Imaging Assessment of Viability

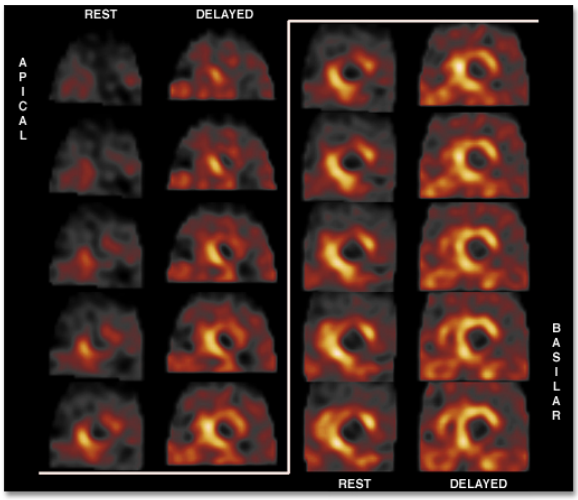
Anthony DeMaria

1

Myocardial Viability and Scar

2

Viability by Delayed Reversibility



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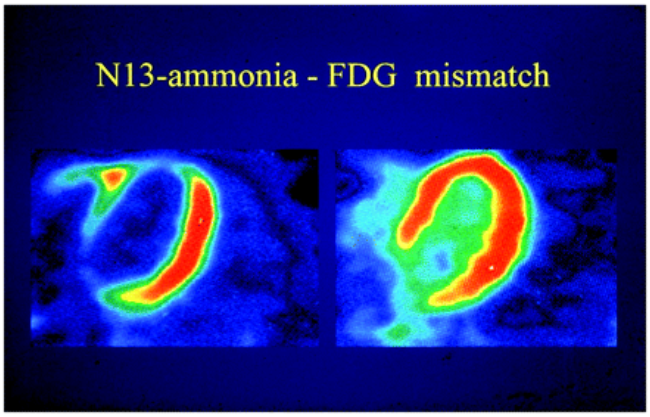
PET for Viability



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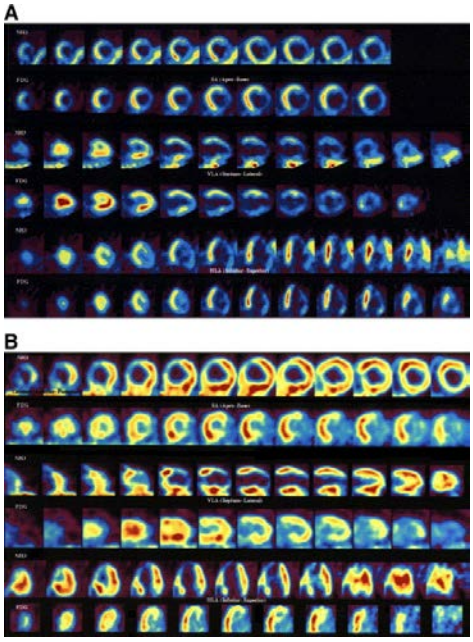
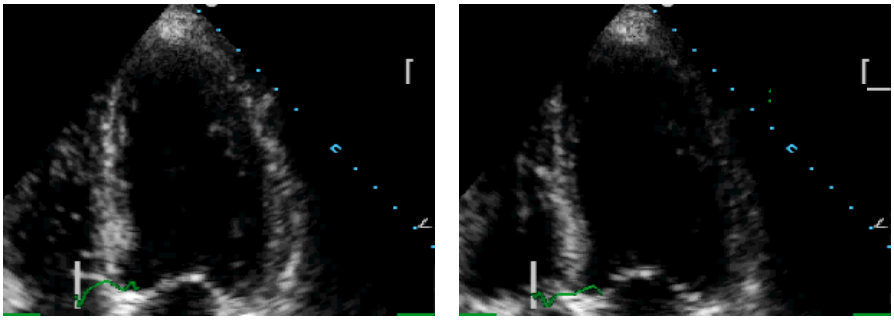
PET for Viability



