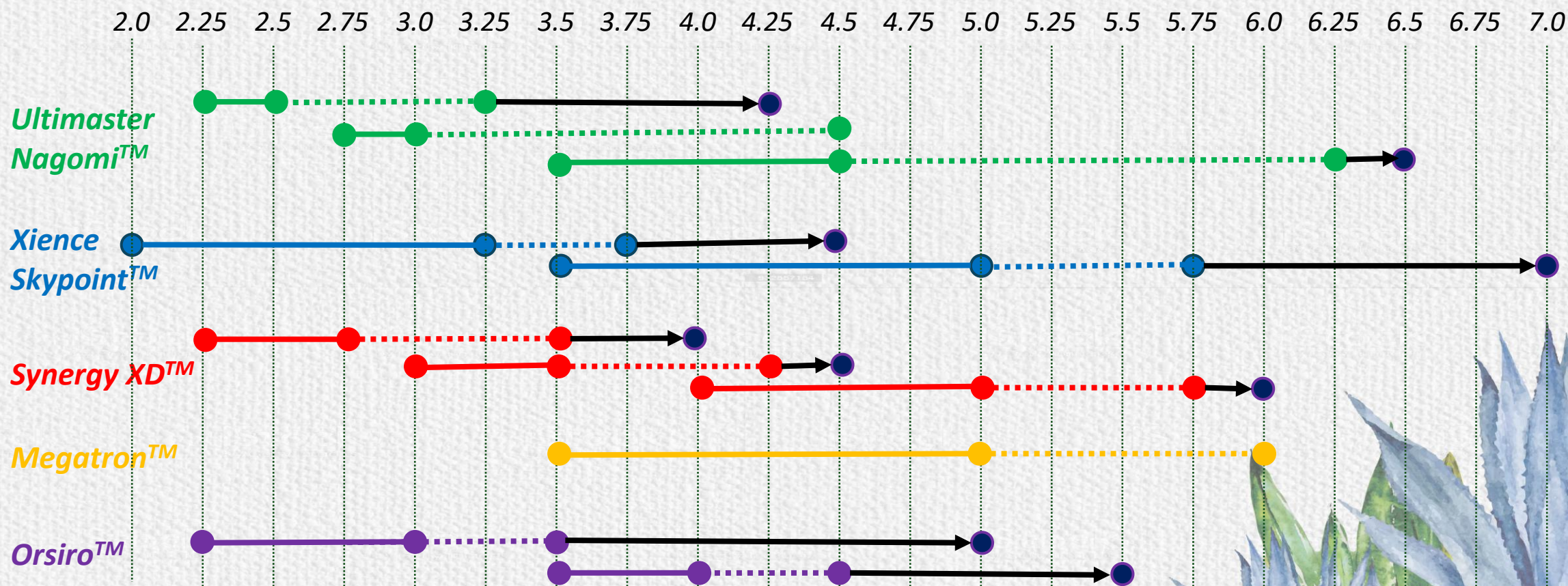
procedure end

Main vessel caliber discrepancy: step down at bifurcation site



Stent size selection

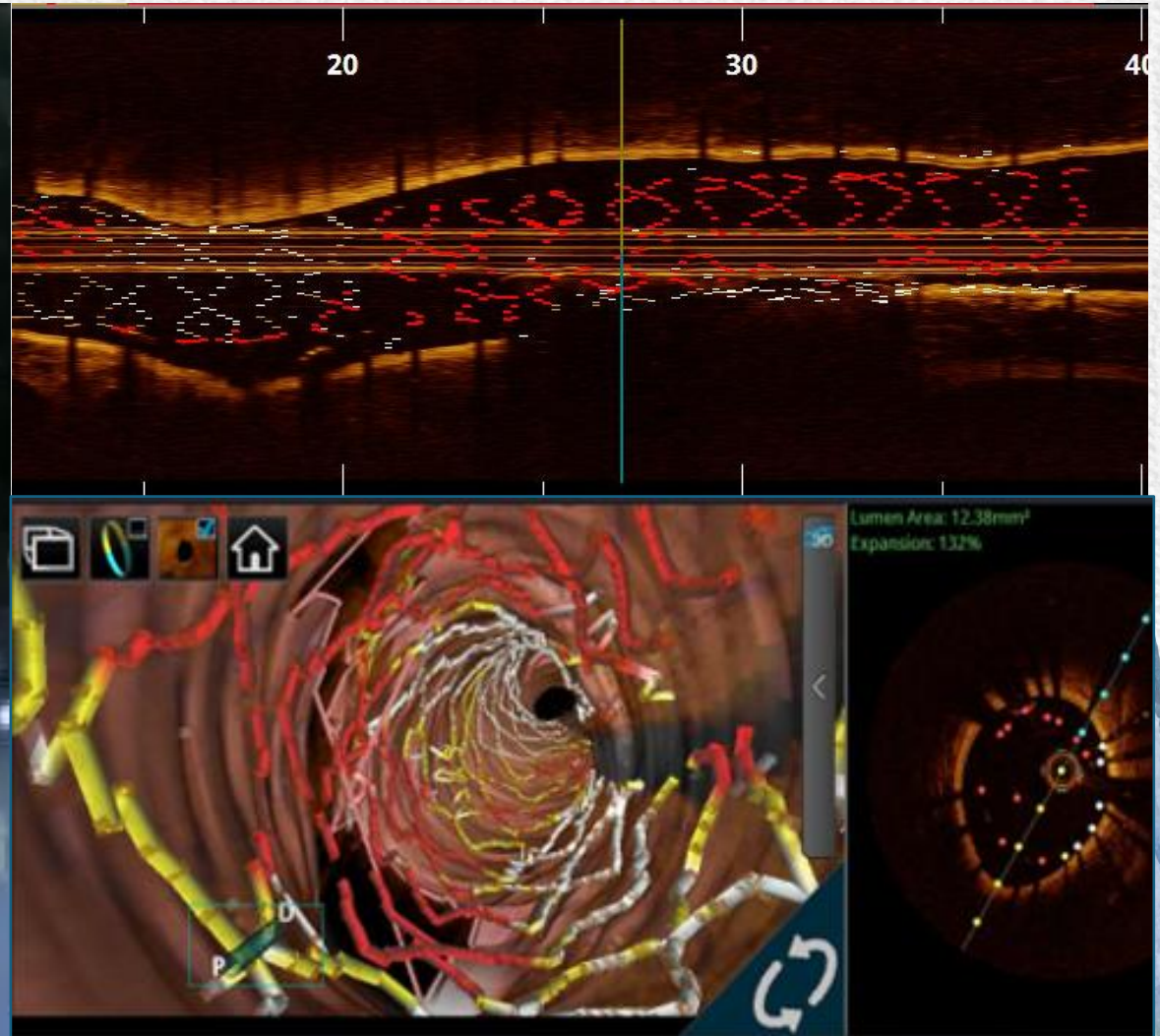
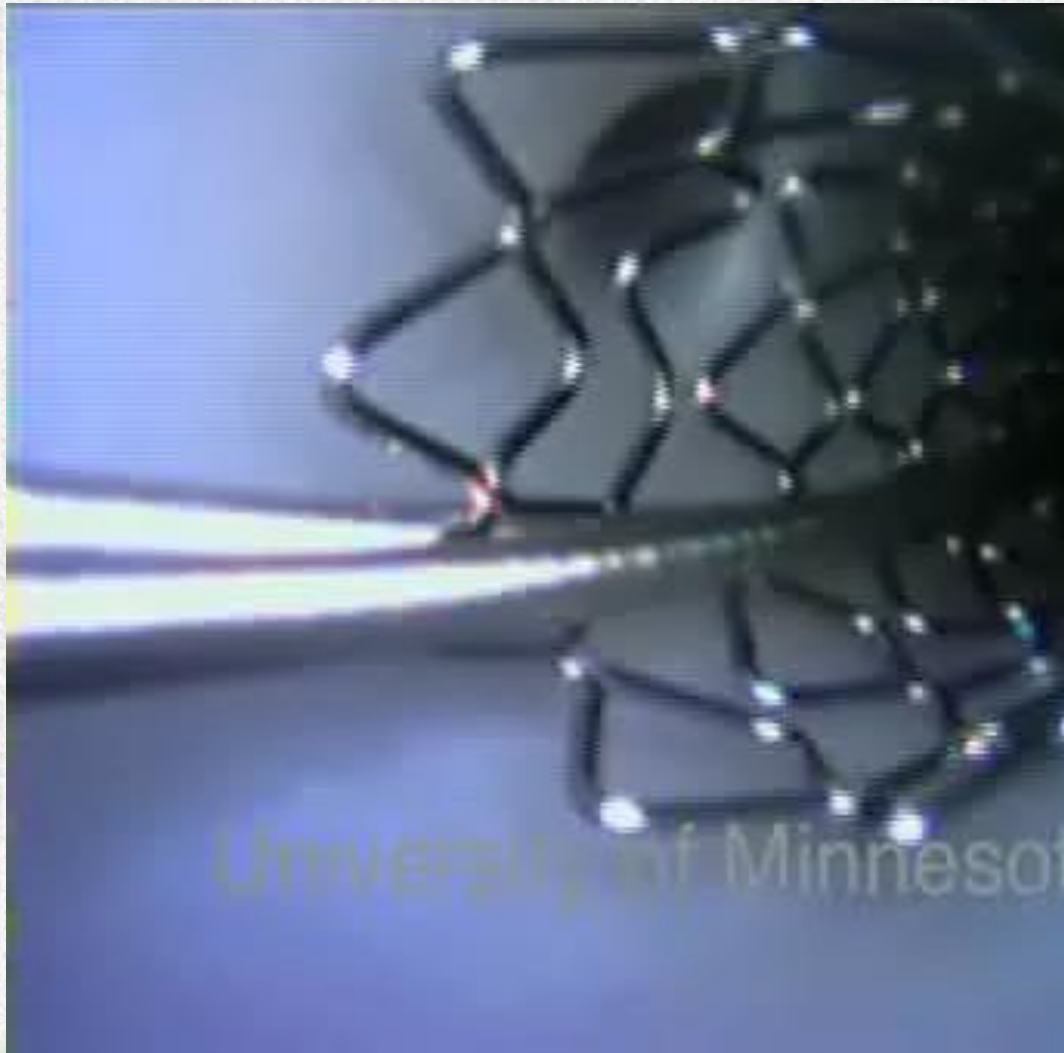
Maximal overexpansion: off label



