



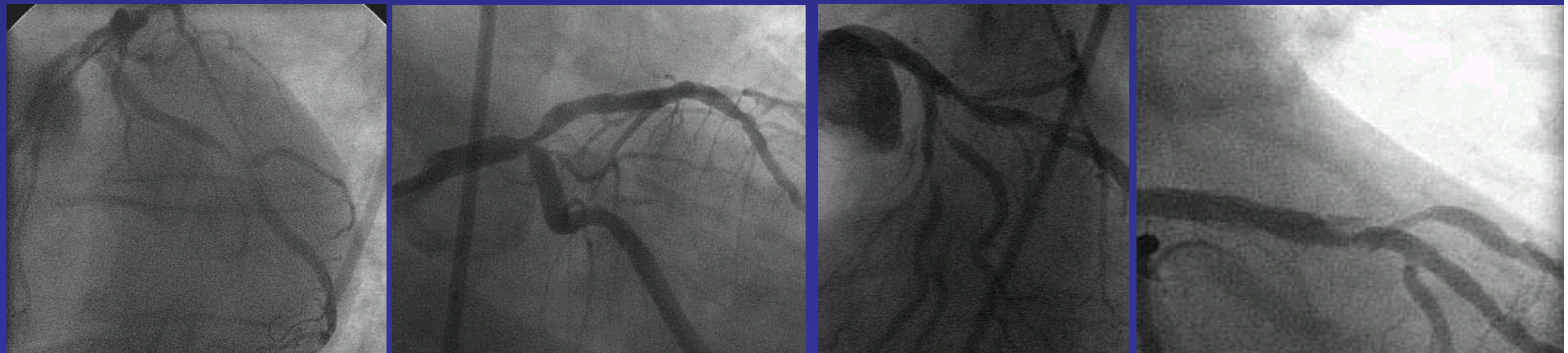
Contemporary therapy of bifurcation lesions

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The challenge of bifurcations

- Risk of peri-procedural infarction
- Relatively high rate of restenosis
- Not all lesions are the same
 - Size of vessels
 - Variable plaque distribution
 - Extent of side branch disease
 - Variable angulation



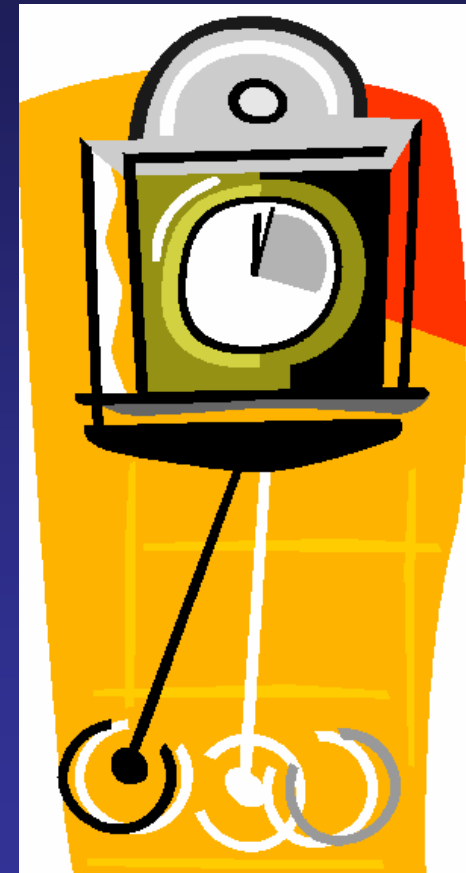
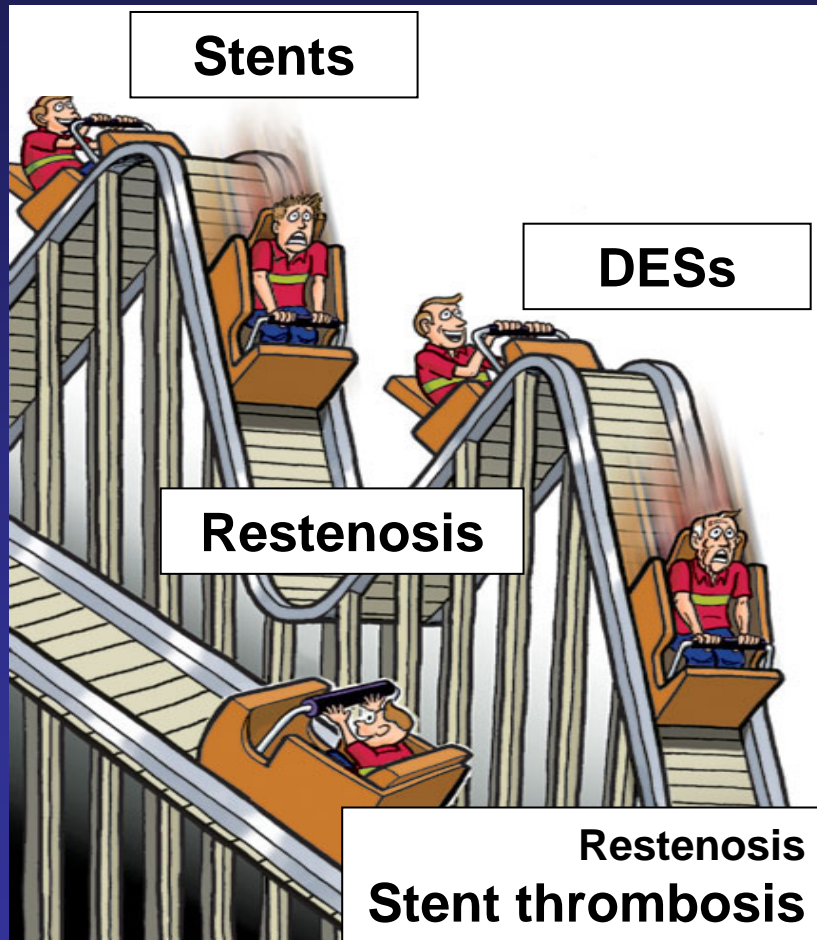
BMS era: worse clinical outcomes

- NHLBI registry of 4,629 patients
 - Increased rate of MACE with increasing lesion complexity
 - Bifurcation: **MACE at 1-year RR: 1.34 (1.09-1.64)**
- PRESTO study: comparison of patients with (n=1,412) and without a bifurcation lesion (n=10,068)
 - **Higher MACE** at 9-months in the bifurcation group (18% versus 15%, p=0.002)
 - The risk of death, and/or MI was similar
 - **Higher rate of TVR** in the bifurcation group (17% versus 14%, p<0.001)

Wilensky et al AJC 2002;90:216-221

Garot et al J Am Coll Cardiol 2005;46:606 –12

Therapy of bifurcations



1 stent



2 stents

Contemporary therapy of bifurcation lesions

- By definition, the side branch is important
- When treating bifurcation lesions we are aiming to get a good result in both branches
- Heterogeneous population
- **Plan your strategy**

Our Disaster Recovery Plan Goes Something Like This...



