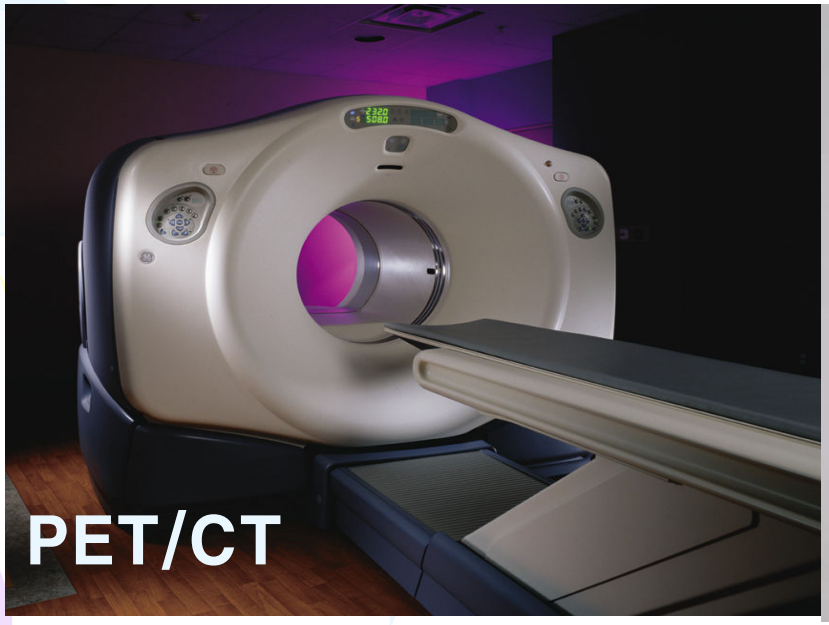
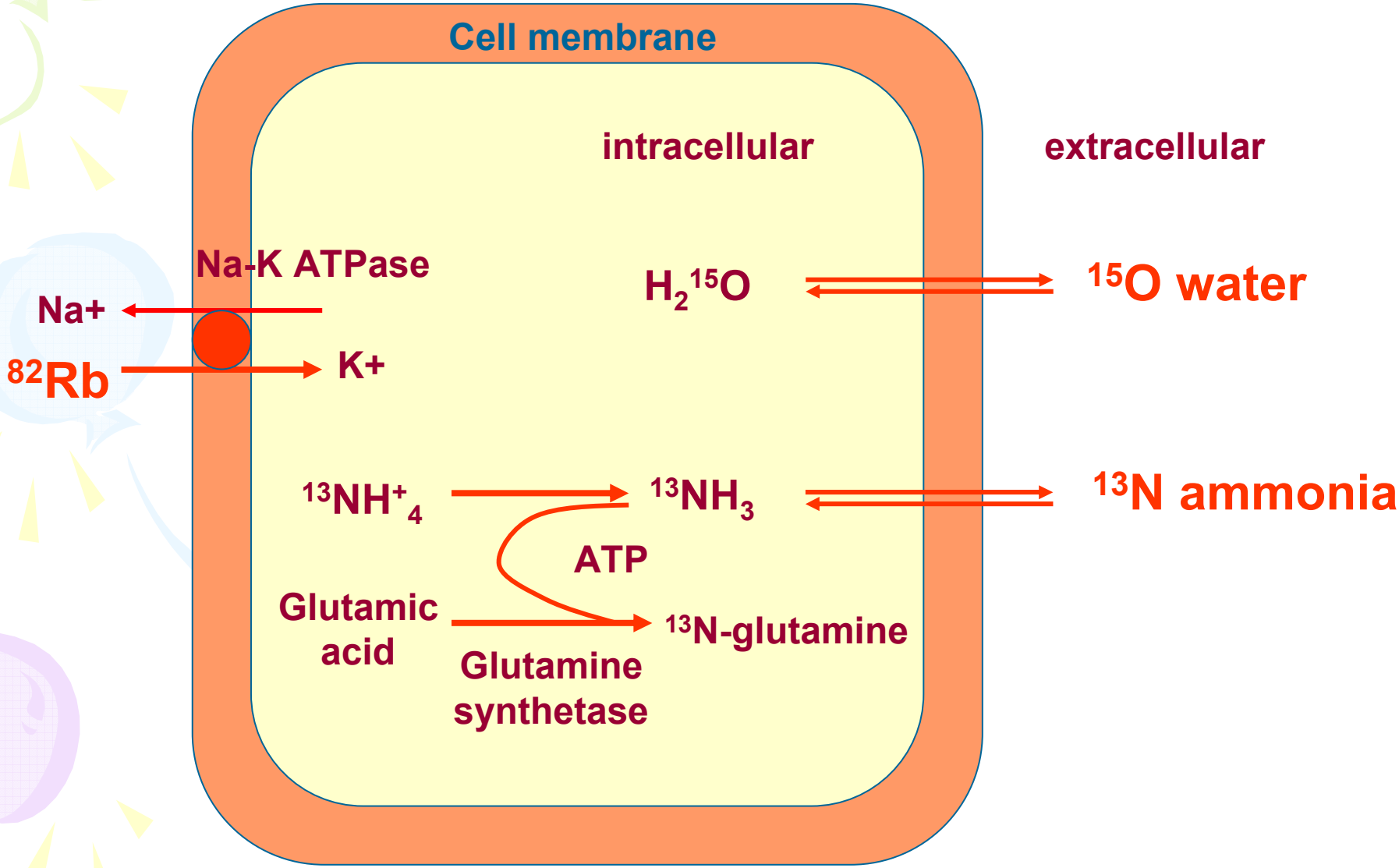
Assessment of Myocardial Perfusion by PET

