Why I try to avoid side branch dilatation

European Bifurcation Club

EBC

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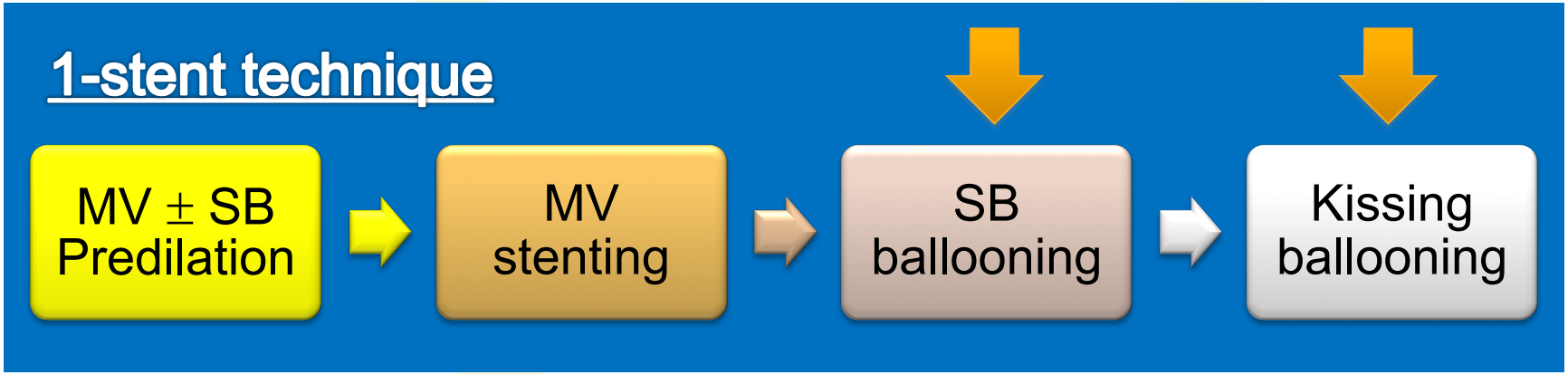
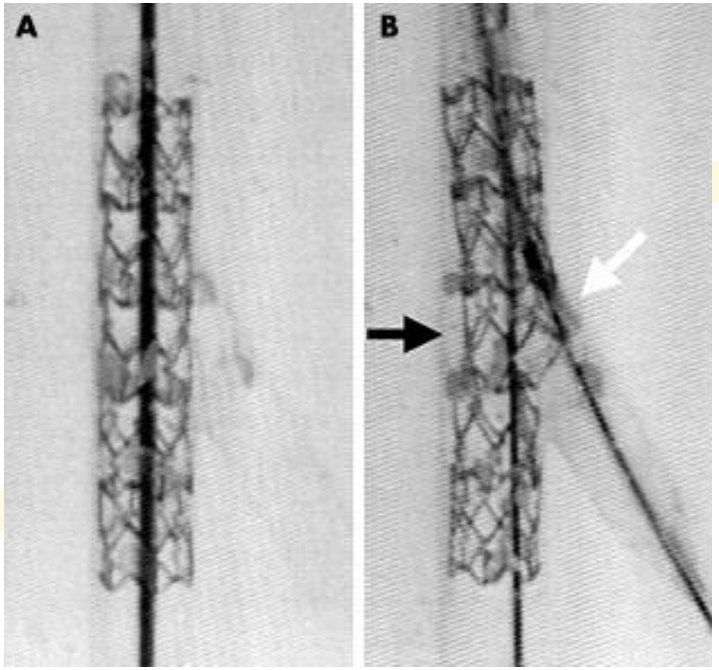
Why I don't kiss? I kiss!

- I prefer to discuss SB ballooning rather than kissing ballooning.
- Side branch ballooning is not always followed by kissing ballooning.



