

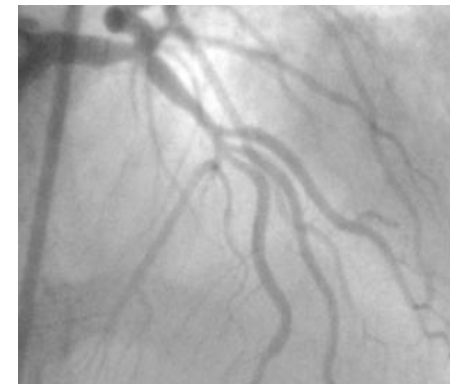
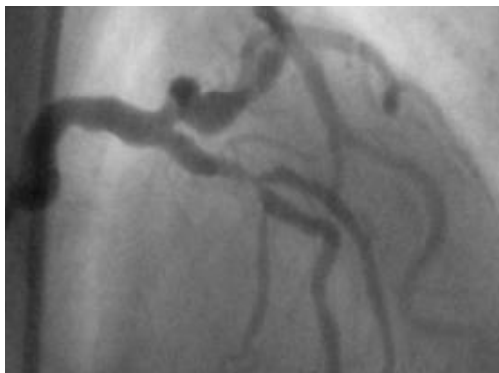
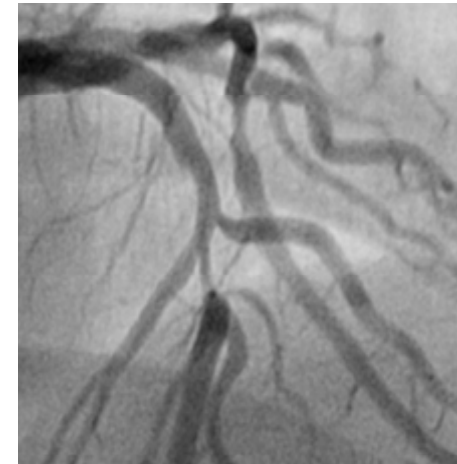
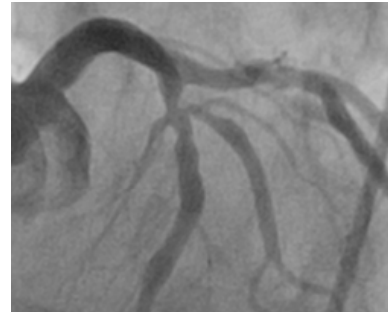
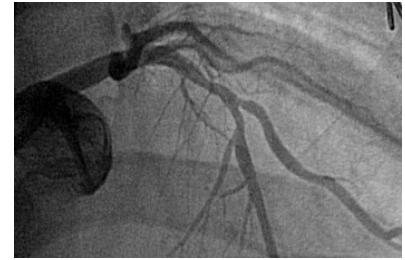
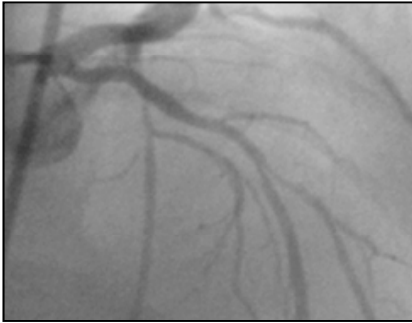
Morphologic vs. Functional Assessment for Bifurcation Lesion

Bon-Kwon Koo, MD, PhD, FACC

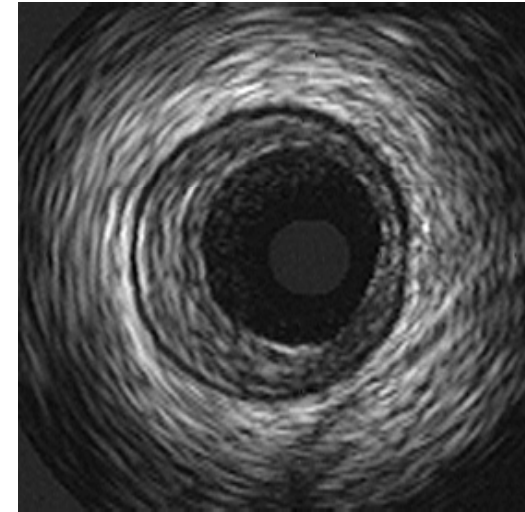
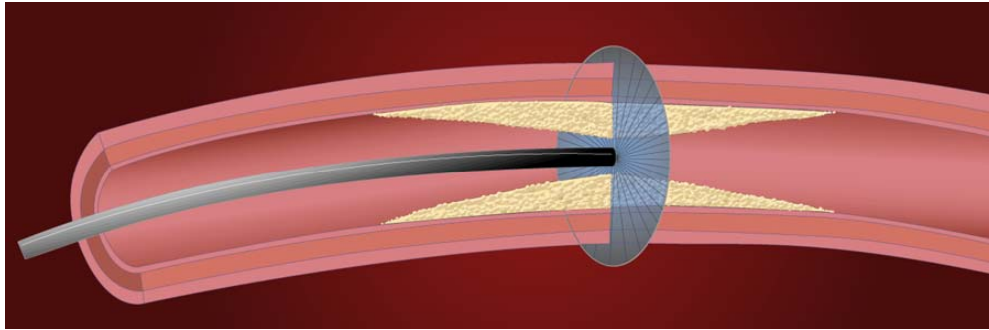


Seoul National University Hospital, Seoul, Korea

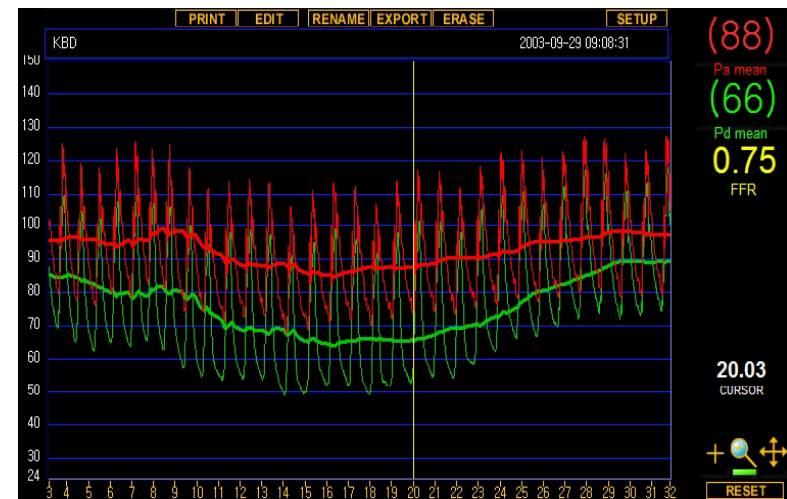
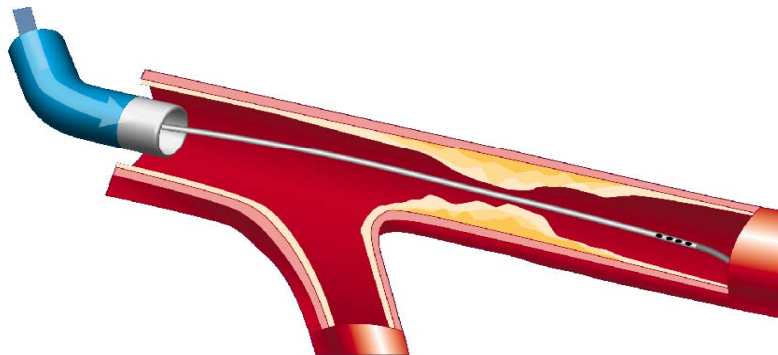
Bifurcations are complex!



