



INSTITUT  
CARDIOVASCULAIRE  
PARIS  
SUD

# Single Stent for all Bifurcations

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Massy, France*

# Conflict of interest to disclose

Minor fees from Boston scientific, Abbott Vascular, Terumo and Biosensor

# We See Bifurcation Lesions Everyday



# We See Bifurcation Lesions Everyday

## Multivessel Disease Series

**ARTS II Reality Syntax Leaders Nobori 2**

53%

52%

70%

28%

33%

*Tsuchida et al, EHJ 2007*  
*Lefèvre et al., ECCO 2008*  
*Serruys et al. ESC 2008*  
*Windecker et al. EBC 2010*

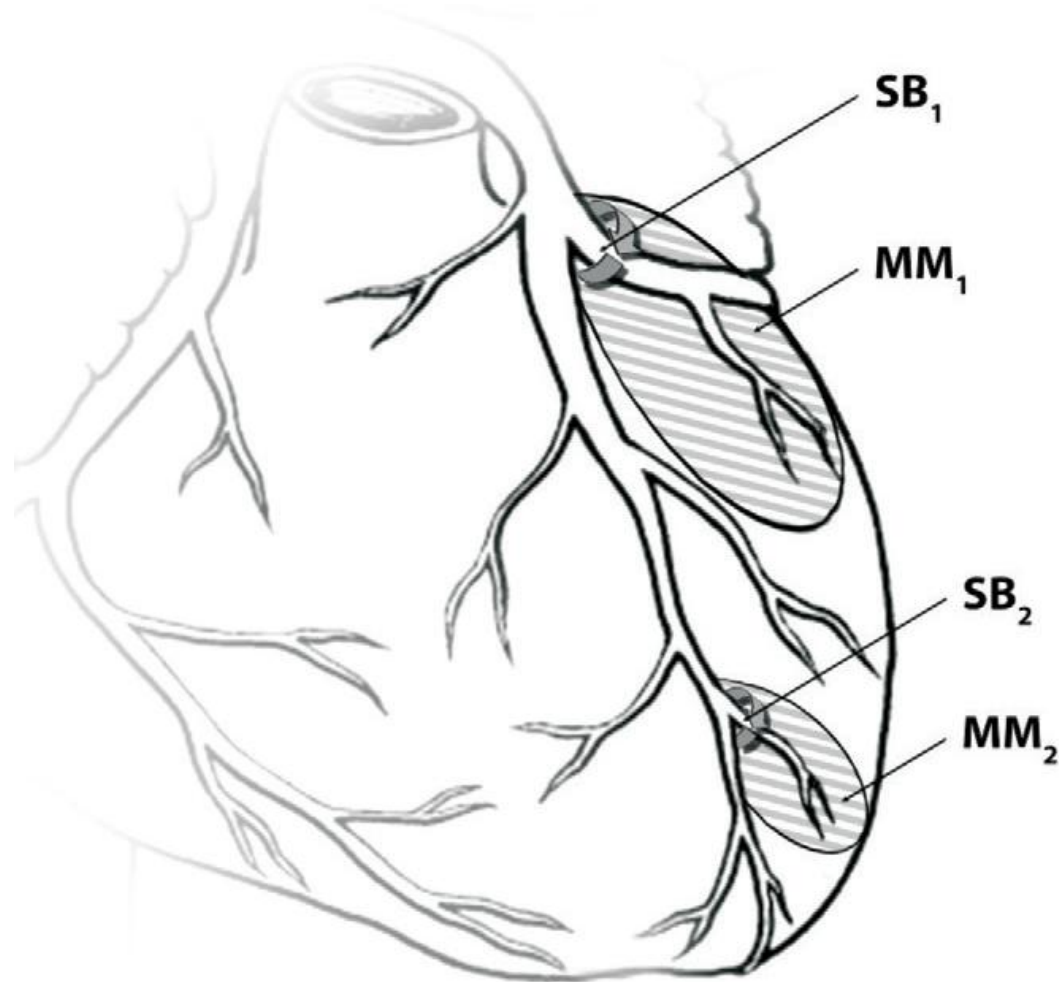
# We See Bifurcation Lesions Everyday

- ✓ Need a standardized approach
- ✓ Simple and safe
- ✓ High rate of success
- ✓ Low rate of complications
- ✓ Good long term results

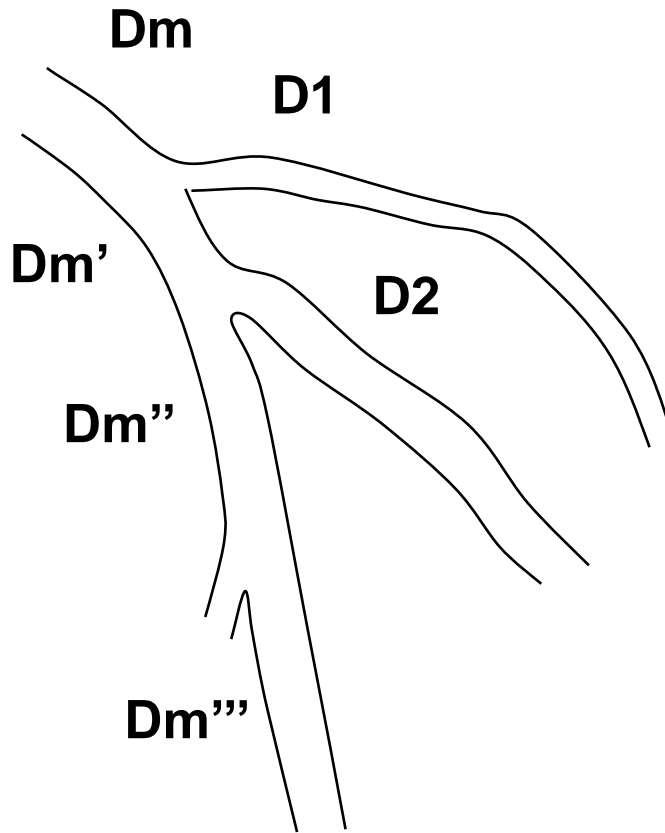
# What should we know before selecting the Optimal Technique ?



# Structure-function scaling laws of vascular trees



# Structure-function scaling laws of vascular trees



$$D_{\text{mother}}^3 = D_{\text{daughter } 1}^3 + D_{\text{mother}'}^3 + \dots$$

*Murray's law*

$$D_{\text{mother}} = 0.67^* (D_{\text{daughter } 1} + D_{\text{mother}'} + \dots)$$

*G. Finet*

$$D_{\text{mother}}^{7/3} = D_{\text{daughter } 1}^{7/3} + D_{\text{mother}'}^{7/3} + \dots$$