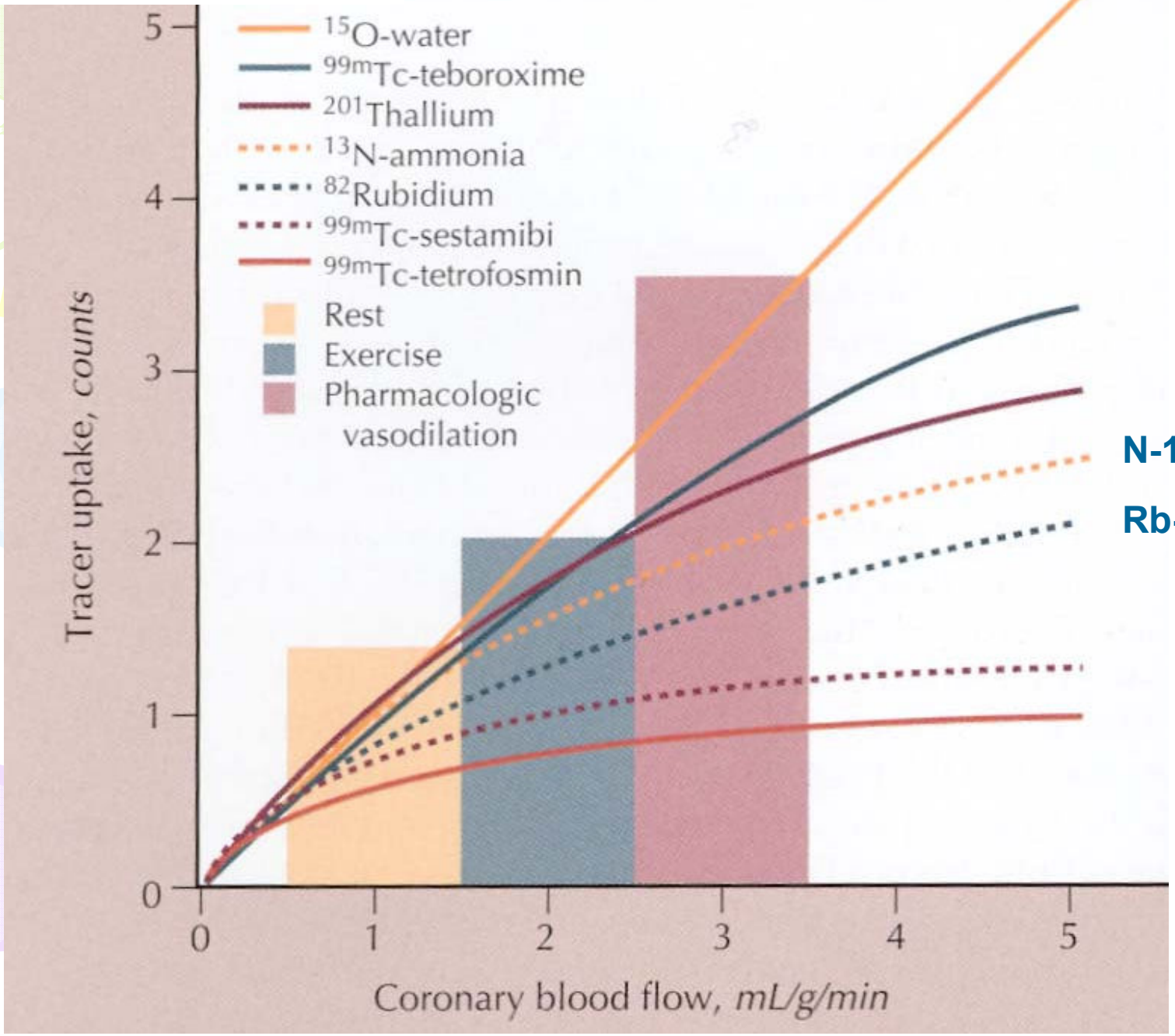


전남의대 핵의학교실　범희승, 이병일

PET radiotracers for myocardial perfusion



Flow vs. Uptake

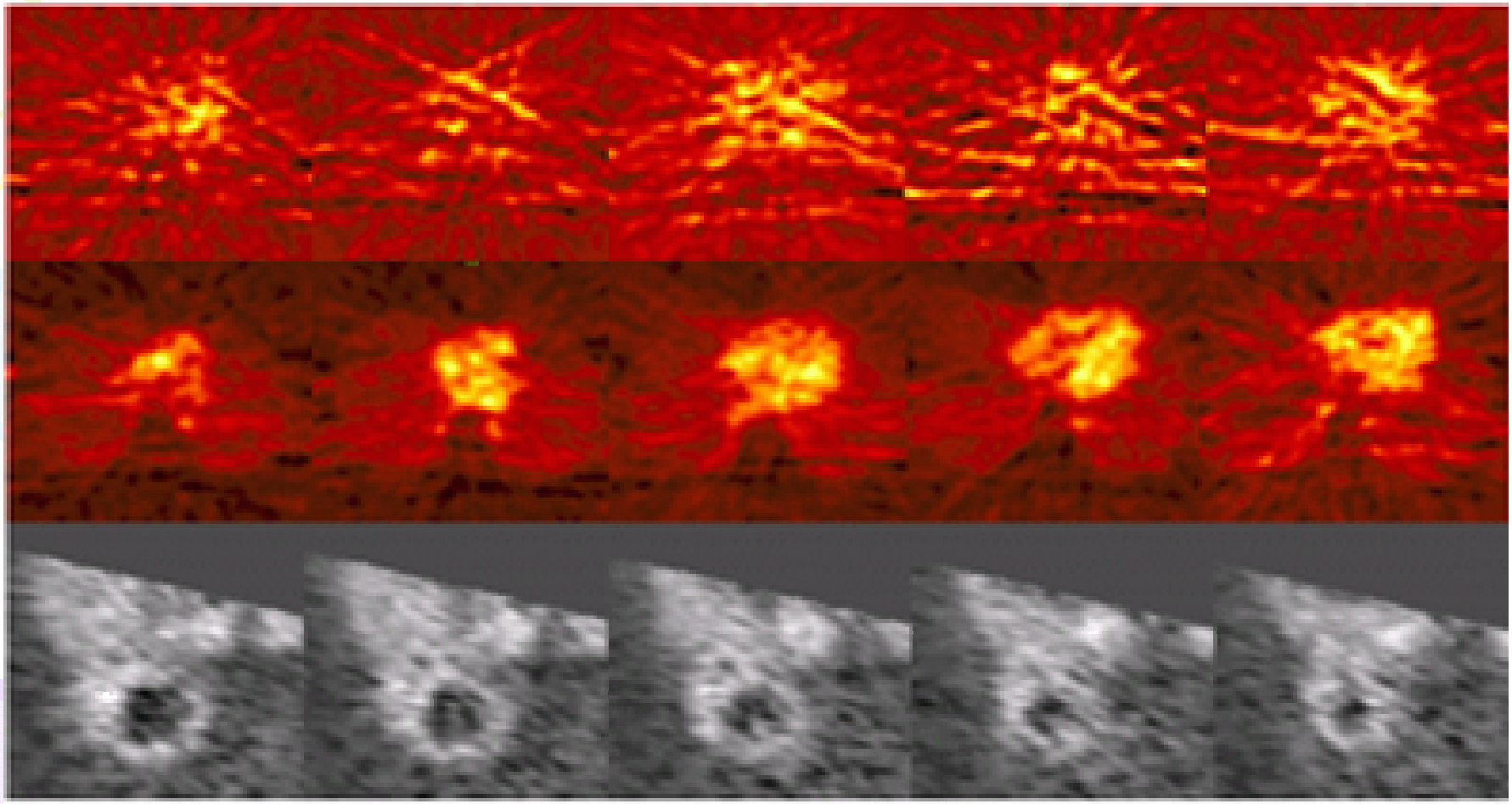


O-15 water

N-13 ammonia

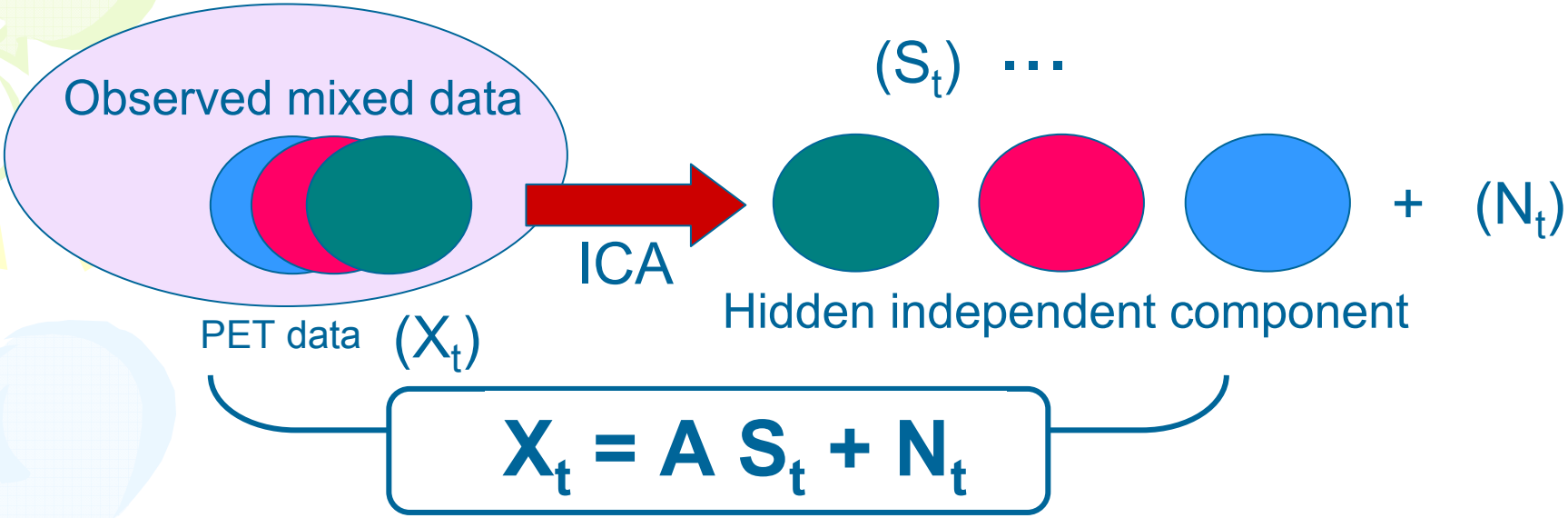
Rb-82

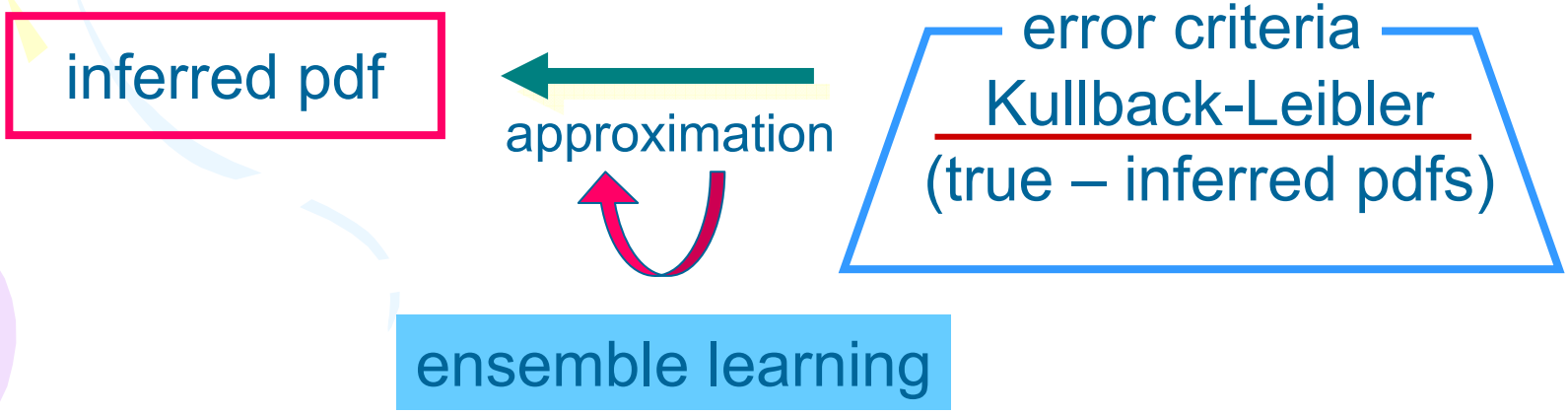
O-15 Water PET



Cyclotron produced, T1/2 = 2 min, Poor resolution

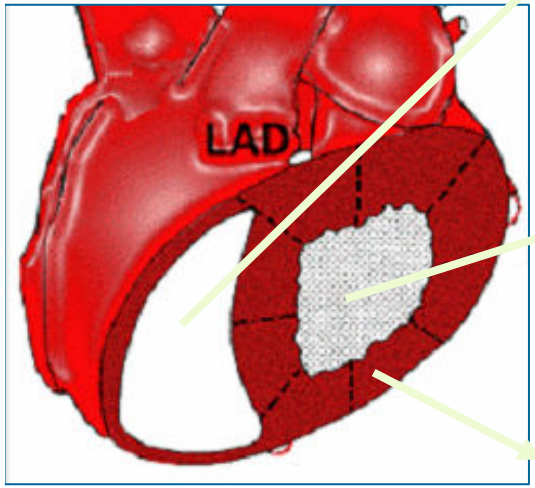
ICA





ensemble learning

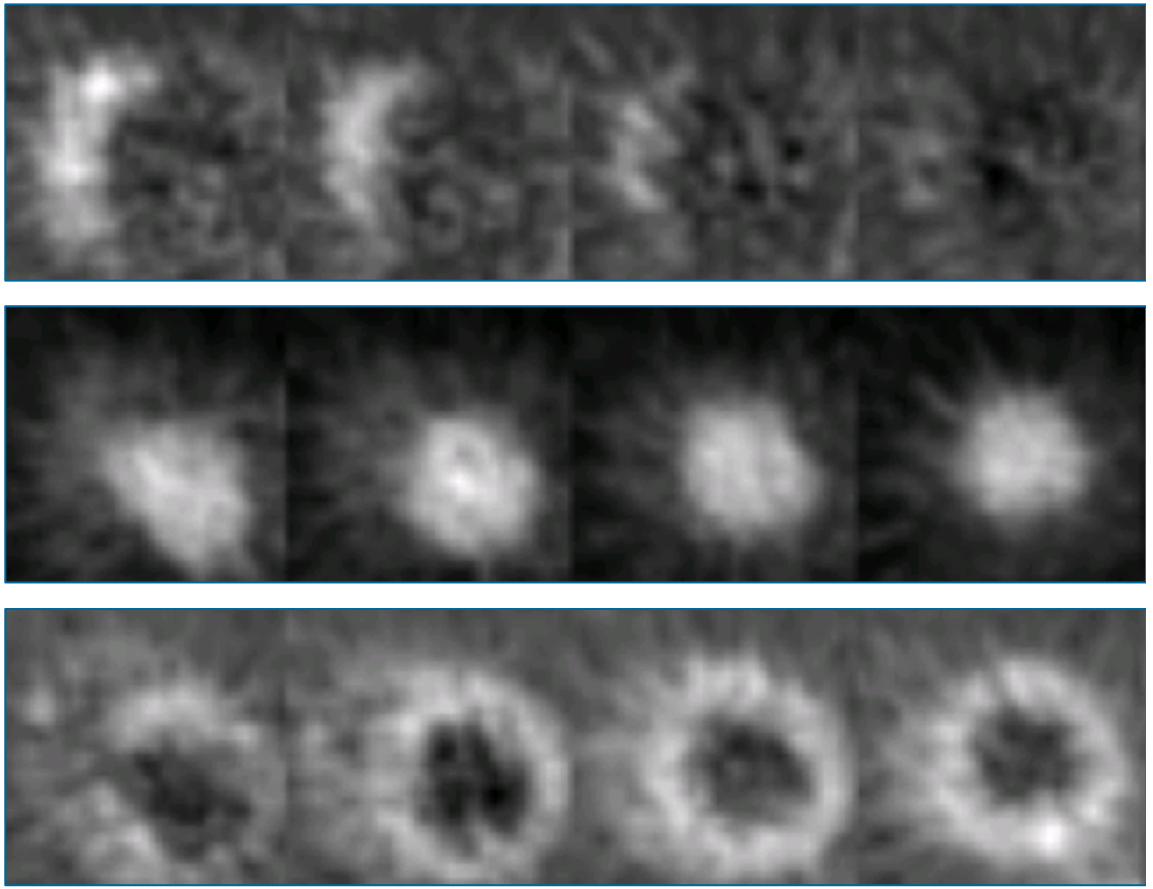
O-15 Water PET, Ensemble ICA



RV

LV

Myo-cardium

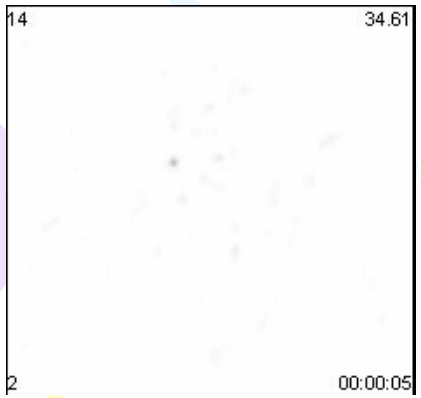


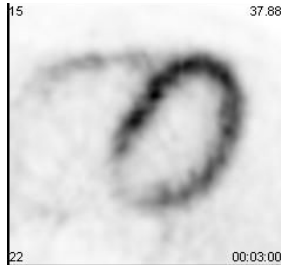
Lee et al. LNCS 2005

N-13 ammonia PET

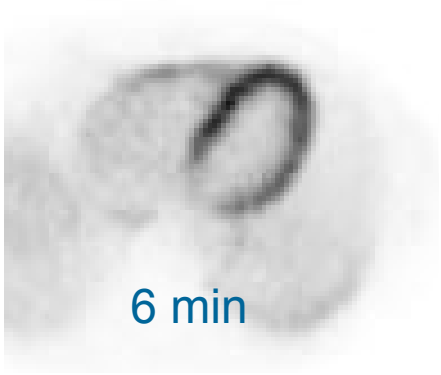
- 5 sec X 12 frames
- 10 sec X 6 frames
- 20 sec X 3 frames
- 30 sec X 6 frames

