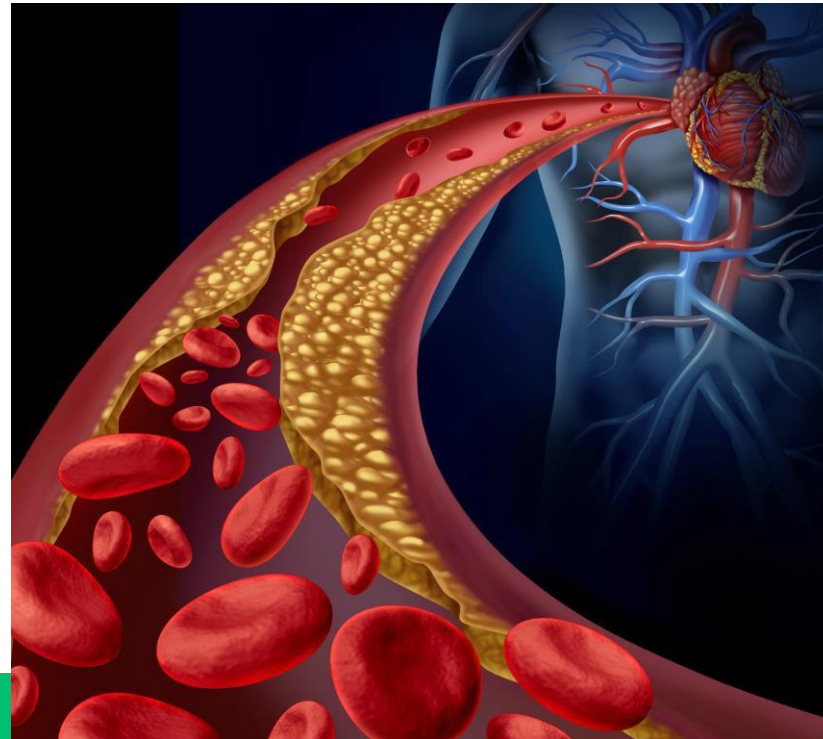


# Cholesterol management in 2021

Dr Ben Fitzgerald  
Cardiologist  
TPCH



# Cholesterol management

**Table 1. PBS criteria for statins**

- The patient must have received dietary therapy (typically for 6 weeks)
- Fasting lipid levels must be checked after completion of dietary therapy

**Patient characteristics**

**Qualifying total cholesterol level**

Patients with existing CHD

Total cholesterol >4 mmol/L

Patients with:

- Diabetes mellitus
- Familial hypercholesterolaemia
- Family history of CHD (first degree relative <60 years of age)
- Hypertension

Total cholesterol level >6.5 mmol/L

or

Total cholesterol level >5.5 mmol/L with HDL <1 mmol/L

Peripheral vascular disease

Patients with HDL <1 mmol/L

Total cholesterol level >6.5 mmol/L

Men aged 35–75 years

Total cholesterol level >7.5 mmol/L

Postmenopausal women aged up to 75 years

or a triglyceride level >4 mmol/L

Other patients not included above

Total cholesterol level >9 mmol/L or a triglyceride level >8 mmol/L

# Cholesterol management

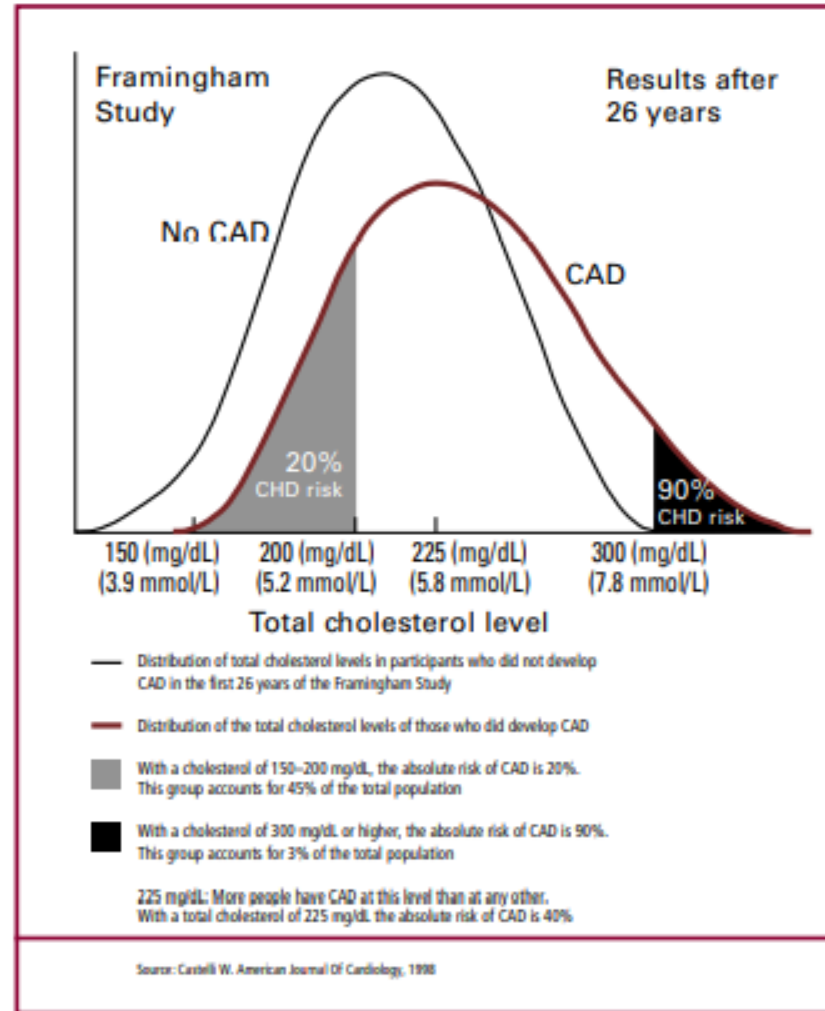
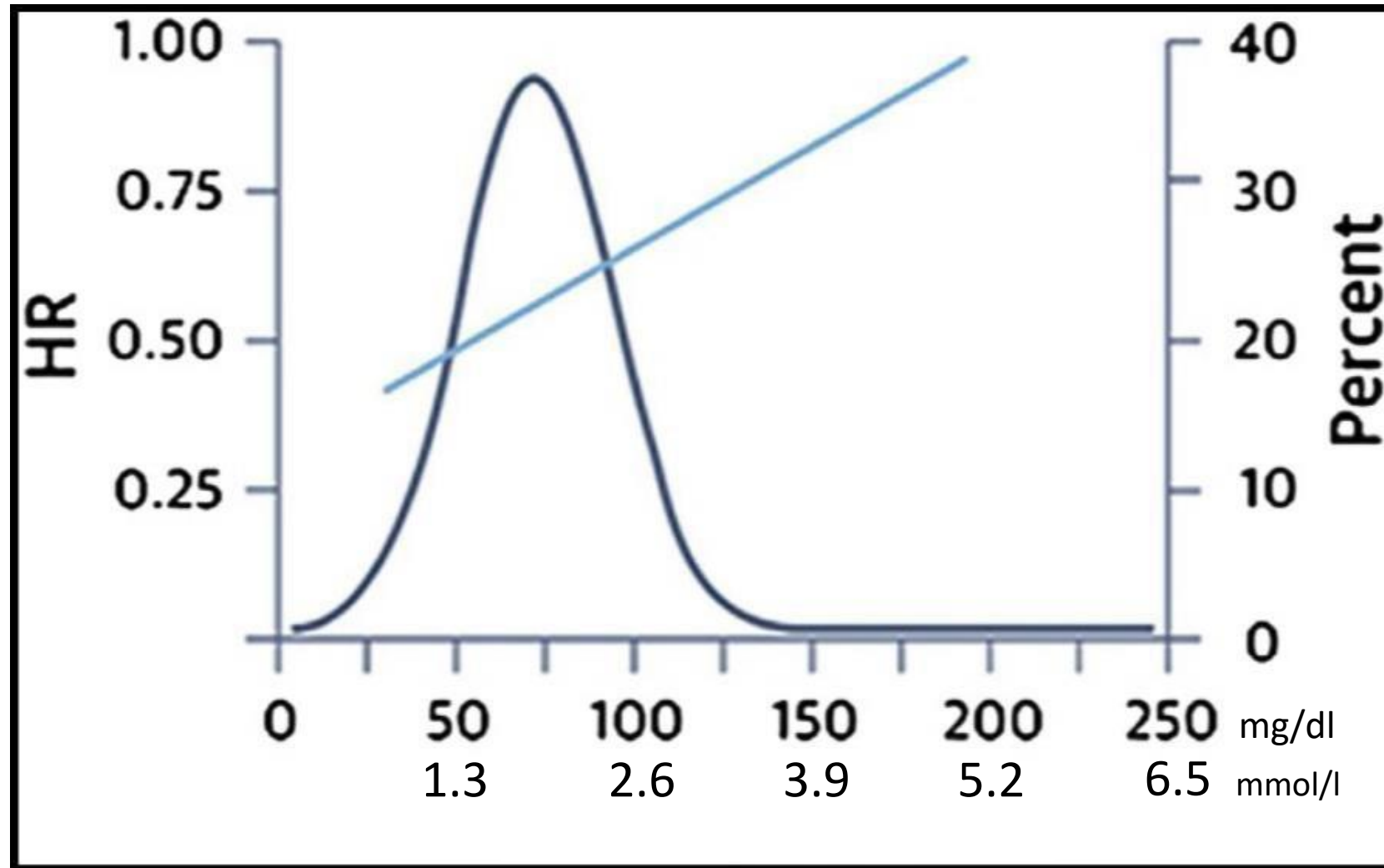


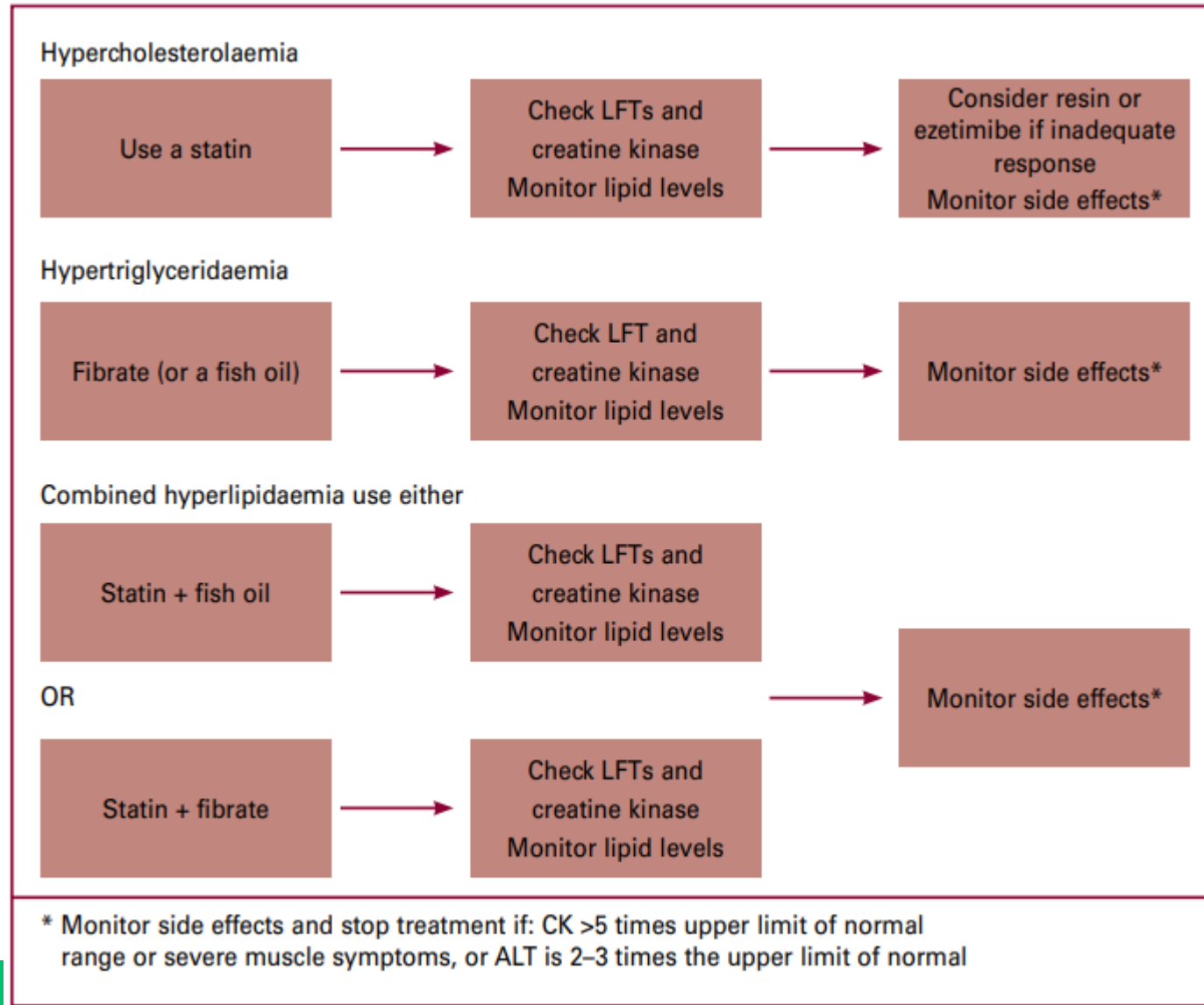
Figure 1. Incidence of CHD vs. total cholesterol

# Cholesterol management

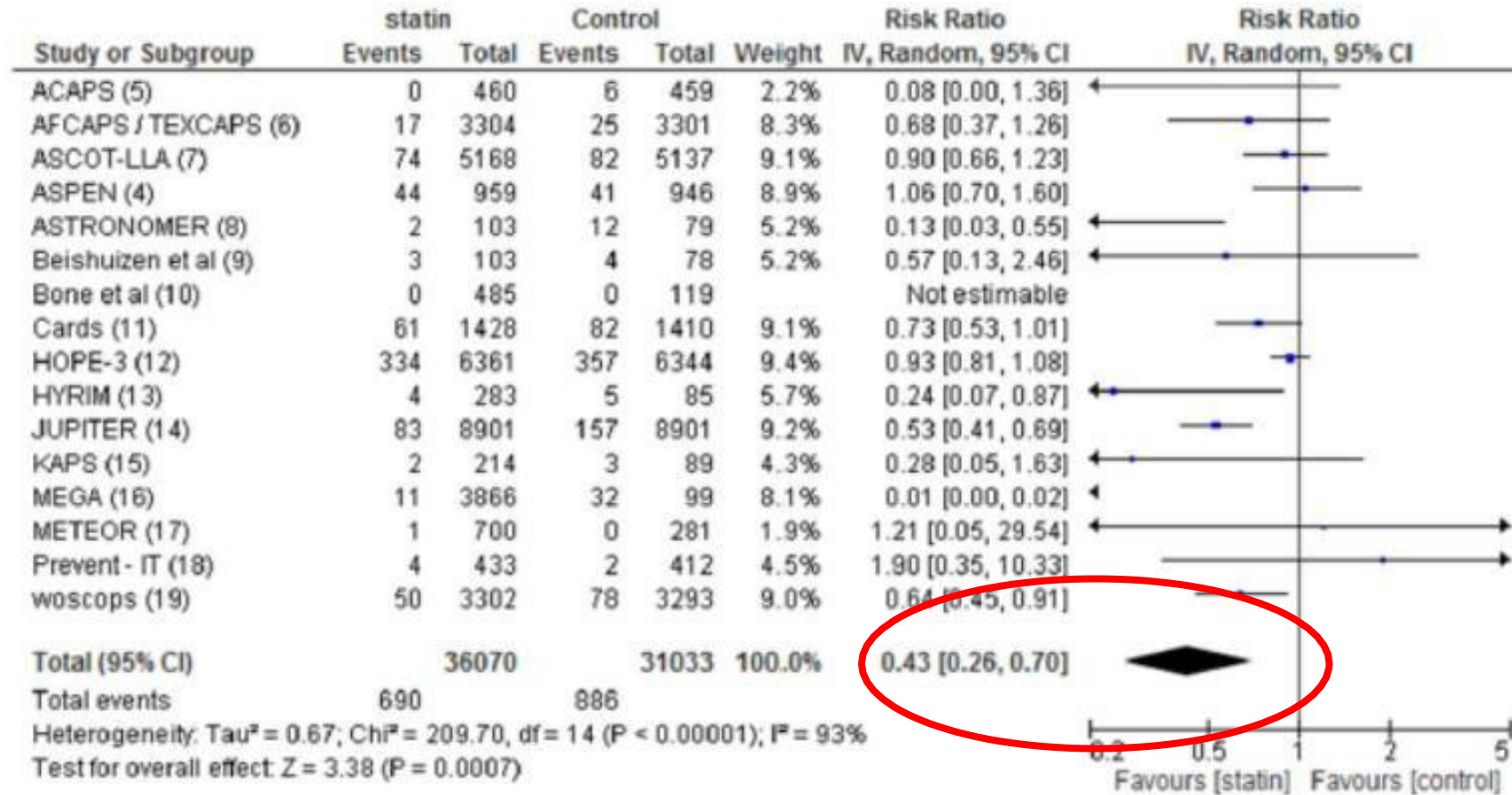




# Cholesterol management



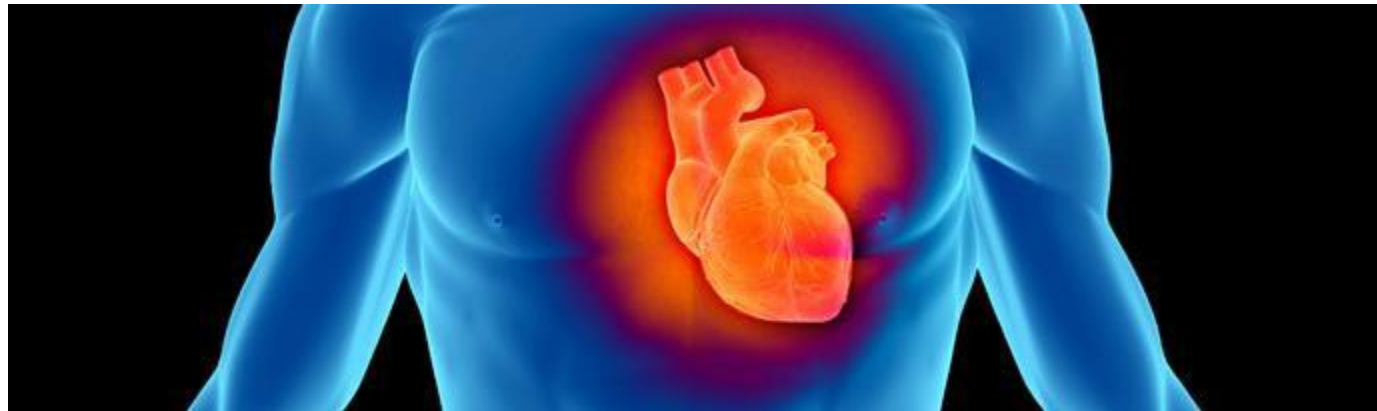
# Cholesterol management



**Figure 1:** Over all meta-analysis of comparative studies in statin use and risk ratio of all cause mortality events.

# Functional testing in 2021

Dr Ben Fitzgerald  
Cardiologist  
TPCH



- Anatomy versus function
- Anatomical tests provide us with information about the coronary arteries
- Functional tests give us information regarding underlying ischaemia – whether the underlying anatomy has functional significance

Why do we care?



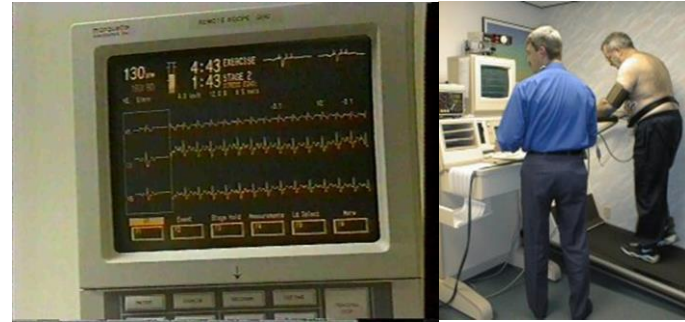
# Why do we care?