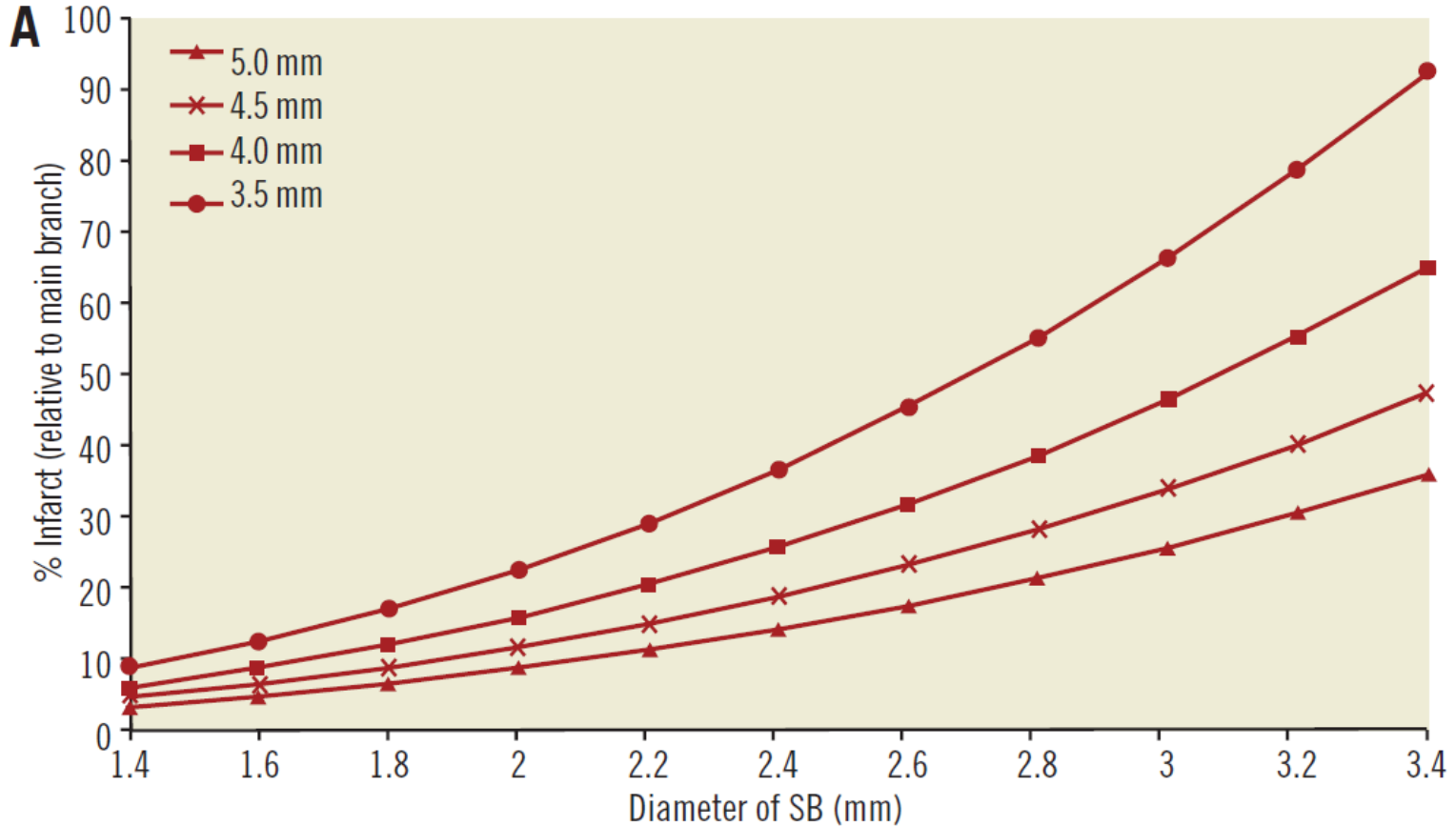
*KB model*

*Finet et al. Eurointervention 2007; 3: 490-8*

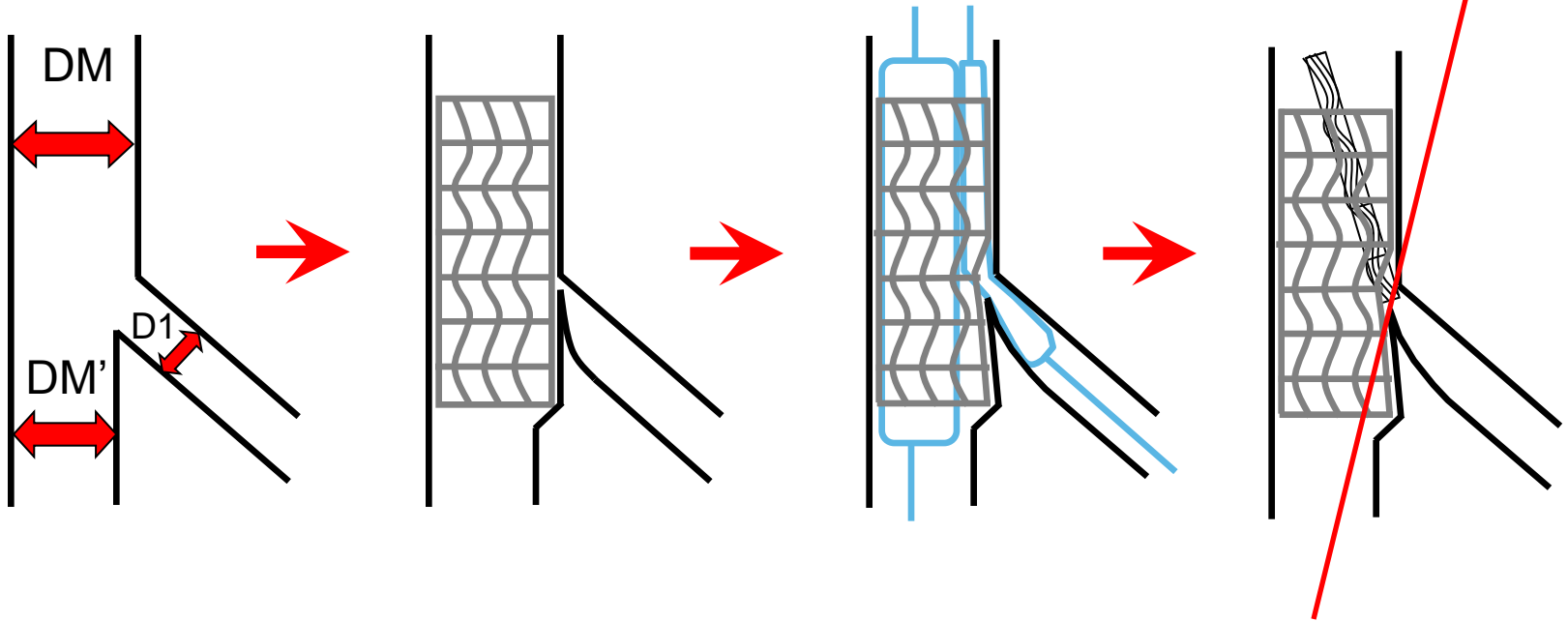
*Huo et al. Eurointervention 2012; 7: 1310-16*



