MASTER Case Series -Tips and Tricks

Long Diffuse Lesions Management

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Hong Kong SAR
TCTAP- 2023 SEOUL

Conflicts of Interest

- I have *NOTHING* to disclose concerning this presentation

Case Illustration

- M/66
- DM HT Lipid Ex-smoker
- CRF on Peritoneal Dialysis
- Chronic stable IHD with increasing symptoms despite adequate medical Px
- Thallium – Positive reversible ischemia in **LAD** region
- Echo – mild MR , LAD region hypokinetic , EF 45%
- Coro. Angiogram -> LMN – minor

  LAD – long diffuse lesion, calcification ++

 LCX – moderate lesion

Dw patient→ prefer PCI

Coronary Angiogram

LAD – very **long diffuse calcified** lesions
Culprit lesion +ve

Management Strategy – FACTORS to consider :

- <u>Stable</u> case with symptoms
- <u>Long diffuse calcified</u> lesion LAD
- Prone to <u>high MACES w high TVR rate</u>
- What is the best treatment strategies (Medical vs PCI vs CABG)
- PCI approaches ?

  IVUS guidance – **<u>Anatomical</u>** approach

  Spot stenting vs Long multiple stentings vs DCB ?

  Calcification <u>modification</u> ?
- **<u>Physiology Guidance</u>** on Revascularization Strategies

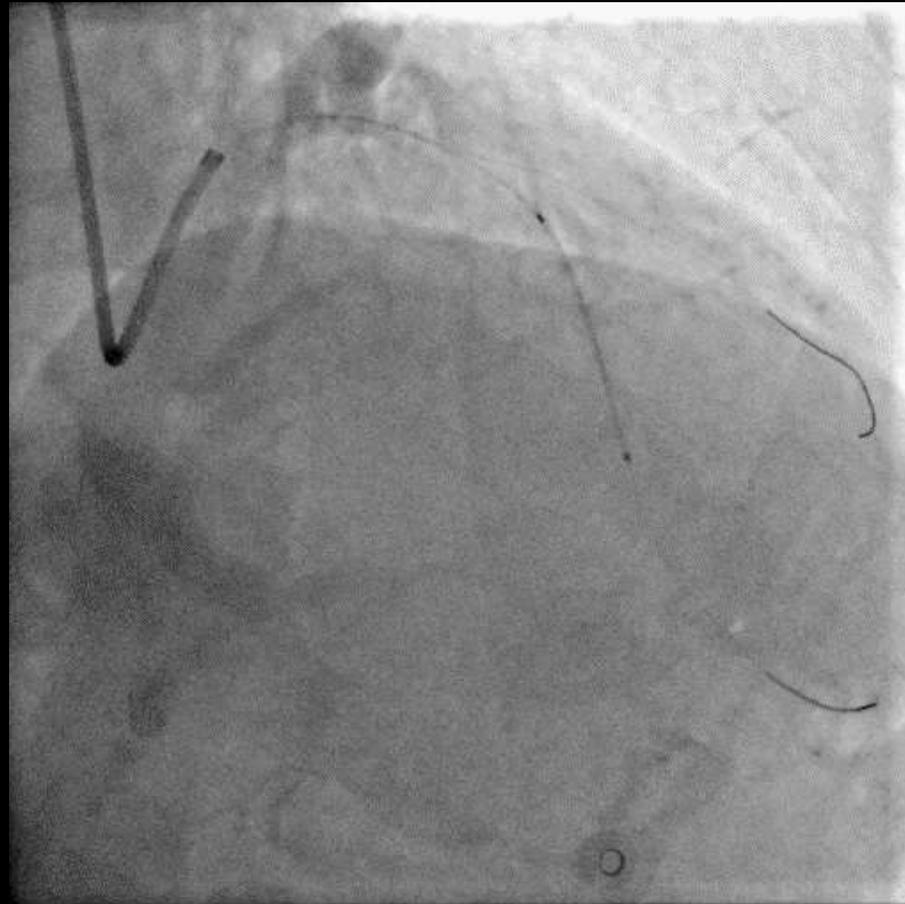 **<u>(CHANGE in CONCEPTS</u>**〉

PCI to LAD
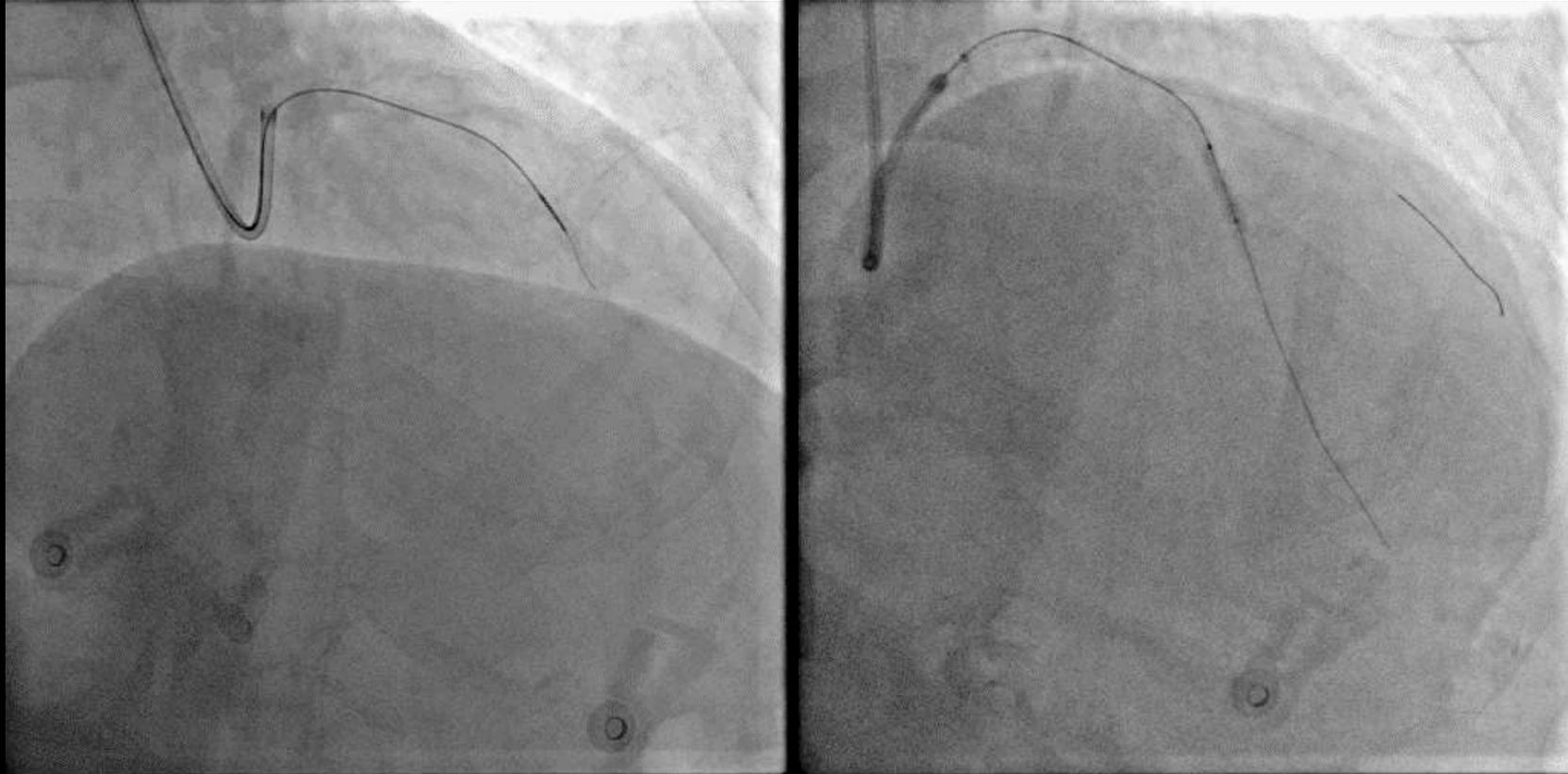
RRA
7F, SPB Slender 3.5 Guide

Turnspike LP catheter – Runthru GW, then XTA
0.85mm, 1 mm, 1.5 mm balloons , IVUS catheter **_ALL fail to cross_**
Glenadoplasties – failed
Anchor balloons, Guide extension catheter (Telescope) – fail

