

# Case Matched Physiologic Detection of Vulnerable Patient

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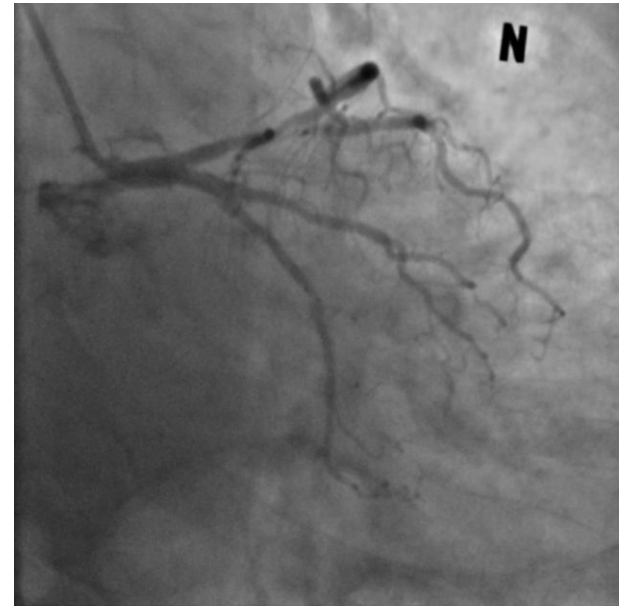
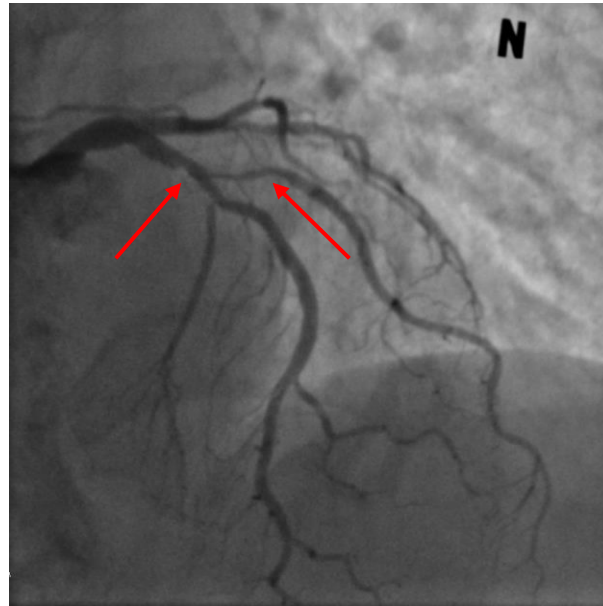
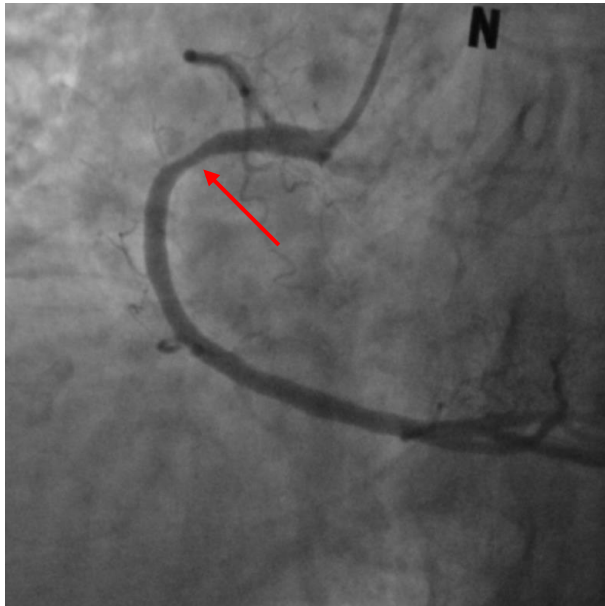
# Brief Summary of Case

**M/75**

**Stable Angina**

**Angiographically 2-Vessel Disease (RCA, LAD-D1 intermediate stenosis)**

**No evidence of inducible myocardial ischemia from non-invasive test**



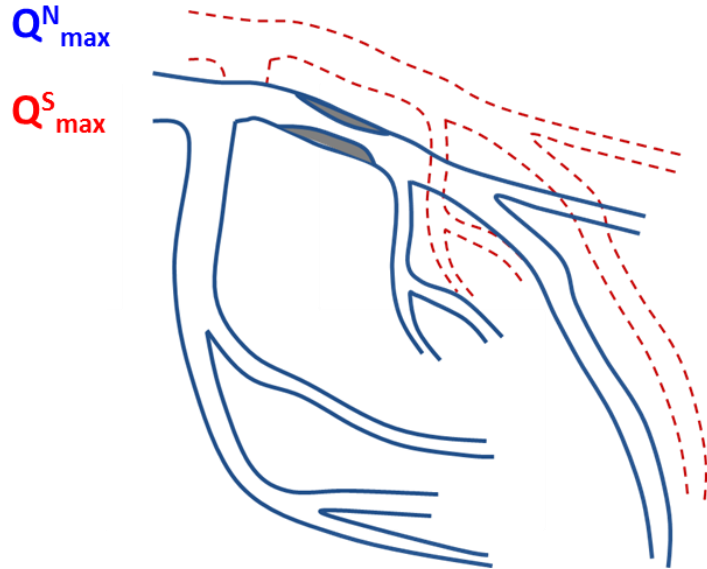
# What treatment option can we select?

