Anatomical and Functional Approaches for Bifurcation Lesions "CROSS and PERFECT" Trials

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On behalf of CROSS and PERFECT investigators.
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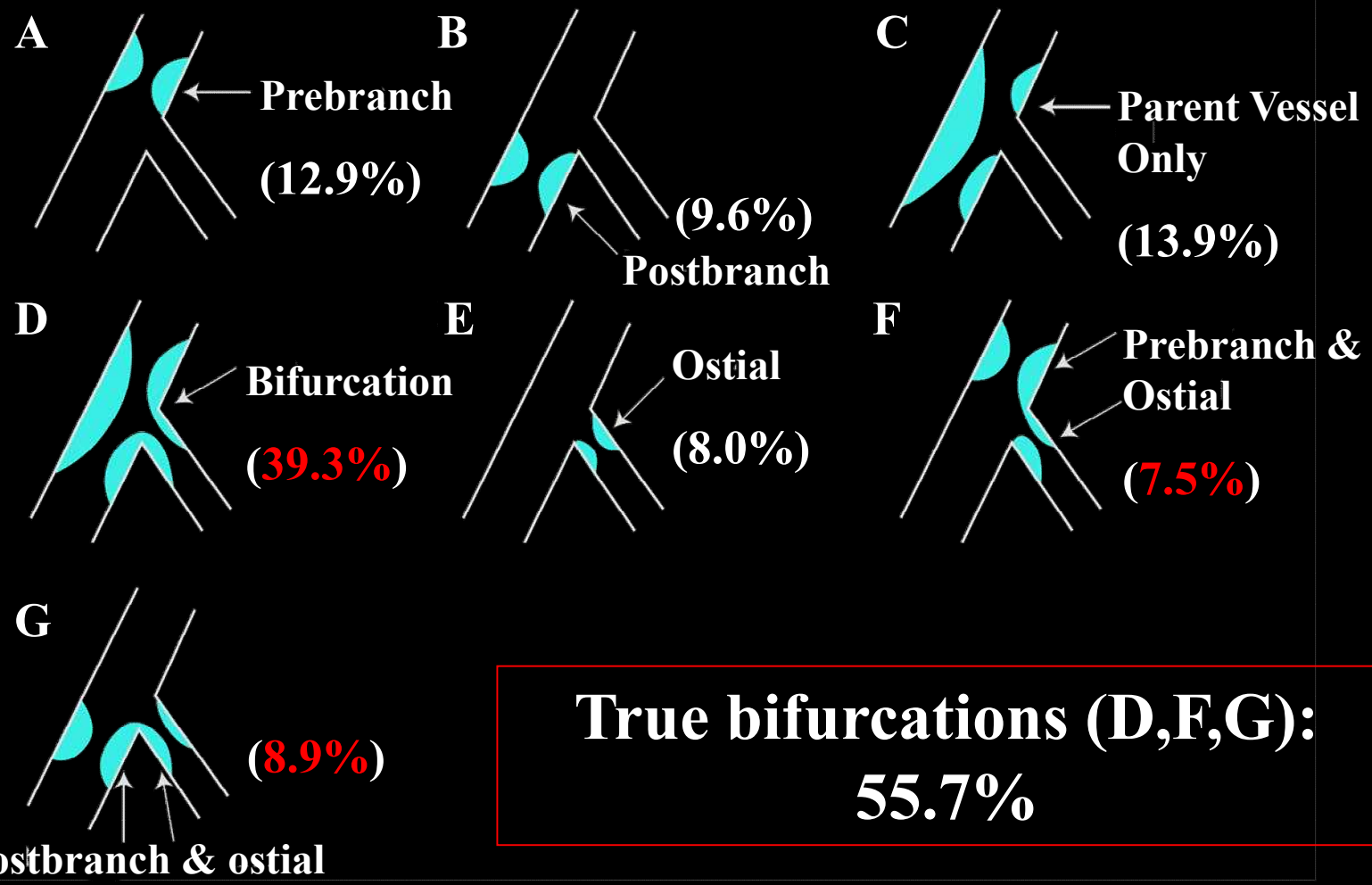
Disclosure Information

Supported by research grants from
the Korean Society of Interventional Cardiology
& CardioVascular Research Foundation (CVRF)

No industry sponsorship relevant to this study

SYNTAX Bifurcation Substudy

Bifurcation / Trifurcation Subset



True bifurcations (D,F,G): 55.7%

*Medina Classification not available at study design

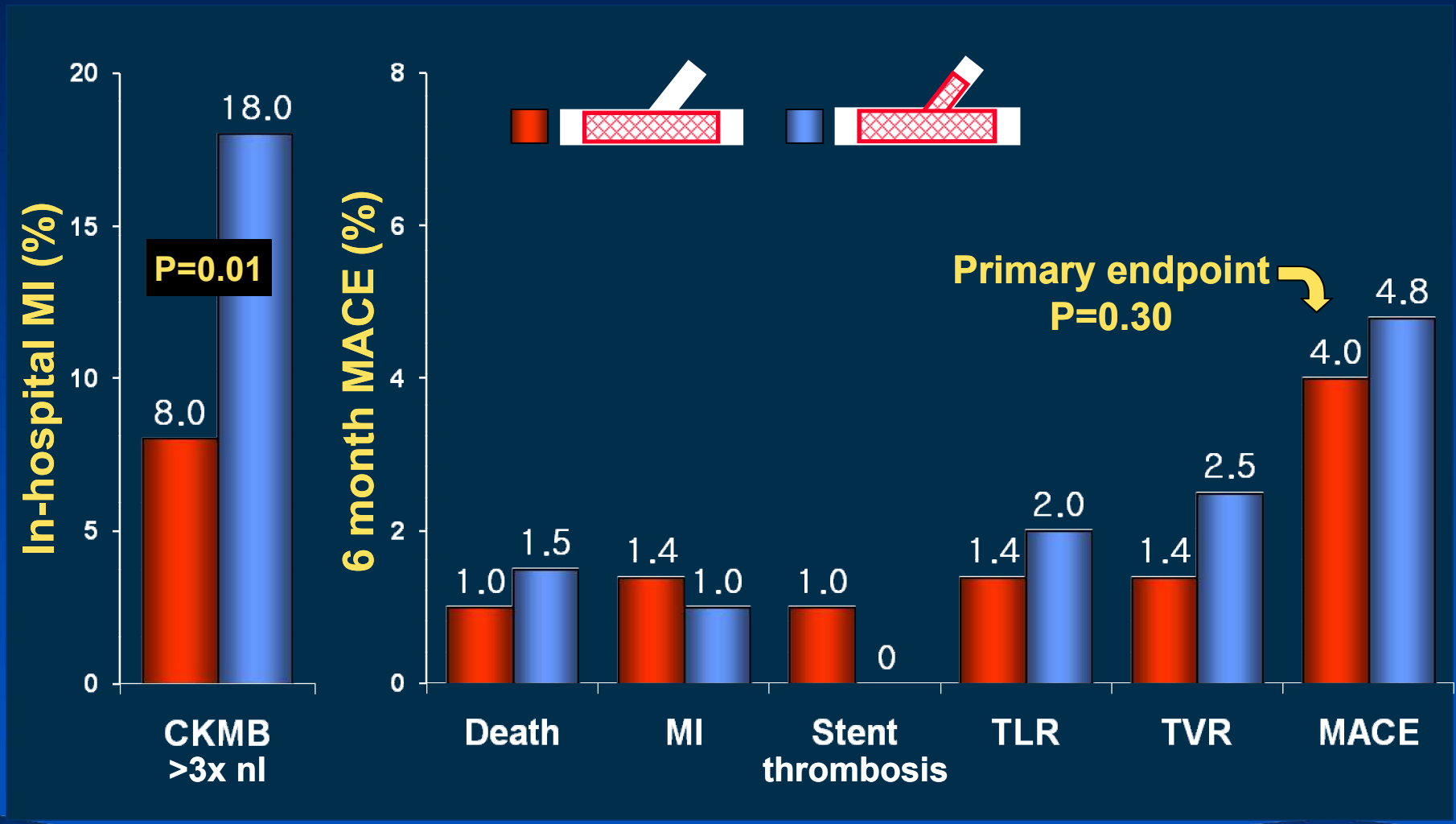
Current RCTs for Bifurcation Lesions

Evaluation of the Benefit of Complex Stenting

Trials	Main Purpose
NORDIC 1	Provisional T vs. Systemic T stenting
NORDIC 2	Crush vs. Culotte
NORDIC 3	Kissing balloon vs. leave alone
CACTUS	Provisional T vs. Crush

Nordic 1 trial (413 pts)

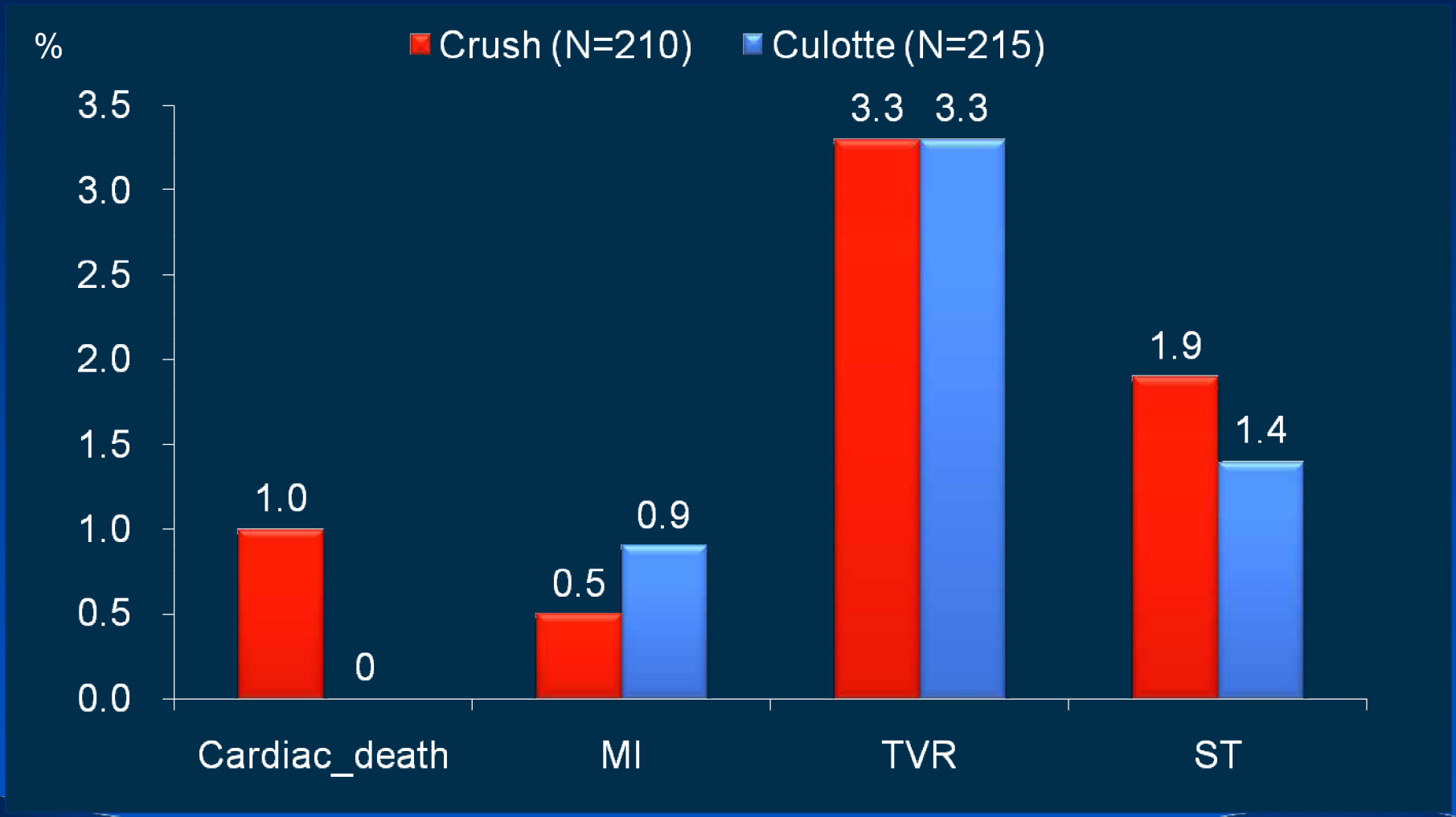
Single vs. Two



Steigen T. et al; Circulation 2006;114:1955-61

NORDIC 2 trial (425 pts)

Crush vs. Culotte

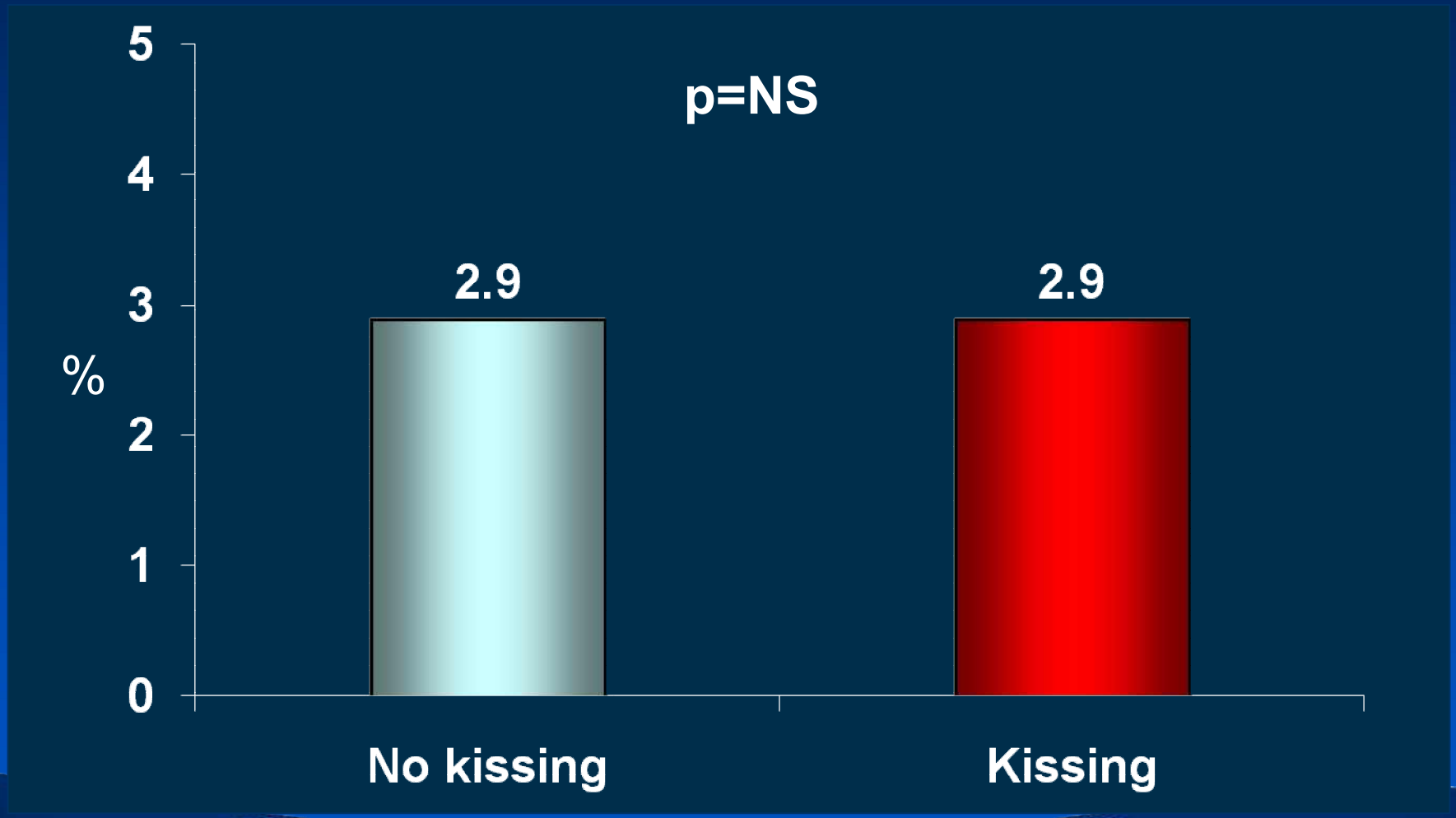


Erglis A et al, Circ CV Interventions 2009

NORDIC 3 trial (477 pts)

