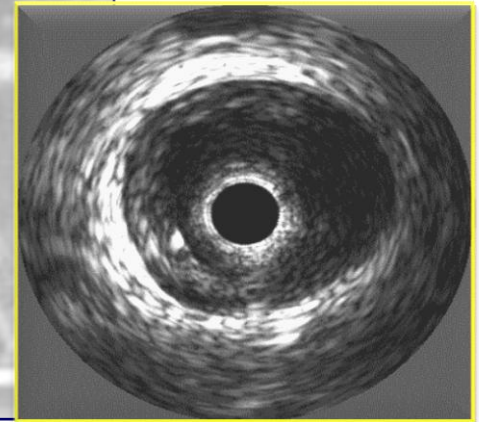
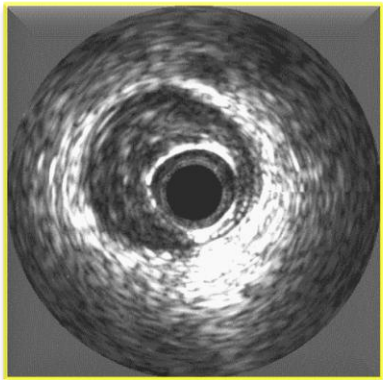
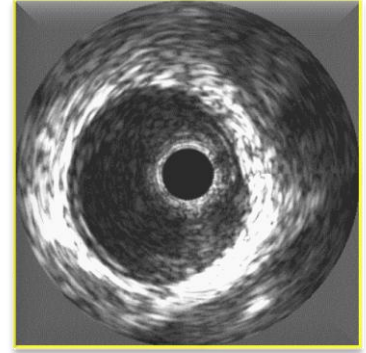
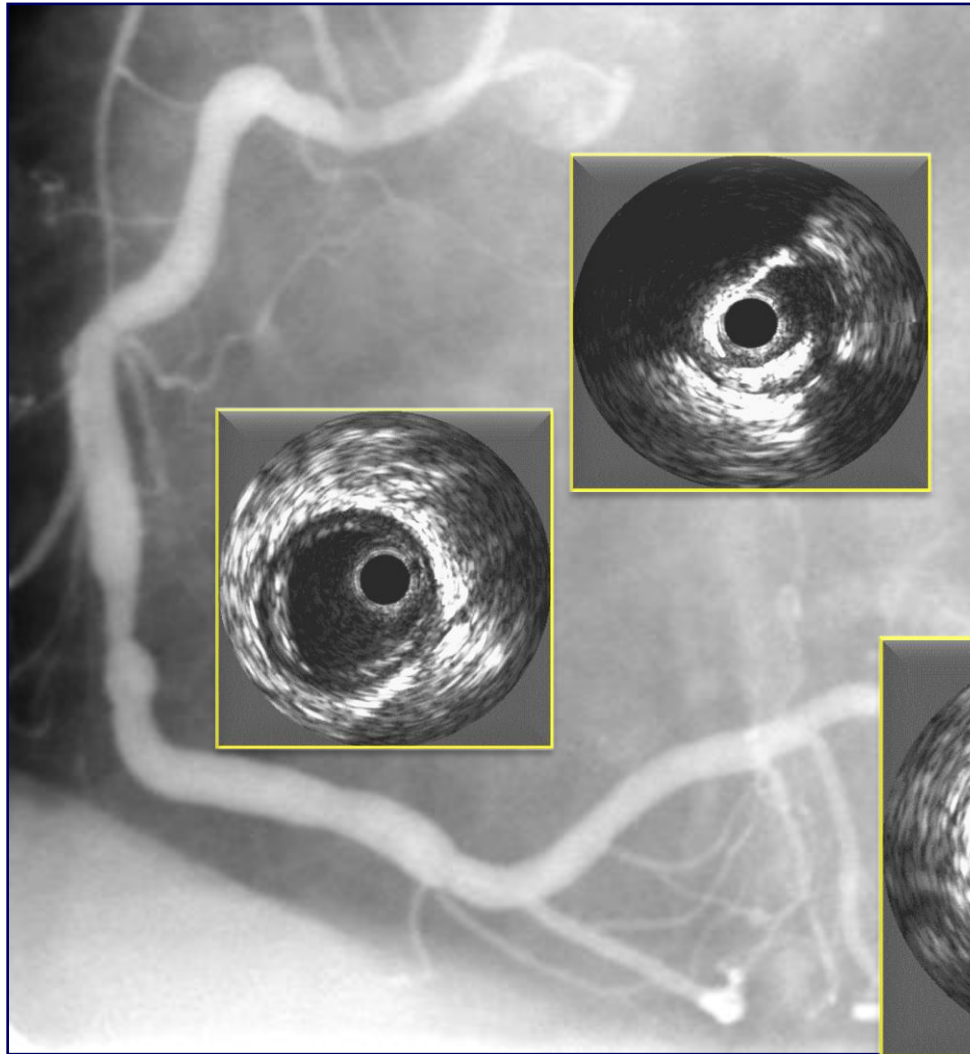
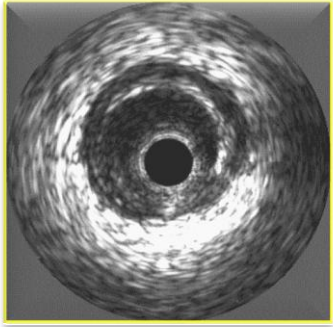


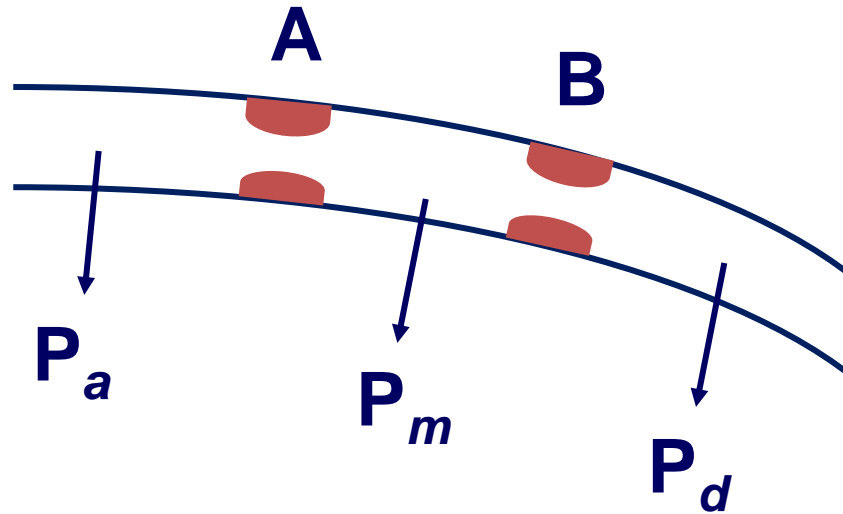
Diffuse Disease and Serial Stenoses

Bernard De Bruyne
Cardiovascular Center Aalst
Belgium

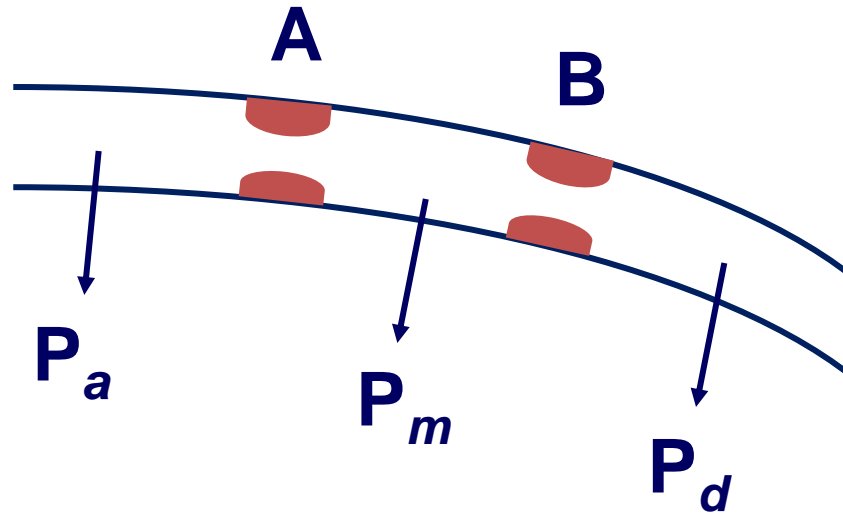
Atherosclerosis is a Diffuse Disease



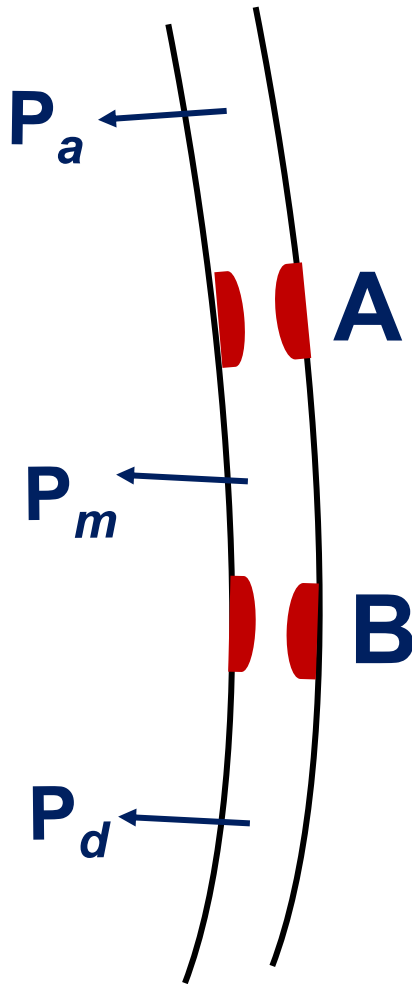
Serial Stenoses



When A is isolated, hyperemic flow through stenosis A = maximal
When B: hyperemic flow through stenosis A \neq maximal .



When B is isolated, hyperemic flow through stenosis A = maximal
When A: hyperemic flow through stenosis B \neq maximal .



$$FFR(A)_{pred} = \frac{P_d - (P_m/P_a) P_w}{P_a - P_m + P_d - P_w}$$

$$FFR(B)_{pred} = \frac{(P_a - P_w) (P_m - P_d)}{P_a (P_m - P_w)}$$

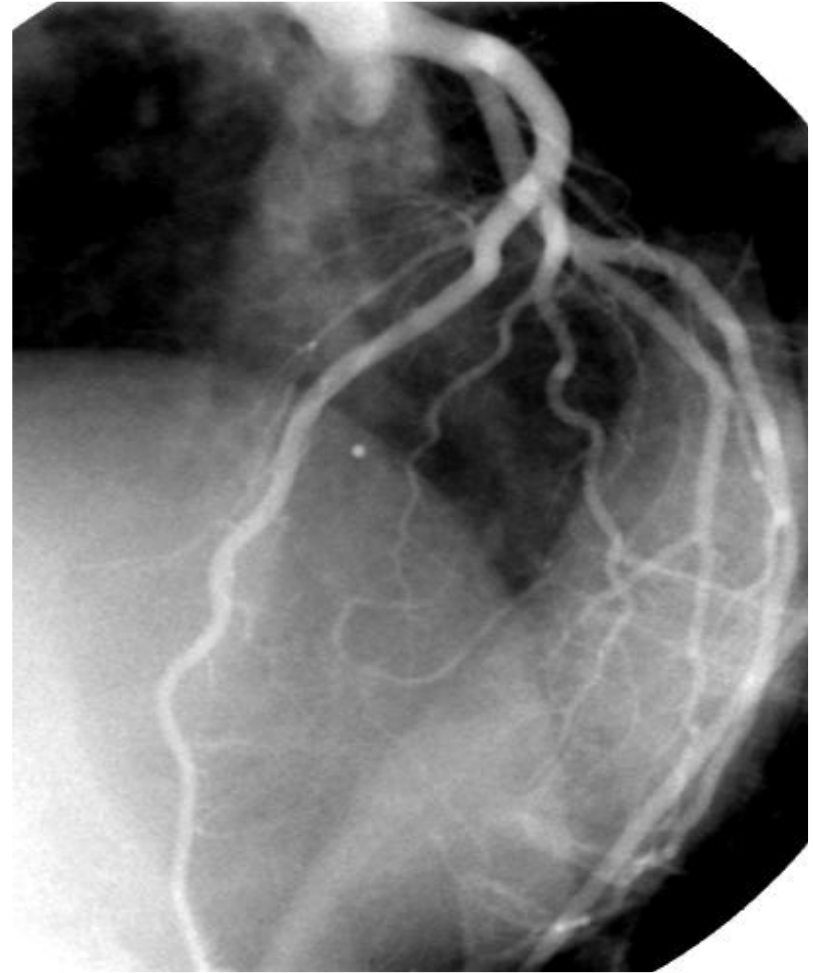
P_w = Coronary occlusive pressure

Serial stenoses: 4 rules to keep in mind

1. FFR applies for all stenoses together
 2. When two stenoses are present, each of them will influence the flow across the other one (cross-talk between stenoses)
 3. The influence of the distal one is much larger and difficult to predict than the influence of the proximal one
 4. Their influence will be proportional to the myocardial mass
- Pull back under steady state hyperemia (Adenosine IV)**