SB Ballooning in 1-Stent Technique

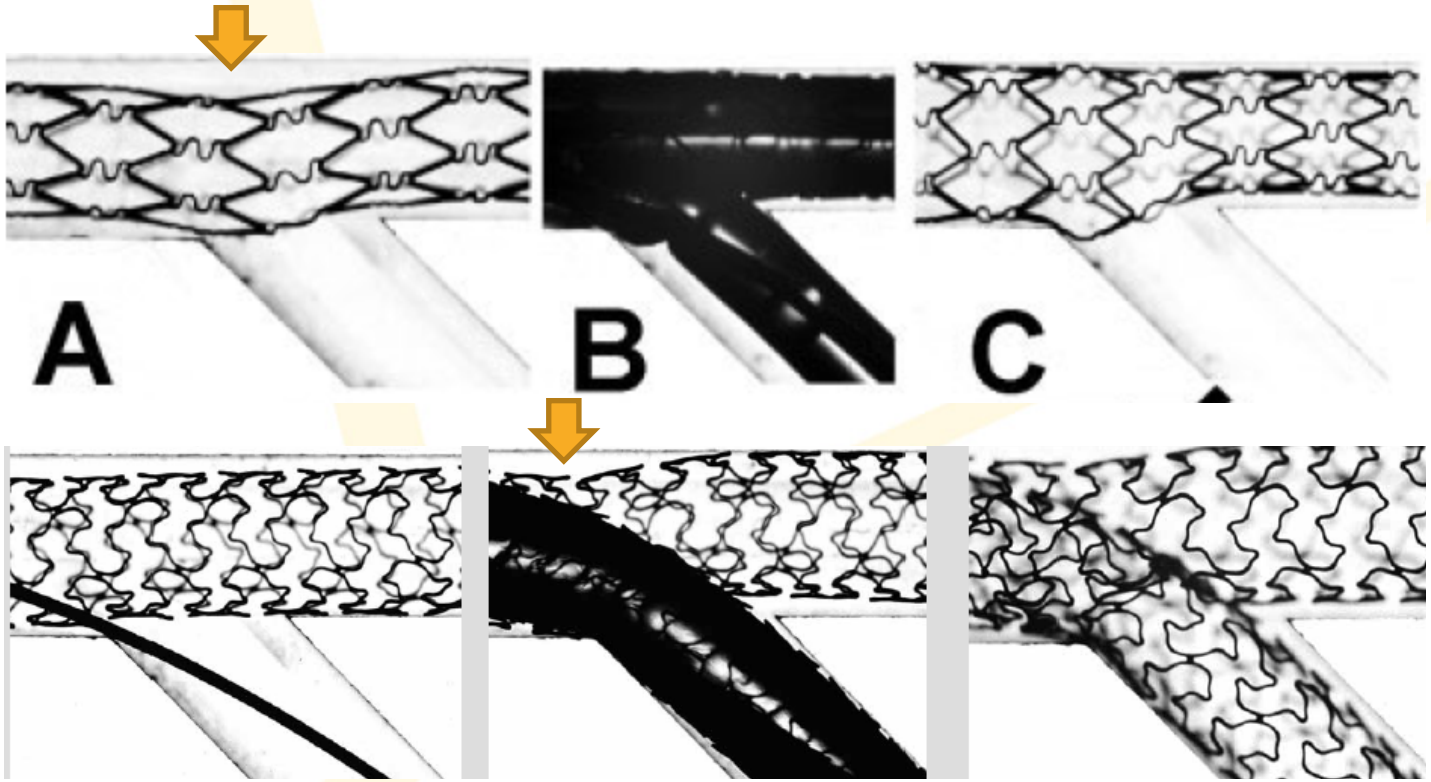
- Pros
  - Scaffolding of SB ostium
  - Access to SB preserved
  - Correct distal stent sizing
  - Optimizing proximal stent architecture
- Cons
  - Complicates the procedure
  - SB ostial injury
  - MV stent deformation



Modified from Hildick-Smith D, TCT 2009
Picture from Lefevre T, Heart 2005

SB ballooning distorts MV stent struts

- Stent distortion can be corrected by kissing ballooning in the *in vitro* study .



Ormiston JA, CCI 2006

Stent deformation was not corrected by kissing ballooning in clinical study

- N=55, provisional or T stents
  - SB dilated after MV stenting
- IVUS analysis
  - The lumen area at main branch ostium was significantly smaller than that at the point of maximum stent expansion (6.7±1.8 vs. 5.1 ±1.3 mm^2; P<0.05).
  - Under-expansion was not influenced by use of a kissing balloon