Kissing vs. No kissing

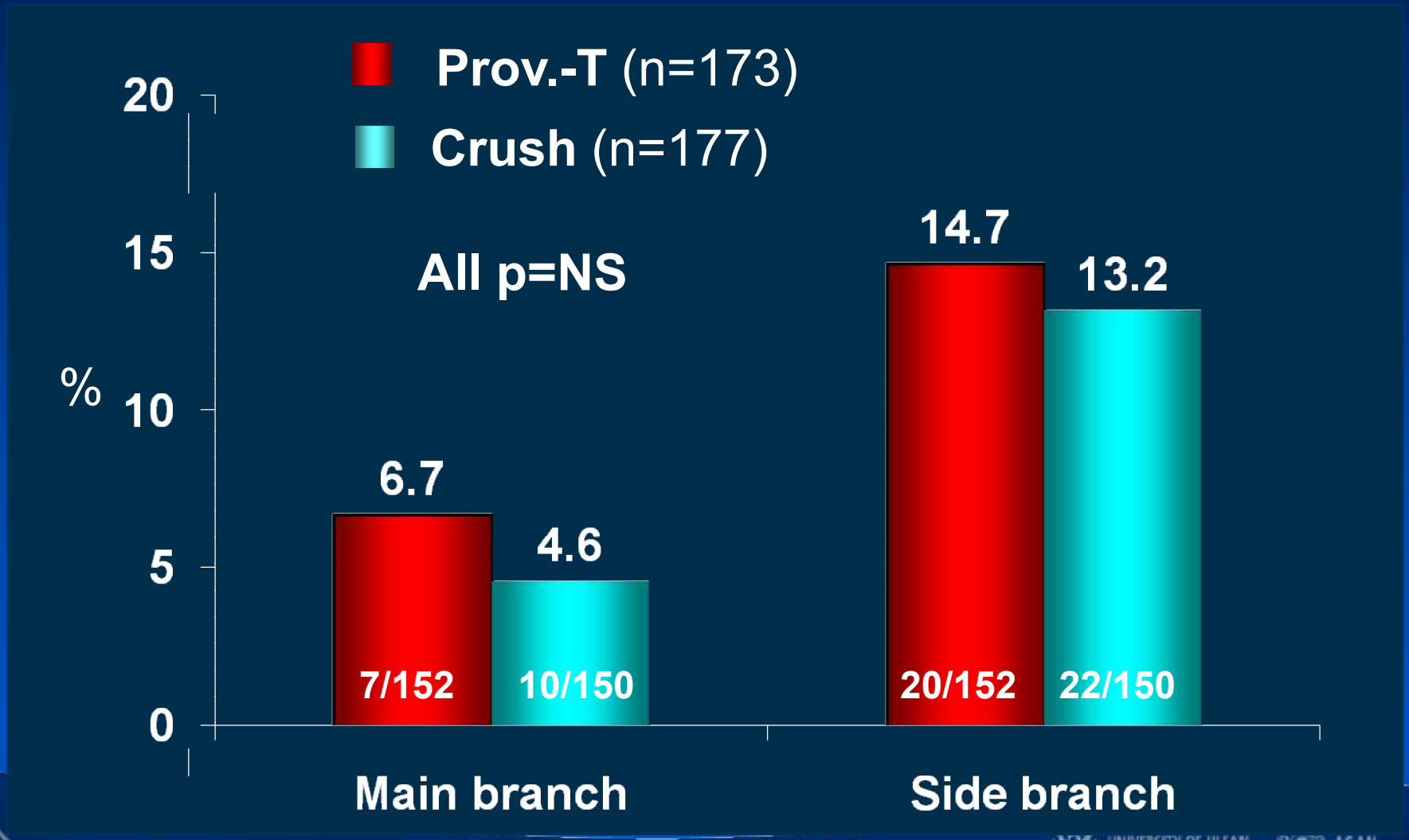
6-month composite of death, MI, TLR, and ST



CACTUS trial (350 pts)

Provisional T vs. Crush

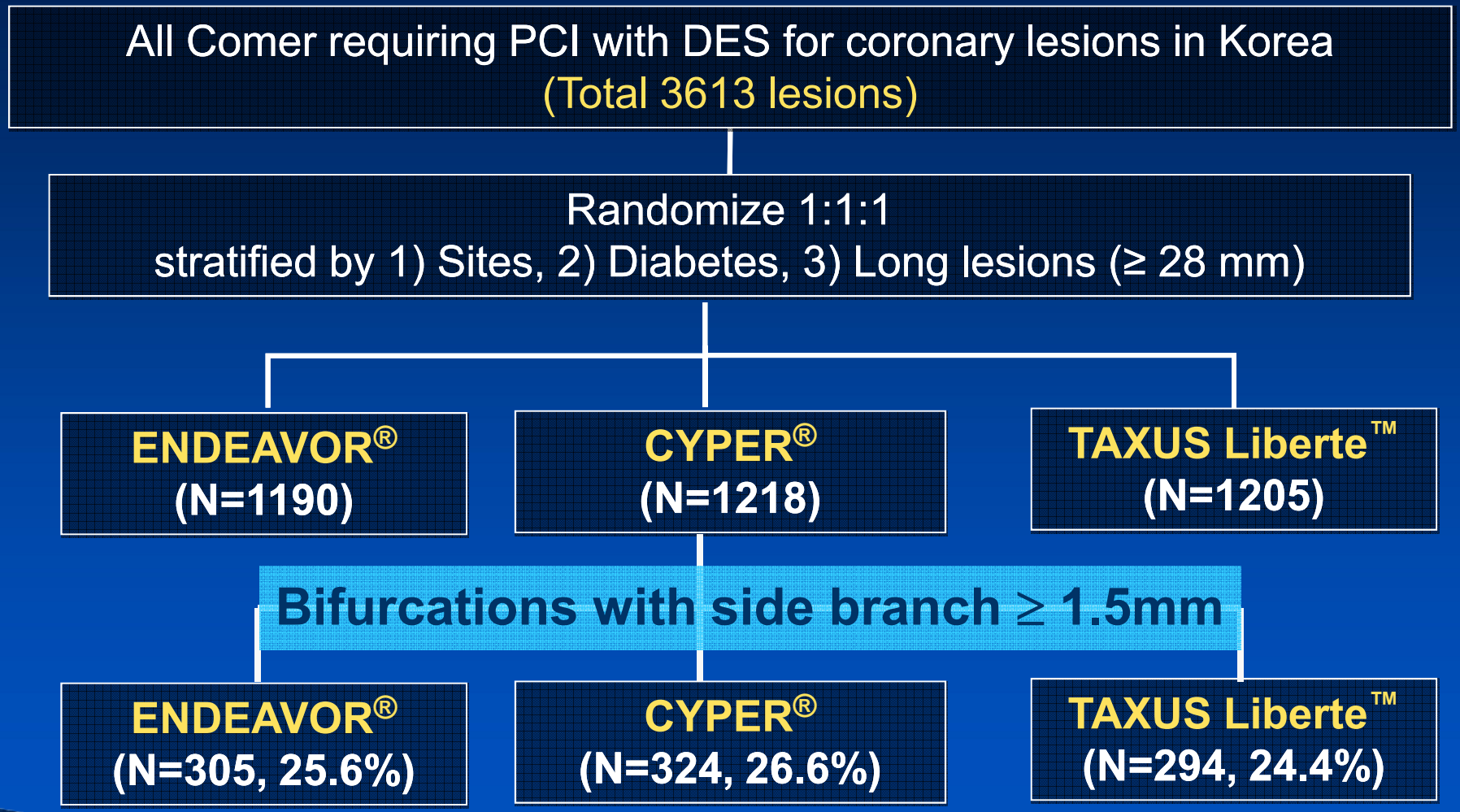
6-Month In-segment Restenosis



Colombo A et al. Circulation. 2009;119:71

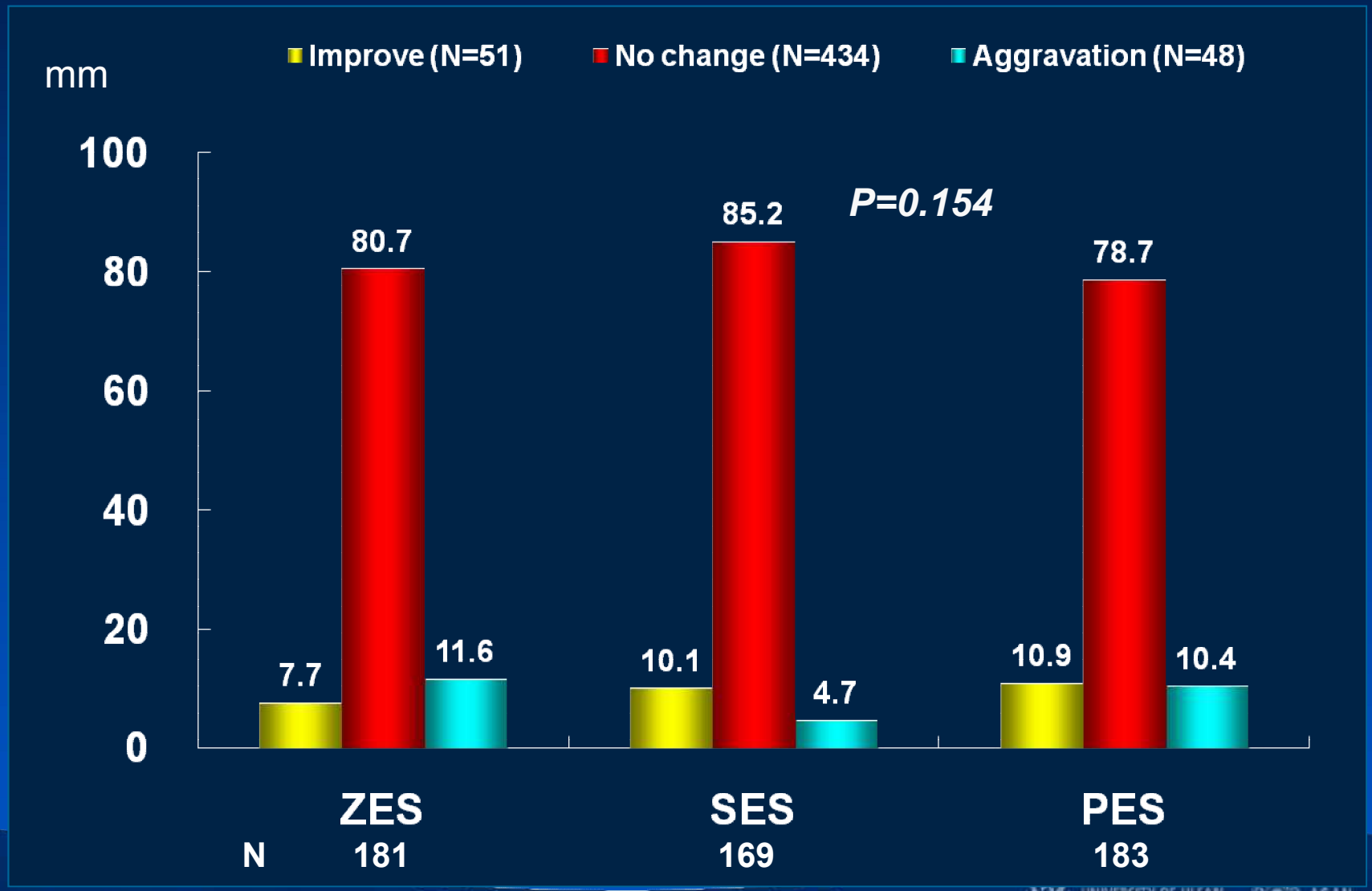
ZEST Bifurcation Substudy

25% of all lesions had bifurcations



Fate of SB Stenosis in Overall

Improve or steady in 91%



Kim YH et al. JACC Cardiovasc Int (in press)

Message from Trials

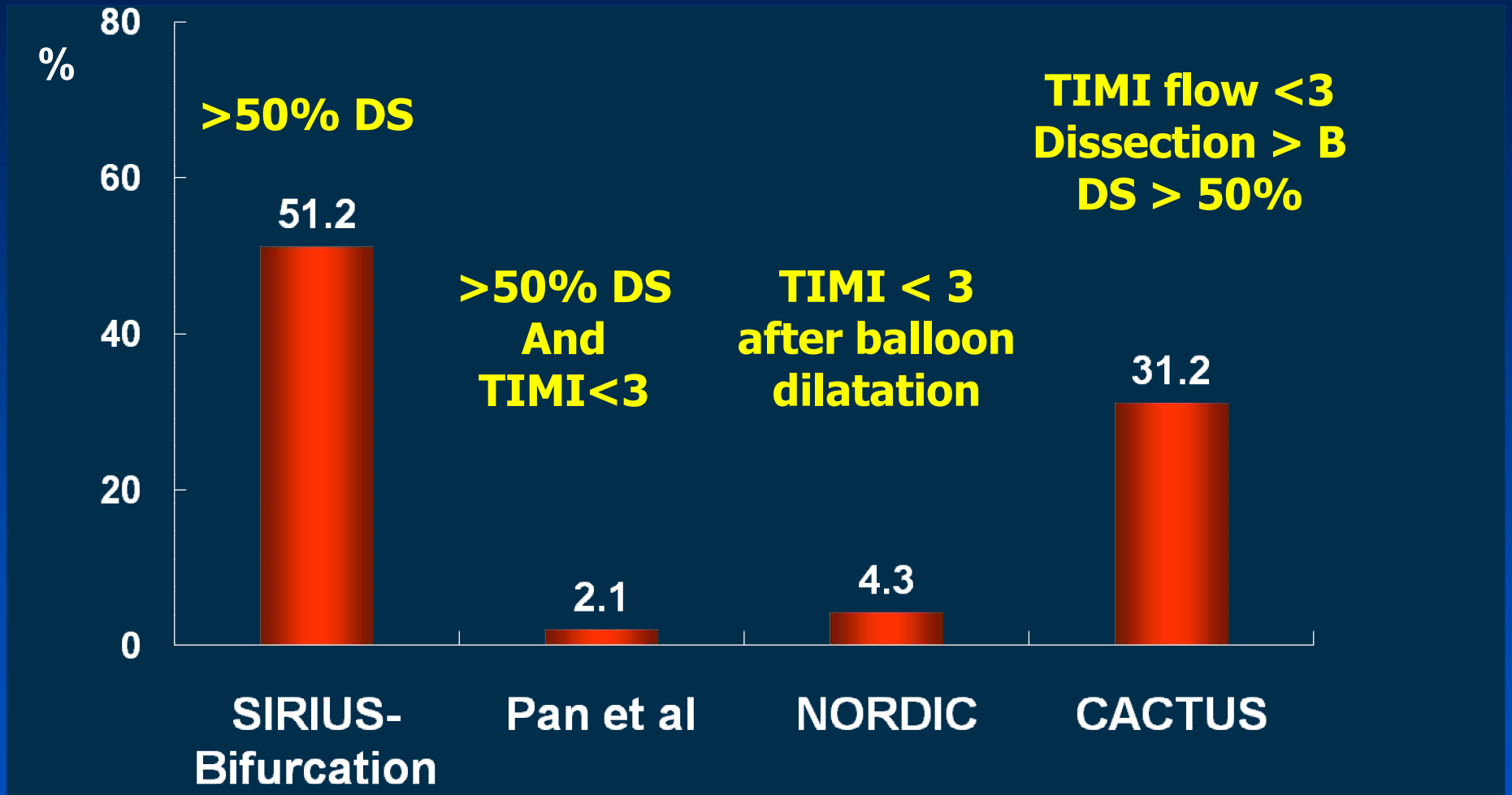
Keep it simple !

because there is no difference in clinical outcomes across the diverse bifurcation stenting strategies.

