EAE TEACHING COURSE 2010
Belgrade, Serbia
October 22-23, 2010

ACUTE MYOCARDIAL INFARCTION

and other causes of

ACUTE CHEST PAIN

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Lisbon, PT

Chest Pain

Cardiac

Coronary ArteryDisease (STEMI, NSTEMI, UA)
Myocarditis
Pericarditis
Myopericarditis
Cardiomyopathy
Valvular disease
Tako-Tsubosyndrome

Gastrointestinal

Gastritis/Pepticulcer
Esophagealdiseases
Reflux
Spasm
Esophagitis
Galbladderdisease
Pancreatitis

Vascular

AorticDissection
AorticAneurysm
Pulmonary Embolism
PulmonaryHypertension
CerebrovascularDisease

Musculoskeletal

Cervical DiskDisease
Arthritisoftheshoulder
Costochondritis
IntercostalMuscleCramps
SubacromialBursitis
Rib fracture
Herpes zoster

Pulmonary

Pleuritis or Pneumonia
Tracheobronchitis
Pneumothorax
Mediastinitis or Mediastinal Emphysema

Psychogenic

Anxietydisorders
Panicdisorder
Hyperventilation
Somatoformdisorders

INITIAL STRATEGY

HISTORY

Chest pain characteristics and associated symptoms

Atypical complaints: younger (25-40 yrs) and older (>75), women, pts with diabetes, chronic renal failure or dementia

PHYSICAL EXAMINATION

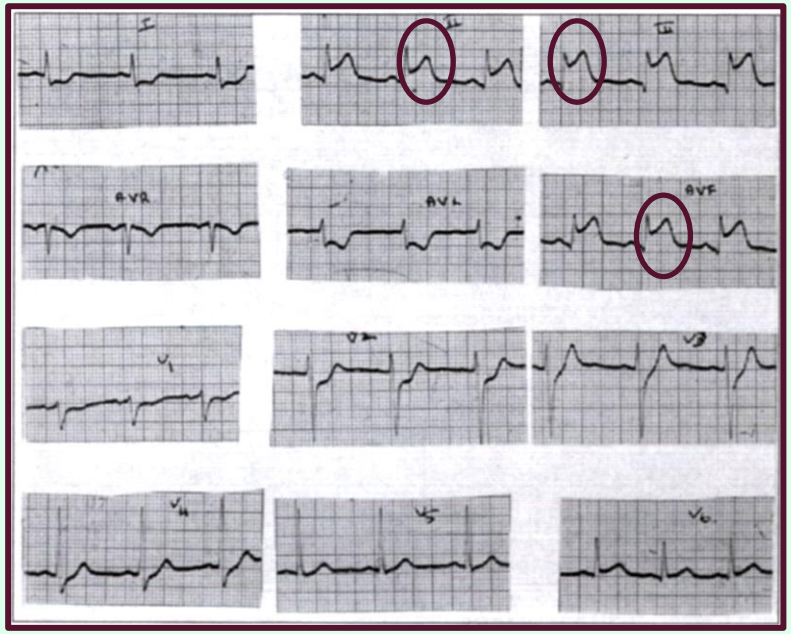
Usually normal
HF, hemodynamic instability, new MR murmur → high-risk
Should target potential non-cardiac causes for the symptoms (prominent murmurs, friction rub, fever, abnormal lung sounds, chest pain after palpation)

ECG

The easiest, simplest, most important tool
One of the "vital signs" for pts with chest pain
Performed/interpreted within 10 minutes of presentation

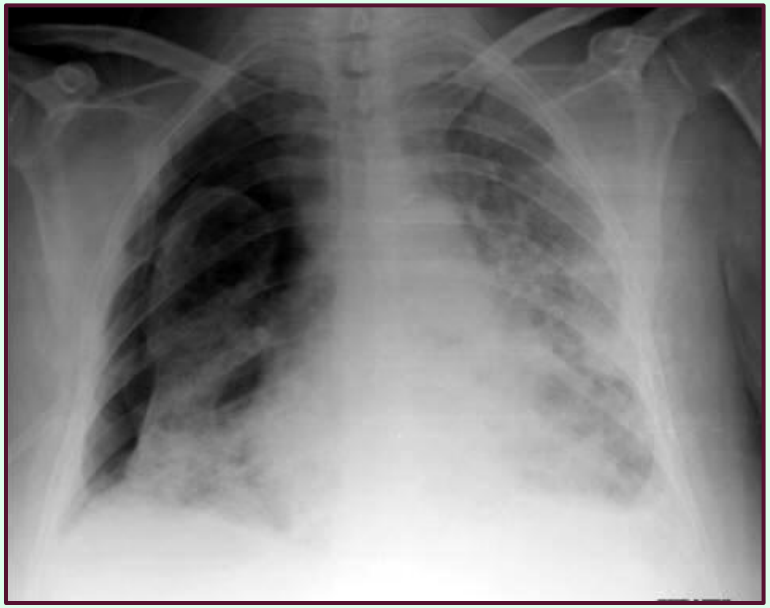
INITIAL STRATEGY

ST-segment elevation on initial ECG



Evaluation for immediate reperfusion therapy

An obvious non-cardiac cause for the symptoms



Treatment based on the alternative diagnosis

RECOMMENDATIONS FOR ECHOCARDIOGRAPHY IN PATIENTS WITH CHEST PAIN

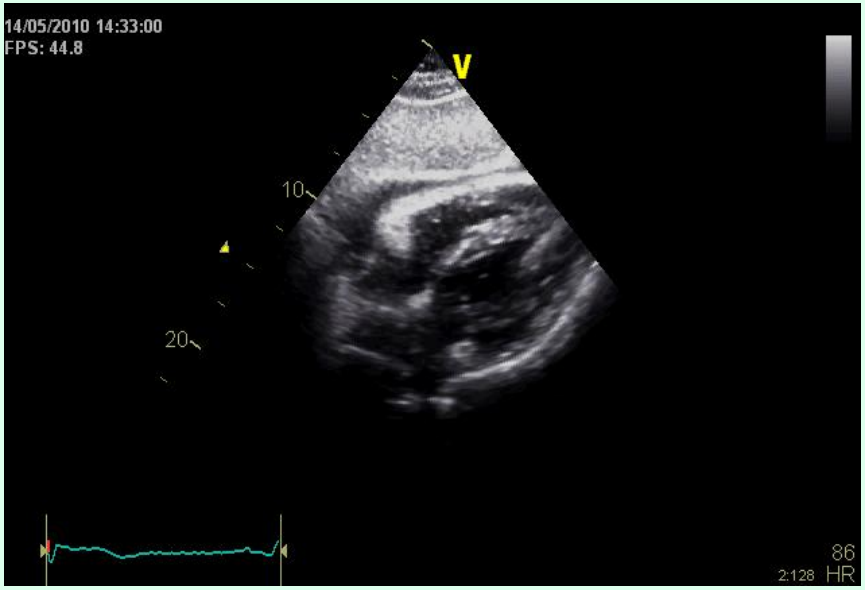
- Diagnosis of underlying disease in patients with chest pain and **Clinical evidence of valvular, pericardial, or myocardial disease**
- Evaluation of chest pain in patients with **suspected aortic dissection**
- Evaluation of chest pain in patients with **suspected acute myocardial ischemia, when baseline ECG and other laboratory markers are non-diagnostic and when study can be obtained during pain or within minutes after its abatement**
- Evaluation of patients with chest pain and **hemodynamic instability** unresponsive to simple therapeutic measures

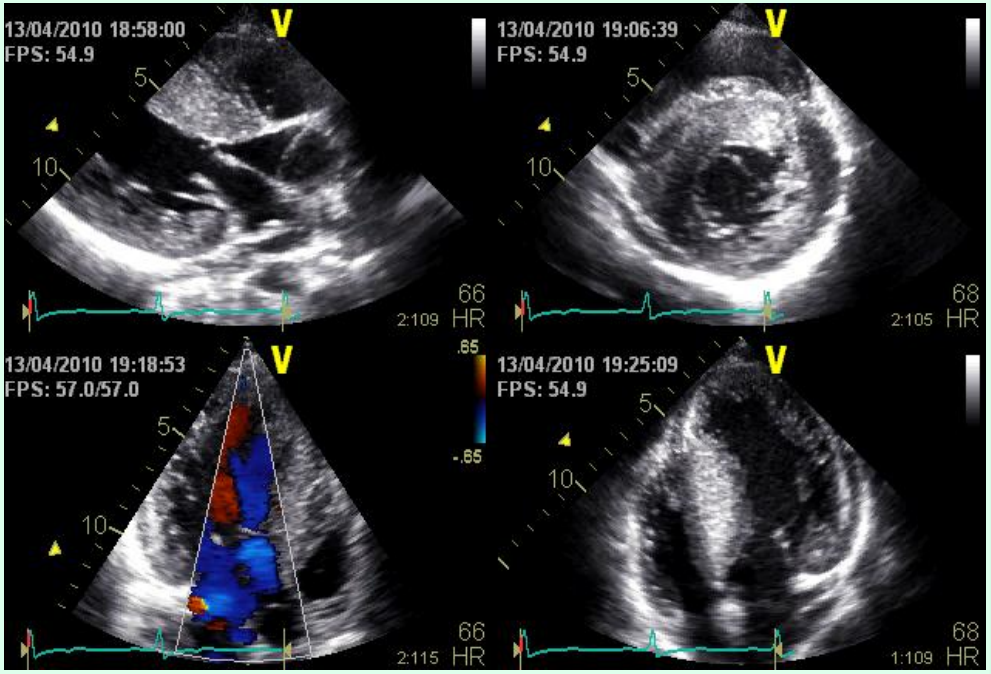
ACC/AHA PRACTICE GUIDELINES—FULL TEXT

ACC/AHA/ASE 2003 Guideline Update for the Clinical Application of Echocardiography