PTCR – 1.25 mm Rota burr

Change to Rotafloppy GW –> 1.25mm burr – Rotablation– Success
Then stepwise balloons dilatation
IVUS – severe long diffuse calcified lesion

ANGIOGRAM-post long overlapping DES / DEB
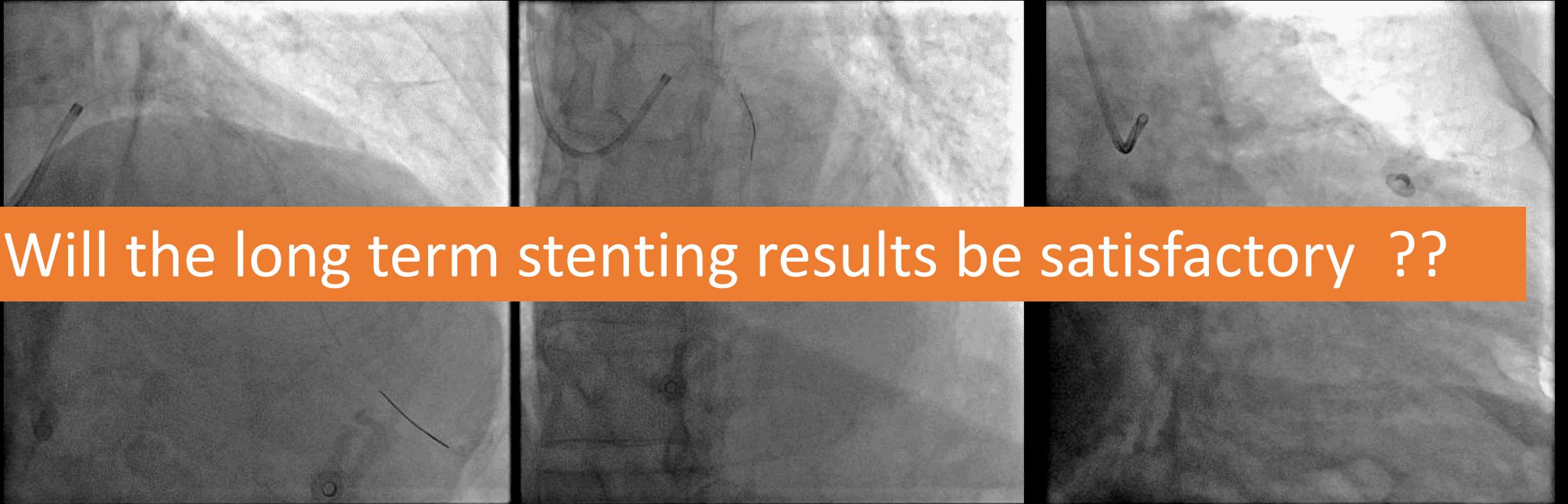
Will the long term stenting results be satisfactory ??

Stenting- Xience Skypoint 2.5x 38mm overlap 3 x 38 mm

Post NC 3.0mm, 3.5 mm HP balloon

IVUS guidance x Optimization

d-LAD long lesions small sizes 2.0 mm

Px by Complimentary DCB - Essential Pro 2.0 x 30 mm x 60 sec

DISCUSSION- Why Long Diffuse lesions COMPLEX ?

- Diffuse long coronary artery lesions consist of approximately **20%** of PCI

- Associated with **multivessel** diseases

- **Incidences increase** as increasing DM/ Surgical turndowns in very elderly

- **High-risk** lesions subset --> Therapeutic challenge

- Extend to small distal vessels

- Involvement of bifurcation lesions

- Often long treated segments → implantation of multiple long stents
  →associated poor clinical outcomes (increased stent thrombosis and restenosis[1])

- Higher incidences periprocedural complications

- Increased Cost

1,Bourassa MG, Lespérance J, Eastwood C, et al. Clinical, physiologic, anatomic and procedural factors predictive of restenosis after percutaneous transluminal coronary angioplasty. J Am Coll Cardiol. 1991;18:368–376.

Independent Predictors of Subacute Stent Thrombosis

Analysis of 2229 patients treated with DES

STENT Length

| Variables	Hazard Ratio (95% CI)	P value
Premature antiplatelet discontinuation	161.17 (26.03-997.94)	<0.001
Renal failure	5.96 (1.90-18.68)	<0.001
Bifurcation lesion	5.96 (1.90-18.68)	0.002
Diabetes	5.84 (1.74-19.56)	0.004
LVEF per 10% decrease	1.12 (1.06-1.19)	<0.001
Stent length per 1mm increase	1.03 (1.00-1.05)	0.01

Iakovou I et al. JAMA 2005;293:2126

Stent thrombosis rate increased with increased Stented segment length by meta-analysis

$$Y = -1.455 + 0.121 X$$
95% CI for b:0.014-0.023
R=0.716; P=0.031
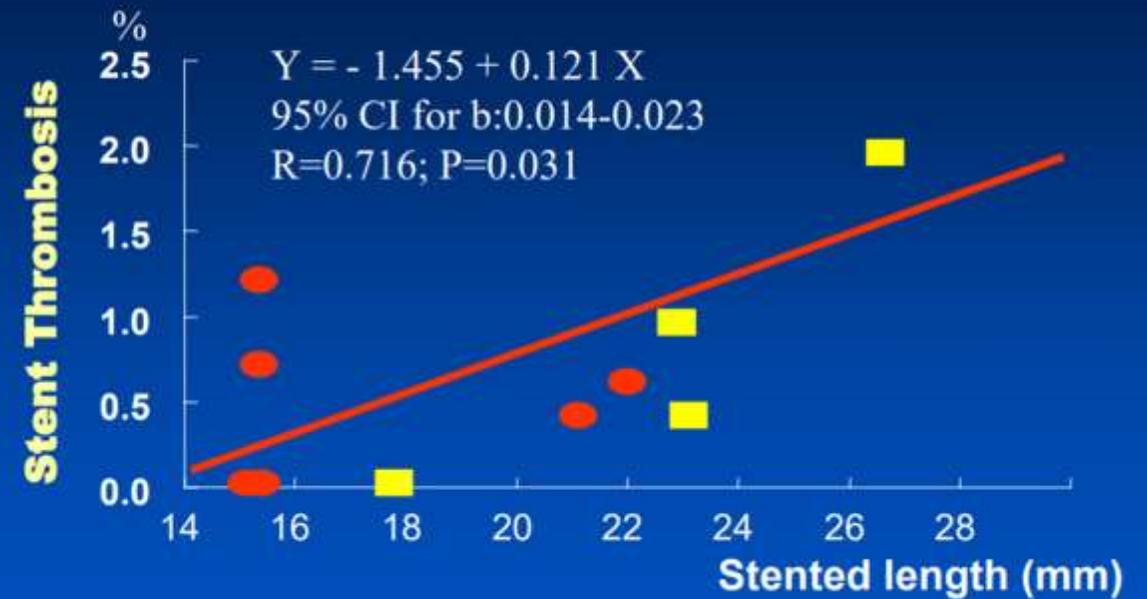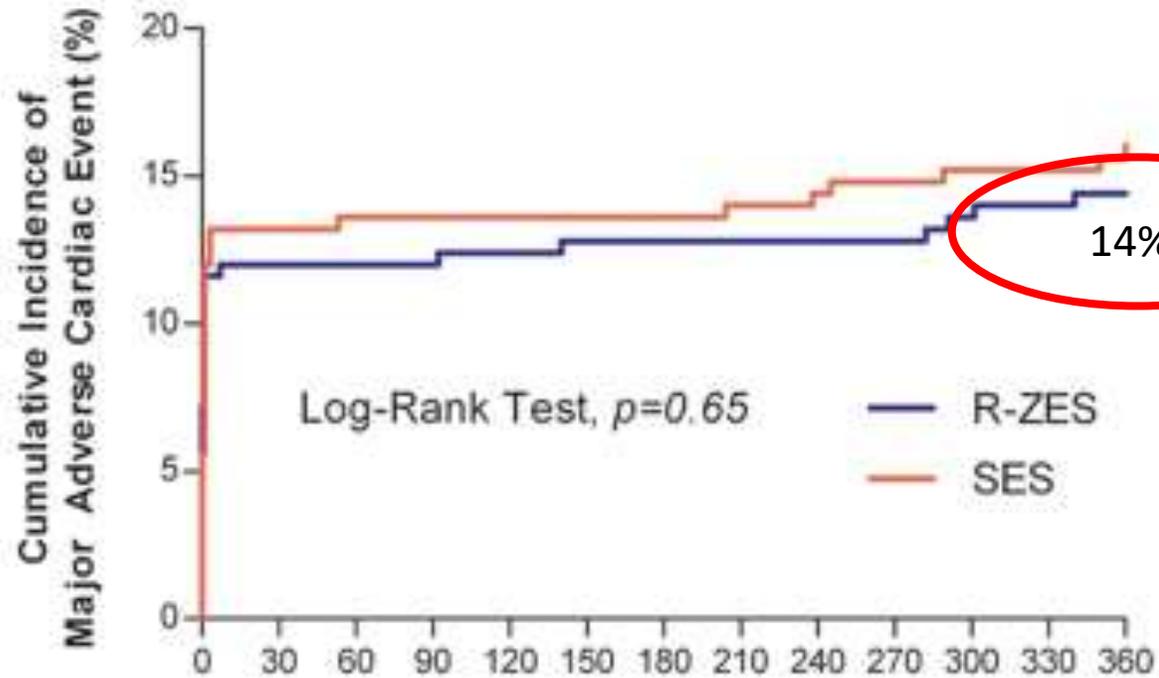
Moreno R et al. J Am Coll Cardiol 2005;45:954

