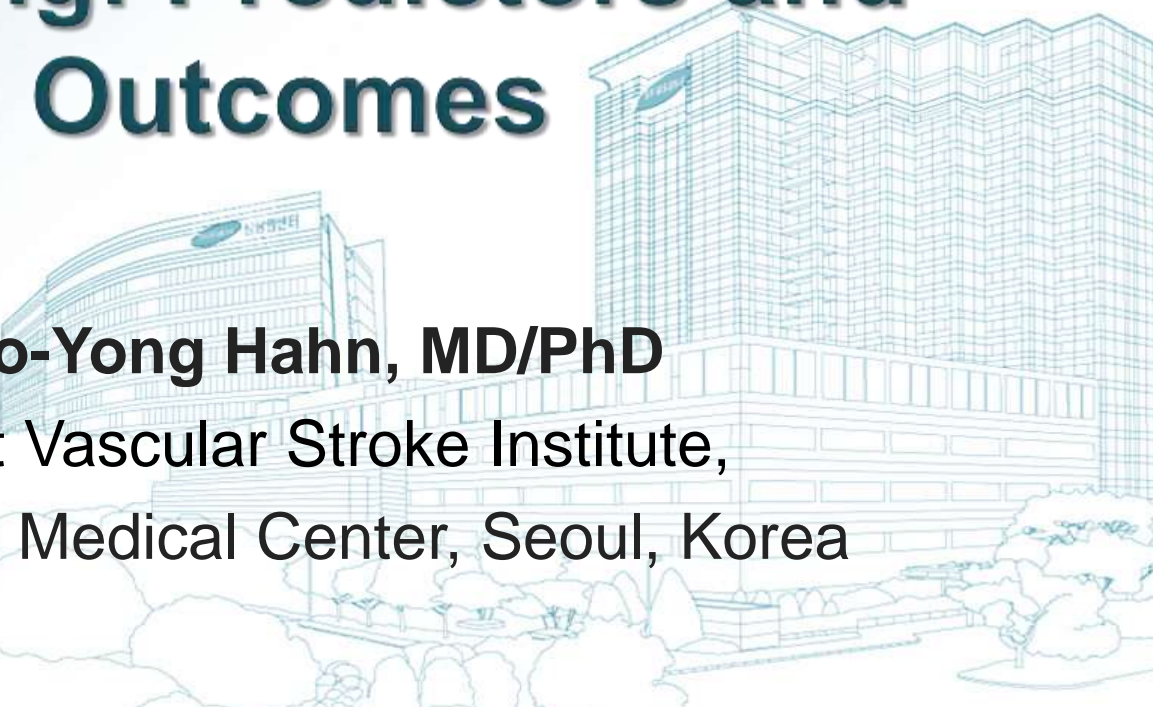


# Side Branch Stenosis and Occlusion After Main Vessel Stenting: Predictors and Outcomes

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# Disclosure

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# Provisional approach and SB occlusion

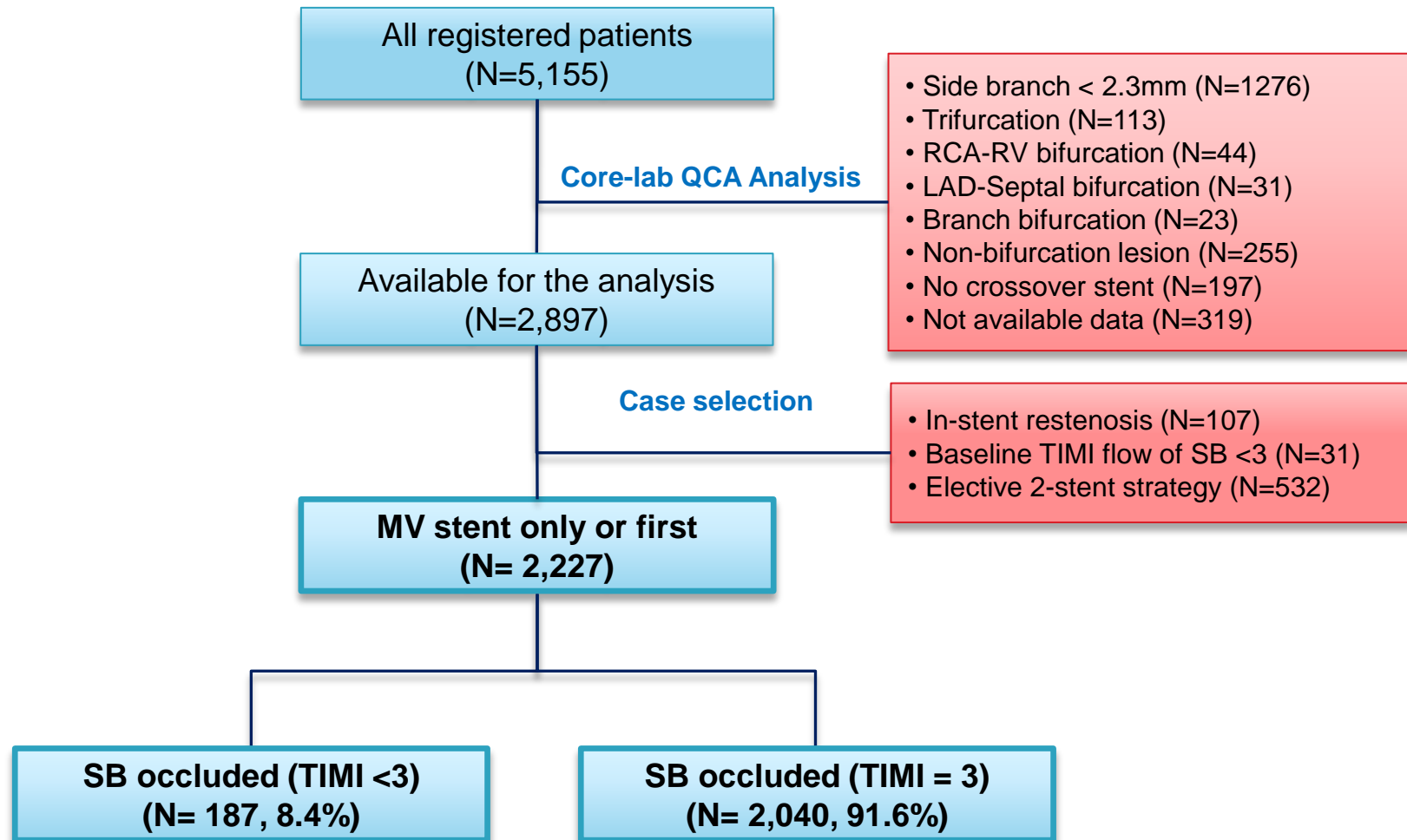
- ▶ The provisional approach is now regarded as the standard technique for most coronary bifurcation percutaneous coronary intervention (PCI).
- ▶ However, one of the serious procedural complications of the provisional approach is side branch (SB) occlusion after main vessel (MV) stenting.
- ▶ There have been limited data on predictors and outcomes of SB occlusion.

