



# Fisiologia Coronária

## Investigação

Sérgio Bravo Baptista

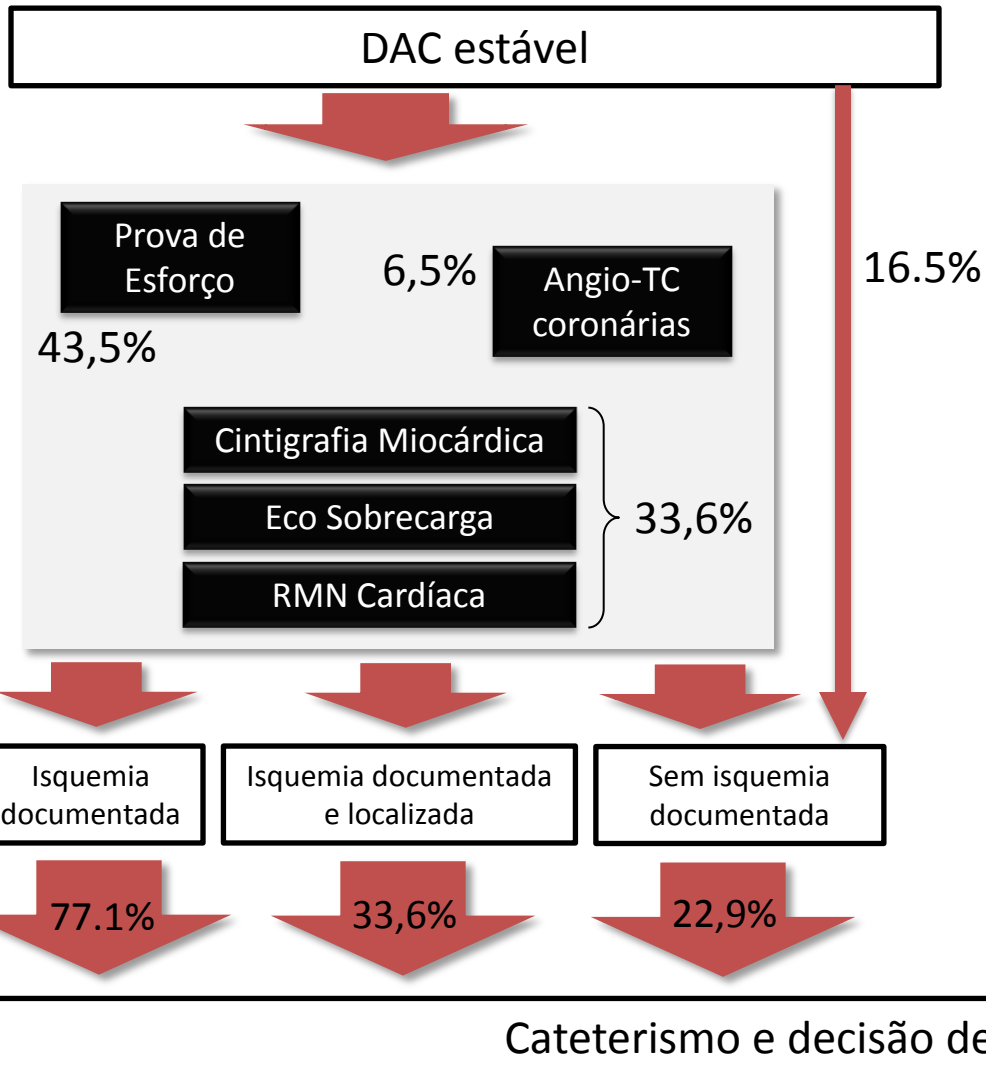
Serviço de Cardiologia, Unidade de Cardiologia de Intervenção  
Hospital Fernando Fonseca



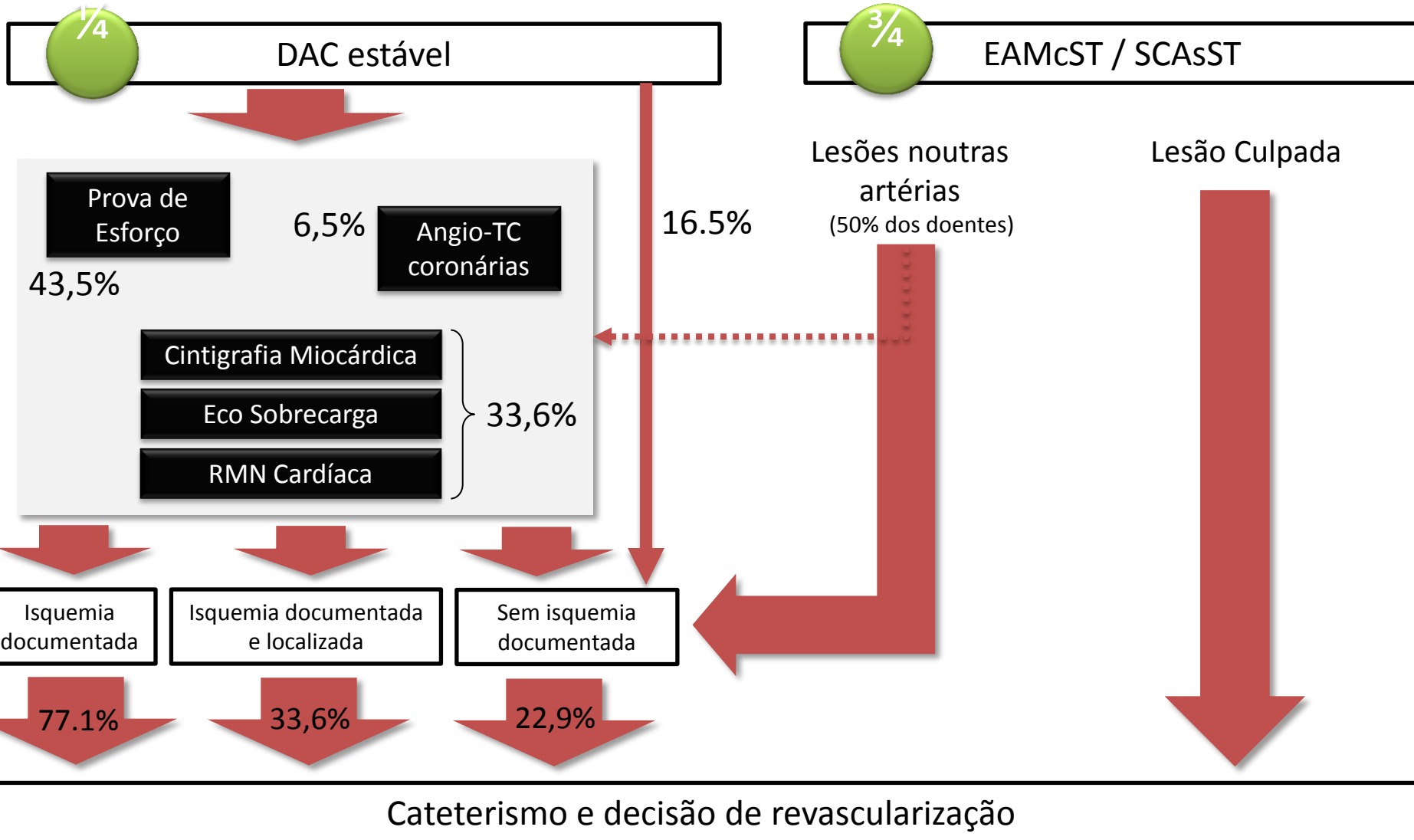
Hospital Fernando  
Fonseca

Serviço de  
*cardiologia*

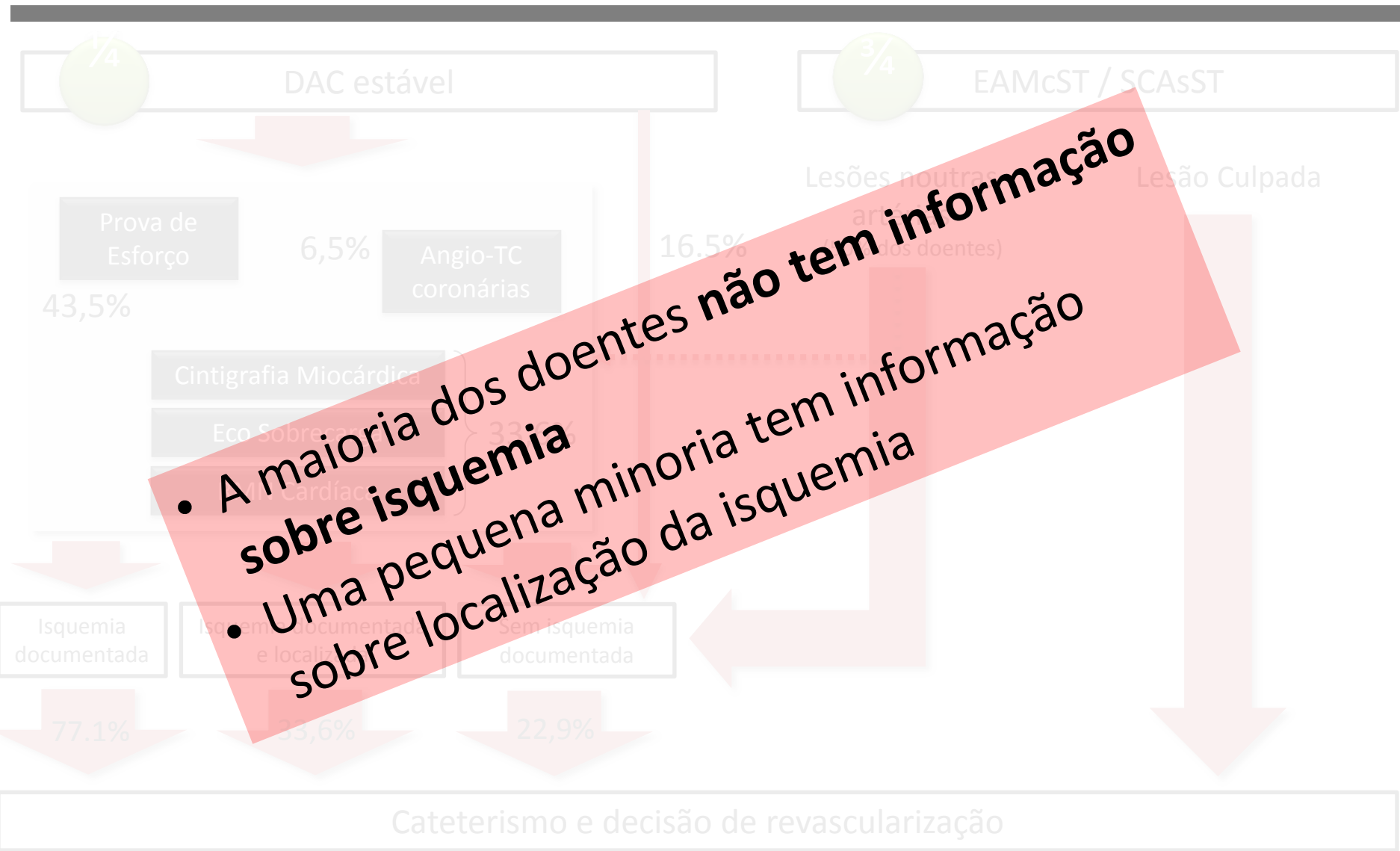
# Percurso dos doentes submetidos a cateterismo por suspeita de doença coronária



