

STRESS MRI

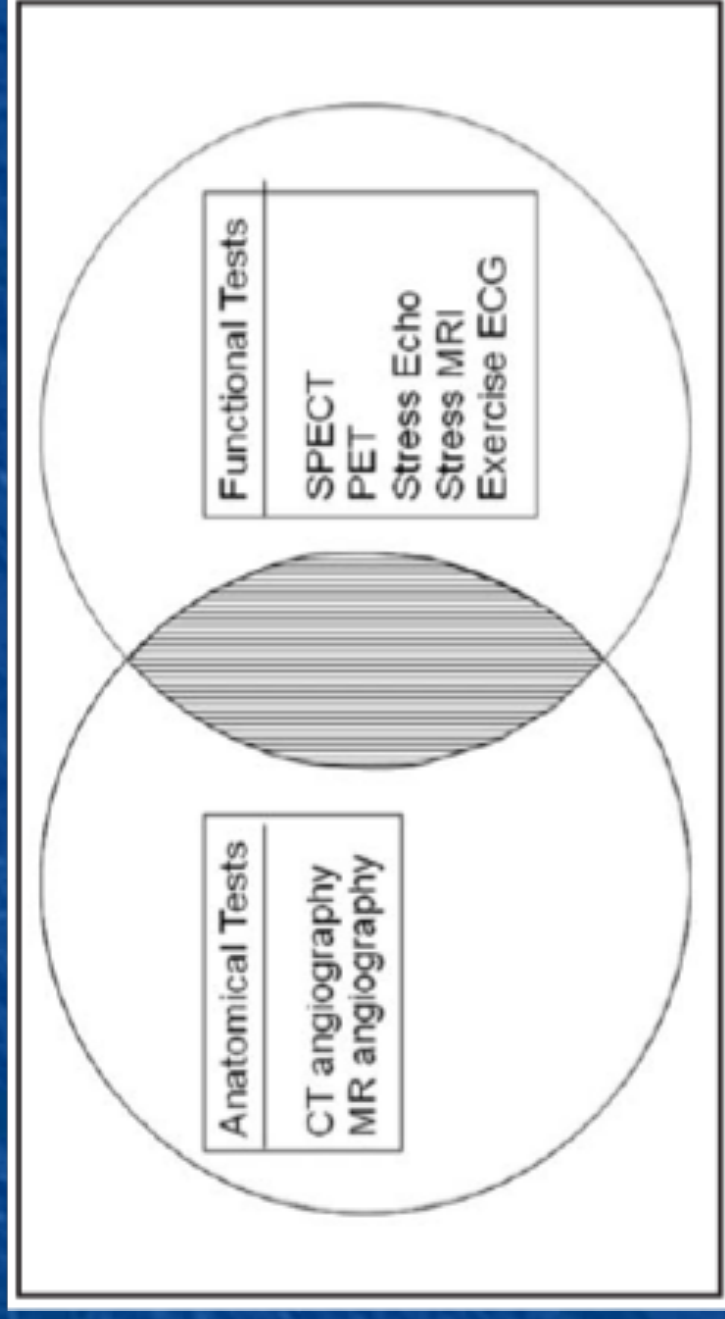
F. CIVAIA – L. IACUZIO

Goal of imaging in IHD

- To detect disease *before symptoms* occur
- To confirm disease in *symptomatic* patient
- To monitor disease *progression* over time

CARDIAC IMAGING MODALITIES

Selecting the best test !



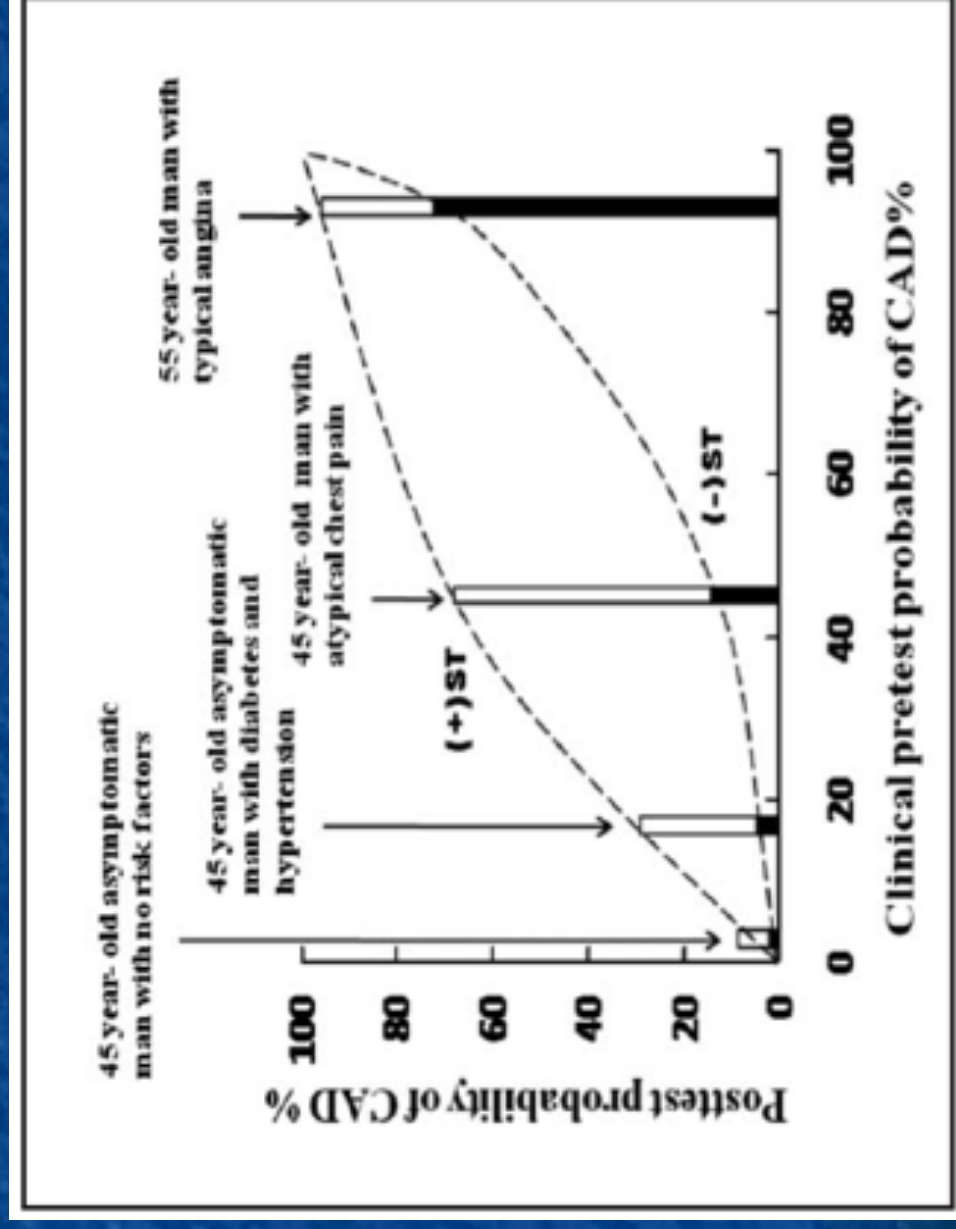
THE CHOICE: depends on the clinical question at hand

CARDIAC IMAGING MODALITIES

Selecting the best test !

- What's the patient's DIAGNOSIS ?
- *Likelihood of having CAD*
- What's the patient's PROGNOSIS ?
- *Risk of future CV events*

Bayes' theorem



- HIGH PRE TEST PROBABILITY

- - PROGNOSIS > diagnosis
- - FUNCTIONAL > anatomical

- INTERMEDIATE PRE TEST PROBABILITY

- - PROGNOSIS = DIAGNOSIS
- - FUNCTIONAL = ANATOMICAL

- LOW PRE TEST PROBABILITY

- - prognosis = DIAGNOSIS
- - functional = ANATOMICAL

Pre-test likelihood for CAD

Table 1. Pretest Probability of Coronary Artery Disease by Age, Gender and Symptoms					
Age (years)	Sex	Typical/definite angina	Atypical/probable chest pain	Non-anginal chest pain	Asymptomatic
30-39	Men	Intermediate	Intermediate	Low	Very low
	Women	Intermediate	Very low	Very low	Very low
40-49	Men	High	Intermediate	Intermediate	Low
	Women	Intermediate	Low	Very Low	Very low
50-59	Men	High	Intermediate	Intermediate	Low
	Women	Intermediate	Intermediate	Low	Very low
60-69	Men	High	Intermediate	Intermediate	Low
	Women	High	Intermediate	Intermediate	Low

Reprinted and modified with permission from ACC/AHA 2002 Guideline Update for Exercise Testing (Circulation. 2002; 106:1863-1892).