Plan your strategy:

- Have a backup plan B, C, & even D
- Think several moves ahead



Protect both vessels

- Use 2 wires
- TULIPE study demonstrated lower adverse event rate
- Plaque shift: the snowplough effect



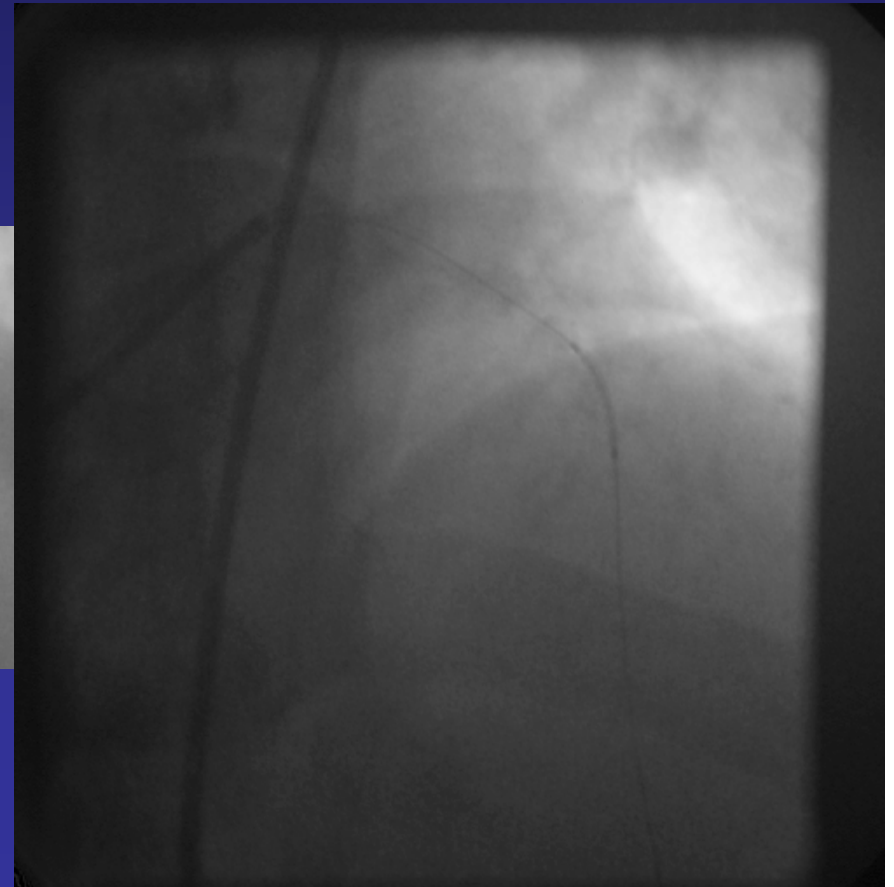
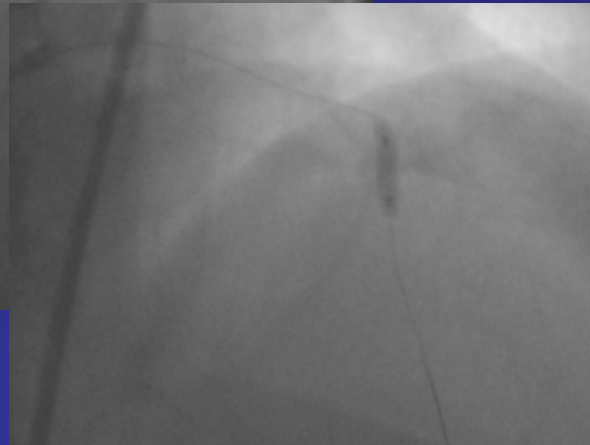
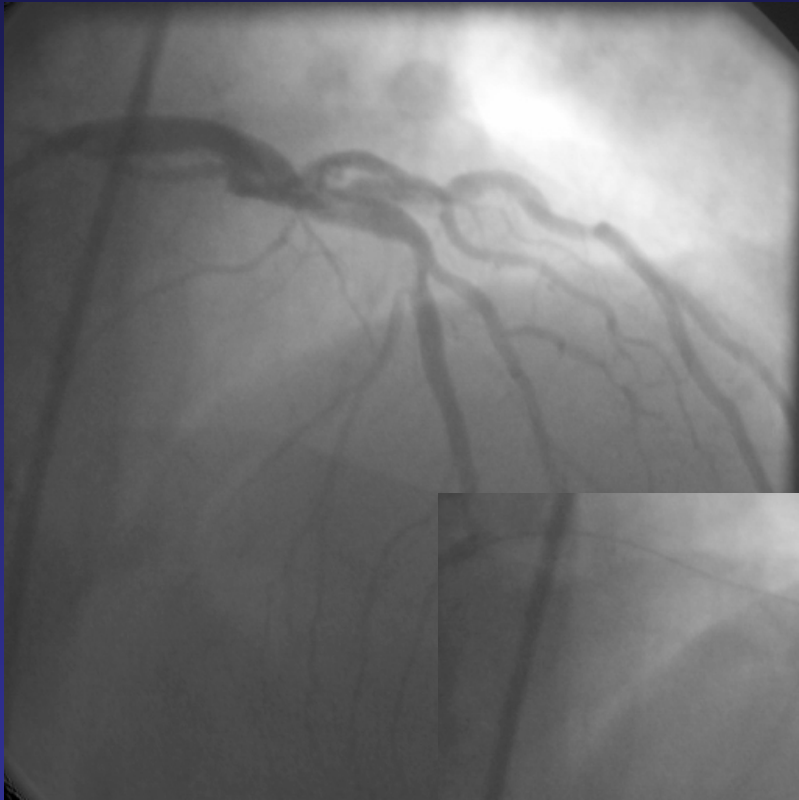
Common & Unpredictable