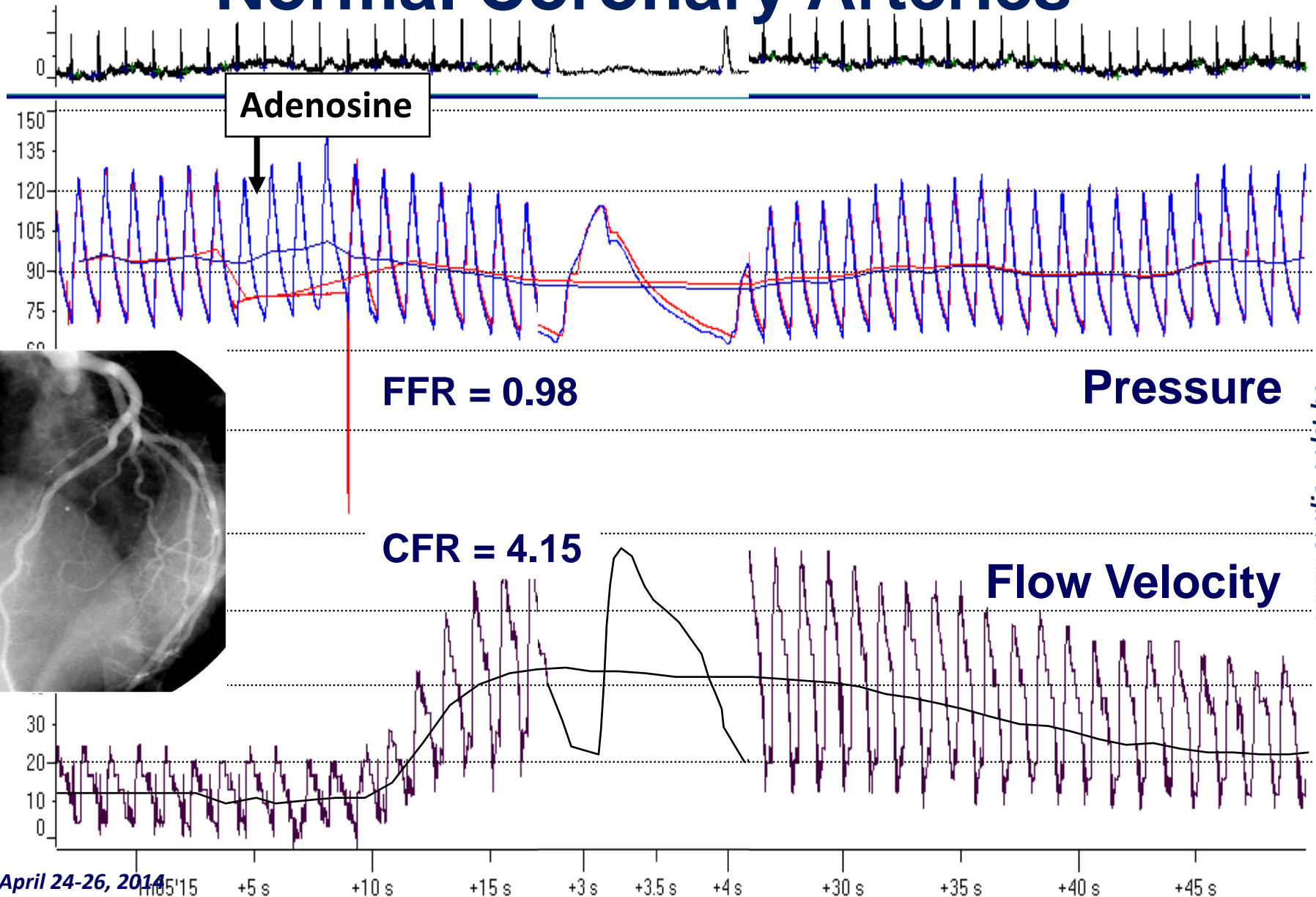
Diffuse Disease

Normal Coronary Arteries

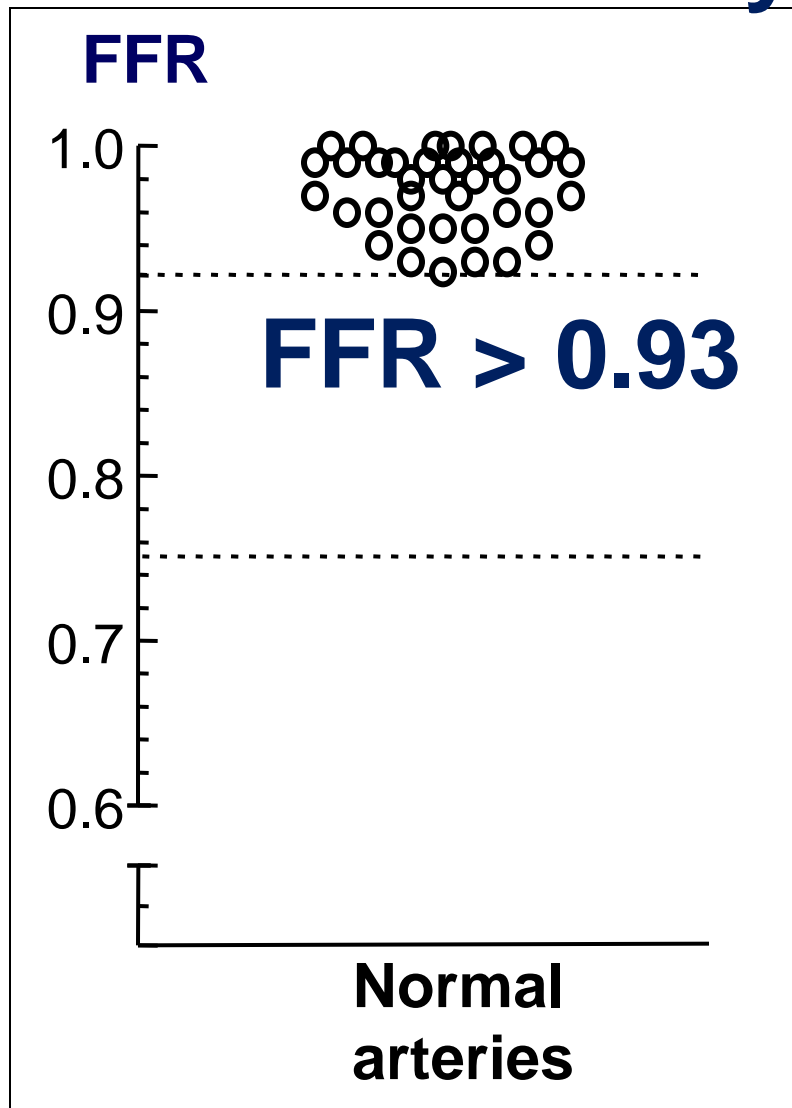


32-y-old man
Control post surgical ASD repair

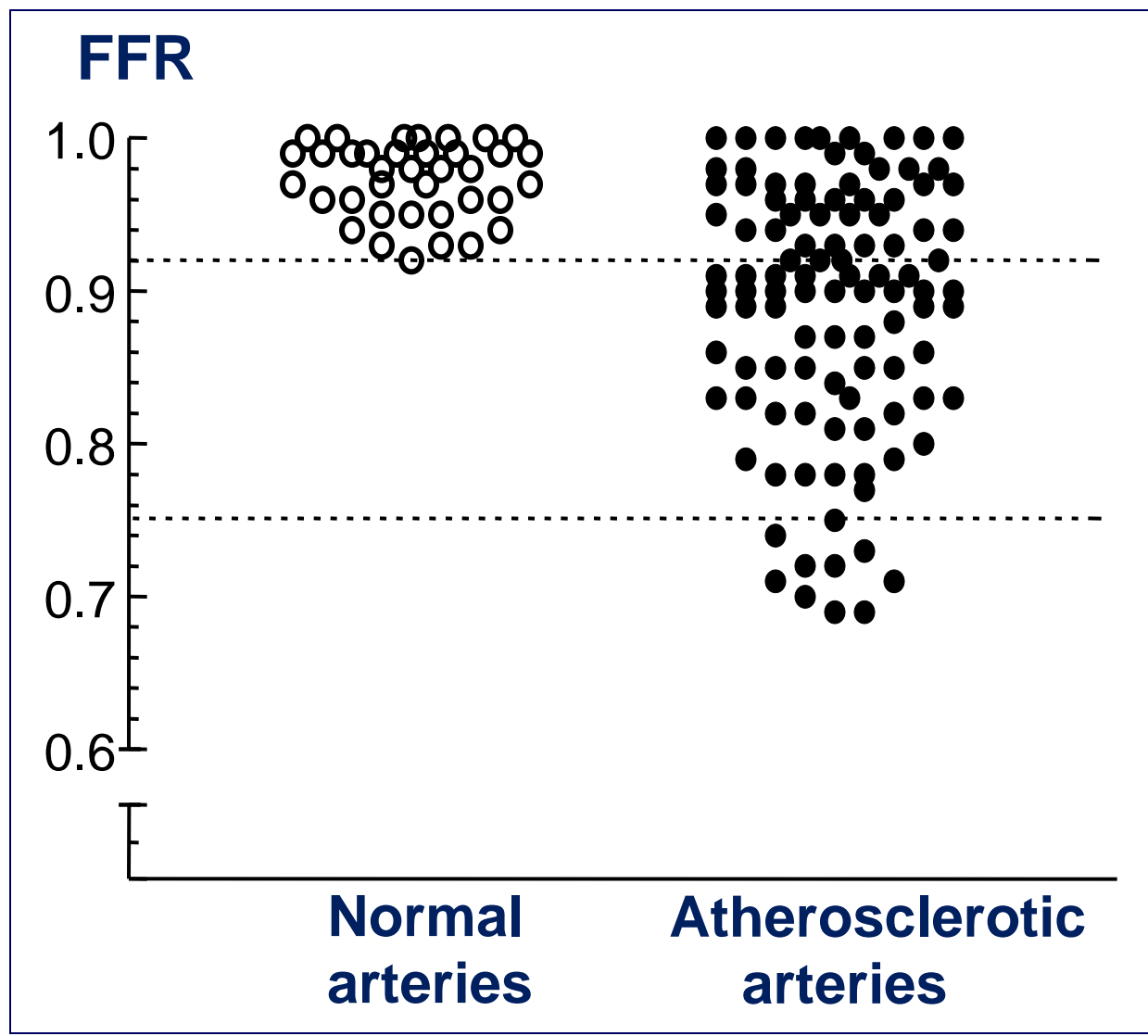
Normal Coronary Arteries



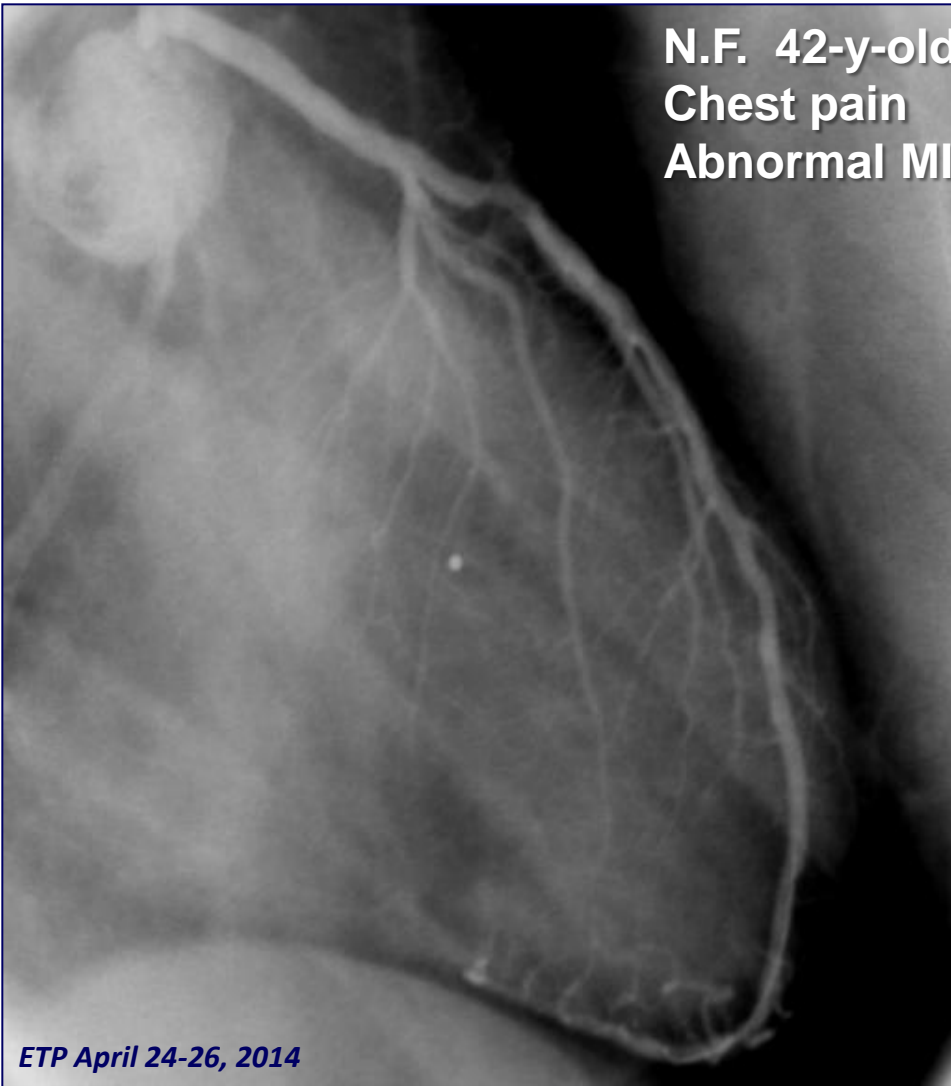
FFR in Normal Coronary Arteries