- Chest pain due to CAD should be due to myocardial ischaemia
  - Intermediate risk patients may better tested with a functional test
- To identify patients for prevention of CAD, an anatomical test may better suited
- High risk patients are usually best investigated with an invasive coronary angiogram



# Functional tests

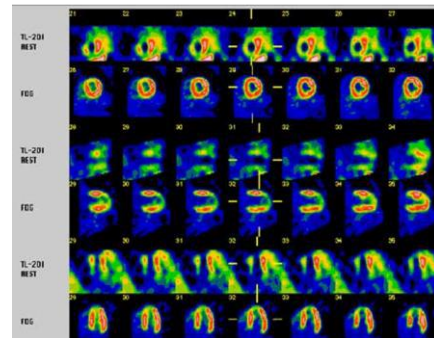
- Treadmill test



- Stress echo

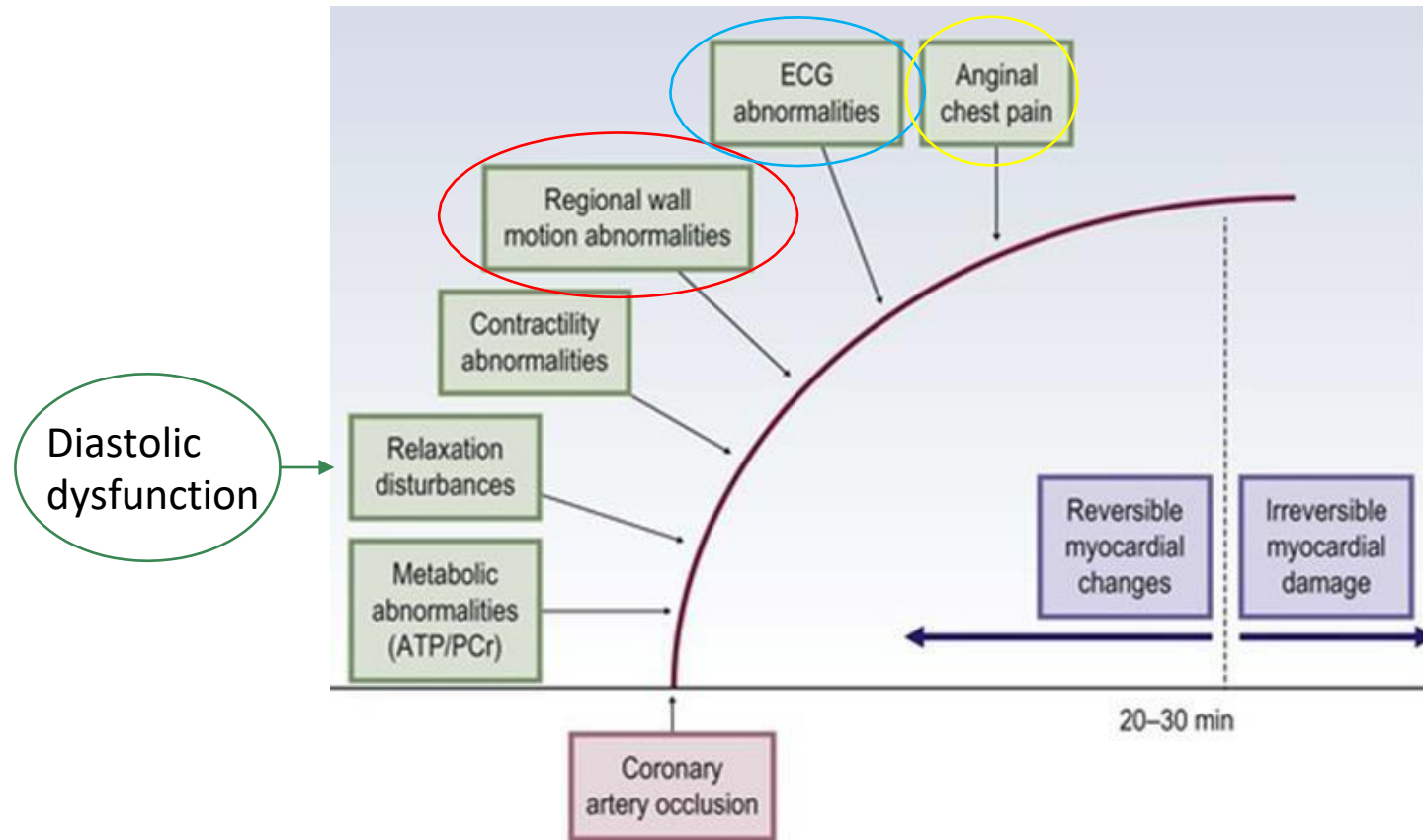


- Myocardial perfusion studies

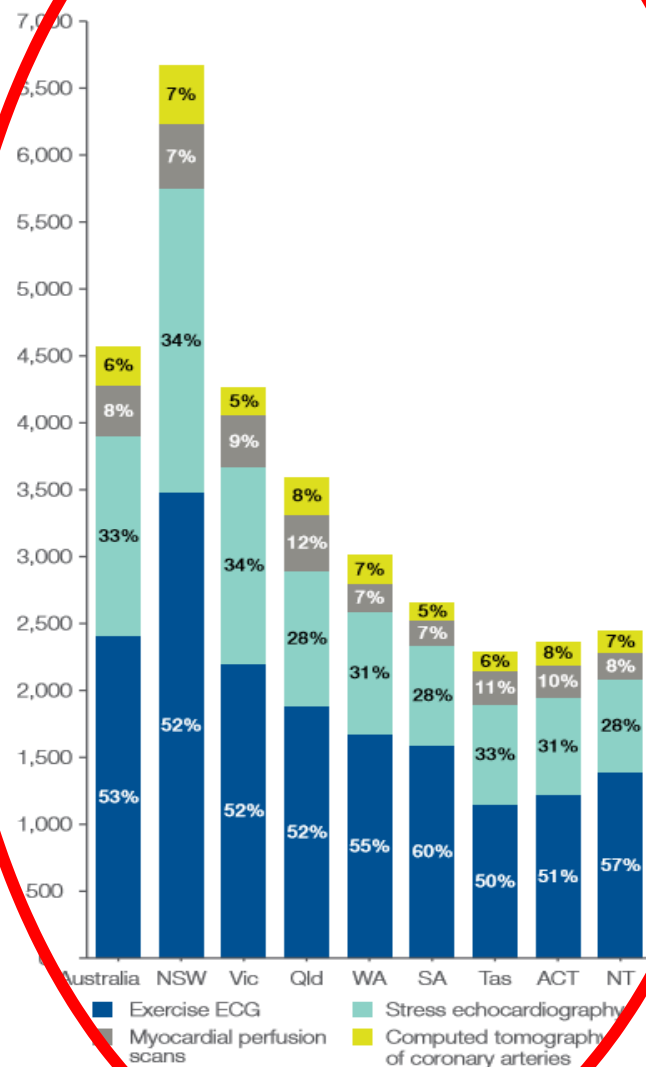


# Functional tests

## Ischaemic cascade

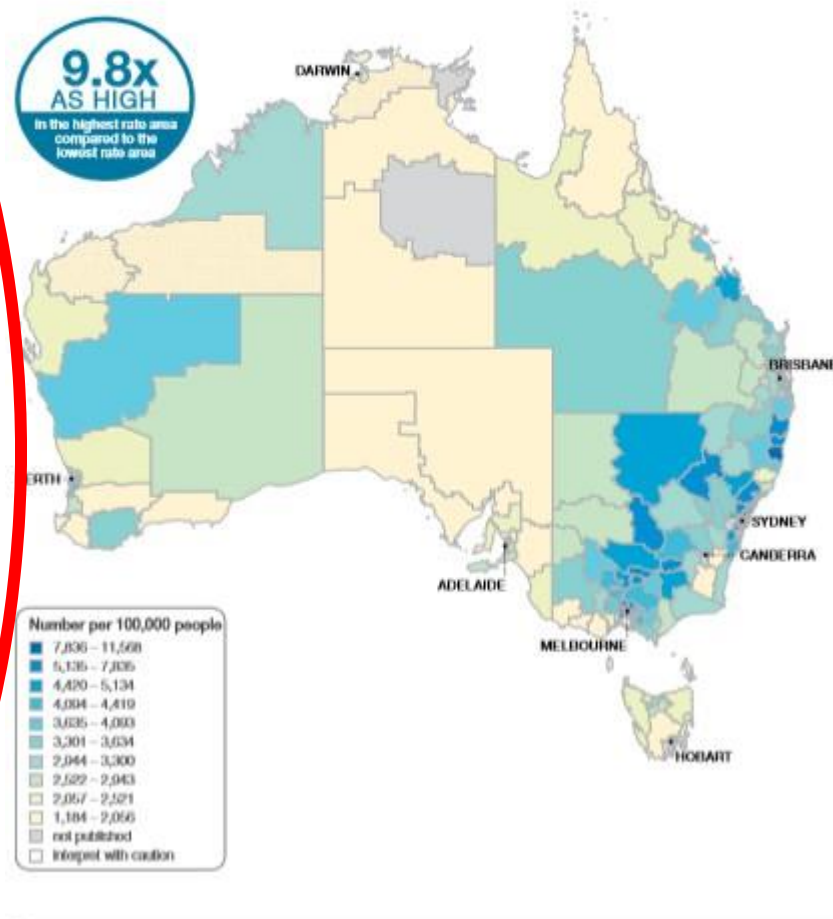


**Figure 4.1: Number of MBS-subsidised services for cardiac stress tests and imaging per 100,000 people aged 18 years and over, age and sex standardised, by state and territory of patient residence, by cardiac test type, 2016–17**



## Cardiac stress tests and imaging, 18 years and over Rates across Australia

**Figure 4.5: Number of MBS-subsidised services for cardiac stress tests and imaging per 100,000 people aged 18 years and over, age and sex standardised, by Statistical Area Level 3 (SA3) of patient residence, 2016–17**



**Notes:**  
Dotted areas indicate rates that are considered more volatile than other published rates and should be interpreted with caution. These rates are excluded from the calculation of the difference between the highest and lowest SA3 rates in Australia.  
For further detail about the methods used, please refer to the Technical Supplement.  
Source: AIHW analysis of Medicare Benefits Schedule data and ABS Estimated Resident Population 30 June 2016.

# Exercise treadmill testing

- Patient is connected to an ECG monitor
- They walk on the treadmill, with the speed and elevation progressively increasing
- Exercise for....
  - Maximum predicted heart rate (220-age)
  - Exercise tolerance



# Exercise treadmill testing

- Easy and readily performed
- Inexpensive
- However...
  - Sensitivity 67%, specificity 72% (meta-analysis: 58 papers, 11691 patients)

International Journal of Clinical Practice 2012





# Myocardial perfusion studies

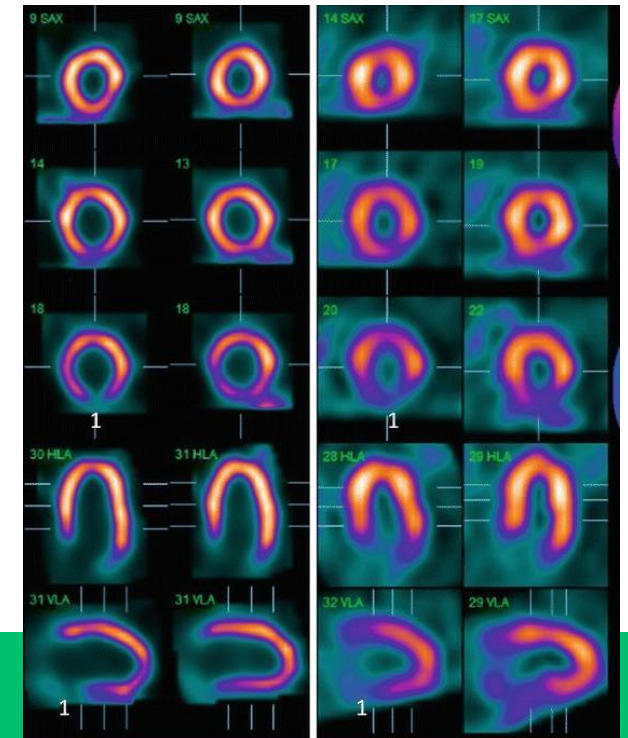
- Radionuclide myocardial perfusion imaging permits assessment of cardiac perfusion and function at rest and during exercise or with pharmacologic stress
- It involves intravenous injection of a radioactive perfusion tracer and then uses a special camera system, to detect the gamma photons
- A specialized computer program reconstructs the images into the standard displays
- It provides rest and post-stress assessment of myocardial perfusion, viability, and global and regional left ventricular systolic function, as markers of underlying coronary artery disease





# Myocardial perfusion studies

- Advantages:
  - Accuracy
  - Proven risk stratification ability
  - Prognostic value
  - Improved diagnostic accuracy over exercise treadmill testing
- Disadvantages:
  - Requirement of specialised equipment
  - Availability of radioactive isotope
  - Image quality
  - Cost
  - Radiation exposure



# Stress echocardiography

- Non-invasive assessment of cardiac status
- Permits the detection of myocardial ischaemia via visualization of regional wall motion abnormalities (RWMA's)



# Stress echocardiography

- **“Conceptually a simple technique...which contrasts with the technical difficulty posed by the practical performance of this technique”**

**Prof Tom Marwick 2002**

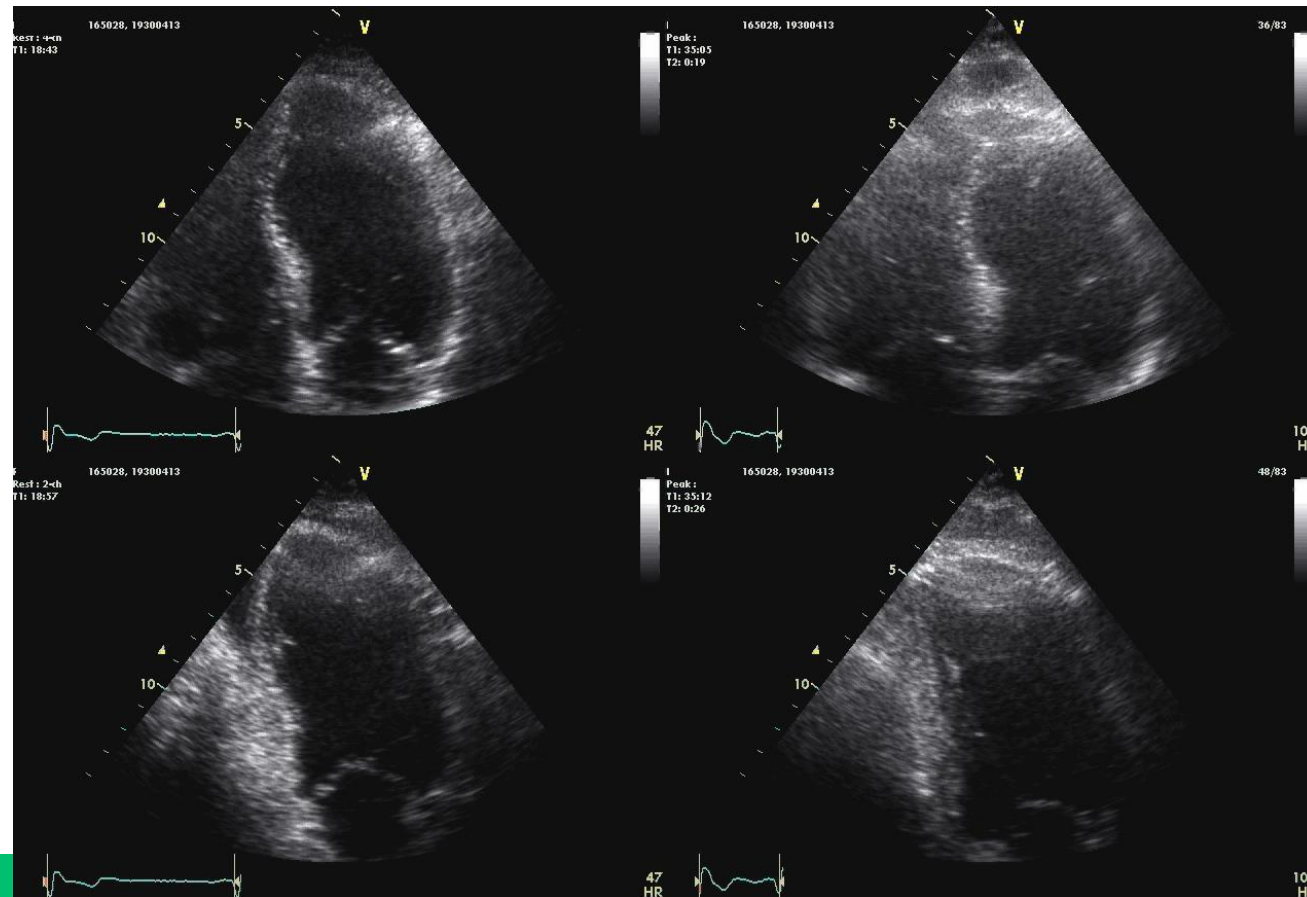


# Stress echocardiography

- Advantages:
  - Accuracy and higher specificity
  - Proven risk stratification ability
  - Prognostic value
  - Improved diagnostic accuracy over exercise treadmill testing
  - Assess cardiac structure and function
  - No radiation
  - Lower cost than nuclear studies
- Disadvantages:
  - Operator dependent (need experts!!!)
  - Availability
  - Image quality (can be addressed with echo contrast)

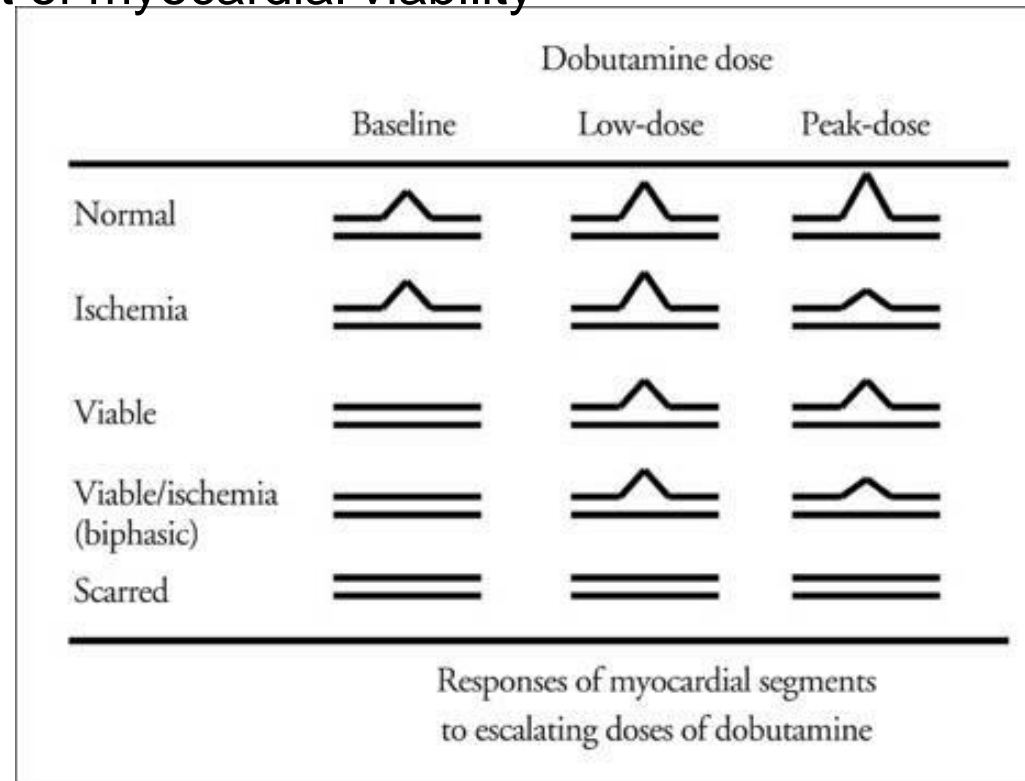
# Stress echocardiography

- Assessment of risk of underlying CAD
- Evaluation of patients with known CAD



# Stress echocardiography

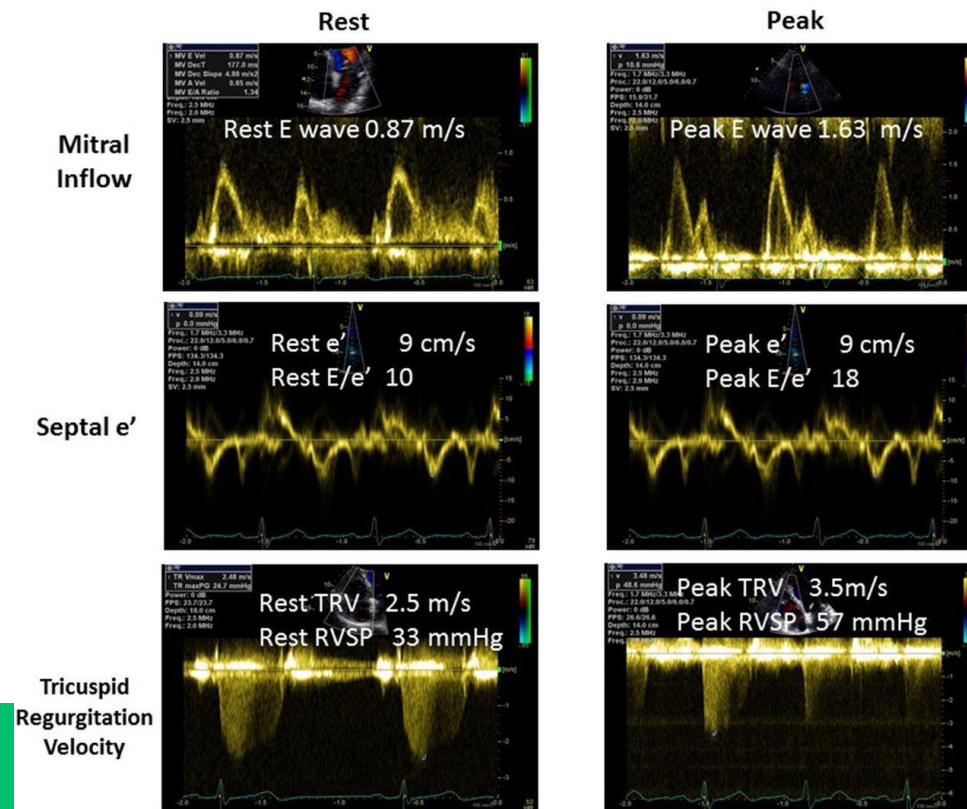
- Assessment of risk of underlying CAD
- Evaluation of patients with known CAD
- **Assessment of myocardial viability**





