

Non-invasive imaging techniques for defining myocardial infarction

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CHINESE CYBERSPIES
COOL NEW SEARCH ENGINES

TIME

HOW TO STOP A **HEART ATTACK** BEFORE IT HAPPENS

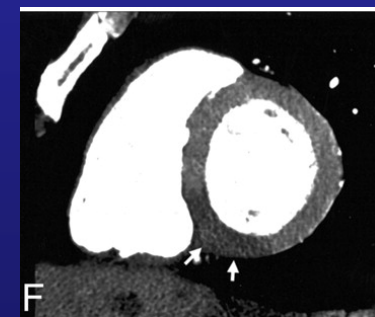
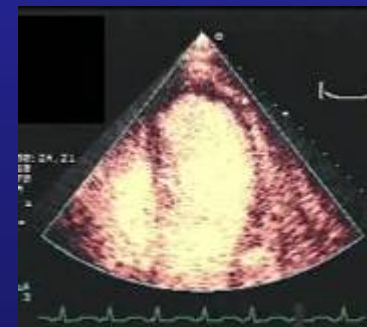
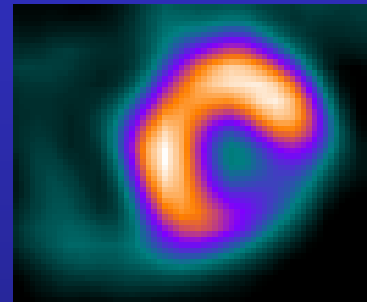
Amazingly detailed new **HEART SCANS** help doctors spot trouble without surgery. How technology could save your life



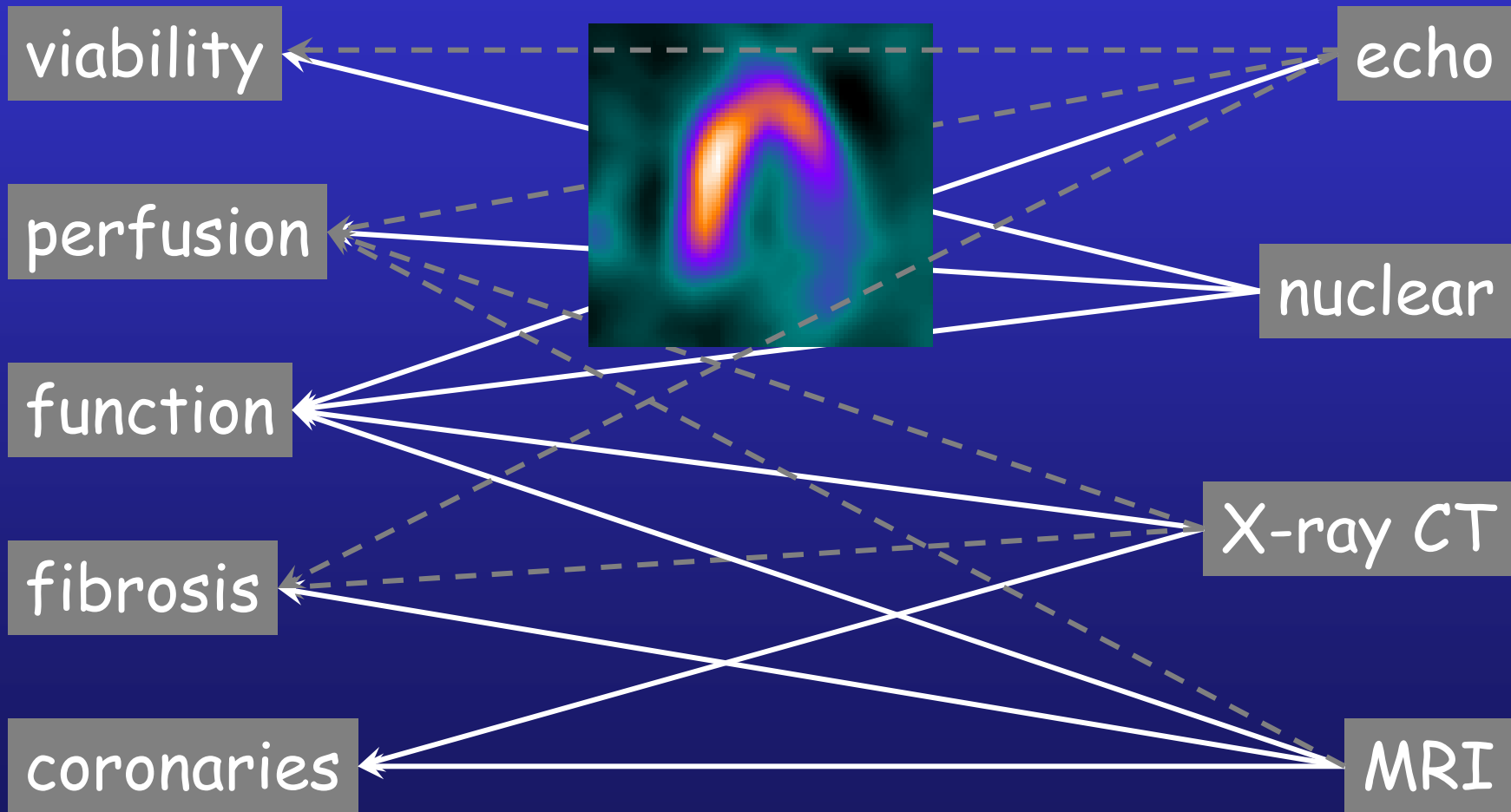
Mike Fackelmann, 50, holds a scan of his heart, which revealed a major blockage of a coronary artery (arrow)

Clinical roles of imaging in MI

- Diagnosis
- Description
- Complications
- Acute risk assessment
- Monitoring acute therapy
- Chronic risk assessment
- Guiding revascularisation
- Monitoring chronic therapy

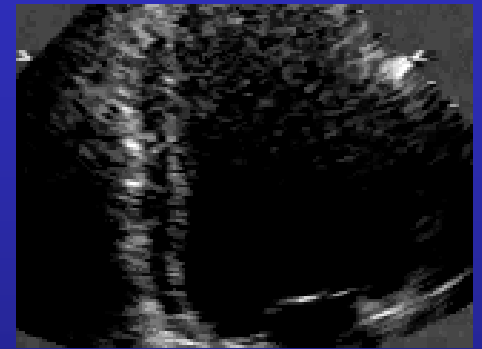


Non-invasive imaging and infarction



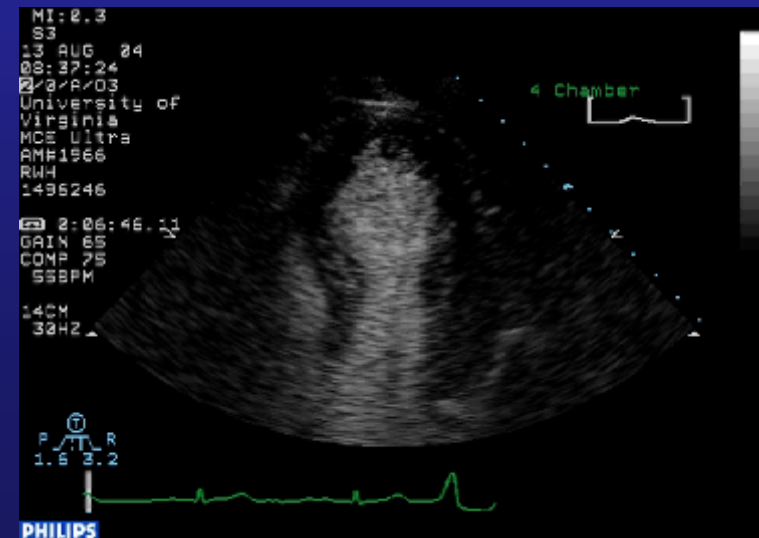
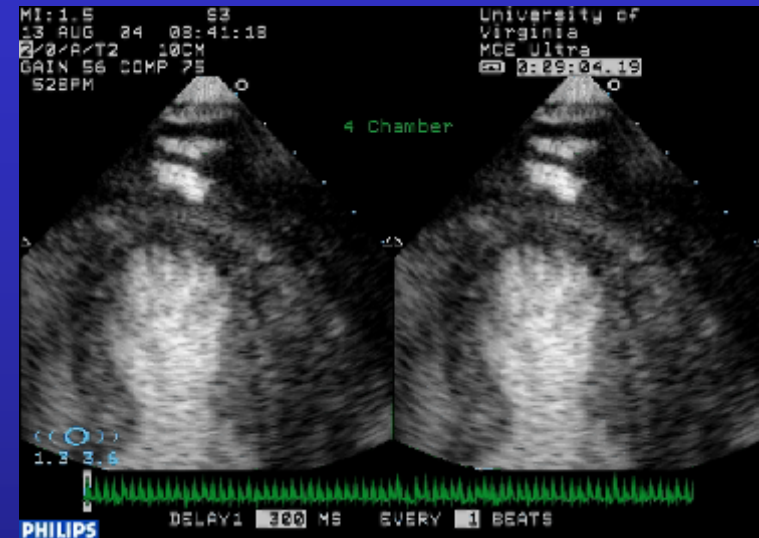
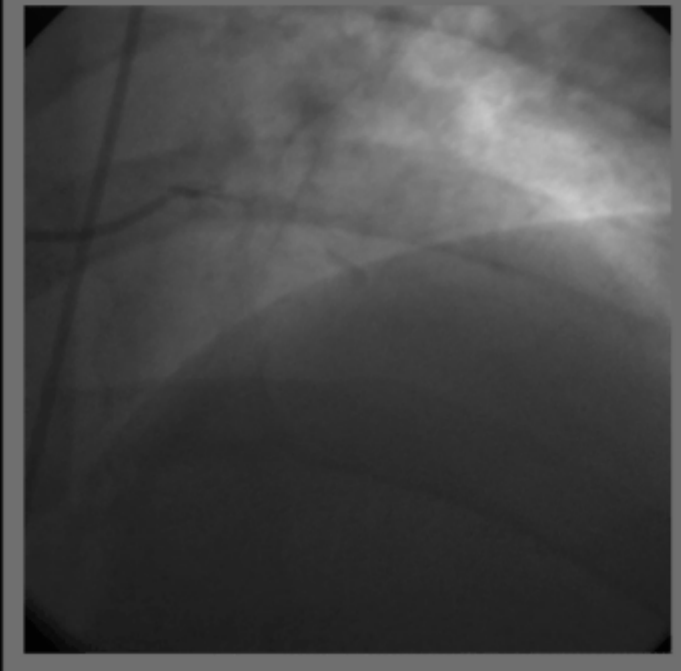
Echocardiography in acute infarction