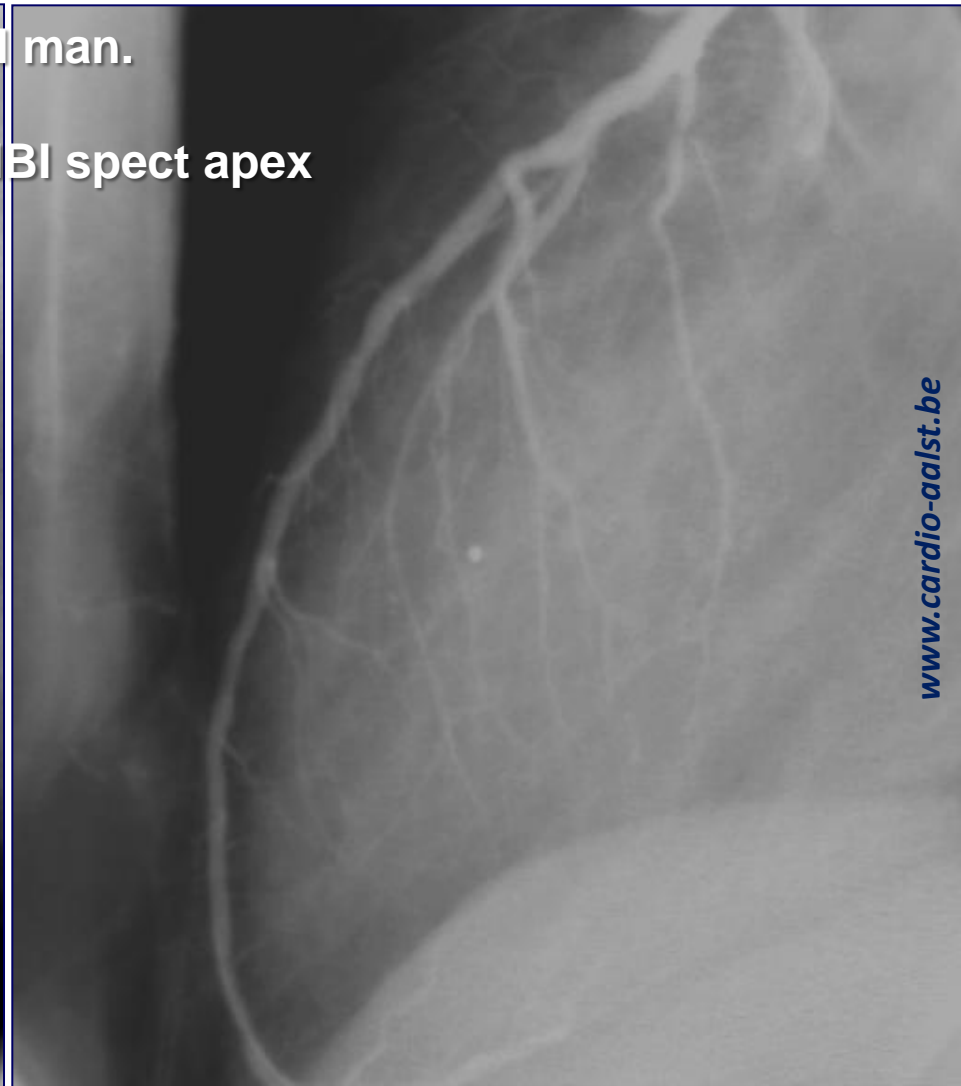
FFR in Diffusely Diseased Coronary Arteries



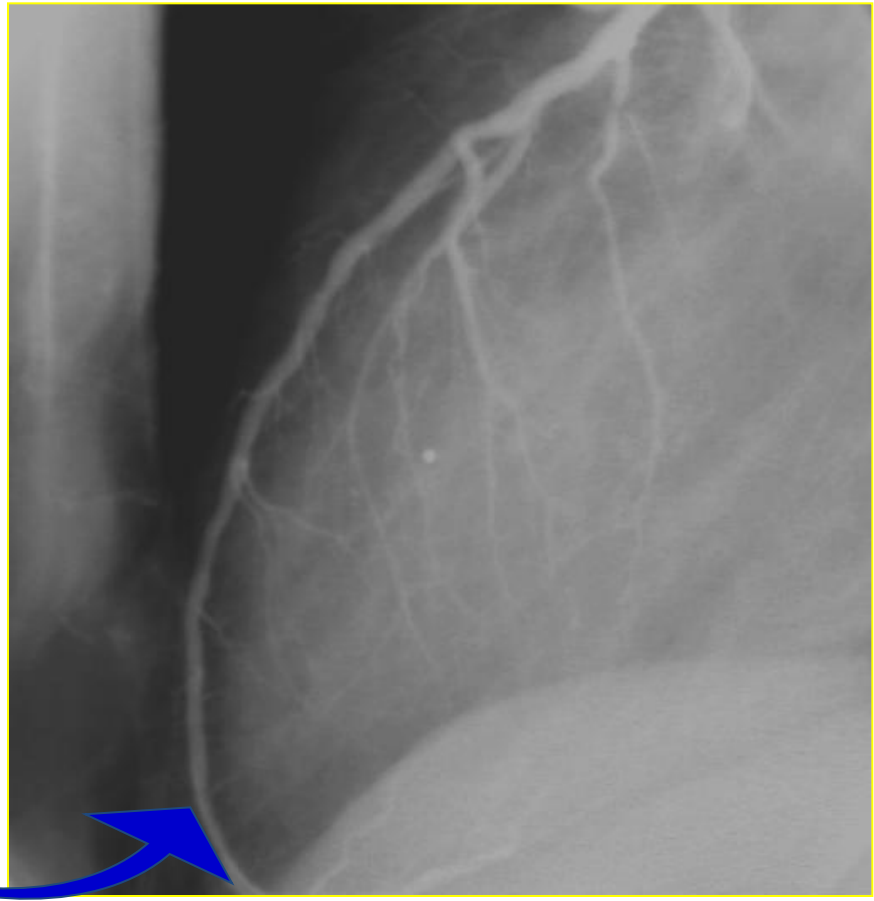
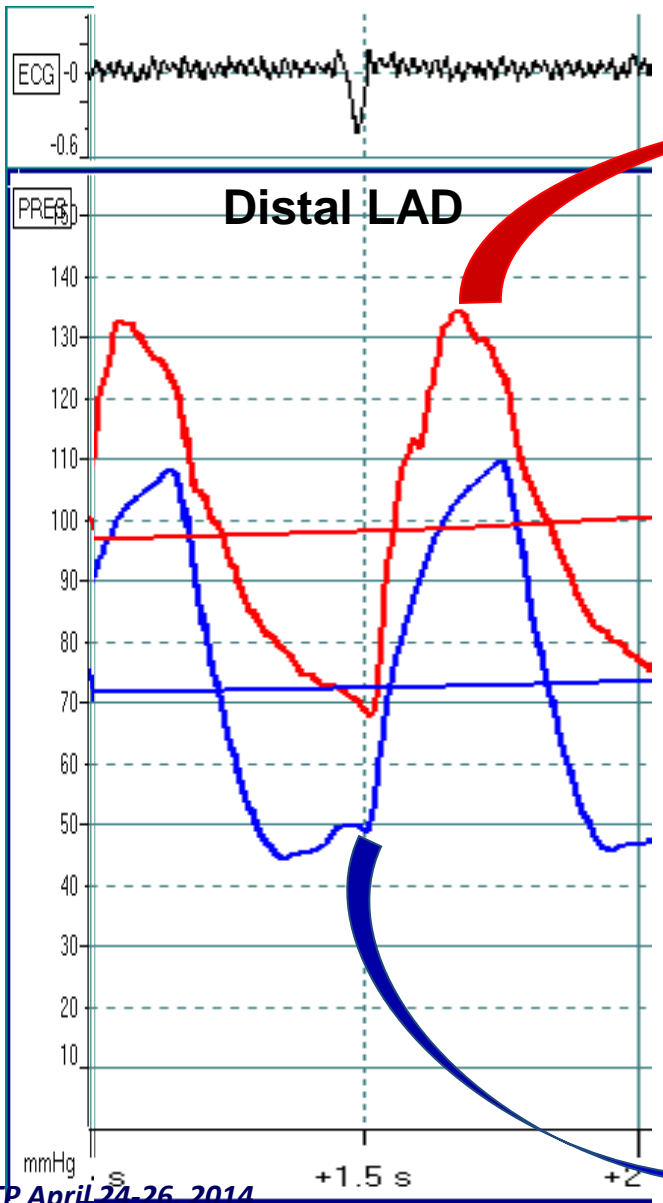
FFR in Diffusely Diseased Coronary Arteries



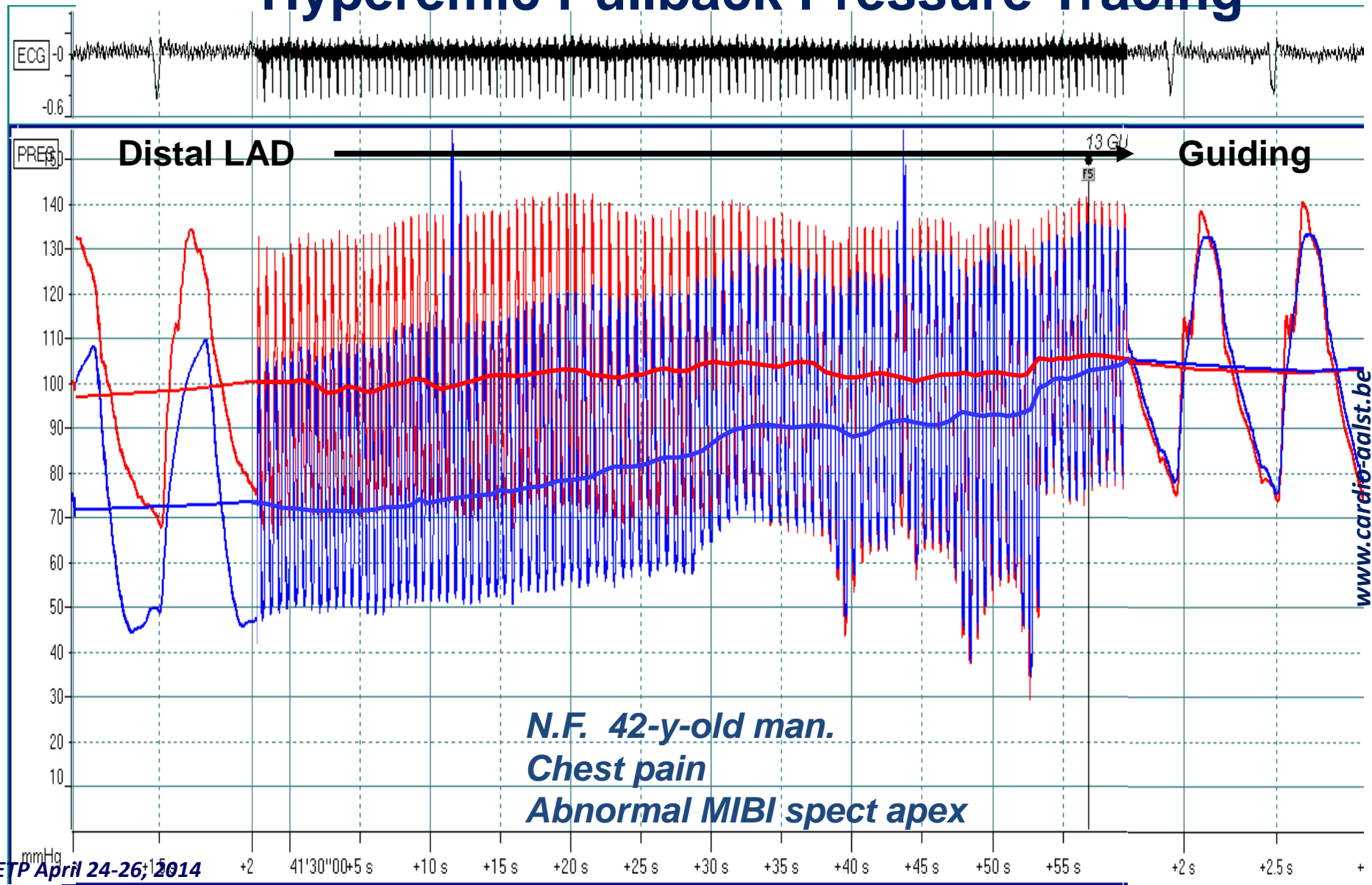
N.F. 42-y-old man.
Chest pain
Abnormal MIBI spect apex

