

## RADIONUCLIDE STUDIES OF THE HEART

- Ventricular wall motion
- Myocardial perfusion
- Myocardial glucose metabolism

Slides of lectures + electronic books:

<http://www.nmc.dote.hu/>

Practice

1

## Investigations

- „pump function” - ejection fraction - ventricular wall motion
- myocardial perfusion
- myocardial metabolism

2

## Equilibrium ECG-gated ventriculography

<i>Pharmaceutical:</i>	[Tc-99m] in vivo labelled red blood cells (with pyrophosphate)
<i>Phenomenon imaged:</i>	Changing blood content of the ventricles and atria during the cardiac cycle
<i>Acquisition mode</i>	ECG-gated, averaging some hundreds of cycles.
<i>Quantitative parameters:</i>	<ul style="list-style-type: none"> <li>• Left (and right) ventricular ejection fraction</li> <li>• Peak filling and emptying rate</li> <li>• Left ventricular volume</li> </ul>

3

## ECG gating

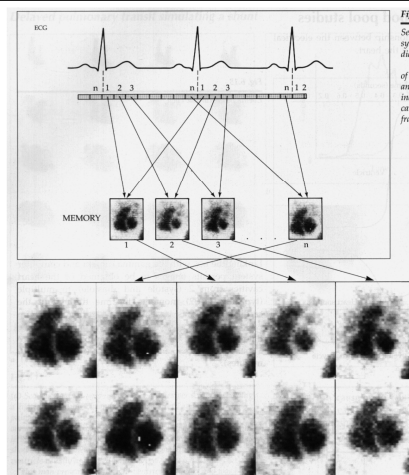


Fig. 6.16  
LAO view, showing the changes from diastole to systole, and then relaxation.

4

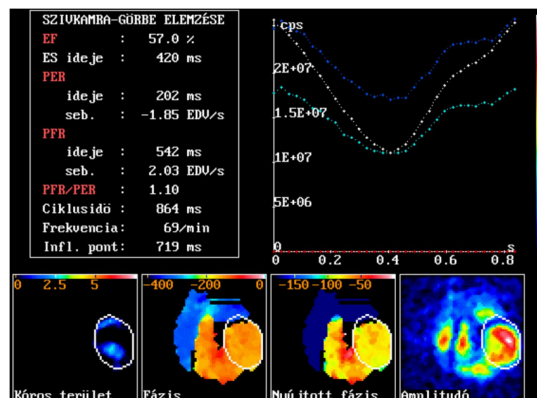
## Why Ejection Fraction?

- RBC labeling → count rate is proportional to ventricular volume
- However, the fraction of radiation attenuation in the patient's body is different for each patient
- So volume estimation is inaccurate

- $$EF = \frac{\text{Stroke volume}}{\text{ED Volume (EDV)}} = \frac{(\text{ED counts}) \cdot k - (\text{ES counts}) \cdot k}{(\text{ED counts}) \cdot k} = \frac{(\text{ED counts}) - (\text{ES counts})}{(\text{ED counts})}$$
- EF can be accurately estimated from the count rates.

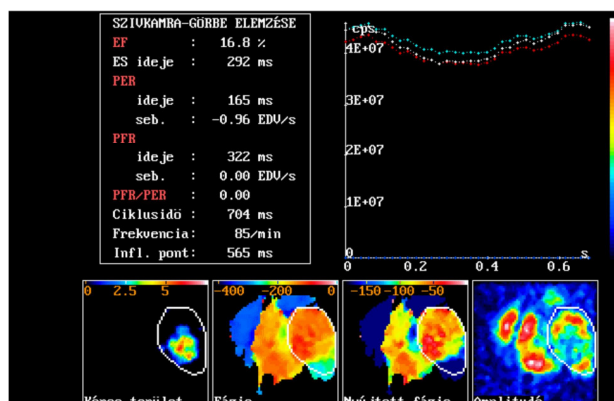
5

## Normal



6

## ECG-gated RN ventriculography: apical aneurism



7

## Myocardial perfusion scintigraphy

<i>Pharmaceuticals:</i>	[Tl-201] Thallium-chloride or [Tc-99m] isonitrile derivatives (e.g. "MIBI")
<i>Phenomenon imaged:</i>	Myocardial perfusion after ergometric or pharmaceutical stress and in resting state.
<i>Abnormalities shown:</i>	<ul style="list-style-type: none"> <li>• <b>"Fix defect"</b> (decreased activity in both the stress and rest images) in scars.</li> <li>• <b>Reversible perfusion defect</b> in ischemic regions: Relatively decreased activity uptake (as compared to the healthy myocardium) in the regions of stenosed coronary arteries, not or less shown in rest (Tl: delayed) images.</li> </ul>