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# Percurso dos doentes submetidos a cateterismo por suspeita de doença coronária



**A maioria dos doentes não tem informação sobre isquemia**

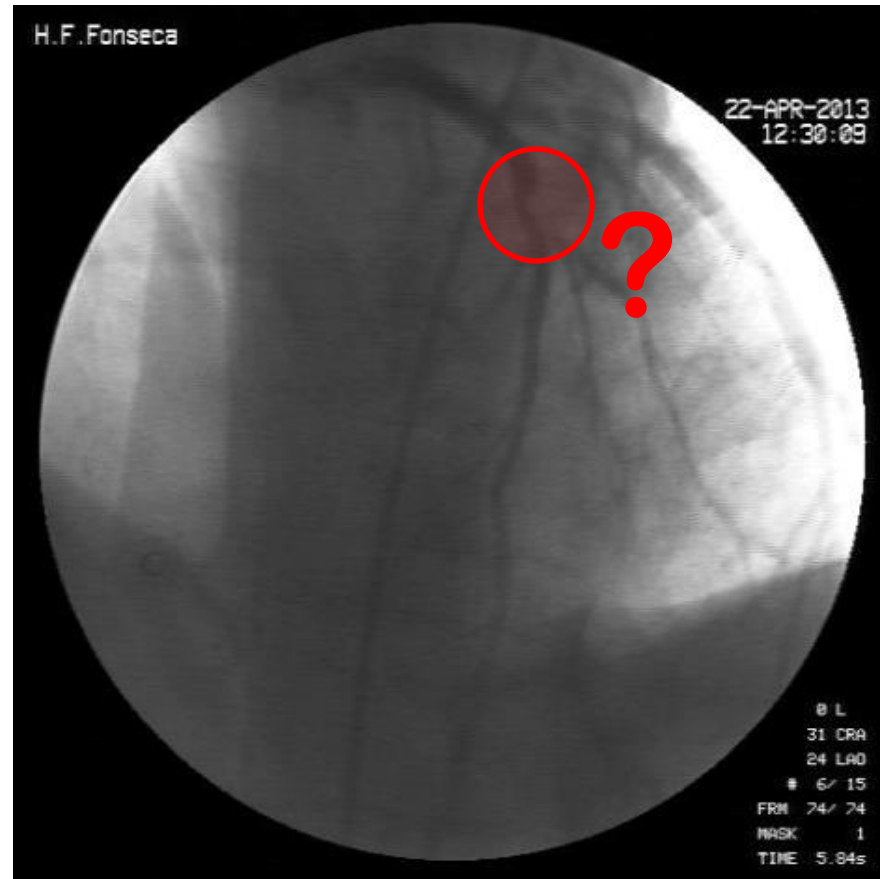
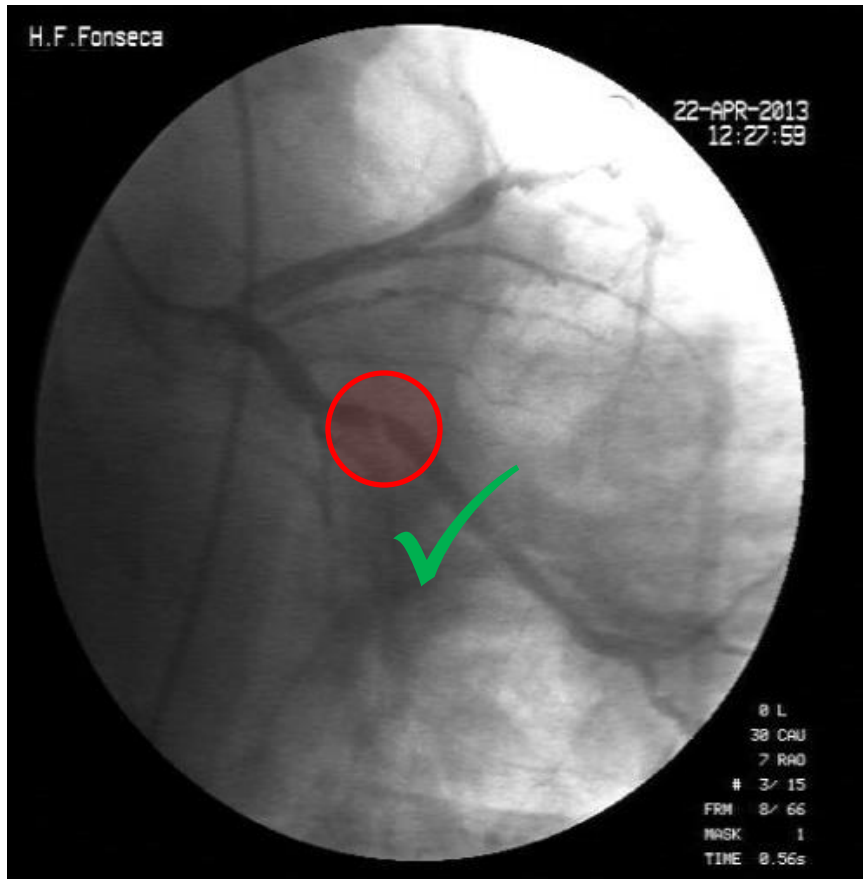
**Uma pequena minoria tem informação sobre localização da isquemia**

# Revascularização de lesões “estáveis”

52 anos, sexo masculino.

Fumador, HTA, Dislipidemia, Diabetes Tipo 2  
EAMsST (TnI max 16 ng/dl)

Eco: FEVE50%, hipocinesia lateral



# Revascularização de lesões “estáveis”

## Papel da avaliação da *Fractional Flow Reserve*

### Avaliação da *Fractional Flow Reserve* (FFR)

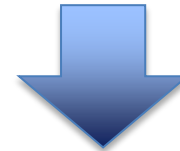
Fio coronário com sensores de pressão (pressure-wire)



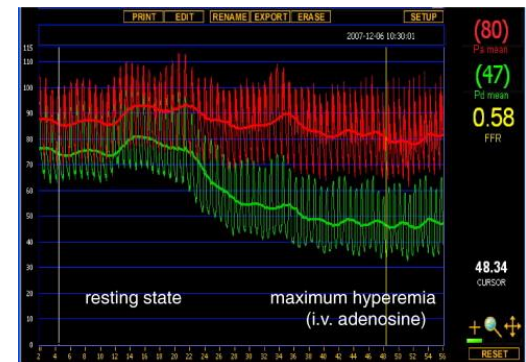
O fio de pressão passa a lesão coronária



Avaliação do fluxo máximo através da lesão, sob hiperemia máxima (com adenosina)



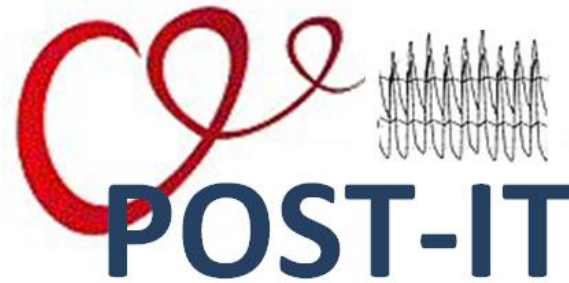
$$\text{FFR} = \frac{\text{Fluxo máximo através da lesão}}{\text{Fluxo máximo teórico normal}}$$



# Investigação em Fisiologia Coronária

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## Portuguese Study on The Evaluation of FFR Guided Treatment of Coronary Disease



Hot Line - PCI registries  
to be held on Thursday 22nd May, 2014,  
from 14:40 to 15:40 in Room 253

Limited data concerning:

- 1) Patients in **whom** FFR is being used in routine clinical practice
- 2) The **impact of FFR** in changing revascularization decisions “per lesion” and “per patient”
- 3) The **clinical results** of a FFR based strategy in unselected “**real-world**” patients



