

New Imaging Techniques 2011

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Proven Clinical Application

- Cardiac catheter
 - pressures
 - coronary angiogram
 - Left ventriculogram
 - Aortogram
 - Fractional flow reserve
 - Intravascular ultrasound
- Echocardiogram
 - Trans transthoracic
 - Trans-oesophageal
 - Stress
 - Exercise
 - Dobutamine
 - Diastolic
 - Valve assessment
 - Intracardiac
 - Contrast
- Nuclear
 - Sestamibi
 - Thallium
 - Rest/ stress/redistribution
 - PET
- MRI
 - Cardiac structure and function
 - Proximal coronaries
 - Delayed contrast enhancement
 - Perfusion
 - Low-dose dobutamine stress
- CT
 - Cardiac structure and function
 - Coronary angiogram

No “one-stop shop”

- Multiple imaging tests may be appropriate



All Diagnostic
Information

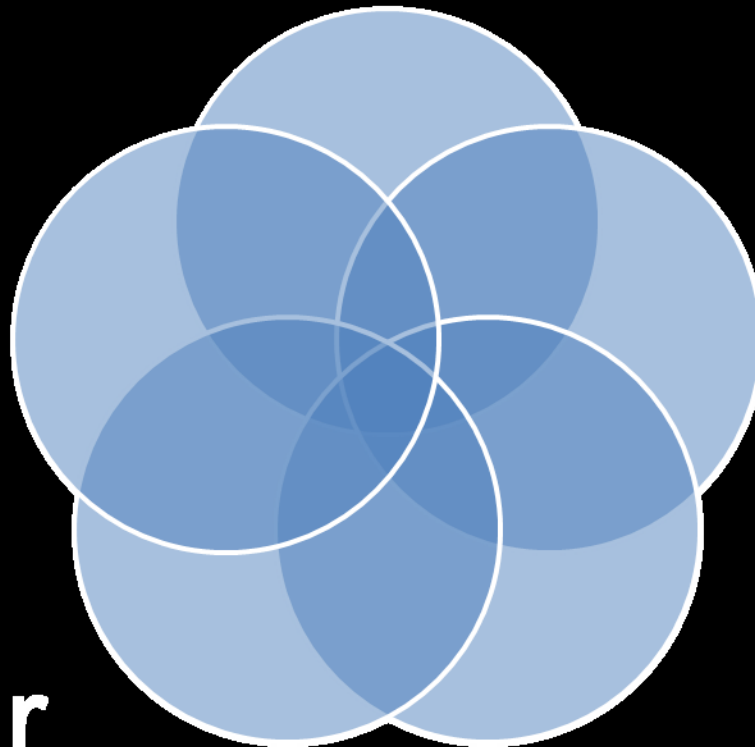
Cath

Echo

MRI

Nuclear

CT



New and Relevant to GP

- Fractional Flow Reserve (FFR)
- Infarct Imaging by contrast MRI
- Diastolic Stress Echo
- CT coronary angiogram
 - New Medicare Item no (Specialist Referral only)

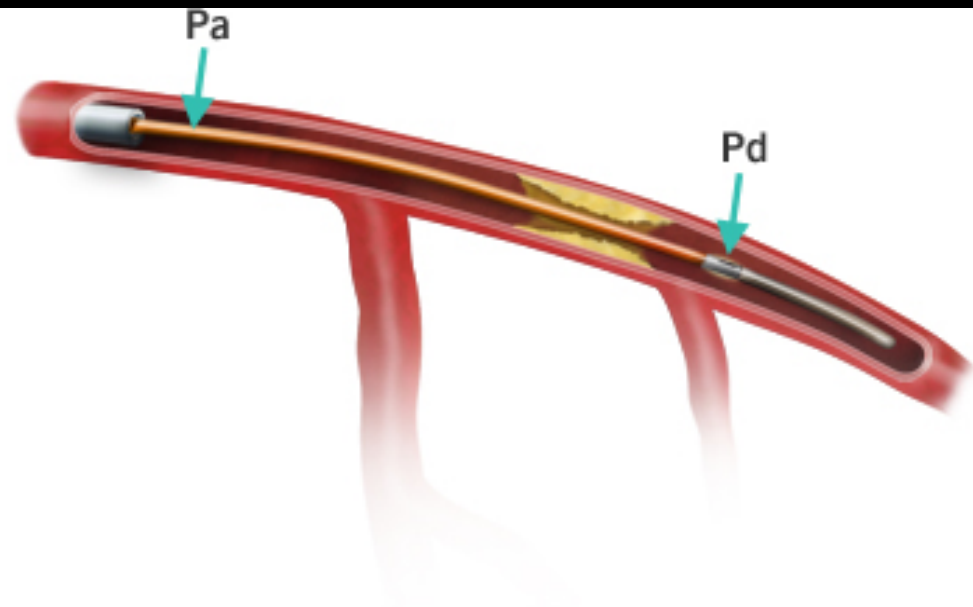
Imaging: Relevance to GP

- GP referring for test without cardiologist consultation
 - Transthoracic echocardiogram
 - Stress echocardiogram
 - MIBI
- GP referring for cardiologist consultation
 - **Knowing when to refer patients:** new imaging techniques create new opportunities for diagnosis and therapy e.g. MRI Dx of Infarct
 - **Knowing when not to refer patients:** e.g. Ca Scoring in 1990's (before any proven clinical application)
 - **Direct their referrals** to where the most appropriate imaging technique is most likely to be utilised
 - **Debriefing patient**
 - **Be aware of future specific risks** based on information obtained from imaging e.g. a dilated left atrium predisposes to future atrial fibrillation

FFR

- performed by an Interventionist as an adjunct to invasive coronary angiography
- “Extremely low risk”

$$\text{FFR} = \frac{\text{Distal Coronary Pressure (Pd)}}{\text{Proximal Coronary Pressure (Pa)}} \\ \text{(During Maximum Hyperemia)}$$



FFR: FAME 2009

- Stents per pt: 3 in angio alone vs 2 in FFR (P<0.001)
- 1-year event rate was 18% in the angio alone and 13% in FFR (P=0.02)
- Angina control better in FFR than angio alone (P=0.2)

FFR: FAME 2009

- Invasive Angio alone is not a perfect test
- Some stenoses are better not being stented- also COURAGE trial

Which test to do next?

