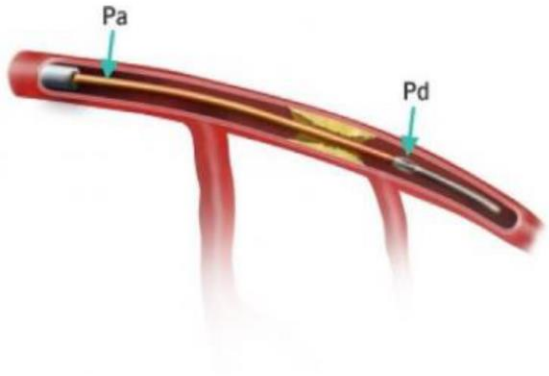
Functional versus Culprit-only Revascularization in Elderly Patients with Myocardial Infarction and Multivessel Disease: the FIRE Trial

Main tools for intracoronary physiology

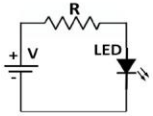
Fractional Flow Reserve

Fractional flow reserve (FFR):
Hyperemic Pd / Pa



Ohm's Law

$V = I*R$



Derivation of Fractional Flow Reserve

$$FFR = \frac{\text{Maximum Myocardial Flow (Stenosis)}}{\text{Maximum Myocardial Flow (Normal)}}$$

$$\text{Myocardial Flow} = \frac{\Delta \text{ Pressure}}{\text{Resistance}}$$

$$FFR = \frac{(P_d - P_v) \,/\!\!\cancel{\text{Resistance}}}{(P_a - P_v) \,/\!\!\cancel{\text{Resistance}}} \quad \textit{at maximal hyperemia}$$

$$FFR = \frac{P_d - P_v}{P_a - P_v}$$

$$\boxed{FFR = \frac{P_d}{P_a}}$$

R "stable and minimal"

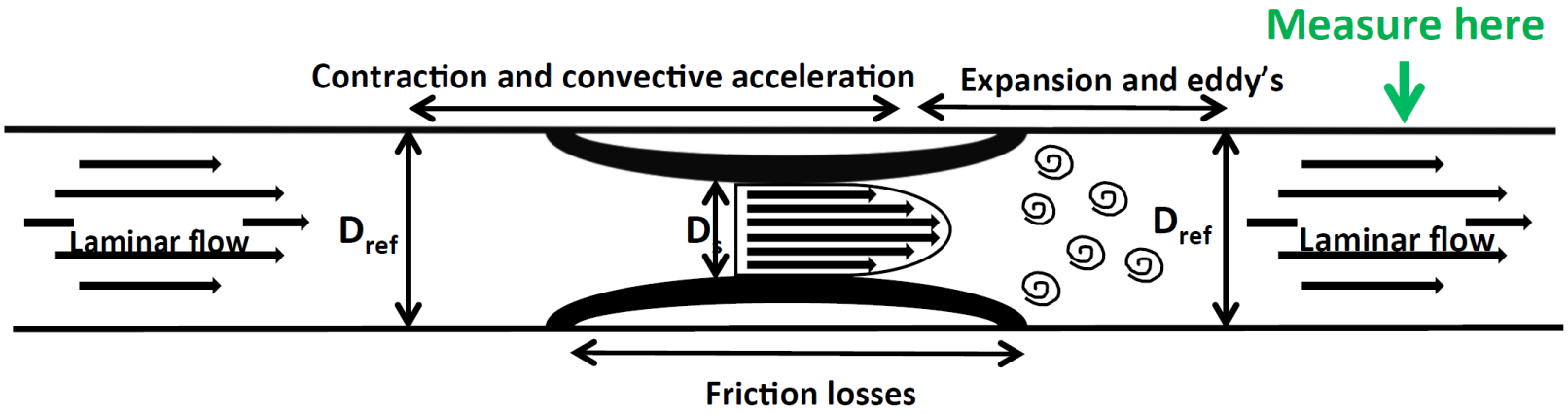
Fractional Flow Reserve

1. Proper placement of the aortic pressure transducer
2. Nitrates
3. Proper catheter placement (damping) & Equalization
4. Wire placement
5. Hyperemia
6. Drift assessment

Pijls Circulation 1993

Wire placement - definition -

Wire placement: at least 3 vessel diameters after the stenosis to measure at a location of laminar flow.