Best of morphological assessment



Best of functional assessment

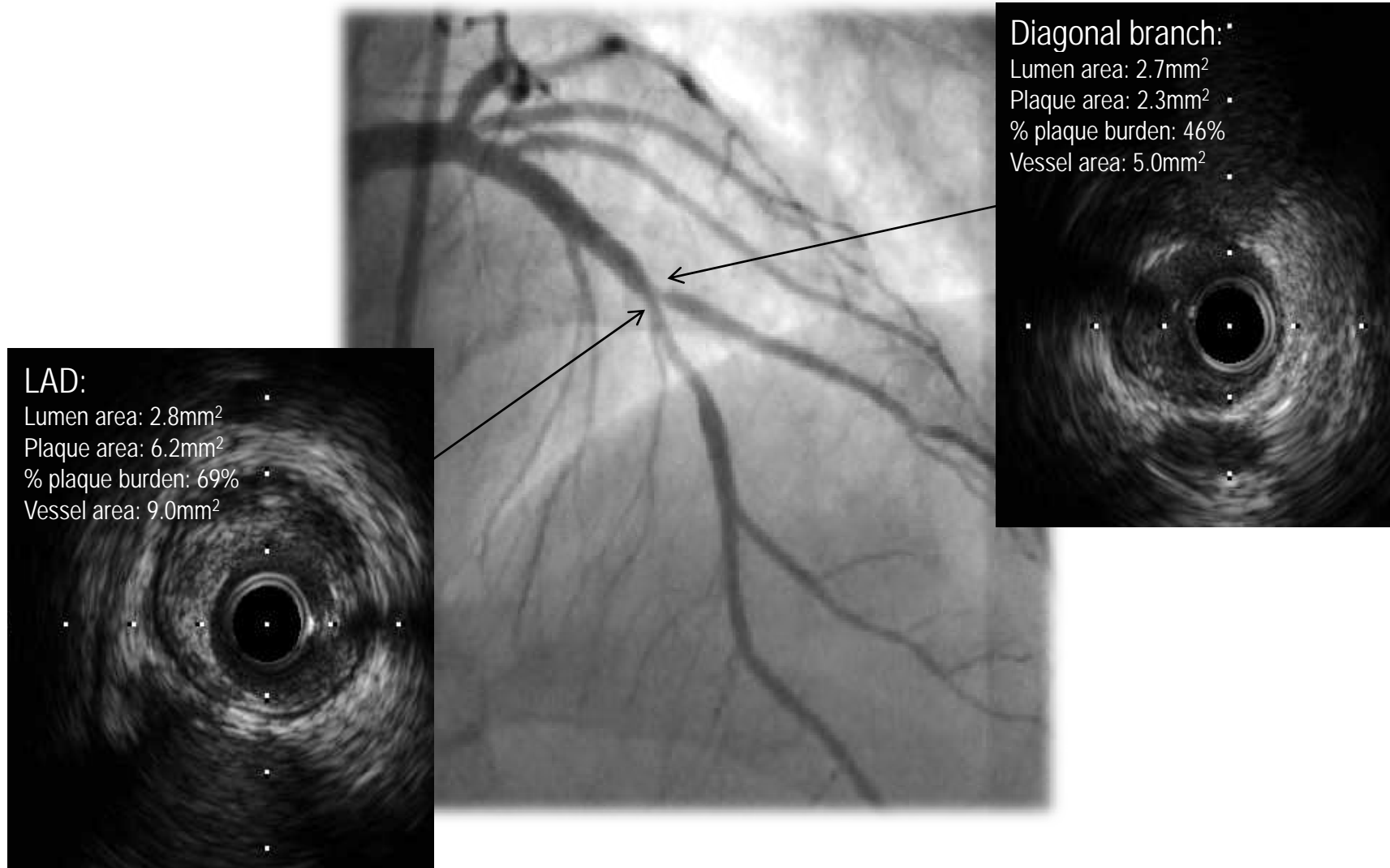


Morphologic vs. Functional Assessment for Bifurcation Lesion

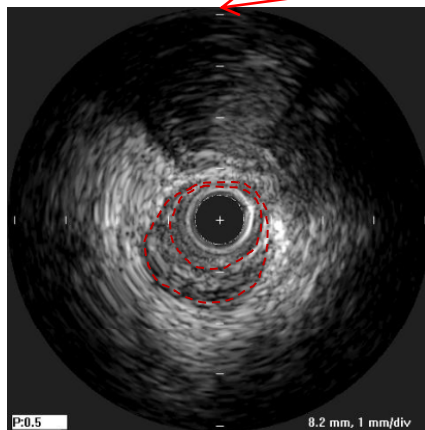
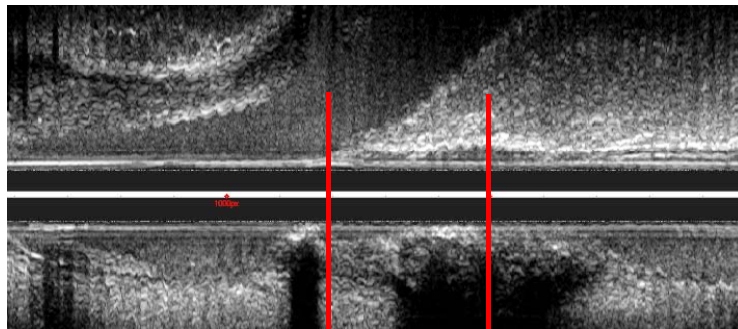
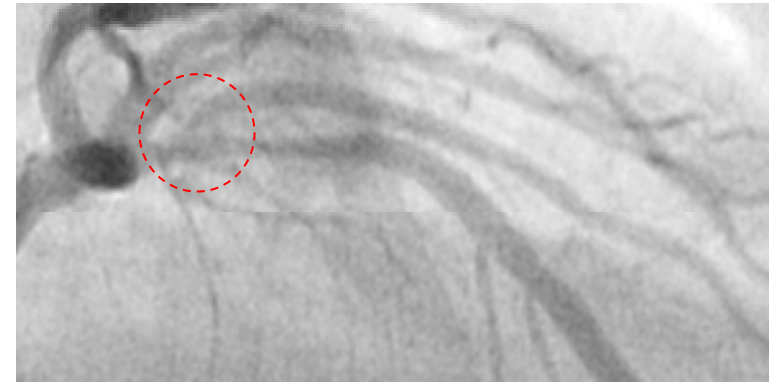
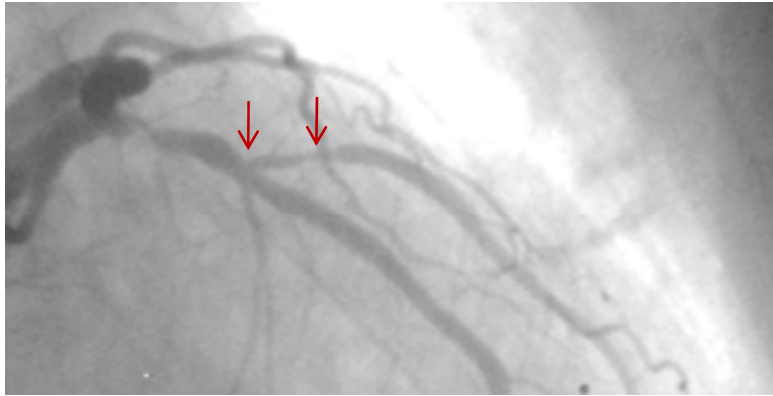
- Pre-intervention
- After main branch stent implantation
- After side branch balloon angioplasty
- After side branch stenting



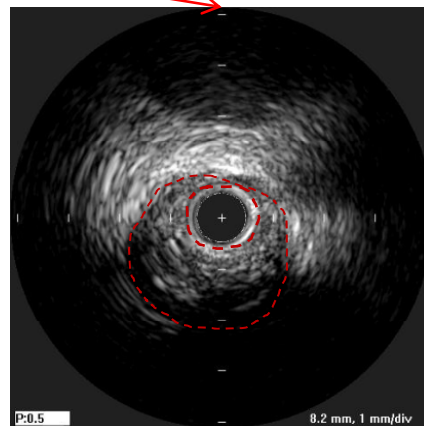
Precise anatomical assessment



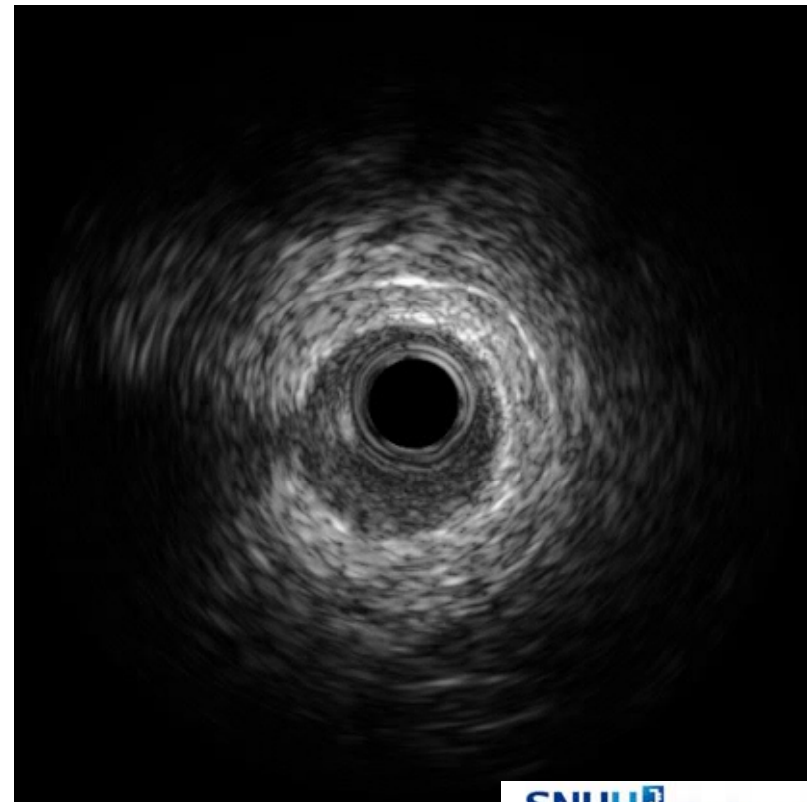
Mechanism of side branch stenosis



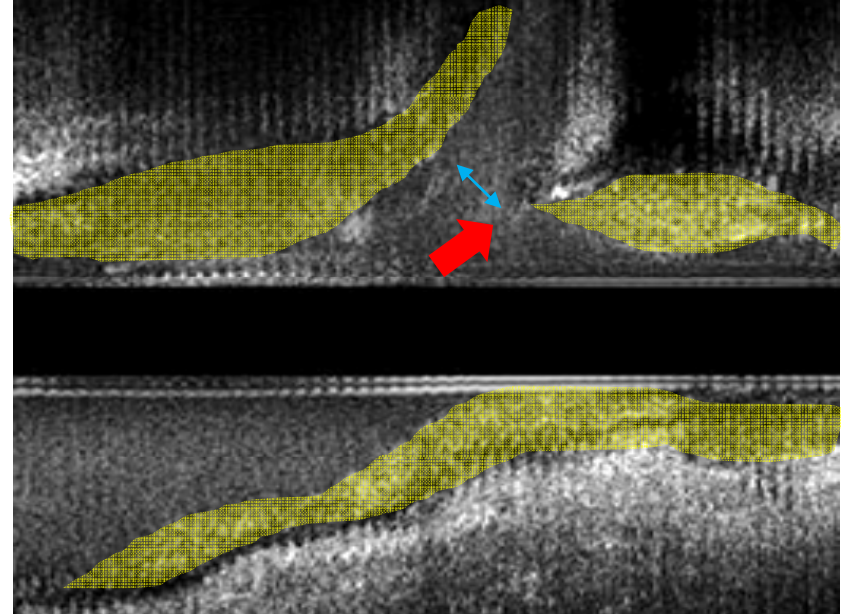
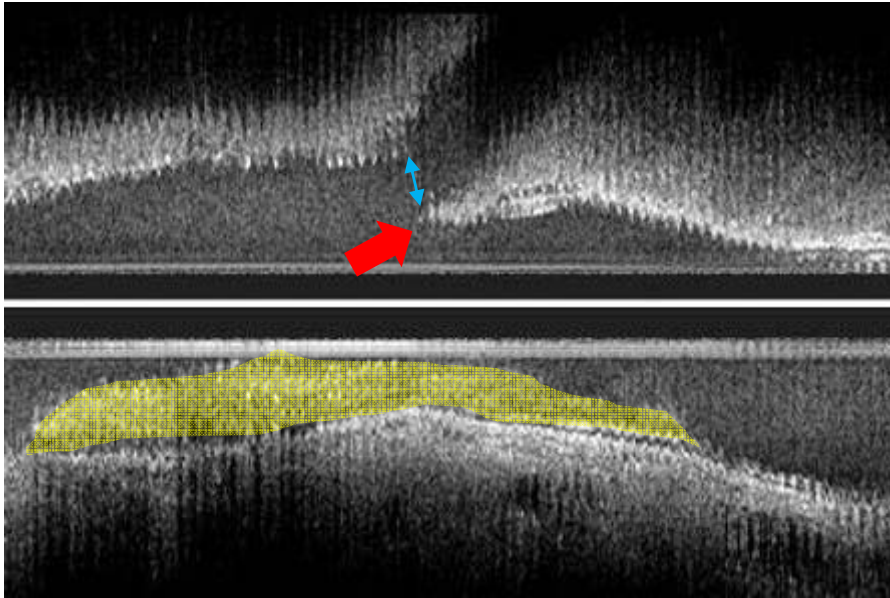
Plaque + Negative remodeling