# Purpose

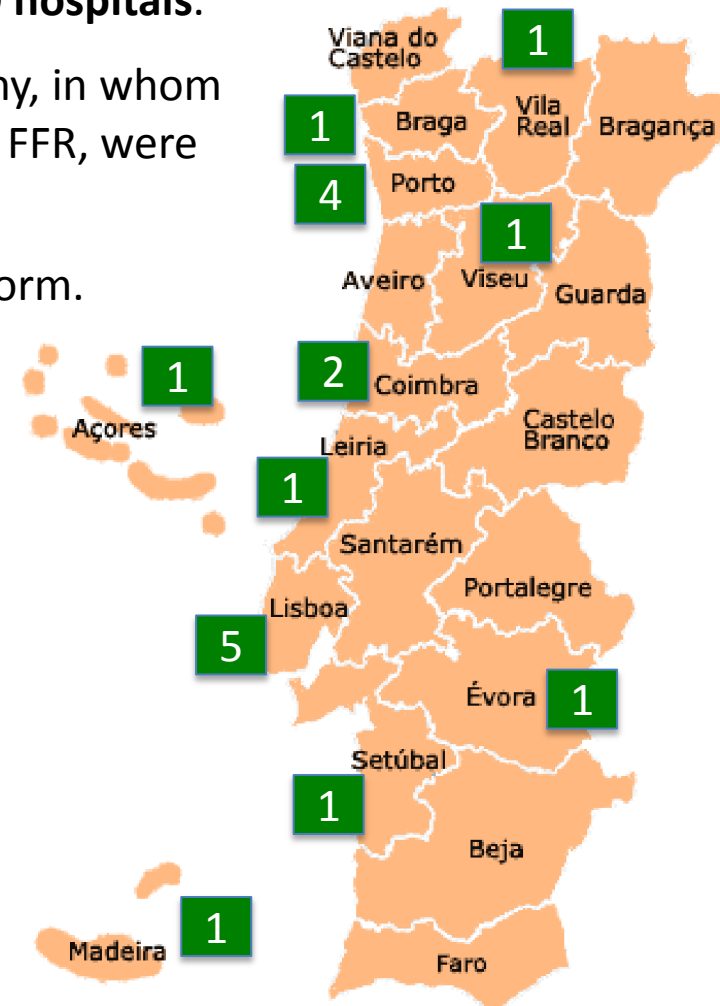
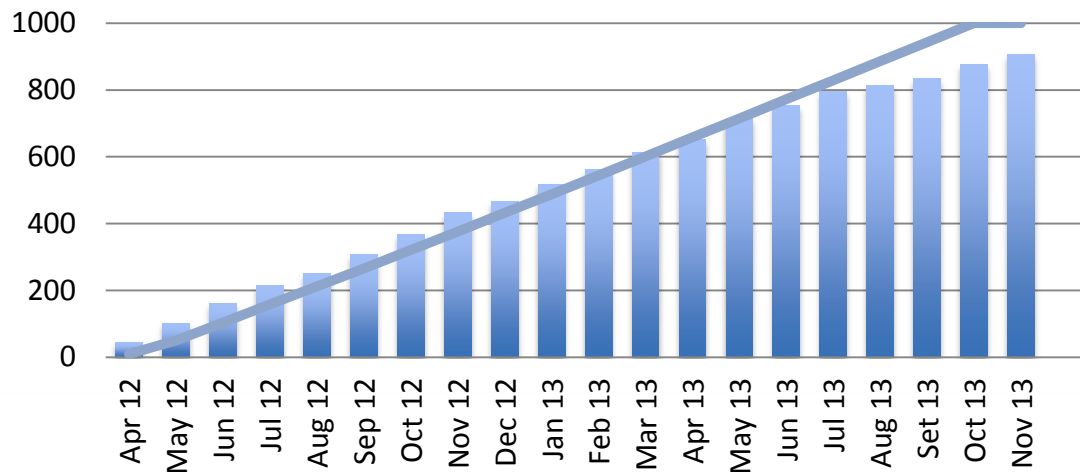
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- 1) To *describe* the **patterns of use** of FFR in a real world setting
- 2) To *evaluate* to which extent the information obtained from FFR would **impact on the final management** strategy
- 3) To *assess* the **concordance** between FFR and the non-invasive stress tests usually used as gate-keepers for coronary angiography
- 4) To *evaluate* the **clinical results** (1 year MACE) of FFR-guided myocardial revascularization in an unselected patient population from daily practice (*available late 2014*)

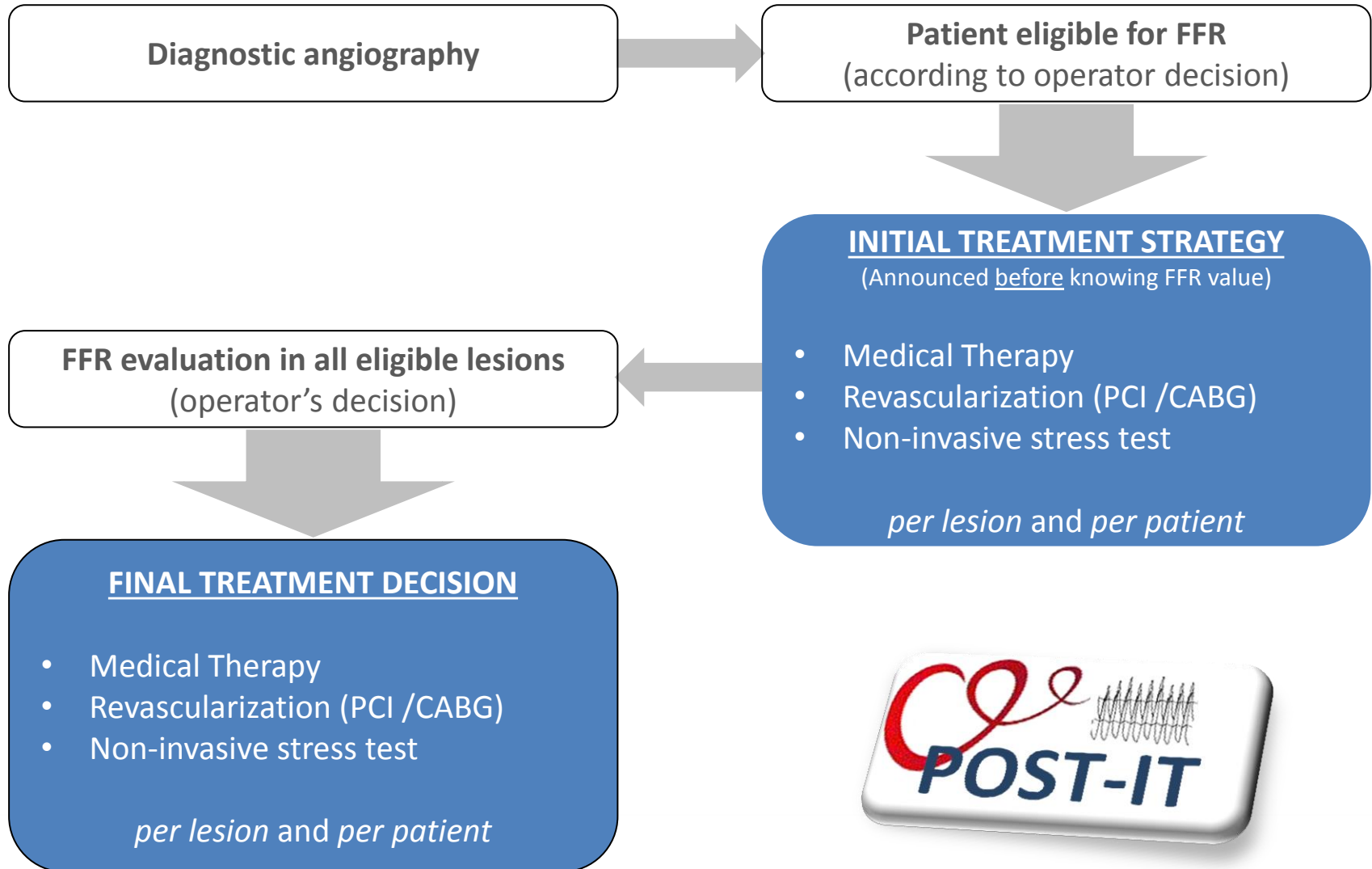
# Methods

- National **prospective** multicenter registry, involving **19 hospitals**.
- **Consecutive patients** referred for coronary angiography, in whom at least one lesion was intended to be interrogated by FFR, were enrolled from **April 2012 to November 2013**.
- Data collected in a dedicated electronic Case Report Form.
- **Non-restricted grant** from St. Jude Medical (Portugal)

**Inclusion rate over the study period**



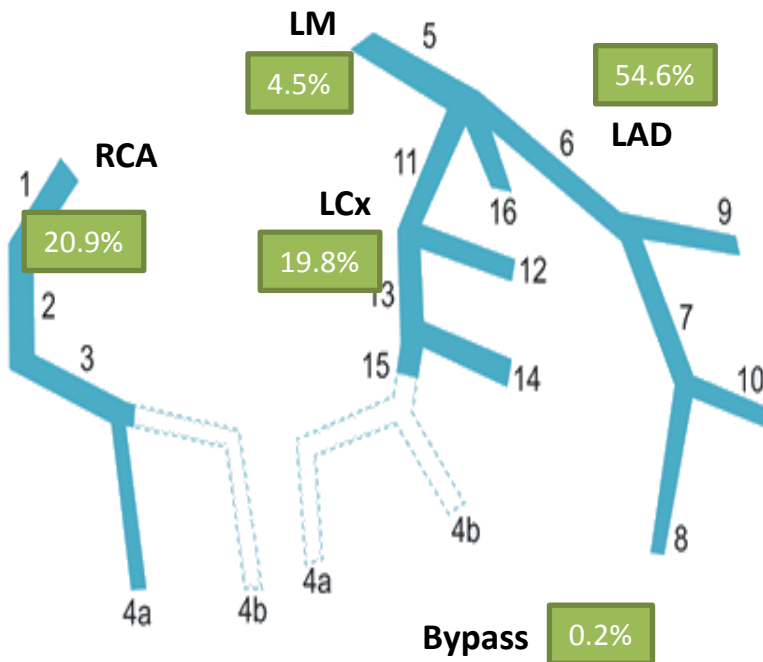
# Methods



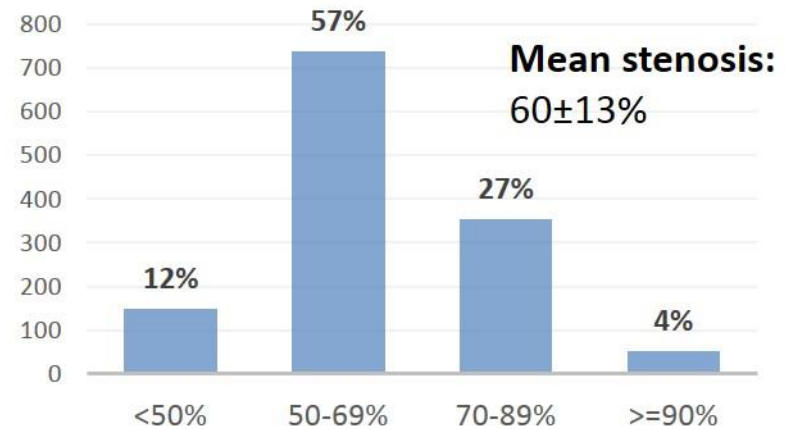
# Results: Lesions Characteristics

- 1.293 lesions (1.4/patient)