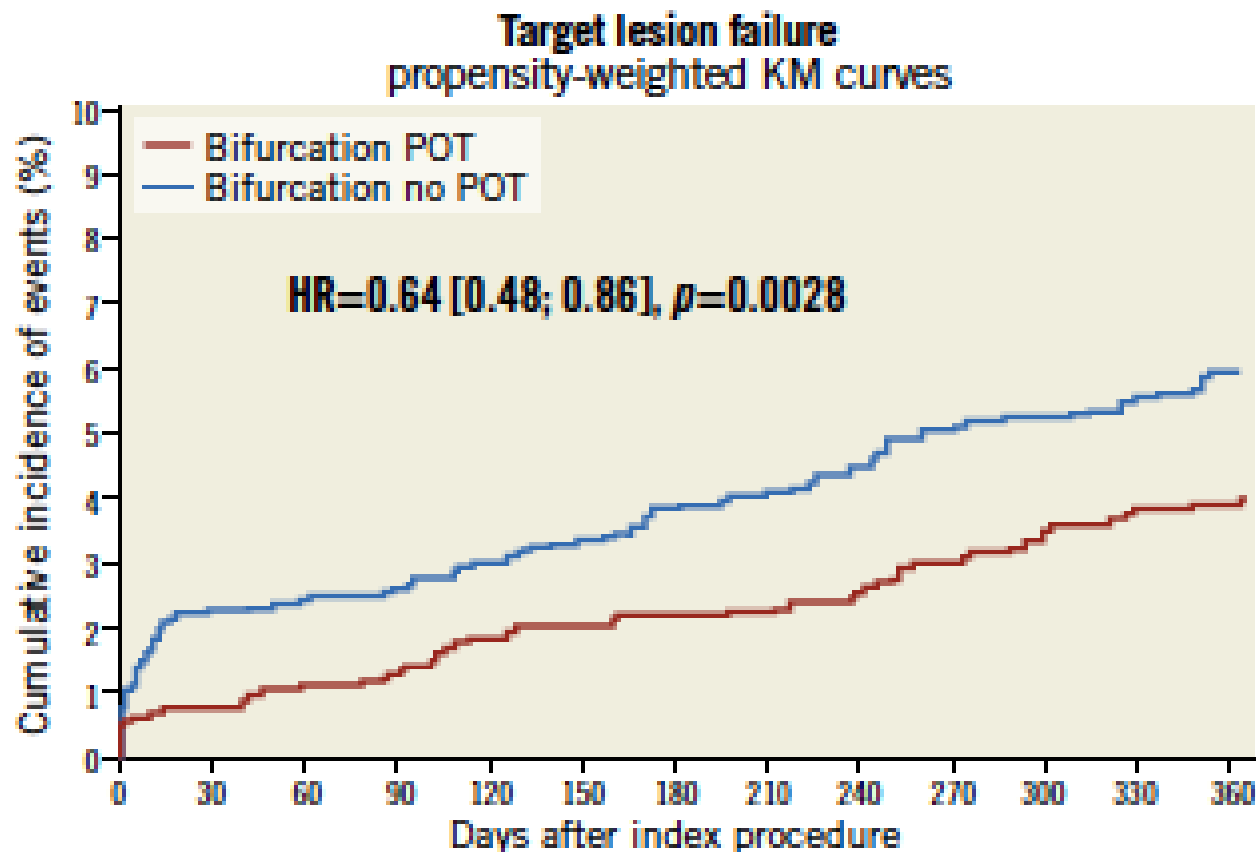
⇒ Real overexpansion >> recommendations

No shortening

The importance of POT



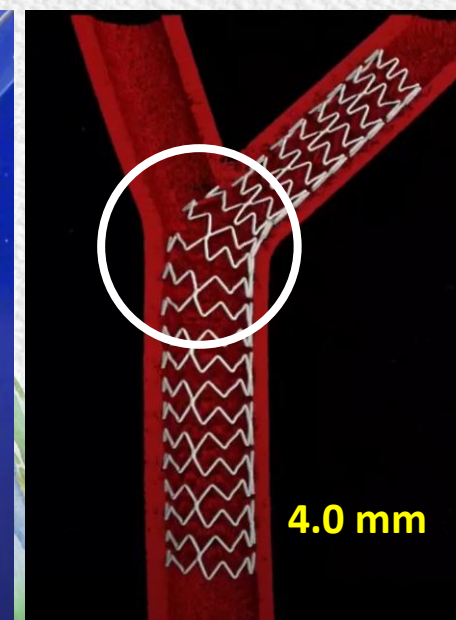
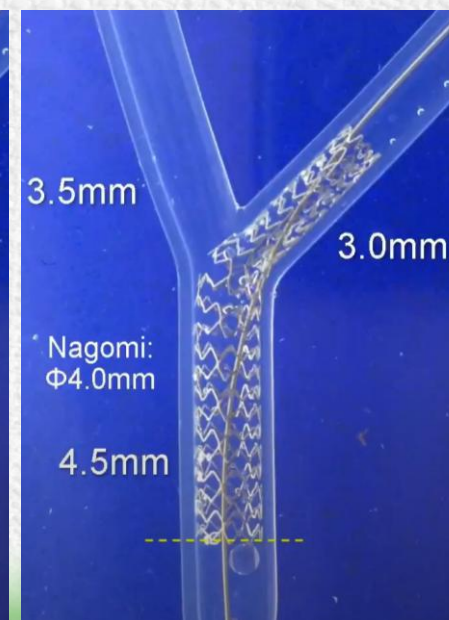
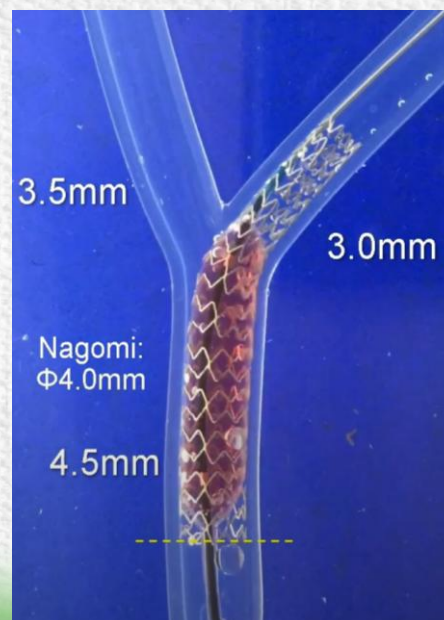
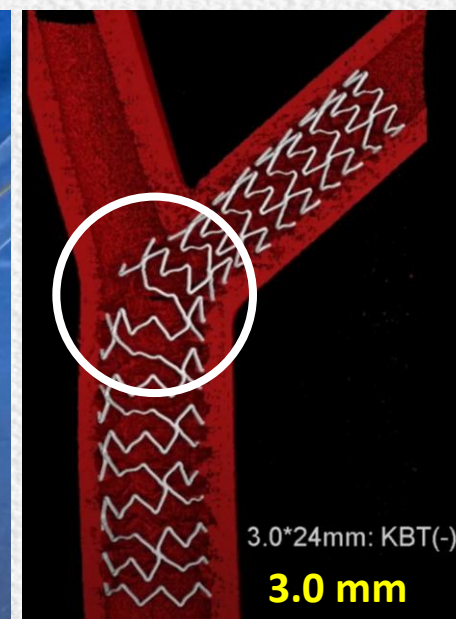
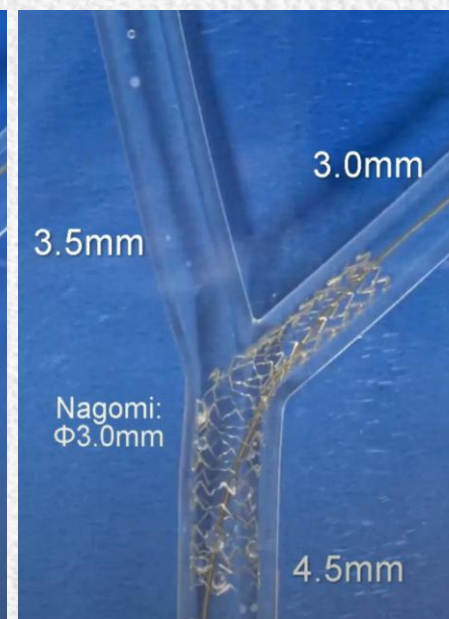
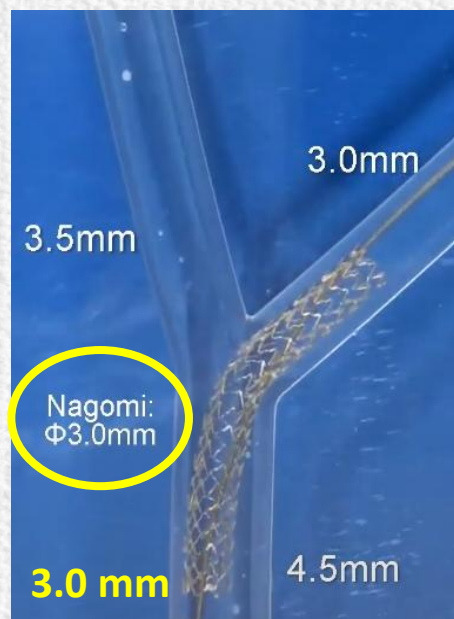
The impact of POT: Clinical evidence from e-Ultimaster registry