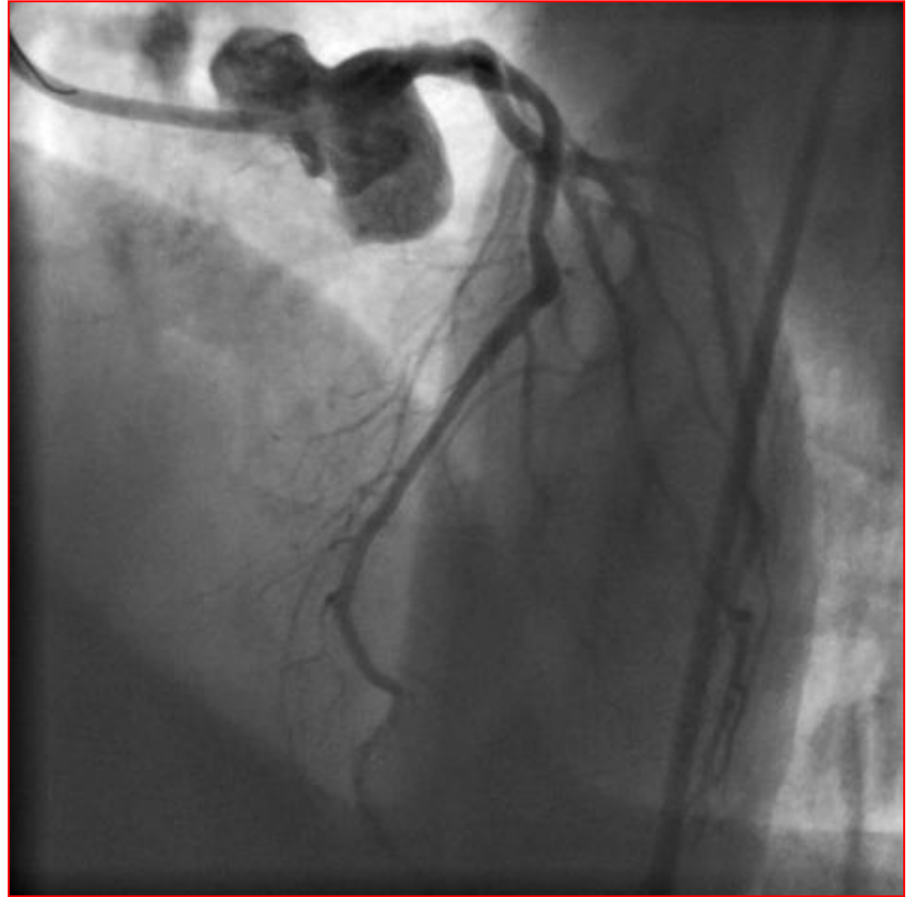


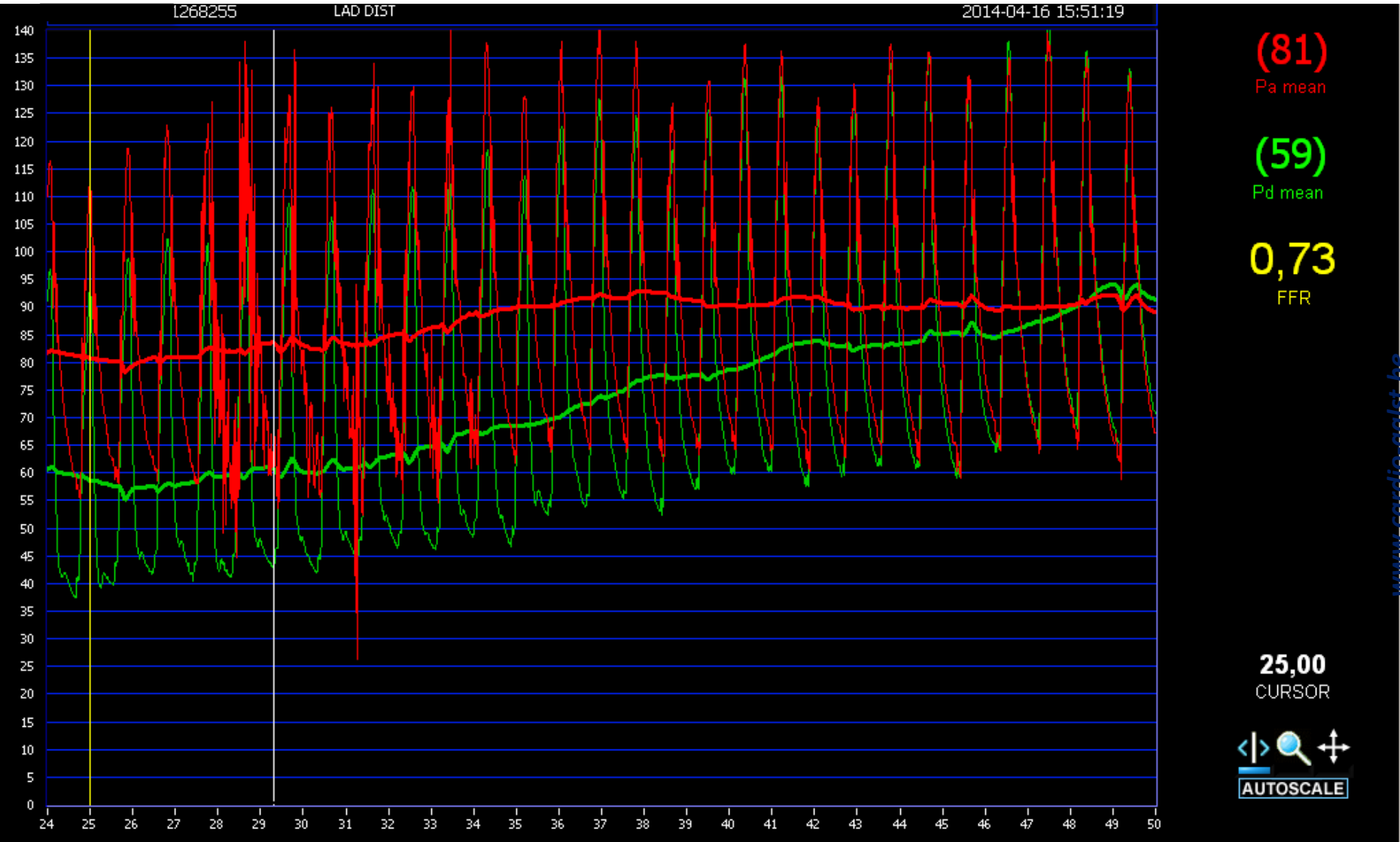
FFR in Diffusely Diseased Coronary Arteries



FFR in Diffusely Diseased Coronary Arteries Hyperemic Pullback Pressure Tracing







Conclusion

**FFR is often abnormal
in diffusely atherosclerotic coronary arteries**

Clinical Implications

- 1. Cause of ischemia in some patients**
- 2. Cause of “false positive” non-invasive stress testing**
- 3. Caveat for FFR after stent implantation**

How to Distinguish Focal from Diffuse ?

Pull Back Hyperemic Pressure Tracing

51-y-o man.

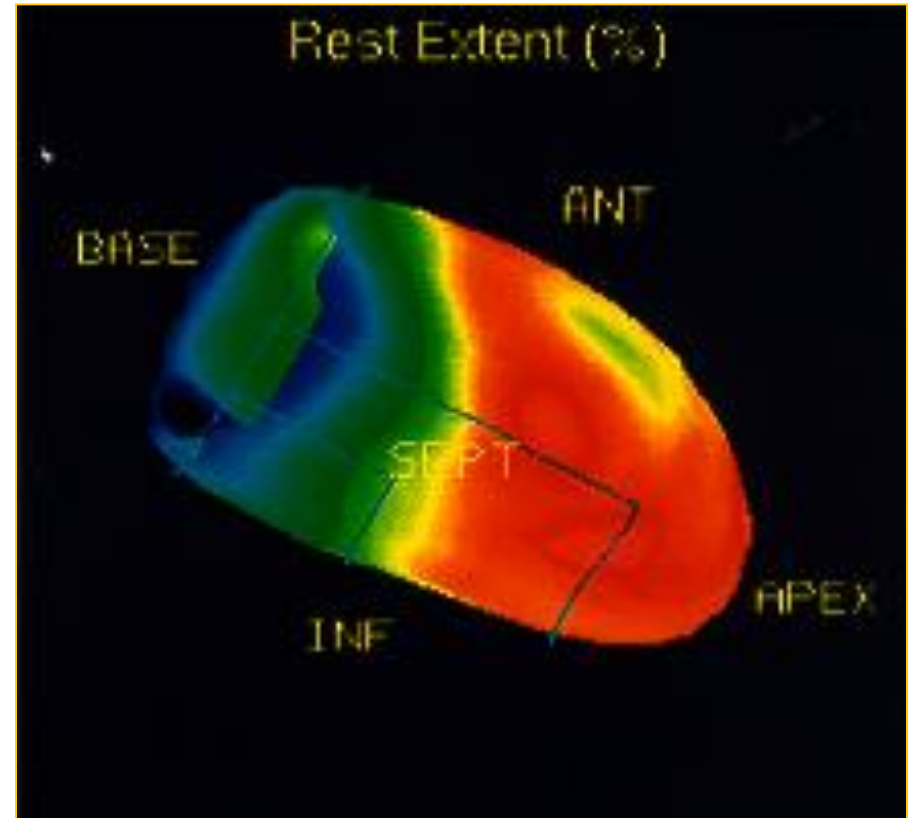
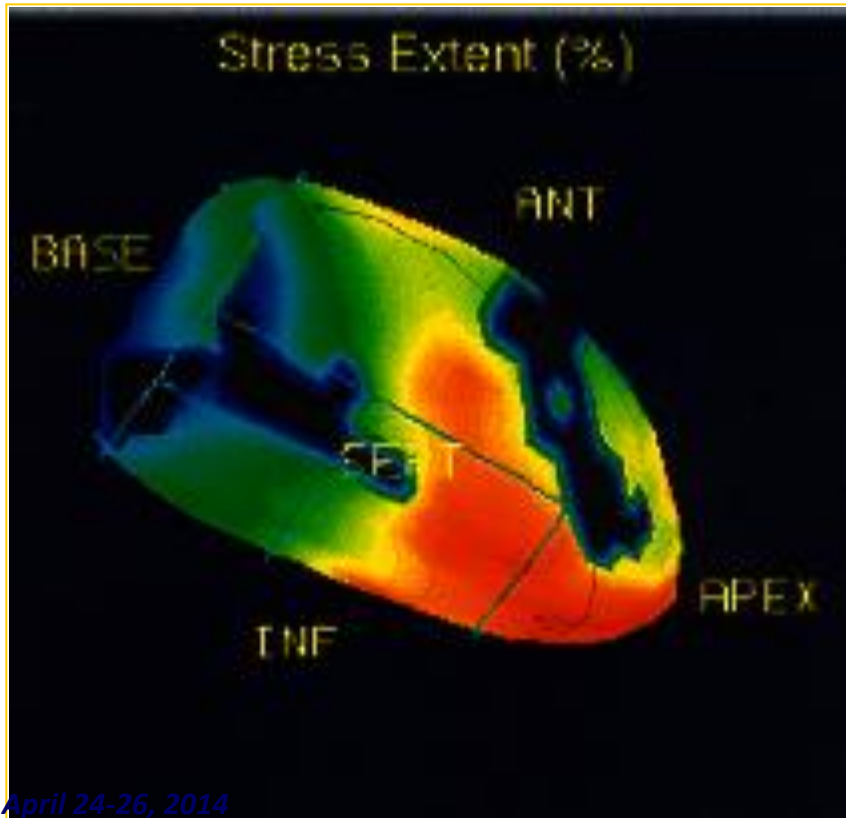
Risk Factors

Familial history of CAD
Former smoker (stopped 11 years ago)
Hyperlipidemia

Current Problem

Since 3 months, typical angina CCS class 1-2
Dubious exercise ECG
Reversible myocardial ischemia at MIBI Spect

Van Puynebroeck Eddy 75139
DOB 27/11/59



51-y-o man.

Risk Factors

Familial history of CAD

Former smoker (stopped 11 years ago)

Hyperlipidemia

Current Problem

Since 3 months, typical angina CCS class 1-2

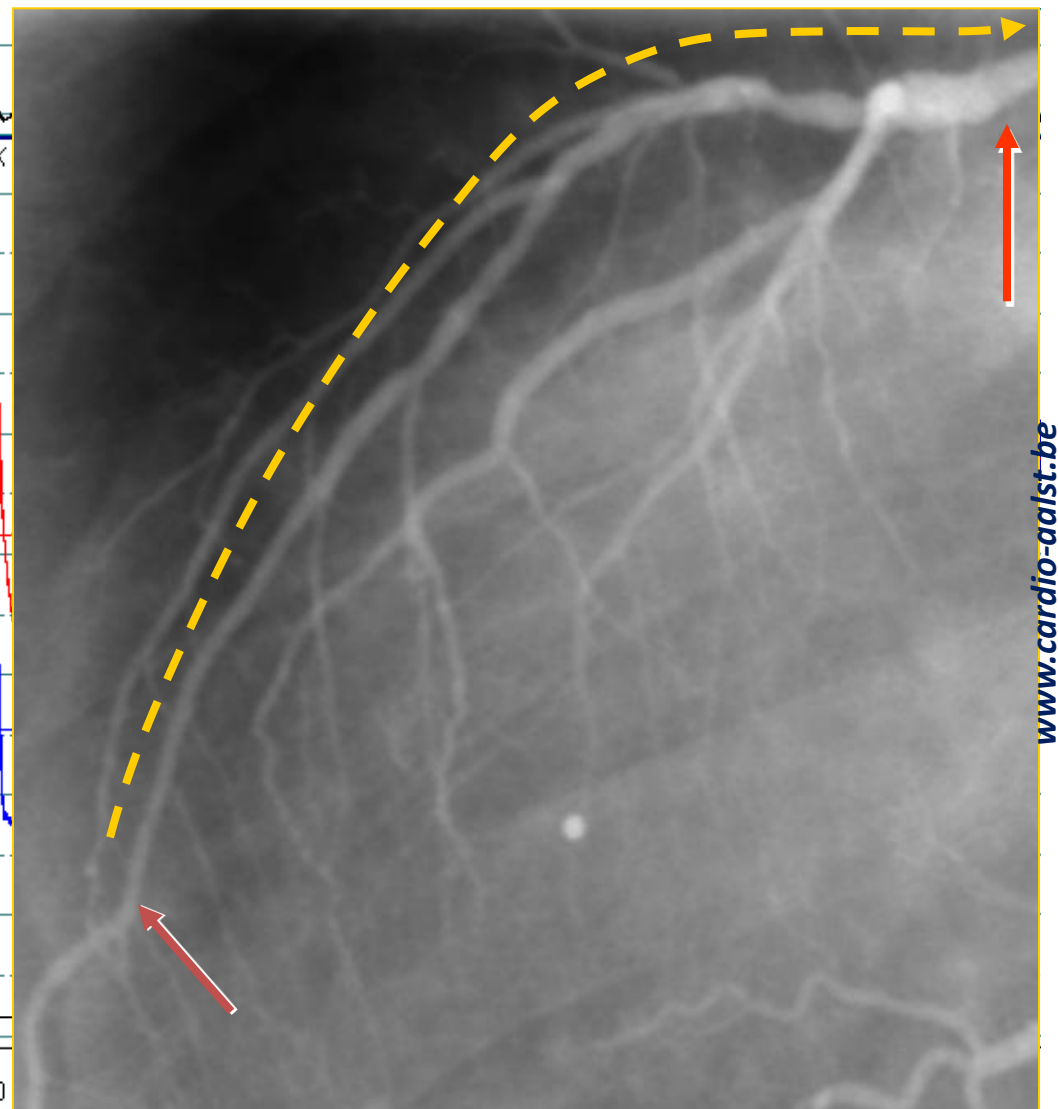
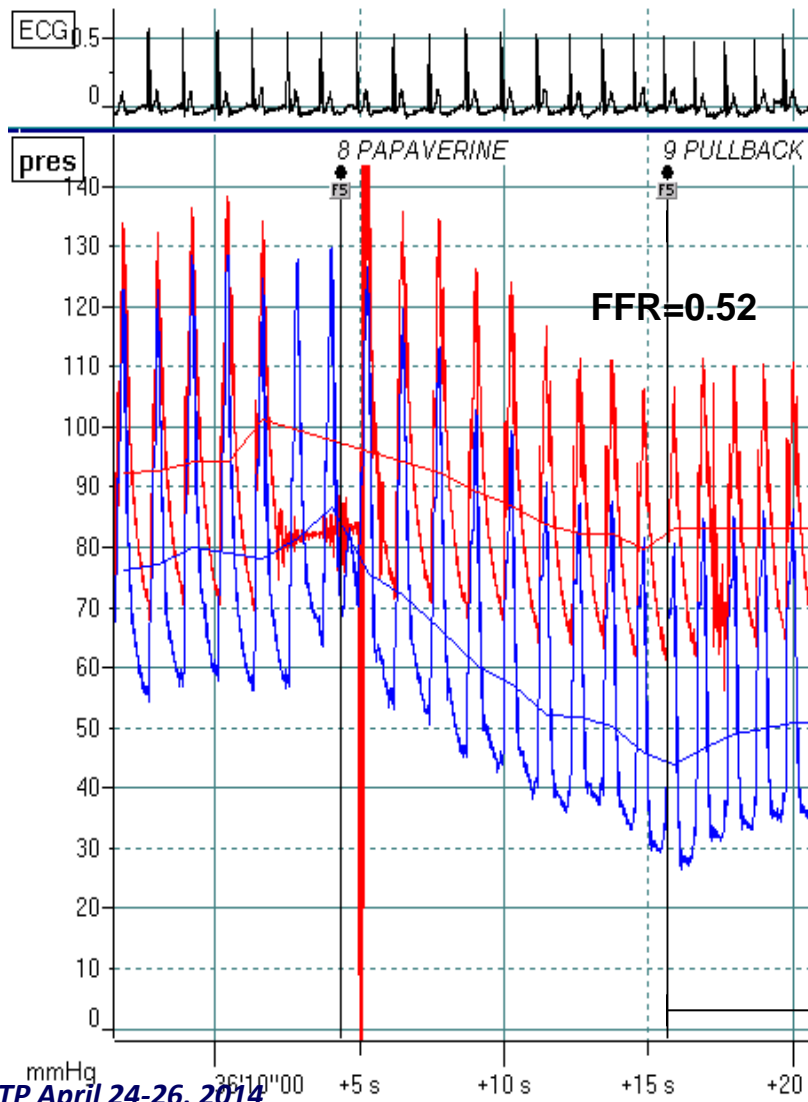
Dubious exercise ECG