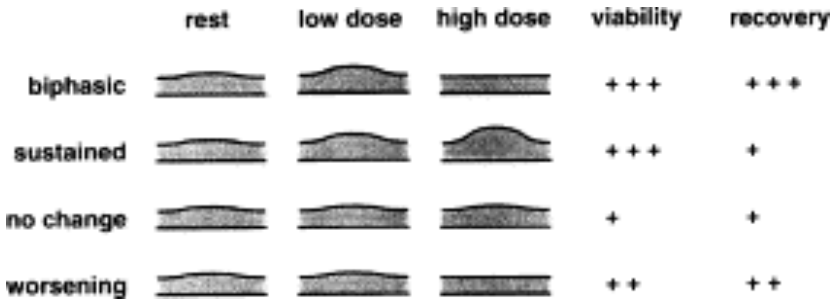
5

Dobutamine Stress Echo for Viability



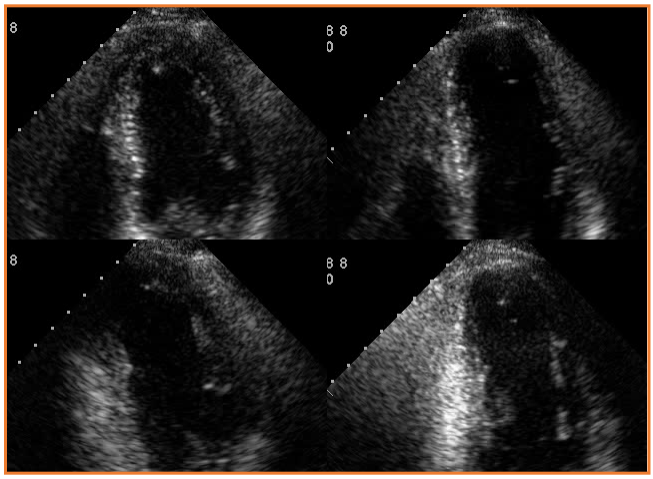
6

DSE: The Biphasic Response



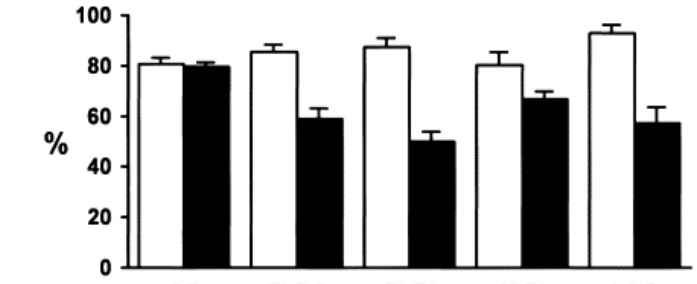
7

63 yo man for post-MI risk stratification No pain or ST changes at 11 METs



8

Comparative Accuracy of Imaging for Viability



	DE	TI-RR	TI-RI	MIBI	FDG
Studies (no.)	32	22	11	20	20
Patients (no.)	1,090	557	301	488	598

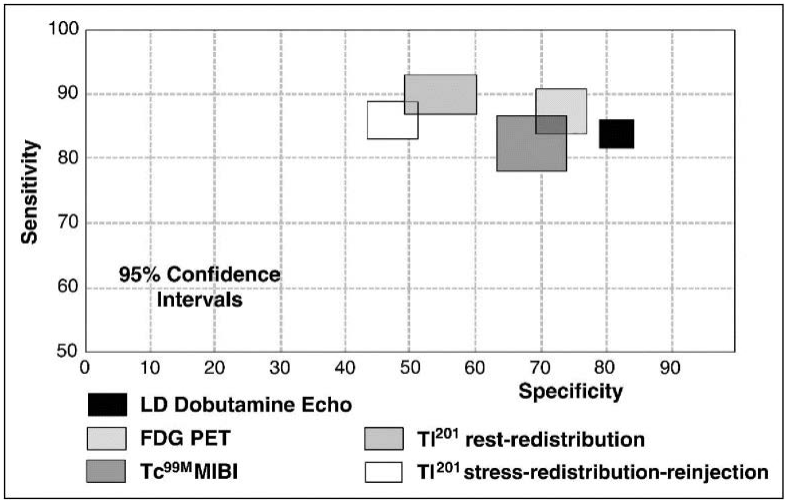
Sensitivity	P	Specificity	P
FDG vs others	<0.05	DE vs others	<0.05
TI-RI vs DE, MIBI	<0.05	Others vs TI-RI	<0.05
TI-RR vs DE	<0.05	MIBI vs TI-RR	<0.05