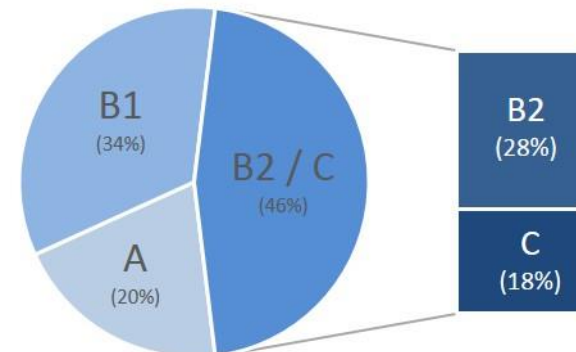
- Lesion localization



- Stenosis severity:



- ACC/AHA lesion classification:





# Patterns of use and clinical utility of Fractional Flow Reserve evaluation in patients referred for coronary angiography

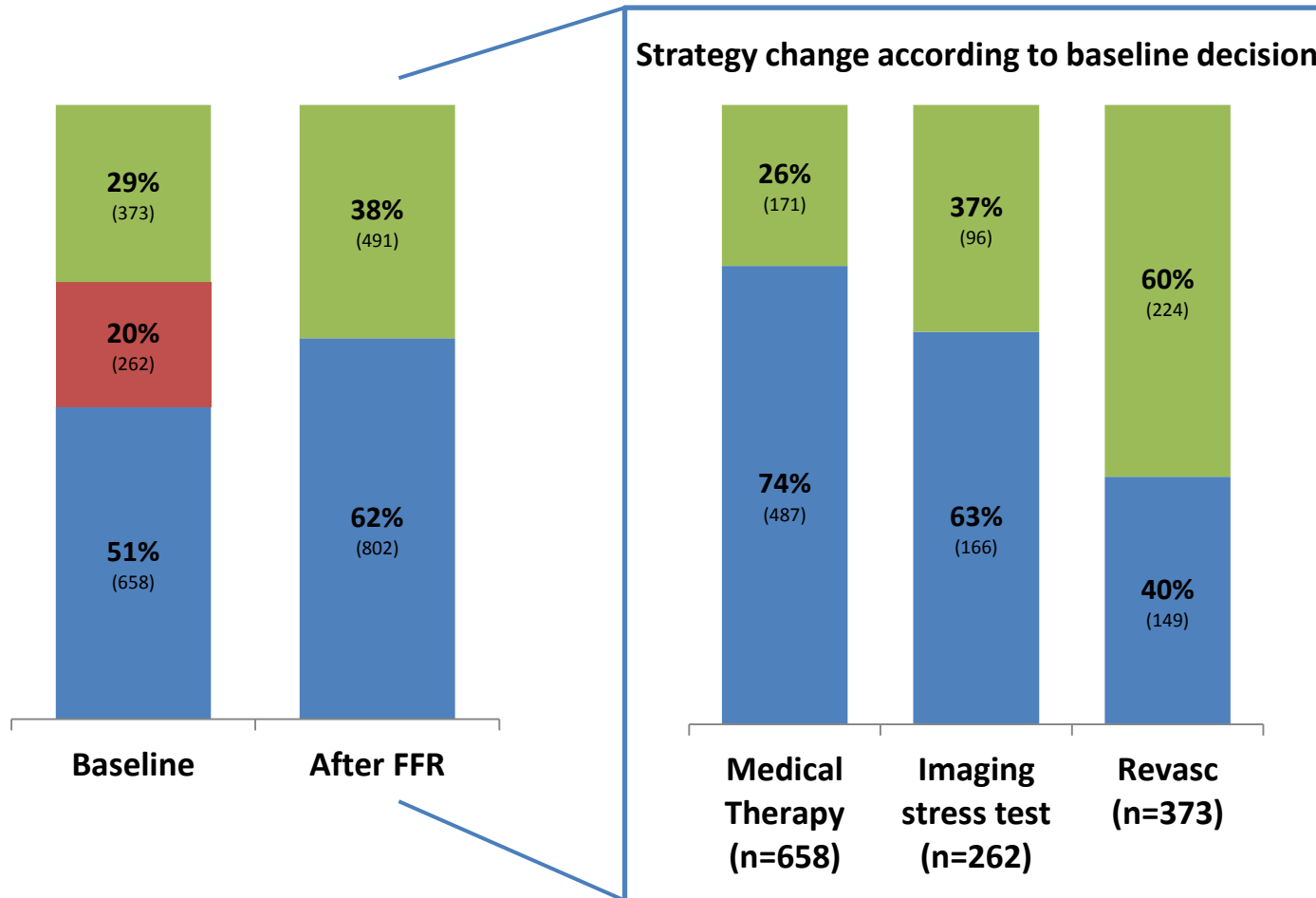
The prospective multicenter Portuguese Study on the Evaluation of FFR-Guided Treatment of Coronary Disease (**POST-IT**)

**BAPTISTA S.B.**, RAPOSO L., SANTOS L., CALÉ R., RAMOS R., JORGE E., MACHADO C., MOTA P., OLIVEIRA E., NABAIS S.,  
PIPA J., FONSECA N., GUARDADO J., SILVA B., SOUSA M.J., SILVA J.C., RODRIGUES A., SECA L., SOARES R.,

for the POST.IT Investigators

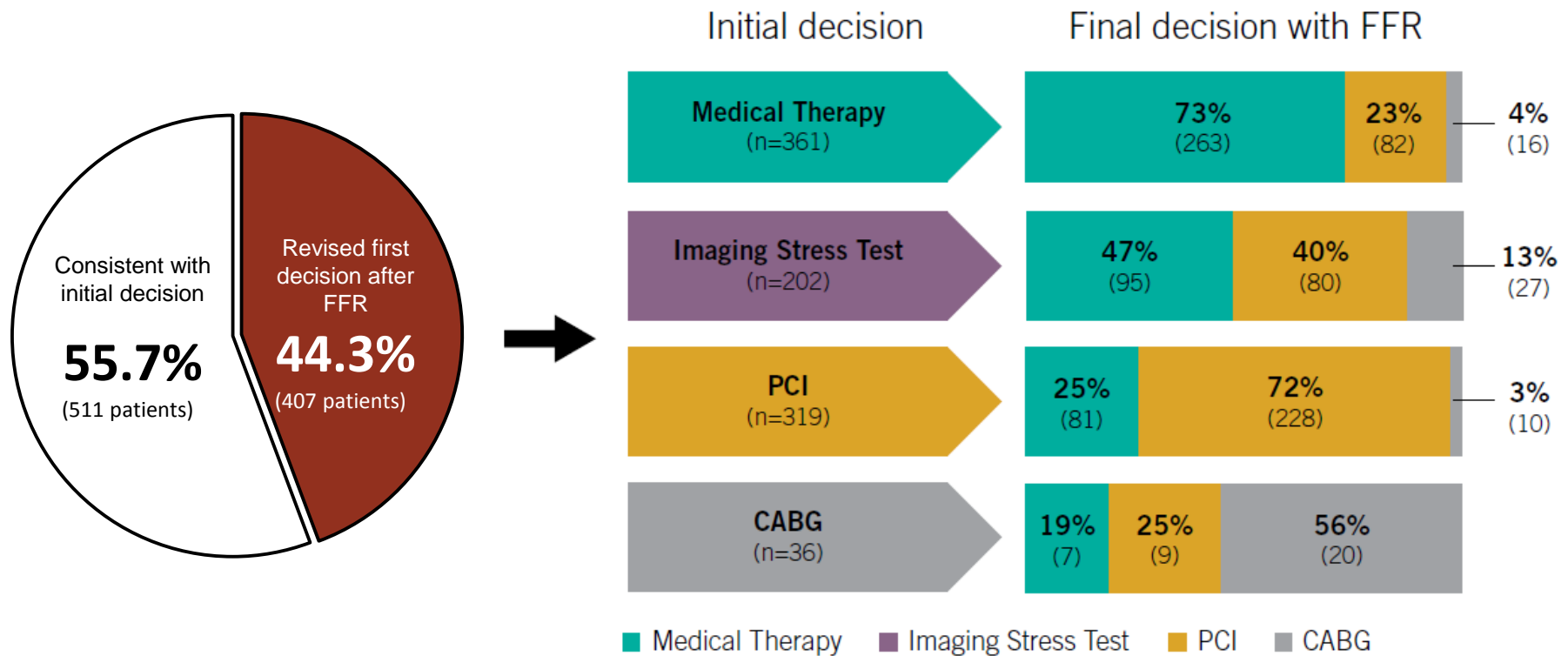
# Results: strategy change *per lesion*

■ Medical therapy    
 ■ Imaging stress test    
 ■ Revascularization



Decision changed in 582 (45,0%) lesions

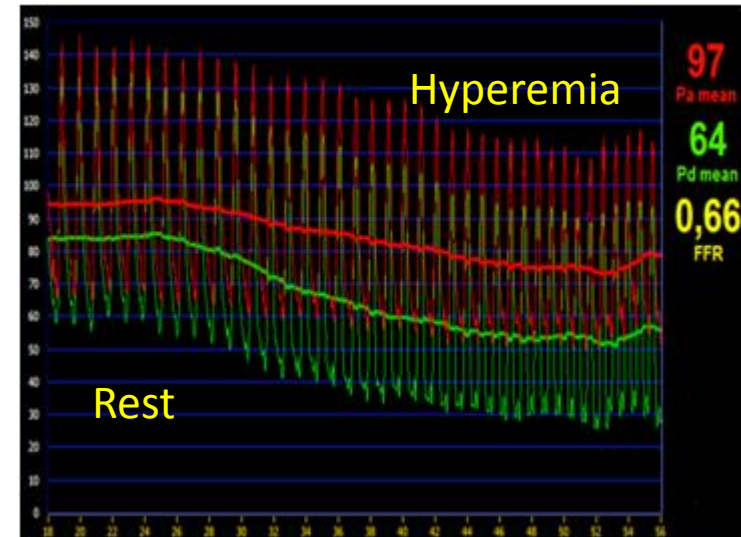
# Results: strategy change *per patient*



# Background and Purpose

Evaluation of functional severity of coronary artery stenosis with a pressure wire implies the induction of pharmacological maximal hyperemia, to eliminate the microvascular flow resistance and accurately calculate the fractional flow reserve (FFR).