- 70 yo female
 - Dyspnoea
 - Hypertension
 - Echo: Normal valves & LV systolic function
 - Positive Stress ECG
 - “Minor coronary disease” on invasive angiogram
- A. Sestamibi
 - B. Stress echo
 - C. CT
 - D. MRI
 - E. Repeat invasive angiogram with a cardiologist you trust +/- FFR

Diastolic Stress (Echo) Test

Elevated filling pressures with exercise

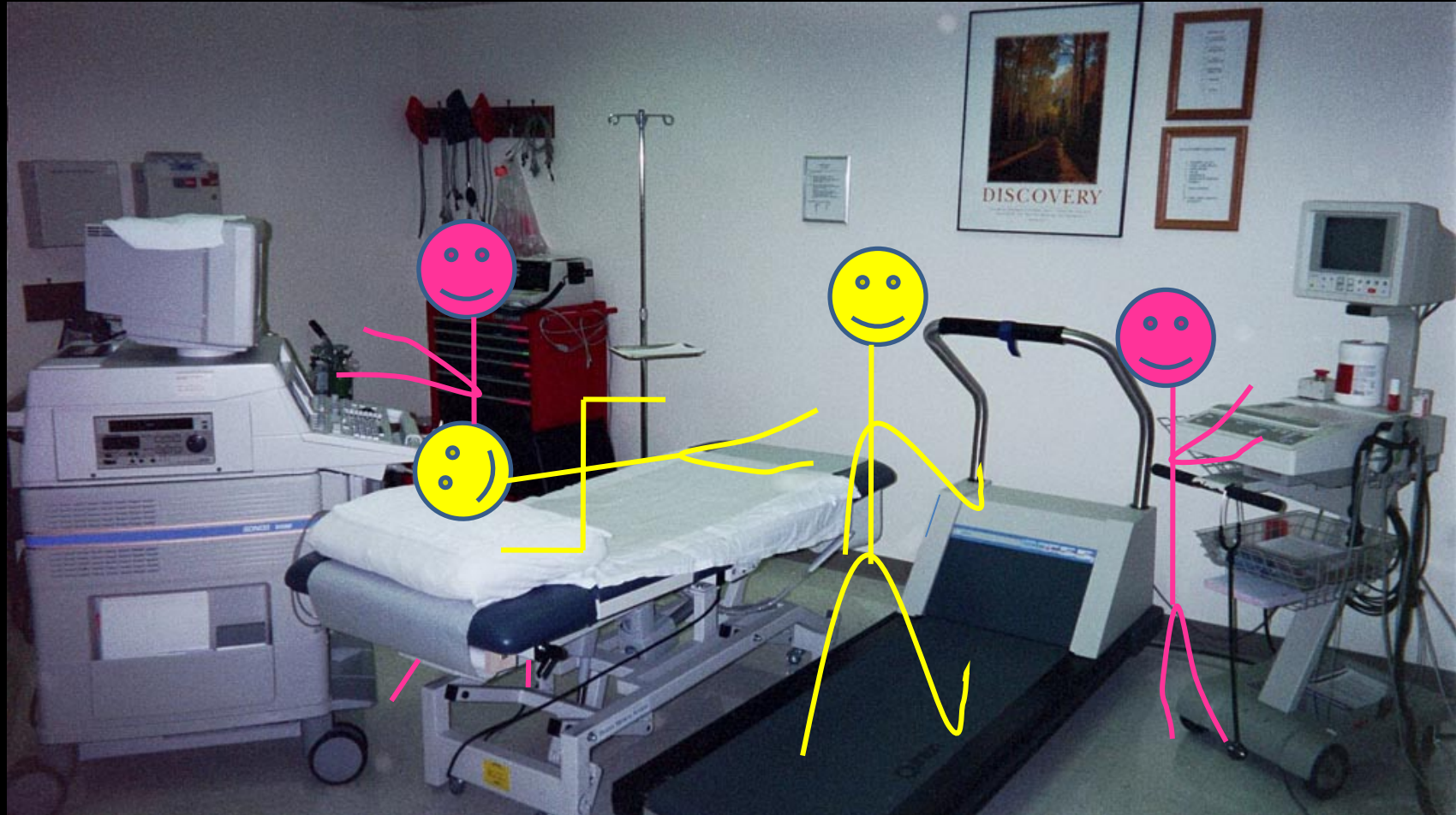
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“Heart Failure with Normal Ejection Fraction”
(HFNEF)
Aka “Diastolic Heart Failure”