Pivotal in which test is indicated

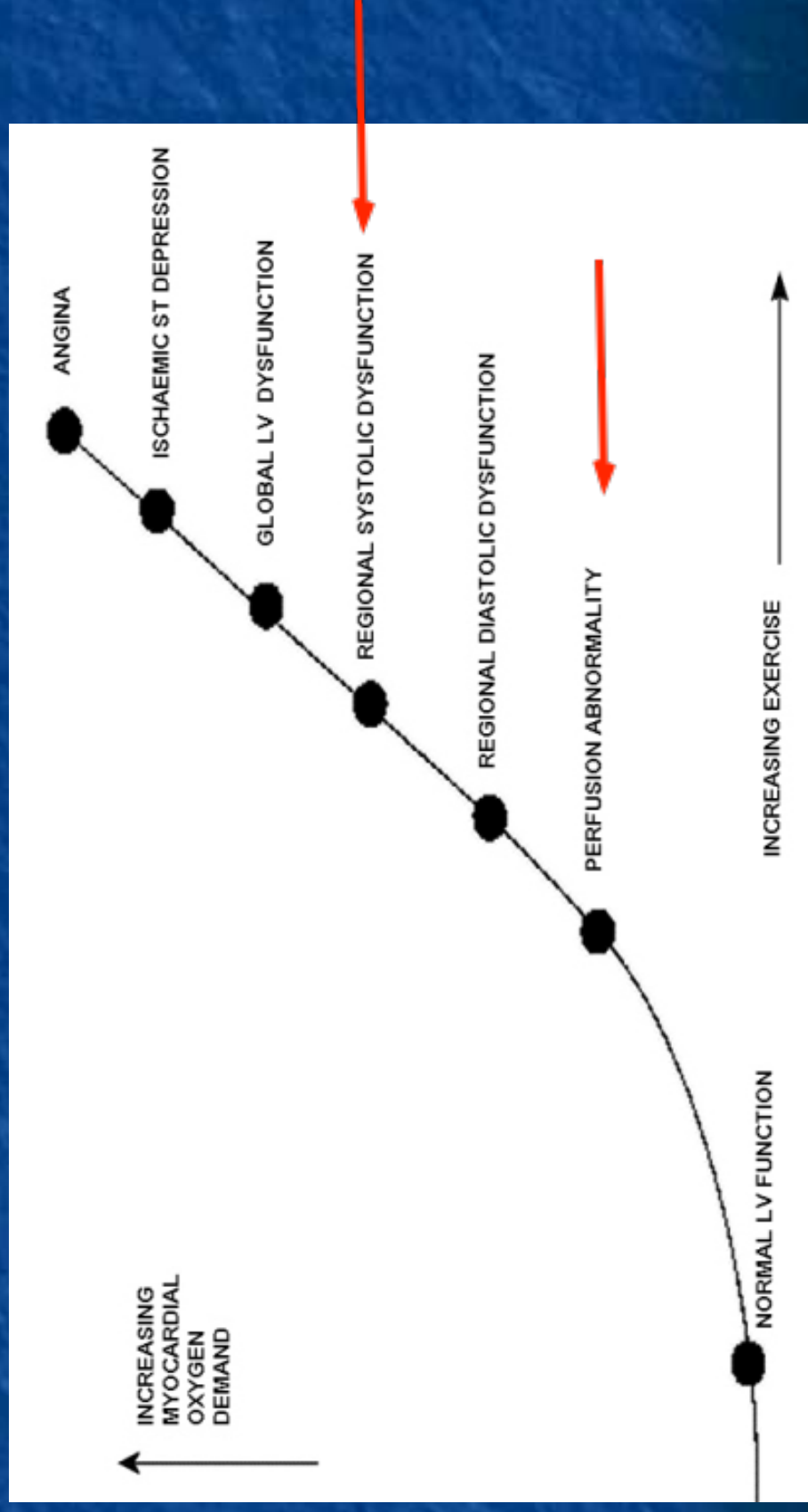
Myocardial ischemia

- - assessing perfusion
- - assessing wall motion
- Exercise stress
- Pharmacological stress
- - vasodilators (adenosine or dipyridamole)
- - beta agonist (dobutamine)

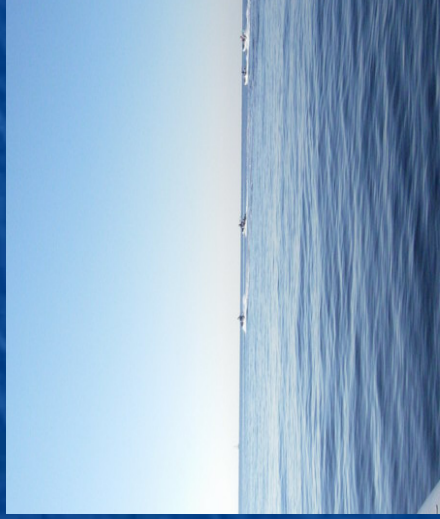
A risk-based approach

- Shift from anatomic to prognostic strategies
- Incremental prognostic value (clinical, historical and treadmill -----advanced stress tests): increased prognostic informations to enhance the risk stratification

Sequence of ischemic events



- *RELATIONSHIP BETWEEN ISCHEMIA*

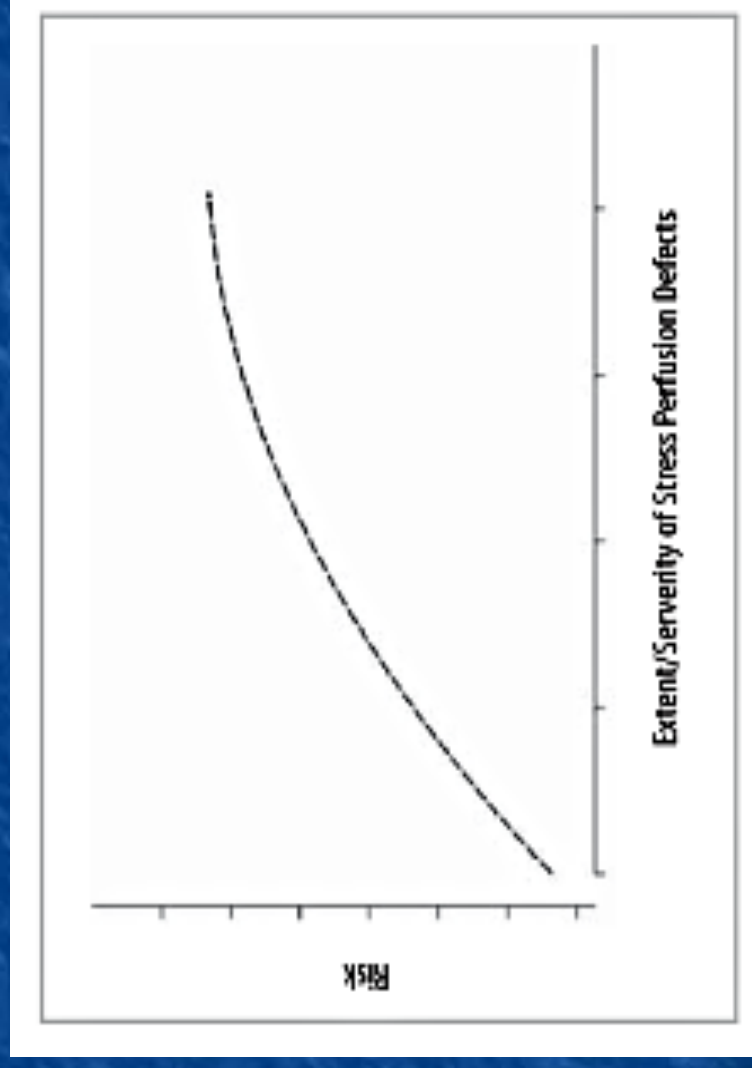


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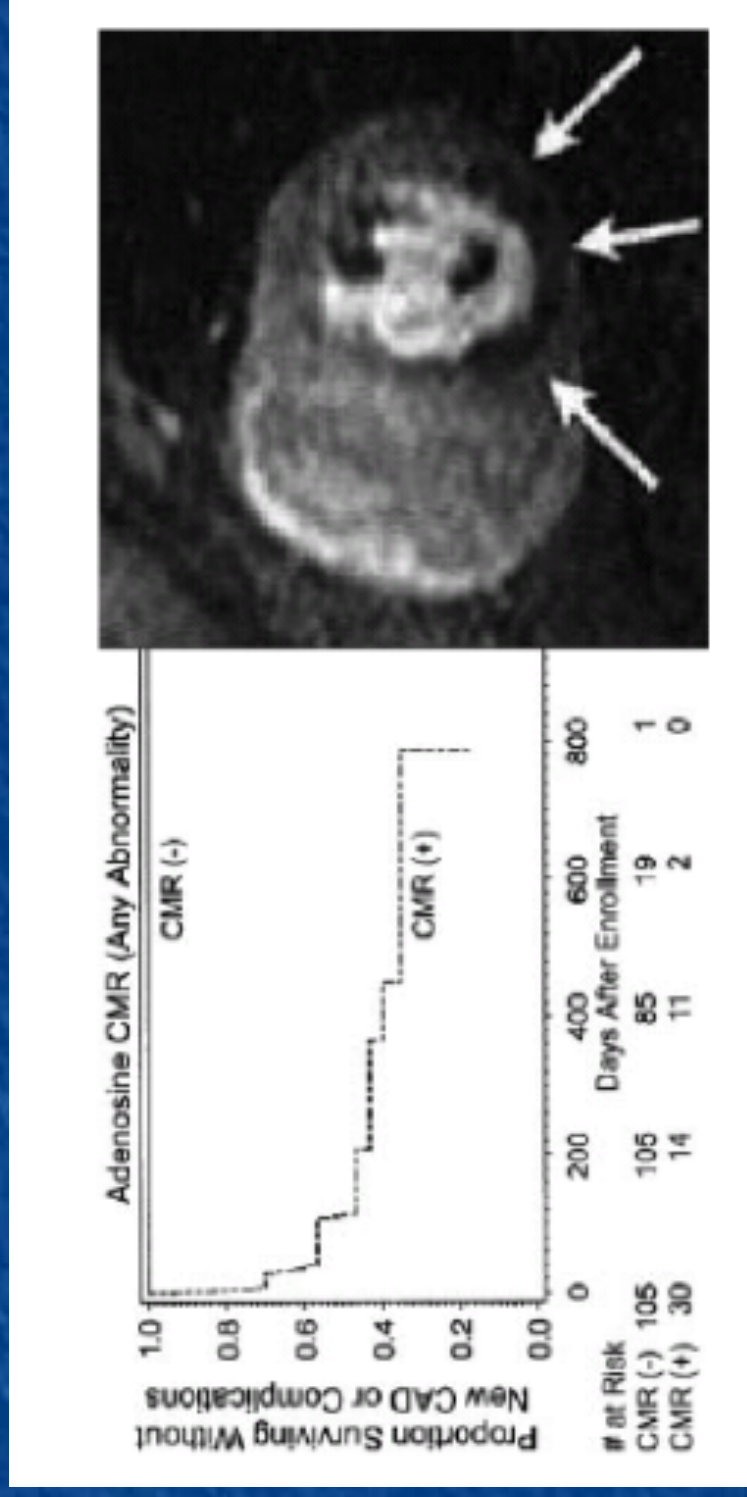