# Stress echocardiography

- Assessment of risk of underlying CAD
- Evaluation of patients with known CAD
- Assessment of myocardial viability
- Evaluation of dyspnoea of possible cardiac origin including assessment of filling pressures



# Stress echocardiography

- Assessment of risk of underlying CAD
- Evaluation of patients with known CAD
- Assessment of myocardial viability
- Evaluation of dyspnoea of possible cardiac origin including assessment of filling pressures
- **Exercise tolerance/capacity**
- **BP response to exercise**
- Evaluation of mitral valve disease, including mitral stenosis and mitral regurgitation
- Evaluation of aortic stenosis
- Evaluation of hypertrophic cardiomyopathy (assess left ventricular outflow tract gradients, mitral regurgitation, and pulmonary hypertension)
- (Evaluation for pulmonary hypertension, as pulmonary artery systolic pressure can be estimated at rest and with exercise)

- Prognostic data
- Imaging data

# Stress echocardiography

- Assessment of risk of underlying CAD
- Evaluation of patients with known CAD
- Assessment of myocardial viability
- Evaluation of dyspnoea of possible cardiac origin including assessment of filling pressures
- Exercise tolerance/capacity
- BP response to exercise
- Evaluation of mitral valve disease, including mitral stenosis and mitral regurgitation
- Evaluation of aortic stenosis
- Evaluation of hypertrophic cardiomyopathy (assess left ventricular outflow tract gradients, mitral regurgitation, and pulmonary hypertension)
- (Evaluation for pulmonary hypertension, as pulmonary artery systolic pressure can be estimated at rest and with exercise)

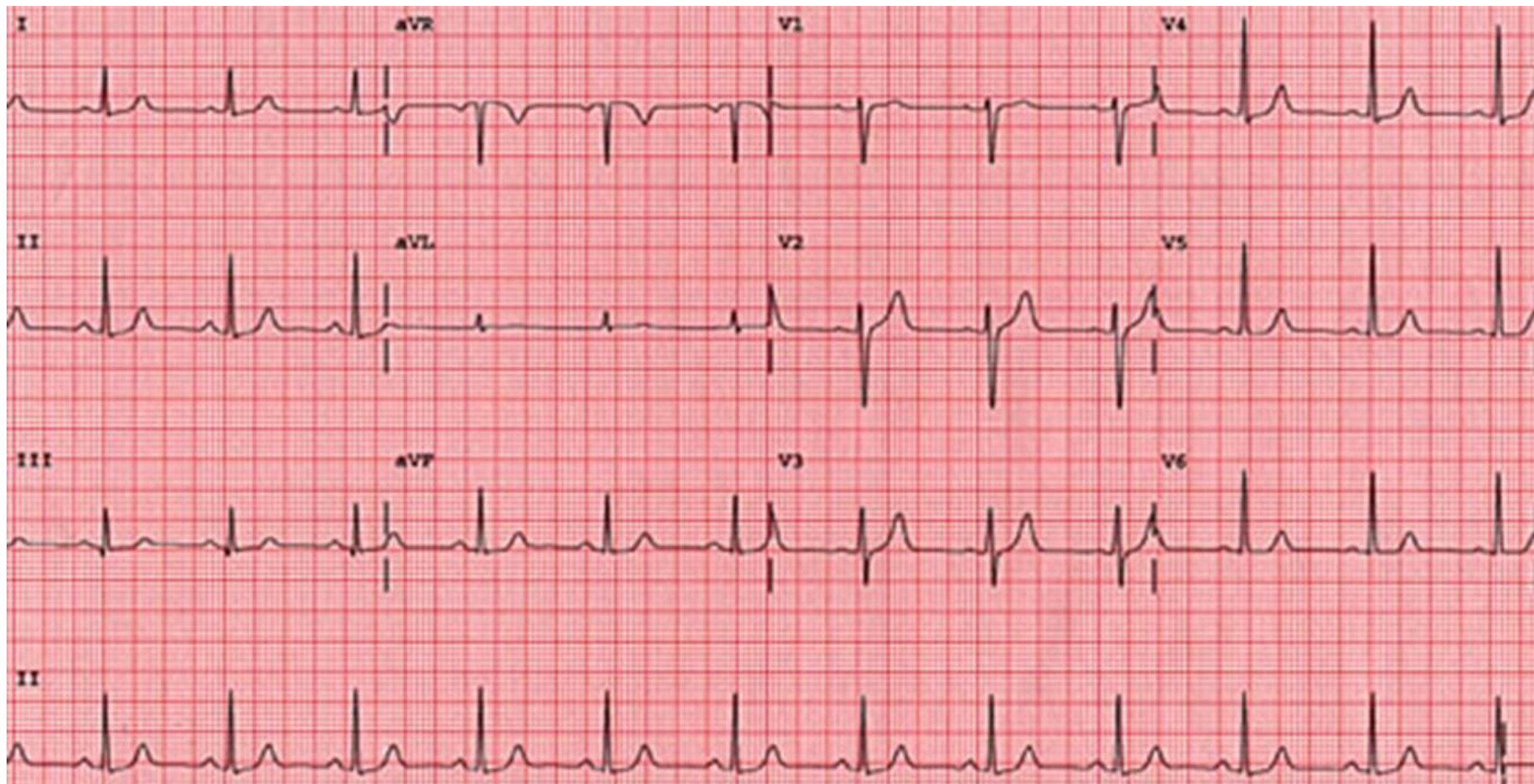
- Prognostic data
- Imaging data

# Stress echocardiography

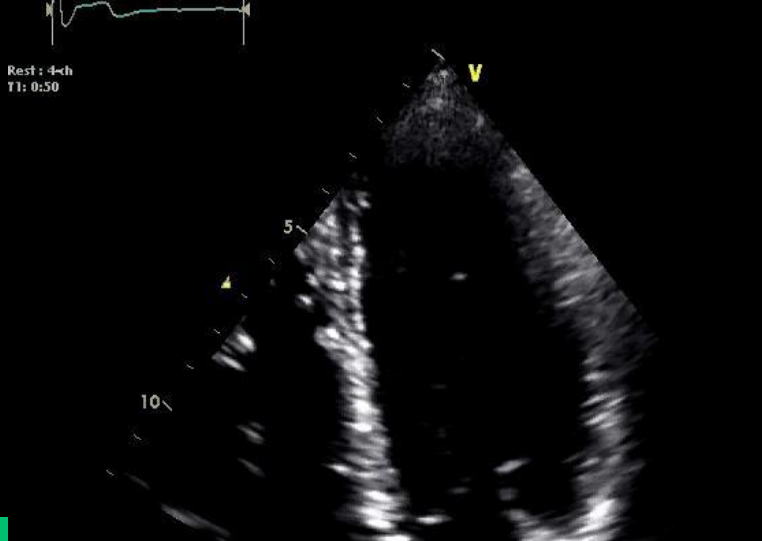
- Assessment of risk of underlying CAD
  - Evaluation of patients with known CAD
  - Assessment of myocardial viability
  - Evaluation of dyspnoea of possible cardiac origin including assessment of filling pressures
  - Exercise tolerance/capacity
  - BP response to exercise
  - Evaluation of mitral valve disease, including mitral stenosis and mitral regurgitation
  - Evaluation of aortic stenosis
  - Evaluation of hypertrophic cardiomyopathy (assess left ventricular outflow tract gradients, mitral regurgitation, and pulmonary hypertension)
  - (Evaluation for pulmonary hypertension, as pulmonary artery systolic pressure can be estimated at rest and with exercise)
- Prognostic data
  - Imaging data



# Resting ECG



# Resting quads





# Stress echocardiography



Courtesy of Prof Scalia

# Stress echocardiography

- Exercise to....?
  - Symptom limitation?
  - Set heart rate?
  - Maximal exertion?
- Need to achieve  $\geq 85\%$  MPPHR to maximize sensitivity of the test
- Failure to achieve  $\geq 85\%$  MPPHR has seen the sensitivity drop from 88% to 73%

JACC 1992;19(1):74-81 Stress echo n=179

JACC 1989;14(6):1477-5 Stress thallium n=461

JNM 1980;21(12):1125-30 Nuclear stress ventriculogram n=77

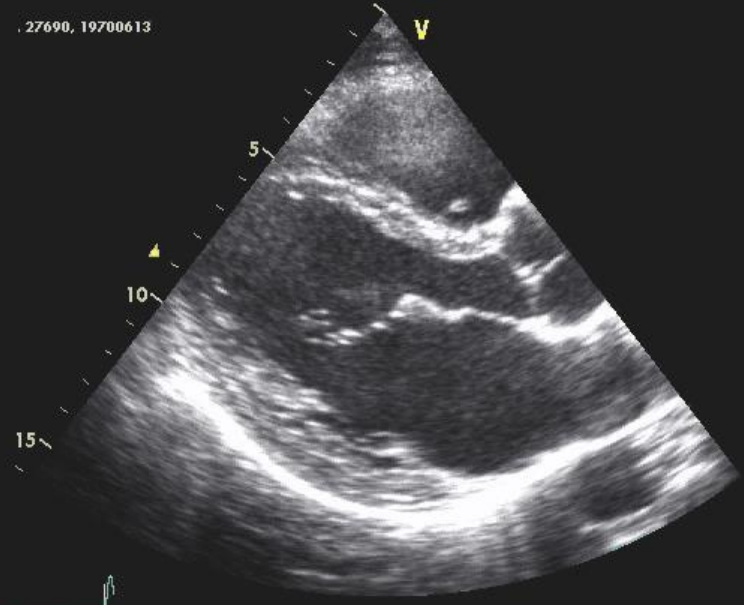
BHJ 1972;34(9):919-23 Bicycle stress test n=63