IMAGING

To confirm /exclude other diagnosis

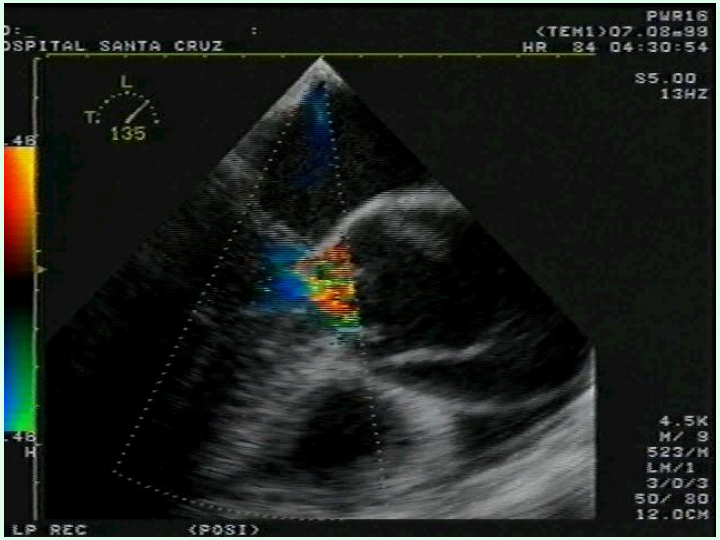


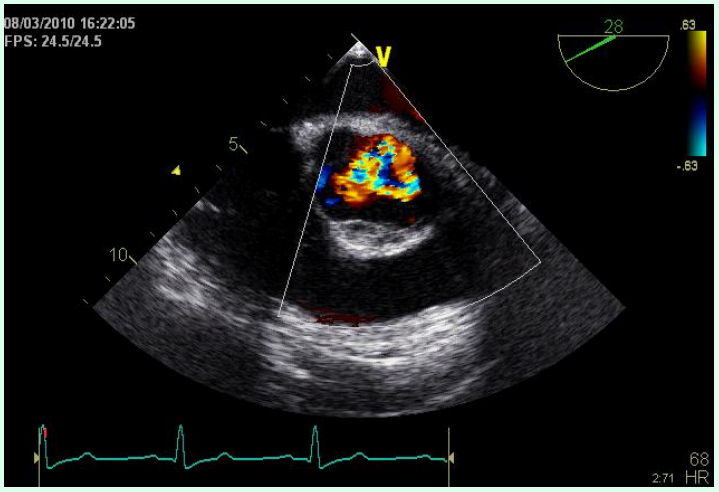


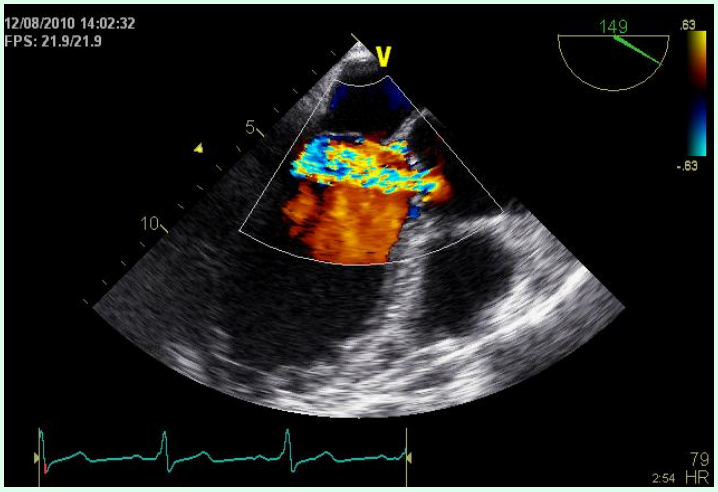
IMAGING

To confirm /exclude other diagnosis

AORTIC PATHOLOGY



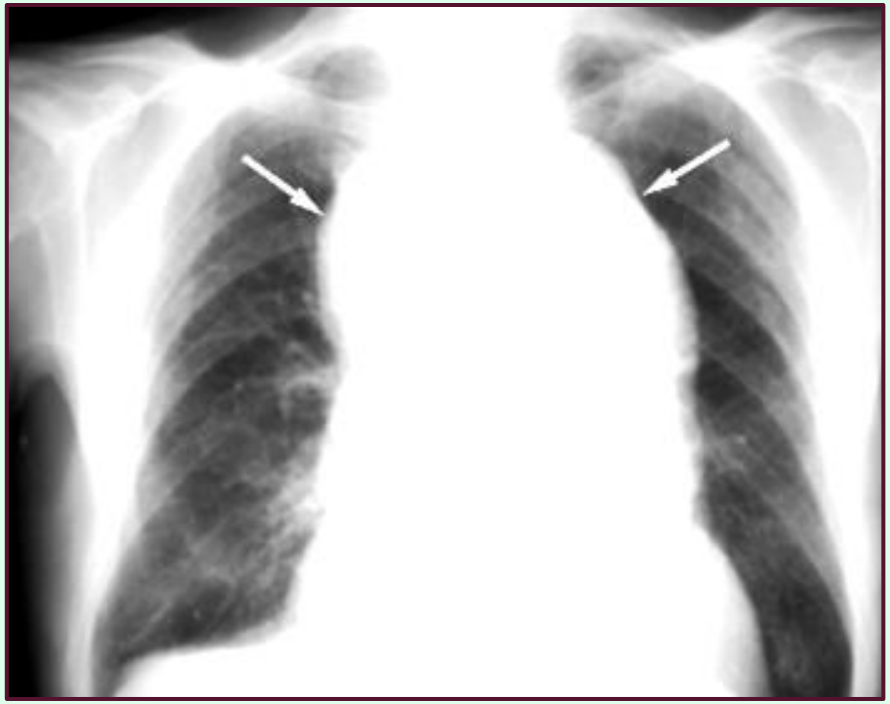


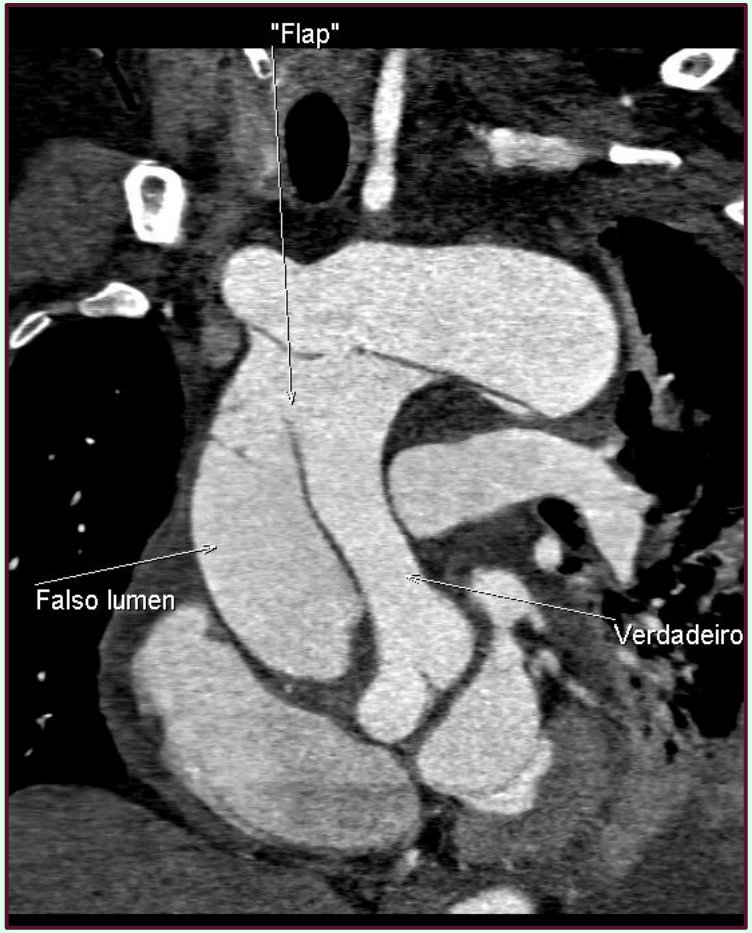


IMAGING

To confirm /exclude other diagnosis

AORTIC DISSECTION





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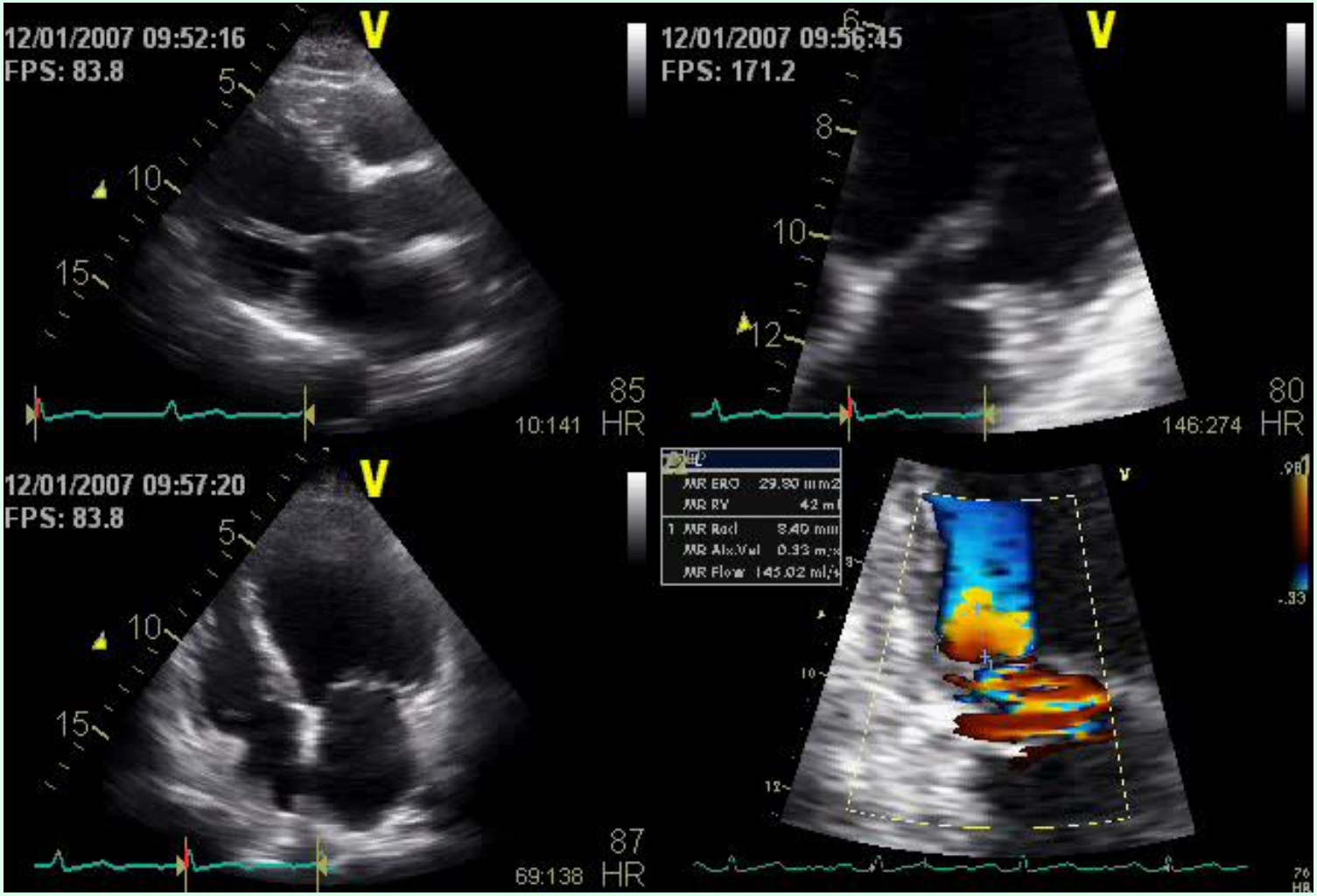
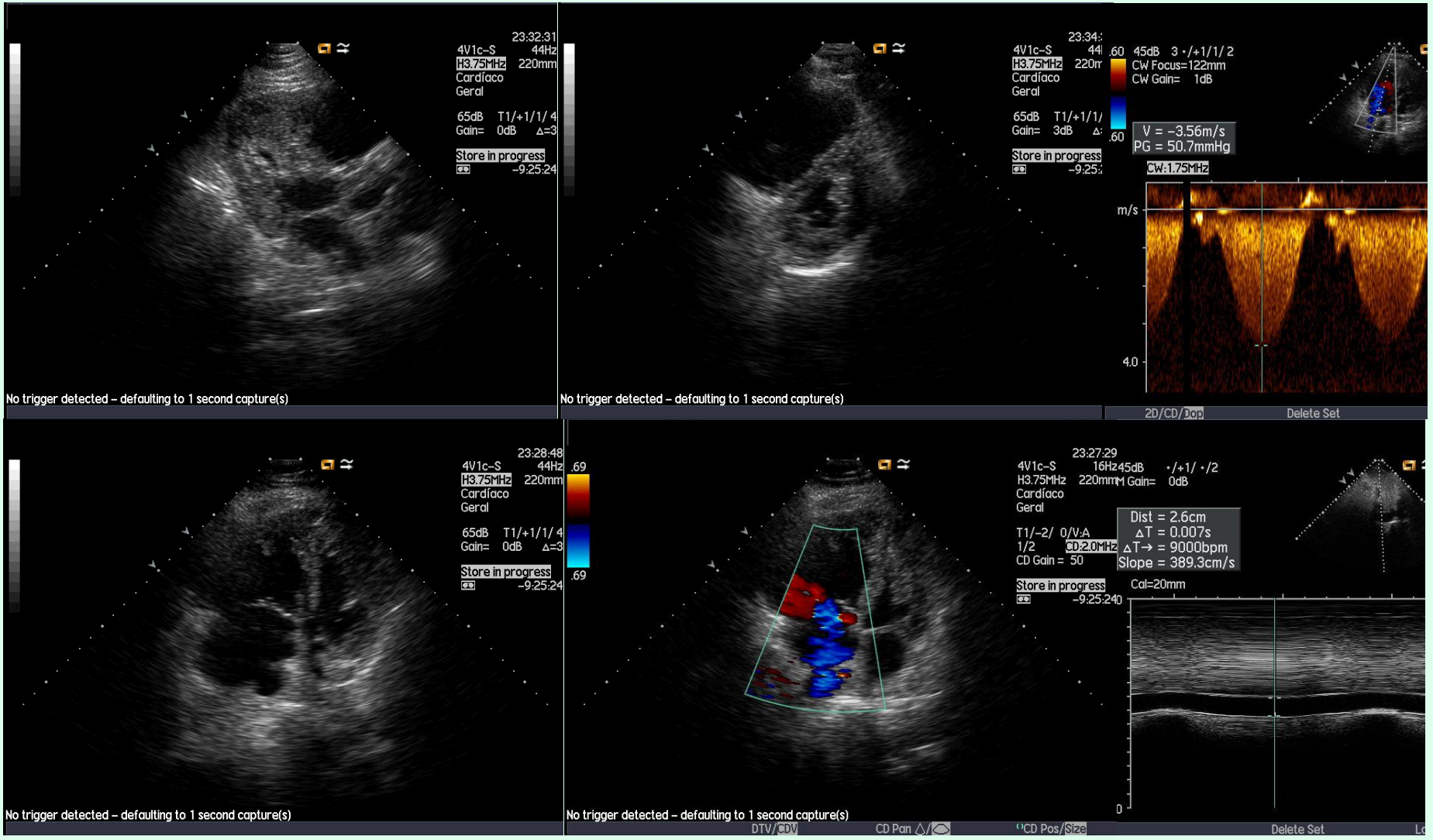