# SB occlusion after MV stenting



- ▶ It is not uncommon (7-20%).
- ▶ Risk factors
  - Severity and length of SB ostial stenosis, plaque burden in SB ostium, narrow bifurcation angle, size and/or pressure of MV stent
- ▶ Limitations of previous studies
  - Small sample size
  - Small SB (with a diameter of  $>1$  mm)
  - Mostly non-true bifurcation lesions
  - No data on left main lesions
  - No information of procedure for the SB
  - Limited data on long-term clinical outcomes

# Patients selection from the COBIS II



# Independent predictors of SB occlusion

\* SB occlusion after MV stenting was defined as TIMI flow <3 (N=187, 8.4%)

Variables	Odds ratio [95% CI]	p Value
Pre-procedural SB DS $\geq$ 50%	2.34 [1.59-3.43]	<0.001
SB lesion length (by 1 mm)	1.03 [1.003-1.06]	<0.001
<b>Pre-procedural proximal MV DS <math>\geq</math>50%</b>	<b>2.34 [1.57-3.50]</b>	<b>0.03</b>
Acute coronary syndrome	1.53 [1.06-2.19]	0.02
Left main lesions (vs. non-left main lesions)	0.34 [0.16-0.72]	0.005

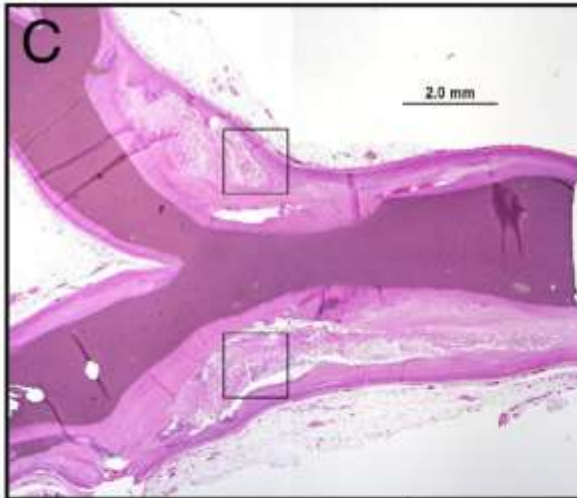
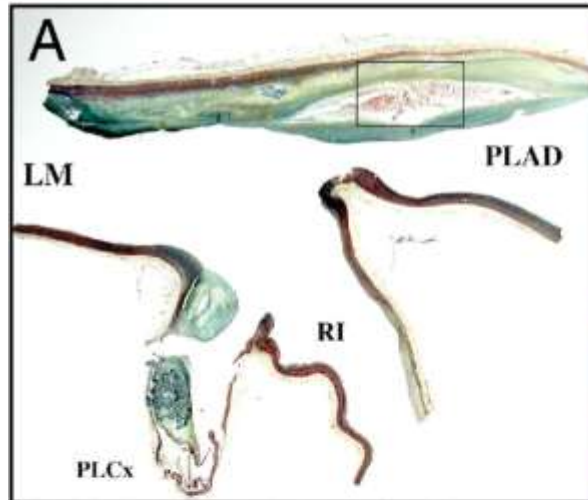
\* DS = diameter stenosis, SB = side branch, MV = main vessel