# Stress echocardiography



Courtesy of Prof Scalia

Rest: PLAX  
TI: 0:45  
27690, 19700613



Rest: PSAX  
TI: 3:20  
27690, 19700613



Peak:  
TI: 25:52  
T2: 0:10  
27690, 19700613



87  
HR



Peak:  
TI: 25:56  
T2: 0:14  
27690, 19700613



80  
HR



8/102

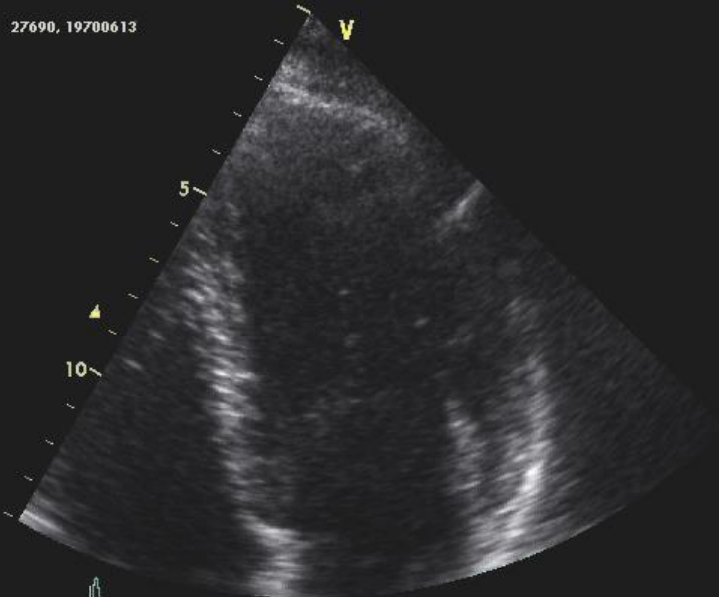
150  
HR

18/102

148  
HR



Rest: 4-h  
TI: 7:55

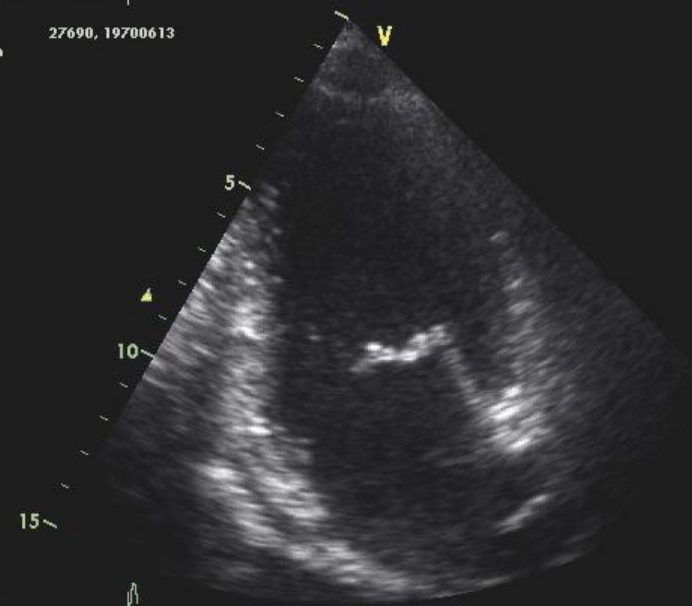


Peak:  
T1: 26:03  
T2: 0:21

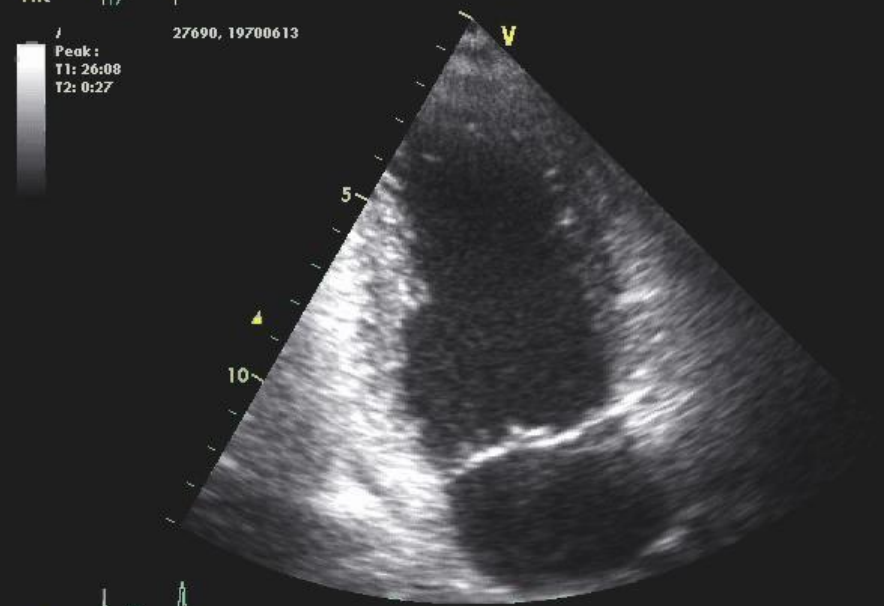


34/102

Rest: 2-h  
TI: 8:52



Peak:  
T1: 26:08  
T2: 0:27



155 HR

48/102

167 HR

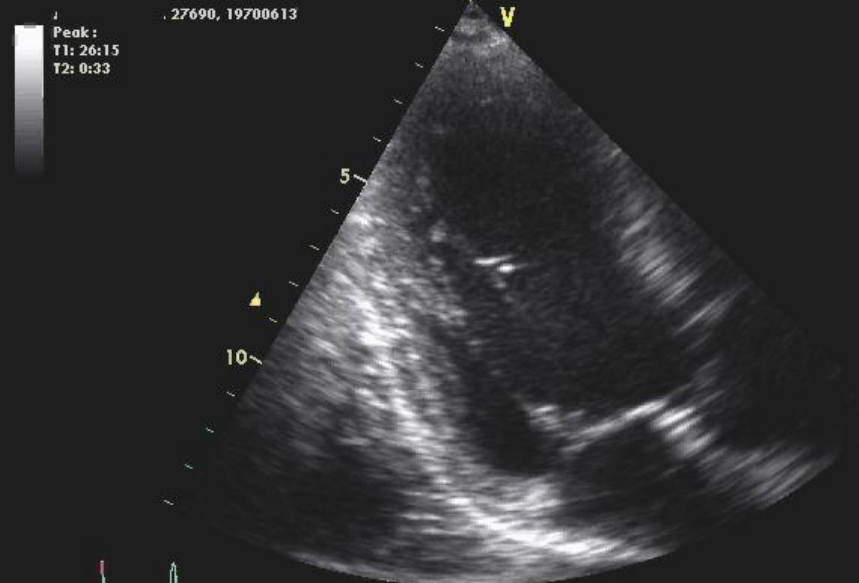
Rest : APLAX  
T1: 9:48



Rest : ASAX  
T1: 10:50



Peak :  
T1: 26:15  
T2: 0:33



Peak :  
T1: 26:26  
T2: 0:45



66/102



159 HR



94/102



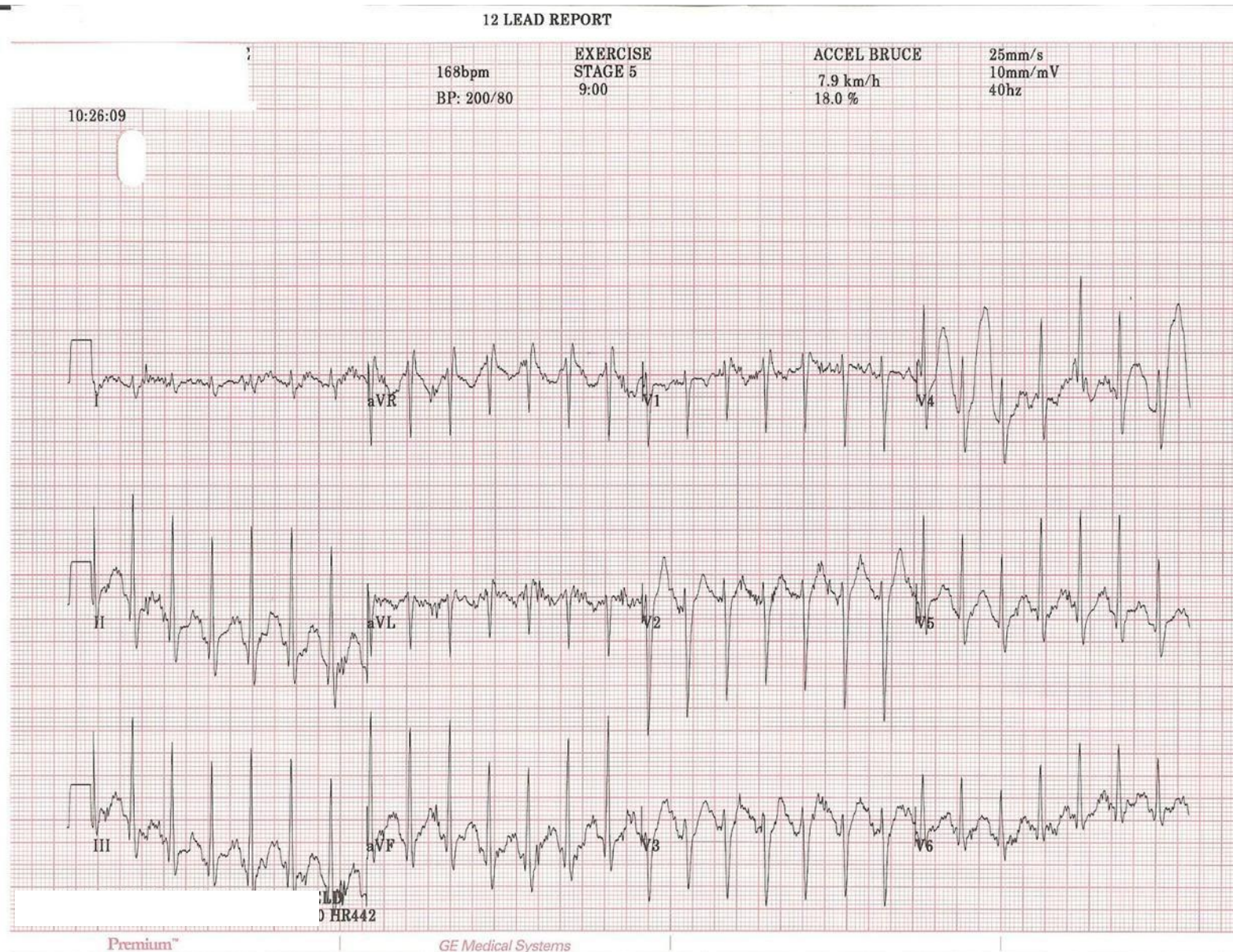
150 HR



**Aim to complete within 90 seconds**

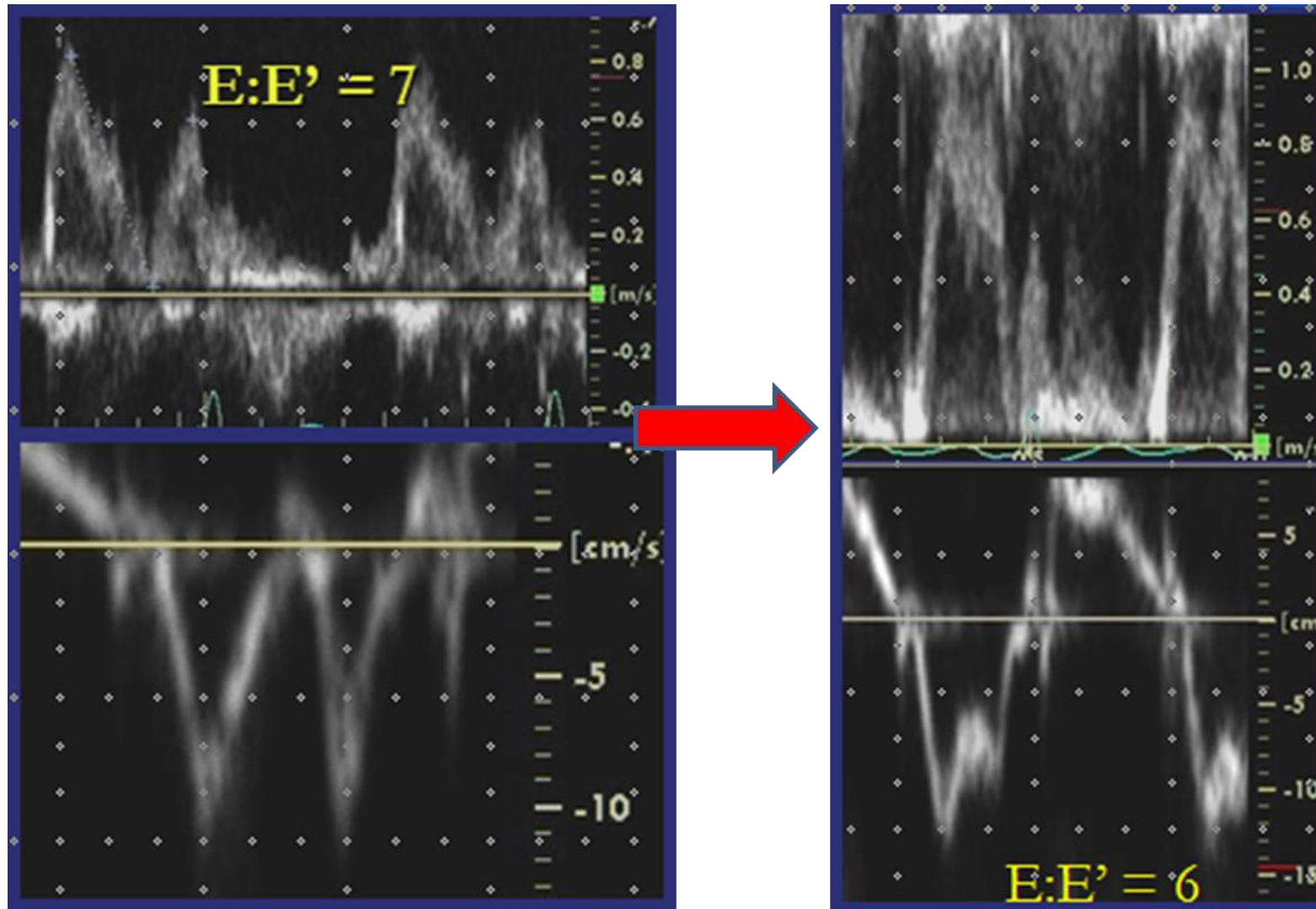


# ECG monitoring including peak





# Stress echocardiography





# Stress echocardiography

- RWMA can also be caused by:
  - Abnormal septal motion
    - Pacing
    - LBBB
    - Post cardiac surgery
  - Sarcoidosis
  - Focal myocarditis
- These are not usually brought on by stress (exercise)

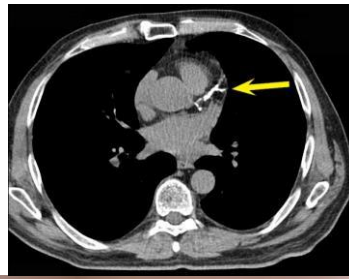
# Case 1

- 52M
- FHx CAD
- No symptoms
- Assessment of risk
- What should we do?

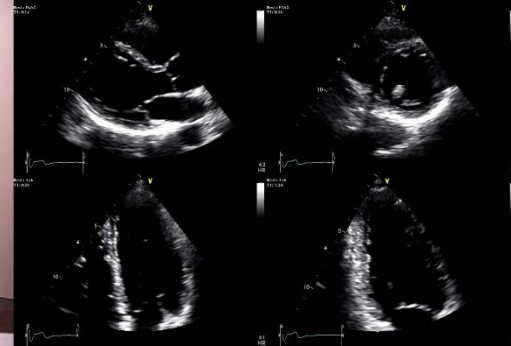
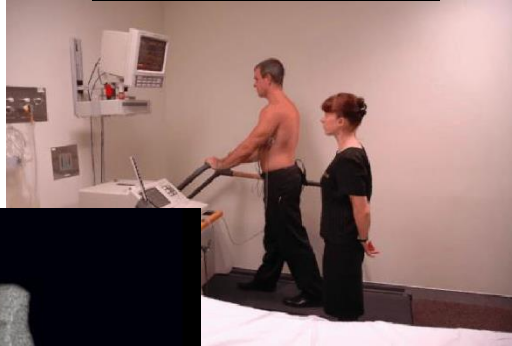


# Options:

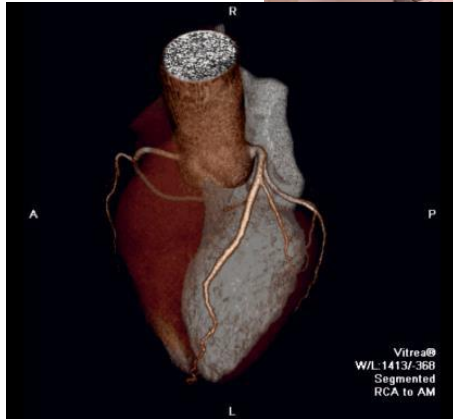
- Calcium score



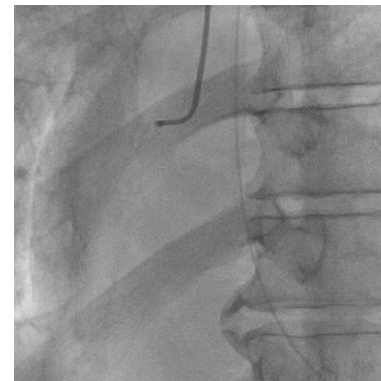
- Stress echo



- CTCA



- ICA (invasive coronary angiography)

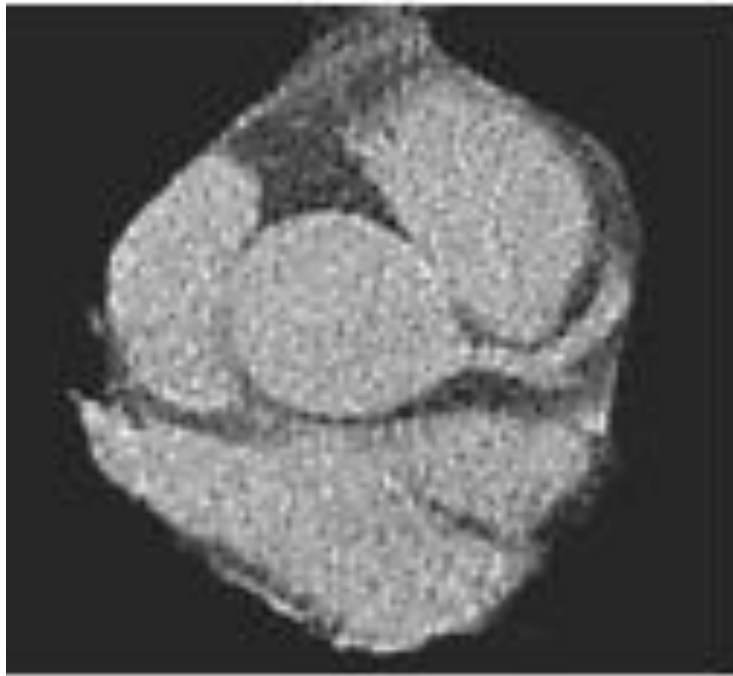




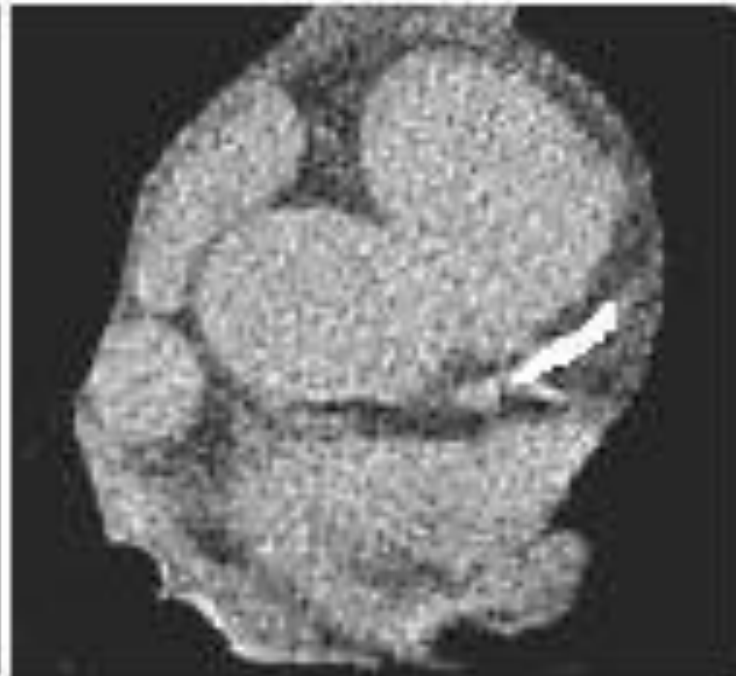
- Calcium score = 0



<b>Calcium score</b>	<b>Interpretation</b>
<b>0</b>	<b>Significant CAD unlikely</b>
<b>1-100</b>	<b>Minimal to mild calcification – low risk</b>
<b>101-400</b>	<b>Moderate calcification – intermediate risk</b>
<b>≥ 400</b>	<b>Extensive calcification – significant CAD more likely</b>

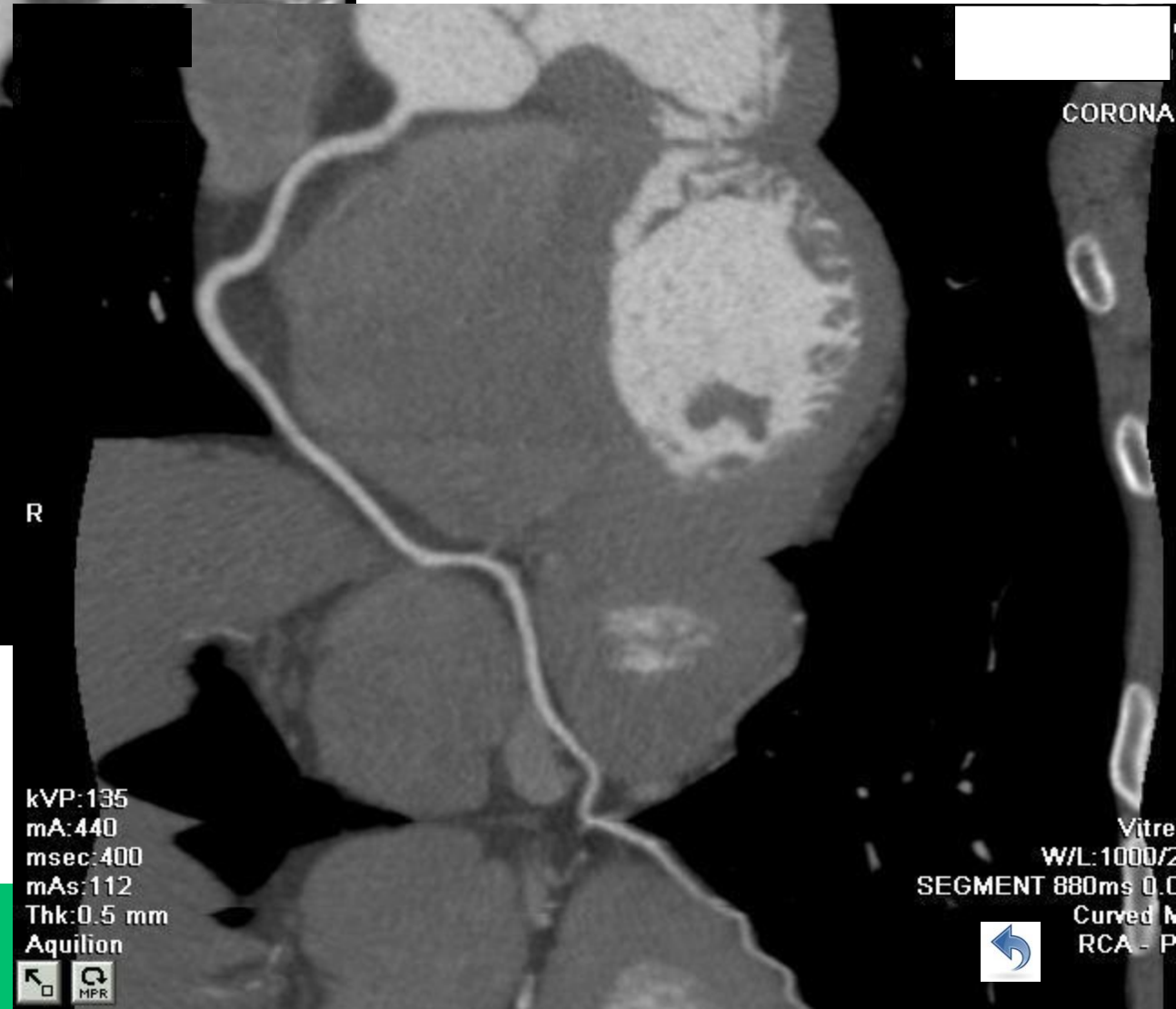
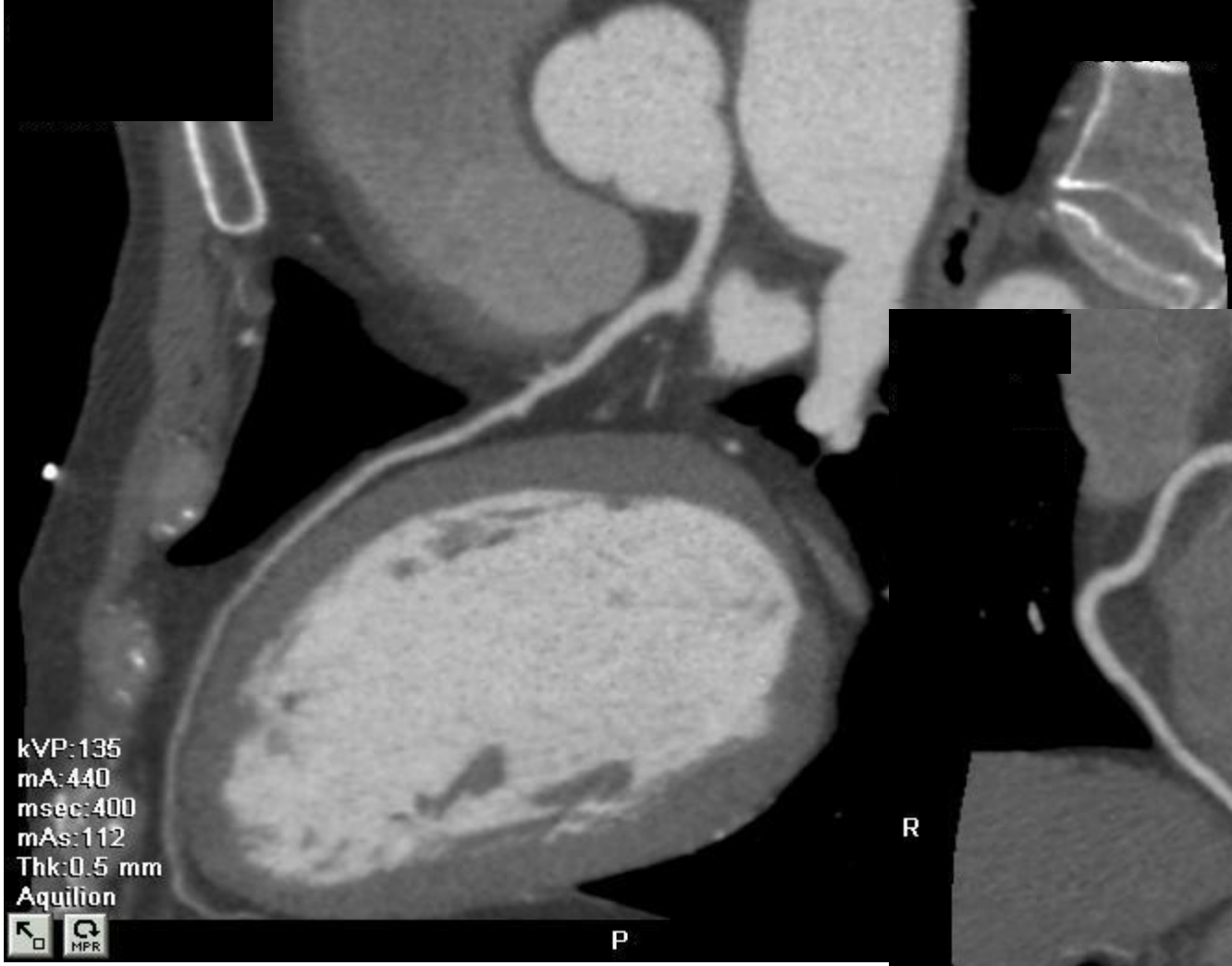


