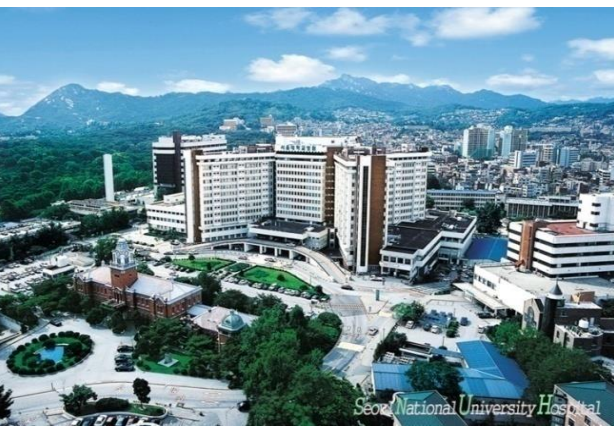


# Physiologic Approach For Non-LM bifurcation lesions

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# Disclosure Statement of Financial Interest

Within the past 12 months, I, [Bon-Kwon Koo] have had a financial interest/arrangement or affiliation with the organizations listed below:

- Grant/Research Support: Institutional Research Grants from Abbott, Philips, and HeartFlow

# Physiologic Assessment for Coronary Artery Bifurcation Disease

Joint Consensus by Korean, Japanese, and European Bifurcation Clubs



JACC: CARDIOVASCULAR INTERVENTIONS

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VOL. 15, NO. 13, 2022

## STATE-OF-THE-ART REVIEW

# Physiological Approach for Coronary Artery Bifurcation Disease

Position Statement by Korean, Japanese, and European Bifurcation Clubs

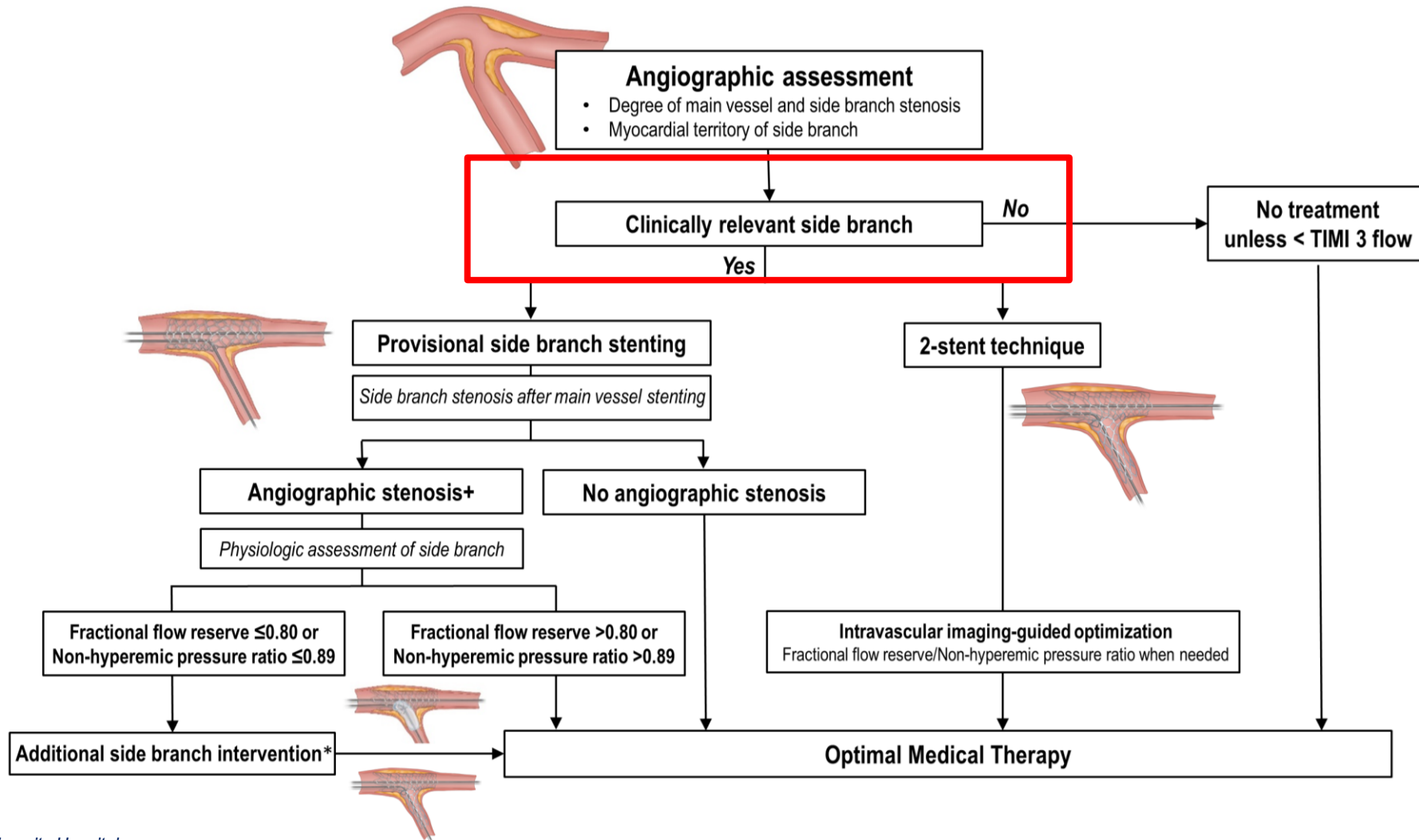


Hak Seung Lee, MD,<sup>a,\*</sup> Ung Kim, MD, PhD,<sup>b,\*</sup> Seokhun Yang, MD,<sup>a</sup> Yoshinobu Murasato, MD, PhD,<sup>c</sup> Yves Louvard, MD,<sup>d</sup> Young Bin Song, MD, PhD,<sup>e</sup> Takashi Kubo, MD, PhD,<sup>f</sup> Thomas W. Johnson, MD,<sup>g</sup> Soon Jun Hong, MD, PhD,<sup>h</sup> Hiroyuki Omori, MD,<sup>i,j</sup> Manuel Pan, MD, PhD,<sup>k</sup> Joon-Hyung Doh, MD, PhD,<sup>l</sup> Yoshihisa Kinoshita, MD,<sup>m</sup> Adrian P. Banning, MD,<sup>n</sup> Chang-Wook Nam, MD, PhD,<sup>o</sup> Junya Shite, MD, PhD,<sup>p</sup> Thierry Lefèvre, MD,<sup>d</sup> Hyeon-Cheol Gwon, MD, PhD,<sup>e</sup> Yutaka Hikichi, MD, PhD,<sup>q</sup> Yiannis S. Chatzizisis, MD, PhD,<sup>r</sup> Jens Flensted Lassen, MD, PhD,<sup>s</sup> Goran Stankovic, MD, PhD,<sup>t</sup> Bon-Kwon Koo, MD, PhD<sup>a</sup>