Adenosine is the most widely used drug to obtain maximal hyperemia



However, adenosine has several side effects and alternatives to its use have been recently evaluated (Pd/Pa, iFR)

The contrast medium used in angiography is in itself a hyperemic stimuli, that correlates with adenosine hyperemic response



# Contrast-induced hyperemia as an alternative to adenosine-induced hyperemia in the evaluation of fractional flow reserve in coronary lesions

Baptista SB, Faustino M, Loureiro J, Brizida L, Magno P, Leal P, Lourenço E, Monteiro C, Nédio M, Farto e Abreu P, Gil V, Morais C

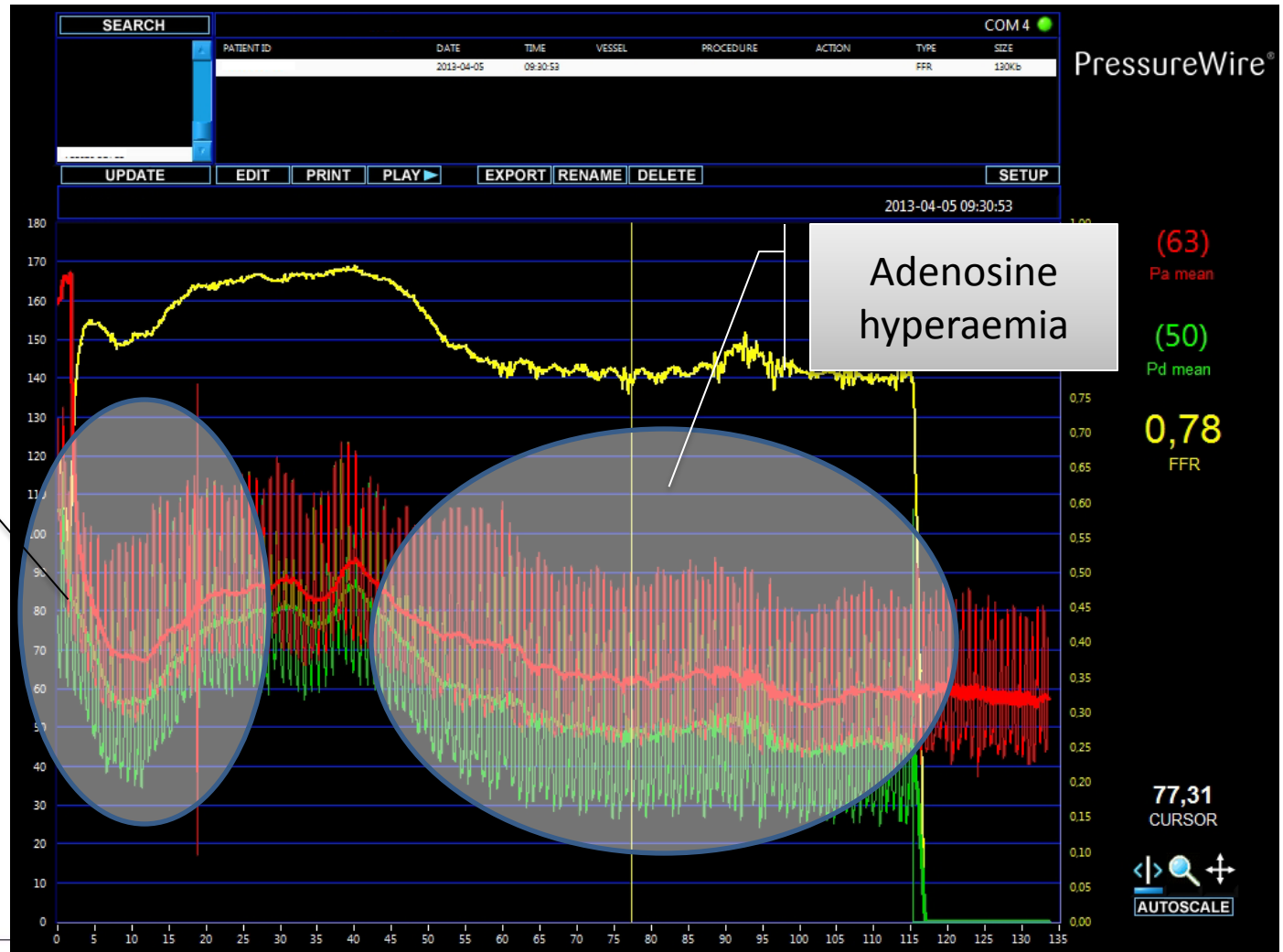
Cardiology Department

Hospital Fernando Fonseca, Amadora, Portugal



# Contrast FFR evaluation

## Example 1



Contrast hyperaemia

Adenosine hyperaemia

# Contrast FFR evaluation

## Example 1

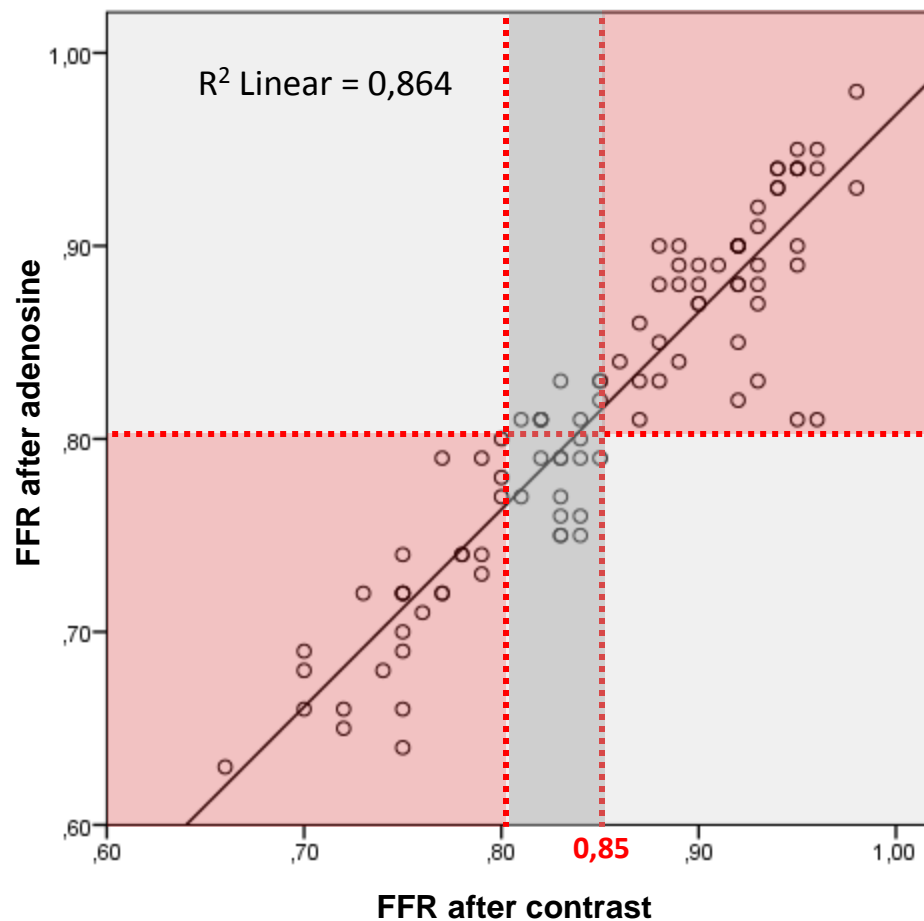


## Correlation $FFR_{cont}$ vs. $FFR_{ad}$

$FFR_{cont}$  adequately  
classified functional  
significance of **84/98**  
lesions (**85,7%**)

“Gray zone”