Plaque

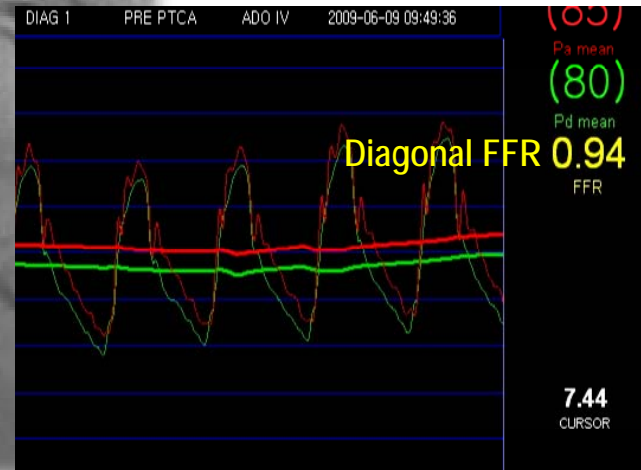
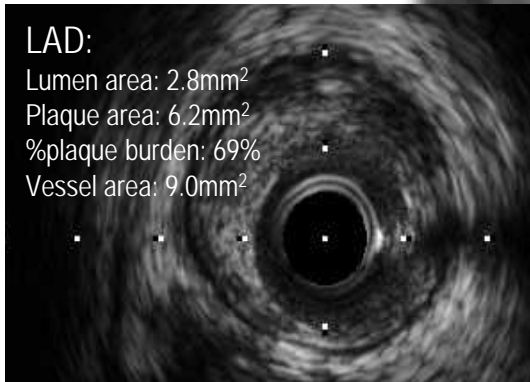
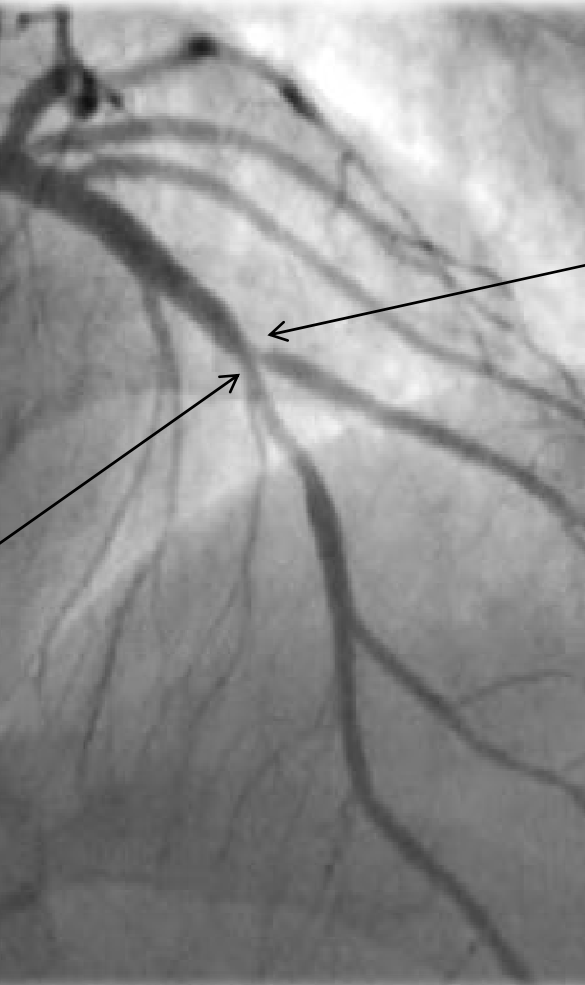


Important of longitudinal view

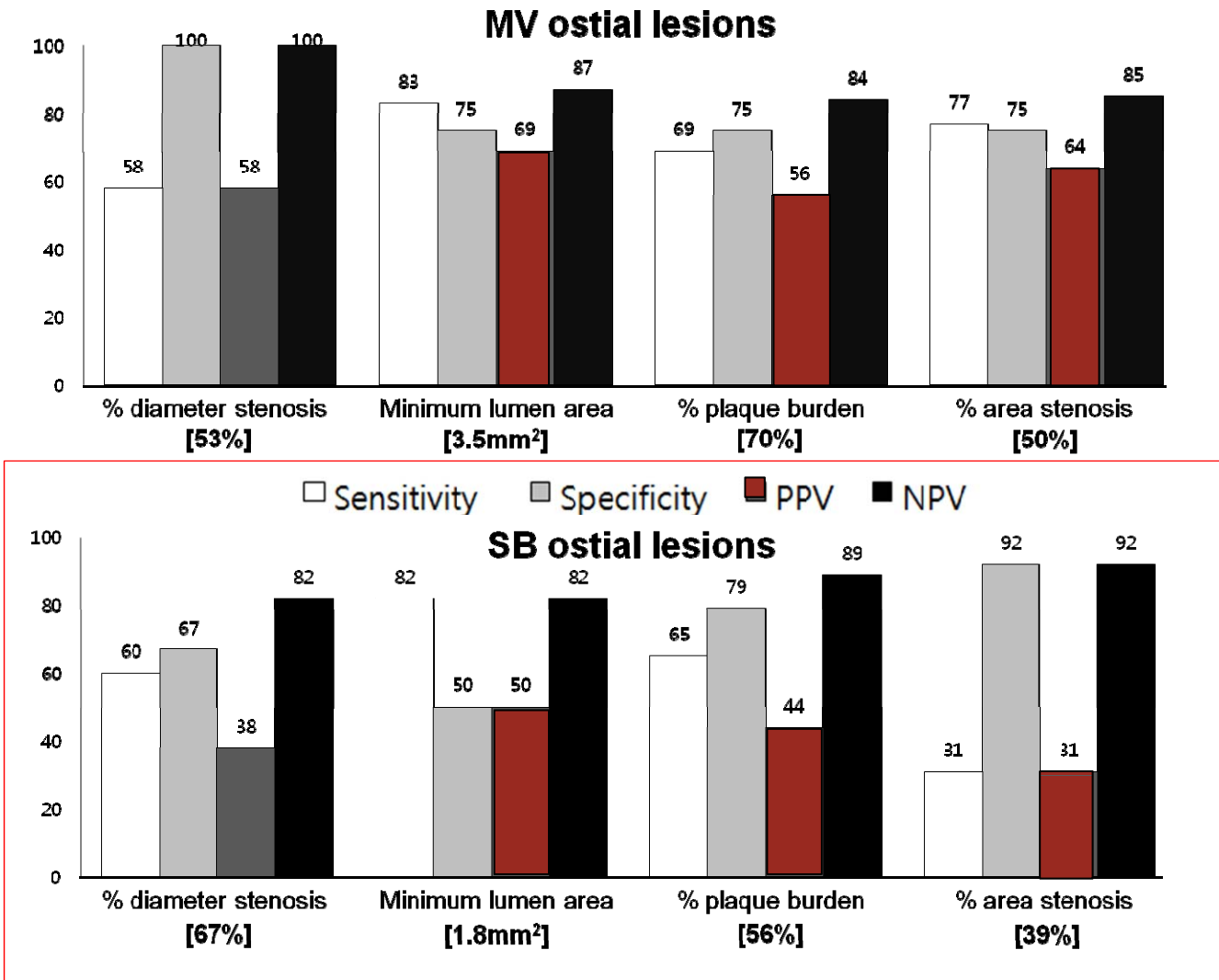


- Bifurcation geometry
- Amount, character and distribution of plaque
- Location, length of carina
- Distance between carina and outer lumen of a side branch

Precise anatomical (=functional) assessment?



Diagnostic accuracy of IVUS parameters in pure ostial lesions



Morphologic vs. Functional Assessment for Bifurcation Lesion

- Pre-intervention
 - IVUS can provide detailed anatomical information which is very helpful to plan the intervention strategy
 - Longitudinal view is important to predict the mechanism and degree of side branch jailing after main branch stent implantation.
 - IVUS parameters have low positive predictive values to predict the presence of myocardial ischemia.

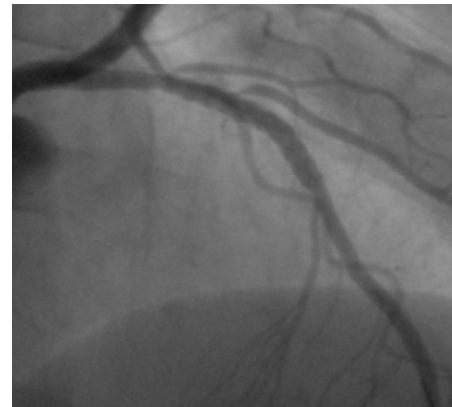
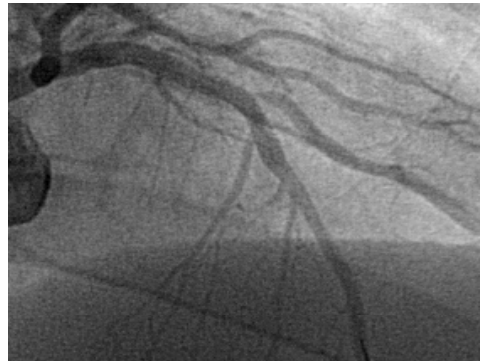
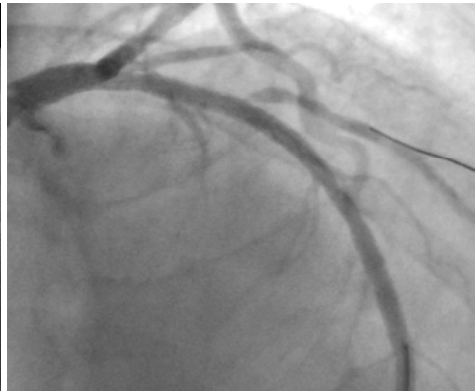


Morphologic vs. Functional Assessment for Bifurcation Lesion

- Pre-intervention
- After main branch stent implantation
- After side branch balloon angioplasty
- After side branch stenting