8

## Comparison of radiopharmaceuticals for MPI

- **Thallium-chloride:**
  - K-analogue
  - Redistribution may occur
  - A single injection during stress
    - Early images after 15'
    - Late images after 3-4 h
- **Metoxy-Iso-Butyl-Isonitril (MIBI):**
  - Passes cells membranes passively (negative membrane potential). Accumulates in the mitochondria
  - No redistribution
  - Separate injections for stress and rest study (images after 60')
  - Single-day protocol:
    - Starting with rest preferred
    - ~250 + 750 MBq

9

## Coronary artery territories on SPECT views

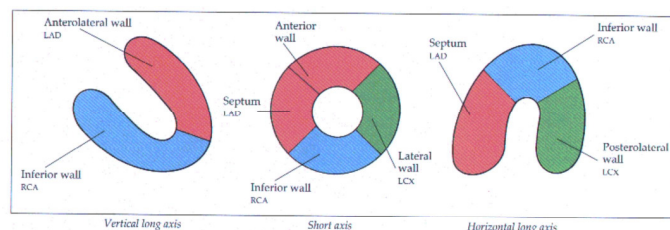
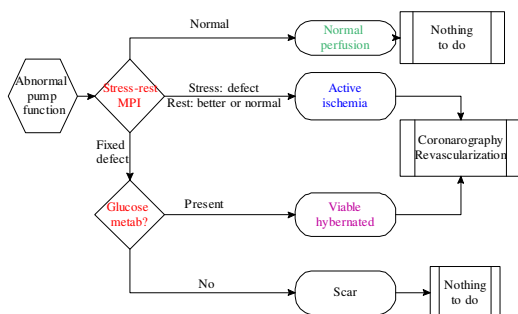


Fig. 6.5  
Normal coronary artery territories in the left ventricle corresponding to  $^{201}\text{Tl}$  myocardial SPECT views. LAD, left anterior descending artery; RCA, right coronary artery; LCX, left circumflex artery.

