

OCT

- Studies comparing OCT measurements with FFR (FFR been used as the gold standard)
- OCT characteristics of vulnerable plaques

THE MAIN QUESTION REMAINS HOW TO DEAL WITH SENSITIVE PLAQUES OTHER THAN LOWERING CHOLESTEROL LEVELS

3D QCA

- Better assessment of lesion severity compared to 2D QCA (especially eccentric lesions)
- Better correlation with FFR than 2D QCA

ANGIOGRAPHIC ASSESSEMENT OF LESION SEVERITY IS LESS SENSITIVE THAN FFR IN PREDICTING FUTURE EVENTS

- Not always possible to get the views needed

Conclusions

- Only IVUS VH has been proved able to predict future events in a similar manner to FFR
- Both methods have low predictability: $\approx 18\%$
- FFR is far more easy to use

Imaging coupled with physiology

- FFRct
- vFAI
- Different imaging modalities coupled with ESS

FFRct

- Important advance in the field
- Will continue to be refined
- Increases the cost of CTCA by 4-fold
- Unnecessary ICA and revascularizations can be avoided
- Pts less likely to benefit
 - severe, high risk lesions (80-90% proximal LAD)
 - Unequivocally low-risk lesions (distal, branch vessels)

vFAI: Estimation of coronary stenoses' functional severity by using coronary angiography coupled with physiology?

- The 2nd published study

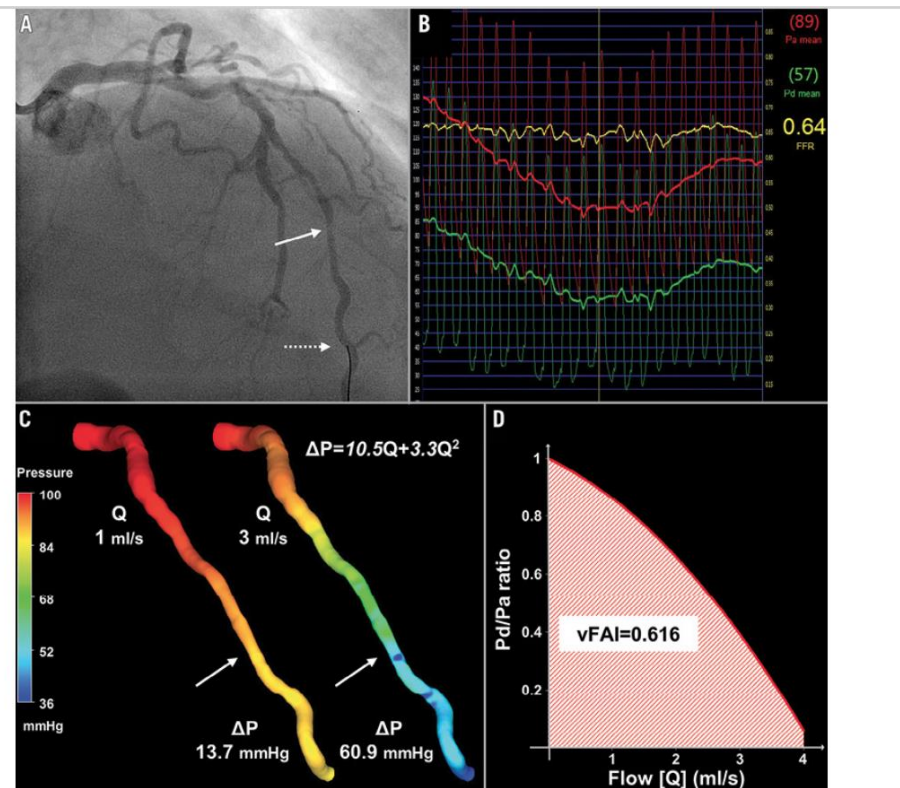


Figure 2. Intermediate lesion with haemodynamic significance. (A) Representative example of a left anterior descending artery (LAD) with a moderate lesion (arrow: maximal stenosis) in angiography (3D-QCA %diameter stenosis: 35%) that had (B) a low fractional flow reserve (FFR=0.64) measured at a distal location (dotted arrow) using the pressure wire. (C) 3D-QCA coronary lumen reconstruction with the pressure distribution in a colour-coded map for two different flow rates (Q), which resulted in a pressure gradient (ΔP) of 13.7 and 60.9 mmHg. The computed artery-specific ΔP -Q relationship is provided. The arrows denote the location of maximal stenosis. (D) Relationship between the ratio of distal to aortic pressure (P_d/P_a) and flow for the studied artery, and calculation of the artery-specific virtual functional assessment index (vFAI: 0.62) shows the good agreement with wire-FFR.