Diastolic Heart Failure

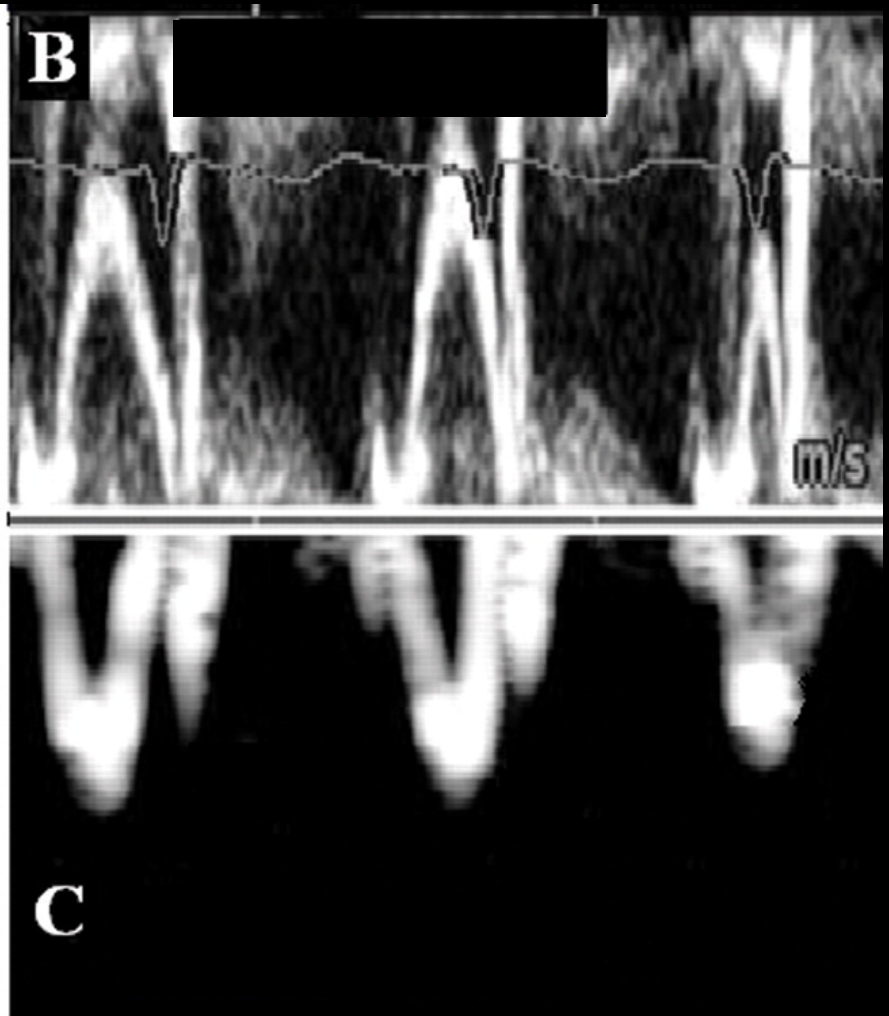
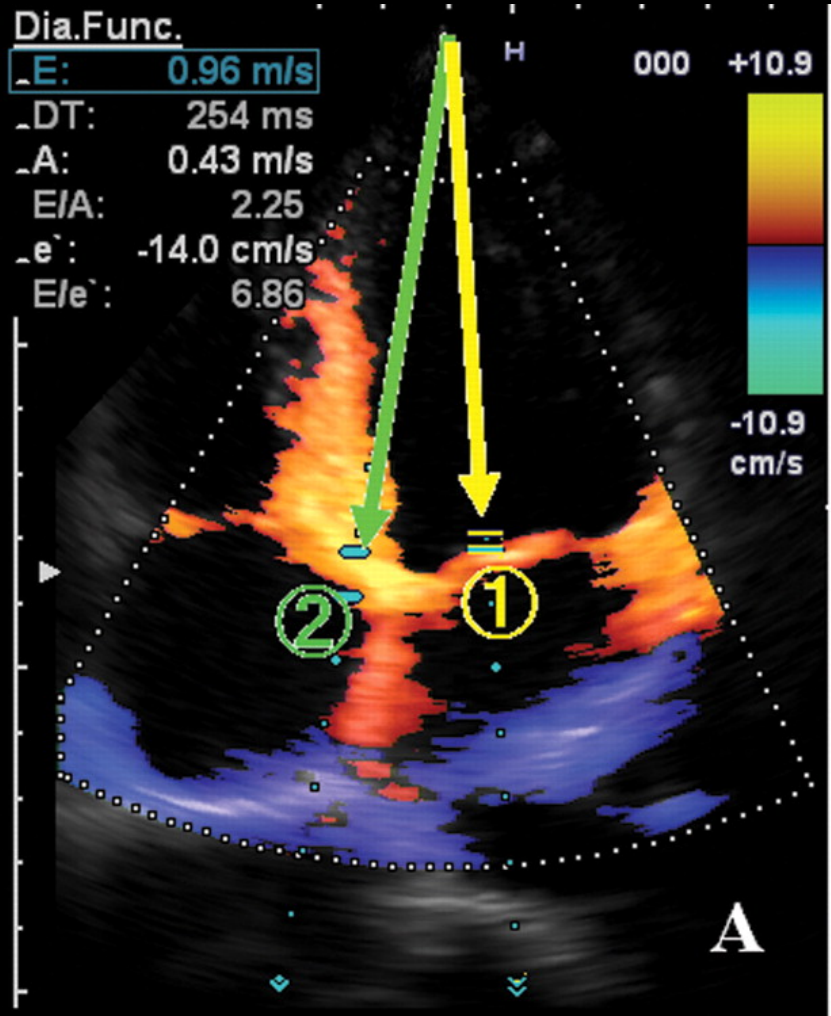
- > 50 % of Heart Failure Diagnoses
- 1% at 50 yo, >10% at 80 yo
- > 55 yo remaining lifetime risk: 1 in 6
- Prognosis
 - equally poor as systolic heart failure 43% 5 yr survival rate after 1st episode (new evidence)
 - significantly lower than the age- and sex-matched general population (72%)

Stress Echo



Dia.Func.

E: 0.96 m/s
DT: 254 ms
A: 0.43 m/s
E/A: 2.25
e: -14.0 cm/s
E/e': 6.86



Exercise Stress Echocardiogram Report

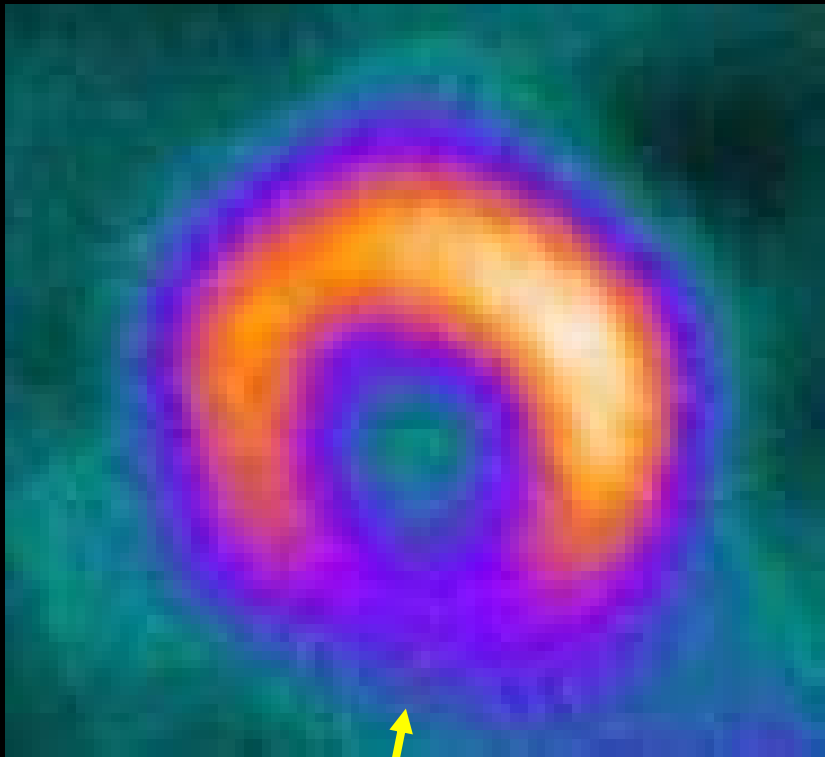
Name of Patient: XXXXX

Dob: XXXX

FINAL CONCLUSIONS:

1. No ischaemia
 2. Reduced exercise capacity (limited by dyspnoea)
 3. Elevated filling pressures with exercise consistent with Diastolic Heart Failure
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Infarct Imaging



Nuclear



MRI

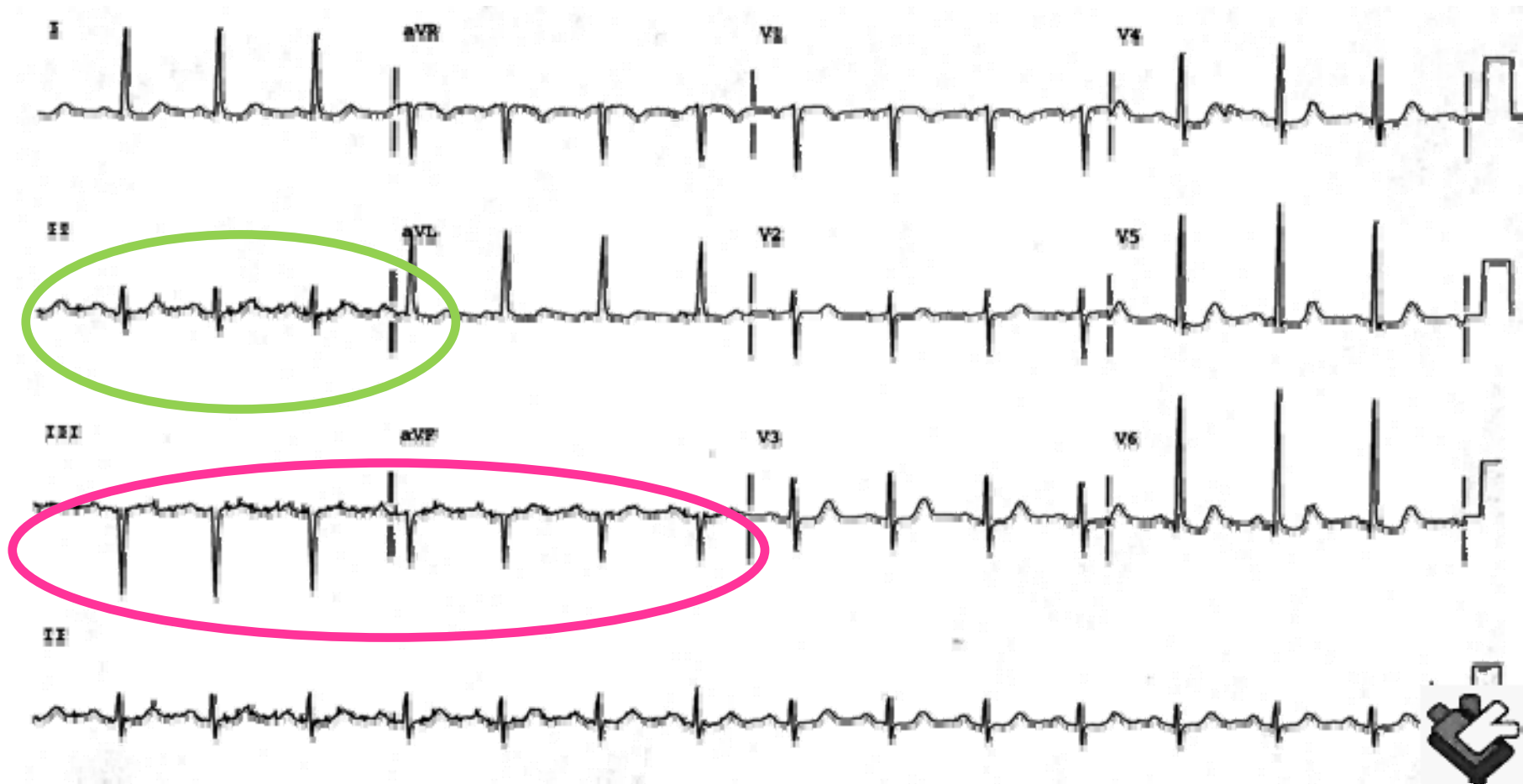
Silent Infarction on MRI

- Risk of silent infarct
 - 6% if 2 risk factors
 - 26% if 4-5 risk factors.