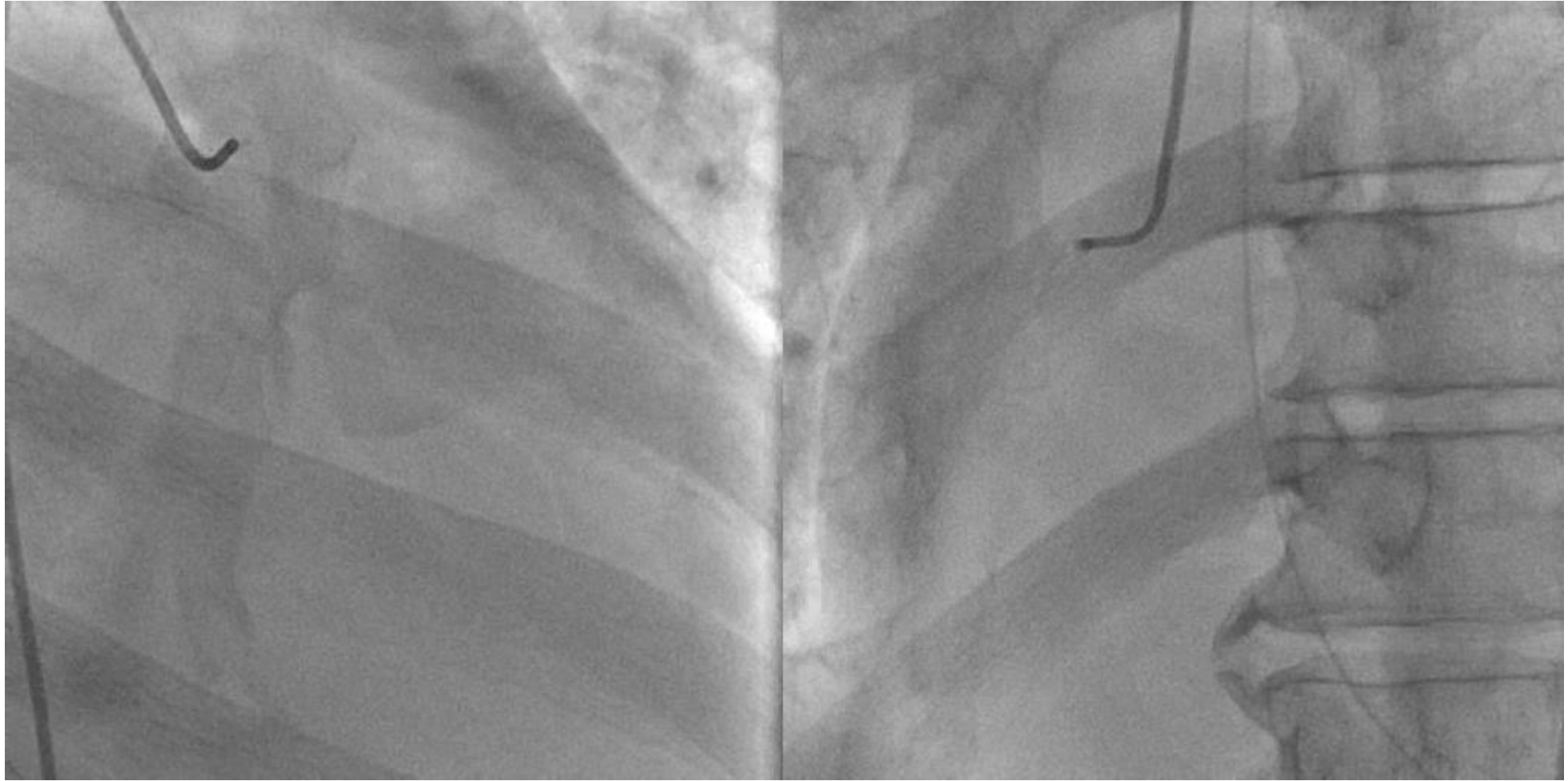
Negative Scan

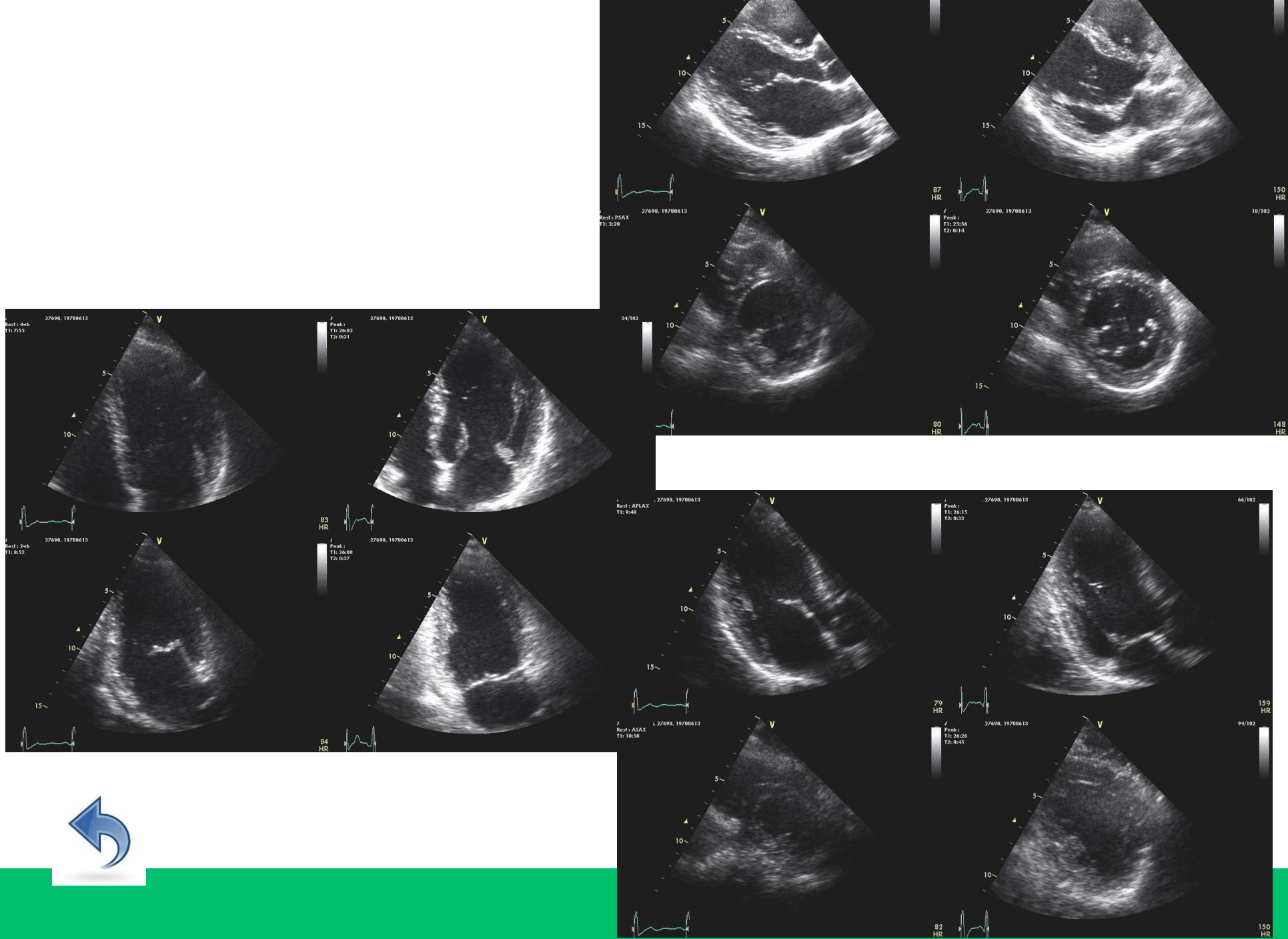


Positive Scan









# Case 2

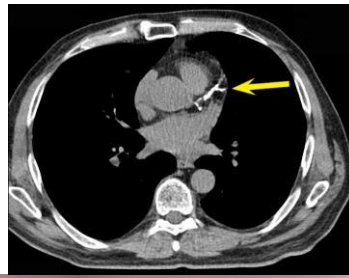
- 72F
- HT and mild to moderate AR
- Recent sudden and unexpected death of her daughter
- Some increasing SOB/OE over last few weeks or months
- “Am I going to have the same problem?”





# Options:

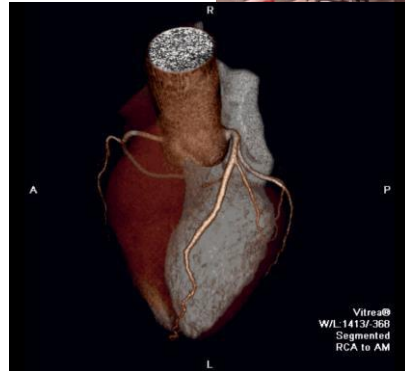
- Calcium score



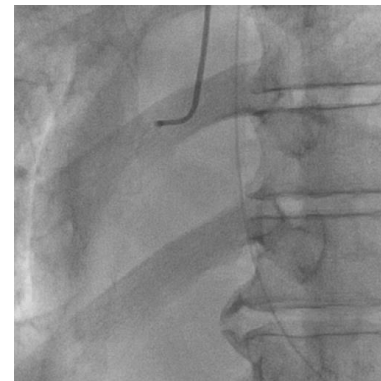
- Stress echo



- CTCA



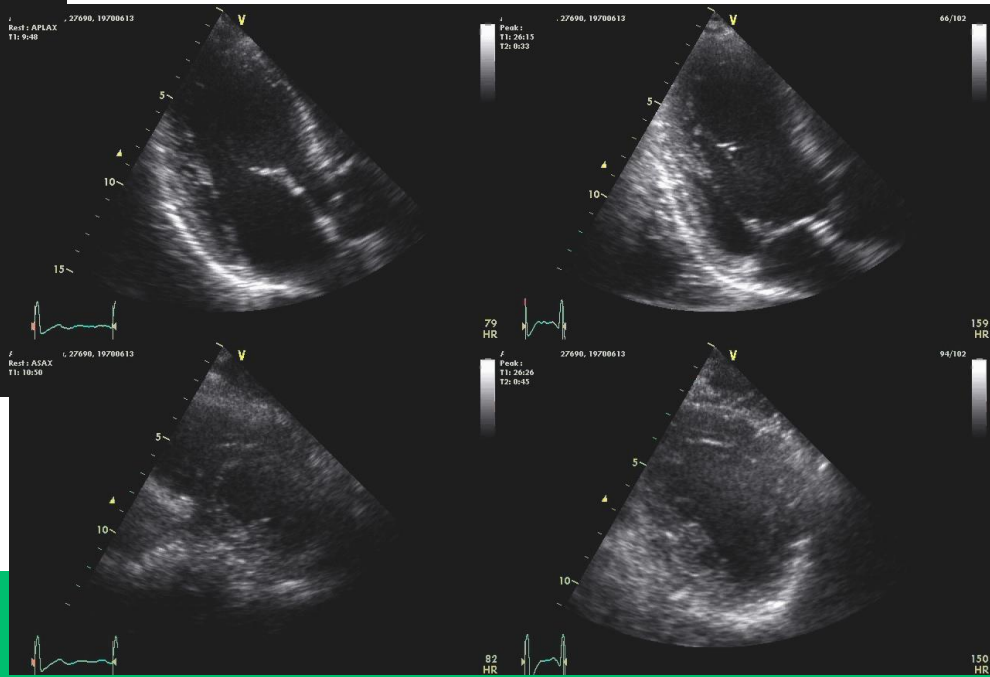
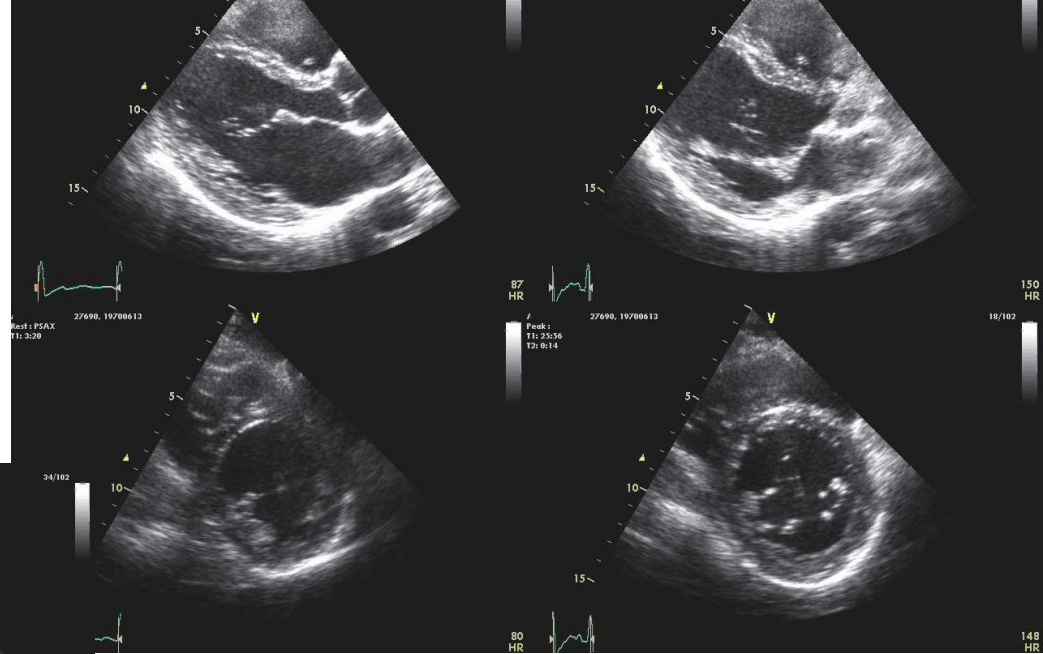
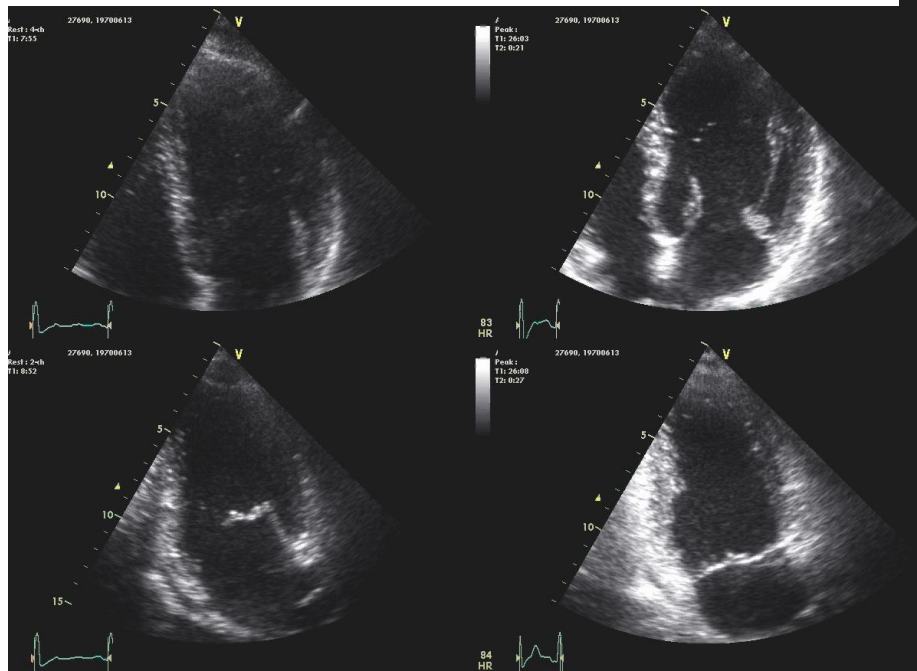
- ICA (invasive coronary angiography)

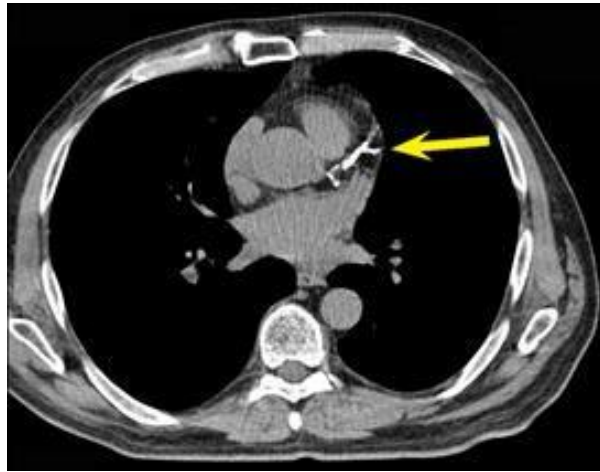
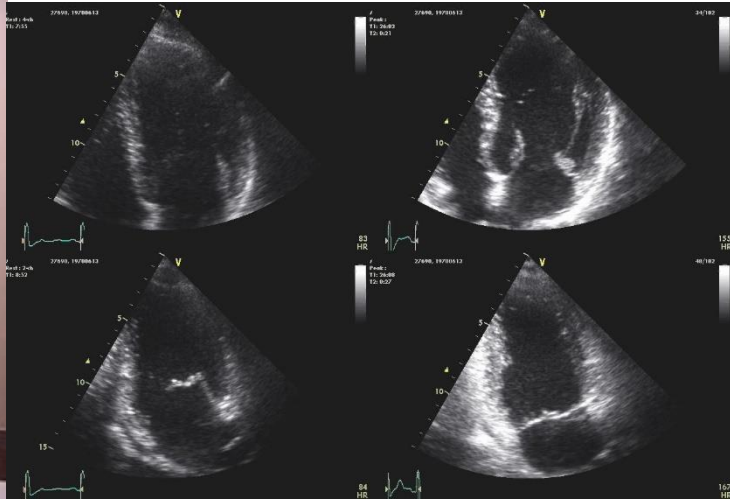


- Stress echo:

- Preserved LV function
- No change to AR
- exercised for 5 minutes and 40 seconds according to a standard Bruce protocol
- 166bpm (112% of maximum predicted heart rate) and to 6.8METS (moderate workload)
- No chest pain
- No ECG changes with exercise









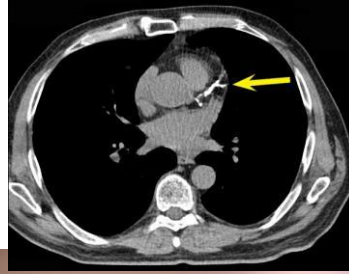
# Case 3

- 63F
- History of HT and benign palpitations, on metoprolol
- Presented with chest heaviness at rest
- ECG – sinus rhythm, no ischaemic changes
- Normal troponins

