심부전이 동반된 관상동맥질환: Is ‘viability issue’ still viable?

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부산의대
양산 부산대 병원

Is ‘viability issue’ still viable?....????

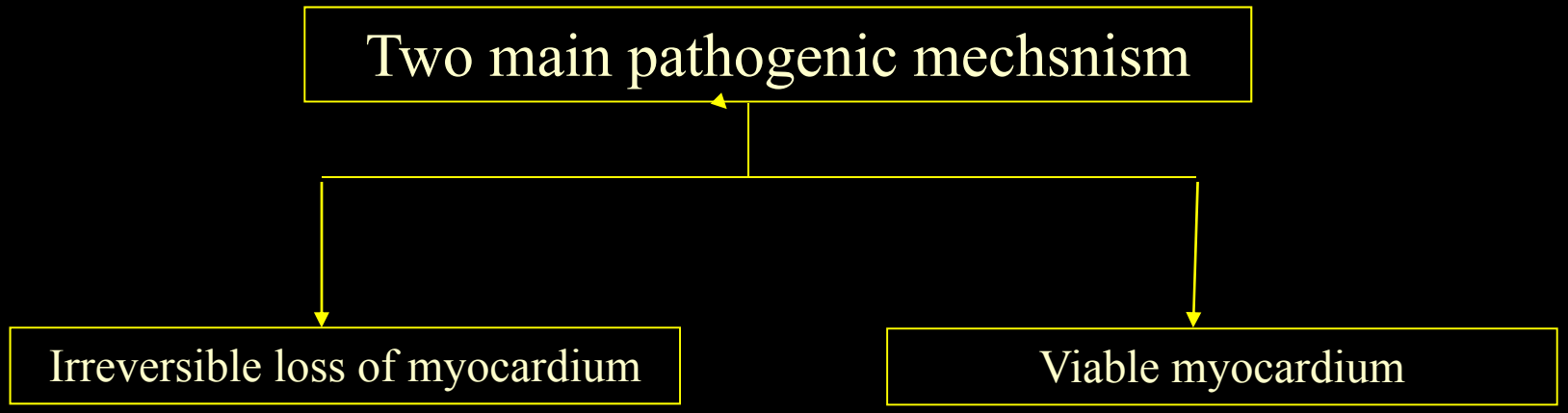
Unprecedented improvement in Tx of CAD over the last 3 decades

- Thrombolytic treatment
- Percutaneous coronary intervention

- Multivessel disease with increased LV volume
- concept of ‘viability’

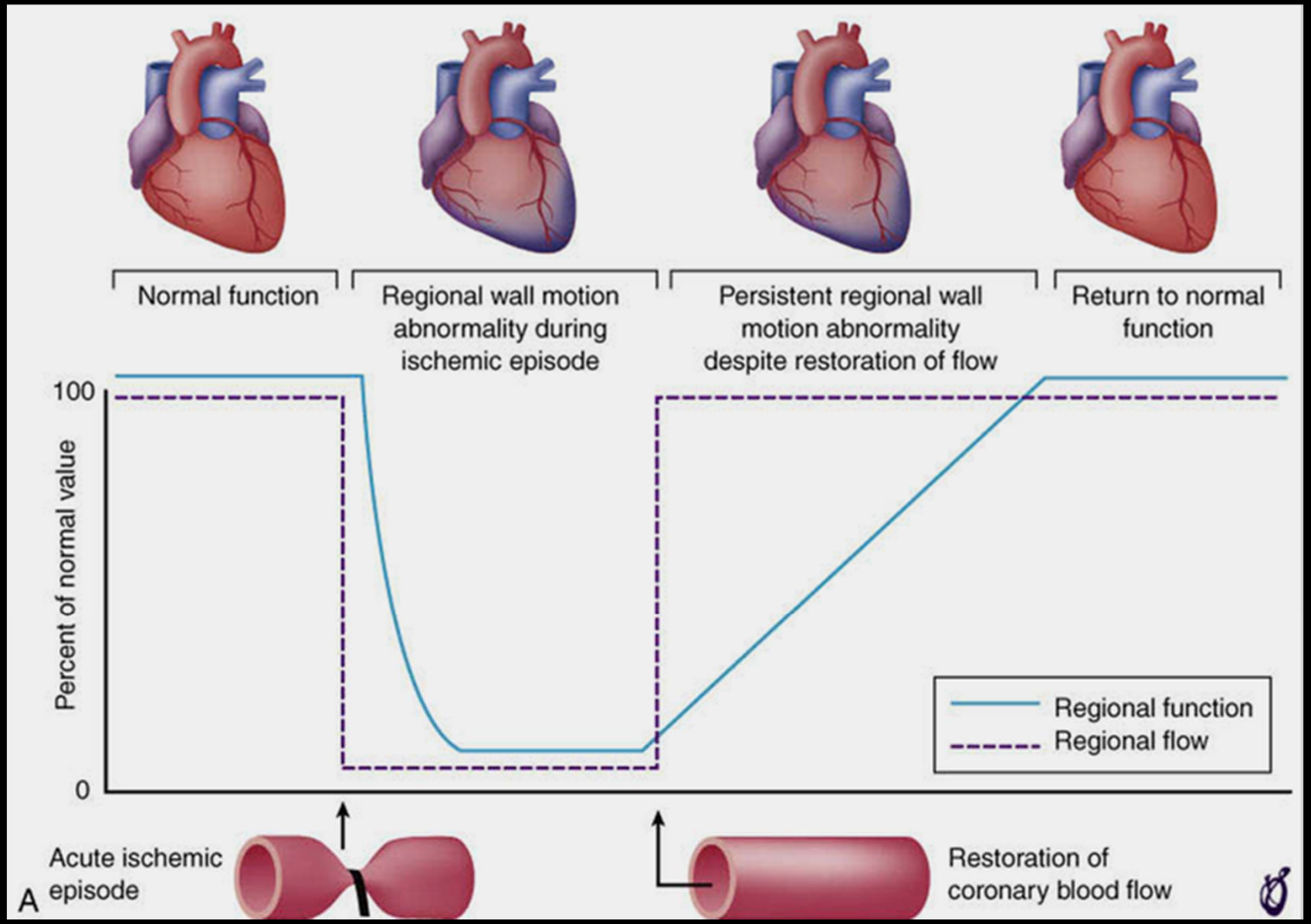
Definition of “ischemic cardiomyopathy”

- is currently applied to patients with significantly impaired left ventricular dysfunction (left ventricular ejection fraction 35 to 40 percent) that results from coronary artery disease
- Most common cause of HF

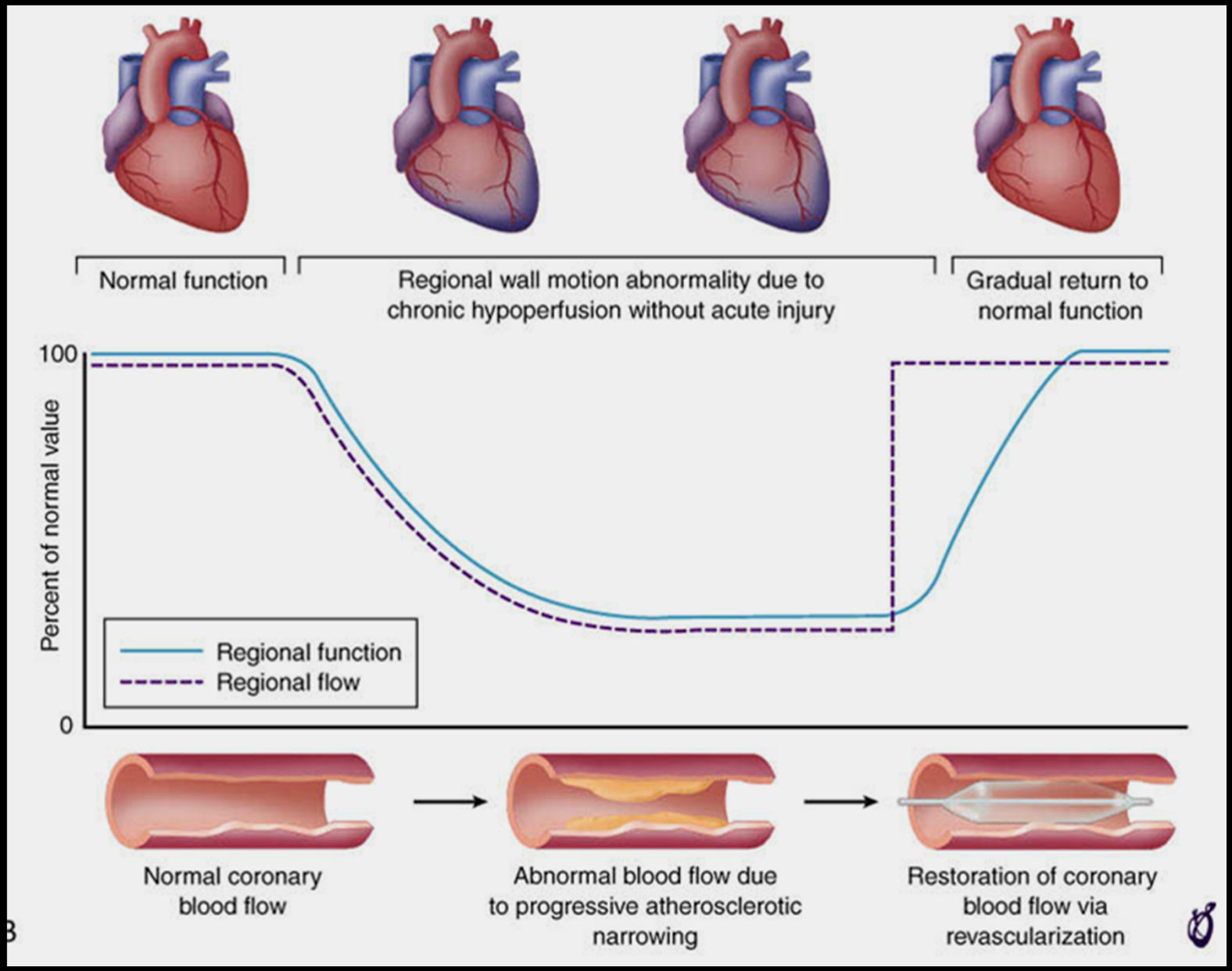


Myocardial Stunning and Hibernation

Myocardial Stunning



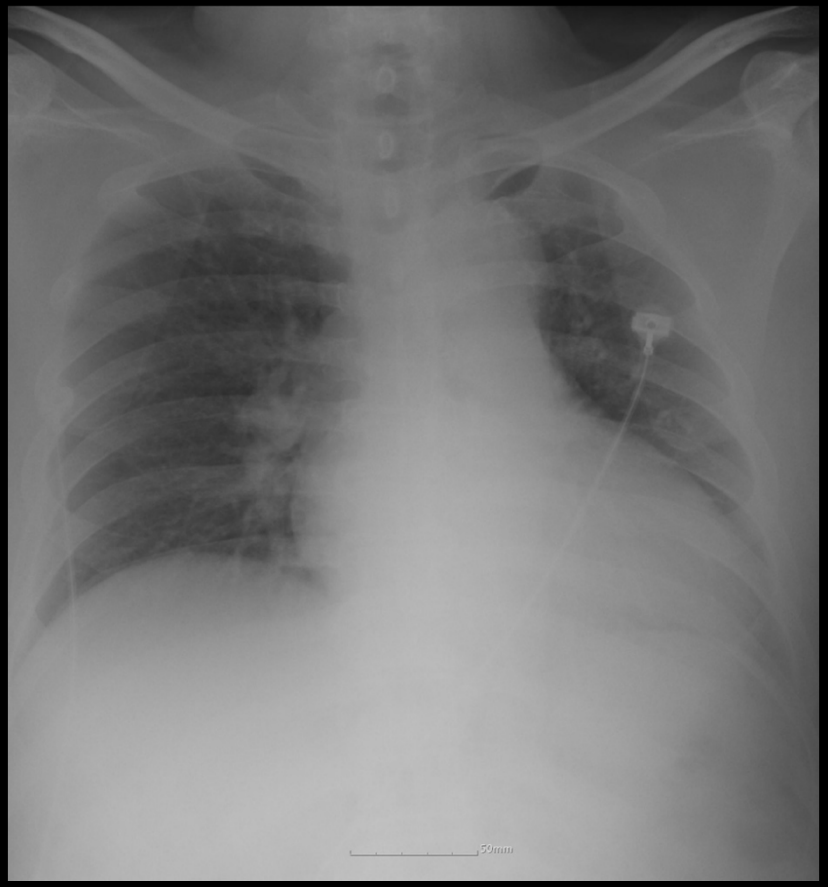
Myocardial Hibernation



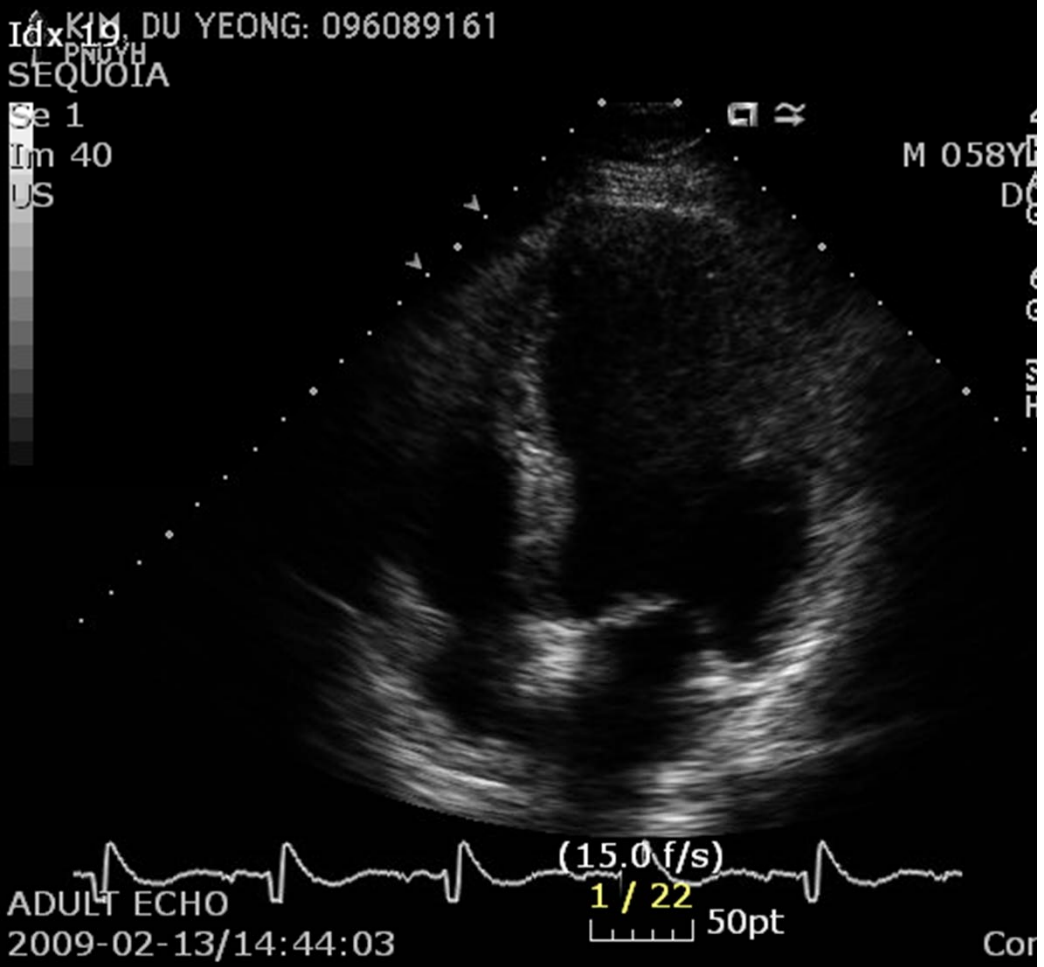
A case of Hibernating Myocardium

- M/58
- 3년전부터 effort related chest pain
- 최근 들어 증상이 심해짐
  (minimal effort related chest pain)
- RF : HTN/chol
- T chol 250 mg/dl BNP 709 pg/mL, CRP 0.32 mg/dL
- ECG : NSR, nonspecific ST change
- Echo : Mulitiple RWMA
  & global hypokinesia (22%)
  Moderate functional MR