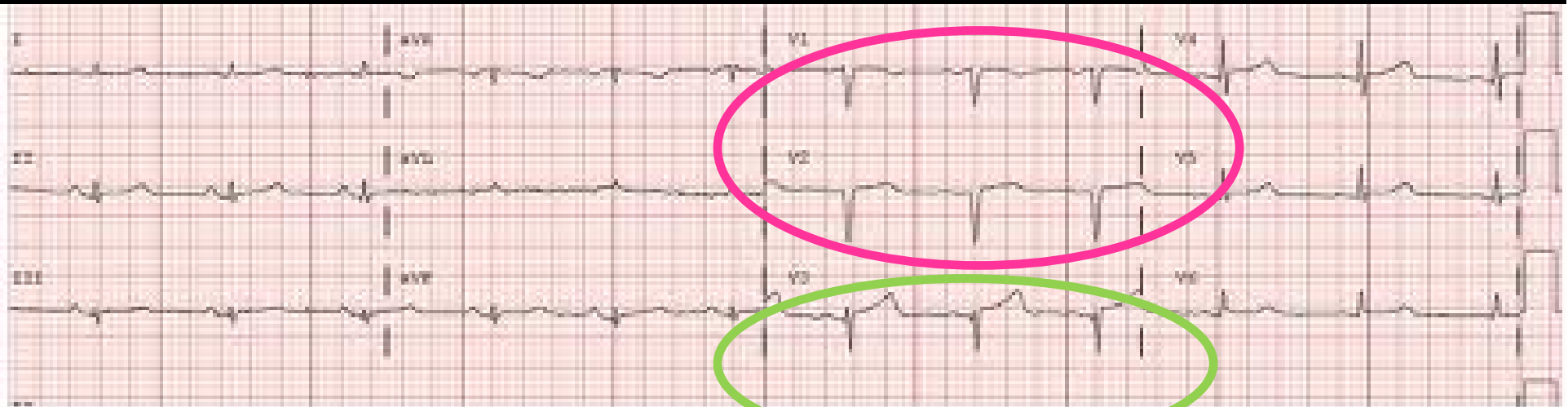
Clinical Significance of Old Infarct

- Even if no obstructive coronary disease and normal LV systolic function
- Diagnostic
 - Superior to ECG, MIBI, Echo
- Prognostic
 - Natural Hx vs Prognosis with Rx
- Therapeutic
 - Aspirin, Clopidogrel, Beta blocker, ACE I, Statin

Old Inferior Infarct: True or False ?



Old Anterior Infarct: True or False ?

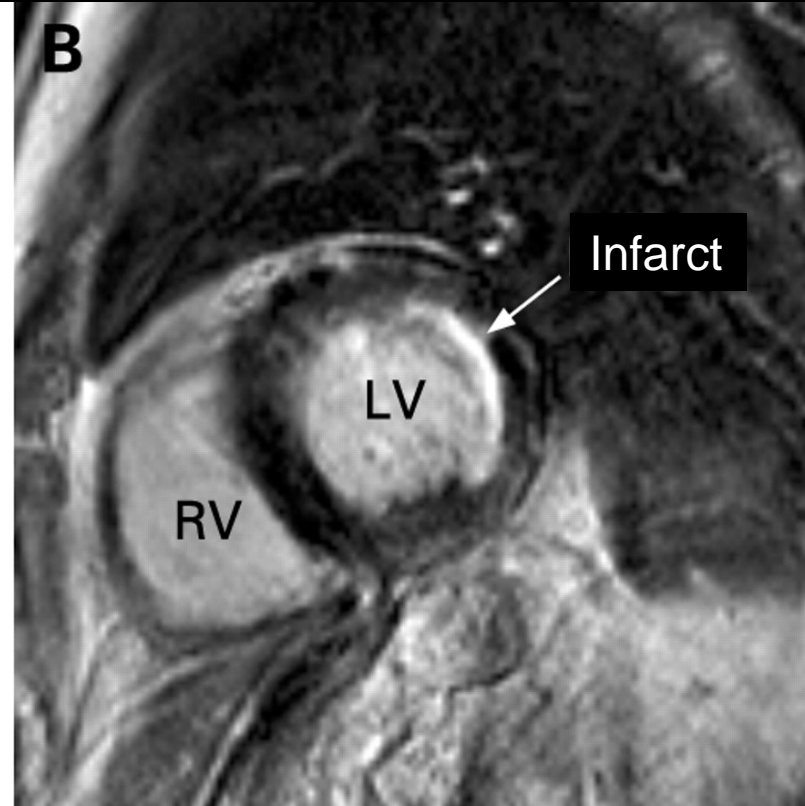
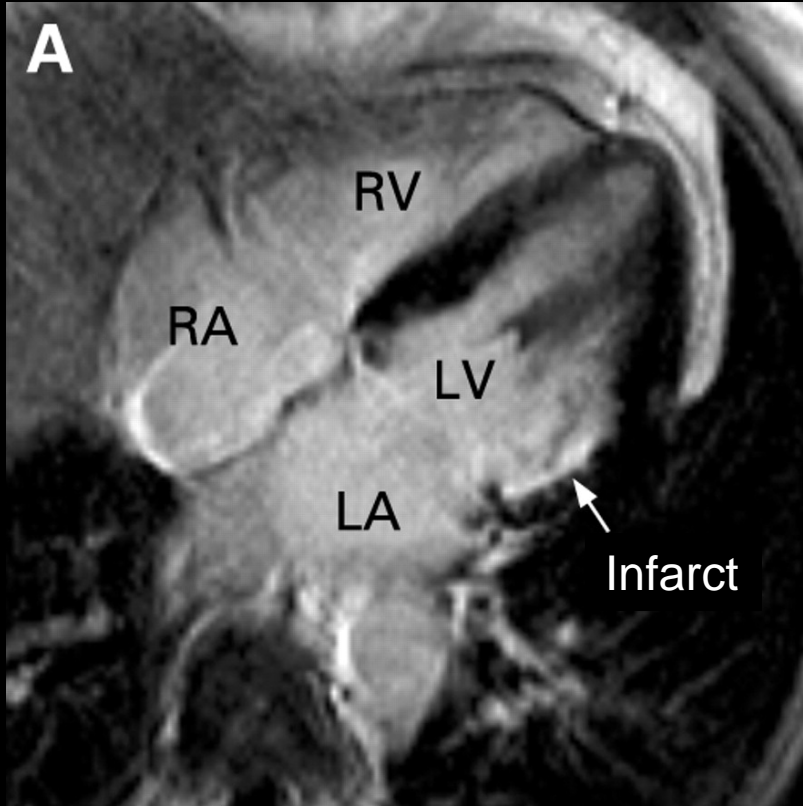


Old Anterior Infarct: True or False ?

PERSANTIN Tc-99m SESTAMIBI MYOCARDIAL PERFUSION STUDY

CONCLUSION:

Probable anterior infarction with minimal peri-infarctional ischaemia.