# Structure-function scaling laws of vascular trees



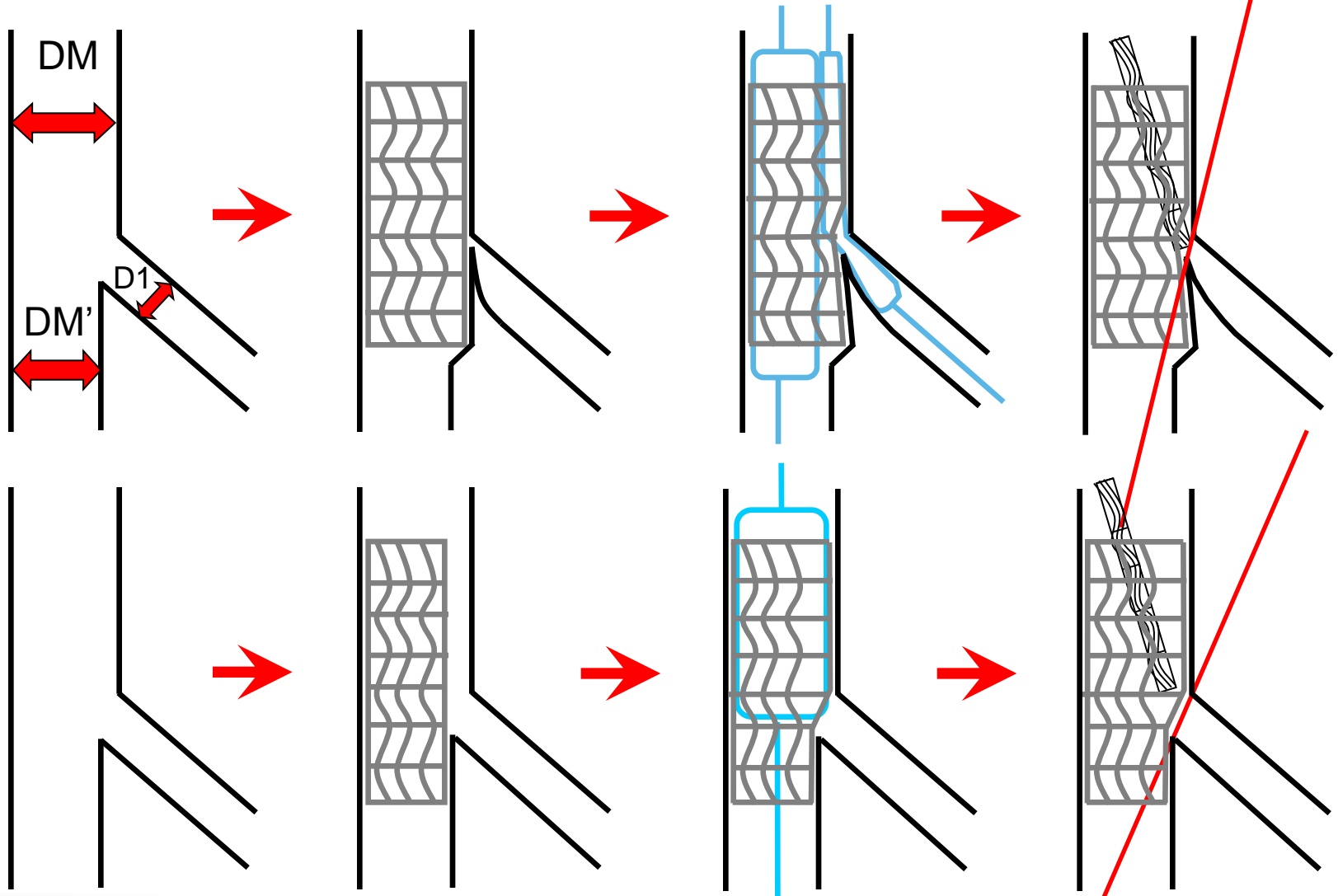
# The 3 Diameters Rule



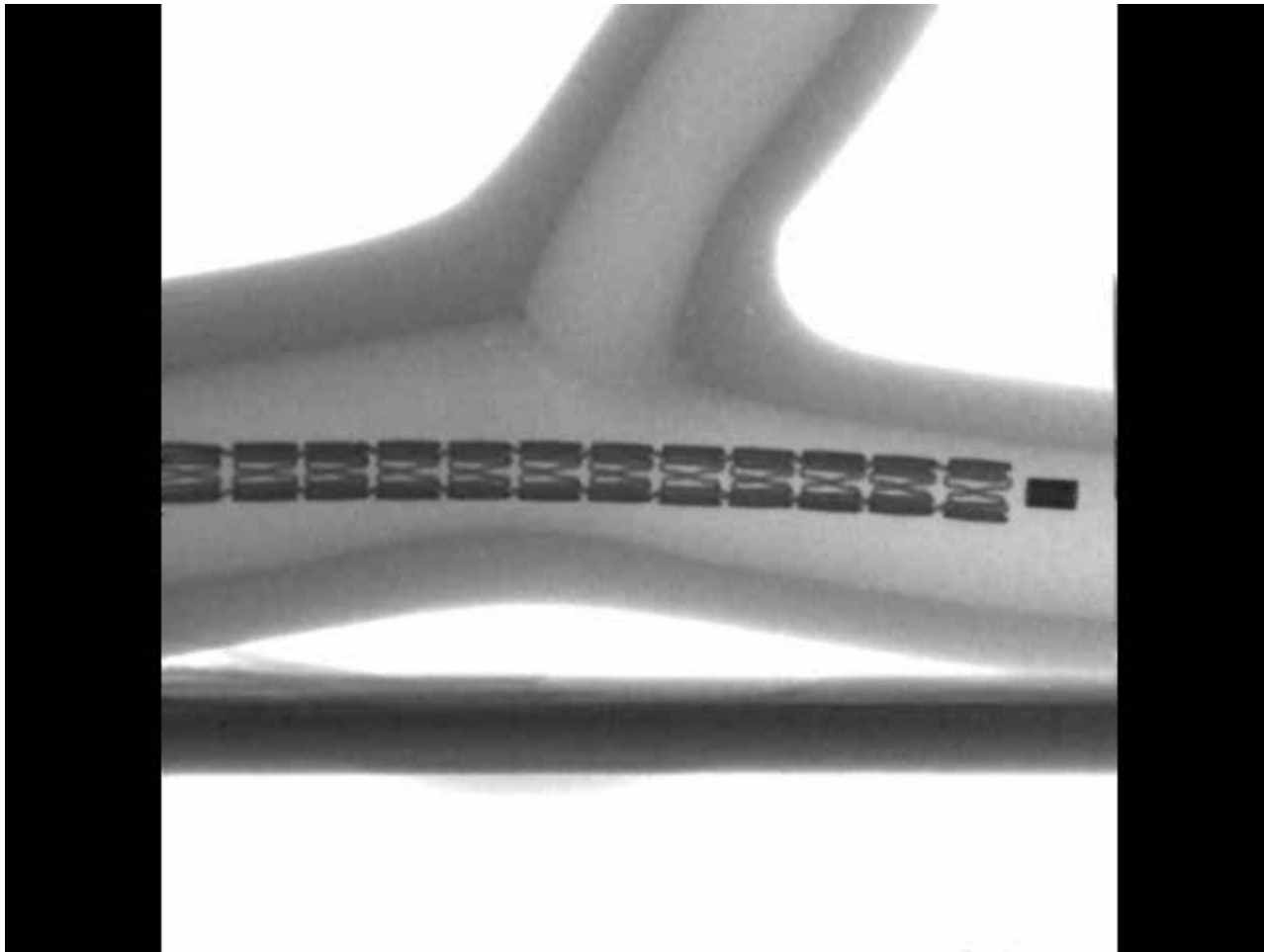
Murray's Law

$$(DM+DM') \times 0.678$$

# The 3 Diameters Rule

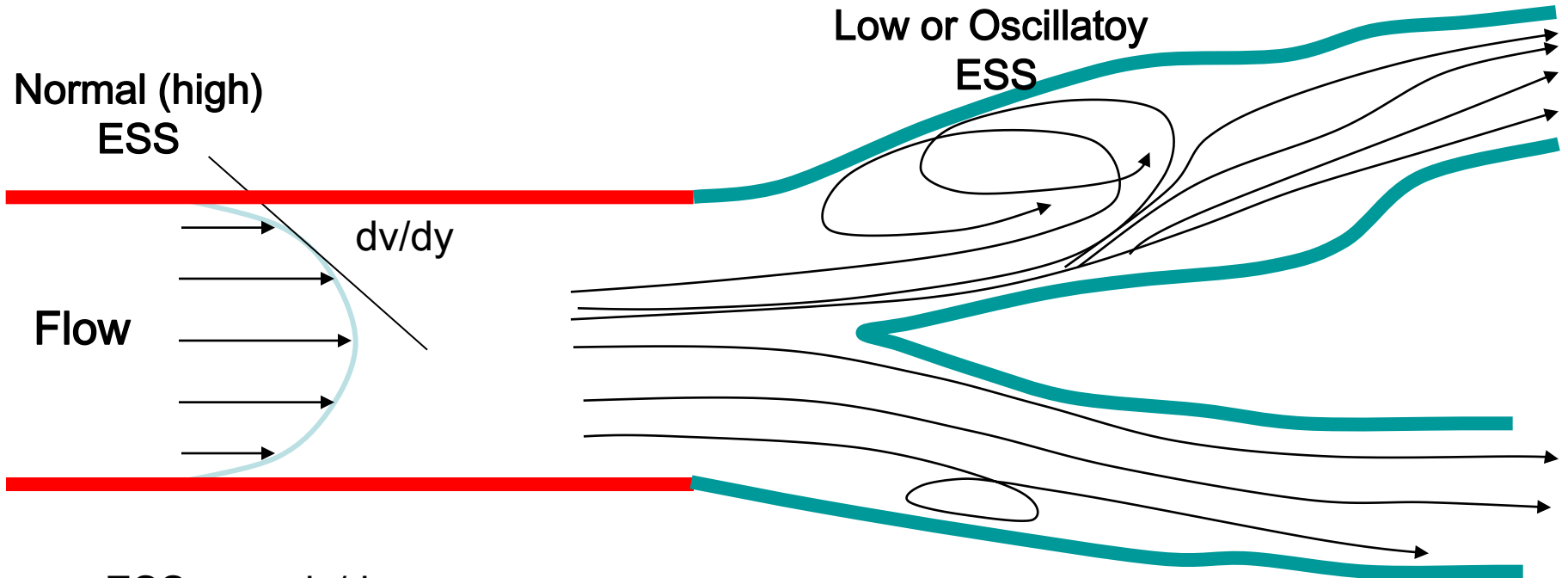


# POT + SKS



*Kissing balloon post dilatation + POT (Kaname<sup>R</sup>)*

# Bifurcation and Flow Modifications

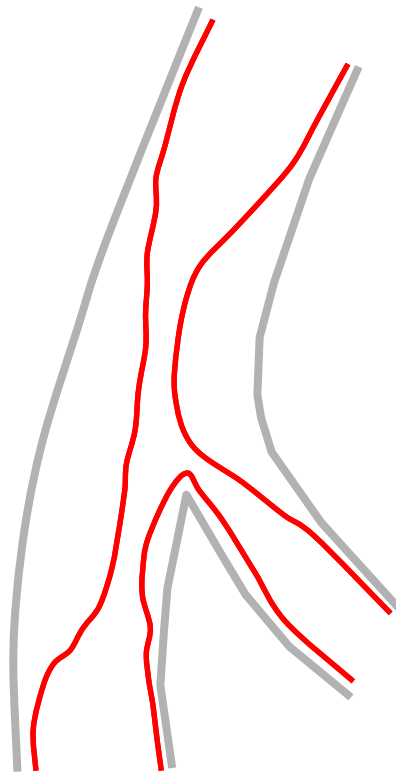


$$ESS = \mu \cdot dv/dy$$

$\mu$  = viscosity

$dv/dy$  = spatial gradient of blood velocity at the wall

# What About Carena Disease ?



Carena is usually  
free of disease

*Virmani EBC 2007*

*Oviedo et al ACC 2008*

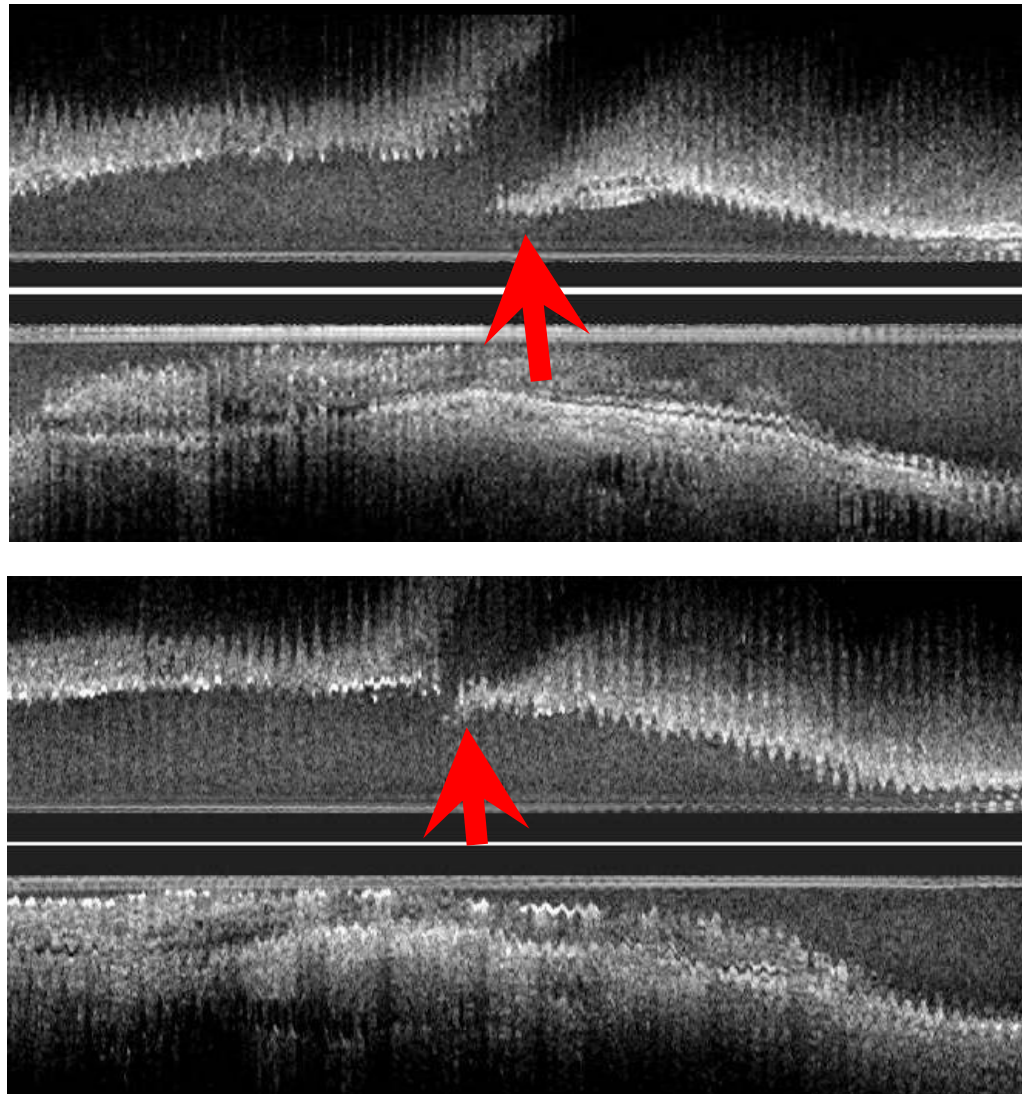
*Van der Giessen, et al. Euroint 2008*

*Nakazawa G, et al. JACC 2010*

*Suarez de lezzo, Euroint 2011*

# **The Risk of SB Occlusion After MB Stenting is Mainly a Problem of Carena Shifting**

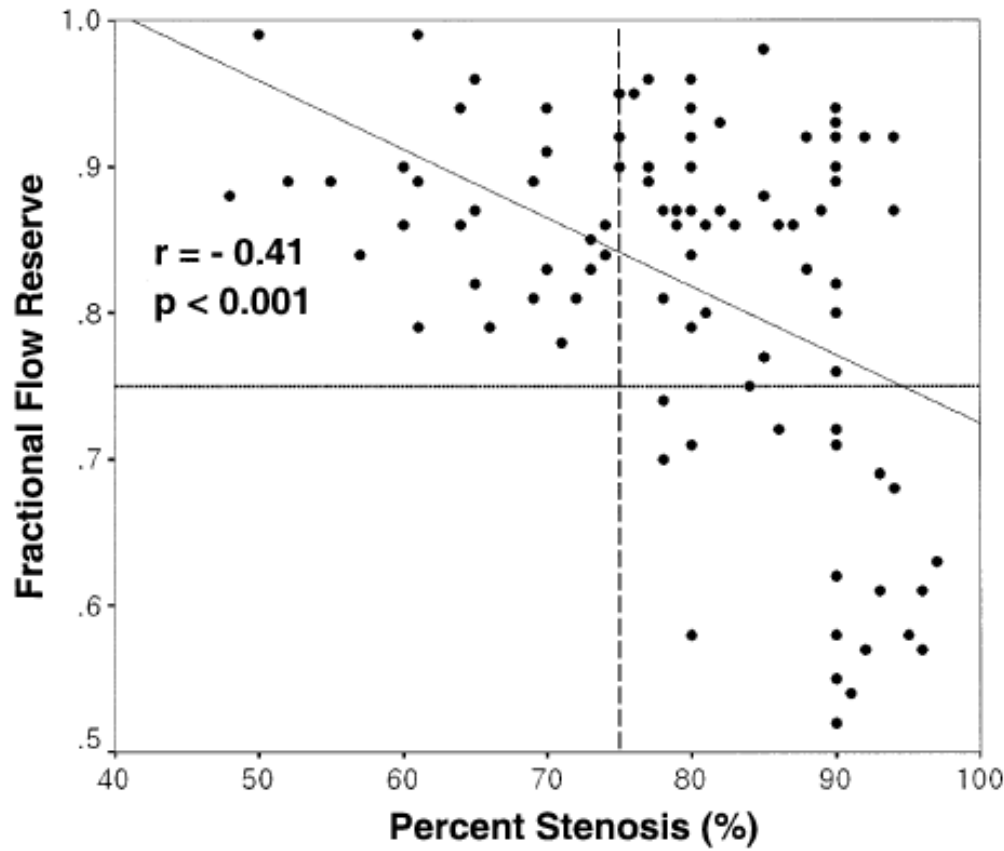
# Carena Shifting





# **The functional Significance of SB Ostial Lesions after MB stenting is Overestimated**

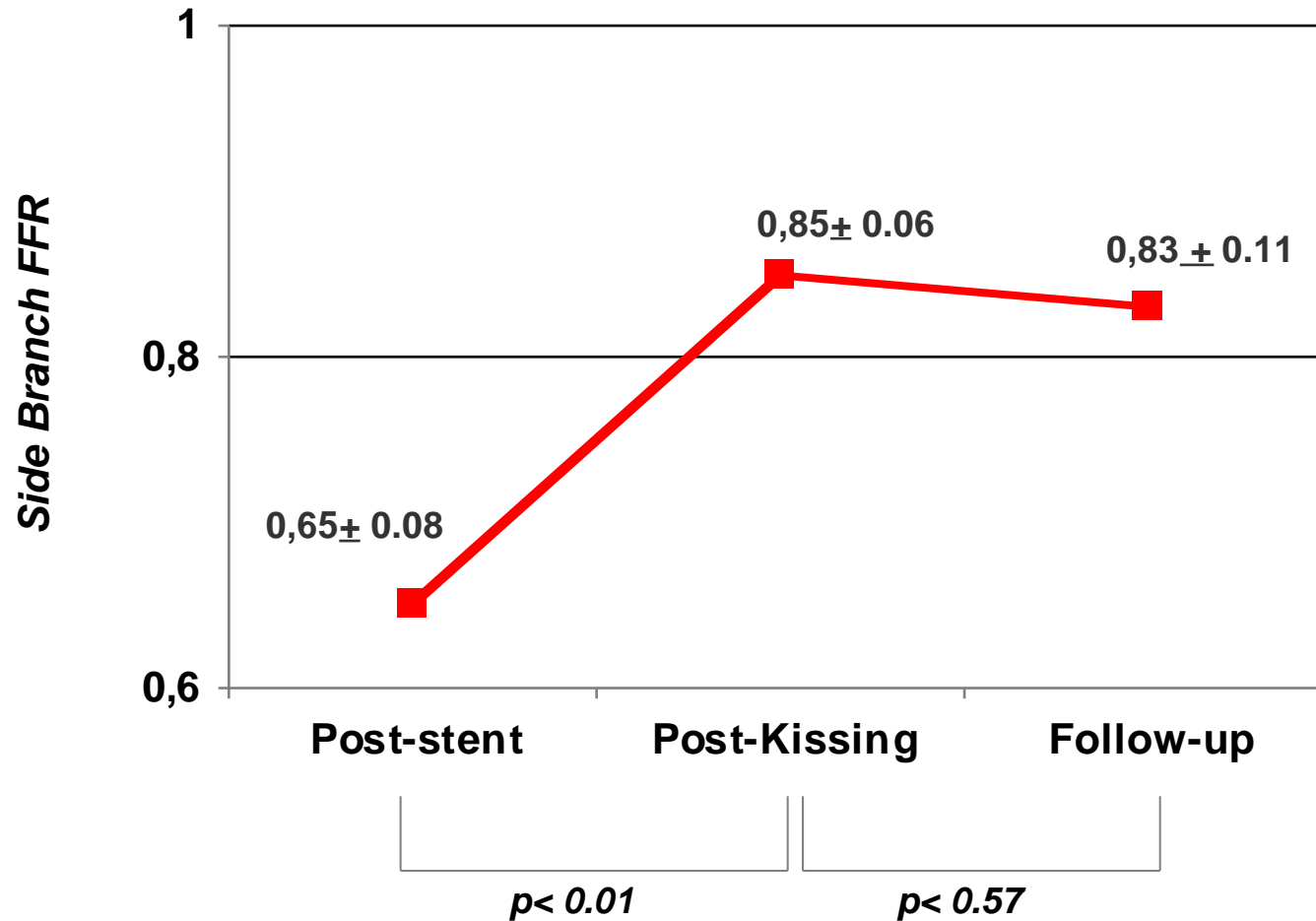