Chest PA



Echo

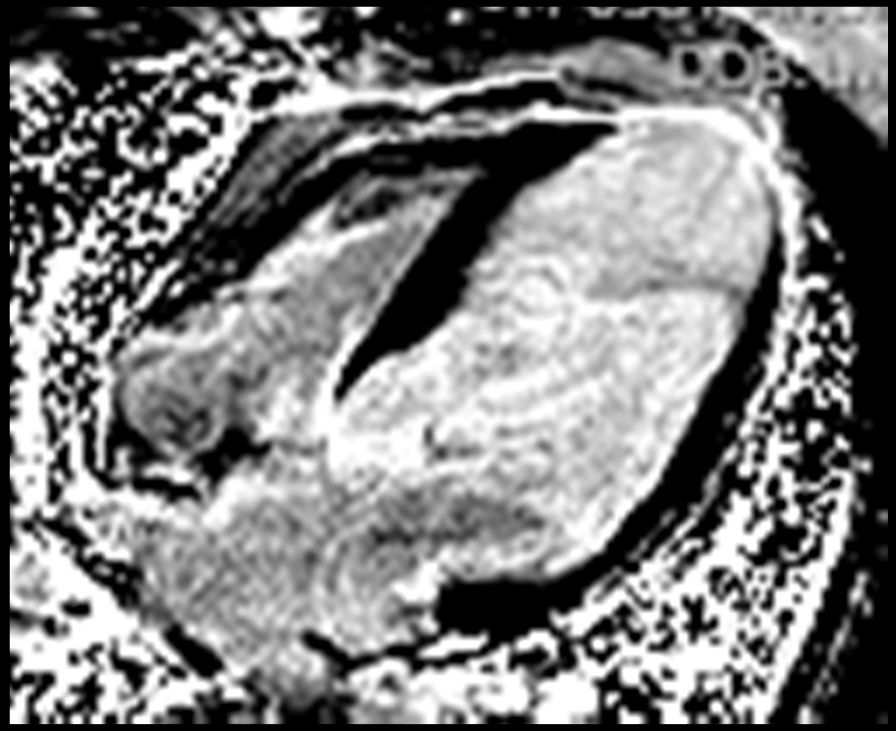


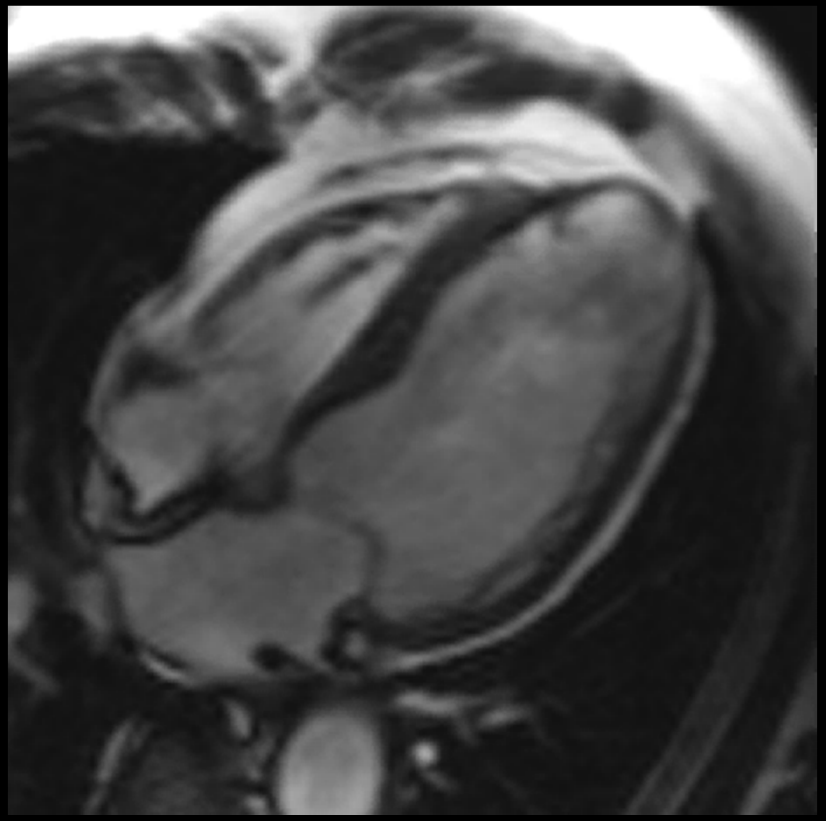
EF 22%

CAG finding

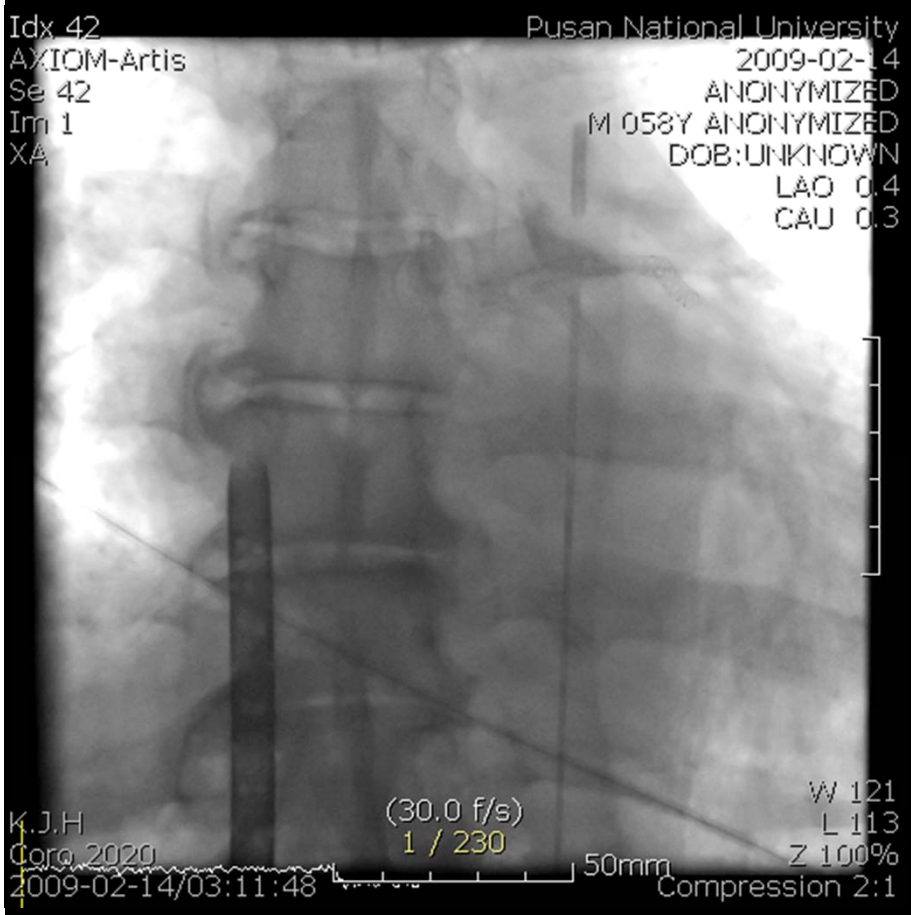
RCA = diminutive RCA

Cardiac MRI finding



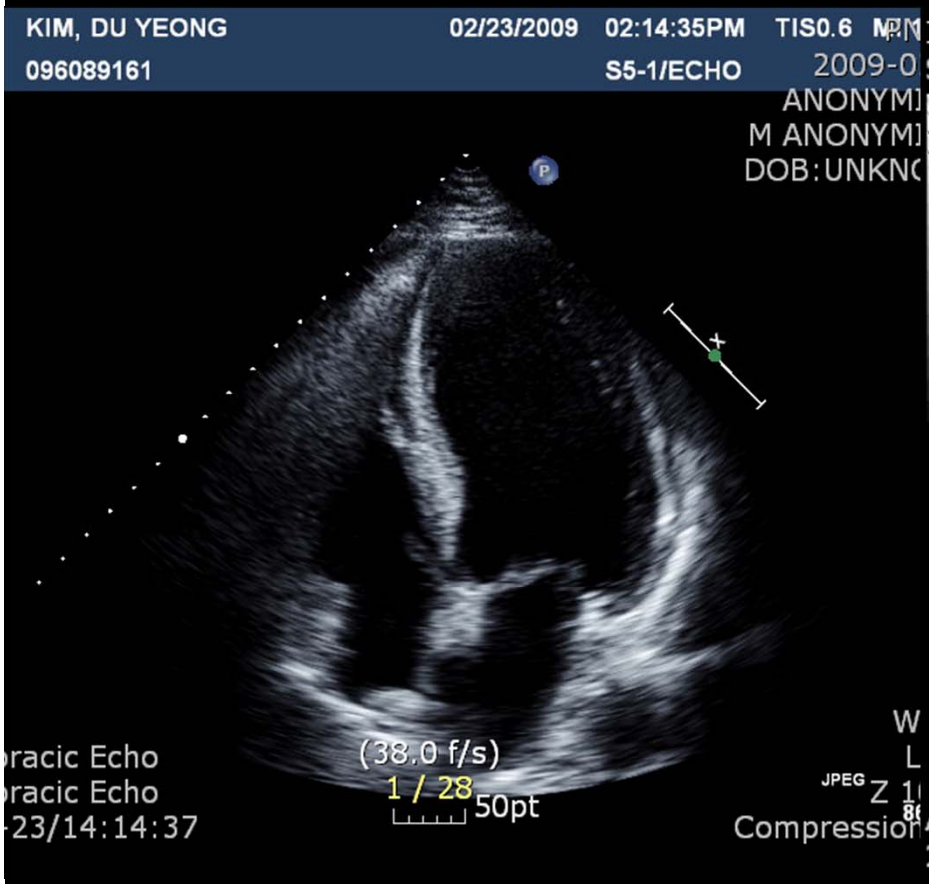


PCI with LV assist devices



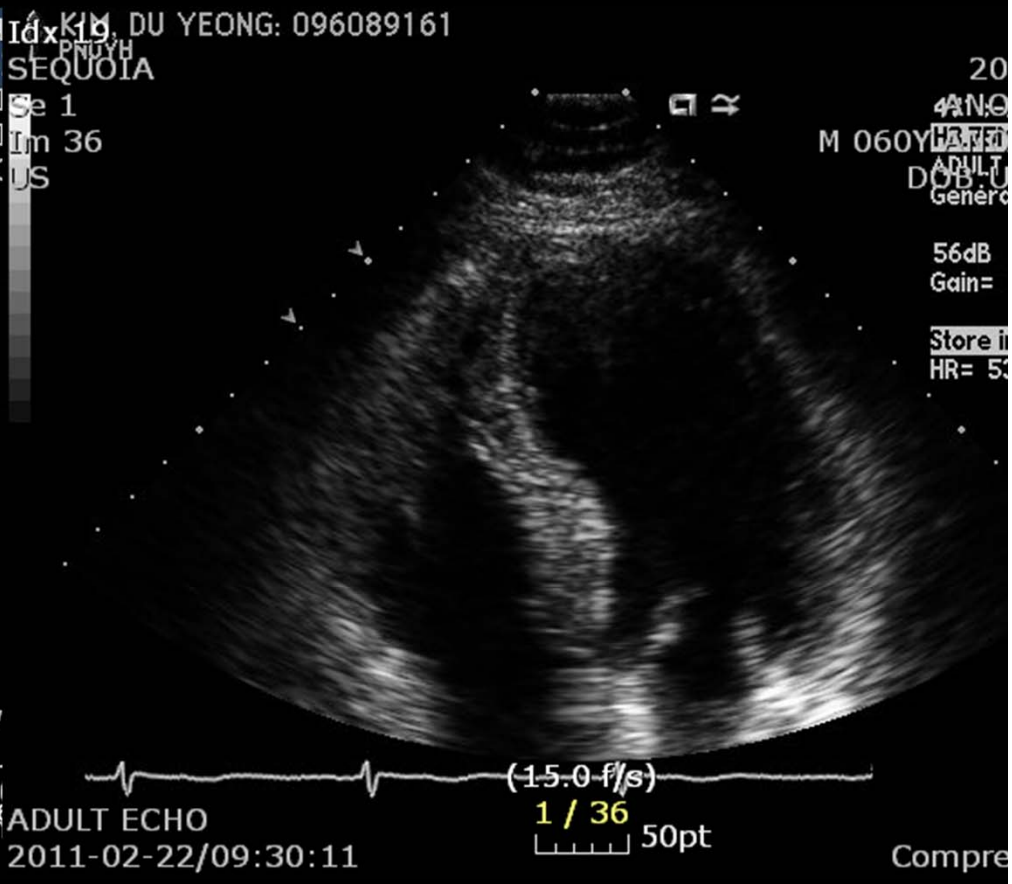
Serial change of LV recovery after PCI :

2 weeks



EF 37%

1 year



Normal LV

Assessment of Viability

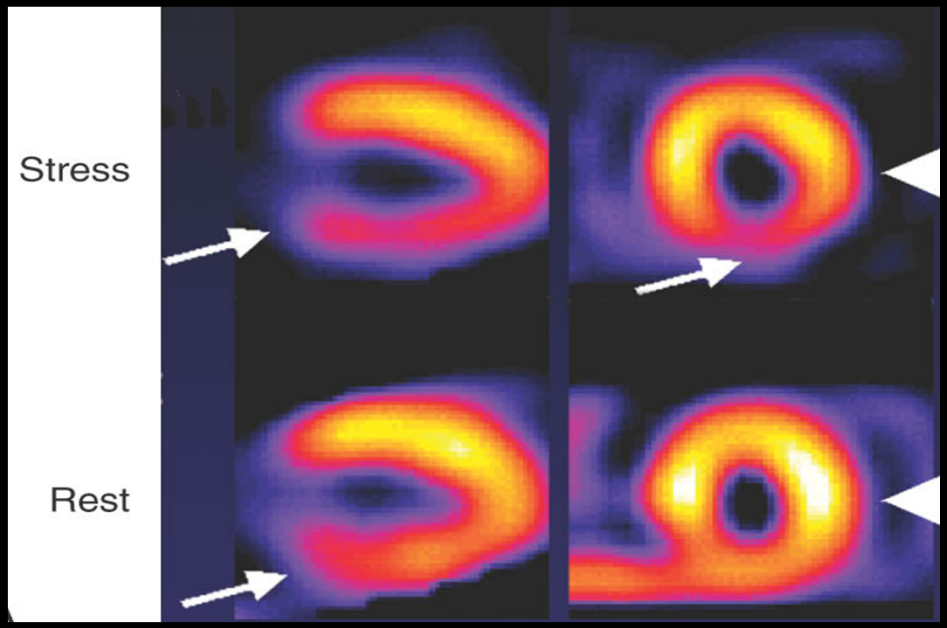
SPECT

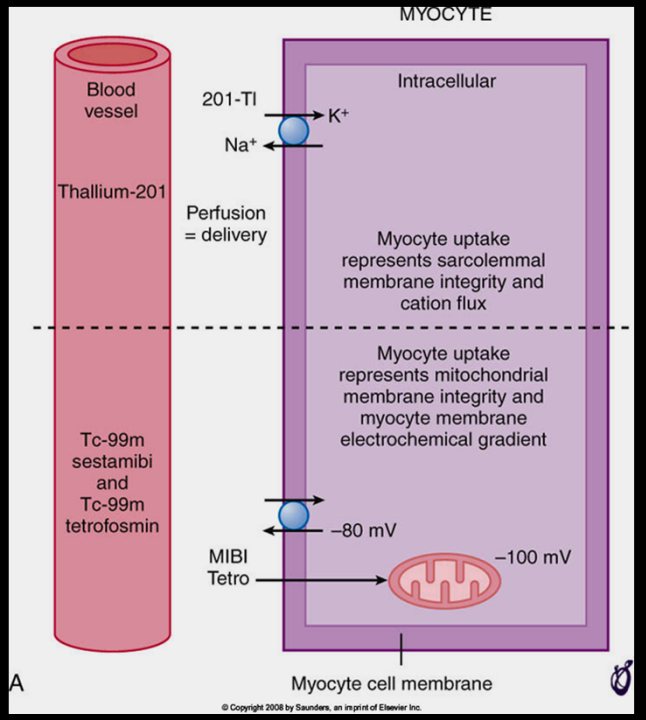
PET

Dobutamine - ECHO

MRI

SPECT (Single Photon Emission CT)

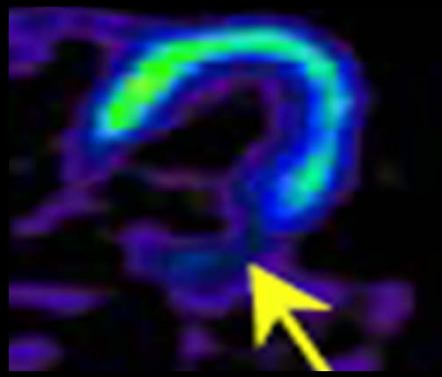




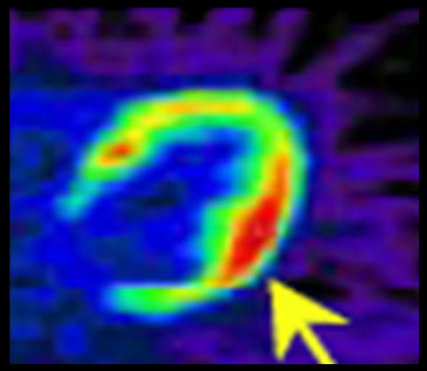
A large, moderately severe, reversible inferior wall defect (arrows) reflecting a severe flow reserve abnormality.