□ Sens
■ Spec

Bax et al; *Curr Probl Cardiol* , 2001

11

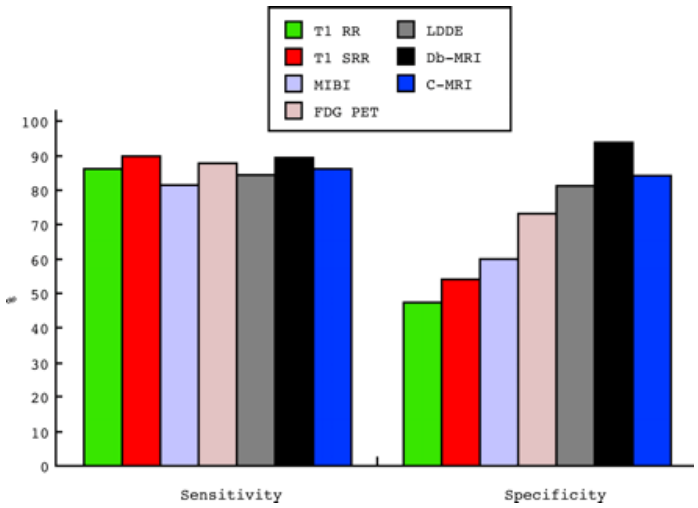
Comparative ROC for Identification of Viability