Presence of
“soft” material

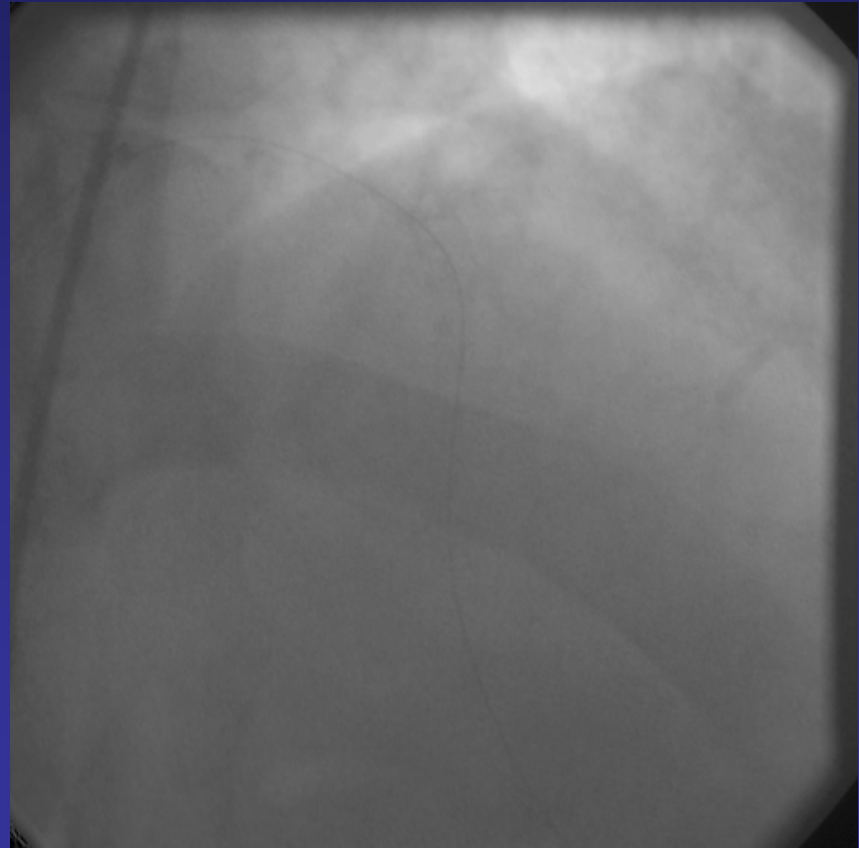
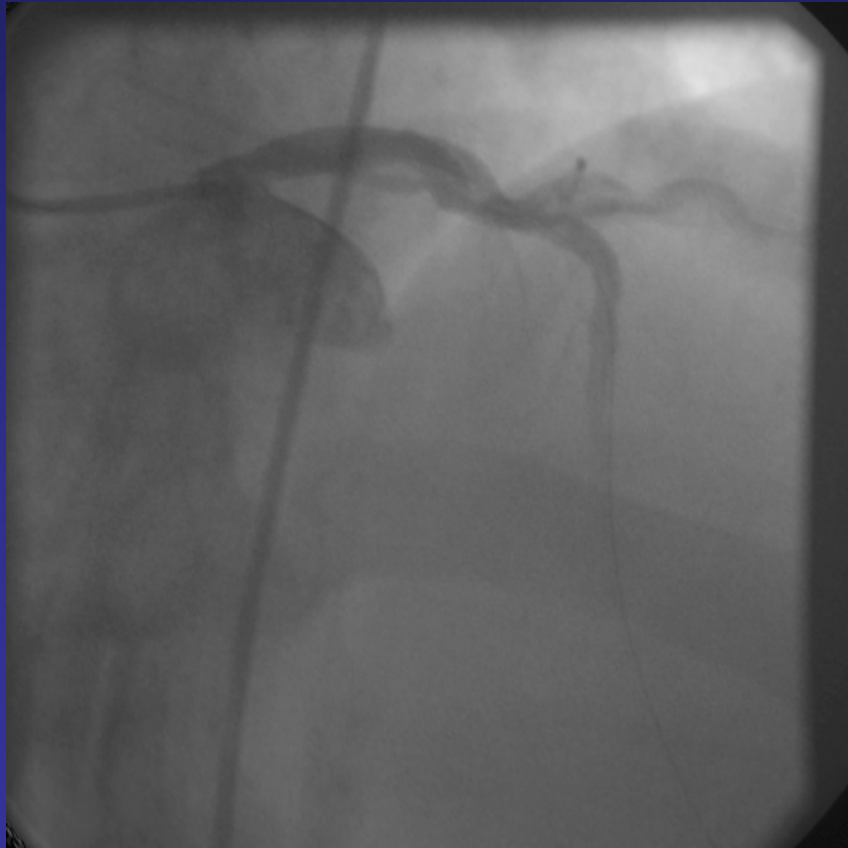
Small diameter
of SB

Always use 2 wires!

62 year old man with NYHA II
stable angina



Always use 2 wires!



Lesion preparation



- “It is better to stop something bad happening than it is to deal with it after it has happened”
- Pre-dilatation can provide information about how the lesion is going to behave
 - Helps to plan the stenting strategy
 - Helps ensure optimal stent expansion
 - Helps to reduce ischemia during stent positioning

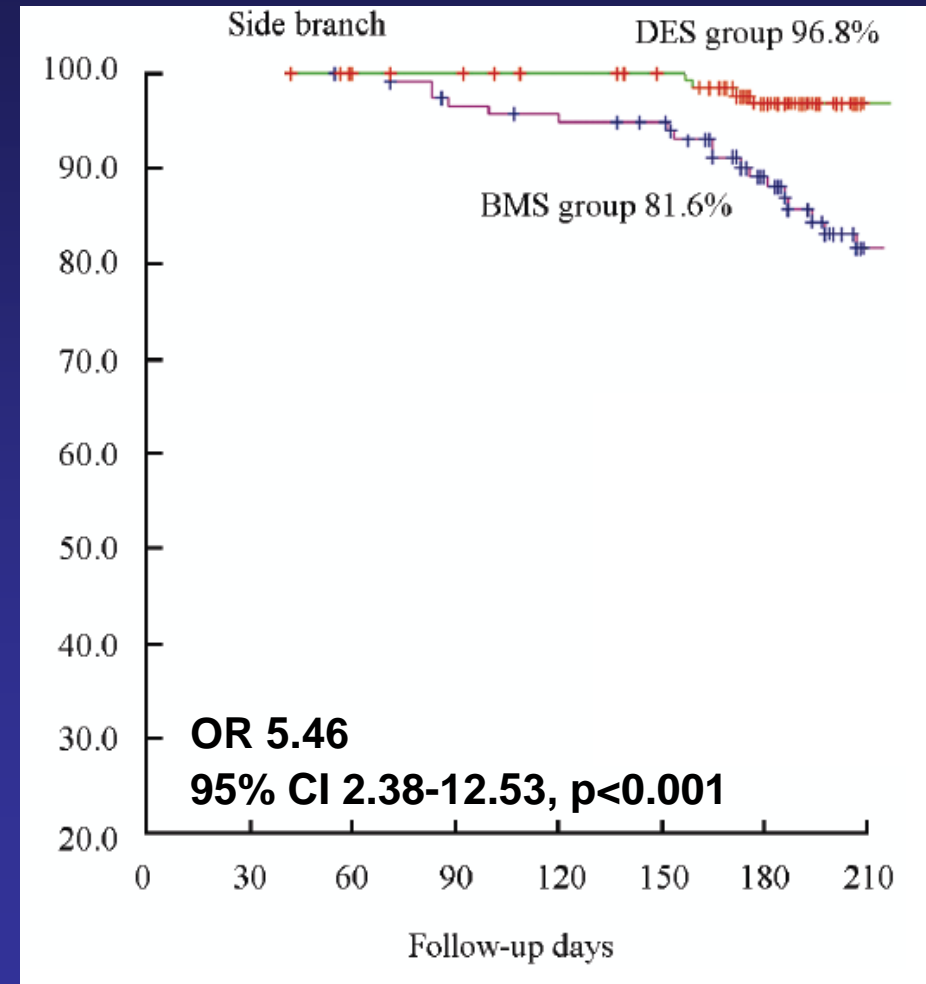
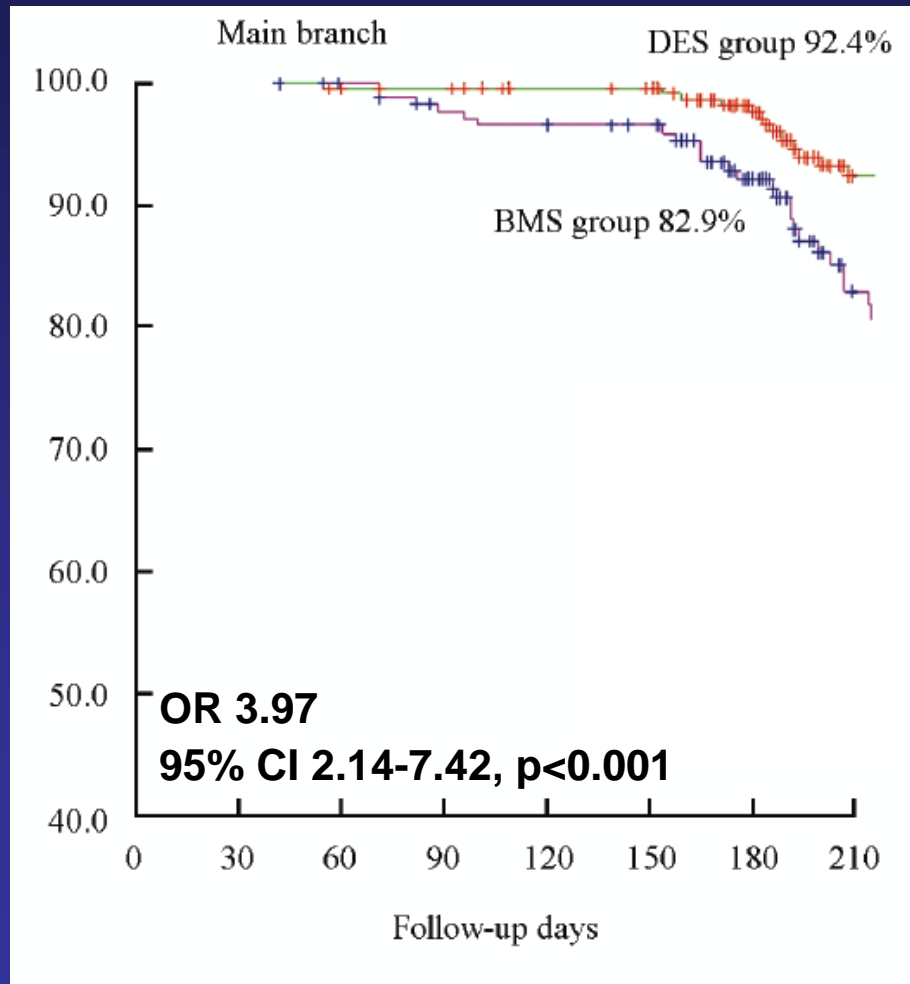
Which stent: DES or BMS?