Table 2. Diagnostic performance of the virtual functional assessment index (vFAI) and the anatomic measures from 3D- and 2D- quantitative coronary angiography (QCA) using the optimal cut-points (receiver operator characteristic curve analysis). Fractional flow reserve (≤ 0.80) measured using the pressure wire was used as the reference standard.

Diagnostic measure	vFAI ≤ 0.82	3D-QCA %AS $> 64\%$	3D-QCA MLA $\leq 1.66 \text{ mm}^2$	3D-QCA %DS $> 41\%$	2D-QCA max %DS $> 51\%$
Diagnostic accuracy	87.8% (81.1-92.7%)	72.7% (64.5-79.9%)	79.1% (71.4-85.6%)	74.1% (66-81.2%)	73.4% (65.2-80.5%)
Sensitivity	90.4% (79-96.8%)	69.2% (54.9-81.3%)	80.8% (67.5-90.4%)	65.4% (50.9-78%)	44.2% (30.5-58.7%)
Specificity	86.2% (77.2-92.7%)	74.7% (64.3-83.4%)	78.2% (68-86.3%)	79.3% (69.3-87.3%)	90.8% (82.7-96%)
Positive predictive value	79.7% (67.2-89%)	62.1% (48.4-74.5%)	68.9% (55.7-80.1%)	65.4% (50.9-78%)	25.8% (11.9-44.6%)
Negative predictive value	93.8% (86.01-97.9%)	80.3% (69.9-88.3%)	87.2% (77.7-93.7%)	79.3% (69.3-87.3%)	73.2% (63.8-81.2%)

Values are presented as estimates (95% CI); %AS: percent area stenosis; %DS: percent diameter stenosis; MLA: minimum lumen area

[EuroIntervention](#). 2014 Sep;10(5):574-83. doi: 10.4244/EIJY14M07_01.

Fast virtual functional assessment of intermediate coronary lesions using routine angiographic data and blood flow simulation in humans: comparison with pressure wire - fractional flow reserve.

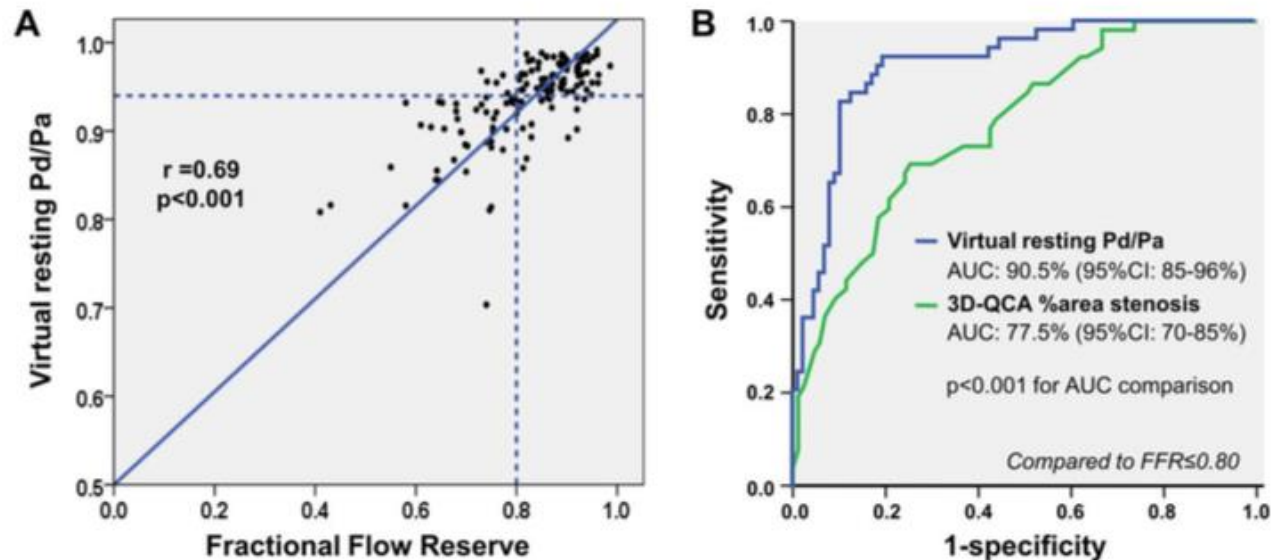
[Papafaklis MI](#)¹, [Muramatsu T](#), [Ishibashi Y](#), [Lakkas LS](#), [Nakatani S](#), [Bourantas CV](#), [Liqthart J](#), [Onuma Y](#), [Echavarria-Pinto M](#), [Tsirka G](#), [Kotsia A](#), [Nikas DN](#), [Mogabgab O](#), [van Geuns RJ](#), [Naka KK](#), [Fotiadis DI](#), [Brlakis ES](#), [Garcia-Garcia HM](#), [Escaned J](#), [Zijlstra F](#), [Michalis LK](#), [Serruys PW](#).