**jailed wire technique, SB predilation, IVUS guidance: not associated with SB occlusion**

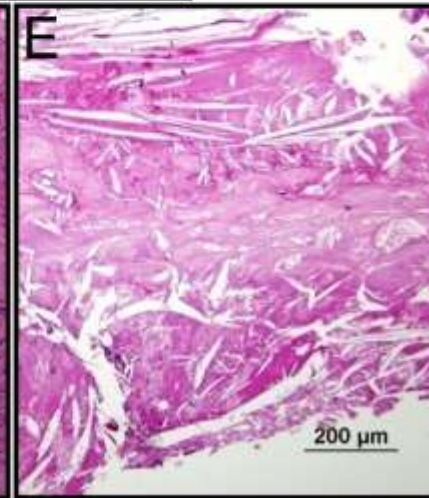
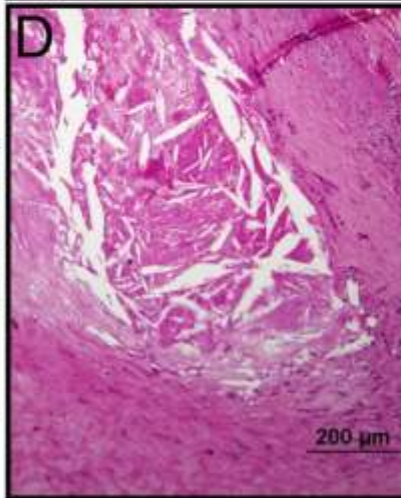
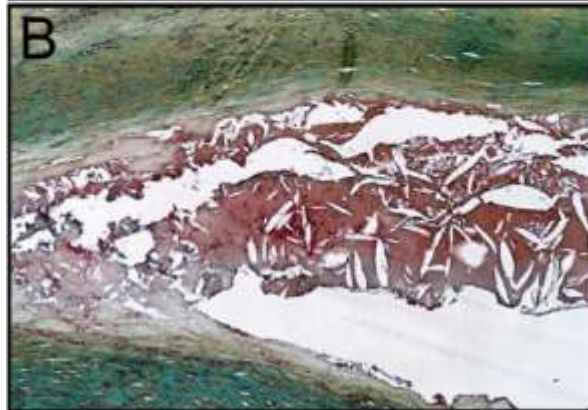




# Plaque Distribution

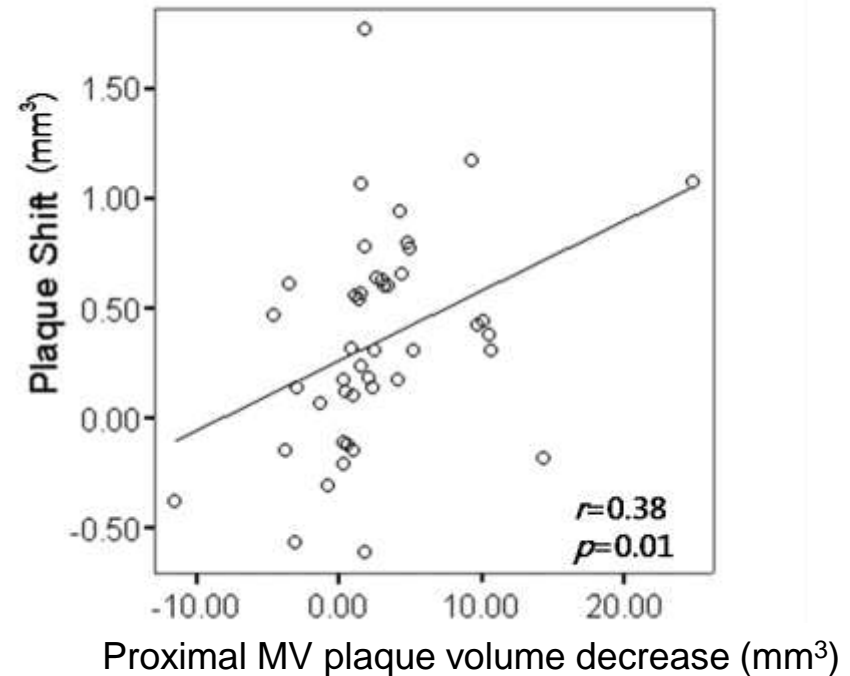
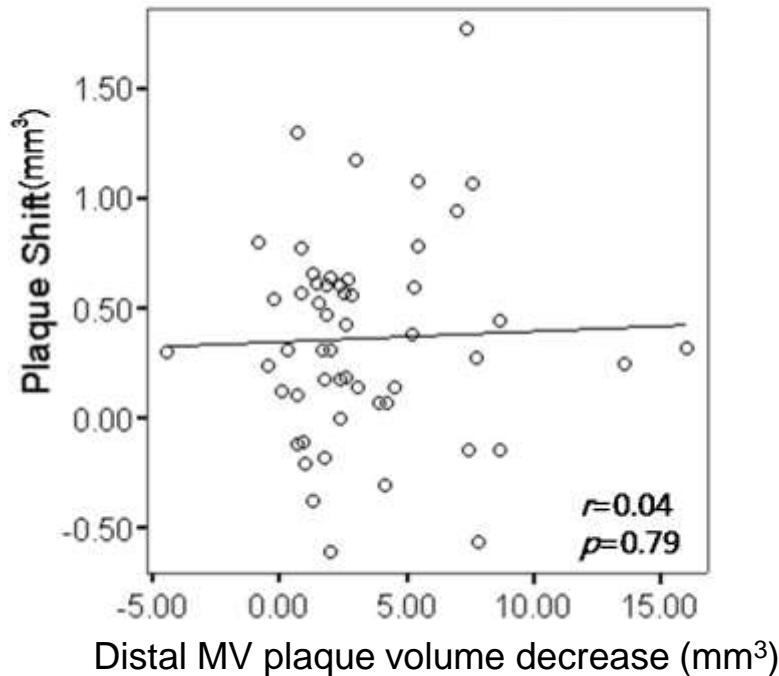


- 1) Carina is spared.
- 2) Abcarinal zone is most diseased, and also lipid-rich.