# Correlation Between FFR and % Stenosis (QCA) in Jailed SB



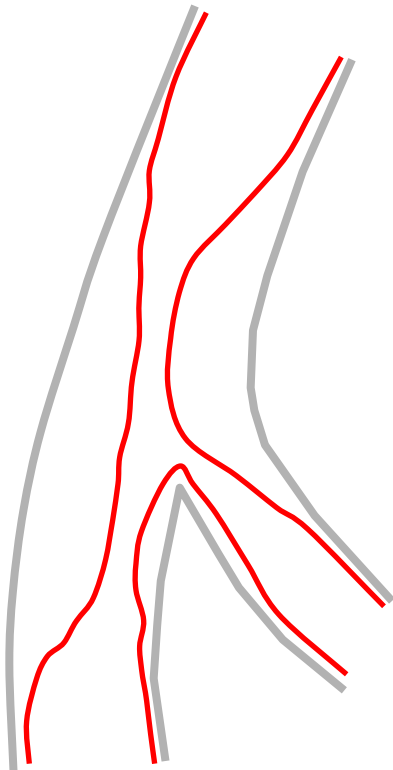
No lesion with  $<75\%$  stenosis had  $FFR < 0.75$ .

**Among 73 lesions with  $\geq 75\%$  stenosis, only 20 lesions were functionally significant.**

# FFR after kissing balloon inflation



# *What are our Main Objectives ?*



**To Restore the natural configuration (fractal) of the bifurcation:**

- SB open (better with non significant lesion)
- 3 diameters
- MB Stent well apposed
- Optimal rheology
- Easy access in both branches in the future

# What are the Recommendations ?

# US guidelines : bifurcation

## **CLASS I**

1. Provisional side-branch stenting should be the initial approach in patients with bifurcation lesions when the side branch is not large and has only mild or moderate focal disease at the ostium (726–729). (*Level of Evidence: A*)

## **CLASS IIa**

1. It is reasonable to use elective double stenting in patients with complex bifurcation morphology involving a large side branch where the risk of side-branch occlusion is high and the likelihood of successful side-branch reaccess is low (730–733). (*Level of Evidence: B*)

