

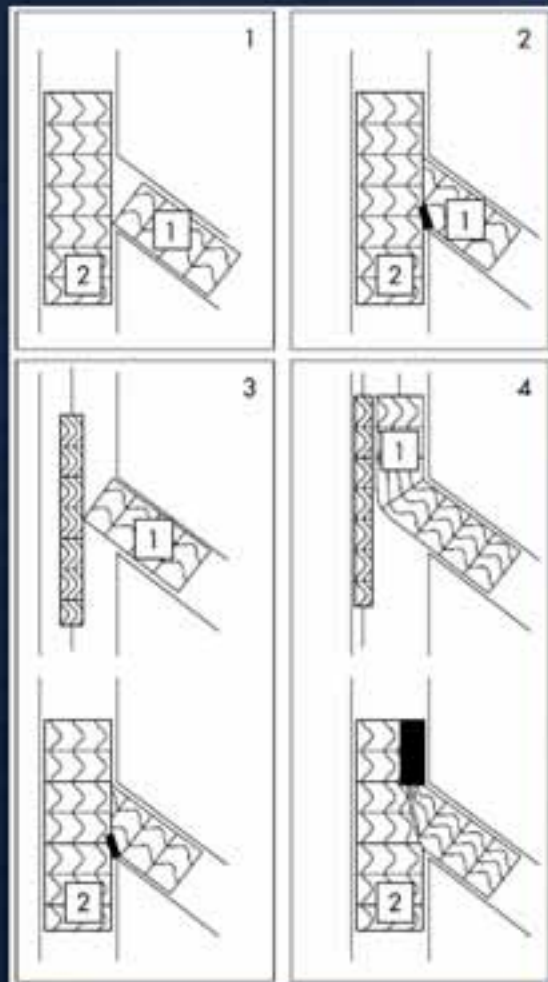
# **Bifurcation Stenting: The Return of T-Stenting**

**Hyeon-Cheol Gwon**

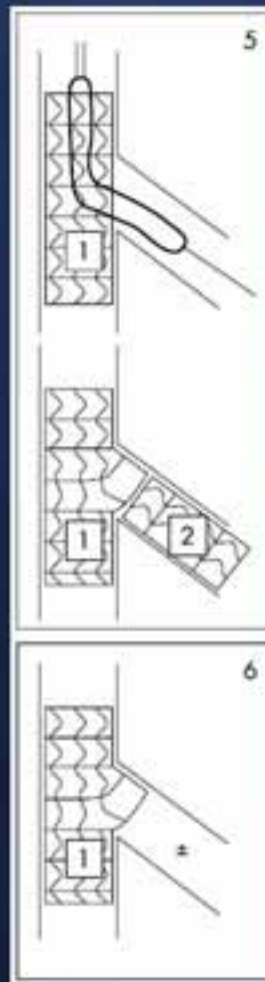
Cardiac and Vascular Center, Samsung Medical Center  
Sungkyunkwan University School of Medicine

# Bifurcation Stent Techniques

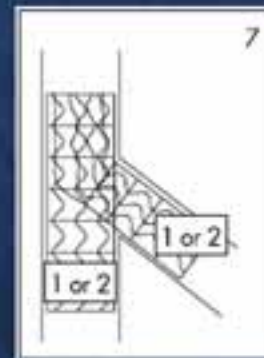
Type A



Type B



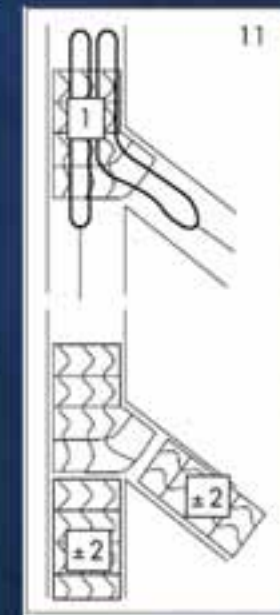
Type C



Type D



Skirt

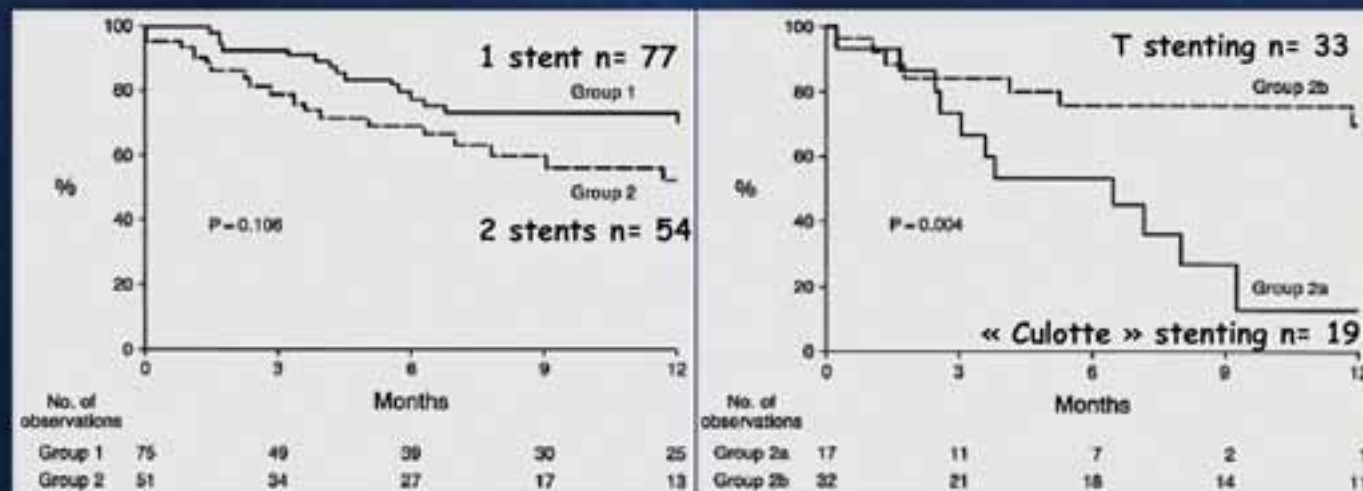


Louvard  
Heart 2004

# Lessons learned from BMS studies

- One stent is equivalent or better than two stent
  - Equivalent restenosis rate
  - Lower acute complication rate
- T-stenting is better than V- or Y-stenting

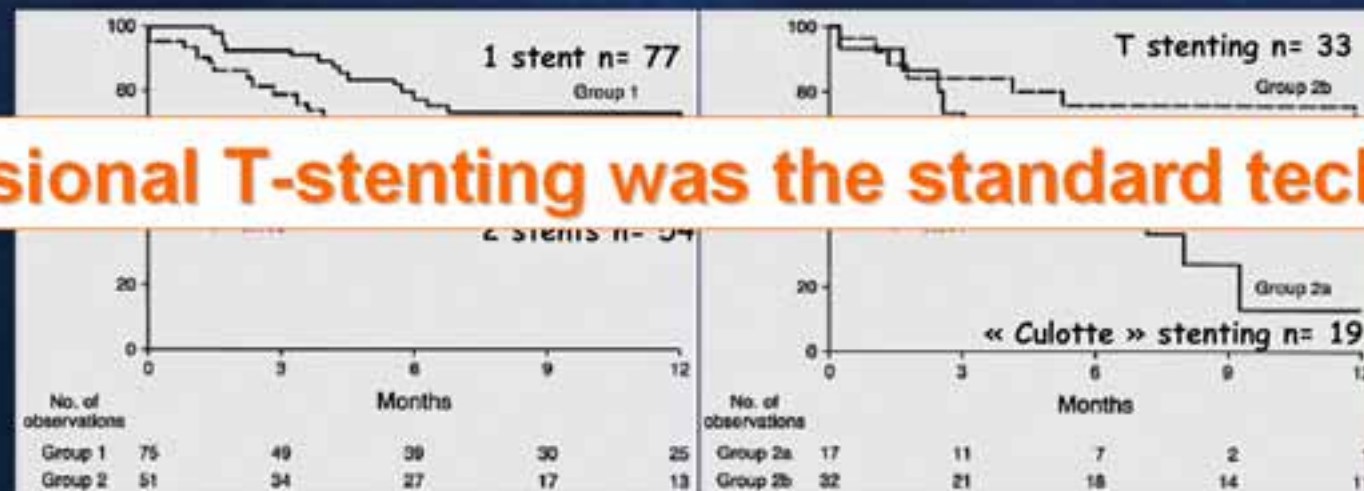
## 1Y MACE and angina (Al Suwaidi JACC 2000)



