Viabilita myokardu: která metoda pro její hodnocení je nejlepší?

Viabilita myokardu: nejlepší pro její hodnocení je ... echokardiografie

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XXV. výroční sjezd české kardiologické společnosti
Brno, 7. - 10. 5. 2017

I. INTERNÍ KLINIKA
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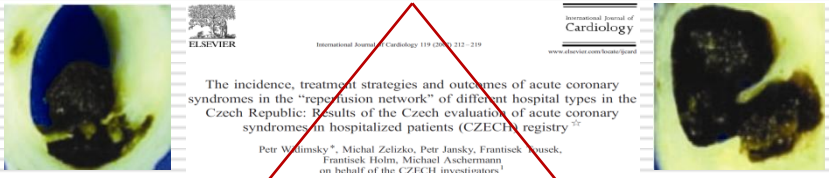
ICHS – epidemiologie a důsledky

Akutní koronární syndromy

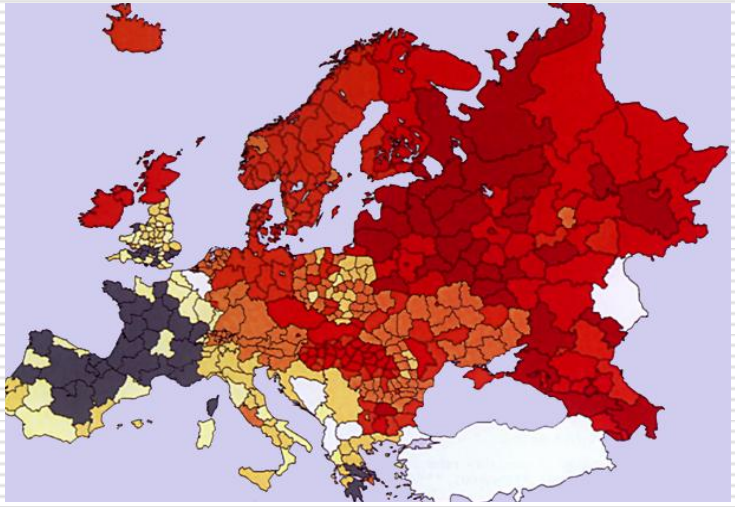
I: *3248/1 mil./rok* **M:** *5.1%*

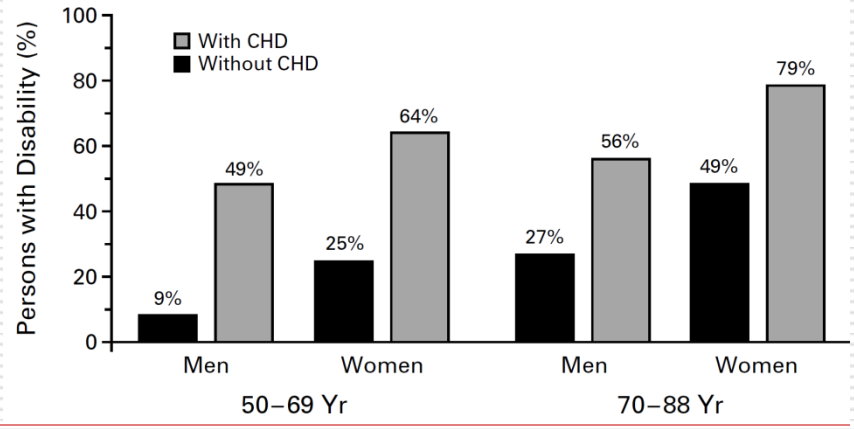


NAP/NSTEMI | **STEMI**

2587/1 mil./rok *661/1 mil./rok*

M: *Q-IM 10%, non-Q IM 4.4%, NAP 0.9%*

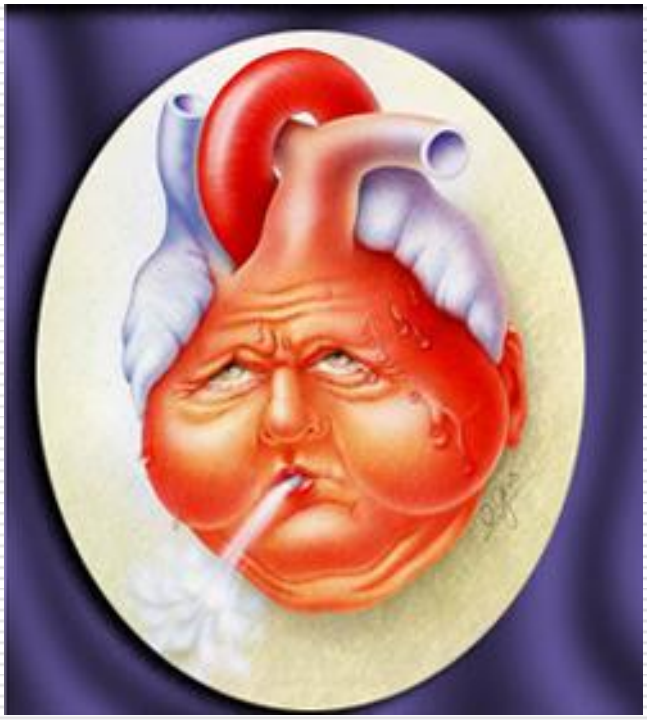




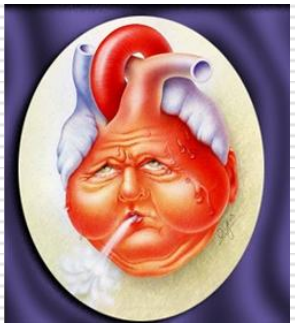
P. Widimsky et al. International Journal of Cardiology 119 (2007) 212–219
Sans S et al. Eur Heart J. 1997;18:1231-1249
Ades PA. NEJM, Vol. 345, No. 12, September 20, 2001
Gheorghiade et al. Circulation. 2006;114:1202-1213

Chronické srdeční selhání

- **USA:** ročně 5 milionů pacientů ročně, 1 milion hospitalizací a 300 000 úmrtí
- Odhadovaná **prevalence** 0,5-2% (5,5%)
- Prevalence ≥ 10 % u osob ve věku **nad 70 let**
- Nejméně **1/2 nemocných** se SS HFrEF
- Nemocní s HFpEF mají o něco lepší **prognózu** než ti s HFrEF
- Jediné kardiovaskulární onemocnění se **vzrůstající** prevalencí, incidencí, počtem hospitalizací, náklady na léčbu



American Heart Association. Heart and Stroke Statistics: 2004 Update. Dallas, Texas: American Heart Association; 2003. http://www.americanheart.org.



ICHS - chronické srdeční selhání

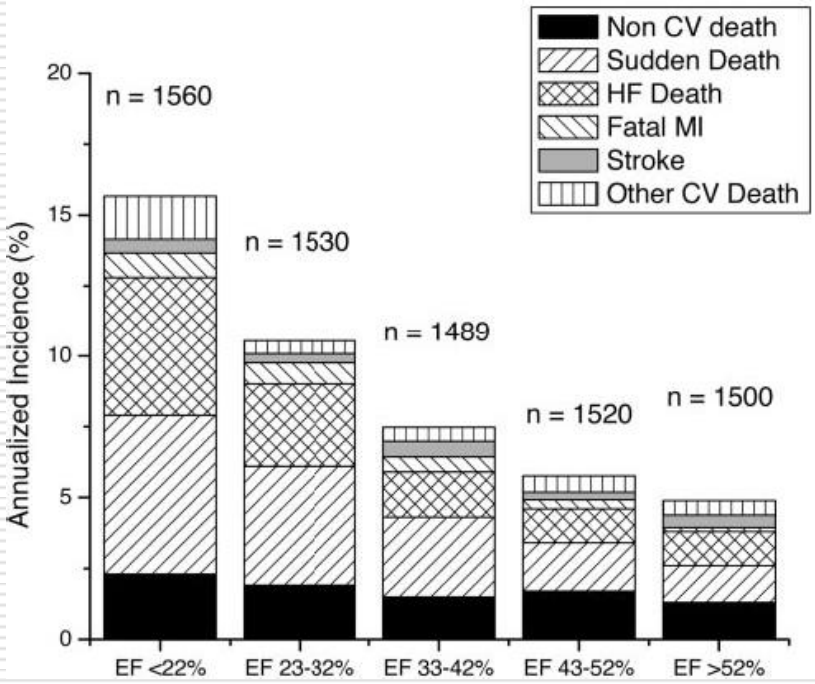
- Metananalýza 24 multicentrických studií léčby CHF
- Publikovaných v *NEJM* (1986-2005)
- Zahrnující > 43 000 pacientů
- Prevalence ICHS u srdečního selhání u 62% pacientů
- CHF prevalence: 0,5-2% (5,5%)