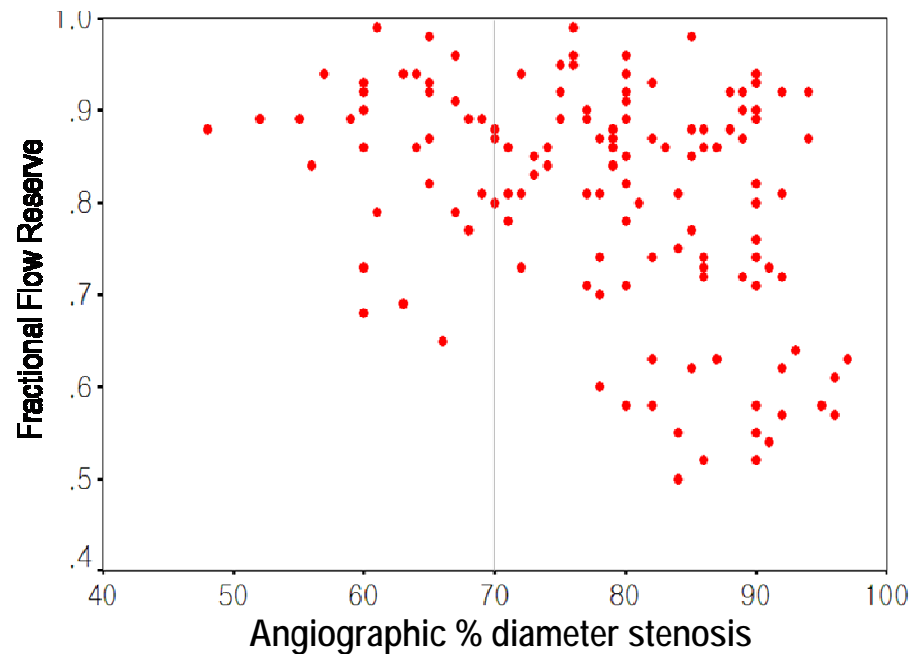
How can these jailed side branches be assessed?



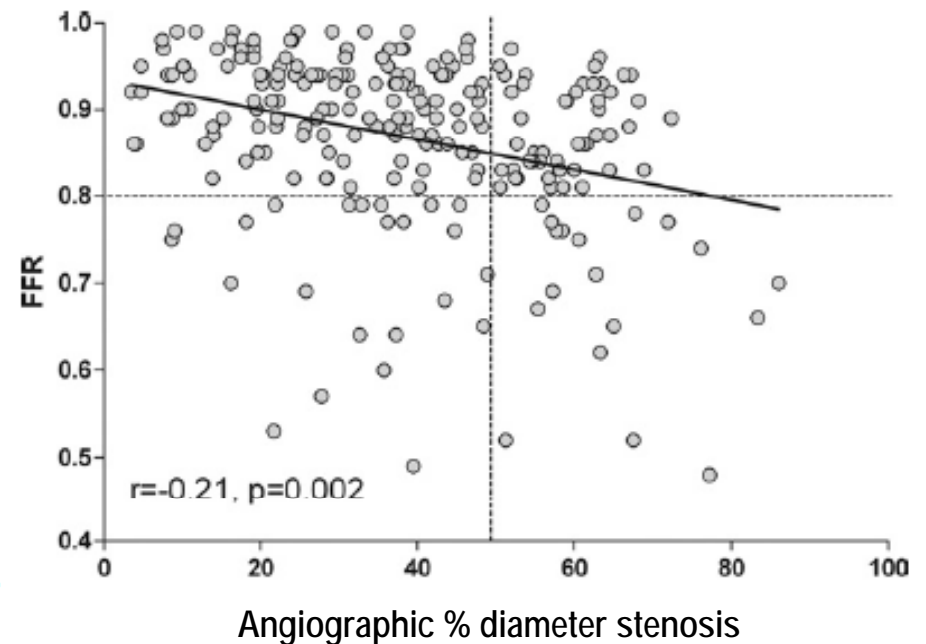
Does stenosis of a side branch ostium matter?

Angiographic inaccuracy to predict the presence of myocardial ischemia

FFR vs. % diameter stenosis in jailed side branches

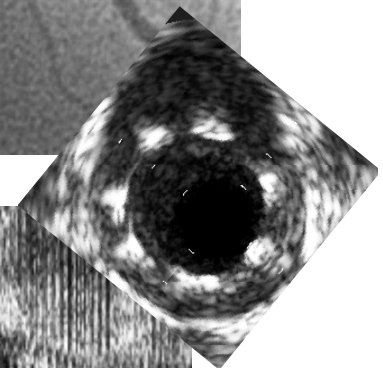
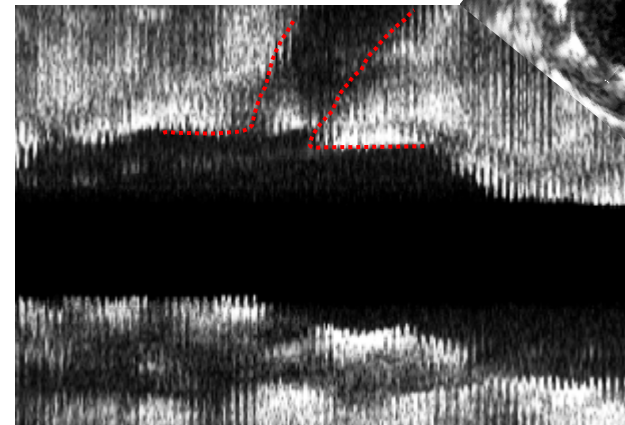
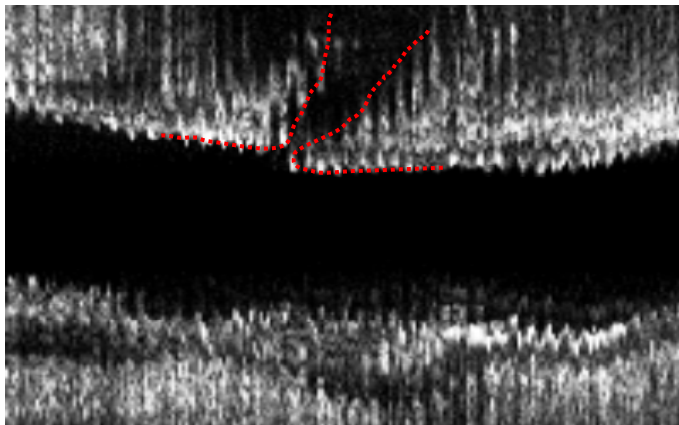
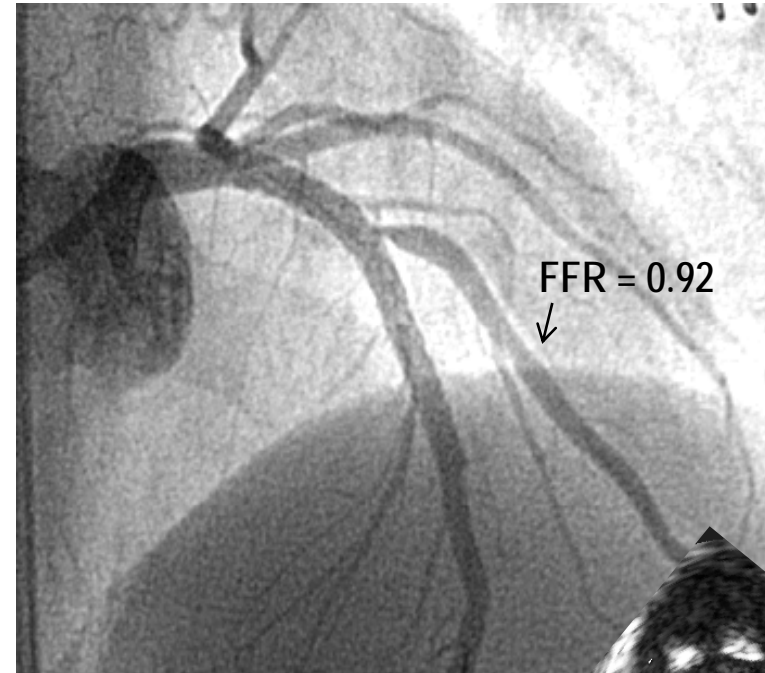
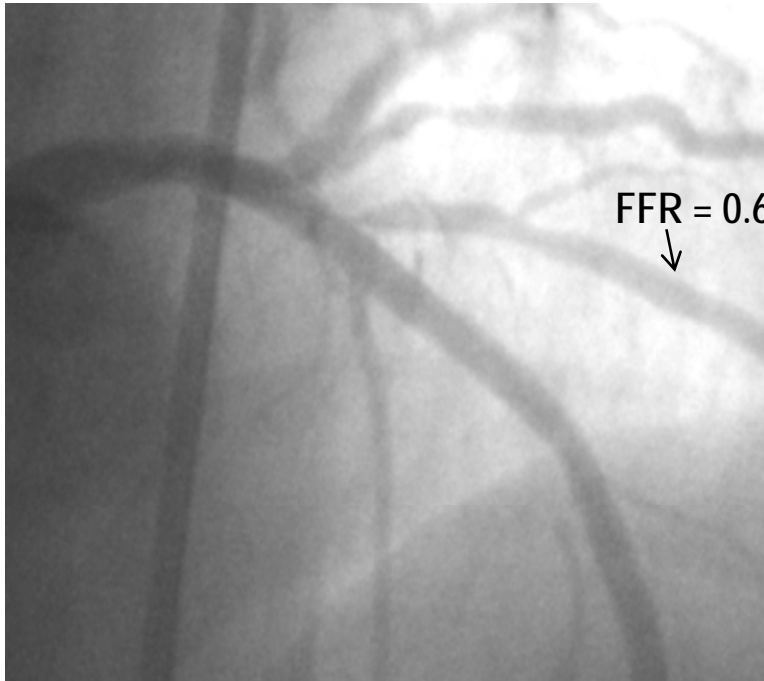