- *EXTENT AND RISK OF DEATH OR EVENTS*

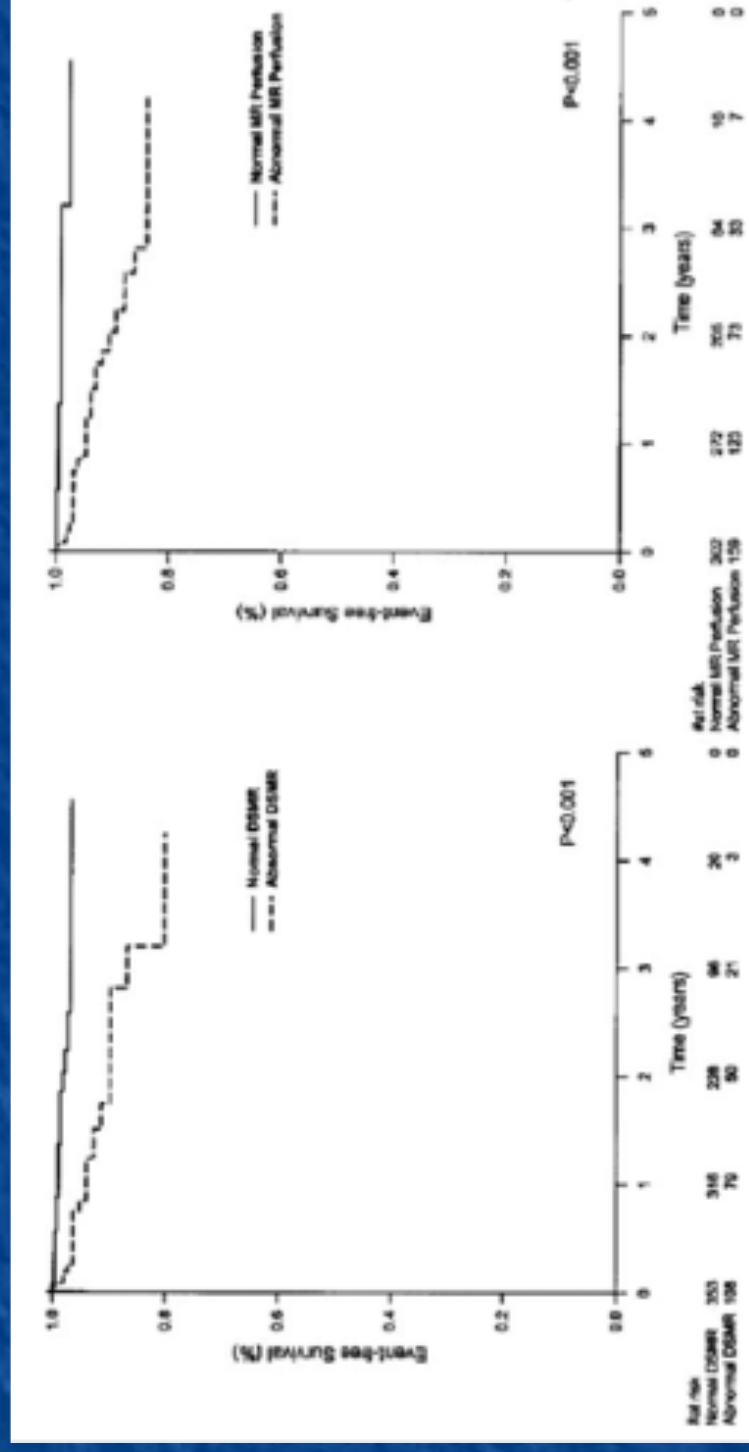
Is there a direct relationship between increasing extent and severity of stress perfusion defects and increasing patient risk of cardiac death or events



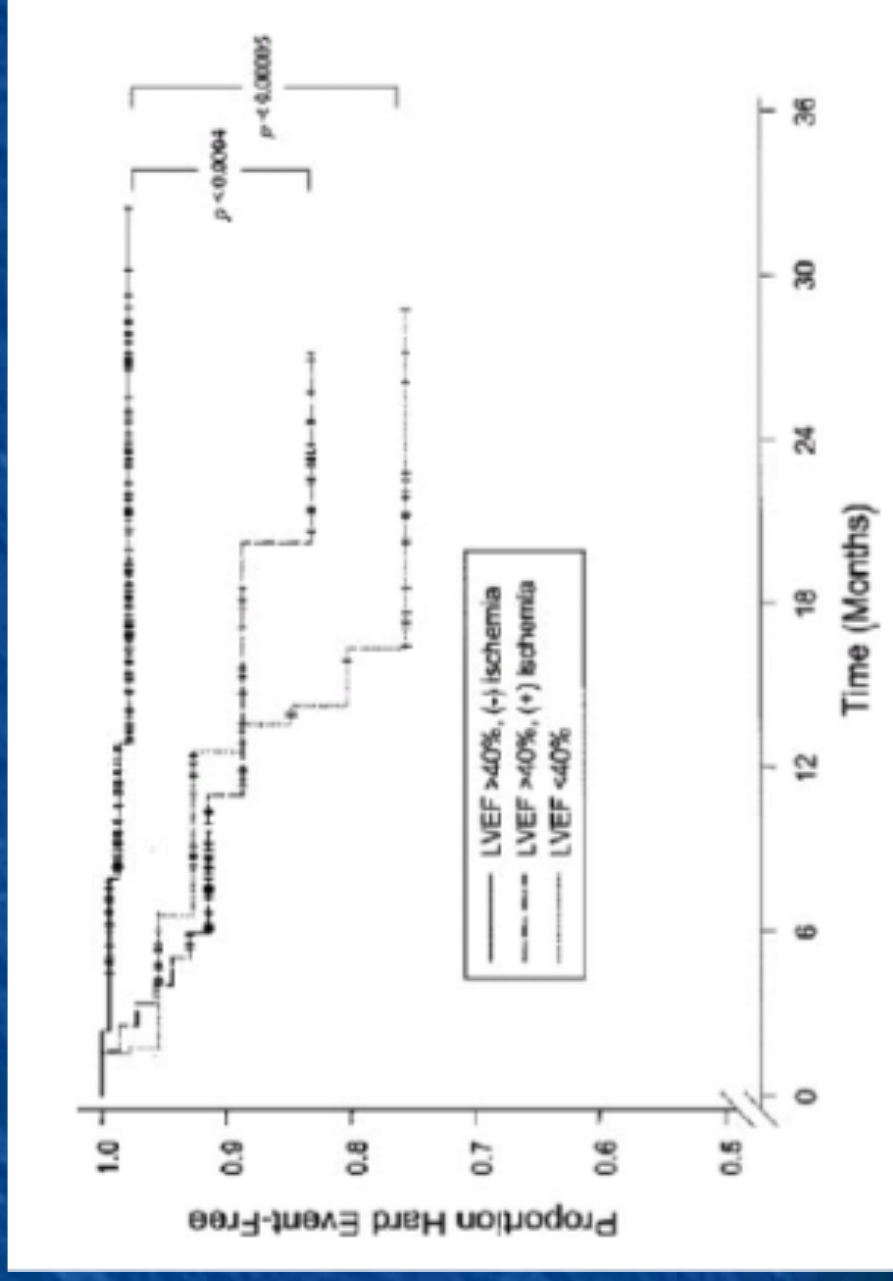
Kaplan-Meier survival distribution based on presence/absence of hypoperfusion



Kaplan-Meier curves based on the results on dobutamine and adenosine CMR

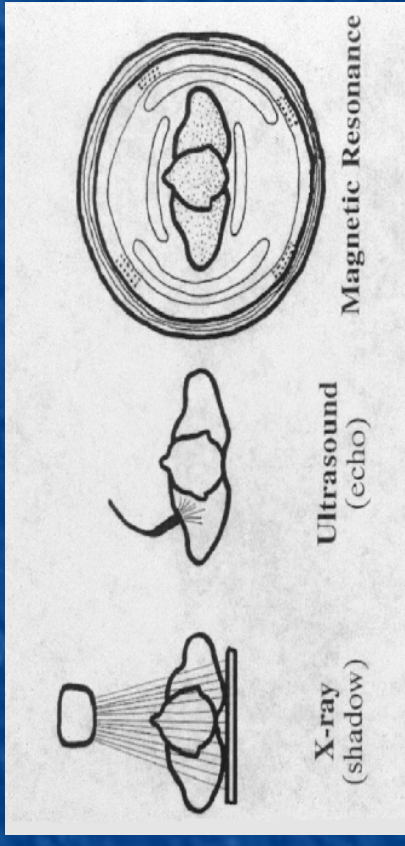


Kaplan-Meier event free curves in pts. with EF $\geq$ 40% with or without inducible ischemia by dobutamine CMR