Myocardial metabolism in ischemic myocardium

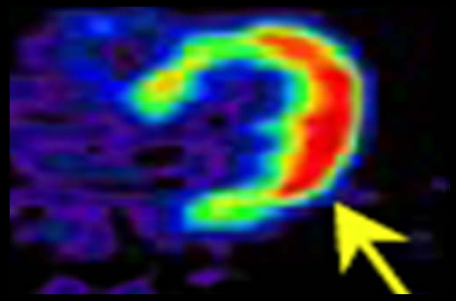
MBF



fasting FDG



Glucose loaded FDG



Ischemic myocardium

↑Glucose uptake

↑ Glycogen breakdown

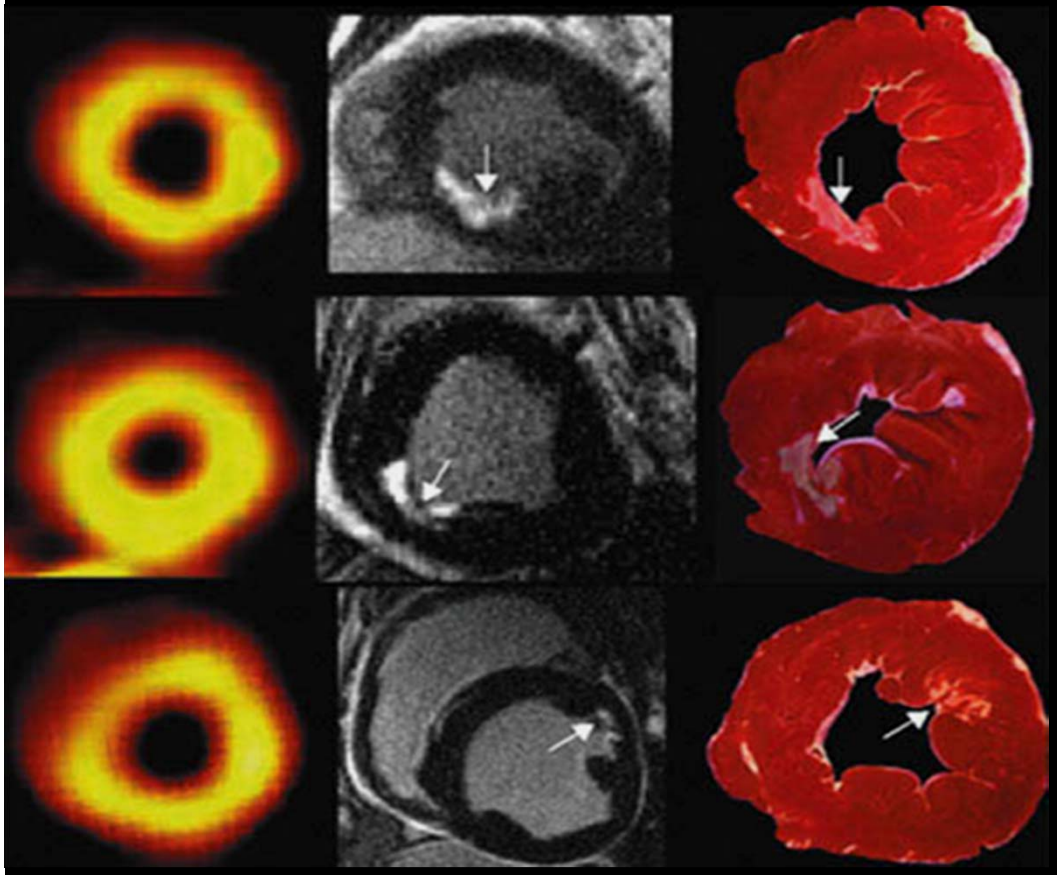
↑ Glucolysis

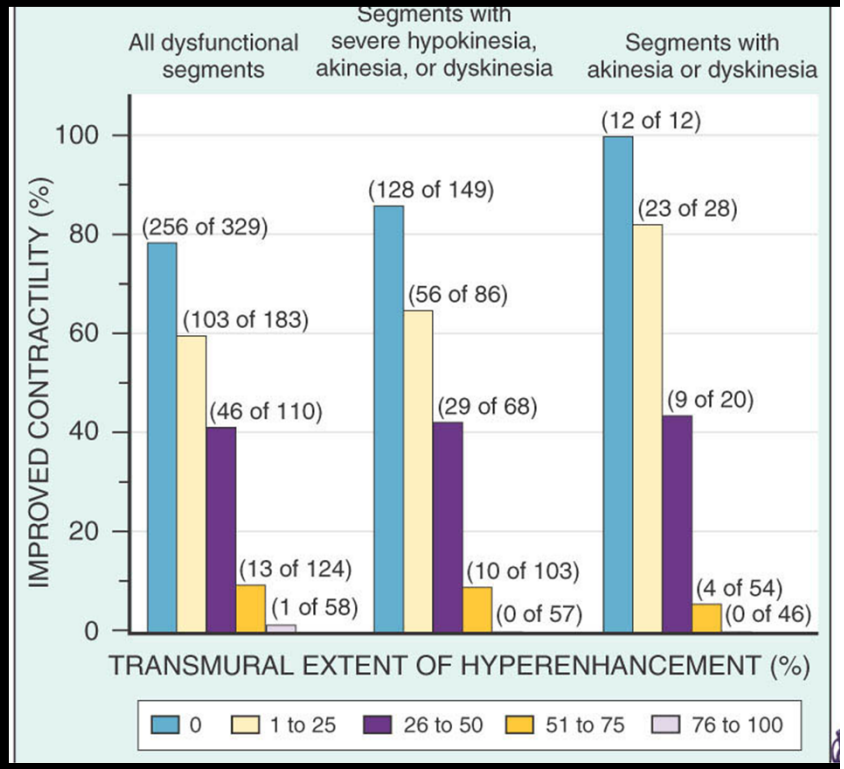
↓ Mitochondrial metabolism

↓ FFA uptake

Cardiac MRI detecting myocardial infarction

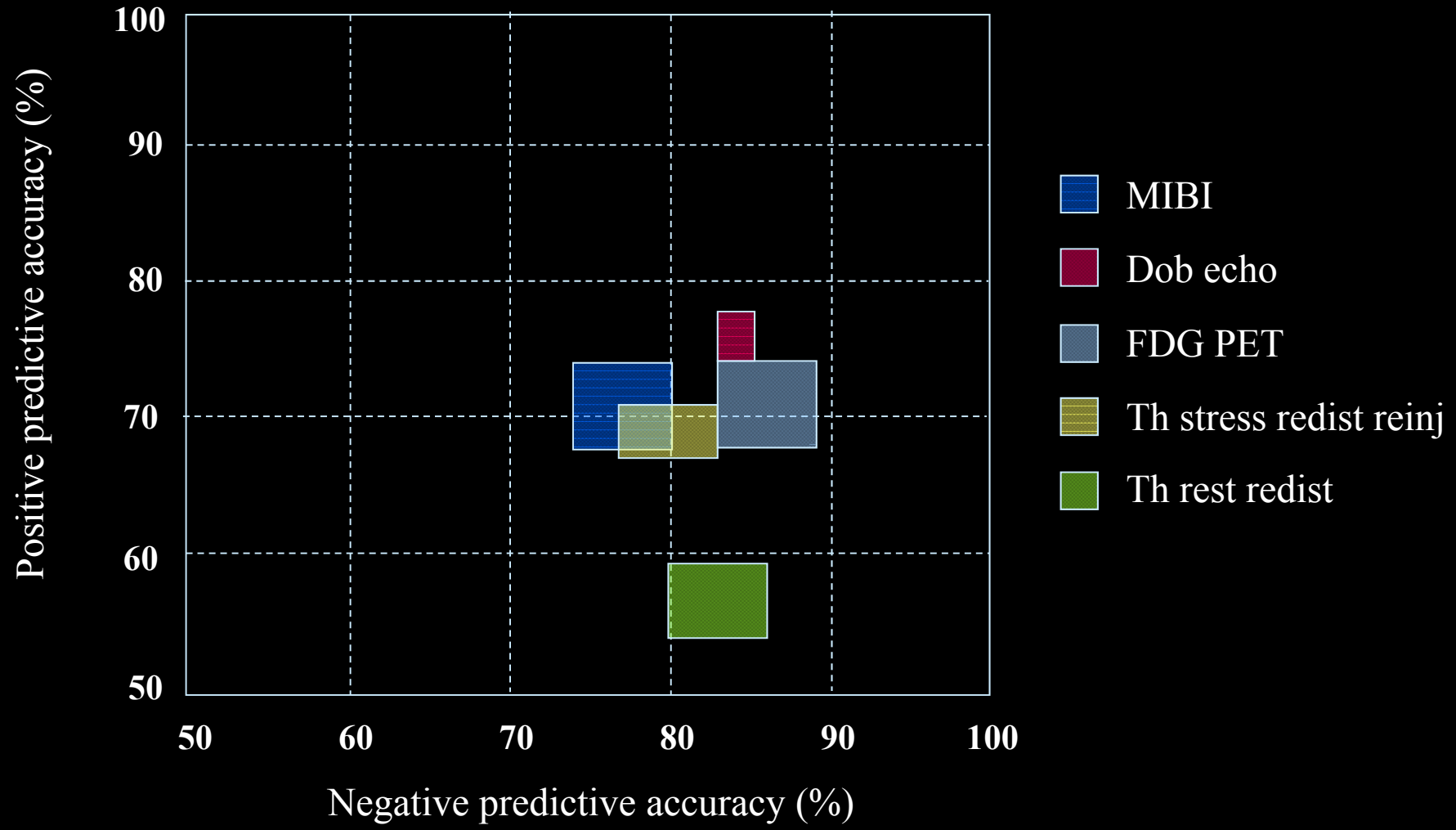
imaging 1g of myocardial necrosis with a spatial resolution of 2mm





Lancet ;361:374, 2003

Accuracy for predicting recovery of wall motion after revasuclarization



Underwood et al : EHJ 2004;25:815

Which one is better?

- SPECT/PET : excellent sensitivity
- Echo & CV MRI with dob stress

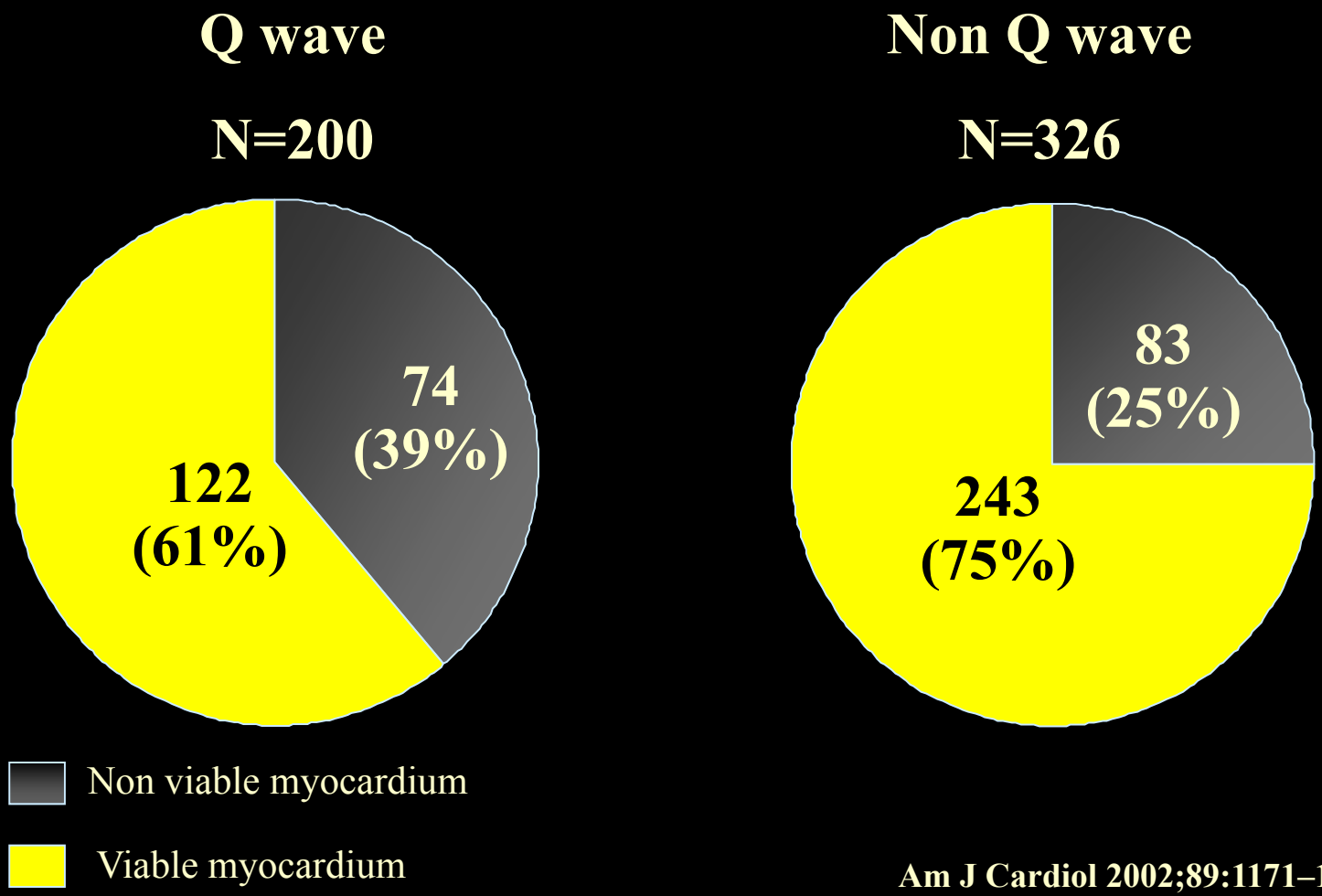
: superior specificity and positive predictive value.

- late-enhancement CV MRI

: better negative predictive value for segments of nonviable segments in 6 months after revascularization compared with MIBI or PET

Circulation. 2008;117:103-114.

Assessment of viable myocardium in Q wave region



Am J Cardiol 2002;89:1171–1175

Impact of revascularization in ICMP

LV function improvement ?

Reverse remodeling ?

Mortality benefit ?