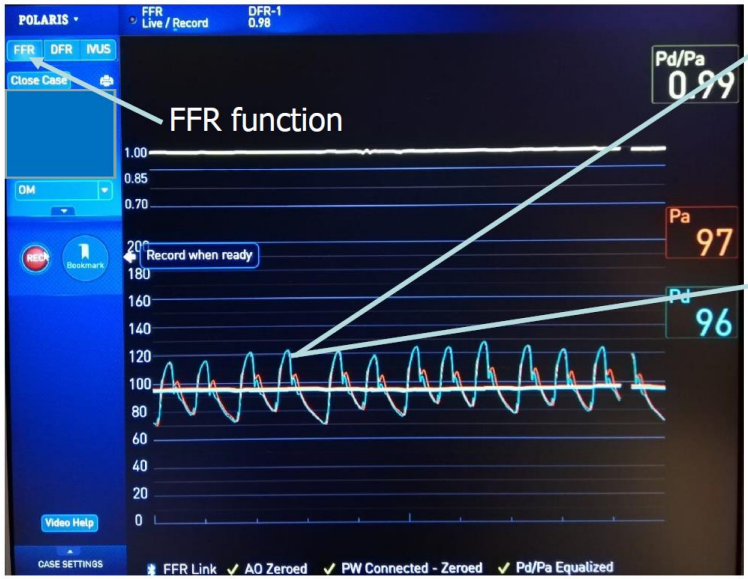


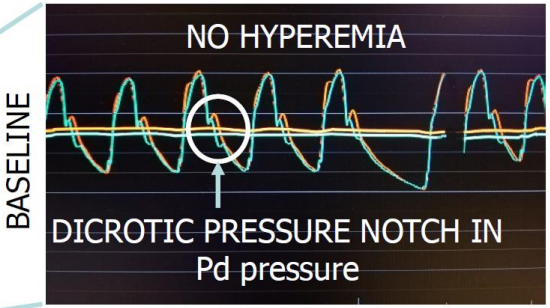
Maximal Hyperemia - definition -

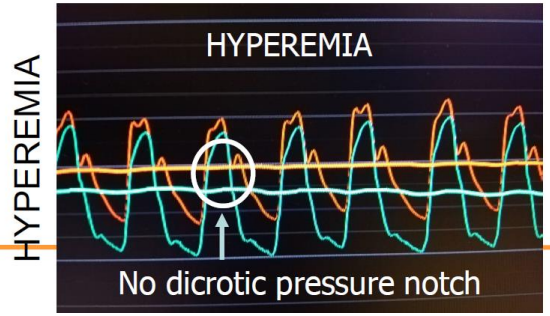
- Select FFR function - Press REC - Induce Hyperemia

FFR measurement have to be performed during the **steady state of the hyperemia**. This timing is characterized by three events:

1) ventricularization of the distal pressure waveform
2) disappearance of the distal dicrotic pressure notch;
3) separation of mean aortic and distal pressures







FFR CUT-OFF ≤0,80

The correct FFR value is the lowest during the steady state hyperemia

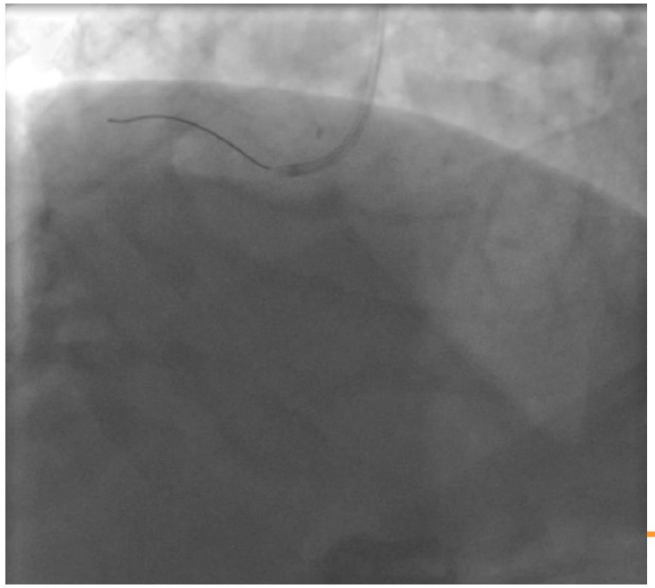
Drift - definition -

At the end of the procedure bring the Comet wire back to the equalization point:

1. Wash the guiding catheter with heparized saline
2. Remove the needle
3. Test the DRIFT

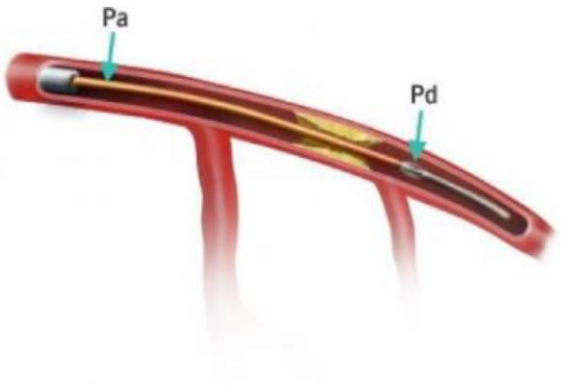
0.96-1.04 accepted as drift
if the FFR value obtained is between 0.76-0.84, the accepted drift is 0.98-1.02