Bax et al; JACC. 1997

12

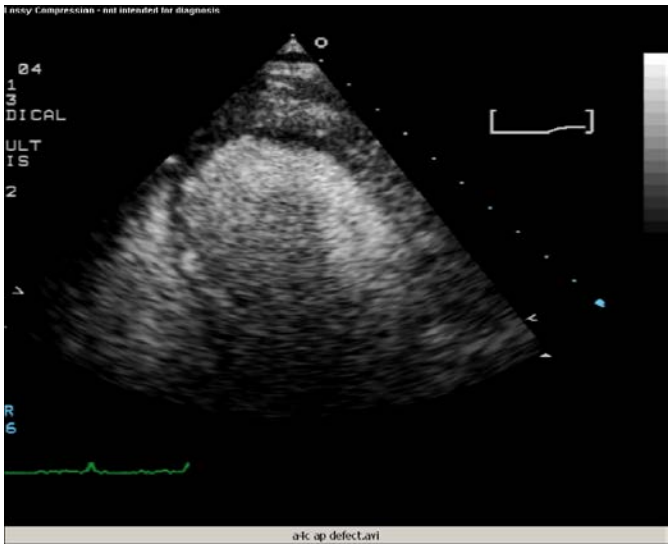
Cardiac Imaging for Viability



Marwick, Heart. 2003

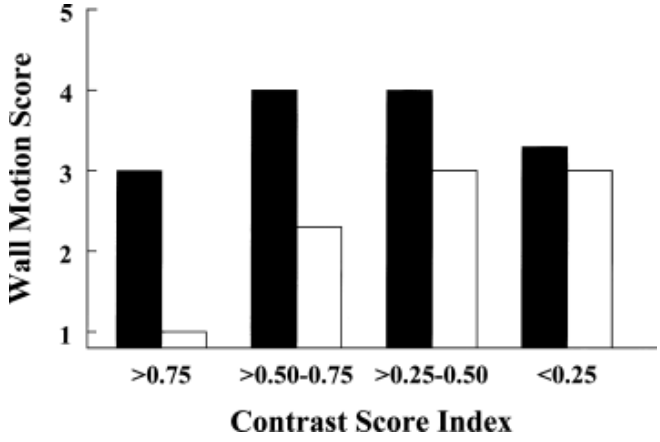
13

Post Infarction No Perfusion



14

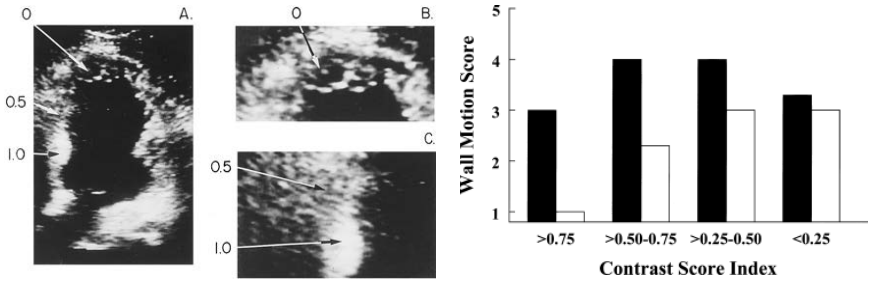
Viability by MCE vs LV Function



Ragosta et al, Circ; 1994

16

Viability by MCE

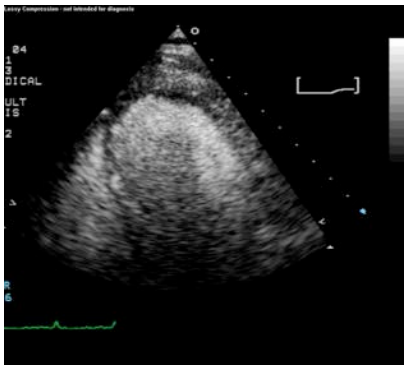


Ragosta et al, Circ; 1994

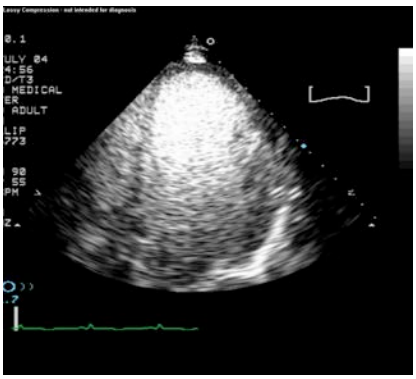
17

Viability by Contast Echo

Absent – Nonviable



Patchy - Viable



18

MCE for Myocardial Viability Post MI

Authors	Imaging type	Sensitivity (%)	Specificity (%)	Pts
Janardhanan (2005)	Low MI	82	83	42
Hickman (2005)	Low MI	83	78	56
Senior (2003)	High MI	62	85	96
Greavea (2003)	Low MI	88	74	15
Aggeli (2003)	High MI	87	72	34
Janardhanan (2003)	Low MI	92	75	50
Hillia (2003)	Low MI	86	44	33
Hillis (2003)	High MI	80	67	38
Lepper (2002)	High MI	94	87	35
Main (2001)	Low MI	77	83	34
	Mean	**83**	**75**	**(n 430)**

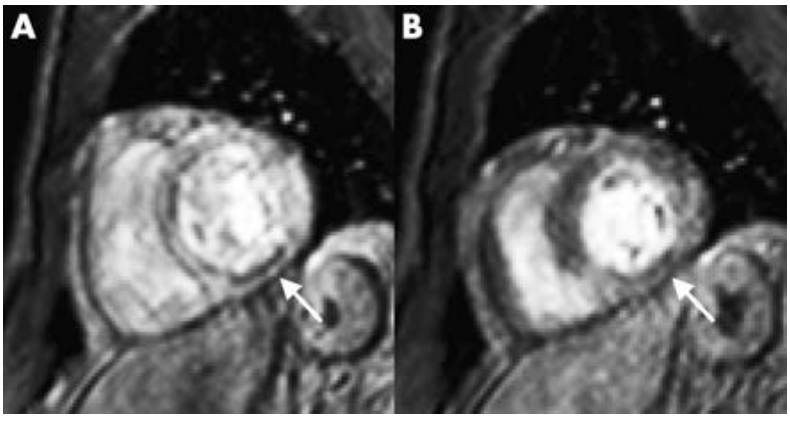
20

Why is MCE Not Clinical?