# Physiological Approach: Nuts and Bolts

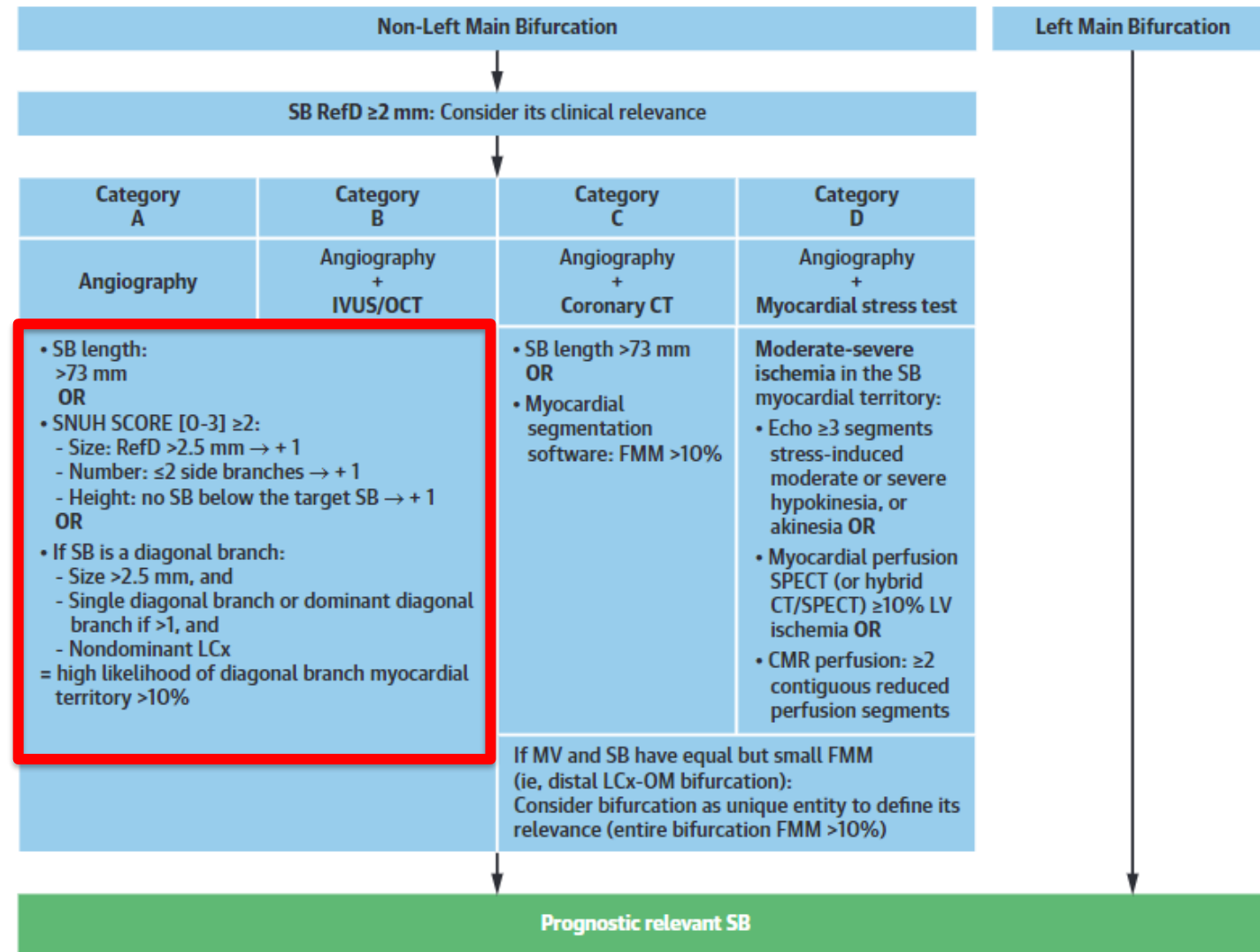
- **Relevance**
- Judge the risk and benefit
- Observe the guideline
- Imaging-guidance
- Check your knowledge
- Evolution

# Proposed algorithm for physiological approach by Korean, Japanese, and European Bifurcation Clubs



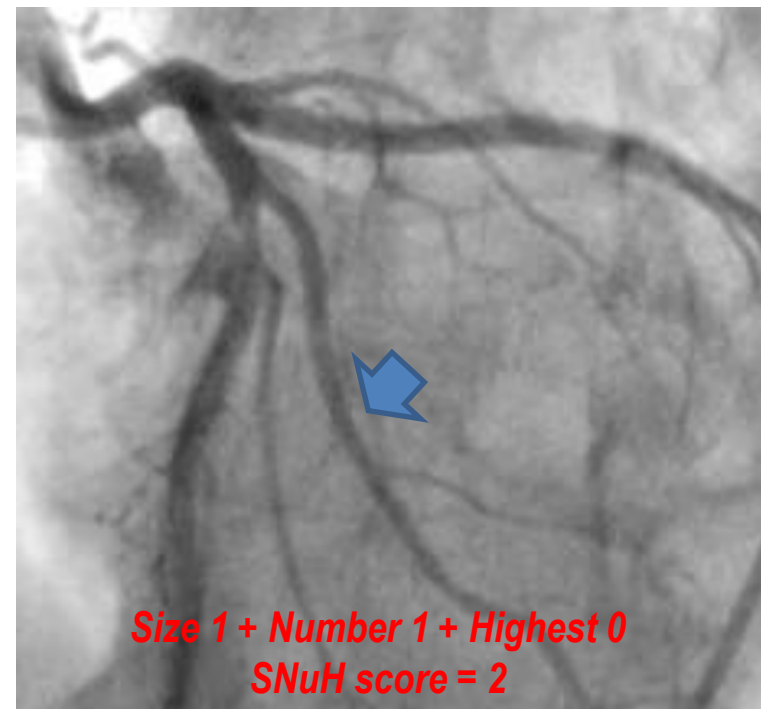
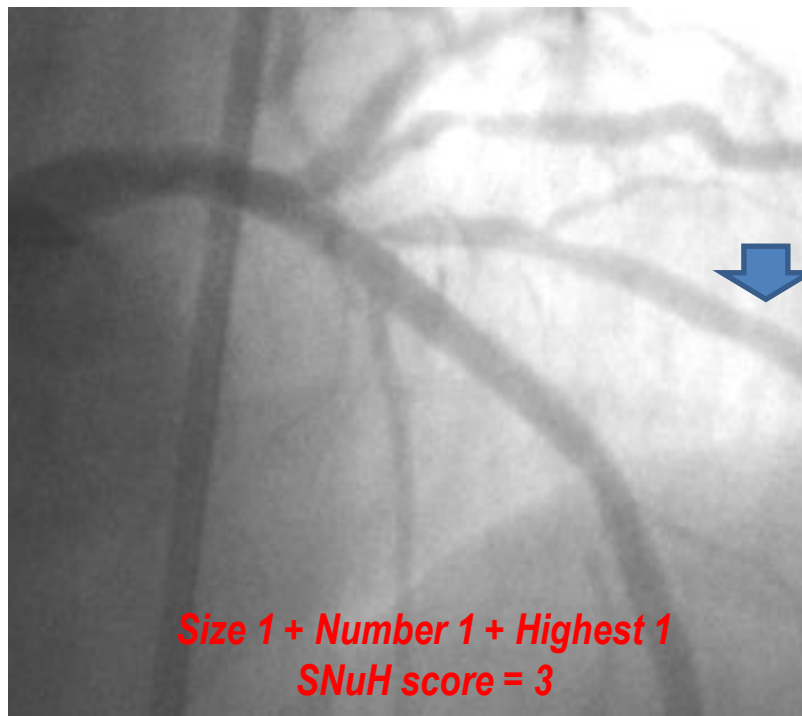
# Bif-ARC 2022