IMAGING

To confirm /exclude other diagnosis

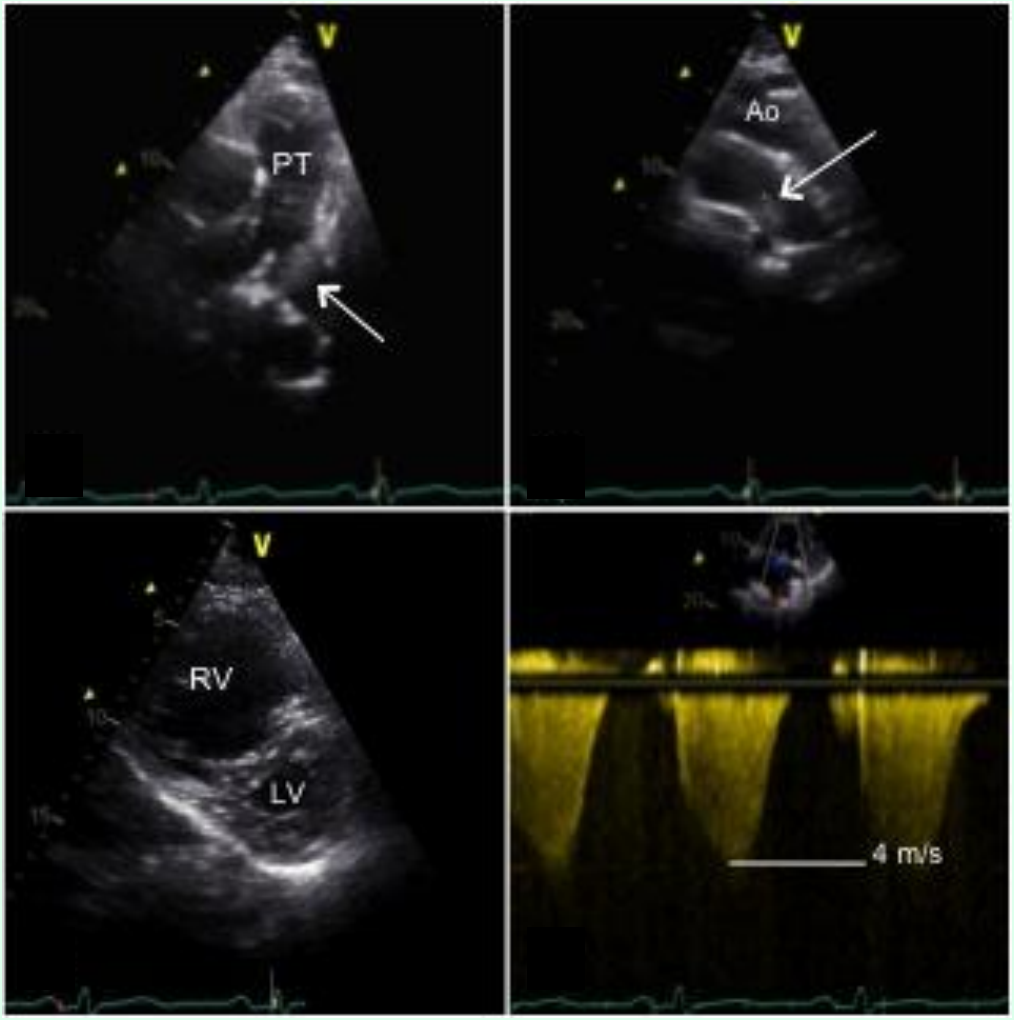
PULMONARY EMBOLISM



IMAGING

To confirm /exclude other diagnosis

PULMONARY EMBOLISM

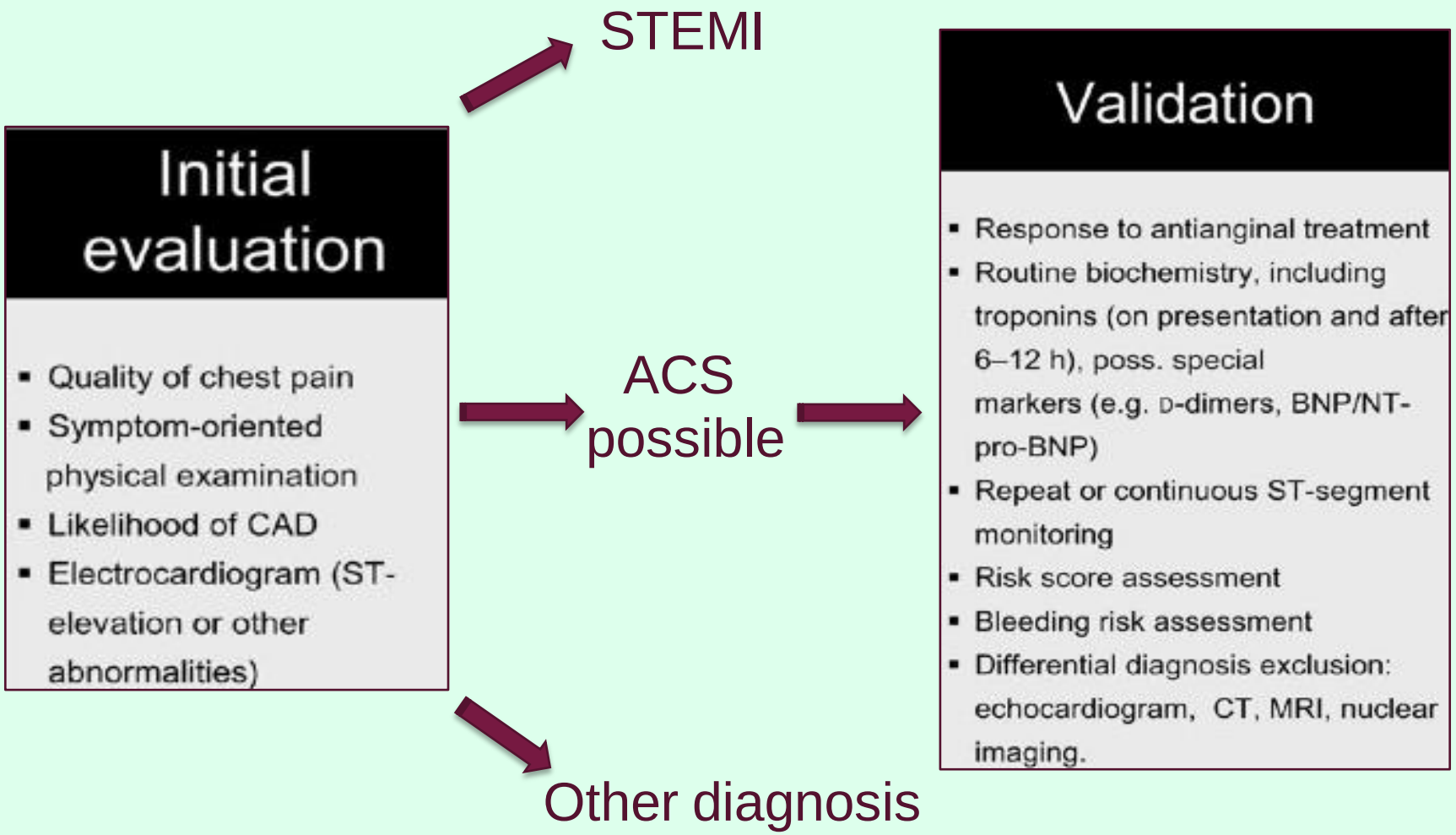


IMAGING - Role of Multislice CT

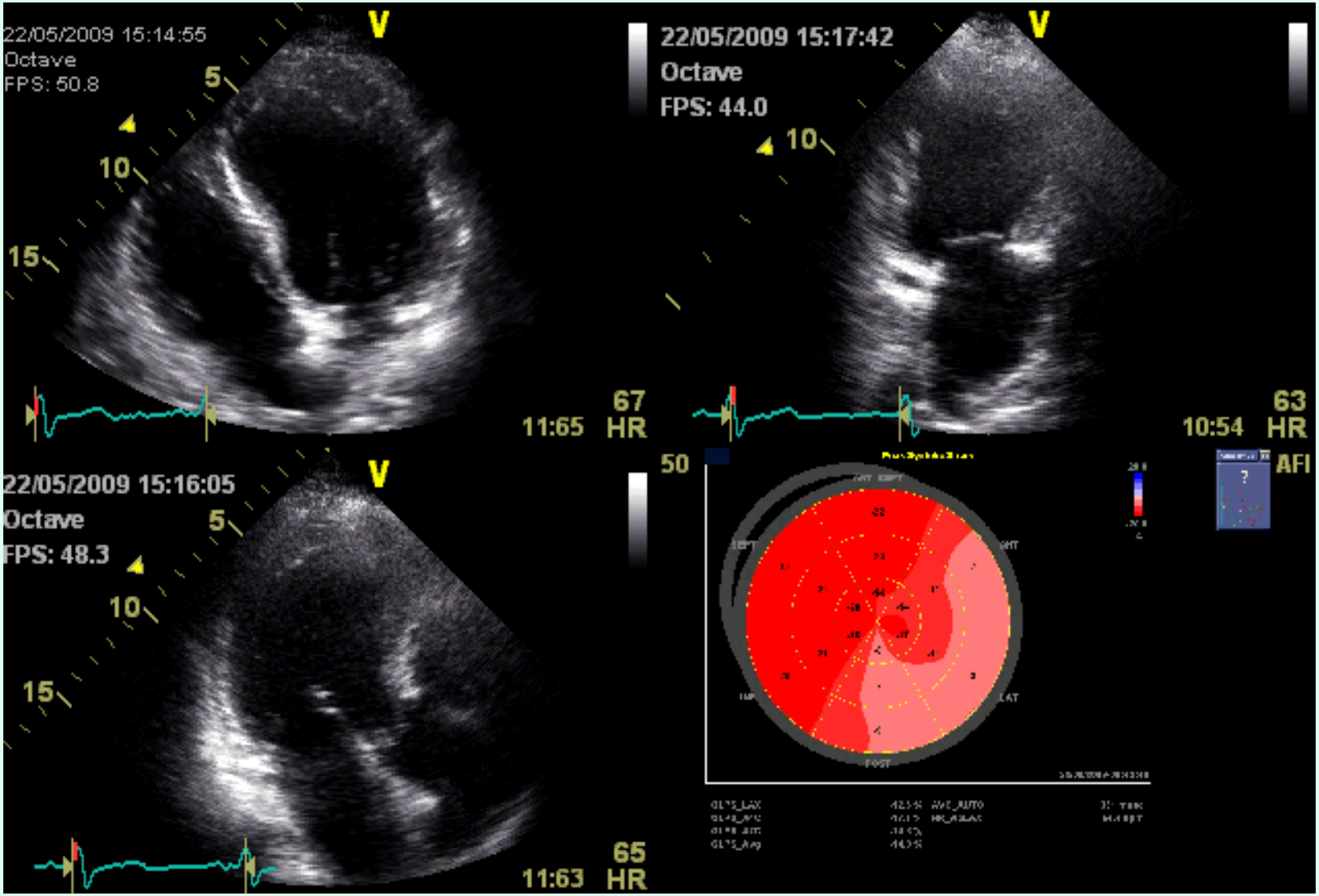
Patients with chest pain in the Emergency Room

PULMONARY EMBOLISM

SECOND STEP - DIAGNOSTIC VALIDATION AND RISK ASSESSMENT



INFARCT-RELATED ARTERY



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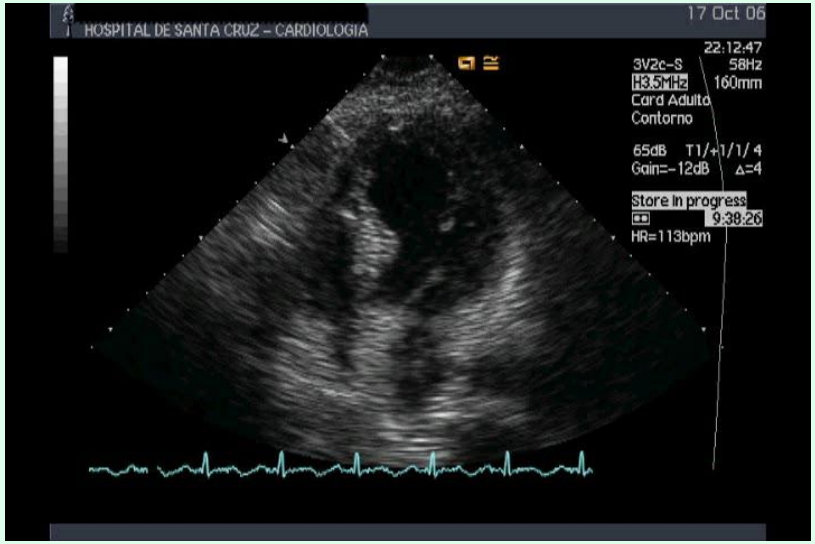
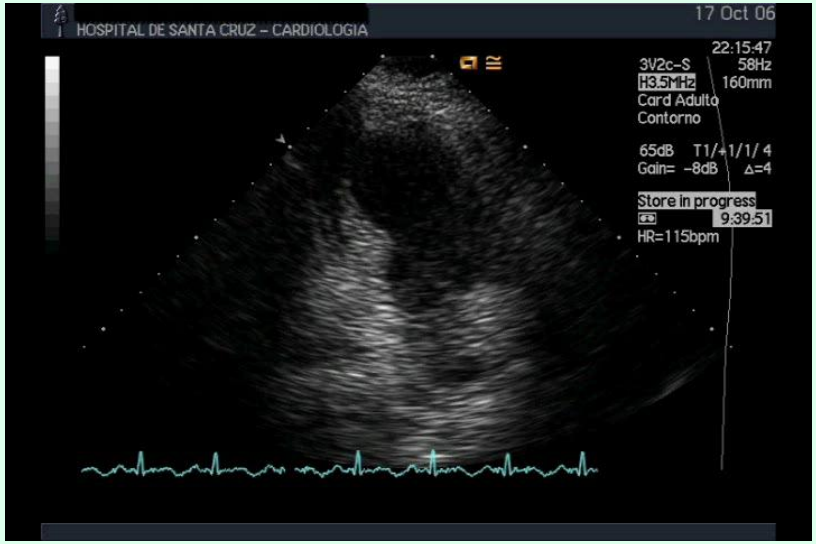
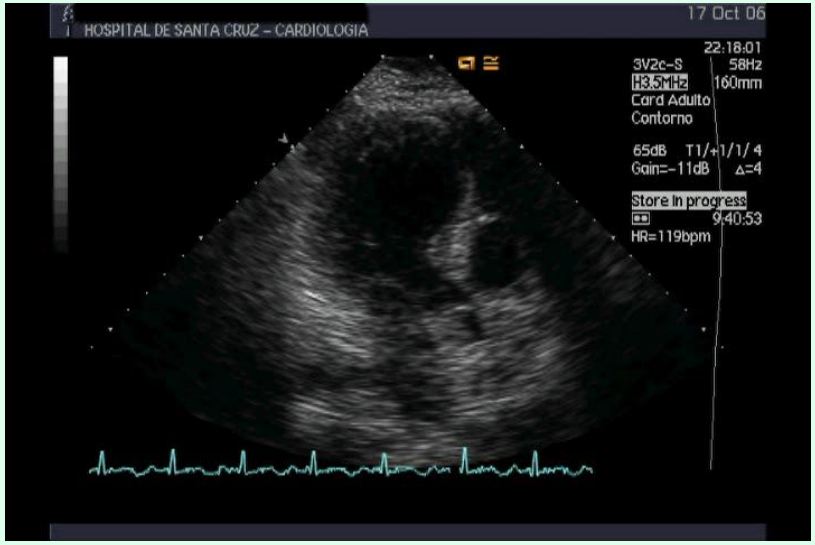
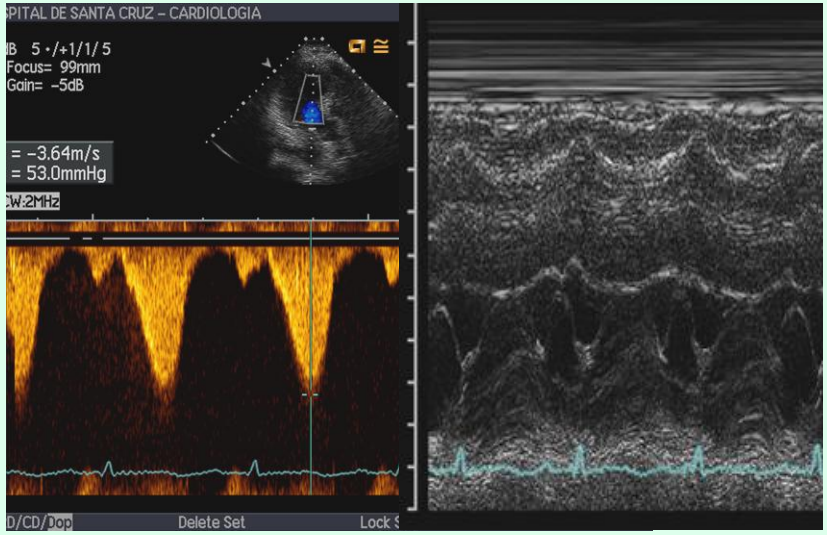


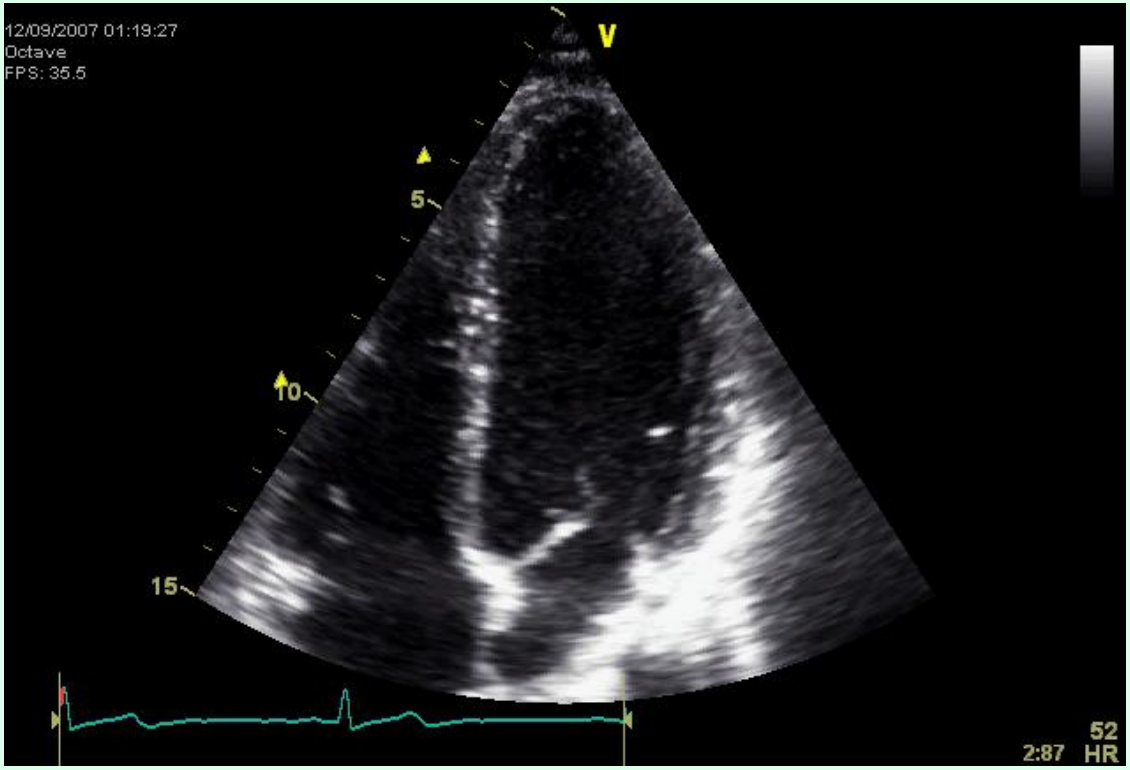






IMAGING

Regional Asynergy (WMA)



Absent if:

Resting CF ↓ <50%

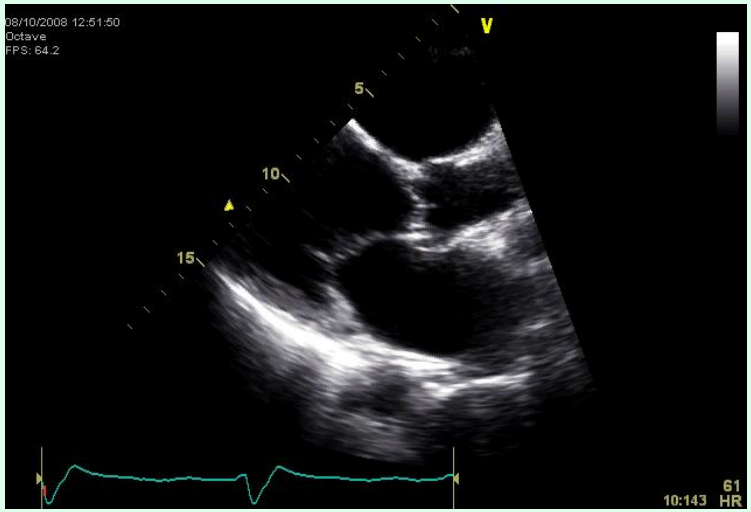
< 20% wall thickness

< 1-6% LV mass

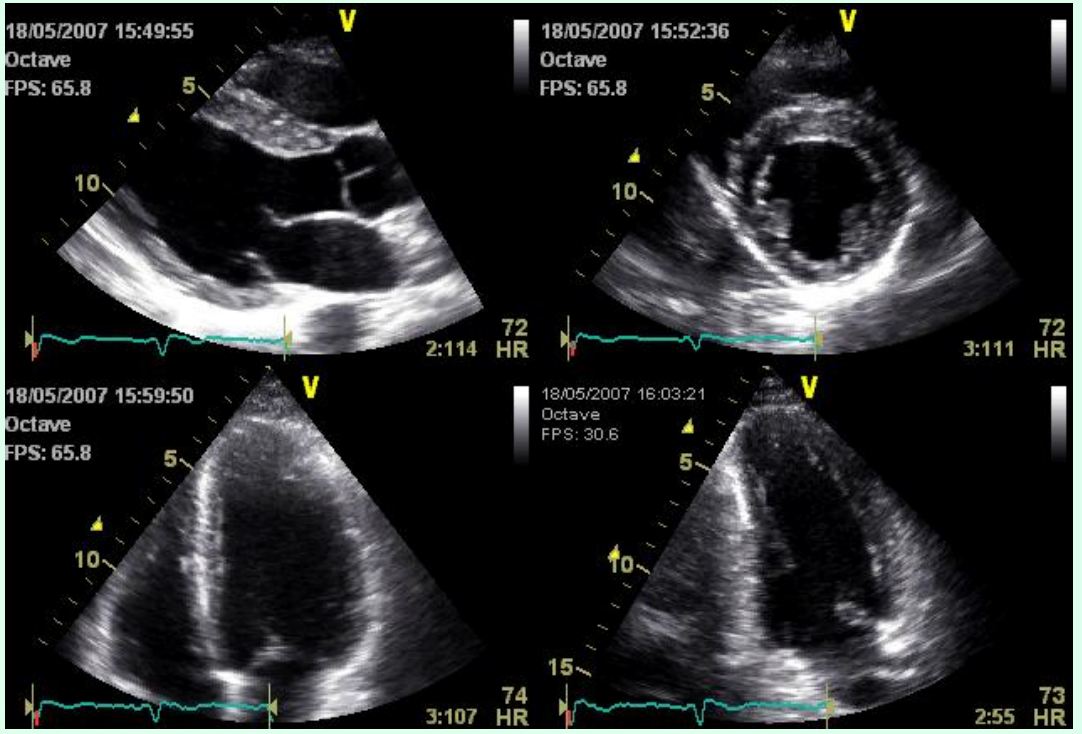
IMAGING

Differentiation from acute and old MI

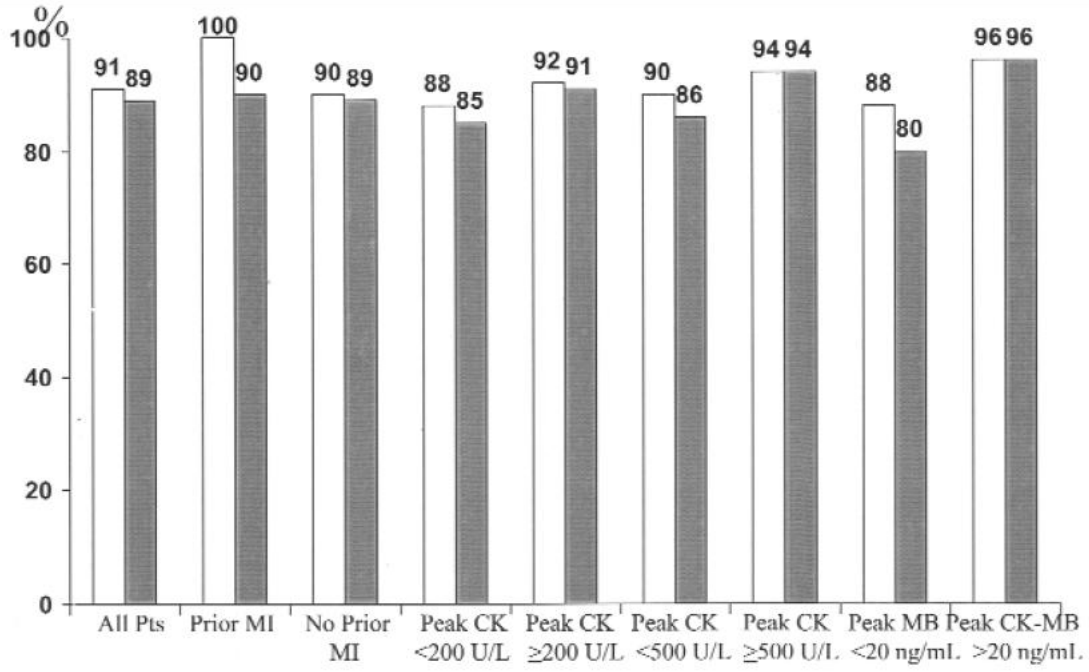
Fibrosis / Scar



Edema



Comparison of 2D Echo and MPI for diagnosing AMI in emergency department patients



Comparison of sensitivities of echocardiography *(white bars)* and myocardial perfusion imaging *(gray bars)* for detection of MI. No significant differences were seen in sensitivity between 2 techniques for any of cut-off values. *Pts,* Patients; *CK,* CK level.

141 pts

low to moderate

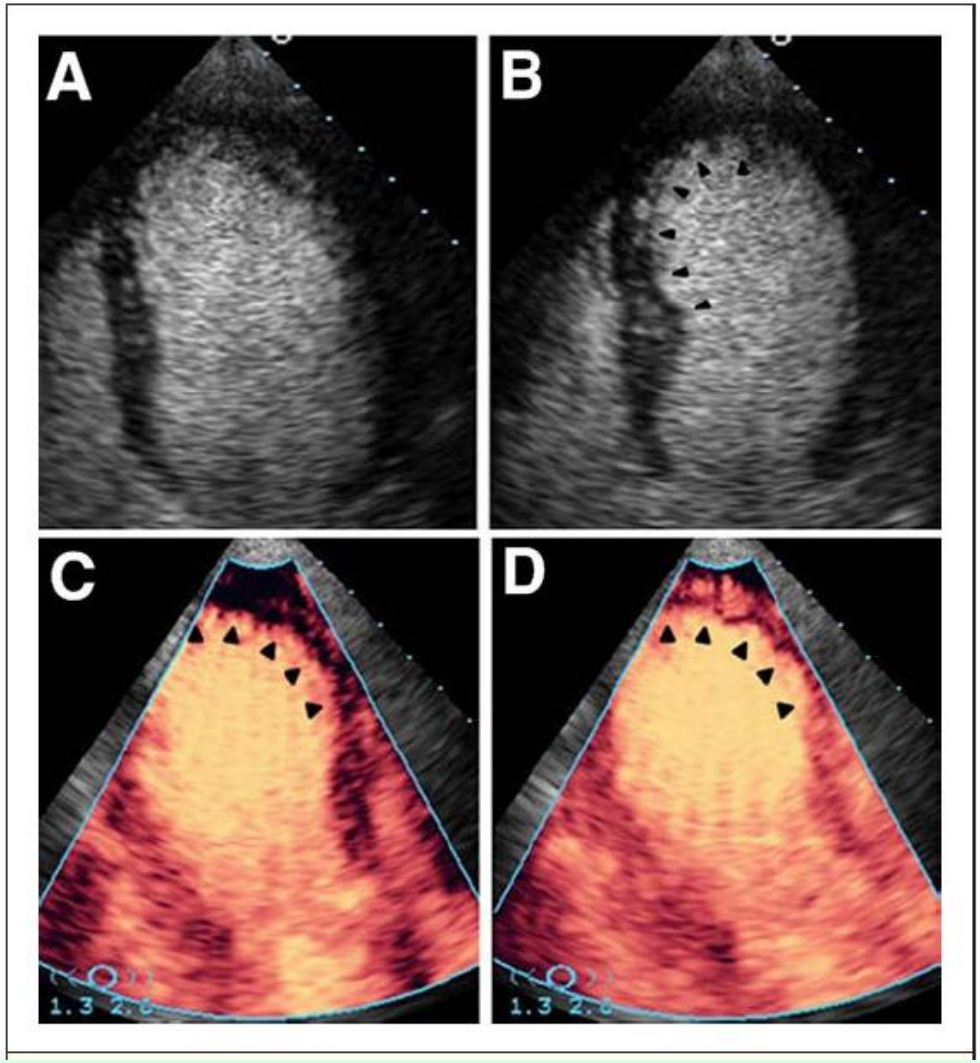
risk for ACS

(no ST ↑ or ↓

Kontos, M et al. Am Heart J 2002;143:659-67

IMAGING

Regional Asynergy (WMA)

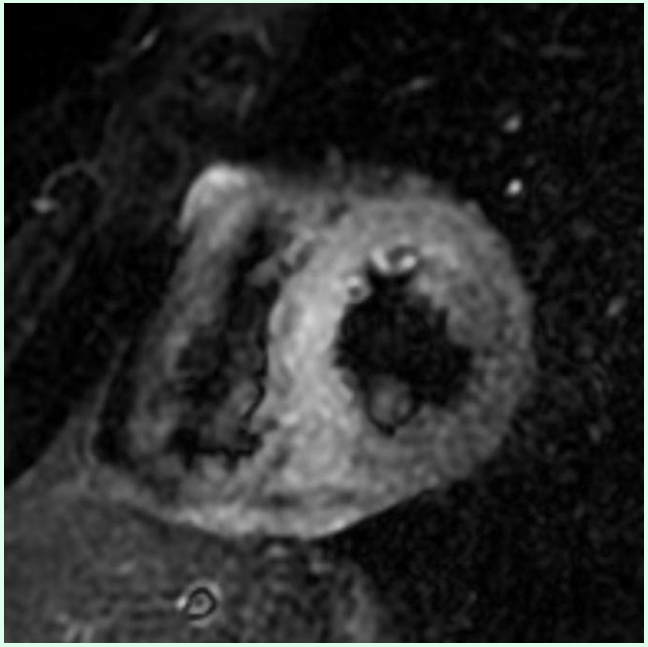


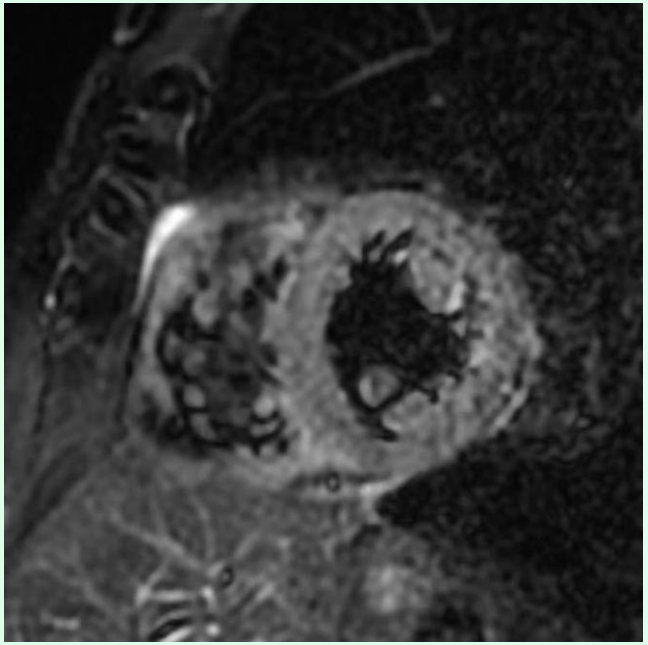
Wei K. J Am Coll CardiolImg 2010;3:197-203

IMAGING

Role of MRI

Differentiate Acute from Chronic infarction



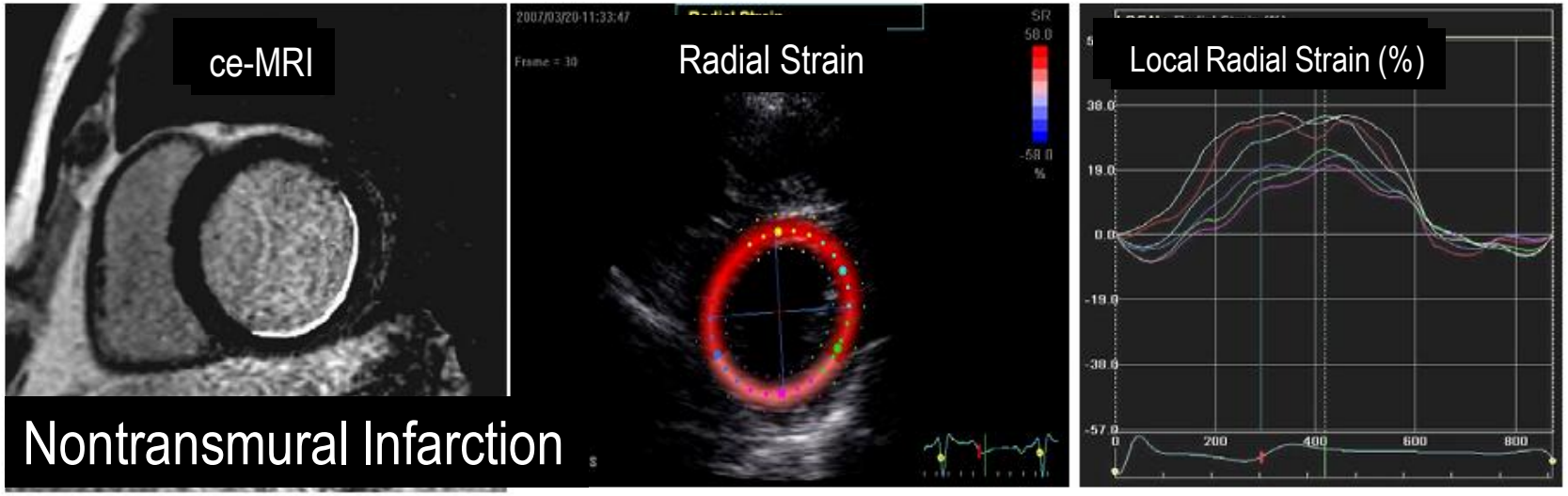


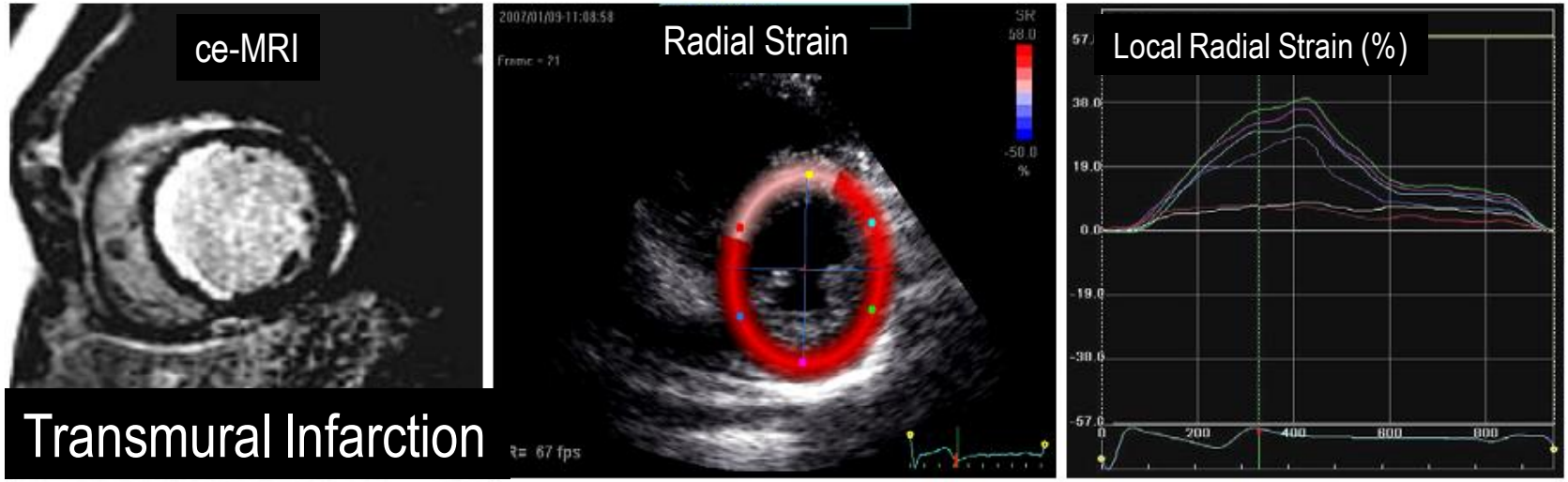
Delayed Enhancement and T2-Weighted Cardiovascular Magnetic Resonance Imaging Differentiate Acute From Chronic Myocardial Infarction

Abdel-Aty H, Zagrosek A, Schulz-Menger J, et al. Circulation 2004;109:2411–16.

Cury R, Shash K, Naguerney et al. Circulation 2008;118:837–844.