# Lessons learned from BMS studies

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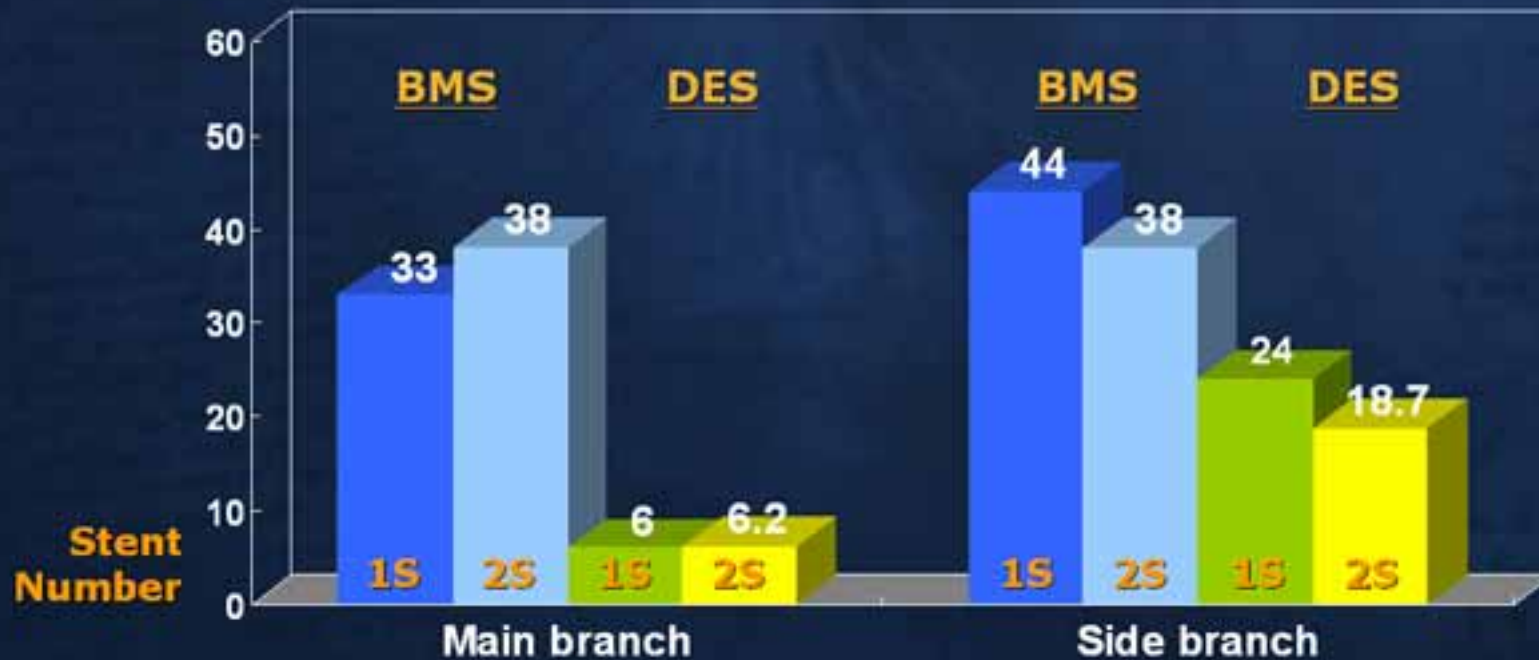
## 1Y MACE and angina (Al Suwaidi JACC 2000)



**Provisional T-stenting was the standard technique**

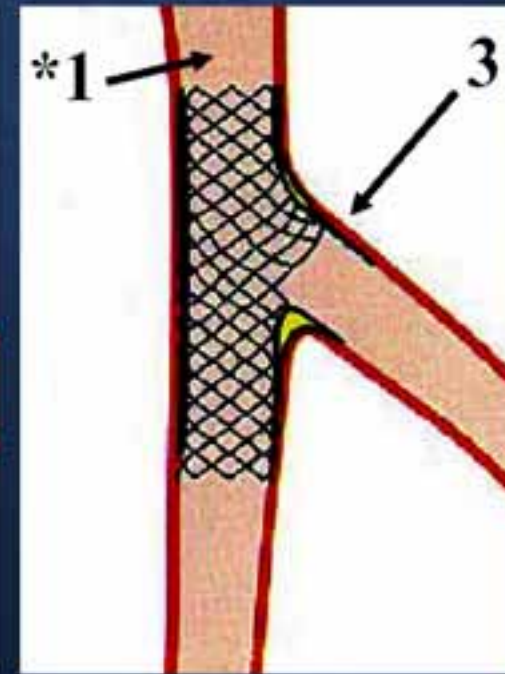
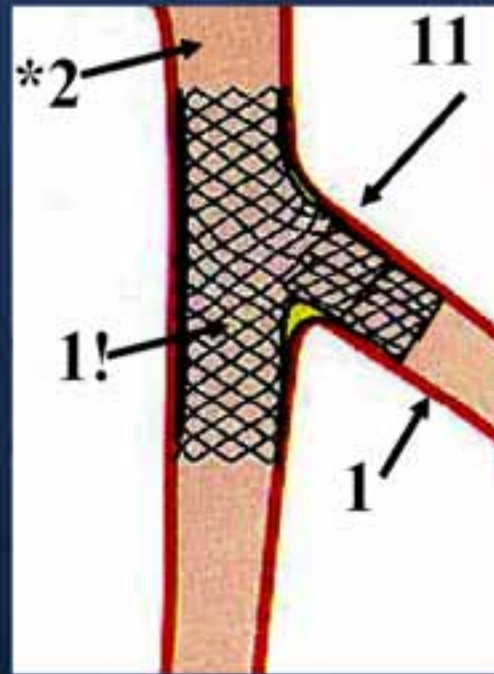
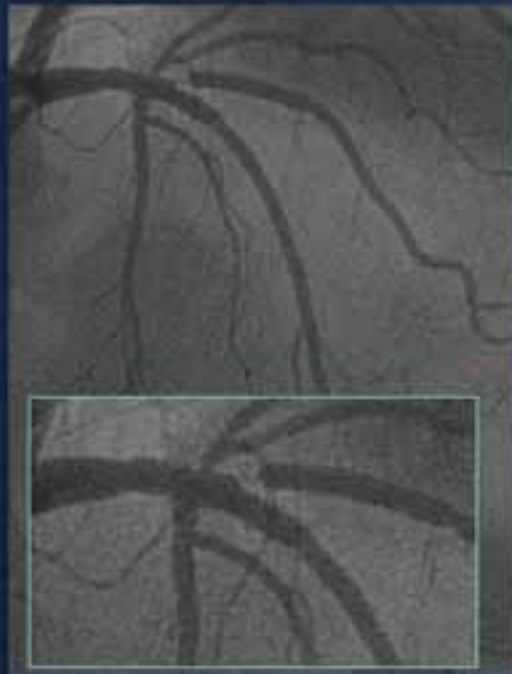
# DES in Bifurcation Lesion

- DES vs. BMS
  - BMS: 7 months restenosis (Yamashita JACC 2000)
  - DES: 6 months restenosis (SIRIUS Bifurcation)
    - Mostly T-stenting



# Limitation of T-stenting

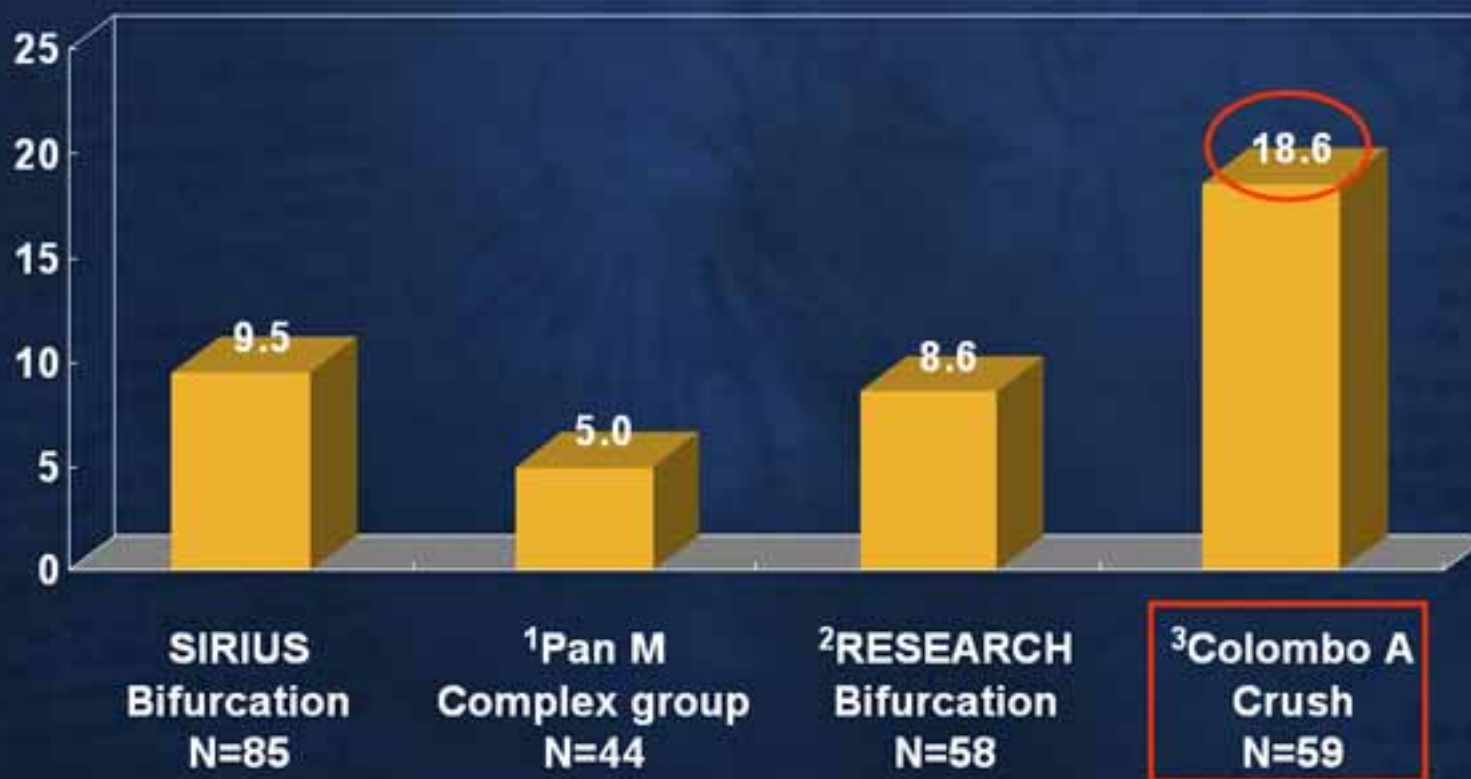
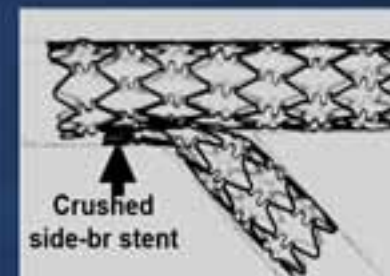
Restenosis site in SIRIUS Bifurcation Study