# 7 Randomized Studies With DES

**8 Meta-analysis  
No advantage for using 2 stents**

Study	Stent	Patients (n)		True Bif. (%)	Cross-over (%)		CS Technique (n)	Final kissing		FU (n)	
		PS	CS		to CS	to PS		PS	CS	PS	CS
BBC One	PES	250	250	83	2.8	1.6	Crush 100				
							Crush 100				
Nordic	SES	207	206					31	74	151	156
							Crush 43				
							Other 69				
CACTUS						ND	Crush	90	92	150	152
					19	3	T stent 120	100	100		ND
				86	2.1	9.1	T stent 45	56	77		80
		43		ND	51.2	4.7	T stent 60	86	95		ND
							V stent 1				
							Y stent 2				

# Nordic I

## Procedural Data

Procedural Characteristics	MV n=207	MV+SB n=206	P value
SB stented	9 (4.3)	196(95.1)	<0.0001
Final kissing balloon	65 (32)	152 (74)	<0.0001
Procedural success	200 (97)	194 (94)	0.35
Procedure time, min	62±51	76 ±40	<0.0001
Fluoroscopy time, min	15±9	21±10	<0.0001
Contrast volume, mL	233±93	283±117	<0.0001
Biomarker Elevation	n=153	n=126	P value
>3 elevation (%)	8	18	0.011
>5 elevation (%)	4	13	0.008
>10 elevation (%)	3	5	NS