- Emergency room triage
- Left ventricular function
- Non-ischaemic causes of chest pain
- Complications of acute infarction



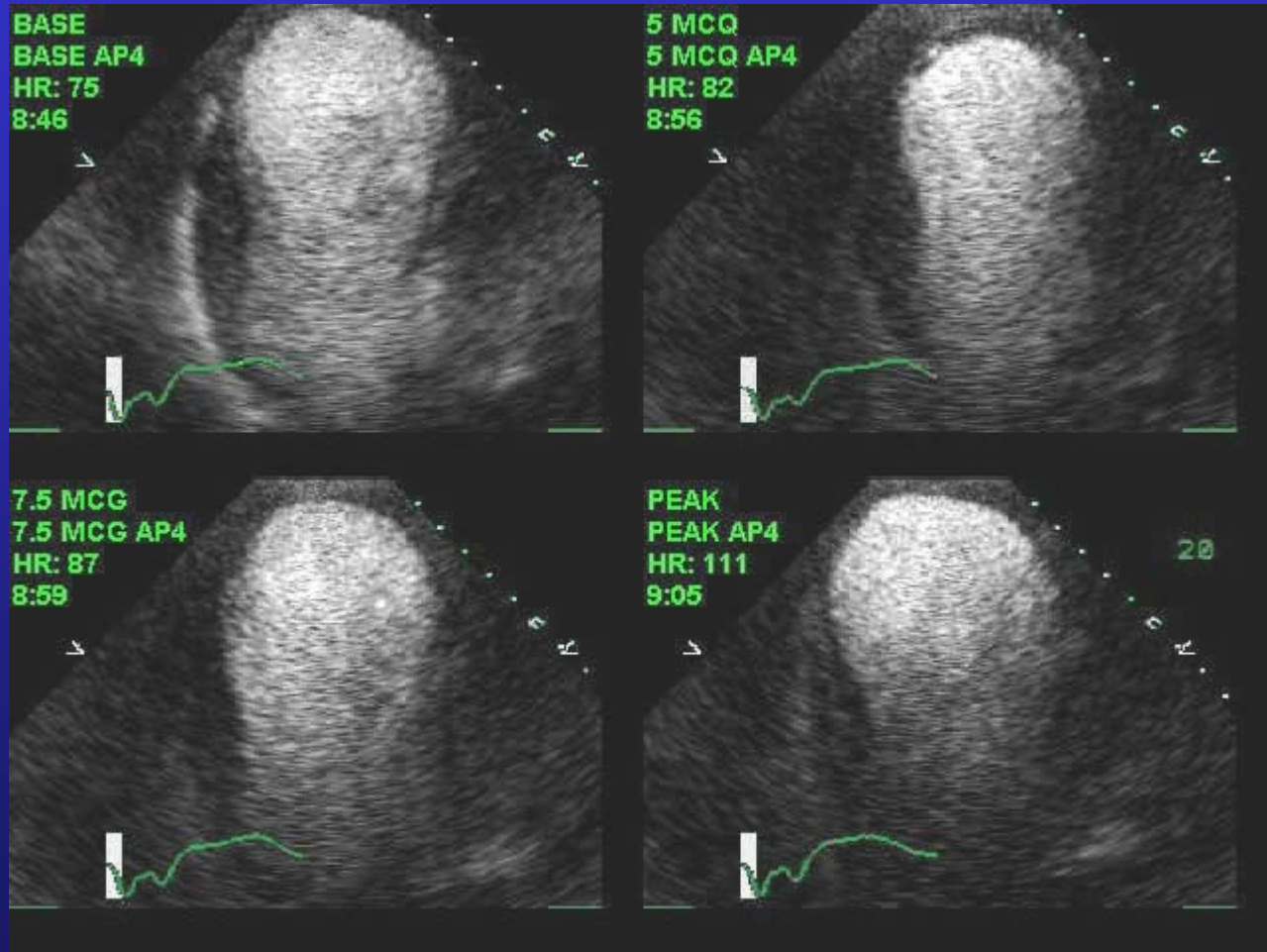
Acute myocardial infarction

Leaky Capillaries - not intended for diagnosis



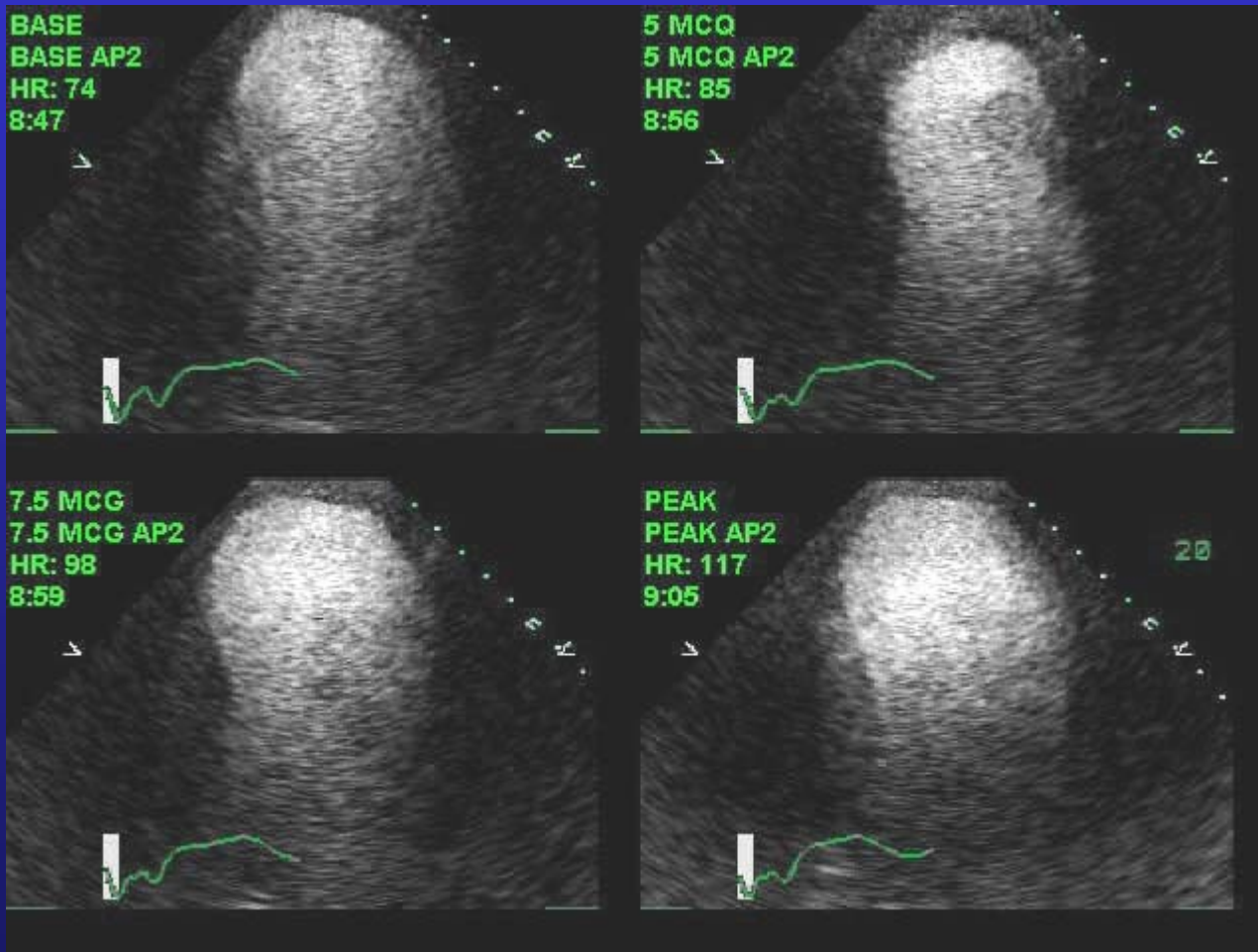
Tong KL, et al. JACC 2005.03.076

Dobutamine echo



Apical four chamber - biphasic response

Dobutamine echo

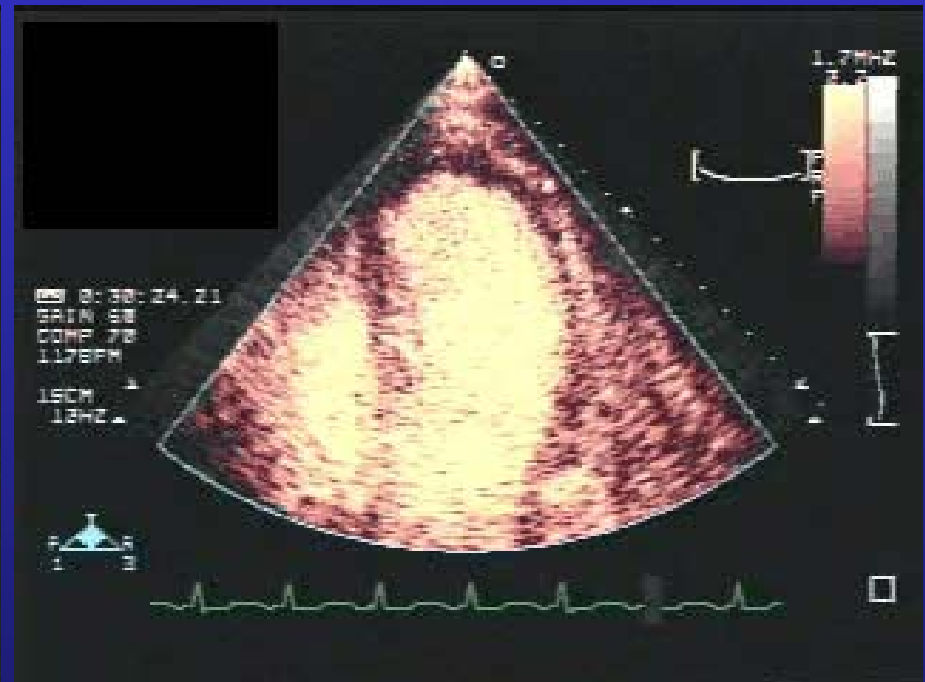


Apical two chamber - biphasic response

Stress contrast echo



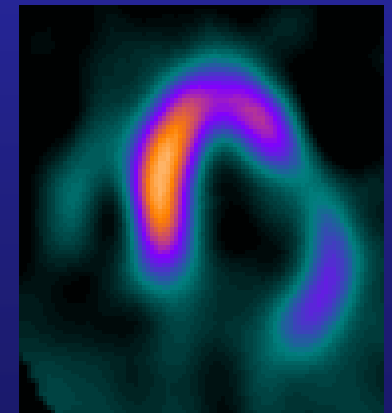
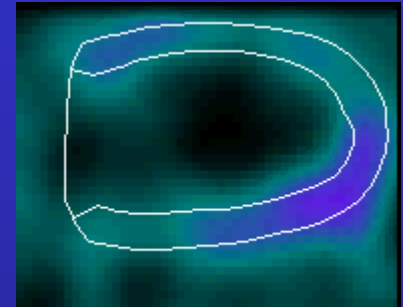
Baseline