IMAGING
Transmurality of MI



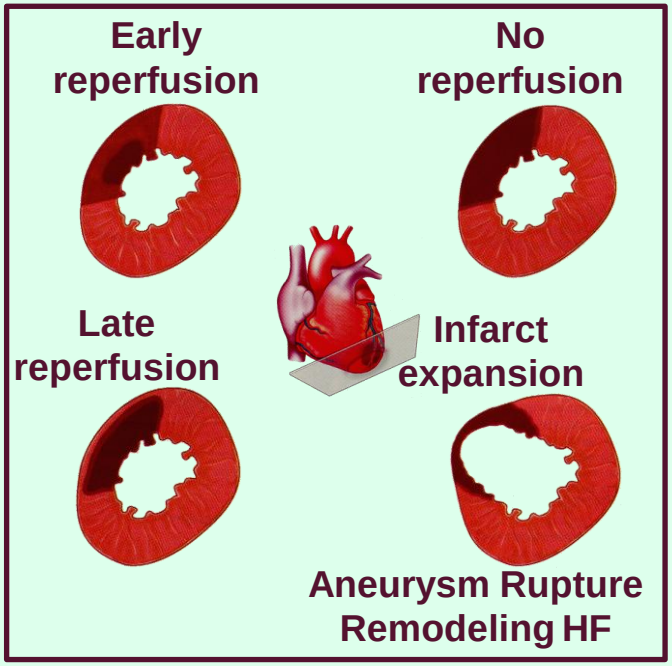


Becker et al, JACC April 2008

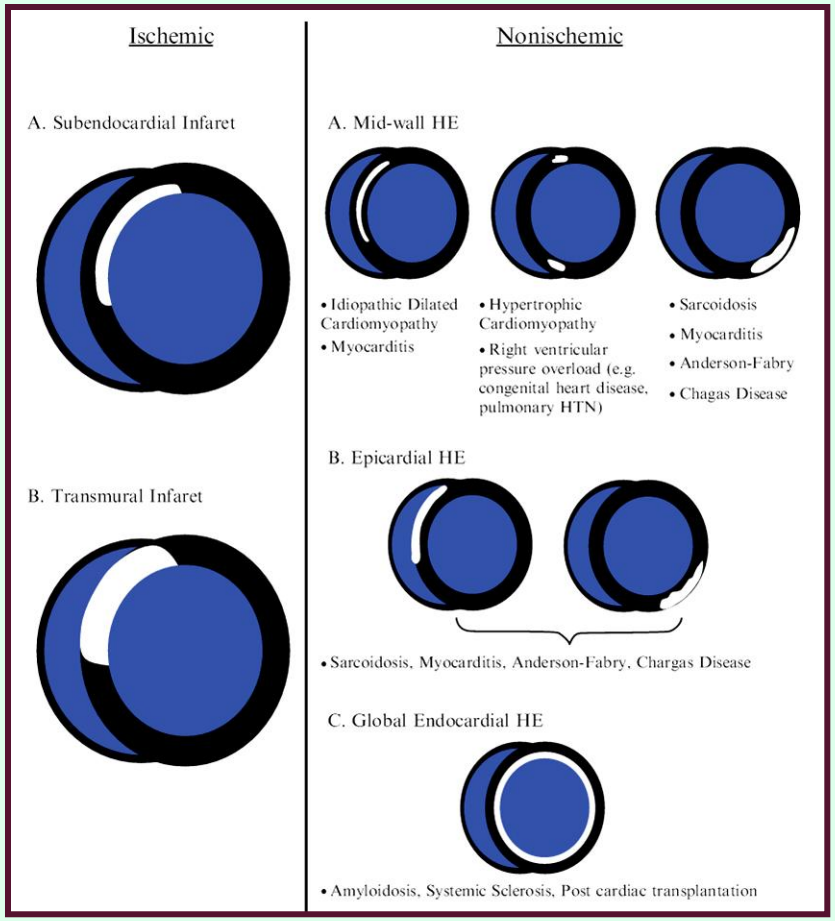
IMAGING

Role of MRI

“wave front phenomenon”
of ischemic cell death



HE Patterns for Ischemic and Non-ischemic Disorders



Karamitsos et al. JACC 2009; 54: 1407

BIOMARKERS

All patients with suspected ACS should undergo serial cardiac biomarker sampling

Current recommendations indicate troponin as the preferred biomarker

The diagnosis of NSTE-ACS should never be made only on the basis of cardiac biomarkers, whose elevation should be interpreted in the context of other clinical findings

cTn (+)	INCIDENCE	CLINICALSIGNIFICANCE
Acute PE [1]	32%	↑ Riskofin-hospitalmortality
AcutePericarditis[2]	22%	correlates with recent infection
HF Severebutstable	≤15%	Independent predictor of long-term survival or readmission for HF
Acute, left[3,4,5]	≤55%	
Myocarditis[6]	≥34%	Recent onset of HF
Sepsis[6,7]	≤85%	↑Risk of in-hospital mortality
Renal failure[8]	≤20%	Poor long-term outcome

1. Giannitis E et al. *Circulation* 2000; 102: 211
2. Bonnefoy E et al. *Eur Heart J* 2000; 21: 832
3. La Vecchia L et al. *Am J Cardiol* 1997; 80: 88
4. Cummins B et al. *Am Heart J* 1987; 113: 1333
5. Missov E et al. *Circulation* 1997; 96: 2953
6. Arlati S et al. *Intensive Care Med* 2000; 26: 31
7. ElstKM et al. *ClinChem* 2000; 46: 650
8. Khan NA et al. *Circulation* 2005; 112: 3088

PARAMETERS USED FOR ASSESSMENT OF PROGNOSIS AFTER ACUTE MI

LV EF → *mortality*

Large asynergic zone (high WMSi)→ *shock, HF*

Infarct expansion→ *LV remodelling, aneurysm*

End-systolic volume→ *mortality*

Short DT→ *LV remodelling, mortality*

E/e' ratio → *cardiac events, mortality*

Stress Echo→ *cardiac events, mortality*

Viability→ *LV dilation, mortality*

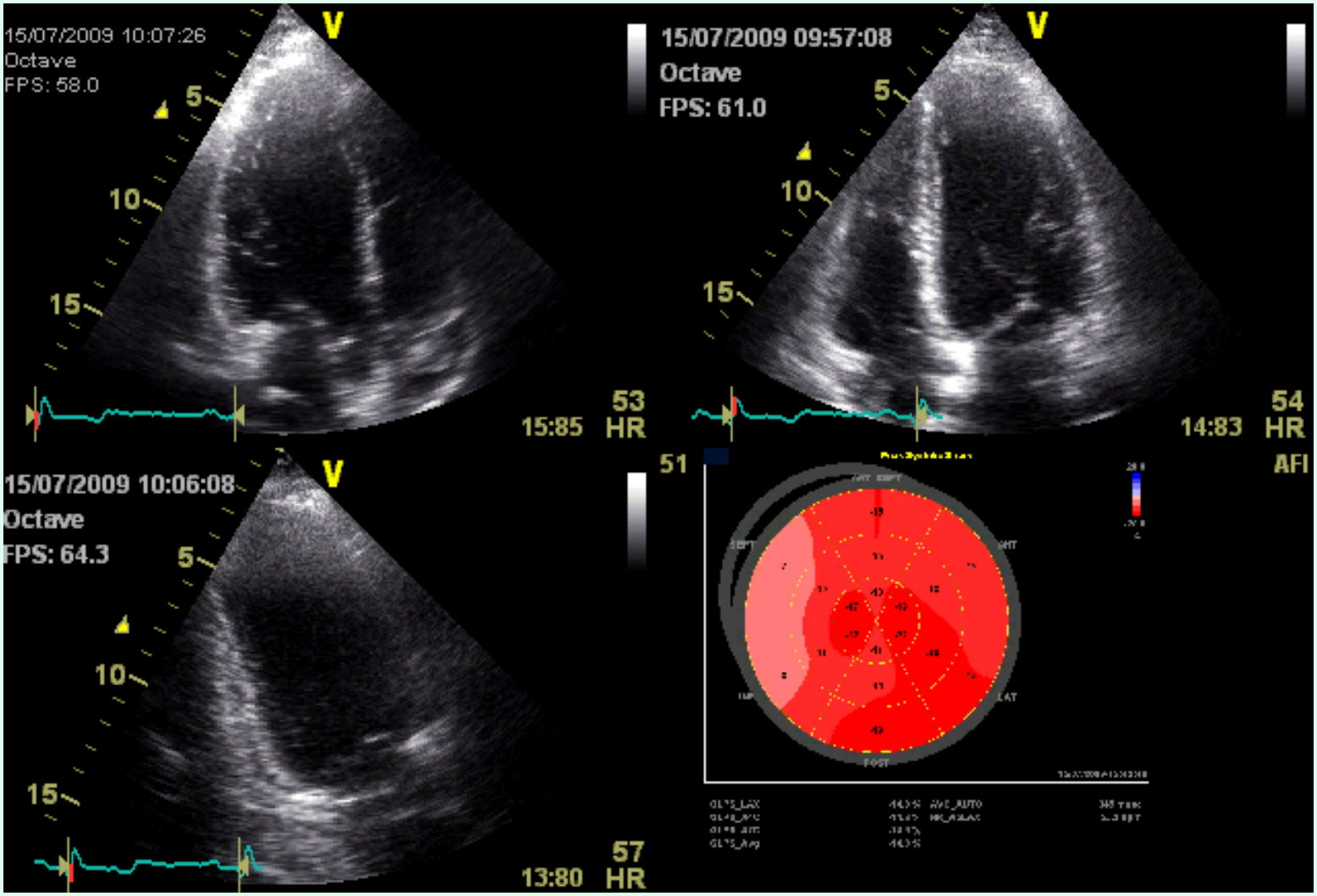
Remote dyssynergy→ *multivessel CAD*

Mitral regurgitation→ heart failure, *mortality*

Left atrial enlargement → *LV remodelling,aneurysm*

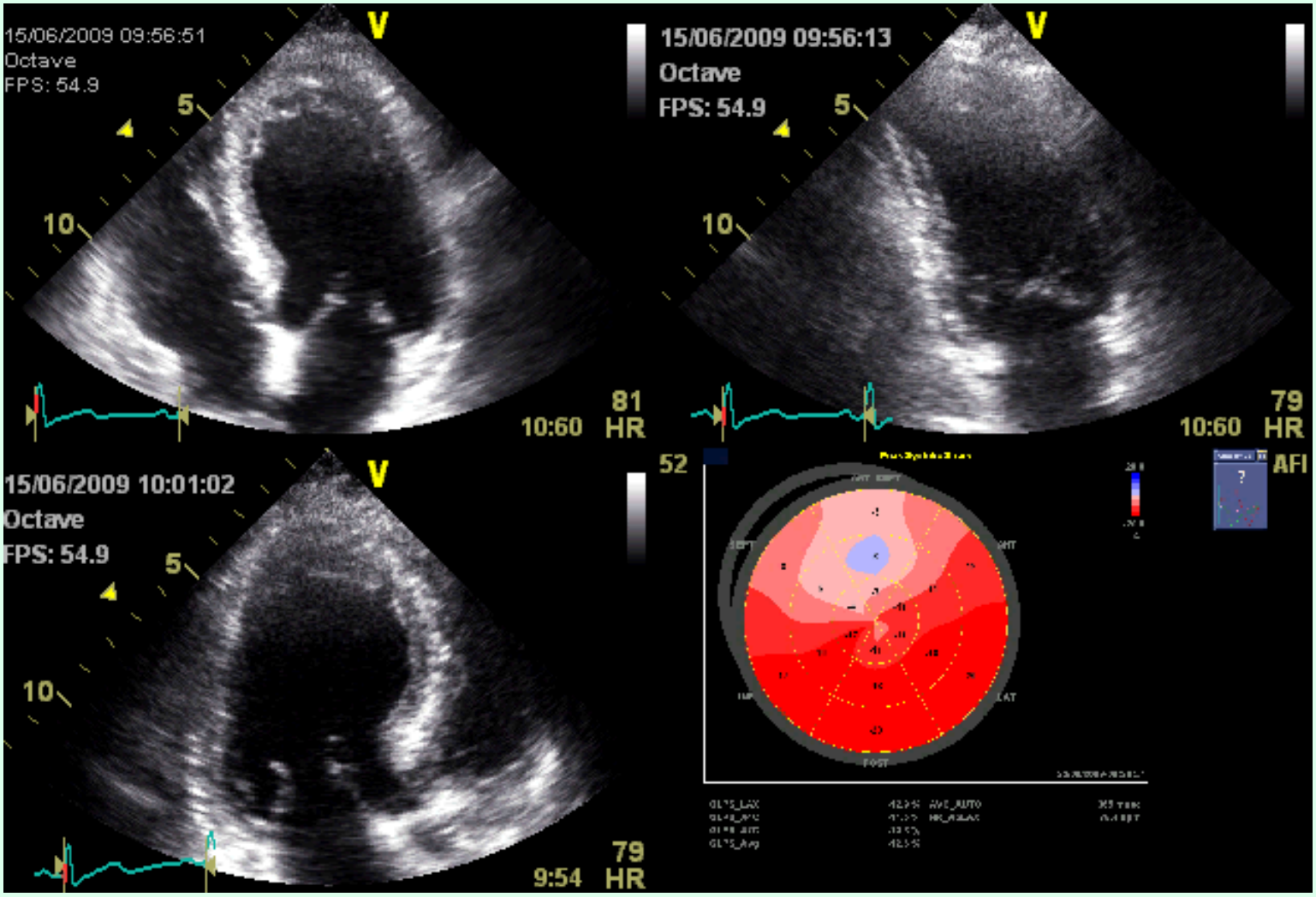
Right ventricular dysfunction→ *mortality*

INFARCT-RELATED ARTERY



The LV global strain shows a good correlation with LV infarct size

INFARCT-RELATED ARTERY



The LV global strain shows a good correlation with LV infarct size

PREDICTORS OF LV REMODELING AFTER AMI

Pre-existing hypertension

Infarct size Large asynergic zone (high WMSi)

Cardiac enzyme indexEjection Fraction

Anterior location Infarct expansion

Transmurality of infarction

End-systolic volume **Short early mitral DT**

Patency of the IRA TIMI grade <3 flow

Microvascular obstruction

Mitral regurgitation Left atrial enlargement

Viability

Markers of neurohormonal activation

Mostly **interrelated** risk factors

LV Dyssynchrony acutely after MI Predicts LV Remodeling

- *178 pts; primary PCI*
- *2D-echo + radial strain analysis (speckle-tracking) within 48h + 6 mo f-up*
- *LV Remodeling: >15% increase of LVESV*