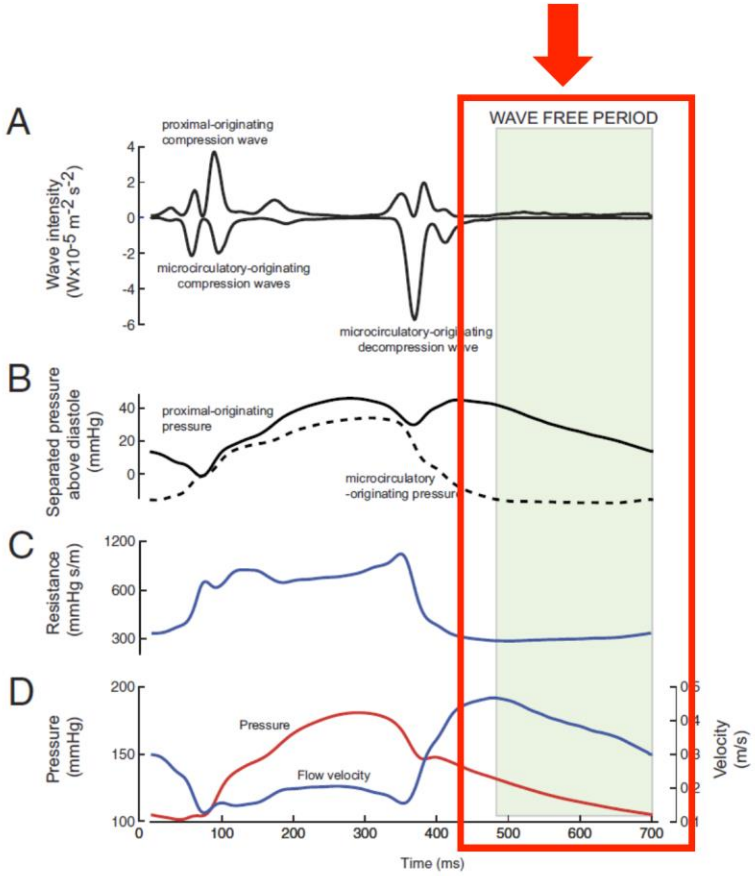
If an unacceptable DRIFT is present, re-equalize the system and re-test FFR



Istantaneous wave-free ratio

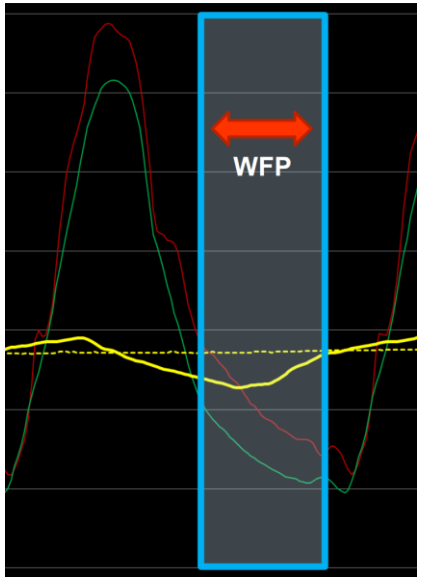
Instantaneous wave free ratio (iFR):
Mid-end diastolic resting Pd / Pa