TABLE 4. **Influence of Kissing Balloon Inflation in 6-Month IVUS Results***

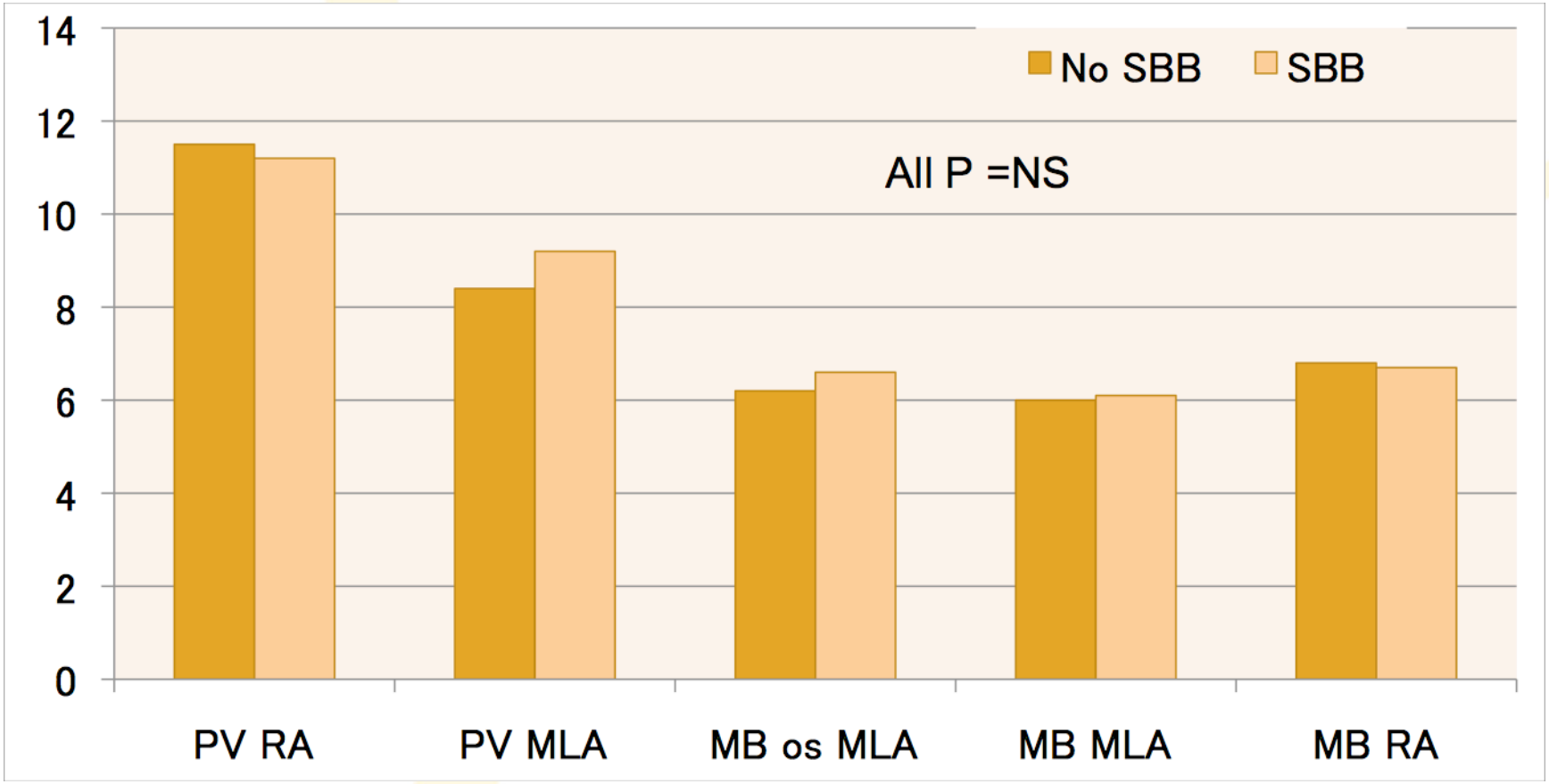
	Yes, (n=19)	Non, (n=36)	*P*
Proximal reference			
EEL area, mm^2	18.4±6.7	18.0±7.3	NS
Lumen area, mm^2	11.7±4.5	9.8±6.1	NS
Proximal edge			
EEL area	18.9±5.5	18.9±7.4	NS
Lumen area	9.3±3.6	8.6±4.6	NS
Maximal lumen diameter			
EEL area, mm^2	19.1±3.9	18.6±5.3	NS
Stent area, mm^2	7.8±1.8	6.8±1.7	<.05
Lumen area, mm^2	7.1±1.9	6.5±1.8	NS
Minimal lumen diameter			
EEL area, mm^2	16.8±4.6	14.9±6.2	ns
Stent area, mm^2	5.3±1.2	4.9±1.7	NS
Lumen area, mm^2	4.7±1.0	4.5±1.4	ns
Under side branch origin			
EEL area, mm^2	17.2±4.3	16.3±4.2	NS
Stent area, mm^2	5.5±0.9	5.6±1.6	NS
Lumen area, mm^2	5.1±0.9	5.2±1.4	NS
Distal edge			
EEL area, mm^2	12.4±4.5	12.3±5.8	NS
Lumen area, mm^2	6.6±2.0	6.8±3.1	NS
Distal reference			
EEL area, mm^2	11.4±4.6	11.3±5.9	NS
Lumen area, mm^2	6.7±2.3	6.4±2.8	NS

*EEL indicates external elastic laminae.