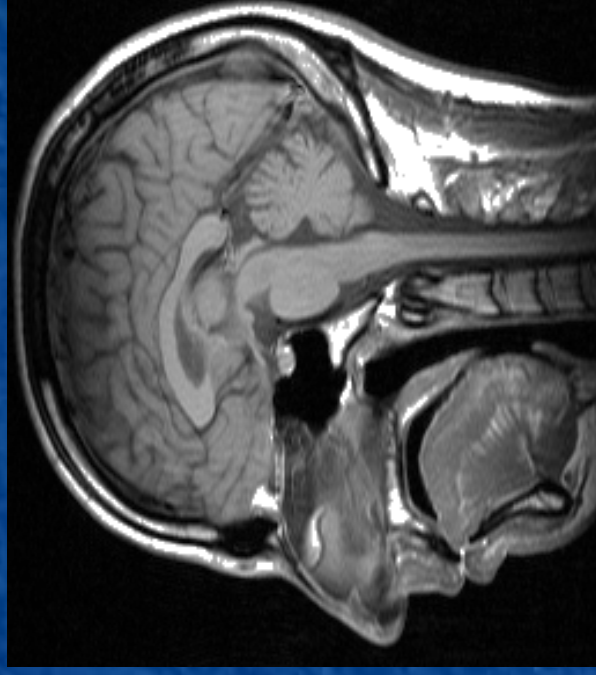
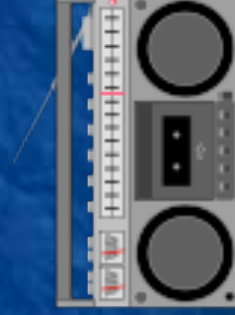


MRI is a complementary means of *« seeing » inside the body*

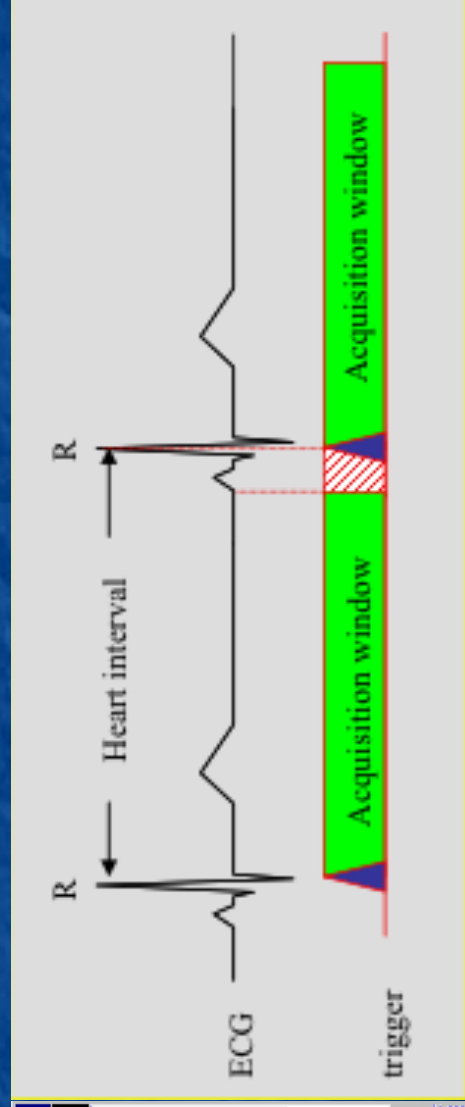
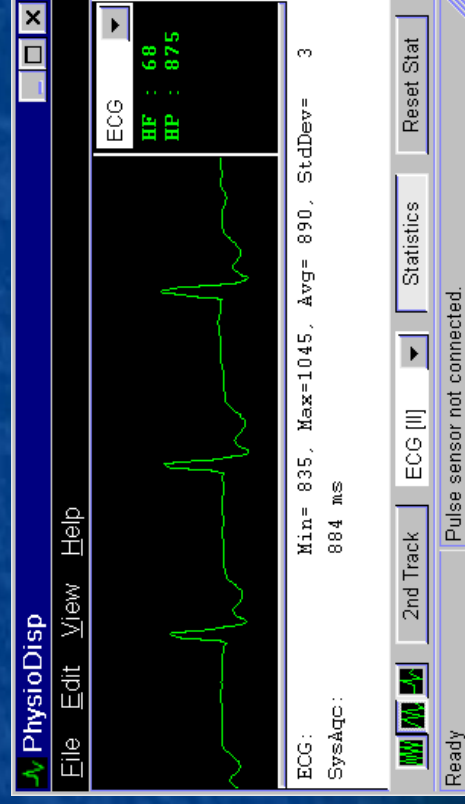
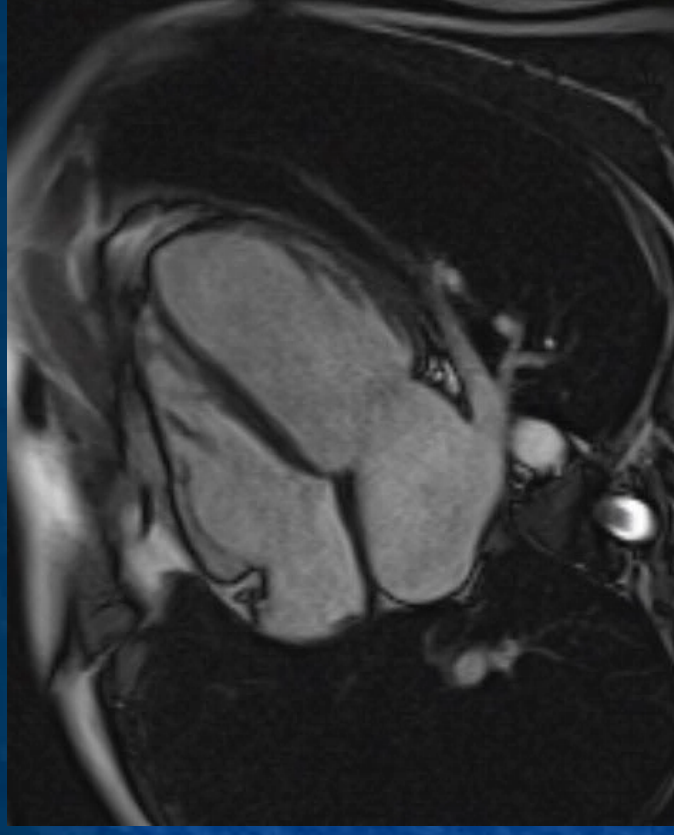
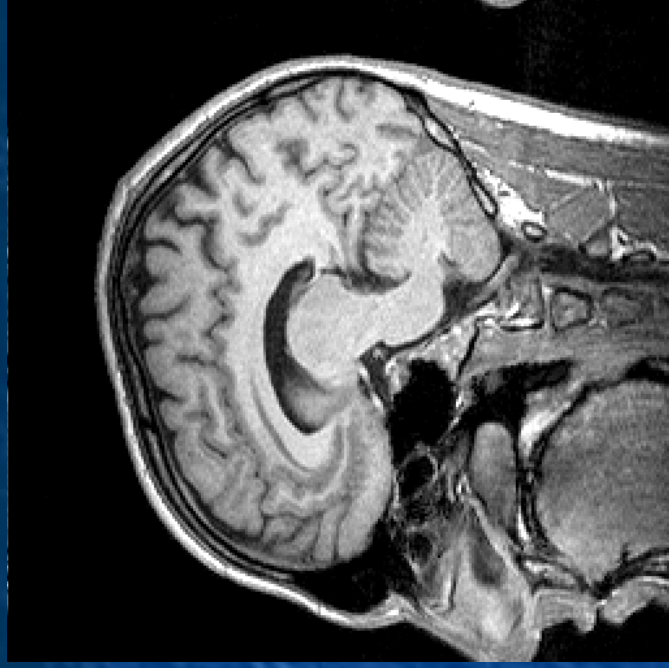
- *Non-invasive imaging*
technique
- *High-resolution images in*
any desired plane
- *No radiation*
- *Combined modalities*
(morphology, function ...)
- *Accurate diagnosis*
- *Less observer-dependent*



MRI looks simple....

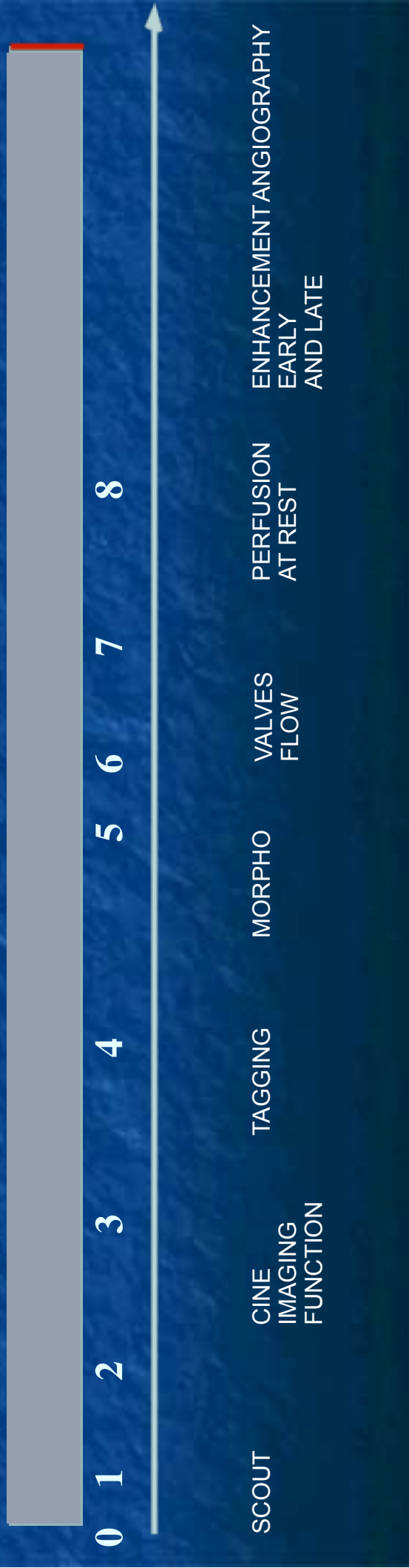
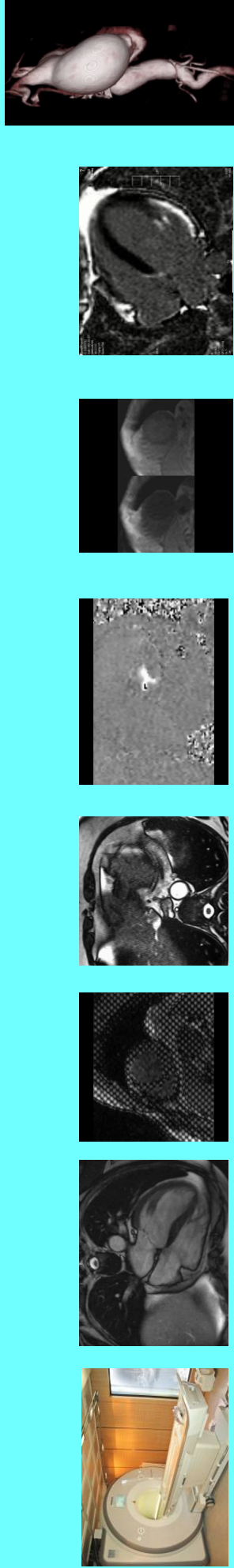