6 min





3 min

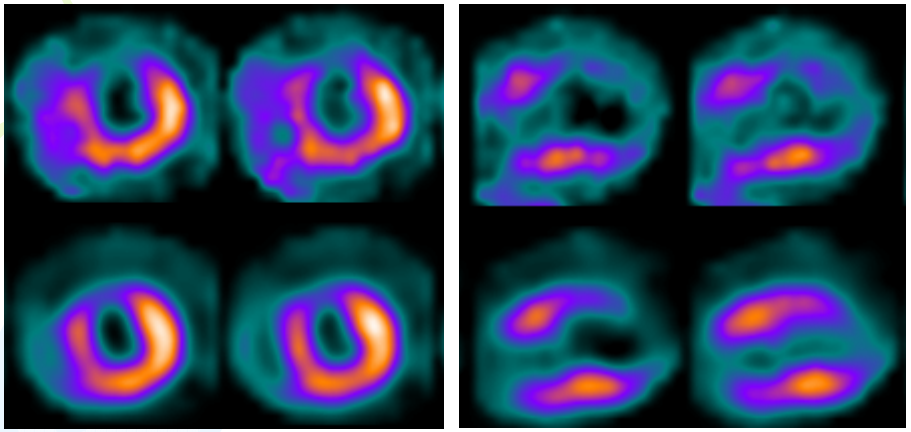


6 min

M/76, 1 vessel disease

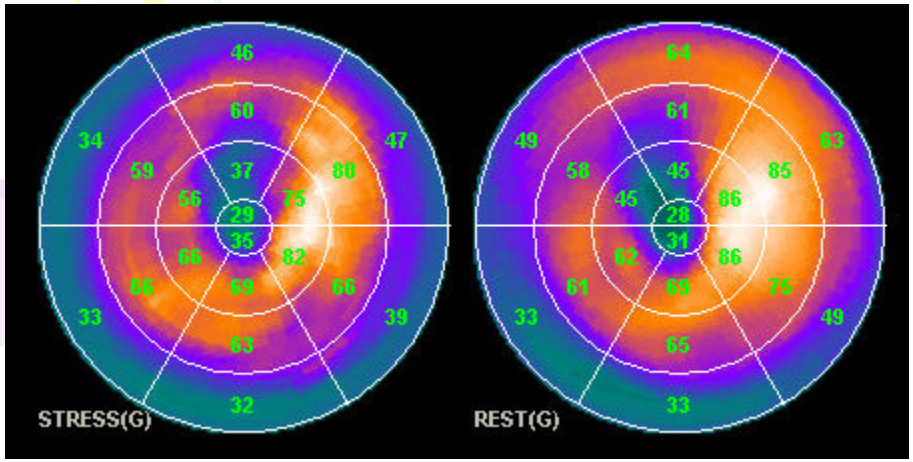
Tc-99m sestamibi MPS

Stress



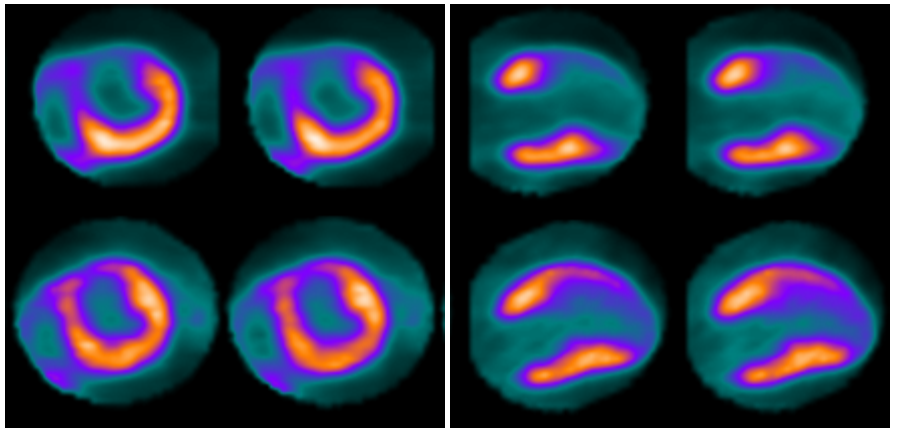
Rest

Stress Rest



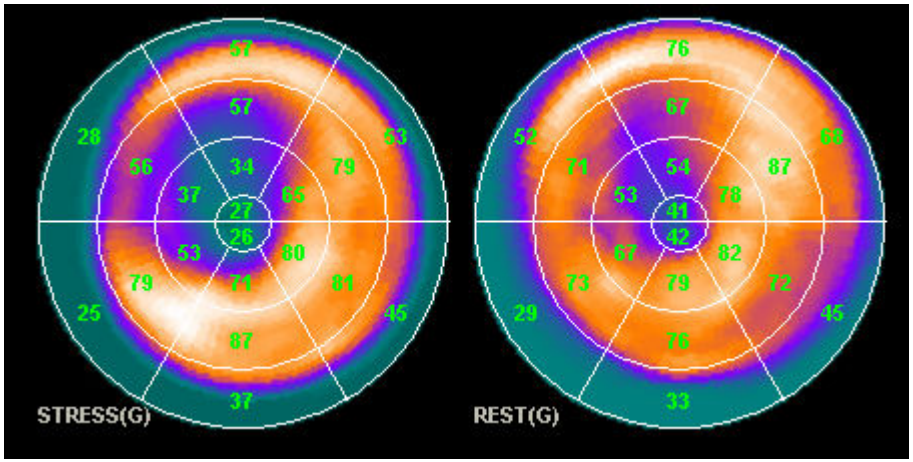
N-13 ammonia PET

Stress



Rest

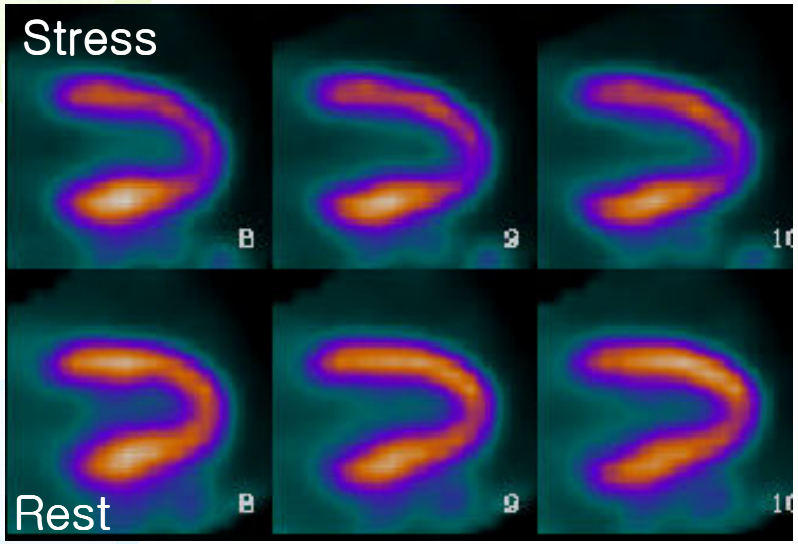
Stress Rest



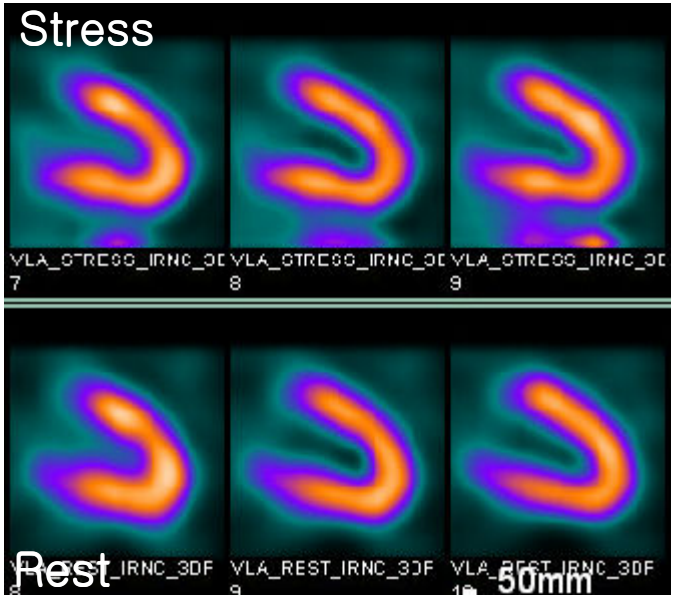
Cho et al. 9th WCNMB, 2006

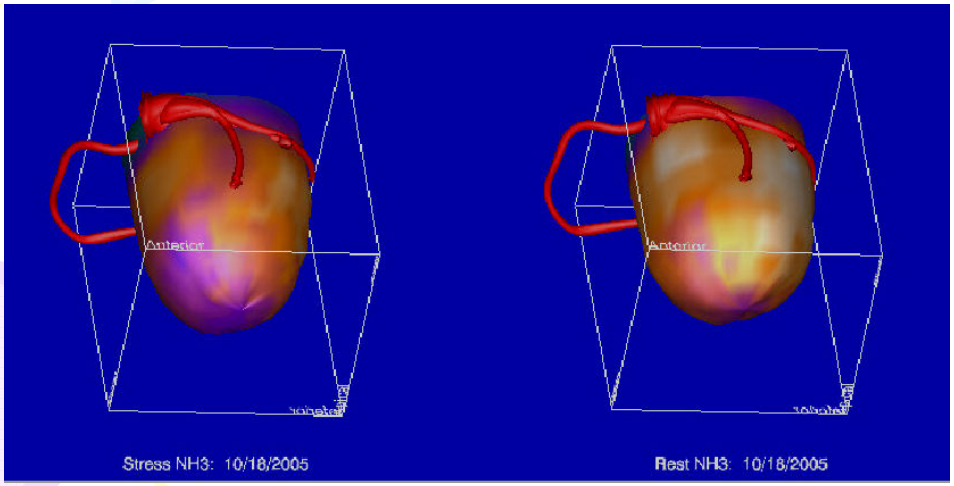
M/67, 1 vessel disease

PET/CT



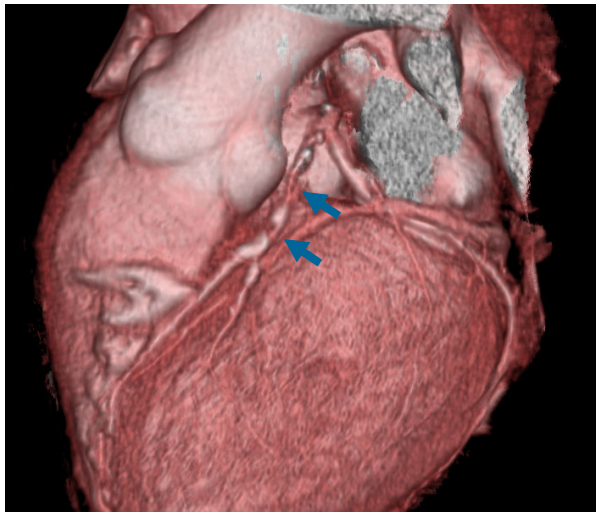
Tc-99m sestamibi MPS





Stress N-13 NH_3

Rest N-13 NH_3



Cho et al. 9th WCNMB, 2006

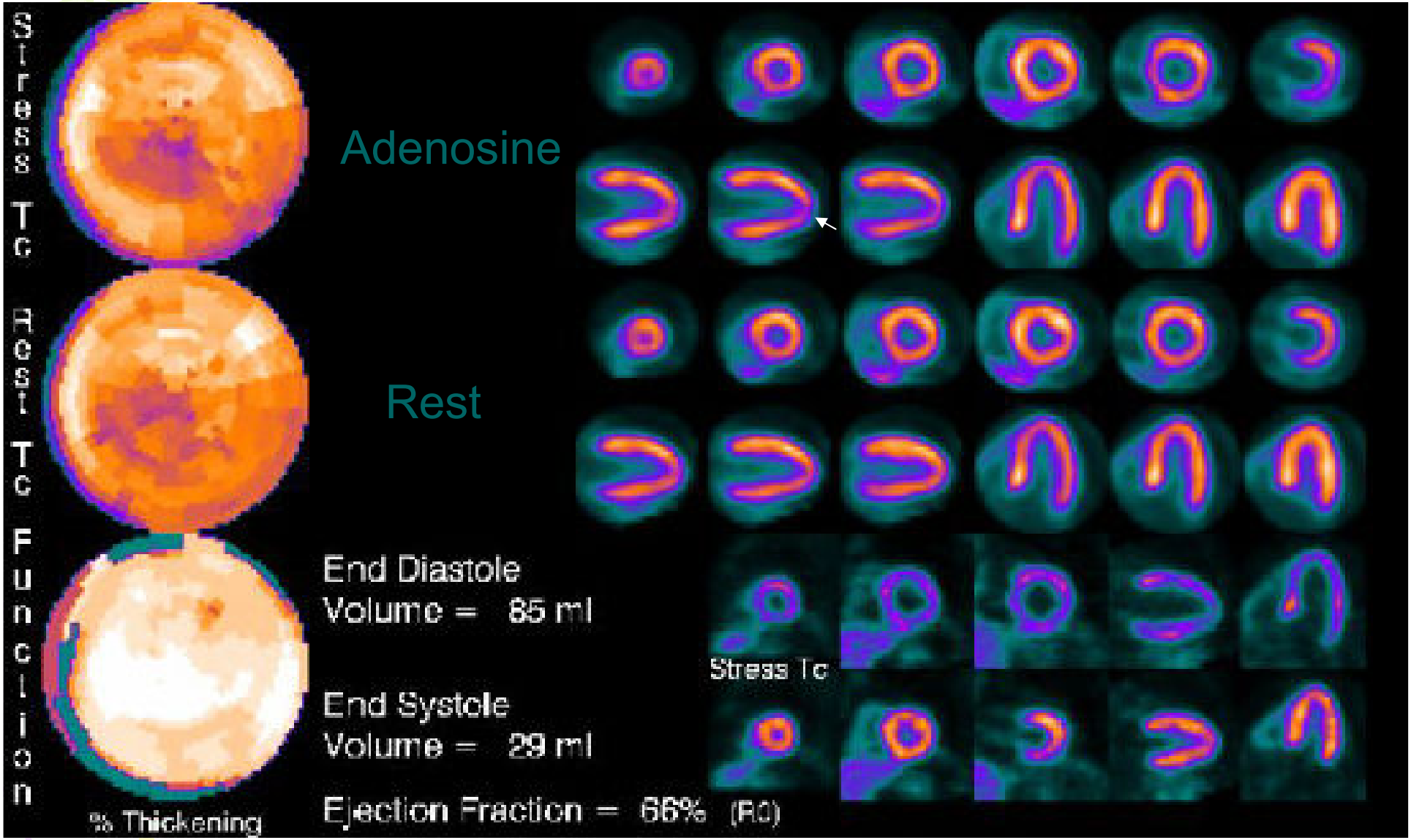
PET vs. SPECT

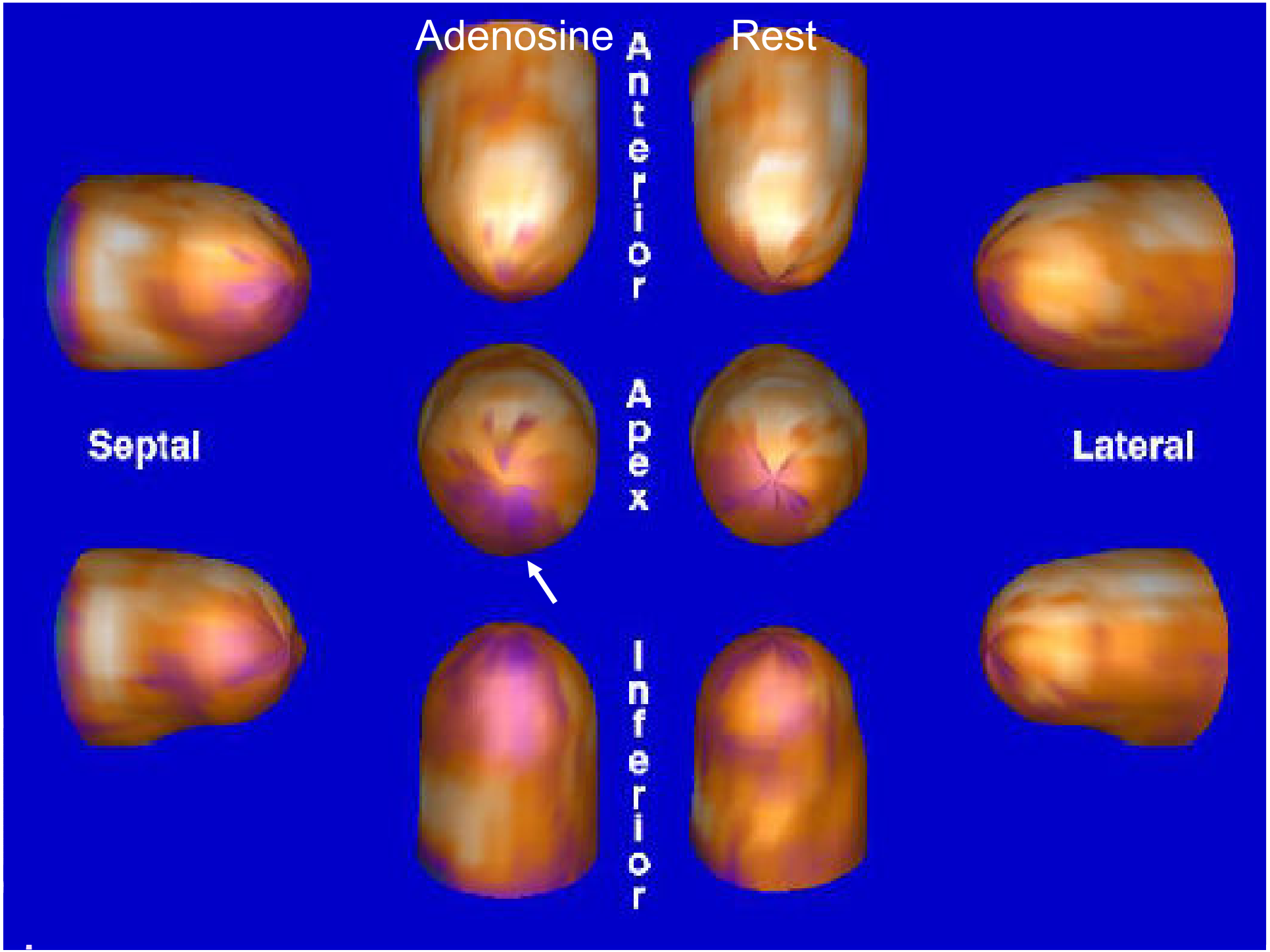
- Sensitivity and specficity of detecting an individual coronary artery stenosis (> 50% in coronary angiography)
  - **PET/CT: 91% 89%, SPECT: 65% 82%**
- Number of segments with stress and rest uptake difference over 10 %
  - **42 segments (43%) in N-13 ammonia PET/CT**
  - **16 segments (16%) in Tc-99m Sestamibi SPECT (p<0.01)**