Problems of long overlapping stents
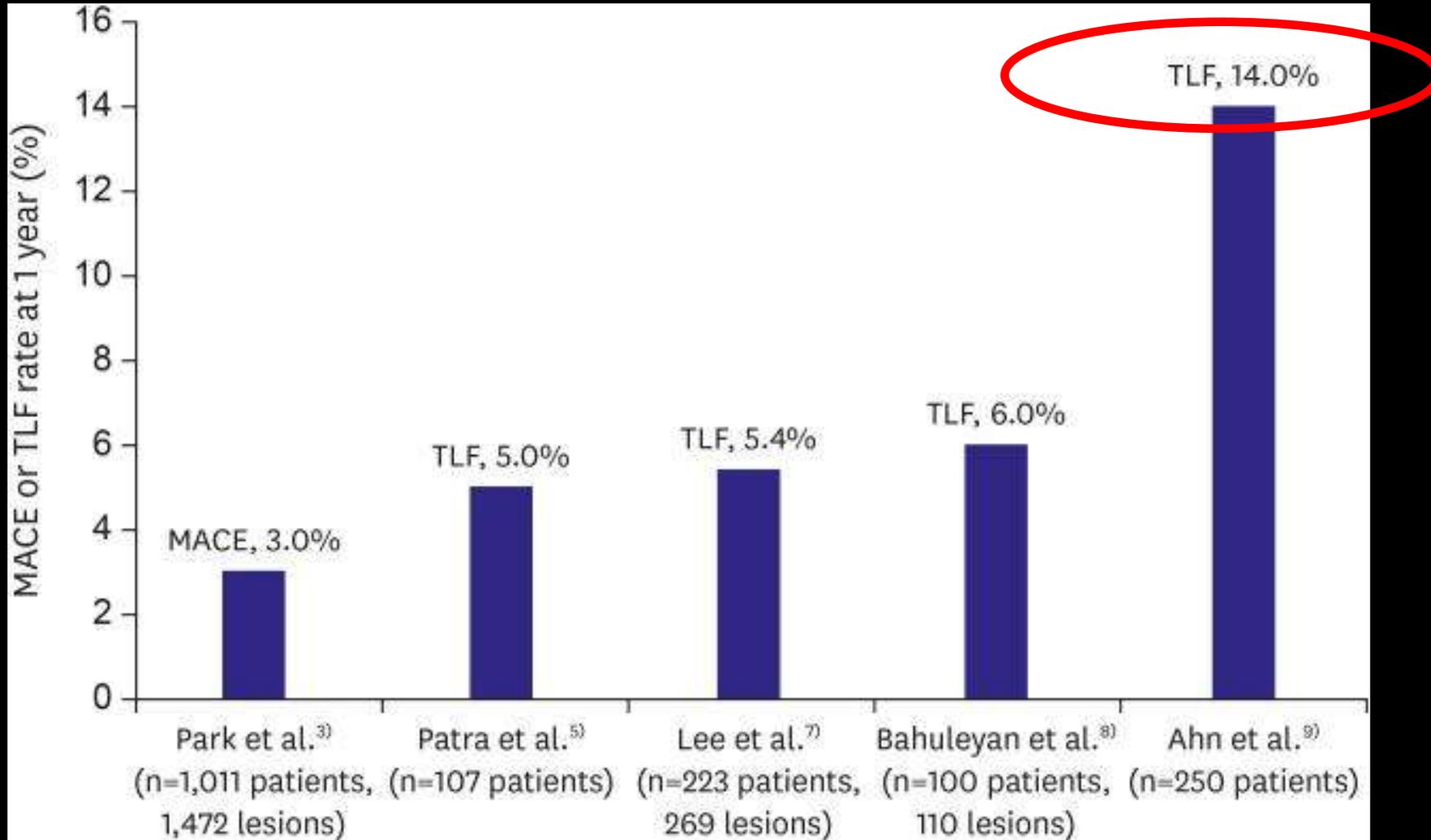
* One-year MACE or TLF after implantation of R-ZES for diffuse long coronary artery disease

LONG Native Coronary Lesions With Drug-Eluting Stent-IV (LONG-DES IV)

- Higher TLR (14%) of R-ZES at 1-year : due to more implantation of multiple stents (52.8% > 2 stents) and longer stent length (45.9 ± 17.1 mm)

Procedural and One-Year Clinical Outcomes of Long 48 mm Xience Xpedition Everolimus-Eluting Stent in Complex Long Diffuse Coronary Artery Lesions

Fu-Chih Hsiao, Cheng-Ting Tsai, Lung-An Hsu, Ying-Chang Tung, Fa-Chang Yu, Chia-Pin Lin, Shing-Hsien Chou, Hsin-Fu Lee, Yen-Chen Lin, Chi-Jen Chang [1]

Affiliations + expand
PMID: 35058374

Free article

Roles of New - LONG stent in diffuse long lesions

Procedure success	98.6%
Target-vessel failure (TVF) rate 1yr	4.2%
target-vessel myocardial infarction	1.4%
TVR	3.3%
definite/ probable stent thrombosis	0.9%

- After adjusting patient variables by propensity score matching, no significant difference was found for cardiac death, TVF, TV-MI, and clinically driven TVR.