From static to cardiac imaging

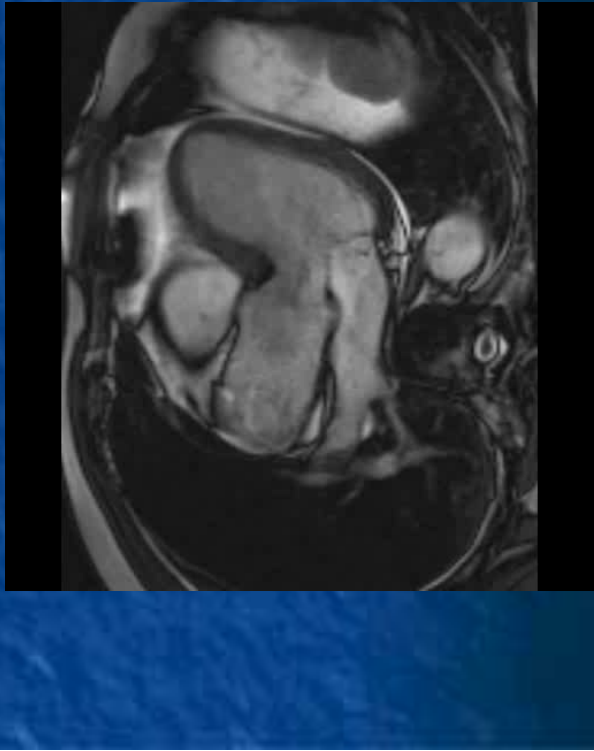
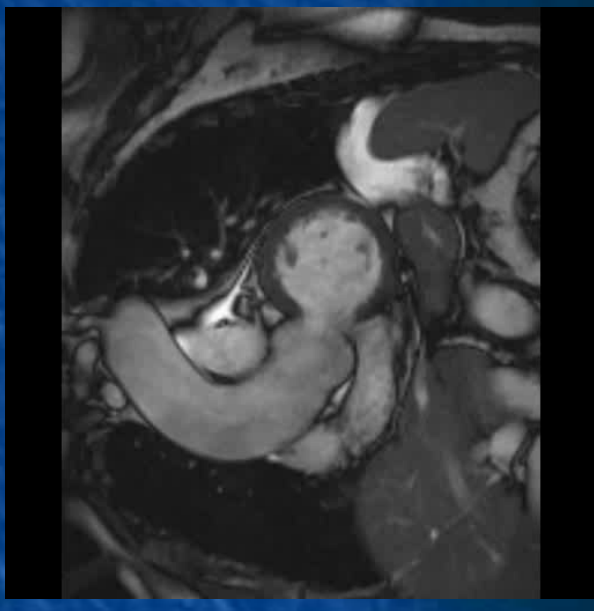
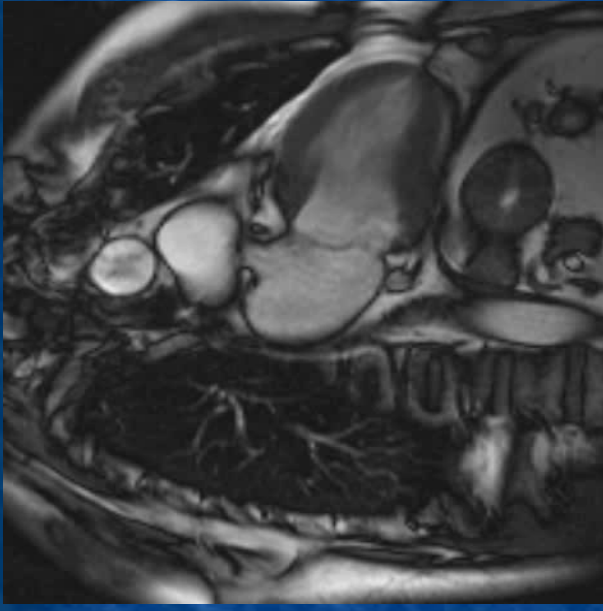
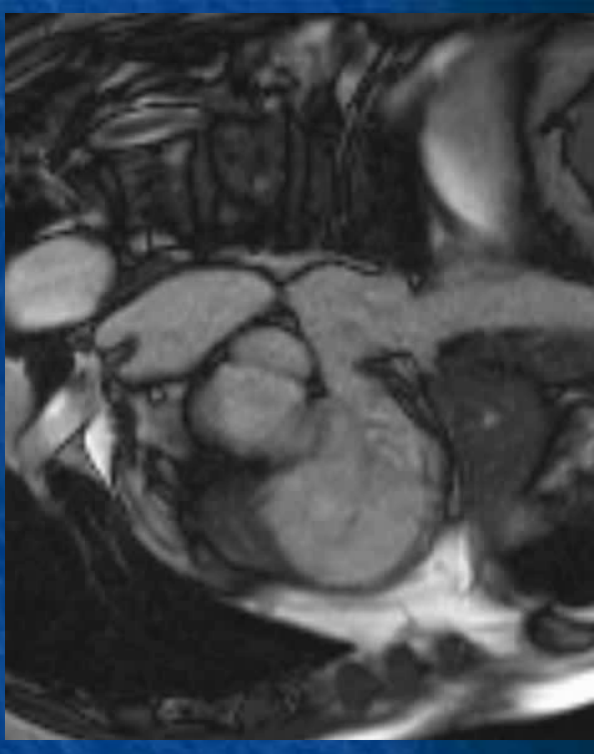
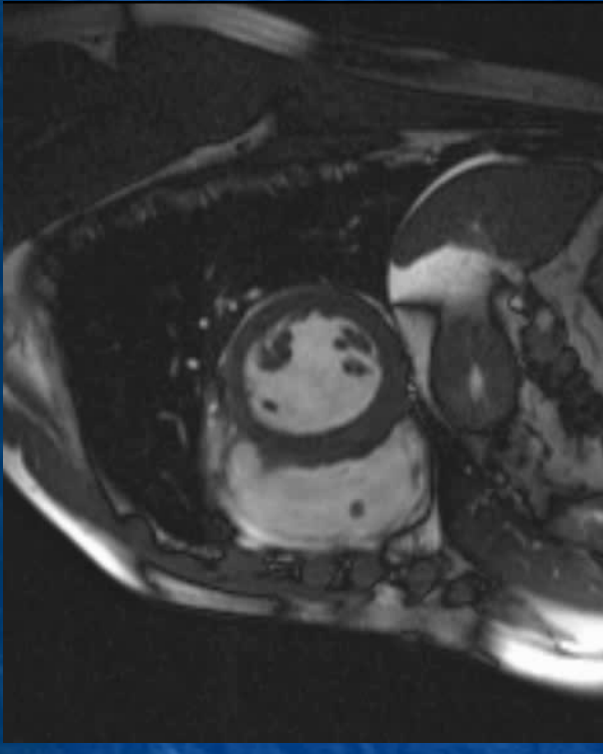