Koo BK, et al JACC 2005, EHJ 2008, Circulation CVI 2010

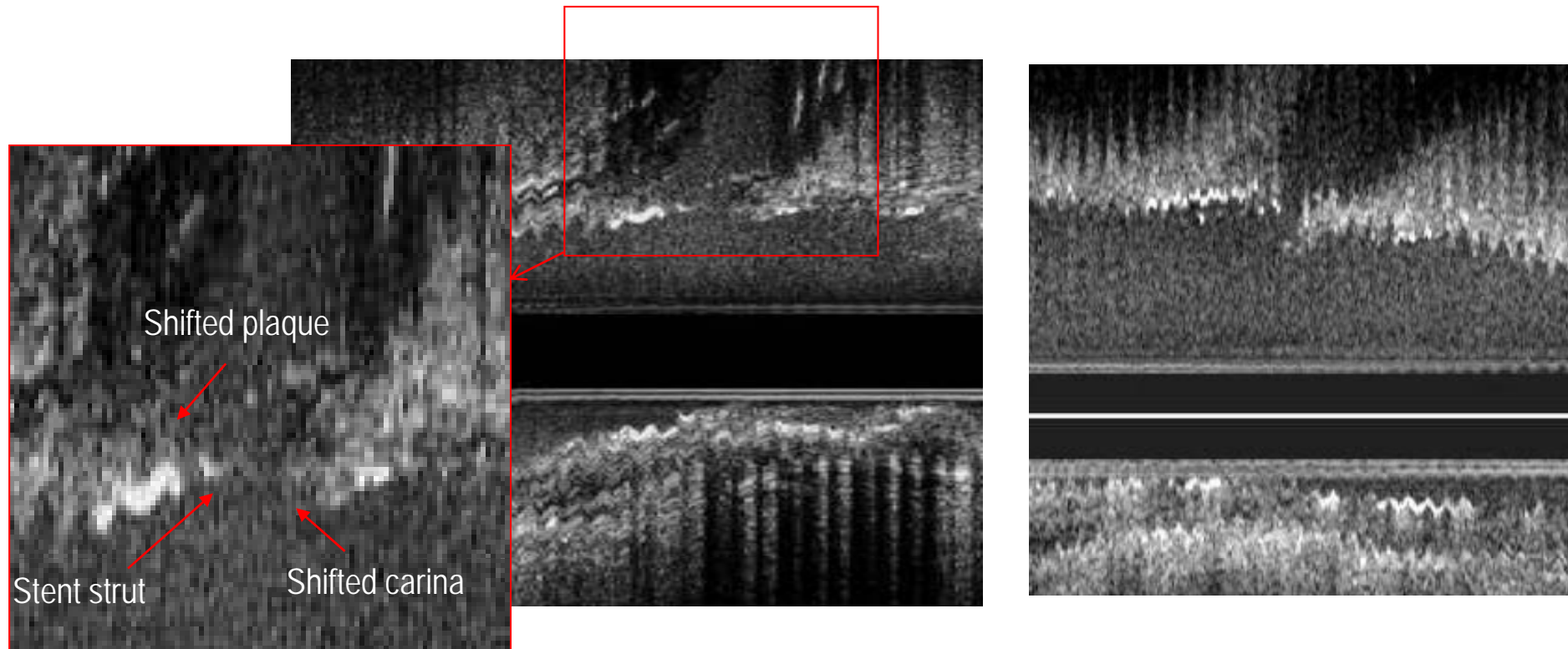


Ahn JM, et al. JACC intv 2012

True vs. Pseudo-stenosis

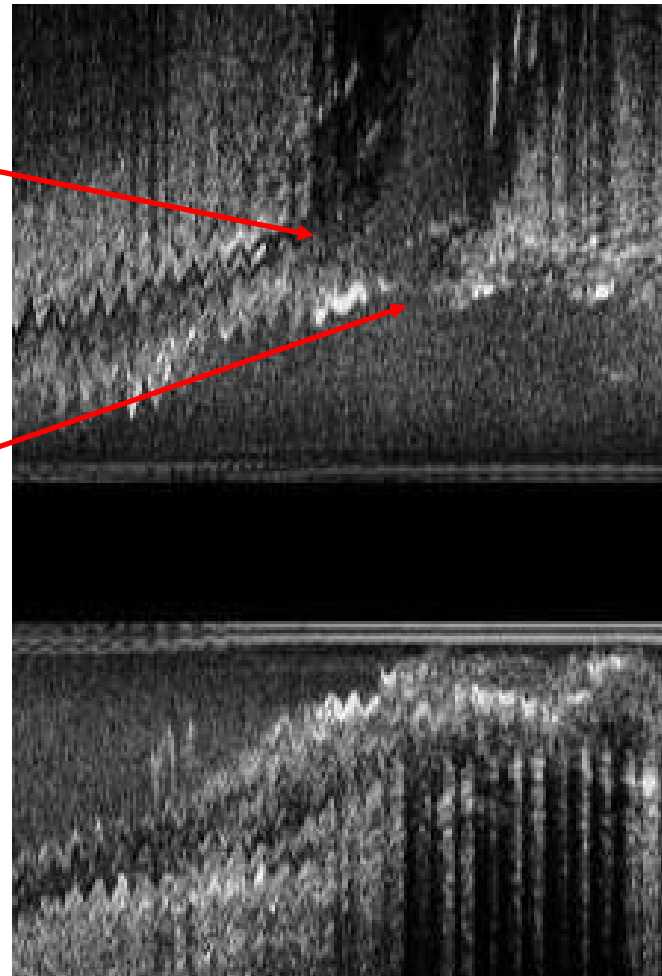


Complexity of SB jailing: Plaque, Carina, Stent.....

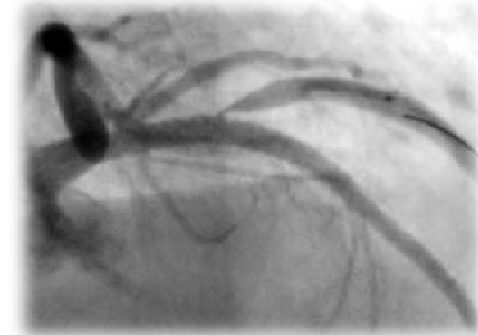


Different target, different strategy

- **Target: SB plaque**
 - Large balloon, high pressure
 - More injury, more dissection
 - Higher chance of SB stenting
 - More late loss
- **Target: Shifted carina**
 - Relatively small balloon, low pressure
 - Less injury, less dissection
 - Less chance of SB stenting
 - Less late loss



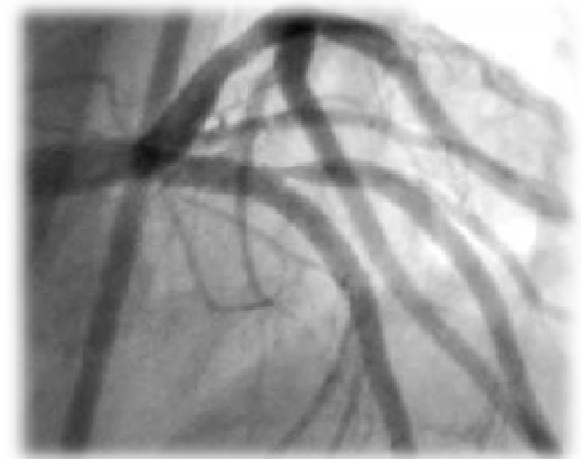
Morphologic vs. Functional Assessment for Bifurcation Lesion



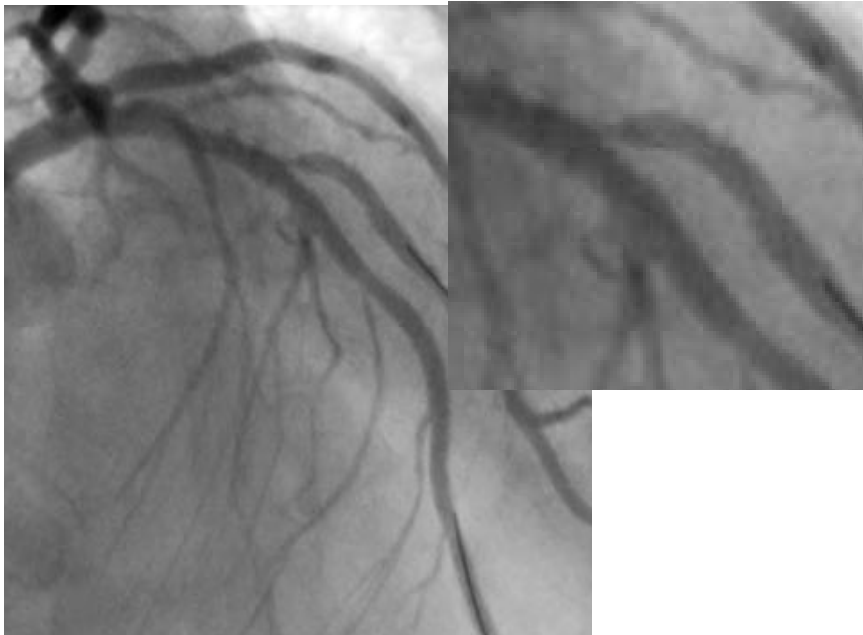
- After main branch stent implantation
 - IVUS for jailed side branches is generally not recommended.
 - The pressure wire should not be jailed by a stent.
 - Main branch IVUS is helpful to define the mechanism of side branch jailing and to plan the treatment strategy.

Morphologic vs. Functional Assessment for Bifurcation Lesion

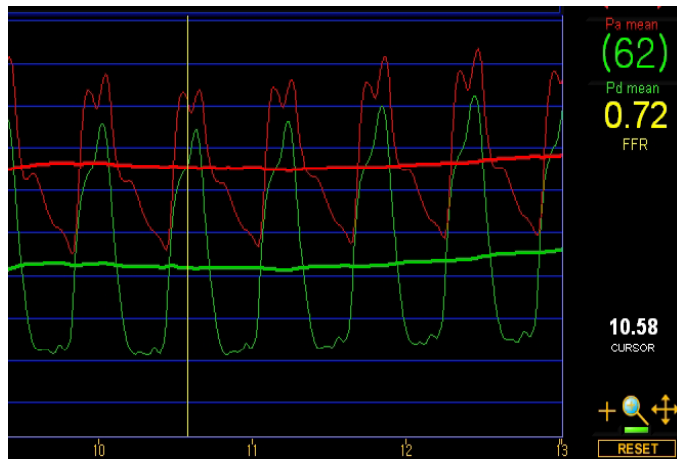
- Pre-intervention
- After main branch stent implantation
- After side branch balloon angioplasty
- After side branch stenting