Number at risk (unweighted)

POT	1,453	1,400	1,362	1,347	1,297
No POT	2,828	2,716	2,621	2,576	2,482

bifurcation stenting is the situation where the proximal and distal diameter difference is maximal



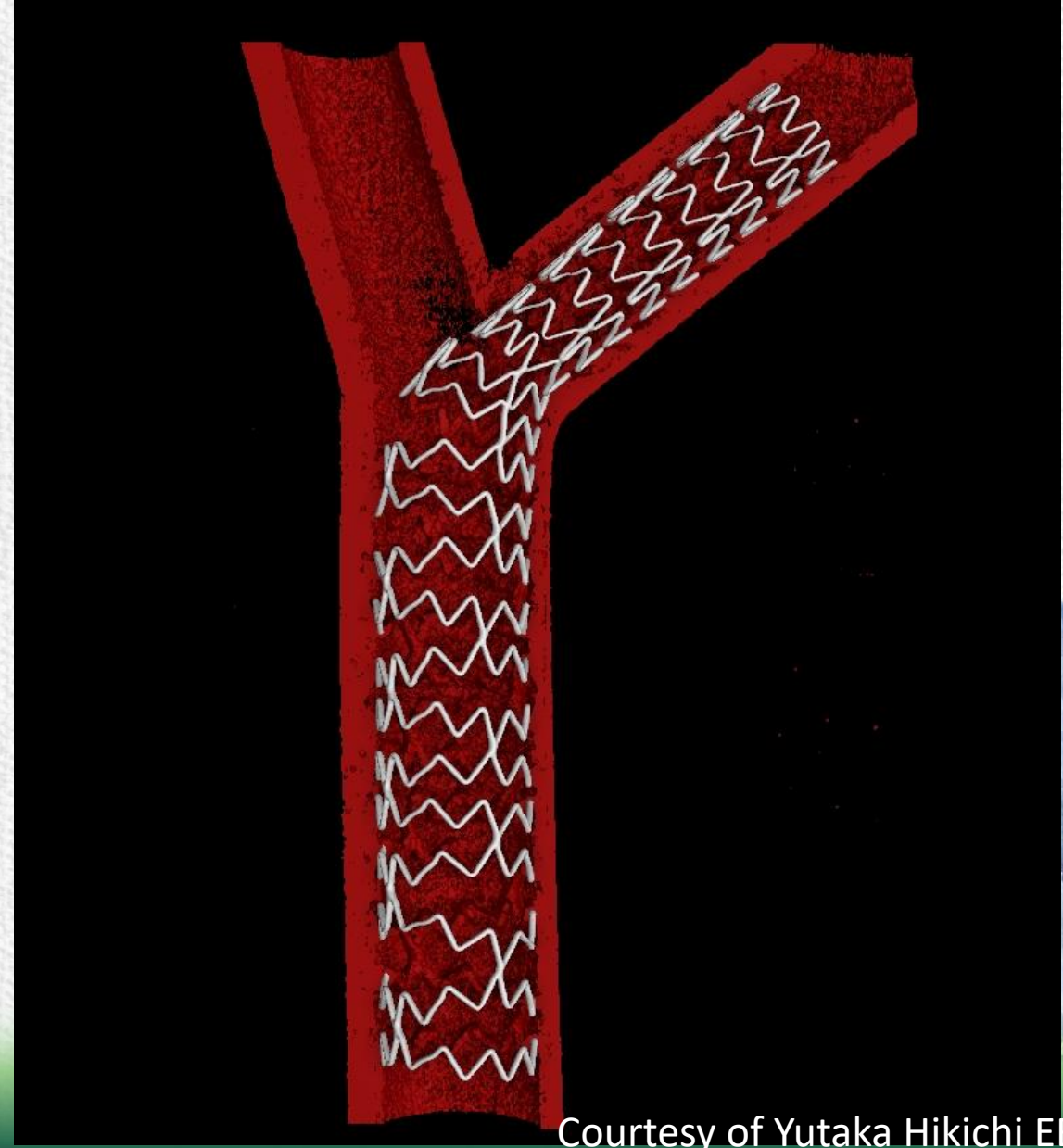
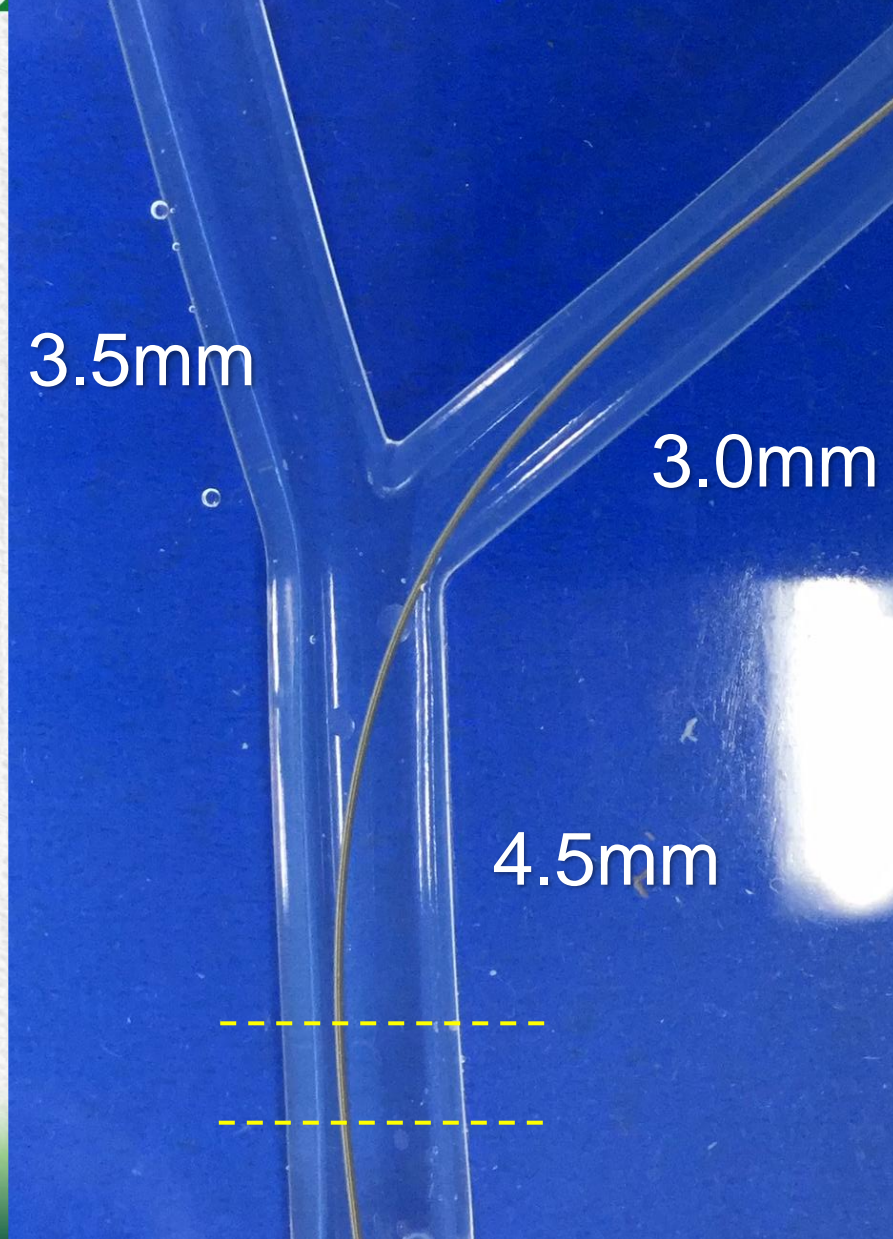
**Crossover stenting
and POT**

Optimal POT:
should we start optimization from **the carina**
site or from the proximal stent edge?