Role of DCB- Drug Coated Balloon in long diffuse coronary lesions
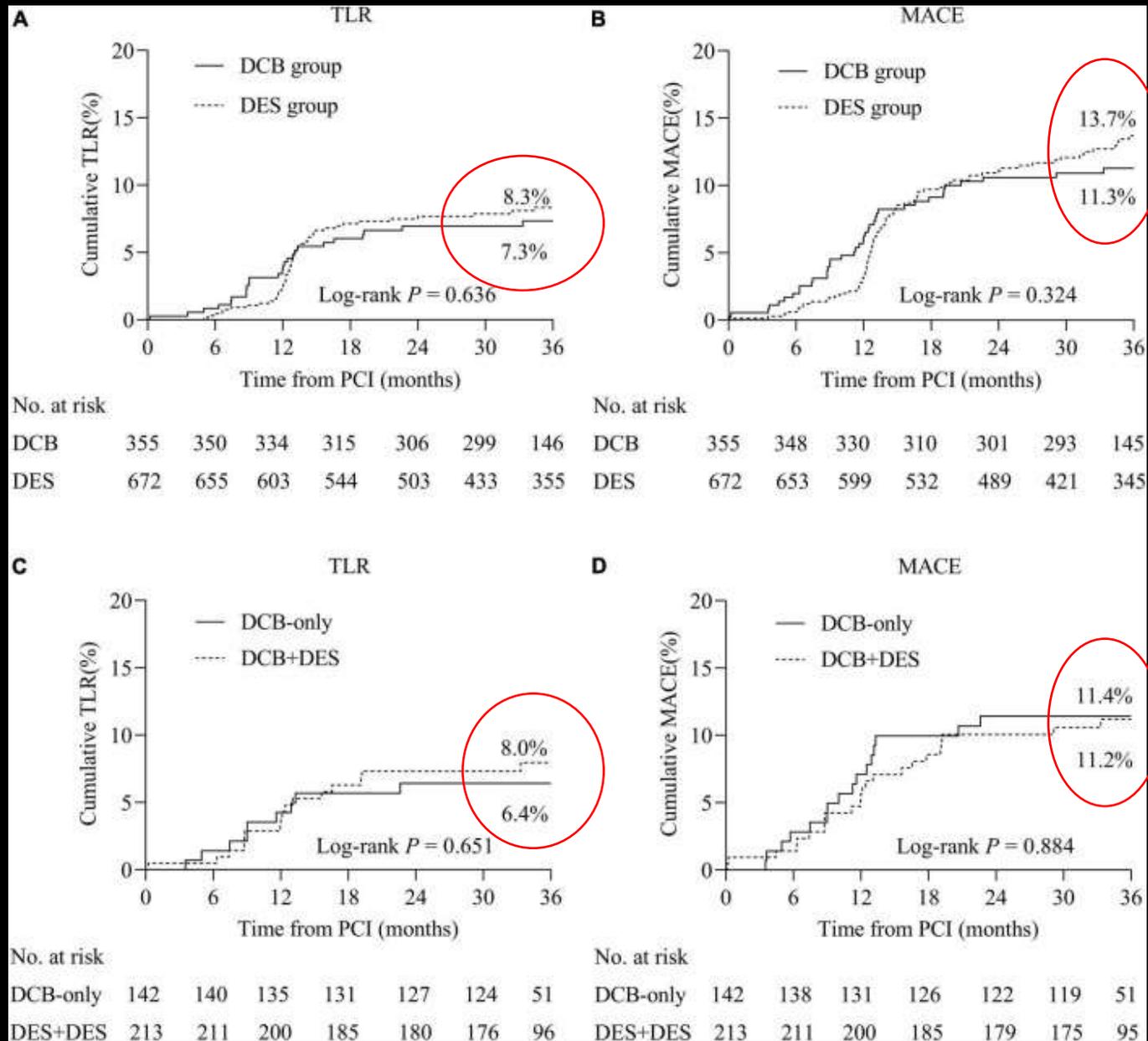
- Prospective, observational, Multicenter study
  Lesion length > 25 mm
  Px : DCB and/ or DES strategy

RESULTS：
  Efficacy and safety of DCB strategy (DCB alone or combined DES) are similar to those of DES alone in long diffuse coronary lesions

4.3. Use of Coronary Physiology to Guide Revascularization With PCI

Recommendations for the Use of Coronary Physiology to Guide Revascularization With PCI
Referenced studies that support the recommendations are summarized in Online Data Supplement 5.

COR	LOE	Recommendations
1	A	1. In patients with angina or an anginal equivalent, undocumented ischemia, and angiographically intermediate stenoses, the use of fractional flow reserve (FFR) or instantaneous wave-free ratio (iFR) is recommended to guide the decision to proceed with PCI.[1-6]
3: No benefit	B-R	2. In stable patients with angiographically intermediate stenoses and FFR >0.80 or iFR >0.89, PCI should not be performed.[7-10]

CHANGING CONCEPTS

• Anatomical Guided →

    Physiology GUIDANCE of Revascularization

• Any Latest Evidences ?? X Long Diffuse lesions

Physiology Guidance in Long Diffuse Lesions - RATIONALE

- Clinical significance of moderate diffuse /long lesions can be **uncertain**
- These lesions may not associate with visually severe stenosis, physiological assessment with **pressure wire pullback** →can **precisely identify site** of hemodynamically significant **pressure drop**
- In diffuse atherosclerosis, **pressure gradient may be gradual / mild** in some segments, while other regions may have a **sharp pressure change** across **specific areas** **(** contain the most functionally significant lesions)
- **Pressure wire pullback** -> useful for **pre-PCI planning in diffuse disease**
  → stents can be positioned **strategically in a parsimonious manner**
  （intervene only the functionally significant areas that will **maximize** post PCI blood flow)

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nerican Heart Association > Vol. 11, No. 23 > Procedural Outcomes After Percutaneous Coronary Interventions in Focal and Diffuse Coron...

Procedural Outcomes After Percutaneous Coronary Interventions in Focal and Diffuse Coronary Artery Disease

Takuya Mizukami, Jeroen Sonck, Koshiro Sakai, Brian Ko, Michael Maeng, Hiromasa Otake, Bon-Kwon Koo, Sakura Nagumo, Bjarne L. Nørgaard, Jonathon Leipsic, Toshiro Shinke, Daniel Munhoz, Niya Mileva, Marta Belmonte, Hirofumi Ohashi, Emanuele Barbato, Nils P. Johnson, Bernard De Bruyne and Carlos Collet ✉

Other version(s) of this article ∨

Abstract

Background

Coronary artery disease (CAD) patterns play an essential role in the decision-making process about revascularization. The pullback pressure gradient (PPG) quantifies CAD patterns as either focal or diffuse based on fractional flow reserve (FFR) pullbacks. The objective of this study was to evaluate the impact of CAD patterns on acute percutaneous coronary intervention (PCI) results considered surrogates of clinical outcomes.

Methods and Results

This was a prospective, multicenter study of patients with hemodynamically significant CAD undergoing PCI. Motorized FFR pullbacks and optical coherence tomography (OCT) were performed before and after PCI. Post-PCI FFR >0.90 was considered an optimal result. Focal disease was defined as PPG >0.73 (highest PPG tertile). Overall, 113 patients (116 vessels) were included. Patients with focal disease were younger than those with diffuse CAD (61.4±9.9 versus 65.1±8.7 years, P=0.042). PCI in vessels with high PPG (focal CAD) resulted in higher post-PCI FFR (0.91±0.07 in the focal group versus 0.86±0.05 in the diffuse group, P<0.001) and larger minimal stent area (6.3±2.3 mm^2 in focal versus 5.3±1.8 mm^2 in diffuse CAD, P=0.015) compared with vessels with low PPG (diffuse CAD). The PPG was associated with the change in FFR after PCI (R^2=0.51, P<0.001). The PPG significantly improved the capacity to predict optimal
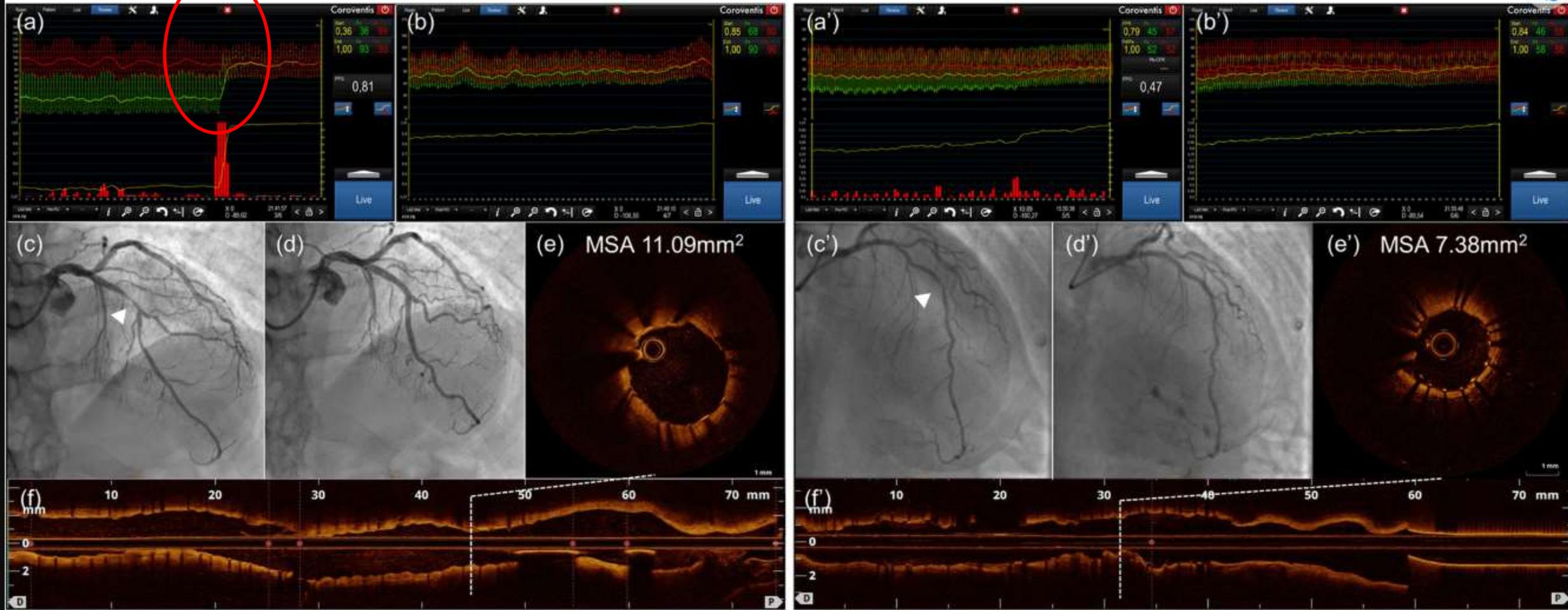