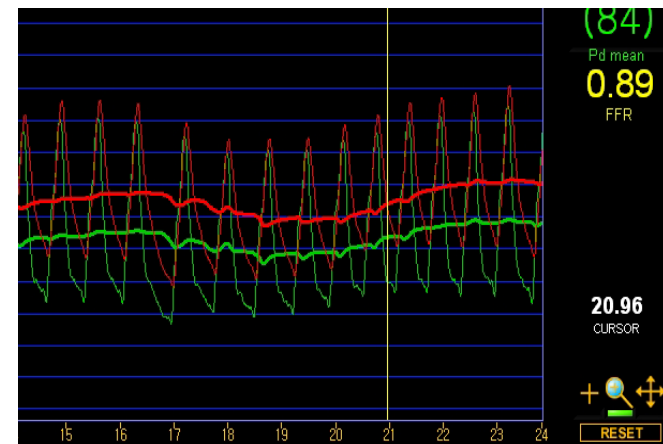
Angiographic vs. FFR changes during PCI



After MB stenting

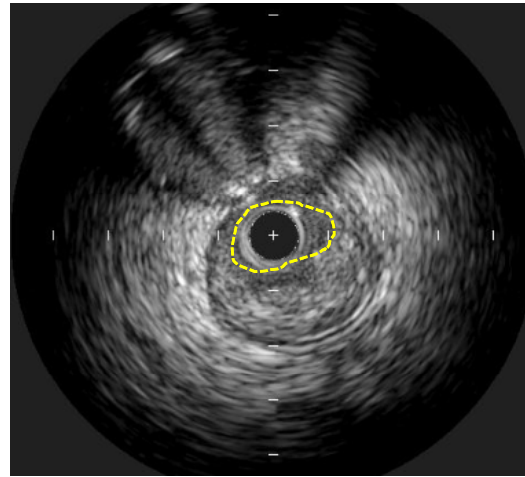
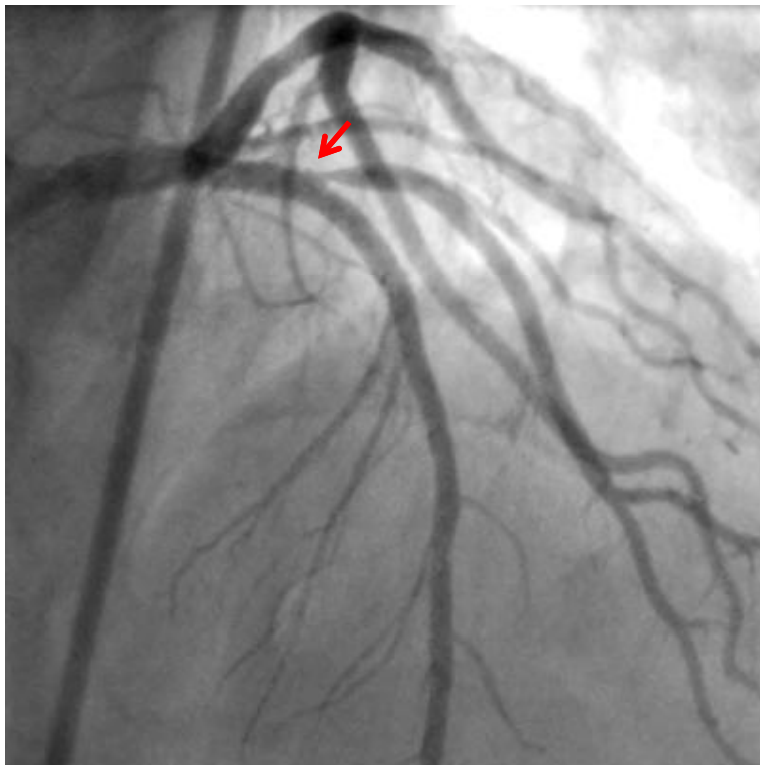


After kissing balloon

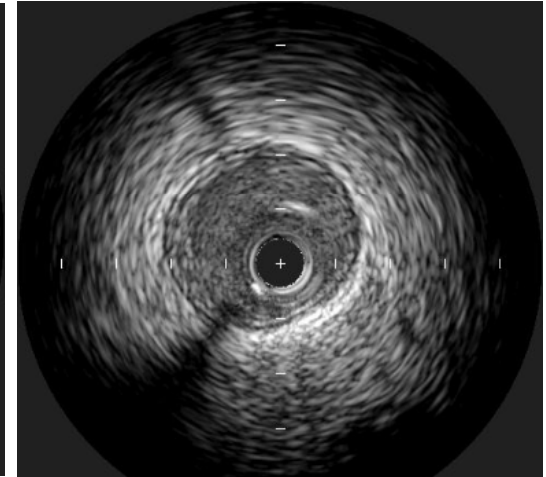


Anatomical severity vs. Functional significance

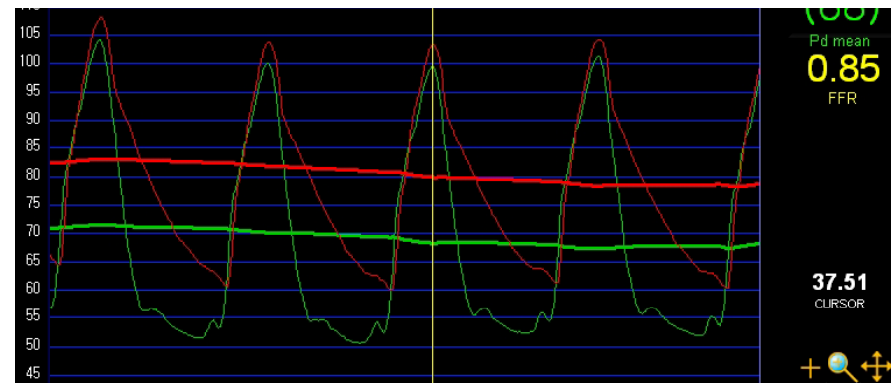
- IVUS vs. FFR in SB ostial lesions -



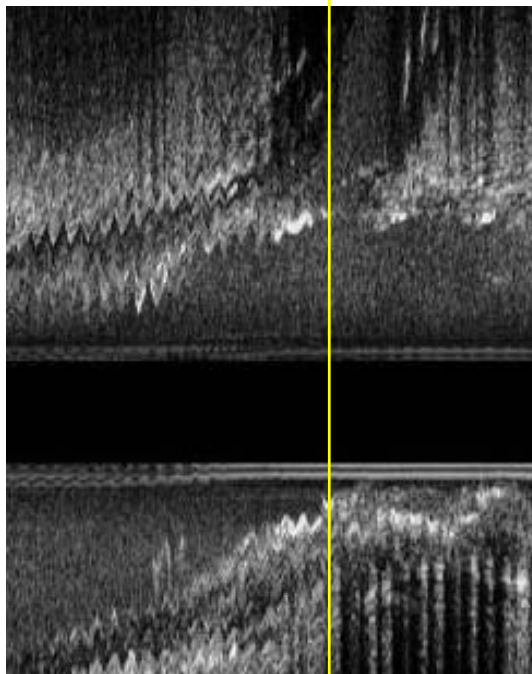
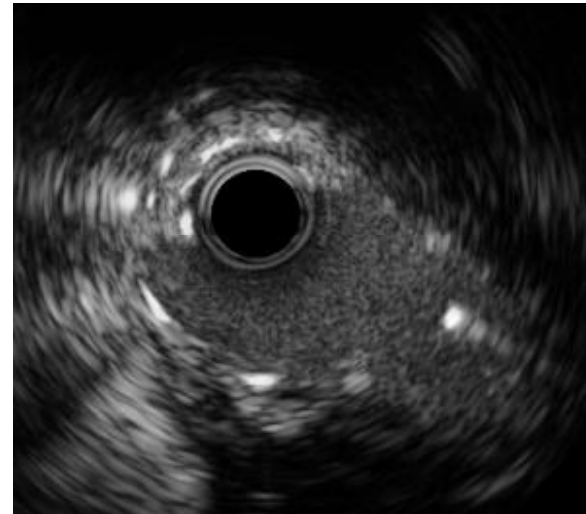
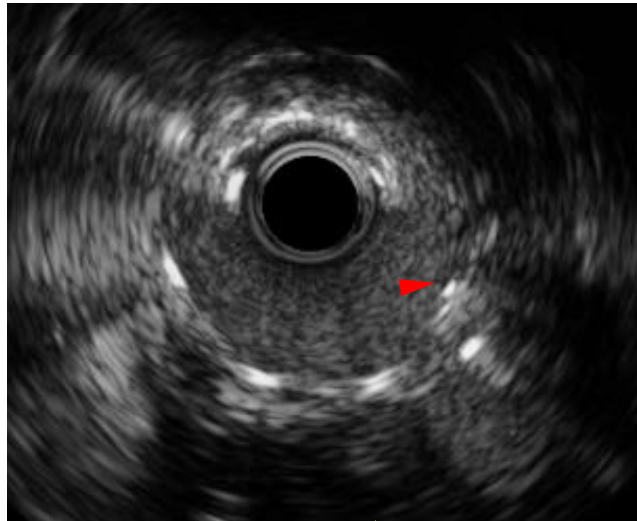
Min Lumen Area: 2.0mm²
MLD: 1.2mm