1. Medical treatment
2. Angiography-based decision of revascularization
3. Physiology-based decision of revascularization
4. Imaging-based decision of revascularization



# Invasive Physiological Indices for Detecting Ischemia

## Fractional Flow Reserve (FFR)

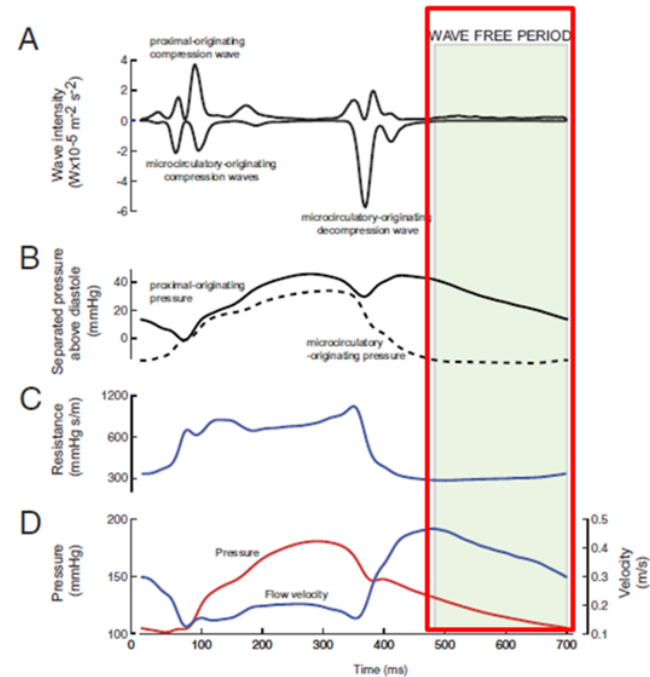


$$FFR = \frac{\text{Maximum flow in presence of stenosis}}{\text{Normal maximum flow}} = \frac{Q_{max}^S}{Q_{max}^N}$$

$$= \frac{(P_d - P_v)/R}{(P_a - P_v)/R} = \frac{\text{Distal Pr } (P_d)}{\text{Proximal Pr } (P_a)}$$

**Under Maximal Hyperemia**

## Instantaneous Wave-Free Ratio (iFR)



$$iFR = \frac{\text{Distal Pr } (P_d) \text{ under wave free period}}{\text{Proximal Pr } (P_a) \text{ under wave free period}}$$