Steps of an MRI exam

30 - 40 MINUTES

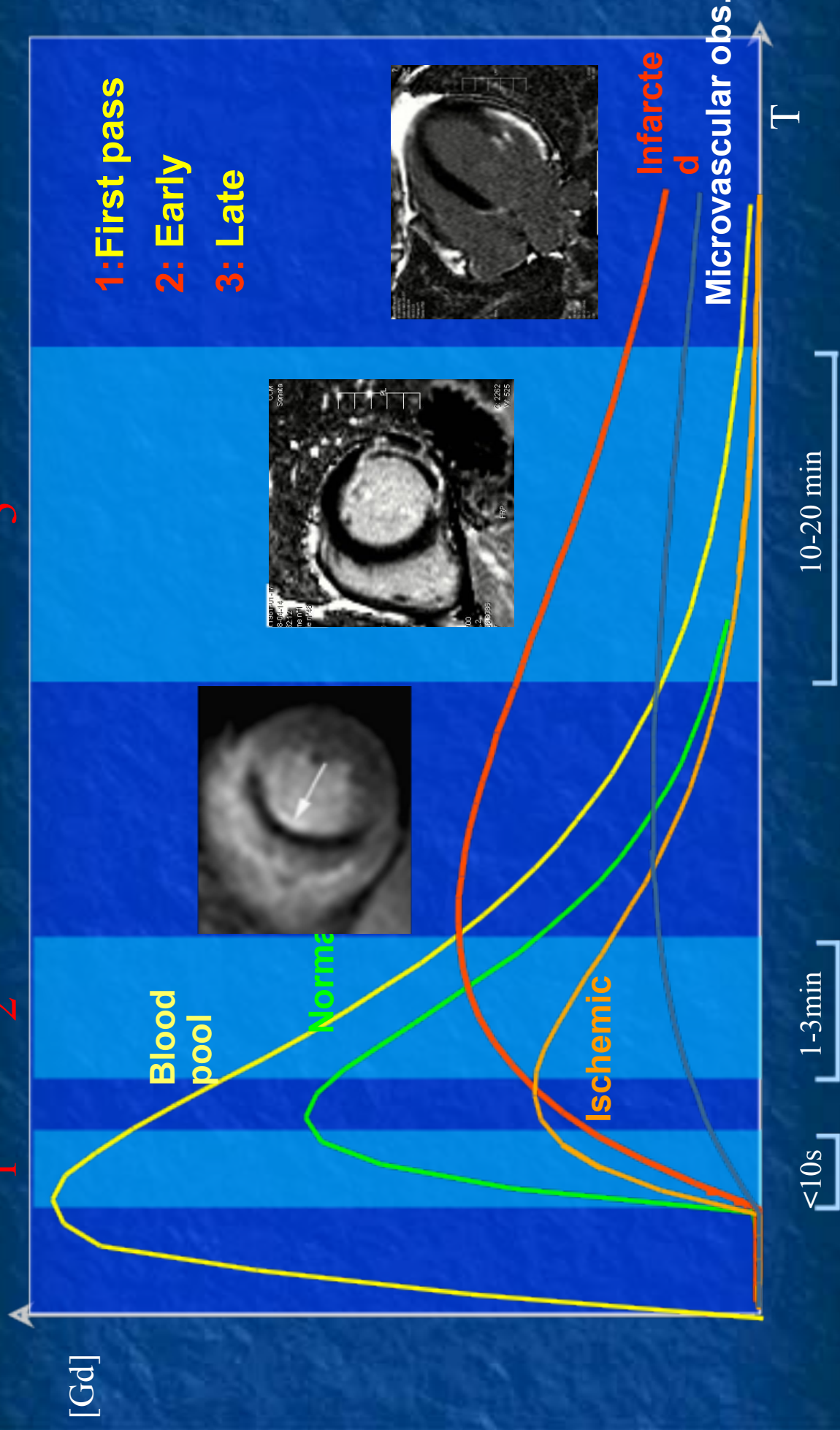


Excellent visualisation of cardiac structures

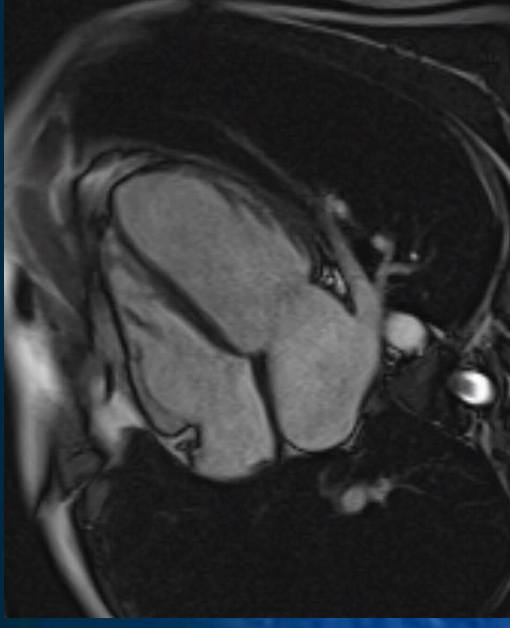


ENHANCEMENT

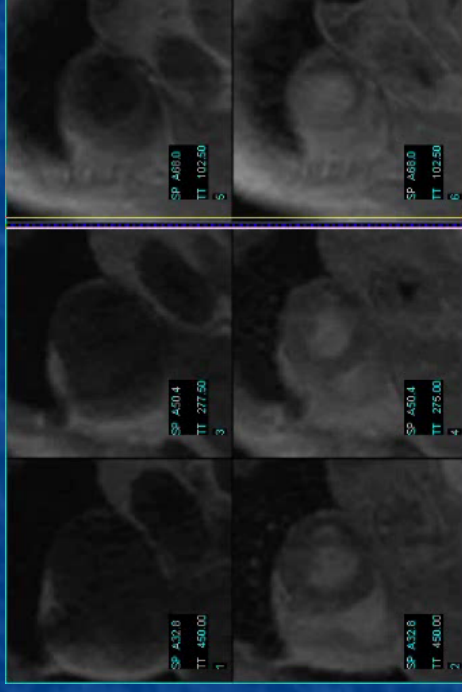
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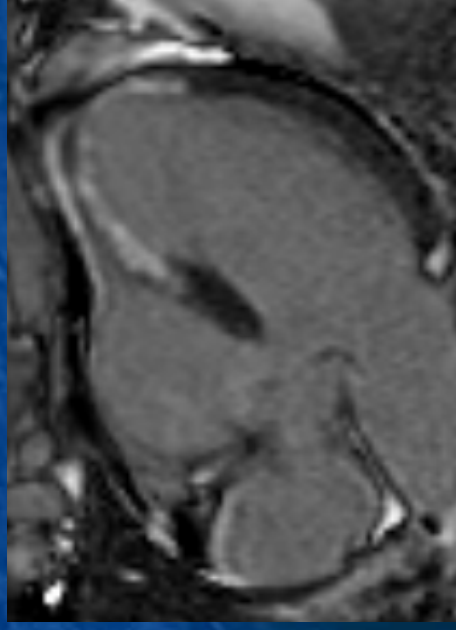
- CINE MRI:
morphological and
functional study of cardiac
structures



- PERFUSION MRI:
rest and stress perfusion
study



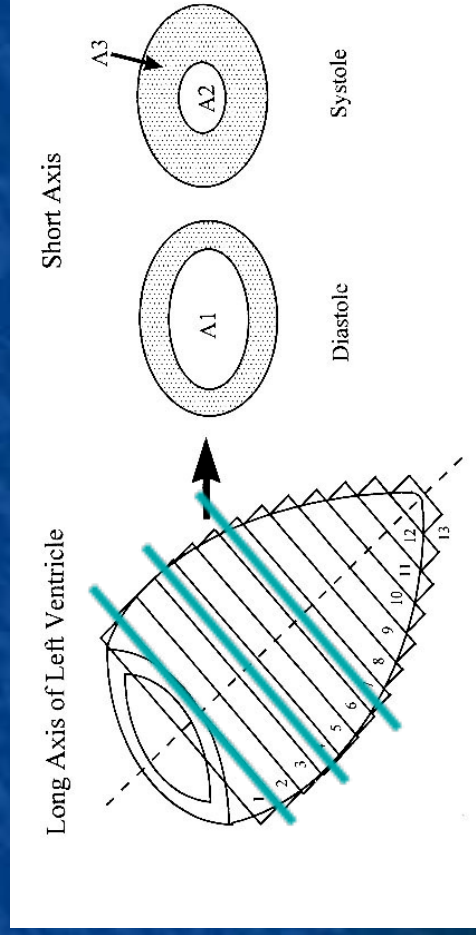
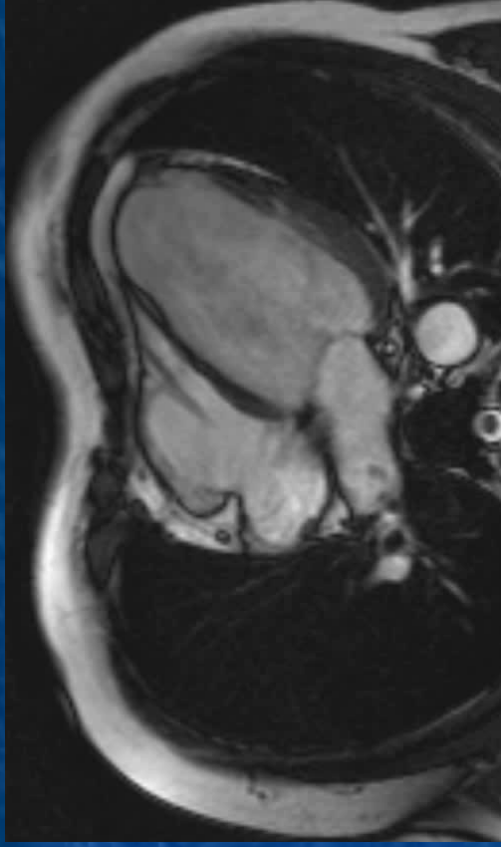
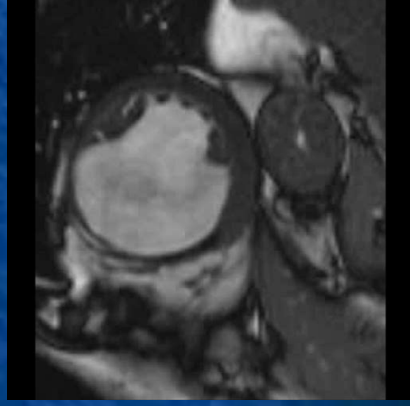
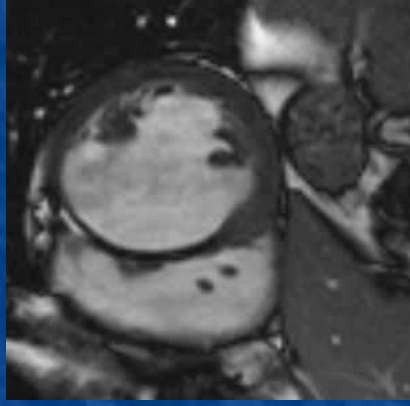
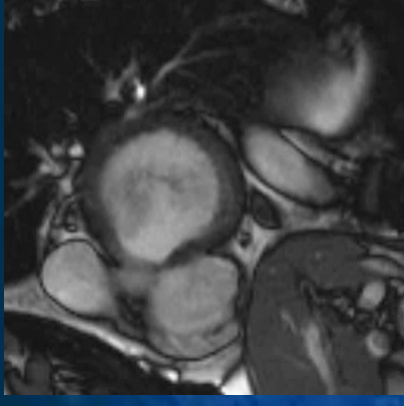
- CONTRAST CMR:
early and late enhancement
(tissue characterisation)