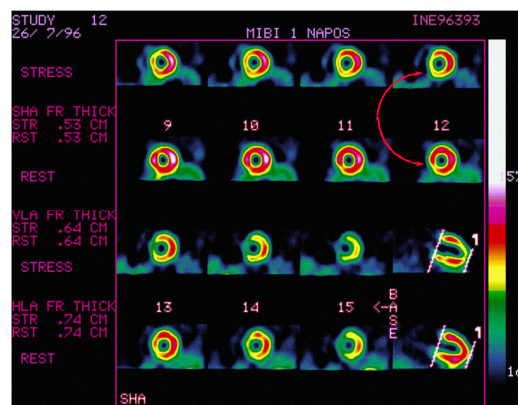
10

## Decision tree



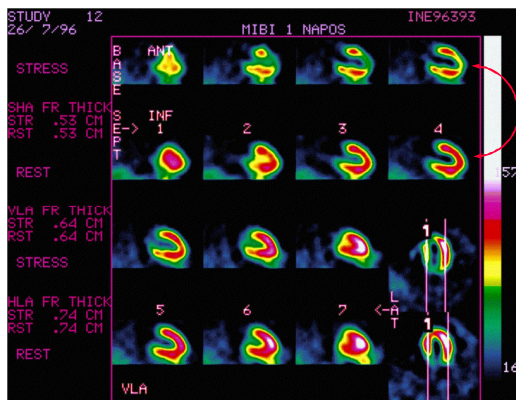
11

## Reverzible defect: short axis slices



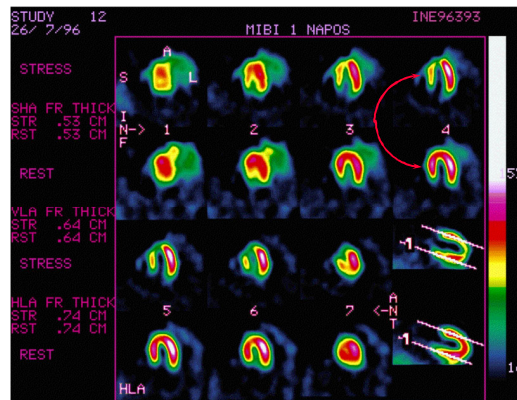
12

## Reverzible defect: vertical long axis slices



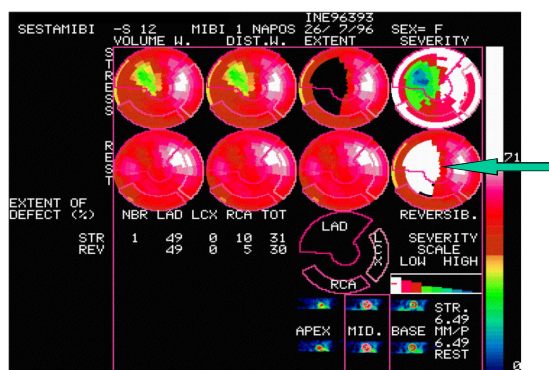
13

## Reverzible defect: horizontal long axis slices



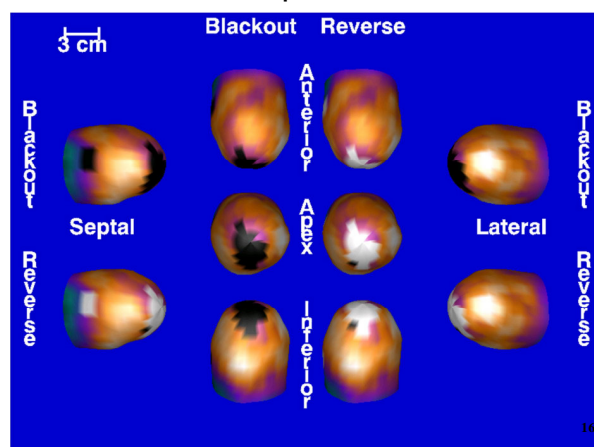
14

## Reverzible defect: bull's eye



15

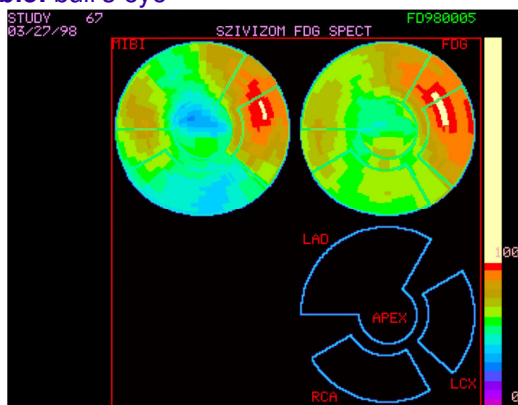