- Non-randomised data of 291 patients treated from April `04-October `05 with DES (387 lesions) and/or BMS (297 lesions)
- Angiographic FU at 7 months

Main branch	DES	BMS	p value
In-segment late loss (mm)	0.26±0.49	0.97±0.71	p<0.001
Restenosis (%)	9.5	28.7	p<0.001
Side branch			
In-segment late loss (mm)	0.32±0.50	0.94±0.71	p<0.001
Restenosis (%)	14.5	37.0	p<0.001

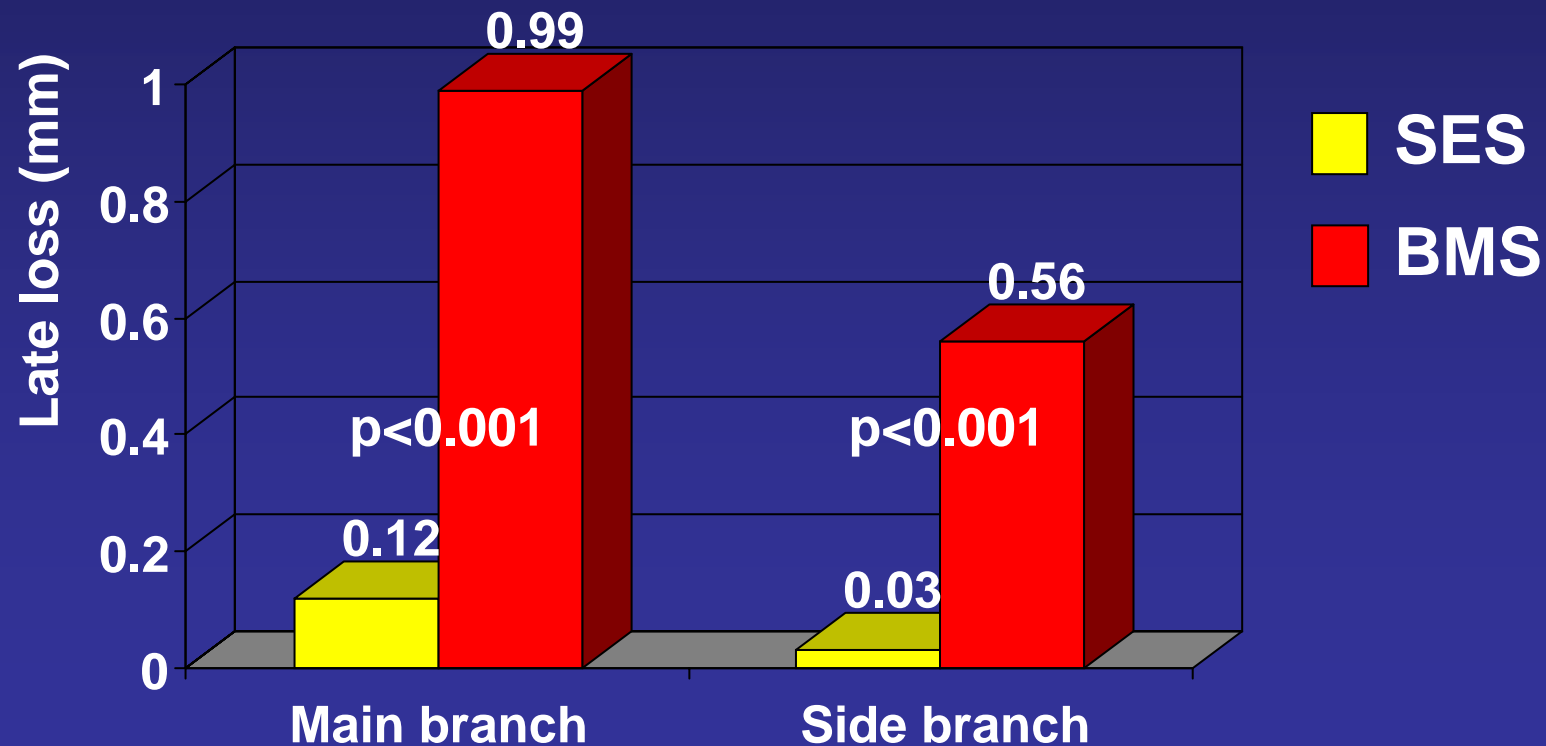
Which stent: DES or BMS?