However, there are still lots of uncertainties in ...

- Those requiring 2-stent technique ?
- Time for kiss ?
- Time to shift to 2-stent from 1-stent ?
- Impact of non-compliant balloon ?
- Benefit of IVUS-guidance ?
- Outcomes of FFR in side branch ?
- Etc…

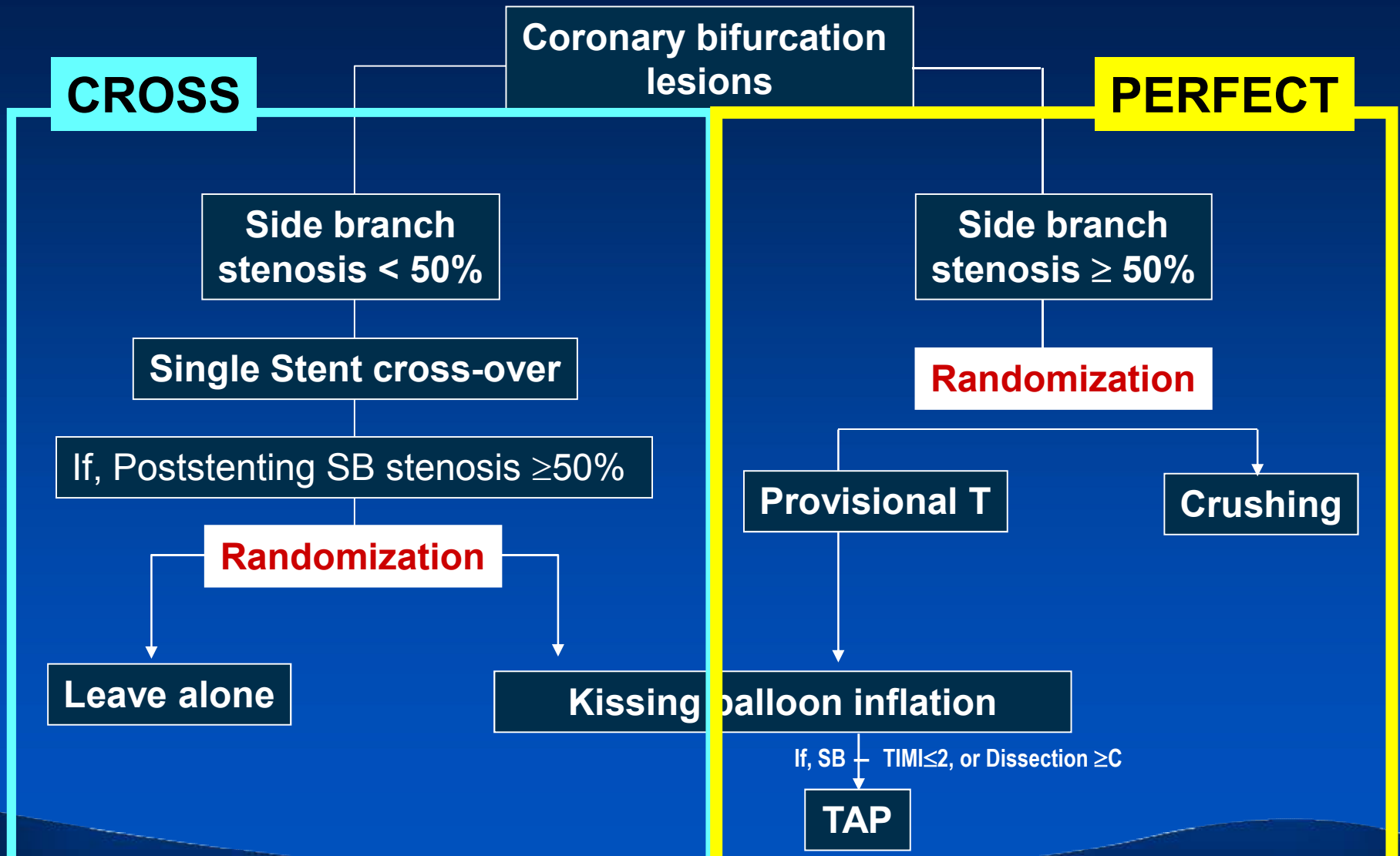
When we need two stents in provisional stenting ?
% of Cross-over to 2-Stent from 1-stent



•Colombo A, et al. SIRIUS Bifurcation Study, Circulation 2004;109:1244-9
•Pan M, et al. Am Heart J 2004;148:857-64.
•Steigen TK, et al. NORDIC Study, Circulation 2006;114:1955-61.

CROSS & PERFECT Trials

to assess IVUS-Guided Bifurcation Stenting



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ASAN Medical Center

PI: Seung-Jung Park, MD

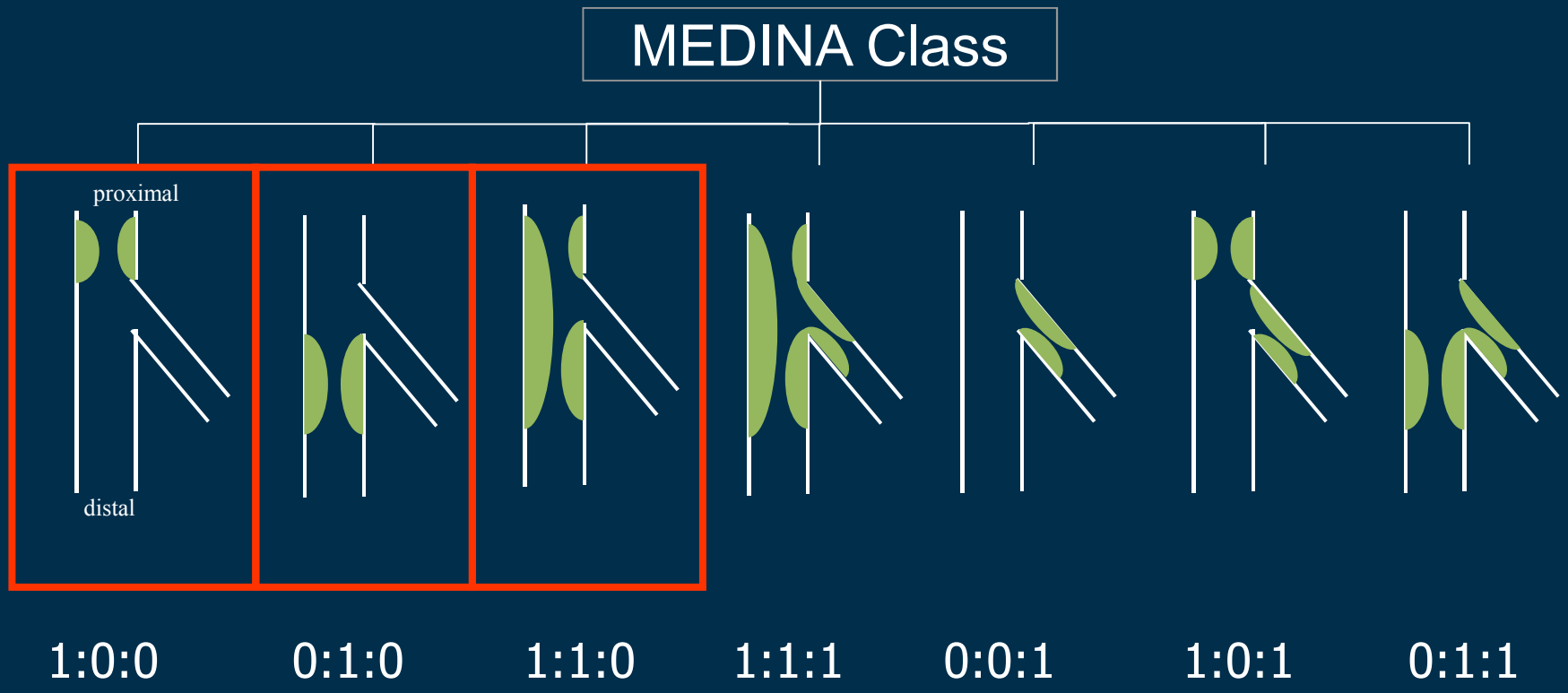
Administration

Sites	• 20 Korean sites • 1 US site (Dr. Yeung, Dr. Fearon)
PI	• Seung-Jung Park, MD
Sponsor	
Angiographic core lab	• CardioVascular Research Foundation, Seoul
IVUS core lab	
Data management	• Young-Hak Kim, MD
Clinical Event Committee	

Choice of optimal stRategy fOr bifurcation leSions with normal Side branch

CROSS Trial

Bifurcations without SB Stenosis



Inclusion Criteria

1. Clinical

- Objective evidence of ischemia
- Age >18 years, <75 ages

2. Angiographic

- De novo with the MEDINA type 1.1.0, 1.0.0, or 0.1.0
- MB: $\geq$ 2.5 mm, $\geq$ 50% and $\leq$ 50 mm by visual estimation
- SB: $\geq$ 2.0 mm and < 50%

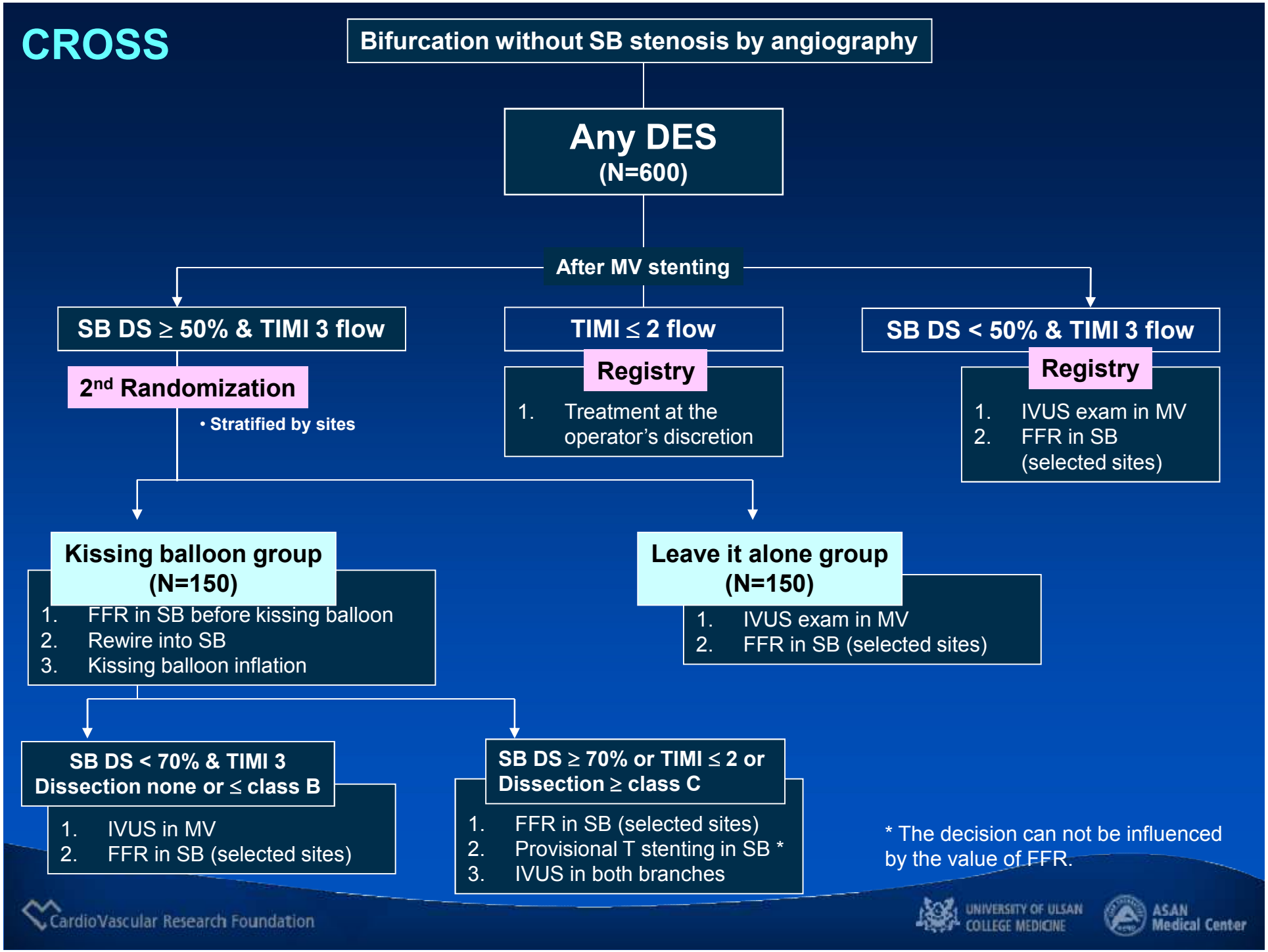
Exclusion Criteria

- Significant comorbidity
- STEMI ≤ 2 weeks
- Characteristics of lesion
  - Left main disease
  - In-stent restenosis
  - Graft vessels
  - TIMI flow ≤ grade 2 in the SB
  - CTO
- Chronic renal failure

CROSS Trial
Study Design

- Primary end points
  - 8-month diameter stenosis in SB

- Design and hypothesis
  - The ‘leave alone strategy’ is not inferior to ‘kissing balloon’