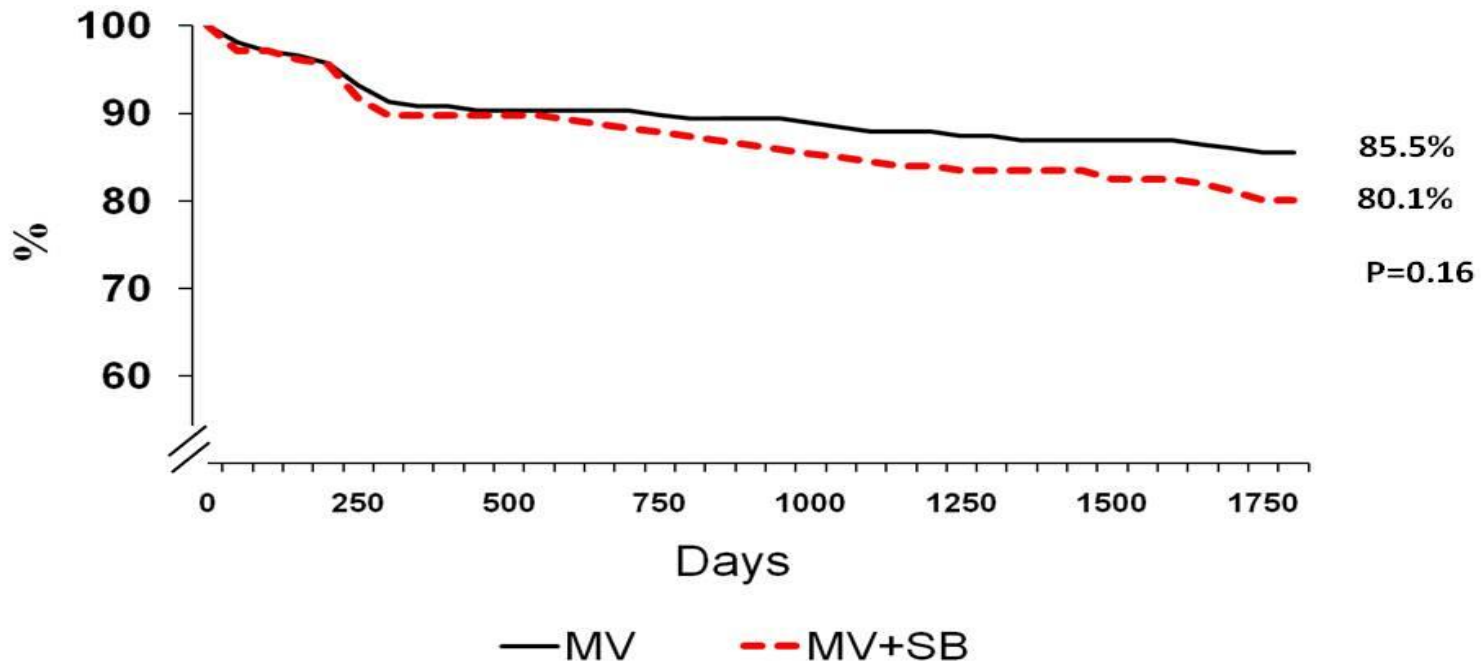


# Nordic I (n=413)

## 5 Years Safety and Efficacy

### MACE Free Survival

Cardiac death, MI, TVR, stent thrombosis



Thuesen L et al. Presented at ACC 2011.