Cho et al. 9th WCNMB, 2006

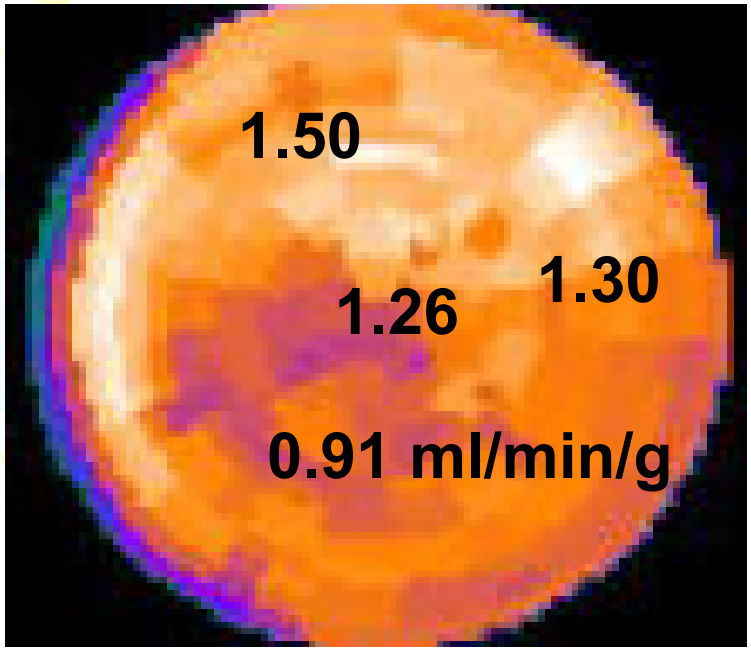
56/M CC: angina

2003: PCI/stent of p-LAD
2005: insignificant ISR m-LAD

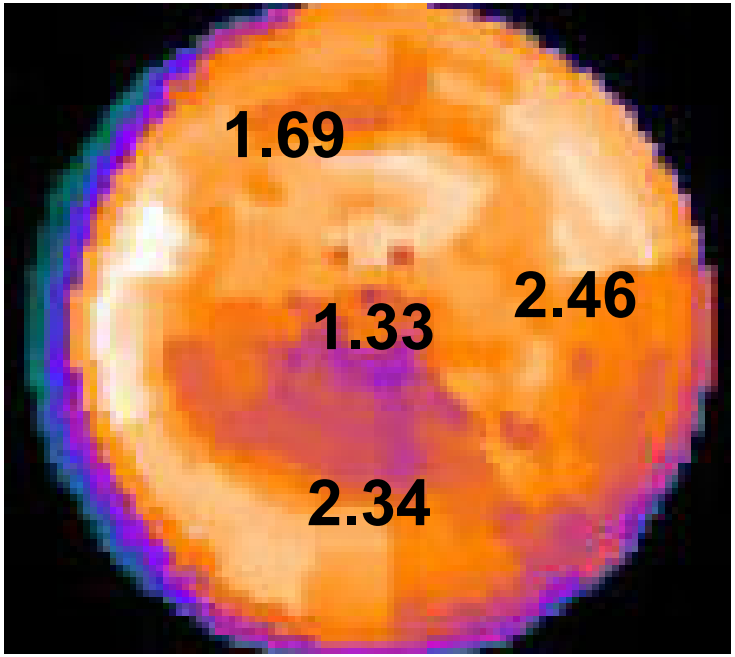



Adenosine
Rest
Anterior
Septal
Apex
Lateral
Inferior

MBF & CFR

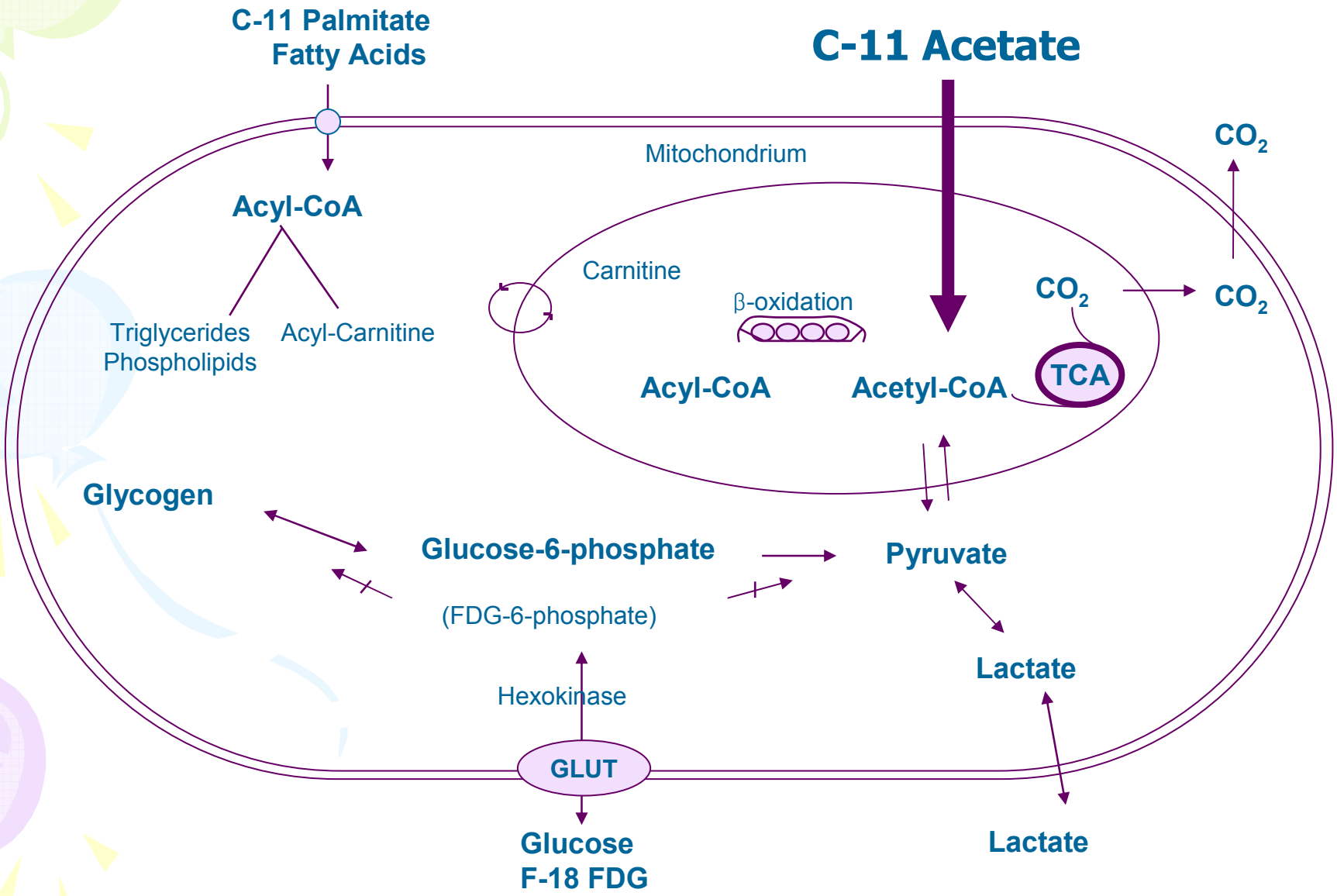


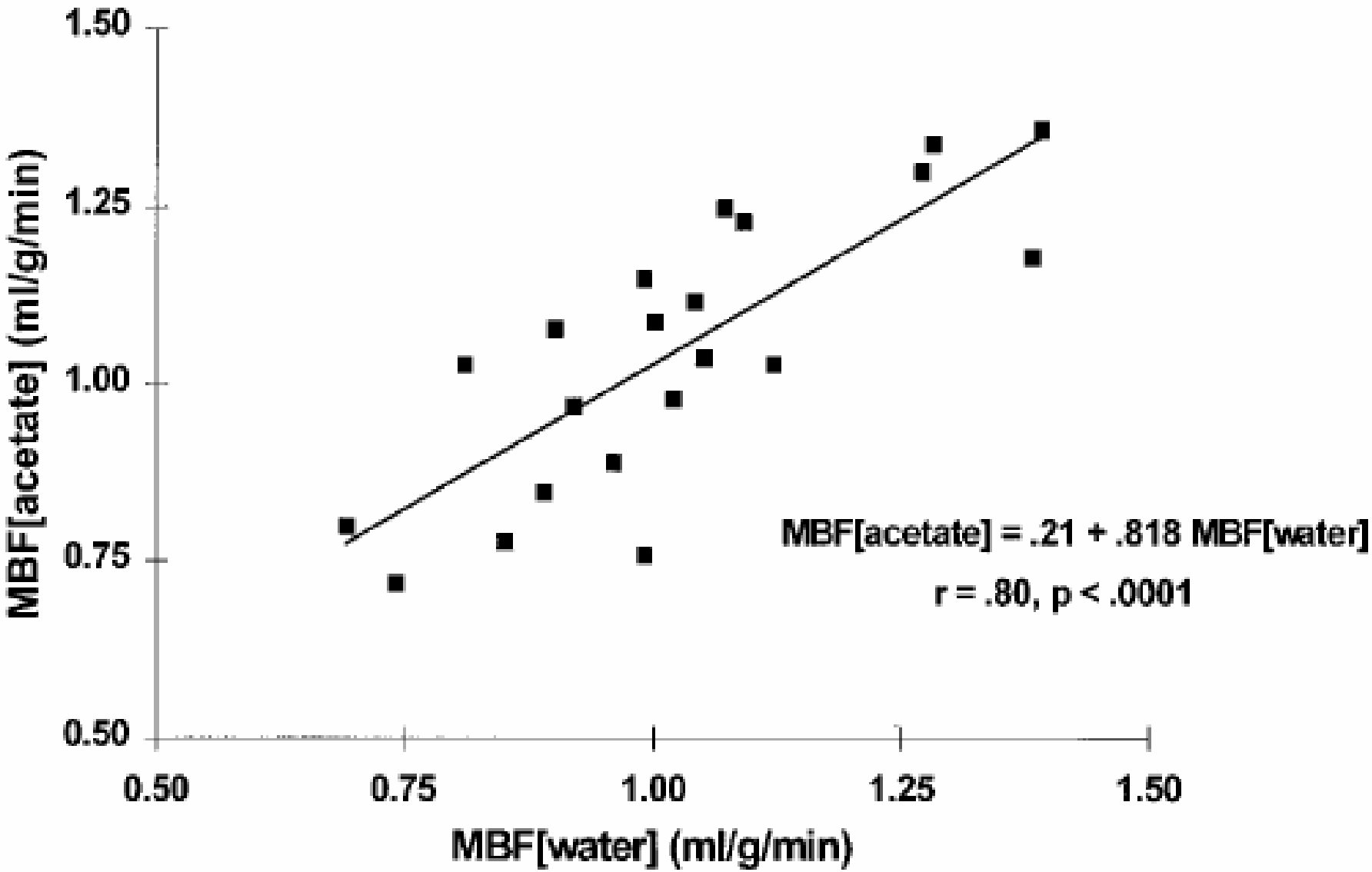
MBF-rest



Flow Reserve

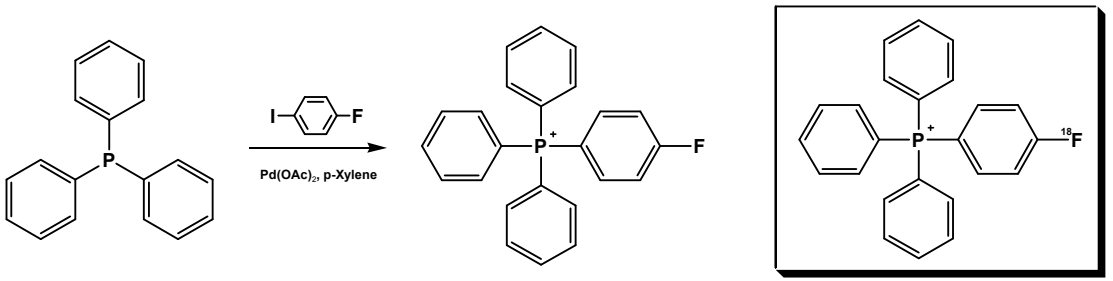
Cardiac Metabolic Tracers for PET

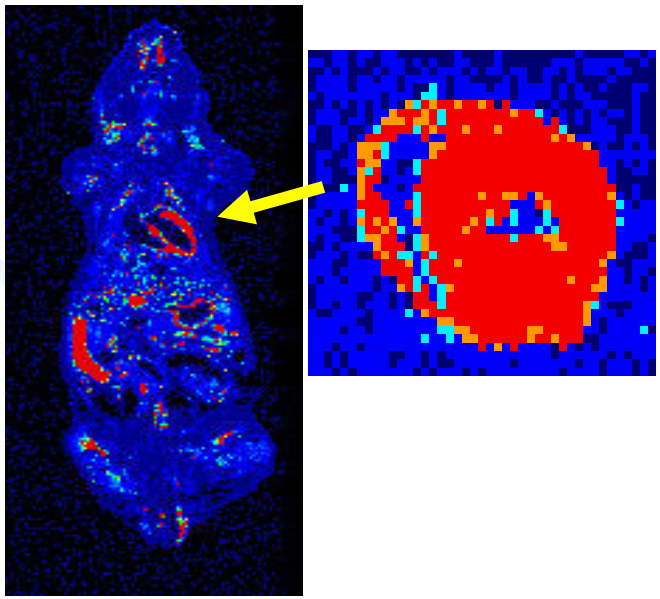




J Nucl Med 2001; 42:63–70

F-18 tetraphenylphosphonium (TPP)