Survival-free of TLR



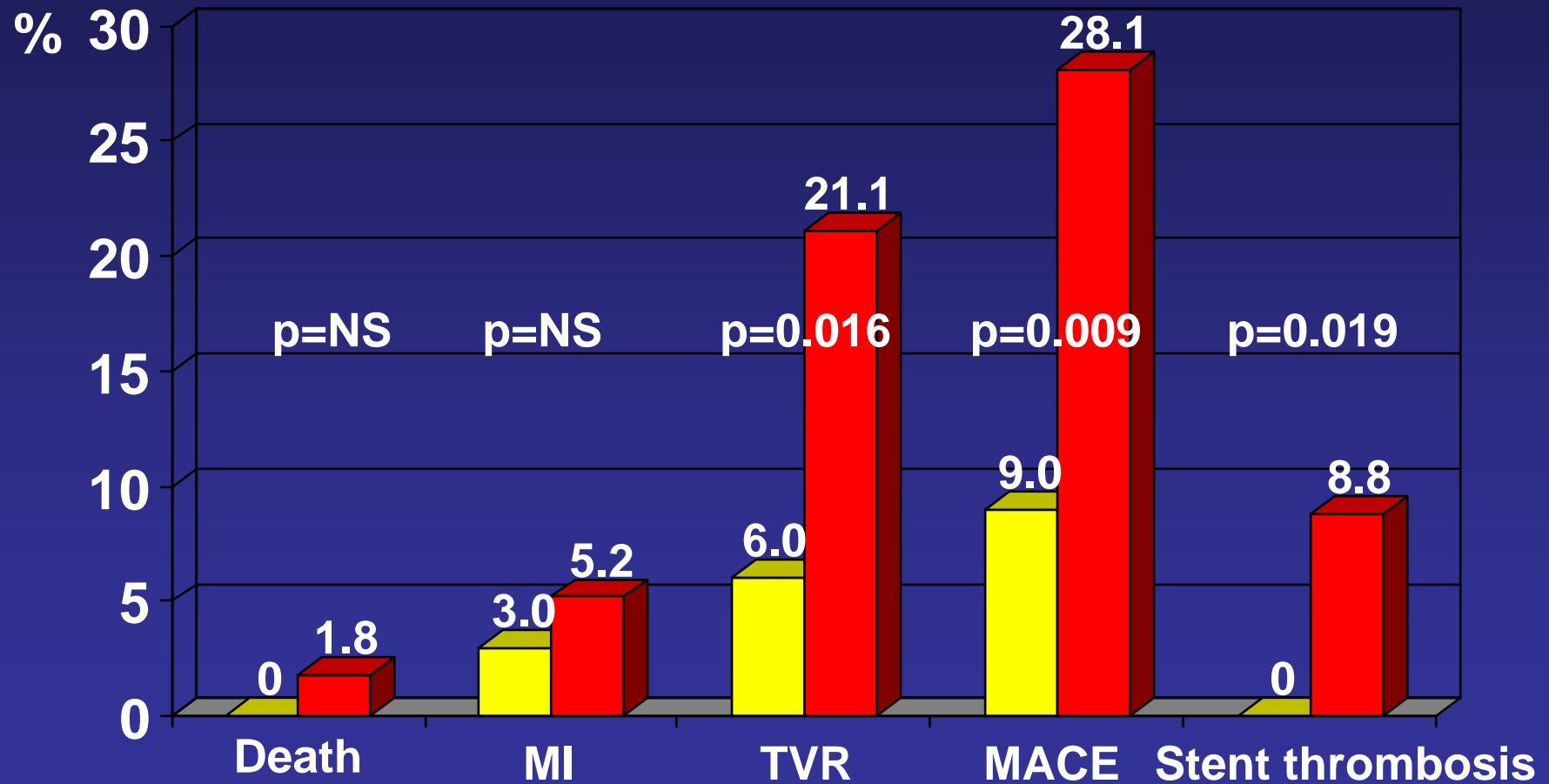
Which stent: DES or BMS?

- SCANDSTENT: randomised study comparing SES with BMS implantation in patients with complex CAD
- Subgroup analysis of those with a bifurcation (n=126)



Clinical outcomes

■ SES ■ BMS



Contemporary therapy of bifurcation lesions: unanswered questions

What don't we know?

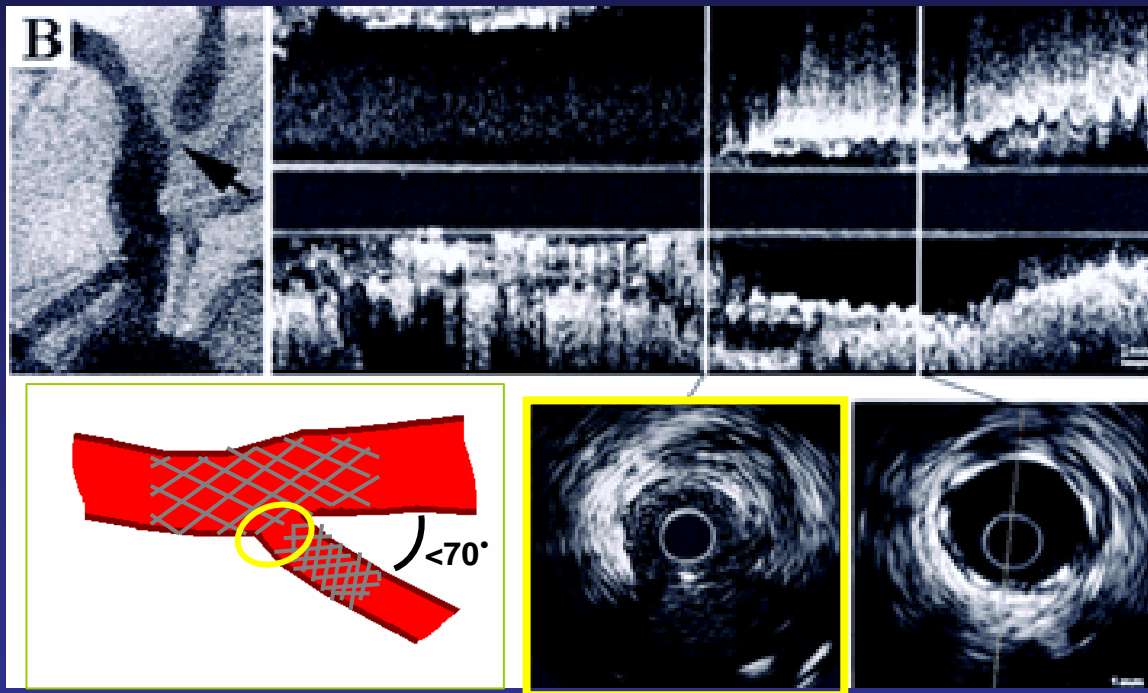


- Under exactly what circumstances should I perform a 2-stent strategy?
- For provisional stenting, when do I need a second stent?
- If I do a 2-stent procedure, what is the best method?
- Is kissing balloon post-dilatation ALWAYS necessary

Choosing the stenting strategy

- Assess the lesion carefully
 - Angulation between the branches
 - Vessel size
 - Plaque distribution
 - etc etc etc.....

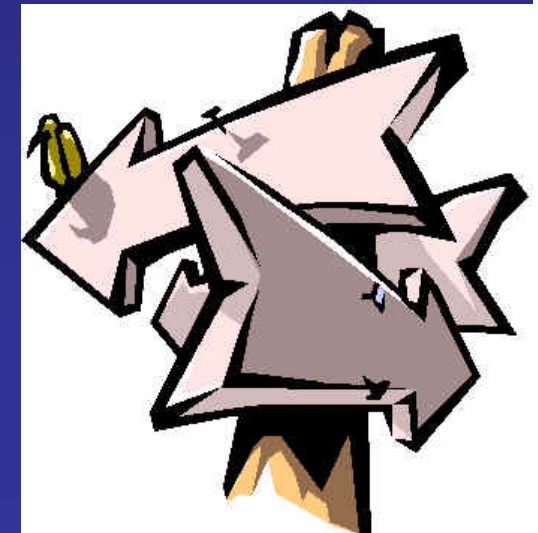
Restenosis after SES implantation



Ostial restenosis was associated with incomplete coverage by SES following a T-stenting strategy

This lead to a move towards stenting techniques which ensure complete coverage of the side branch ostium

Lemos et al Circulation 2003;108: 257-60



NORDIC Bifurcation study

- Multicenter study of the SES in bifurcations
- Randomised to a provisional versus a 2-stent strategy

6-months clinical FU	Single stent n=207	MB + SB stent n=206	p value
Death (%)	1	1	1.0
MI (%)	0	0.5	0.3
TLR (%)	2	1	0.4
TVR (%)	2	2	1.0
MACE (%)	3	3	ns
Stent thrombosis (%)	0.5	0	0.3

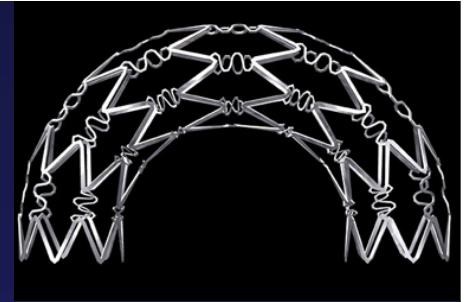
2-stent strategy: which method?