Impact of Revascularization on LVEF according to the presence of Hibernating myocardium

A mean increase in LVEF of about 8 percent after revascularization

	No. of studies	Hibernation		No Hibernation	
		LVEF before	LVEF after	LVEF before	LVEF after
FDG PET	12	37	47	39	40
Th	5	30	38	29	31
MIBI	4	47	53	40	39
Dob Echo	7	35	43	35	36

How much of Viable myocardium (VM) is needed to achieve LV function improvement ?

To predict at least 5% of EF improvement

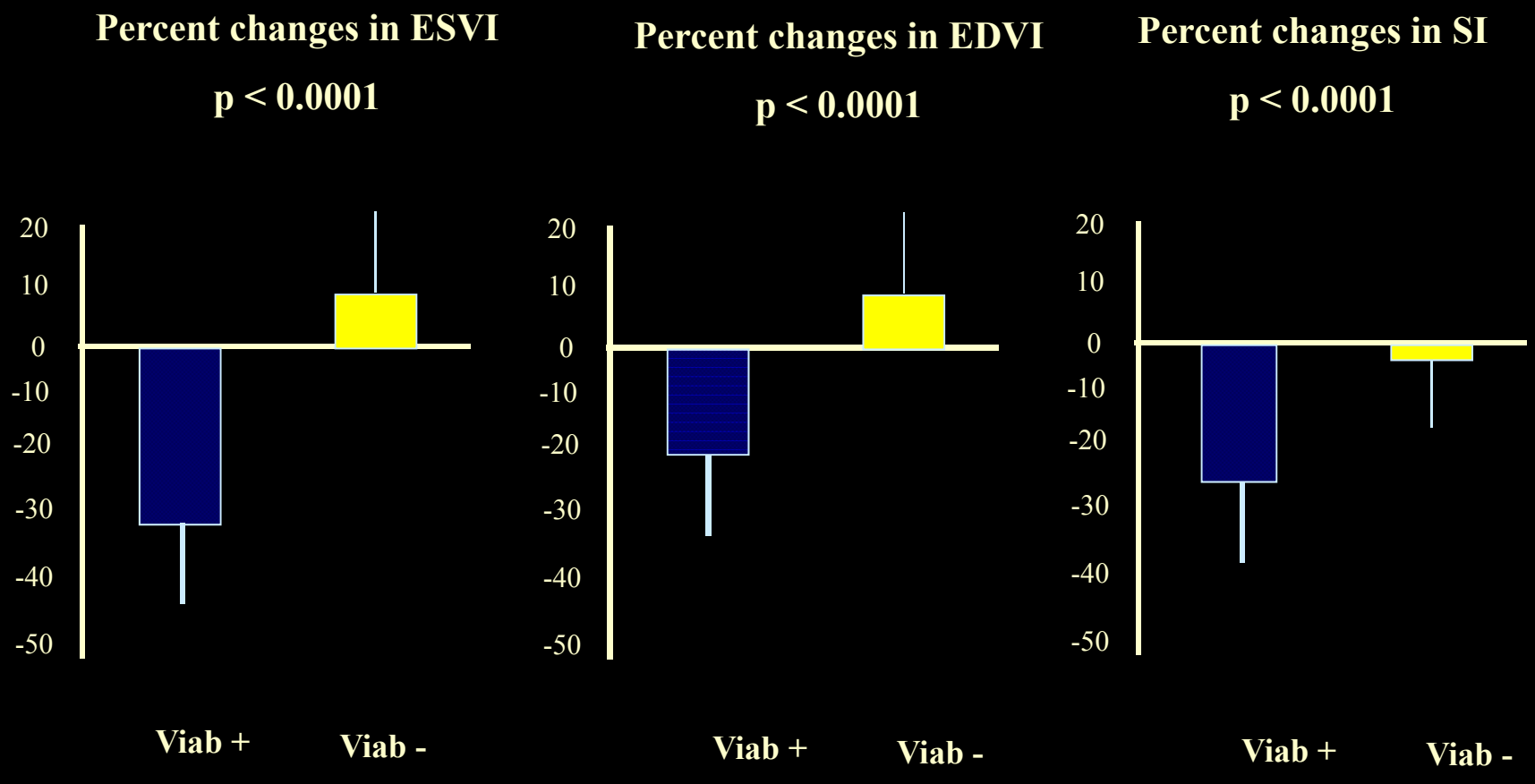
VM > 25% of of LV on Dob Stress Echo

Bax JJ et al *J Nucl Med*. 2002;43:795–802.

VM > 38% using conventional nuclear medicine and PET.

Bax JJ et al. . *Am J Cardiol*. 2003;92:1– 4.

Impact of Revascularization on remodeling according to the presence of Hibernating myocardium

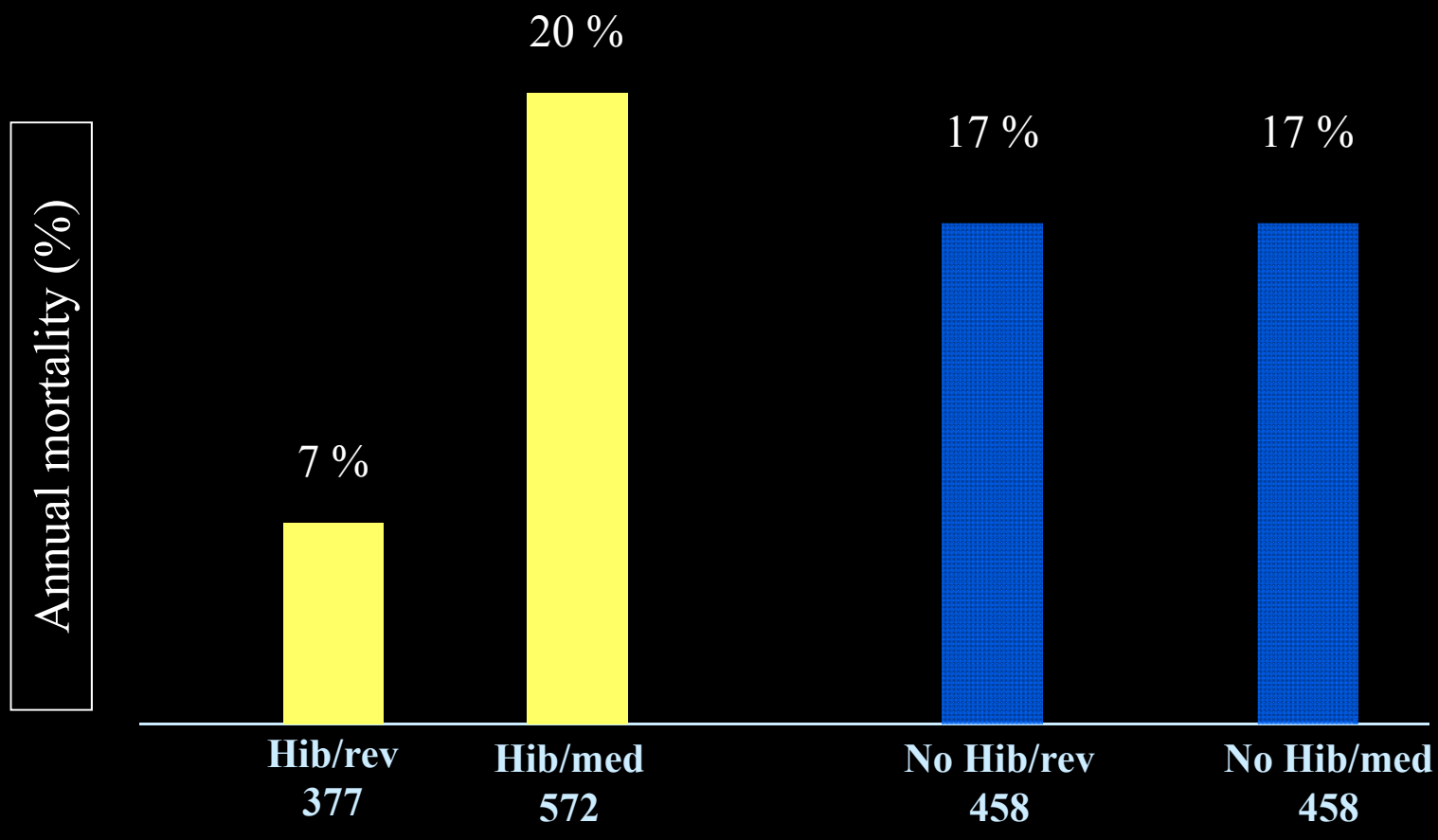


SI = sphericity index

J Am Coll Cardiol 2006;47:969 –77

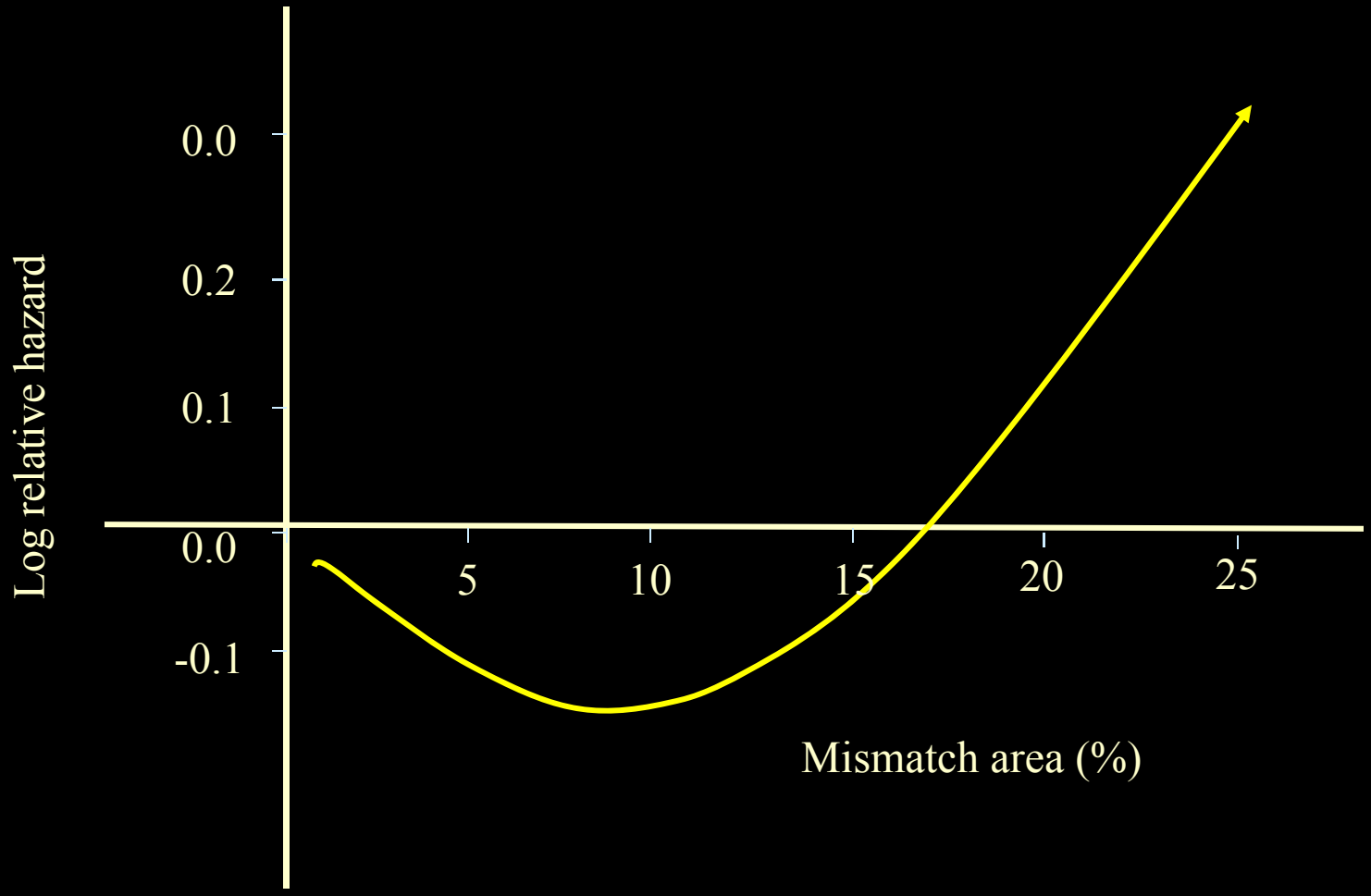
Impact of Revascularization on Mortality according to the presence of Hibernating myocardium

Pooled data from retrospective studies



Underwood et al : European Heart Journal 2004;25:815

PET mismatch and Prognosis in patients with medical Tx only



J Am Coll Cardiol 2005;46:1264 –9

Impact of Revascularization on Mortality according to the presence of Hibernating myocardium

STATE-OF-THE-ART PAPER

Revascularization in Severe Left Ventricular Dysfunction

The Role of Viability Testing

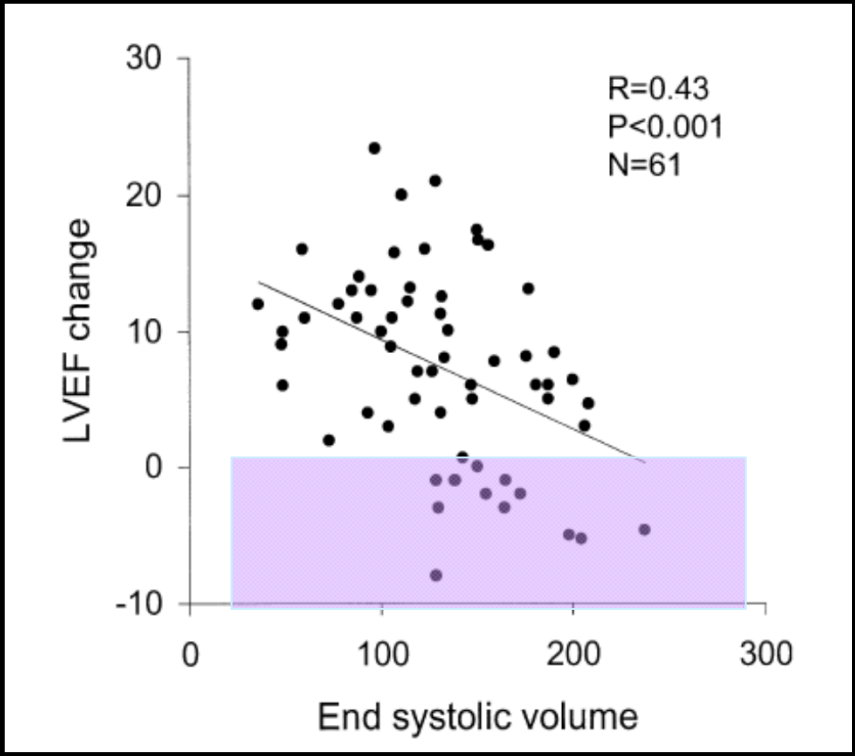
Panithaya Chareonthaitawee, MD, FACC,* Bernard J. Gersh, MB, ChB, DPhil, FACC,*
Philip A. Araoz, MD,† Raymond J. Gibbons, MD, FACC*
Rochester, Minnesota

of patients might experience benefit (50). On the basis of the available literature, we suggest that when 25% to 30% of the LV is dysfunctional but viable by noninvasive testing, revascularization might be considered (Fig. 6). The decision

(J Am Coll Cardiol 2005;46:567–74)