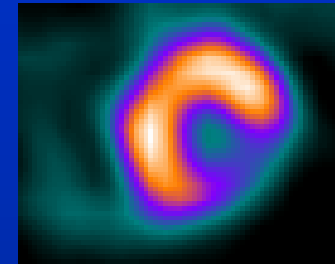
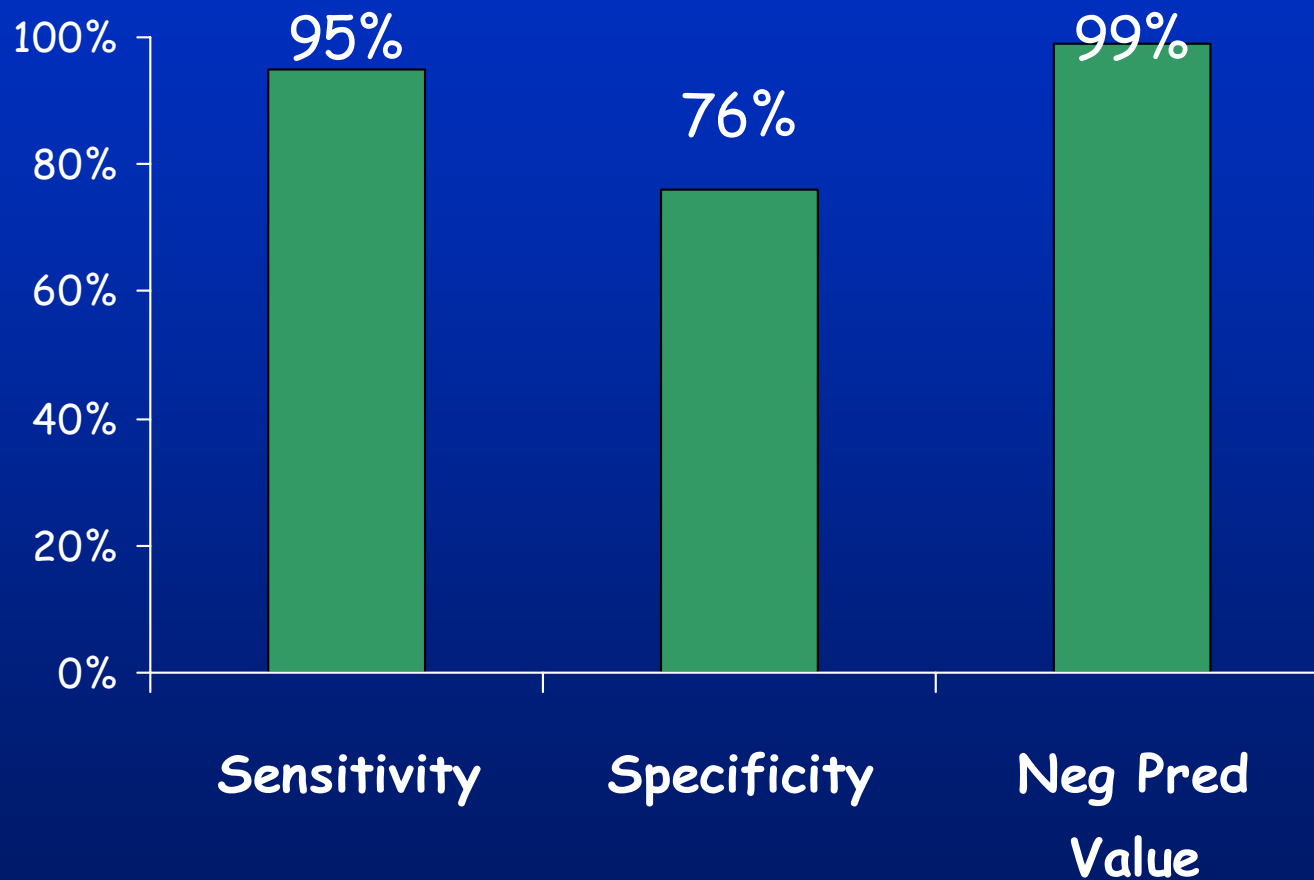
Dipyridamole

MPS in acute infarction

- Emergency room triage
 - High negative predictive value (cf echo)
 - Low positive predictive value (cf echo)
- Extent of infarction
- Risk assessment after infarction



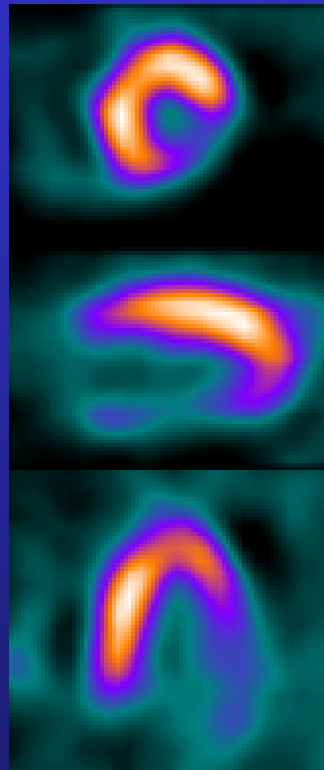
MPS Detection of MI in Emergency Dept



Wackers 1979
Varetto 1993
Hilton 1994
Kontos 1997
Tatum 1997
Heller 1998
Kontos 1999