Diseases pattern by PHYSIOLOGY Guidance By motorized FFG Pullback

Journal of the American Heart Association. 2022;11:e026960

Physiology Classification

Adenosine 140ug/kg/min infusion → Maximal Hyperemia

PPG - Pullback Pressure Gradient (FFR motorized pullback)

- Novel approach to quantify CAD as **focal / diffuse** based on coronary physiology

- PPG is a continuous metric (values approaching 0 representing diffuse CAD , close to 1 characterizing focal CAD)

- **PCI outcomes :**

  High PPG (focal disease) - Better outcomes , higher post-PCI FFR and

  larger MSA, (markers of improved PCI durability)

- Low PPG (diffuse disease)- Poor outcomes (low post-PCI FFR and smaller

  MSA)

- PPG- assessed as a **continuous variable**, is strongly associated with change in FFR after PCI, a parameter predictive of **angina relief post PCI**

Role of other NON-Hyperemic Pressure Indexes

- FFR relies upon maximal hyperemia, if assess individual areas within diffuse disease or isolate relative significance of focal serial lesions, FFR may suboptimal as it is **challenging to deconstruct** the relative contribution of individual lesions in a state of **maximal hyperemia**

- NHPR measure physiology in the **resting state**, are options for pullback studies to create an **accurate physiological map** of lesion severity

- **Co-registration** (combines NHPR pullback with angiographic images) – overlay of physiological maps directly onto the coronary anatomy for precise localization of significant lesions

iFR Pullback in long diffuse lesions

- The i-FR pullback , **allow point-by-point measurement** alongside a coronary vessel, without time restrictions linked to duration of hyperemia, can separately interrogate different parts of a long diffuse diseased vessel

- Motorized i-FR pullback recording, combined with real-time computer tracking of the pressure-wire movement, provides a **complete physiological map** of coronary vessel

- Graphical representation of the point estimations of the iFR can be integrated with a **co-registered angiogram**, providing a fusion of functional and anatomical information

- iLARDI: Usefulness of the Use of Co-registration Strategy With iFR in Long and/or Diffuse Coronary Lesions

First randomized trial to assess the potential utility of SyncVision-guided revascularization in long, sequential and diffuse coronary lesions
- Pending Results
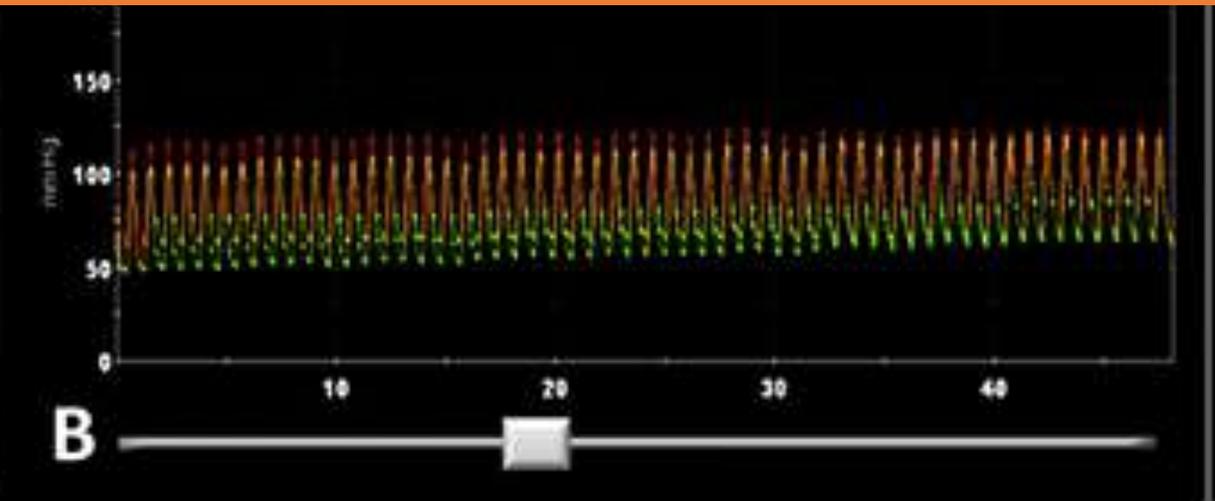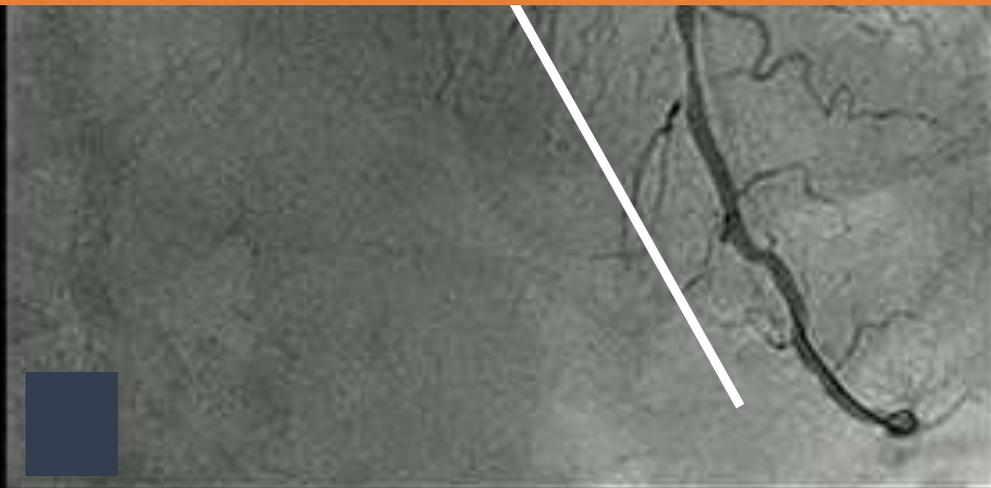
iFR pullback – with Co -registration

iFR Co-registration Pullback

Coronary Physiology: Modern Concepts for the Guidance of Percutaneous Coronary Interventions and Medical Therapy

by Monica Verdoia * and Andrea Rognoni

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Abstract

Recent evidence on ischemia, rather than coronary artery disease (CAD...
outcomes, has led to a progressive shift in the management of patients wi...
most recent guidelines, myocardial revascularization strategies based on an...
abandoned in favor of functional criteria for the guidance of PCI. Thus, em...
the assessment of coronary physiology in order to determine the ische...
However, despite several indexes and tools that have been developed so f...
conditions potentially biasing the functional evaluation of the coronary tree s...
of choice. The present review provides an overview of the available method...
the invasive assessment of ischemia, focusing on the most widely availabl...
and instant-wave free ratio (iFR), in addition to emerging examples, as ne...
(CFR) and microvascular resistance, aiming at promoting the knowledge a...
principles, which are generally advocated to allow a tailored treatment and t...
benefits.

Keywords: coronary flow; coronary reserve; percutaneous coronary int...

