

# Fractional Flow Reserve ( FFR )

Dr. Feras Alam Aldeen

# What is FFR ?

- Fractional Flow Reserve, or FFR, is a guide wire-based procedure that can accurately measure blood pressure and flow through a specific part of the coronary artery. FFR is done through a standard diagnostic catheter at the time of a coronary angiogram.
- The measurement of Fractional Flow Reserve has been shown useful in assessing whether or not to perform angioplasty or stenting on "intermediate" blockages.

# How Does Fractional Flow Reserve Work?

- A very thin guide wire is inserted through a standard 4F or 5F diagnostic catheter during an angiogram.
- The special guide wire crosses the lesion and is able to measure the flow and pressure of the blood, after infusion of a hyperemic agent, such as adenosine.
- Results are displayed on a special monitor (left) along with the "FFR value".



**FFR =**  $\frac{\text{Distal Coronary Pressure (Pd)}}{\text{Proximal Coronary Pressure (Pa)}}$   
(During maximal hyperemia)

The FFR modality uses hyperemic agents to achieve a state of constant resistance.

**Change in pressure =**  
**change in flow x constant resistance**

$$\Delta P = \Delta Q \times R$$

Fundamental equation for relating pressure flow derived from Poiseuille's Law for fluid dynamics

**iFR =**  $\frac{\text{Distal Coronary Pressure (Pd)}}{\text{Proximal Coronary Pressure (Pa)}}$   
(During wave-free period)

The iFR modality measures pressure during the wave-free period of the cardiac cycle when resistance is naturally constant.

# FFR ischemia scale

- An FFR lower than 0.75-0.80 is generally considered to be associated with myocardial ischemia.
- FFR between 0.75 and 0.80 may indicate ischemia.
- FFR  $>0.80$  is highly likely to be non-ischemic.
- AUC guidelines reflect the FAME cutoff of 0.80 ( $\leq 0.80$  Treat,  $>0.80$  Defer).

# How Can FFR Affect Treatment of the Patient?

- Recent studies, such as the COURAGE trial, have re-emphasized what all current medical guidelines recommend: that for low risk patients, even those experiencing angina, optimal medical therapy should be the initial treatment.
- For those patients whose disease progresses, or for whom chest pain is not alleviated, revascularization, either through angioplasty and stenting or surgery, should be performed.
- Fractional Flow Reserve can be a significant tool to help physicians in deciding whether to intervene or not.

# CONT..

- Furthermore, studies such as DEFER show that patients who have been screened out of angioplasty by using FFR have not experienced an increase in adverse outcomes. And in these studies, two-thirds of the patients were judged not to need an intervention with balloons or stents. More recently the FAME study showed that FFR allowed elimination of a third of the lesions that might have been stented using angiography alone, with better outcomes for patients

# IFR

- Another physiologic measurement, called iFR or Instant wave-Free Ratio, was recently approved by the FDA for use in coronary stent guidance. iFR does not require the use of adenosine or other hyperemic agent.
- iFR is proven to reduce procedure time, patient discomfort and cost compared to FFR.



# FFR ct

- Derive from computed tomography.
- Is a noninvasive technology developed to test for coronary artery disease.
- To calculate how much blood is flowing through the coronary arteries.
- It can determine whether a specific plaque in a coronary artery is restricting blood flow, thereby helping determine whether a patient would benefit from stents or bypass surgery.

# QFR

- Quantitative Flow Ratio ( QFR ).
- Derived from coronary angiography.
- Is recently developed technique, less invasive technique for functional assessment of coronary artery disease.

# QFR Versus FFR ct

- QFR, FFRct, and FFR were measured in 152 patients (233 vessels ) with stable coronary artery disease.
- QFR was highly correlated with FFR, whereas FFRct was moderately correlated with FFR.
- The sensitivity, specificity of  $QFR \leq 0.80$  for predicting  $FFR \leq 0.80$  were 90%, 82%.
- Those of FFRct were 82%, 70%.

## Cont..

- The diagnostic accuracy of QFR was 85%, whereas that of FFRct was 76%.
- **Conclusions:** QFR and FFRct showed significant correlation with FFR. Mismatches between QFR and FFR and between FFRct and FFR were frequent.



Thank you