Pan M, Rev Esp Cardiol 2005

SB Ballooning vs. No SB Ballooning

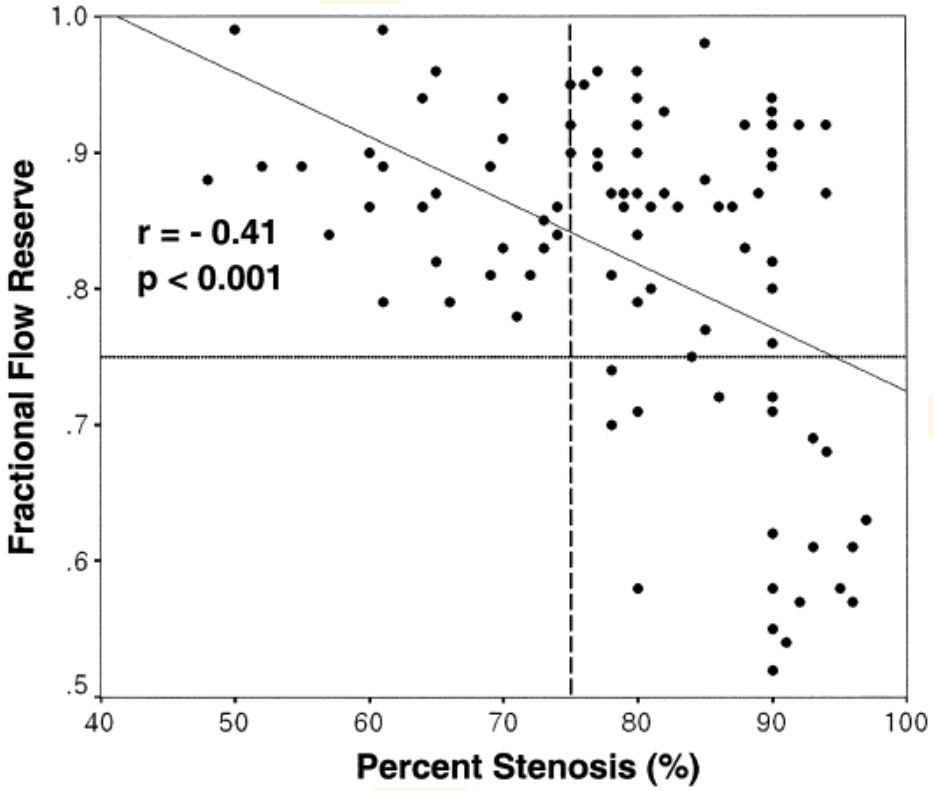
N=69: Cross-over stent N=15, SBB with FKB N=54
Post-PCI IVUS measurement in MV



SMC Unpublished data

Frequently, anatomically significant SB stenosis is functionally insignificant.

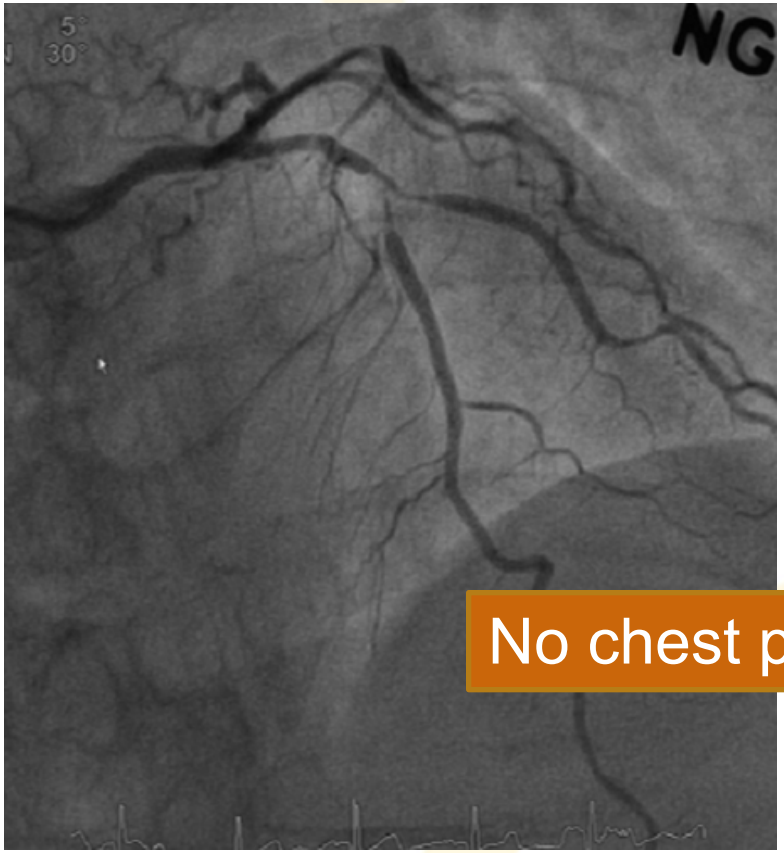
- In side branch, >75% diameter stenosis is good indicator of functionally significant stenosis.