**FIGURE 6** Algorithm to Determine the Lesion Eligibility According to the SB Relevance

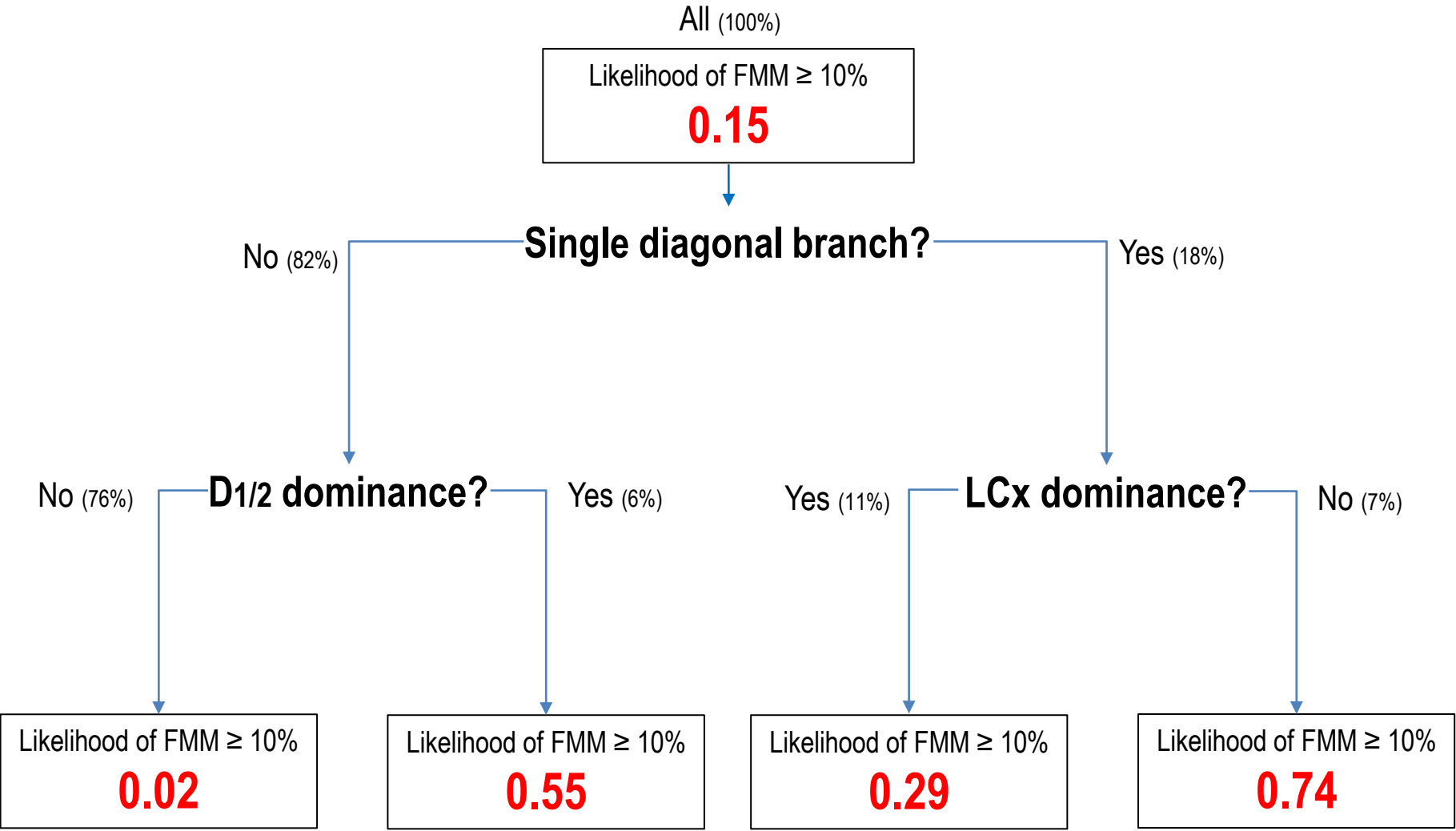


# Scoring system for diagonal branches - SNuH score -

Variables	Description	Score
Size ( <b>S</b> )	Vessel diameter $\geq 2.5\text{mm}$	1
Number ( <b>Nu</b> )	Number of diagonal branches $\leq 2$	1
Highest ( <b>H</b> )	No branch below the target branch	1



# Decision Tree Approach for Significant Side Branch

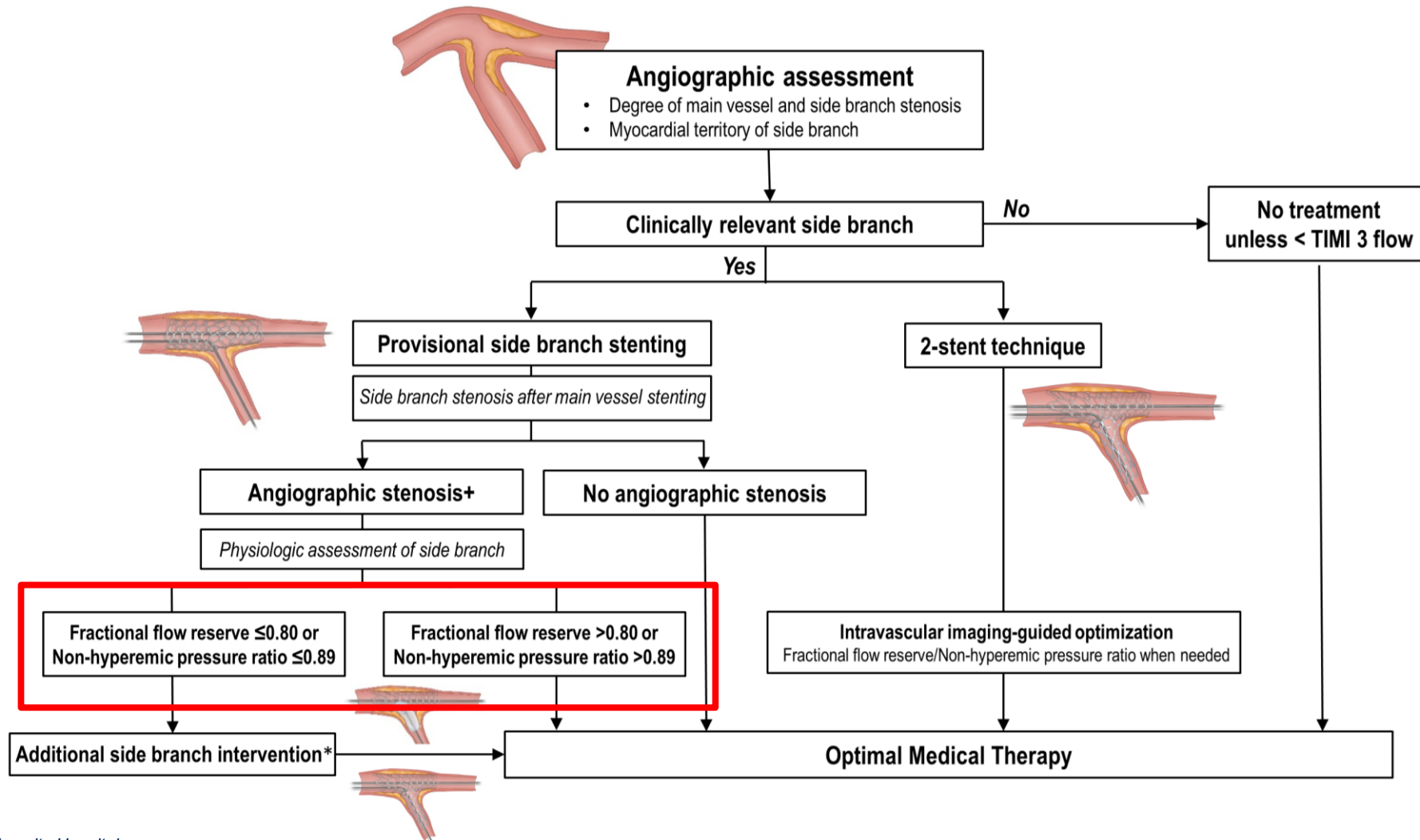




# Physiological Approach: Nuts and Bolts

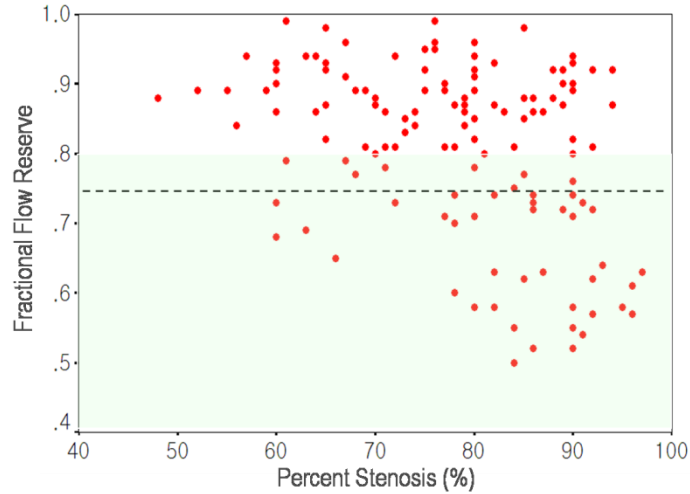
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# Proposed algorithm for physiological approach by Korean, Japanese, and European Bifurcation Clubs