# Plaque shift comes from proximal MV

- ▶ Pre- and post-stenting IVUS for MV and SB (N=44)





# Clinical Impact of SB Occlusion



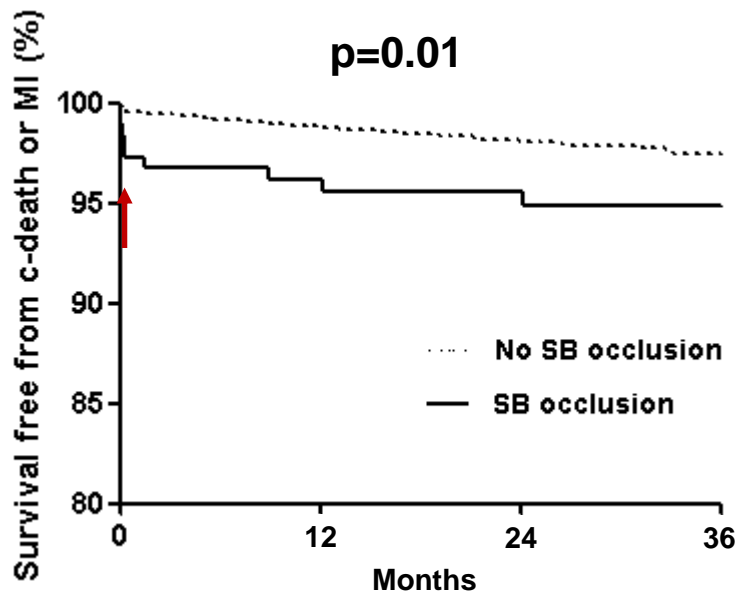
	SB occlusion (n=187)	No SB occlusion (n=2040)	Unadjusted HR (95% CI)	p Value	Adjusted HR* (95% CI)	p Value
<b>Death</b>	10 (5.3)	74 (3.6)	1.6 (0.8-3.0)	0.20	1.5 (0.8-3.0)	0.24
<b>Cardiac death</b>	7 (3.7)	20 (1.0)	<b>4.0 (1.7-9.4)</b>	<b>0.002</b>	<b>4.2 (1.7-10.6)</b>	<b>0.002</b>
<b>MI</b>	4 (2.1)	32 (1.6)	1.4 (0.6-4.1)	0.49	1.5 (0.5-4.4)	0.46
<b>Cardiac death or MI</b>	10 (5.3)	50 (2.5)	<b>2.3 (1.2-4.5)</b>	<b>0.02</b>	<b>2.3 (1.2-4.8)</b>	<b>0.02</b>
<b>Stent thrombosis</b>	6 (3.2)	9 (0.4)	<b>7.7 (2.7-21.6)</b>	<b>&lt;0.001</b>	<b>6.2 (2.0-19.1)</b>	<b>0.002</b>
<b>TLR</b>	14 (7.5)	129 (6.3)	1.3 (0.73-2.2)	0.41	1.3 (0.7-2.3)	0.36
<b>MACE</b>	23 (12.3)	164 (8.0)	<b>1.6 (1.1-2.5)</b>	<b>0.03</b>	<b>1.62 (1.1-2.6)</b>	<b>0.03</b>

\*Adjusted covariates included diabetes, acute coronary syndromes, true bifurcation, left main lesion, use of intravascular ultrasound, SB predilatation, MV stent diameter, and MV stent maximal pressure