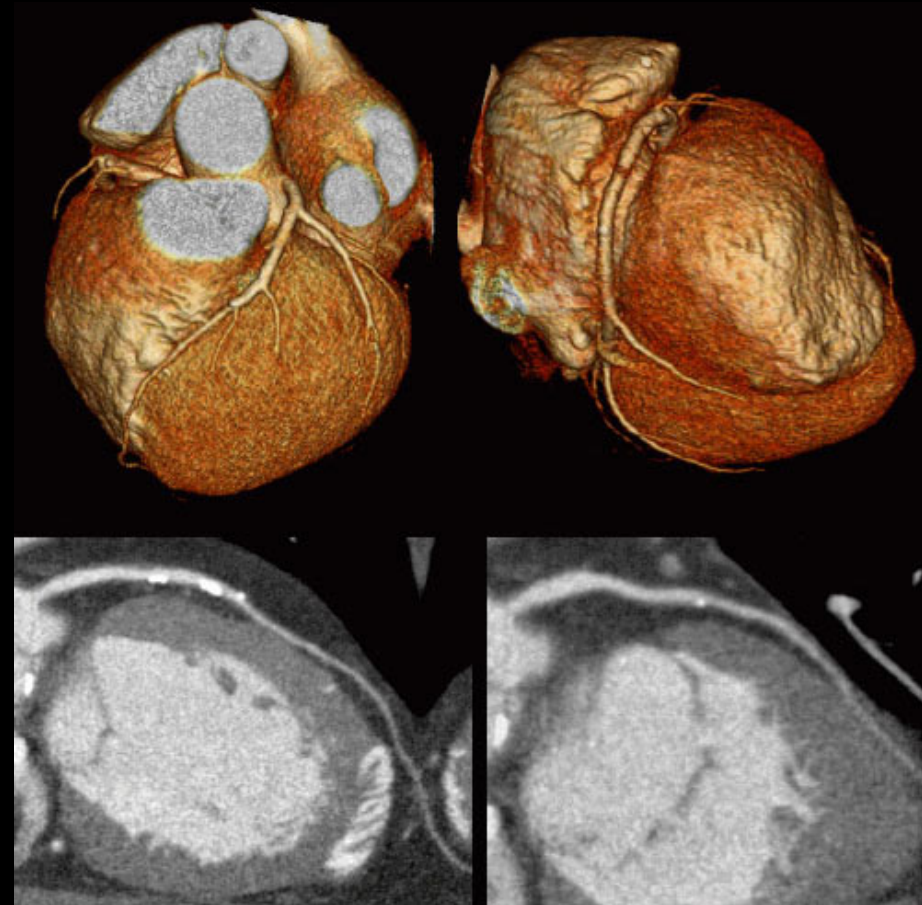


MRI

- Cost \$700-\$800
- No Medicare rebate
- Service Location
 - St Vincent's Public
 - RPA Medical Centre (private)
 - North Shore Private – new service
 - Westmead Public (no cardiologists reporting)

CT Coronary Angiography 2011

- Reported by Cardiologists or Radiologists



CT CORONARY ARTERIES

- **Item 57360**
-where the request is made by a specialist or consultant physician
- the patient
 - has stable symptoms consistent with coronary ischaemia,
 - is at low to intermediate risk of coronary artery disease
 - and would have been considered for coronary angiography
- or
 - the patient requires exclusion of coronary artery anomaly or fistula
- or
 - the patient will be undergoing non-coronary cardiac surgery e.g. valve Sx

CT CORONARY ARTERIES

- **Item 57360**
 - **Schedule Fee \$700**
- **Minimum 64 slice scanner (320 slice)**
- **Equipment >10 yrs old**
 - **1/2 Schedule Fee i.e \$350**

CT Appropriateness Criteria AHA/ACC 2009

- 60 indications appropriate
- 55 “indications” inappropriate
- 52 indications uncertain

- “Appropriate” does not necessarily mean essential
 - alternative testing may be just as “Appropriate”
 - Testing may not change Mx in individual cases

Appropriate

- Possible angina
 - alternative testing
 - Difficulty with performance
 - Equivocal results
- Some asymptomatic patients
 - Intermediate risk (10%-90% Obstructive CAD)
 - Low risk (<10% Obstructive CAD) but FHx premature CAD
- LV systolic dysfunction
?CAD/?Cardiomyopathy
- Noncardiac surgery
- Prior to valve surgery
- ? ACS – ongoing research

Inappropriate

- Definite AMI
- High probability of obstructive coronary disease requiring Stent or CABG
- Serial testing
 - No CAD on imaging test < 2 yrs ago
 - Known CAD on imaging test < 2 yrs ago and asymptomatic or angina stable and not worsening

Inappropriate

- Post Revascularisation
 - CABG < 5 yrs ago, asymptomatic
 - Stent < 2 yrs ago, asymptomatic
 - Stent < 3 mm diameter
- LV function (Echo, MRI preferable)
- Cardiac Mass (Echo, MRI preferable)

Risks of Invasive Angio

- Total major complications 1.7% (includes other not listed complications)
- Death 0.11%
- Myocardial infarction 0.05%
- Stroke 0.07%
- Arrhythmia 0.38%
- Vascular access complication 0.43%
- Haemodynamic complications 0.26%
- Perforation of cardiac chamber 0.03%



Radiation



- Relevant: CTCA, calcium scoring, cath, nuclear: Sestamibi
- Nil with echocardiogram/ MRI
- 2011:
 - CTCA dose reduced
 - CTCA = Cath = 1/3 of Sestamibi
 - Ca Score = 1/2 of CTCA
 - Report dose

Radiation

- Greater risk in:
 - Young
 - Females
- Can be avoided completely in many patients by use of stress echocardiogram
 - “Systems based approach to pt safety”