Trial	Year	All Patients	CAD Patients
V-HeFT I	1986	642	282
CONSENSUS	1987	253	146
Milrinone	1989	230	115
PROMISE	1991	1088	590
SOLVD-T	1991	2569	1828
V-HeFT II	1991	804	427
SOLVD-P	1992	4228	3518
RADIANCE	1993	178	107
Vesnarinone	1993	477	249
CHF-STAT	1995	674	481
Carvedilol	1996	1094	521
PRAISE	1996	1153	732
DIG	1997	6800	4793
VEST	1998	3833	2230
RALES	1999	1663	907
DIAMOND	1999	1518	1017
COPERNICUS	2001	2289	1534
BEST	2001	2708	1587
Val-HeFT	2001	5010	2866
MIRACLE	2002	453	244
COMPANION	2004	1520	842
A-HeFT	2004	1050	242
SCD-HeFT	2005	2521	1310
CARE-HF	2005	813	309
Total	19 y	43 568	26 877(62%)

Gheorghiade M. et al. Navigating the Crossroads of Coronary Artery Disease and Heart Failure Circulation. 2006;114:1202-1213
American Heart Association. Heart and Stroke Statistics: 2004 Update. Dallas, Texas: AHA; 2003. http://www.americanheart.org

Prognostický význam ejekční frakce LK

- 7599 pacientů studie CHARM
- Zvýšení RR celkové mortality o 39% s poklesem EF LK o 10% až do hodnoty EF LK 45%
- Od hodnoty EF LK 45% je riziko celkové a KV mortality stabilní



Scott D. Solomon, Nagesh Anavekar, Hicham Skali et al. Influence of Ejection Fraction on Cardiovascular Outcomes in a Broad Spectrum of Heart Failure Patients Circulation 2005; 112; 3738-3744

European Journal of Echocardiography
doi:10.1093/ehechocard/jer237

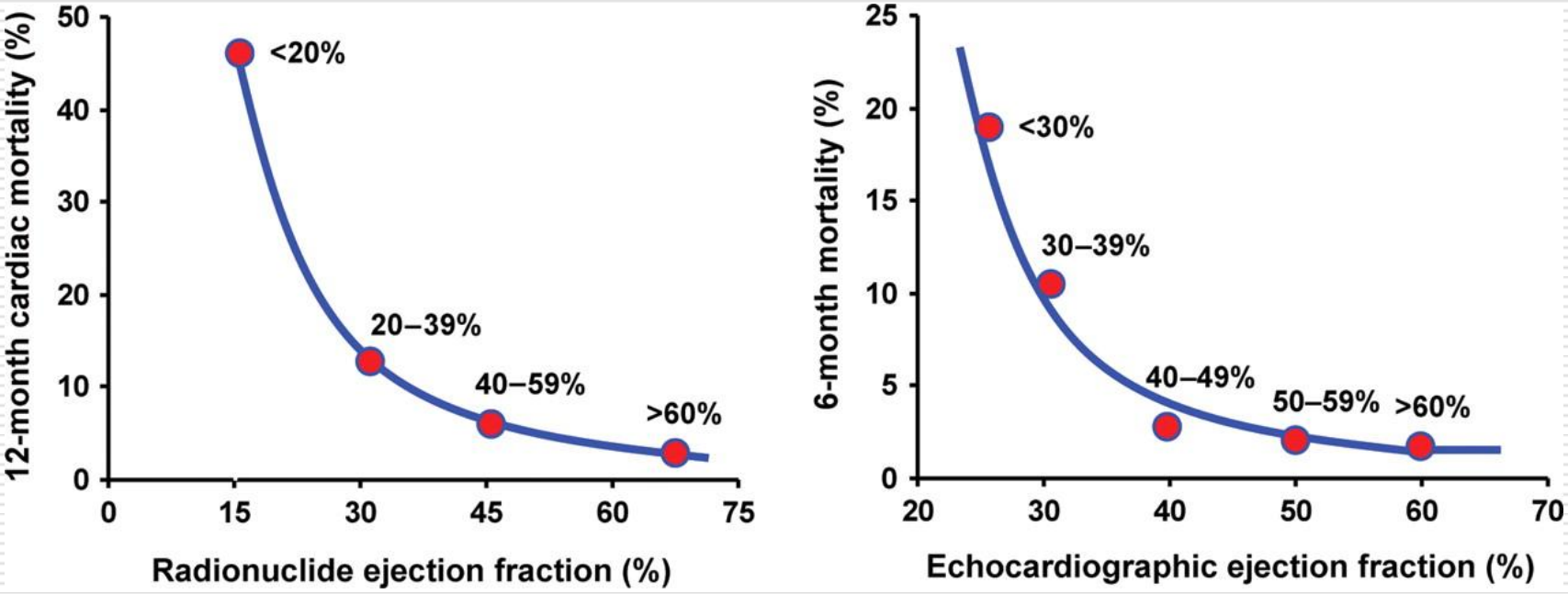
Is viability still viable after the STICH trial?

Lauro Cortigiani[1], Riccardo Bigi[2], and Rosa Sicari[3]*

[1]Cardiovascular Unit, Campo di Marte Hospital, Lucca, Italy; [2]Department of Cardiovascular Sciences, University School of Medicine, Milan, Italy; and [3]Institute of Clinical Physiology, CNR, Via G. Moruzzi 1, 56124 Pisa, Italy

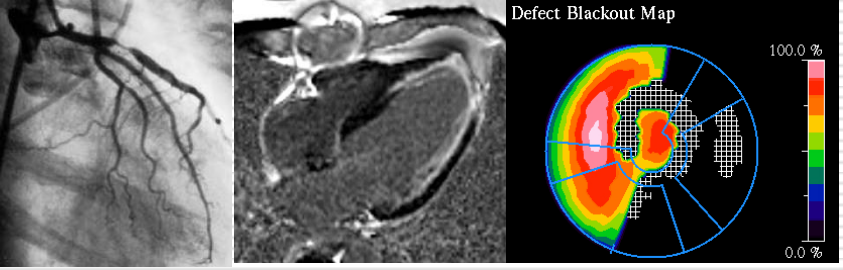
Received 26 August 2011; accepted after revision 17 October 2011

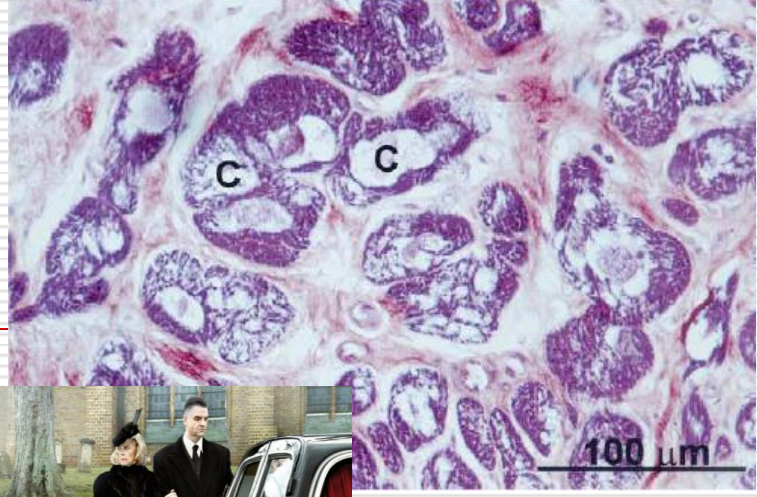
Mortalita a EF LK (po IM)