CROSS
Bifurcation without SB stenosis by angiography
Any DES
(N=600)
After MV stenting
SB DS ≥ 50% & TIMI 3 flow
2nd Randomization
• Stratified by sites
TIMI ≤ 2 flow
Registry
1. Treatment at the operator's discretion
SB DS < 50% & TIMI 3 flow
Registry
1. IVUS exam in MV
2. FFR in SB (selected sites)
Kissing balloon group
(N=150)
1. FFR in SB before kissing balloon
2. Rewire into SB
3. Kissing balloon inflation
Leave it alone group
(N=150)
1. IVUS exam in MV
2. FFR in SB (selected sites)
SB DS < 70% & TIMI 3
Dissection none or ≤ class B
1. IVUS in MV
2. FFR in SB (selected sites)
SB DS ≥ 70% or TIMI ≤ 2 or
Dissection ≥ class C
1. FFR in SB (selected sites)
2. Provisional T stenting in SB *
3. IVUS in both branches
* The decision can not be influenced by the value of FFR.
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ASAN Medical Center

- Influence of Kissing Balloon Inflation
- Morphologic Evaluation by IVUS
- Functional Assessment by FFR

SB DS ≥ 50% & TIMI 3 flow

2nd Randomization

- **Stratified by sites**

TIMI ≤ 2 flow

Registry

1. Treatment at the operator's discretion

SB DS < 50% & TIMI 3 flow

Registry

1. IVUS exam in MV
2. FFR in SB (selected sites)

Kissing balloon group

1. FFR in SB before kissing balloon
2. Rewire into SB
3. Kissing balloon inflation

Leave it alone group

1. IVUS exam in MV
2. FFR in SB (selected sites)

SB DS < 70% & TIMI 3
Dissection none or ≤ class B

1. IVUS in MV
2. FFR in SB (selected sites)

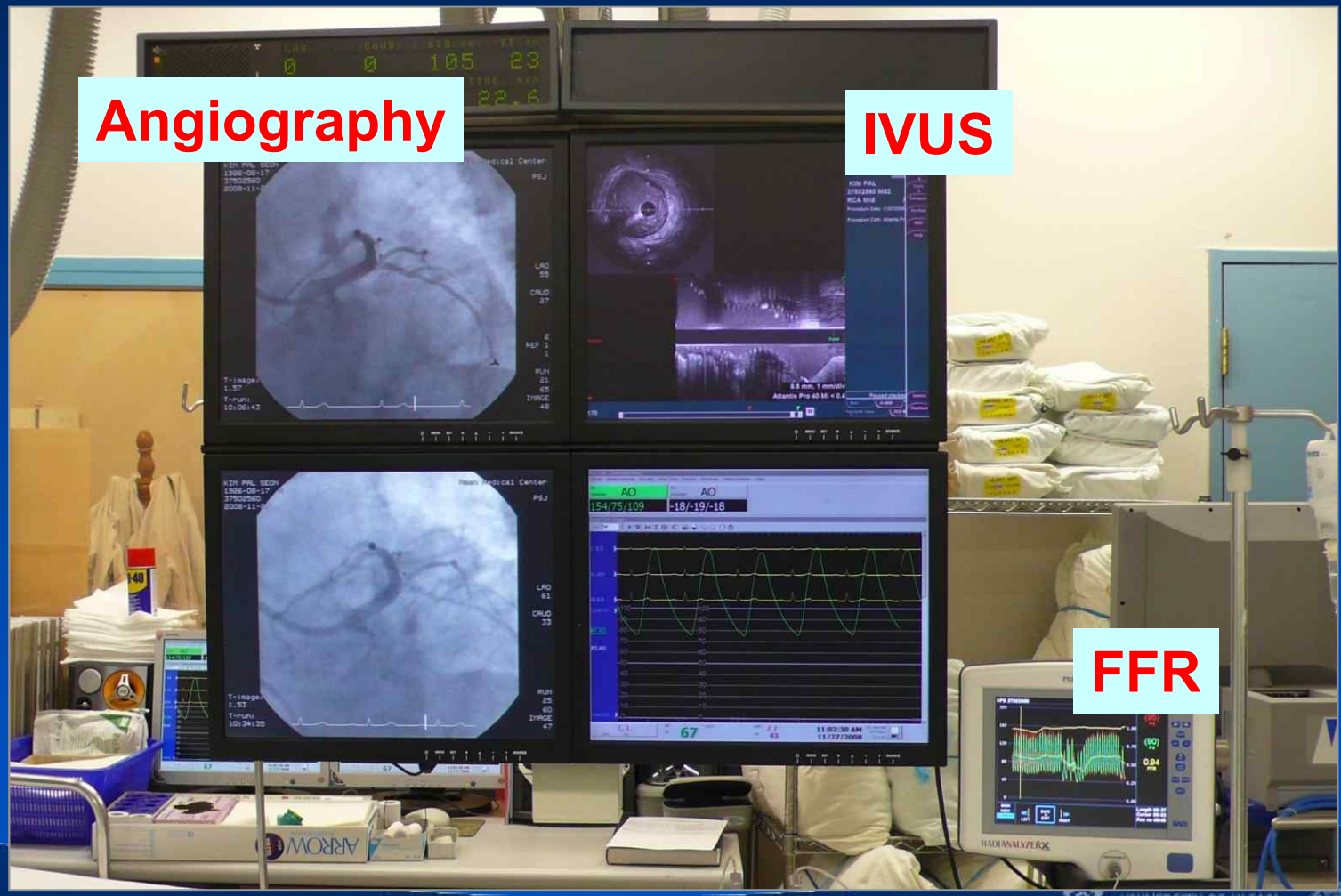
SB DS ≥ 70% or TIMI ≤ 2 or
Dissection ≥ class C

1. FFR in SB (selected sites)
2. Provisional T stenting in SB *
3. IVUS in both branches

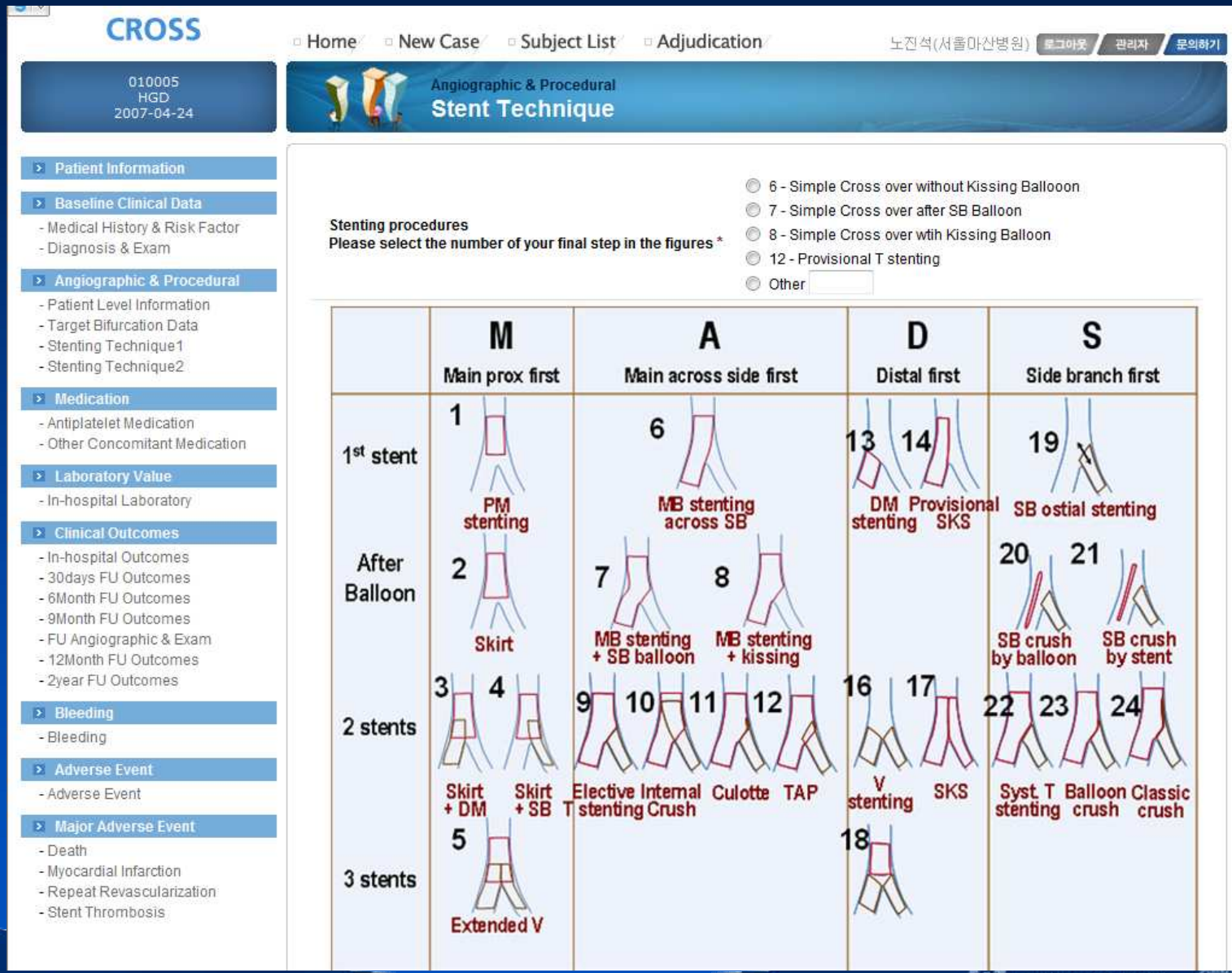
* The decision can not be influenced by the value of FFR.

FFR and IVUS are mandatory

to assess the mechanisms of phenomena occurring in bifurcations after stenting



Stenting techniques classified by EBC



Tracking the All Steps of Procedure

CROSS

Home | New Case | Subject List | Adjudication

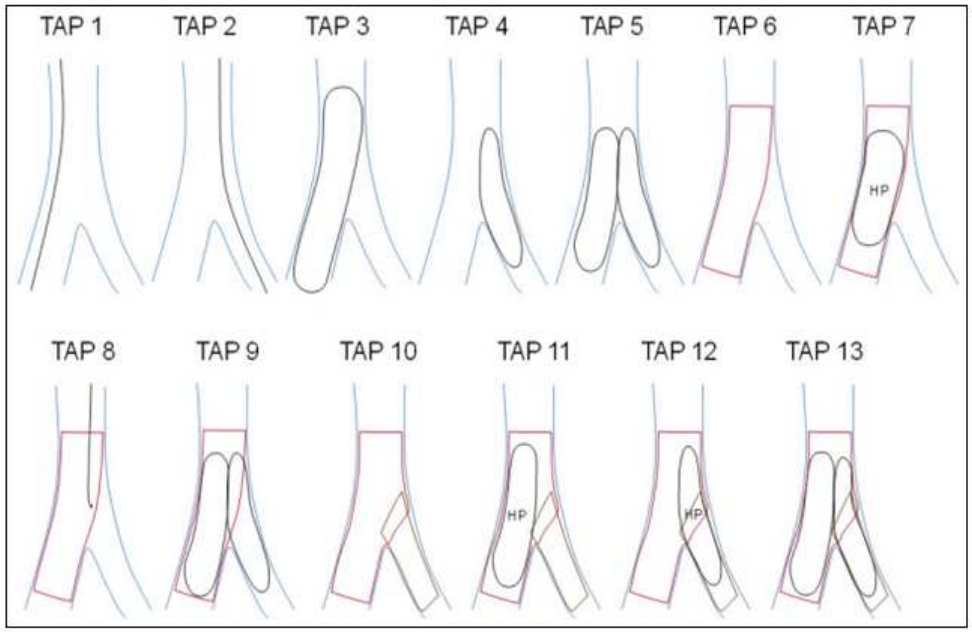
노진석(서울아산병원) 로그아웃 관리자 문의하기

010005
HGD
2007-04-24

Angiographic & Procedural
Stent Technique 2

- Patient Information
- Baseline Clinical Data
  - Medical History & Risk Factor
  - Diagnosis & Exam
- Angiographic & Procedural
  - Patient Level Information
  - Target Bifurcation Data
  - Stenting Technique1
  - Stenting Technique2
- Medication
  - Antiplatelet Medication
  - Other Concomitant Medication
- Laboratory Value
  - In-hospital Laboratory
- Clinical Outcomes
  - In-hospital Outcomes
  - 30days FU Outcomes
  - 6Month FU Outcomes
  - 9Month FU Outcomes
  - FU Angiographic & Exam
  - 12Month FU Outcomes
  - 2year FU Outcomes
- Bleeding
  - Bleeding
- Adverse Event
  - Adverse Event
- Major Adverse Event
  - Death
  - Myocardial Infarction
  - Repeat Revascularization
  - Stent Thrombosis

Sequence	Procedure	Performance	Sequence	Procedure	Performance
TAP 1 *	MB wiring	Done ND	TAP 8 *	SB rewiring after MB stenting	Done ND
TAP 2 *	SB wiring	Done ND	TAP 9 *	Kissing after MB stenting	Done ND
TAP 3 *	MB predilation	Done ND	TAP10 *	SB stenting	Done ND
TAP 4 *	SB predilation	Done ND	TAP 11 *	SB balloon dilatation	Done ND
TAP 5 *	Kissing predilation	Done ND	TAP12 *	MB balloon dilatation	Done ND
TAP 6 *	MB stenting	Done ND	TAP13 *	Final kissing	Done ND
TAP 7 *	MB in-stent HP dilatation with short balloon	Done ND			