## Reversible apical defect – 3D



16

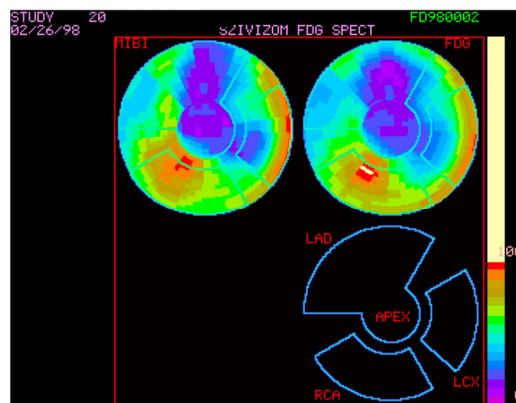


## **Viab**le: bull's eye



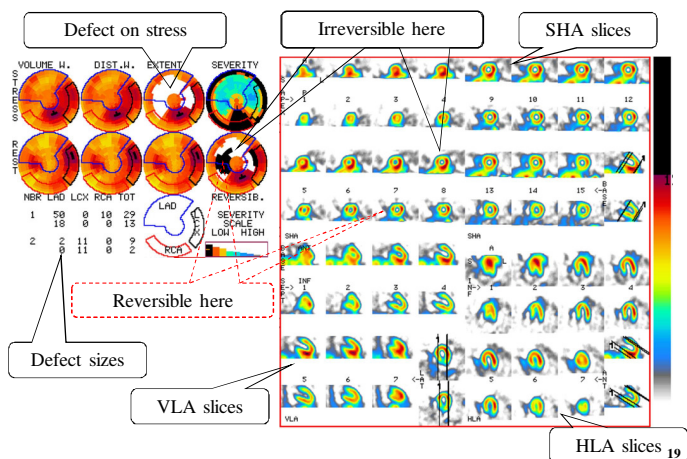
17

## **Perf+metab.** fix defect: non viable scar



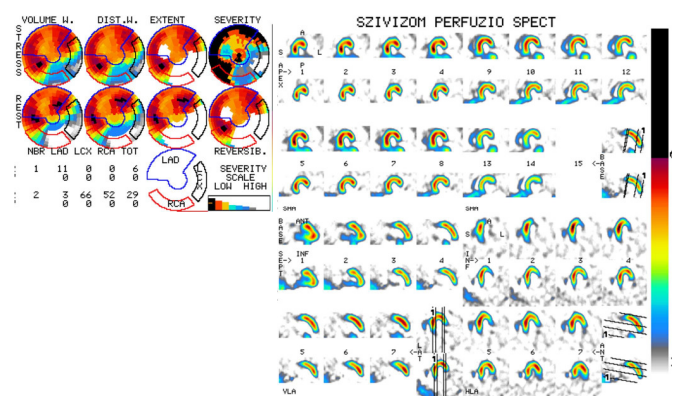
18

## **IN020127** MIBI



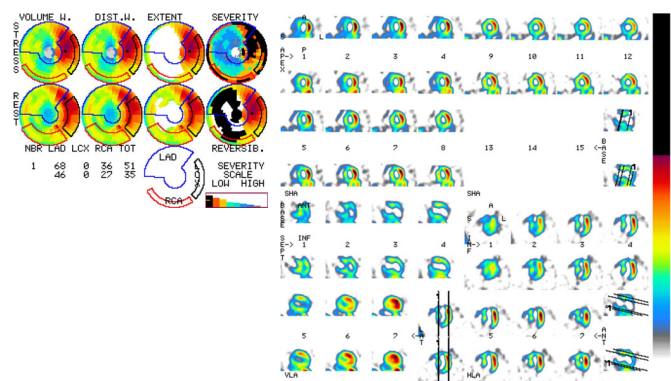
19

## **IN01227** MIBI



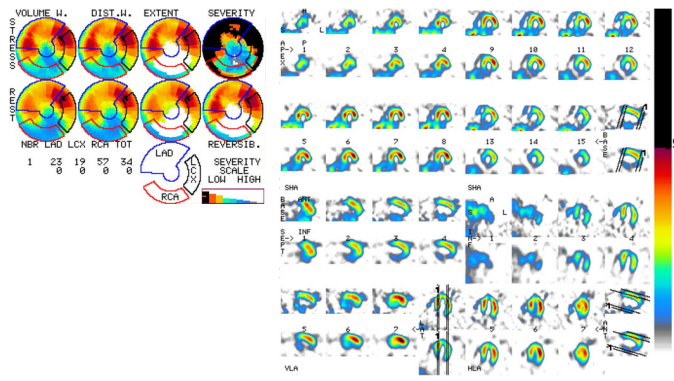
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## **IN001080** MIBI