	No. pts	MACE (%)	MV binary restenosis (%)	SB binary restenosis (%)
Crush	231	16% at 9 months	9	25
Mini crush	45	16% at 8 months	12	2
SKS	100	10% at 6 months	-	-
Culotte	23	15% at 8 months	19	13

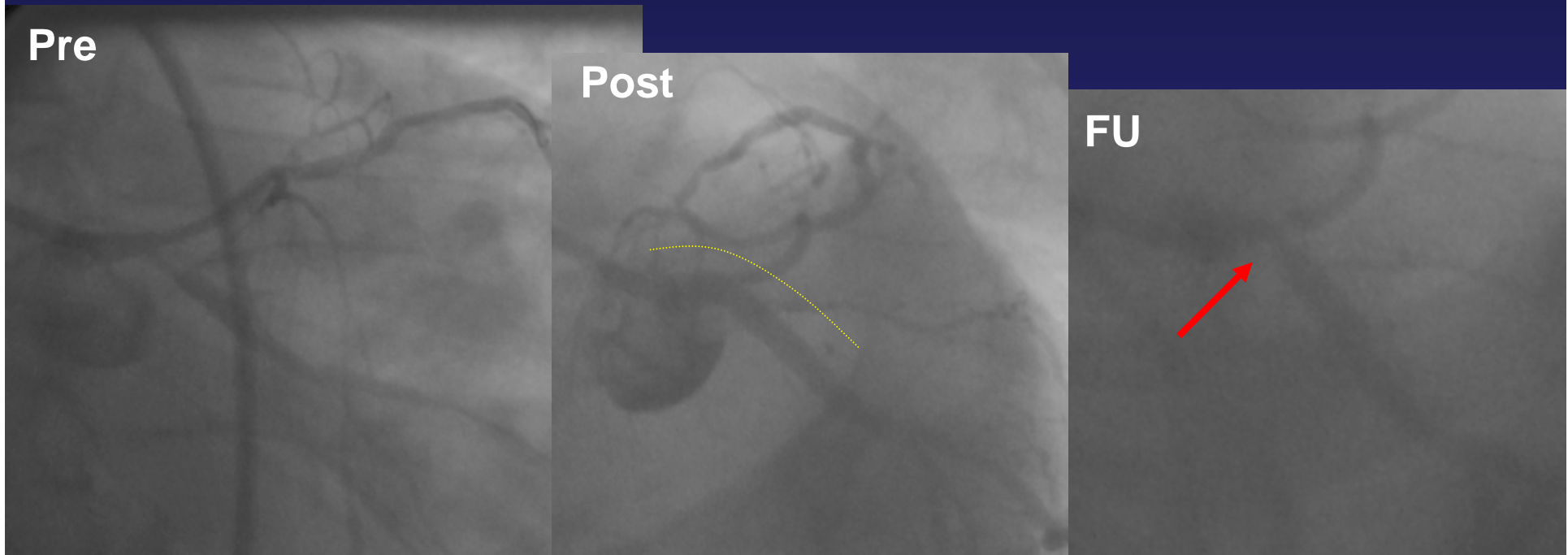
Hoye et al JACC 2006;47, Galassi et al CCI 2007 epub, Sharma et al AJC 2004;94,
Hoye et al Int J Cardiovasc Interv 2005;7



**Our current stents
are not designed for
bifurcations**



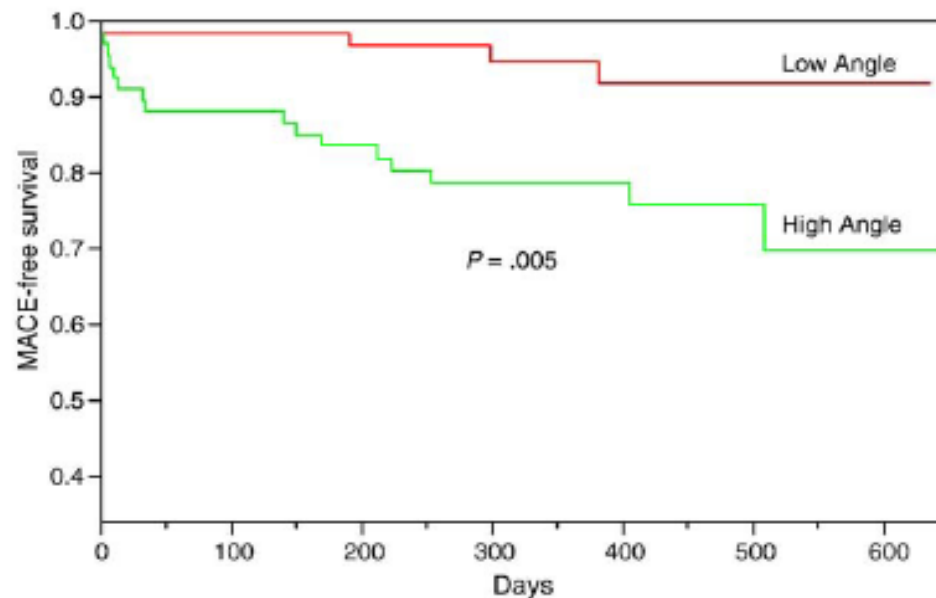
Remember the angulation - stents don't like bends!



- In a cohort of 280 patients treated with SES, the incidence of stent fracture was 2.6%, all occurring at the site of a “hinge point” during the cardiac cycle
- 50% of these patients required TLR

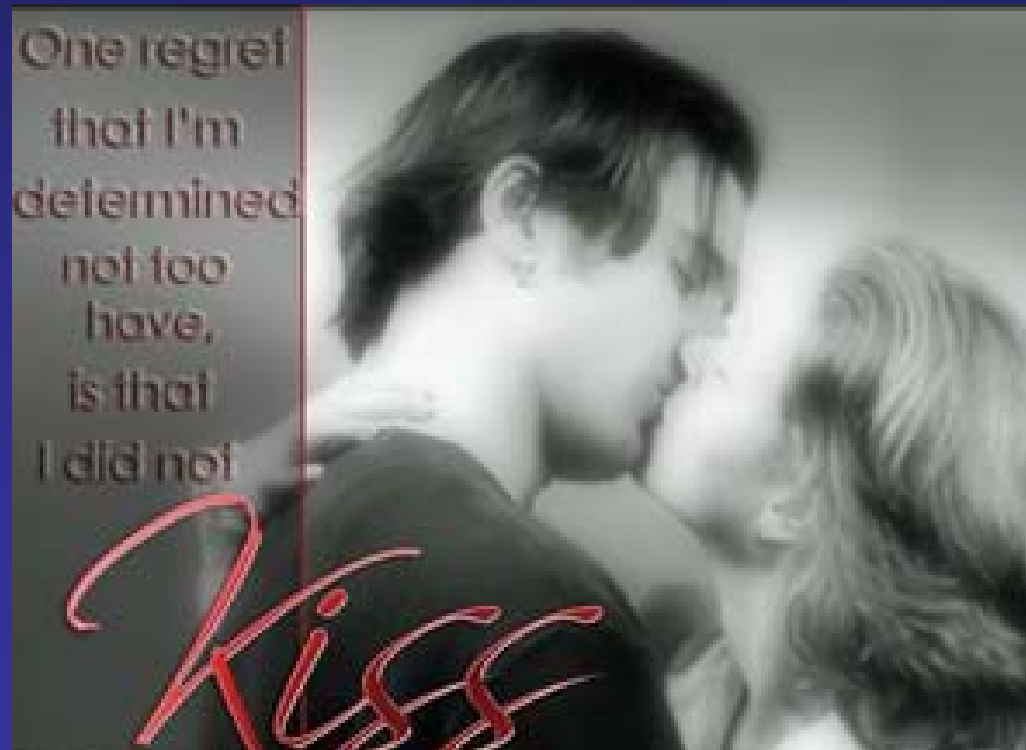
Crush stenting and angulation

Influence of bifurcation angle on outcome following use of the crush technique



Kaplan-Meier plot comparing MACE-free survival up to 648 days between the low-angle group (BA <50°) and high-angle group (BA ≥50°).