**Under Resting Status**

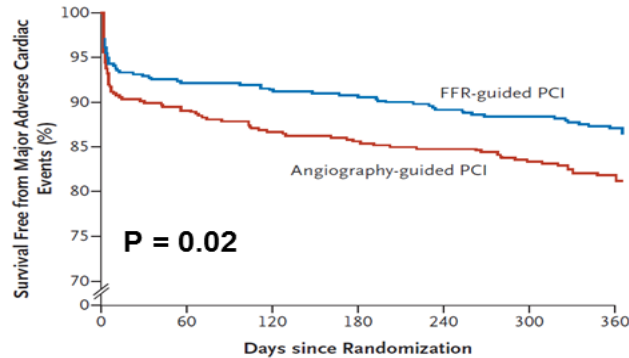
# Benefits of Physiology-Guided PCI

## FFR-Guided PCI and Outcomes

### FAME Trial

Tonino et al, NEJM 2009

#### FFR vs. Angio-guided PCI in multi-vessel CAD

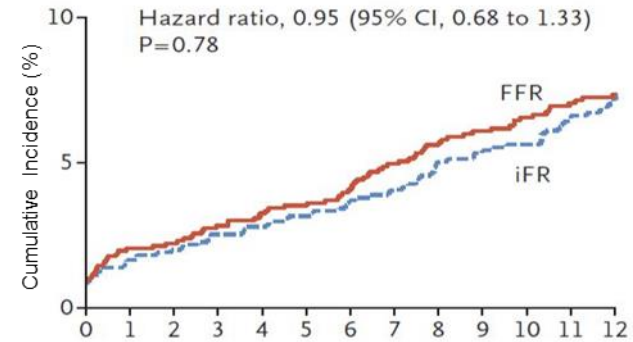


## iFR-Guided PCI and Outcomes

### DEFINE FLAIR Trial

Davis et al, NEJM 2017

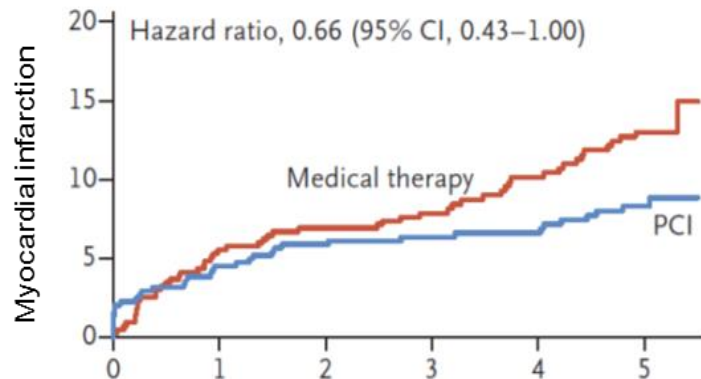
#### FFR guided vs. iFR guided PCI



### FAME 2 Trial (5-Year)

Xaplanteris et al, NEJM 2018

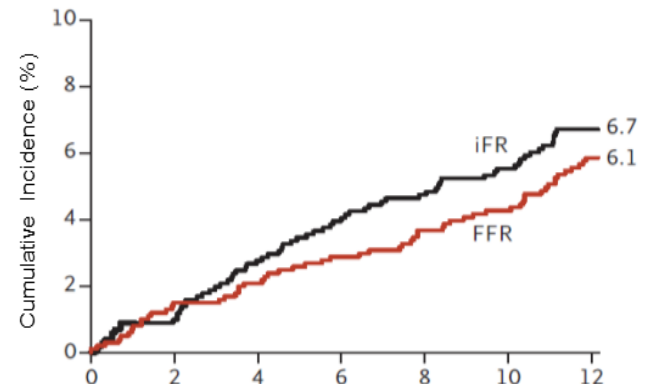
#### FFR guided vs. Medical therapy in Stable CAD



### iFR-SWEDEHEART Trial

Göteborg et al, NEJM 2017

#### FFR guided vs. iFR guided PCI



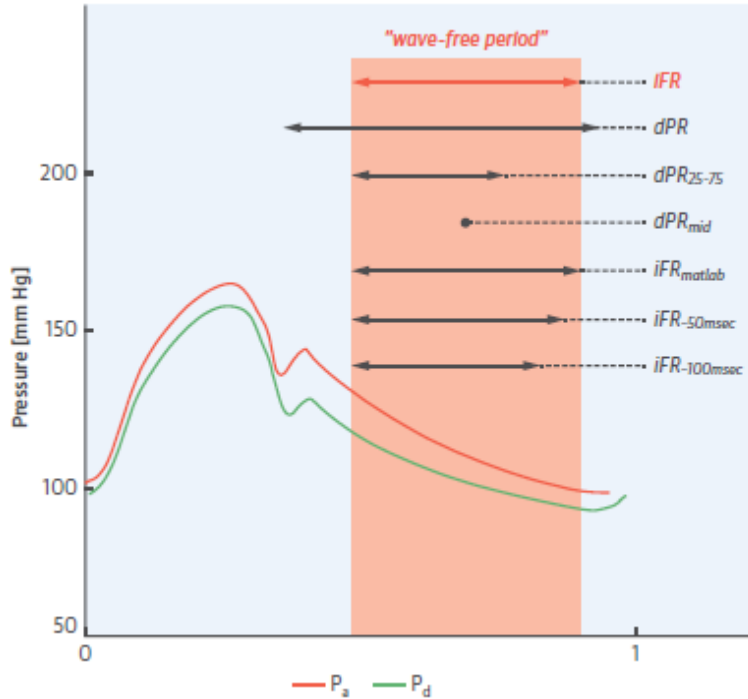
# Current Guideline's Recommendation

Recommendations	Class <sup>a</sup>	Level <sup>b</sup>
When evidence of ischaemia is not available, FFR or iwFR are recommended to assess the haemodynamic relevance of intermediate-grade stenosis. <sup>15,17,18,39</sup>	I	A
FFR-guided PCI should be considered in patients with multivessel disease undergoing PCI. <sup>29,31</sup>	IIa	B

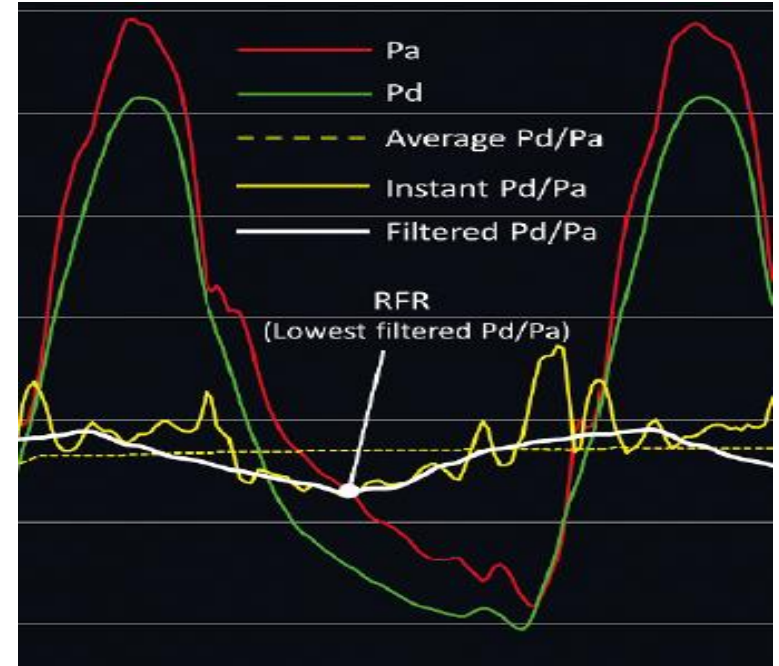
Beyond FFR and iFR, **novel resting indices** and **angiography-derived FFR** have been developed to overcome the low adoption rate of physiology guided PCI even though the current guideline's strong recommendation.

# Novel Resting Index

No hyperemia, Short Measurement Time, Less Patient Discomfort and Medical Cost



Diastolic pressure-ratio (dPR) is an averaged  $Pd/Pa$  ratio during the entire diastolic period.