SOLACI
SOCIME'25

POT: Expanding from the distal side using a short balloon

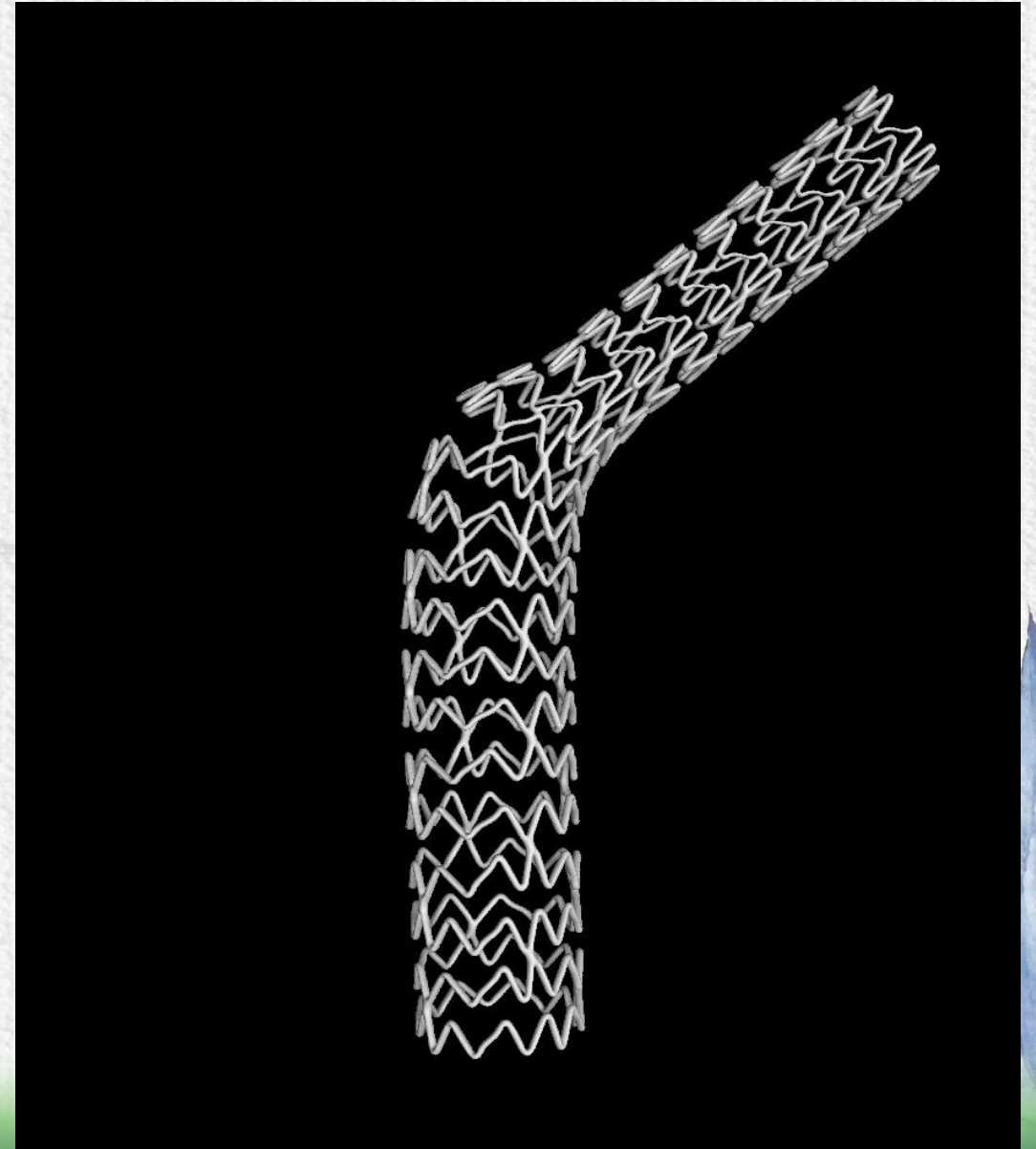
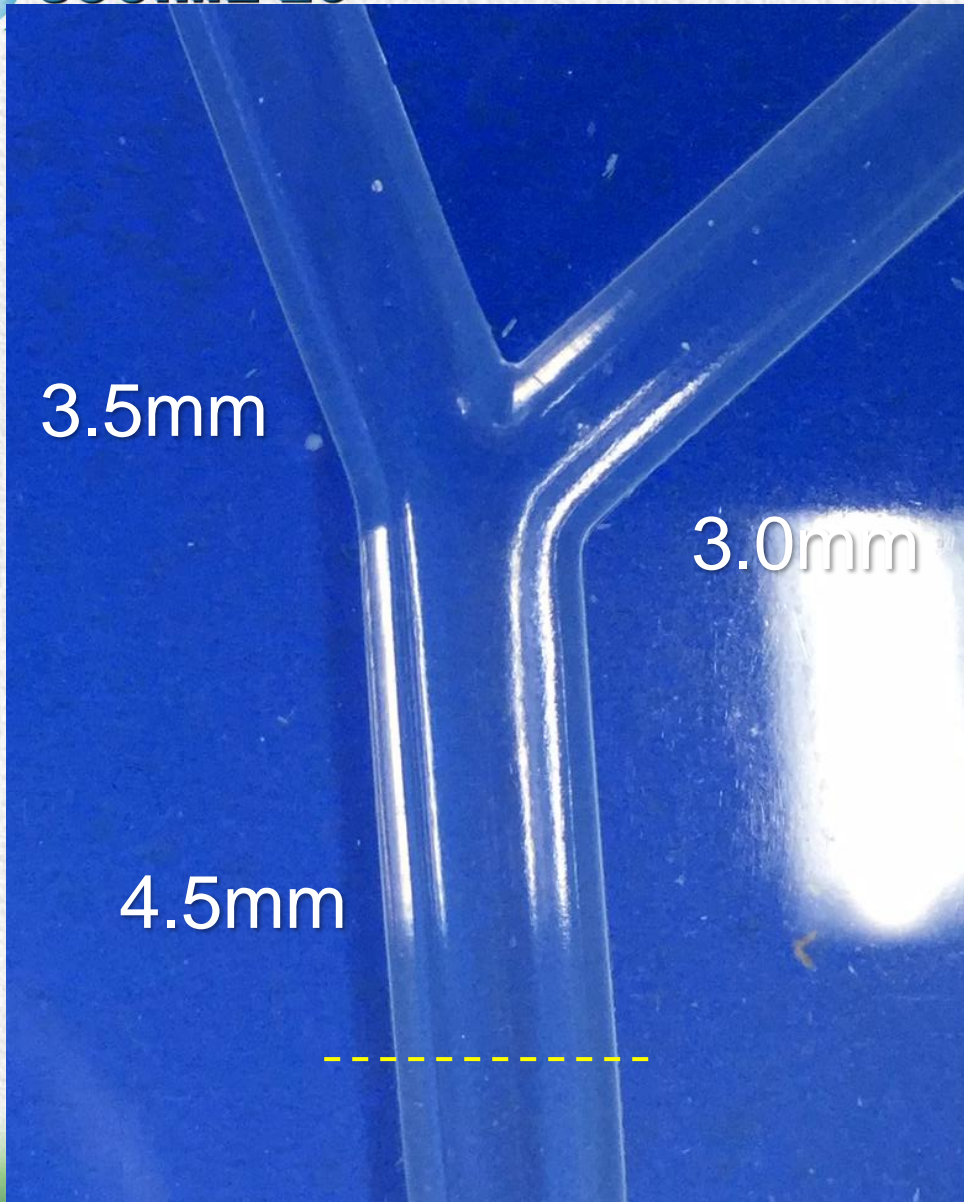


Courtesy of Yutaka Hikichi EBC 2023



SOLACI
SOCIME'25

POT: Expanding from the proximal side using a short balloon



How to size POT balloon:

Angio vs. Imaging:

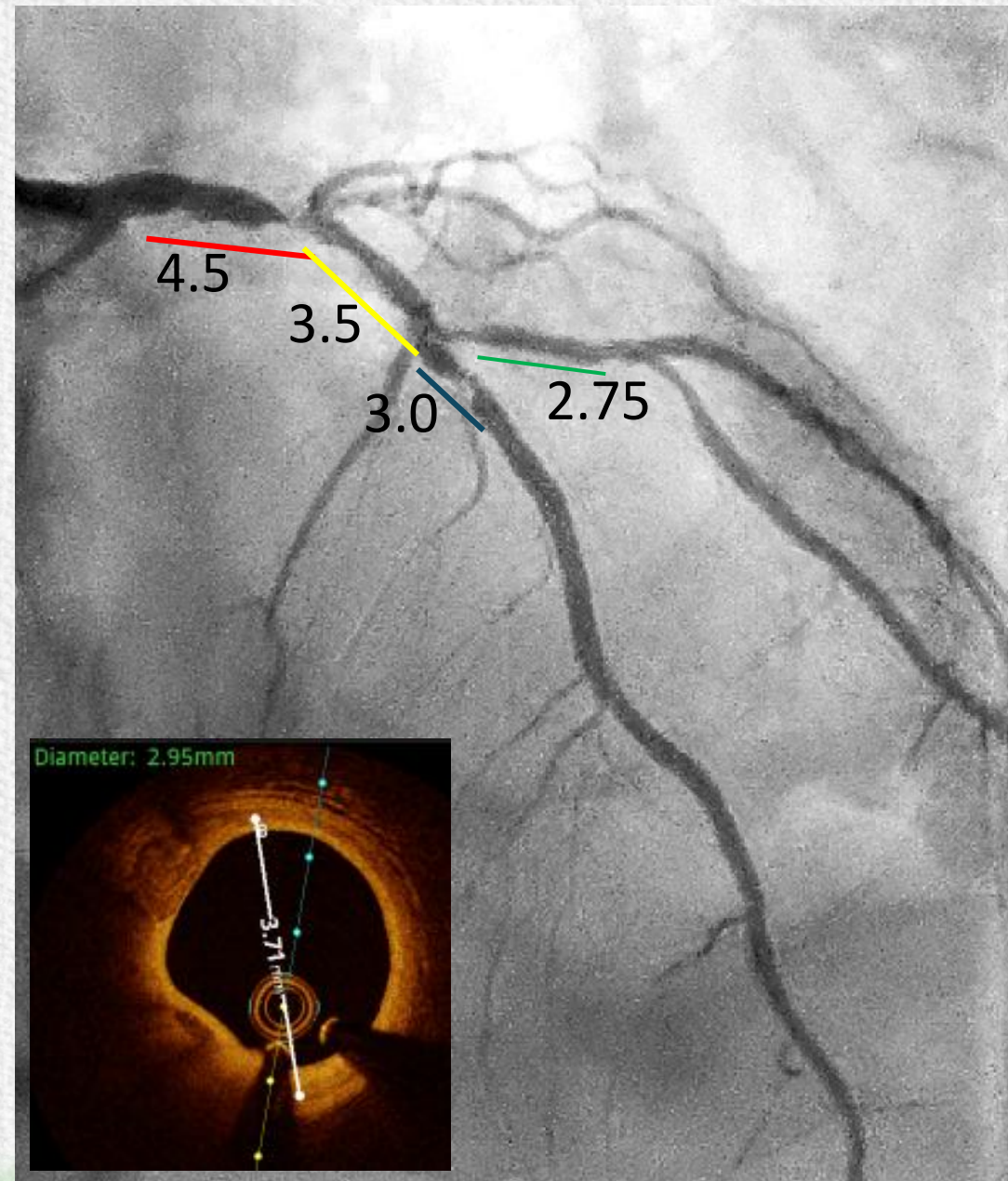
Ref diam was limit for largest balloon

Largest balloon

- OCT: $4.2 \pm 0.03 \text{mm}$
- Angio: $4.0 \pm 0.02 \text{mm}$

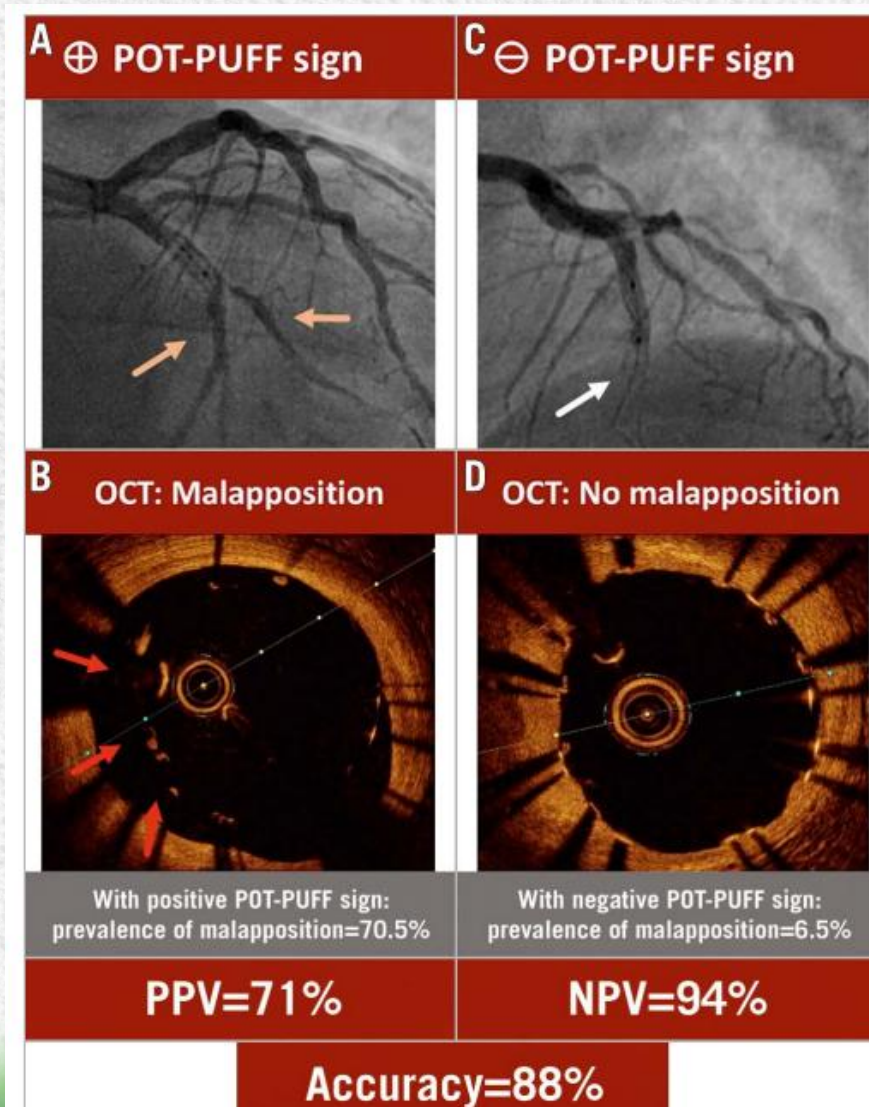
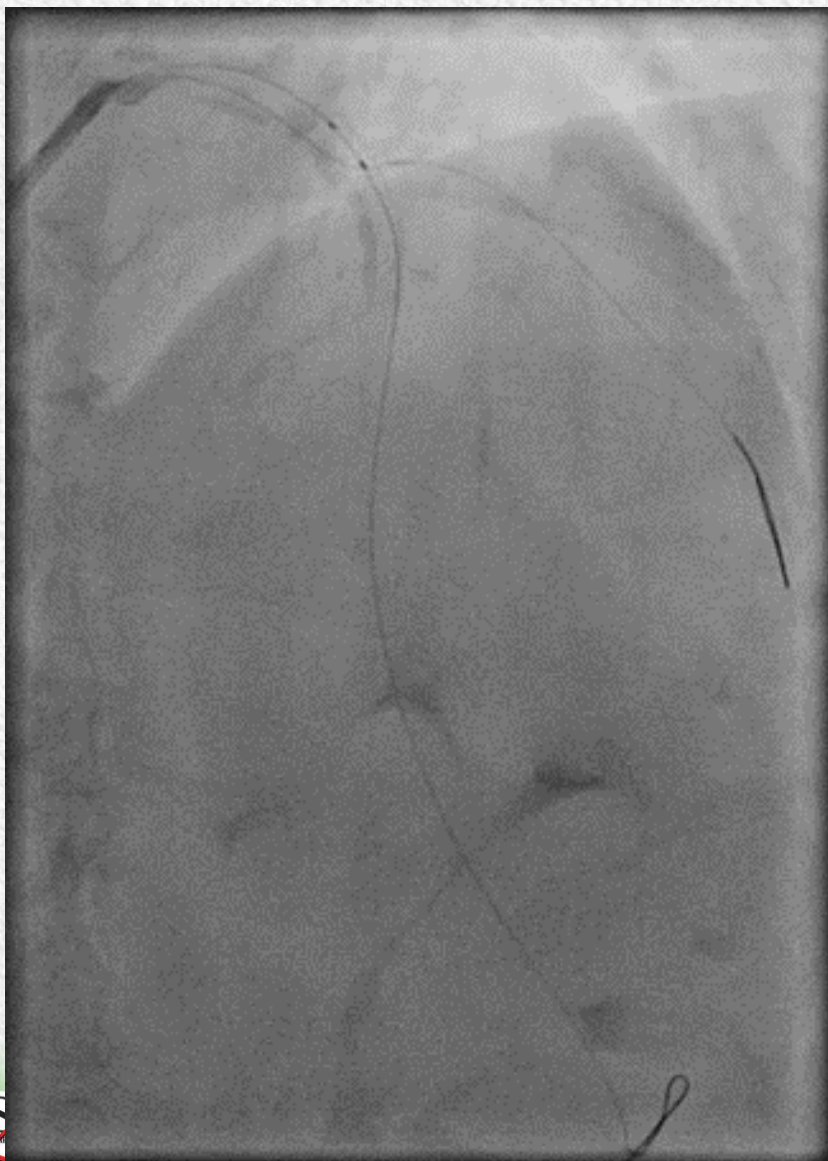
Perforations

- OCT: 0.8%
- Angio: 1.0%



Stent apposition

The **POT-PUFF** sign: an angiographic mark of stent malapposition during proximal optimization



Stepwise provisional non-LM bifurcation PCI

How it applies to everyday practice

- Wire both vessels
- Predilate the “main” branch
- Consider use of IVUS/OCT and cutting/scoring/rota/IVL
- Stent “main” vessel according to distal diameter
- **POT in MV** along stented length (**mandatory step**)
- Rewire SB
- **Optional kiss for large SB** (optional POT-KISS-POT)
 - If you need to do more...
- Optional 2nd stent (with mandatory kiss)



KISS trial - Provisional stenting in bifurcation lesion: benefit of side branch intervention?