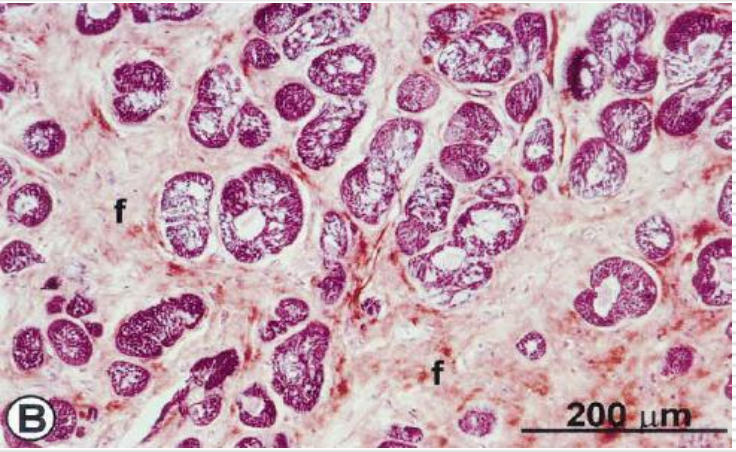
Hyperbolic curves relating mortality and radionuclide and echocardiographic assessed LVEF in patients recovering from an acute myocardial infarction.

Cortigiani L et al. Eur J Echocardiogr 2011;ejechocard.jer237





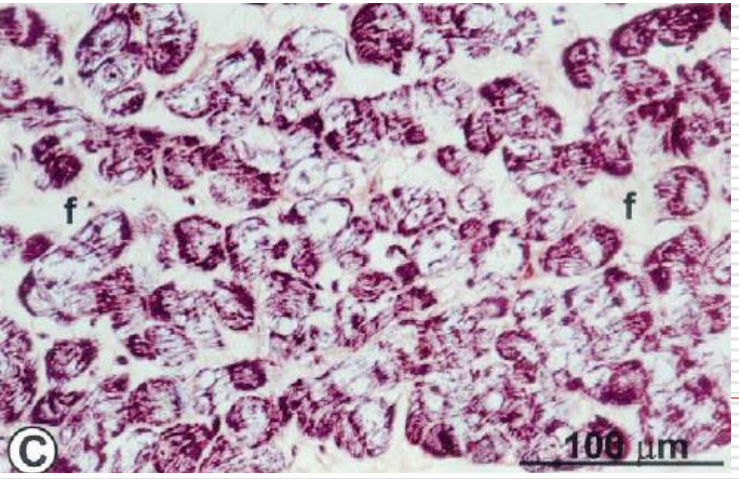
Norma

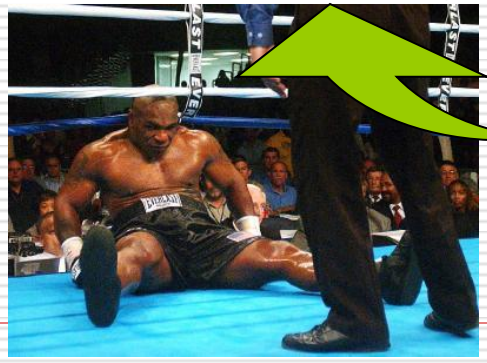


Jizva

Stunning

Hibernace





Sheppard, Nicholas et al. The histology of viable and hibernating myocardium in relation to imaging characteristics. J. Am. Coll. Cardiol. 2002;39;428-435

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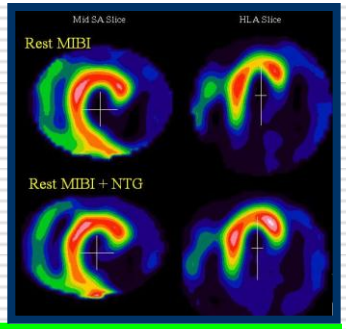
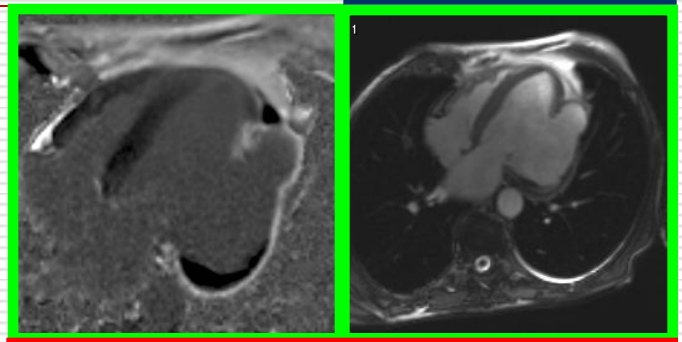
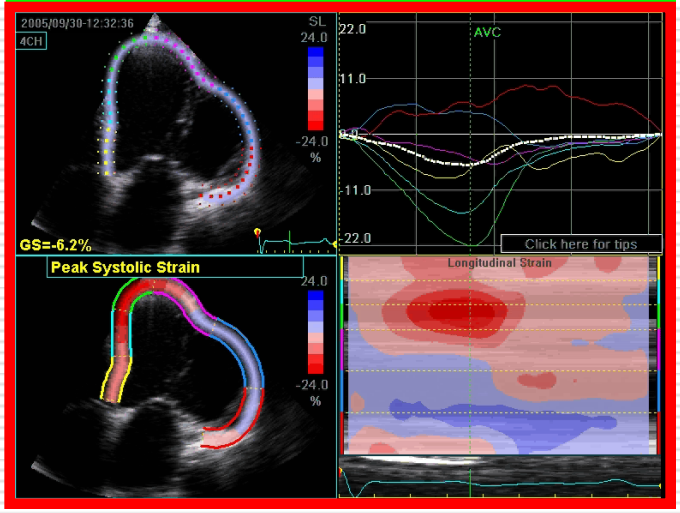
Zobrazovací metody - úvod



- **Dobutaminová echokardiografie**
- **+…. další metody**
- **SPECT/PET**
- **CeCMR** je referenční metodou v zobrazení lokalizace, distribuce a rozsahu jizvy a má vysokou přesnost v predikci (ne)viabilního myokardu. **(1,2)**





1. Kim RJ, et al. Relationship of MRI delayed contrast enhancement to irreversible injury, infarct age, and contractile function. Circulation 1999;100:1992–2002.
2. Kim RJ, et al. The use of contrast-enhanced magnetic resonance imaging to identify reversible myocardial dysfunction. N Engl J Med 2000;343:1445–53.
3. Becker M, et al. Myocardial Deformation Imaging Based on Ultrasonic Pixel Tracking to Identify Reversible Myocardial Dysfunction. J Am Coll Cardiol 2008;51;1473-1481
4. Becker M. et al. Eur Heart J. 2006 Nov;27(21):2560-6. Epub 2006 Oct 11.