→ **Crush Technique (Dr. Colombo)**

# Crush Technique

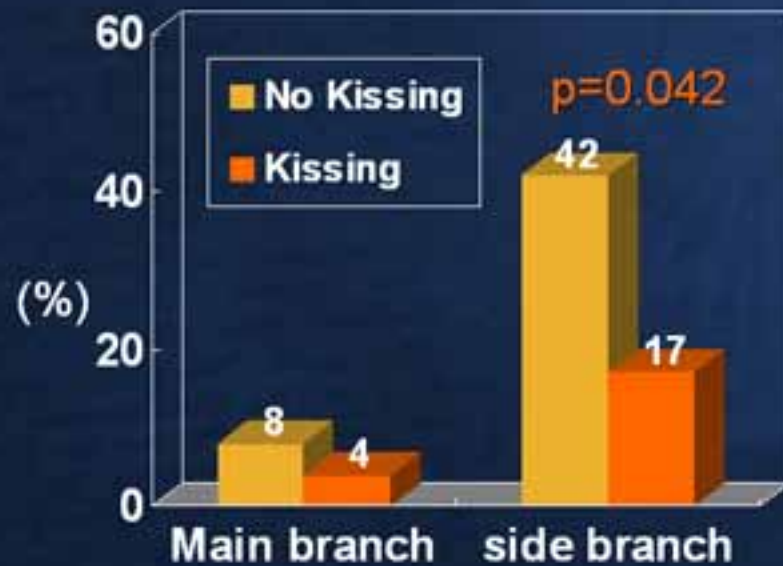
- 6-month Target lesion revascularization (%)



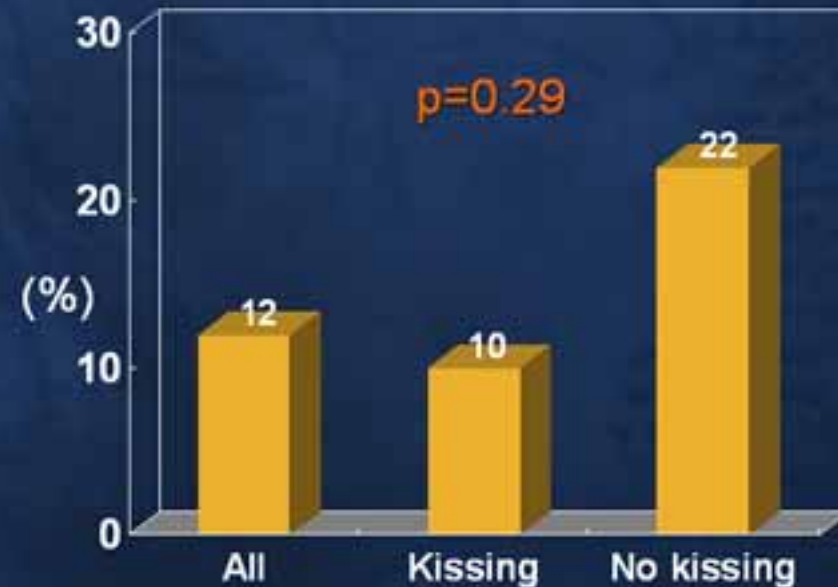
1. Pan M. AHJ 2004
2. Tanabe AJC 2004 (T-stenting 60%, Crush 26%...)
3. Colombo A, TCT 2004 (First 59 patients)

# Kissing Ballooning is Crucial in Crush Technique

**6-mo restenosis rate**  
(Colombo A, Ital Heart J 2005)



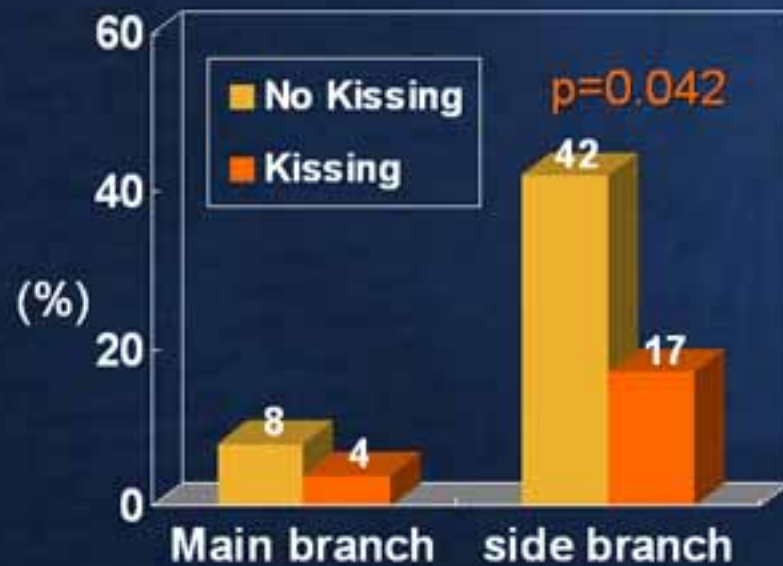
**6-mo TLR**  
(Lenox Hill, TCT 2004)



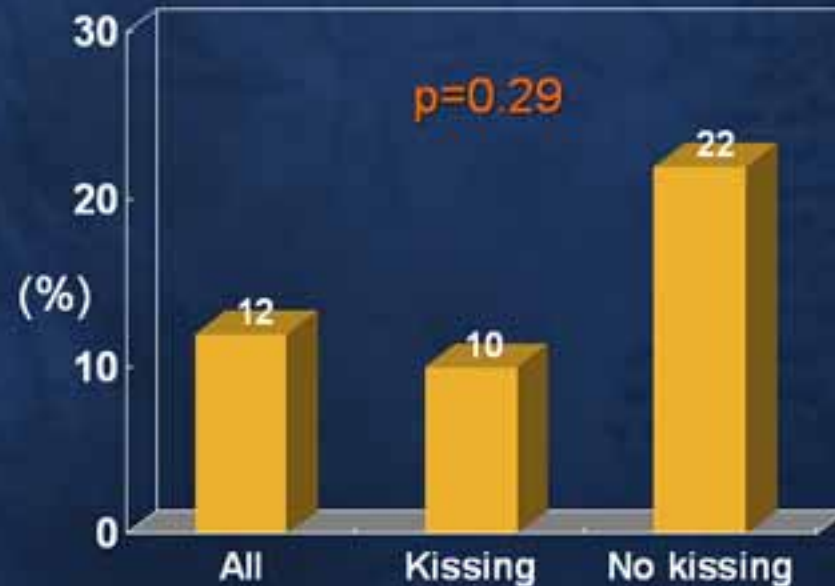


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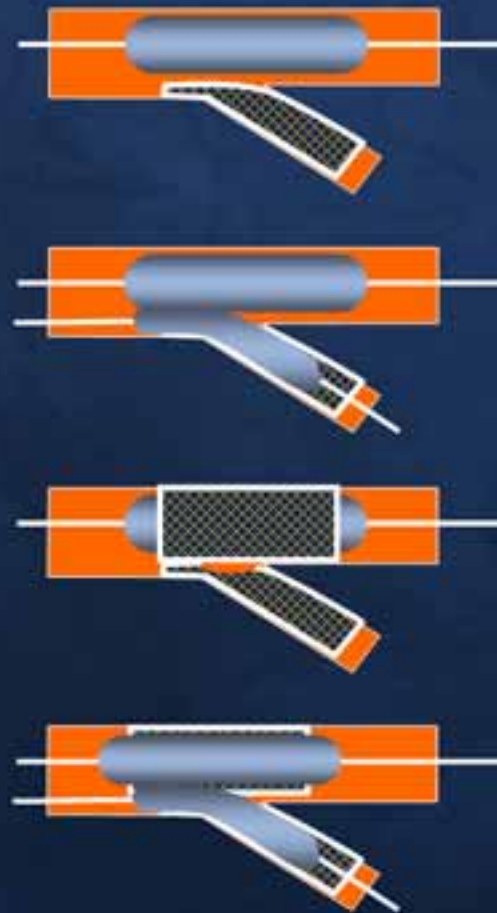
**6-mo TLR**  
(Lenox Hill, TCT 2004)