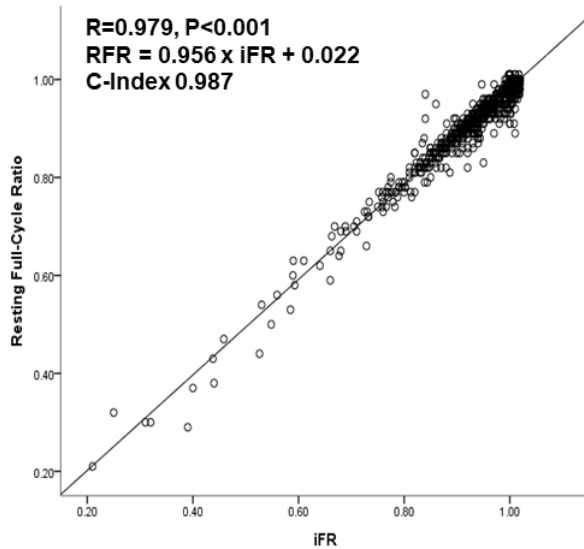


Resting full-cycle ratio (RFR) is based on unbiased identification of lowest  $Pd/Pa$  within the entire cardiac cycle

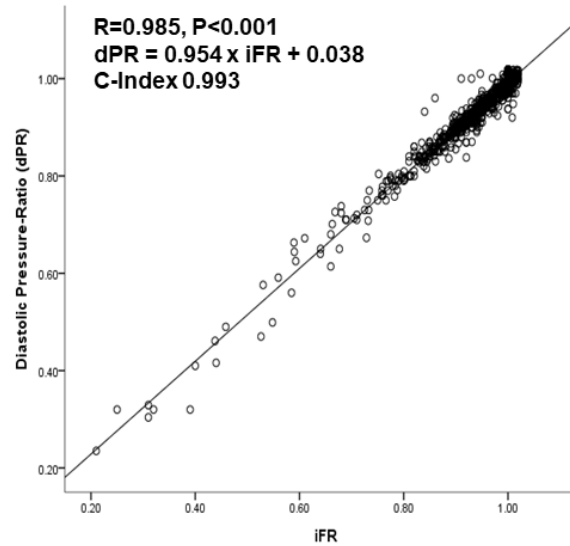
# Novel Resting Index

## Association Between Different Resting Physiologic Indices

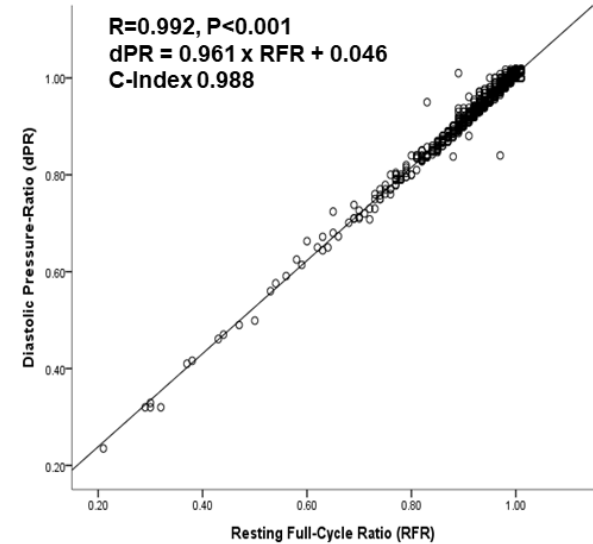
A. RFR - iFR



B. dPR - iFR



C. dPR - RFR



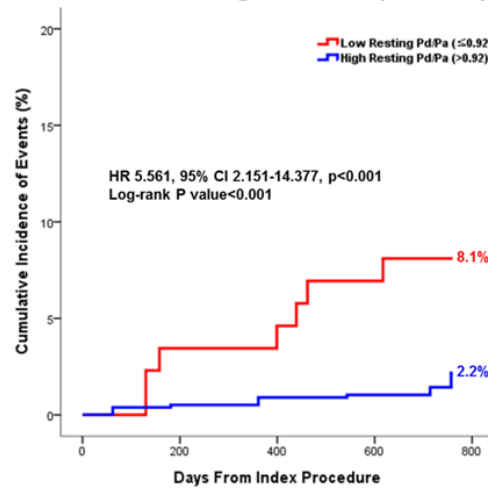
**All novel resting indices showed strong linear correlation each other.**



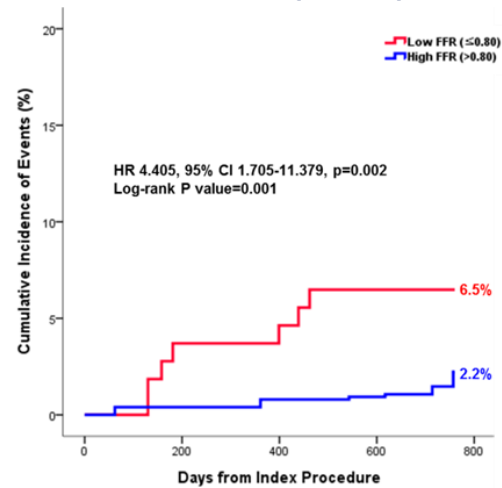
# Novel Resting Index

## Outcomes of Deferral Lesions according to Resting Physiologic Indices

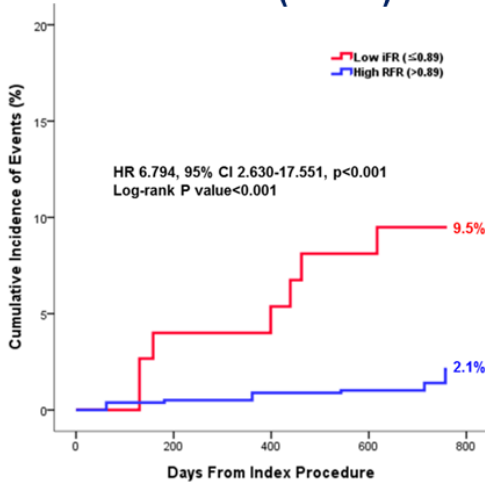
### Resting Pd/Pa ( $\leq 0.92$ )