Eur J Echocardiography (2006) 7, 79–108

ELSEVIER

GUIDELINES

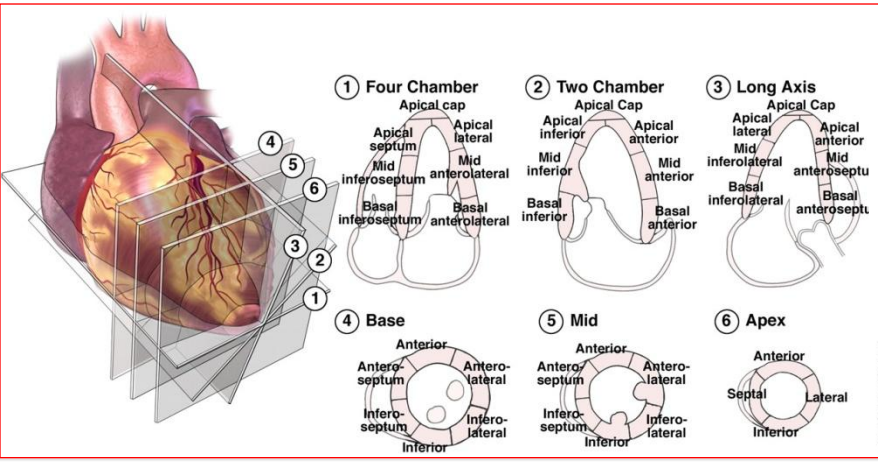
Recommendations for chamber quantification☆

Roberto M. Lang, Michelle Bierig, Richard B. Devereux, Frank A. Flachskampf*, Elyse Foster, Patricia A. Pellikka, Michael H. Picard, Mary J. Roman, James Seward, Jack Shanewise, Scott Solomon, Kirk T. Spencer, Martin St. John Sutton, William Stewart

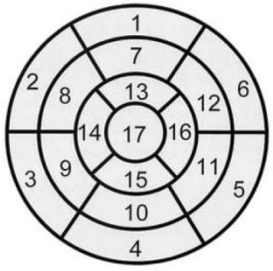
EUROPEAN SOCIETY OF CARDIOLOGY®

Standardized myocardial segmentation and nomenclature for tomographic imaging of the heart: A statement for healthcare professionals from the Cardiac Imaging Committee of the Council on Clinical Cardiology of the American Heart Association

Manuel D. Cerqueira, MD,[b] Neil J. Weissman, MD,[a] Vasken Dilsizian, MD,[b] Alice K. Jacobs, MD,[d] Sanjiv Kaul, MD,[a] Warren K. Laskey, MD,[d] Dudley J. Pennell, MD,[e] John A Rumberger, MD,[c] Thomas Ryan, MD,[a] Mario S. Verani, MDH†,[b] and American Heart Association Writing Group on Myocardial Segmentation and Registration for Cardiac Imaging[a,b,c,d,e]



Left Ventricular Segmentation



1. basal anterior
2. basal anteroseptal
3. basal inferoseptal
4. basal inferior
5. basal inferolateral
6. basal anterolateral
7. mid anterior
8. mid anteroseptal
9. mid inferoseptal
10. mid inferior
11. mid inferolateral
12. mid anterolateral
13. apical anterior
14. apical septal
15. apical inferior
16. apical lateral
17. apex

Coronary Artery Territories

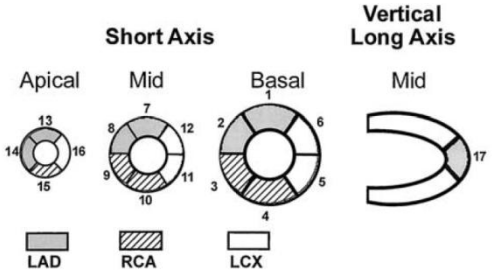


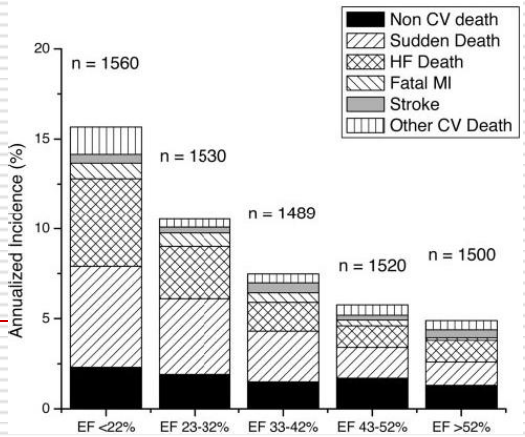
Figure 5. Assignment of the 17 myocardial segments to the territories of the left anterior descending *(LAD)*, right coronary artery *(RCA)*, and the left circumflex coronary artery *(LCX)*. Modified from reference 5.

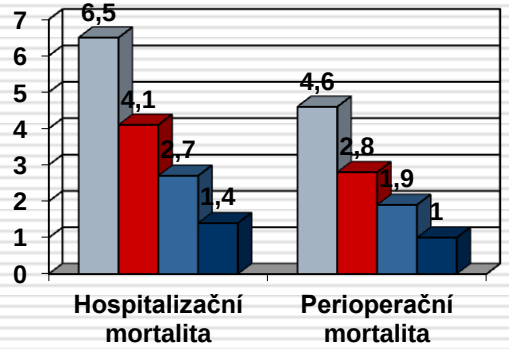
Lang R M et al. Eur J Echocardiogr 2006;7:79-108
Cerqueira MD et al. Standardized myocardial segmentation and nomenclature for tomographic imaging of the heart: A statement for healthcare professionals from the Cardiac Imaging Committee of the Council on Clinical Cardiology of the American Heart Association. Circulation 2002;105:539-42.

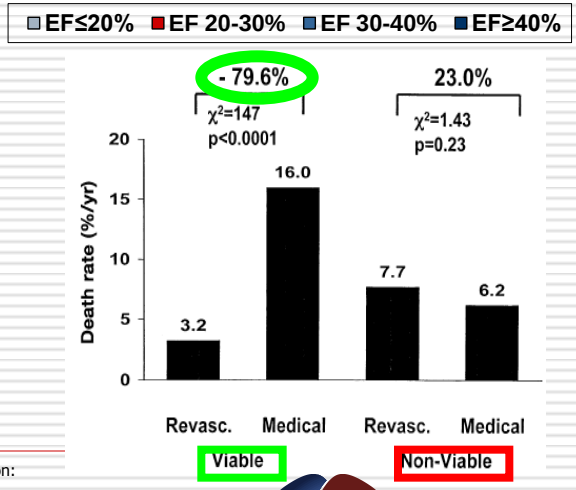
Význam viability myokardu

1. **PROGNOSTICKÝ VÝZNAM A EVIDENCE REVASKULARIZACE:**
   Metanalýza 24 nerandomizovaných studií, 3088 pacientů, průměrná EF LK 33%.....významný profit pacientů s předoperačním průkazem viability myokardu a systolickou dysfunkcí LK z revaskularizace a naopak negativní prognostický marker neprovedení revaskularizace viabilního myokardu

2. **COST/BENEFIT A PERIPROCEDURÁLNÍ RIZIKO**
   revaskularizačních operací (CABG)