RELIABLE EJECTION FRACTION, VOLUME AND MASS

Normal Values

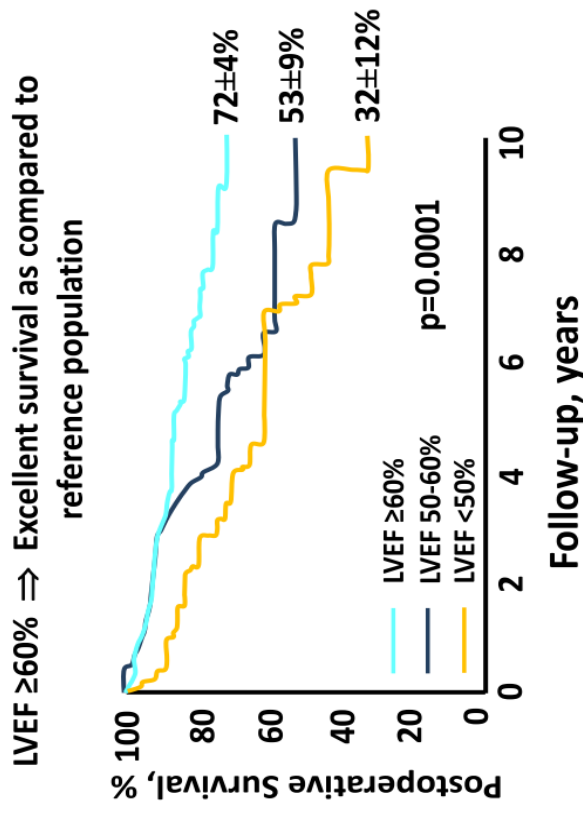
LVEF :
56 - 78 %
EDVI :
47 - 92 ml/m²
ESVI :
13 - 33 ml/m²
LV Mass :
70 - 113 g/m²



- 3 Times more accurate & reliable compared with Angio & 2D Echo (Simpson formula)
- Correlated with 3D Echo (+- 3%)

Patient's prognosis closely related to LV function

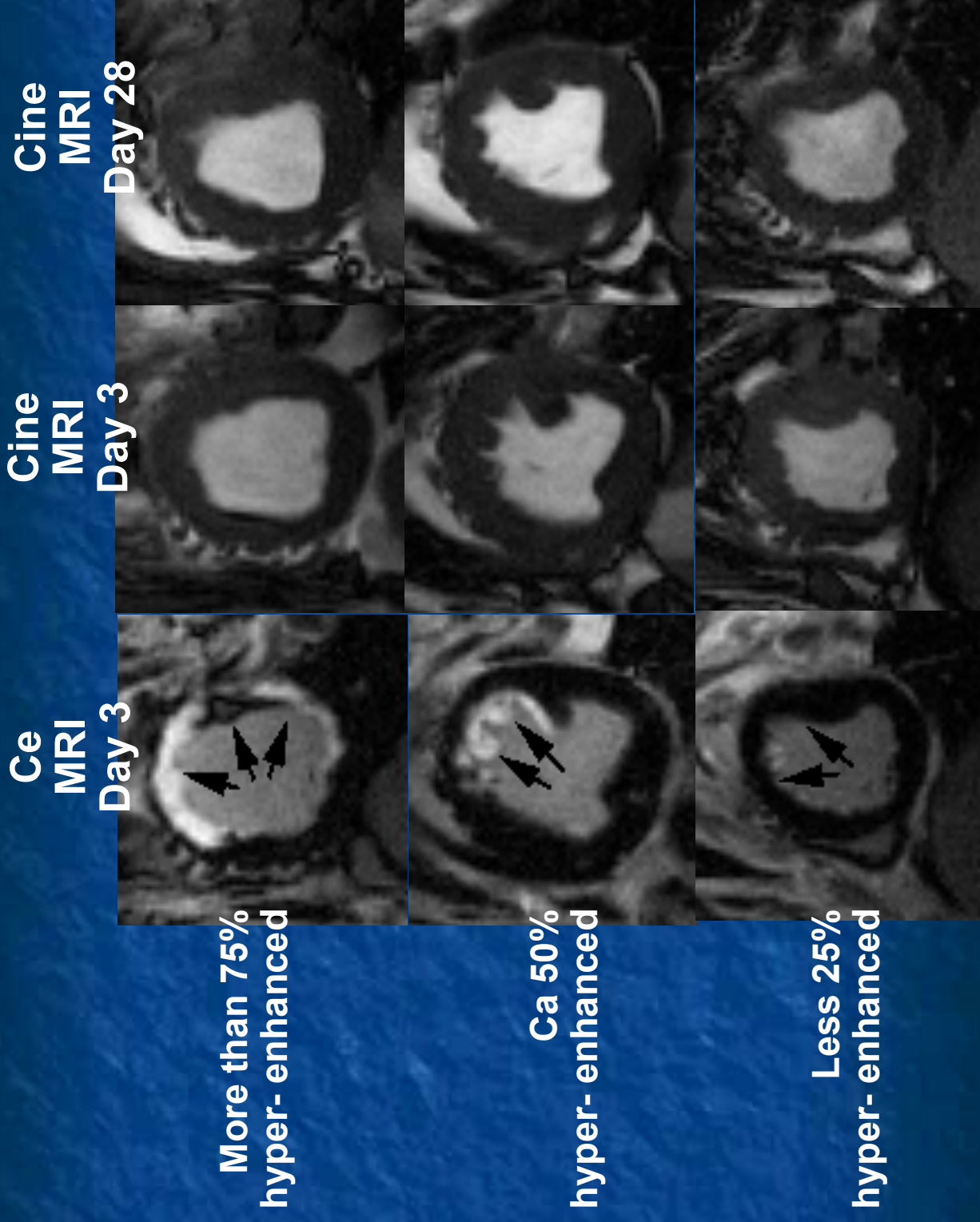
Impact of LVEF on Postoperative Outcome



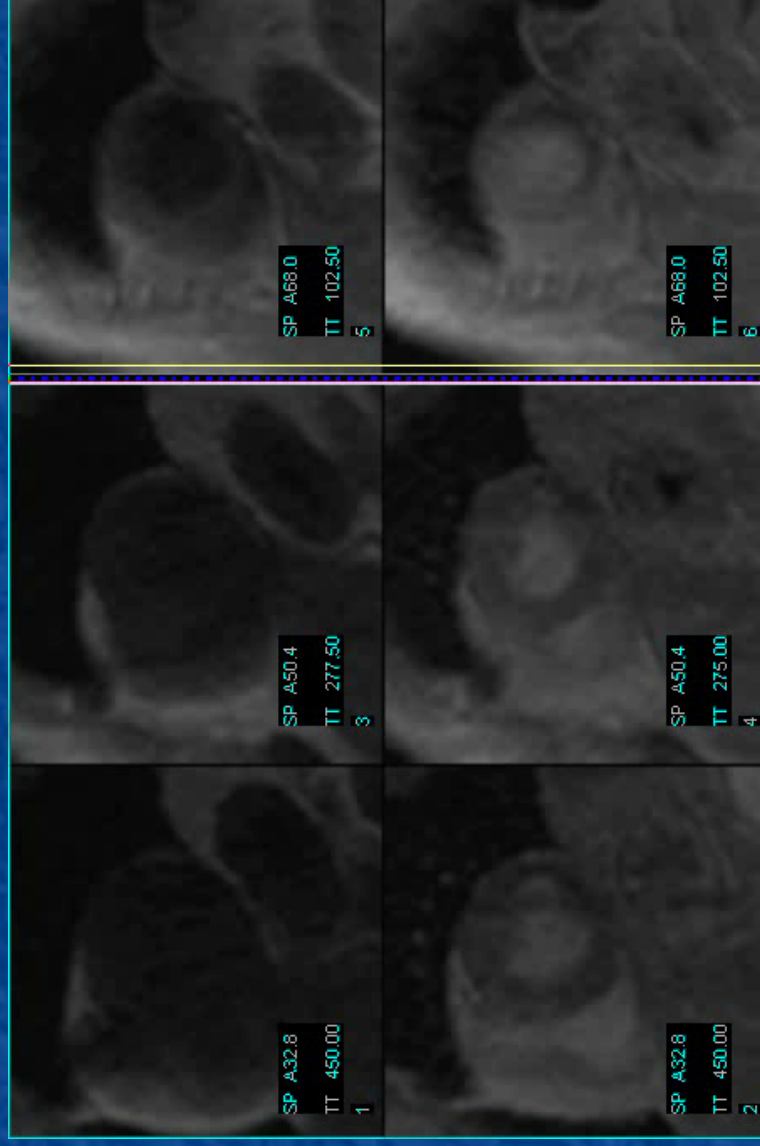
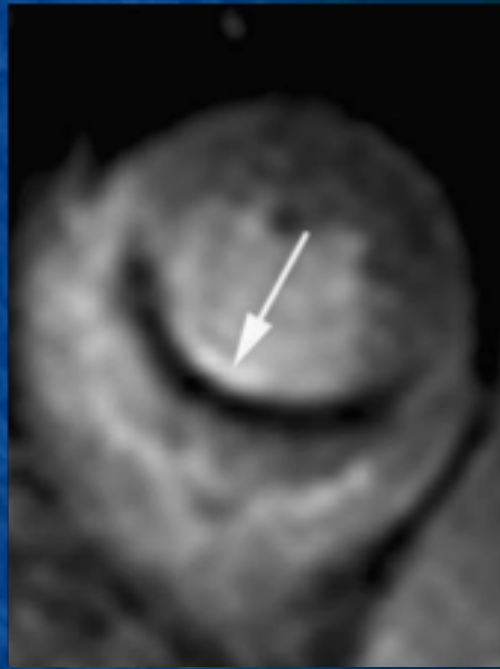
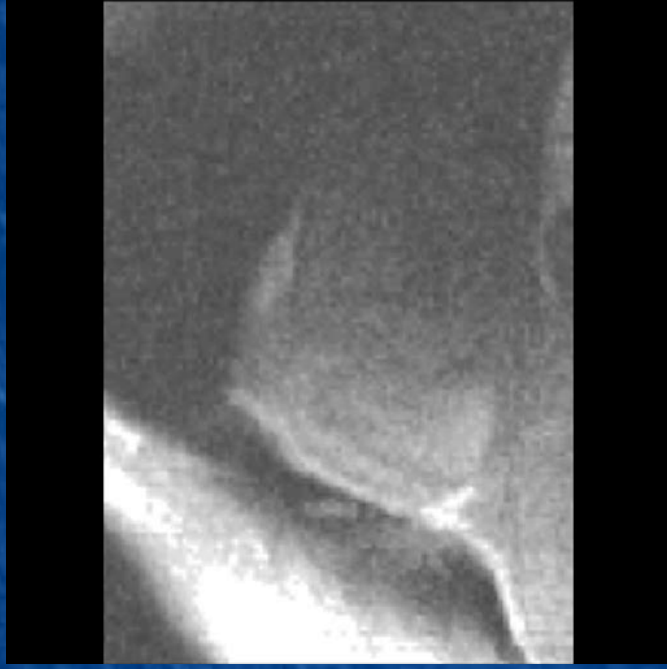
Enriquez-Sarano et al. *Circulation*, 1994