# Modified crush technique with double kissing balloon inflation Sleeve technique / DK Crush

- To improve the success rate of final kissing ballooning  
*(Jim MH CCI 2006)*

**Getting complex!**



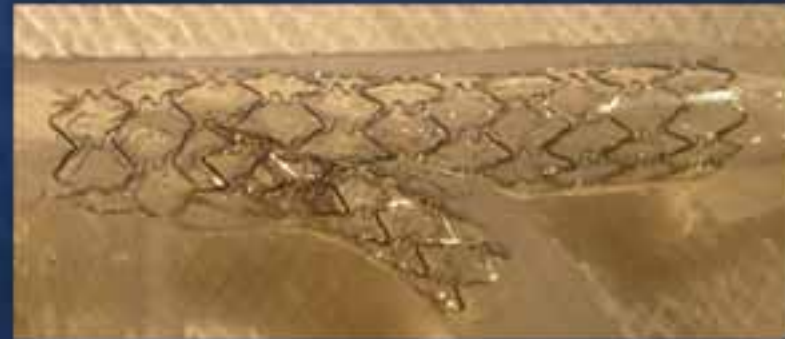
# The Secret of Crush Technique

## It may not be crushed!

- Colombo A (*JACC* 2005.8)
  - IVUS analysis in 40 bifurcation lesion treated with crush technique
  - MV was the minimum stent area was found in the crush area in **56%**.
  - "Incomplete crushing"--incomplete apposition of SB or MV stent struts against the MV wall proximal to the carina--was seen in **>60%** of non-left main lesions.

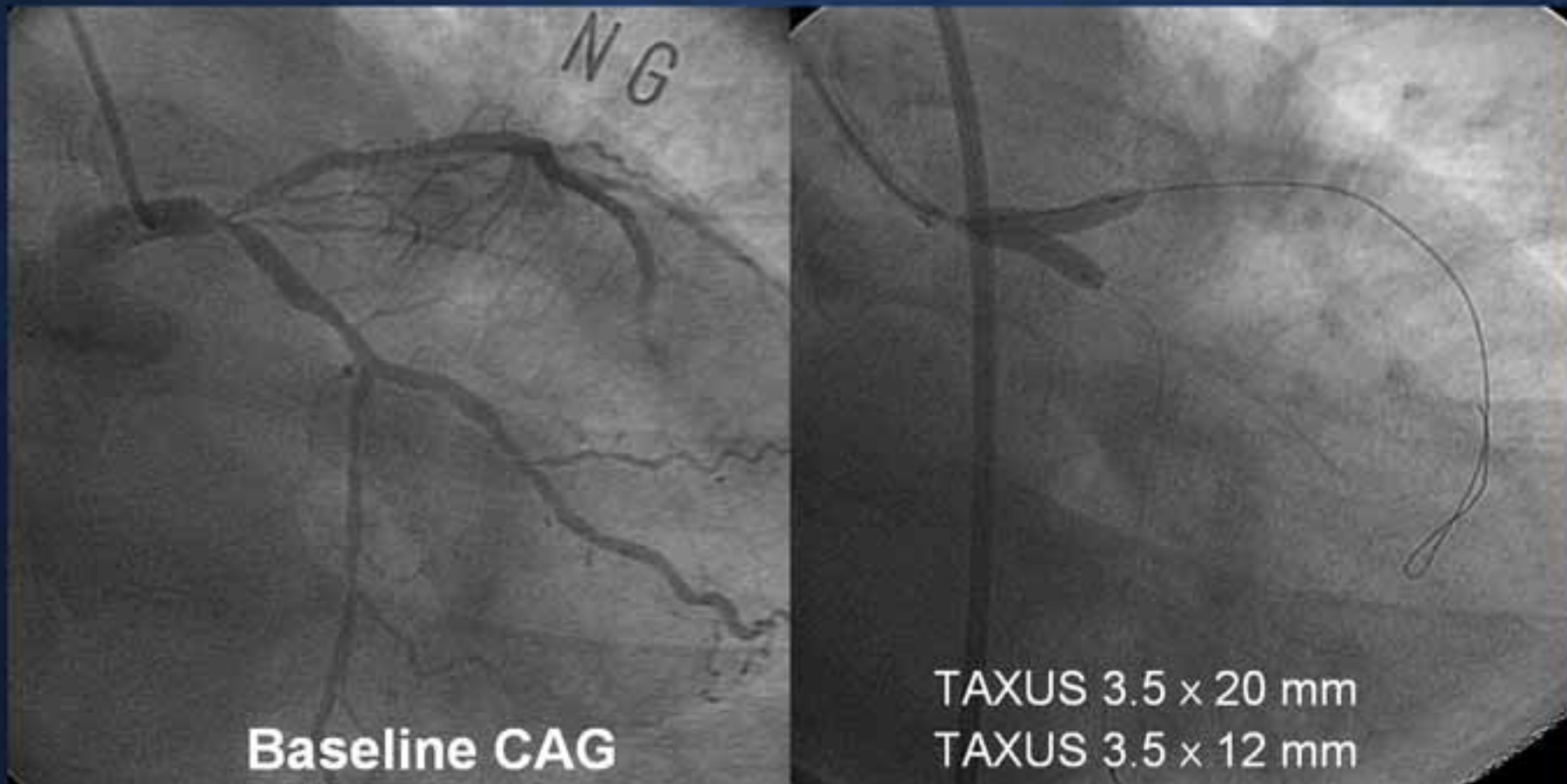
# The Secret of Crush Technique

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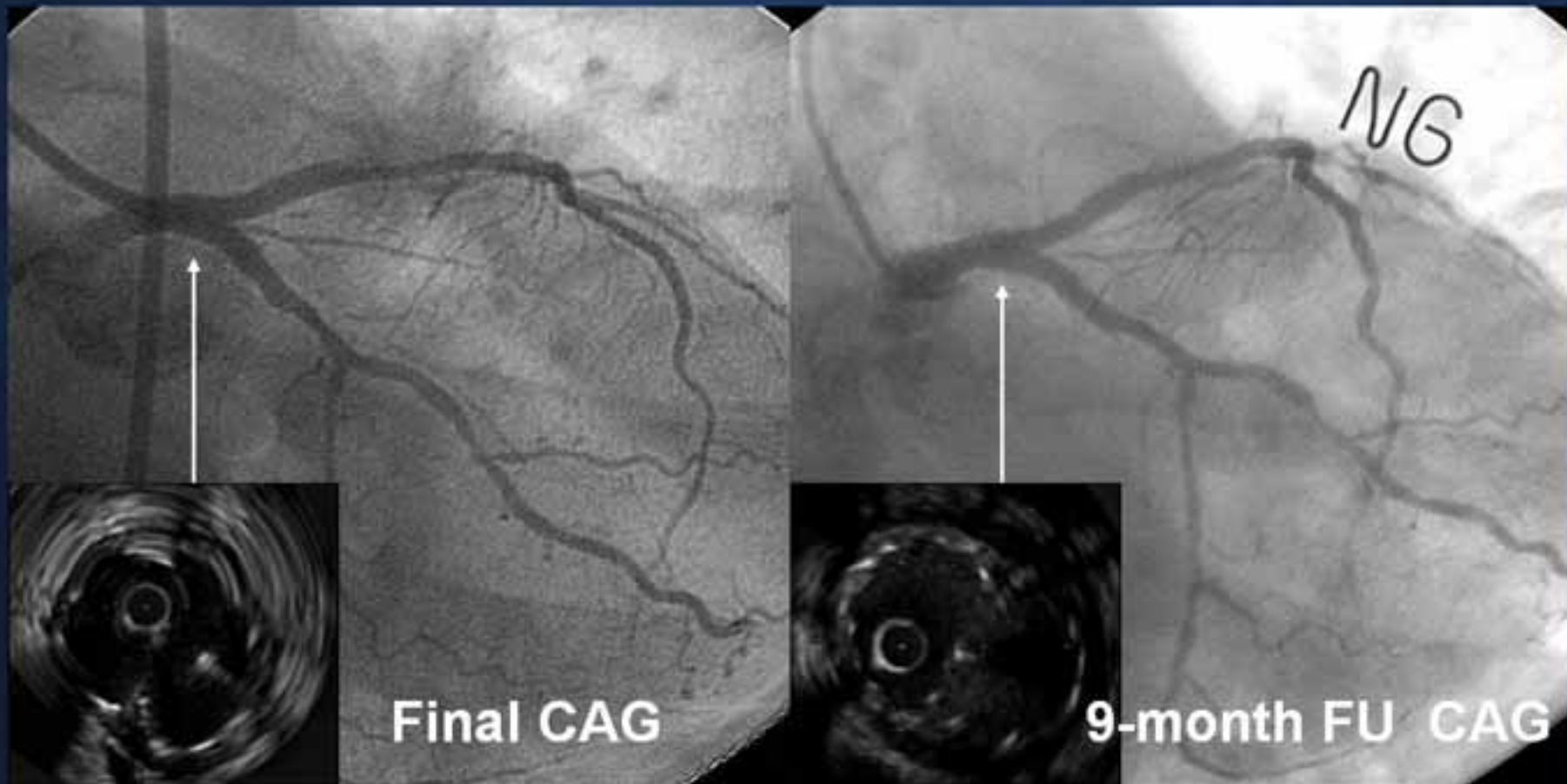
# Kissing Stent Technique