How fast virtual FFR can be measured.

Virtual FFR using only coronary angiography in 4 minutes.

10

Figure 2



Conclusions:

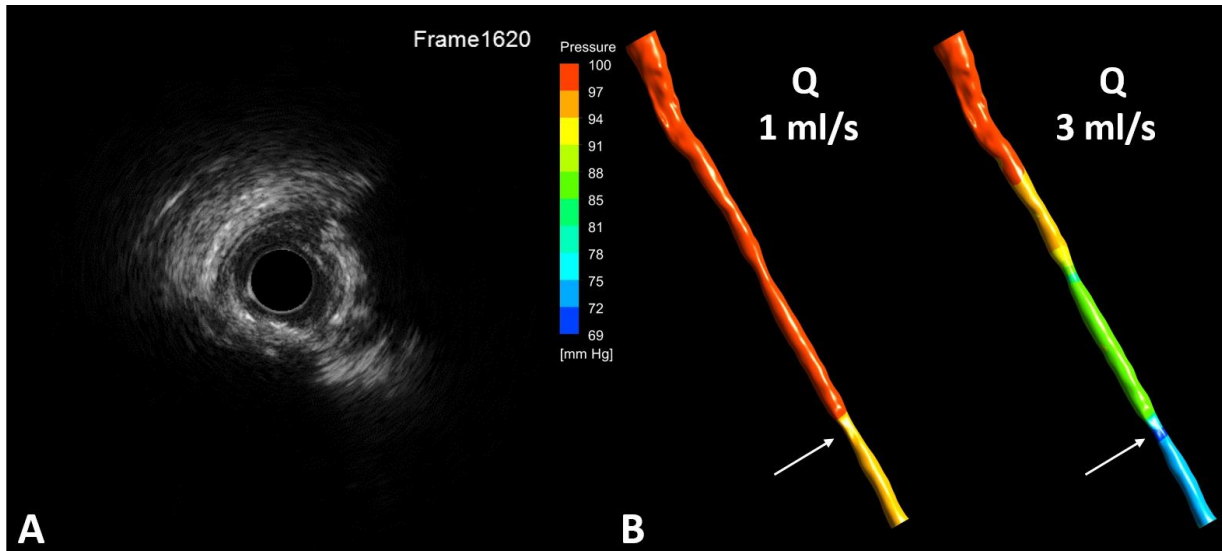
Virtual resting Pd/Pa using routine angiographic data and a simple flow model provides fast and of high diagnostic performance functional assessment of coronary lesions.