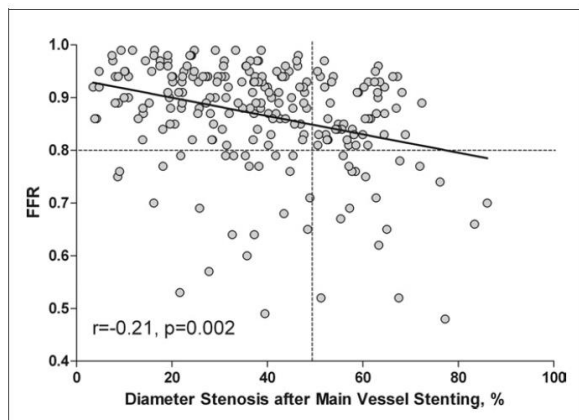


# Can anatomical severity predict the functional significance?

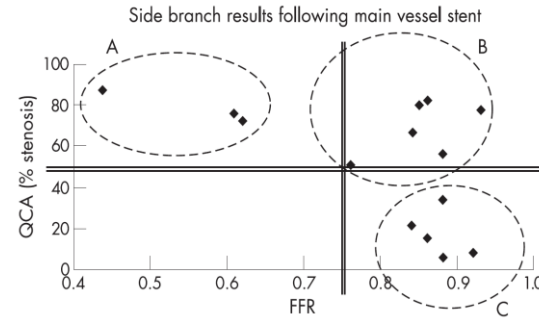
## FFR vs. anatomical stenosis in Jailed side branches



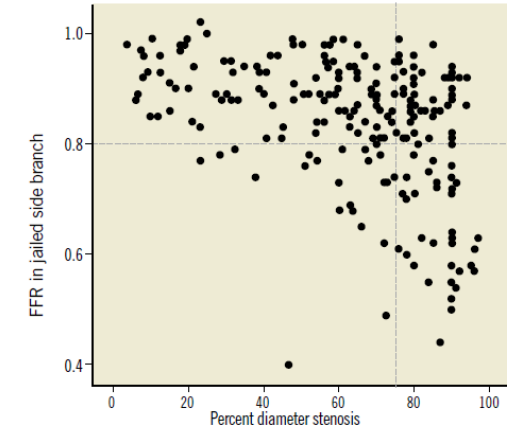
Koo BK, et al. J Am Coll Cardiol 2005;46:633  
Park SH & Koo BK J Geriatr Cardiol 2012;9:278



Ahn JM, et al. JACC interv 2012

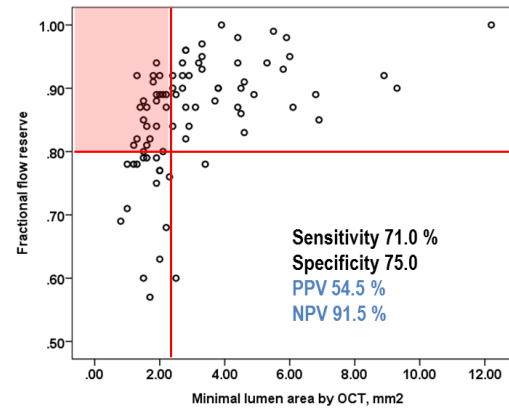


Bellenger, et al. Heart 2007



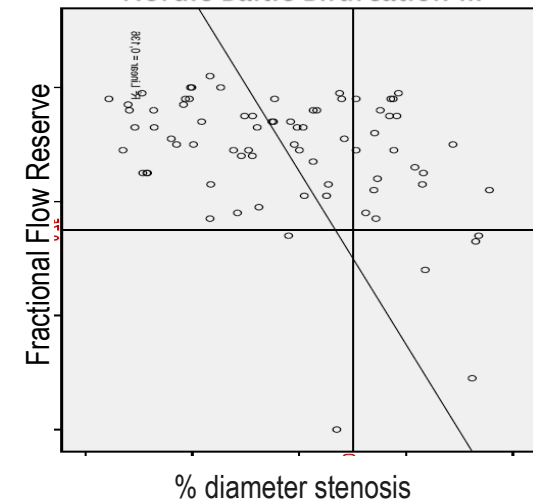
Lee JM, et al. Eurointervention 2015;11:V59

### OCT 2.05mm<sup>2</sup> Vs. FFR 0.80



Ha J, et al JACC Imag 2013

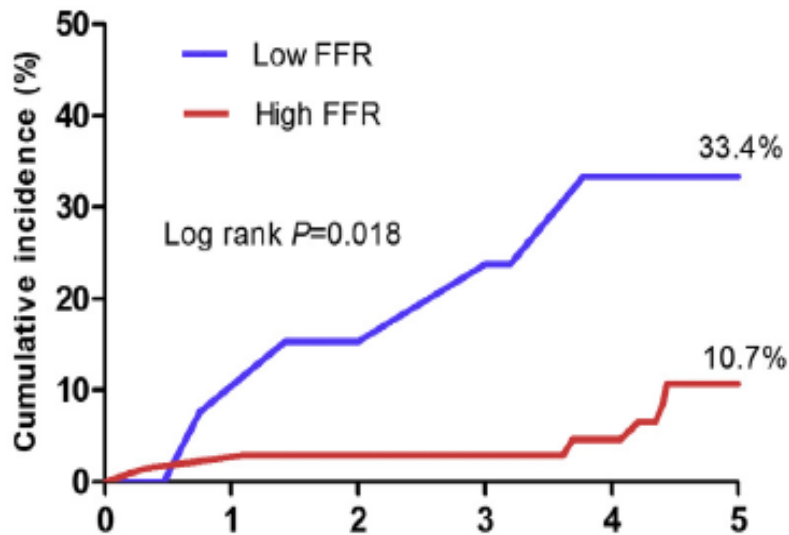
### SB FFR substudy Nordic Baltic Bifurcation III



Kumsars I, et al. Eurointervention 2011

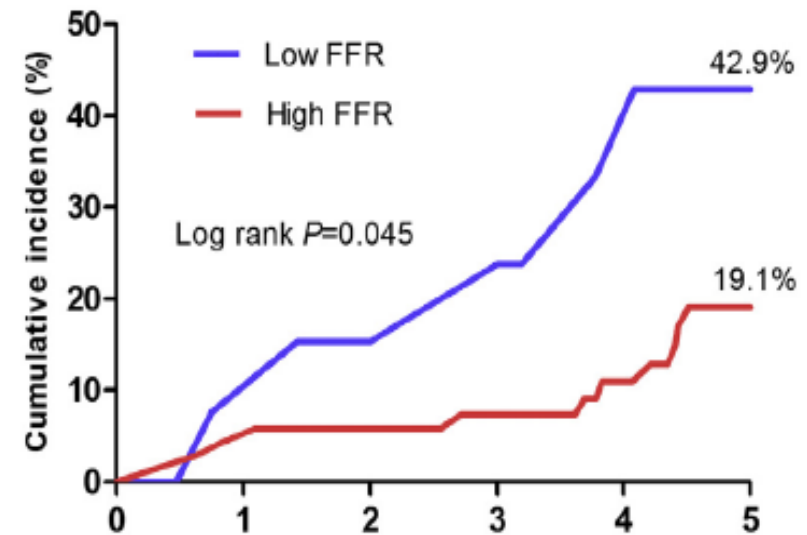
# 5-year outcome of jailed LCX according to FFR

Target-lesion failure



	No. of patients at risk					
	0	1	2	3	4	5
Low FFR	14	13	12	11	8	4
High FFR	69	69	66	60	51	37

MACE



	No. of patients at risk					
	0	1	2	3	4	5
Low FFR	14	13	12	11	8	4
High FFR	69	67	64	57	48	34