- M/64, Unstable angina



# Kissing Stent Technique

- M/64, Unstable angina



# TABLE Registry

## TAxus Kissing Stenting in the Bifurcation LEsion

- Purpose of the study

To evaluate the safety and effectiveness of kissing stent technique using TAXUS stent in the bifurcation lesions

- Design: Multicenter prospective registry

Samsung Medical Center	Gwon HC	34 cases
Shincheon Severance Hospital	Jang YS	9 cases
Inchon Ghil Hospital	Ahn TH	4 cases
Asan Medical Center	Hong MK	3 cases

# Results

- Subjects
  - N=50 (M=42, Age=61±10 years)
  - Left main 19, LAD 24
  - Type I 43
- Angiographic success rate: 100 %
- 9-month late loss
  - Main branch 0.69 mm
  - Side branch 0.67 mm
- 9-month ISR: 43%



# Cardiovascular Events

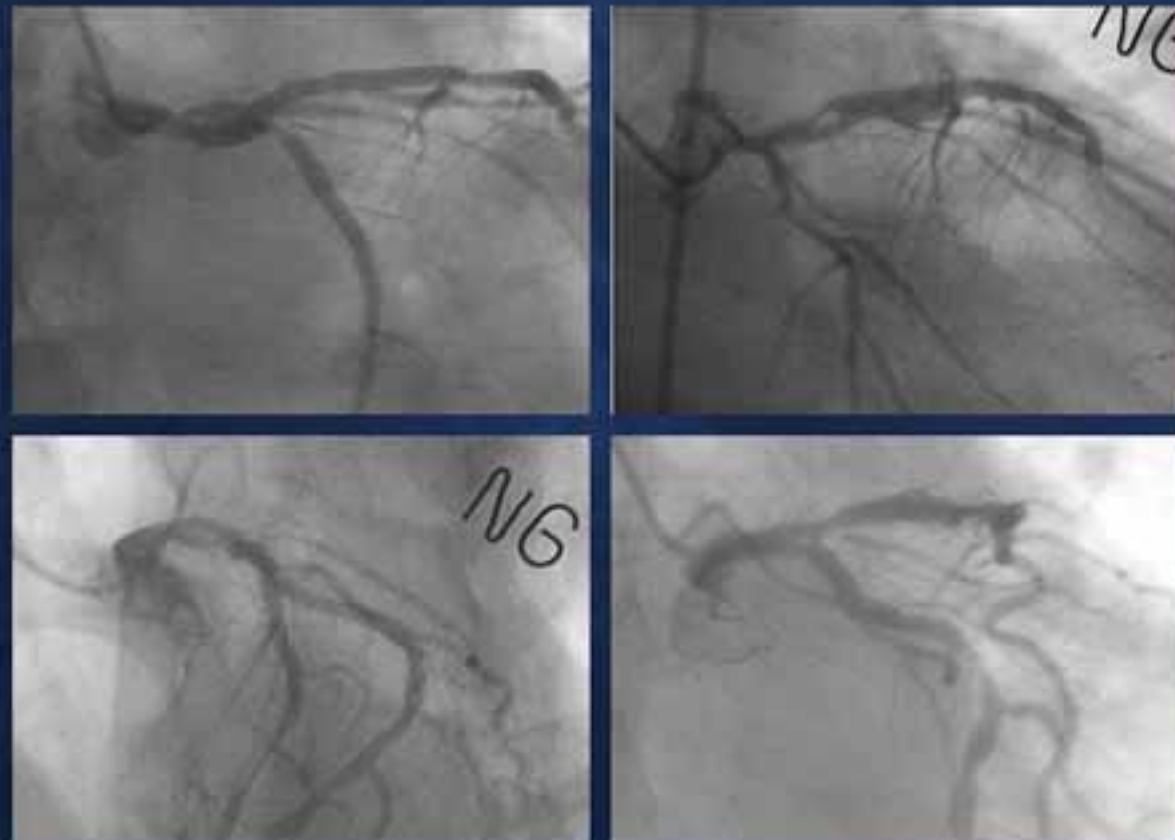
## 9-month Cardiac Events (N=50)

- MACE 7 (14%)
- Death 1 ( 2%)
- TLR 6 (12%)
  - Stent thrombosis 2
  - Restenosis 4
- Stent Thromb. 3 ( 6%)
  - Death 1
  - Angiographic 2