Early detection and treatment before irreversible damage is mandatory

CMR and late enhancement

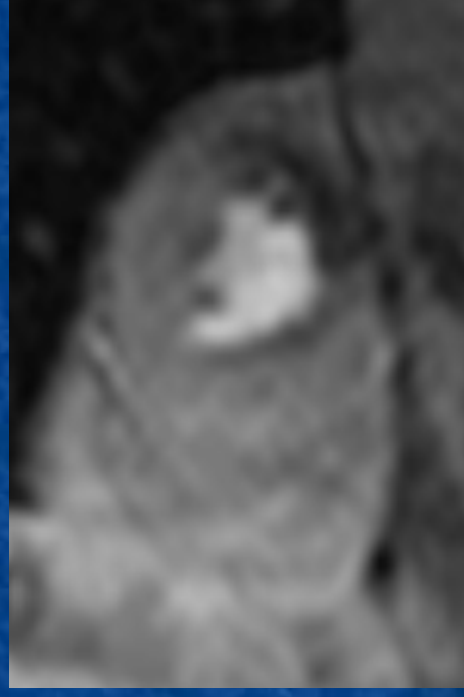
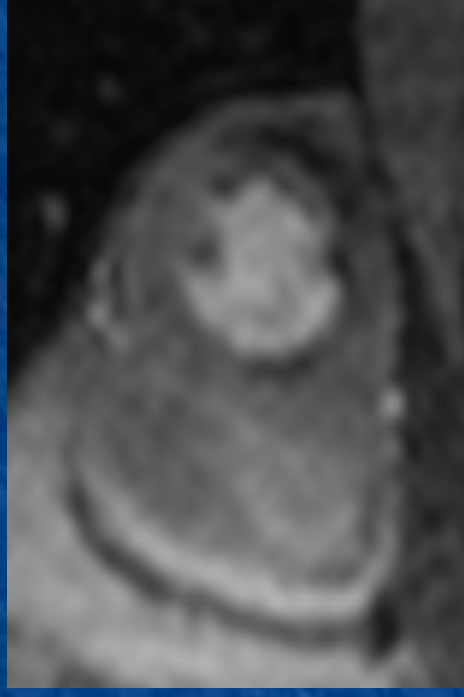
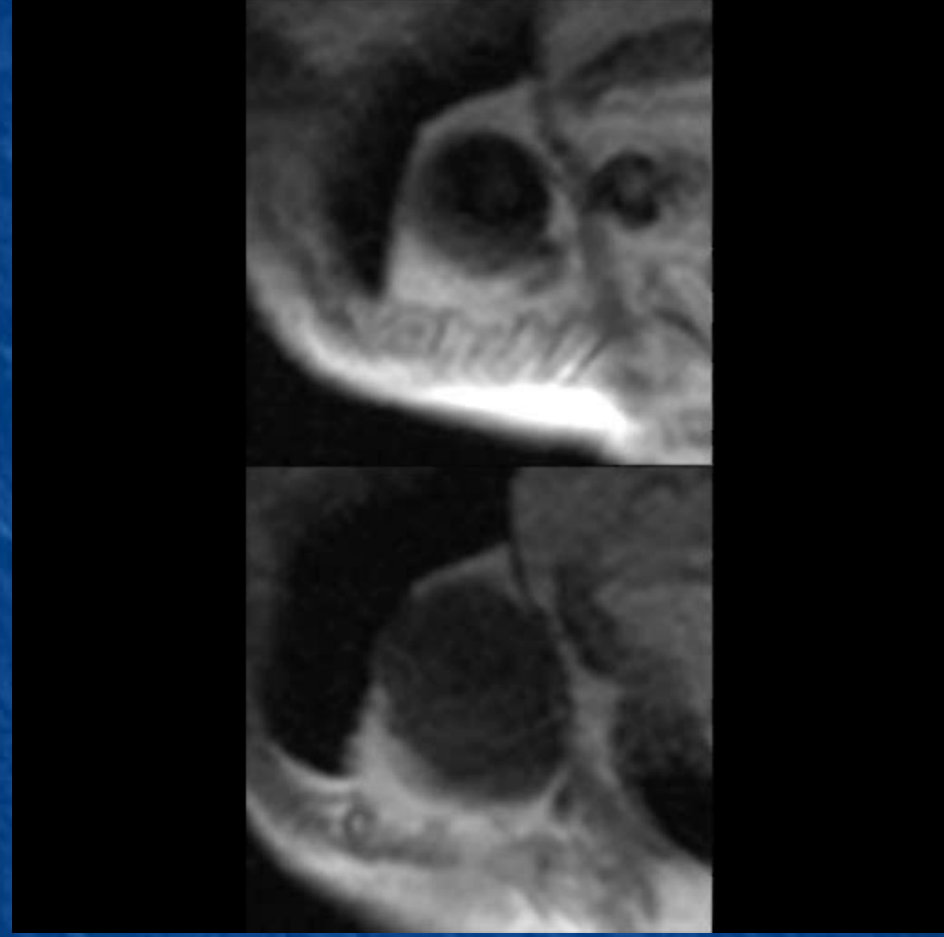


Perfusion study



Septal
hypoperfusion

Perfusion study



Infero-lateral hypoperfusion

Stress

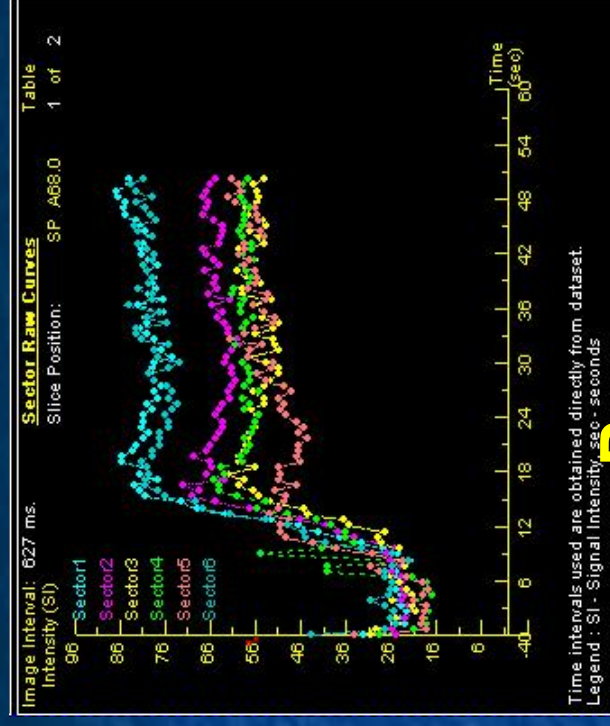


Figure 1 is a line graph titled "Sector Raw Curves". The Y-axis is labeled "Intensity (SI)" and ranges from 5 to 45. The X-axis is labeled "Time (sec)" and ranges from 0 to 60. There are six data series representing different sectors: Sector1 (blue), Sector2 (red), Sector3 (green), Sector4 (cyan), Sector5 (magenta), and Sector6 (yellow). All sectors show a sharp initial rise in intensity, peaking around 12-18 seconds, followed by a gradual decline. Sector1 (blue) has the highest peak intensity, reaching approximately 42. Sector6 (yellow) has the lowest peak intensity, reaching approximately 25. The curves are noisy, indicating variability in the data.

post