**Figure 2.** Co-registration of pullback instant wave-free flow reserve (iFR) and coronary angiography. (**A**) (left image) displays a pattern of focal disease: two pressure drops are evident in the iFR registration graph (white arrows) corresponding to two focal stenoses on the mid and distal left anterior descending artery (black arrows). (**B**) (right image) shows a pattern of diffuse disease: no significant pressure drop is evident in the iFR graph.

Pre-angioplasty instantaneous wave-free ratio pullback provides virtual intervention and predicts hemodynamic outcome for serial lesions and diffuse coronary artery disease.

S. Nijjer, S. Sen, +19 authors, J. Davies · Published 1 December 2014 · Medicine · JACC, Cardiovascular Interventions
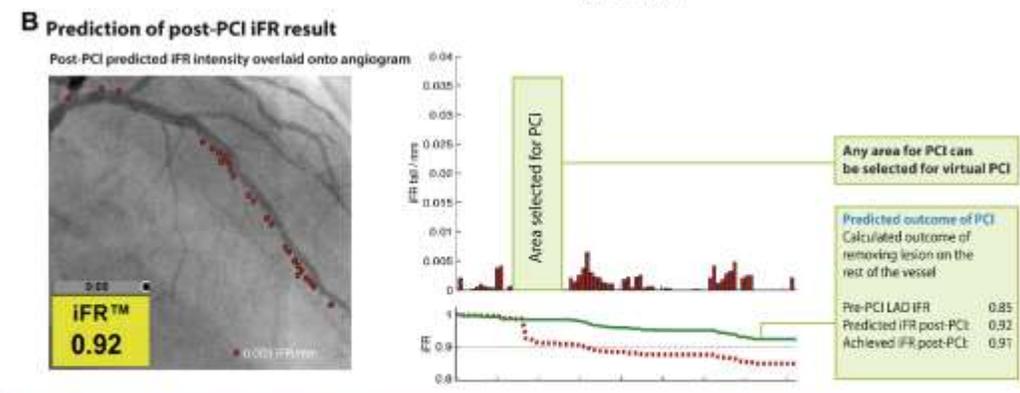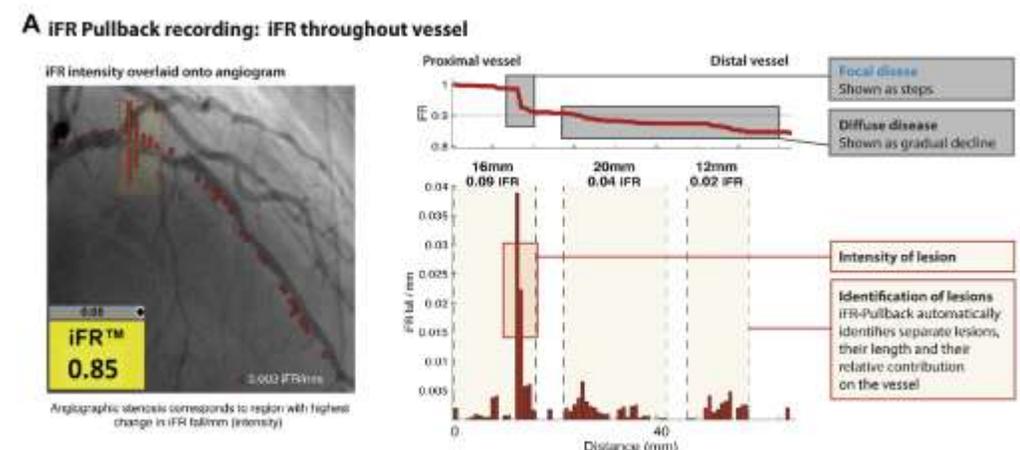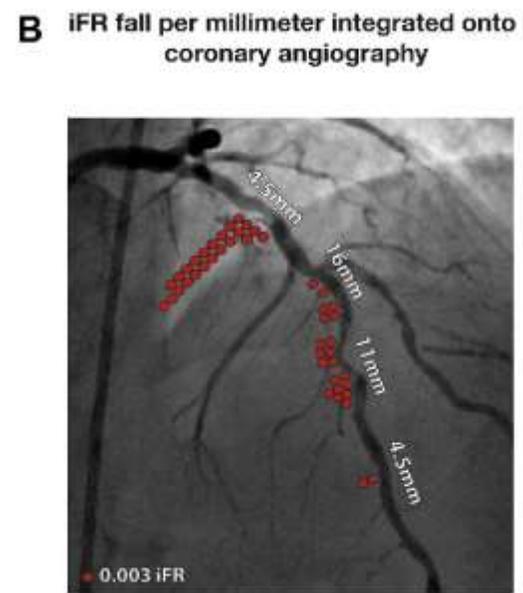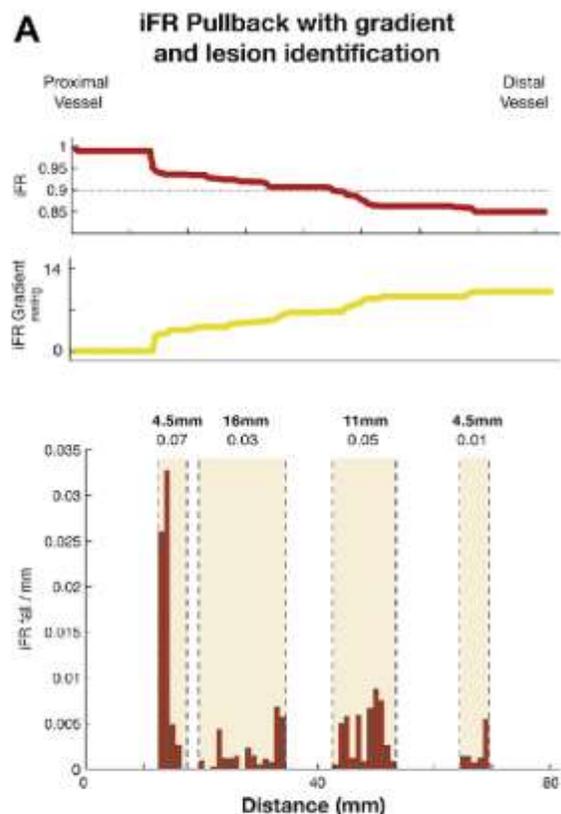
FIGURE 2 iFR Pullback Can Identify Lesions, Measure Length, and Integrate With Coronary Angiography

(A) An iFR pullback (top: iFR plotted along the length of wire movement). iFR gradient (middle: the transstenotic pressure gradient measured

FIGURE 3 iFR Pullback Can Predict the Outcome of PCI

Schematic representation of work flow and interpretation of iFR pullback data. Focal discrete disease can be distinguished from diffuse disease and individual physiological lesions identified (A). These can be virtually removed by selecting regions of interest (B). The pullback will calculate the expected post-PCI iFR if that area is treated by stenting and demonstrate a predicted pullback result. This corresponds closely to the observed result. iFR = instantaneous wave-free ratio; LAD = left