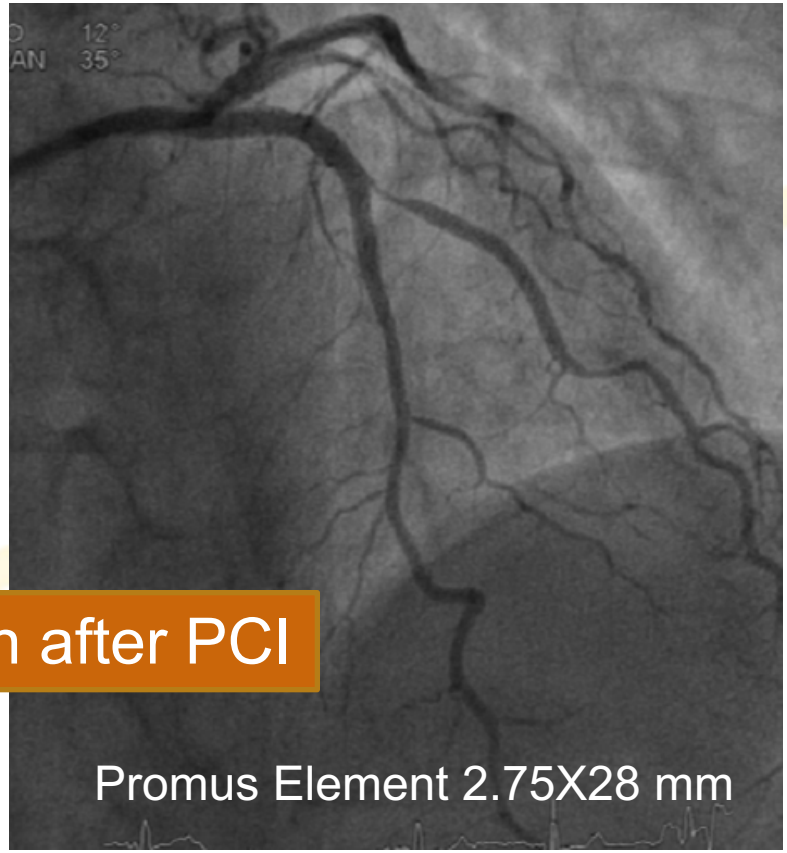


Correlation between FFR and %stenosis (Koo BK, JACC 2005)