Lee CH, Nam CW, et al. JACC Intv 2019

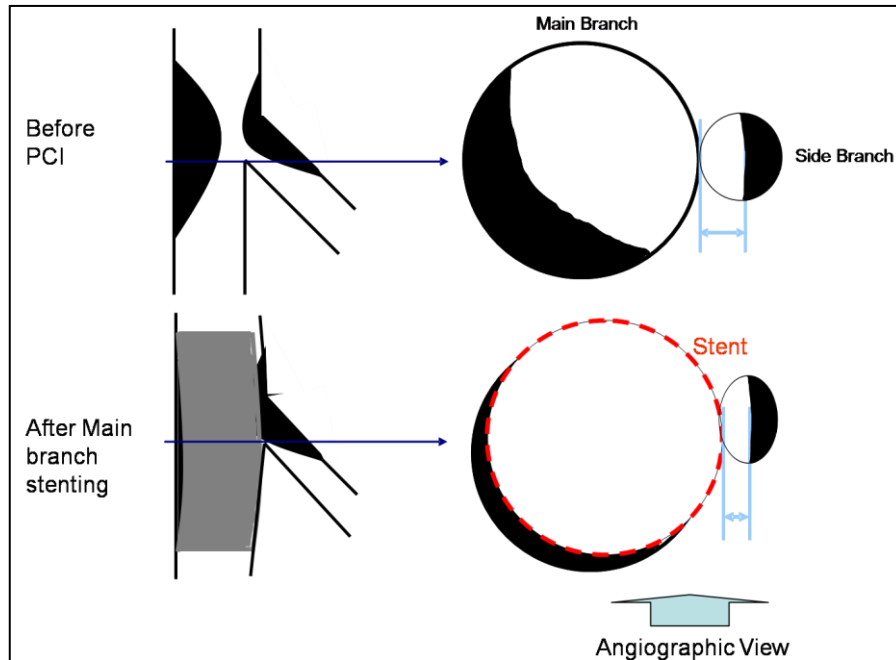
# Jailed side branch assessment: Benefit vs. Risk

- Failure rate of crossing SB with Pressure Wire

: 3.9% (95% CI 1.5%-9.6%) from 6 studies (n=648)

Ather et al. Eur J Clin Invest 2016

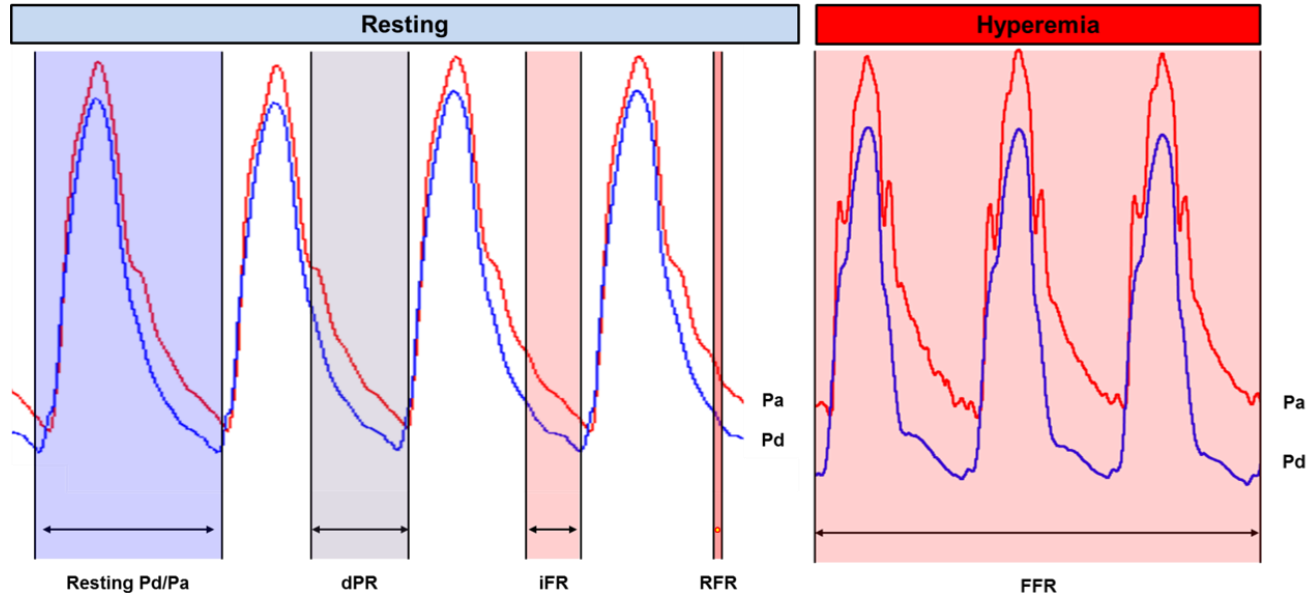
## Main mechanism of discordance between anatomy vs. function “CARINA SHIFT”



Koo BK et al. Circ Cardiovasc Interv 2010

	Benefit	Risk
Small branch	-	+
Short lesion	+++	+
Ostial lesion	+++	+
Diffuse lesion	++	+
Tandem lesion	++	+
Heavy calcification	++	++
Severe tortuosity	++	++

# Which is better, FFR or non-hyperemic pressure ratios?



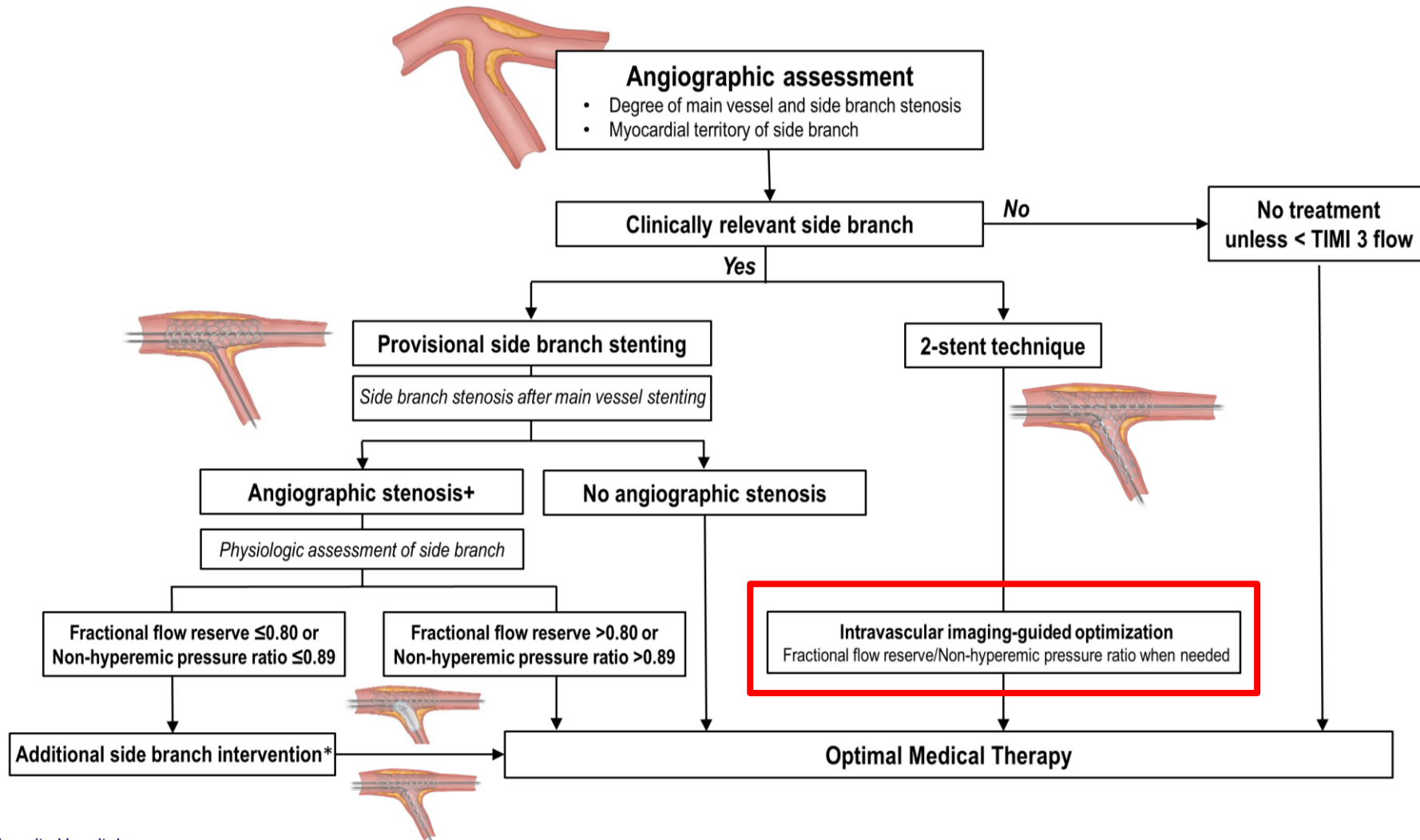
Although some fundamental and practical differences exist among the available invasive physiological indexes, **the greater priority is more adoption of a guideline-endorsed physiology-based approach** rather than the debate over which is a better index.