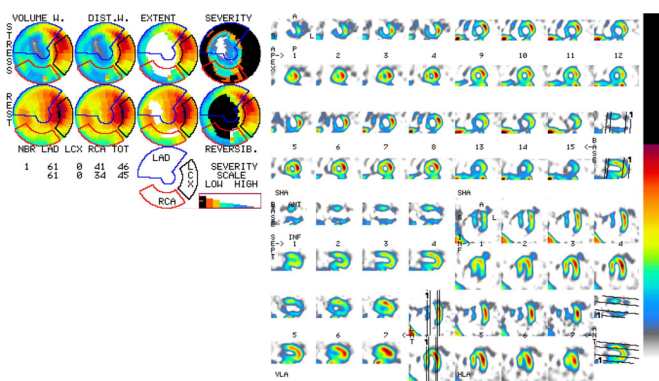
21

## **IN001175** MIBI



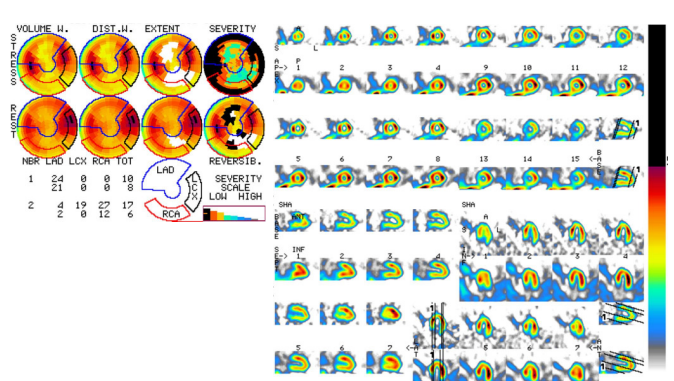
22

## **IN01088** MIBI



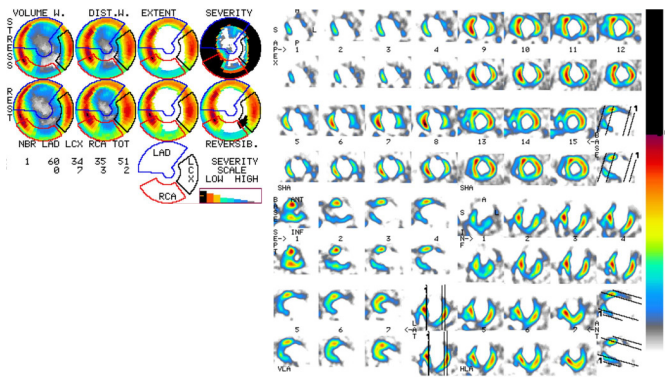
23

## **IN01240** MIBI



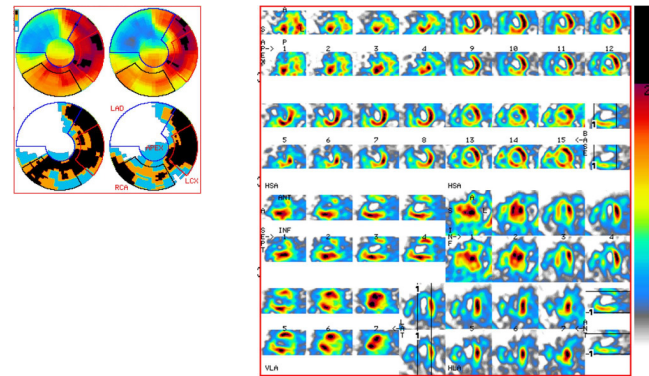
24

IN010304 MIBI



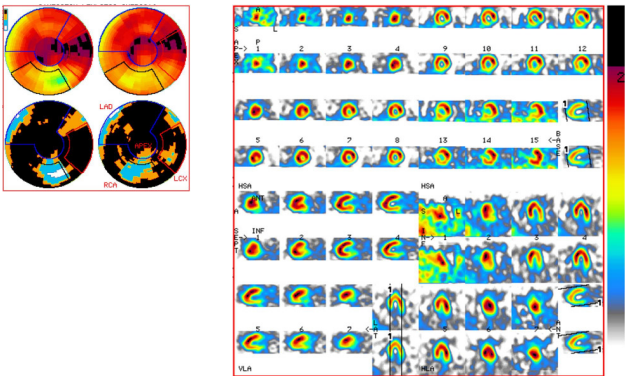
25

IN010846 TICl



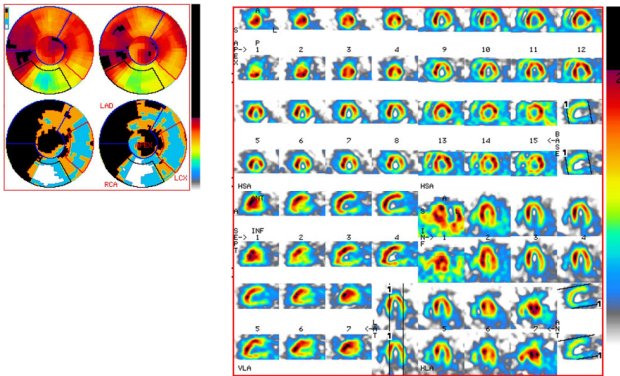
26

IN010843 TICl



27

IN010844 TICl



28