# Problems of Kissing Stenting

- Grotesque restenosis pattern



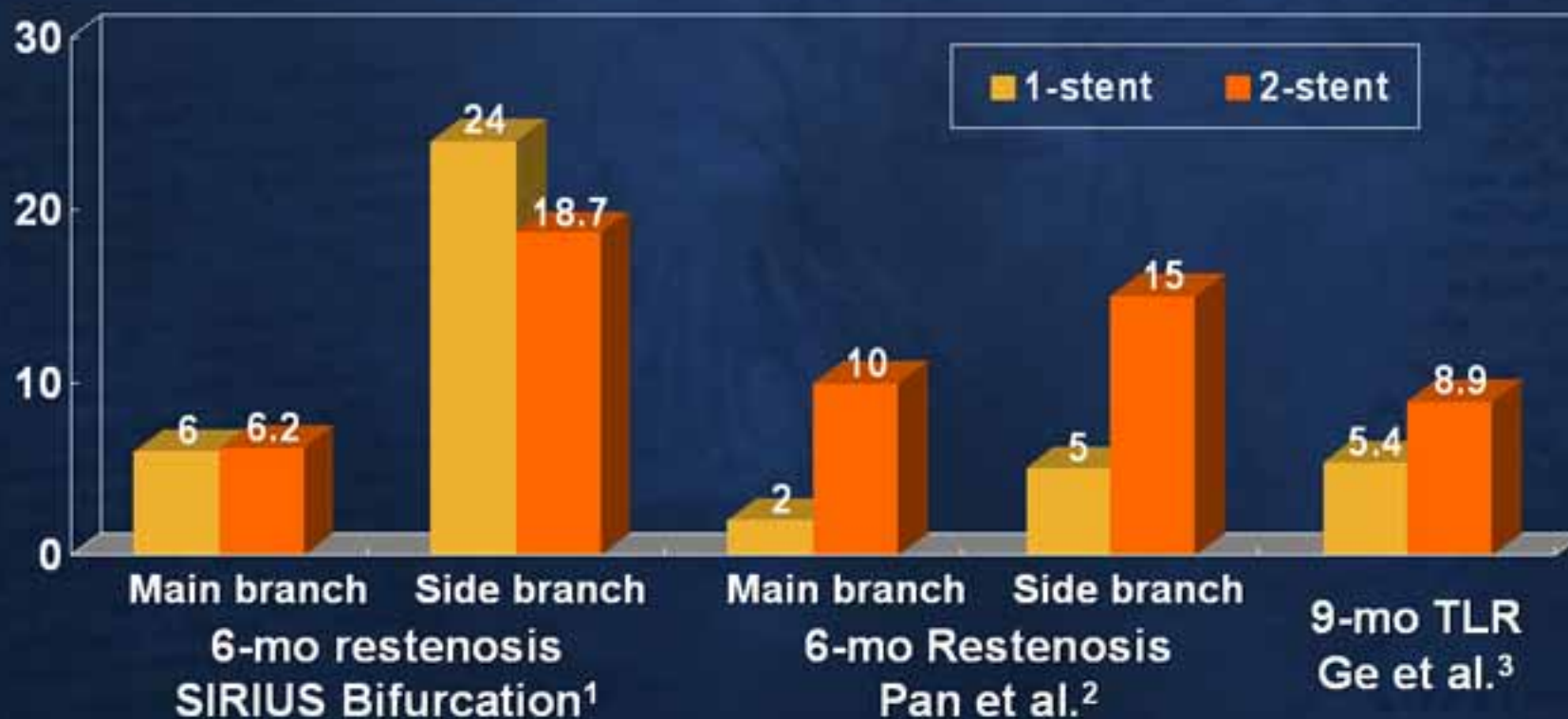
# Problems of Kissing Stenting

- Difficult to treat restenosis



# Provisional Approach Still Works

## SES in Bifurcation Lesions



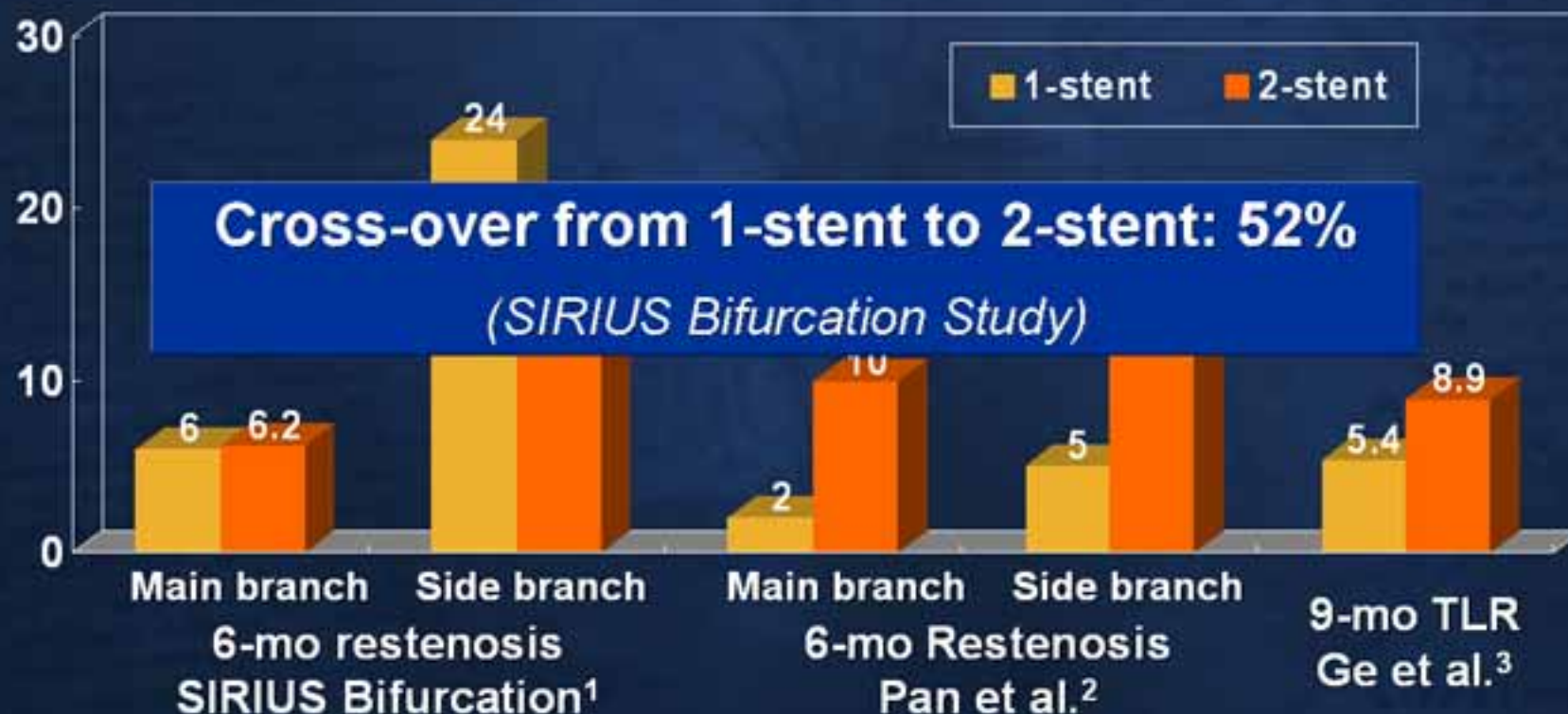
1. Colombo A, Circulation 2004

2. Pan M, AHJ 2004

3. Ge, Colombo, Heart 2005

# Provisional Approach Still Works

## SES in Bifurcation Lesions



1. Colombo A, Circulation 2004

2. Pan M, AHJ 2004

3. Ge, Colombo, Heart 2005

# Routine 2-stent will increase myocardial damage

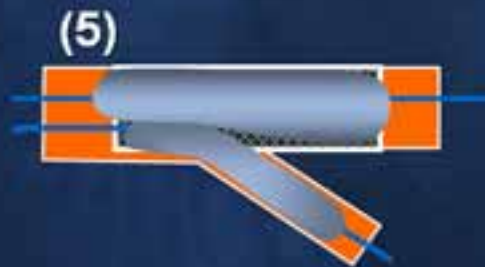
- 1-stent vs. 2-stent (*Thuesen L, ACC 2006*)

Procedural outcomes	No routine SB stent (n=107)	Routine SB stent (n=106)	P-value
CK-MB >3x ULN (%)	8	18	0.011
CK-MB >5x ULN (%)	4	13	0.008
Procedure time (min)	59	74	<0.001
Fluoroscopy time (min)	15	21	<0.001
Contrast volume (mL)	233	283	<0.001

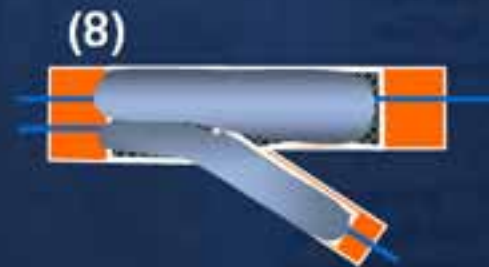
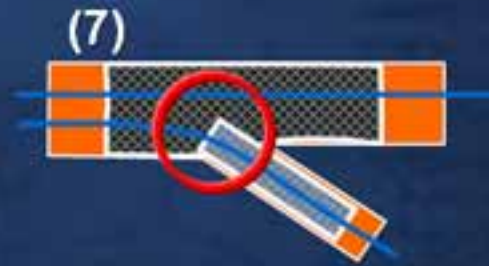
# Provisional T-stenting with DES



If RS > 50%  
Go To (4)



If RS > 50%  
Or dissection (+)  
Go To (7)