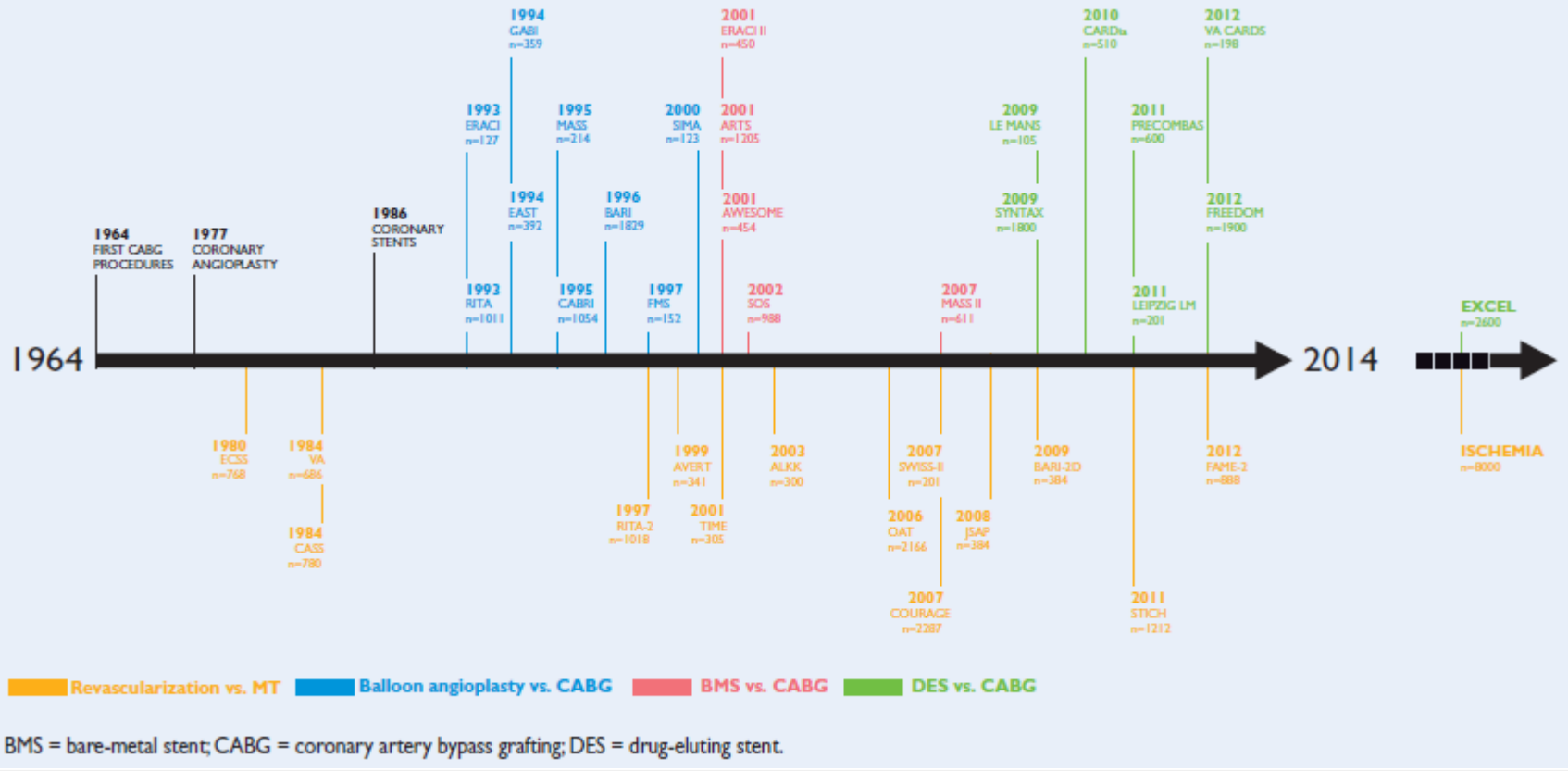
Allman K.C. et al. Myocardial viability testing and impact of revascularization on prognosis in patients with coronary artery disease and left ventricular dysfunction: a meta-analysis. JACC 2002 39: 1151-58

Scott D. Solomon, et al. Influence of Ejection Fraction on Cardiovascular Outcomes in a Broad Spectrum of Heart Failure Patients Circulation 2005; 112; 3738-3744

European Heart Journal (2014) **35**, 2541–2619
doi:10.1093/eurheartj/ehu278

2014 ESC/EACTS Guidelines on myocardial revascularization

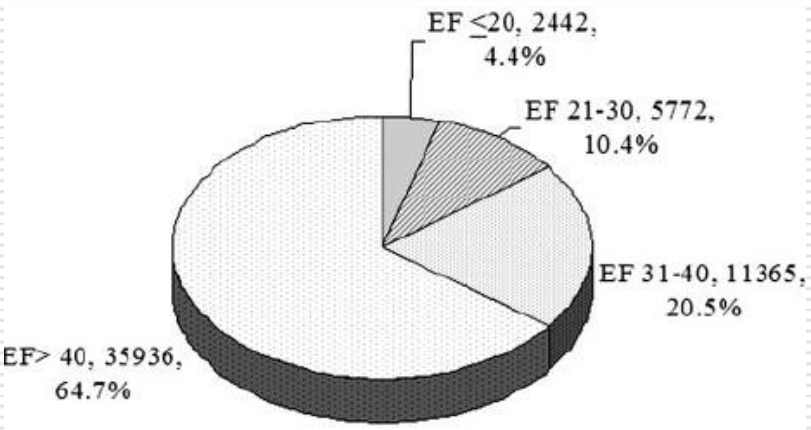
The Task Force on Myocardial Revascularization of the European Society of Cardiology (ESC) and the European Association for Cardio-Thoracic Surgery (EACTS)

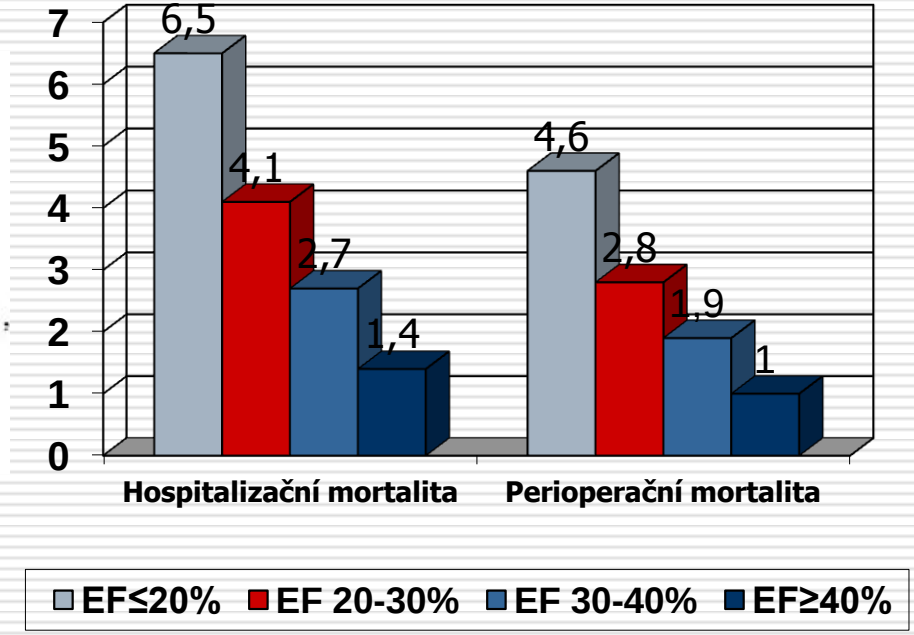


BMS = bare-metal stent; CABG = coronary artery bypass grafting; DES = drug-eluting stent.

Operační riziko

Analýza databáze 55 515 pacientů státu NY, kteří podstoupili CABG v letech 1997-1999





Topkara et al.: Coronary Artery Bypass Grafting in Patients With Low Ejection Fraction, Circulation 2005;112;344-350

Vliv revaskularizace na symptomy

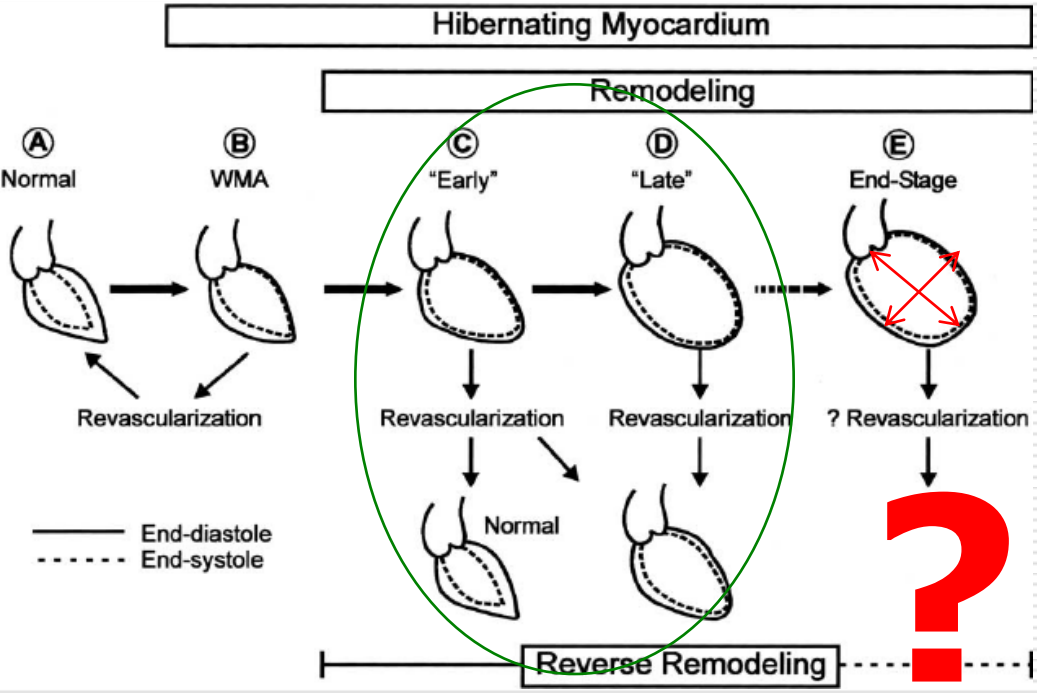
- Starší registry s minimálním vlivem CABG na redukci symptomů srdečního selhání, která byla doložena u 9-25% pacientů
- Novější studie s výrazným benefitem revaskularizace na redukci symptomů srdečního selhání u 59-92% pacientů