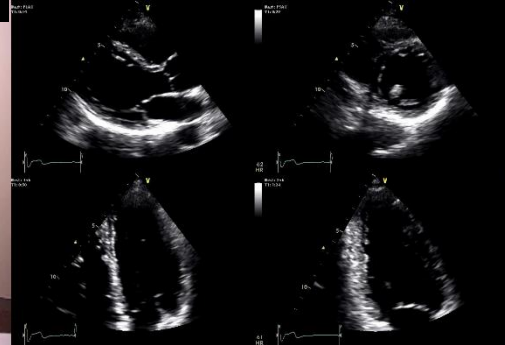


# Options:

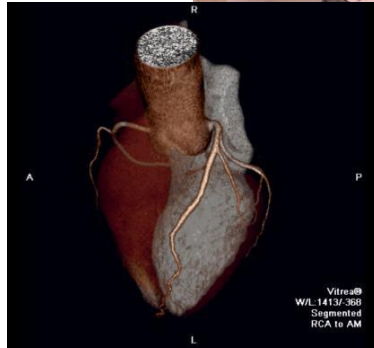
- Calcium score



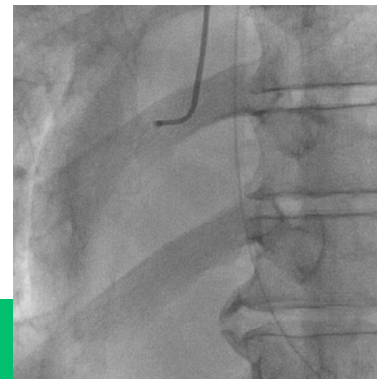
- Stress echo



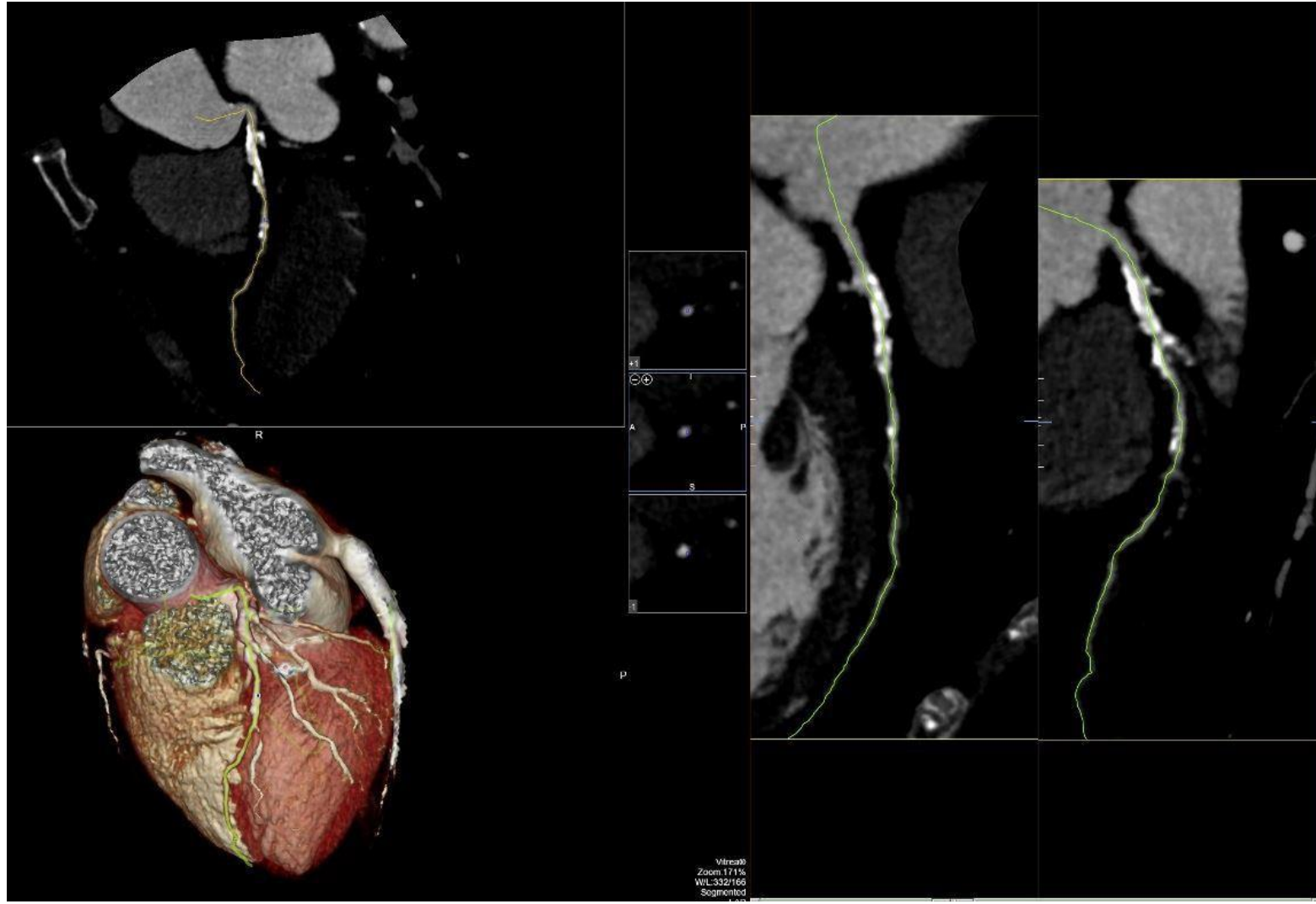
- CTCA



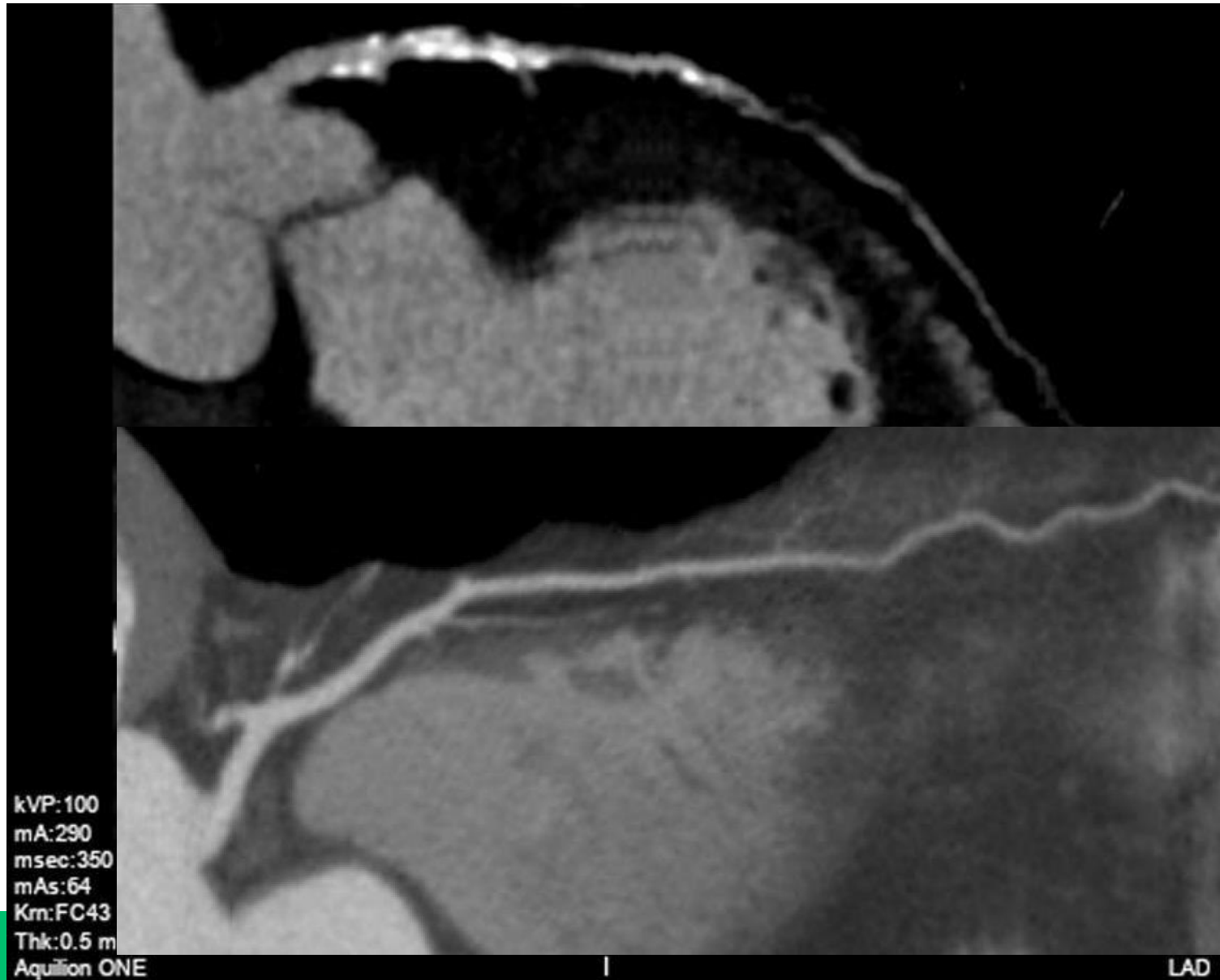
- ICA (invasive coronary angiography)











kVP: 100  
mA: 290  
msec: 350  
mAs: 64  
Km: FC43  
Thk: 0.5 m

Aquilion ONE

I

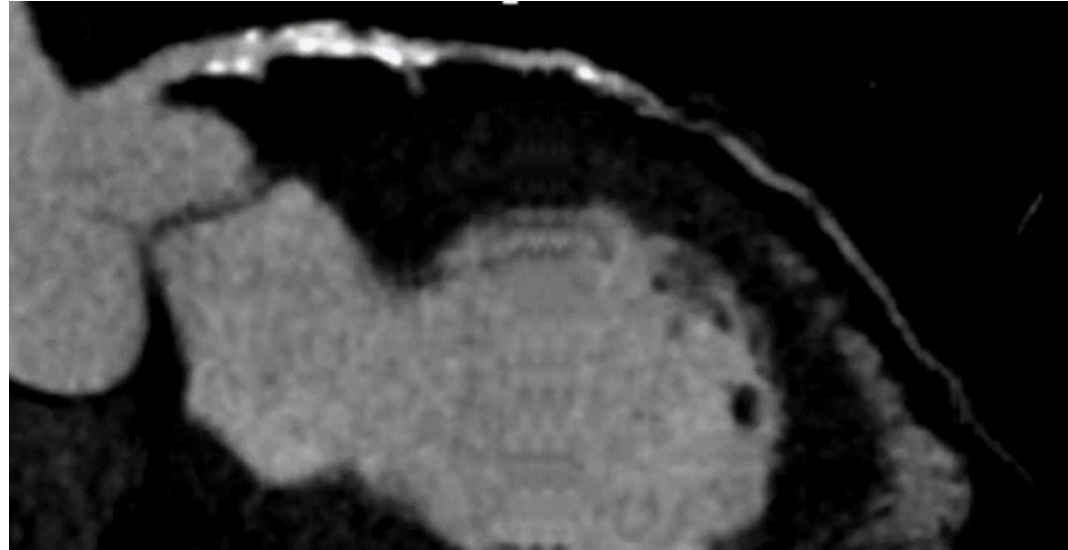
LAD

# CORONARY ANGIOGRAM & ANGIOPLASTY REPORT

- The coronary vasculature in general demonstrates significant calcification and relatively diffuse disease.
- **Left Main:** Moderate calibre vessel with mild disease.
- **LAD:** Relatively small vessel which does not quite reach the ventricular apex. There is a severe (99%) stenosis with associated calcification proximally. There is further segments of severe diffuse disease midvessel and distally
- **Intermediate Artery:** Small to moderate calibre vessel with mild diffuse disease.
- **Circumflex Artery:** Small vessel with a 70% stenosis midvessel.
- **Right Coronary Artery:** Large calibre dominant vessel with mild to moderate diffuse disease. There is no significant focal stenosis.
  
- **PCI TO THE LAD**

# Case 3 Summary

- CP
- Non-ischaemic ECG
- Normal troponins
  
- CTCA
  
  
  
  
  
  
  
  
  
  
- PCI to LAD



# Case 4

- 67M
- Chest tightness running up the stairs to the train
- Settled with rest
  
- Mild dyslipidaemia

## Australian absolute cardiovascular disease risk calculator

Enter patient information below: PRINT

Sex	<input checked="" type="radio"/> Male	<input type="radio"/> Female
Age	<input type="text" value="67"/> years	
Systolic blood pressure	<input type="text" value="120"/> mmHg	
Smoking status	<input type="radio"/> Yes	<input checked="" type="radio"/> No <span>i</span>
Total cholesterol	<input type="text" value="6.1"/> mmol/L	
HDL cholesterol	<input type="text" value="1.1"/> mmol/L	
Diabetes	<input type="radio"/> Yes	<input checked="" type="radio"/> No <span>i</span>
ECG LVH	<input type="radio"/> Yes	<input checked="" type="radio"/> No <input type="radio"/> Unknown

COMPARE RESET

Your heart and stroke risk score is **11%**


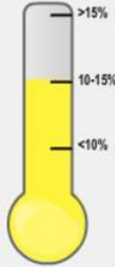
This means you are at moderate (medium) risk of getting cardiovascular disease in the next 5 years.

[Click here](#) if you would like to have a look at the information on this website that explains what your risk score means.

The next step is to talk to your doctor about what steps you can take to lower your chance of getting cardiovascular disease.

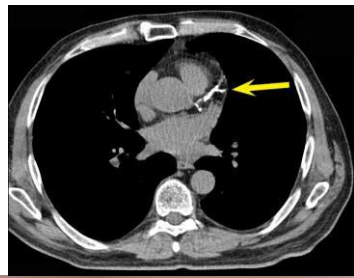
**Please note:** the absolute risk calculator score is only a guide to your heart and stroke risk score. Print out this page and take it to your doctor for further information on your personal risk.

[View guidelines and resources](#)

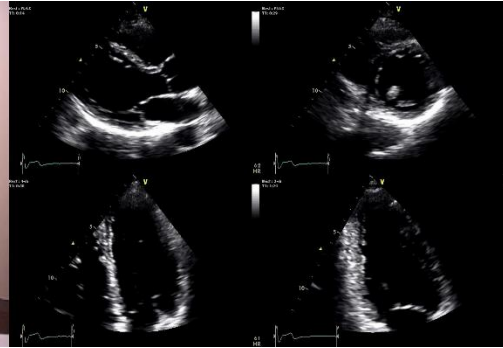
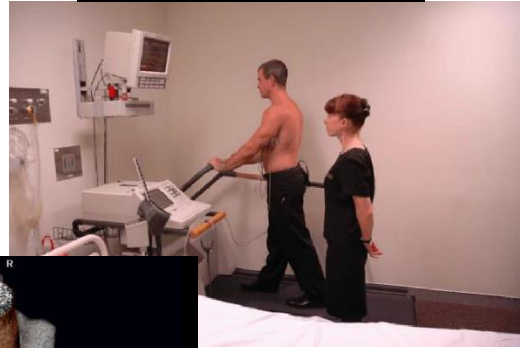


# Options:

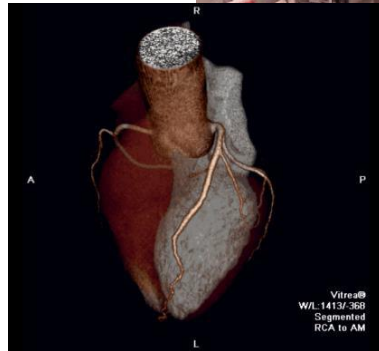
- Calcium score



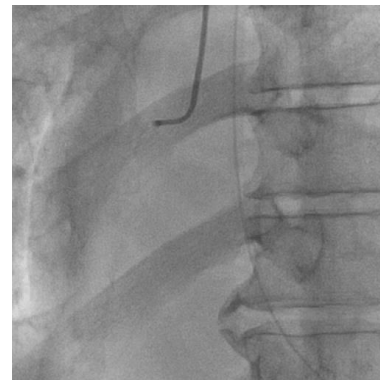
- Stress echo



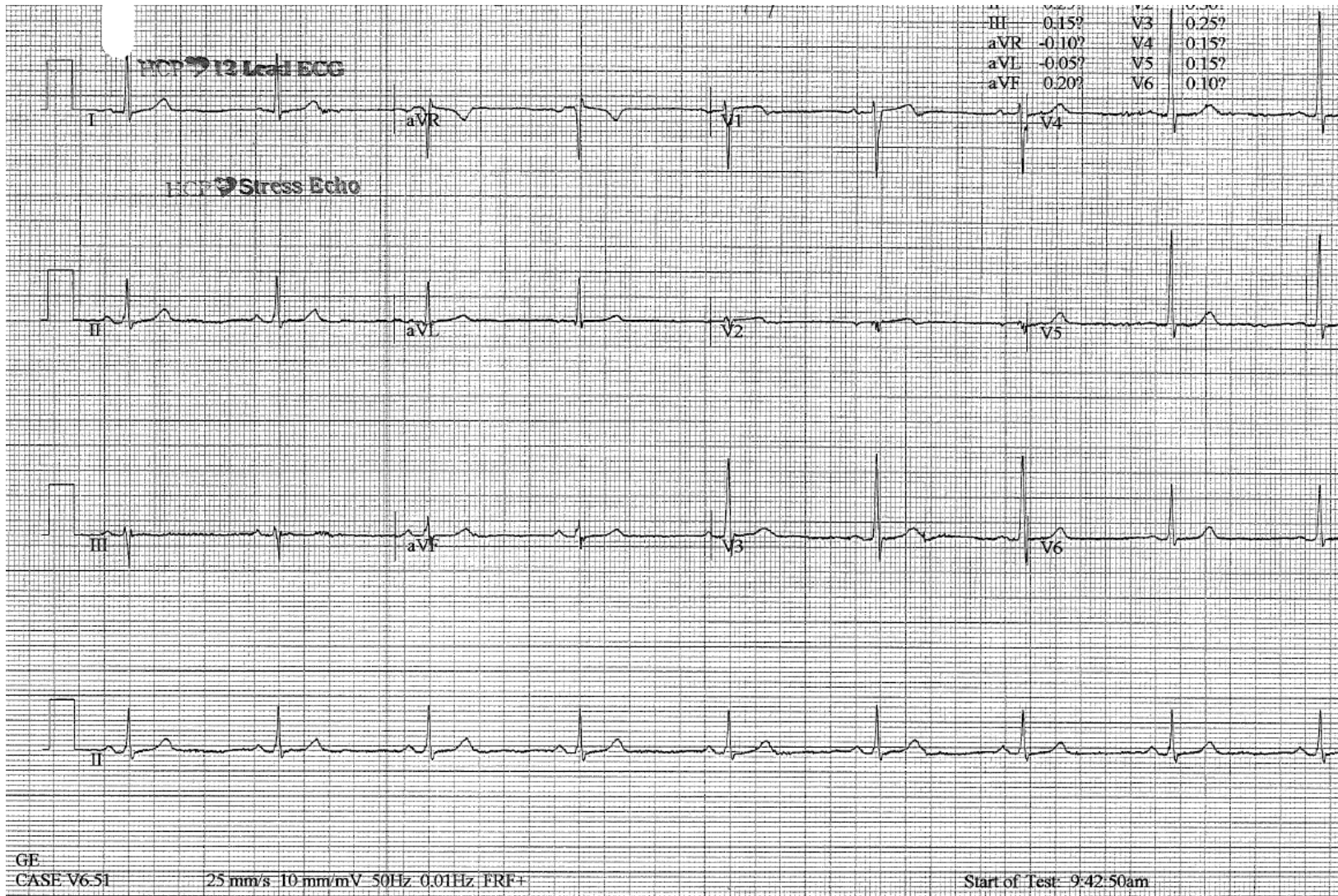
- CTCA

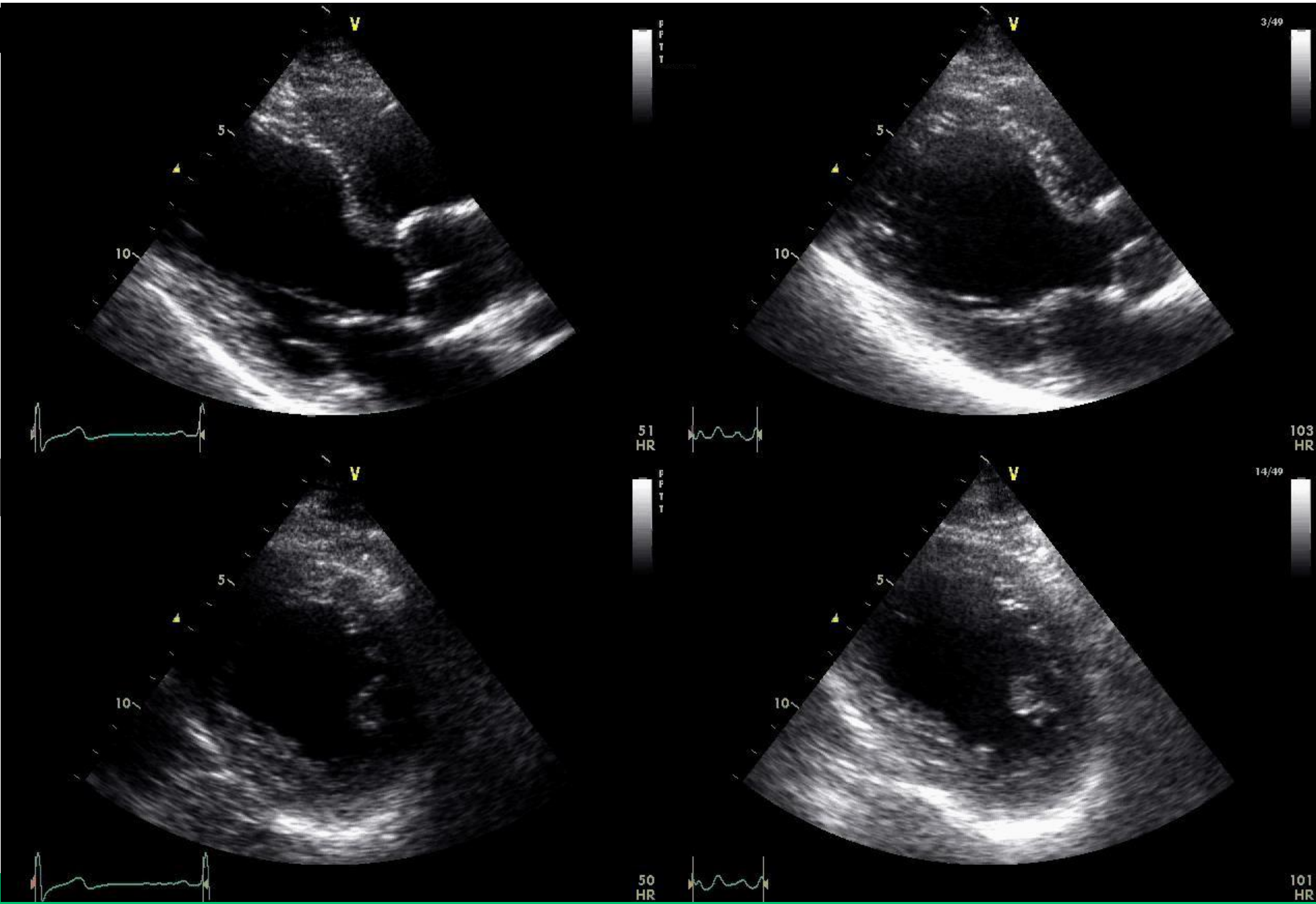


- ICA (invasive coronary angiography)