- Images still inadequate in difficult patients
- Pulsing sequences still complex
- No agreed upon protocol exists
- Quantitation still has limited reproducibility
- Multicenter studies are not published
- No reimbursement

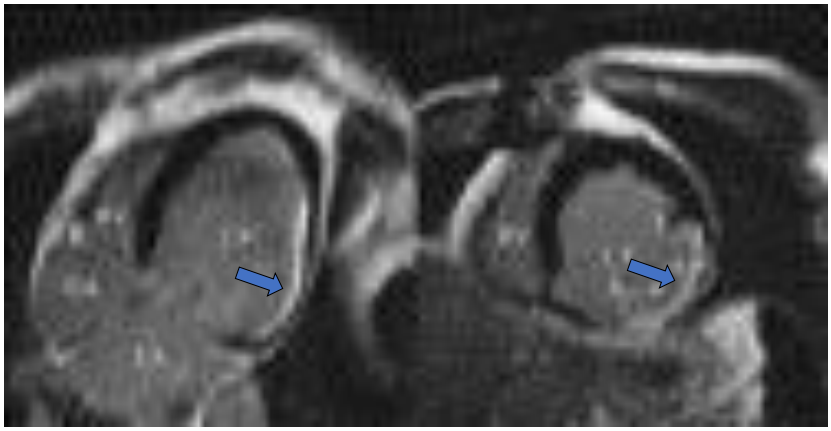
21

Myocardial Scar by Cardiac MRI



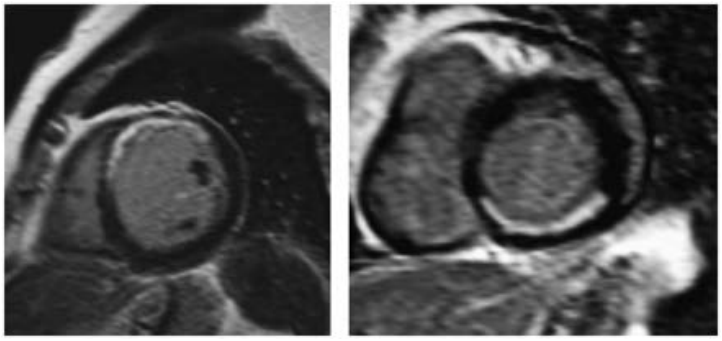
24

Scar by Delayed Enhancement by MRI



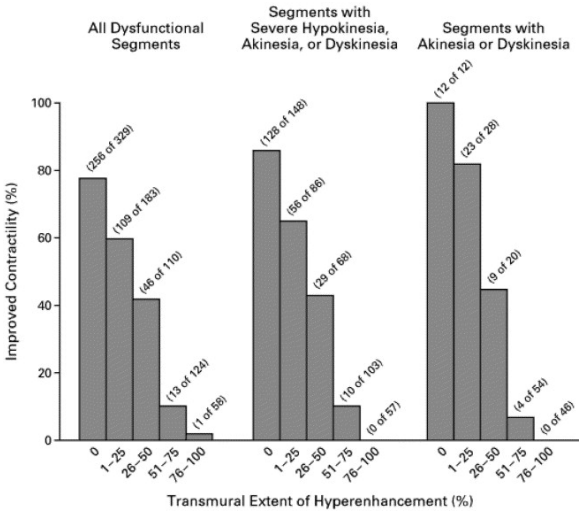
25

Scar by Delayed Enhancement MRI



26

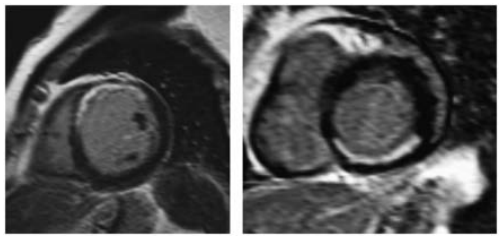
MRI Transmural Enhancement and Improved Contraction