Patients do not always recover in function after revascularization

In 1/3 of all patients (n=118), LVEF didn't improve after CABG



Predictor of LVEF improvement

1. Viable myocardium
2. LVESV (140ml)

LVESV > 140 ml

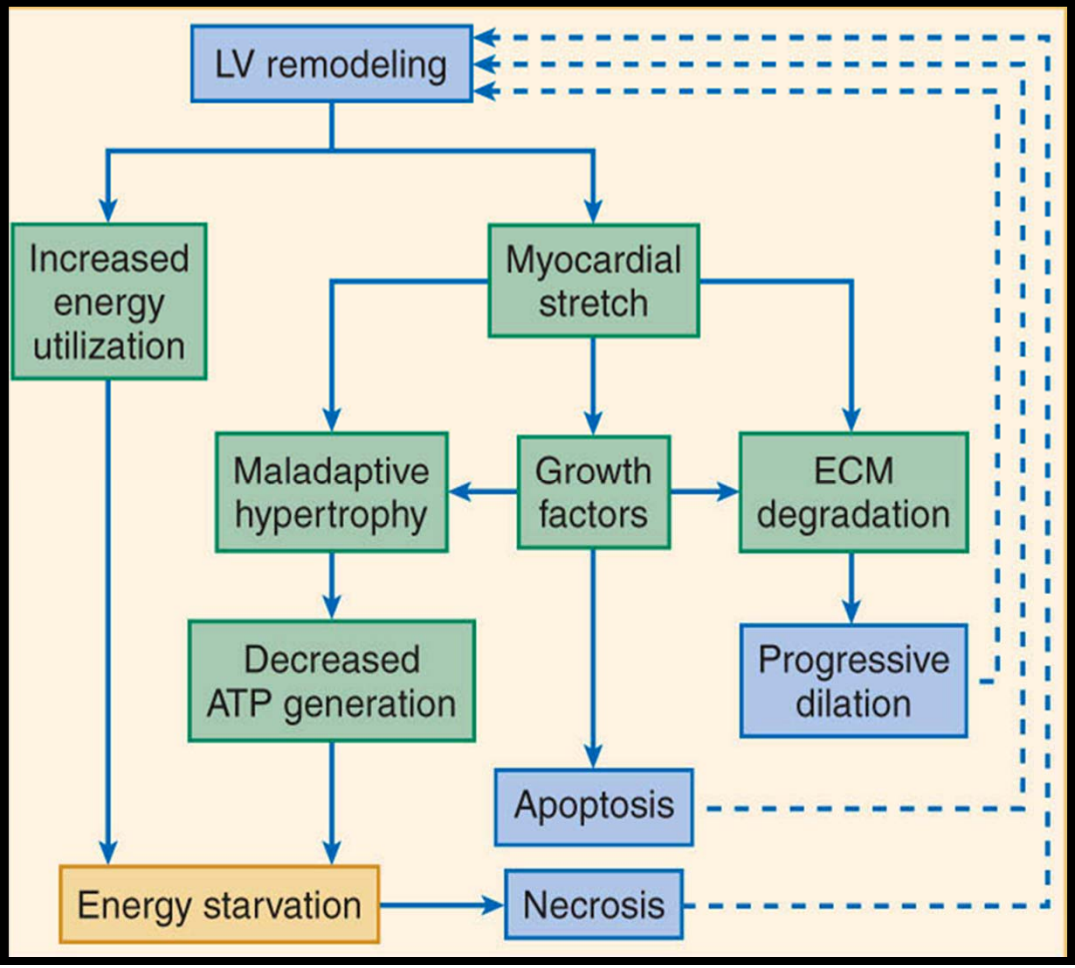
Highest sensitivity/specificity to predict the absence of global recovery (68/65%)

Schinkel et al. J of Thor & CV Surg 2004. 127:385

LV size as a determinant outcome of revascularization ; LV remodeling

Law of LaPlace. T = Pr

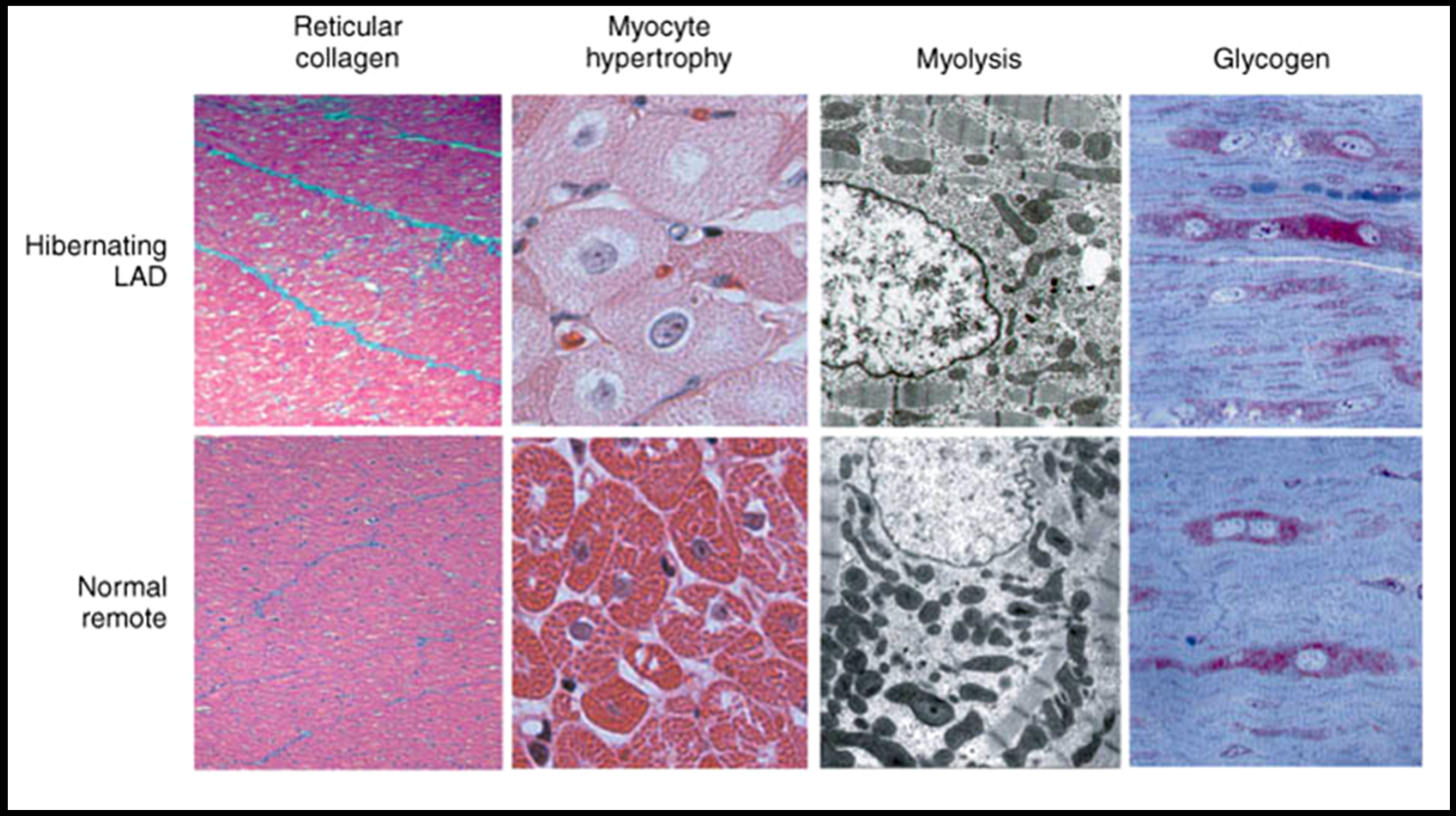
LVEDD > 7 cm (4cm/m2) : operative mortality is high



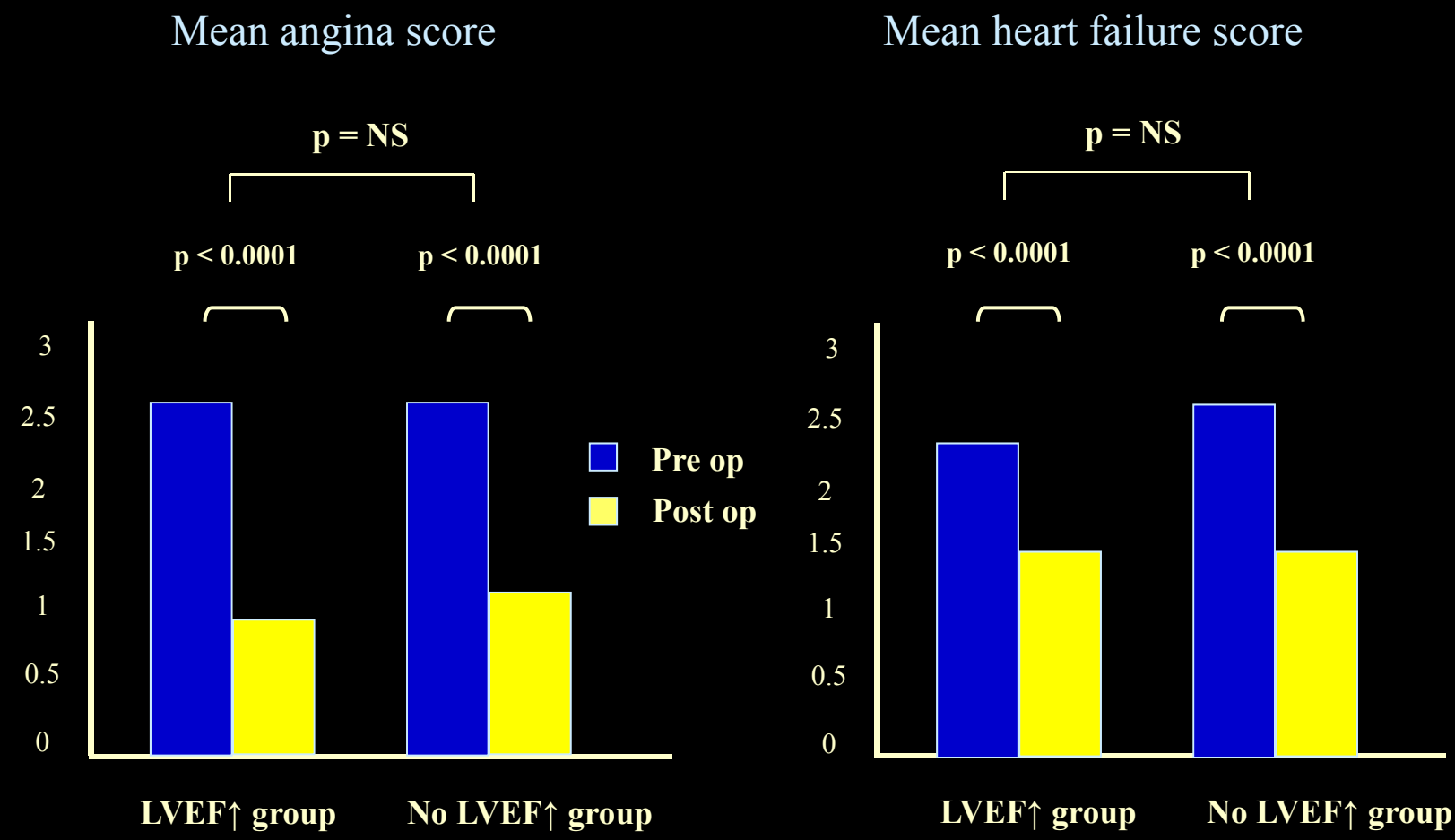
Time course of recovery of viable myocardium

protract up to 14 months

May be due to different stage of structural abnormality

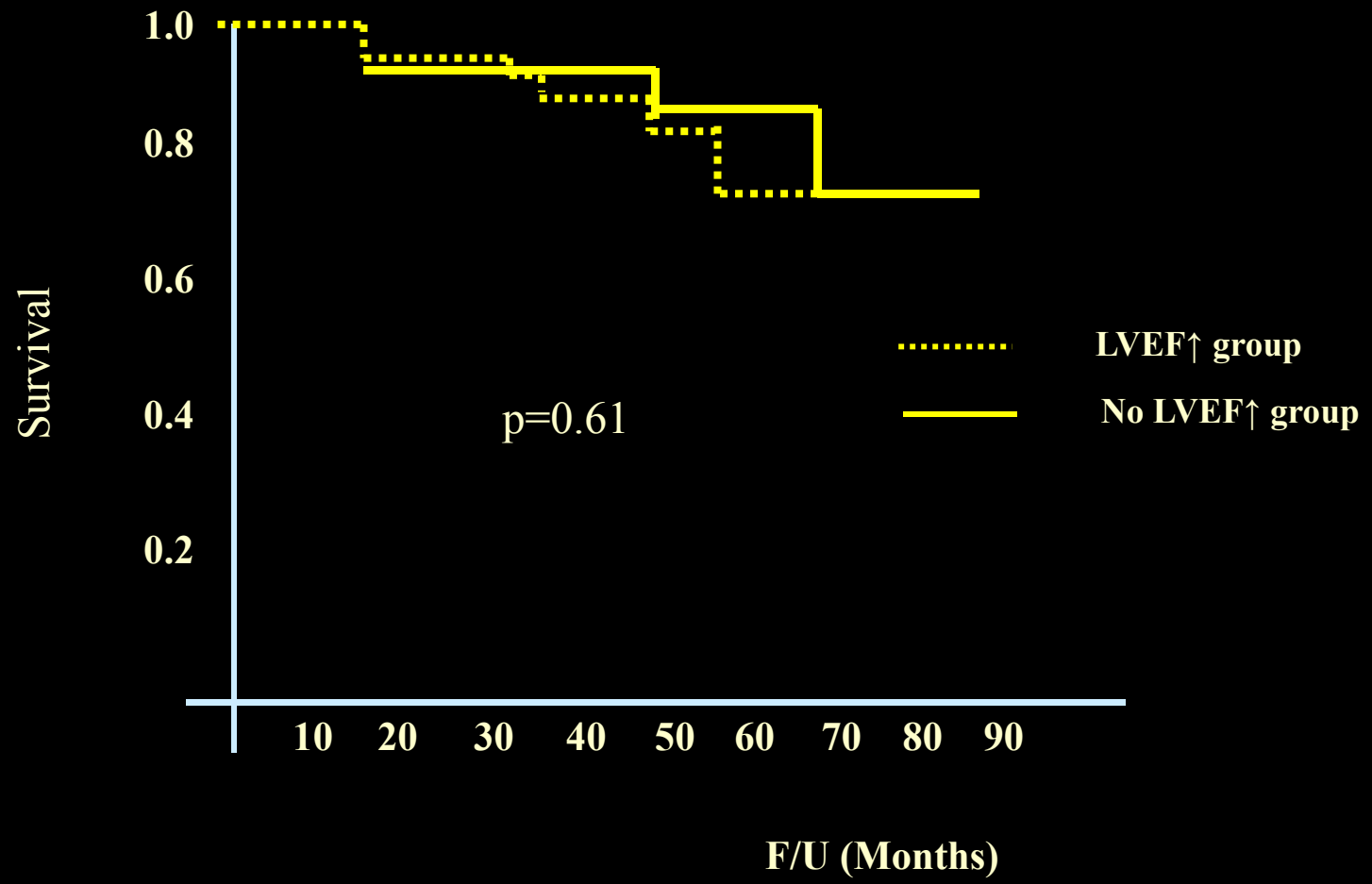


Failure to Improve Left Ventricular Function After Coronary Revascularization for Ischemic Cardiomyopathy Is Not Associated With Worse Outcome