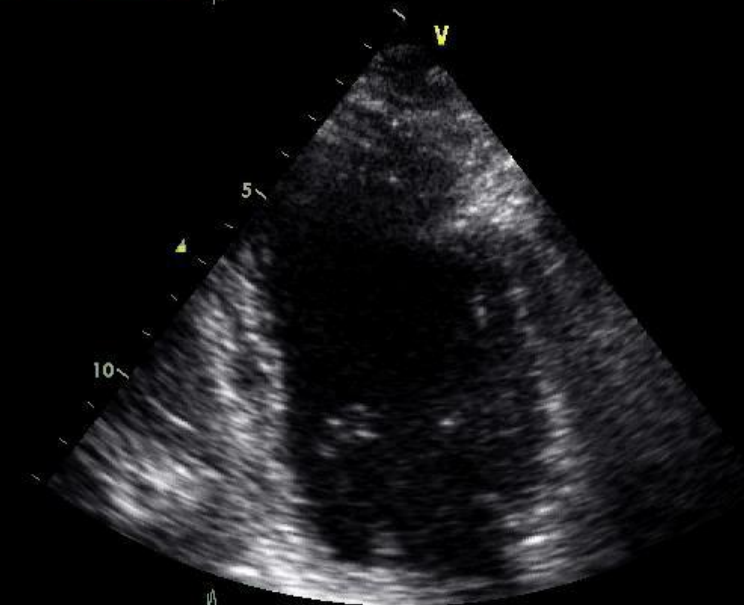
20/49



51 HR



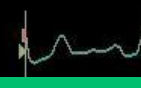
80 HR



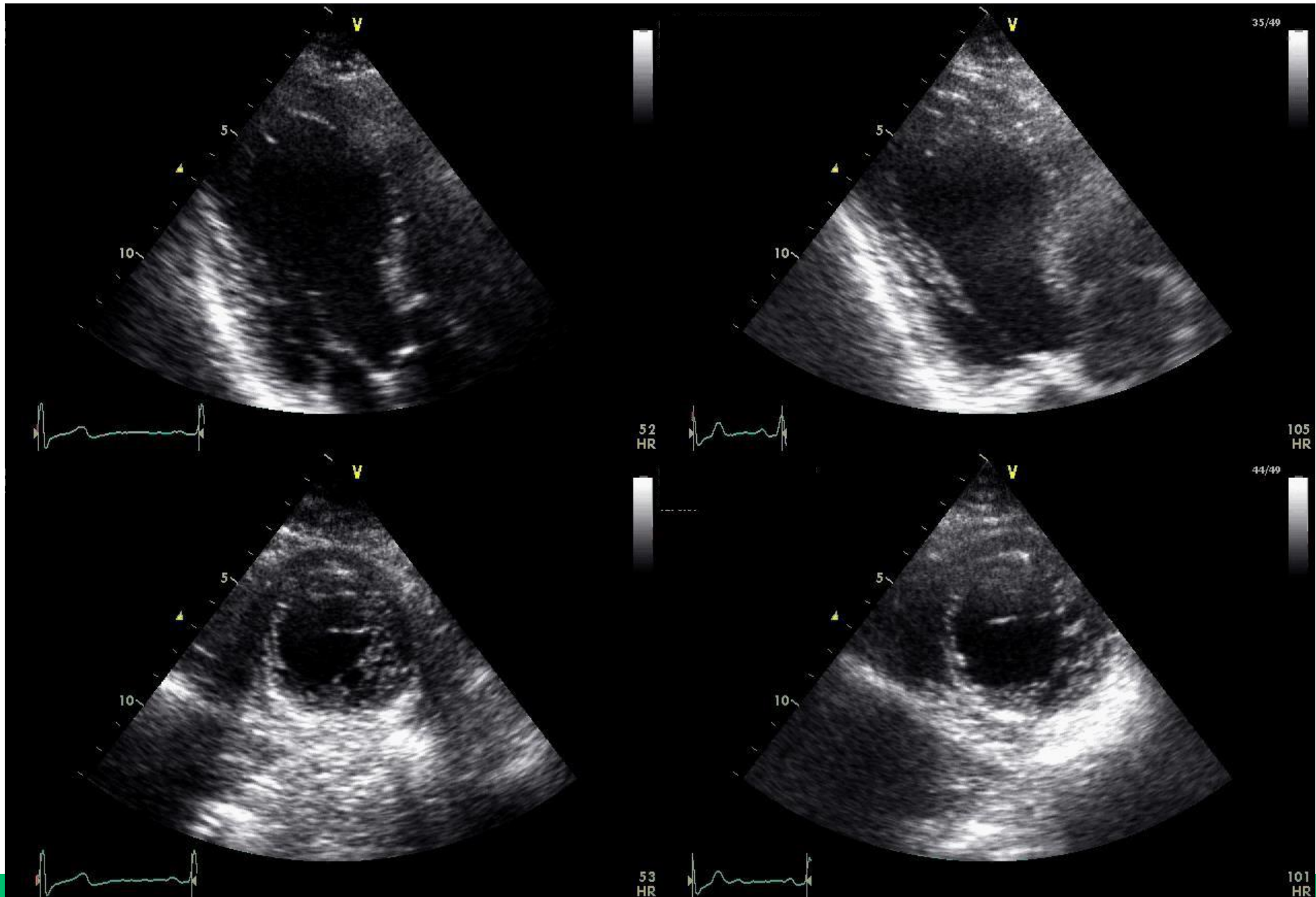
22/49



52 HR

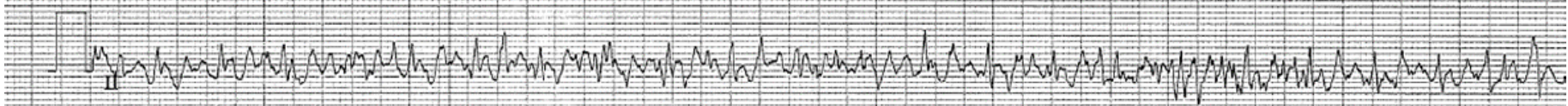
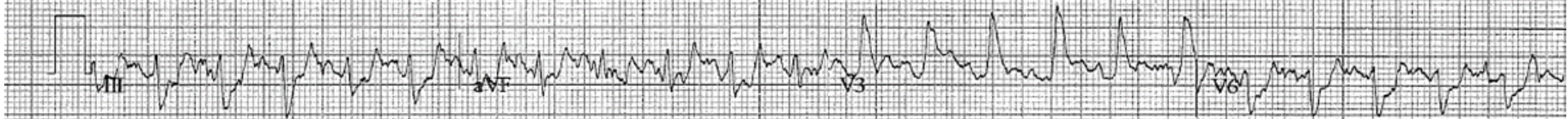
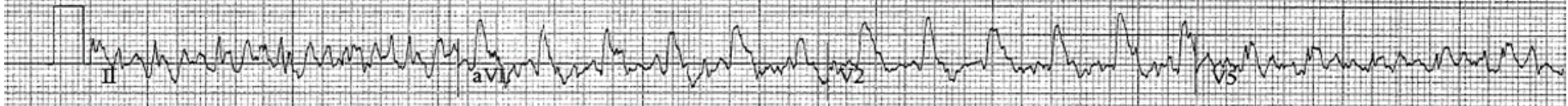
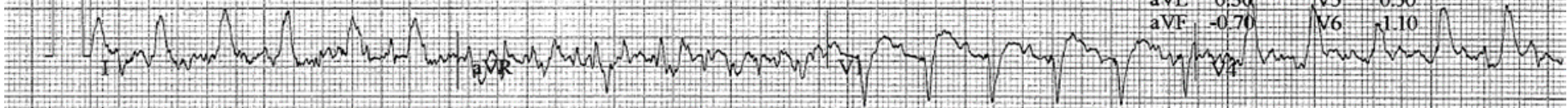


107 HR





II	-0.80	V2	1.10
III	-0.50	V3	1.90
aVR	0.40	V4	1.20
aVL	0.30	V5	0.50
aVF	-0.70	V6	1.10



GE  
CASE V6.51

25 mm/s 10 mm/mV 50Hz 0.01Hz FRF+ HR(V1,V5)

Start of Test: 9:42:50am



[Redacted]

4

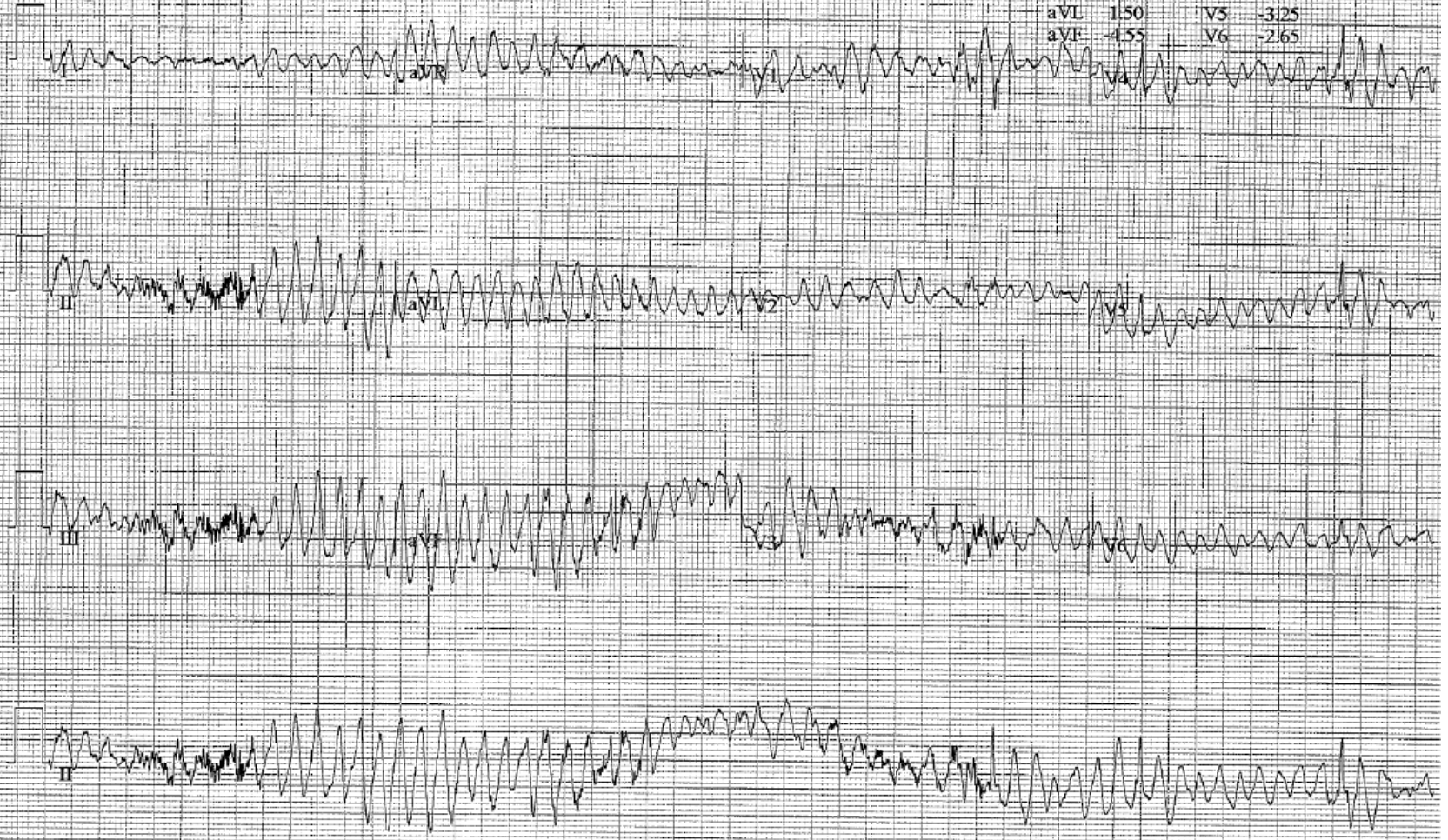
196 bpm

RECOVERY  
#1  
02:34

BRUCE HCP  
0.0 km/h  
0.0%

Measured at 80ms Post J (10mm/mV)  
Auto Points

Lead	ST(mm)	Lead	ST(mm)
I	-0.85	V1	4.00
II	-4.85	V2	1.55
III	-4.00	V3	-2.05
aVR	2.80	V4	-3.90
aVL	1.50	V5	-3.25
aVF	-4.55	V6	-2.65

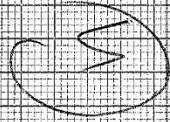


GE  
CASE V6.51

25 mm/s 10 mm/mV 50Hz 0.01Hz FRF+ HR(V3,II)