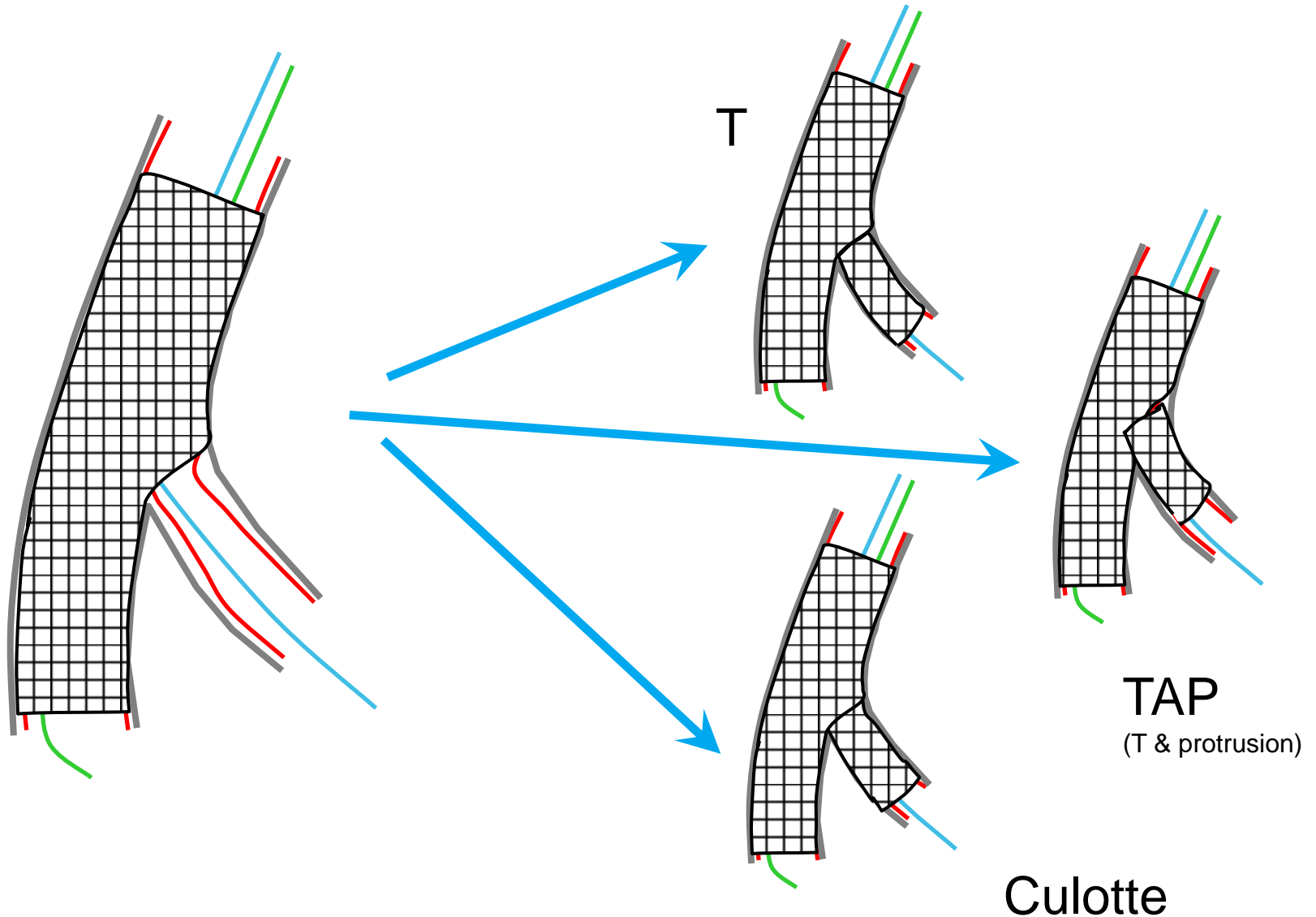
# One stent when we can

*An optimal strategy will help to decrease the need for SB stenting*

# Two stents when needed

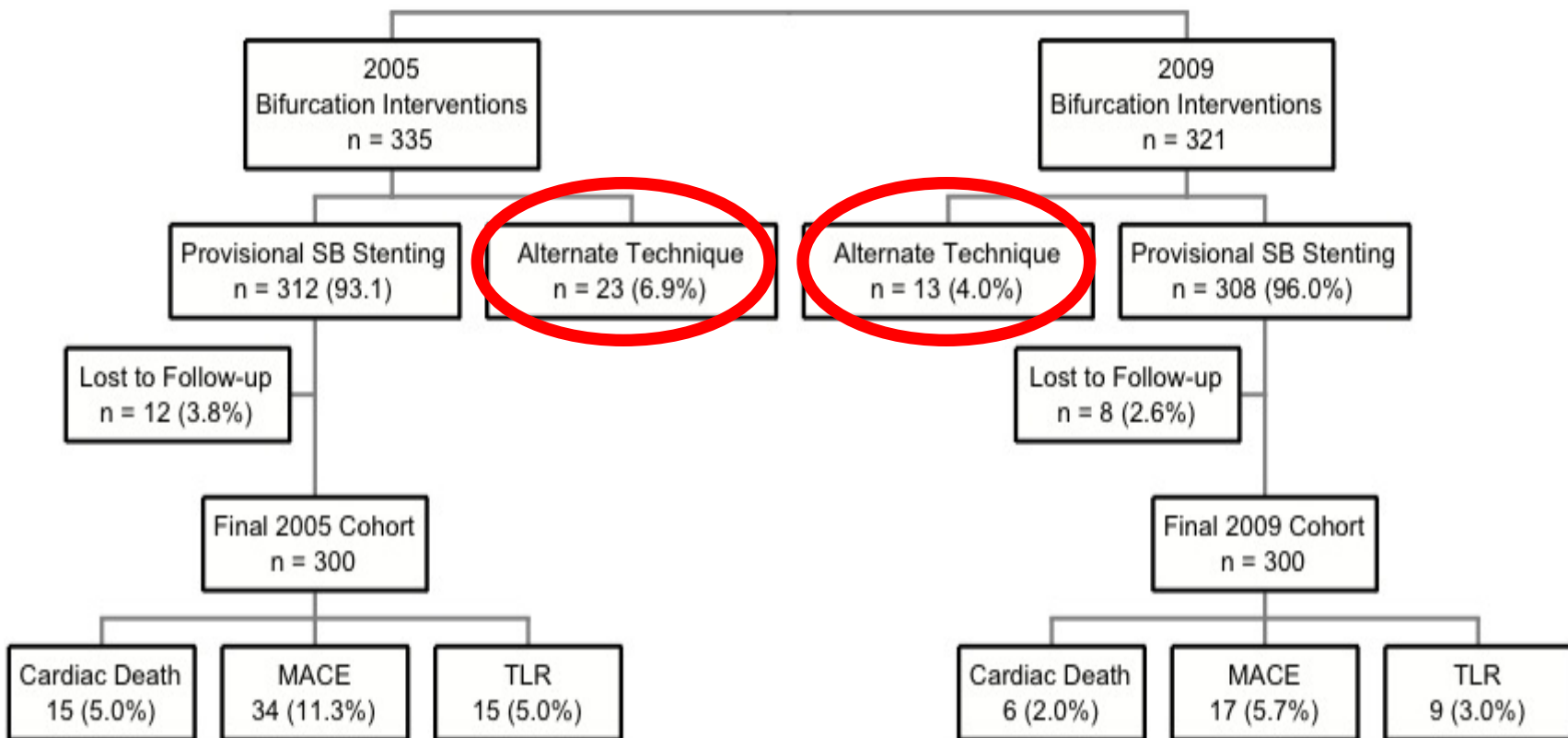
*Develop strategies to make it easy, safe and effective*

# Provisional Side Branch Stenting



# What Are the Real World Data ?

# Provisional SB-Stenting for Coronary Bifurcation Lesions: Evidence of Improving Procedural and Clinical Outcomes



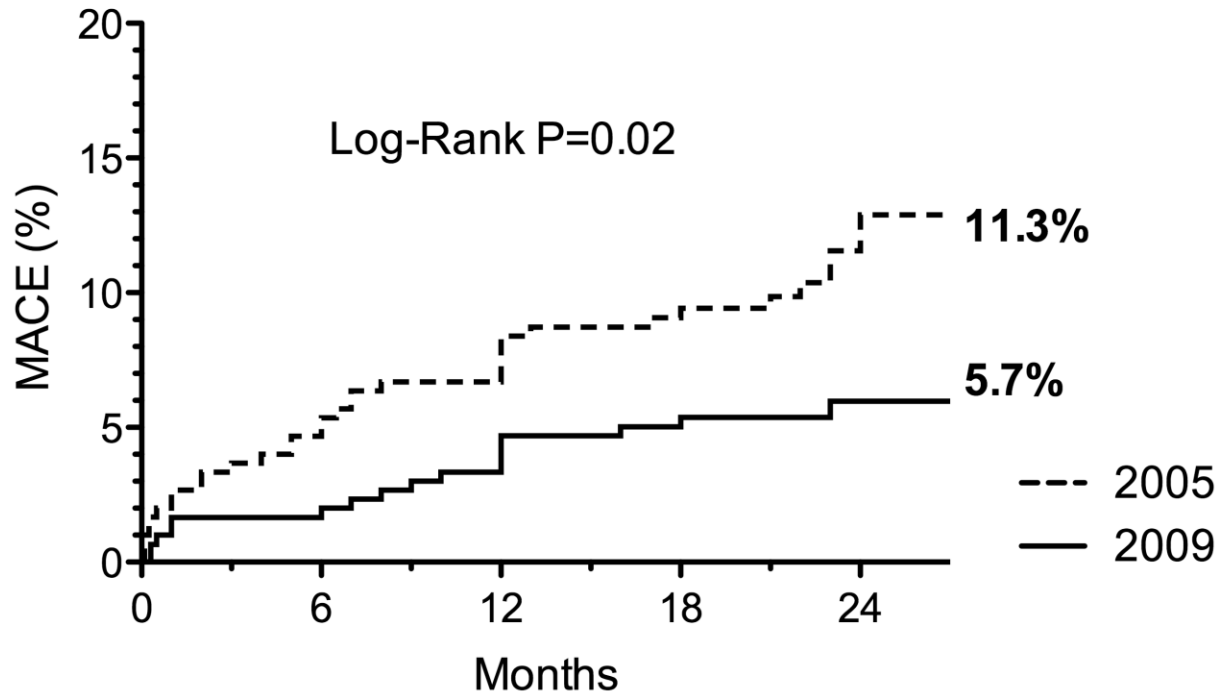
## Provisional SB-Stenting for Coronary Bifurcation Lesions: Evidence of Improving Procedural and Clinical Outcomes

	2005 (n=300)	2009 (n=300)	p Value
Age (years)	65.9±12.4	66.9±11.4	NS
Diabetes (%)	25.0	25.3	NS
Prior MI (%)	8.0	18.0	0.0004
Prior PCI (%)	16.3	33.7	<0.0001
Prior CABG (%)	3.0	5.7	NS
ST-segment elevation MI (%)	7.9	8.7	NS
Stable angina (%)	49.4	48.0	NS
EF (%)	60.7±12.3	53.6±13.4	<0.0001
Left main (%)	25.7	24.7	NS
LAD (%)	45.0	48.3	NS
Two vessel (%)	45.7	38.6	NS
Three vessel (%)	31.3	36.3	NS
True bifurcation (%)	71.0	69.7	NS

## Provisional SB-Stenting for Coronary Bifurcation Lesions: Evidence of Improving Procedural and Clinical Outcomes

	2005 (n=300)	2009 (n=300)	p Value
6 F guide	97.3	97.0	0.99
IVUS (%)	9.3	6.0	0.13
Rotablator (%)	0.7	3.3	0.04
MB Stent type (%)			
Cypher	52.5	31.0	<0.0001
Taxus	47.5	11.0	<0.0001
Xience V	0	47.0	<0.0001
Other DES	0	11.0	<0.0001
POT (%)	0	36.3	<0.0001
Final kissing balloons (%)	93.3	91.7	0.54
Non-compliant balloons %)	0	81.3	<0.0001
MB stent diameter (mm)	3.1±0.4	3.0±0.4	0.002
MB stent length (mm)	20.6±6.6	22.7±7.2	0.0002
Side-branch stent (%)	22.3	9.0	<0.0001