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COLLEGE MEDICINE

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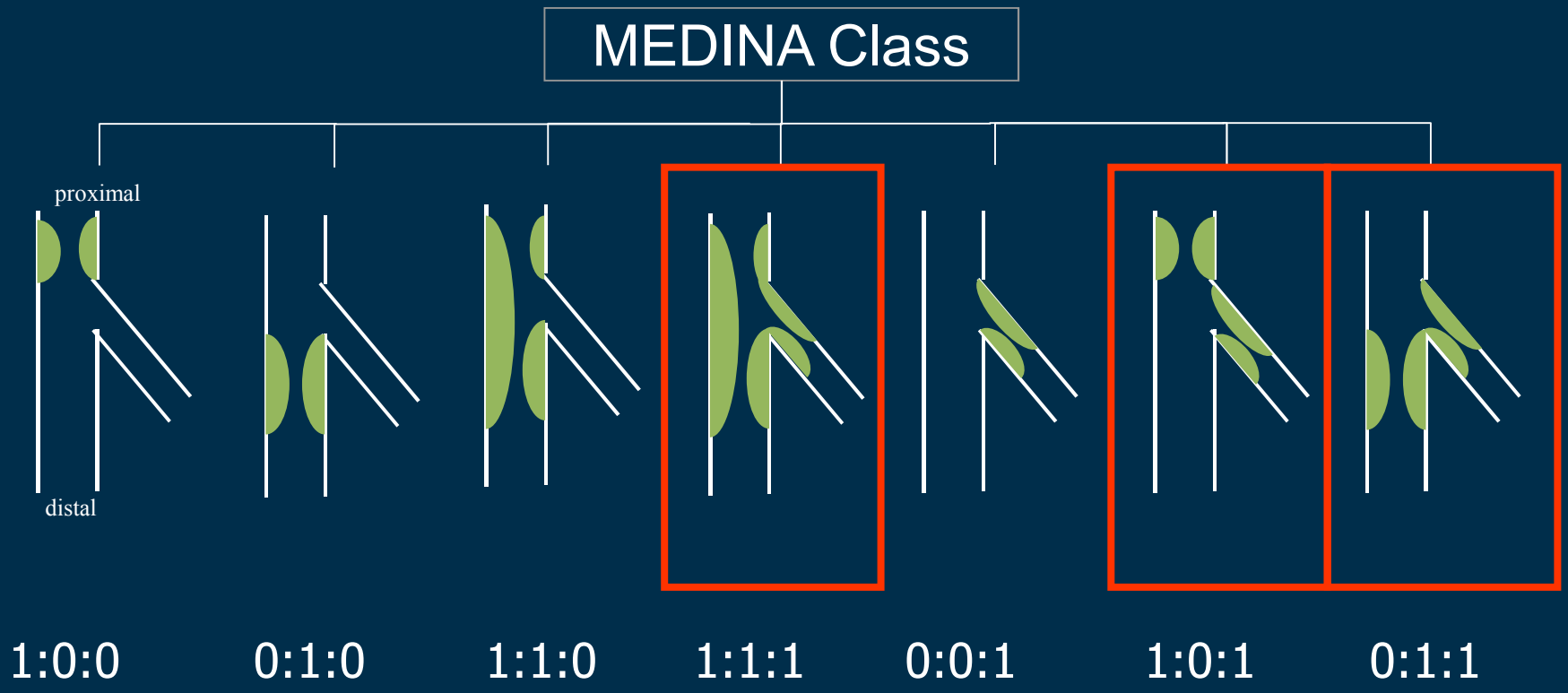
OPtimal StEnting StRategy For TruE BifurCaTion

PERFECT Trial

Bifurcations with SB Stenosis



Inclusion Criteria

1. Clinical

- Objective evidence of ischemia
- Age >18 years, <75 ages

2. Angiographic

- De novo with the MEDINA type 1.1.1, 1.0.1, or 0.1.1
- MB: $\geq$ 2.5 mm, $\geq$ 50% and $\leq$ 50 mm
- SB: $\geq$ 2.0 mm, $\geq$ 50%, and < 20 mm

PERFECT Trial
Study Design

- Primary end point
  - 8-month overall restenosis rate in MB or SB

- Hypothesis for sample size estimation
  - The provisional T is not inferior to the routine Crush technique

PERFECT Trial

True bifurcation by angiography

Wire insertion into both branches

Randomization with any DES

Crush group (N=240)

1. Preprocedural IVUS in both branches
2. Predilation in the MV and SB
3. SB stenting while keeping MB stent
4. Removal of SB stent and wire
5. MV stenting
6. Rewire into the SB stent
7. Sequential high pressure balloon dilatation in both in-stent areas
8. Kissing balloon inflation
9. Postprocedural IVUS in both branches

Crossover to crush
Serious dissection necessitating urgent stenting in SB after predilation*

Provisional T stenting group (N=240)

1. Preprocedural IVUS in both branches
2. Predilation in the MV
3. MV stenting while keeping jailed wire in the SB
4. Rewire into the SB
5. Kissing balloon inflation with low pressure at SB

Indication of SB Stenting

Angiography at SB

- **TIMI ≤ 2 flow or**
- **DS ≥ 70% or**
- **Dissection ≥ NHLBI class C**

1.

4. Kissing balloon inflation
5. Postprocedural IVUS in both branches

*** Predilation in SB is strongly discouraged.**

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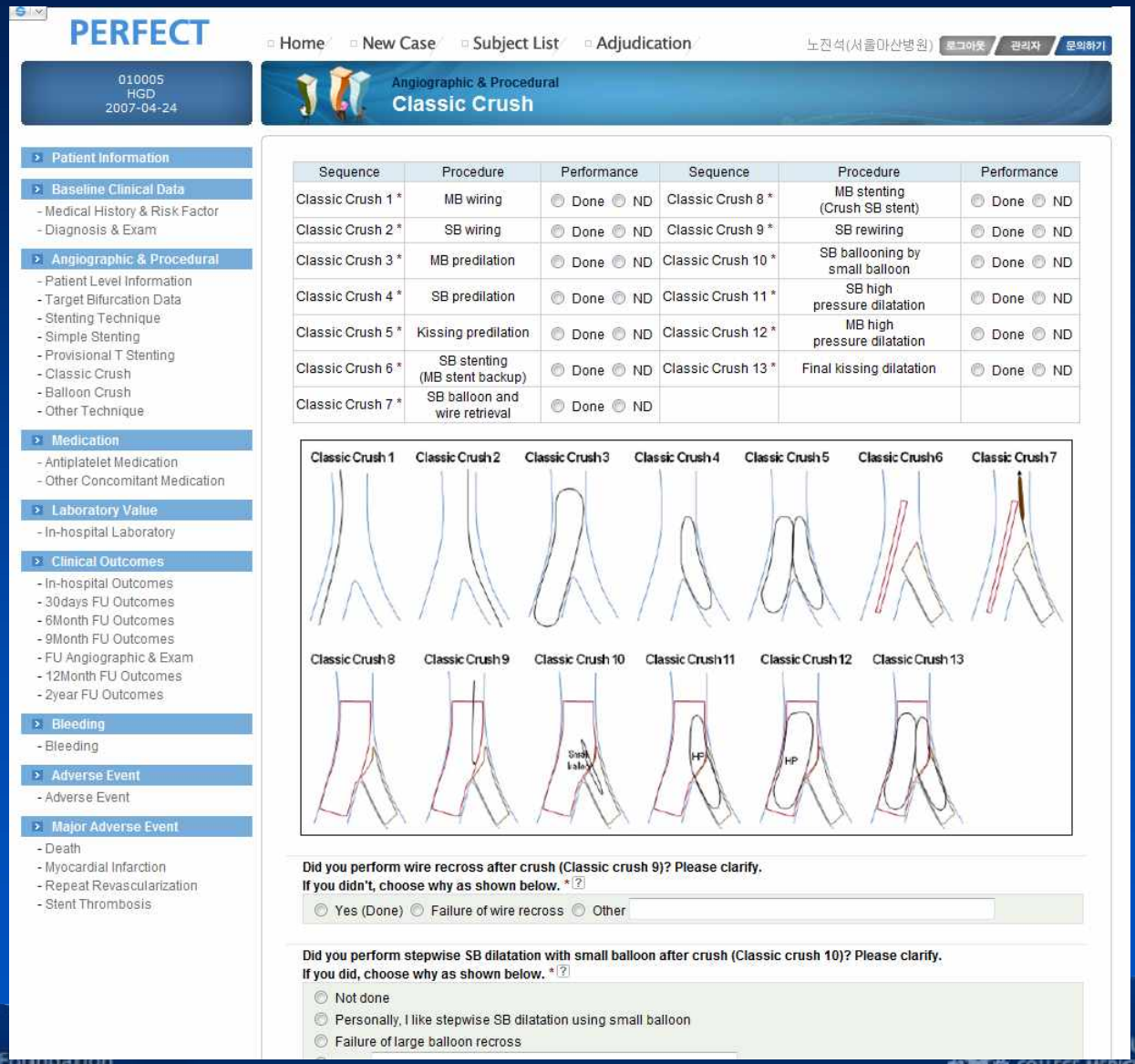
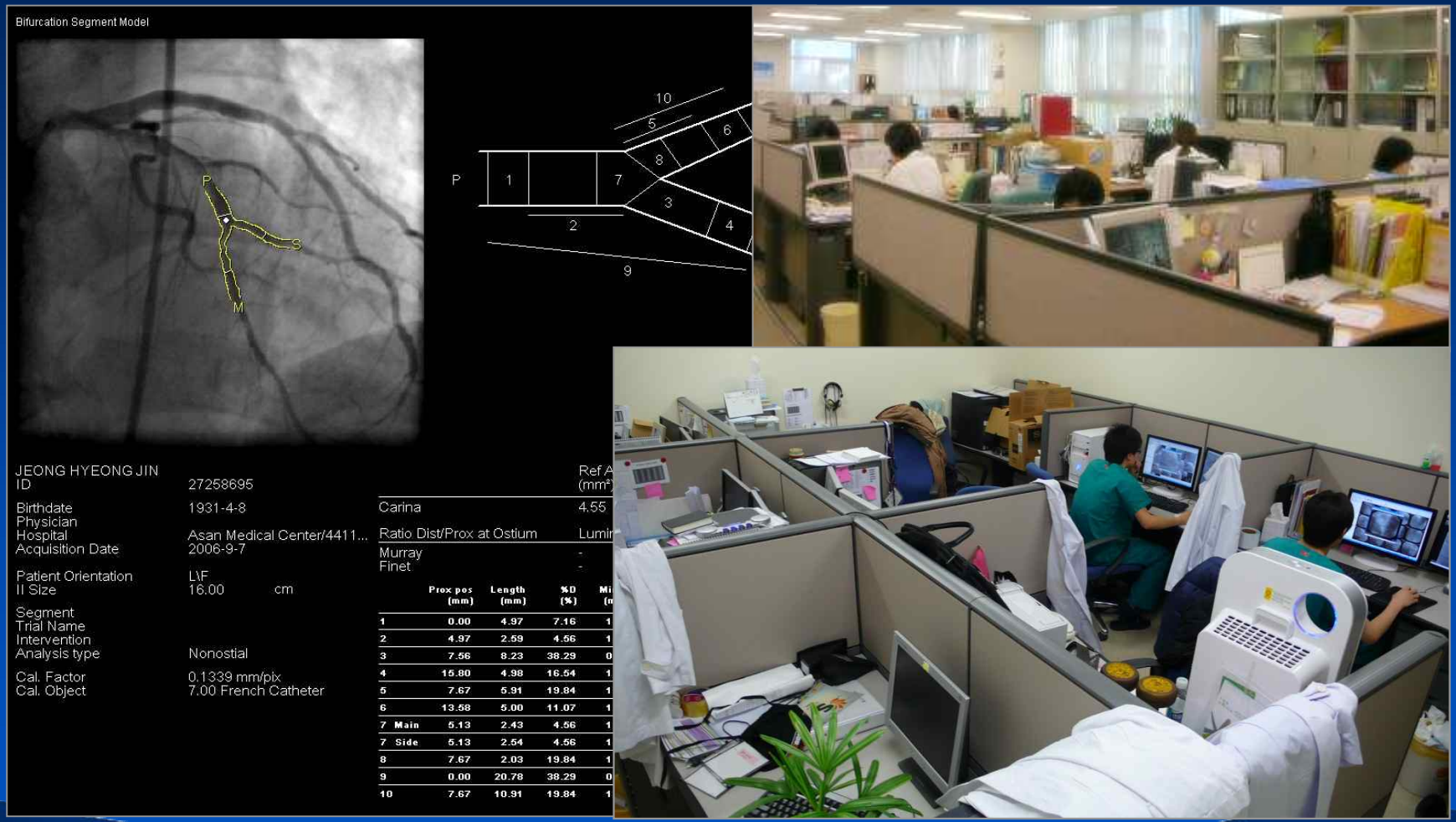
Crush & Kiss with non-compliant balloons