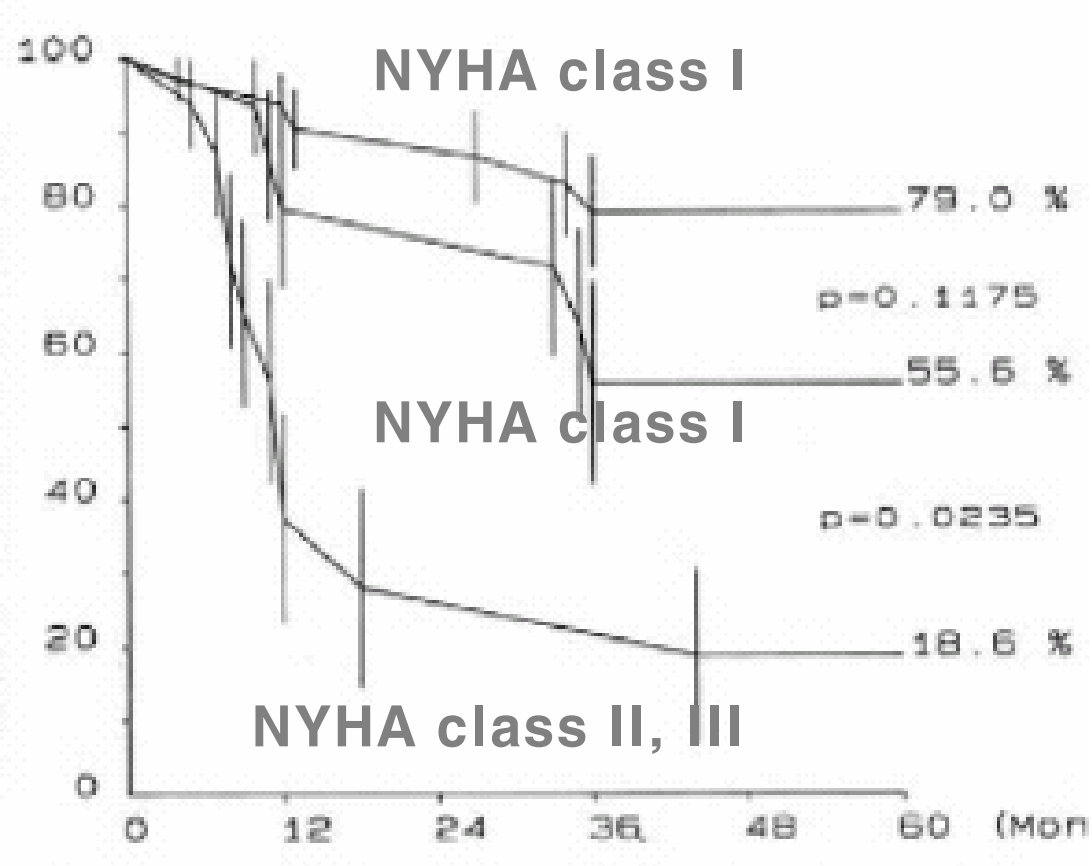




Nuclear Medicine and Biology, 2006

Clinical Applications

Myocardial Blood Flow after Dipyridamole vs. Prognosis in patients with Dilated Cardiomyopathy



MBF-DP

>1.36 ml/min/g

≤1.36 ml/min/g

≤1.36 ml/min/g

Neglia et al. Circulation, 2002

Cold Pressor Test (CPT)
: endothelial function test

At rest

Dynamic Imaging (6 min)

$^{13}NH_3$ 20 mCi

60 min Break

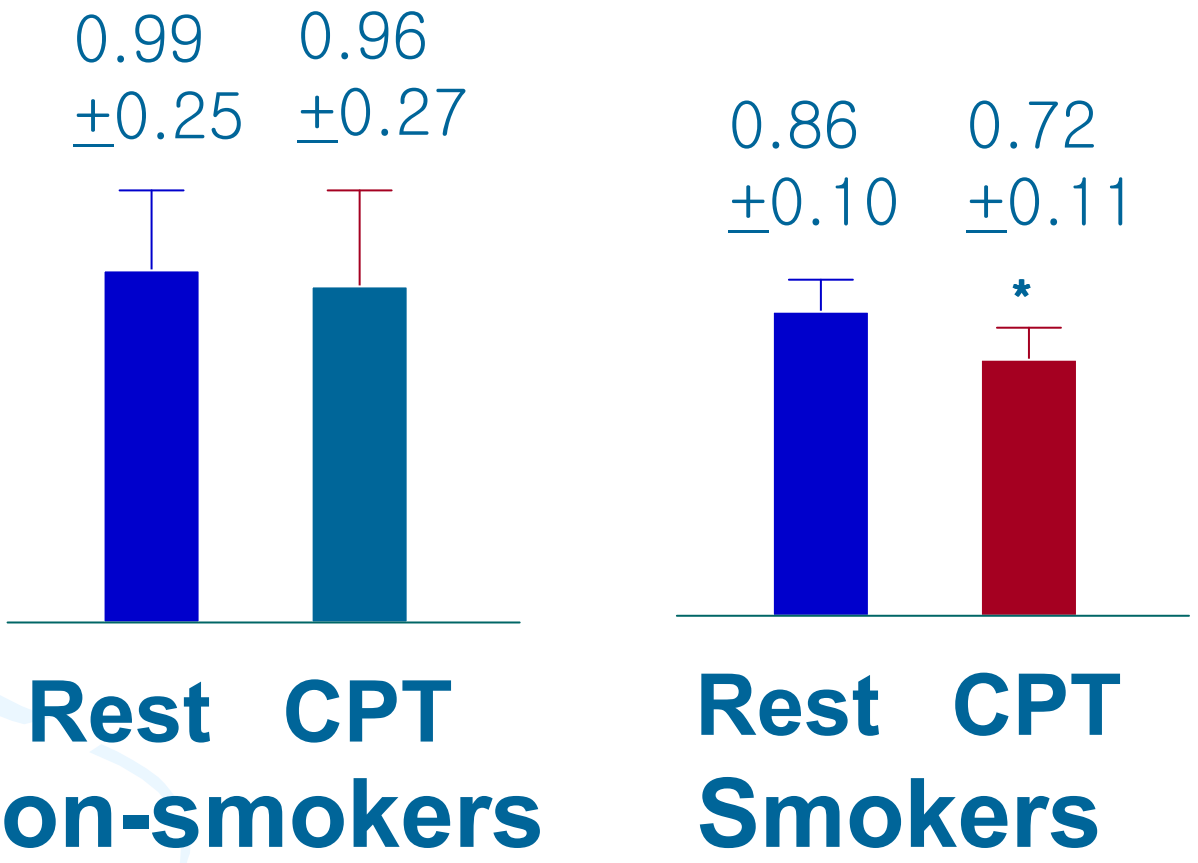
One Hand in Ice Water

1 min | 1 min

Dynamic Imaging (6 min)