A) RCA with 4 distinct areas of pressure loss
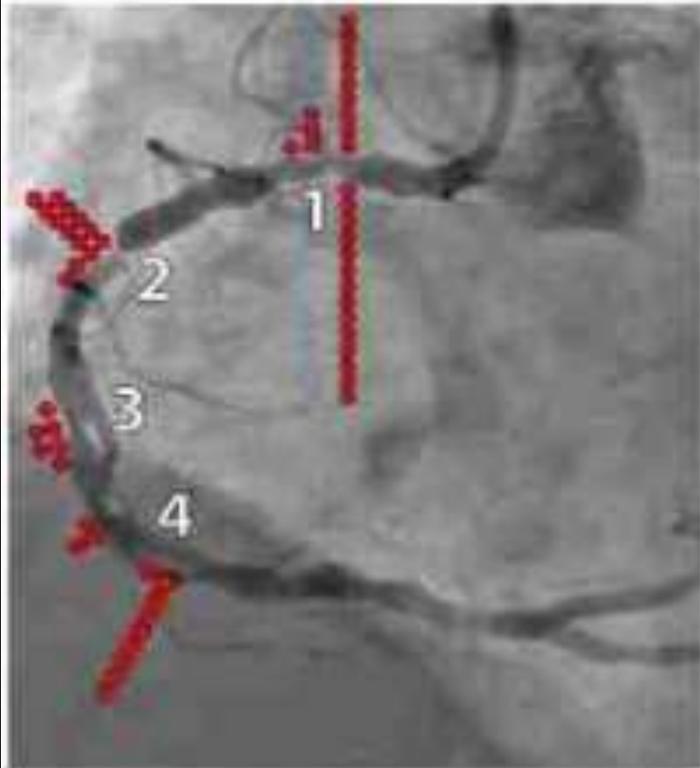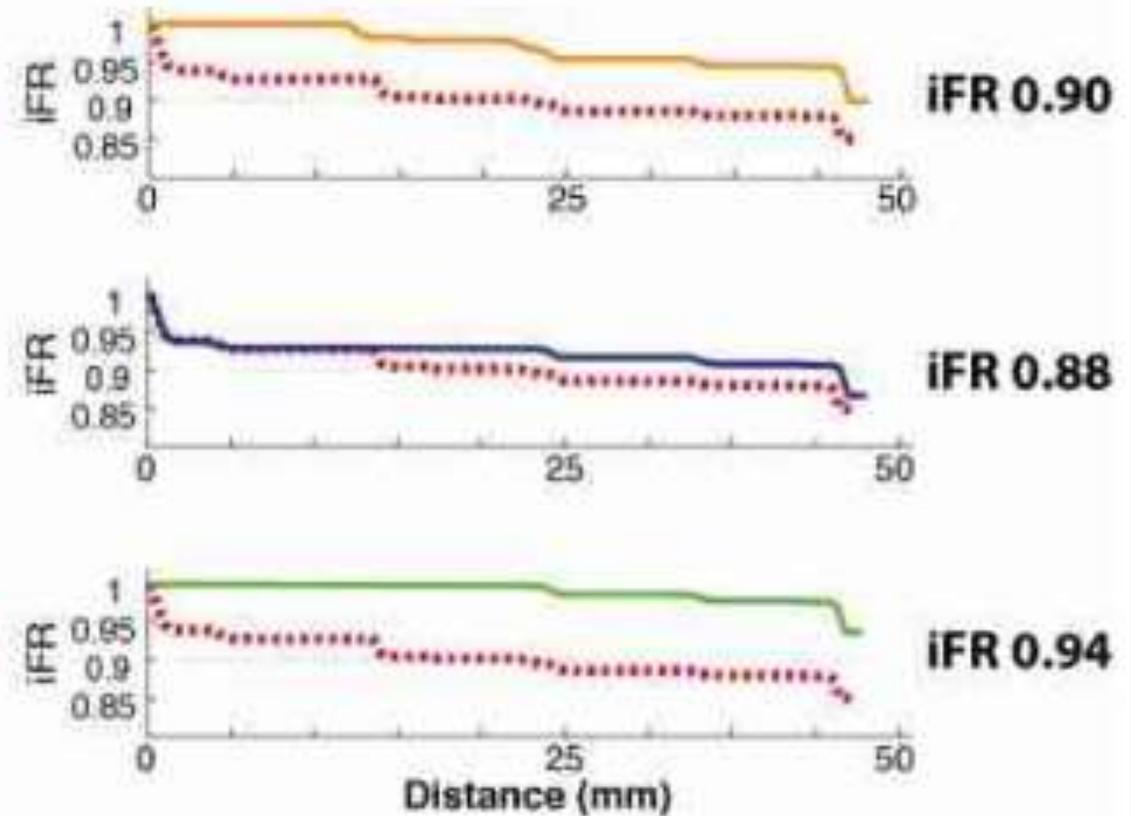
B) Different stenting strategies can be considered
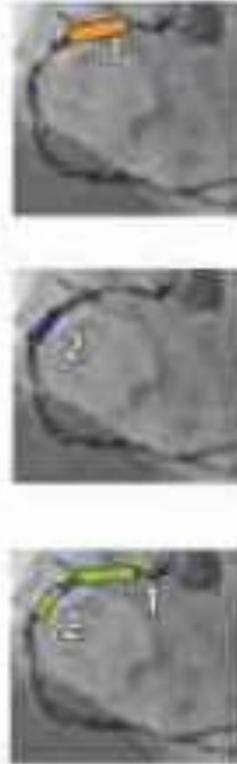
C) The physiological results of each stenting strategy can be predicted

1 only — iFR 0.90

2 only — iFR 0.88

1 and 2 — iFR 0.94

Distance (mm)

Virtual PCI can be performed on iFR-Pullback to calculate the effect of removing a stenosis.

ORIGINAL RESEARCH

Feasibility of Quantitative Flow Ratio Virtual Stenting for Guidance of Serial Coronary Lesions Intervention

Shaofeng Guan, MD*; Qian Gan, MD *; Wenzheng Han, MD; Xinrong Zhai, MD; Ming Wang, MD; Yang Chen, MD; Liang Zhang, MD; Tianqi Li, MD; Xifeng Chang, MD; Hongyuan Liu, MD; Weilin Hong, MD; Zehang Li, PhD ; Shengxian Tu, PhD ; Xinkai Qu, MD

Background: Coronary physiology measurement in serial coronary lesions with multiple stenoses is challenging. Therefore, we evaluated the feasibility of Murray fractal law-based quantitative flow ratio (μQFR) virtual stenting for guidance of serial coronary lesions intervention.

Methods and Results: Patients who underwent elective coronary angiography and had 2 serial de novo coronary lesions of 30% to 90% diameter stenosis by visual estimation were prospectively enrolled. μQFR and fractional flow reserve (FFR) were assessed after coronary angiography. In vessels with an FFR ≤0.80, the lesion with the larger pressure gradient was considered to be the primary lesion and treated firstly, followed by FFR measurement. The second lesion was stented when FFR ≤0.80. All μQFR and predicted μQFR after stenting were calculated from diagnostic coronary angiography before interventions, with the analysts masked to the FFR data. A total of 54 patients with 61 target vessels were interrogated. Percutaneous coronary intervention was performed in 44 vessels with FFR ≤0.80. After stenting the primary lesions, 14 nonprimary lesions had FFR ≤0.80 and a second drug-eluting stent was implanted. There was excellent correlation ($r=0.97$, $P<0.001$) and good agreement (mean difference: 0.00±0.03) between baseline μQF

QFR- Quantitative Flow Ratio

Virtual stenting by quantitative flow ratio will be a simple noninvasive evaluation method --