Case

- F/71 Unstable angina
  - NT-pro-BNP 612 pg/ml (> 222 pg/ml), Echo: normal



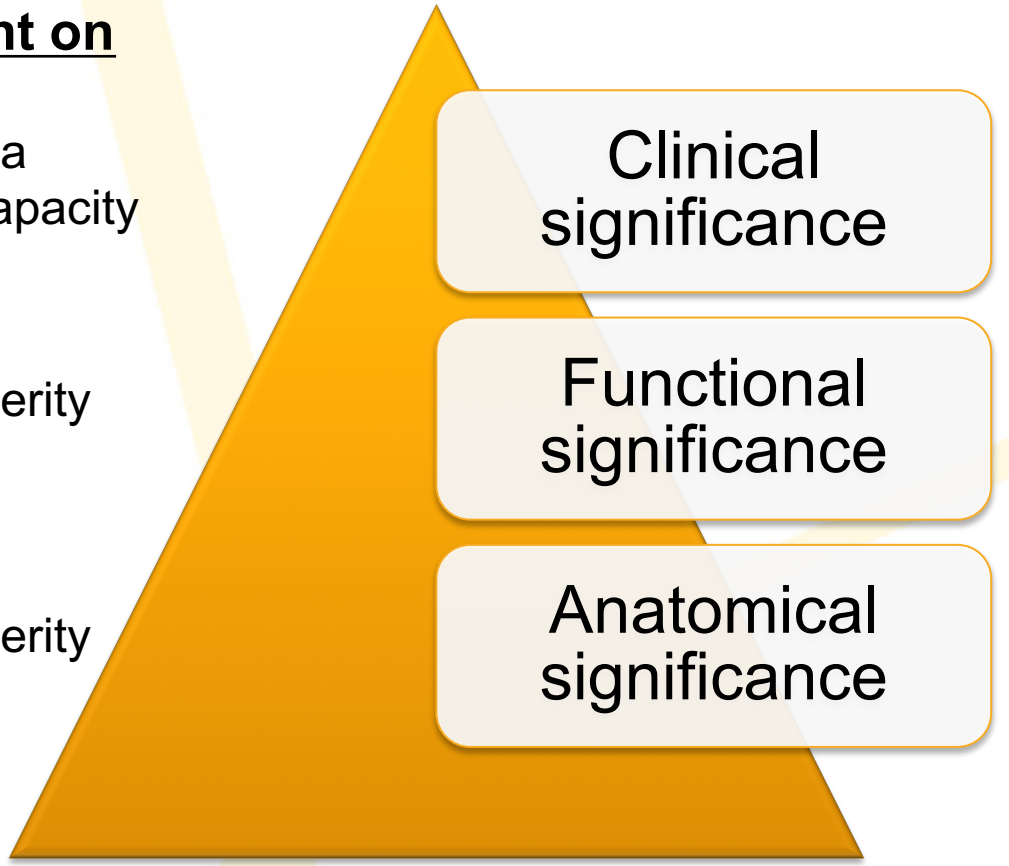


No chest pain after PCI

Pt. No. 25686693

Frequently, functionally significant SB stenosis is clinically insignificant.

Dependent on		Assessed by
Ischemic area Functional capacity	Clinical significance	Treadmill test Symptoms
Stenosis severity	Functional significance	FFR SPECT Treadmill test
Stenosis severity	Anatomical significance	CAG IVUS/OCT CT angiography



SB stenosis rarely progresses after main vessel stenting

- 66 SBs in 57 stent placements
- 60 SBs patent after balloon angioplasty
- 57 SBs patent after stenting
- 60 SBs patent after 6 months

- The patency of SB ostia is well maintained at long-term follow-up.

Fischman JL, JACC 2003

NORDIC III Study

FKB vs. no FKB in 1-Stent Technique

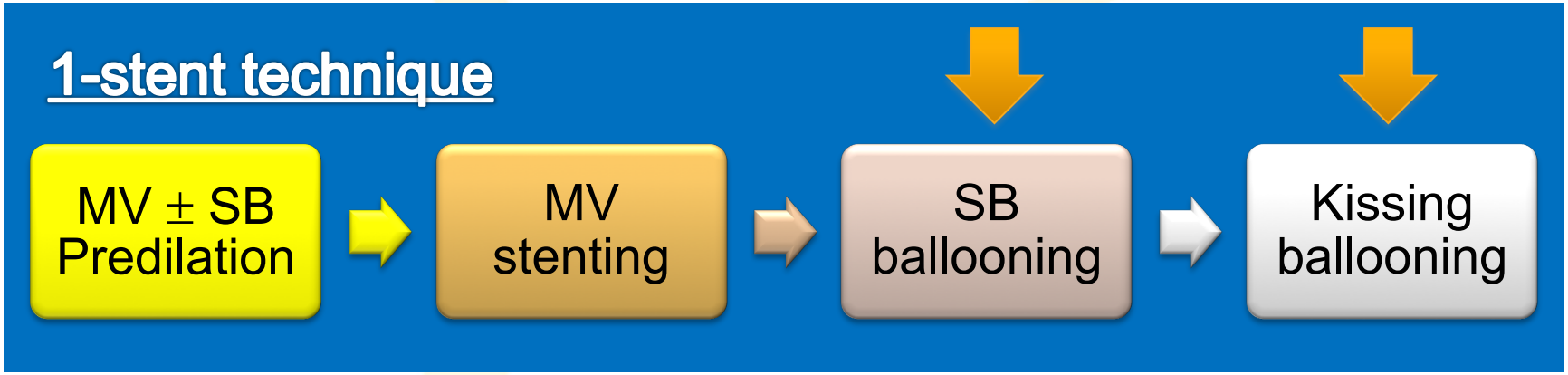
	No Kissing (N=239)	Kissing (N=238)	P-value
Procedure time (min)	47±22	61±28	0.0001
Fluorosc. Time (min)	11±10	16±12	0.0001
Contrast (ml)	200±92	235±97	0.0001
6-mo MACE (%)	2.9	2.9	NS
6-mo Index lesion MI (%)	2.2	0.0	NS
6-mo TLR (%)	2.1	1.3	NS
6-mo Stent thrombosis (%)	0.4	0.4	NS

SB ballooning followed by kissing ballooning did not improved mid-term clinical outcome. On the contrary, it complicates the procedure.