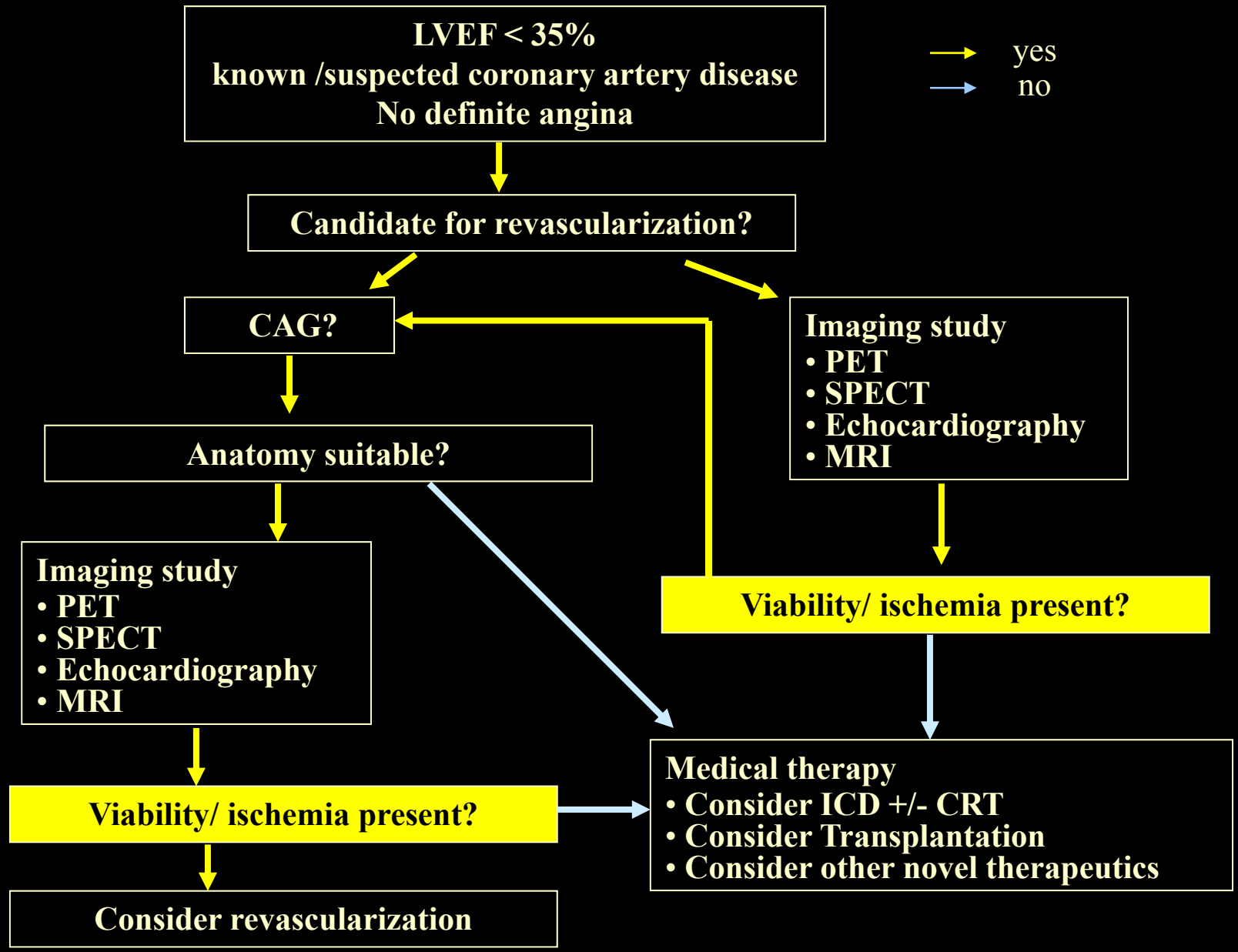
Circulation. 1999;100:1298

Failure to Improve Left Ventricular Function After Coronary Revascularization for Ischemic Cardiomyopathy Is Not Associated With Worse Outcome



Circulation. 1999;100:1298

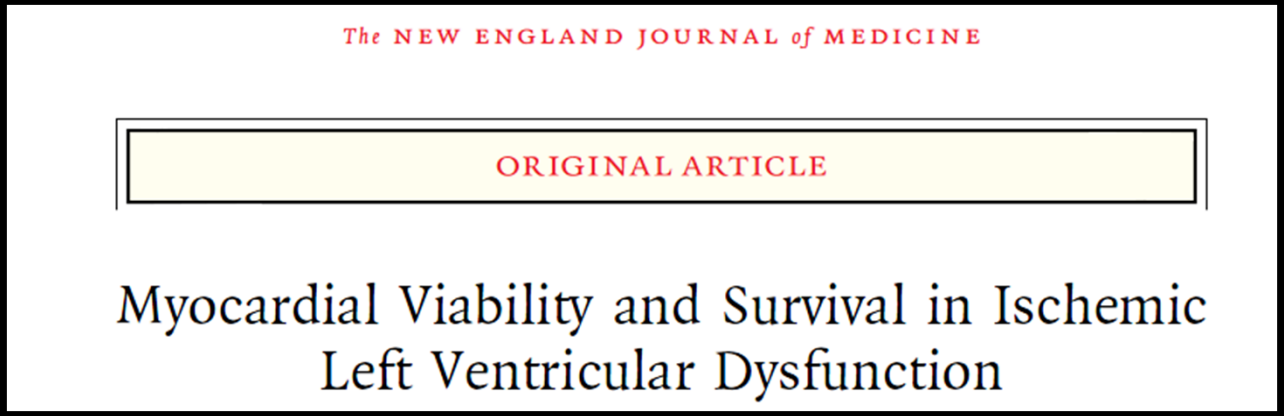
Summary : approach to ICMP



But…. Do we have the definite evidence of study designed as prospective random trial about myocardial viability?

The first prospective randomized trial

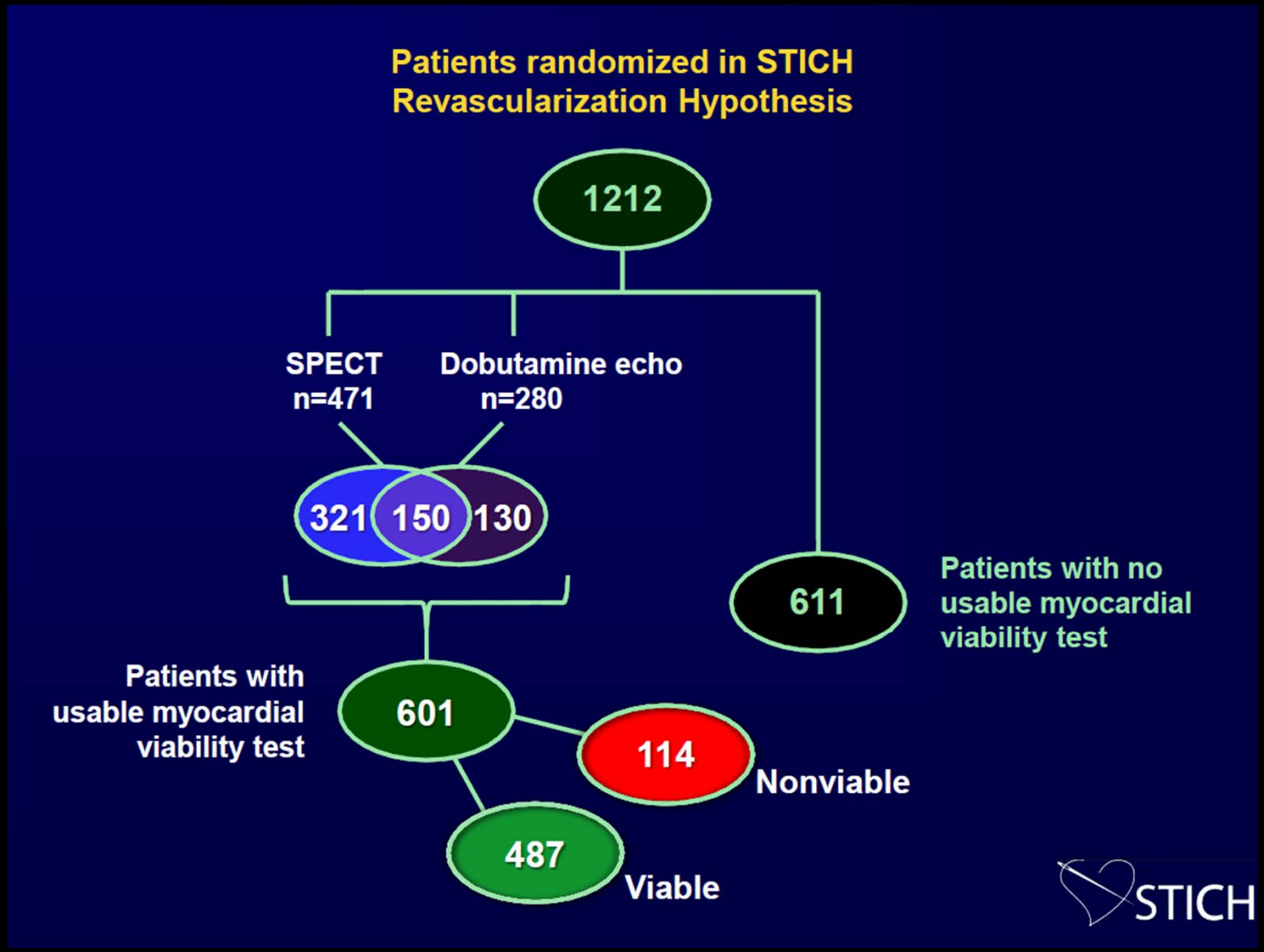
STICH Viability study



ACC 2011, NEJM Apr 4, 2011

To test the hypothesis that CABG improves survival in patients with ischemic LV dysfunction compared to outcome with aggressive medical therapy

Study Design : ICMP < EF 35%



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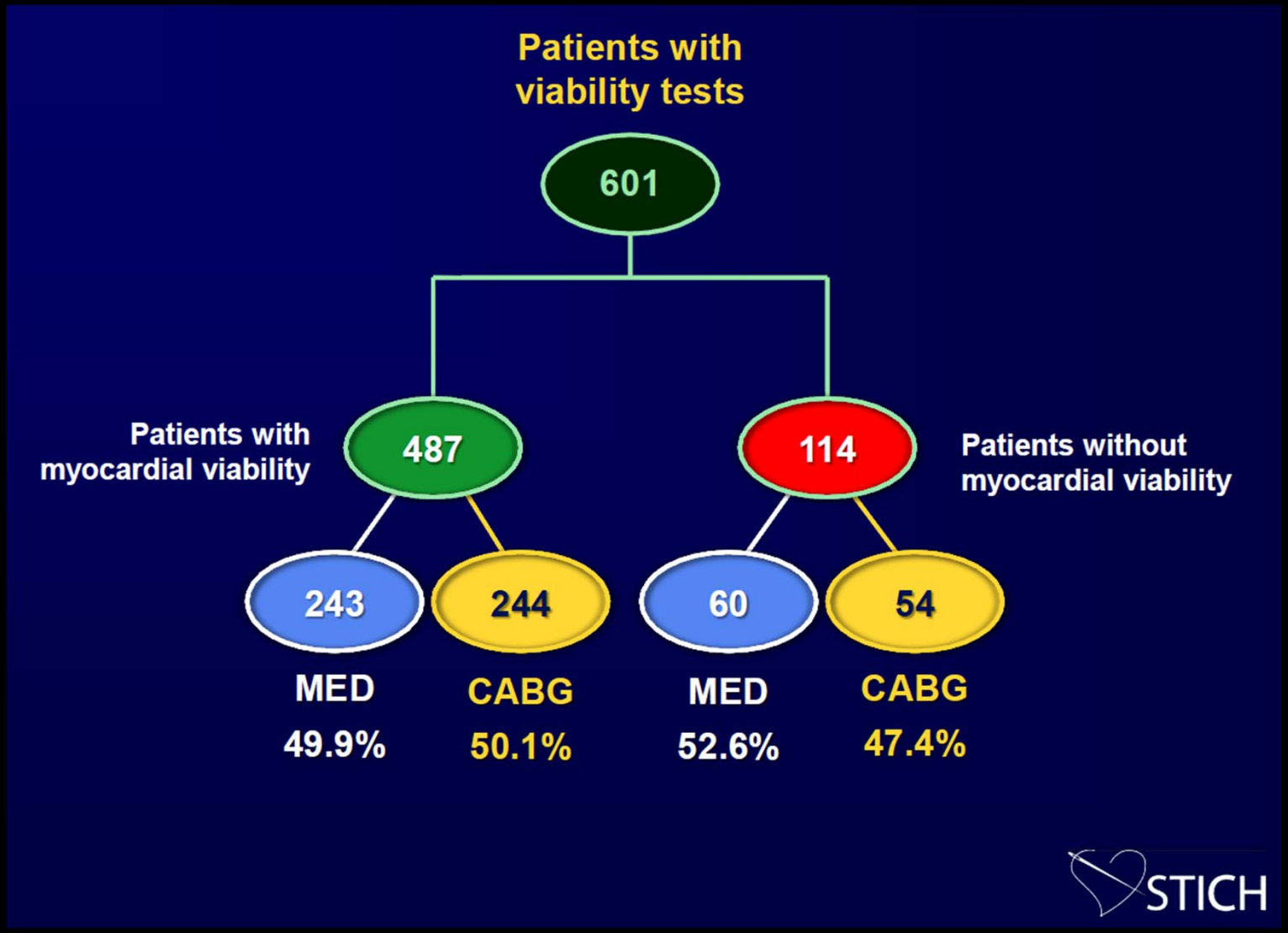
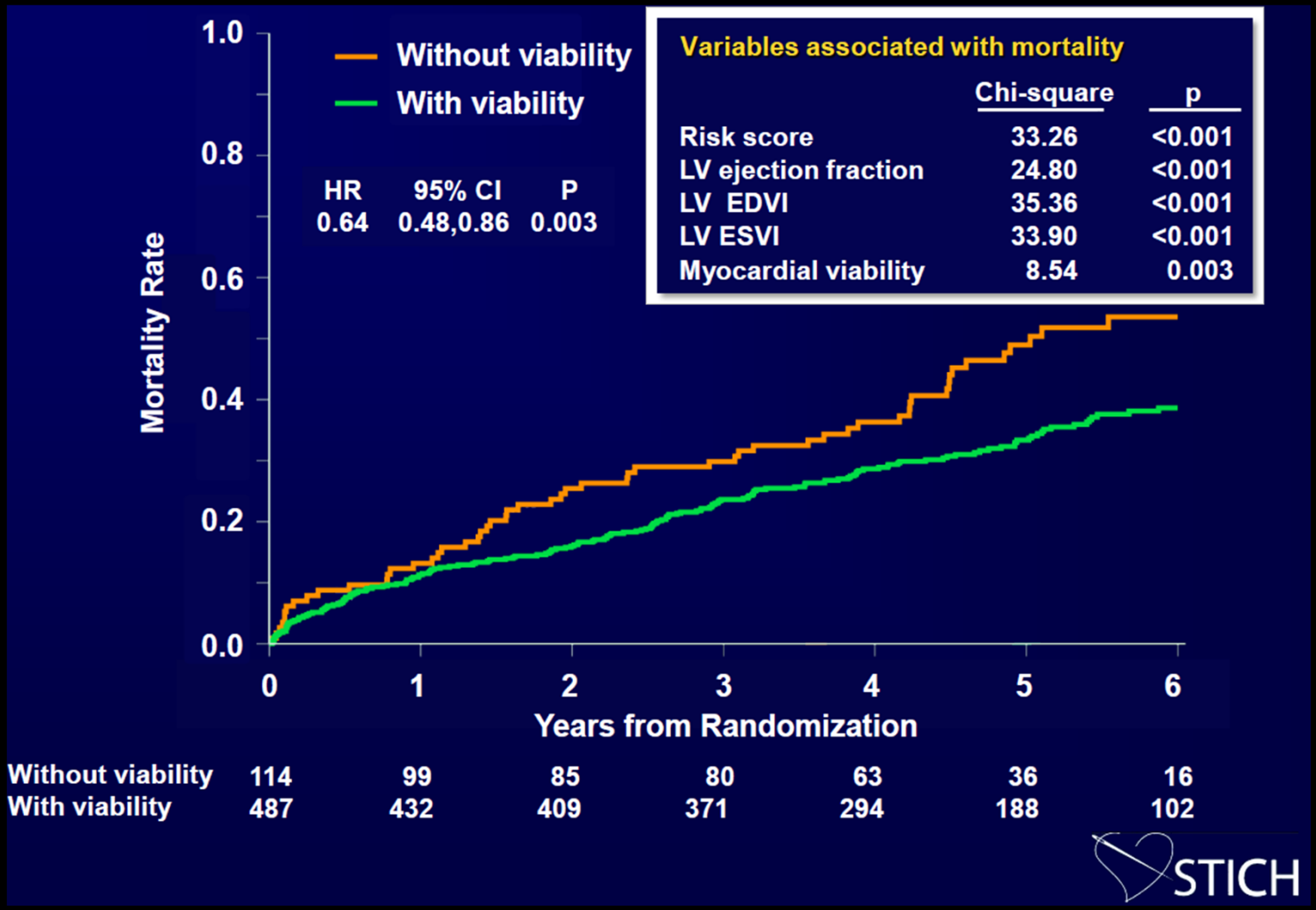