Bernard Chevalier on behalf of the KISS investigators
(Kee**p** bifurcation stenting simple)

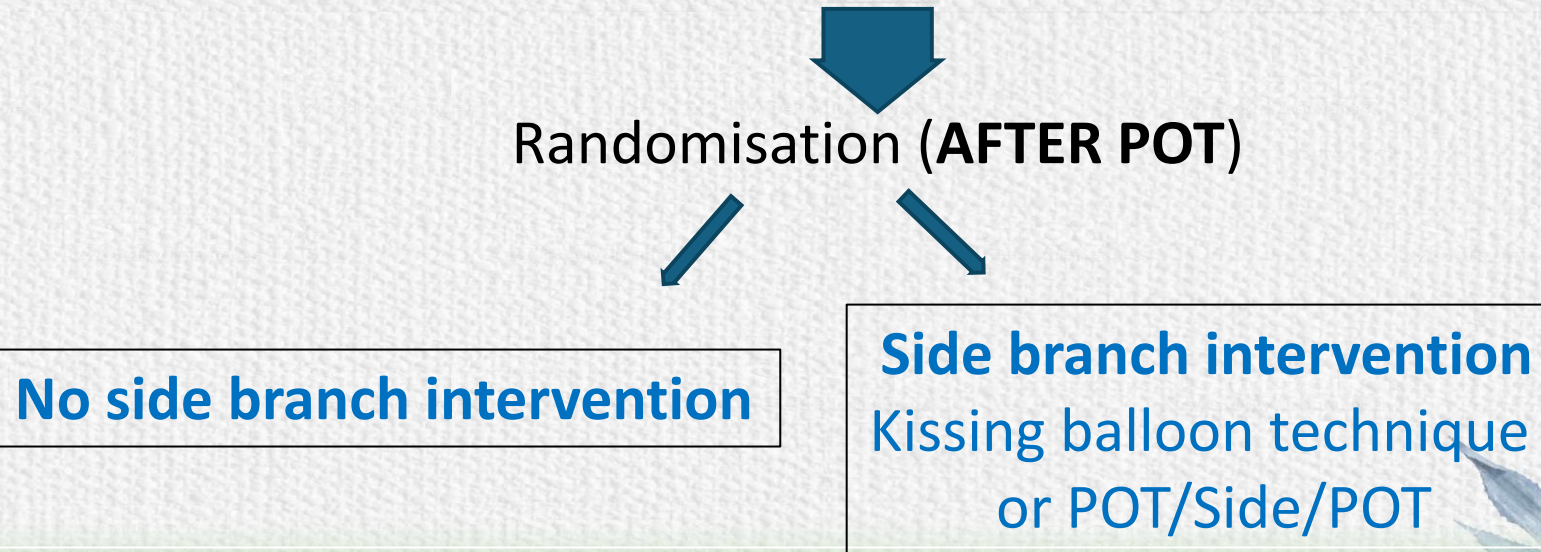
KISS trial design

Any de novo non-LM bifurcation lesion except 001 requiring a wire-based side branch protection

Side branch large enough to accomodate a coronary stent

Main branch stenting (Resolute Onyx) sized to distal reference diameter with a **systematic proximal optimisation technique**

Side branch patent with no flow reduction or any sign of ongoing ischemia



KISS trial endpoints

Primary endpoint: rate of periprocedural infarction/injury using ARC 2 definition within 48 hours

Increase of 70 x troponine ULN of 35 x troponine ULN with additional criteria

Considering $\alpha=0.05$ et $\beta=0.8$ with a rate of 15% in control group and a non-inferiority limit of 7.5%, 596 patients have to be randomized. Superiority will be tested if noninferiority is met.

Secondary procedural endpoints:

Technical success, Acute gain (QCA), Procedure time, Xray exposure (Air kerma, Fluoro time)

Secondary clinical endpoints @ 1 and 12 months:

TLF with its individual components, Def/probable stent thrombosis, Angina status

ITT analysis

304 vs 313 patients

Per Protocol analysis

268 vs 272 patients

(Cross over 2%vs 1,6%)



Procedural results

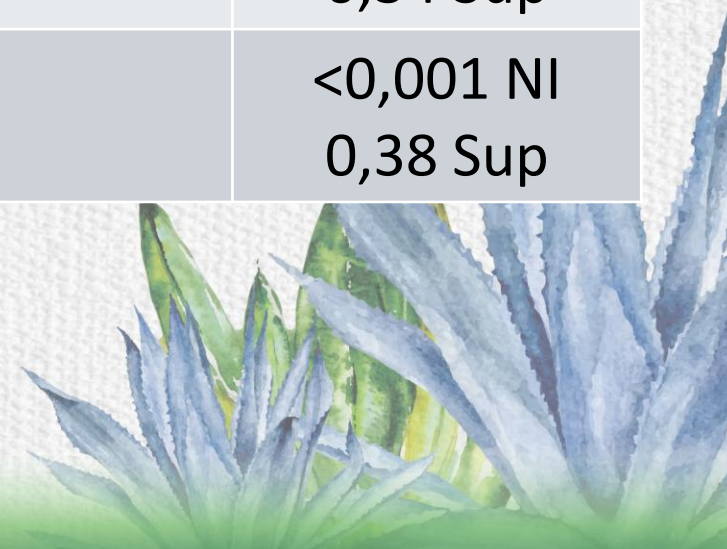
N patients	No SB intervention (303)	Control (314)	p
Technical success*	80,2%	82,1%	NS
Procedure time (median)	34 min	45 min	<0,001
Fluoro time (median)	10 min	13,2 min	<0,001
Air Kerma (median)	453 mGy	629 mGy	<0,001
Contrast volume (median)	130 ml	150 ml	<0,001
Acute gain in SB**	-0,04+-0,36 mm	0,10+-0,31 mm	<0,001

Reduction in procedure time(24%), contrast media volume(13%), X-ray exposure (28%)

* Technical success: successful stenting with residual stenosis <20% by QCA & TIMI > I in SB ** by QCA analysis

What are the main results?

Primary endpoint	No SB intervention	Control	p
ITT (303/313)	4,1%	5,7% <i>(3,4% P/S/P 8,9% KBT)</i>	<0,001 NI 0,38 Sup <0,066
Per protocol (268/272)	4,1%	5,9%	<0,001 NI 0,34 Sup
AS treated (302/314)	4%	5.7%	<0,001 NI 0,38 Sup



One-year outcome

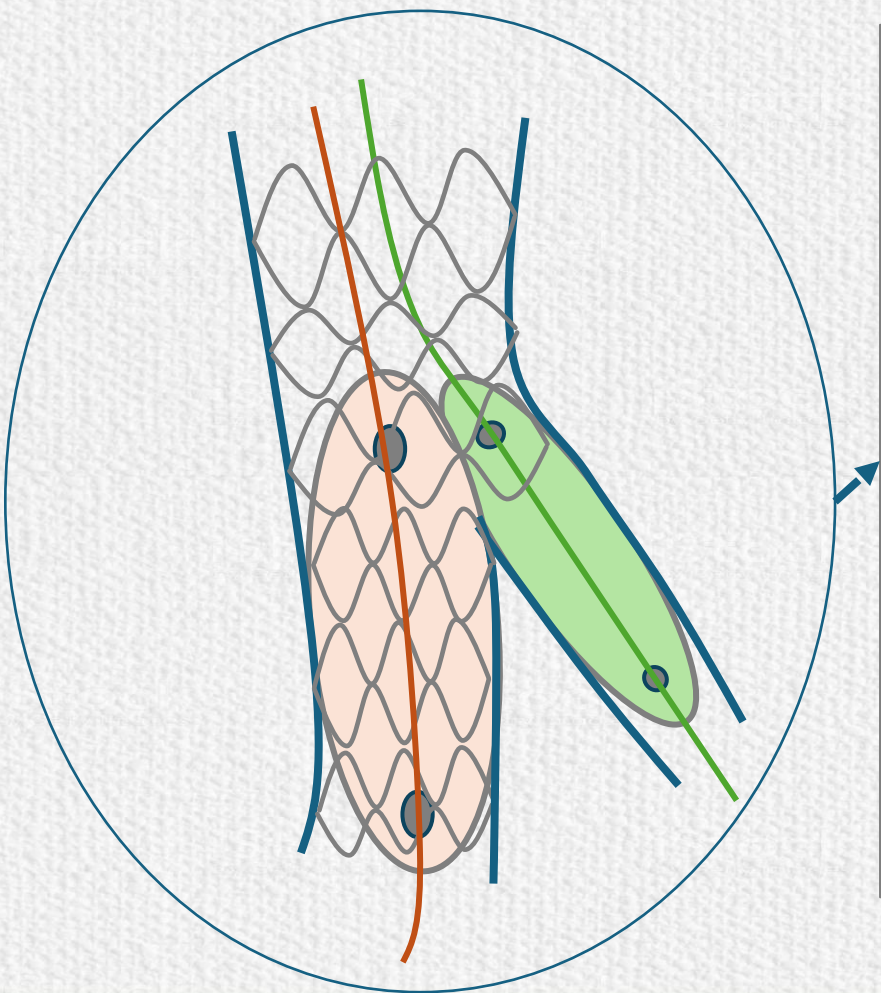
One-year clinical endpoints	No SB intervention		Control		p	
TLF	3.6%	5%	4.5%	6.4%	NS	NS
Cardiac death	0.3%	0.3%	0%	0%	NS	NS
TV MI	3.3%	4%	4.5%	4.8%	NS	NS
CD-TLR	0.7%	1.3%	0%	1.9%	NS	NS
Main branch CD-TLR	0.7%	1.3%	0%	1.9%	NS	NS
Side branch CD-TLR	0.3%	0.7%	0%	0.3%	NS	NS
Stent thrombosis (def/prob)	0.3%	0.7%	0.3%	0.6%	NS	NS
TLF Kissing subgroup			8.9%	9.1%	NS	
TLF SB ballooning			3.4%	4.6%	NS	

Why is this study important

- Provisional stenting in routine non-LM bifurcation using Resolute Onyx DES is associated with a good short & mid-term outcome
- A no-touch strategy is non-inferior @ 30 days to systematic SB intervention and safe/efficient @ 1 year
- A further study in LM bifurcation would be useful