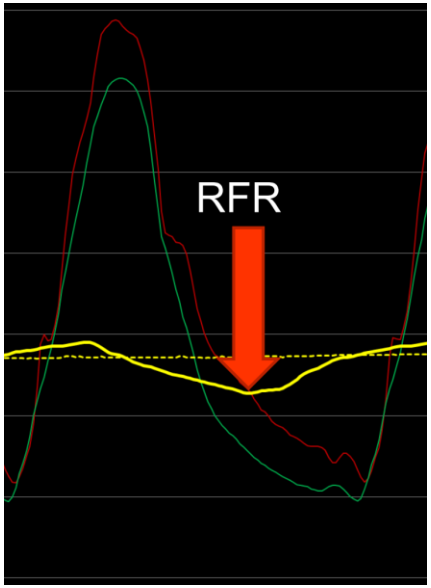


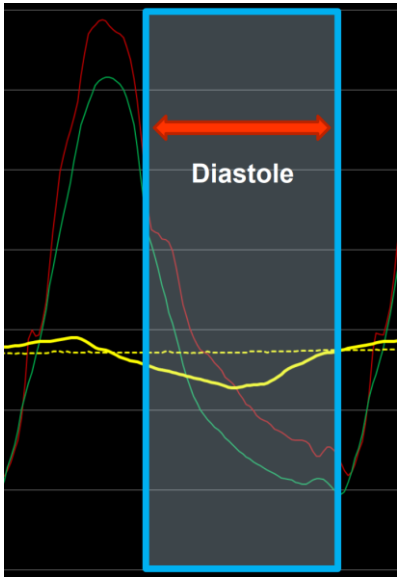


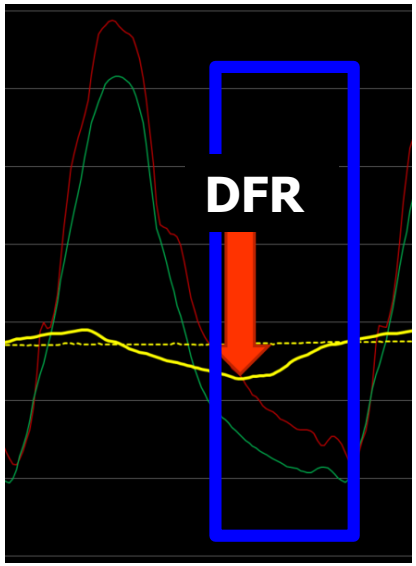
Sen JACC 2012

Resting indexes









iFR

Istantaneous wave-free ratio

Average Pd/Pa in WFP

RFR

resting full cycle ratio

Lowest Pd/Pa in full cycle

DPR

diastolic pressure ratio

Average Pd/Pa in diastole

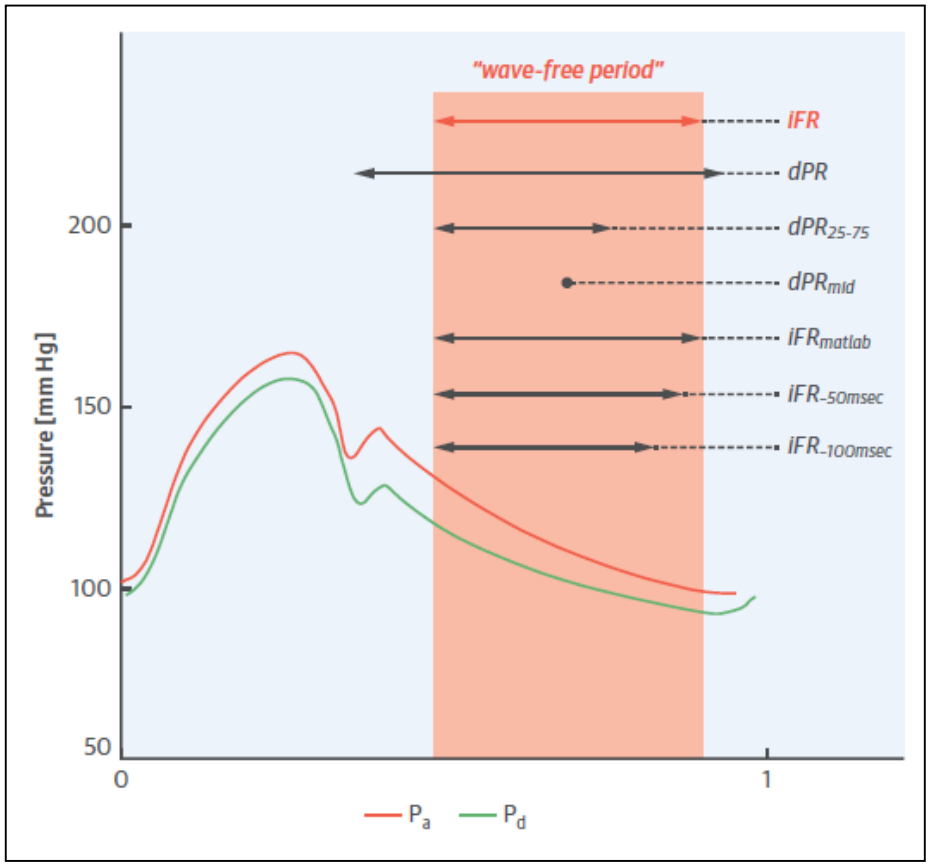
DFR

diastolic hypermia free ratio

- **DFR window is average Pd/Pa when Pa less than mean Pa ending at systole**
- **Does not require ECG signal**
- **No need to identify dicrotic notch**
- **Averages over 5 beats**

Resting index

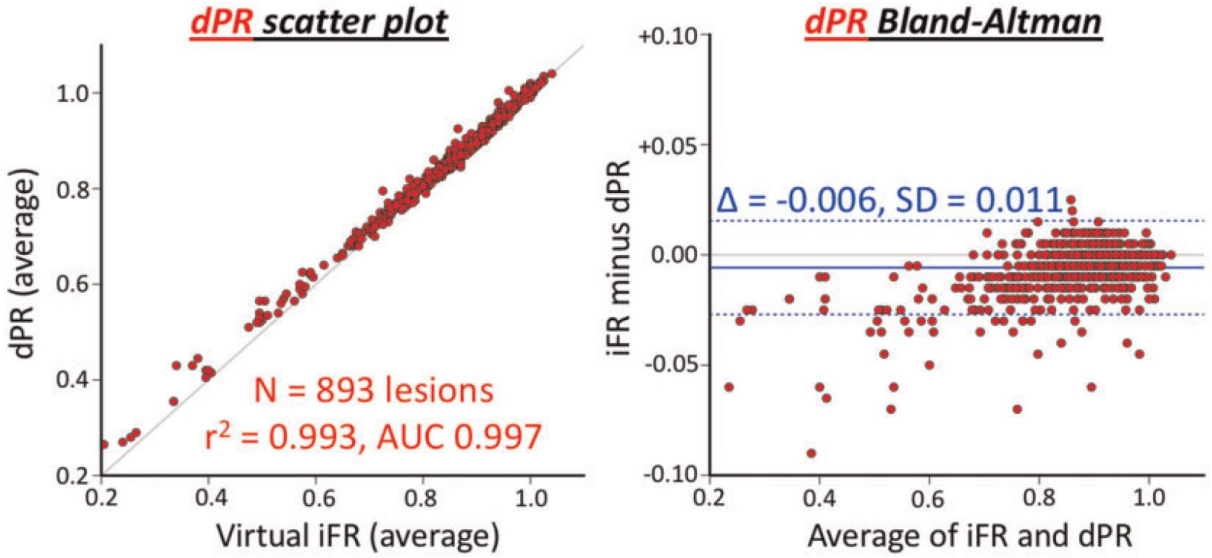
Comparison of different Diastolic Resting Indexes to iFR using population of VERIFY2 study