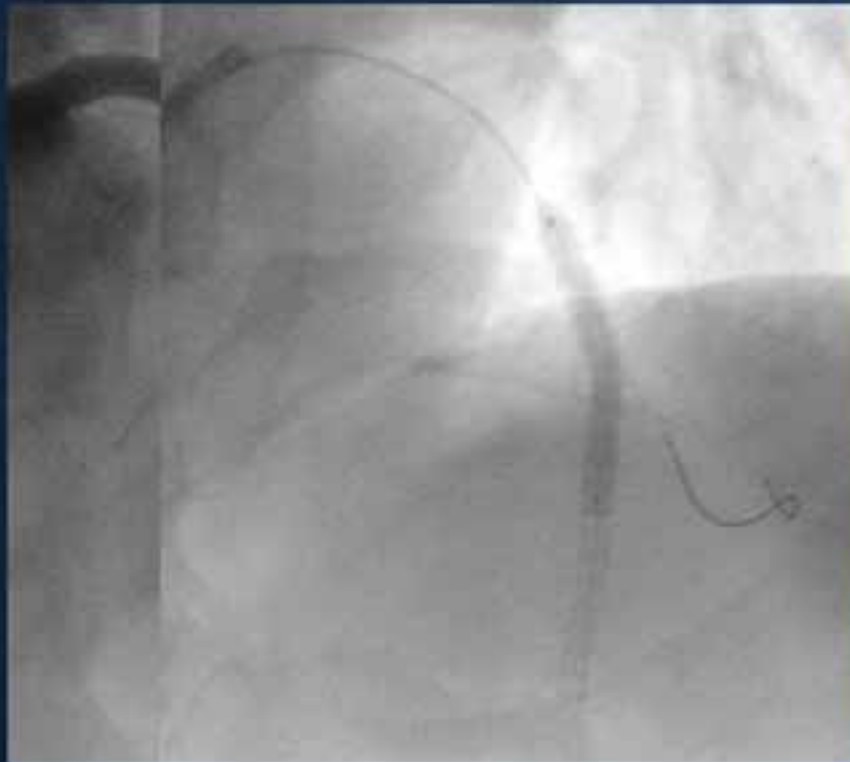
Pull-back T-stenting

# Provisional T-Stenting Case





# Provisional T-Stenting Case



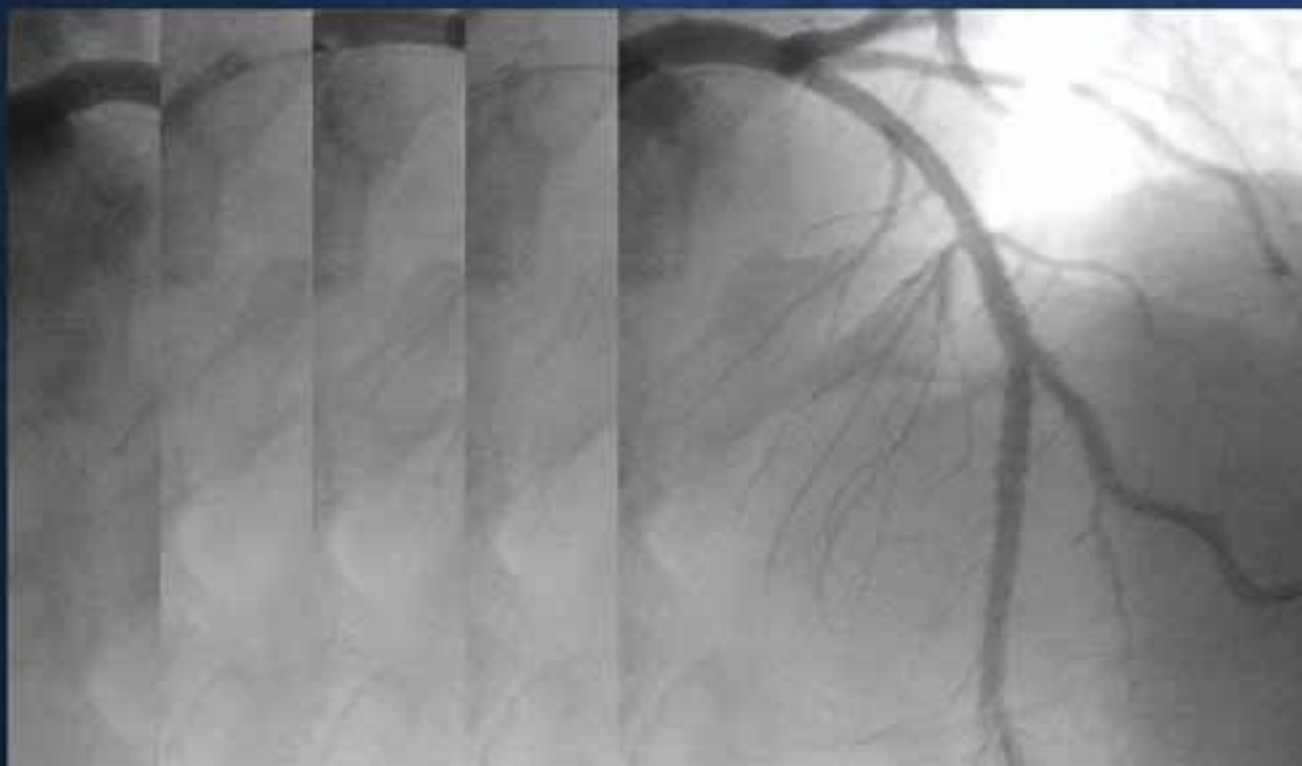
# Provisional T-Stenting Case



# Provisional T-Stenting Case



# Provisional T-Stenting Case



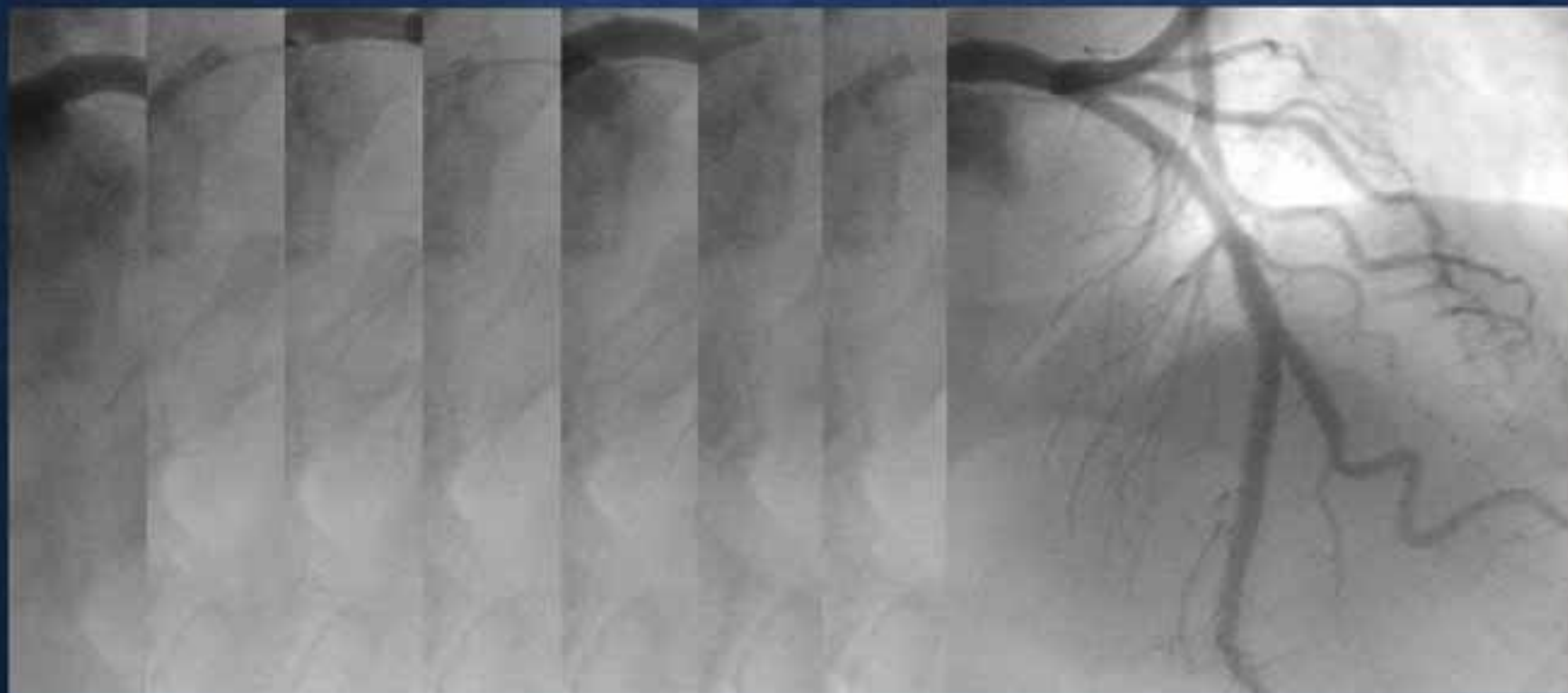
# Provisional T-Stenting Case



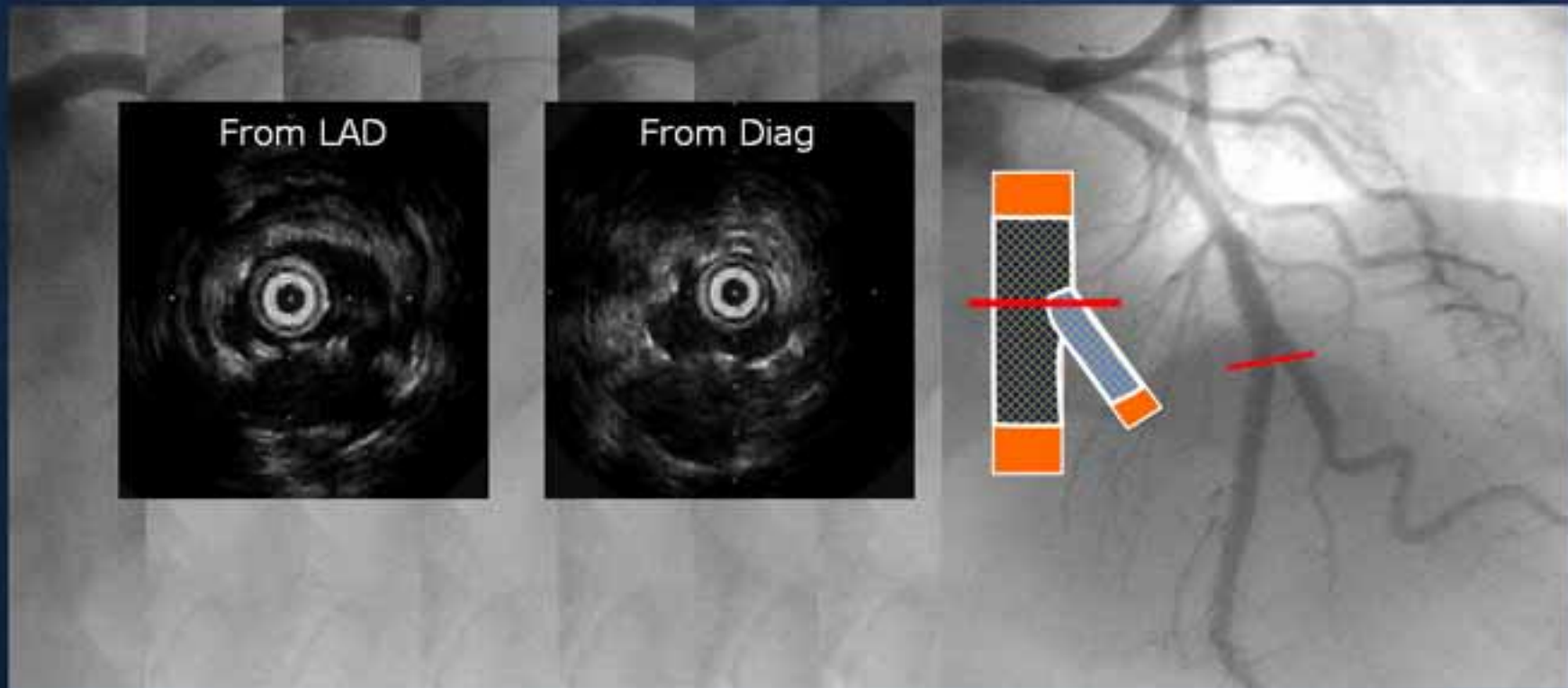
# Provisional T-Stenting Case



# Provisional T-Stenting Case



# Provisional T-Stenting Case





# Provisional T-stenting Registry with Cypher Stent

- Design: single center prospective registry
- Subjects
  - Inclusion criteria
    - Type 1, 2, 4
    - Both branches stentable (Vessel size **2.0 – 3.5 mm**)
  - Exclusion criteria
    - Cardiogenic shock
    - STEMI within 1 week
    - Thrombotic lesion
    - Instent restenosis



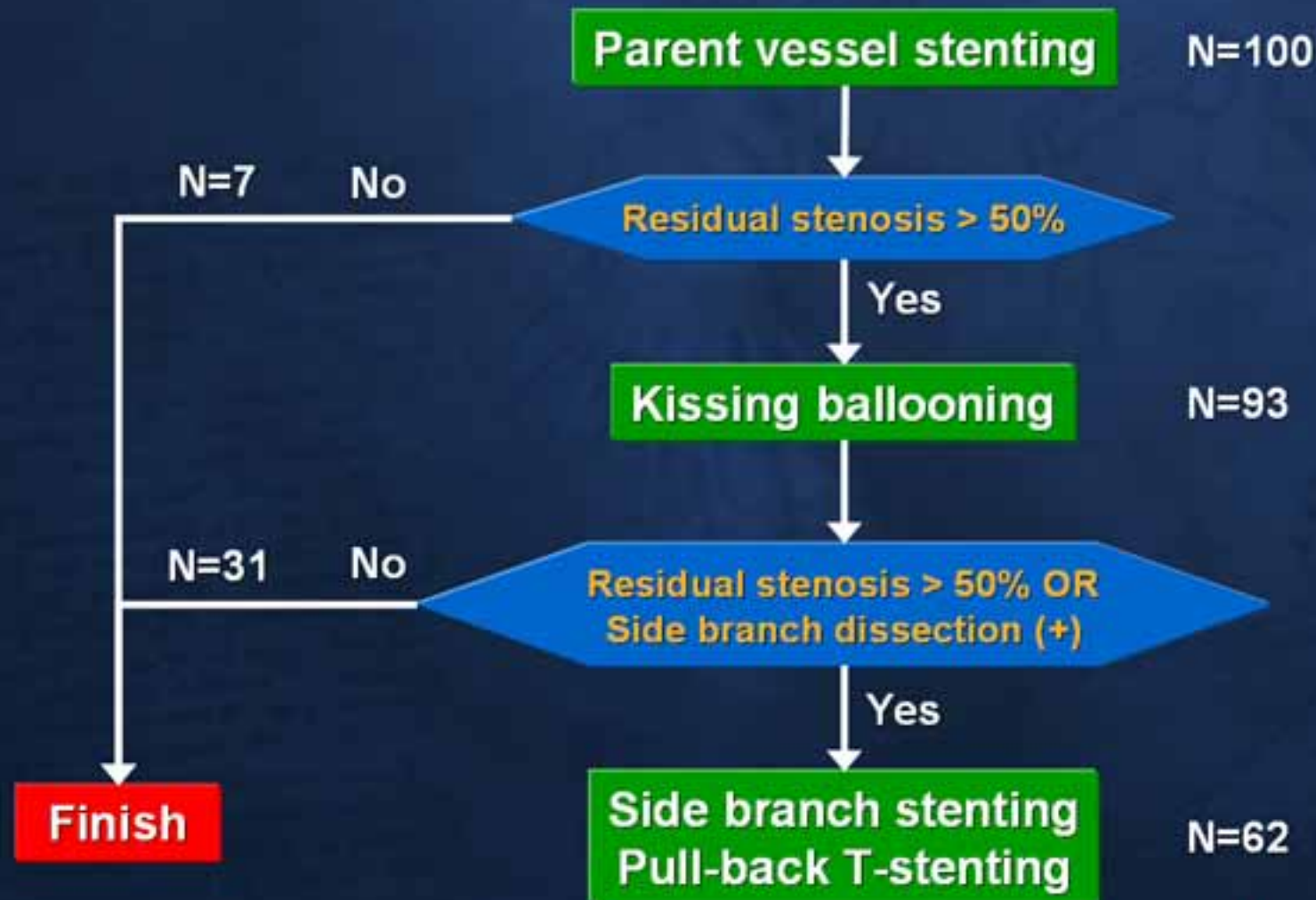
# Provisional T-stenting Registry with Cypher Stent

- 100 lesions in 94 patients
- Sex: male 71 (75%)
- Age: 62.9±10.8 years
- Clinical diagnosis
  - Stable angina 53 (56%)
  - UA/ Non-STEMI 35 (37%)
  - Silent ischemia 4 ( 4%)
  - STEMI 2 ( 2%)

# Provisional T-stenting Registry with Cypher Stent

- Bifurcation location (N=100)
  - Left main 34
  - LAD 54
  - LCX 8
  - RCA 4
- Procedural characteristics
  - Transradial approach 41 (44%)
  - Guiding catheter
    - 6 Fr 7 ( 7%)
    - 7 Fr 40 (43%)
    - 8 Fr 47 (50%)

# Provisional T-stenting Registry with Cypher Stent



# Provisional T-stenting Registry with Cypher Stent

- QCA measurements (N=100)