Sensitivity to anatomical/hemodynamic stenosis severity	iFR/RFR/dPR	<	FFR
Binary prognostic implications	iFR/RFR/dPR	~	FFR
Influence of measurement variability on estimated MACE risk	iFR/RFR/dPR	>	FFR

# Physiological Approach: Nuts and Bolts

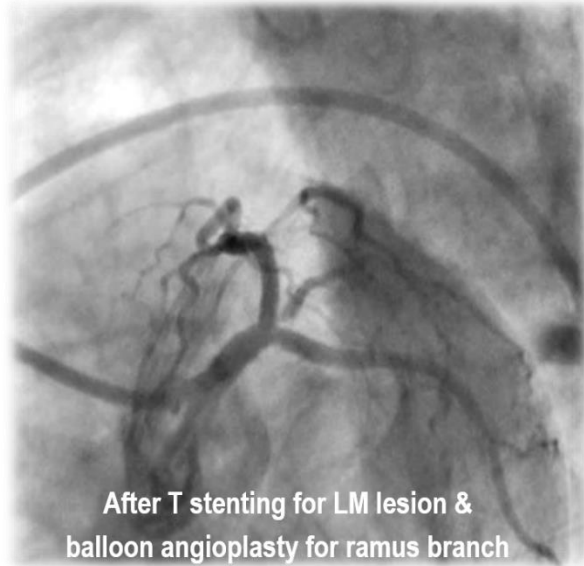
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# Proposed algorithm for physiological approach by Korean, Japanese, and European Bifurcation Clubs



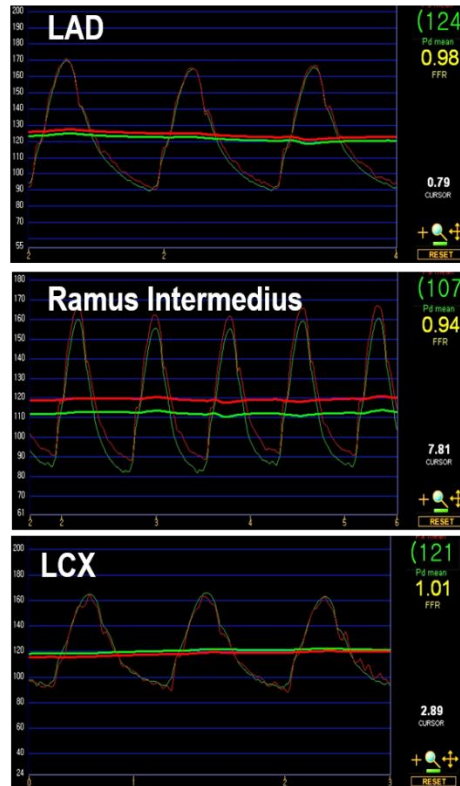


# Physiology- vs. Imaging-guidance in 2 stenting



After T stenting for LM lesion & balloon angioplasty for ramus branch

**Functionally complete revascularization**



## Imaging-guidance is more important in 2-stenting technique

Good Effective Stent Area *Can Make a Good Clinical Outcomes: Restenosis Rate < 5% and TLR < 2%*

**CORONARY INTERVENTIONS**  
EXPERT REVIEW

**Joint consensus on the use of OCT in coronary bifurcation lesions by the European and Japanese bifurcation clubs**

Yoshinobu Onuma<sup>1</sup>, MD, PhD, Yuki Katagiri<sup>2</sup>, MD, Francesco Barzotta<sup>3</sup>, MD, Niels Ramsing Holm<sup>4</sup>, MD, Nicolas Amabile<sup>5</sup>, MD, PhD, Takayuki Okamura<sup>6</sup>, MD, PhD, Gary S. Mintz<sup>7</sup>, MD, Olivier Darremont<sup>8</sup>, MD, Jens Flensted Lassen<sup>9</sup>, MD, PhD, Thierry Lefevre<sup>10</sup>, MD, Yves Louvard<sup>11</sup>, MD, Goran Stankovic<sup>12</sup>, MD, PhD, Patrick W. Serruys<sup>13</sup>, MD, PhD

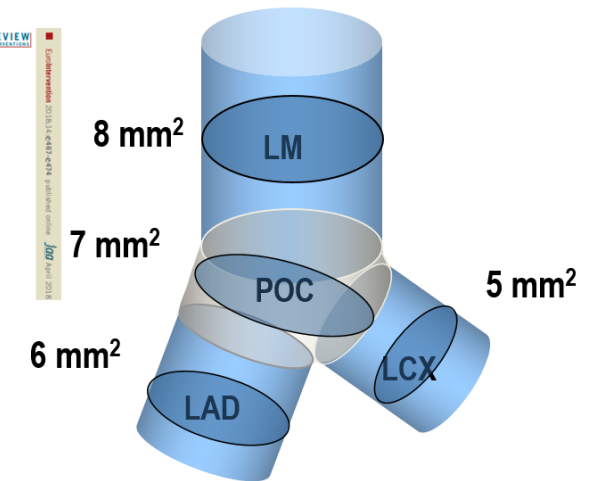
**Intravascular ultrasound in the evaluation and treatment of left main coronary artery disease: a consensus statement from the European Bifurcation Club**

Cardiovascular Intervention and Therapeutics (2021) 36:54–66  
<https://doi.org/10.1007/s12928-020-00701-2>

**EXPERT REVIEW**  
CORONARY INTERVENTIONS

**Efficacy of coronary imaging on bifurcation intervention**

Kensuke Takagi<sup>1</sup> · Ryoji Nagoshi<sup>2</sup> · Byeong-Keuk Kim<sup>3</sup> · Woong Kim<sup>4</sup> · Yoshihisa Kinoshita<sup>5</sup> · Junya Shite<sup>2</sup> · Yutaka Hikichi<sup>6</sup> · Young Bin Song<sup>7</sup> · Chang-Wook Nam<sup>8</sup> · Bon-Kwon Koo<sup>9</sup> · Soo-Joong Kim<sup>10</sup> · Yoshinobu Murasato<sup>11</sup>