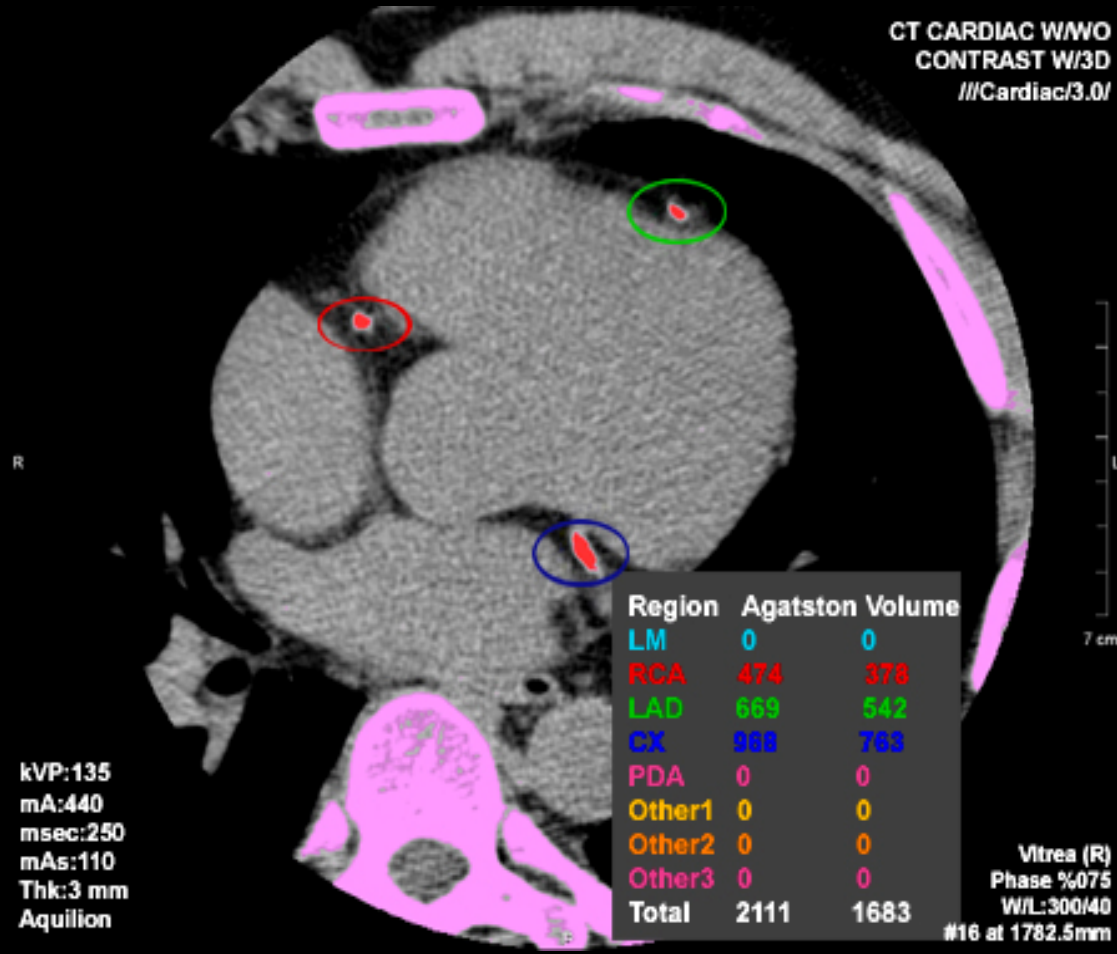


Radiation Risk

- 20 yo Female 16 mSv , Ca Risk 0.3%
- 75 yo Male 4 mSv , Ca Risk 0.01%
- 50 yo Male 7 mSv , Ca Risk 0.035%

- xrayrisk.com
- Natural Background radiation 3.1 mSv /yr
- Estimated lifetime risk of MVA death is 1%

Ca Scoring



Ca Scoring

- Available at no additional cost with CT coronary angiogram
- No medicare rebate if performed alone
- Should not be performed routinely with every CT coronary angiogram
- Reasonable in a limited number of cases but not essential-alternatives
- Not universal screening test

Quantitative Stenosis Grading (SCCT)

Grade	Stenosis %
Normal	0 %
Minimal	<25 %
Mild	25-49 %
Moderate	50-69 %
Severe	>70 %
Occluded	100 %

Normal



Minimal (<25%)



Mild (25-49%)



Moderate (50%)

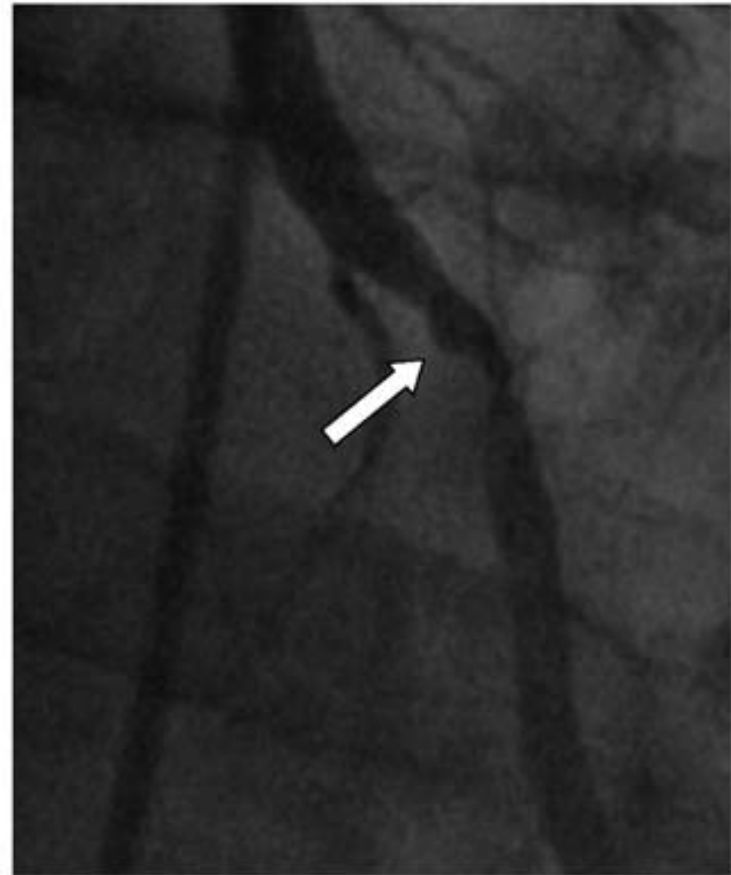
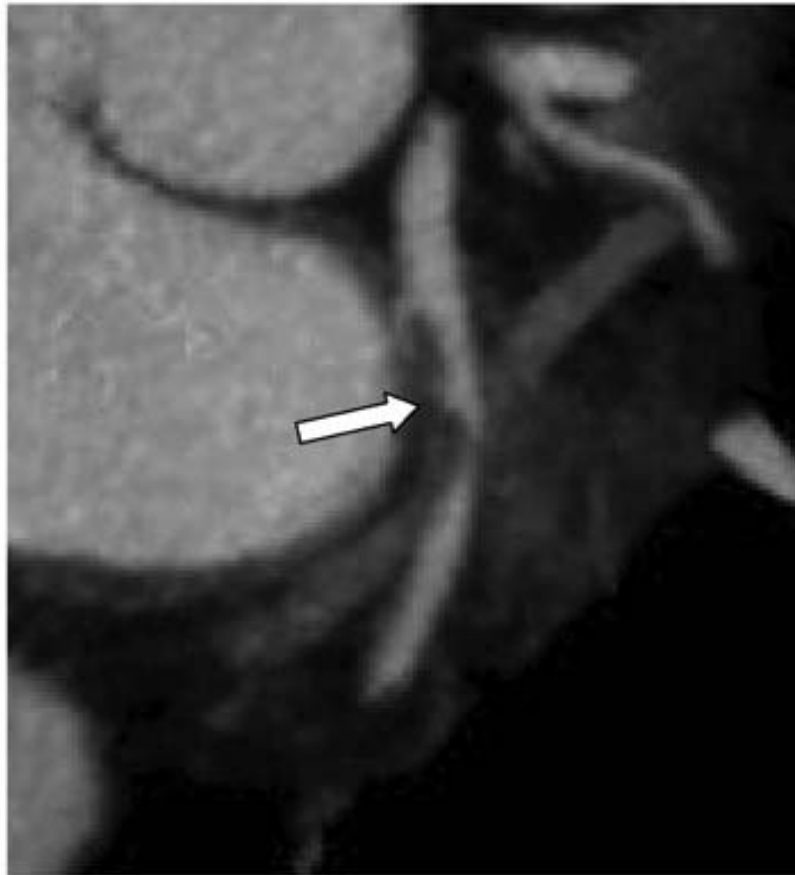