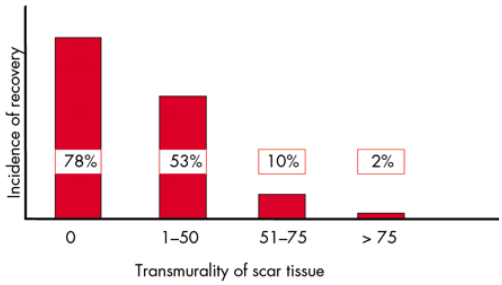


Kim et al; NEJM, 2000

28

Scar by Delayed Enhancement MRI





Klein et al; Circ, 2002

30

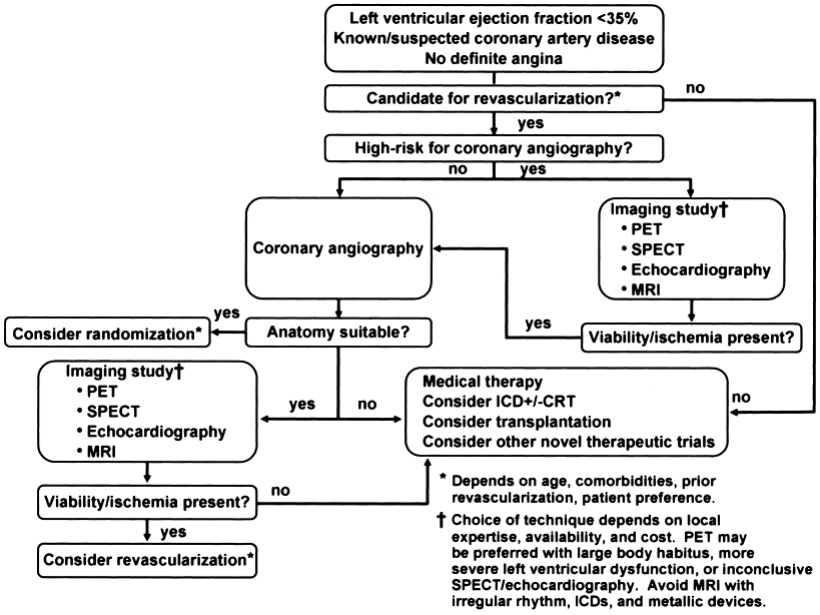
Accuracy of 50% DEMRI for Viability

Study	No. of patient	M	age	EF			Segments recovered	Sensitivity	Specificity
Kim	41	88	63	43	NA	42	53	97 (411/425)	44 (211/379)
Lauerma	10	80	69	44	100	70	66	62 (NA)	98 (NA)
Selvanayagan	52	87	61	62	NA	50	59	95 (326/343)	26 (71/269)
Wellnhofer *et*	29	93	68	32	NA	93	NA	90 (111/124)	52 (85/164)
Average	33	87	65	45	NA	64	59		
Weighted mean								**95**	**45**

31

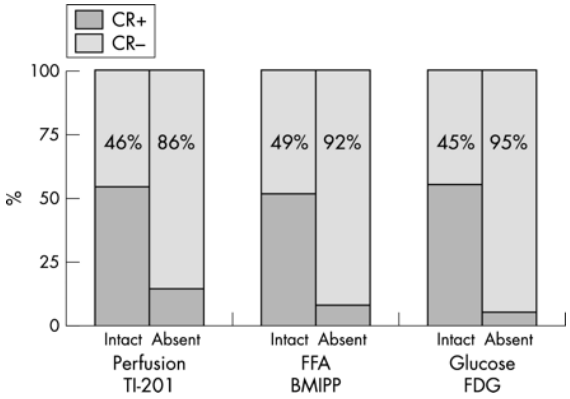
What's the optimal imaging technique to identify viability?

35



36

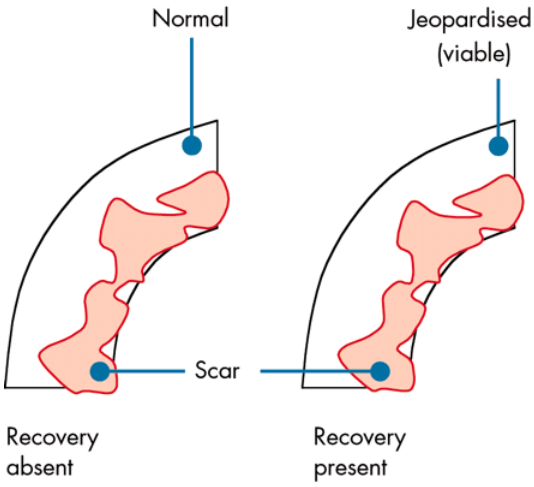
Perfusion and Contractile Reserve Diverge in Dysfunctional Myocardium



Sloof et al; *Nucl Med Commun,* 2002

37

Contractile Reserves Depends Upon the State of Viable Myocardium



38

What Imaging Mode for Viability?