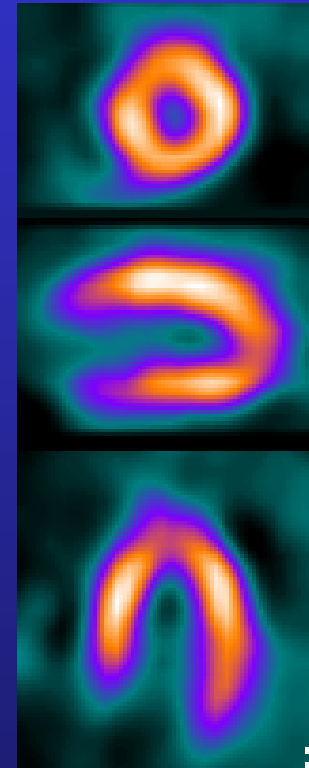
n = 2316

Assessing myocardial salvage



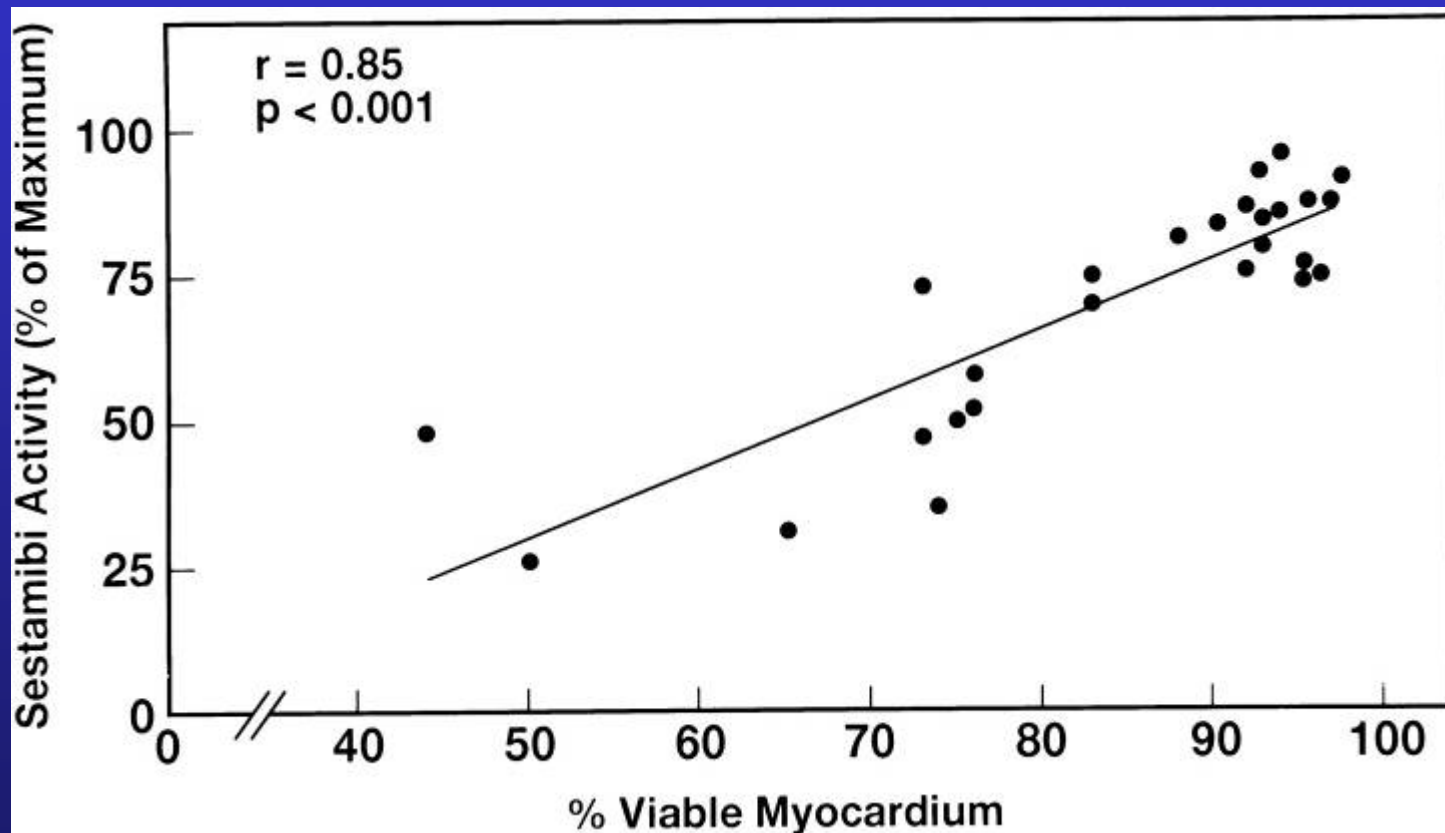
STEMI
Rest MIBI injection
23% LV defect

Primary PCI →



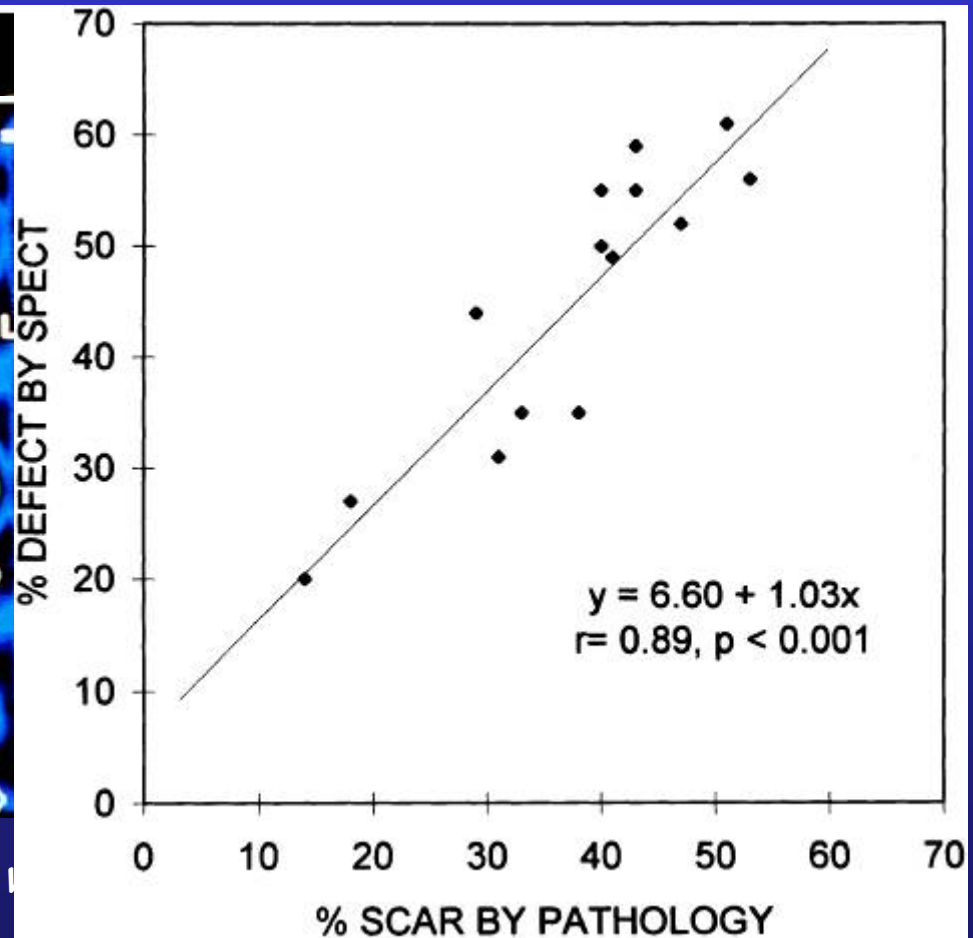
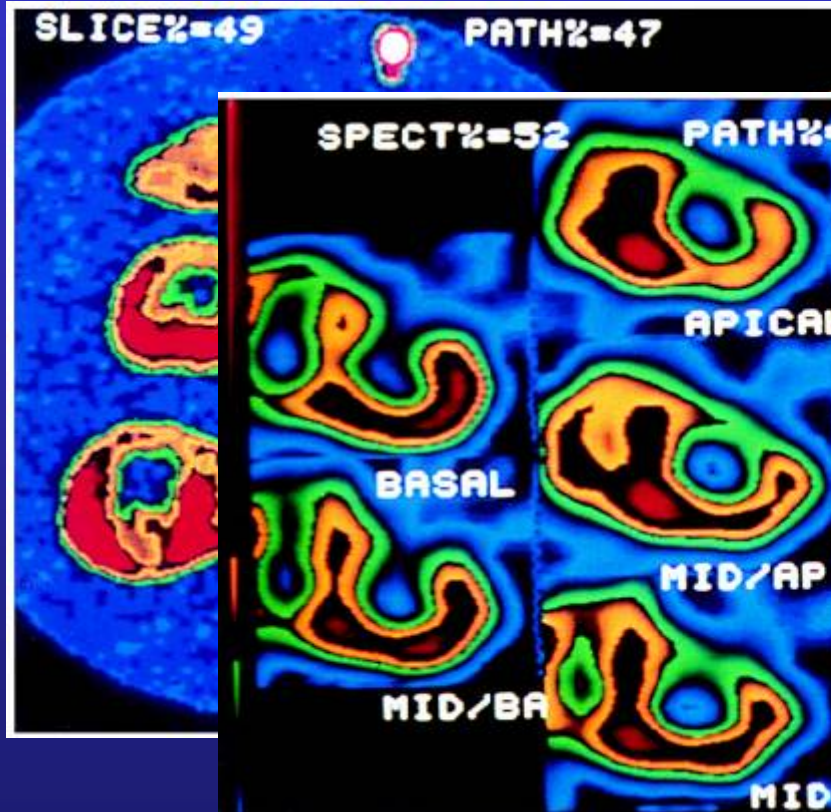
Day 4
Rest MIBI injection
0% LV defect

Viability detection by MPS



Dakik HA, et al. Circulation 1997; 96: 2892-8
21 patients with biopsy during CABG

Infarct detection by MPS

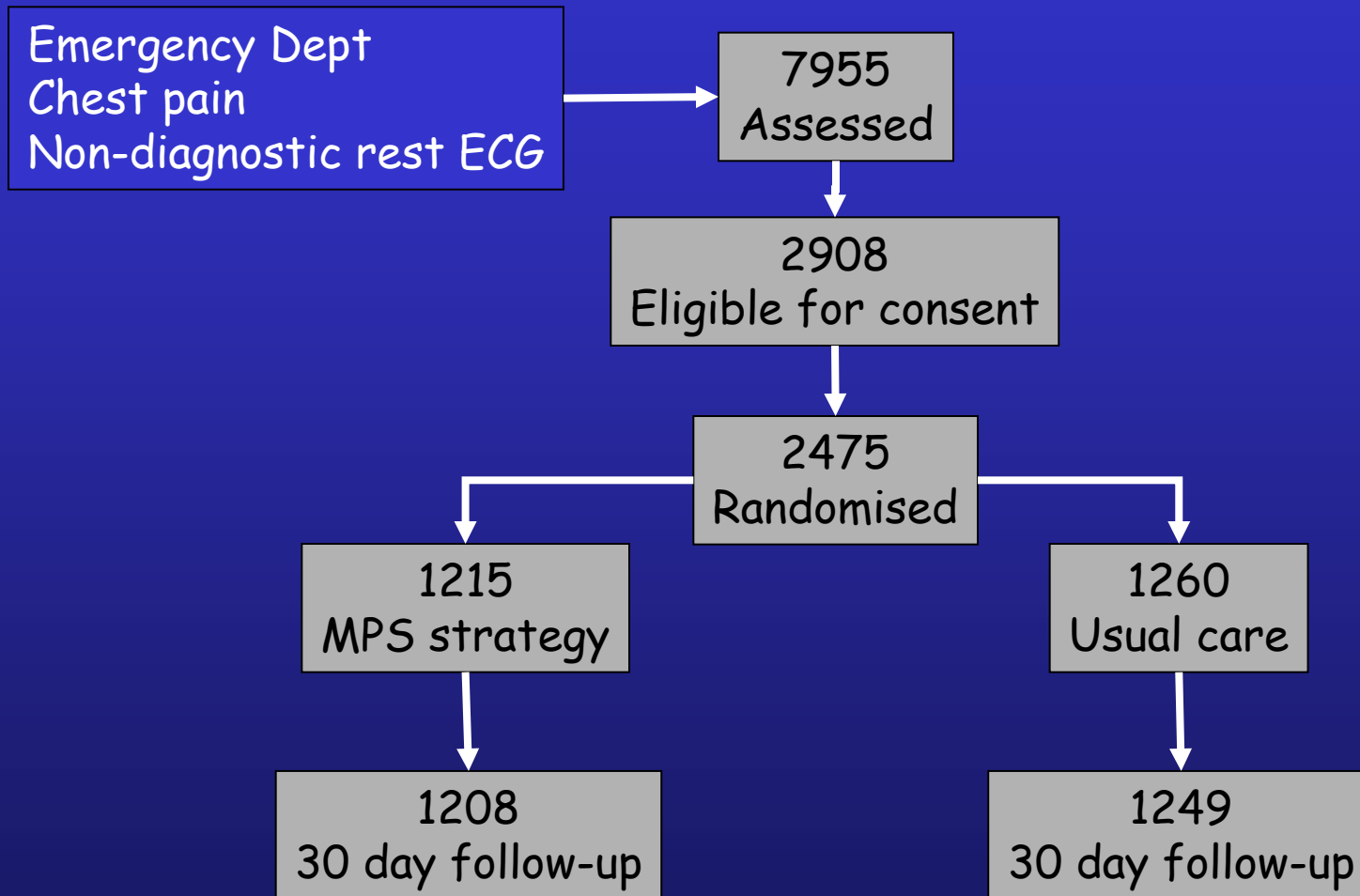


Medrano R, et al. Circulation 1996; 94: 1010-7
15 patients undergoing transplantation