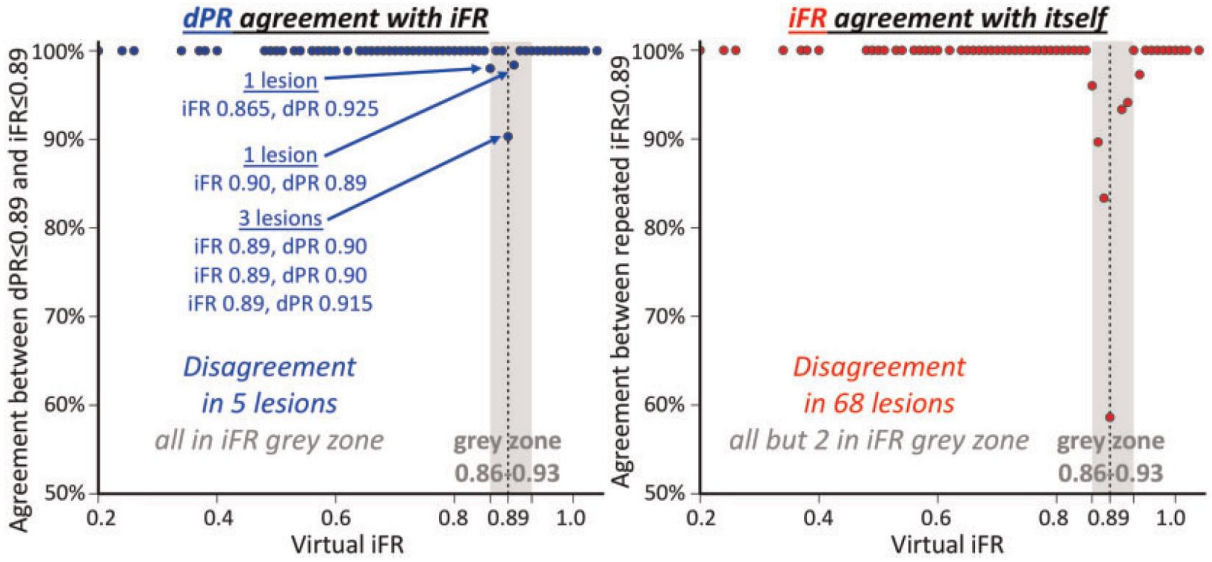


All diastolic resting indexes tested were identical to iFR

Van't Veer JACC 2017

Resting index





Johnson EHJ 2019

Università degli Studi di Ferrara

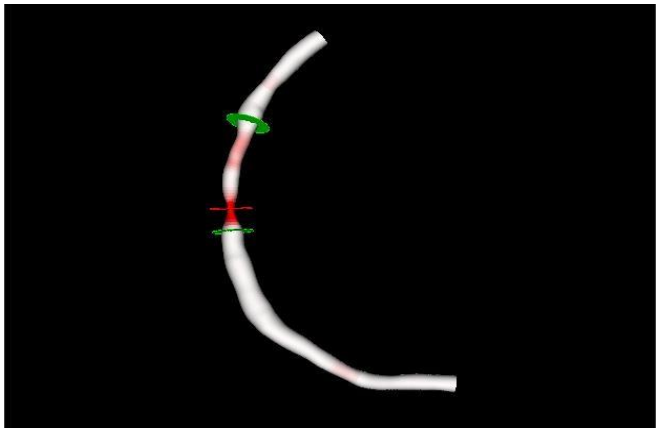
Resting Indexes

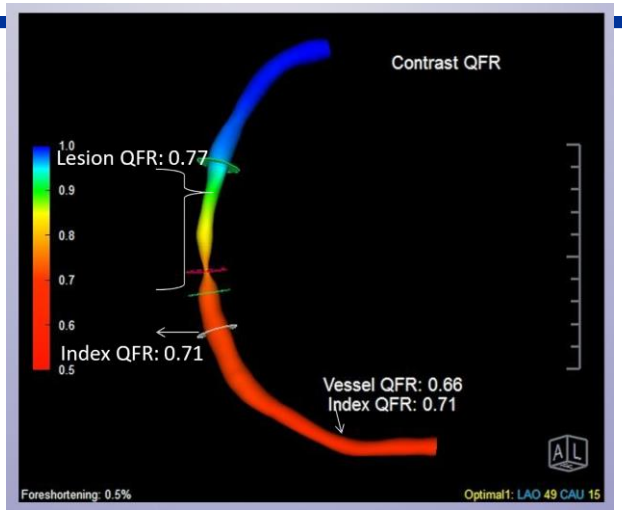
a. Very careful during «ZERO» setting and wire calibration