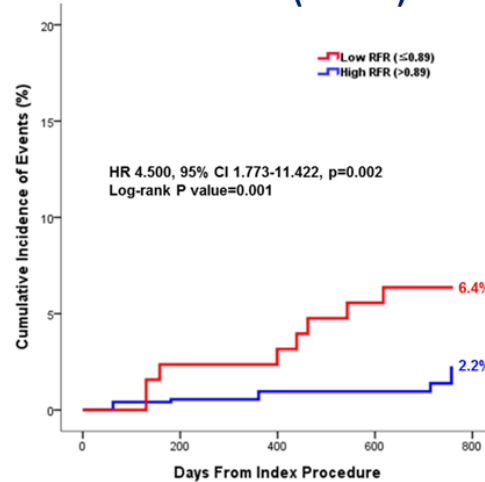
### FFR ( $\leq 0.80$ )



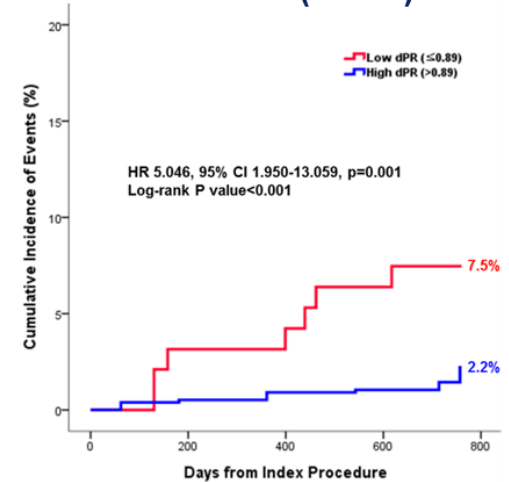
### iFR ( $\leq 0.89$ )