QCA using dedicated software and IVUS analysis in the Core Lab



Current Status

April 2010

CROSS Study

- 318 (53%) enrolled
- **183 (58%)** randomization to kissing vs. leave alone

PERFECT Study

- **287 (67.2%)** randomization

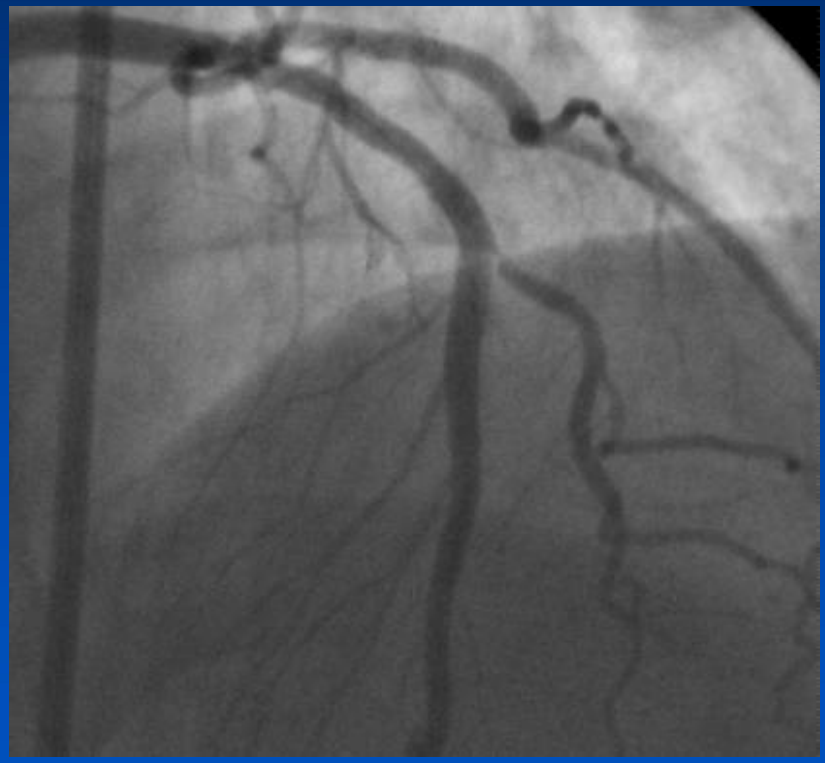
Preliminary Personal Experiences

CROSS Patient

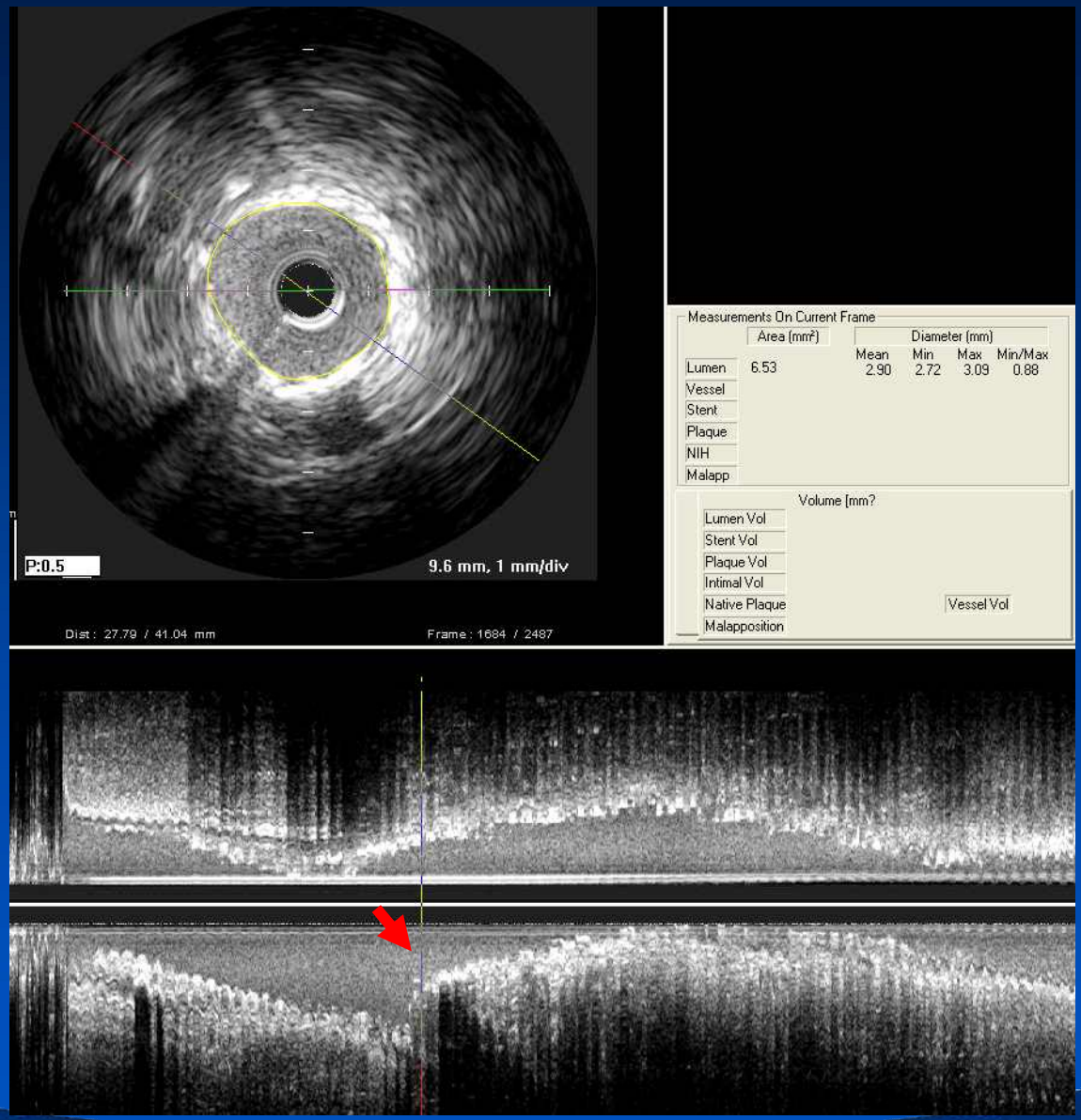
Treated with Endeavor 3.0 X 24 mm

Pre-

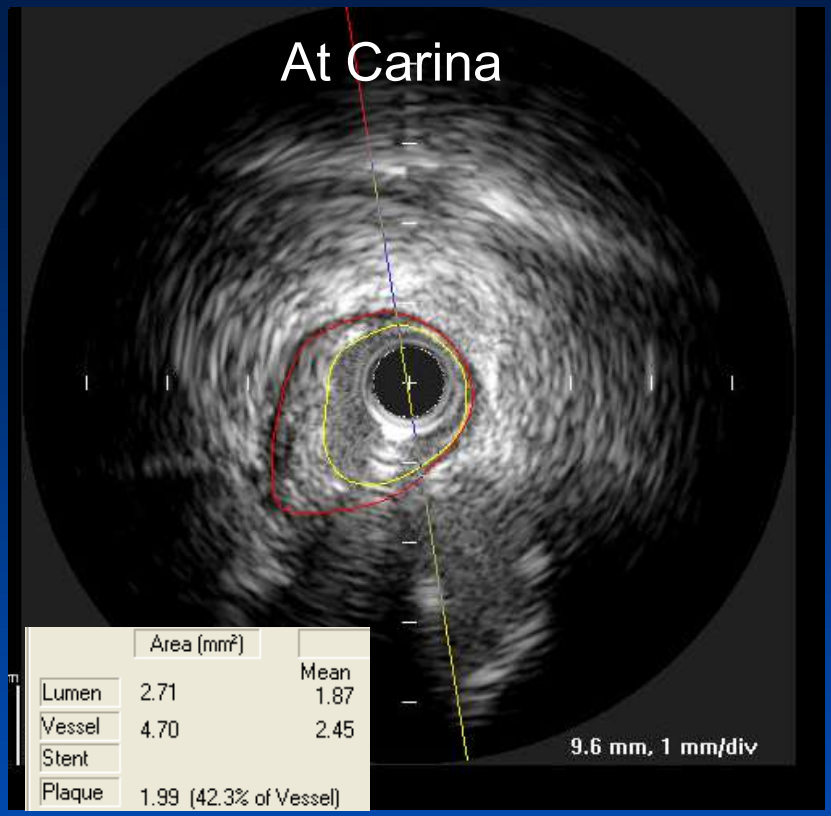
Post-stenting

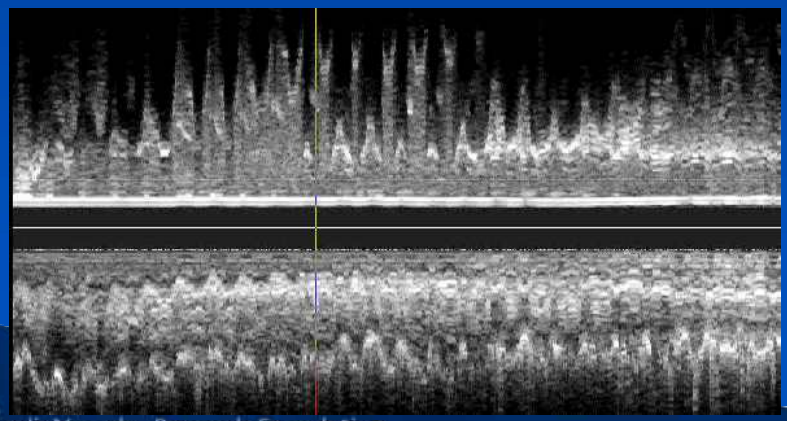


MB IVUS after Procedure

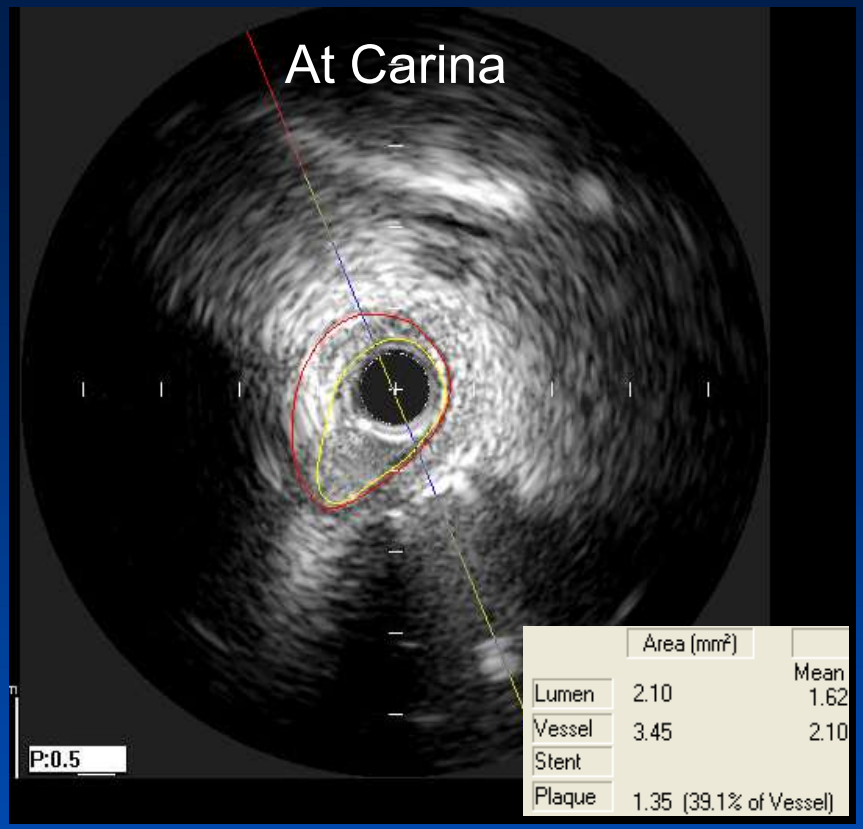


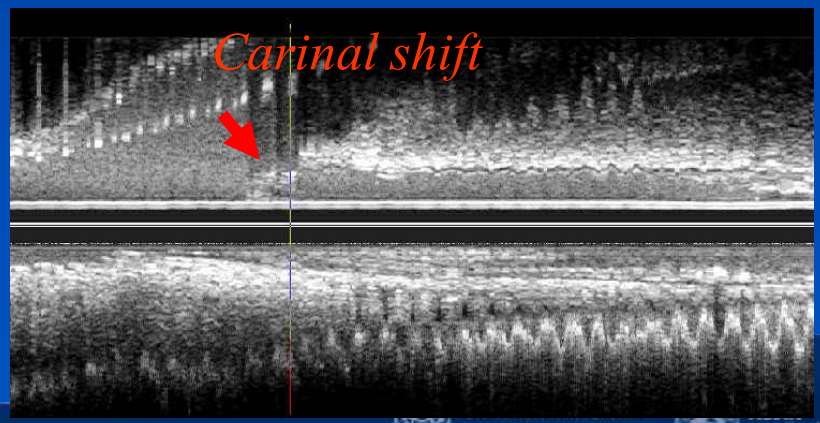
SB before Procedure



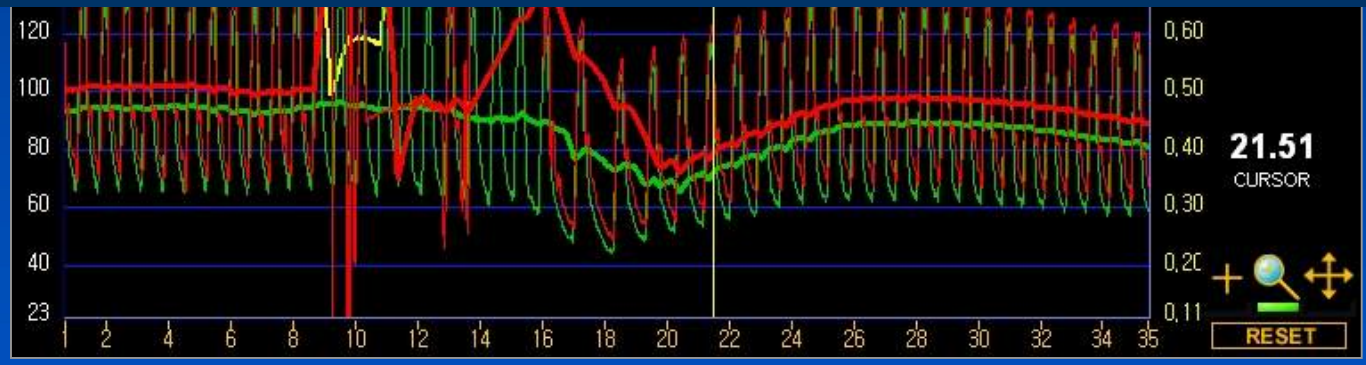


SB after Procedure

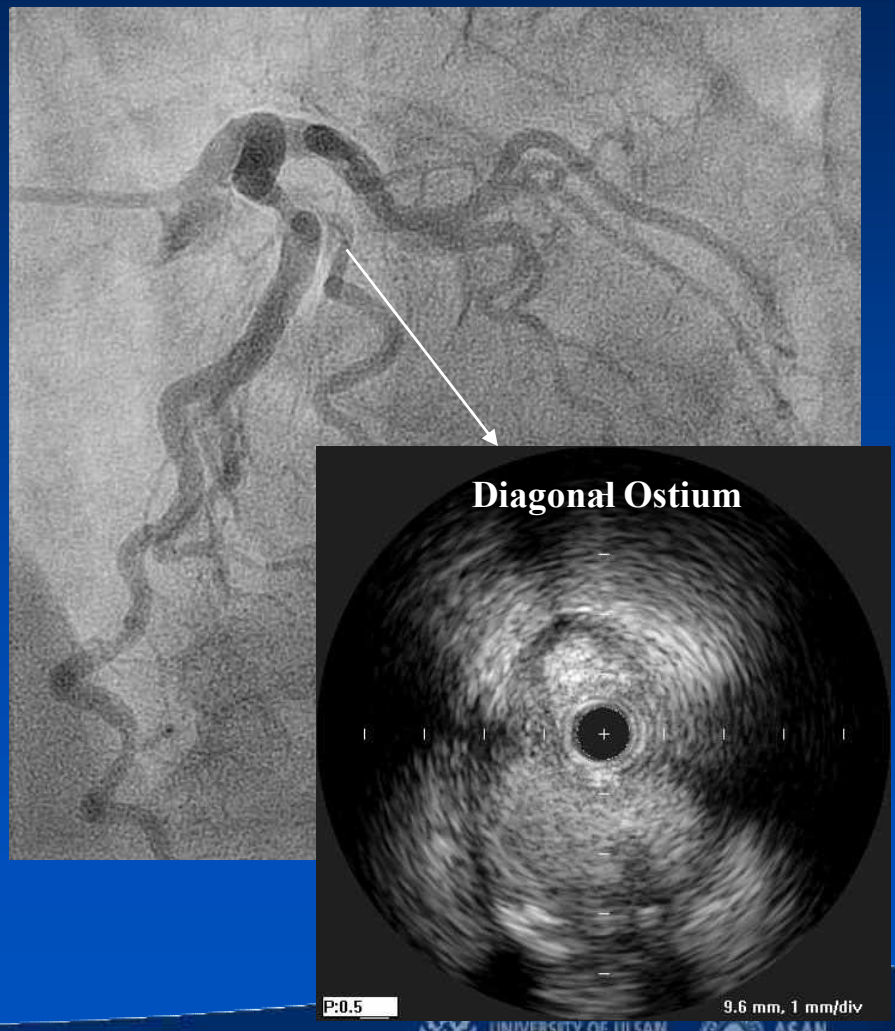




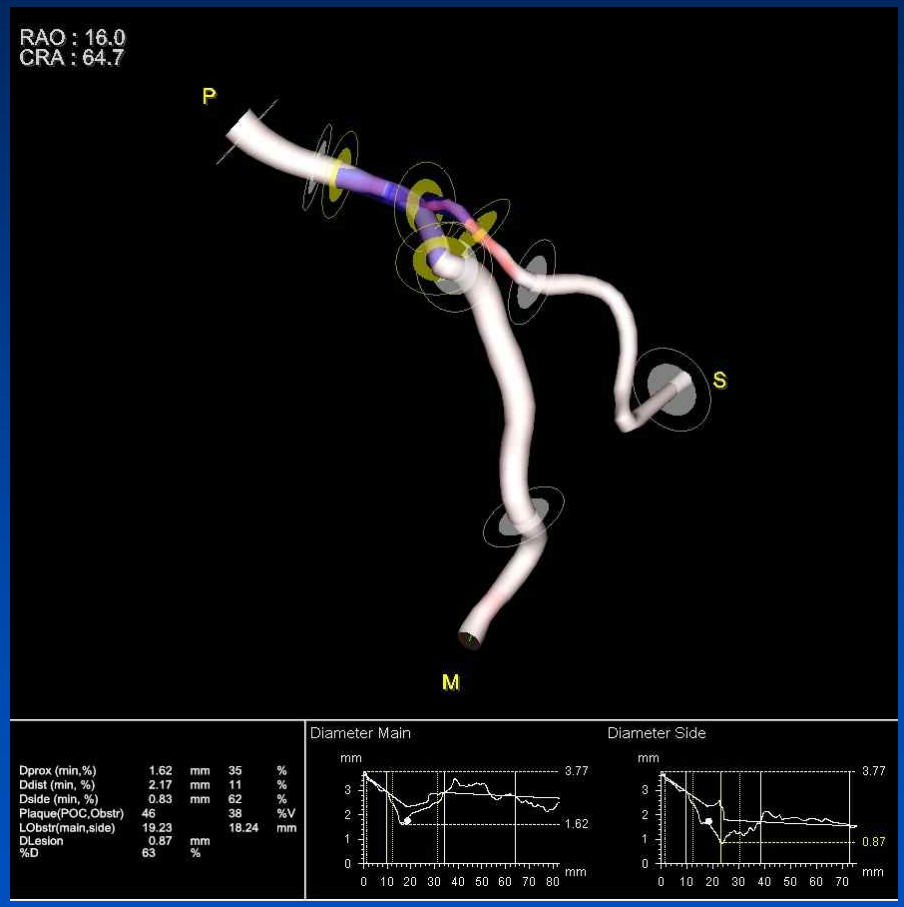
- Negative remodeling in short SB stenosis was very often.
- Both plaque and carina shifts contributed to the SB compromise.
- The FFR at SB after stenting was > 0.8 in more than 90%.
- Provisional SB stenting was performed in < 5% of patients.