**REVIEW ARTICLE**

**Efficacy of coronary imaging on bifurcation intervention**

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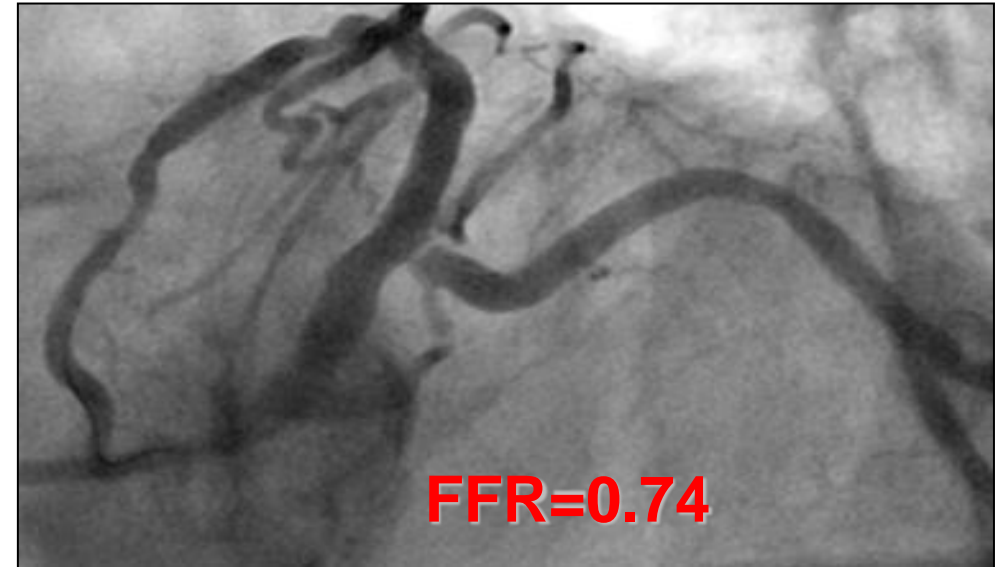
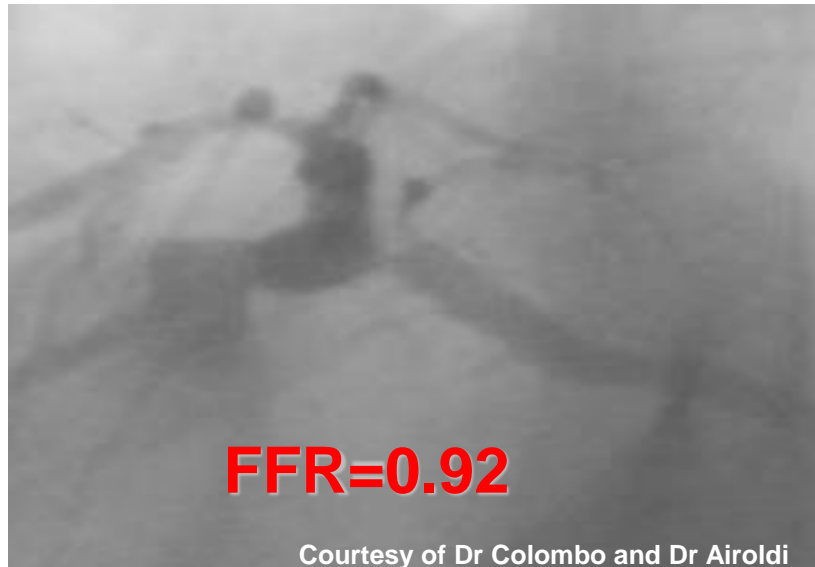
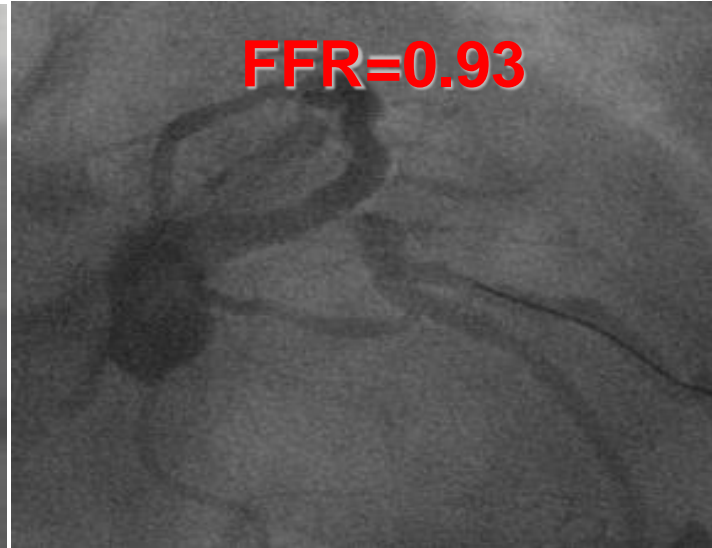
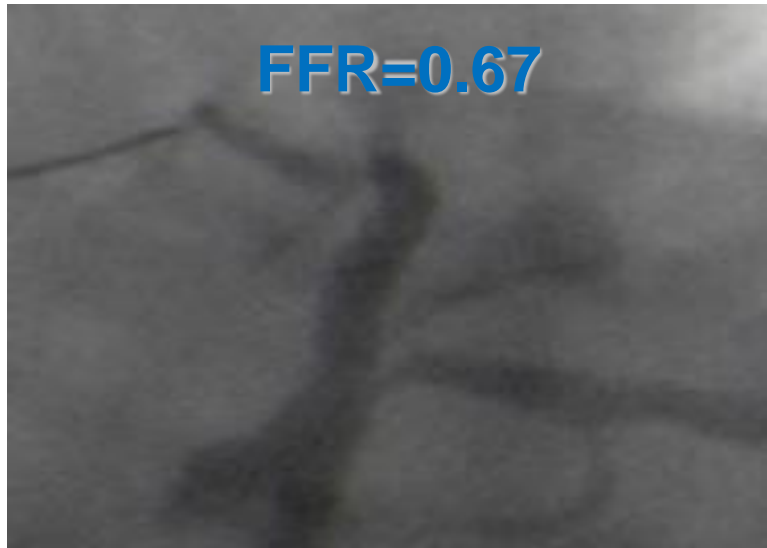
Kang et al. Circ Cardiovasc Interv 2011;4:1168-74

Maintain enough stent area, respect the fractal ratio, and try to minimize overlap and strut malapposition

# Physiological Approach: Nuts and Bolts

- Relevance
- Judge the risk and benefit
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- Imaging-guidance
- **Check your knowledge**
- **Evolution**

# Can you believe these numbers?



# Adequate Knowledge is Essential!

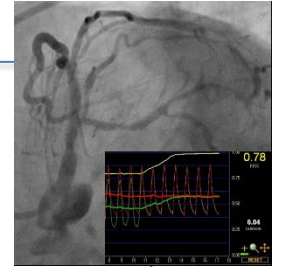
## When there is a mismatch...

- Measurement errors
  - Drift
  - Guiding catheter damping
    - Pull the guide catheter out of the ostium
- Pitfalls of FFR measurement
  - Influence of other vessel's critical stenosis (LM)
  - Inadequate hyperemia
    - IV adenosine is the ideal hyperemic agent
    - Check the infusion system
    - Use different route, higher dosage, different agent
- Influence of microvascular dysfunction



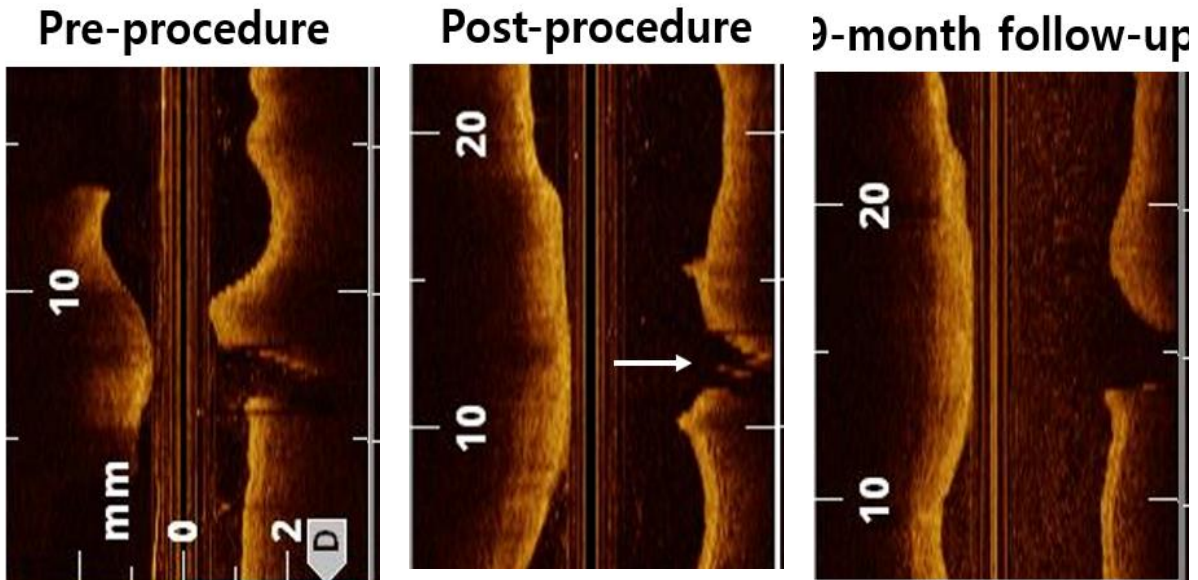
## When there is a reverse mismatch...