Do I always need to perform kissing balloon post-dilatation?



Crush stenting: angiographic FU

Main vessel		Kissing balloon dilatation	No kissing balloon dilatation	p value
FU angiography, n (%)		94 (77%)	92 (77%)	1.0
Reference diameter (mm)		2.78 ± 0.61	2.64 ± 0.57	0.1
Pre	MLD (mm)	0.97 ± 0.53	0.89 ± 0.52	0.3
	DS (%)	66 ± 17	66 ± 18	0.7
	Lesion length (mm)	14.84 ± 10.40	15.97 ± 10.55	0.5
Post	MLD (mm)	2.89 ± 0.54	2.55 ± 0.53	<0.001
	DS (%)	12 ± 9	14 ± 9	0.2
FU	MLD (mm)	2.64 ± 0.81	2.21 ± 0.75	<0.001
	DS (%)	20 ± 20	26 ± 19	0.04
Late loss (mm)		0.26 ± 0.65	0.35 ± 0.64	0.3
Binary restenosis rate (%)		6 (6%)	11 (12%)	0.2

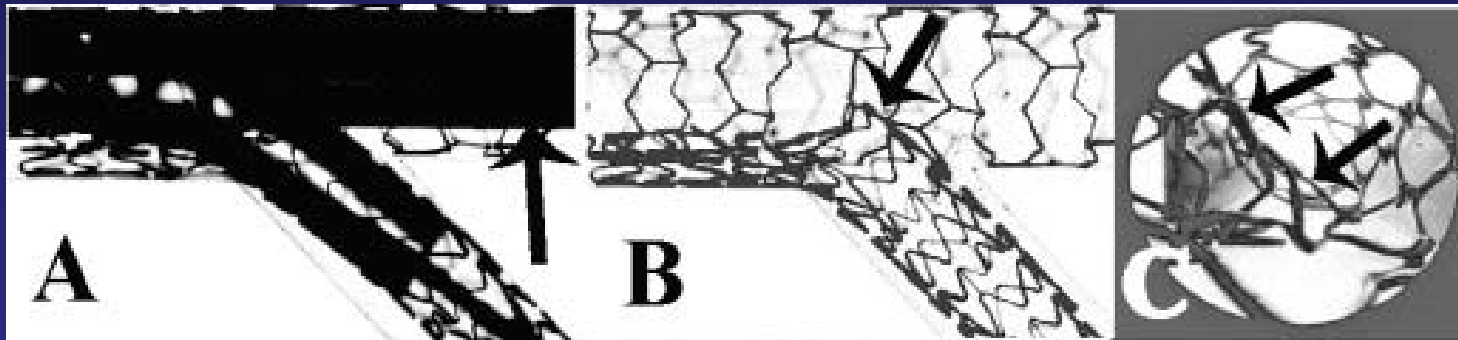
Crush stenting: angiographic FU

Side branch	Kissing balloon dilatation	No kissing balloon dilatation	p value
Follow-up angiography n (%)	94 (77%)	92 (77%)	1.0
Reference diameter (mm)	2.45±0.53	2.32±0.49	0.1
Pre MLD (mm)	0.90±0.53	0.88±0.52	0.8
DS (%)	63±21	62±20	0.8
Lesion length (mm)	9.01±6.06	8.97±6.03	1.0
Post MLD (mm)	2.43±0.53	2.10±0.44	<0.00001
DS (%)	13±9	18±10	<0.0001
FU MLD (mm)	2.18±0.71	1.52±0.86	<0.00001
DS (%)	21±18	41±32	<0.00001
Late loss (mm)	0.24±0.50	0.58±0.77	<0.001
Binary restenosis rate (%)	9 (10%)	38 (41%)	<0.00001

Hoye et al JACC 2006; 47: 1949-1958

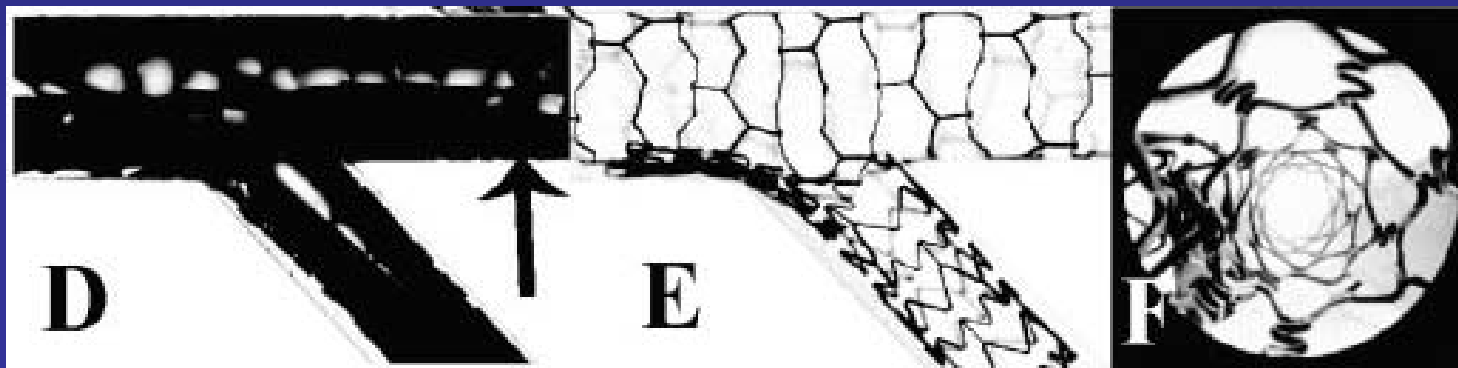
Crush stenting: importance of “good” kissing