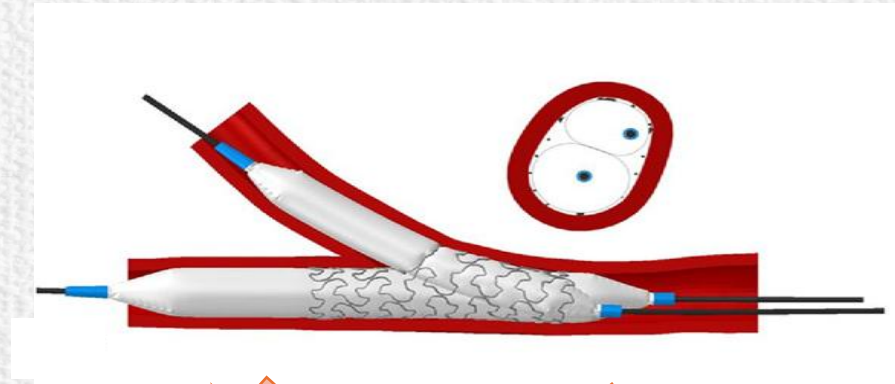
Final Kissing balloon inflation optional

When an important SB is jeopardized after MV stenting

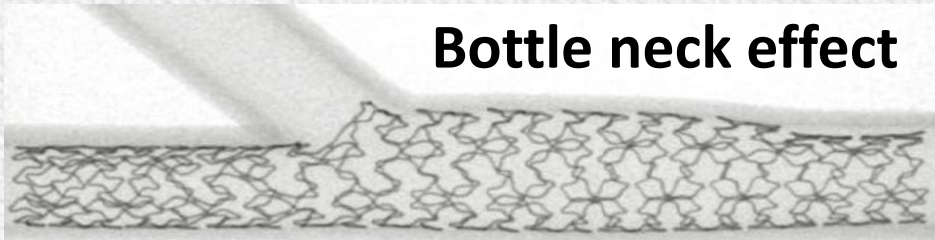


- 2 NC balloons;
- Both sized according to the distal reference of the MB and the SB;
- Short proximal overlap (if longer proximal overlap, consider re-POT);
- Sequential balloon inflation (SB first) and simultaneous deflation;
- Keep balloons inflated 30 sec.

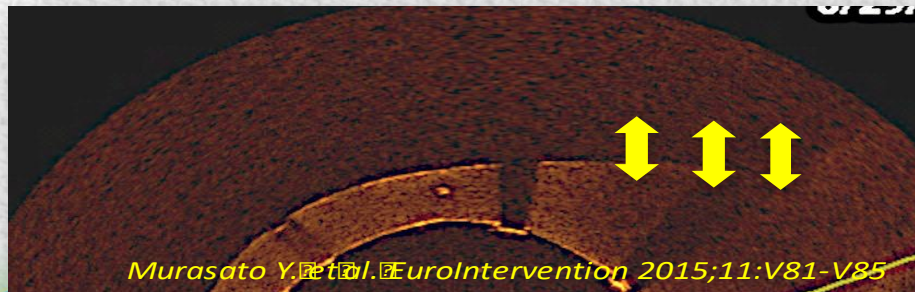
Final POT to correct deformation after KBI



Bottle neck effect



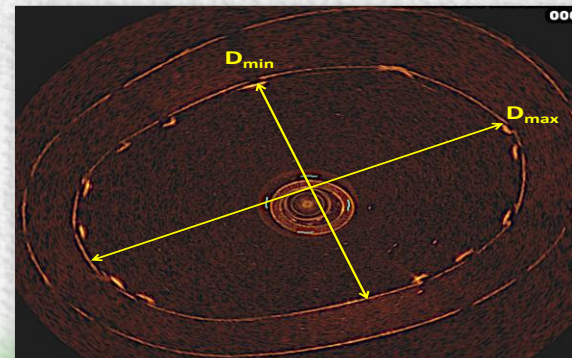
Foin et al. EuroIntervention 2011.



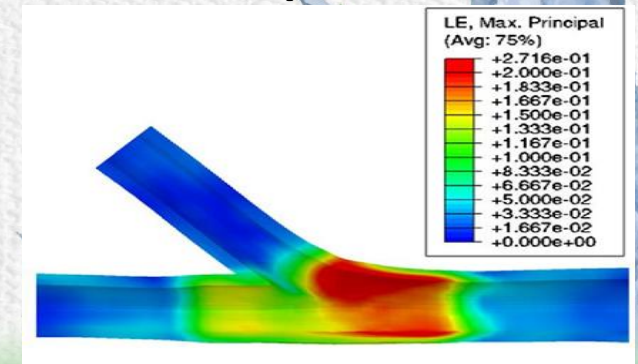
Murasato Y et al. EuroIntervention 2015;11:V81-V85

mm

Proximal elliptic deformation with kissing balloon inflation (arterial + plaque overstretch)

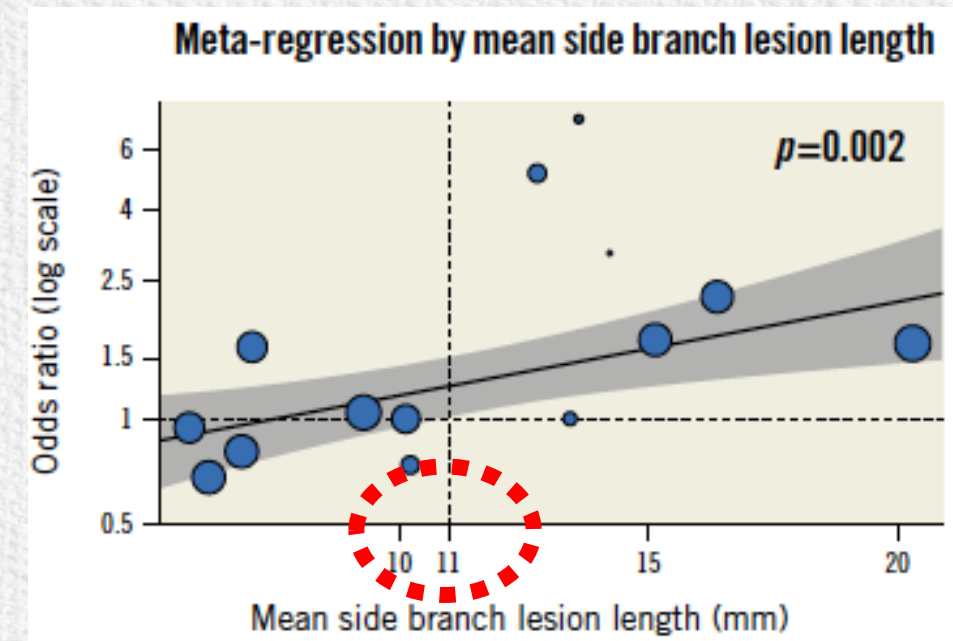
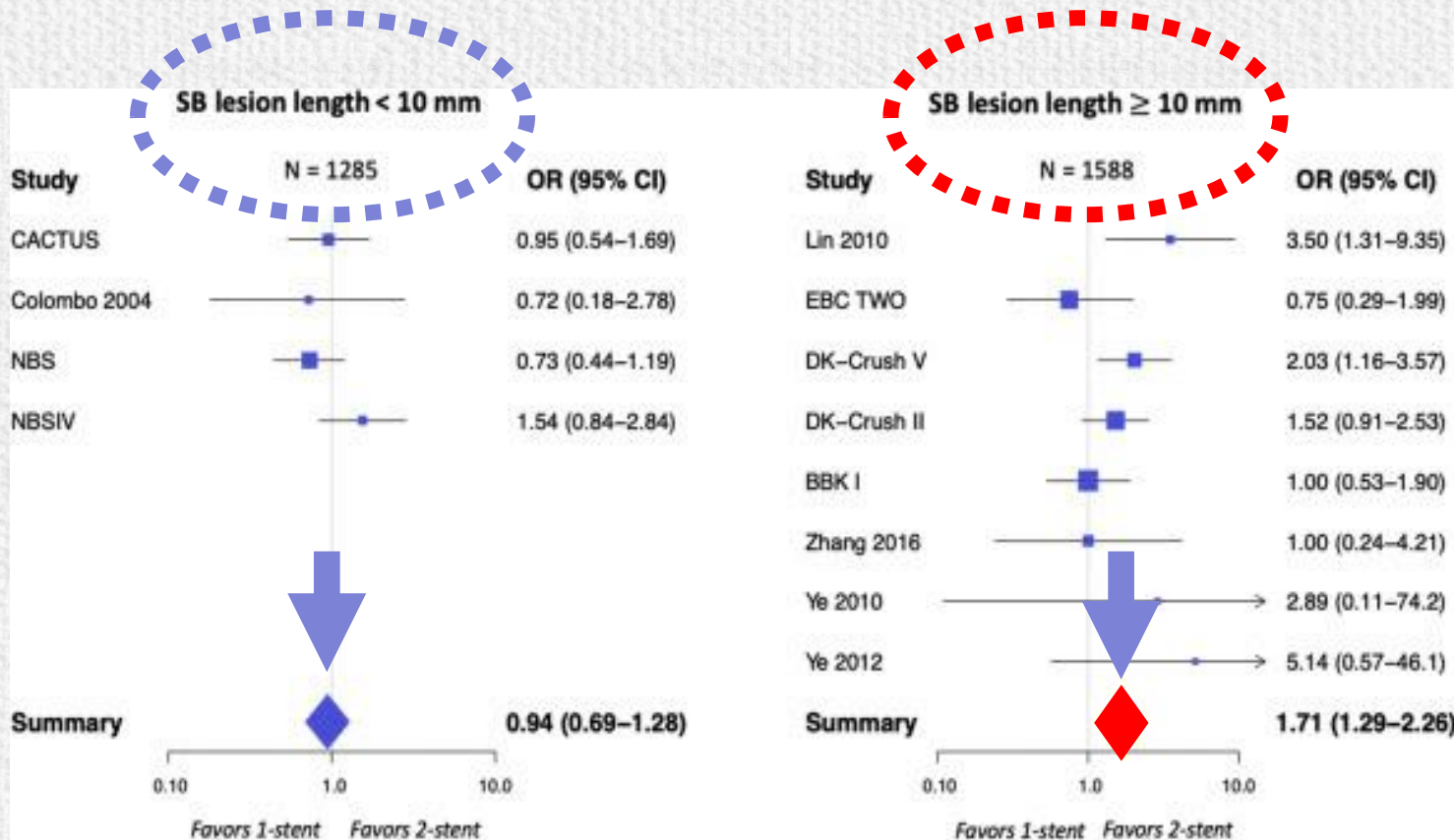