- Measurement errors
  - Drift
- Influence of other stenosis
  - Pressure pullback tracing
  - Measure FFR at the other vessel (LM)
  - Use NHPR pullback tracing
- Diffuse disease
  - Pressure pullback tracing
- Coronary spasm
- Wire-induced accordion phenomenon
- Presence of dissection



# New approaches and novel technologies

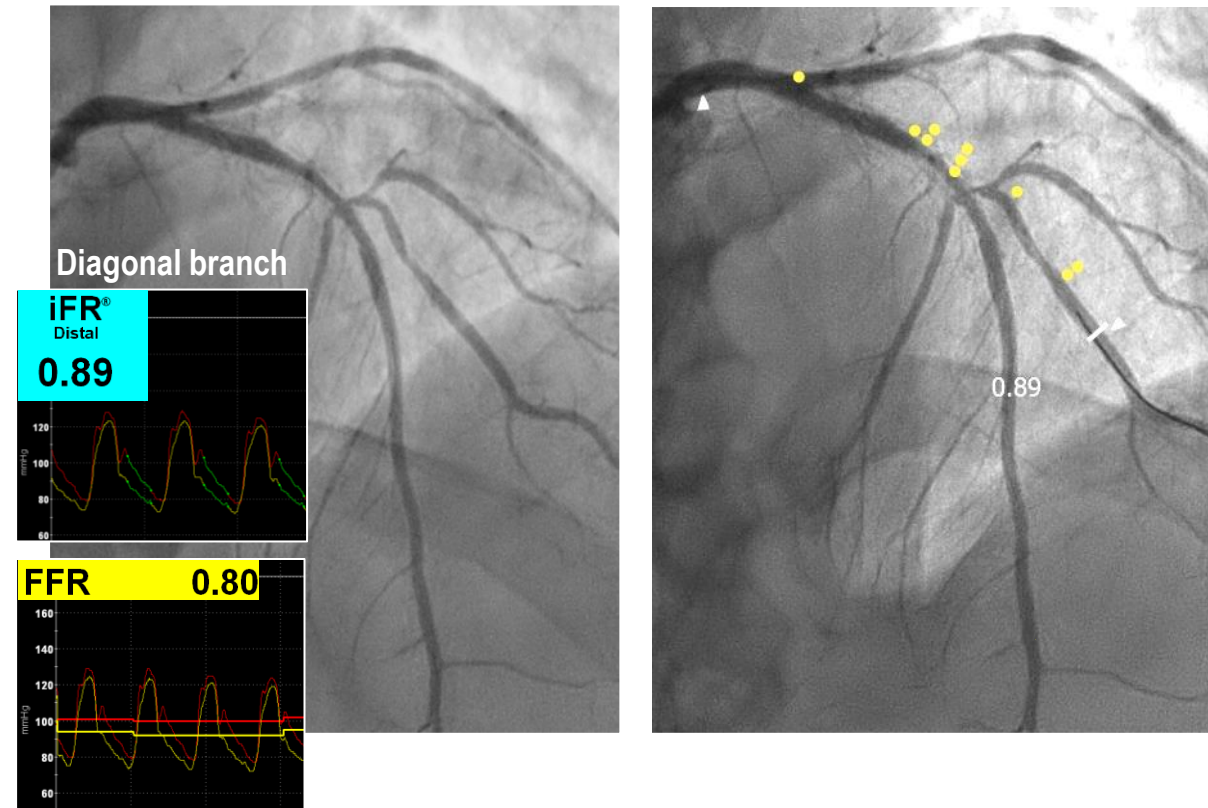
## Physiological index-guided DCB treatment



Courtesy of Dr ES Shin

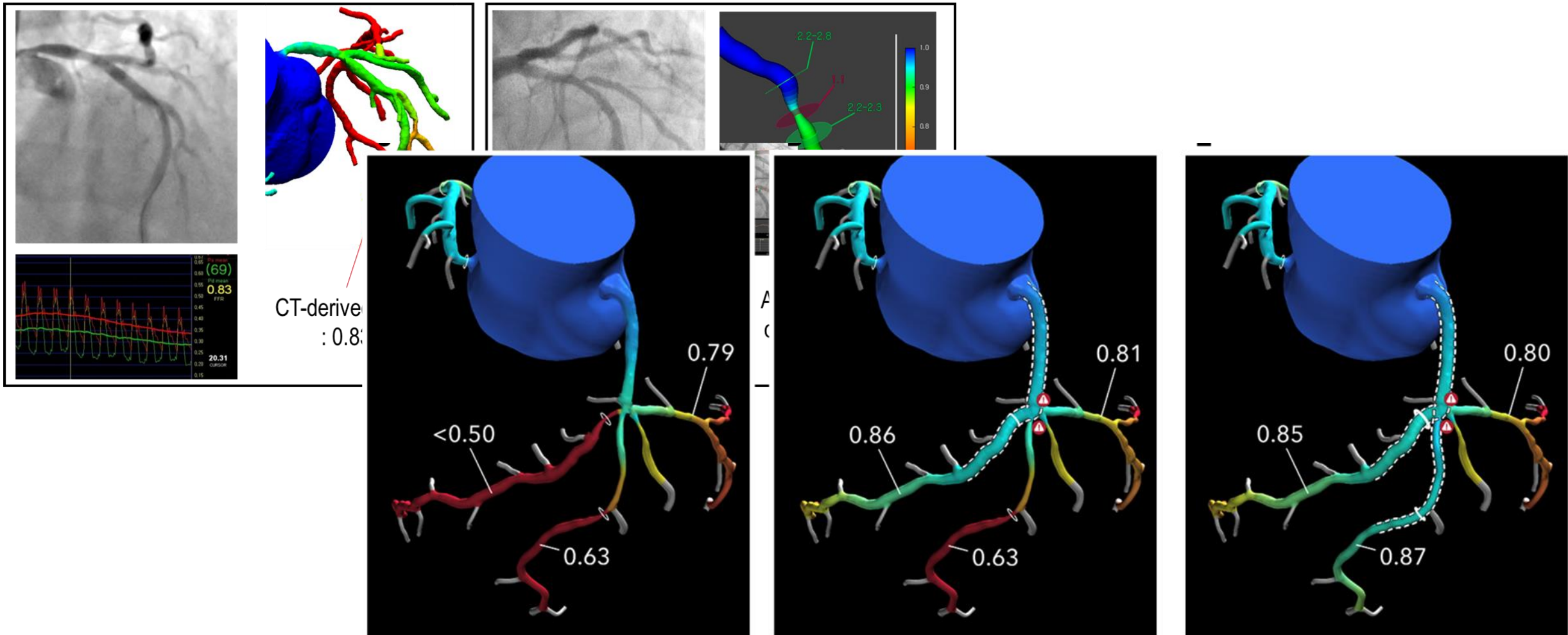
## Co-registration of image and physiology

### iFR Co-registration



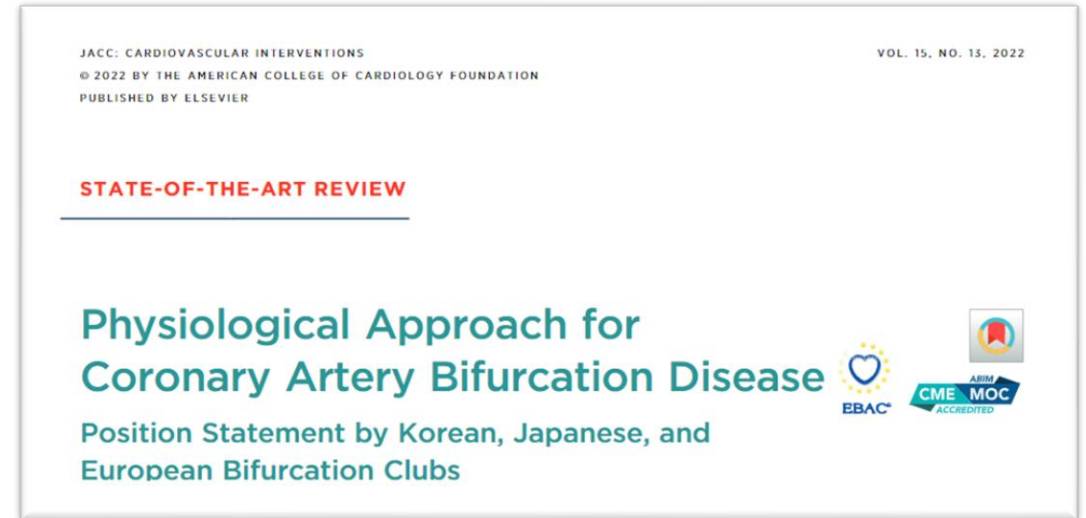
# New approaches and novel technologies

Image-based physiological assessment: Potentials, limitations and future



# Physiological Approach: Nuts and Bolts

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<https://www.sanctifiedbychrist.com/rejoice-in-the-lord-always/>