[Heart Lung Circ.](#) 2017 May 3. [Epub ahead of print]

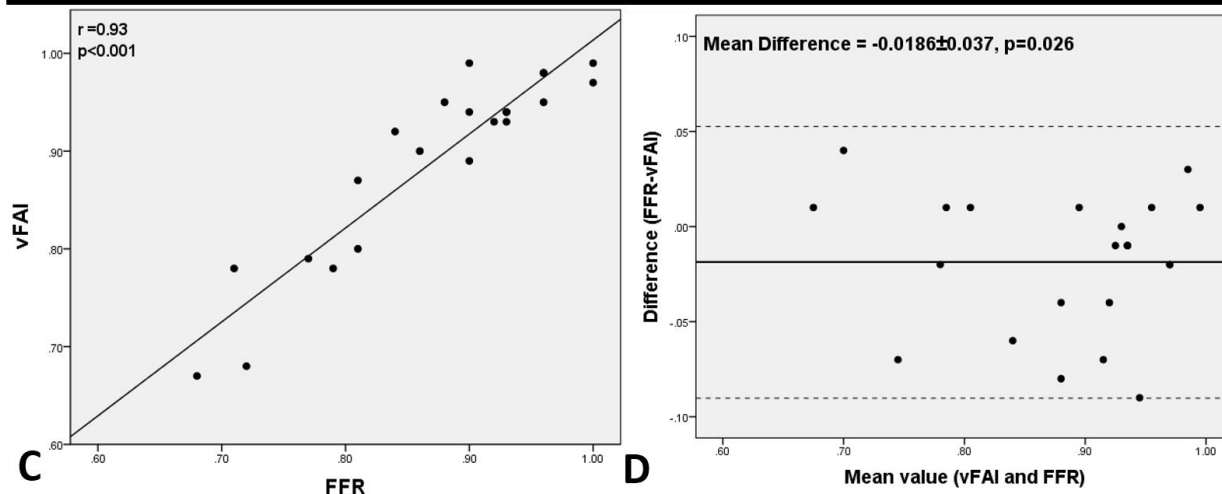
Virtual Resting Pd/Pa From Coronary Angiography and Blood Flow Modelling: Diagnostic Performance Against Fractional Flow Reserve.

[Papafaklis MI](#)¹, [Muramatsu T](#)², [Ishibashi Y](#)², [Bourantas CV](#)², [Fotiadis DI](#)³, [Brilakis ES](#)⁴, [Garcia-Garcia HM](#)², [Escaned J](#)⁵, [Serruys PW](#)⁶, [Michalis LK](#)⁷.

Can we make IVUS an one stop shop (IVUS and vFFR at the same time). Measuring v FFR from IVUS



Close correlation between the IVUS-based vFAI and fractional flow reserve (FFR; $r=0.93$).



Virtual Functional Assessment of Coronary Stenoses Using Intravascular Ultrasound Imaging: A Proof-of-Concept Pilot Study

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ESS coupled with different imaging modalities

- IVUS & shear stresses
- OCT & shear stresses
- IVUS & VH & shear stresses
- CTCA & shear stresses
- 3D QCA & shear stresses

MAIN PROBLEM: BASED UPON STUDIES

WITH SMALL NUMBER OF EVENTS

NO EVENTS: PROGRESSION OF ATHEROSCLEROSIS



Prediction of Progression of Coronary Artery Disease and Clinical Outcomes Using Vascular Profiling of Endothelial Shear Stress and Arterial Plaque Characteristics : The PREDICTION Study

Peter H. Stone, Shigeru Saito, Saeko Takahashi, Yasuhiro Makita, Shigeru Nakamura, Tomohiro Kawasaki, Akihiko Takahashi, Takaaki Katsuki, Sunao Nakamura, Atsuo Namiki, Atsushi Hirohata, Toshiyuki Matsumura, Seiji Yamazaki, Hiroyoshi Yokoi, Shinji Tanaka, Satoru Otsuji, Fuminobu Yoshimachi, Junko Honeye, Dawn Harwood, Martha Reitman, Ahmet U. Coskun, Michail I. Papafaklis and Charles L. Feldman

The largest natural history of atherosclerosis study which investigated the effect of ESS on plaque progression in 506 pts with an ACS

- **Low ESS** was independently associated with disease progression
- Large plaque burden and **low ESS** appeared as independent predictors of plaque progression
- Large plaque burden and low ESS predicted with **41%** accuracy worsening lumen obstruction requiring PCI