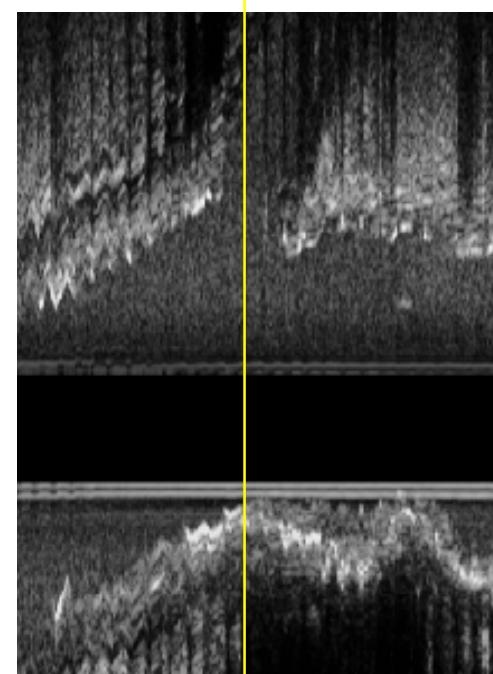
Reference segment



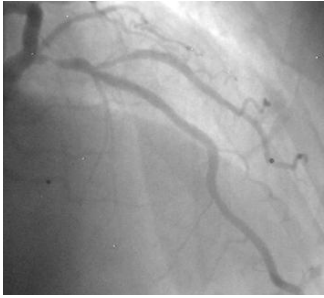
Assessment of procedural results



Before Kissing balloon inflation



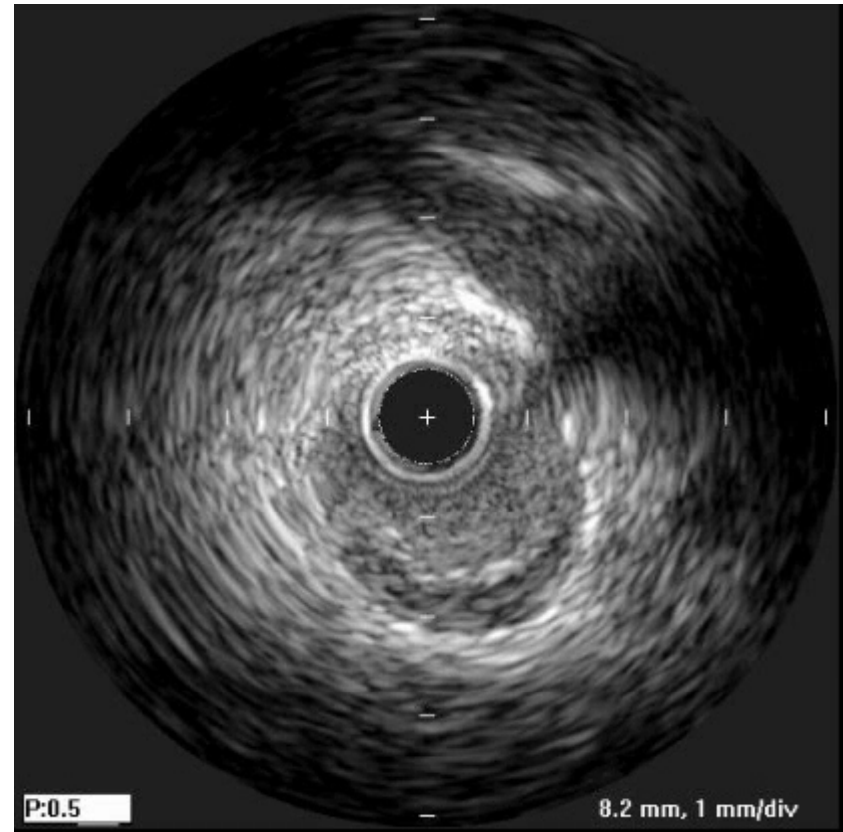
After Kissing balloon inflation



What happened?

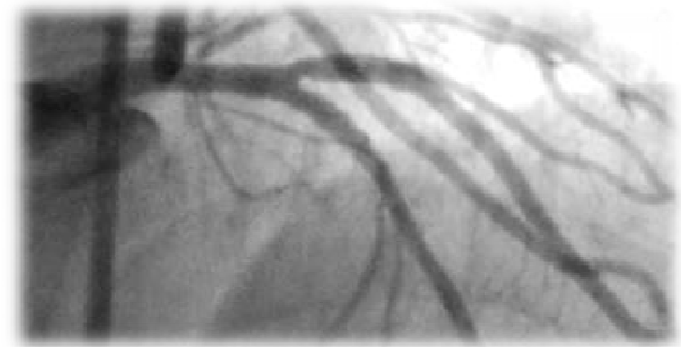


After Kissing balloon inflation

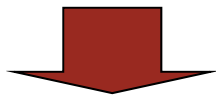


Morphologic vs. Functional Assessment for Bifurcation Lesion

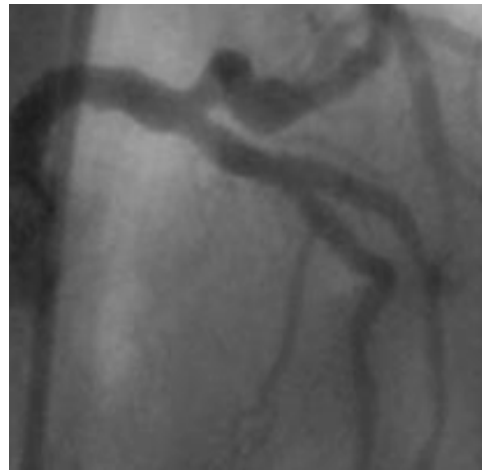
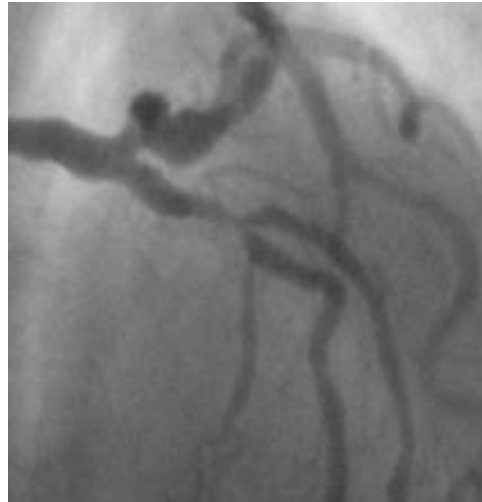
- Pre-intervention
- After main branch stent implantation
- After side branch balloon angioplasty
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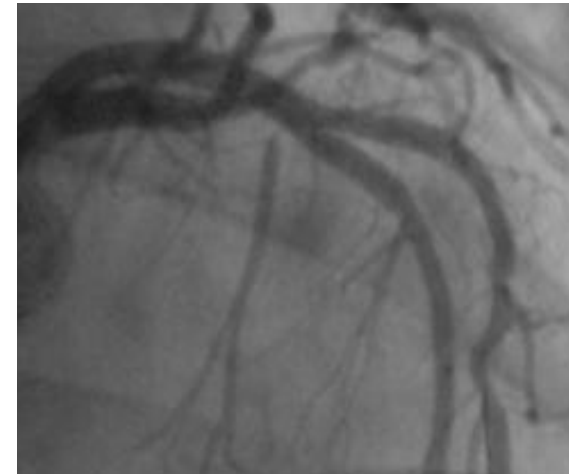
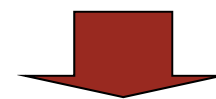
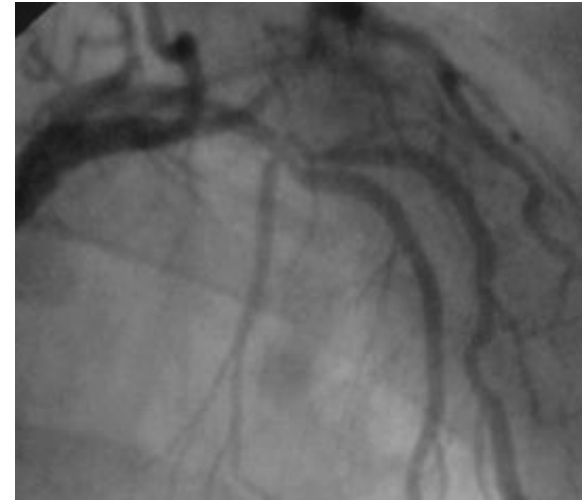
Excellent results?



Modified T



Kissing



Crush

Angiographically excellent, but.....

604 Costa et al.
Crush Stenting for Bifurcation Lesions

JACC Vol. 46, No. 4, 2005
August 16, 2005:599-605

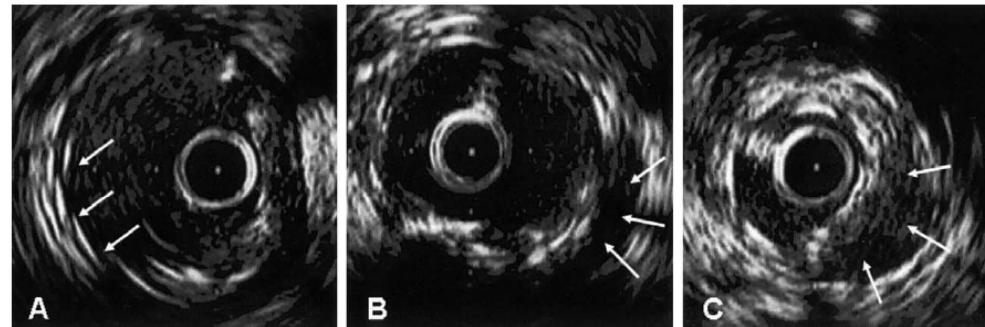
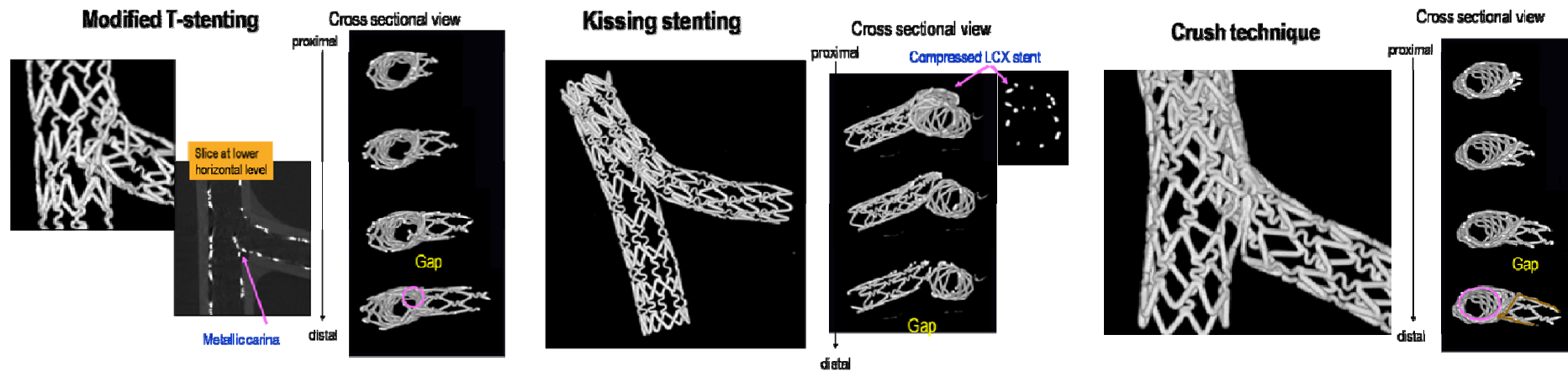
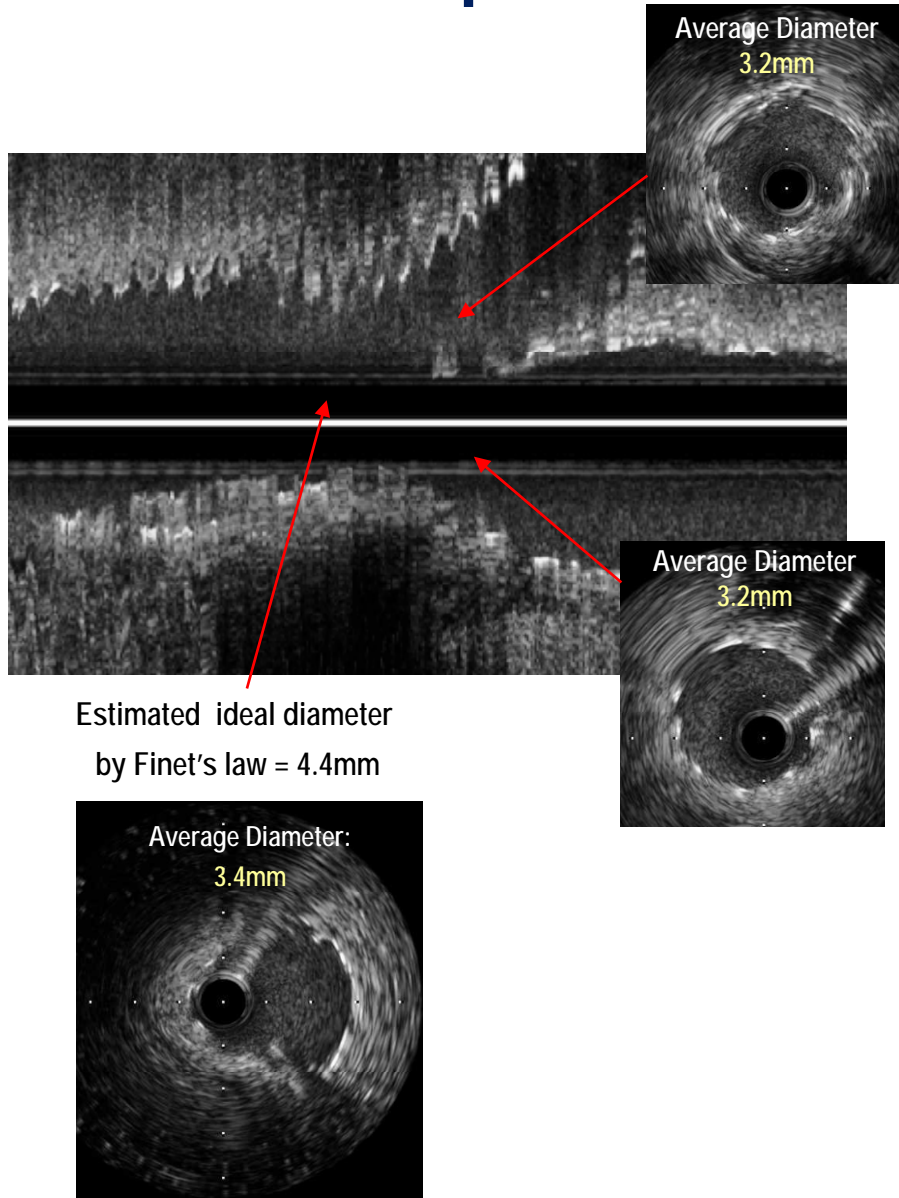