		RD (mm)	MLD (mm)	DS (%)	Length (mm)
Parent vessel	Pre	2.9±0.6	0.9±0.5	68±19	12.5±5.9
	Post	3.4±0.6	2.8±0.6	16±15	-
Side branch	Pre	2.4±0.6	1.2±0.7	45±39	5.1±5.6
	Post	2.6±0.6	2.3±0.9	12±32	-

(RD: reference diameter, MLD: minimal luminal diameter  
DS: diameter stenosis)

# Provisional T-stenting Registry with Cypher Stent

- IVUS measurements (N=98)

		RA (mm <sup>2</sup> )	MLA (mm <sup>2</sup> )
Parent vessel	Pre	8.7±2.4	2.7±1.2
	Post	10.0±2.8	7.0±3.2
Side branch	Pre	6.3±2.5	3.9±2.3
	Post	6.4±3.0	5.0±2.0

*(RA: reference area, MLA: minimal luminal area)*

# Provisional T-stenting Registry with Cypher Stent

- Post-procedure enzyme leak (N=94)
  - Peak CK-MB:  $15.6 \pm 30.0$  ng/ml (0.2 – 181)
  - Peak CK-MB > 3 time of normal limit: 18 patients (19.1%)
- 30-day clinical FU (N=100)
  - Death 1 (due to stent thrombosis)
  - Q-wave MI 0
  - TLR 0
- 1~9 month clinical FU (N=25)
  - Death 0
  - Q-wave MI 0
  - TLR 1 (4%) (LAD 2.5 mm stent)

# Provisional T-stenting Registry with Cypher Stent

- 9-months angiographic FU (N=18)
  - Restenosis: parent vessel 2 (11%), side branch 2 (11%)

	RD (mm)	MLD (mm)	Ds (%)
Parent vessel	3.1±0.6	2.4±0.7	22±17
Side branch	2.4±0.5	1.8±0.5	27±16

*(RD: reference diameter, MLD: minimal luminal diameter  
 DS: diameter stenosis)*



# Bifurcation Stent Techniques

## My perspective

- **Crush Technique**
  - Innovative, but unreasonable
- **Kissing stent Technique**
  - Simple procedure, complex result
- **Provisional T-Stenting**
  - It still works in DES era