### RFR ( $\leq 0.89$ )

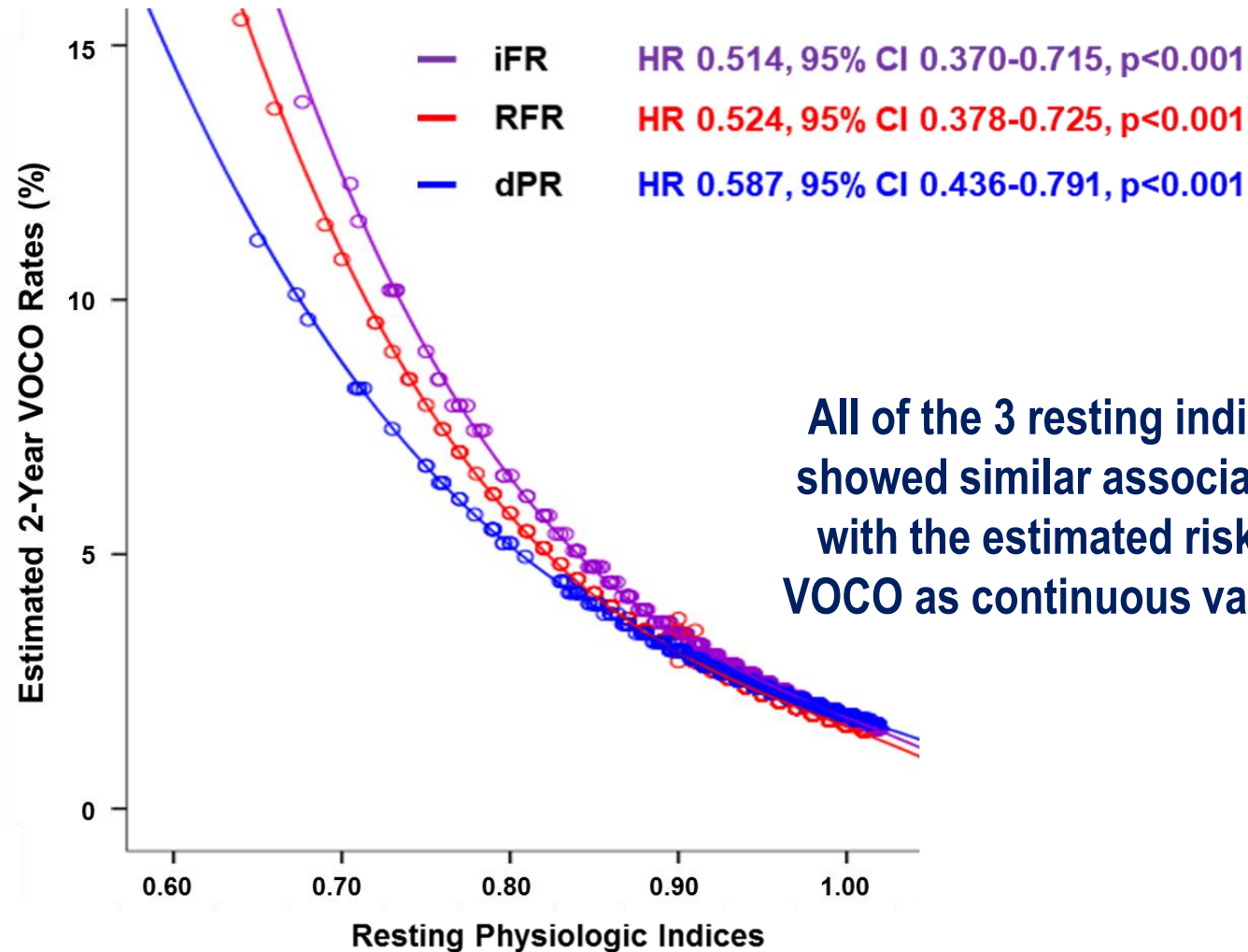


### dPR ( $\leq 0.89$ )



# Novel Resting Index

## Outcomes of Deferral Lesions according to Resting Physiologic Indices



All of the 3 resting indices showed similar association with the estimated risk of VOCO as continuous values.

# Angiography-derived FFR

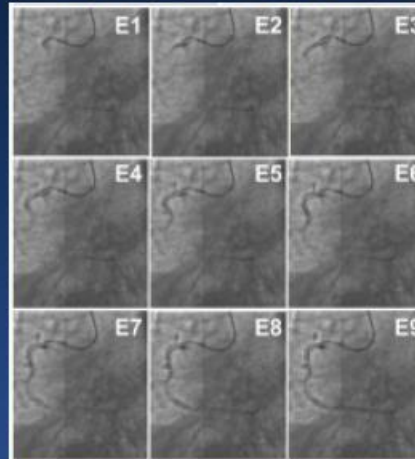
## Quantitative Flow Ratio (QFR)

- Computed FFR based on two angiographic projections
- 3-dimensional QCA derived FFR
- No need of pressure wire or hyperemic agent

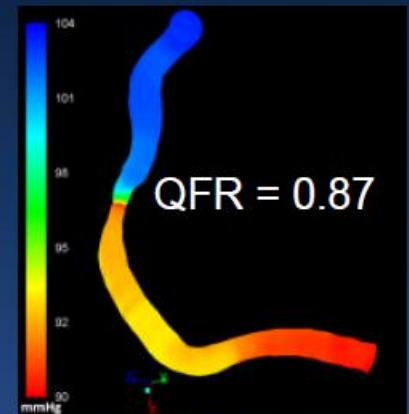
### 3D Reconstruction



### Modified Frame Count



### QFR

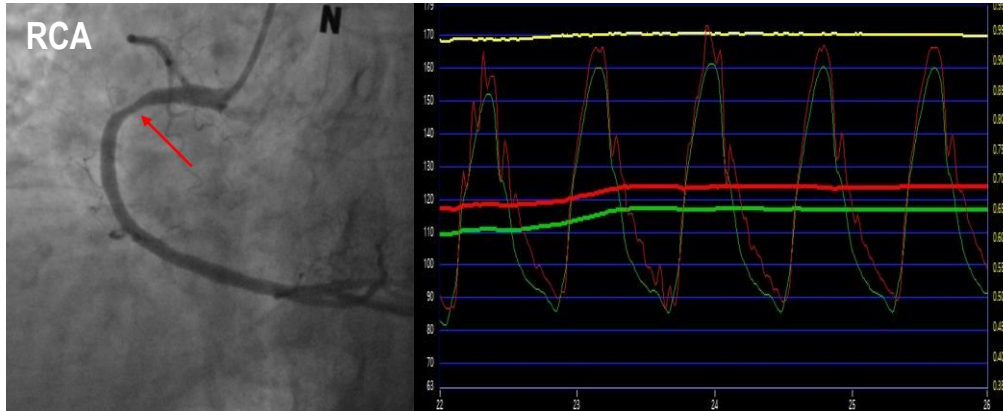


Without Inducing Hyperemia

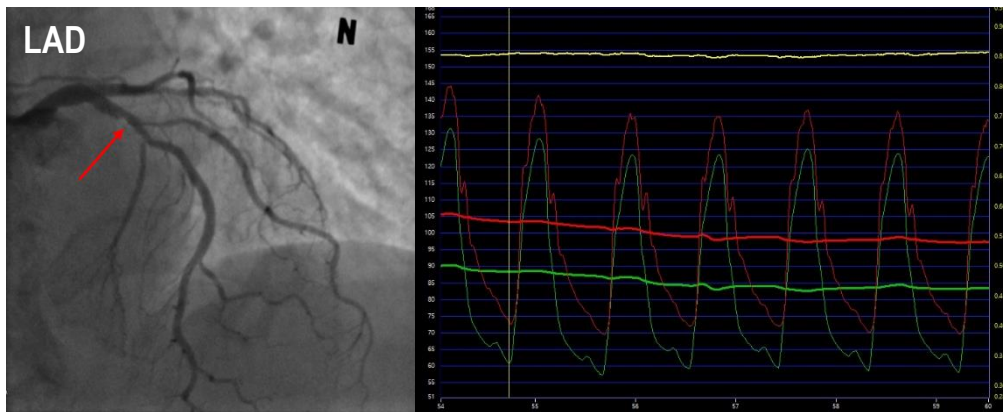
Fast computation of FFR from coronary angiography (QFR) without pressure wire or hyperemic agents is well validated in patients with SIHD.