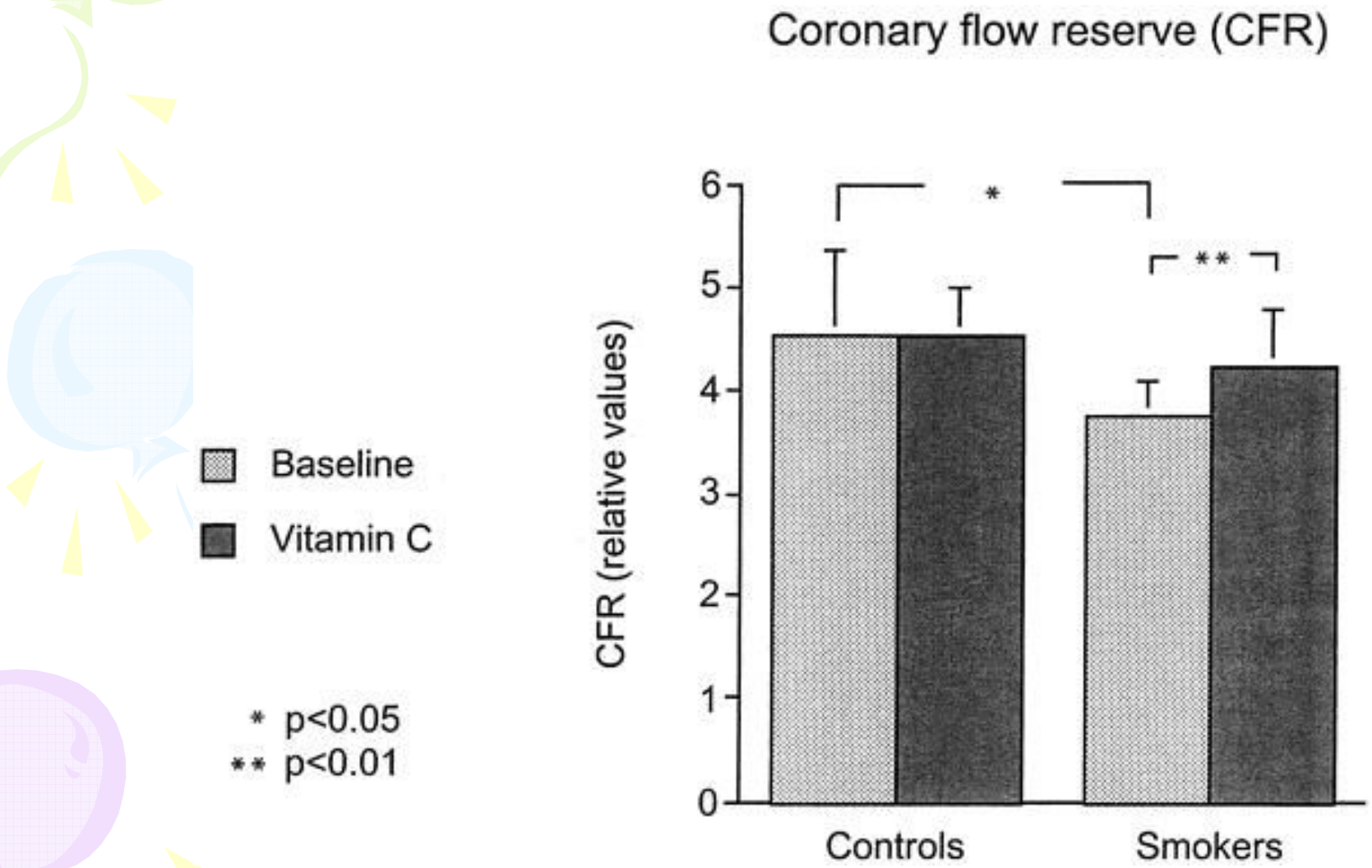
$^{13}NH_3$ 20 mCi

Abnormal MBF Response in Asymptomatic Smokers



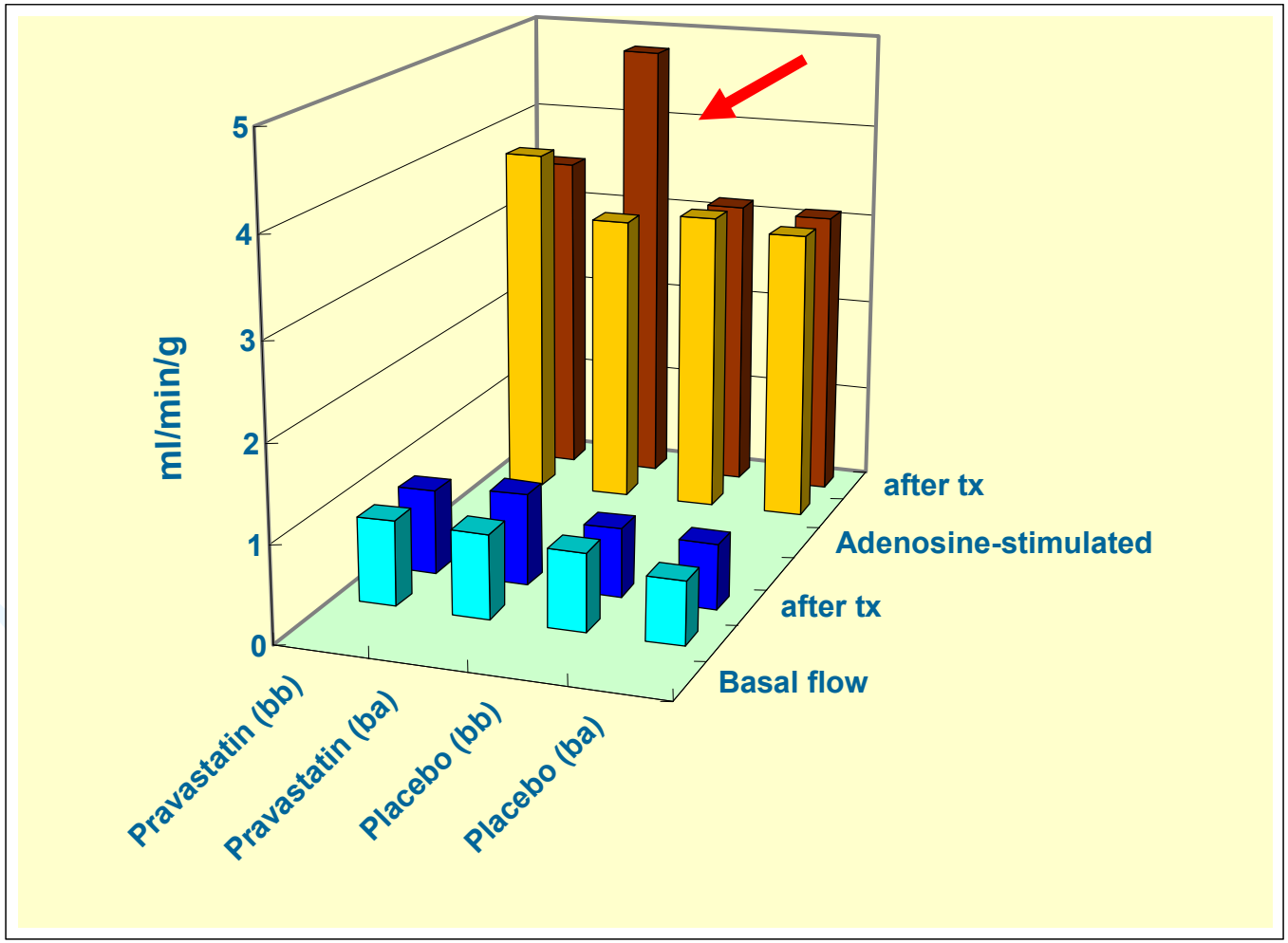
Circulation, 1998

Vitamin C Restores Coronary Microcirculatory Function in Smokers



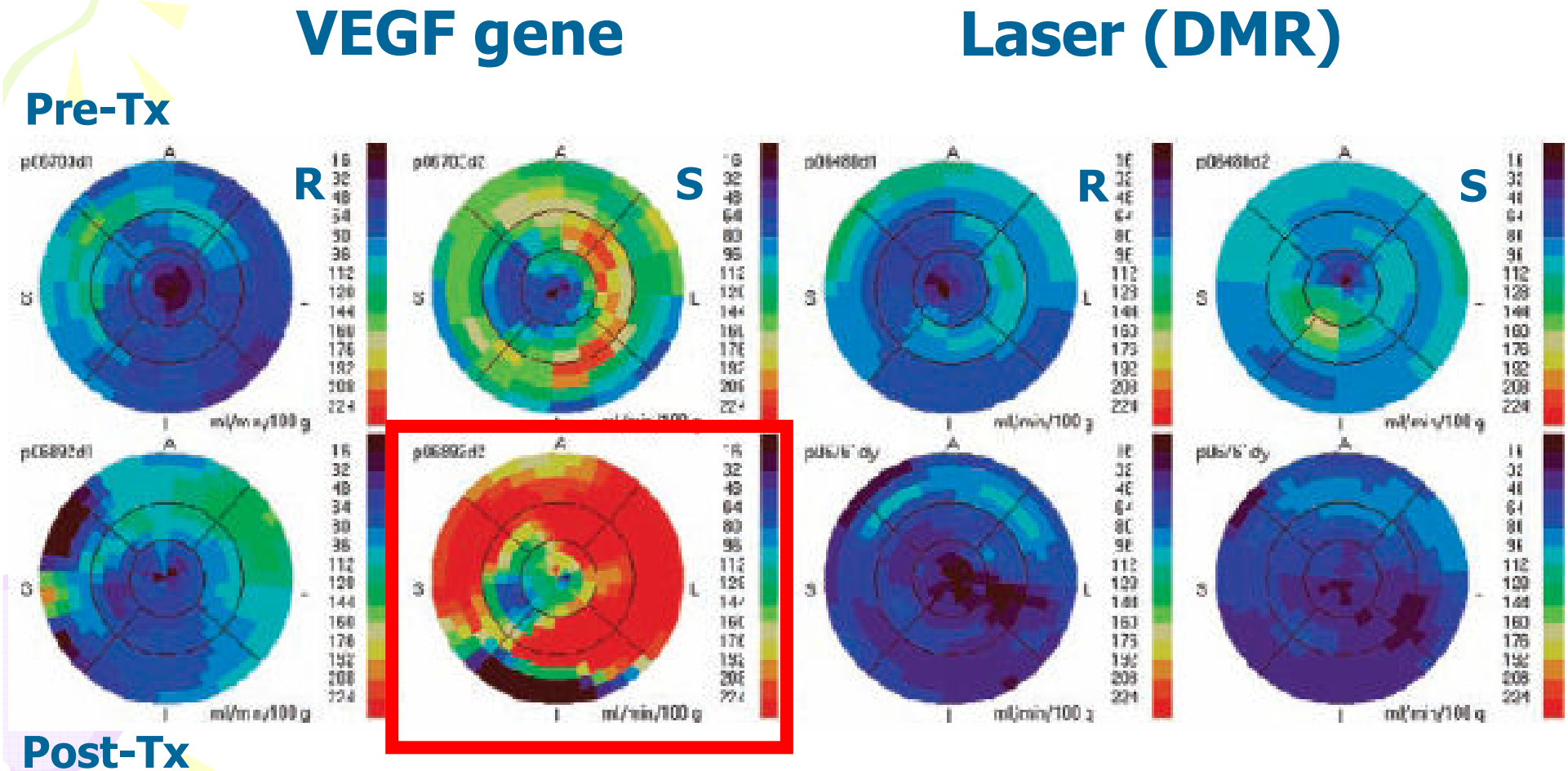
Circulation, 2000

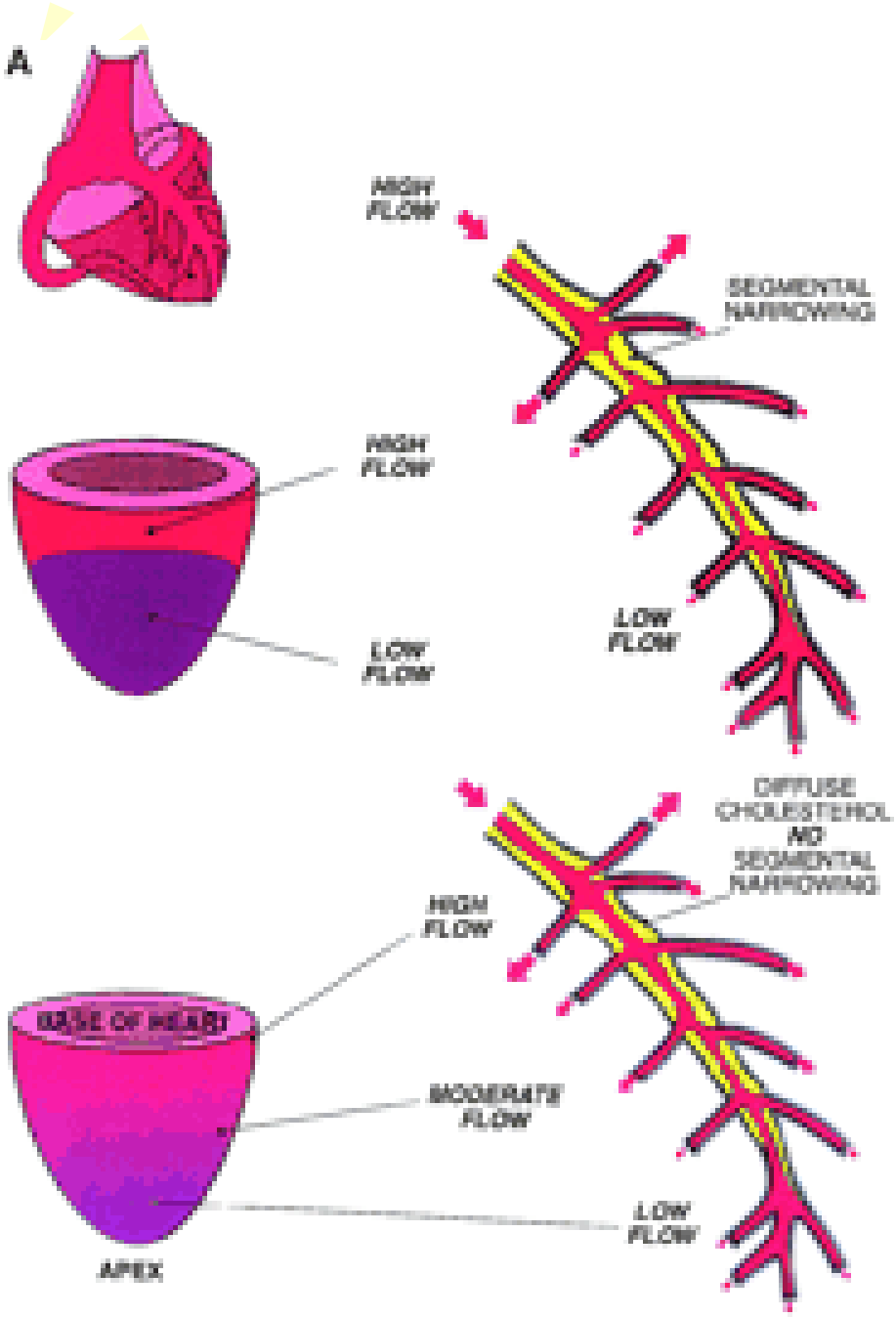
eNOS genotype modulates the improvement of coronary blood flow by pravastatin: a placebo-controlled water PET study



J Mol Med 2002

PET for Evaluation of Differential Myocardial Perfusion Dynamics After VEGF Gene Therapy and Laser Therapy in End-Stage Coronary Artery Disease (J Nucl Med 2004; 45:1437–43)

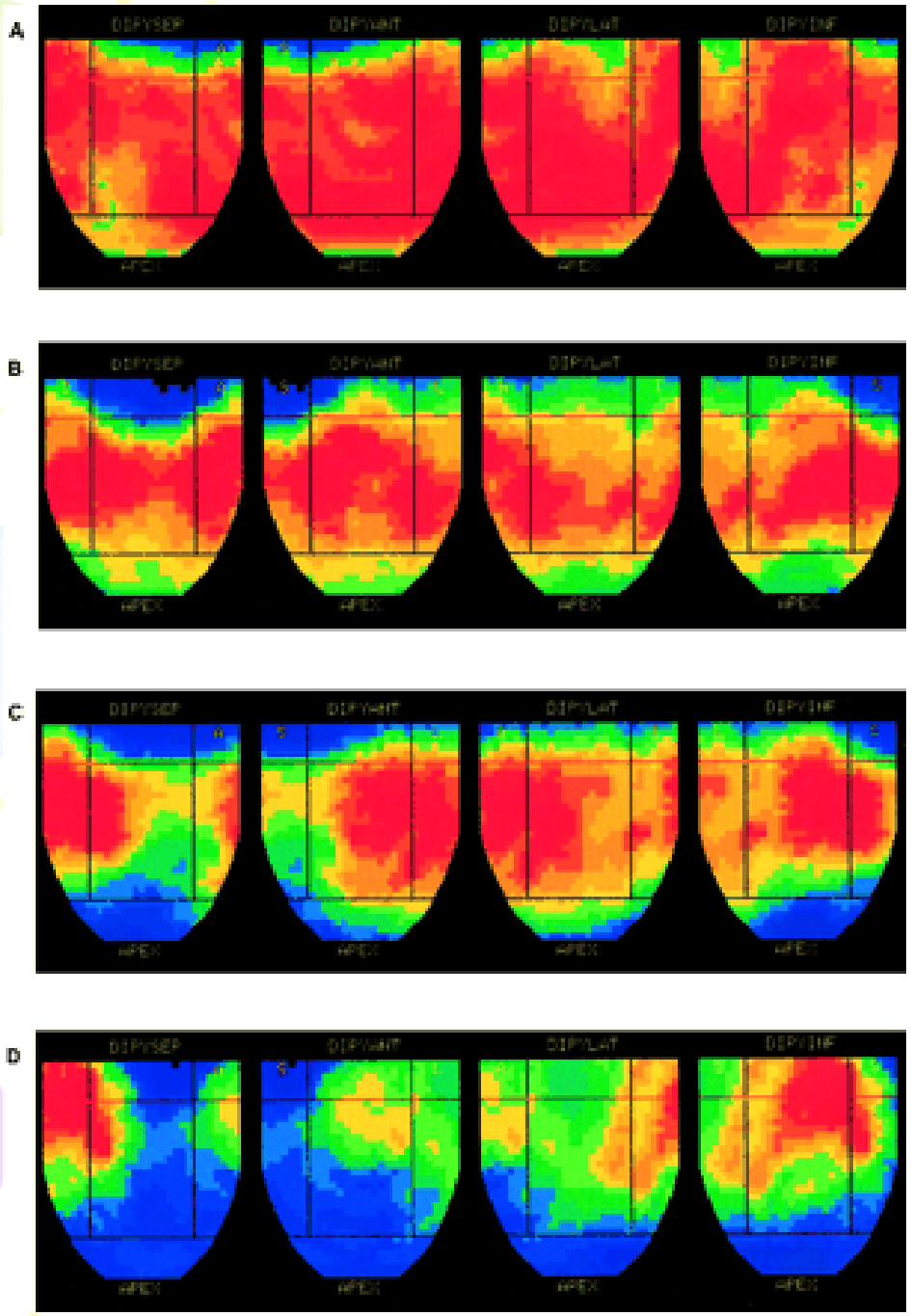




Localized Stenosis

Diffuse Narrowing

Circulation 2000; 101:1931–9

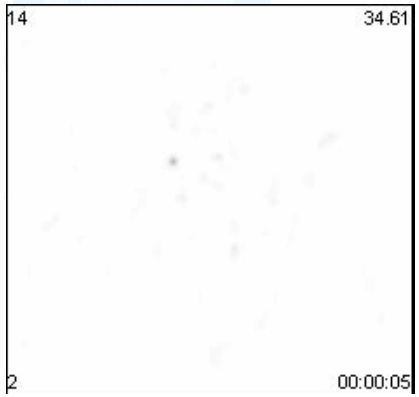


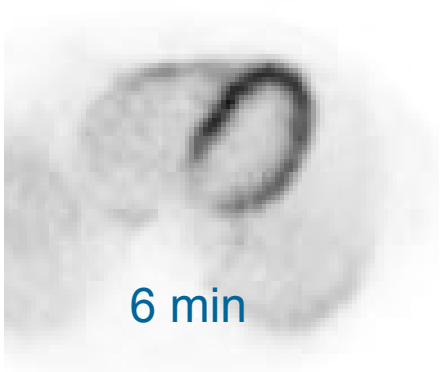
Rb-82 PET after Dipyridamole Stress who showed normal rest images