Validation of infarct sizing by MPS

- Close associations with
 - biochemical markers
 - left ventricular function
 - fibrosis by histology
 - short and medium-term mortality
- Tracer uptake predicts recovery of function
- Interventions that reduce measured infarct size improve clinical outcome

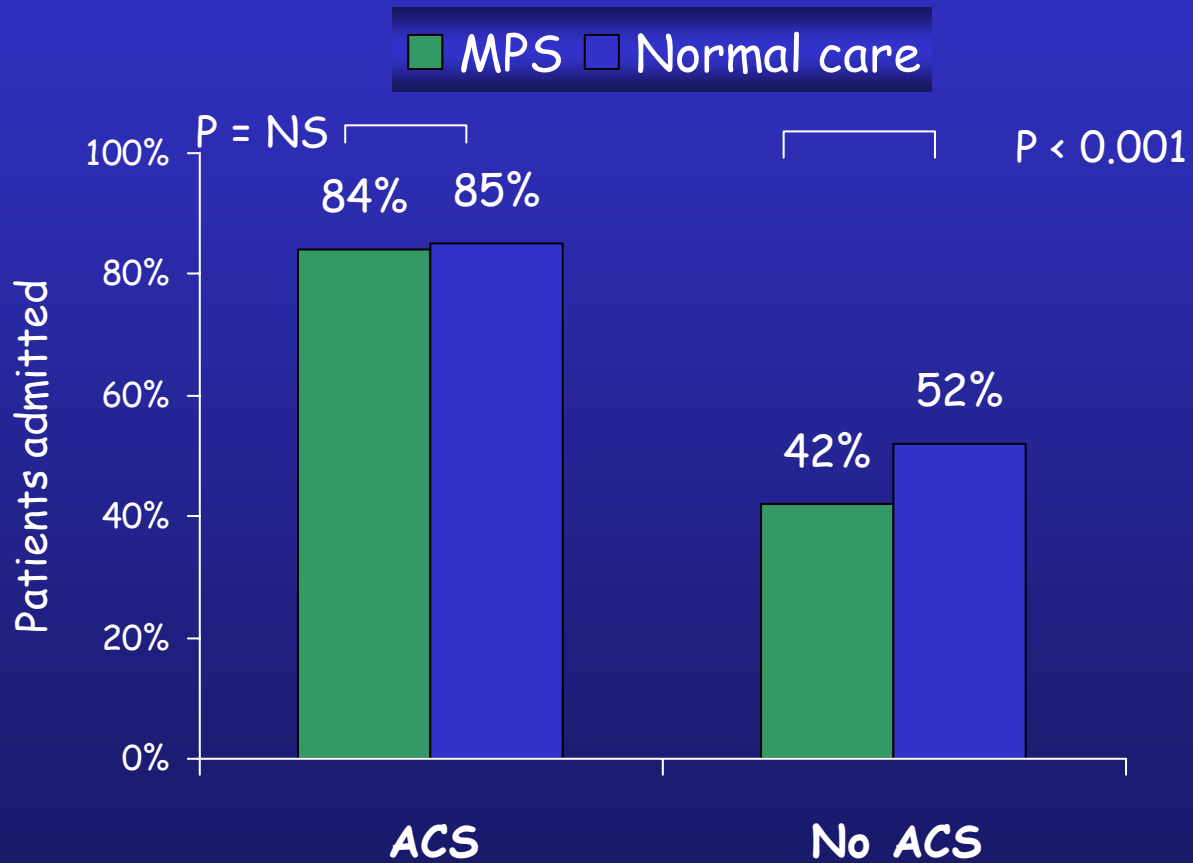
ERASE Trial



Udelson JE, et al. JAMA 2002; 288: 2693-700

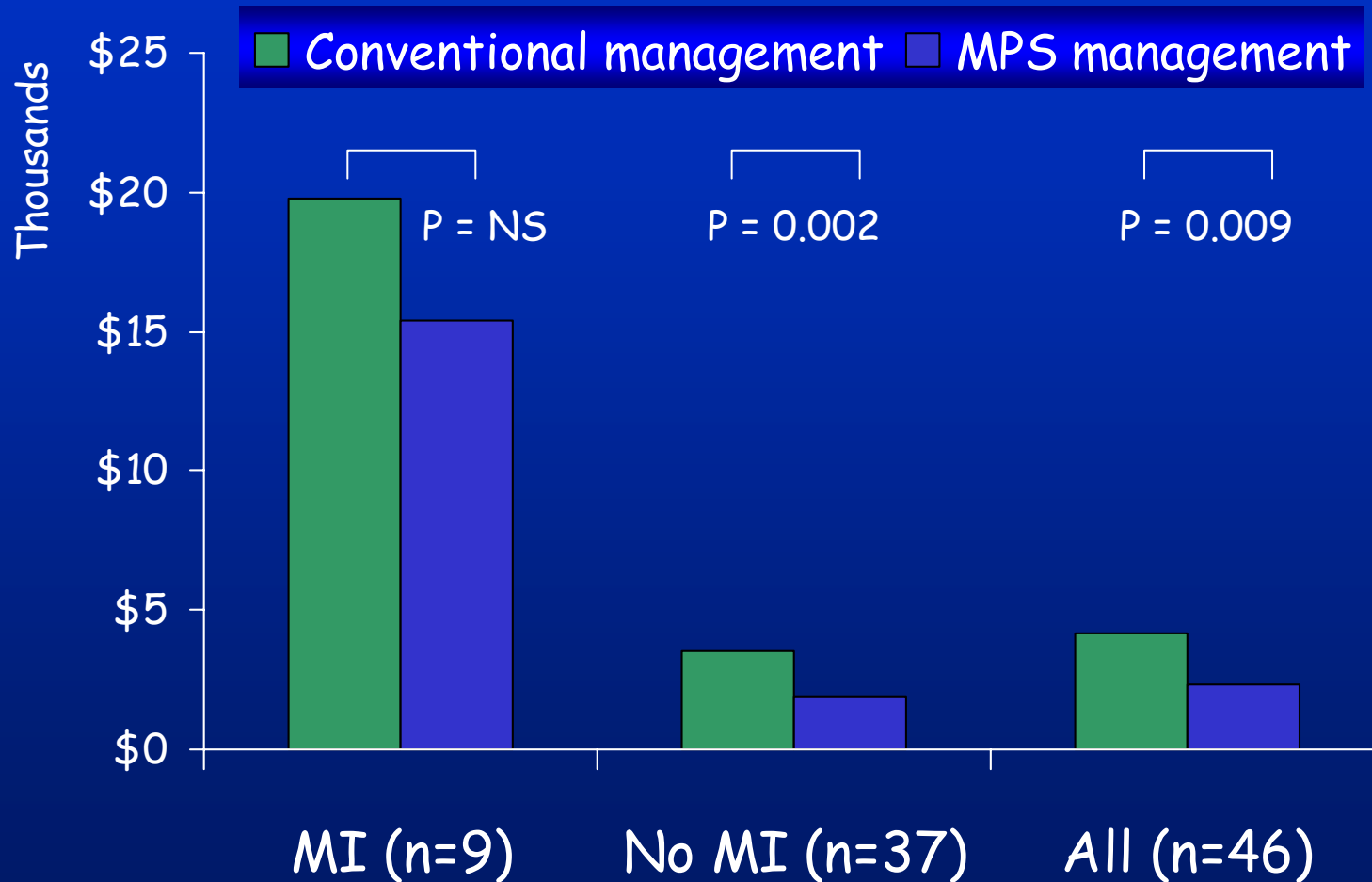
ERASE Trial

30 day outcome unchanged



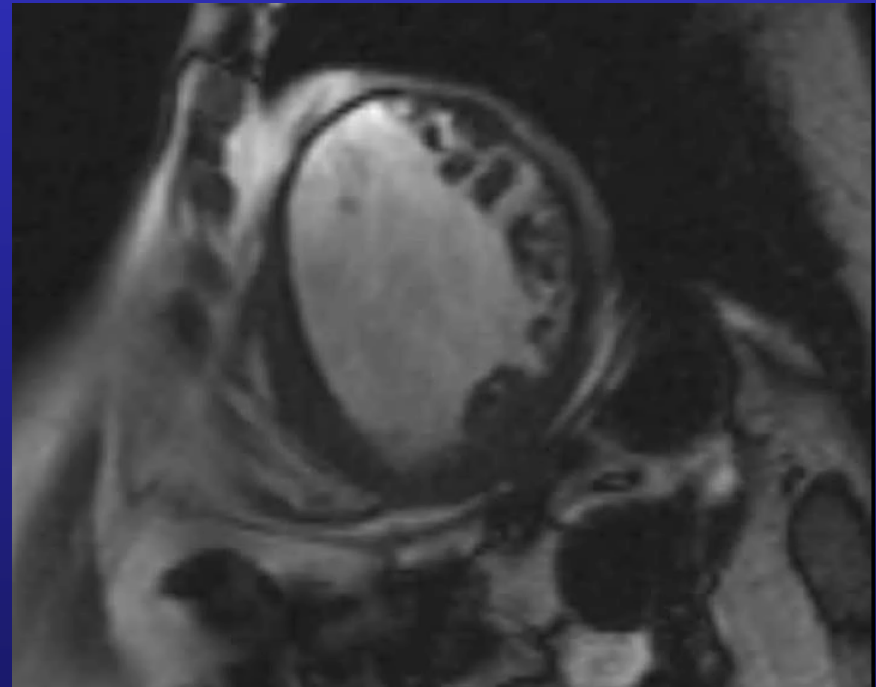
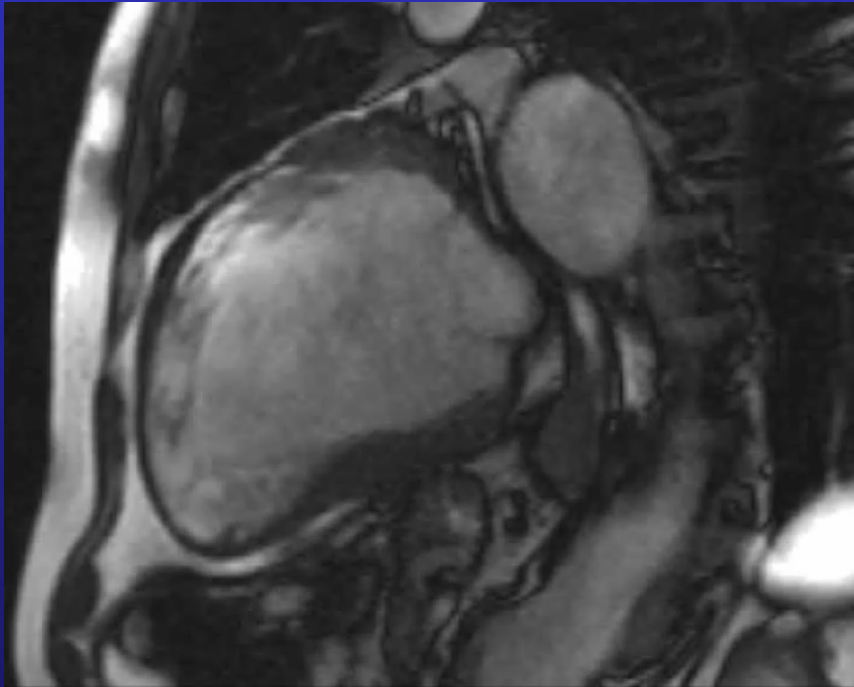
Udelson JE, et al. JAMA 2002; 288: 2693-700