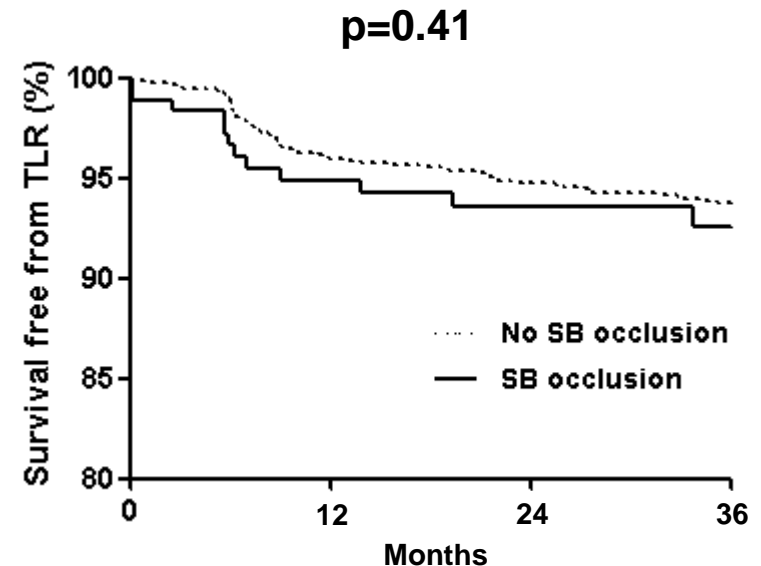


# Clinical Impact of SB Occlusion

## Cardiac Death / MI



## TLR

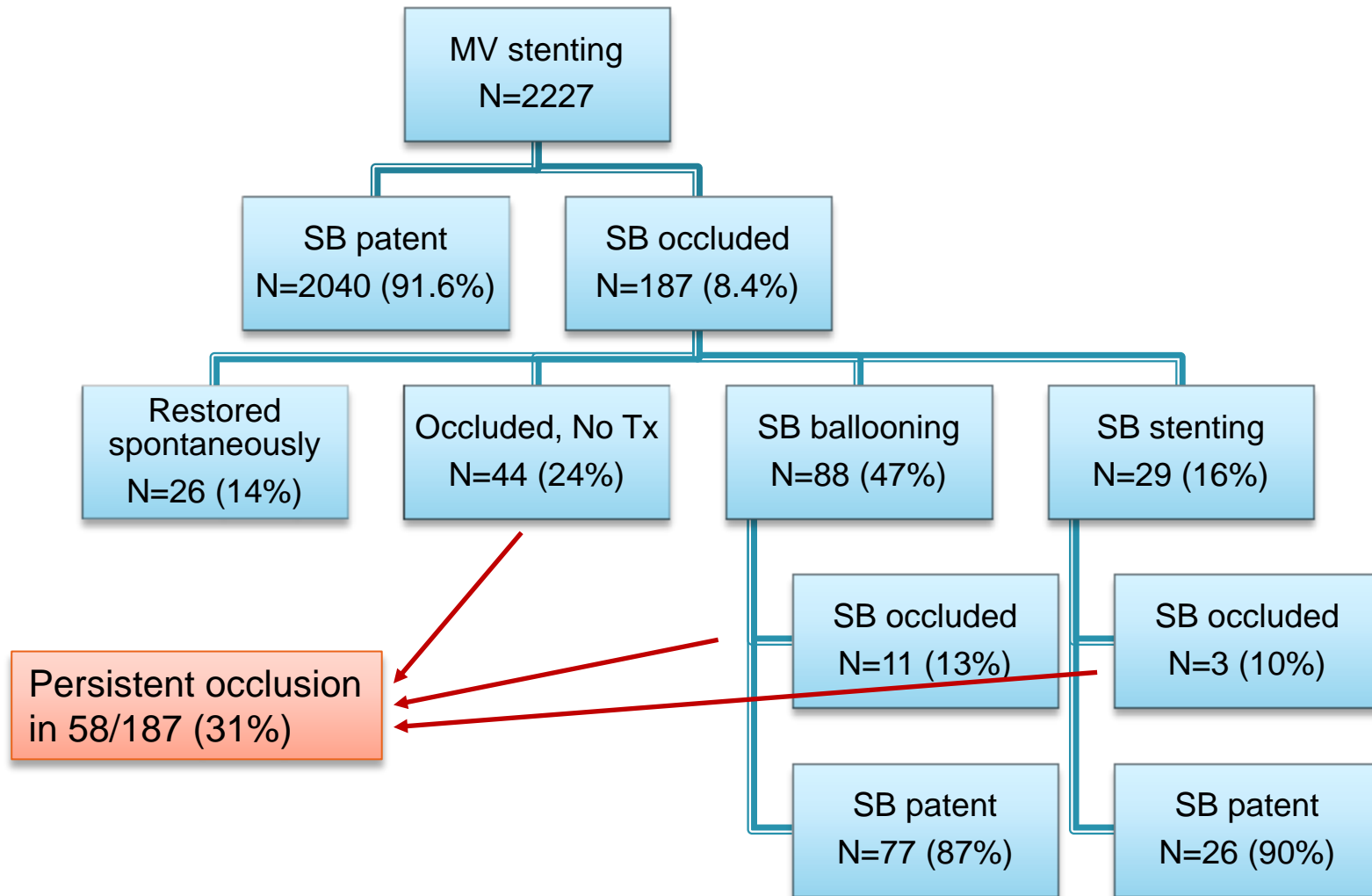


SB occlusion	187	163	128	83
No SB occlusion	2040	1851	1542	991

SB occlusion	187	156	121	80
No SB occlusion	2040	1790	1478	950



# Fate of Occluded SB





# Predictors of SB recovery

	SB recovery (n=129)	No SB recovery (n=58)	p Value
<b>Bifurcation location</b>			0.65
Left main bifurcation	9 (7.0)	5 (8.6)	
LAD/diagonal	84 (65.1)	40 (69.0)	
LCX/OM	25 (19.4)	7 (12.1)	
RCA bifurcation	11 (8.5)	6 (10.3)	
<b>True bifurcation</b>	94 (72.9)	45 (77.6)	0.49
<b>Jailed wire in the SB</b>	<b>92 (71.3)</b>	<b>31 (53.4)</b>	<b>0.02</b>
<b>SB predilation before MV stenting</b>	45 (34.9)	16 (27.6)	0.33
<b>Guidance of intravascular ultrasound</b>	39 (30.2)	13 (22.4)	0.27
<b>MV stent diameter (mm)</b>	3.0 (3.0-3.5)	3.0 (2.9-3.5)	0.62
<b>MV stent length (mm)</b>	24.0 (20.0-30.0)	24.0 (20.0-32.0)	0.91
<b>MV stent maximal pressure (atm)</b>	12.0 (10.0-15.5)	12.0 (10.0-14.0)	0.57
<b>MV stent to artery ratio</b>	1.2 (1.1-1.3)	1.2 (1.1-1.4)	0.25