Vliv revaskularizace na systolickou funkci LK

- 1 starší randomizovaná studie s nesignifikantním vlivem revaskularizace na EF LK v CABG (n=102) a konzervativně léčené skupině (n=92).
- Observační studie s průkazem signifikantního vlivu na EF LK v revaskularizované skupině, ale s limitacemi
- .....

Baker DW, et sl. Management of heart failure: the role of revascularization in the treatment of patients with moderate or severe left ventricular systolic dysfunction. JAMA 1994;272:1528 –34
Detre KM, Peduzzi P, Hammermeister KE, Murphy ML, Hultgren HN, Takaro T. Five-year effect of medical and surgical therapy on resting left ventricular function in stable angina: Veterans Administration Cooperative Study. Am J Cardiol 1984;53:444 –50.
Sciagra et al.: Predicting Revascularization Outcome in Patients With Coronary Artery Disease and Left Ventricular Dysfunction (Data from the SEMINATOR Study). Am J Cardiol 2002;89:1369–1373

Optimální načasování revaskularizace



Přesnost predikce reverzní remodelace LK pomocí zobrazovacích metod

	Sensitivity (%)	Specificity (%)	Predictive Values of Positive Test (%)	Predictive Values of Negative Test (%)
Dobutamine echocardiography*	81	80	77	85
Radionuclide†	81–86	50–66	69–71	77–80
Positron-emission tomography‡	93	58	71	86

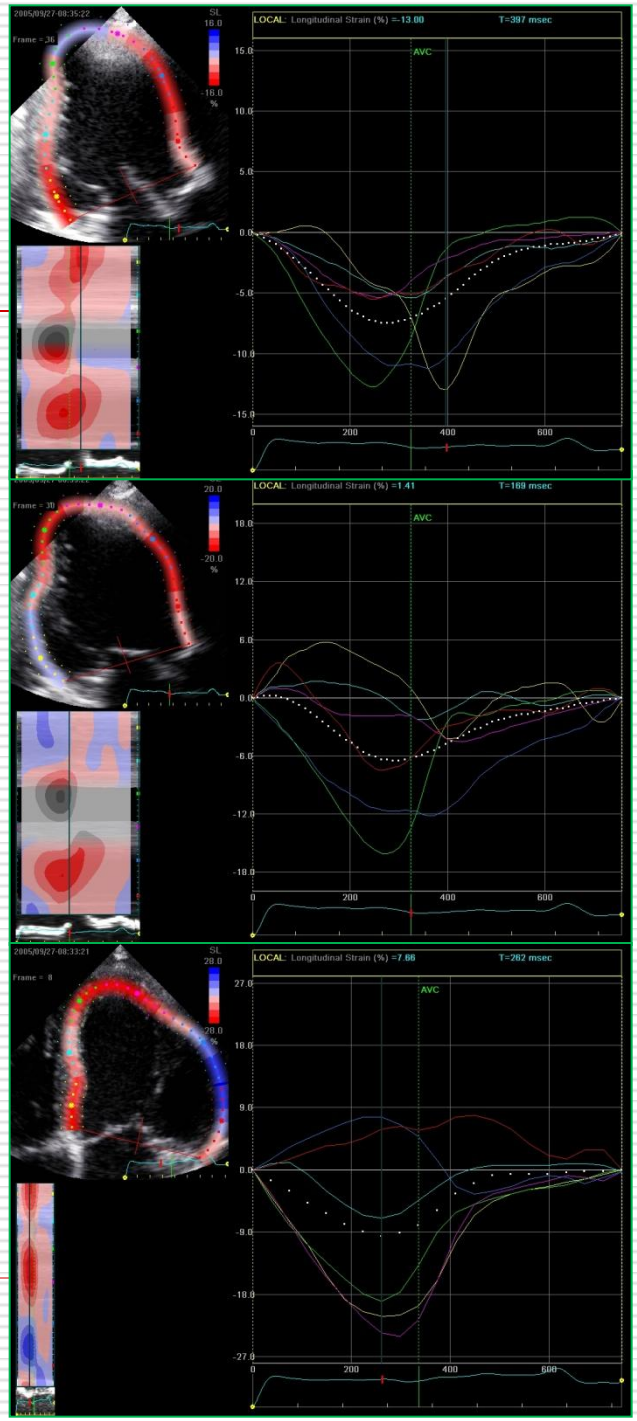
*32 studies, 1,090 patients; †53 studies; 1,346 patients; ‡20 studies; 598 patients.

Rahimtoola SH. : Hibernating Myocardium: Another Piece of the Puzzle Falls Into Place. JACC. 2006;47;978-980