1. Proper placement of the aortic pressure transducer
2. Nitrates
3. Proper catheter placement (damping) & Equalization
4. Wire placement
5. ~~Hyperemia~~ **5. Wait at least 30-40 seconds before assessment**
6. Drift assessment

Pijls Circulation 1993

Quantitative Flow Ratio





3D QCA

3D vessel modelling by QAngioXA 3D is the backbone for the PCI procedure:

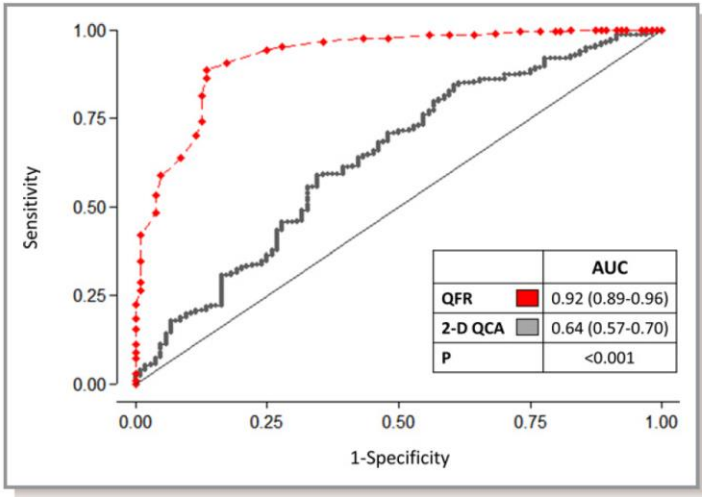
- Allows the calculation of the functional significance parameter QFR *and* the QFR pullback curve
- Optimal viewing angle for PCI
- Precise stent sizing
- Co-registration with OCT or IVUS

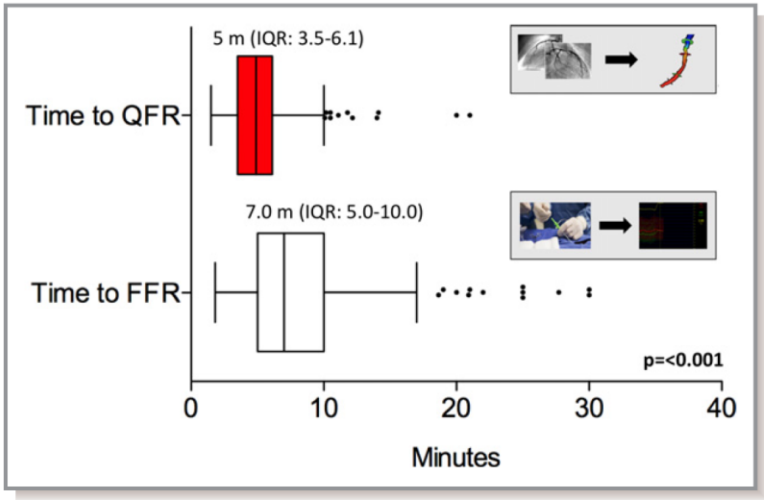
- Three modelling methods
  - Fixed flow QFR
  - Basal/Rest QFR
  - Hyperaemic QFR

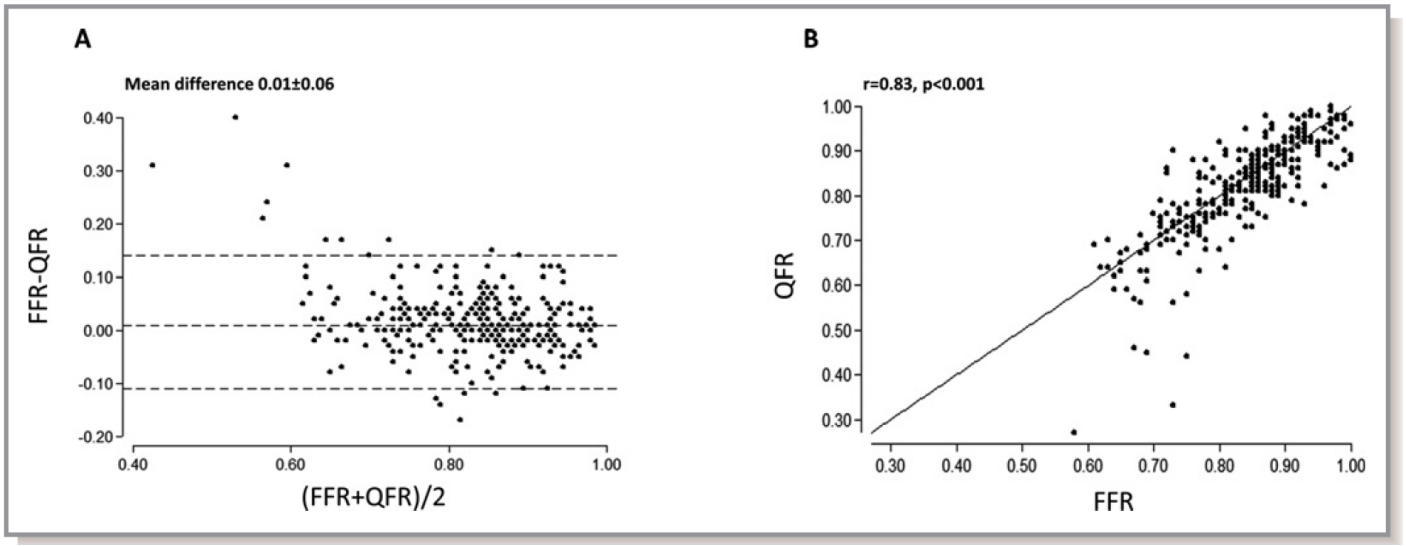
In all cases we model the hyperaemic condition of the flow. So we mimic the FFR condition and NOT the Pd/Pa or iFR