# Summary

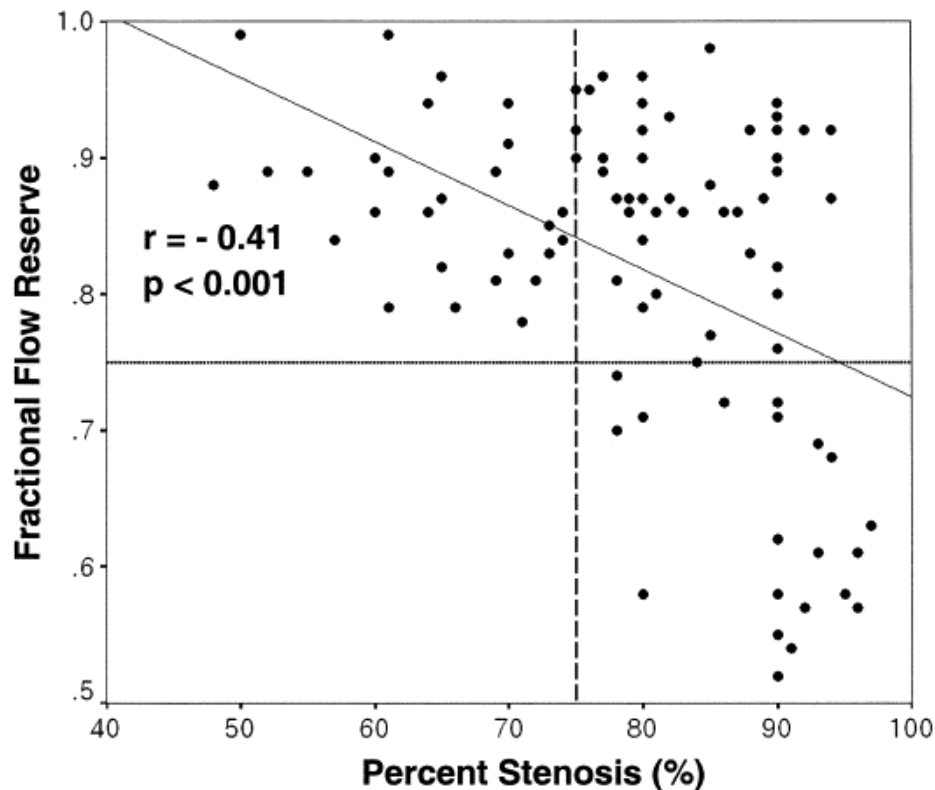
- ▶ SB occlusion after MV stenting occurred in 8.4% of bifurcation lesions treated with provisional approach.
- ▶ Angiographic findings of the SB, proximal MV stenosis and clinical presentation are associated with occlusion of SB after MV stenting.
- ▶ Occlusion of sizable SB is associated with adverse clinical outcomes.
- ▶ Jailed wire in the SB may be helpful for recovery of the occluded SB.



# SB stenosis after MV stenting



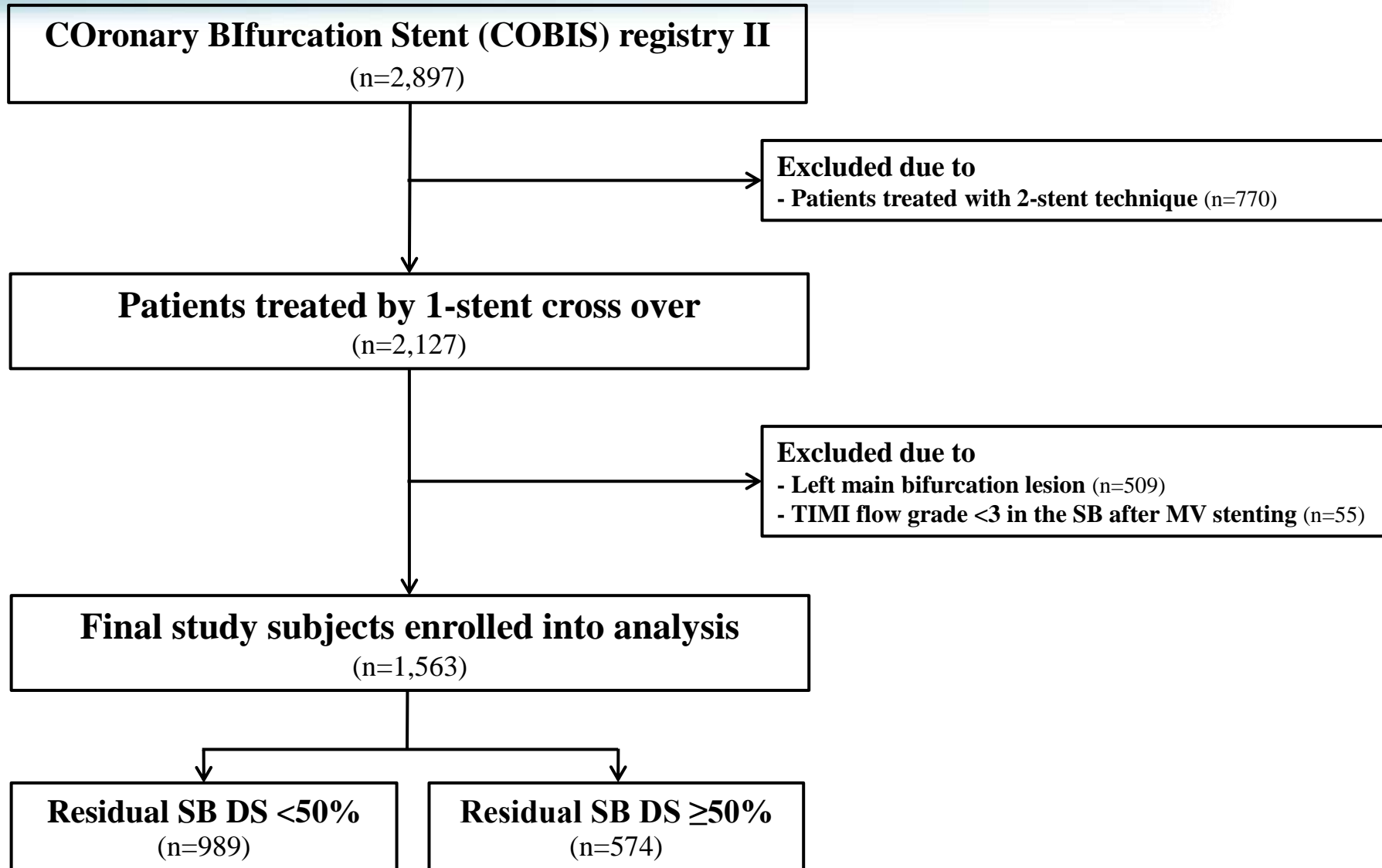
- ▶ Most of jailed SB lesions do not have functional significance.