Zobrazovací metody

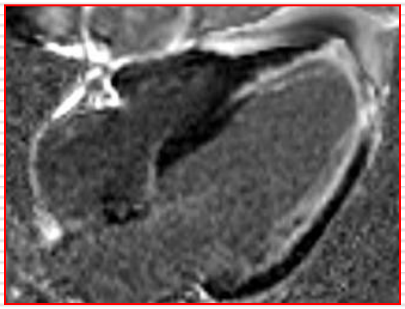
Echokardiografie

- Dobutaminová zátěžová, deformace myokardu LK



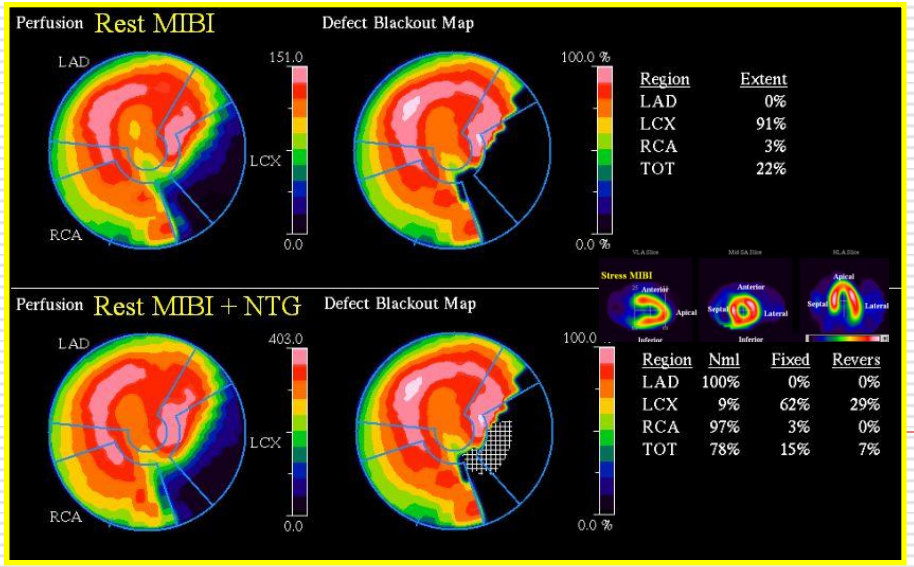
Magnetická rezonance

- LGE



SPECT a PET myokardu

- Perfuzní scintigrafie myokardu
- metabolizmus

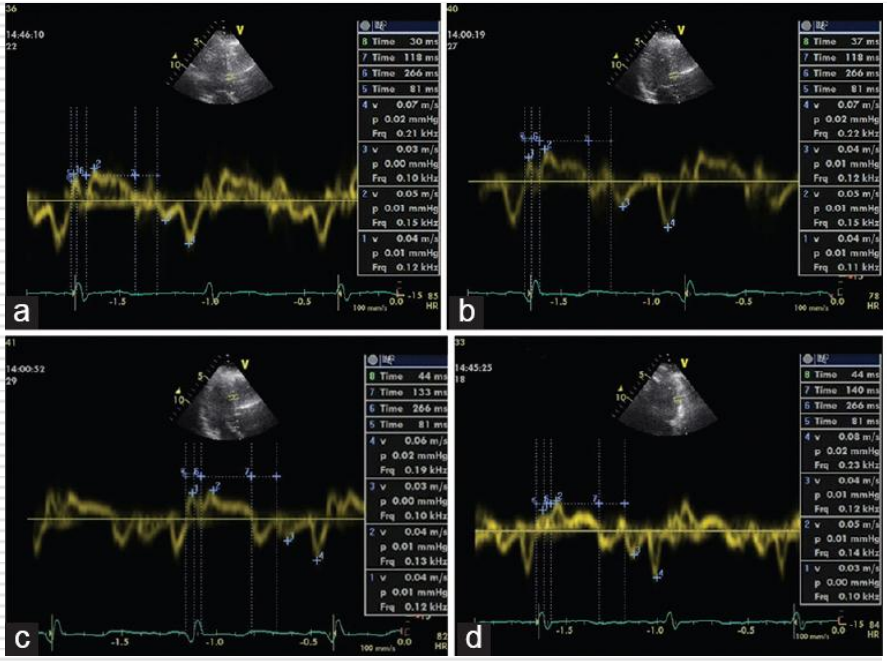


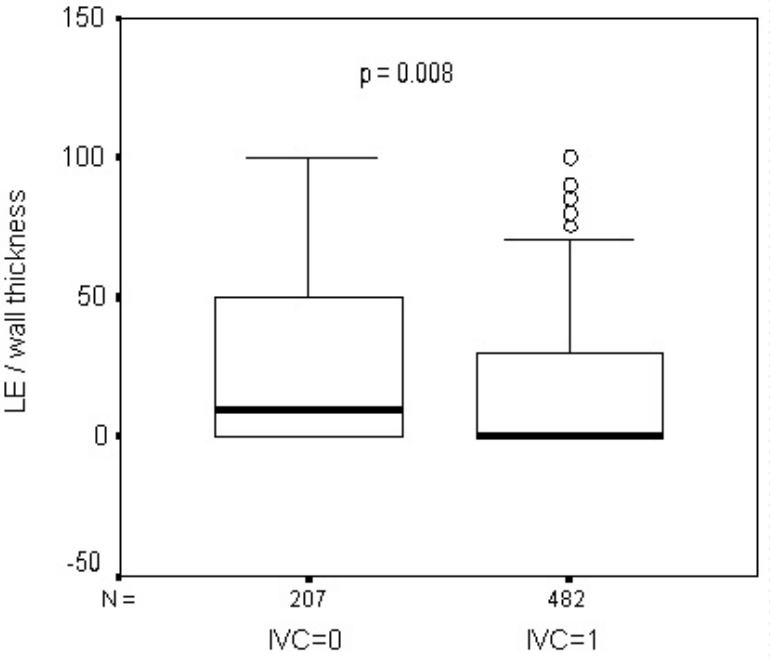
Biomed Pap Med Fac Univ Palacky Olomouc Czech Repub. 2010 Sep; 154(3):251–256.

SEGMENTAL COLOR DOPPLER MYOCARDIAL IMAGING DERIVED PRE-EJECTION VELOCITIES ARE NOT CLINICALLY USEFUL IN THE ASSESSMENT OF POST-INFARCTION SCAR TRANSMURALITY

Tomas Skala[a]*, Martin Hutyra[a], David Horak[b], Milos Taborsky[a]

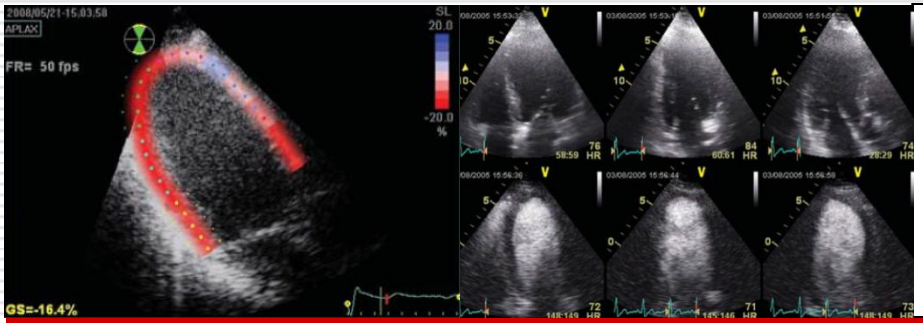
Echokardiografie – klidové vyšetření/regionální





- Přesnost **absence V_{IVC}** v detekci segmentu s transmurální jizvou po IM byla 66%.
- Přítomnost (ne)viabilního myokardu v daném konkrétním segmentu tak nemůže být spolehlivě potvrzena ani vyvrácena pouze na základě přítomnosti resp. absence Vivc

	LGE ≥75%	95% CI
Sensitivita	72.7 %	69.4 % – 76.0 %
Specificita	41.2 %	37.5 % – 44.9 %
Přesnost	66.5 %	62.9 % – 70.0 %
PPV	83.4 %	80.6 % – 86.2 %
NPV	27.1 %	23.7 % – 30.4 %



European Heart Journal (2011) **32**, 810–819
doi:10.1093/eurheartj/ehr002

REVIEW

Imaging

Myocardial ischaemia and viability: the pivotal role of echocardiography

Petros Nihoyannopoulos [1,2]* and Jean Louis Vanoverschelde [3,4]

	Rest flow	Flow reserve	Contractile reserve	Fasting FDG uptake	Structural changes	Reversibility
Chronic stunning	↔	↓	Yes	↔	No	Yes
Transition phase	↔	↓↓	Yes	↔ or ↑	Mild	Yes
Chronic hibernation	↓	↓↓↓	May be absent	↑	More severe/fibrosis	Delayed/incomplete
Infarction	↓	↓↓	No	↓	Fibrosis	No
Remodelling	↔	↔	May be absent	↔	Fibrosis	No

	Regional		Global	
Stress method	Normal response	Ischemic response	Normal response	Ischemic response
Treadmill	Postexercise increase in function compared with rest	Postexercise decrease in function compared with rest	Decrease in ESV, increase in EF	Increase in ESV, decrease in EF in multivessel or L main disease
Supine bicycle	Peak exercise increase in function compared with rest	Peak exercise decrease in function compared with rest	Decrease in ESV, increase in EF	Increase in ESV and decrease in EF in multivessel or L main disease
Dobutamine	Increase in function, velocity of contraction compared with rest and usually with low dose	Decrease in function, velocity of contraction compared with low dose; may be less compared with rest	Greater decrease in ESV, marked increase in EF	Often same as normal response; infrequently, ischemia produces decreased EF; cavity dilatation rarely occurs
Vasodilator	Increase in function compared with rest	Decrease in function compared with rest	Decrease in ESV, increase in EF	Often same as normal response; occasionally, ischemia produces decreased EF; cavity dilatation rarely occurs
Atrial pacing	No change or increase in function compared with rest	Decrease in function compared with rest	Decrease in ESV, no change in EF	No change or increase ESV, decrease in EF