**In-procedure time: < 5 min**

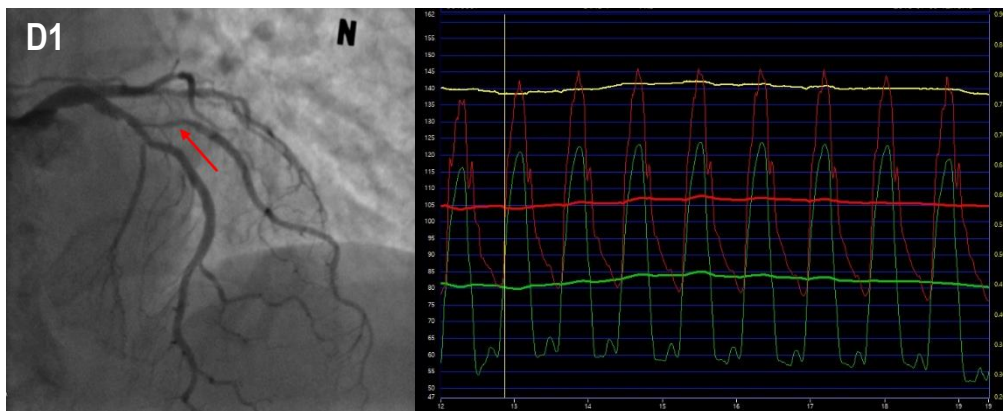
# Back to the Case (Physiologic Assessment)



RCA FFR  
0.94  
Functionally Insignificant



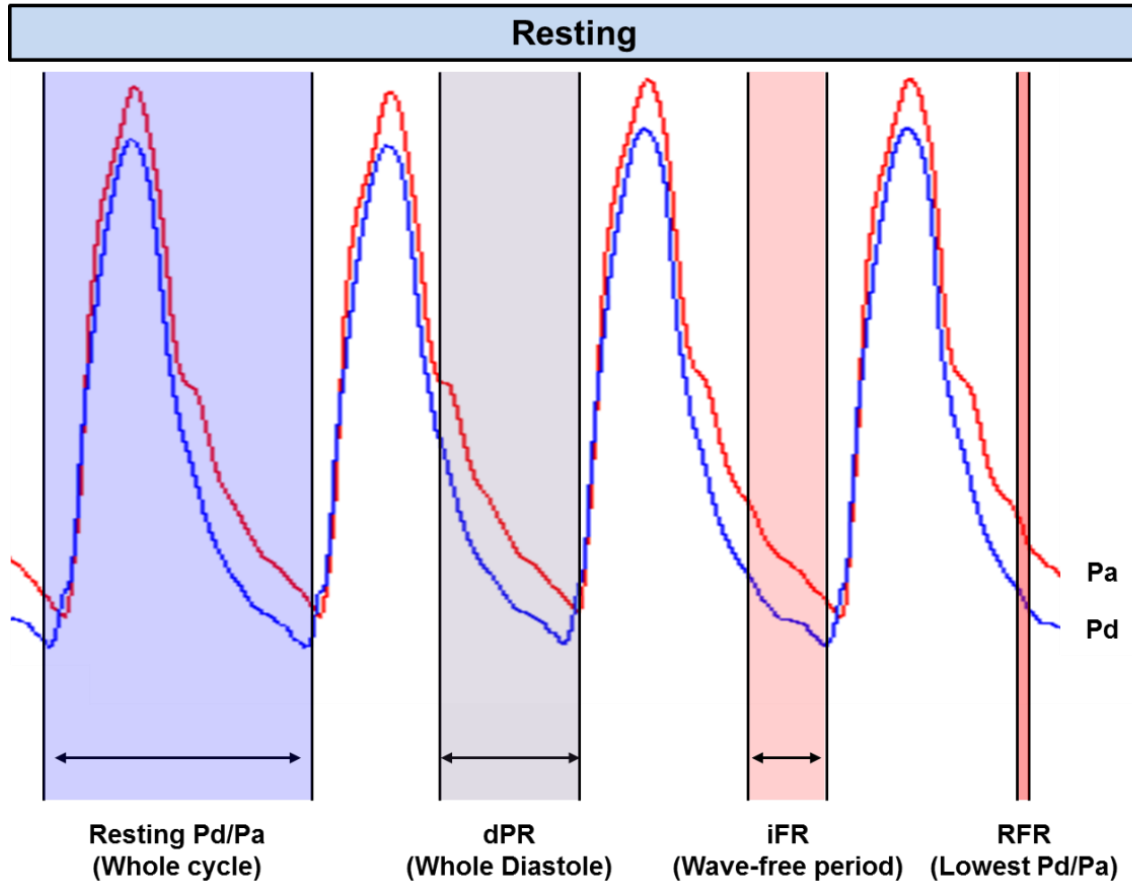
LAD FFR  
0.85  
Functionally Insignificant