Balloon in the MV is smaller than the stent diameter

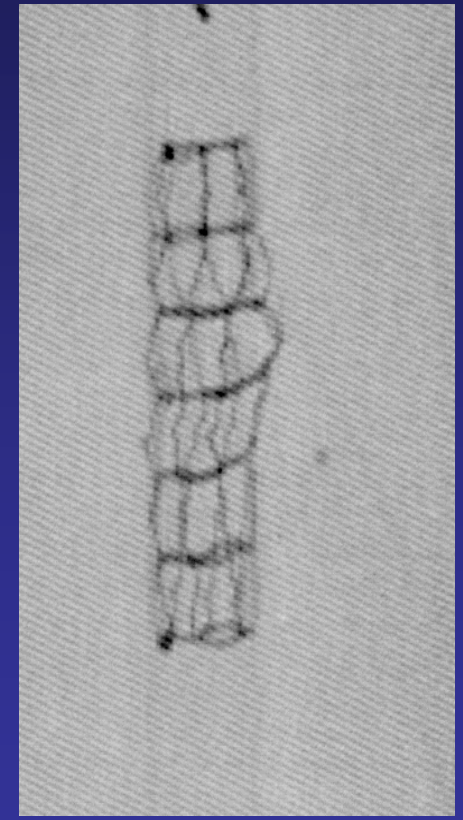
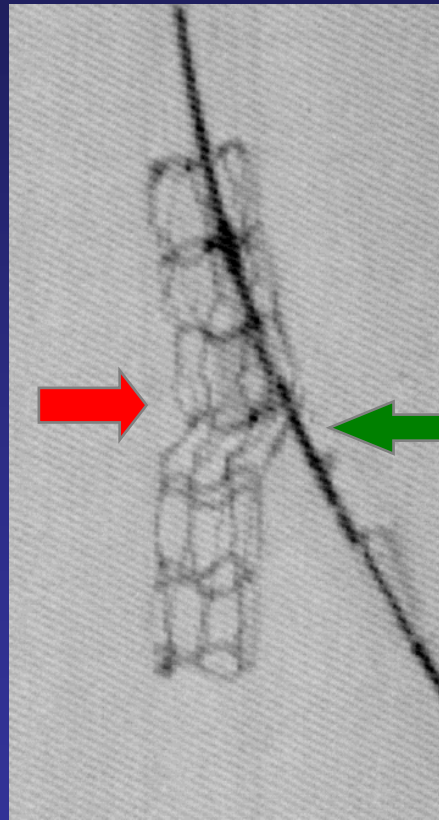
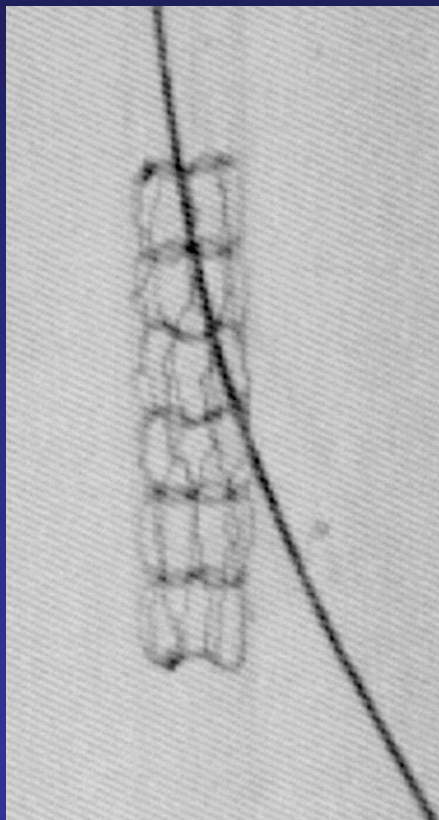


Use a balloon of appropriate size, inflated at high pressure

Kissing balloon inflation with an appropriately sized MV balloon



Do I always need to perform kissing balloon post-dilatation?

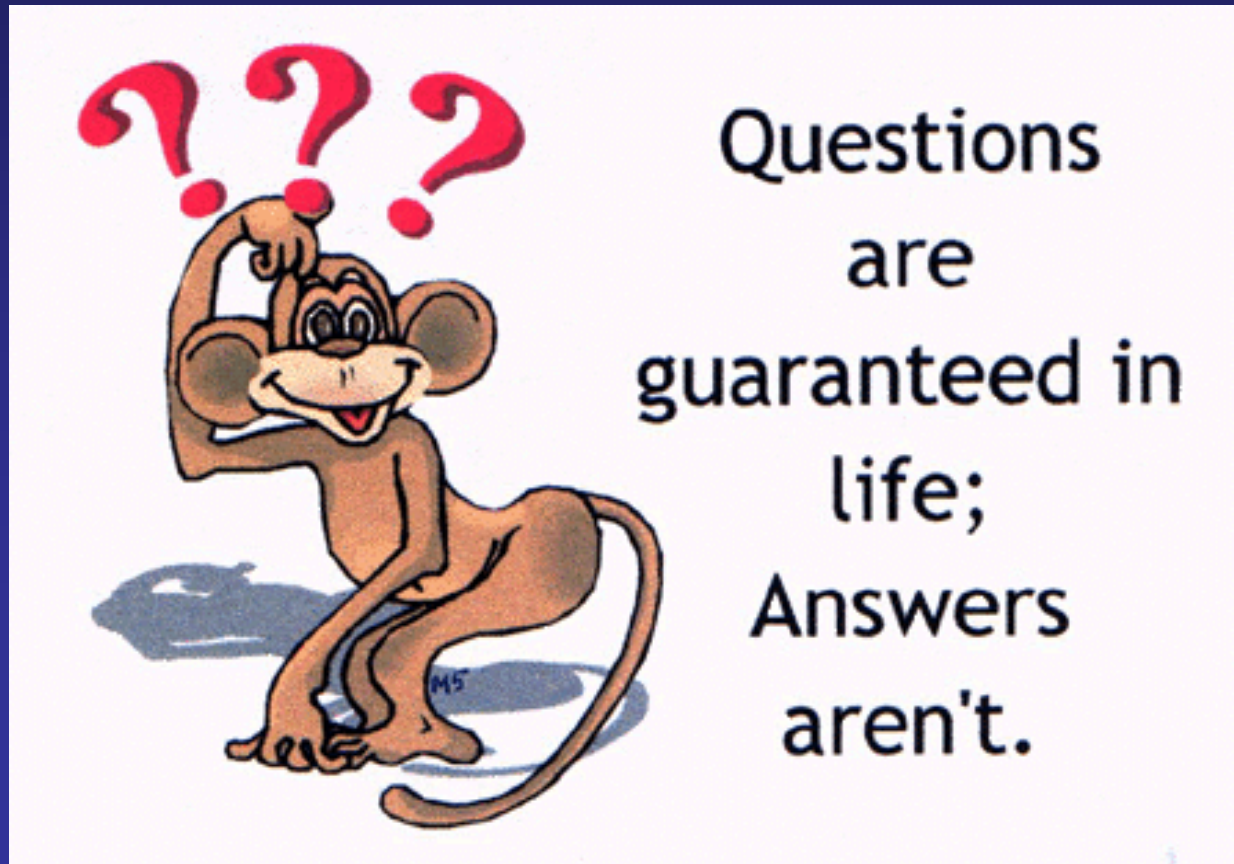


Do I always need to perform kissing balloon post-dilatation?

- Randomised study of SES in bifurcations comparing a 1-stent strategy (n=47) versus a 2-stent strategy (n=44)
- Kissing balloon post-dilatation was performed in 60% single stent group, and 77% 2-stent group

	Kissing inflation	No kissing inflation	p value
FU % diameter stenosis of MV	21 ± 11	26 ± 27	NS
FU % diameter stenosis of SB	32 ± 25	23 ± 10	NS
Maximum lumen diameter by IVUS	6.9 ± 2	6.8 ± 2	NS
Minimum lumen diameter by IVUS	4.7 ± 0.9	4.5 ± 1.6	NS

What is the contemporary therapy of bifurcation lesions?



Summary of my preferred strategy

- Optimal patient preparation eg clopidogrel pre-loading
- Prepare well!
- 2 wires
- Single (drug-eluting) stent with provisional stenting of the side branch for the majority

UNLESS

- side branch is $>2.5\text{mm}$ AND significantly diseased, especially if long segment of disease

Summary of my preferred strategy

- Personal preference for T-stent if high angulation, Culotte if angle $<70^\circ$
- If use a 2-stent strategy
 - Post-dilatation with SEQUENTIAL HIGH PRESSURE inflation (MV then SB)
 - Simultaneous kissing balloon post-dilatation
- GP IIb/IIIa inhibitors if 2-stent strategy used

Conclusions:

- **Contemporary therapy of bifurcation lesions utilises DES(s)**
- **There is no single strategy for all bifurcations. Must take into account:**
 - plaque distribution
 - angulation
- **Particularly when the side branch is of large calibre and is significantly diseased, a 2-stent strategy is reasonable, but remember the angulation - stents don't like bends!**