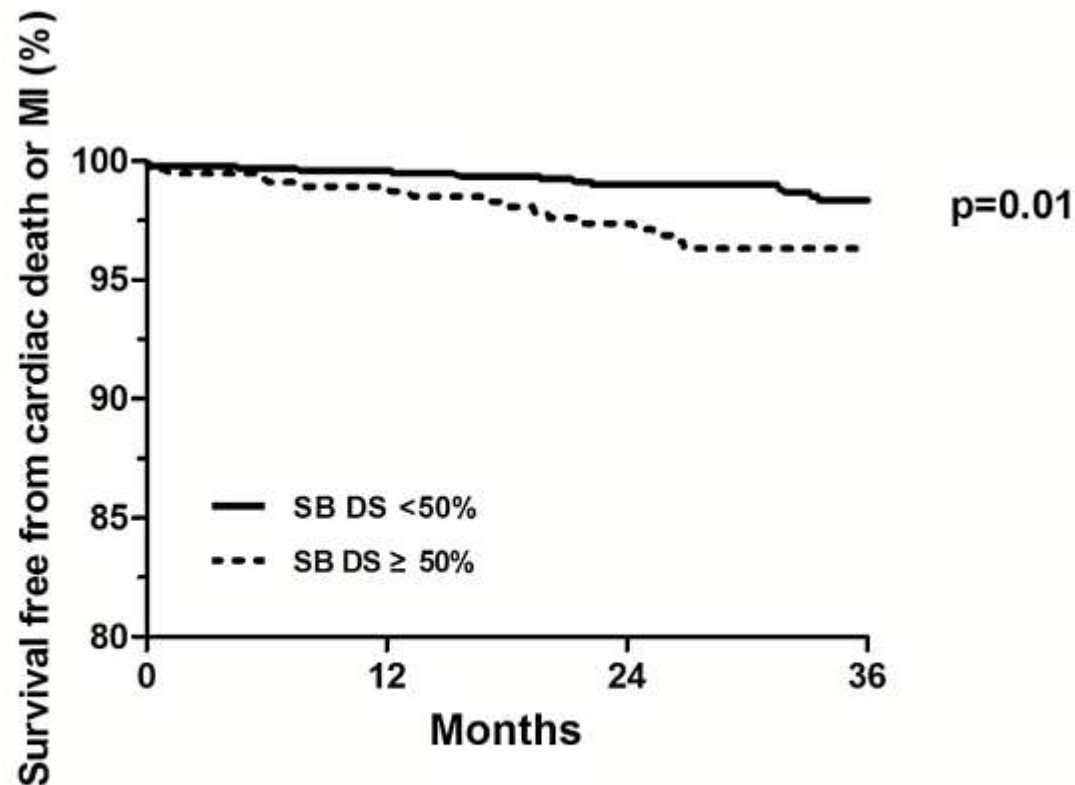
Correlation between  
FFR and % stenosis  
( $n = 73$ )