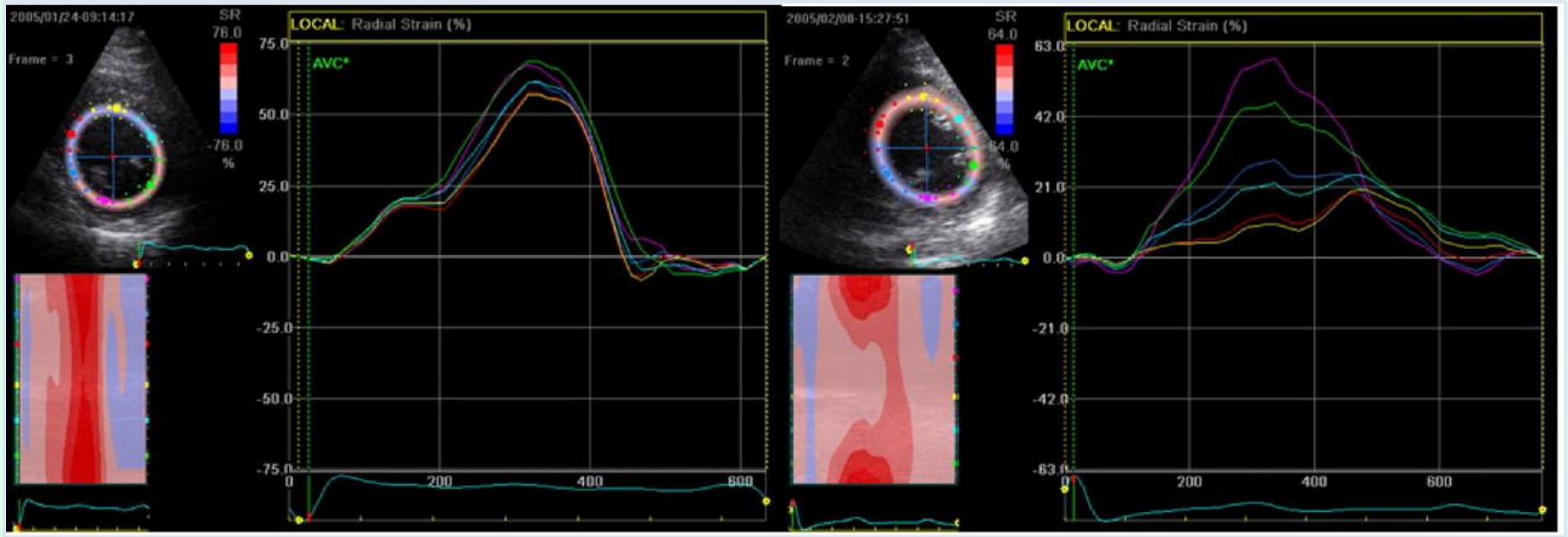
Baseline Characteristics	No LV Remodeling (n = 142)	LV Remodeling (n = 36)	p Value
Peak cTnT level, μg/l, (25th, 75th percentiles)	5.2 (1.9, 9.8)	10.1 (6.3, 15.3)	<0.001
Peak CPK level, U/l (25th, 75th percentiles)	1,893 (868, 3,236)	3,877 (1,816, 5,597)	<0.001

Echo parameters	No LV Remodeling (n = 142)	LV Remodeling (n = 36)	p Value
Baseline			
LVESV, ml	64 (54, 70)	76 (54, 91)	NS
LVEDV, ml	128 (106, 148)	139 (108, 160)	NS
LVEF, %	47 (42, 52)	47 (42, 51)	NS
WMSI	1.50 (1.25, 1.63)	1.56 (1.38, 1.69)	<0.05
LA dimension, mm	38 (34, 42)	41 (37, 43)	NS
E/E′ ratio	11.7 (9.7, 15.7)	14.8 (12.3, 18.4)	<0.05
MR, moderate-severe (%)	6 (4)	2 (6)	NS
LV dyssynchrony, ms	31 (12, 77)	148 (134, 180)	<0.001

Mollema et al. J Am Coll Cardiol 2007; 50:1532

IMAGING

LV Dyssynchrony acutely after MI predicts LV remodeling



No dyssynchrony at baseline

⇩

No remodeling at follow-up

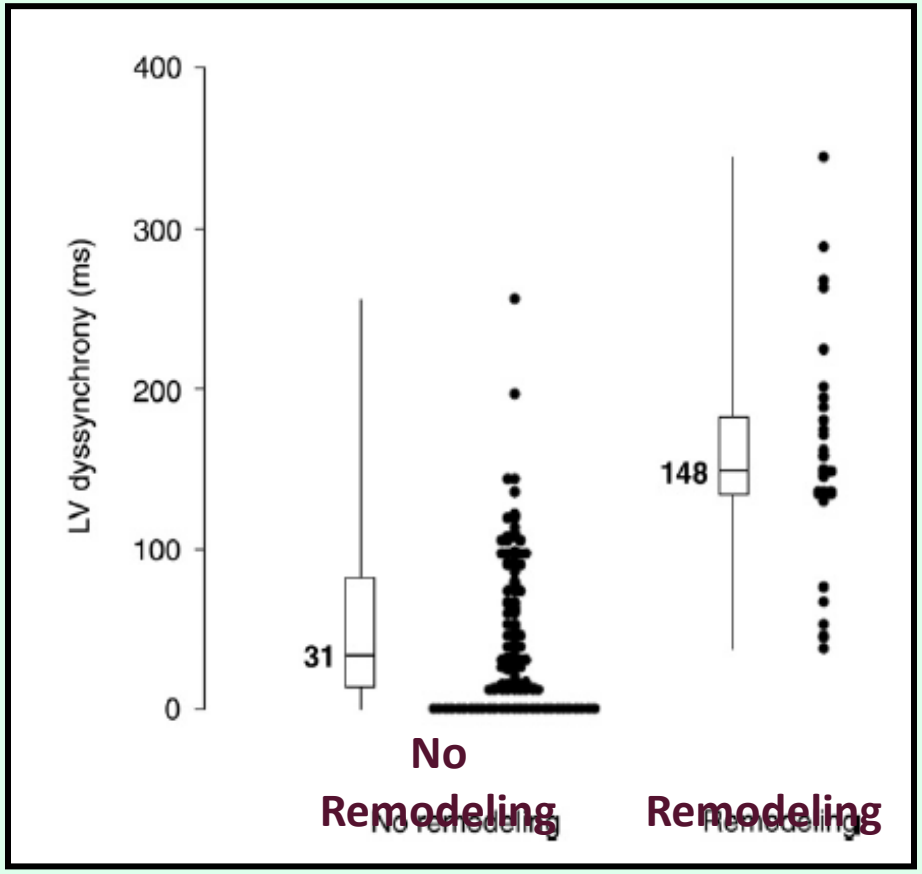
Dyssynchrony at baseline

⇩

Remodeling at follow-up

Mollema et al. J Am Coll Cardiol 2007; 50:1532

EXTENT OF LV DYSSYNCHRONY WAS SIGNIFICANTLY LARGER IN PATIENTS WITH LV REMODELING DURING FOLLOW-UP VERSUS THOSE WITHOUT LV REMODELING



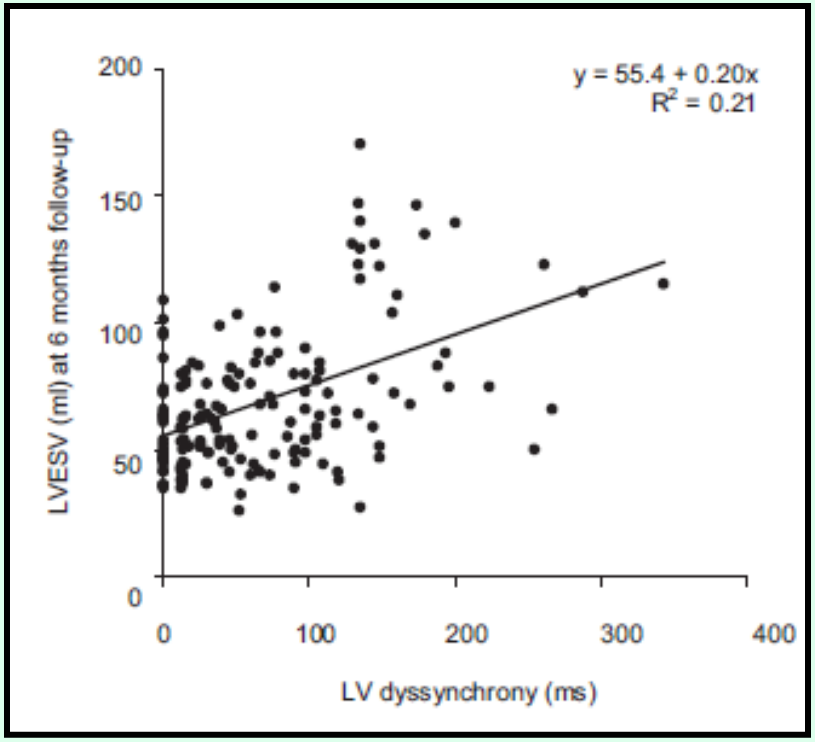
ROC curve:

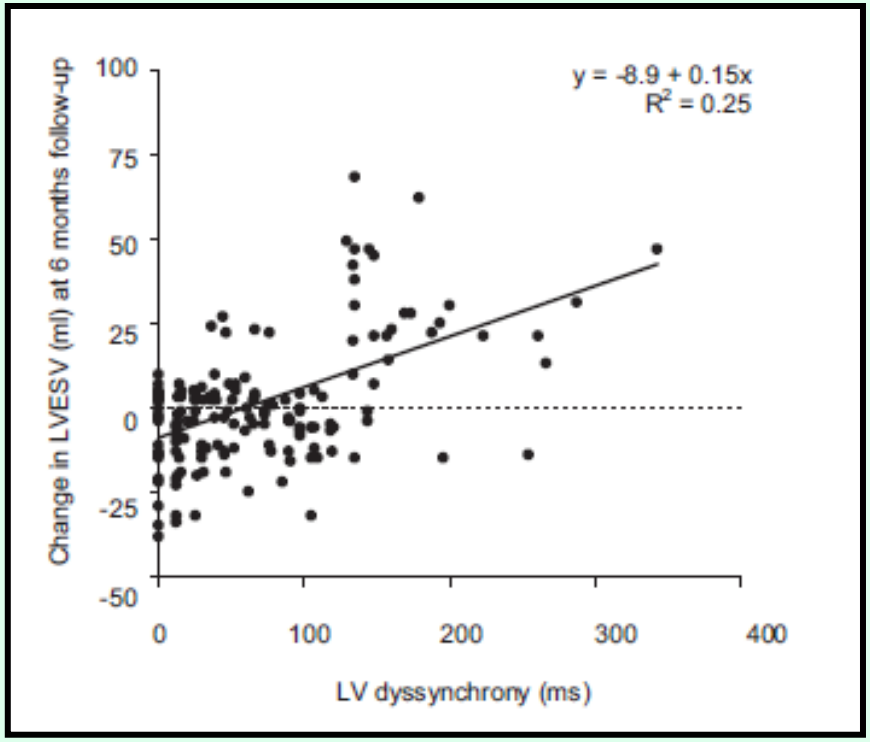
cutoff
130 ms

Sensitivity of 82%
Specificity of 95%
to predict
LV Remodeling at 6 mo

Mollema et al. J Am Coll Cardiol 2007; 50:1532

CORRELATION BETWEEN LV DYSSYNCHRONY AT BASELINE AND LVESV AND CHANGE IN LVESV AT 6-MONTH F-UP

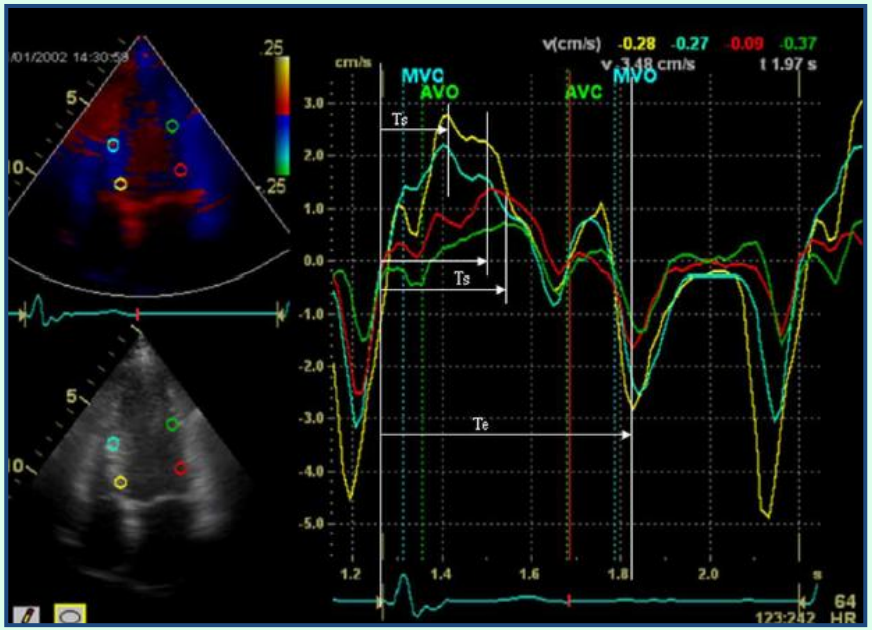


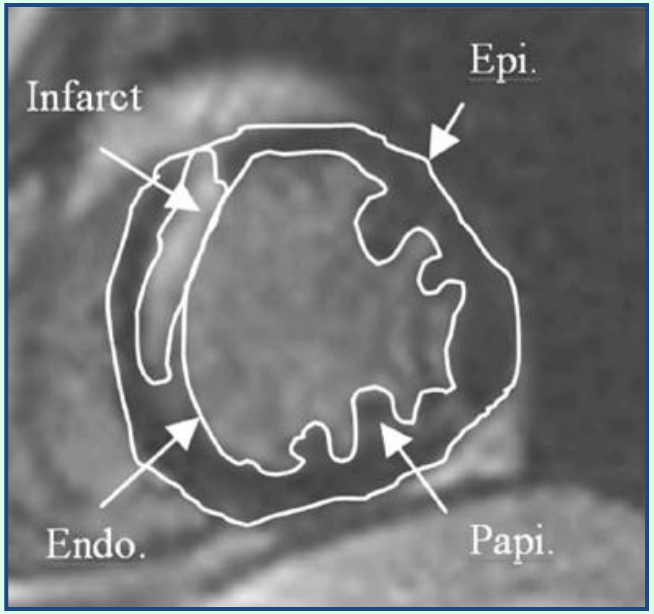


Resynchronization therapy?? ⟶ Further studies needed !!!

Mollema et al. J Am Coll Cardiol 2007; 50:1532

LV systolic dyssynchrony predicts cardiac remodeling after MI





- *47 pts; 35 with early PCI*
- *2D-echo + TDI for dyssynchrony*
- *Ce-MRI for infarct size*