Reversible myocardial ischemia at MIBI Spect



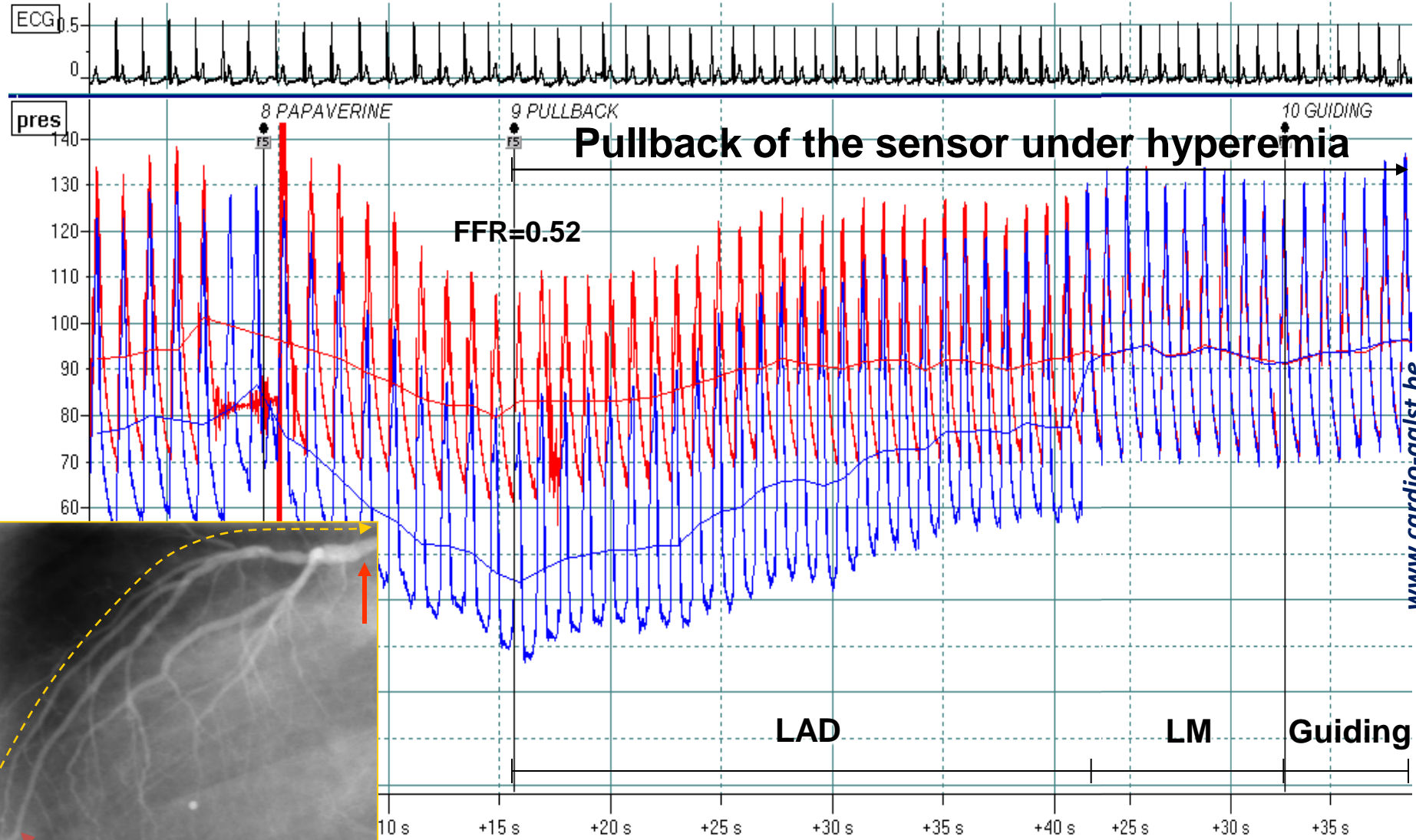
Pull Back in de LAD under Maximal Hyperemia

Van Puymbroeck Eddy 75139
DOB 27/11/50

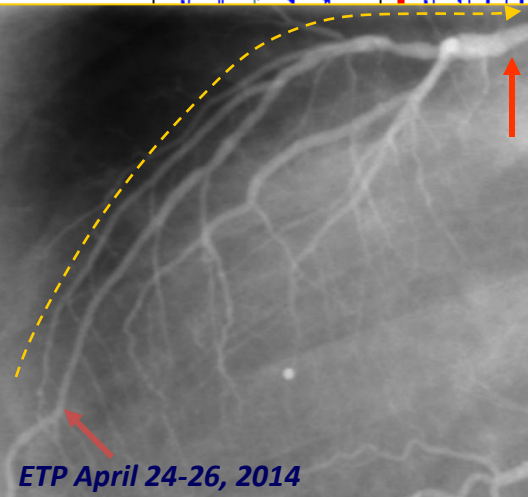


Pull Back in de LAD under Maximal Hyperemia

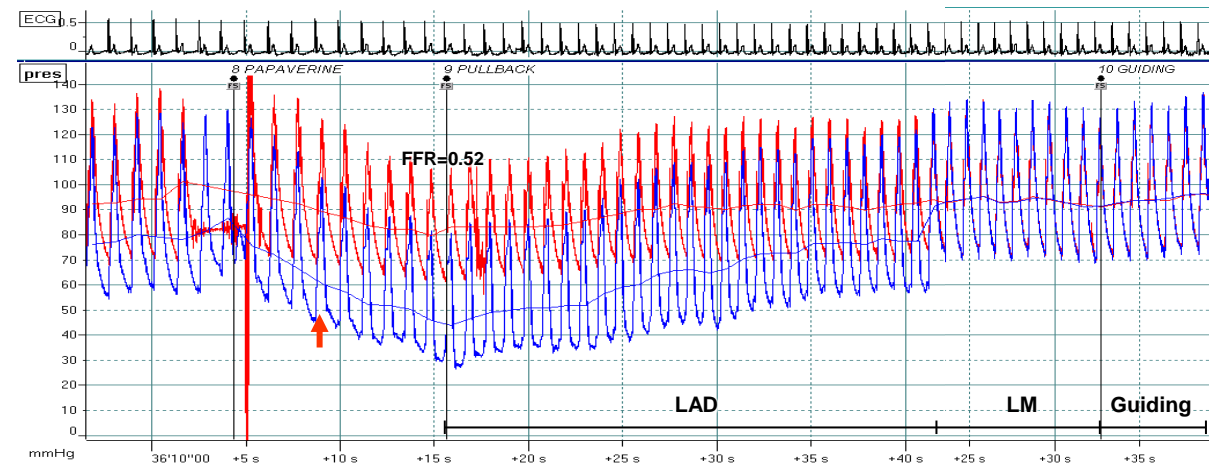
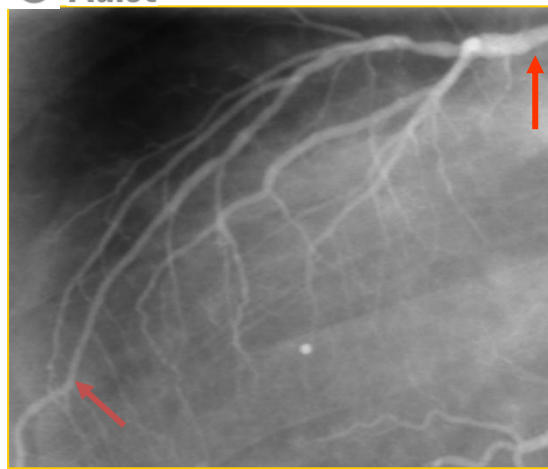
Van Puynebeek Eddy 19139
DOB 27/11/50



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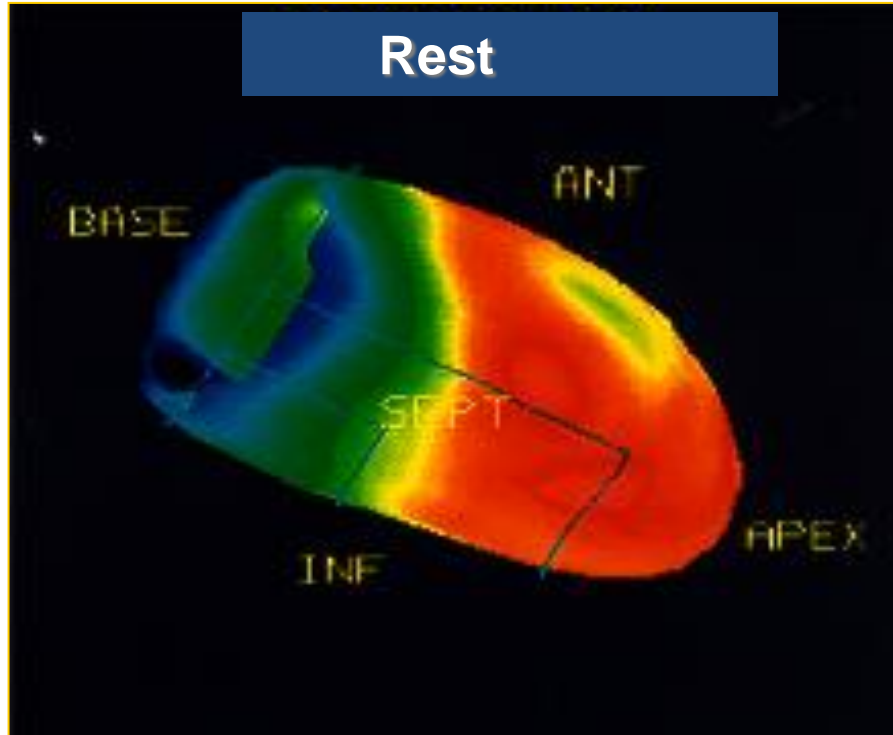
Back in de LAD under Maximal Hyperemia



Stress (Adenosine IV)