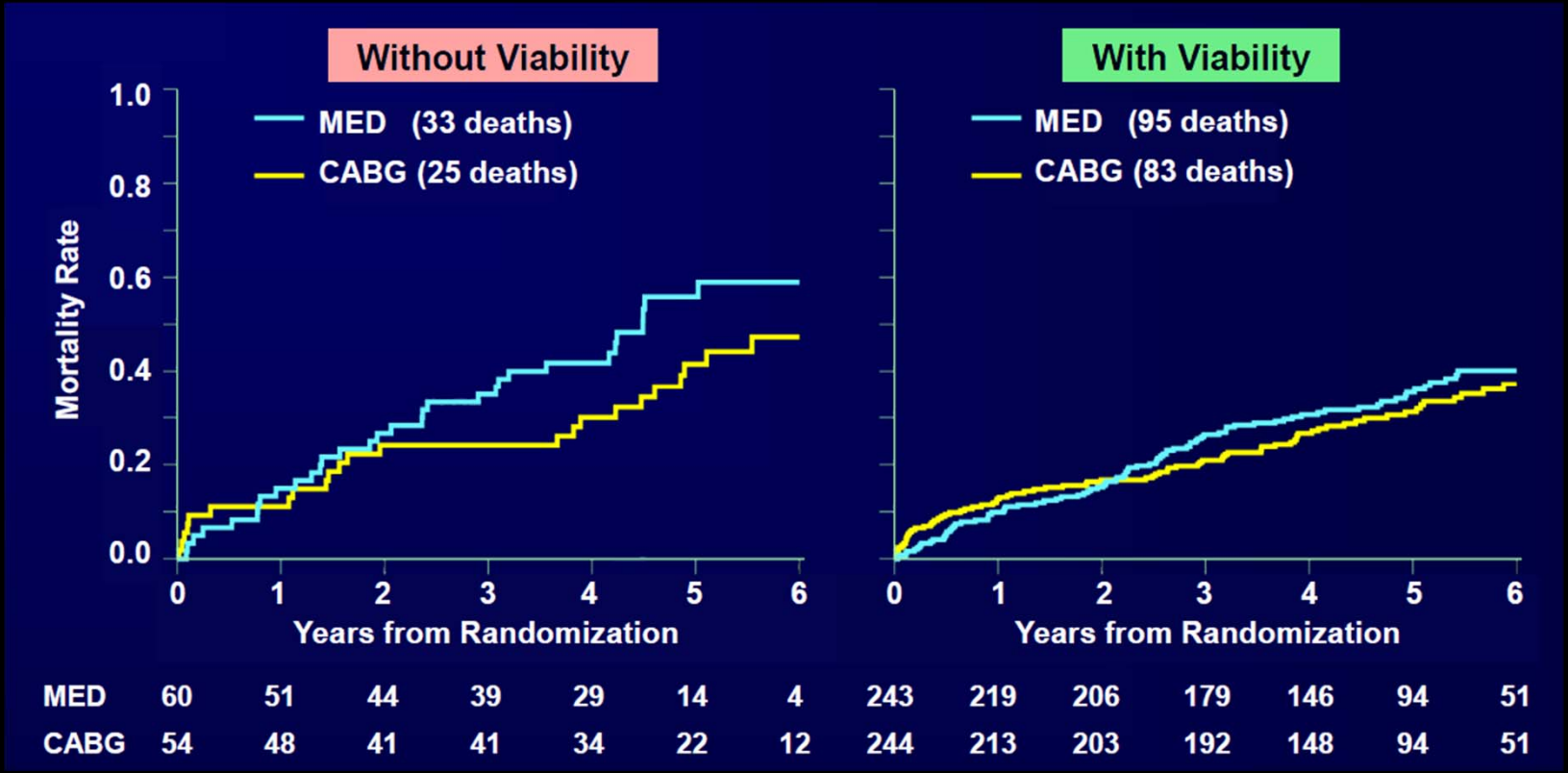
Baseline characteristics

Variable	Viable (n=487)		P value	Non-Viable (n=114)		P value
	MED (n=243)	CABG (n=244)		MED (n=60)	CABG (n=54)	
Age	60 ± 10	62 ± 9	NS	62 ± 9	60 ± 9	NS
Gender (% male)	84%	86%	NS	92%	93%	NS
Previous MI	78%	75%	NS	93%	96%	NS
Multivessel CAD	72%	73%	NS	68%	78%	NS
Proximal LAD	65%	63%	NS	70%	70%	NS
Risk score*	11.9 ± 8.4	12.8 ± 903	NS	13.7 ± 9.8	12.9 ± 9.3	NS
LV EF (percent)	28 ± 8	27± 8	NS	23 ± 9	23 ± 9	NS
LV EDVI (ml/m^2)	118 ± 38	116 ± 35	NS	151 ± 51	140 ± 54	NS
LV ESVI (ml/m^2)	86 ± 34	86 ± 32	NS	121 ± 50	111 ± 51	NS

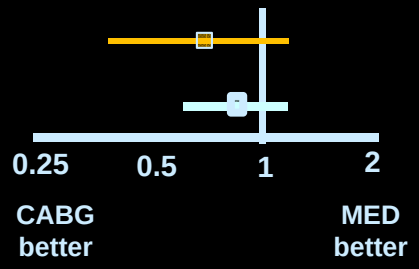
Viable vs Non-viable



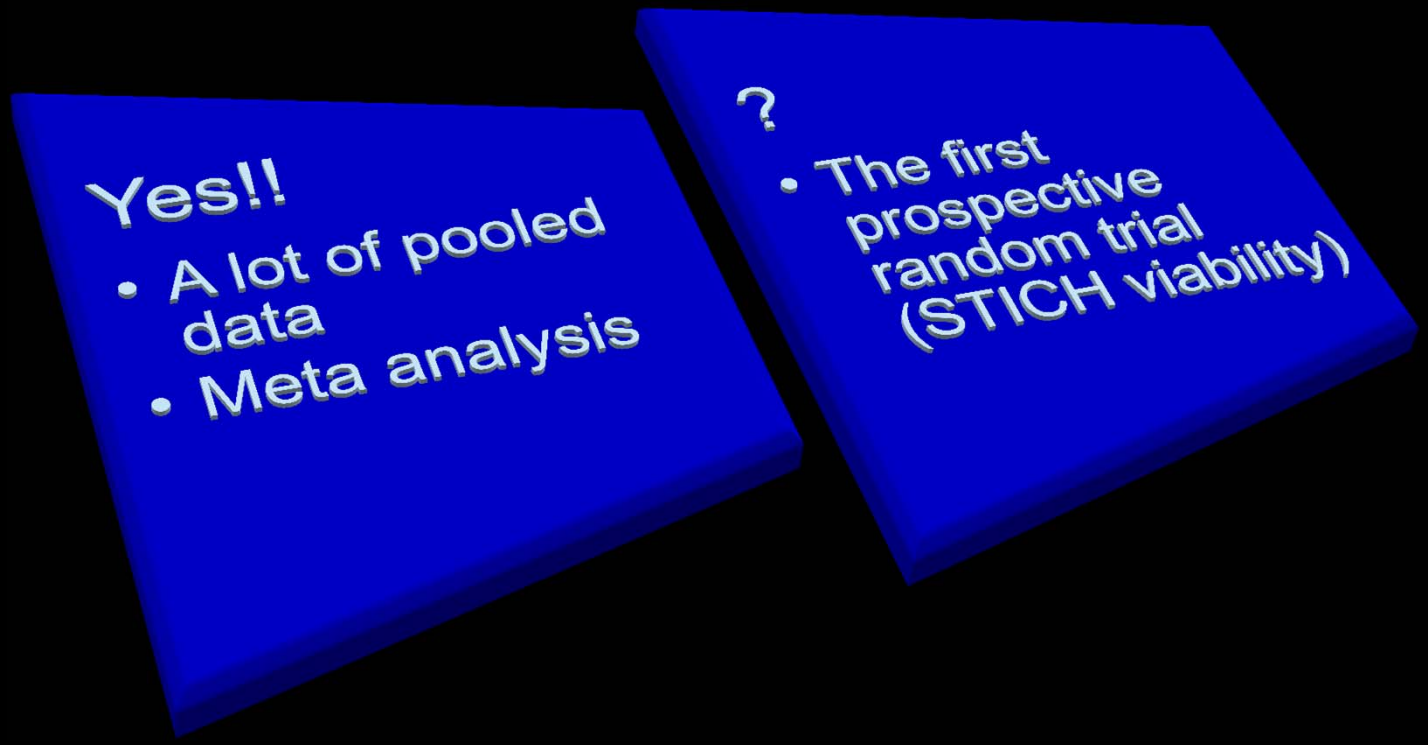
MED vs CABG



subgroup	N	Deaths	HR	95% CI
Viability(-)	114	58	0.70	0.41,1.18
Viability (+)	487	178	0.86	0.64,1.16



Is 'viability issue' still viable?....????

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재활병원
양산부산대학교병원
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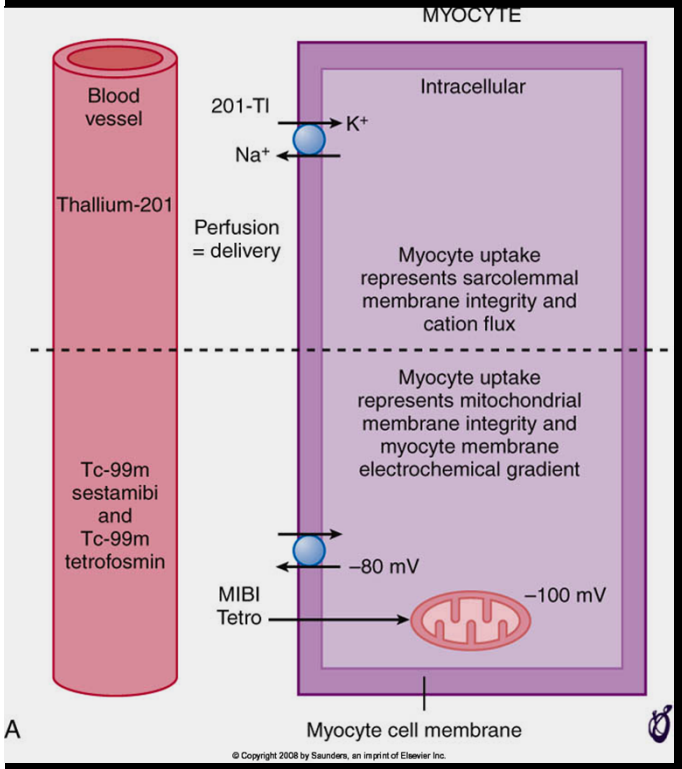
한방병원
치과병원
임상연구센터
간호센터
감사합니다

Thallium vs Tc-labeled tracer

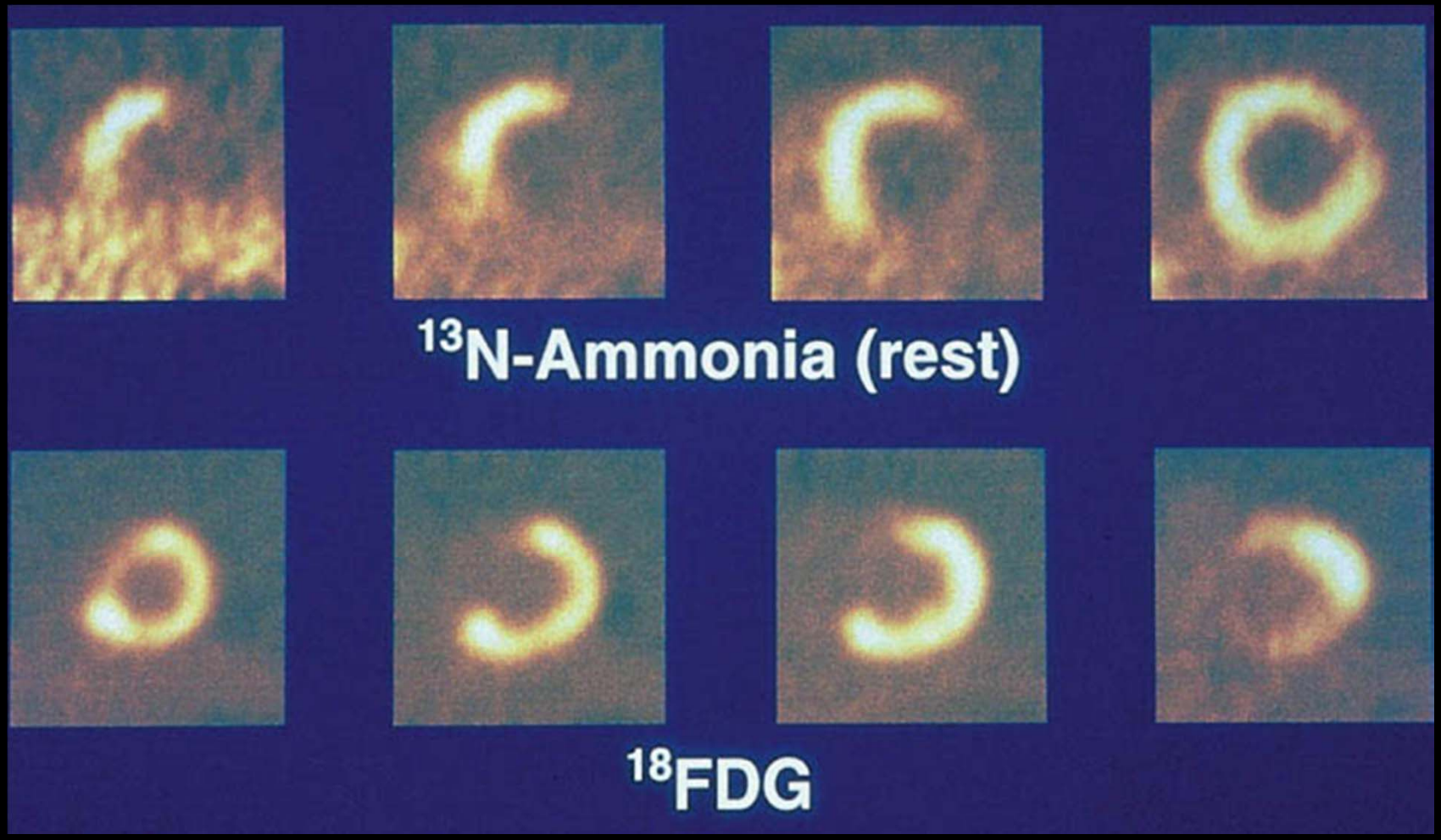


- Much less distribution with time
- Better image resolution
- Less radiation exposure (short half life)