Figure 4. (A) Intravascular ultrasound image showing complete crush (apposition) of the side branch (SB) stent; arrows indicate the three layers of stent struts. (B, C) Intravascular ultrasound images showing incomplete crush (apposition) of the SB stent struts (arrows).

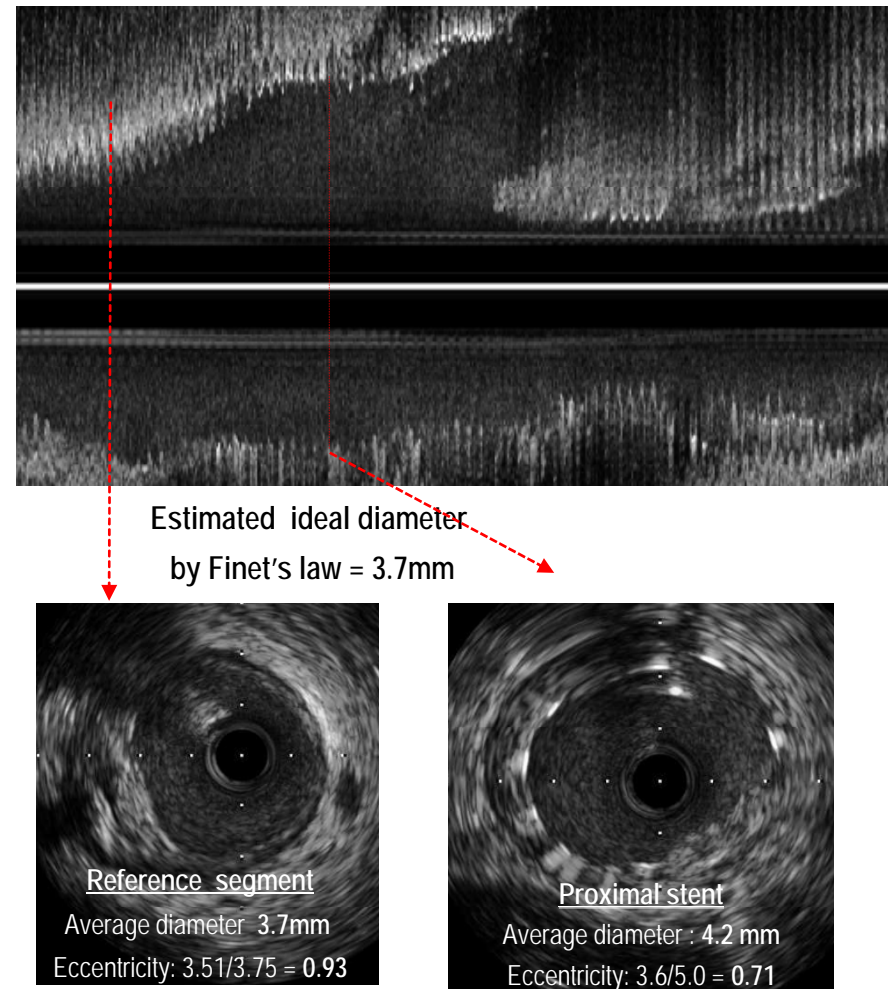


Courtesy of Dr. Murasato

Under-expansion



Over-expansion



FFR after side branch stenting

The Acute Changes of Fractional Flow Reserve in DK (Double Kissing), Crush, and 1-Stent Technique for True Bifurcation Lesions

FEI YE, M.D., JUN-JIE ZHANG, M.D., NAI-LIANG TIAN, M.D., SONG LIN, M.D., ZHI-ZHONG LIU, M.D., JING KAN, M.D., HAI-MEI XU, M.D., ZHONGSHENG ZHU, M.D., and SHAO-LIANG CHEN, M.D., F.S.C.A.I., F.A.C.C.

From the Nanjing First Hospital, Nanjing Medical University, Nanjing, China

FFR before and after PCI (DK crush vs Provisional)

	DK Group	1-Stent Group	P Value
FFR preprocedure			
MB FFR at baseline	0.83 ± 0.15	0.89 ± 0.13	0.109
SB FFR at baseline	0.84 ± 0.15	0.91 ± 0.12	0.100
MB FFR at hyperemia	0.76 ± 0.15	0.83 ± 0.10	0.029
SB FFR at hyperemia	0.76 ± 0.15	0.83 ± 0.16	0.103
FFR postprocedure			
MB FFR at baseline	0.96 ± 0.02	0.95 ± 0.03	0.376
SB FFR at baseline	0.97 ± 0.02	0.96 ± 0.03	0.043
MB FFR at hyperemia	0.92 ± 0.04	0.92 ± 0.05	0.581
SB FFR at hyperemia	0.94 ± 0.03	0.90 ± 0.08	0.028

Efficacy of Fractional Flow Reserve Measurements at Side Branch Vessels Treated With the Crush Stenting Technique in True Coronary Bifurcation Lesions

Byoung Kwon Lee, MD; Hyun Hee Choi, MD; Kyung-Soon Hong, MD; Byoung-Keuk Kim, MD; Jaemin Shim, MD; Jung-Sun Kim, MD; Young-Guk Ko, MD; Donghoon Choi, MD; Yangsoo Jang, Myeong-Ki Hong, MD, PhD

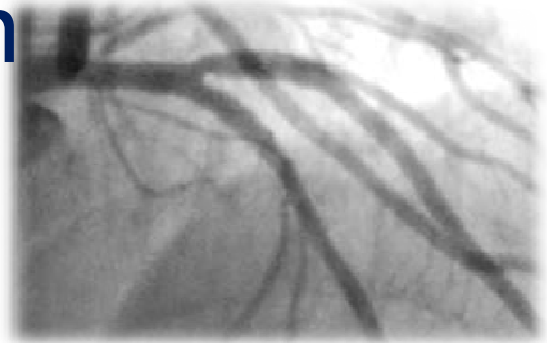
	Pre-KBA MLD, MV/SB (mm)	Post-KBA MLD, MV/SB (mm)	Pre-KBA FFR	Post-KBA FFR
1	2.4/2.5	2.6/2.6	0.90	0.96
2	2.9/2.5	2.9/2.4	0.96	1.00
3	3.0/2.3	3.0/2.5	0.95	0.95
4	2.7/2.3	2.8/2.4	0.96	0.96
5	2.9/2.2	2.9/2.4	0.92	1.00
6	3.1/1.8	3.2/2.0	0.95	0.98
7	3.0/2.2	2.9/2.3	0.94	0.96
8	2.8/1.6	2.7/1.8	1.00	1.00
9	3.0/2.8	2.9/2.8	0.94	0.94
10	3.1/2.9	3.0/3.0	0.88	0.94
11	3.4/2.4	3.3/2.3	0.88	0.94
12	3.2/2.1	3.2/2.3	0.97	1.00

0.94±0.04 0.97±0.03

J Interv Cardiol 2010

Clinical Cardiol 2010

Morphologic vs. Functional Assessment for Bifurcation Lesion



- After side branch PCI
 - IVUS is helpful to understand the cause of procedural difficulty and to determine the procedural success of side branch PCI.
 - High side branch FFR after stenting does not always guarantee the excellent outcomes of 2 stenting.

Morphologic vs. Functional Assessment for Bifurcation Lesion

- IVUS/FFR-guided intervention strategy for bifurcation lesion is feasible and helpful from the beginning till the end of procedures.
- Adequate knowledge on coronary anatomy/physiology and pitfalls of IVUS/FFR is mandatory to properly use these tools during complex bifurcation PCI.