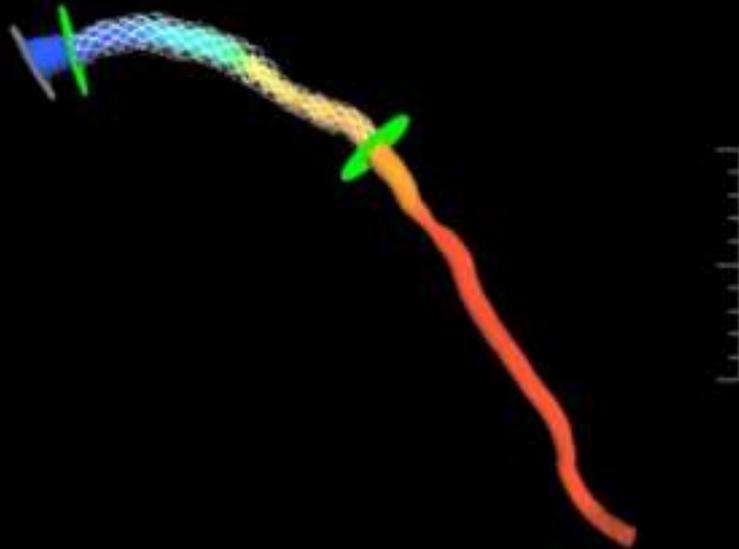Guidance of serial coronary lesions intervention without administration of hyperemic drugs and easily done before PCI
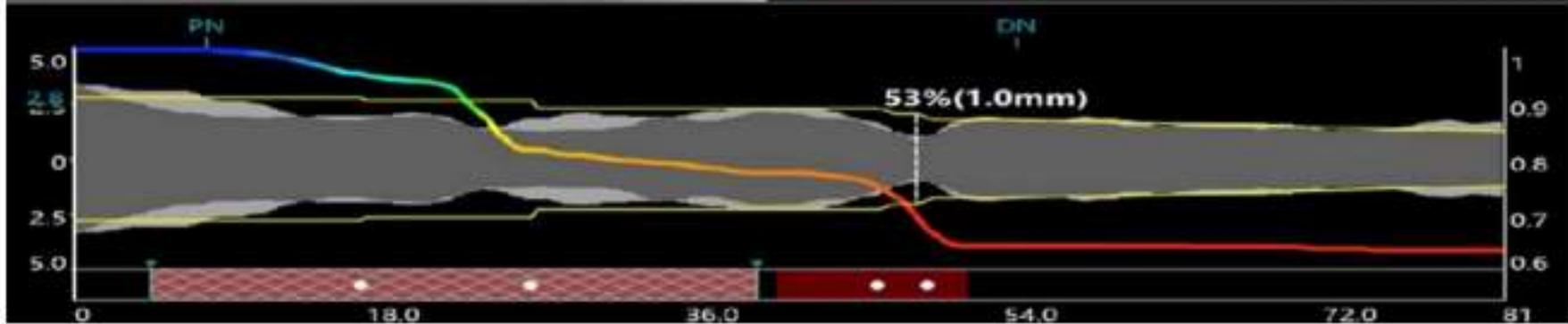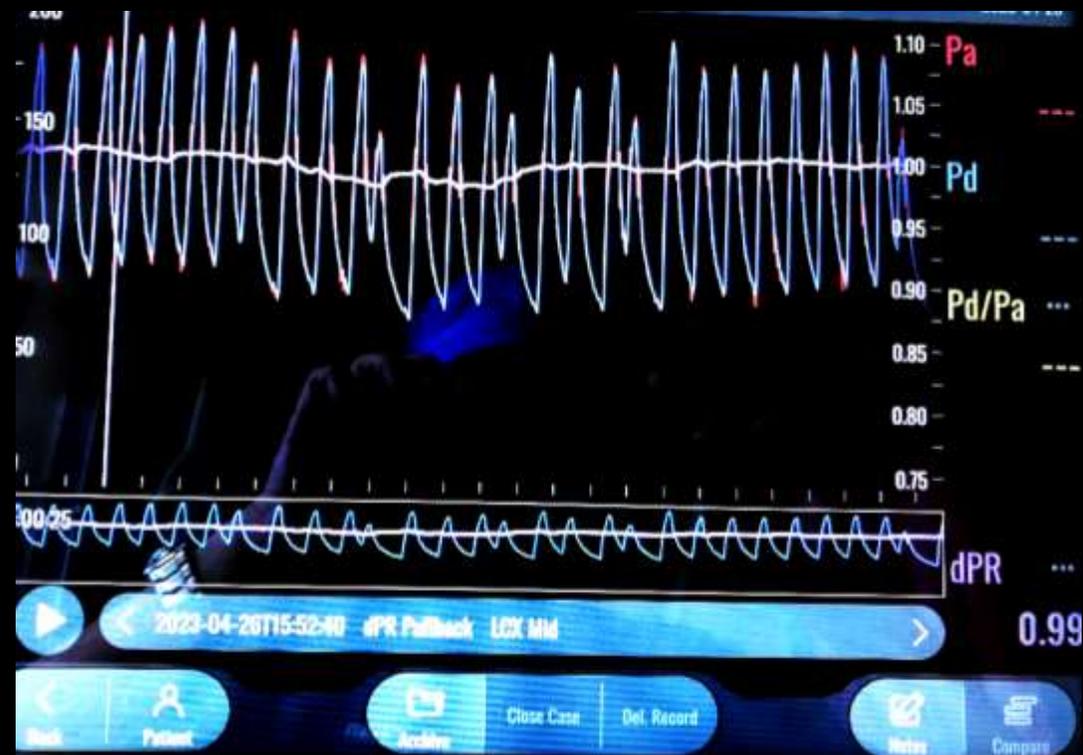
Angiogram – Lf
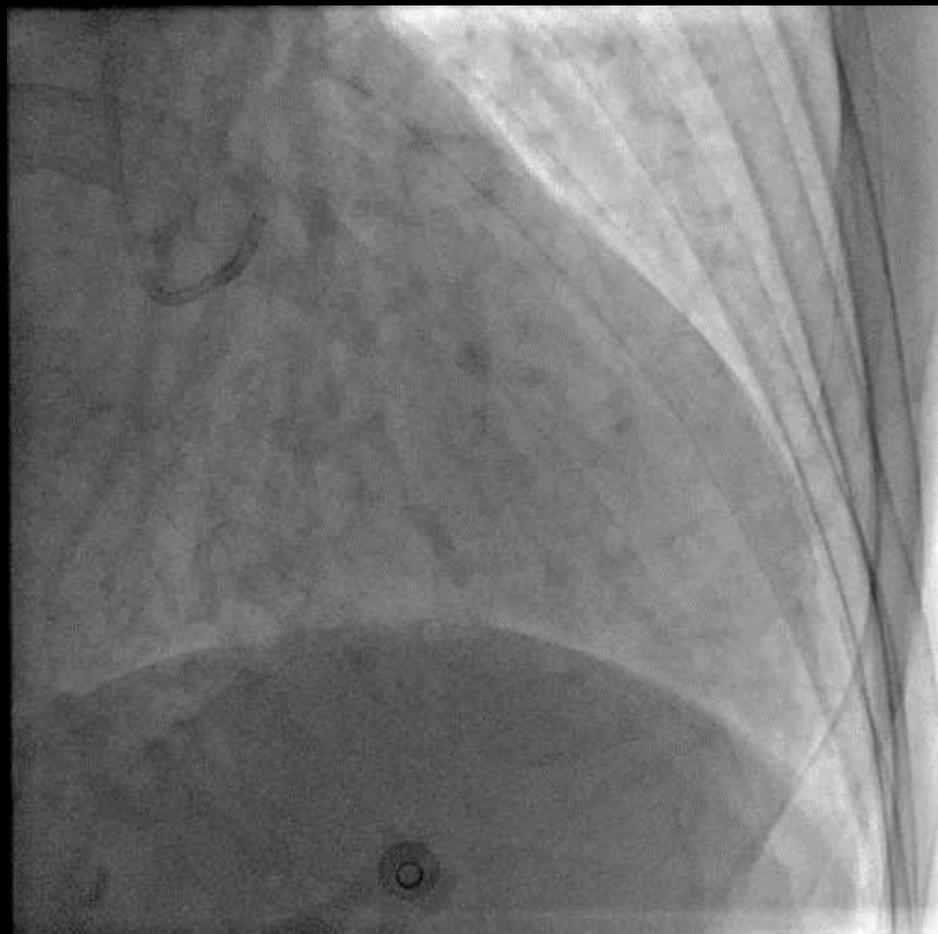
FFR Pullback of LAD/ LCX

iFR 0.92

iFR 0.99

Conclusion

- Long Diffuse lesion still poses a great **challenge** in current day PCI
- Current PCI strategy with long stenting still carries *high TVF / MACE rates*
- Long stenting with Complimentary DCB under IVUS guidance is **technically feasible** and has good immediate outcome
- However, more emerging evidences suggest a **Change in Concept** to **Physiology – guided** revascularization approach in long diffuse lesions
- The use of NHPR is promising to guide strategies in long diffuse lesions
- **However More clinical trials /data** are needed to decide on the best treatment approaches for long diffuse lesion either Medical Px or PCI or CABG

The REVIVED-BCIS2 trial: percutaneous coronary intervention *vs.* optimal medical therapy for stable patients with severe ischaemic cardiomyopathy

Rocco Vergallo [1]* and Giovanna Liuzzo [1,2]

[1]Department of Cardiovascular Medicine, Interventional Cardiology Unit, Fondazione Policlinico Universitario A. Gemelli—IRCCS, Largo A. Gemelli, 8–00168, Rome, Italy; and [2]Catholic University of the Sacred Heart, Largo F. Vito, 8, 00168, Rome, Italy

- Incidence of CV death similar in PCI group and OMT group (21.9% vs. 24.9%; HR: 0.88; 95% CI: 0.65–1.20) and MI (10.7% vs. 10.8%; 1.01; 95% CI: 0.64–1.60)
- Patients with severe ischemic LV systolic dysfunction who received OMT , PCI did not result in a lower incidence of death from any cause or hospitalization for heart failure