Graded, longitudinal, base-to-apex myocardial perfusion abnormalities

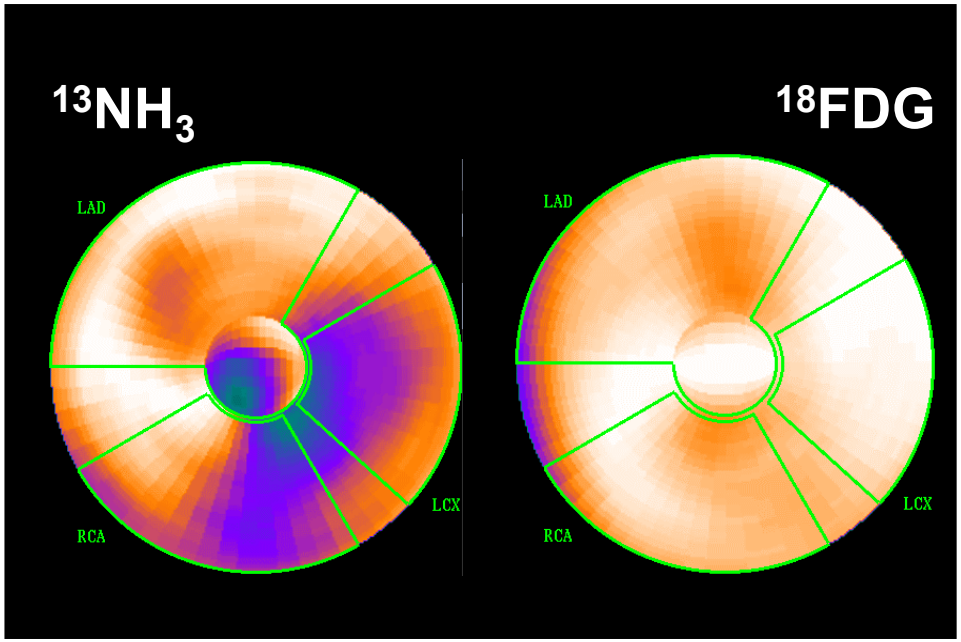
Circulation 2000; 101:1931–9

Perfusion and Myocardial Viability

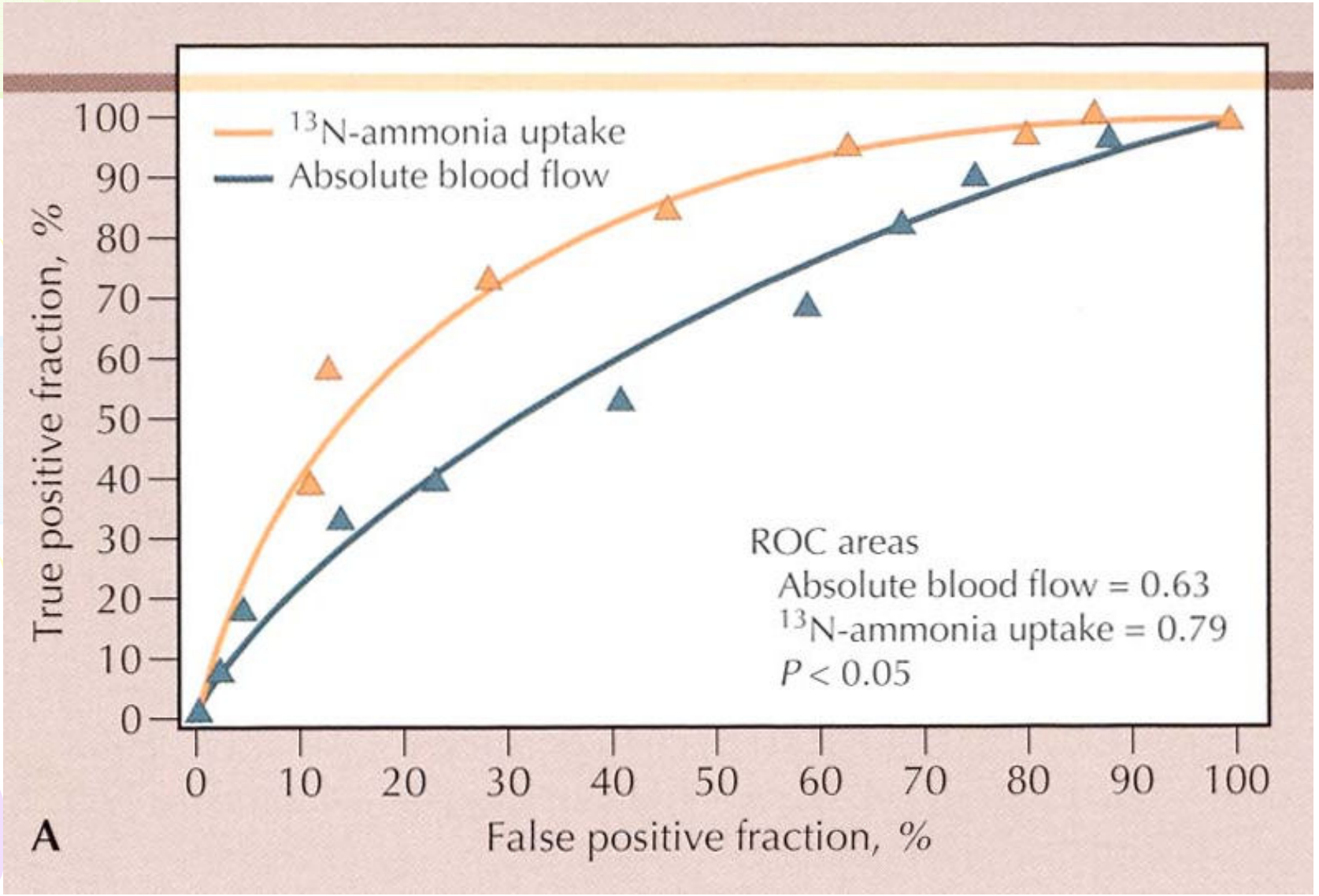




N-13 ammonia

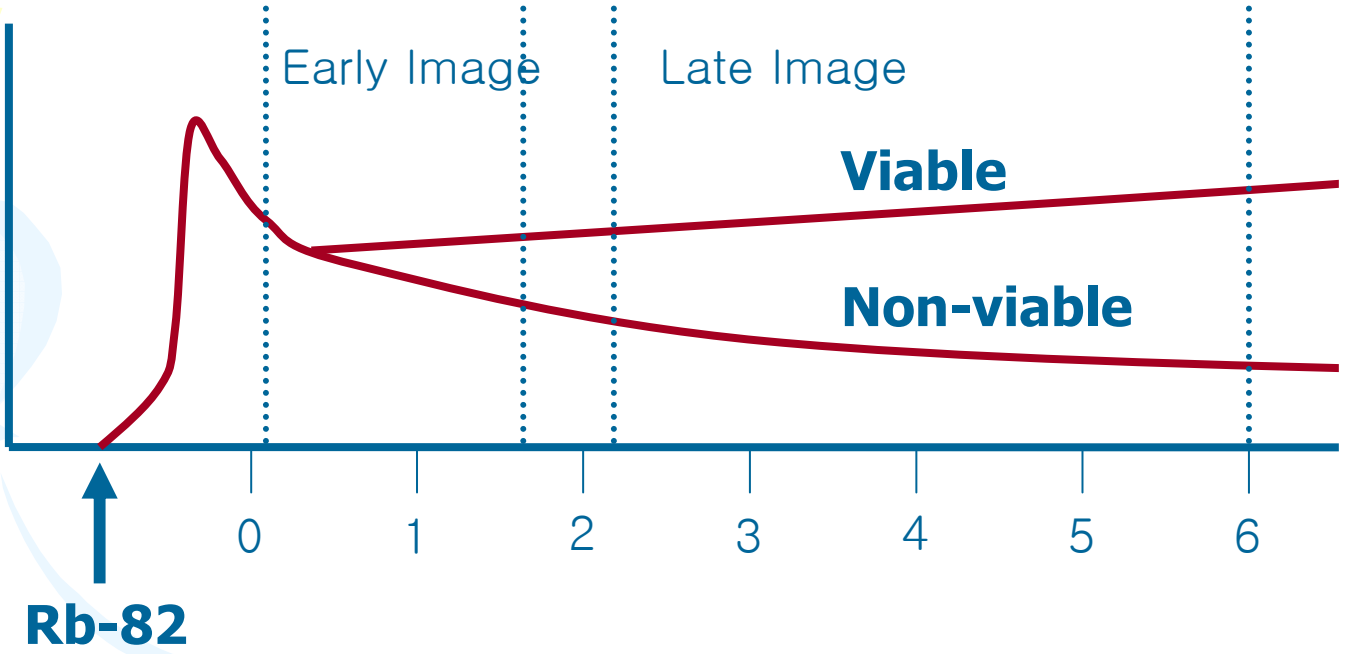


ROC analysis of N-13 ammonia PET for Myocardial Viability



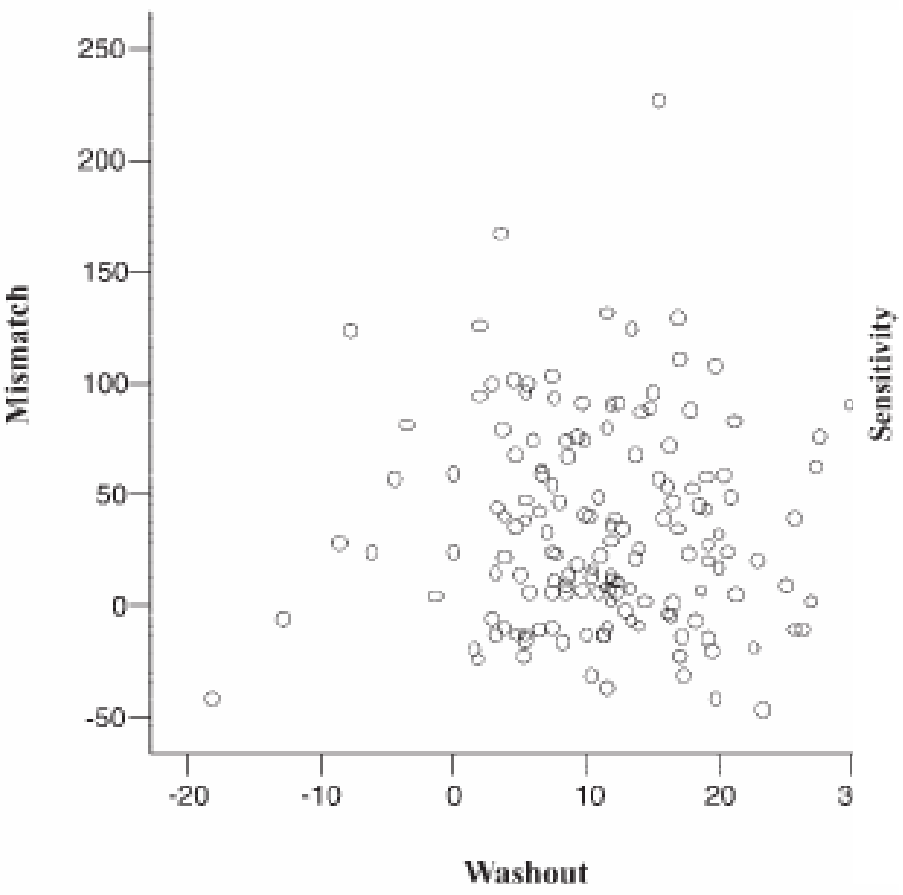
J Am Coll Cardiol 1999; 33: 678-86

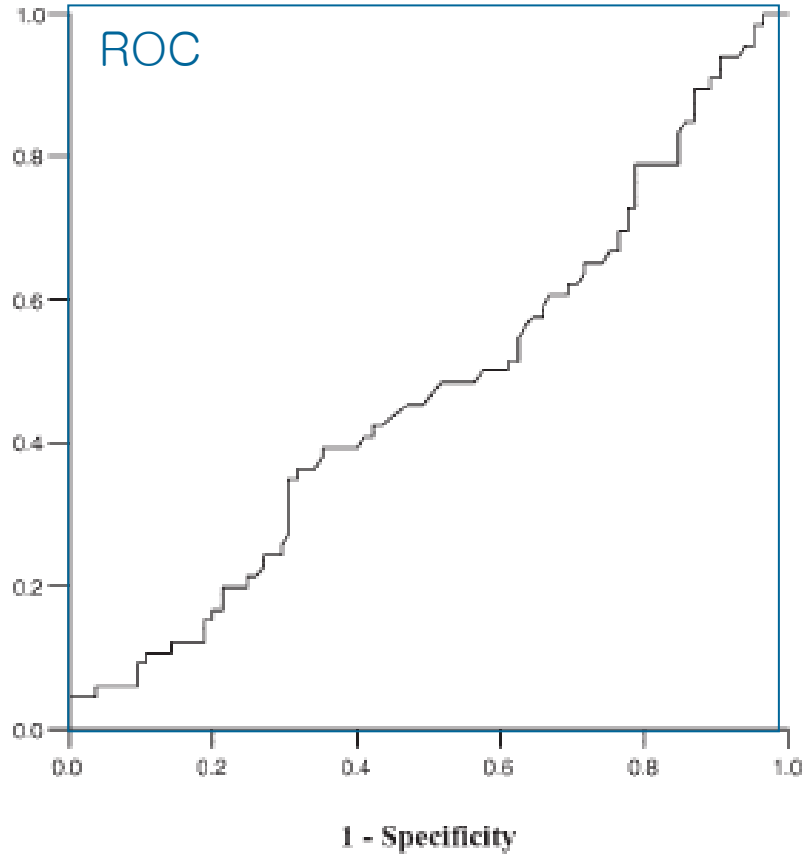
Kinetics of Rb-82 and Myocardial Viability