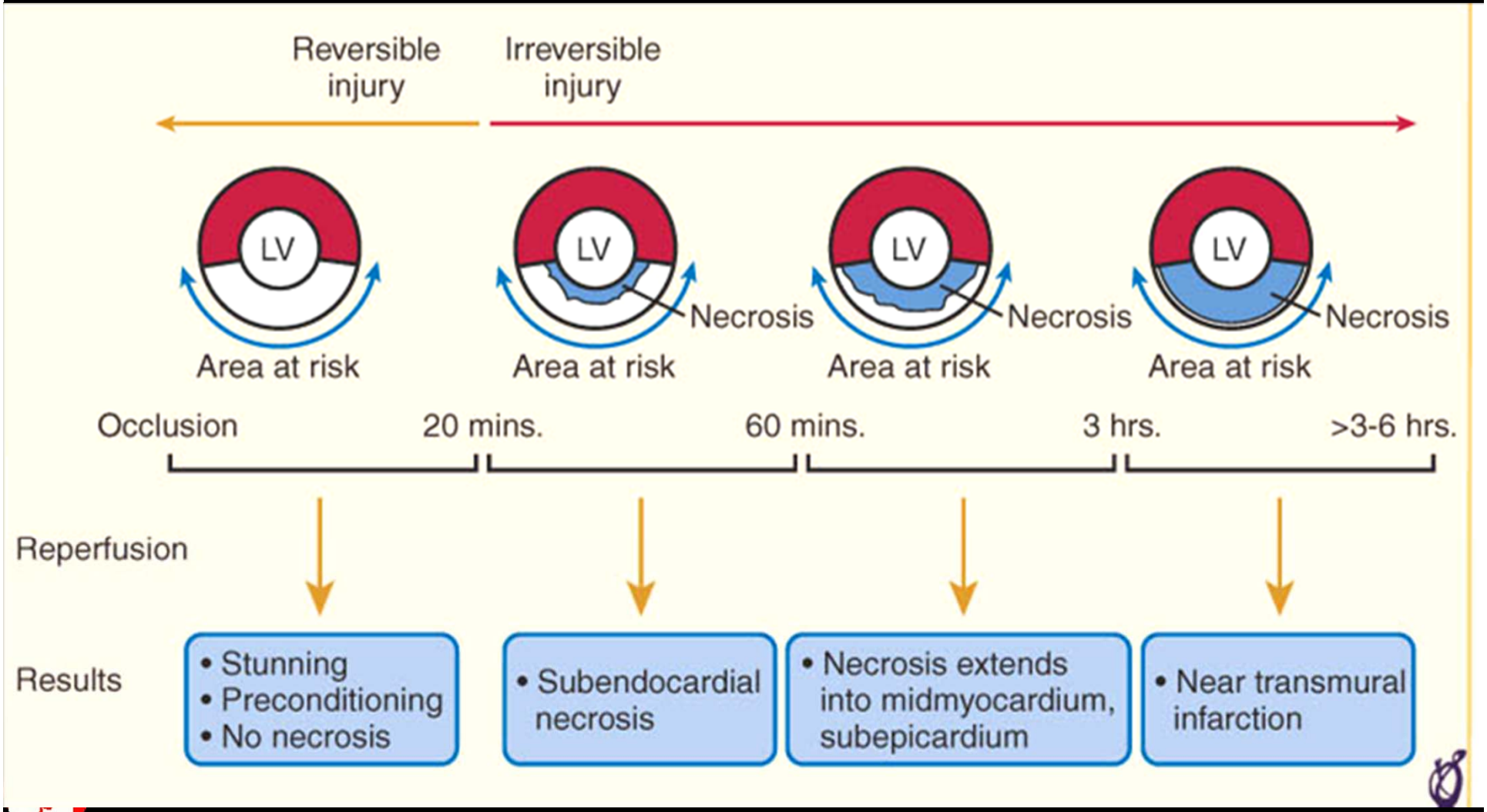
PET (Positron Emission Tomography)

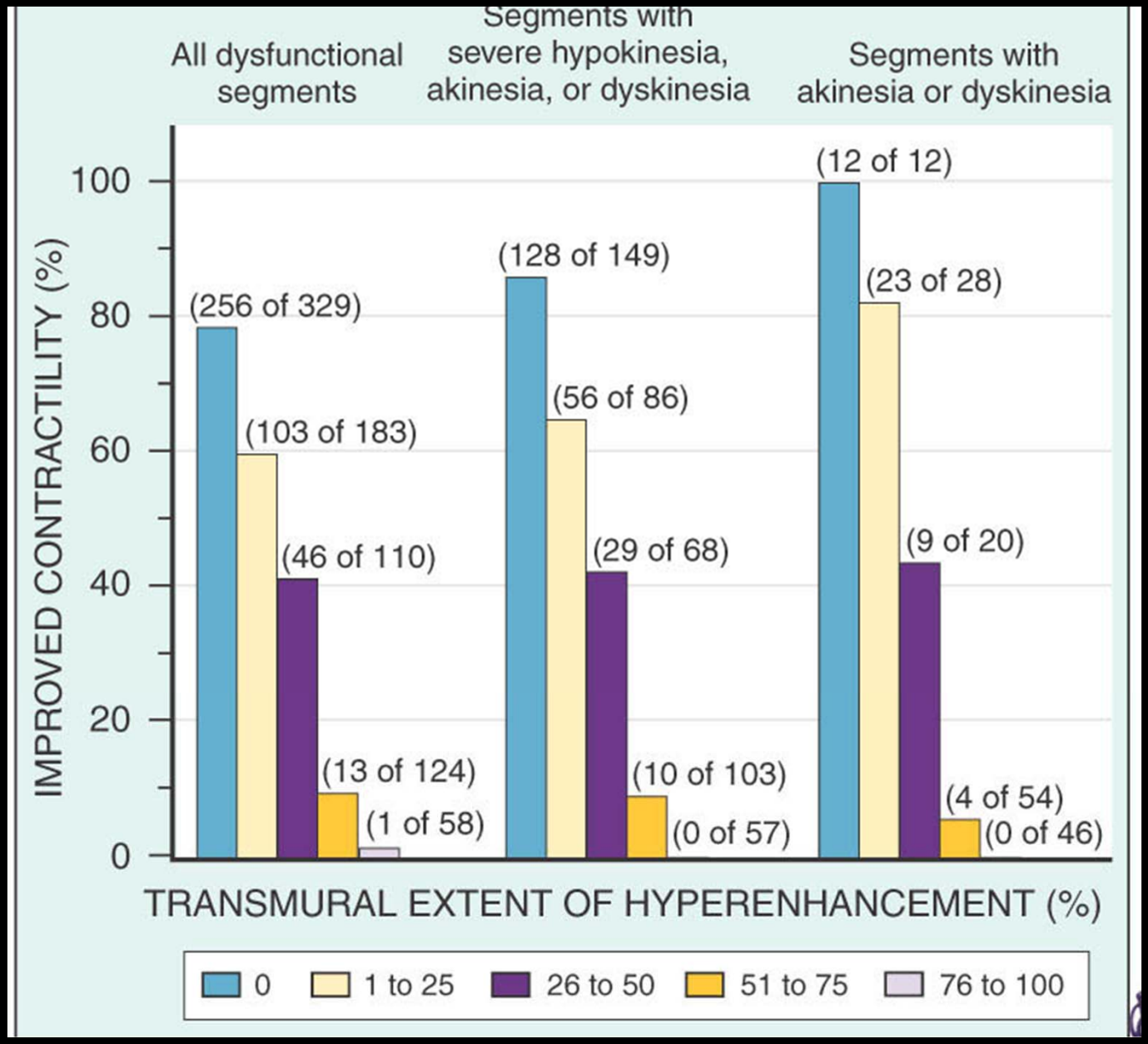
superior spatial resolution and attenuation correction

"Flow metabolism mismatch" gold standard of viability



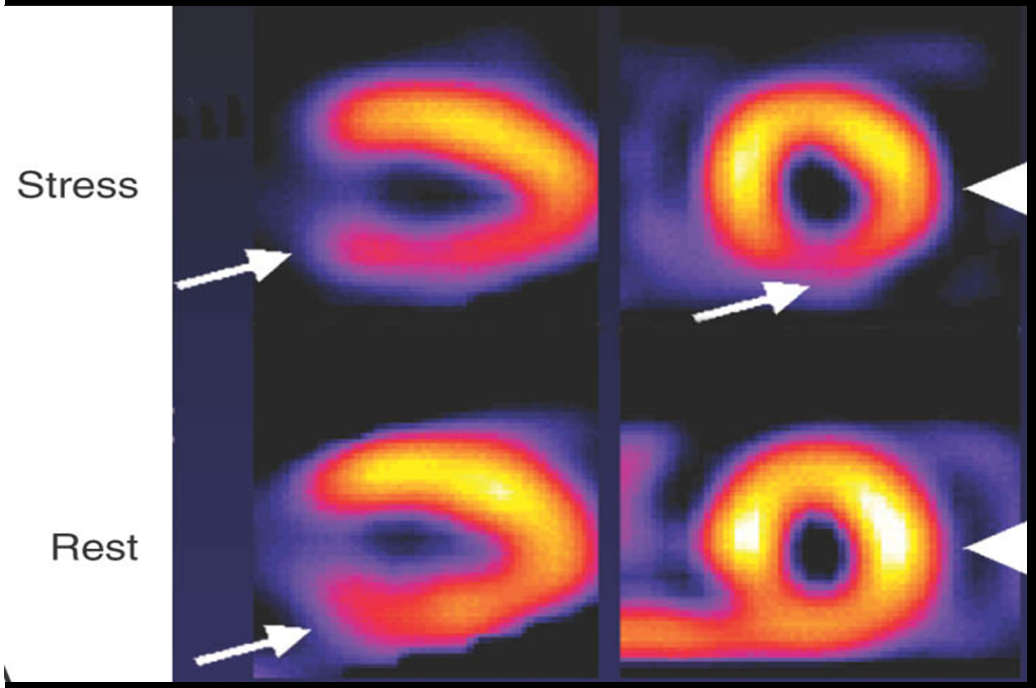
Wave front of necrosis in infarction in the absence of collaterals.



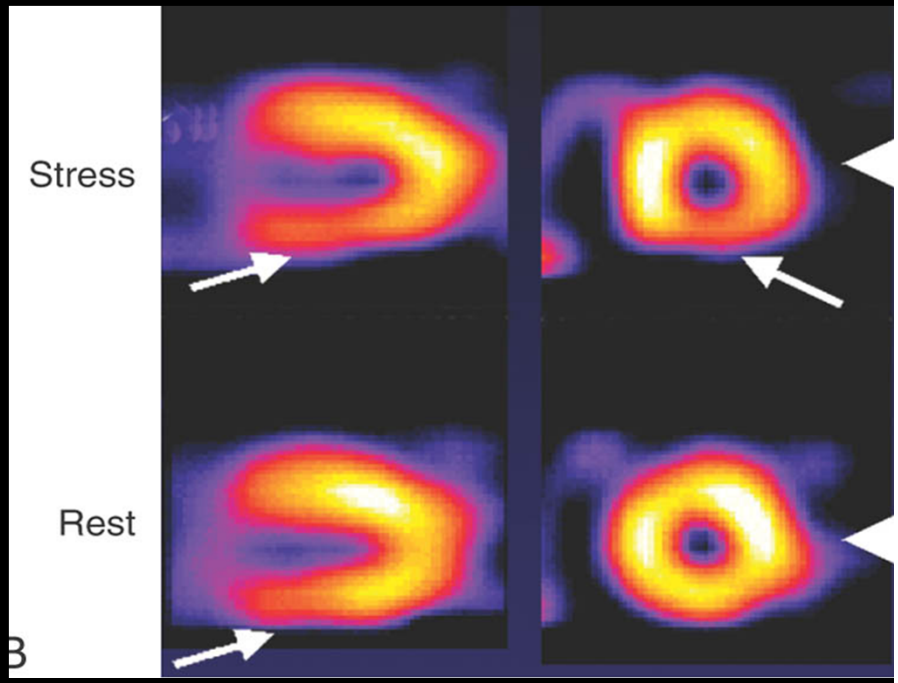


Kim et al, N Engl J Med 16:1445, 2000.

SPECT (Single Photon Emission CT)



A large, moderately severe, reversible inferior wall defect (arrows) reflecting a severe flow reserve abnormality.

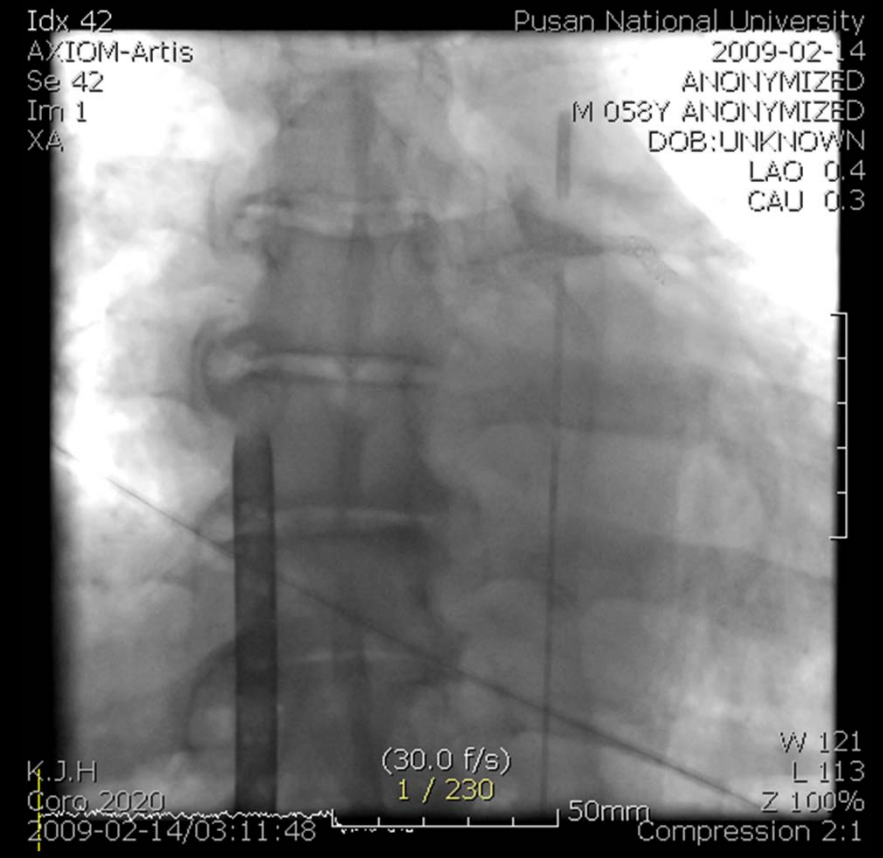


A milder reversible inferior wall defect (arrows) reflecting a less severe stenosis or a more severe stenosis with well-developed collaterals minimizing the defect severity.

"Syncopal attack during CABG permisson….."

And then refuse CABG…

PCI with LV assist devices



ECMO + IABP insertion

Which one is better?

Table 2. Results of Studies That Evaluated the Improvement in Function on a Segmental Basis

	Patients, n	Sensitivity, Mean (95% CI)	Specificity, Mean (95% CI)	PPV, Mean (95% CI)	NPV, Mean (95% CI)
CMR					
Contrast enhanced[67]	29	97 (91–100)	68 (51–85)	73 (57–89)	93 (84–100)
Dobutamine stress[73–75]	193	94 (90–97)	90 (86–94)	86 (81–91)	92 (88–96)
Total		94 (91–97)	87 (83–91)	84 (79–89)	87 (89–96)
Conventional nuclear					
^{99m}Tc-sestamibi[76]	30	96 (89–100)	55 (37–73)	87 (75–99)	80 (66–94)
SPECT FDG[70]	47	89 (80–98)	86 (76–96)	…	…
^{201}Tl rest, reinjection[22,76,77]	104	86 (80–93)	63 (54–73)	69 (60–8)	85 (78–92)
Total	181	89 (84–93)	68 (61–75)	73 (66–81)	84 (78–90)
Echocardiography					
DSE[22,66,72,73,77–80]	424	76 (72–80)	81 (77–84)	66 (61–71)	89 (86–93)
DSE SRI[66]	55	82 (72–92)	80 (69–91)	…	…
End-diastolic wall thickness[22]	43	94 (87–100)	48 (33–63)	53 (38–68)	93 (85–100)
Total	522	78 (74–81)	78 (74–81)	64 (59–70)	90 (86–93)
PET					
PET-FDG[67,70,75,79–81]	280	89 (85–93)	57 (51–63)	73 (66–80)	90 (86–95)
Total	280	89 (85–93)	57 (51–63)	73 (66–80)	90 (86–95)

PPV indicates positive predictive accuracy; NPV, negative predictive accuracy; CMR, cardiovascular magnetic resonance; and SRI,

- SPECT/PET : excellent sensitivity
- Echo & CV MRI with dob stress

: superior specificity and positive predictive value.

- late-enhancement CV MRI

: better negative predictive value for segments of nonviable segments in 6 months after revascularization compared with MIBI or PET

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