Mortier P et al. JACC CI 2014



Foin et al. JACC CI 2012

2-stents provide better outcomes if SB length ≥ 10 mm



Elective two-stent strategies

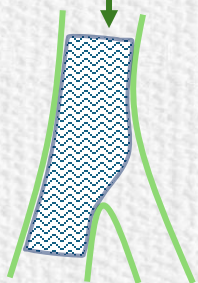
- Elective 2-stent strategies may be considered for *long SB lesions, high risk of SB compromise or difficult access*;
- When a planned two stent strategy is used, this should be done in a provisional stepwise approach to the lesion, finalizing the procedure using a T/TAP or a culotte technique (*as a part of provisional*);
- For operators with appropriate experience, DK-Crush is a valuable option for complex bifurcation lesions;

Elective two-stent strategies

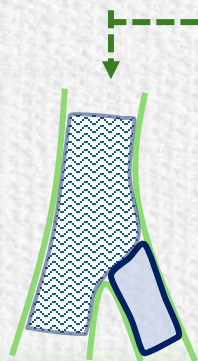
Bifurcated lesion with extensive atherosclerotic involvement of both MB and (an important) SB

Low risk of losing the SB after MB stenting

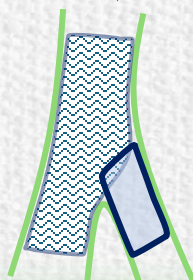
Major concerns regarding the SB after MB stenting



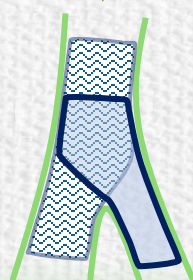
MB stenting across SB/Provisional strategy



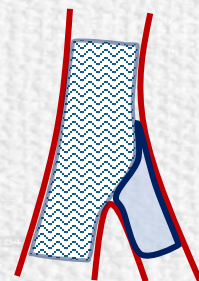
T-stent
SOLACI



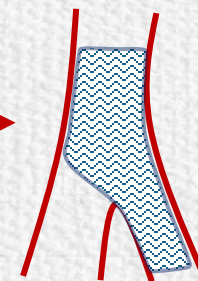
TAP



Culotte

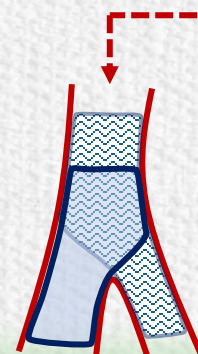


DK Crush

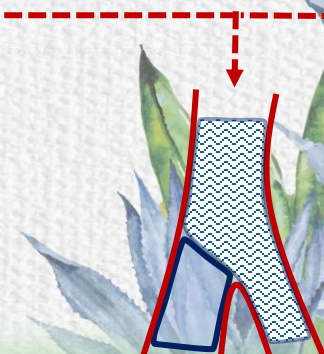


Inv. MB stenting across SB

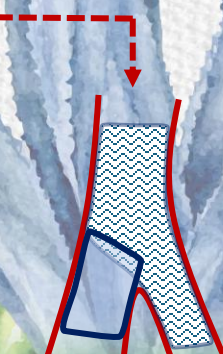
POT, distal MB rewiring, MB dilation



Inv. Culotte

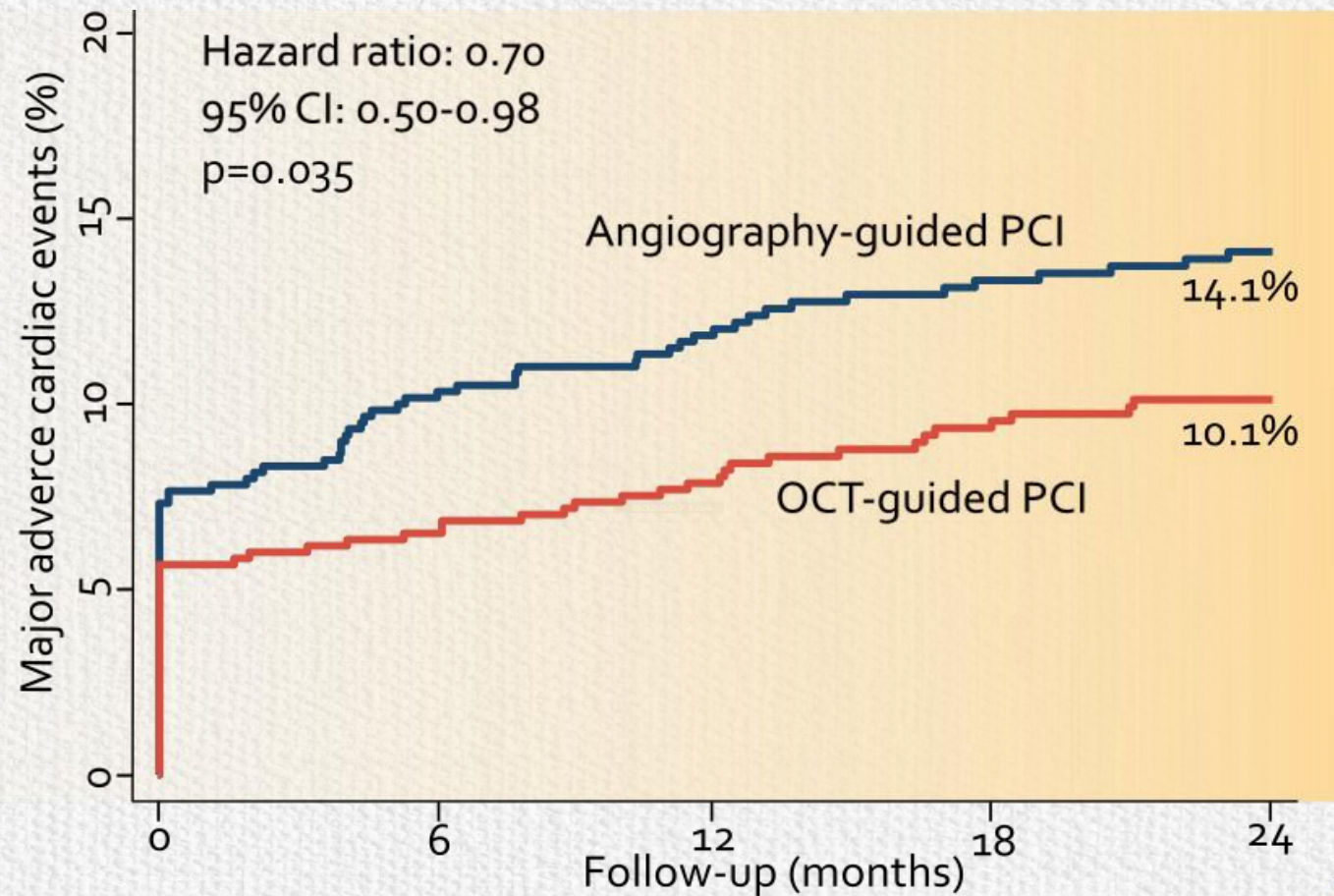


Inv. Elective T



Inv. TAP

OCTOBER Trial: Primary endpoint **OCTOBER**



MACE: cardiac death, target lesion myocardial infarction, ischemia-driven target lesion revascularization

No. At Risk:					
OCT-guided PCI	600	553	537	472	439
Angiography-guided PCI	601	534	509	452	408

OCT-guided PCI was associated with a lower incidence of the composite endpoint of two-year MACE than angiography-guided PCI in treatment of complex bifurcation lesions

ICI Class I in LM and bifurcation PCI

2024 ESC Guidelines on Chronic Coronary Syndrome

- 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.



European Heart Journal 2024

2025 ACC/AHA/ACEP/NAEMSP/SCAI Guidelines on Acute Coronary Syndrome

- 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.



Conclusions

- Stepwise provisional is logical, straightforward, reproducible, and versatile and remains the strategy of choice for most non-LM bifurcation lesions;
- Elective two-stent strategies may be considered for important SB with complex/extensive stenoses (the Definition II study criteria), difficult SB access or high risk of SB compromise;
- Use of imaging and physiology strongly encouraged to decide the appropriate stenting strategy and optimize the result of PCI.



Thank You

gorastan@gmail.com