$FFR_{cont}$  **0,80 – 0,85**

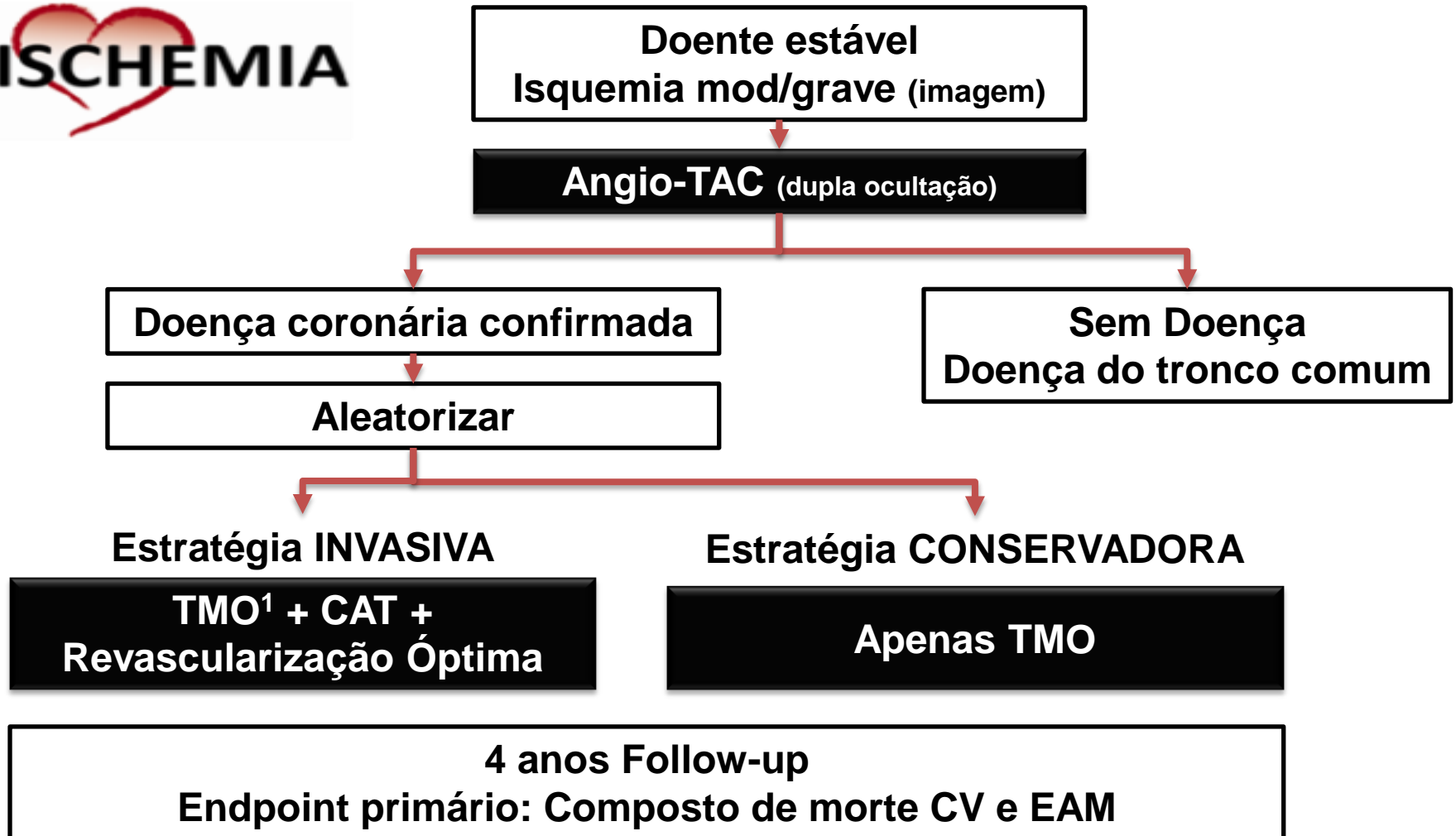


## CONTRAST

(Can cONTrast injection better approximate FFR compared to pure reSTing physiology?)

Em curso...

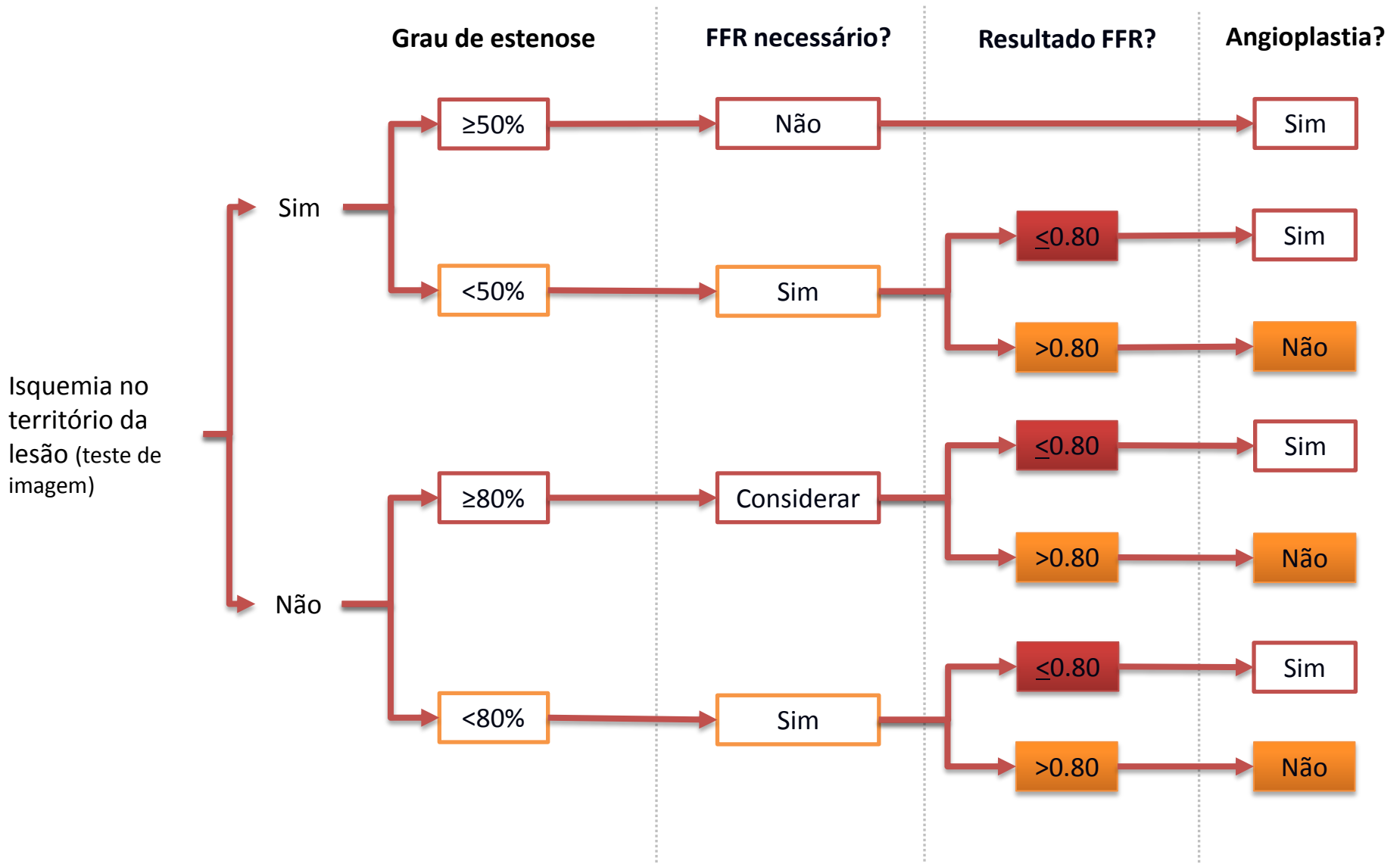
# ISCHEMIA Trial



<sup>1</sup> TMO = Terapêutica médica otimizada

# ISCHEMIA Trial

## Avaliação da Isquemia no cateterismo





**Doente estável**  
**Isquemia mod/grave (imagem)**

**Angio-TAC** (dupla ocultação)

**Doença coronária confirmada**

**Sem Doença**  
**Doença do tronco comum**

**Aleatorizar**

**Estratégia INVASIVA**

**TMO<sup>1</sup> + CAT +  
Revascularização Óptima**

**Estratégia CONSERVADORA**

**Apenas TMO**

**4 anos Follow-up**  
**Endpoint primário: Composto de morte CV e EAM**

**Pronto para começar inclusão...**





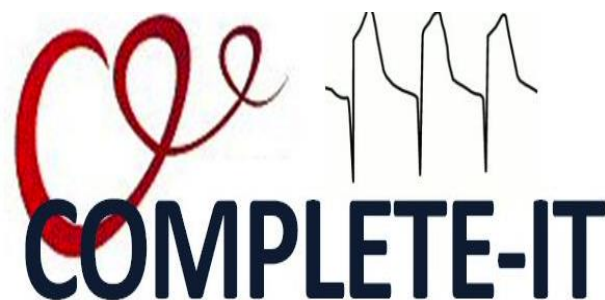
**Functional Assessment  
of Severity of Coronary  
Artery Disease in  
Patients Undergoing  
Surgery for Severe  
Valvular Heart Disease**



**Início Fev 2015**



**Single-stage COMPLETE  
revascularization  
guided by  
instantaneous wave  
free ratio in patients  
with STEMI undergoing  
primary PCI**