J Nucl Med 1991; 32: 1-9

Rb-82 washout vs. F-18 FDG for Viability



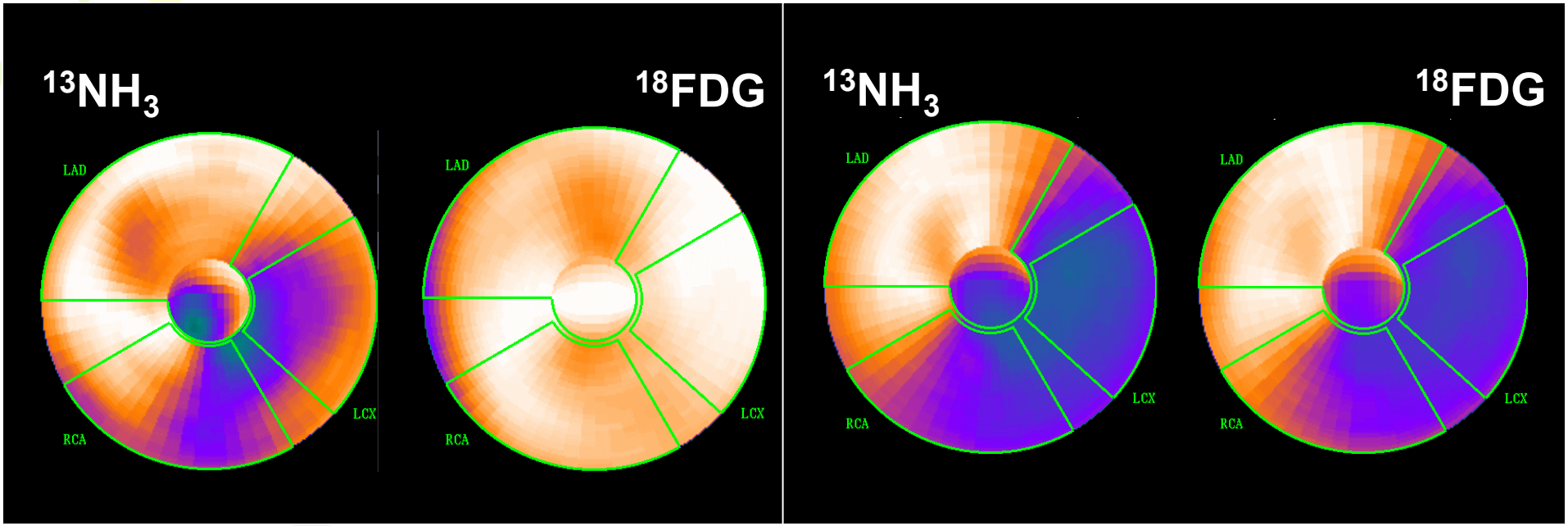


J Nucl Med 2005; 46:923–9

Gold Standard for Myocardial Viability

Viable

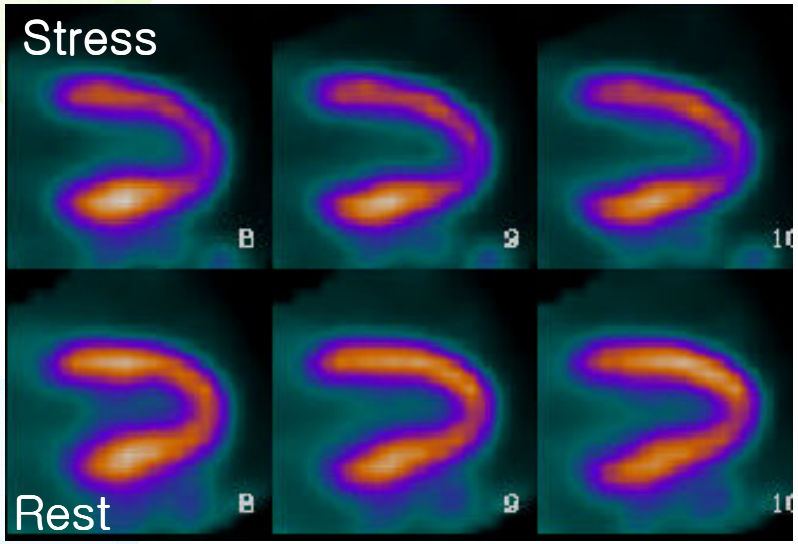
Non-viable

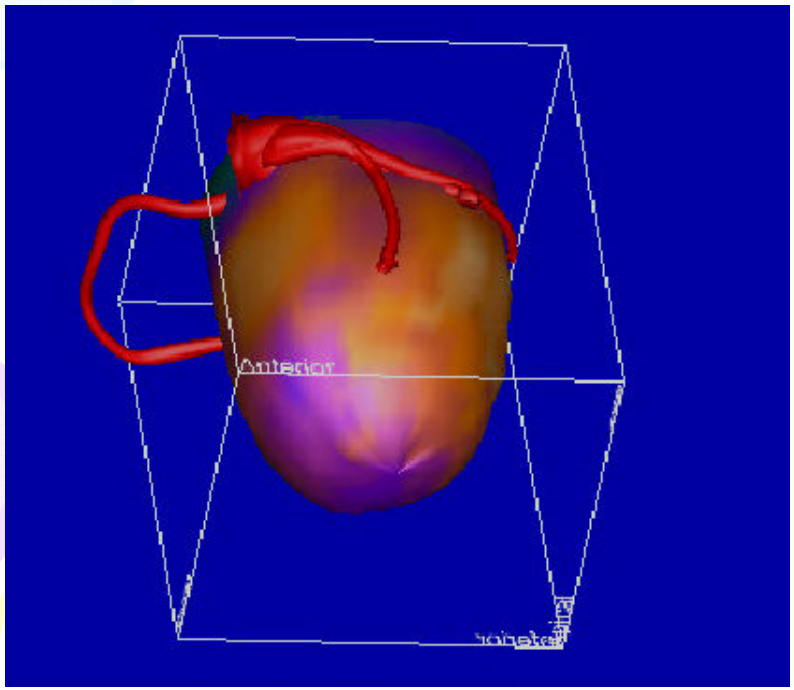


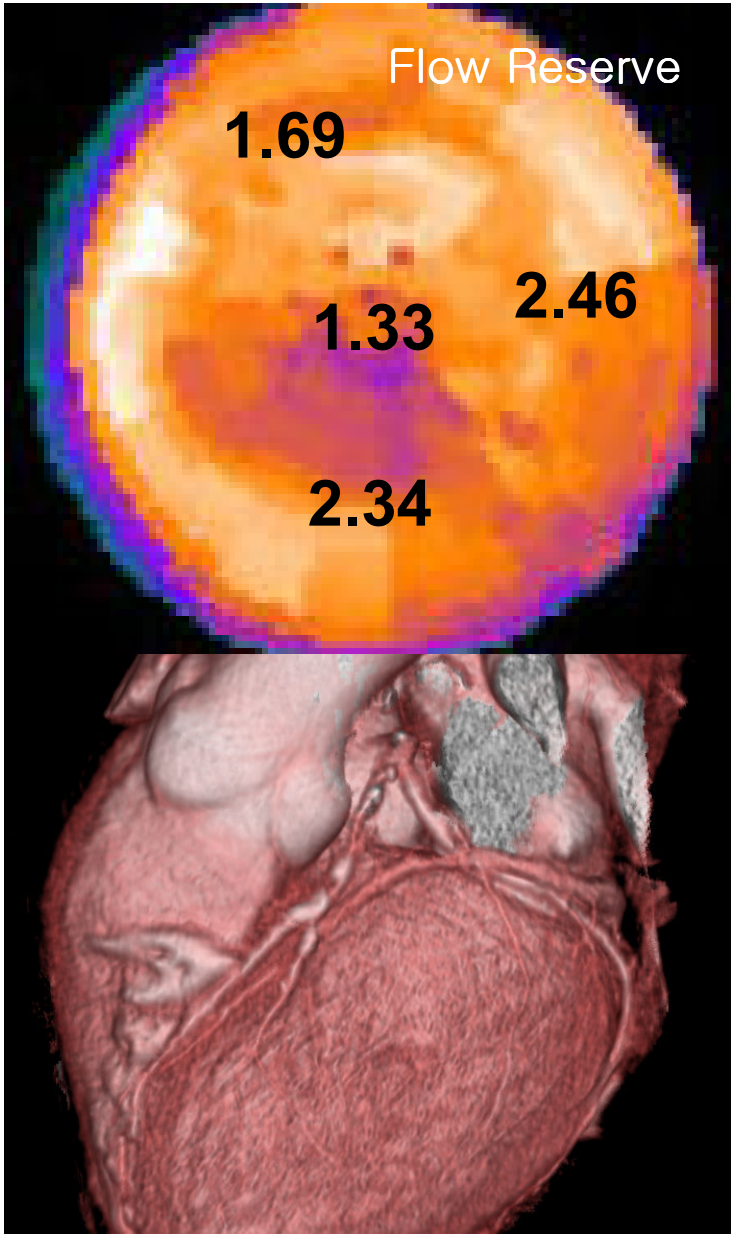
F-18 FDG PET 보험 산정기준 (2006.6.1~)

급여대상: 허혈성 심질환에서 심근의 생존능 평가
치료전, 치료후 각각 1회로 산정함.

1 Accurate Comprehensive Diagnosis







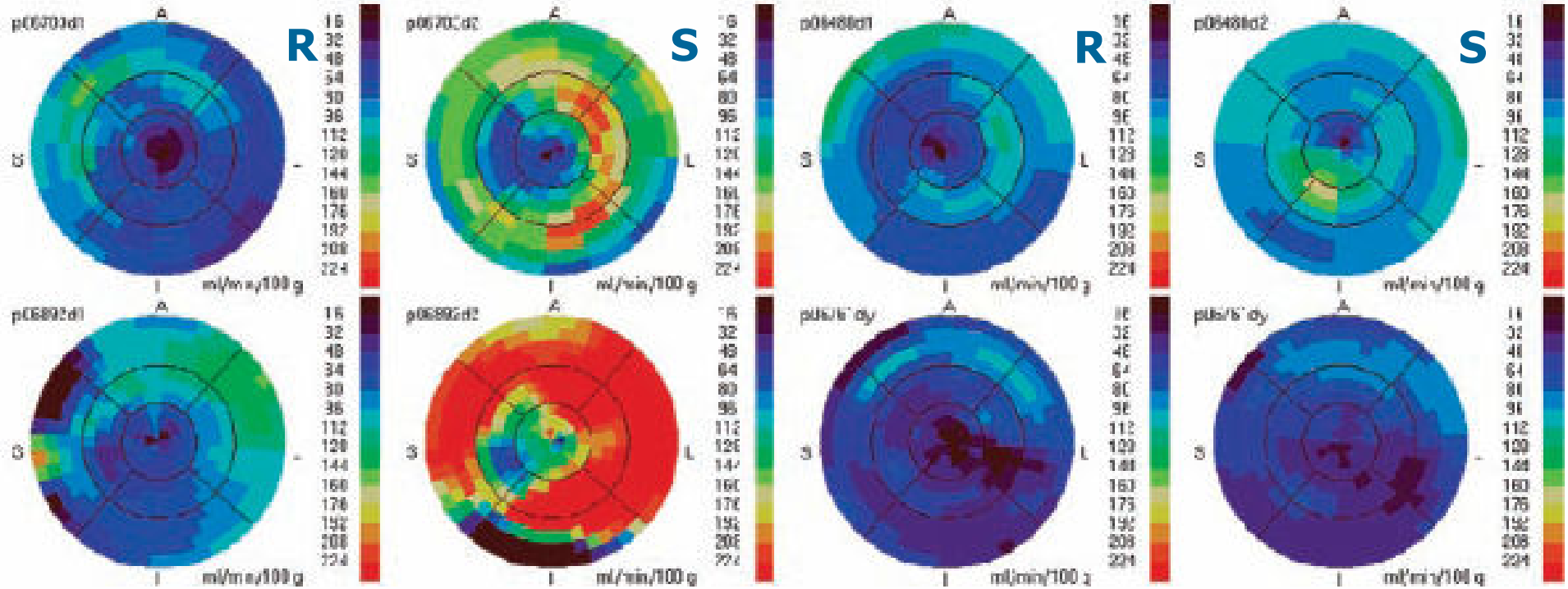
2

Accurate Assessment of Therapeutic Effects

VEGF gene

Laser (DMR)

Pre-Tx



Post-Tx

3

경청해주셔서 감사합니다