- Nuclear and echo fairly equivalent
  - Echo better spec ; nuclear better sens
- Local expertise, availability, cost are important factors
- CMR limited by metal devices and arrythmias

39

Myocardial Viability (Scar)

- Radionuclides and echo the standard
- MRI redefining the issue
  - delayed enhancement
- CT Angio wait and see

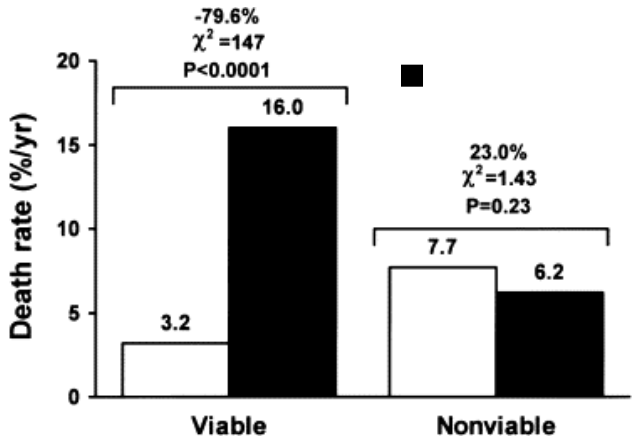
40

Does viability predict benefit?

41

Viability Imaging and Response to Therapy

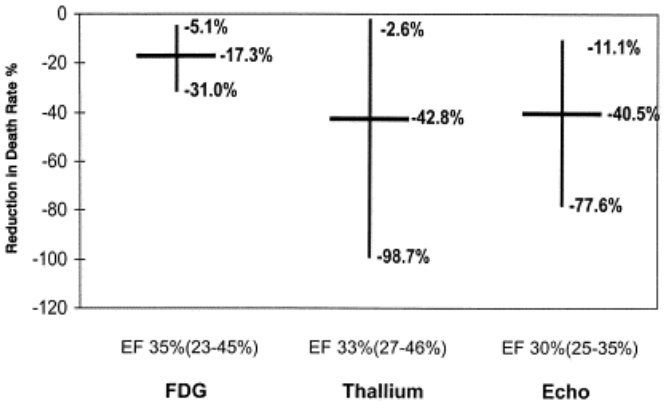
(Meta-analysis of 24 studies)



Allman et al; JACC, 2002

42

Myocardial Viability in CAD: Detection and Treatment

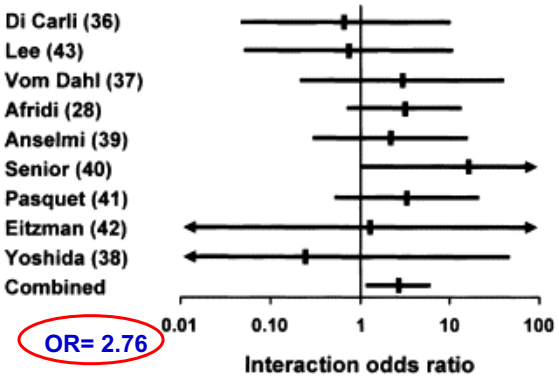


Allman et al; JACC, 2002

43

Interaction of Viability and Response to Therapy

(Meta-analysis of 9 studies with interaction data)



Borque et al; Amer Heart J, 2003

44

Myocardial Viability and Survival in Ischemic Left Ventricular Dysfunction

Robert O. Bonow, M.D., Gerald Maurer, M.D., Kerry L. Lee, Ph.D., Thomas A. Holly, M.D., Philip F. Binkley, M.D., Patrice Desvigne-Nickens, M.D., Jaroslaw Drozdz, M.D., Ph.D., Pedro S. Farsky, M.D., Arthur M. Feldman, M.D., Torsten Doenst, M.D., Ph.D., Robert E. Michler, M.D., Daniel S. Berman, M.D., Jose C. Nicolau, M.D., Ph.D., Patricia A. Pellikka, M.D., Krzysztof Wrobel, M.D., Nasri Alotti, M.D., Ph.D., Federico M. Asch, M.D., Liliana E. Favaloro, M.D., Lilin She, Ph.D., Eric J. Velazquez, M.D., Robert H. Jones, M.D., and Julio A. Panza, M.D., for the STICH Trial Investigators*

ABSTRACT

BACKGROUND
The assessment of myocardial viability has been used to identify patients with coronary artery disease and left ventricular dysfunction in whom coronary-artery bypass grafting (CABG) will provide a survival benefit. However, the efficacy of this approach is uncertain.