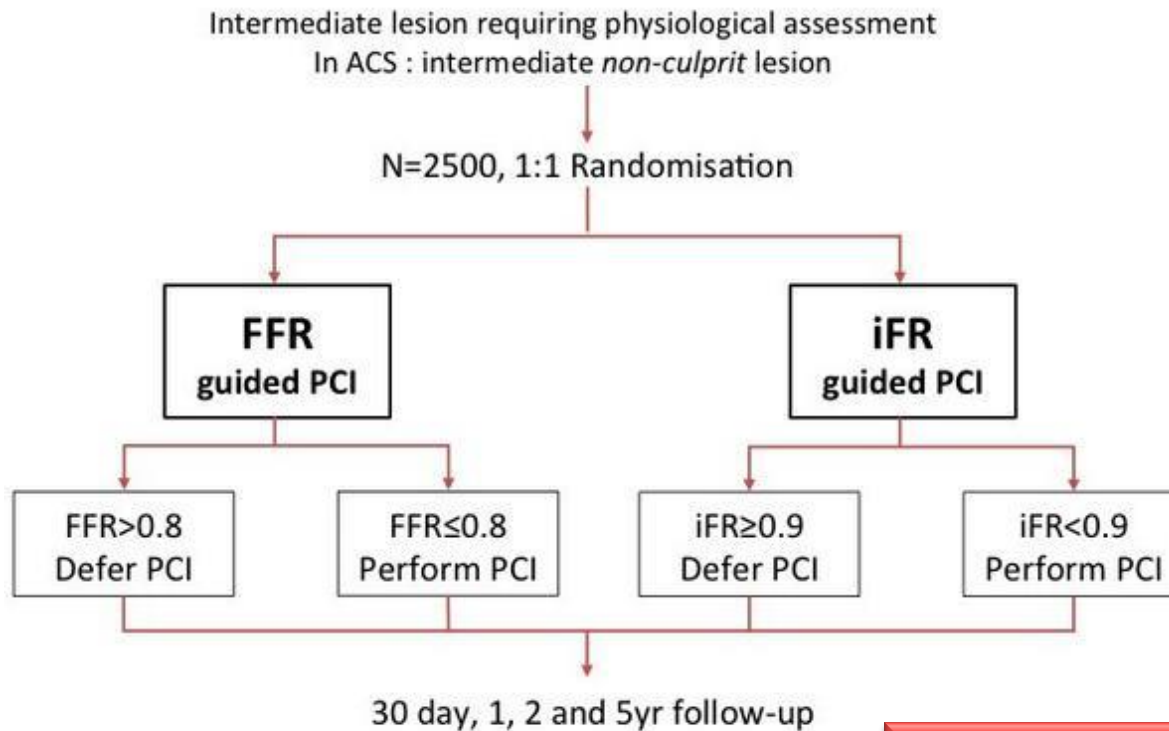
**Estudo Piloto: 1º Semestre 2015**

# iFR versus FFR – DEFINE-FLAIR

Imperial College London

## DEFINE - FLAIR

Functional Lesion Assessment of Intermediate stenosis to guide Revascularisation



**Aprovado hoje!**



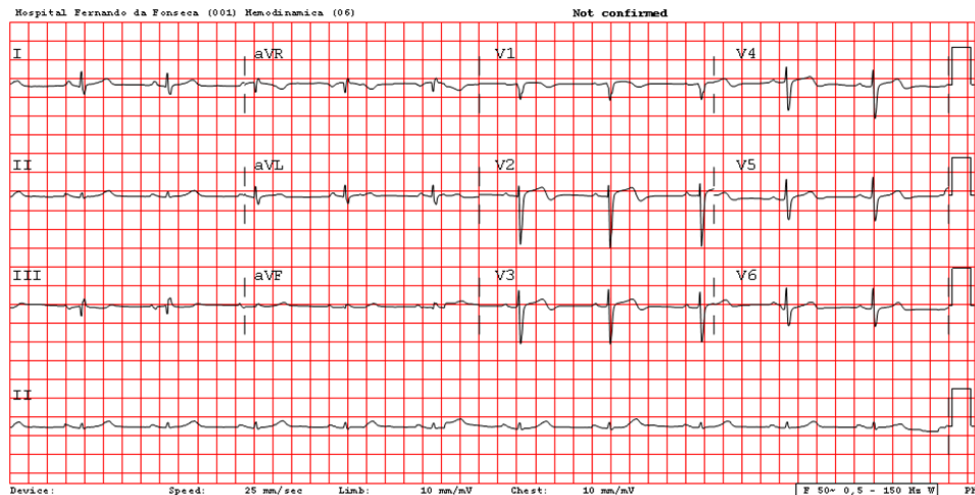
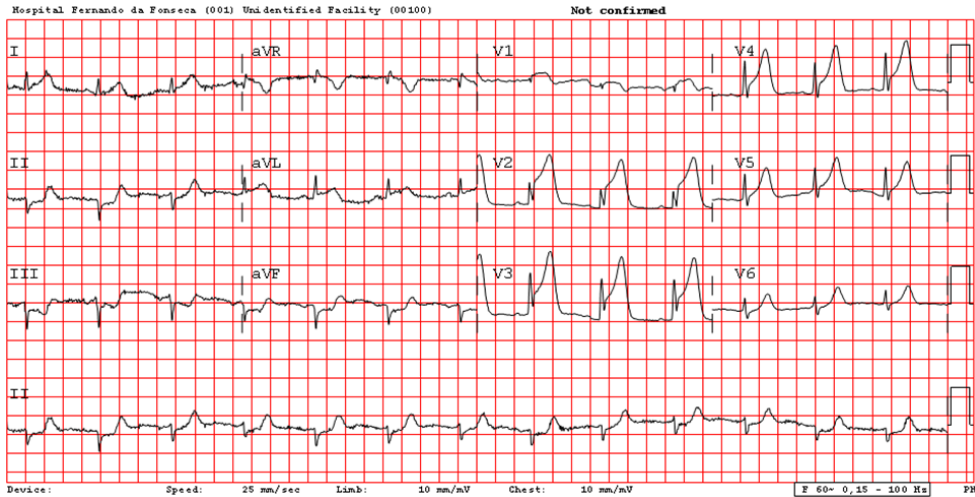
**PhD in Medicine – Clinical Research**  
**Faculty of Medical Sciences – Nova University of Lisbon**



**“Coronary microcirculation and endothelial function evaluation after acute ST elevation myocardial infarction treated with primary angioplasty ”**

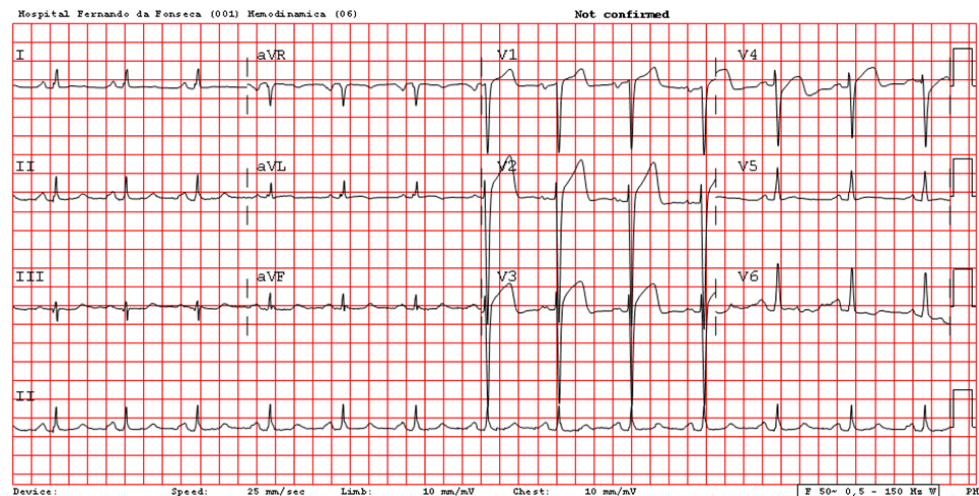
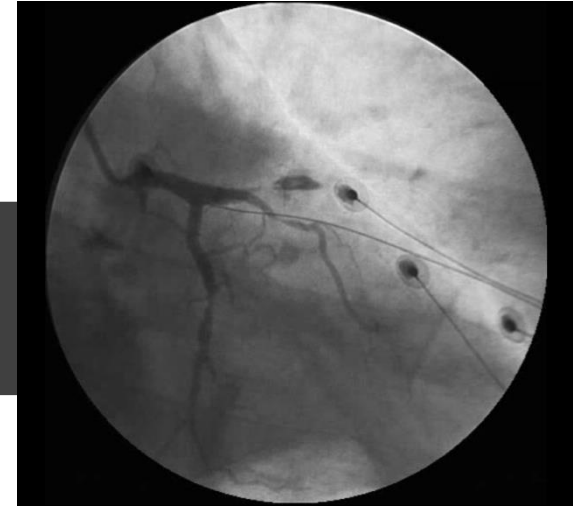
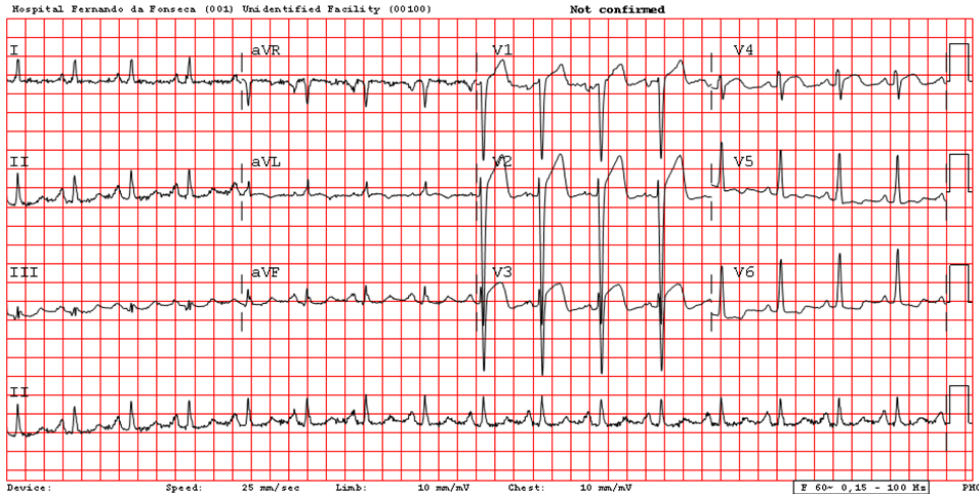
# Why is it important? Research Problem