# Provisional SB-Stenting for Coronary Bifurcation Lesions: Evidence of Improving Procedural and Clinical Outcomes

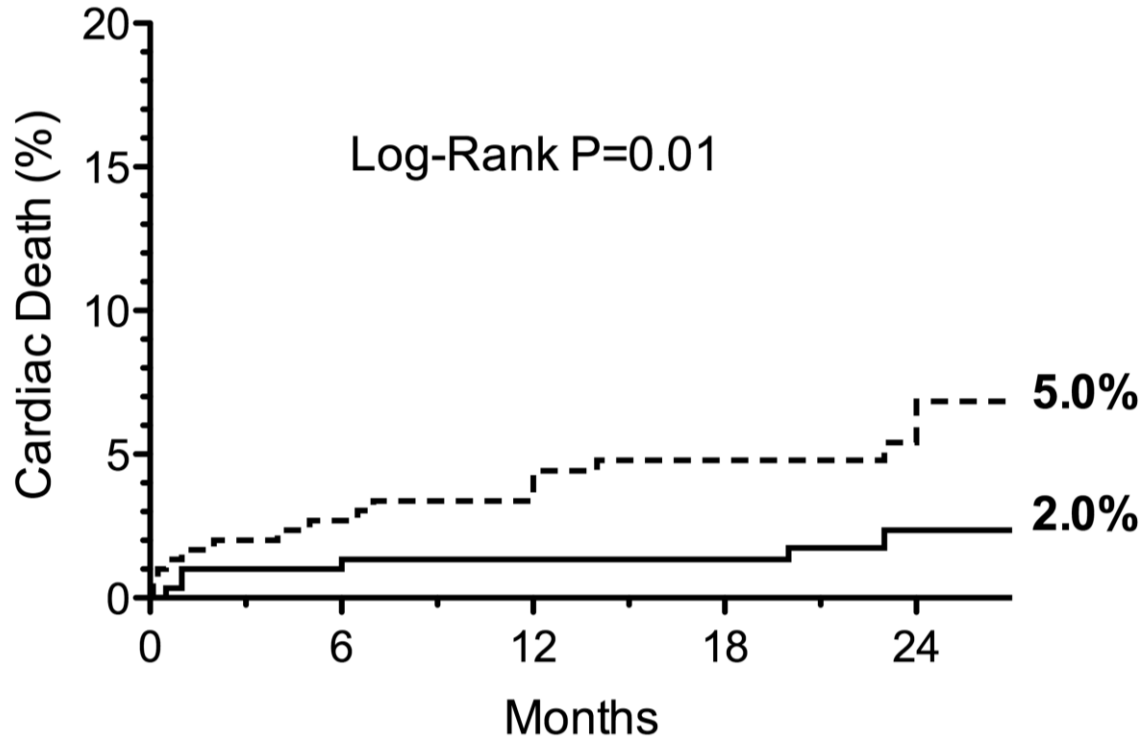


Patients at risk

2005	300	285	276	259	132
2009	300	293	288	272	126



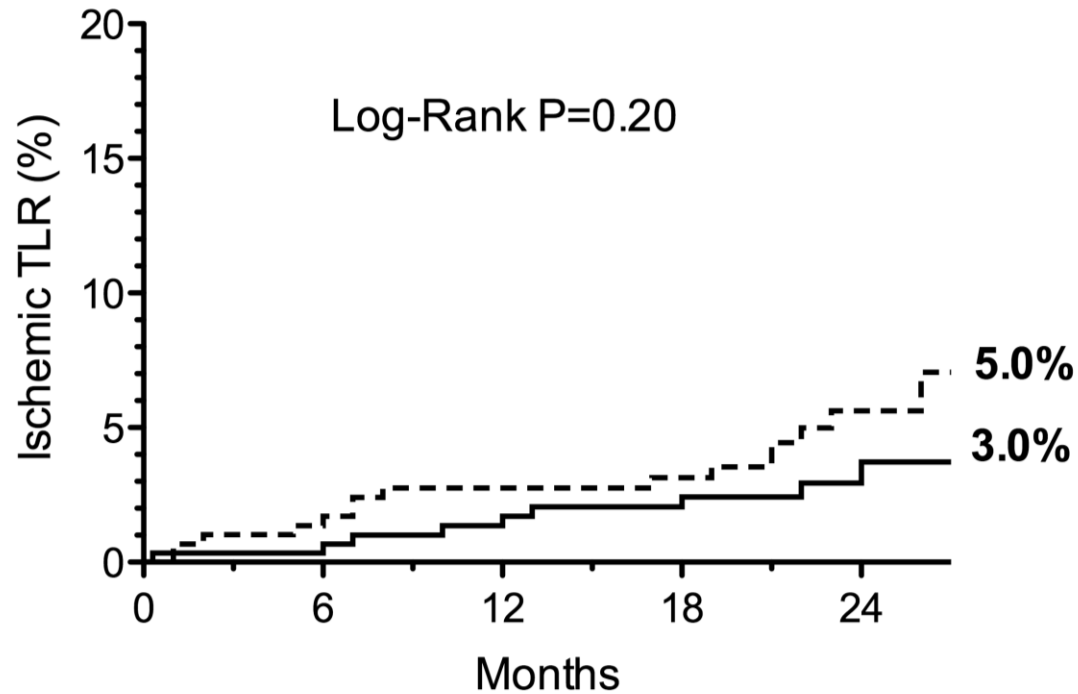
# Provisional SB-Stenting for Coronary Bifurcation Lesions: Evidence of Improving Procedural and Clinical Outcomes



Patients at risk

	0	6	12	18	24
2005	300	286	277	260	132
2009	300	292	288	282	126

# Provisional SB-Stenting for Coronary Bifurcation Lesions: Evidence of Improving Procedural and Clinical Outcomes



Patients at risk

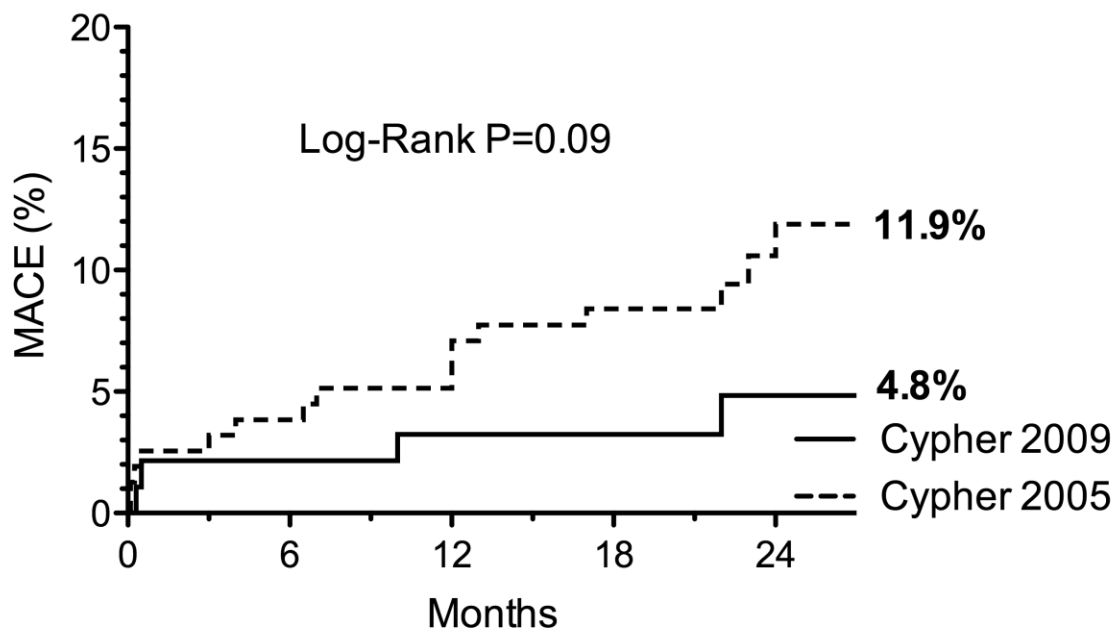
2005	300	285	276	259	130
2009	300	292	286	269	125

# Provisional SB-Stenting for Coronary Bifurcation Lesions: Evidence of Improving Procedural and Clinical Outcomes

## Predictor of MACE (Multiple Cox Regression)

	<b>Hazard Ratio</b>	<b>95% CI</b>	<b>p Value</b>
Diabetes mellitus	1.65	0.92-2.97	0.09
Left main target bifurcation	1.85	1.04-3.29	0.036
Side branch stenting	2.31	1.27-4.20	0.006
PCI in 2005	1.86	1.03-3.37	0.04

# Provisional SB-Stenting for Coronary Bifurcation Lesions: Evidence of Improving Procedural and Clinical Outcomes



Patients at risk

Cypher 2005	157	150	146	135	69
Cypher 2009	93	90	89	87	38

## When to use a two-stent approach ?



- ✓ Large side branches with ostial disease extending > 5 mm from the carina are likely to require a two-stent strategy.
- ✓ Side branches whose access is particularly challenging should be secured by stenting once accessed.
- ✓ Poor SB result despite FKB with NC balloons.

Less Than 5% of cases

# Conclusion

Today the Gold standard technique in the treatment of bifurcation lesions with DES is provisional side branch stenting.

With a standardized approach, it is relatively simple and safe, and it can be used in the vast majority of cases.

## Conclusion

- ✓ With an optimal technique a systematic two stents approach is needed in less than 5% of cases.
- ✓ And provisional SB stenting required in less than 10% of cases.
- ✓ When two stents are used, an optimal technique, including systematic kissing balloon inflation is warranted.