D1 FFR  
0.77  
Functionally Significant

# Back to the Case (Physiologic Assessment)

## Various Resting Physiologic Indices Focused on LAD



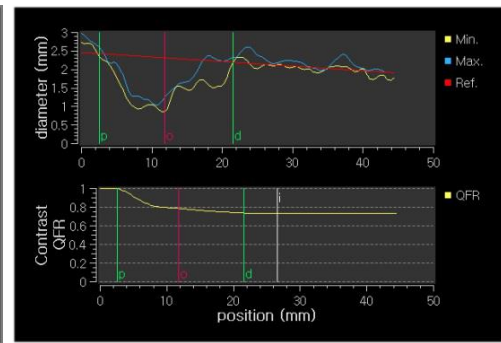
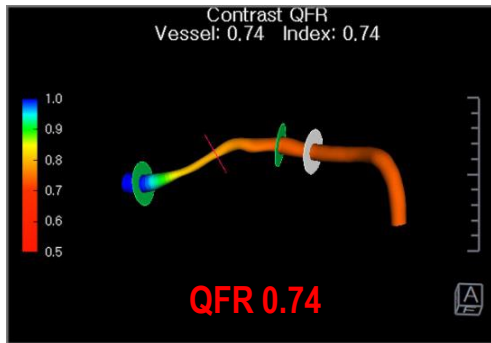
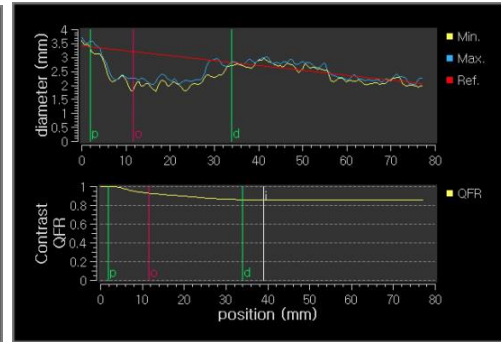
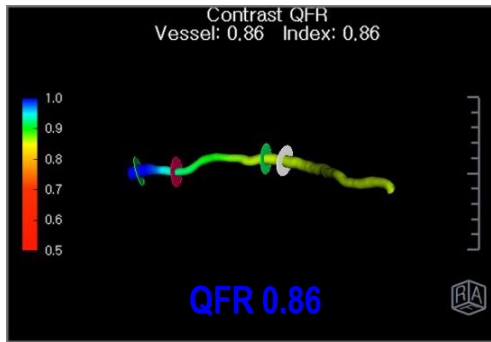
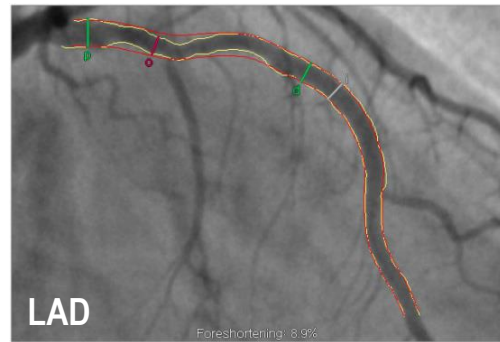
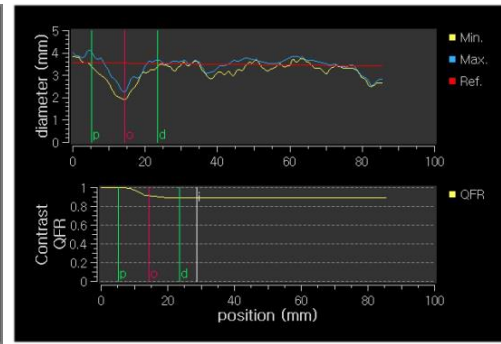
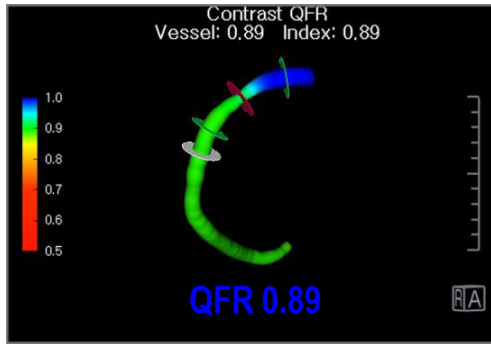
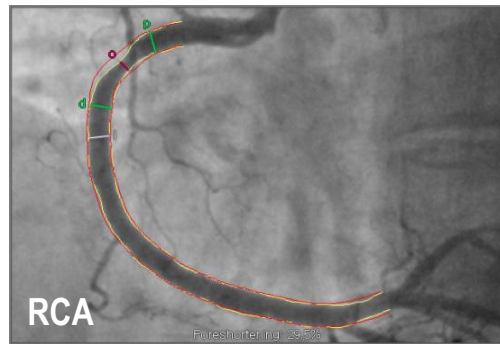
LAD Resting Pd/Pa  
0.93  
Functionally Insignificant

LAD iFR  
0.91  
Functionally Insignificant

LAD RFR  
0.91  
Functionally Insignificant

LAD dPR  
0.91  
Functionally Insignificant

# Back to the Case (Physiologic Assessment)



When analyzed using **QFR**, this patient also had functionally 1-vessel disease (D1).

# Case Summary

**M/75**

**Stable Angina**

**Angiographically 2-Vessel Disease (RCA, LAD-D1 bifurcation intermediate stenosis)**

**We cannot assess the evidence of inducible myocardial ischemia from non-invasive stress test d/t leg pain**

**Functionally 1-Vessel disease**

**(Functionally significant stenosis at diagonal branch, but insignificant stenosis at mid LAD assessed by various physiologic parameters)**

**How would you treat for this patient?**