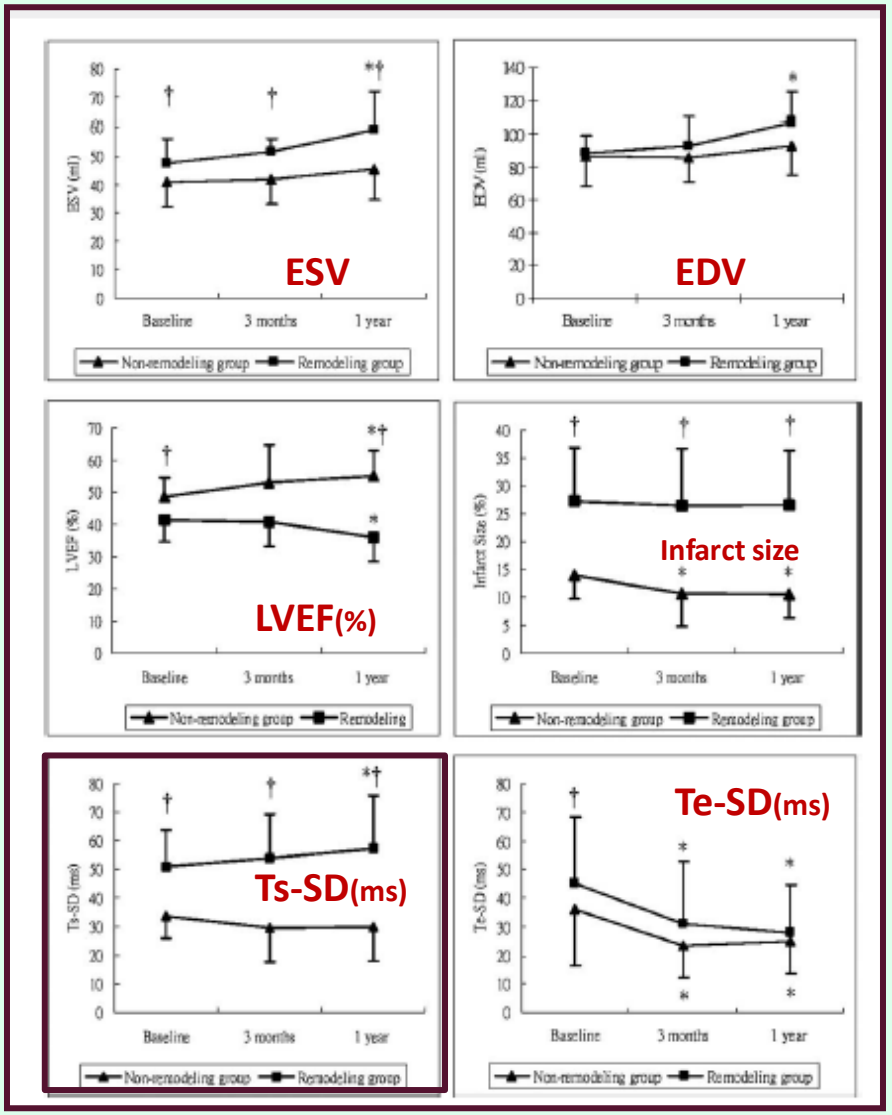
} *2-6d, 3 mo, 12 m after MI*

- *LV Remodeling: >10% increase of LVESV*

Yan Khang et al. Am Heart J 2008;156:1124-32

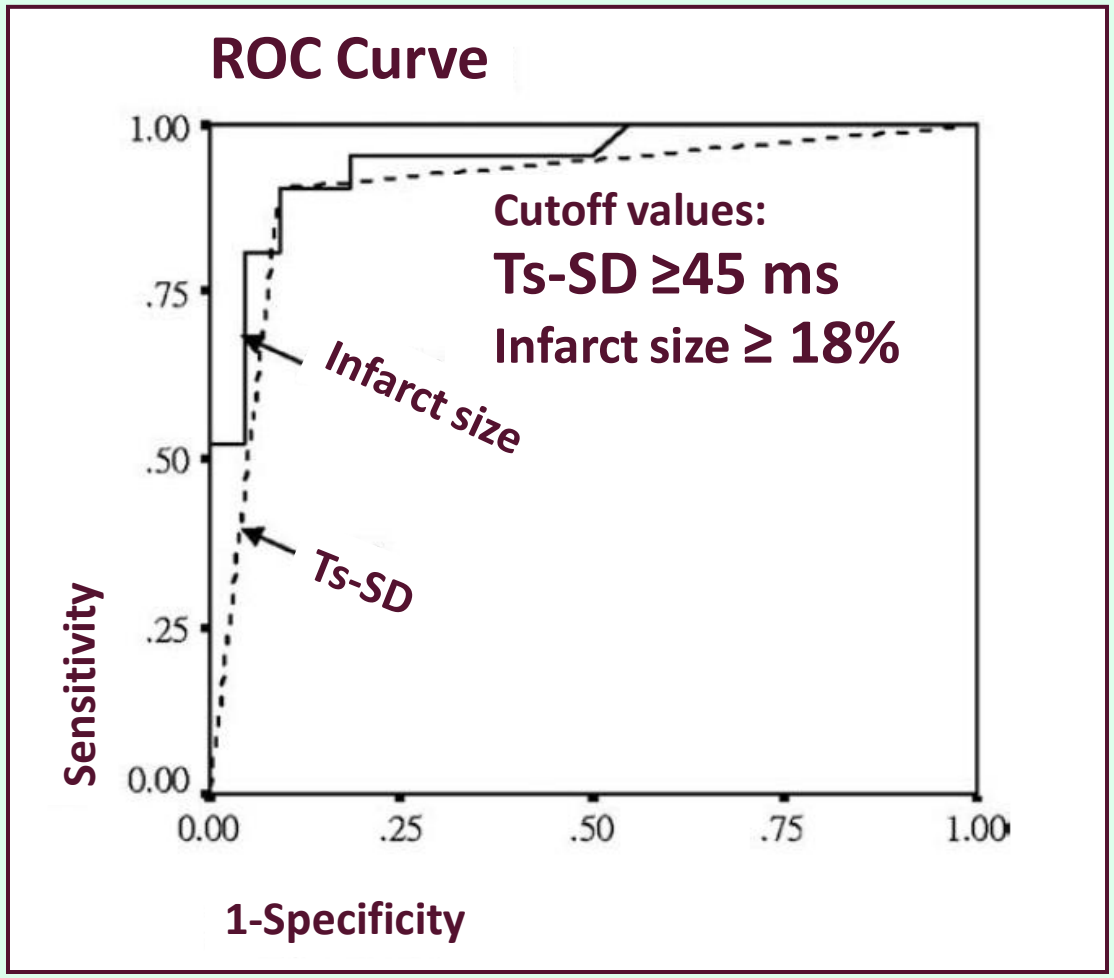
Serial changes of
ESV,
EDV,
LVEF,
Ts –SD
and Te-SD

in the remodeling
and
non-remodeling groups



Yan Khang et al. Am Heart J 2008;156:1124-32

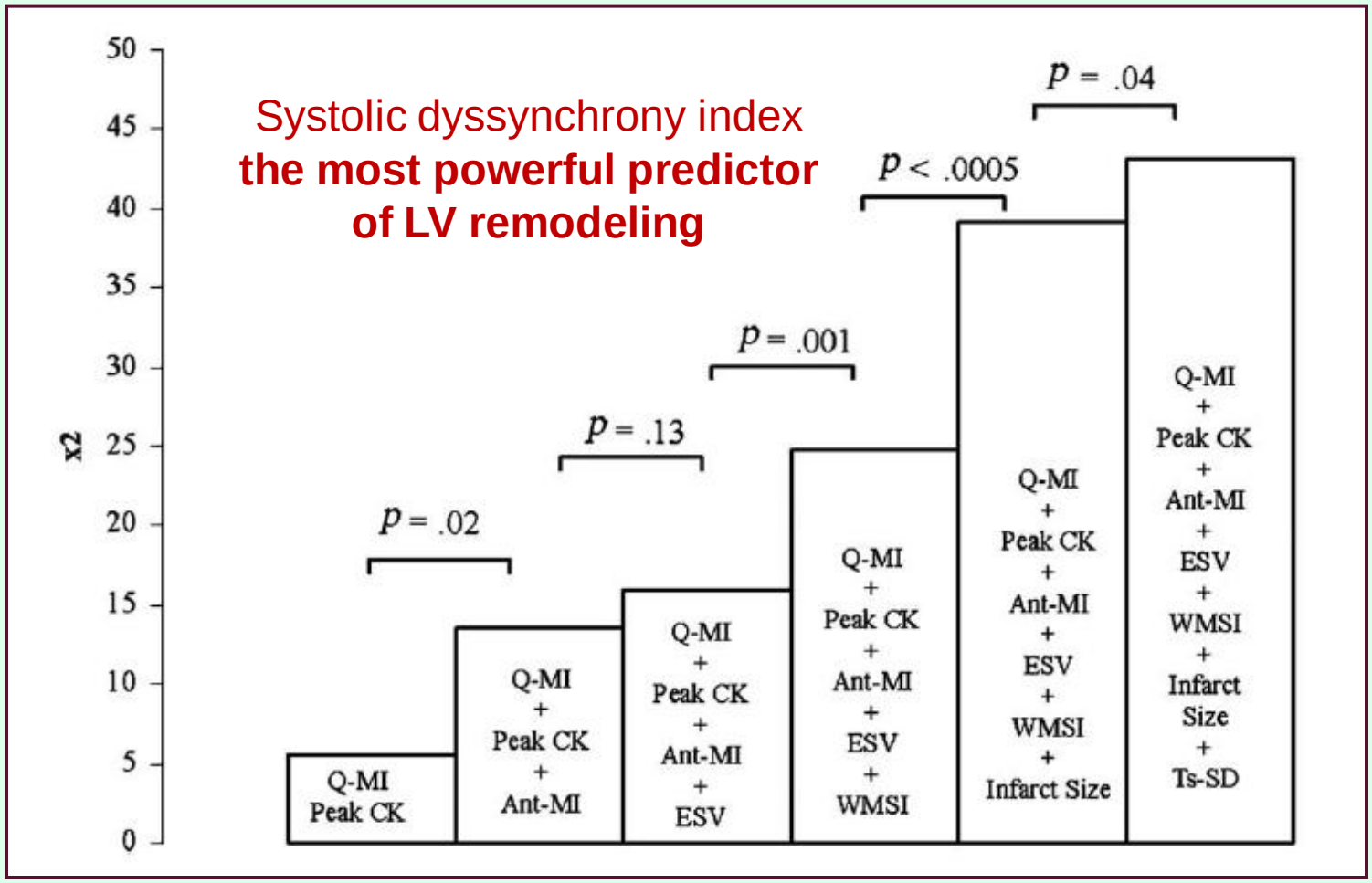
PREDICTIVE VALUE OF SYSTOLIC DYSSYNCHRONY BY TDI AND INFARCT SIZE BY CE-MRI



Sensitivity
91%
Specificity
91%

Yan Khang et al. Am Heart J 2008;156:1124-32

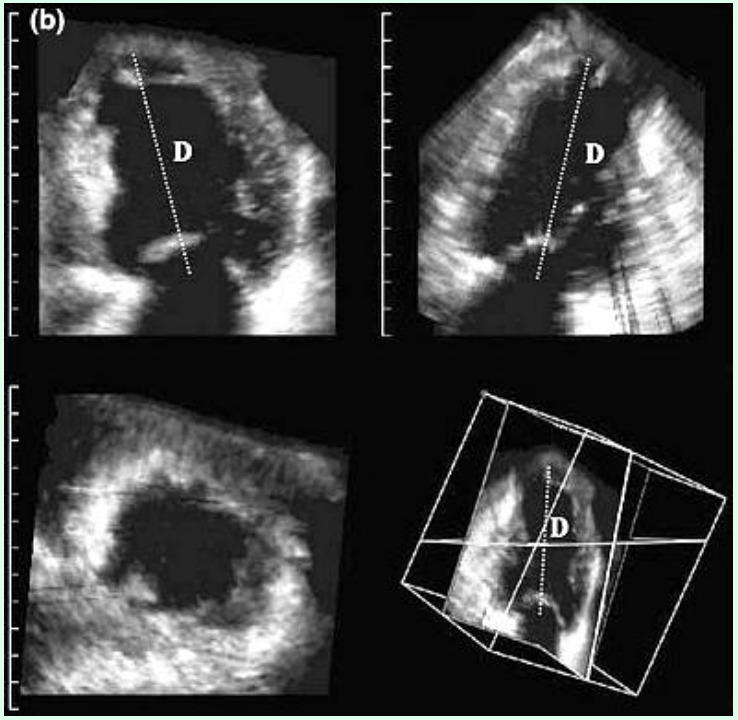
INCREMENTAL PREDICTIVE VALUE OF INFARCT SIZE BY CE-MRI AND SYSTOLIC DYSSYNCHRONY BY TDI



Yan Khang et al. Am Heart J 2008;156:1124-32

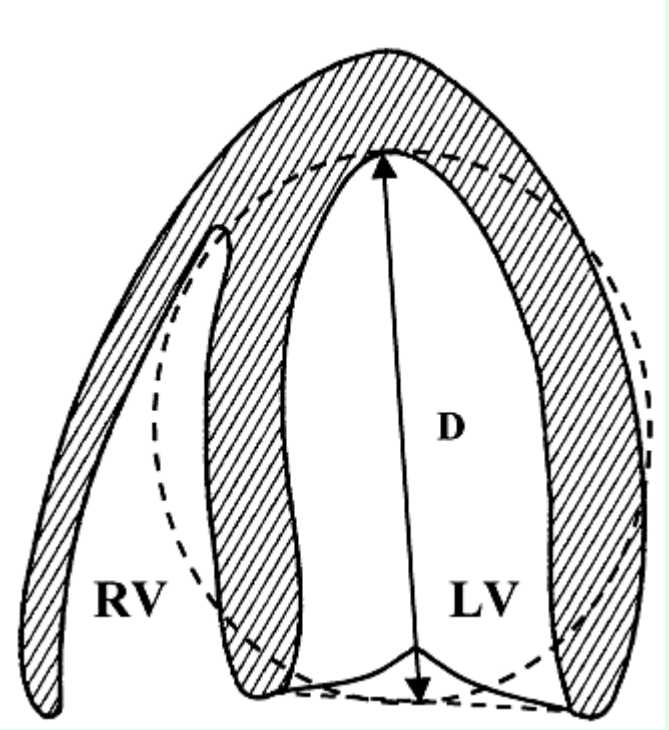
Early Identification of LV Remodeling After MI by 3D Echo

- *33 pts*
- *Serial 3D-echo: 6d, 3mo, 6mo, 12mo post MI*
- *LV Remodelling: >20% increase of EDV*



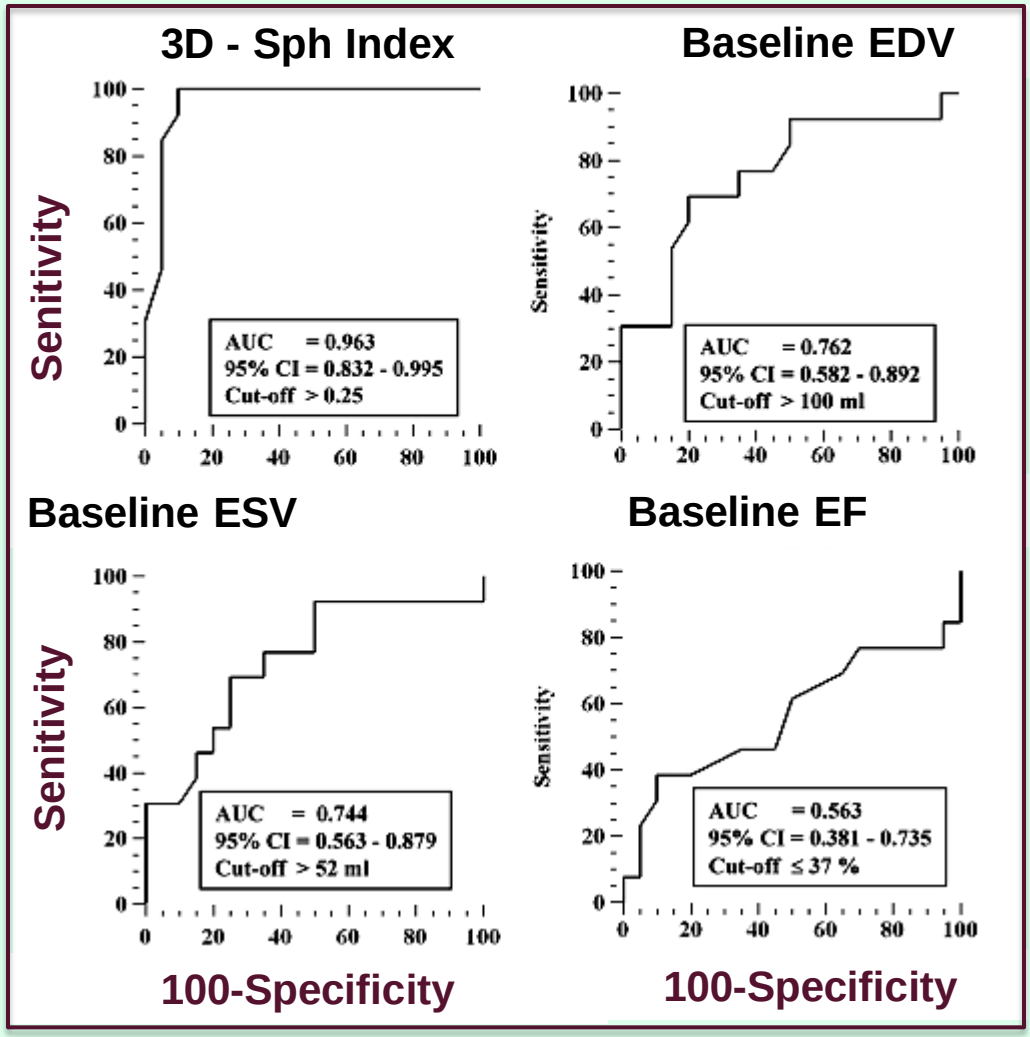
3D Sphericity Index

EDV/(4/3 x π x $(D/2)^3$)