- Fixed Flow QFR
  - Is taking into account an empirical flow through the vessel of interest (in hyperemic situation)
  - Fast and easiest, but larger variability than other methods
- Contrast QFR:
  - Is using the flow velocity in normal coronary angiograms to determine the flow
- Hyperemic QFR:
  - Is using the flow velocity in hyperemic coronary angiograms (with adenosine) to determine the flow

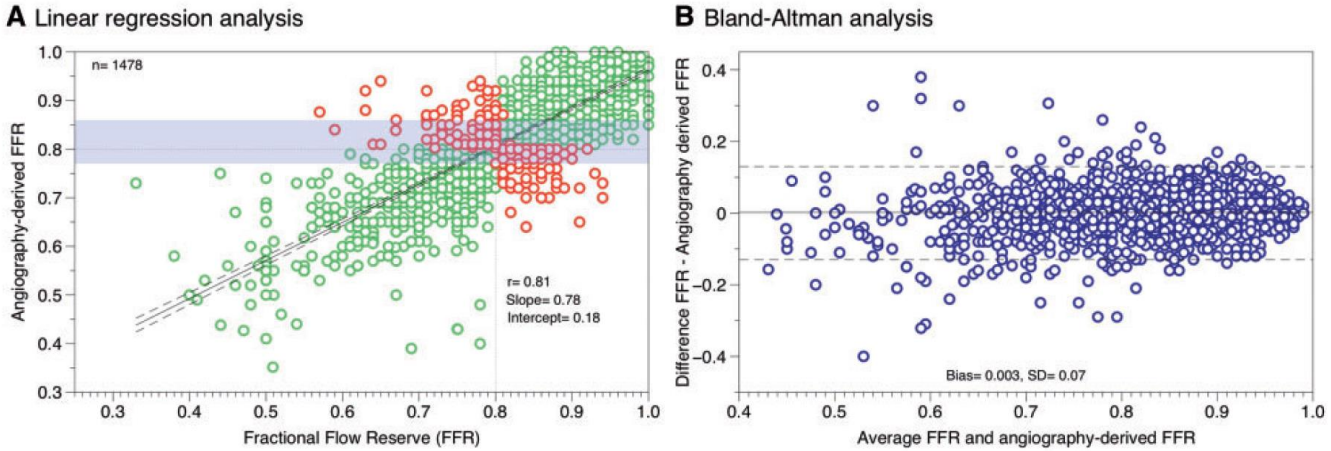
FAVOR II – QFR vs. FFR

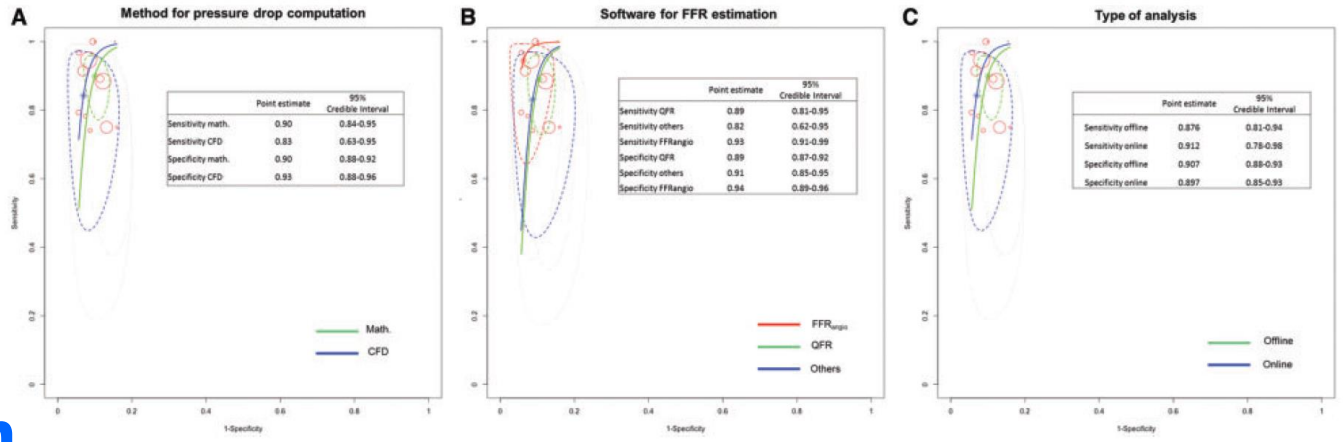






Meta-analysis angio-derived FFR vs. FFR

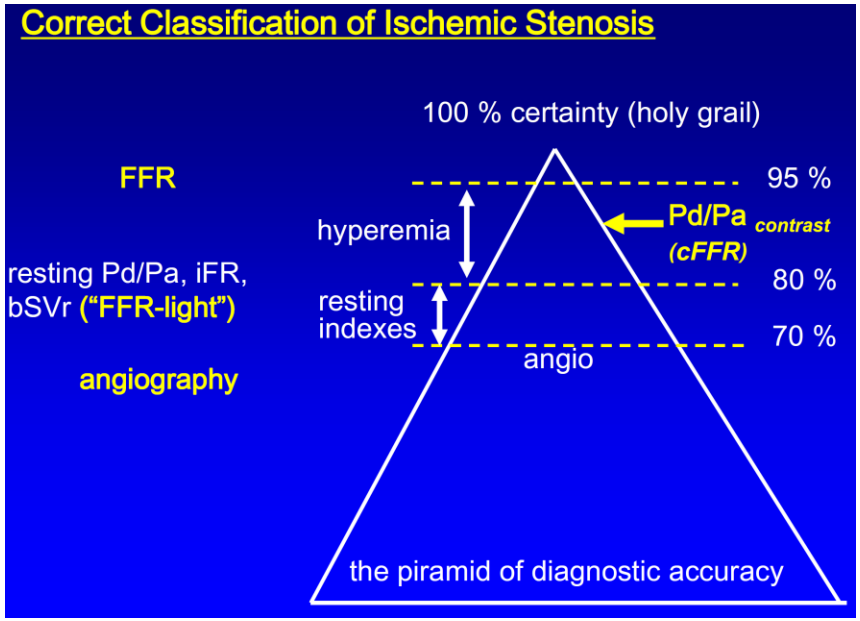




Good correlation

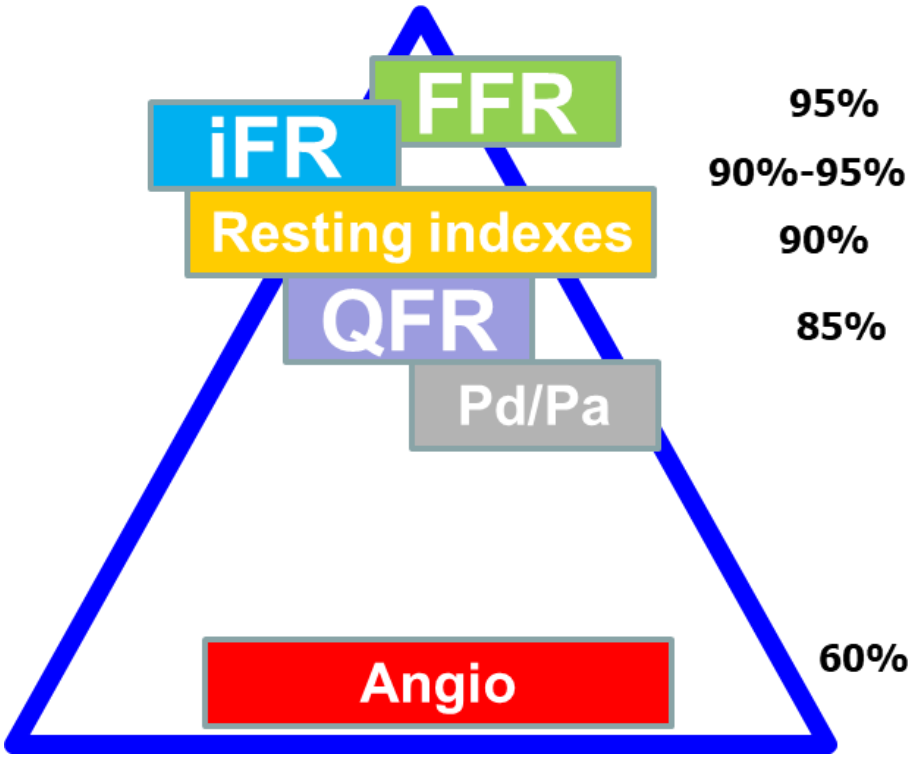
Good alternative option as compared to FFR

Conclusions



2019

100% certainty




THIS IS NOT THE END.
We are moving toward a grand and glorious finish.