Niemela M, TCT 2009

COBIS: Elective SB Ballooning

- Aim of study
  - To assess the impact of elective SB ballooning in 1-stent group.
- SB ballooning rather than kissing ballooning
  - SB ballooning after MV stenting was not followed by FKB in 20% of the lesions.



Gwon HC, TCT 2010

COBIS: Elective SB Ballooning

Selection for the Analysis

N=1668 patients in COBIS registry

↓

Inclusion: 1-stent technique in 1 bifurcation lesion: N=1229

↓

Exclusion: SB compromise after MV stenting: N=59

TIMI flow <3 or dissection ≥ type B

↓

Exclusion: Angiograms suboptimal for analysis: N=13

↓

N=1157 patients for the analysis

Gwon HC, TCT 2010

Clinical Outcomes

Total Population

	No SBB	SBB	p Value	Adjusted HR* (95% CI)	p Value
Cardiac death	5 (0.7)	5 (1.2)	0.38	1.31 (0.35-4.88)	0.55
Cardiac death or MI	15 (2.0)	8 (1.9)	0.90	0.99 (0.38-2.39)	0.93
TLR	24 (3.3)	31 (7.4)	0.002	**2.88 (1.65-5.03)**	**<0.001**
TLR for MV	25 (3.4)	31 (7.4)	0.002	2.57 (1.50-4.37)	0.001
TLR for SB	1 (0.1)	7 (1.7)	0.003	18.2 (2.1-156)	0.008
TVR	35 (4.8)	38 (9.0)	0.004	2.39 (1.74-3.91)	<0.001
MACE	36 (4.9)	37 (8.8)	0.009	**2.16 (1.32-3.52)**	**0.002**

*Adjusted covariates included age, diabetes, acute coronary syndrome, stent type, true bifurcation, intravascular ultrasound guidance, postprocedural MV MLD, postprocedural SB MLD, and lesion length of main vessel

HR=hazard ratio; MACE=major adverse cardiac events; MI=myocardial infarction; MV=main vessel; SB=side branch;TLR=target lesion revascularization; TVR=target vessel revascularization.

Clinical Outcomes

Propensity Score-Matched Population

	No SBB	SBB	p Value	Adjusted HR* (95% CI)	p Value
Cardiac death	3 (0.8)	5 (1.3)	0.48	1.57 (0.35-7.16)	0.56
Cardiac death or MI	5 (1.3)	8 (2.0)	0.40	1.91 (0.57-6.38)	0.30
TLR	17 (4.3)	28 (7.1)	0.08	**1.99 (1.05-3.77)**	**0.03**
TLR for MV	17 (4.3)	27 (6.9)	0.12	1.75 (0.95-3.21)	0.07
TLR for SB	0 (0.0)	6 (1.5)	0.014	-	0.94
TVR	26 (6.6)	34 (8.7)	0.28	1.56 (0.91-2.67)	0.11
MACE	20 (5.1)	33 (8.4)	0.053	**2.00 (1.09-3.55)**	**0.02**

*Adjusted covariates included age, diabetes, acute coronary syndrome, stent type, true bifurcation, intravascular ultrasound guidance, postprocedural MV MLD, postprocedural SB MLD, and lesion length of main vessel

HR=hazard ratio; MACE=major adverse cardiac events; MI=myocardial infarction; MV=main vessel; SB=side branch;TLR=target lesion revascularization; TVR=target vessel revascularization.

QCA Results

Propensity Score-Matched Population

	Pre-PCI			Post-PCI		
	No SBB (n=393)	SBB (n=393)	p Value	No SBB (n=393)	SBB (n=393)	p Value
MV proximal RD (mm)	3.07±0.52	3.07±0.51	0.99	3.16±0.52	3.14±0.52	0.46
MV distal RD (mm)	2.44±0.45	2.45±0.43	0.65	2.61±0.48	2.55±0.46	0.048
SB distal RD (mm)	2.09±0.41	2.16±0.41	0.03	2.03±0.49	2.18±0.41	<0.001
MV proximal MLD (mm)	1.45±0.85	1.47±0.79	0.69	2.74±0.51	2.86±0.47	<0.001
MV middle MLD (mm)	1.24±0.62	1.19±0.58	0.29	2.61±0.49	2.59±0.44	0.55
MV distal MLD (mm)	1.58±0.71	1.63±0.70	0.29	2.49±0.53	2.55±0.47	0.06
SB ostial MLD (mm)	1.24±0.59	1.23±0.55	0.80	1.20±0.56	1.40±0.45	<0.001
SB distal MLD (mm)	1.55±0.56	1.66±0.57	0.007	1.53±0.56	1.73±0.52	<0.001
MV lesion length (mm)	17.6±9.8	17.2±9.7	0.63			
SB lesion length (mm)	5.0±6.0	4.7±5.6	0.46			

Better QCA results in SB ballooning group
was not translated into better clinical outcome.