Cost of MPS in the Emergency Dept



Stowers SA, et al. Ann Emerg Med 2000; 35:17-25
Acute CP, non diagnostic ECG, randomised management

Anterior MI



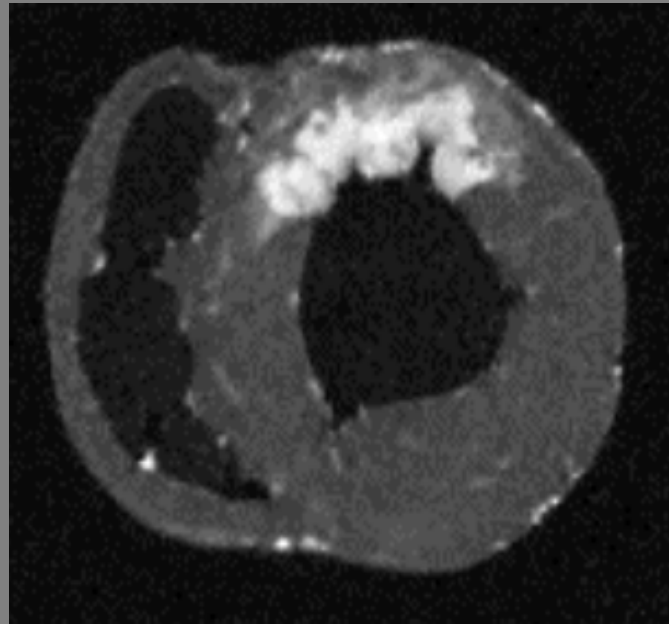
Gadolinium-DTPA

- Paramagnetic contrast agent
- Speeds T1 relaxation of neighbouring H₂O
- Uptake into extracellular water or intracellular if damaged
- Increases signal from areas with increased extracellular space (e.g. myocyte necrosis or myocardial fibrosis)
- Therefore negative imaging of viability

MR late gadolinium enhancement



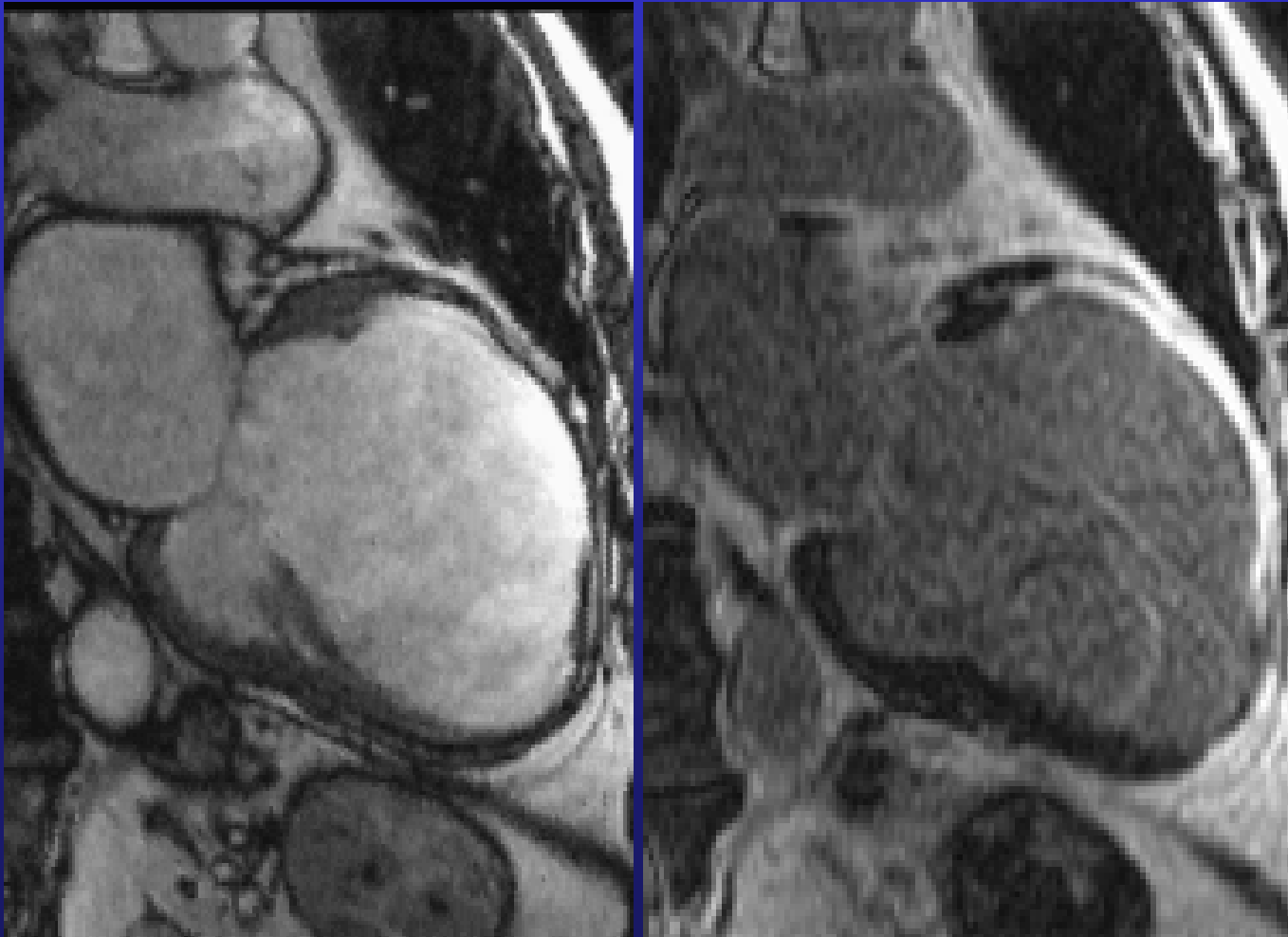
TTC



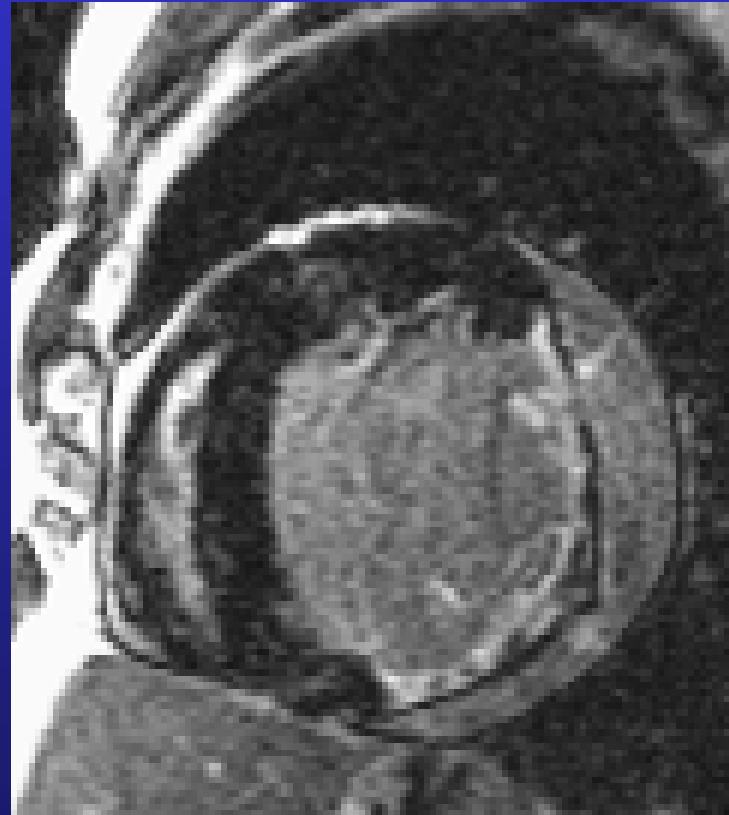
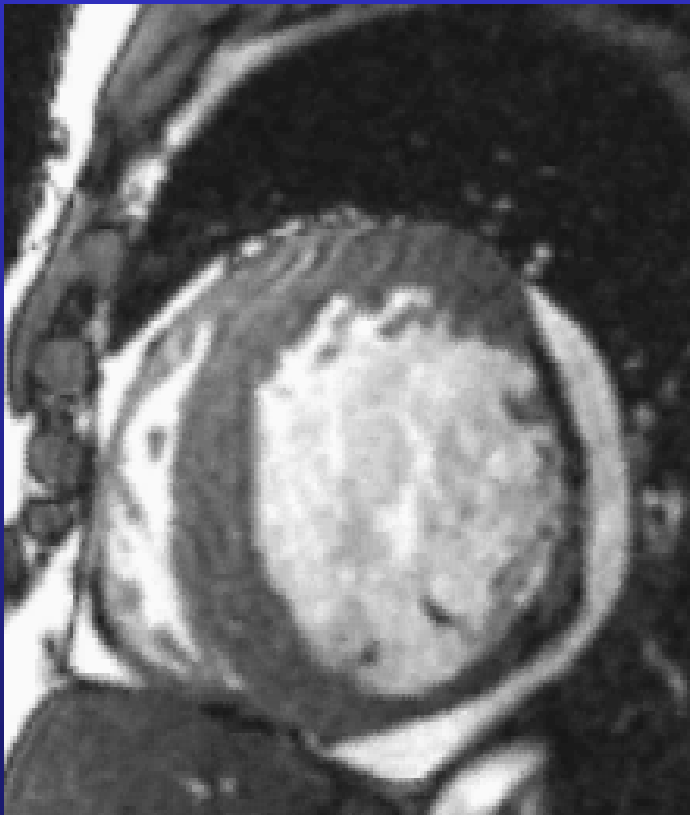
MRI