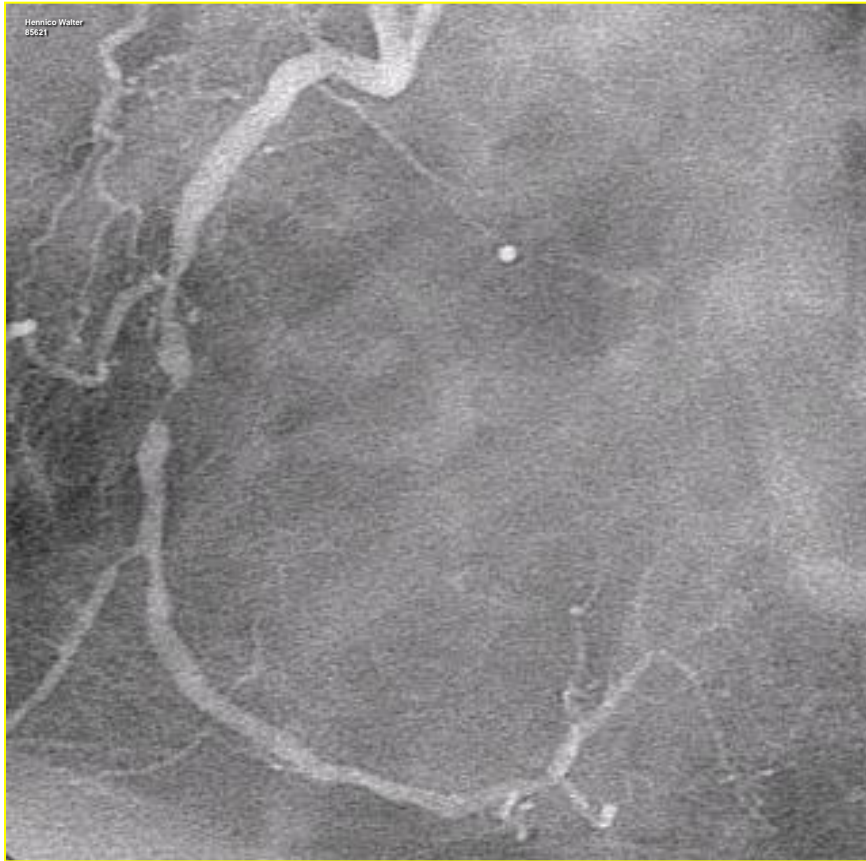


Rest



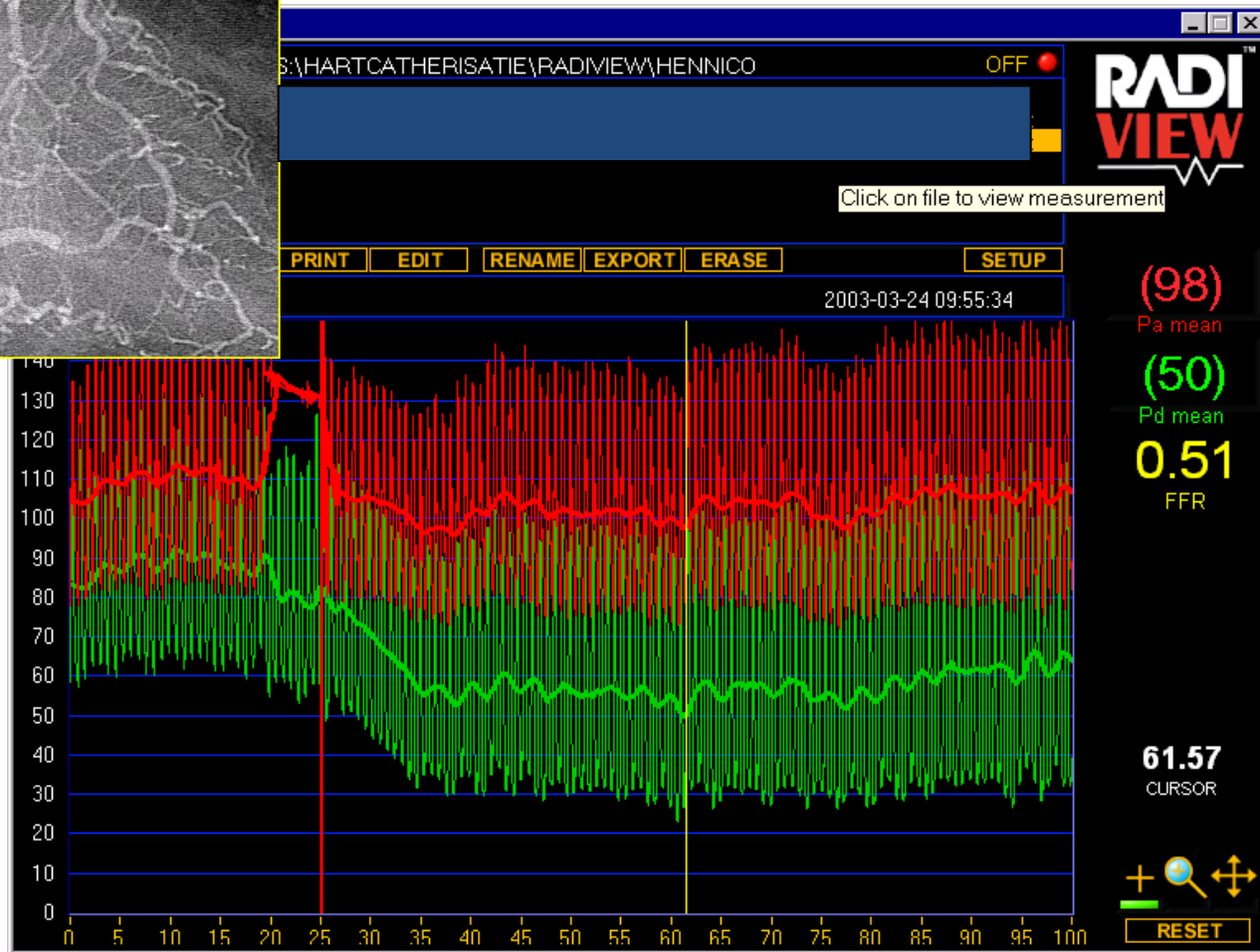
H.W. (85621) 57-y-o man

Unstable Angina



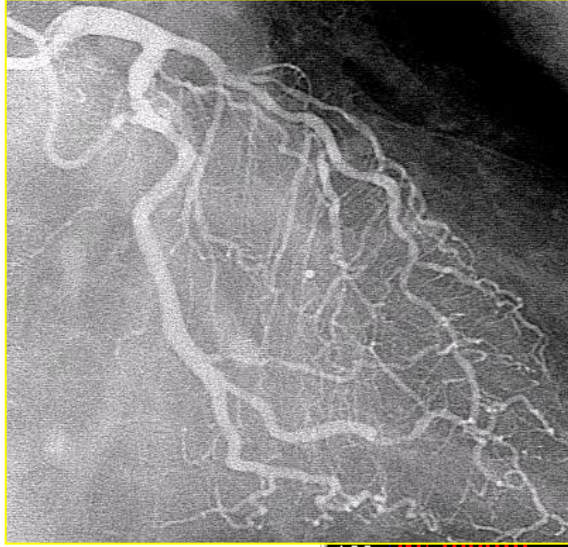
H.W. (85621) 57-y-o man Unstable Angina

Sensor Left in Distal LAD



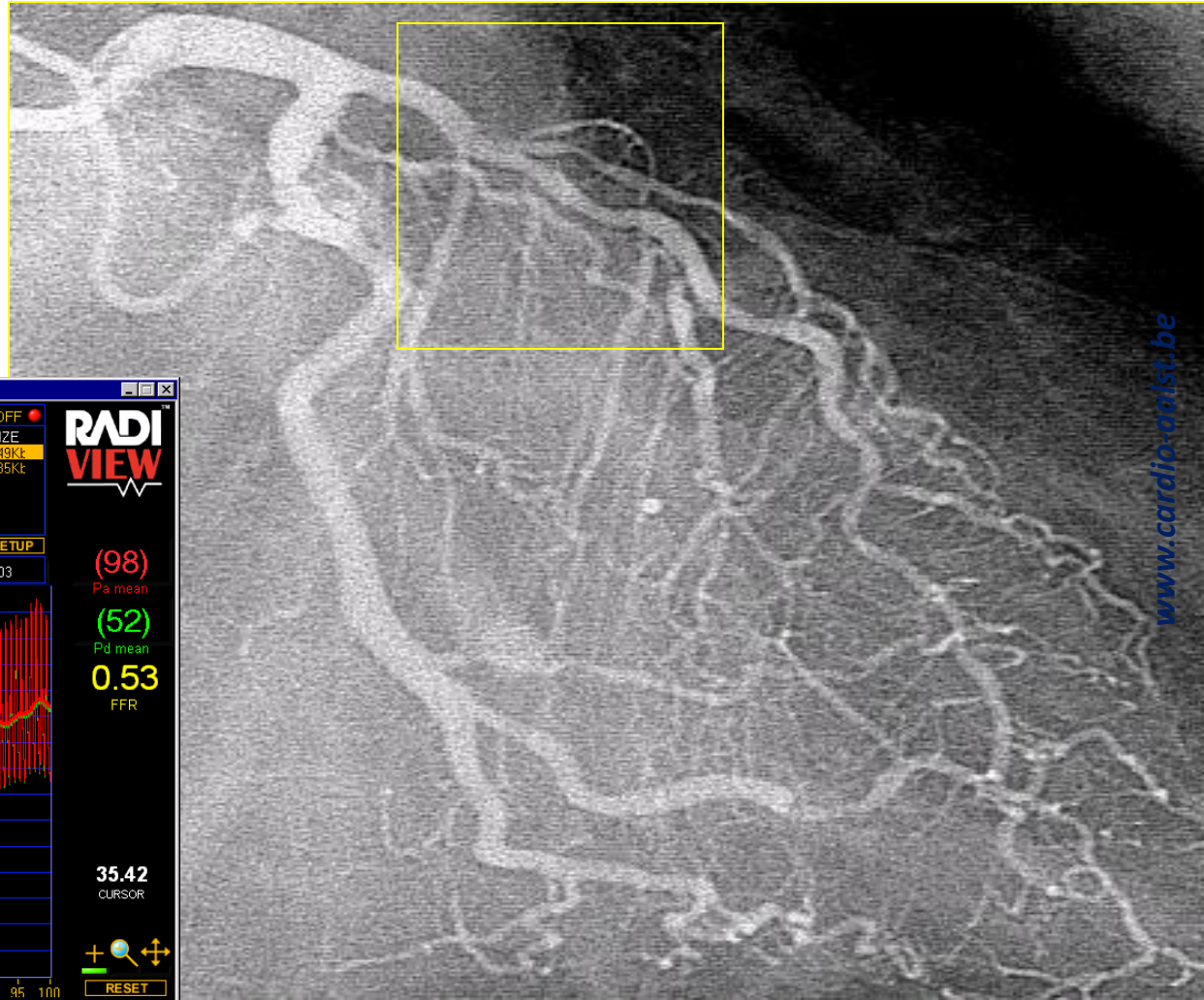
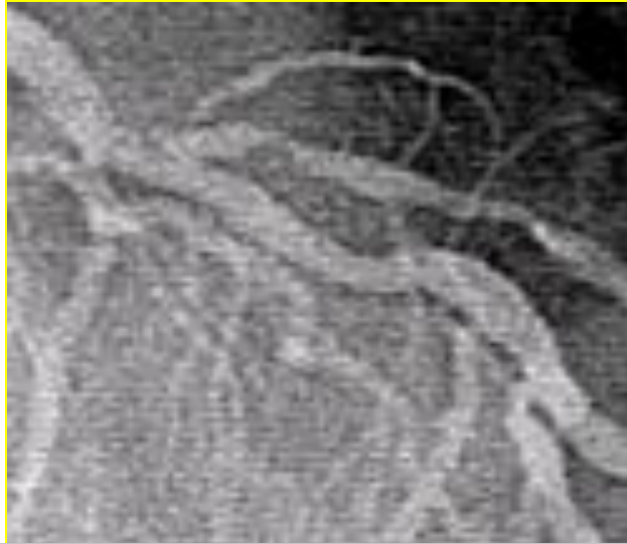
H.W. (85621) 57-y-o man Unstable Angina

Pullback of Sensor from Distal LAD to LM

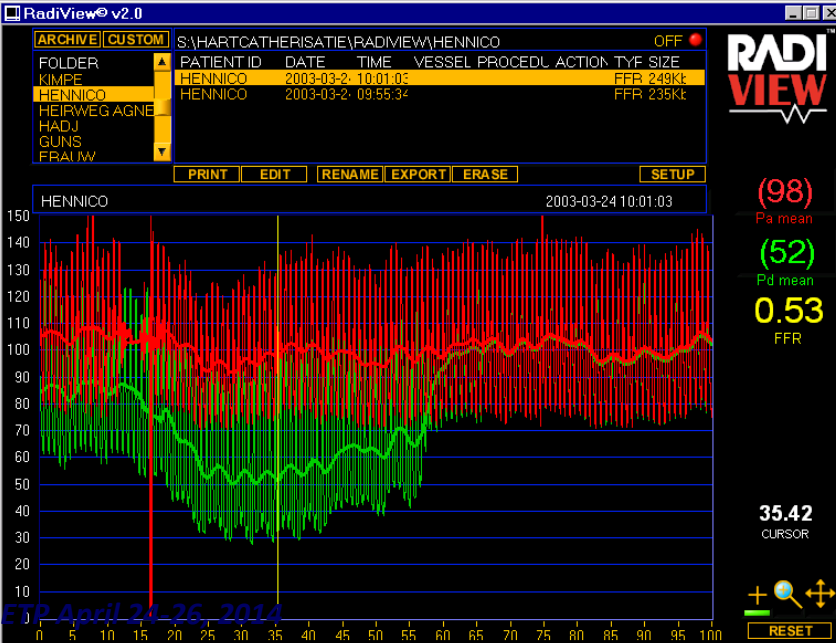


H.W. (85621) 57-y-o man Unstable Angina

Pullback of Sensor from Distal LAD to LM



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Pressure Measurements and Diffuse Disease

Pullback pressure tracings obtained under steady state maximal hyperemia is presently the only available means to localize and to quantify the abnormal resistance along an epicardial vessel.