METHODS
In a substudy of patients with coronary artery disease and left ventricular dysfunction who were enrolled in a randomized trial of medical therapy with or without CABG, we used single-photon-emission computed tomography (SPECT), dobutamine echocardiography, or both to assess myocardial viability on the basis of prespecified thresholds.

RESULTS
Among the 1212 patients enrolled in the randomized trial, 601 underwent assessment of myocardial viability. Of these patients, we randomly assigned 298 to receive medical therapy plus CABG and 303 to receive medical therapy alone. A total of 178 of 487 patients with viable myocardium (37%) and 58 of 114 patients without viable myocardium (51%) died (hazard ratio for death among patients with viable myocardium, 0.64; 95% confidence interval [CI], 0.48 to 0.86; P=0.003). However, after adjustment for other baseline variables, this association with mortality was not significant (P=0.21). There was no significant interaction between viability status and treatment assignment with respect to mortality (P=0.53).

CONCLUSIONS
The presence of viable myocardium was associated with a greater likelihood of survival in patients with coronary artery disease and left ventricular dysfunction, but this relationship was not significant after adjustment for other baseline variables. The assessment of myocardial viability did not identify patients with a differential survival benefit from CABG, as compared with medical therapy alone. (Funded by the National Heart, Lung, and Blood Institute; STICH ClinicalTrials.gov number, NCT00023595.)

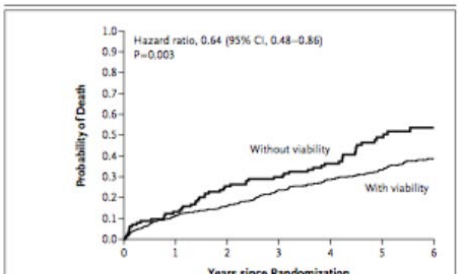
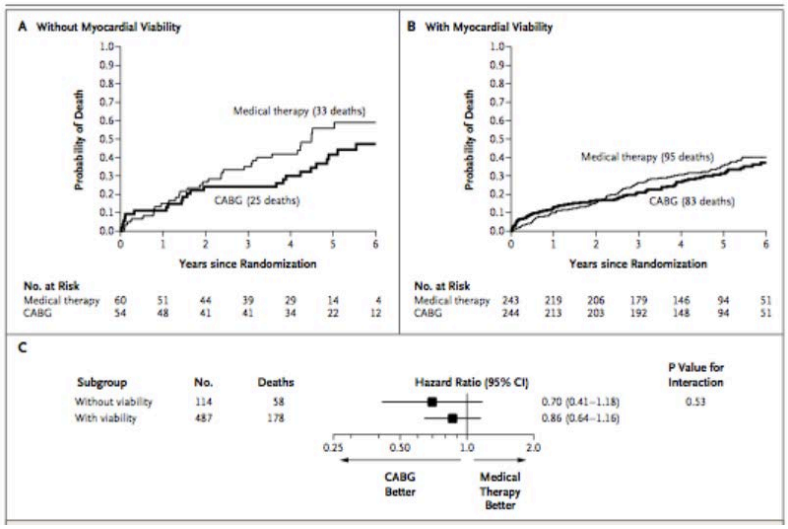


Figure 1. Kaplan–Meier Analysis of the Probability of Death, According to Myocardial Viability Status.
The comparison that is shown has not been adjusted for other prognostic baseline variables. After adjustment for such variables on multivariable analysis, the between-group difference was not significant (P=0.21).

46

Value of Viability in STICH



47

Viability and Therapy

In patients with viability ***by any technique***:

- *Medically treated patients have the lowest survival rate*
- *Data demonstrate significantly improved survival with revascularization*
- *Viability predicts improvement in* ***regional LV function*** *after revascularization*
- *Viability imaging* (extent) *predicts improvement in* ***global LVEF*** *after revascularization.*
- Symptoms and exercise capacity after revascularization appear modestly related to preop presence/extent of viability

48