## Primary PCI – Some patients do good...



# Why is it important? Research Problem

## Primary PCI – ...While others don't...

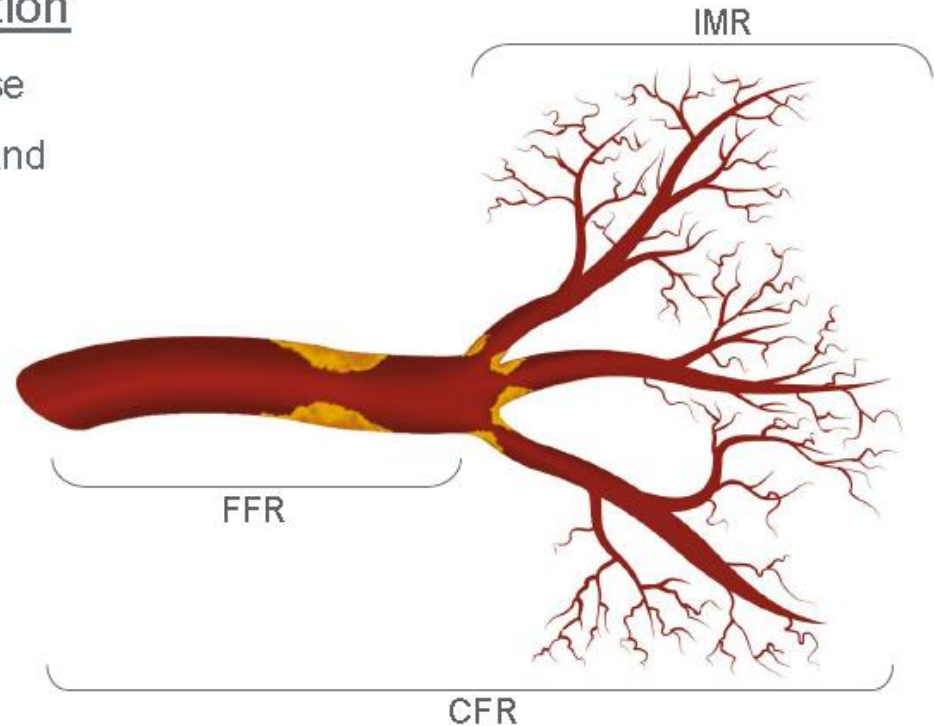


# Microcirculation in STEMI patients

## Index of Microvascular Resistance (IMR)

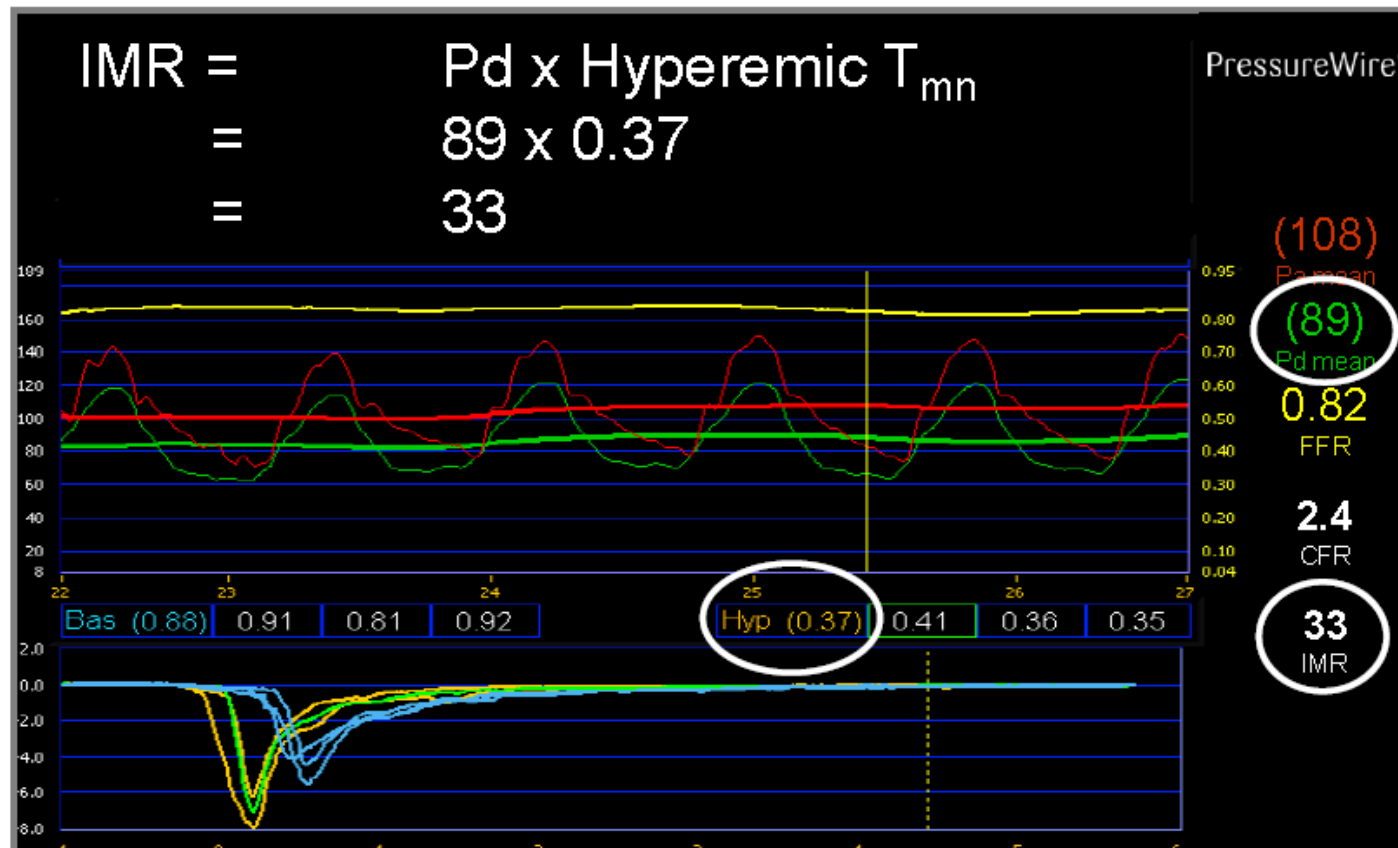
Invasive and quantitative method for evaluating the microcirculation

- FFR: Specific for epicardial disease
- CFR: Affected by both epicardial and microcirculatory disease (cannot distinguish between the two)
- IMR: Specific for microcirculatory disease



# Microcirculation in STEMI patients

## Index of Microvascular Resistance (IMR)





# Microcirculation in STEMI patients

## Digital Pulse Amplitude Tonometry (PAT)

- Noninvasive measurement of endothelial-dependent vasodilator function in the microcirculation of the finger.
- Pulse amplitude in the fingertip measured at rest and following the induction of reactive hyperemia.



EndoPAT 2000  
(Itamar Medical, Caesarea, Israel)

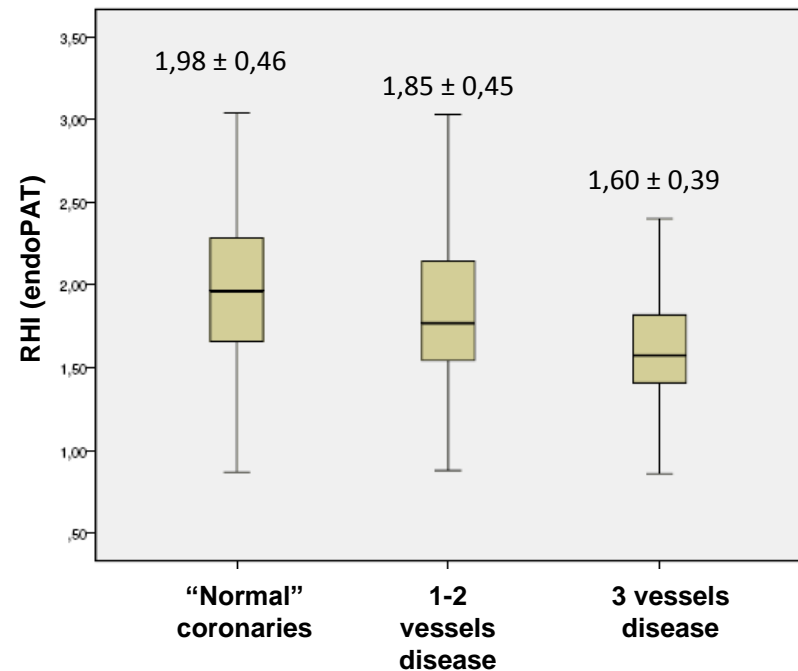
# Microcirculation in STEMI patients

## Endothelial dysfunction and severity of CAD

➔ Endothelial-dependent dysfunction evaluated by RHI-PAT relates to the severity of CAD disease

- 231 CAD patients
- Angiography performed
- endoPAT evaluation

RHI-PAT = only predictor of 3 vessel disease on multivariate analysis



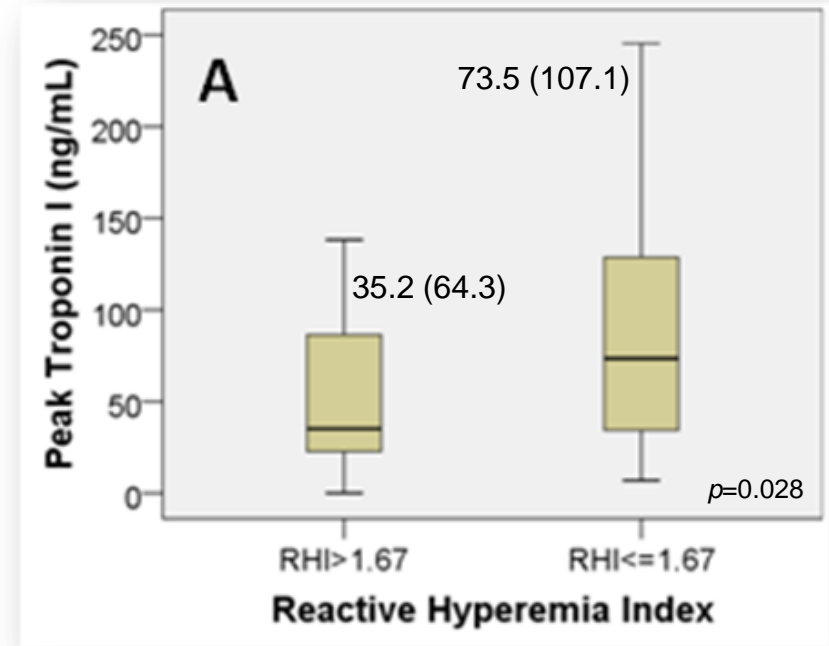
# Microcirculation in STEMI patients

## Endothelial dysfunction and extension of STEMI

➔ Endothelial dysfunction evaluated by RHI-PAT relates with the extension of myocardial infarction (P-PCI treated) measured by peak Tnl

- 58 primary PCI patients
- Peak Tnl
- endoPAT evaluation

RHI-PAT  $< 1,67$  = only variable related with peak Tnl on multivariate analysis



Elsa Lourenço

Pedro Magno

Luís Brízida

Filipa, Fábio...

# Muito Obrigado!

Maura Nédio

Célia Monteiro

Pedro Abreu

José Loureiro

Paulo Leal

Mariana Faustino



Hospital Fernando  
Fonseca

SERVÍÇO DE  
cardiologia