Pressure Measurements in Diffuse Disease

To keep in Mind

1. Atherosclerosis is diffuse in nature (atherosclerotic “plaque” = rare)
2. This “diffuse disease” is often responsible for a marked pressure gradient
3. FFR of all stenoses together can be calculated from the ratio P_d / P_a during maximal hyperemia
4. The pressure gradient through one stenosis can be “masked” by the presence of a second stenosis, especially when the latter is located more distally
5. The severity of one stenosis can be “unmasked” by PCI of a second stenosis

Pressure Measurements in Diffuse Disease

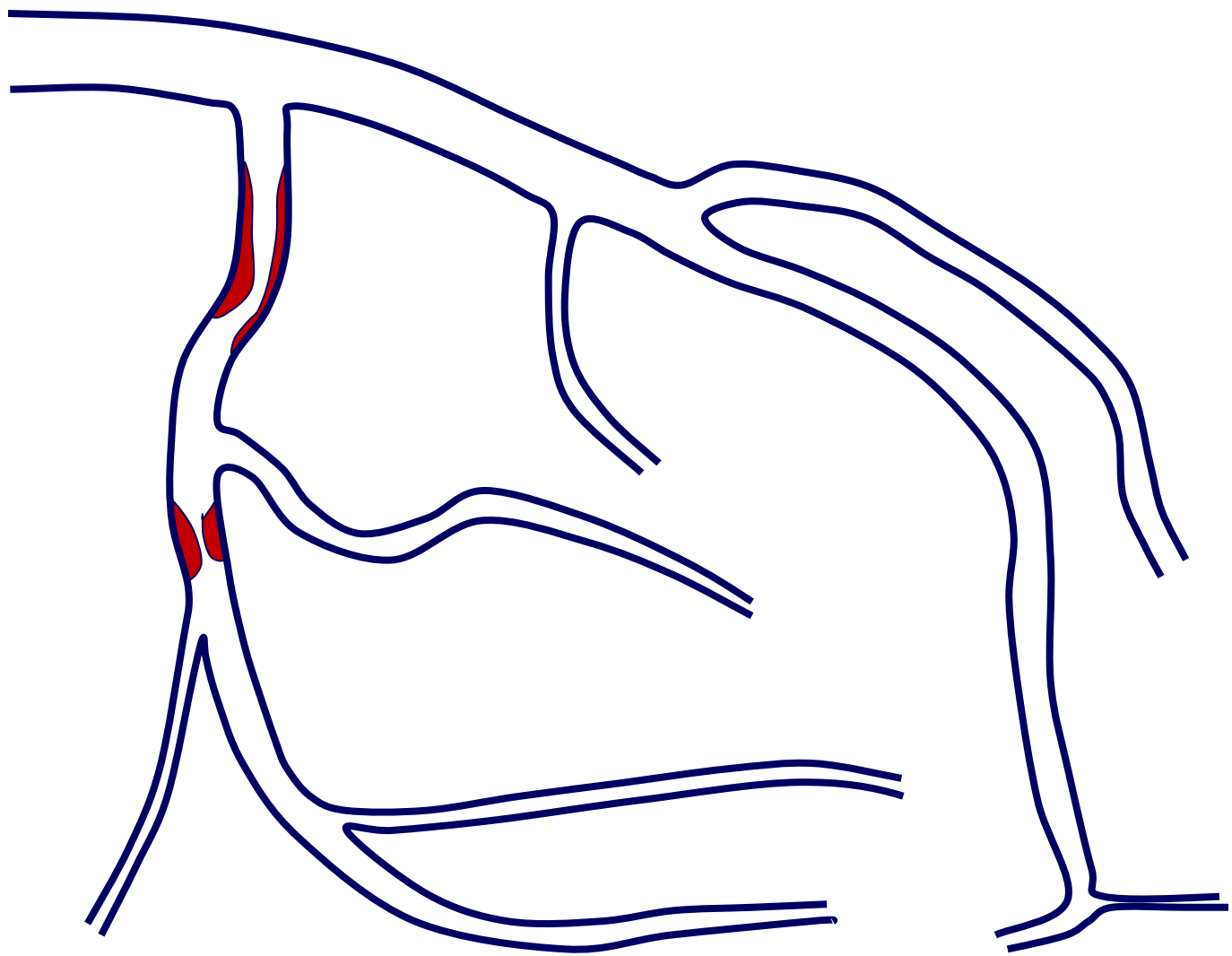
To keep in Mind (Cont'd)

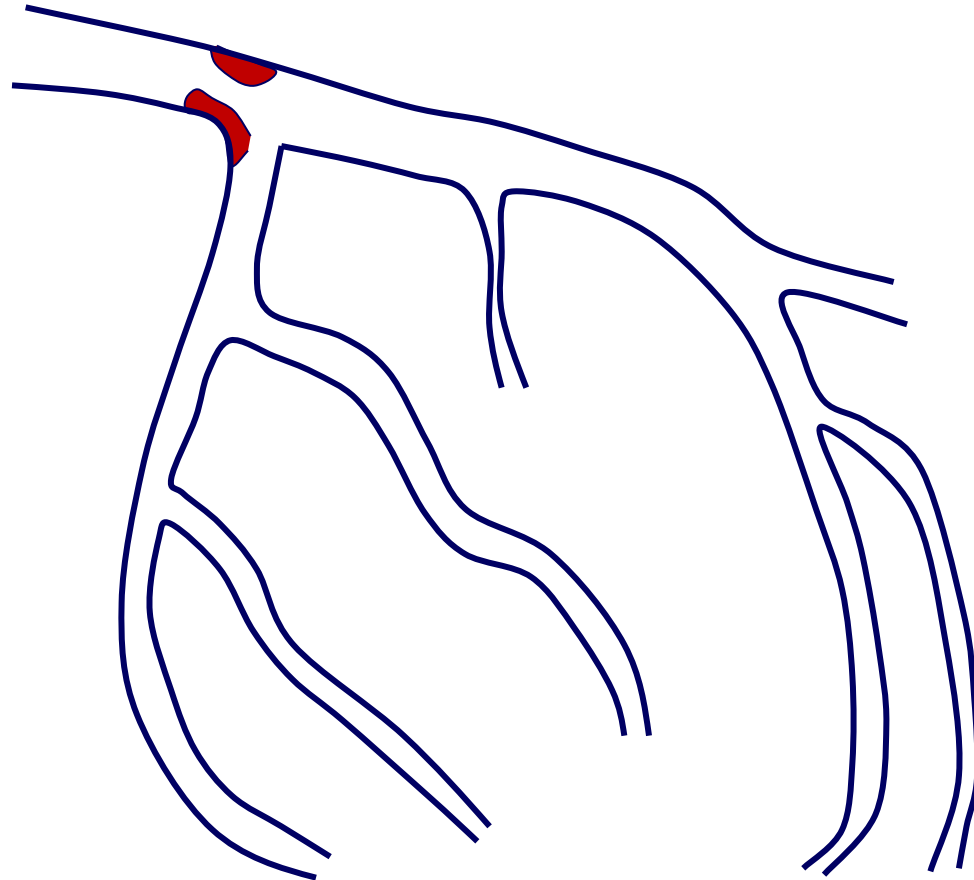
1. When 2 “focal” stenoses:

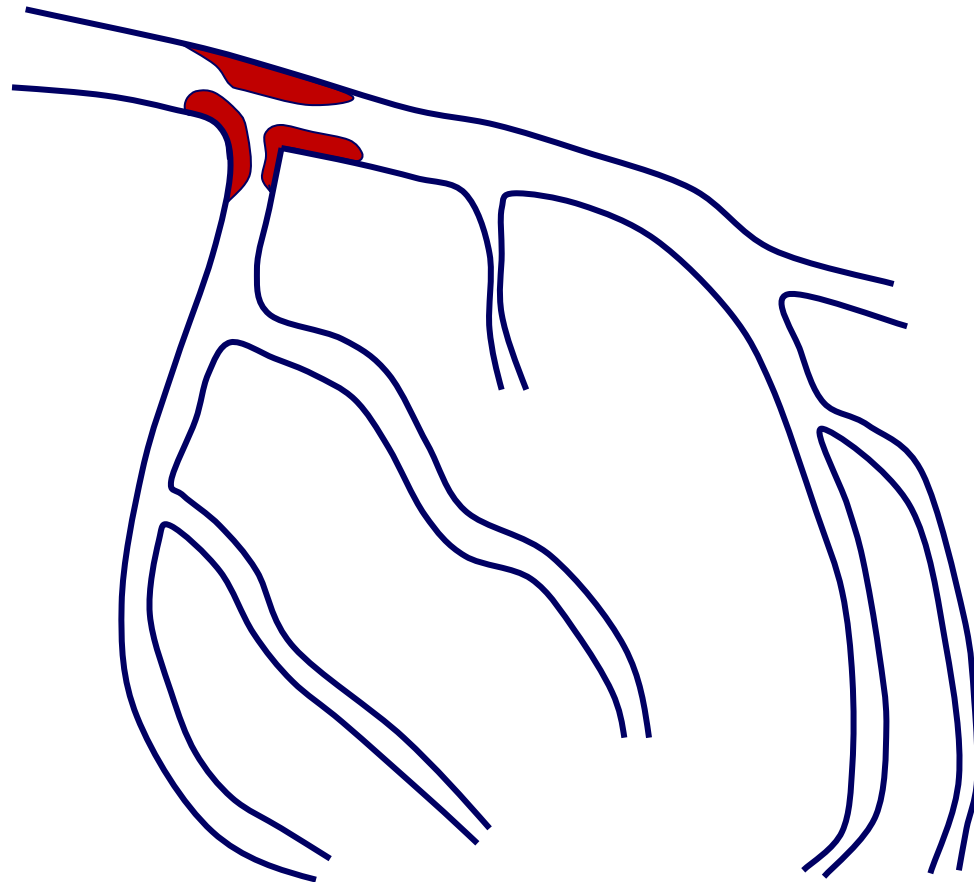
- PCI the most severe stenosis or the distal stenosis
- Repeat hyperemic pressure pullback afterwards

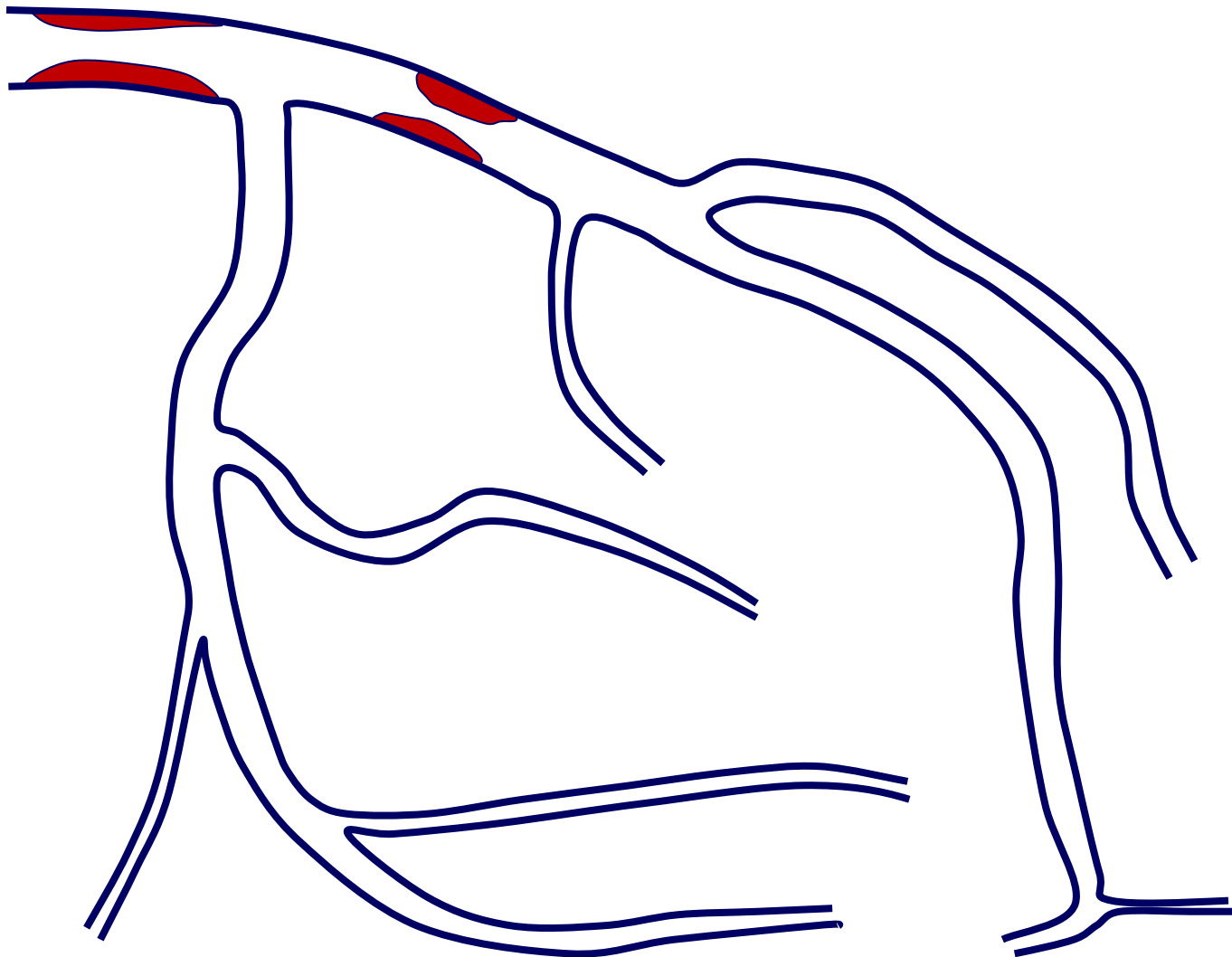
2. When diffuse disease and no angiographical focal stenosis:

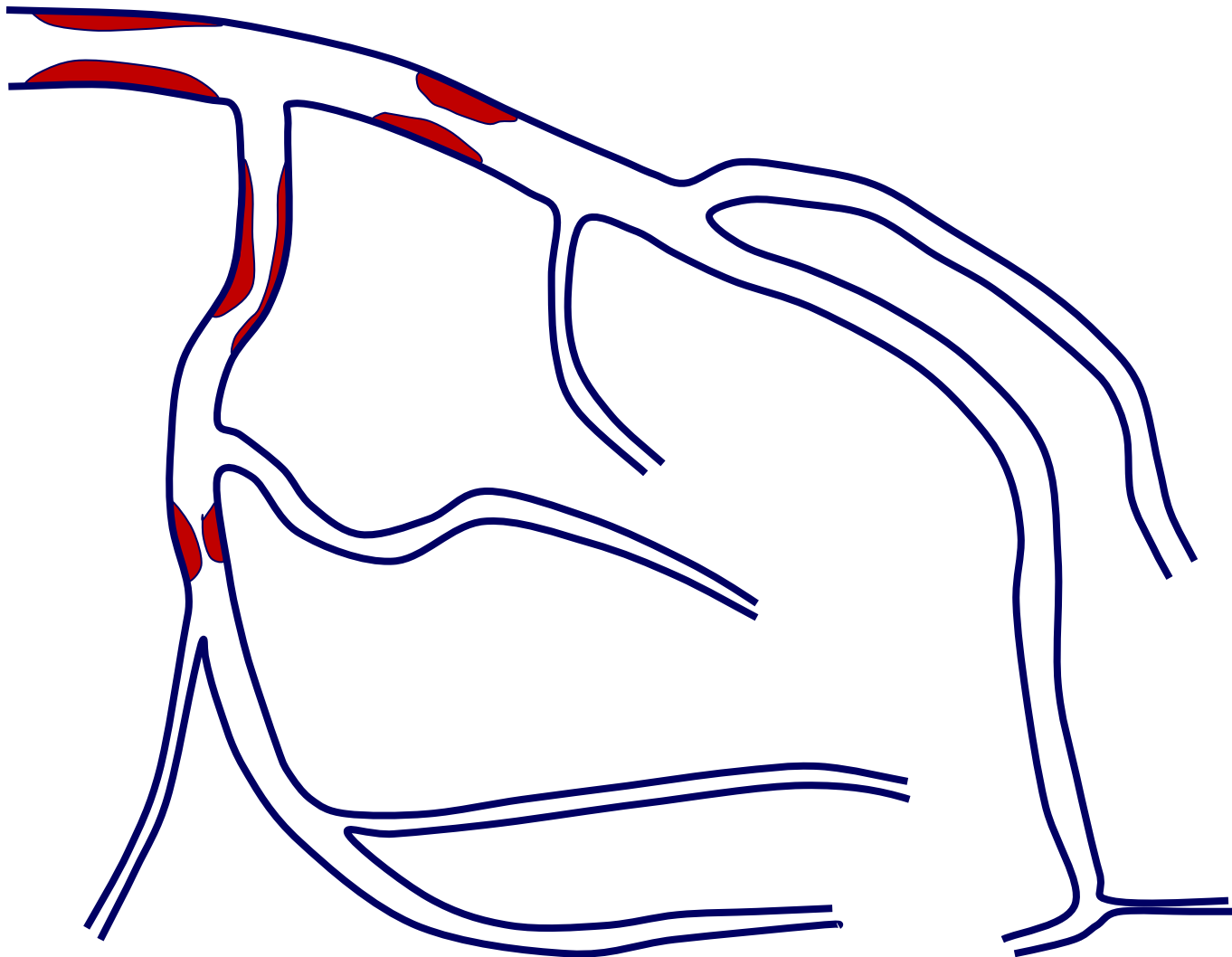
- Place the sensor very distal
- Induce steady state hyperemia (ADO IV)
- Pull back manually under hyperemia and under fluoro (one eye on the fluoro, one eye on the pressure tracing)
- Stent when focal hyperemic $\Delta P > 10-12$ mm Hg (if FFR in the distal part of the vessel < 0.75)

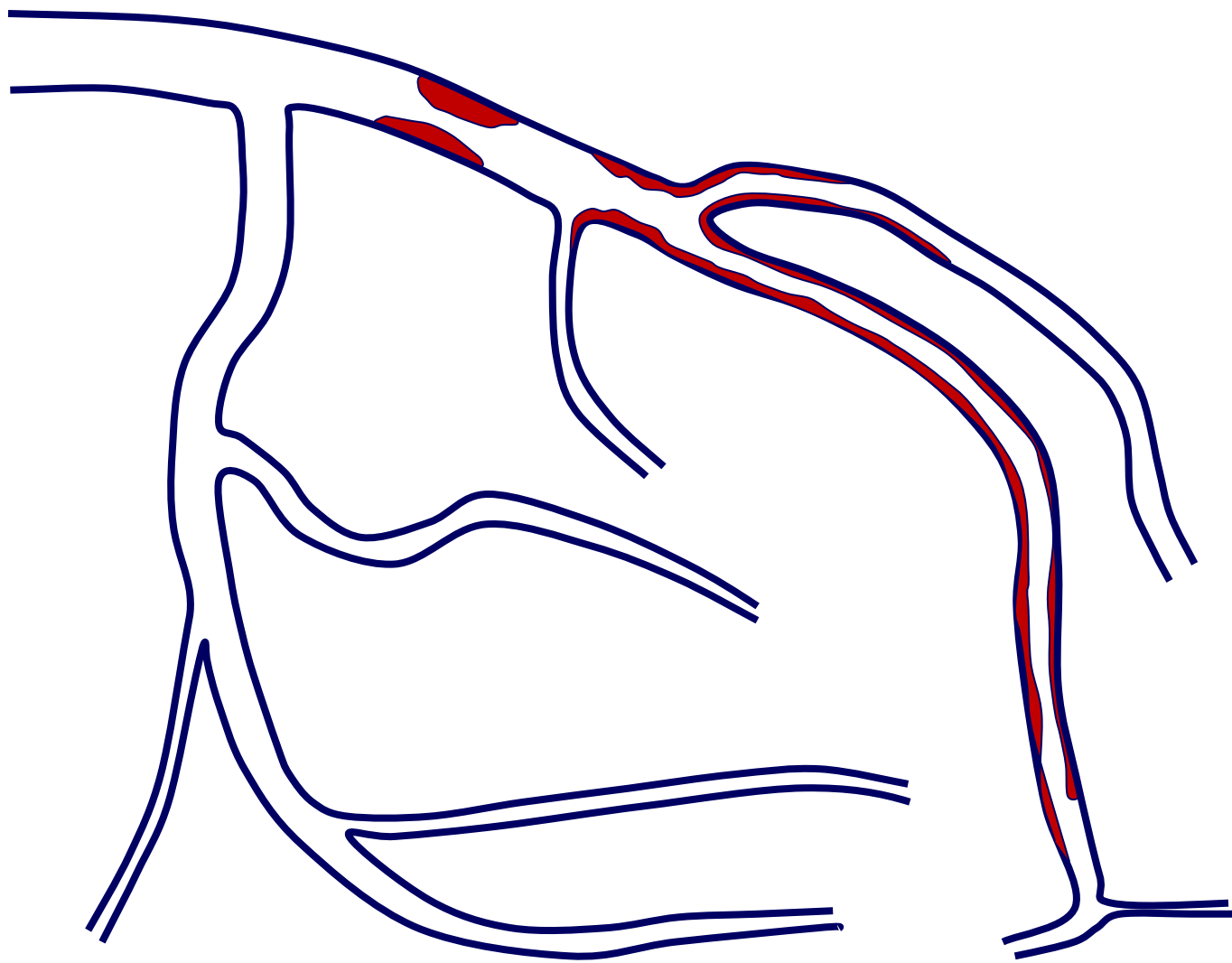


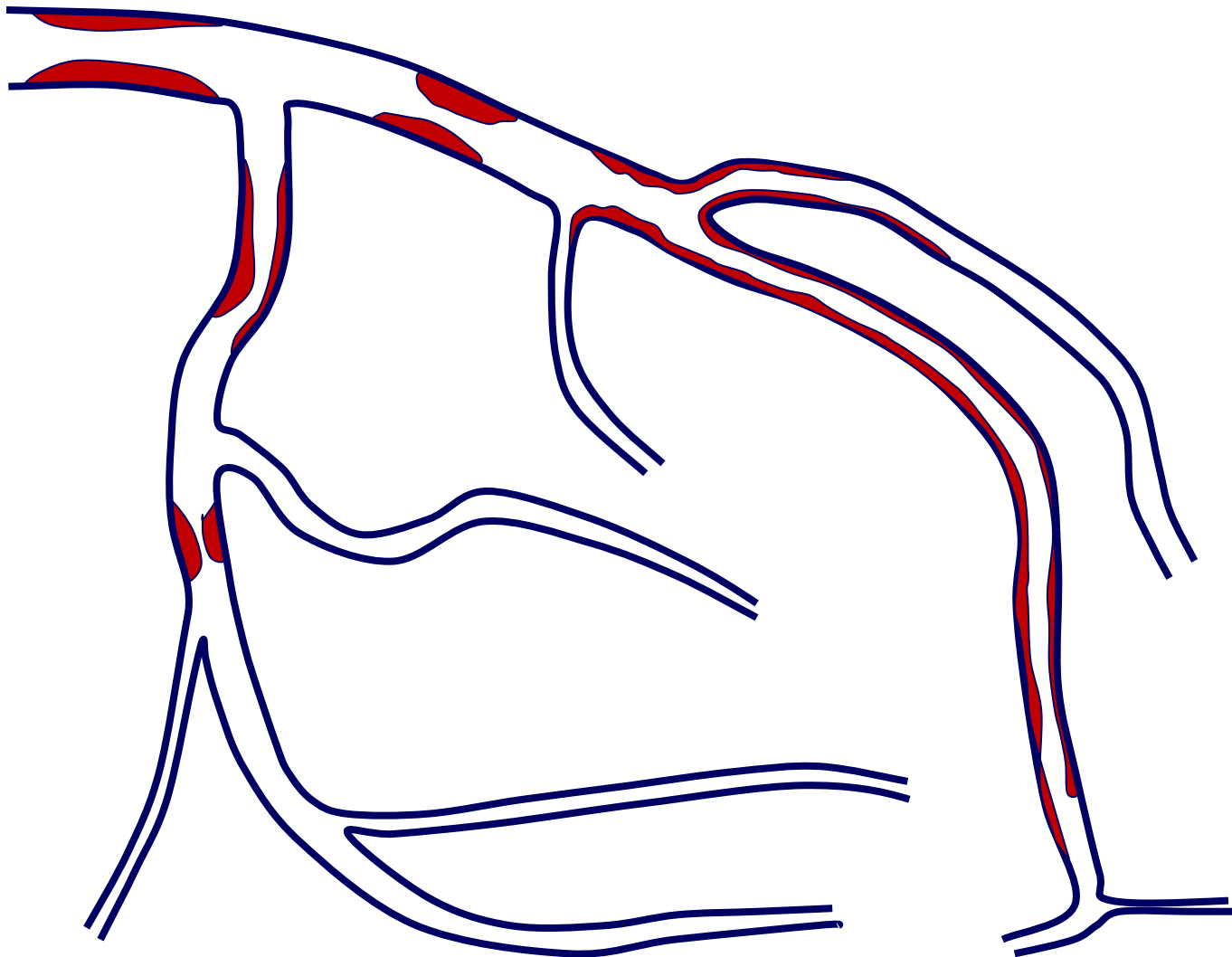




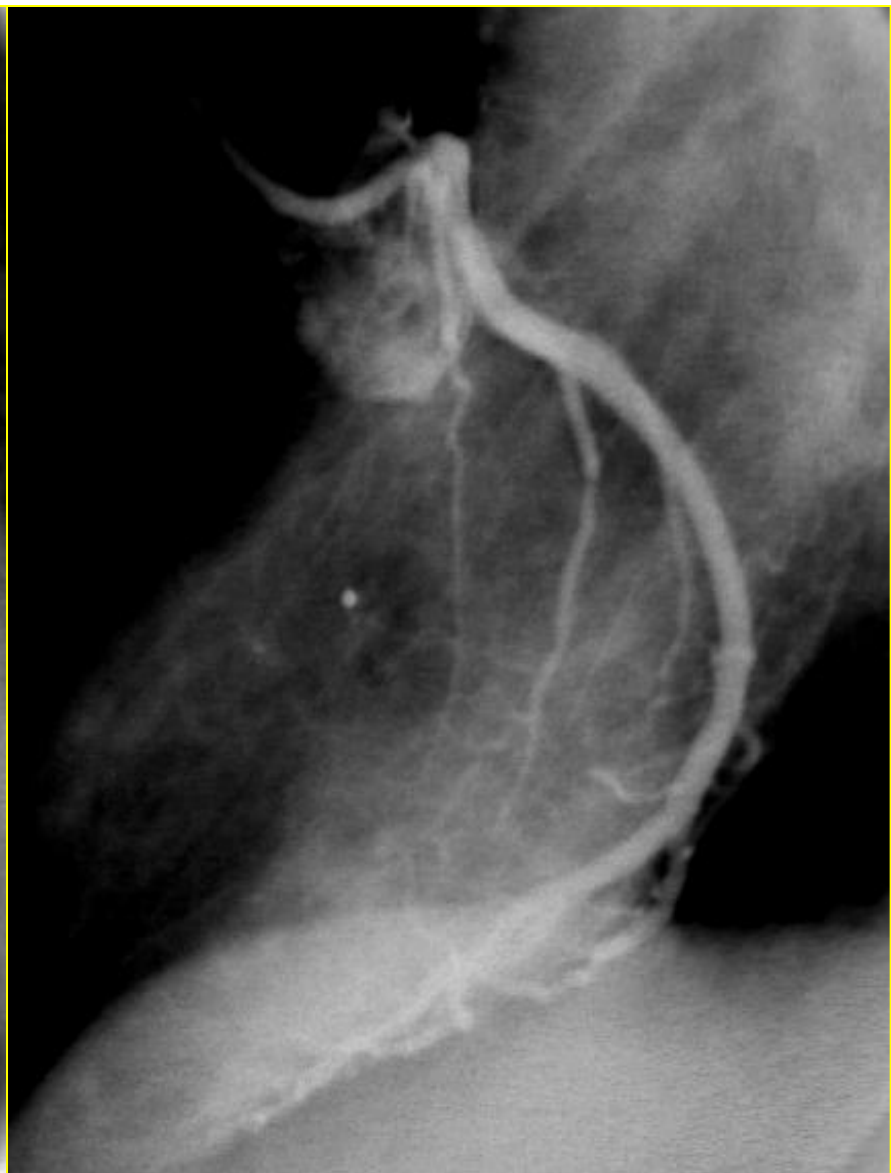








N.F. 42-y-old man.
Chest pain
Abnormal MIBI spect apex



Hyperemic Pullback Pressure Tracing