Mannaerts HFJ et al, EHJ 2005

VALUE OF 3D SPHERICITY INDEX FOR EARLYPREDICTION OF POST MI LV REMODELING



3D-Sph index cut off >0.25

for early prediction of LV remodelling

Sn 100%

Sp 90%

PPV 87%

NPV 100%

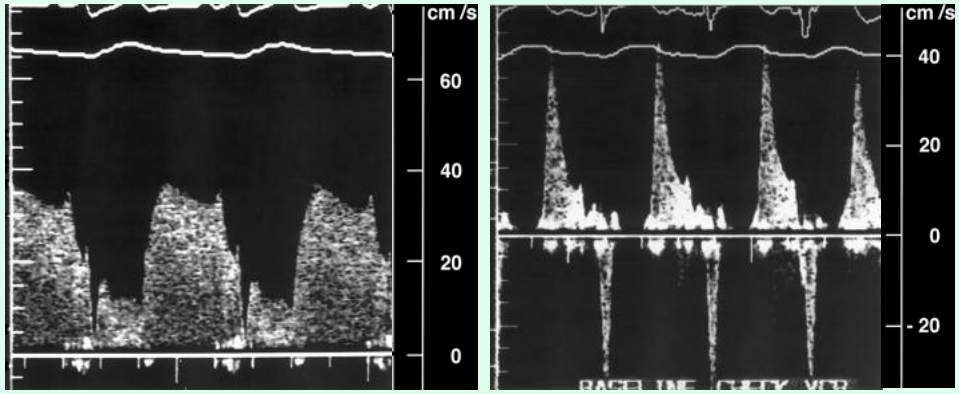
Mannaerts HFJ et al, EHJ 2005

CORONARY FLOW PATTERN OF INFARCT-RELATED ARTERY

Markers of “no-reflow”

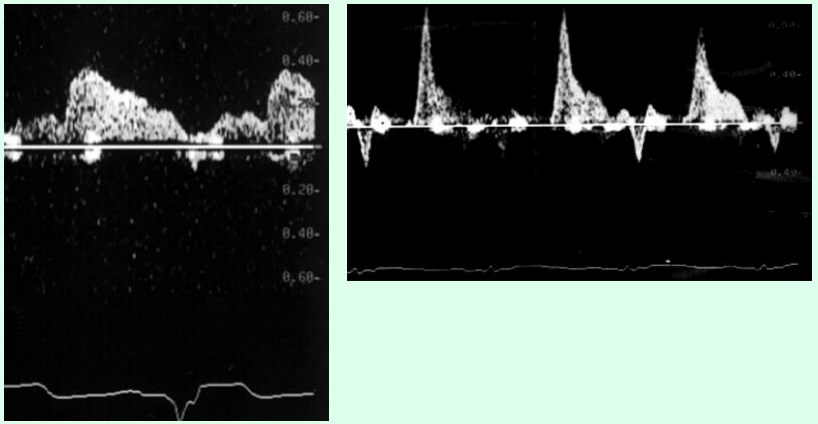
Rapid deceleration of diastolic flow
and
systolic retrograde flow

CathLab



T Kawamotoetal.
Circulation1999;100:339-45

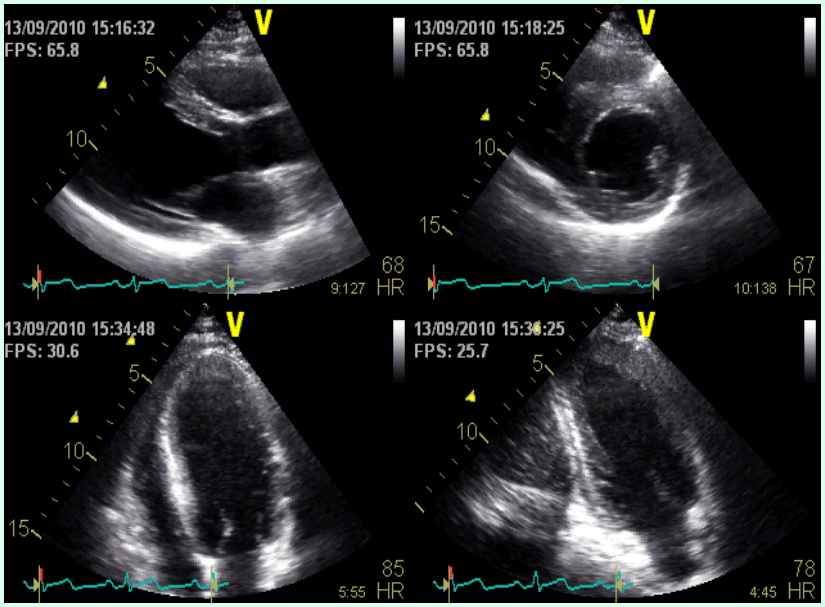
TT Doppler

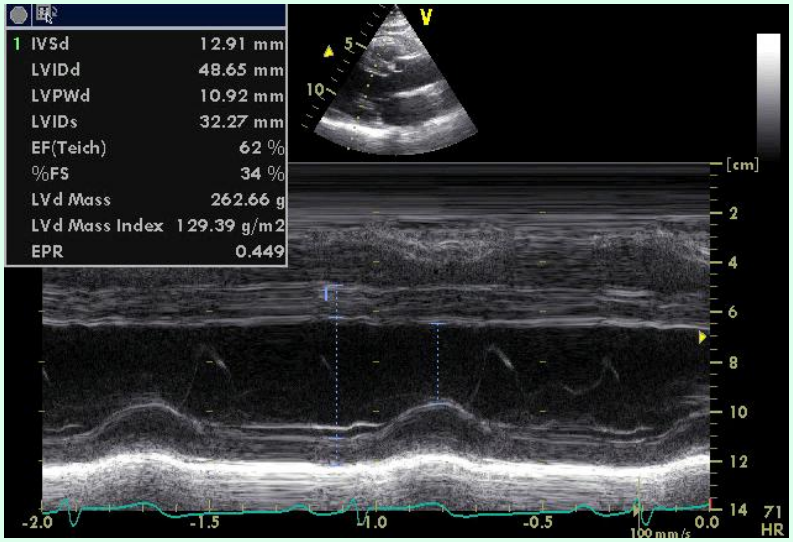


Tani T etal.
CardiovasvularUltrasound 2005; 3:22

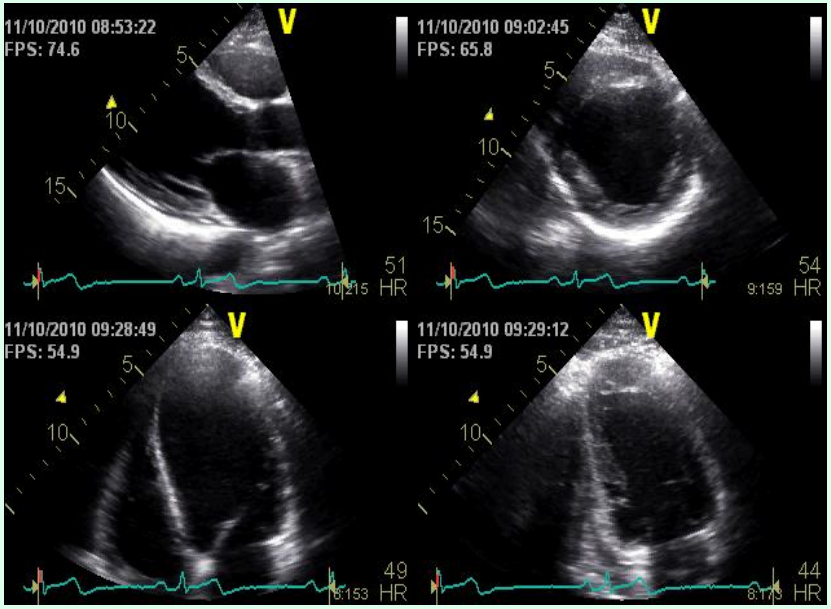
CLINICAL CASE

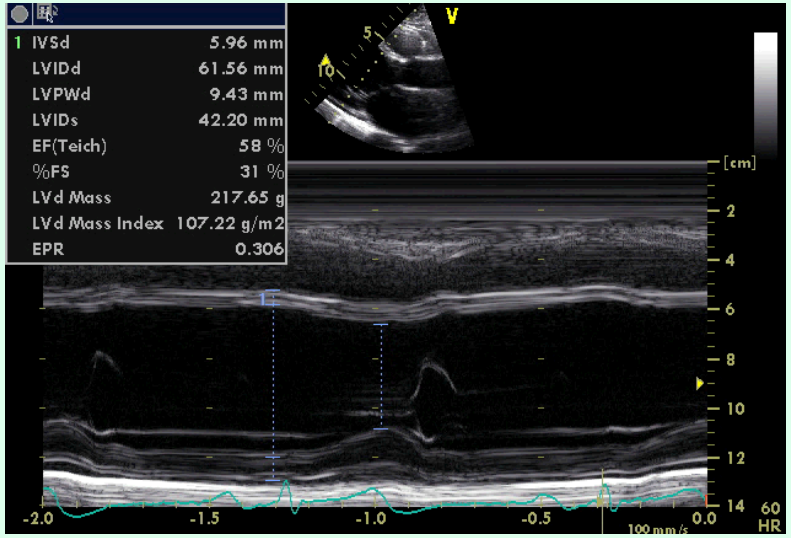
ACUTE





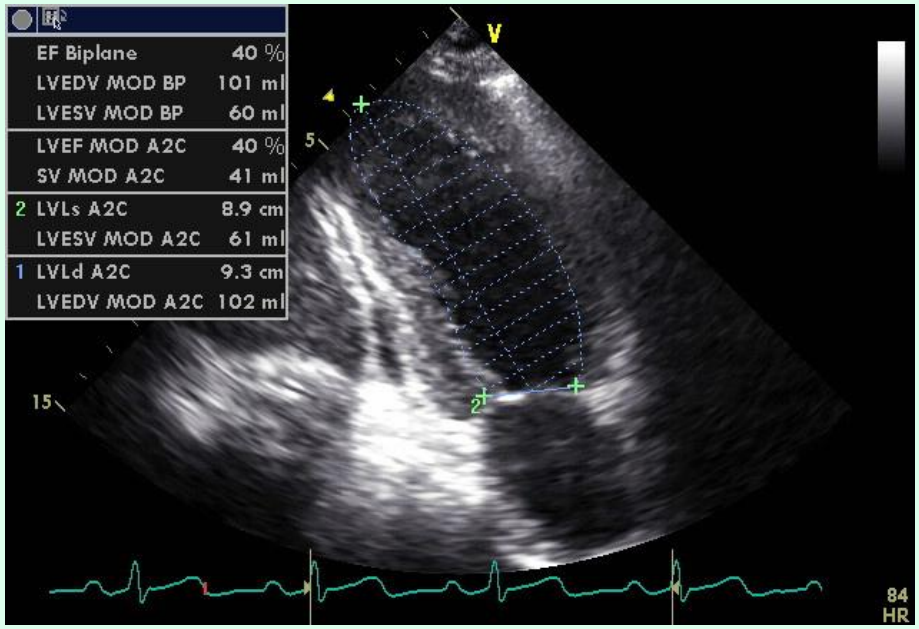
1 MONTHF-UP



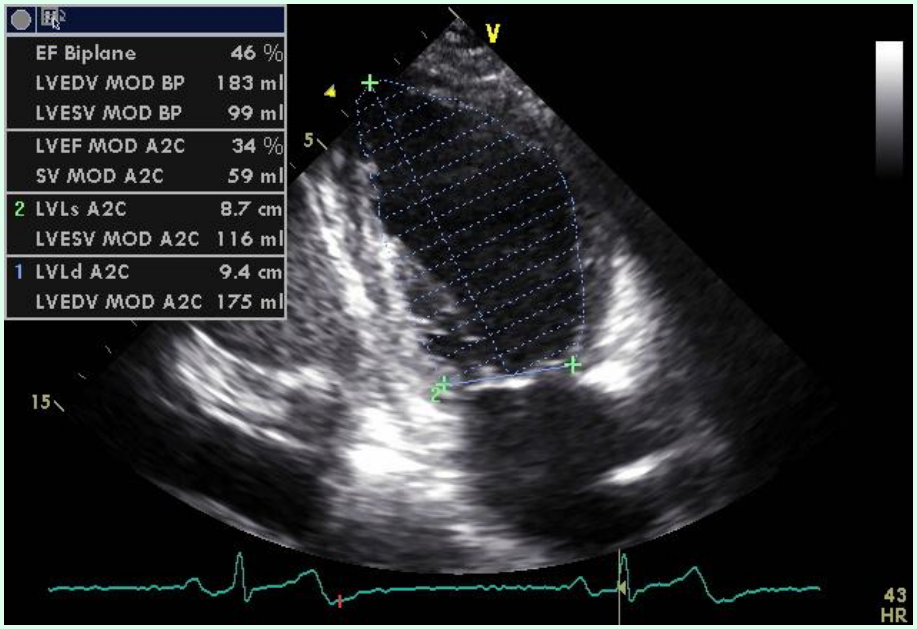


CLINICAL CASE

ACUTE

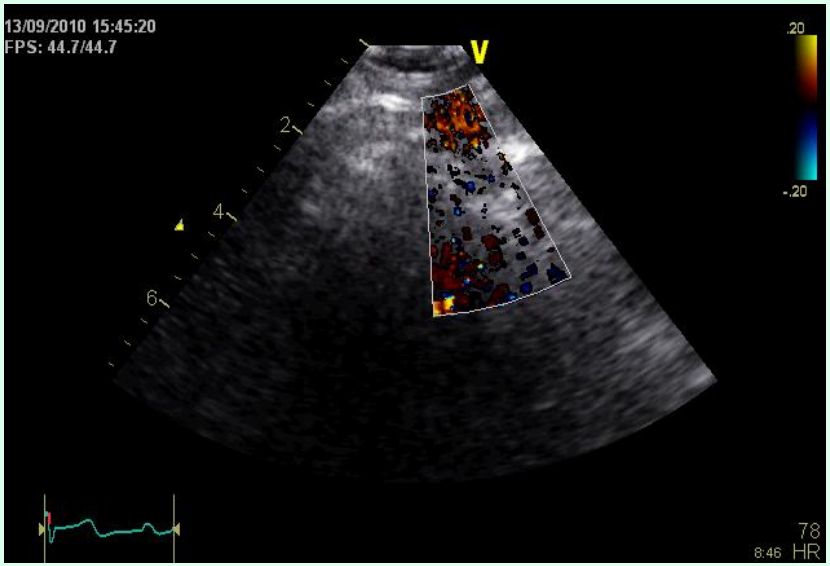


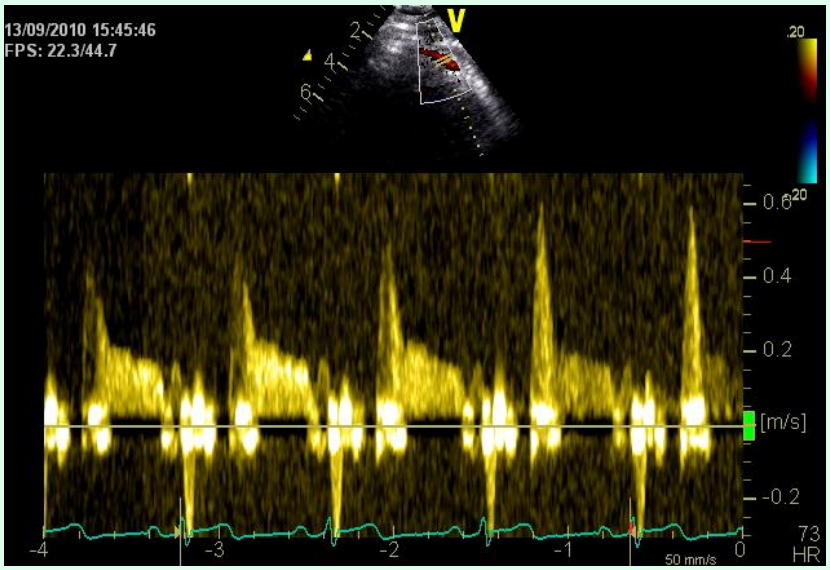
1 MONTHF-UP



CLINICAL CASE

ACUTE





1 MONTHF-UP