Courtesy R Judd

Transmural anterior infarction



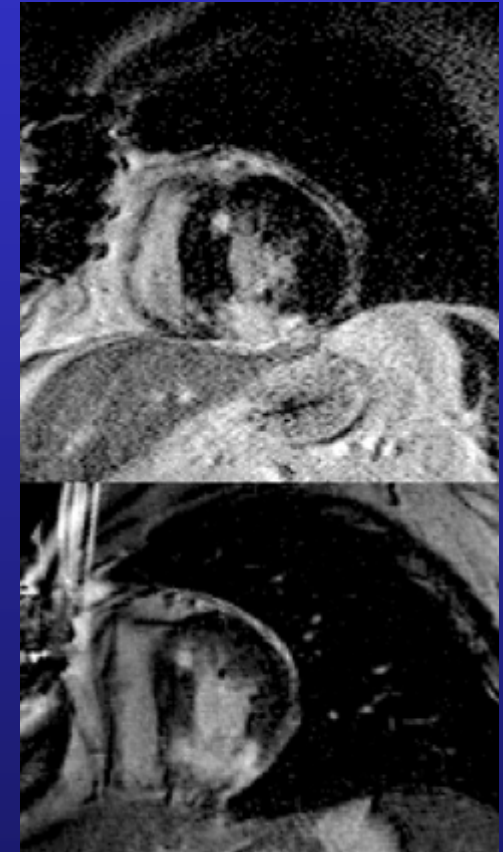
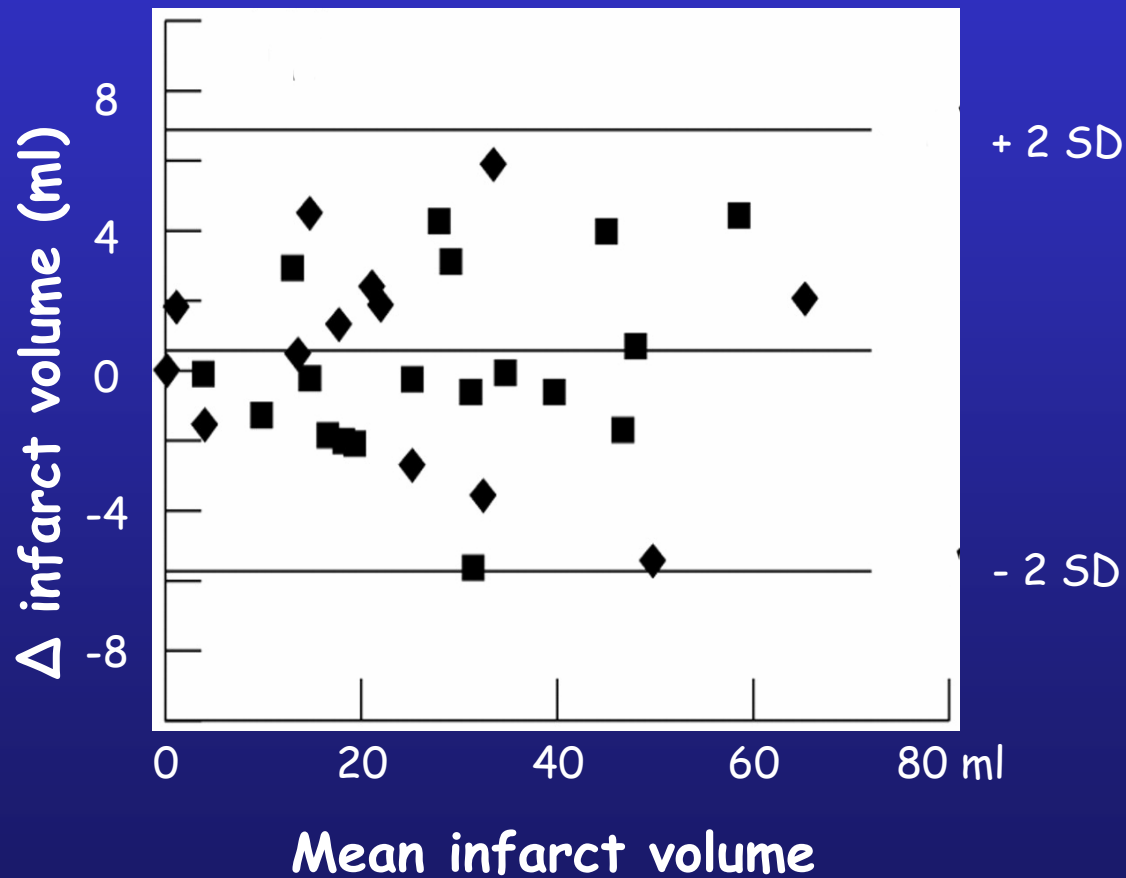
Chronic transmural infarction