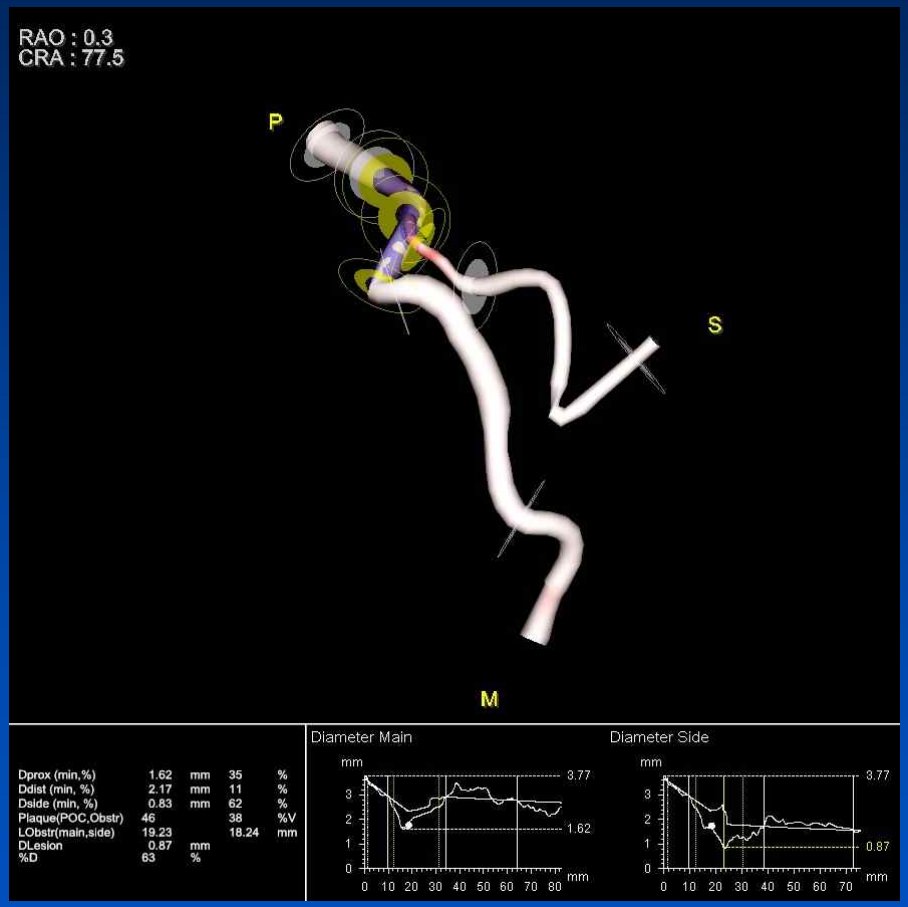


Randomized to Provisional Stenting
in the PERFECT trial

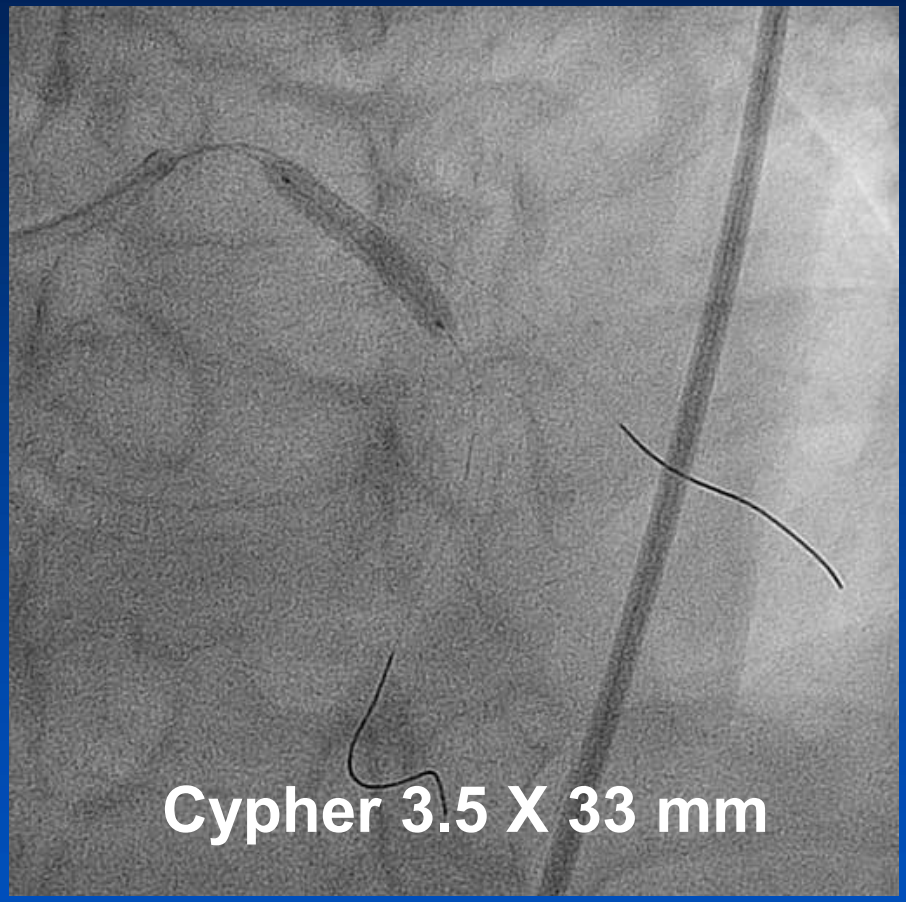


3-D Morphology



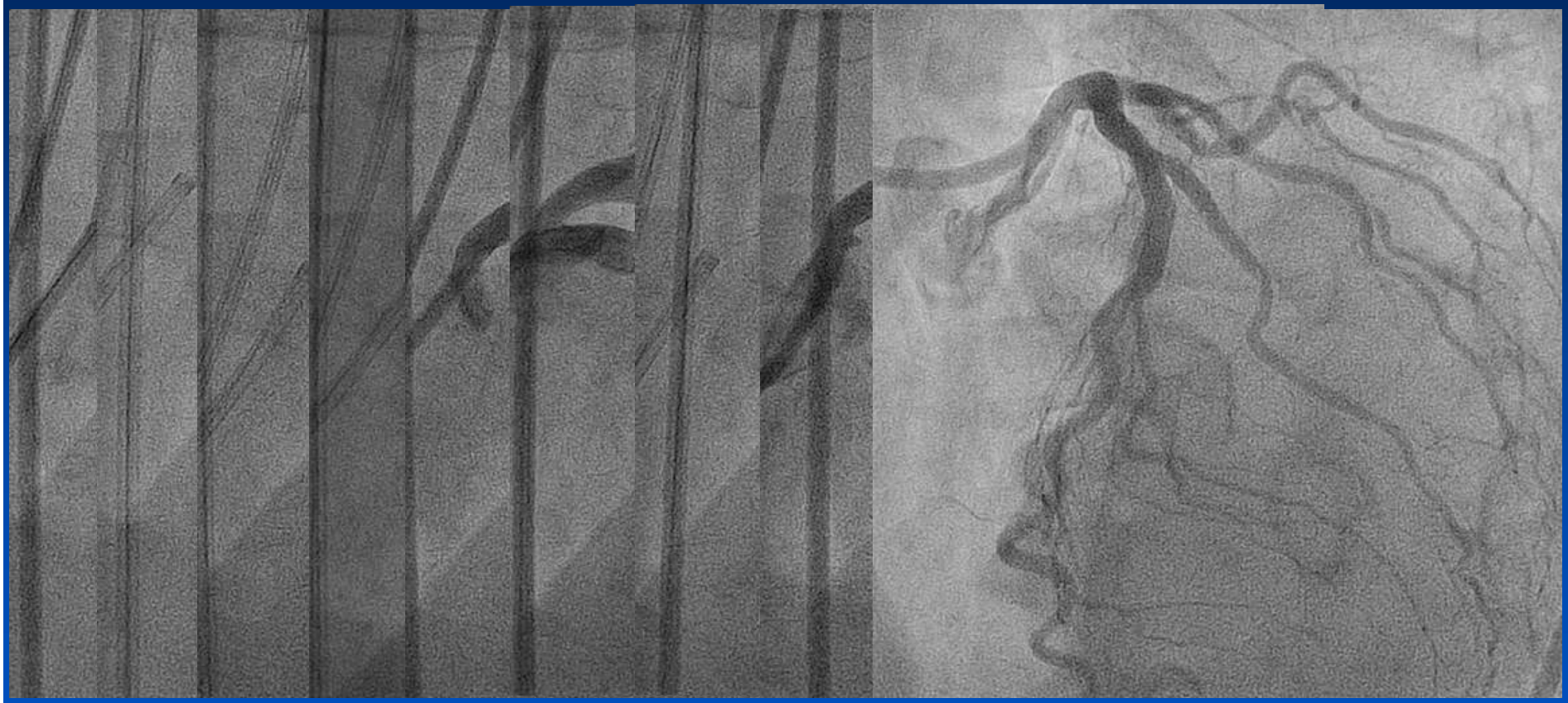


Stenting in the Main Branch



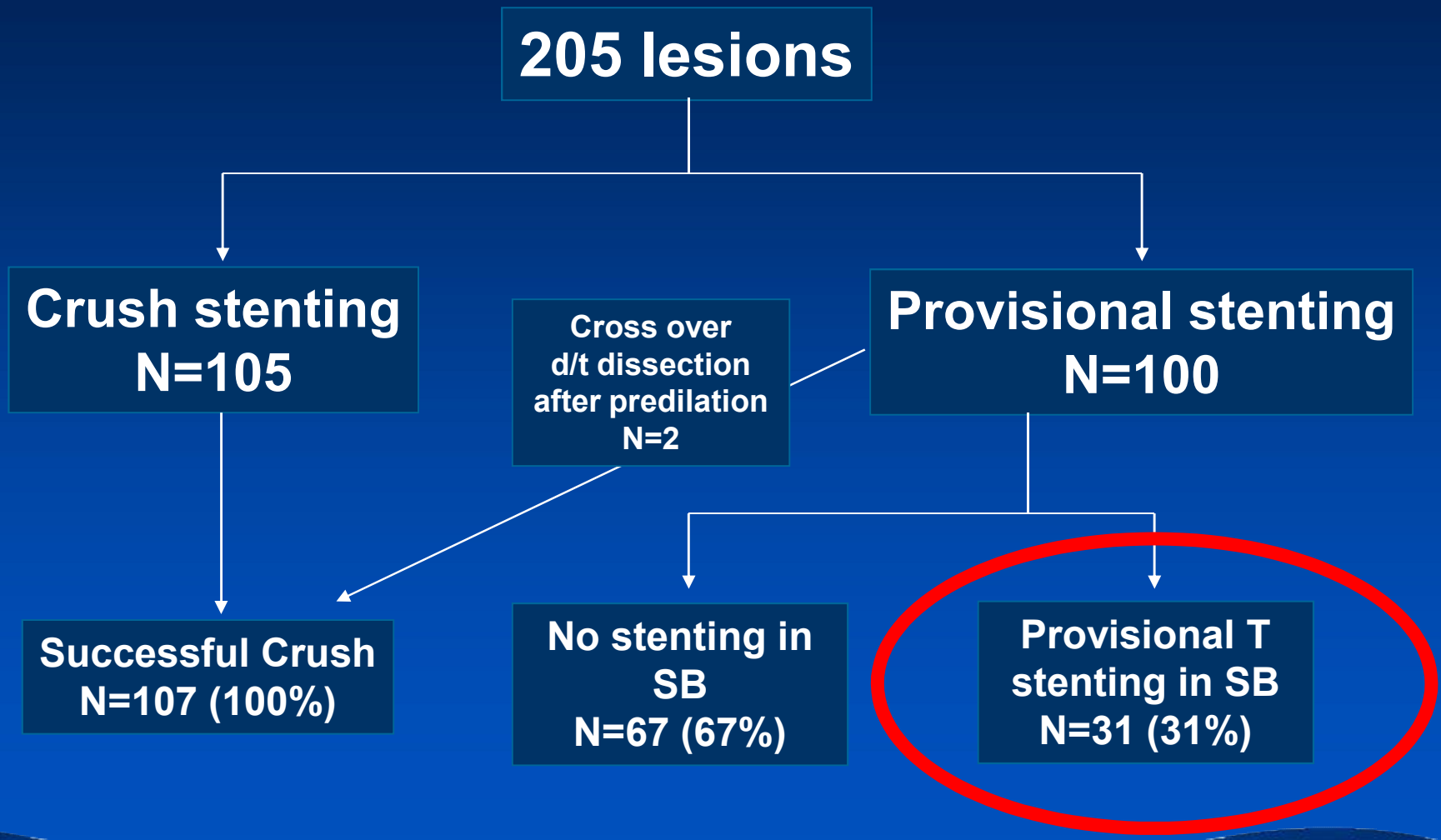
The procedure was getting worse…

Difficult Wiring and TAP
(Minimal Protrusion of SB stent with T-technique)