Moderate (70%)



Severe (>70%)

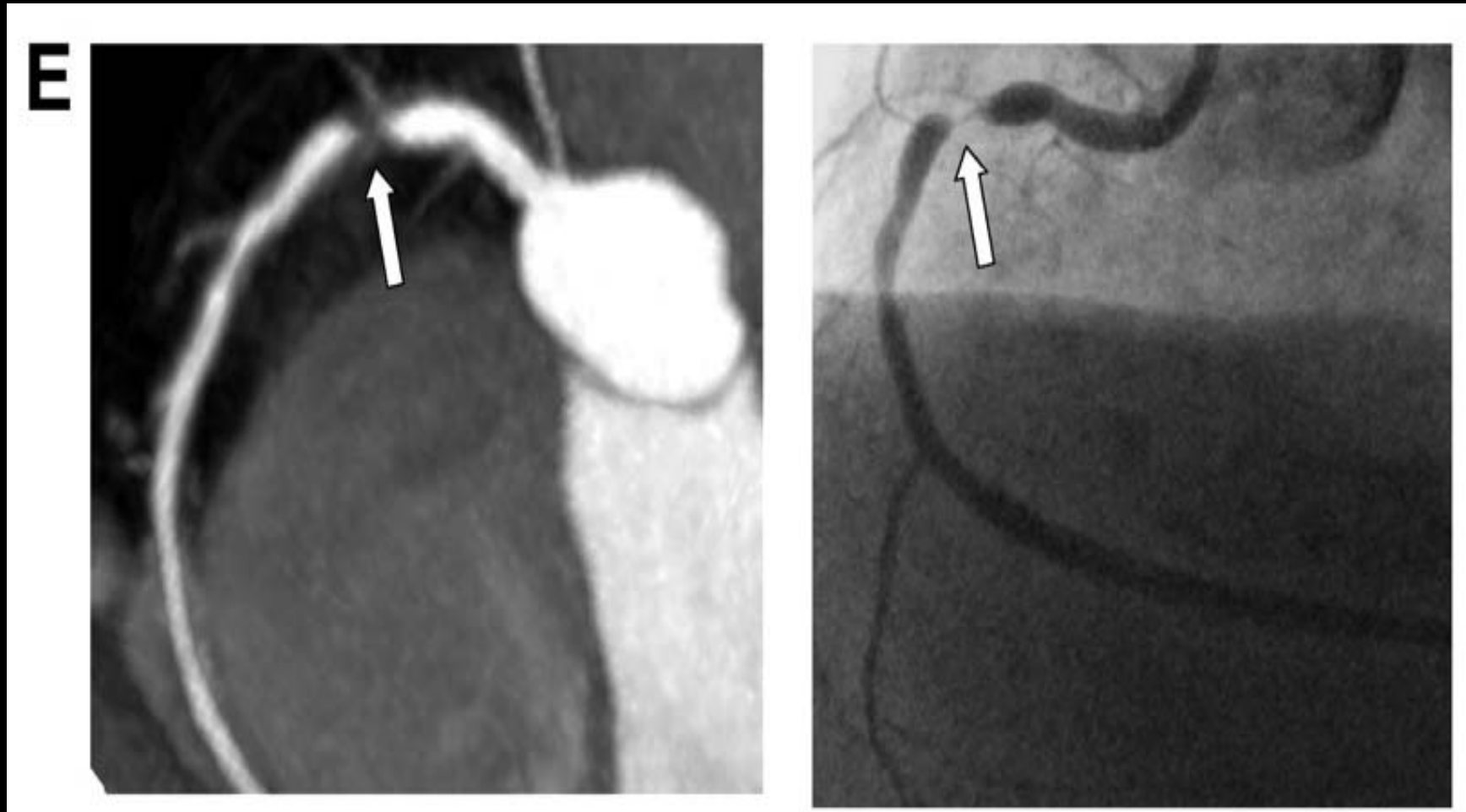
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CT

Invasive

Occluded



THE END

No time for conclusions

MRI: Subendocardial Infarct