Gwon HC, TCT 2010

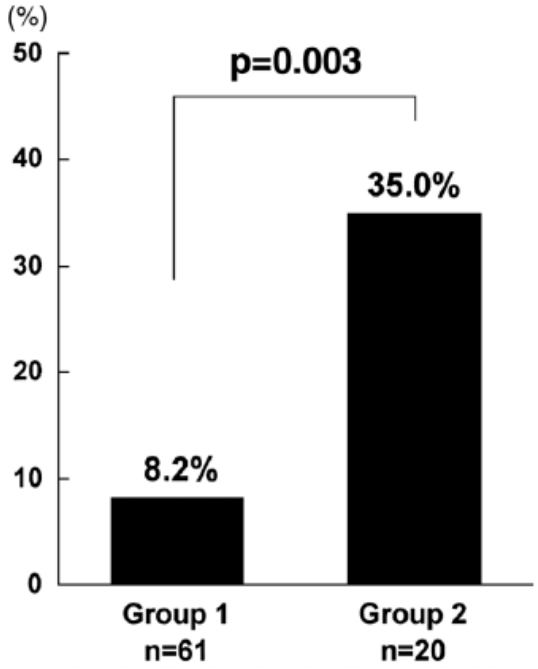
SB Predilation

- Pros
  - Reduce the risk of SB occlusion
  - Treat un-dilatable lesions
  - Possible restenosis benefit
- Cons
  - SB occlusion is not predictable
  - Risk of SB dissection
  - Possible restenosis risk
    - By the balloon injury

IVUS Study

Group I: No SB os disease

Group 2: SB os disease



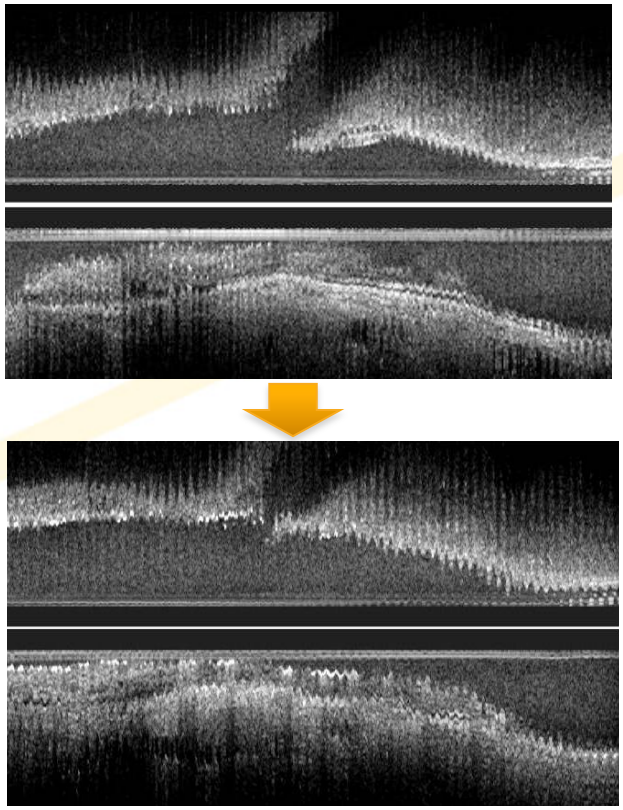
Furukawa, Circ J 2005

My Approach Is…

- MV predilation
- Avoid SB dilation
- MV stenting
  - Avoid stent over-expansion
- Rewire SB
- Full expansion of MV stent

  ± proximal optimization
- If SB occluded, SB ballooning followed by kissing ballooning

Stent over-expansion may be the most important mechanism of SB occlusion after MV stenting



Pictures from Koo BK, ENCORE 2009

Summary
Why I try to avoid SB ballooning

- SB ballooning may deform the stent struts, which is not always corrected by kissing ballooning.
- SB narrowing after MV stenting is frequently insignificant, either physiologically and clinically.
- SB patency is well maintained at long-term follow-up
- Finally, clinical studies showed no benefit of SB ballooning with or without kissing ballooning.

Conclusion

- Side branch is not so important than we thought. The threshold for significant SB should be higher.
- The treatment should be focused on MV, trying to avoid SB ballooning, as far as SB is not occluded.

Nomenclature in this presentation

- Bifurcation = main vessel (MV) + side branch (SB)
- Main vessel (MV) = parent vessel (PV) + main branch (MB)
- MB os and SB os