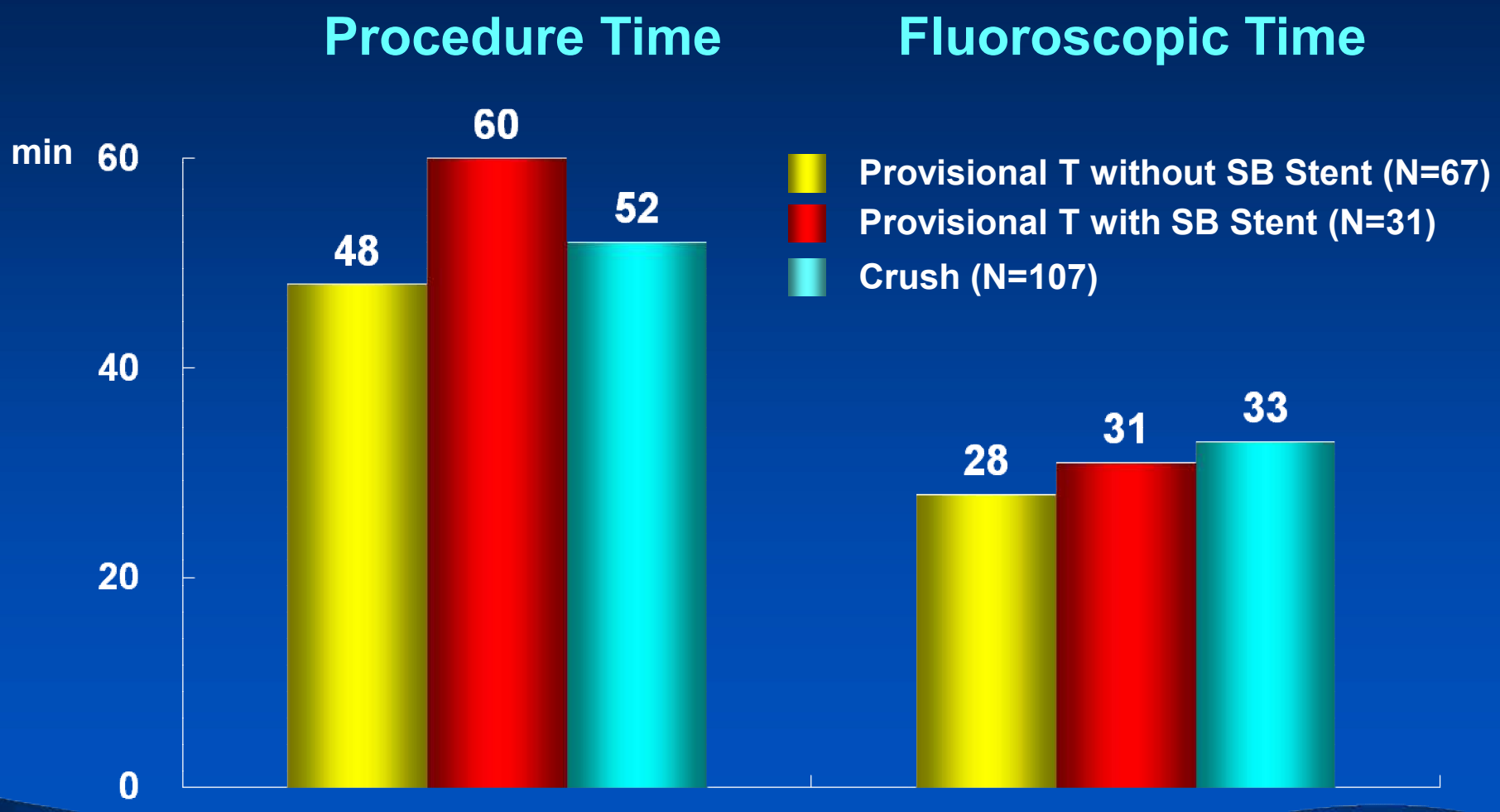


PERFECT Cases in AMC

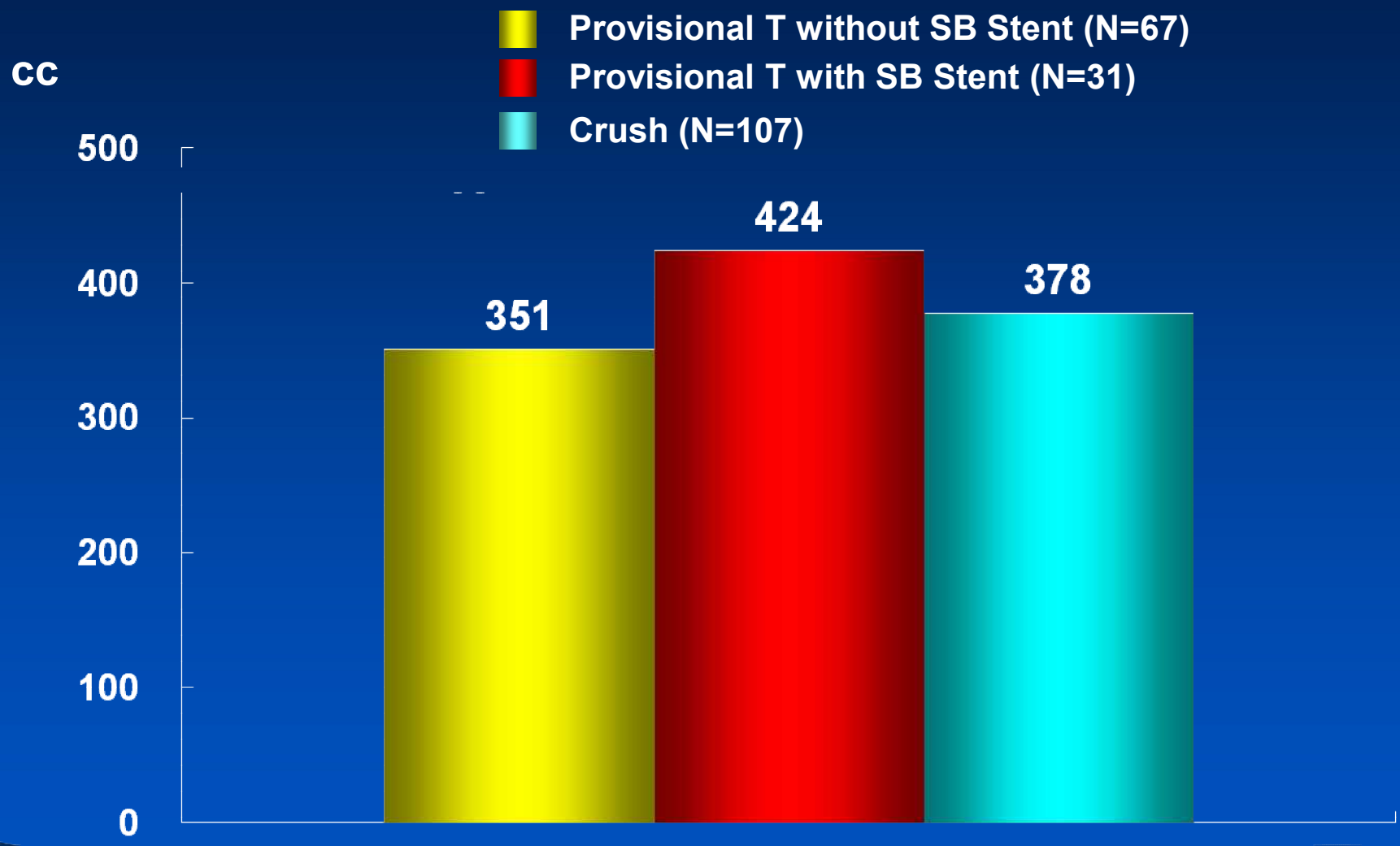
(April 2010)



Procedure Time

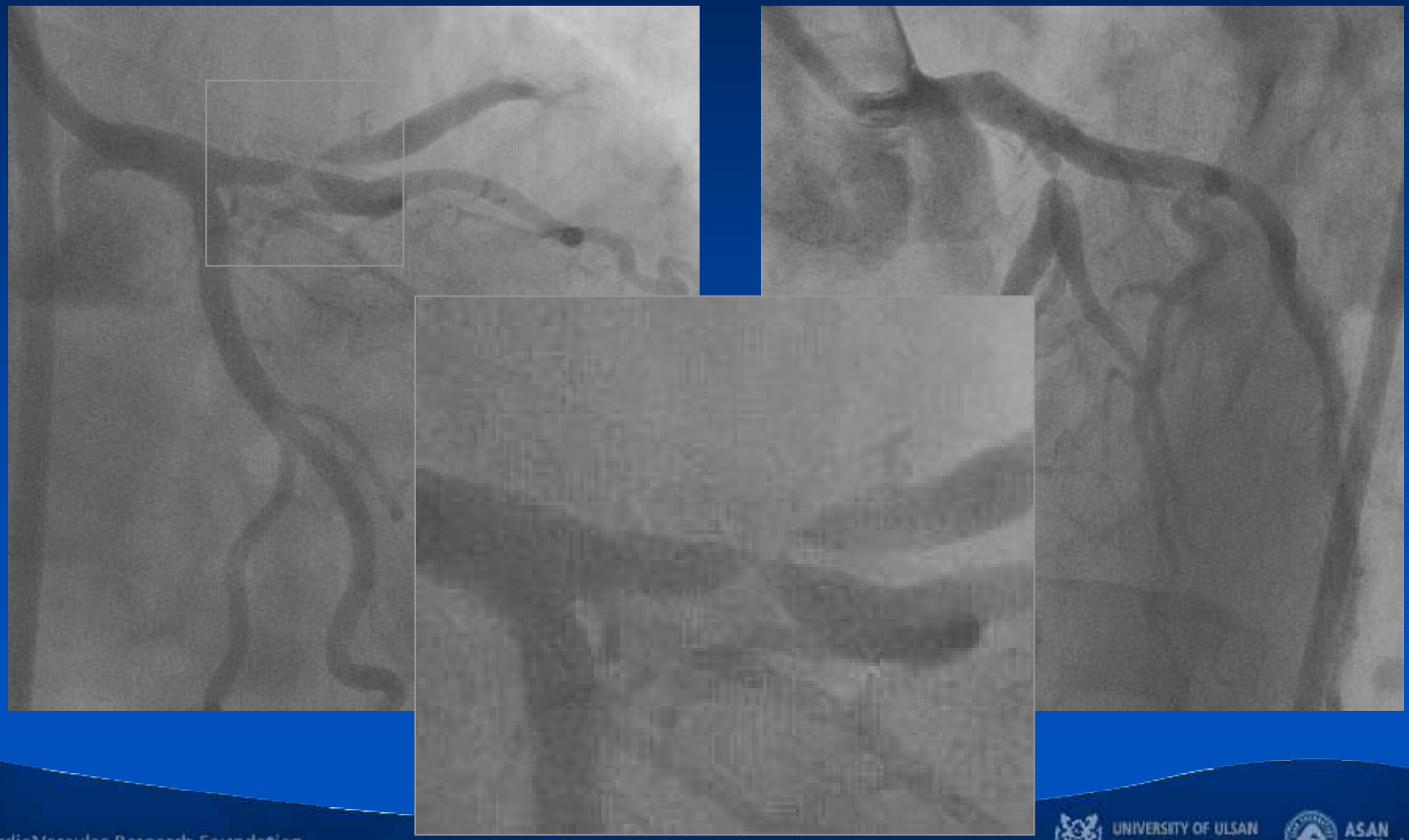


Amount of Contrast Agent

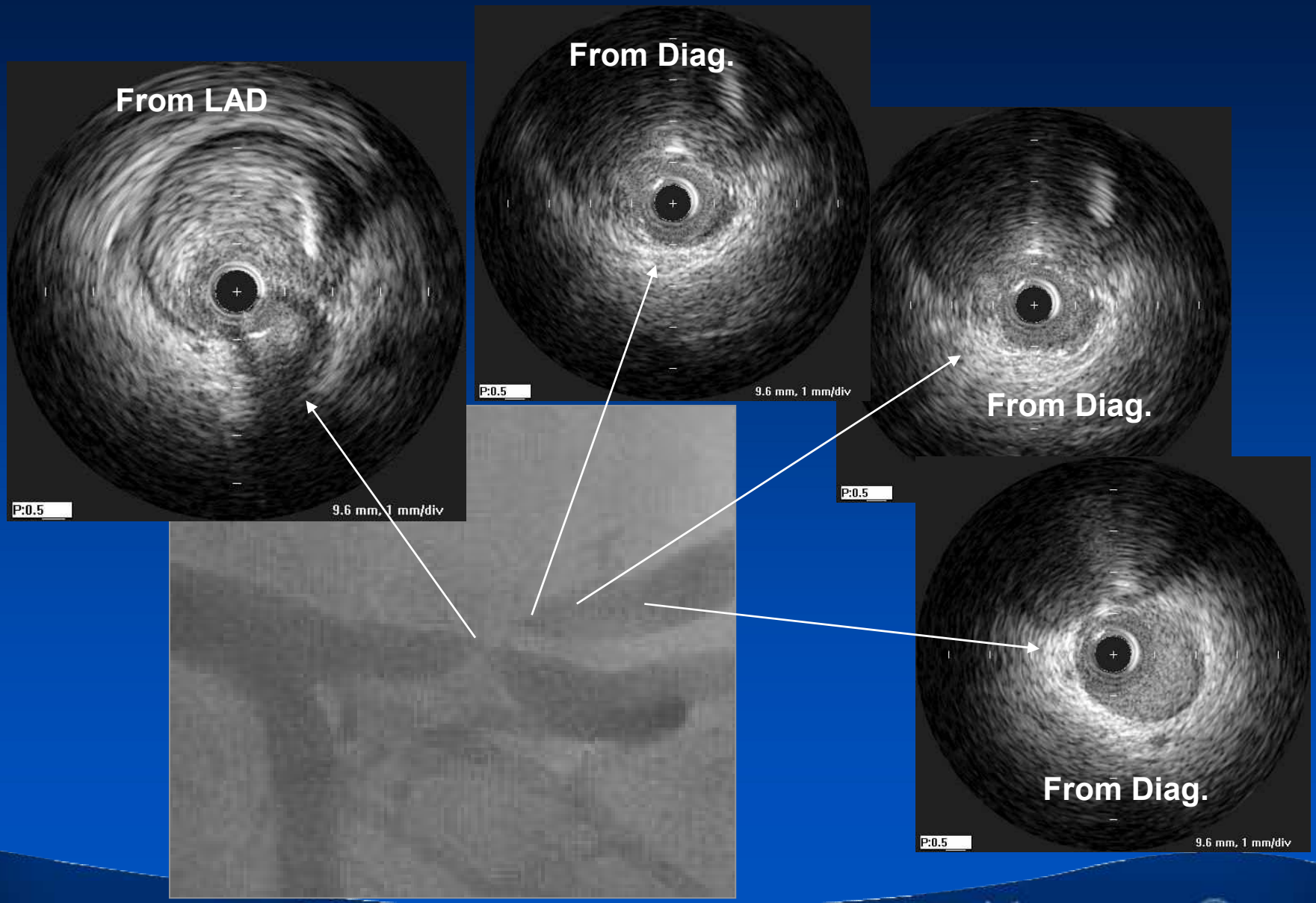


Importance of IVUS-guided Procedure

Randomized to Provisional Stenting in the PERFECT trial



IVUS for Both Branches



Single-Stent with Final Kissing

From CROSS and PERFECT

We hope to reveal that a careful anatomical & functional evaluation provide very useful information improving the outcomes of PCI with DES for bifurcation coronary lesions.