Start of Test: 9:42:50am





292 bpm

RECOVERY

#1

03.26

BRUCE HCP

0.0 km/h

0.0%

11/01/2011 10:10:00 AM

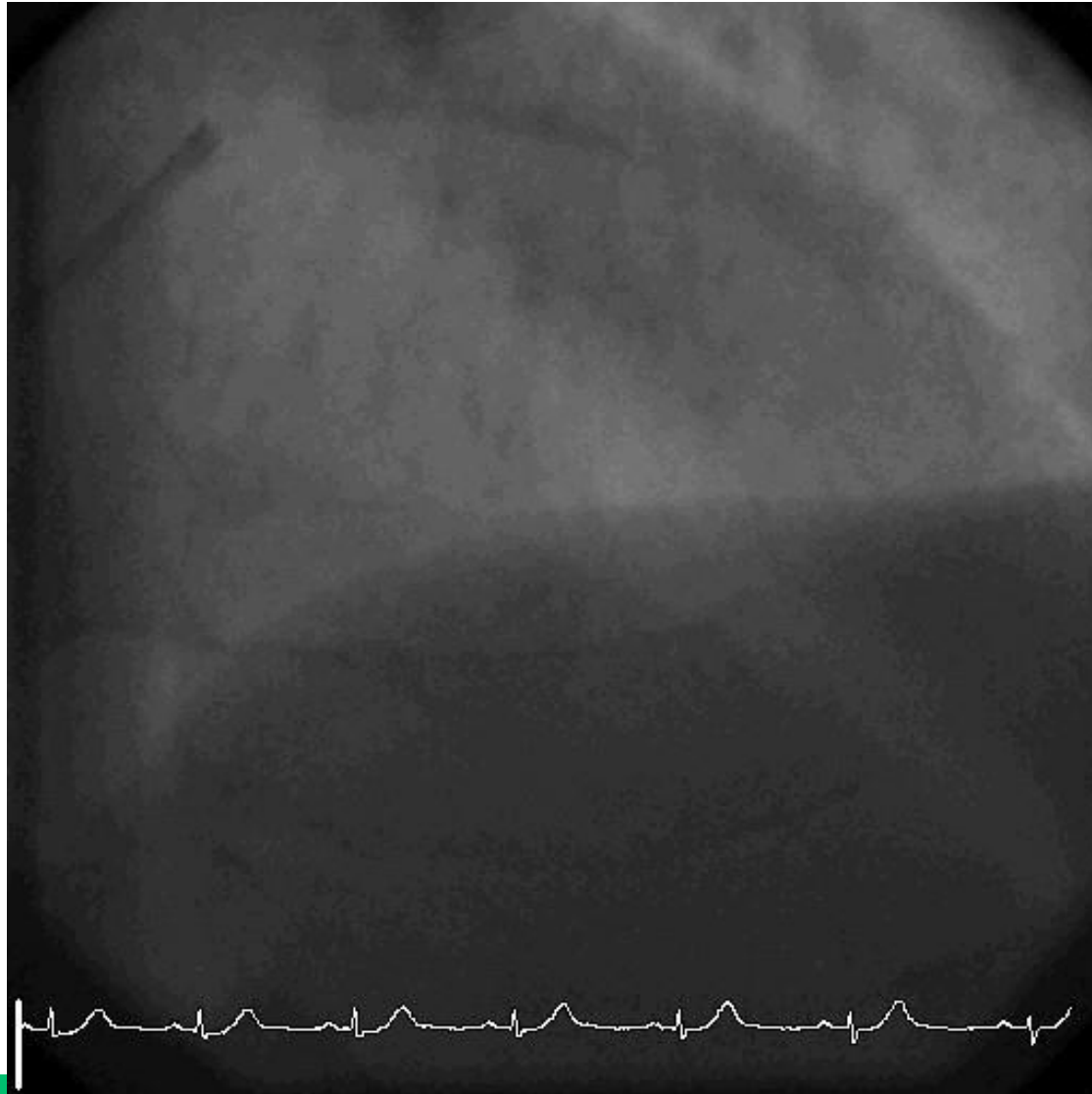


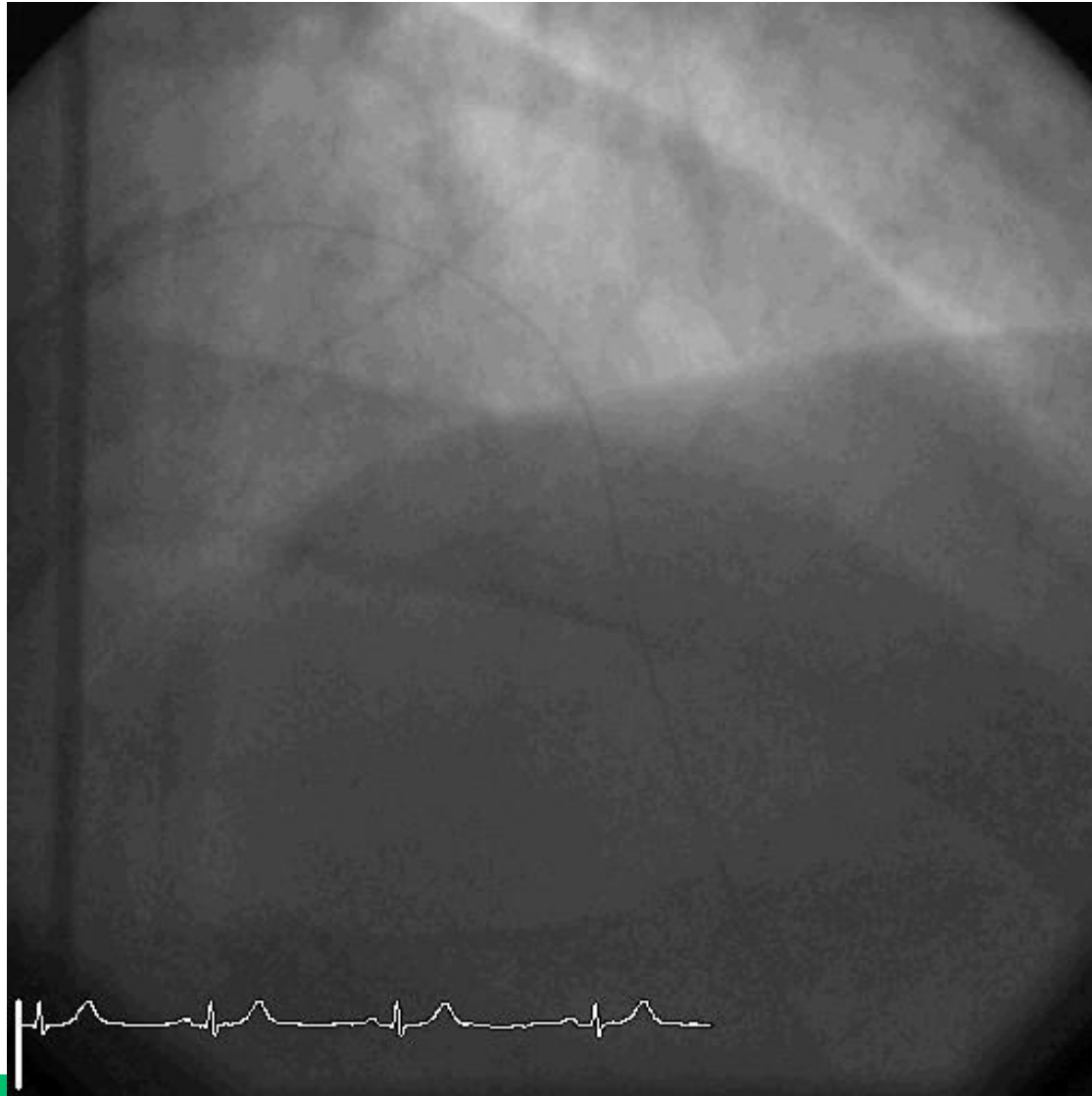
CASE V6.51

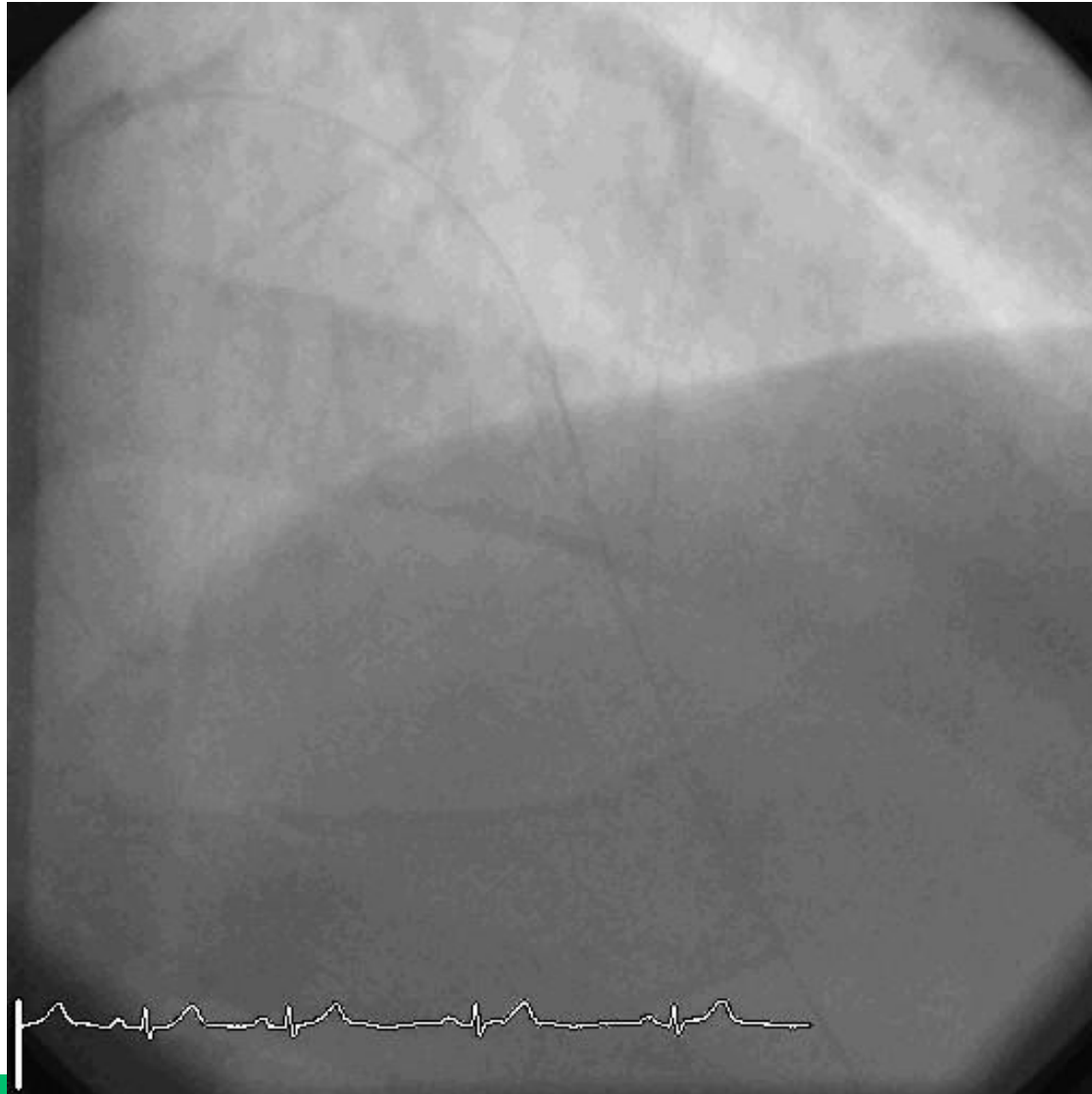
25 mm/s 10 mm/mV 50Hz 0.01Hz FRF+ HR(II,V6)

Start of Test: 9:42:50am

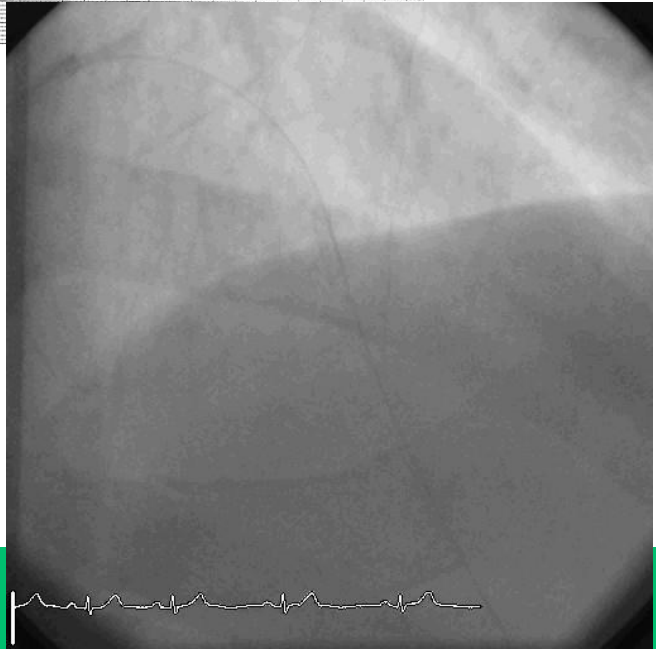
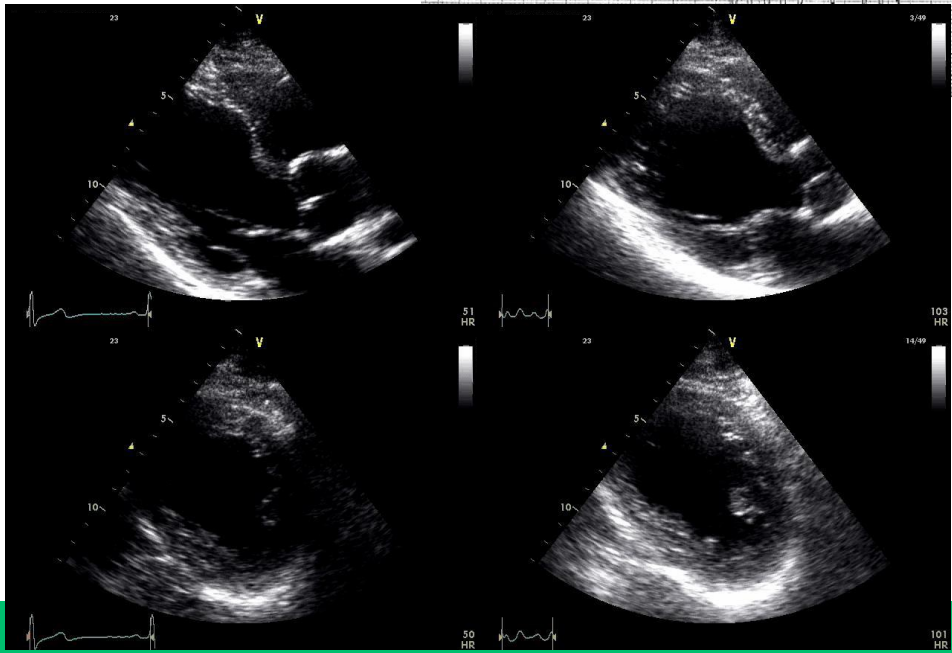
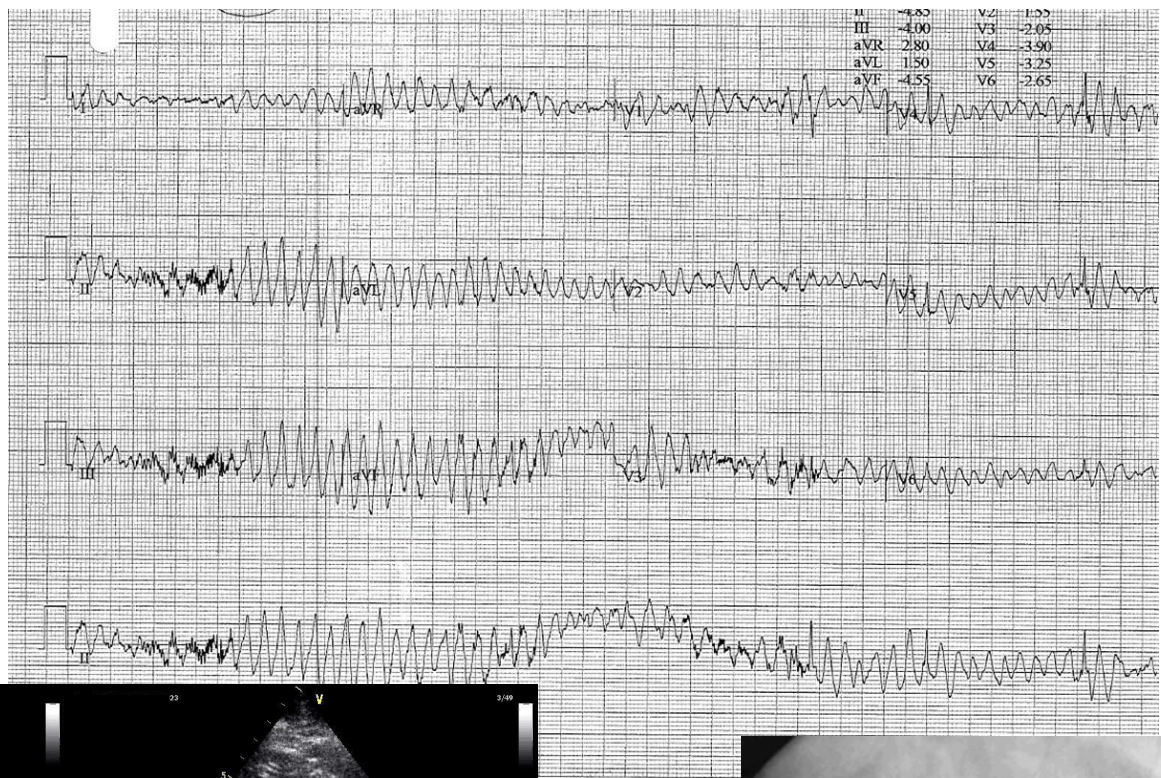












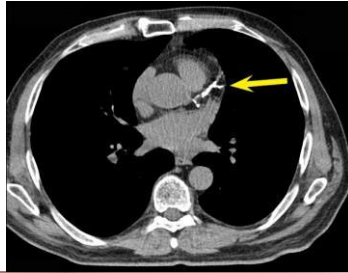
## Case 5

- 53M
- Mining executive
- Corporate health check – CACS 3141

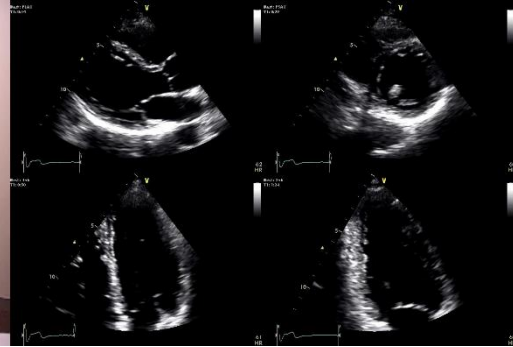


# Options:

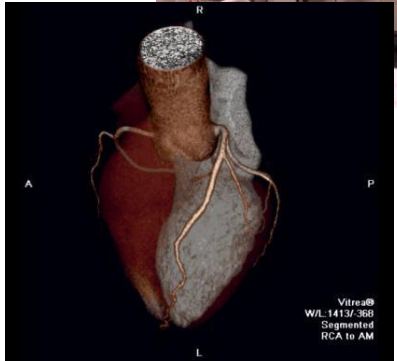
- Calcium score



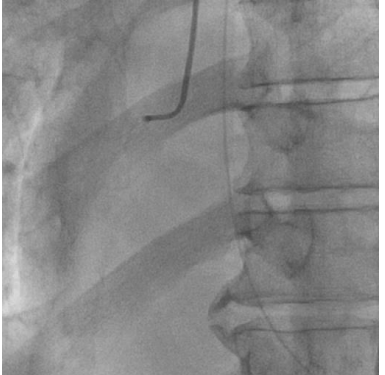
- Stress echo



- CTCA



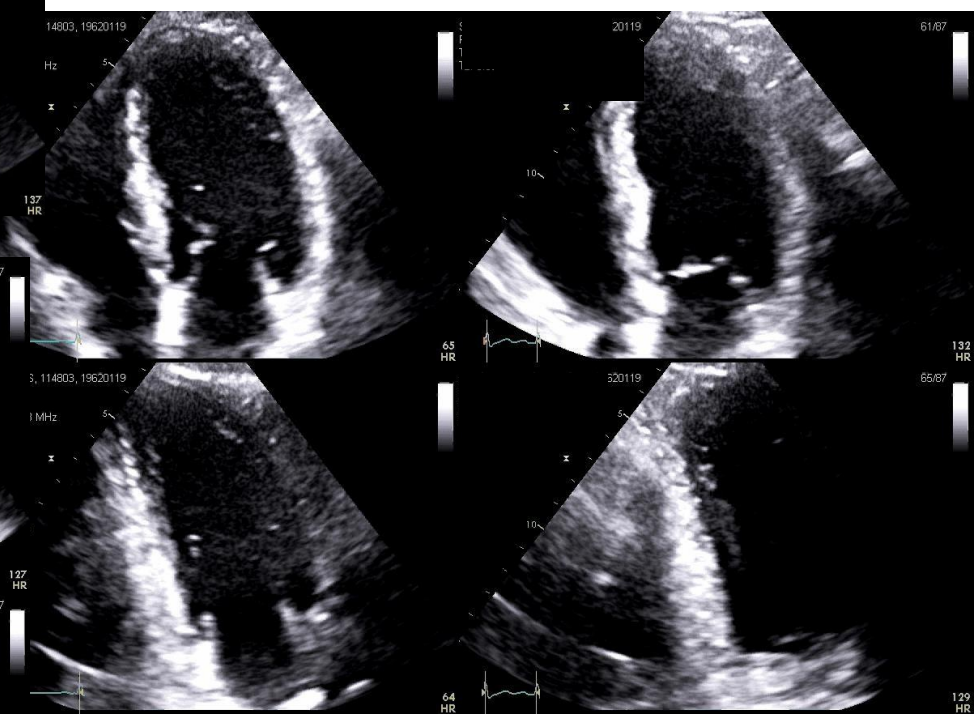
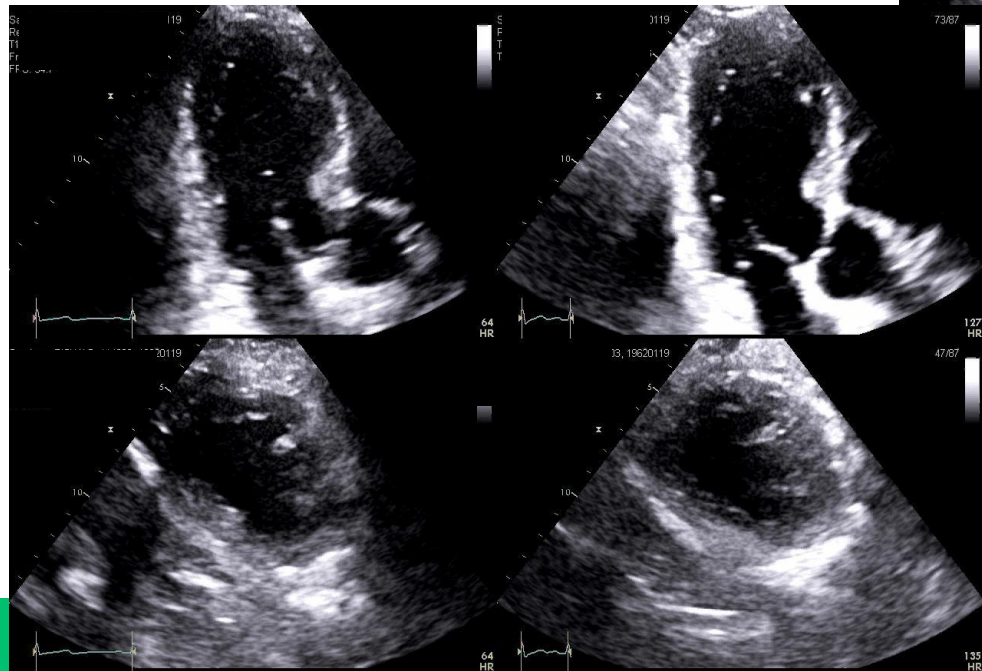
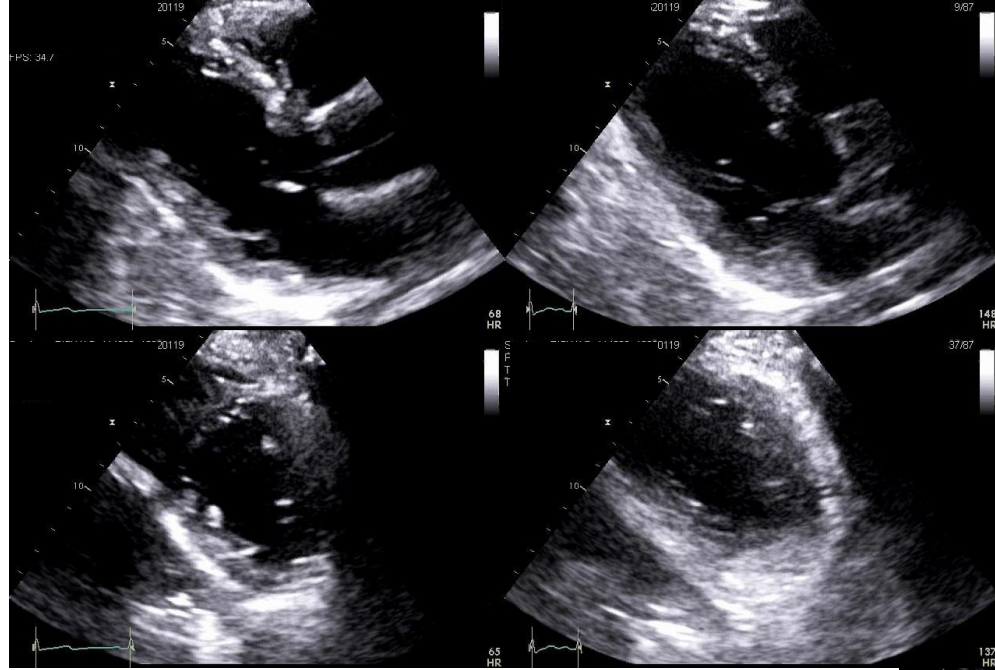
- ICA (invasive coronary angiography)



- Coronary angiogram

- Three vessel coronary disease – moderate but heavily calcified
- Normal left ventricular function
- This pattern of anatomy may not give a durable result with coronary stenting given the heavy calcification







# MBS changes to Cardiac Imaging Services effective 1st August 2020

## **Initial Echocardiography changes, GP requested new items**

- **55126** Initial real time echocardiographic examination (Echo): provides access to a baseline initial echocardiographic examination that is an entry point for patients who may require ongoing echocardiographic examinations. A service under item 55126 is restricted to two years. 55126 replaces 55113, 55114 and 55115 in certain circumstances.
- **55128 (MMM 3-7 area GPs only)** Serial real time echocardiographic examination of the heart (Echo) for valvular dysfunction requested by medical practitioners in a Modified Monash Model (MMM) 3 to 7 area (Echo) for specific clinical indications is a new item. 55128 is expected to replace 55114 in certain circumstances.
- **55133** Frequent repetition serial real time echocardiographic examination (Echo) of the heart to monitor pericardial effusion/pericarditis or assessing the effects of PBS medications. This test can be referred by any practitioner.
- For patients who do not meet the above criteria, please refer the patient to a cardiologist for consultation and review for testing as per MBS guidelines to access Item numbers **55127, 55129 and 55132**.

## **Stress echocardiography changes, GP requested new items**

Items **55141, 55145, 55146** include the exercise stress ECG component (11729 or 11730), and replace 55116 and 55117.

## **Exercise stress echocardiography (Treadmill stress echo) - restricted to one study every two years**

- **55141** Exercise stress echocardiography focussed stress study (Treadmill stress echo)
- **55145** Pharmacological stress echocardiography (Dobutamine stress echo)
- **55146** Pharmacological stress echocardiography (Dobutamine stress echo) following a failed exercise stress echo (must be performed within 4 weeks of failed stress echo).

## **Exercise stress ECG - restricted to one study every two years**