Non-transmural infarction

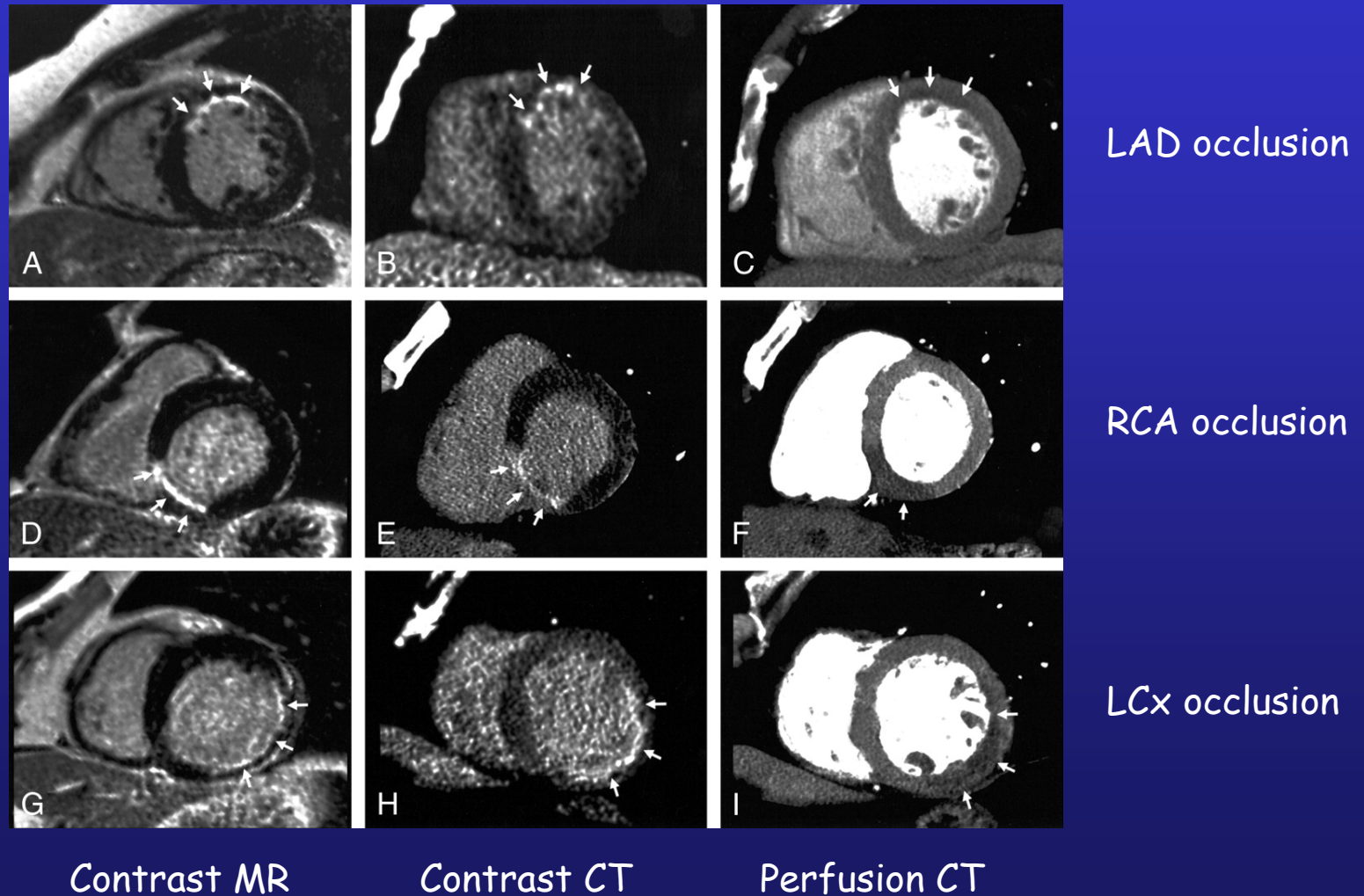


Reproducibility of MR infarct sizing

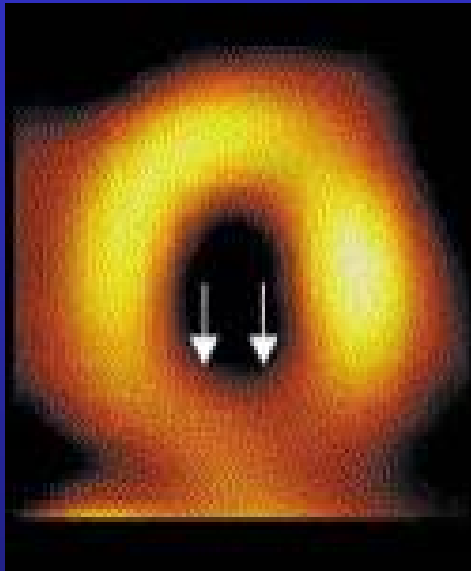


Bulow H, et al. Heart 2005; 91: 1158-63
33 patients, mean interval 9 months

Late contrast enhancement, MR vs CT



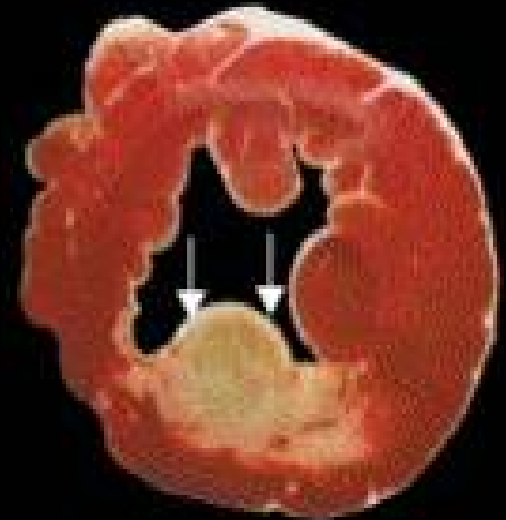
Infarct detection



MPS



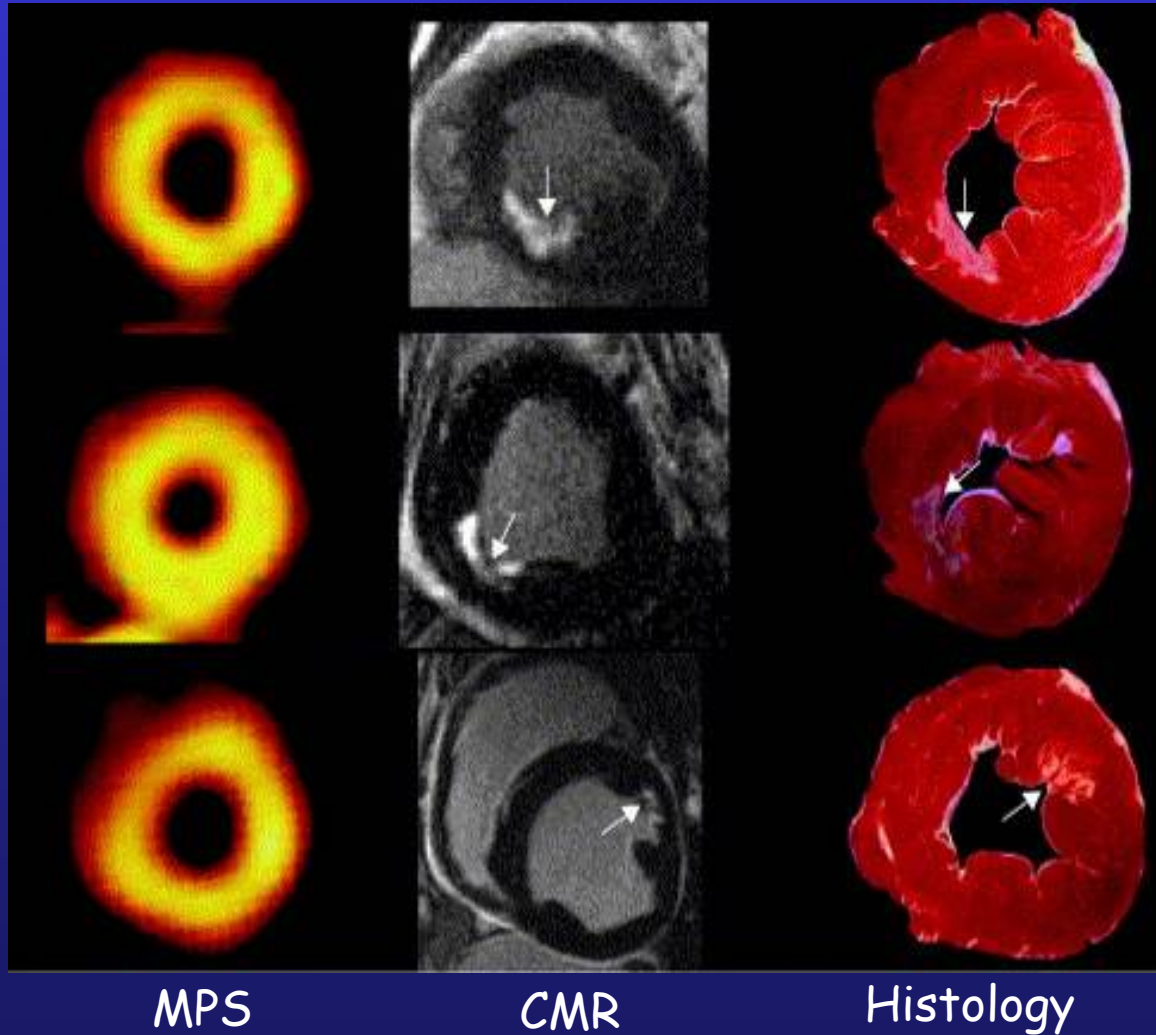
CMR



Histology

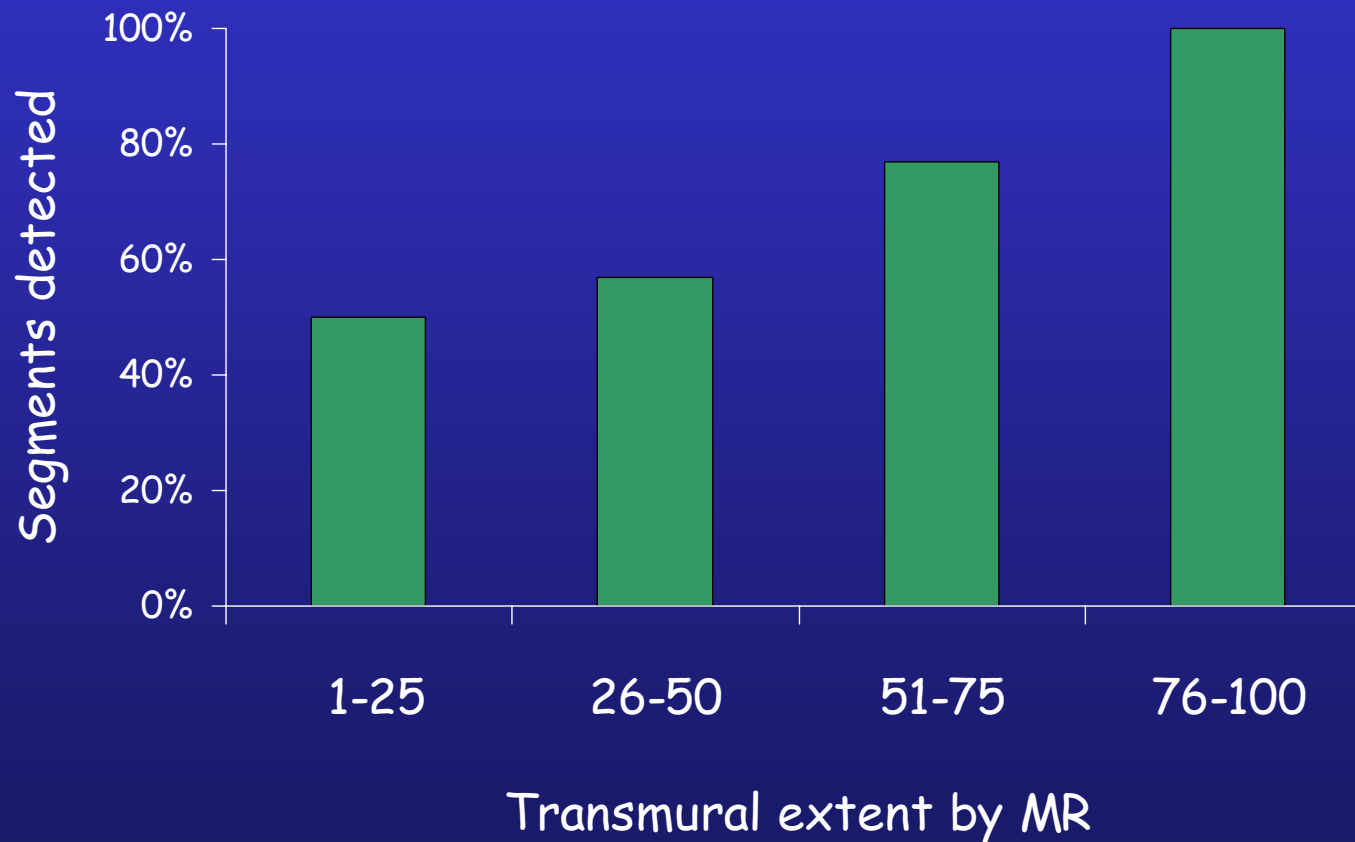
Wagner A, et al, Lancet 2003; 361: 359-60

Infarct detection



Wagner A, et al, Lancet 2003; 361: 359-60

Infarct detection by MPS



Wagner A, et al, Lancet 2003; 361: 359-60

Definition of myocardial infarction

Developments since 2000

- Better understanding of imaging viability and the ischaemic syndromes (EHJ 2004; 25: 815-36)
- Validation of late Gd enhancement of non-viability on MRI
- Wider clinical availability of MRI and cardiac CT
- Demonstration of cost effectiveness of radionuclide imaging in emergency department triage (ERASE study)

Proposed imaging definition of infarction

"Imaging evidence of new loss of viable myocardium or new regional wall motion abnormality in the presence of at least one other defining factor of infarction (clinical, ECG, biochemical) and in the absence of a non-ischaemic cause"

Discussion point 1

- To distinguish old from new?
- ?restrict definition to loss of viable myocardium
- ?require previous normal imaging or just knowledge of no prior MI

Discussion point 2

Discussion point 3

- Is this necessary if combined with other aspects of definition?