# Patient selection

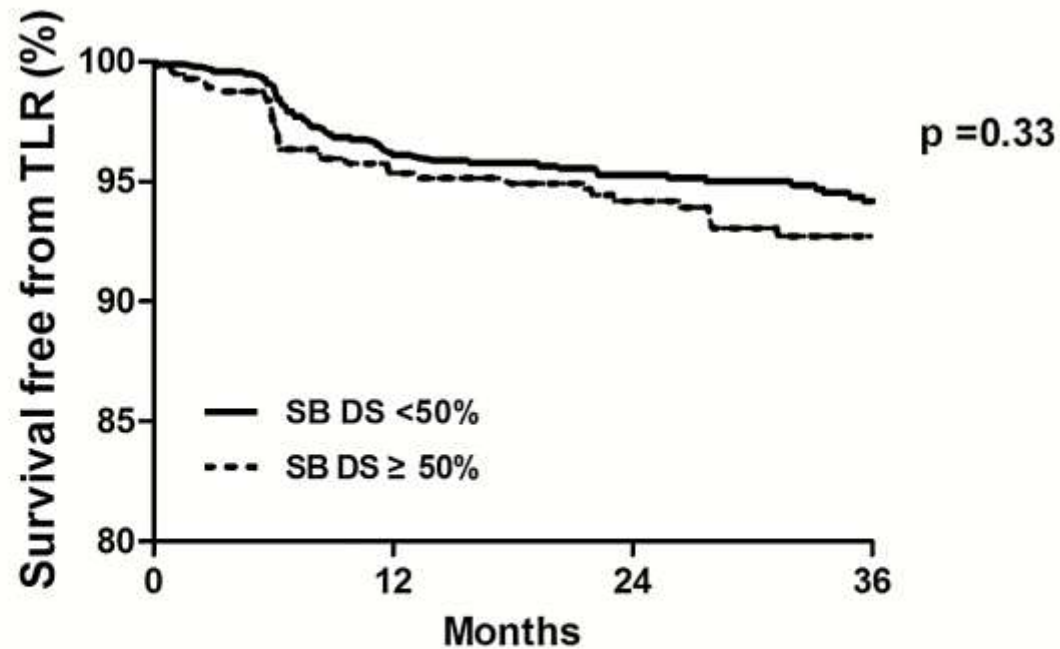


# SB residual stenosis and cardiac death or myocardial infarction



SB DS <50%	988	914	781	539
SB DS ≥50%	573	495	391	250

# SB residual stenosis and TLR



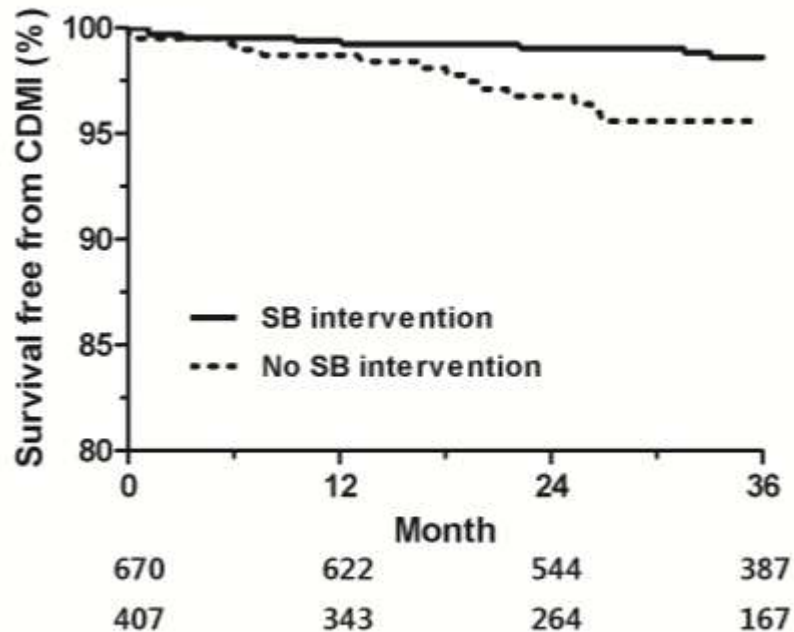
SB DS <50%	988	883	749	520
SB DS ≥50%	573	473	373	237

# Differential Effects of SB Intervention According to SB Stenosis after MV Stenting

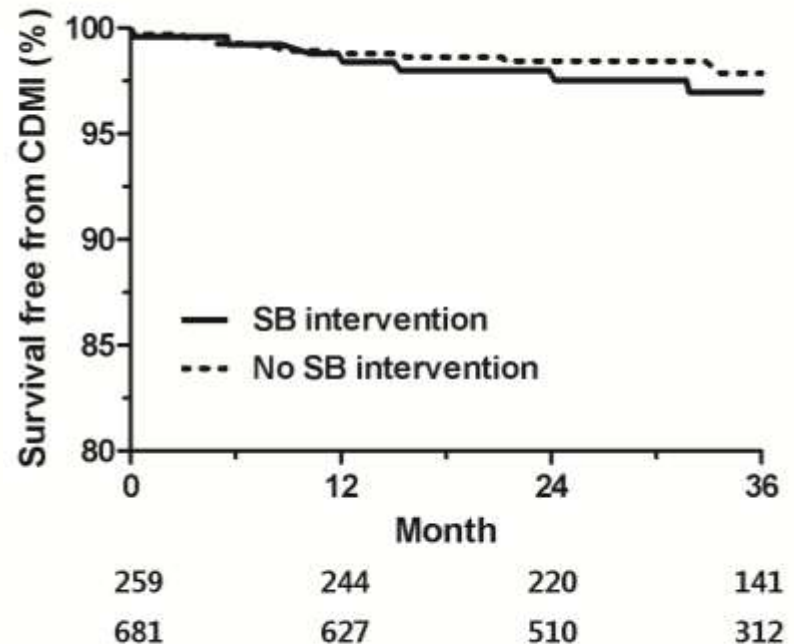
adjusted HR 0.22;  
95% CI 0.09 to 0.52;  
 $p=0.001$

adjusted HR 1.36;  
95% CI 0.58 to 3.20;  
 $p=0.48$

Patients with DS of SB  $\geq$  50% after MV stenting



Patients with DS of SB  $<$  50% after MV stenting





# Summary and possible explanation

- ▶ Residual stenosis of sizable SB affected long-term clinical outcomes mainly due to increased myocardial infarction.
  - Natural course! They are sizable SBs.
  - Underexpansion of MV stents related with SB compromise
  - Mere reflection of more advanced coronary artery disease
- ▶ SB intervention may be beneficial in bifurcation lesions with (significant) residual stenosis of SB after MV stenting.