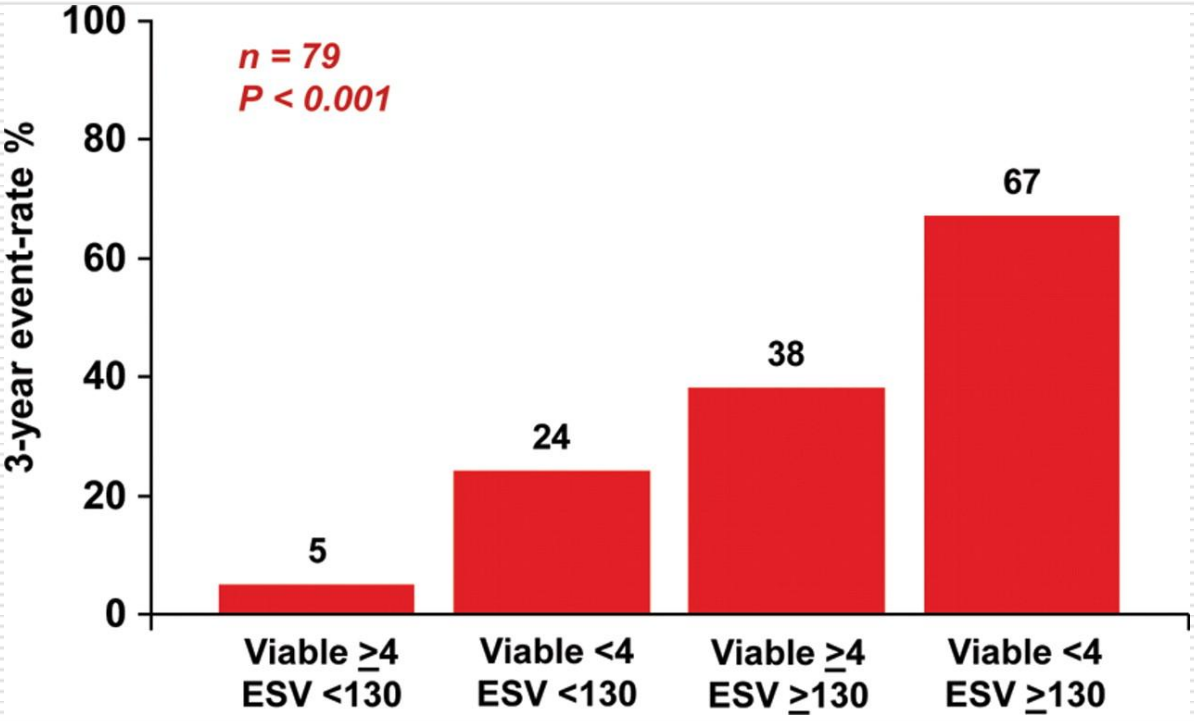
GUIDELINES AND STANDARDS

American Society of Echocardiography Recommendations for Performance, Interpretation, and Application of Stress Echocardiography

Patricia A. Pellikka, MD, Sherif F. Nagueh, MD, Abdou A. Elhendy, MD, PhD, Cathryn A. Kuehl, RDCS, and Stephen G. Sawada, MD, *Rochester, Minnesota; Houston, Texas; Marshfield, Wisconsin; and Indianapolis, Indiana*

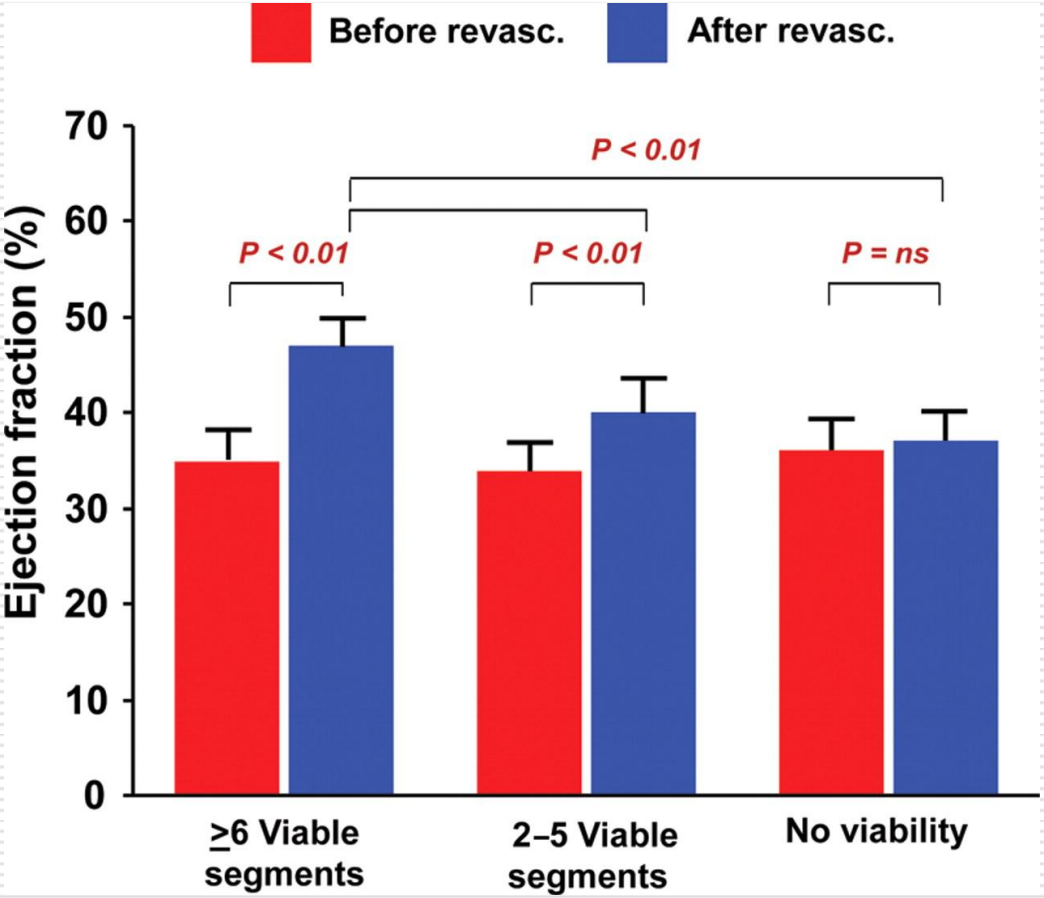
Prognostický význam rozsahu viabilního myokardu a ESV LK

Cardiac events (cardiac death, myocardial infarction, and hospitalization for heart failure) at 3-year follow-up for four different patient categories with ischemic LV dysfunction according to the presence of substantial viable myocardium (>4 segments) at dobutamine stress echo and the left ventricular end-systolic volume.



Cortigiani L et al. Eur J Echocardiogr 2011;ejechocard.jer237
Bax JJ, Schinkel AF, Boersma E et al. Extensive left ventricular remodeling does not allow viable myocardium to improve in left ventricular ejection fraction after revascularization and is associated with worse long-term prognosis. Circulation 2004;110(11 Suppl 1):II18–22.

Rozsah viabilního myokardu a reverzní remodelace LK



Meluzin J, et al. Prognostic value of the amount of dysfunctional but viable myocardium in revascularized patients with coronary artery disease and left ventricular dysfunction. JACC 1998;32:912–20.

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PII S0735-1097(02)01726-6

Coronary Revascularization

Myocardial Viability Testing and Impact of Revascularization on Prognosis in Patients With Coronary Artery Disease and Left Ventricular Dysfunction: A Meta-Analysis

Kevin C. Allman, MB, BS, FRACP, FACC,* Leslee J. Shaw, PHD,† Rory Hachamovitch, MD, FACC,† James E. Udelson, MD, FACC‡

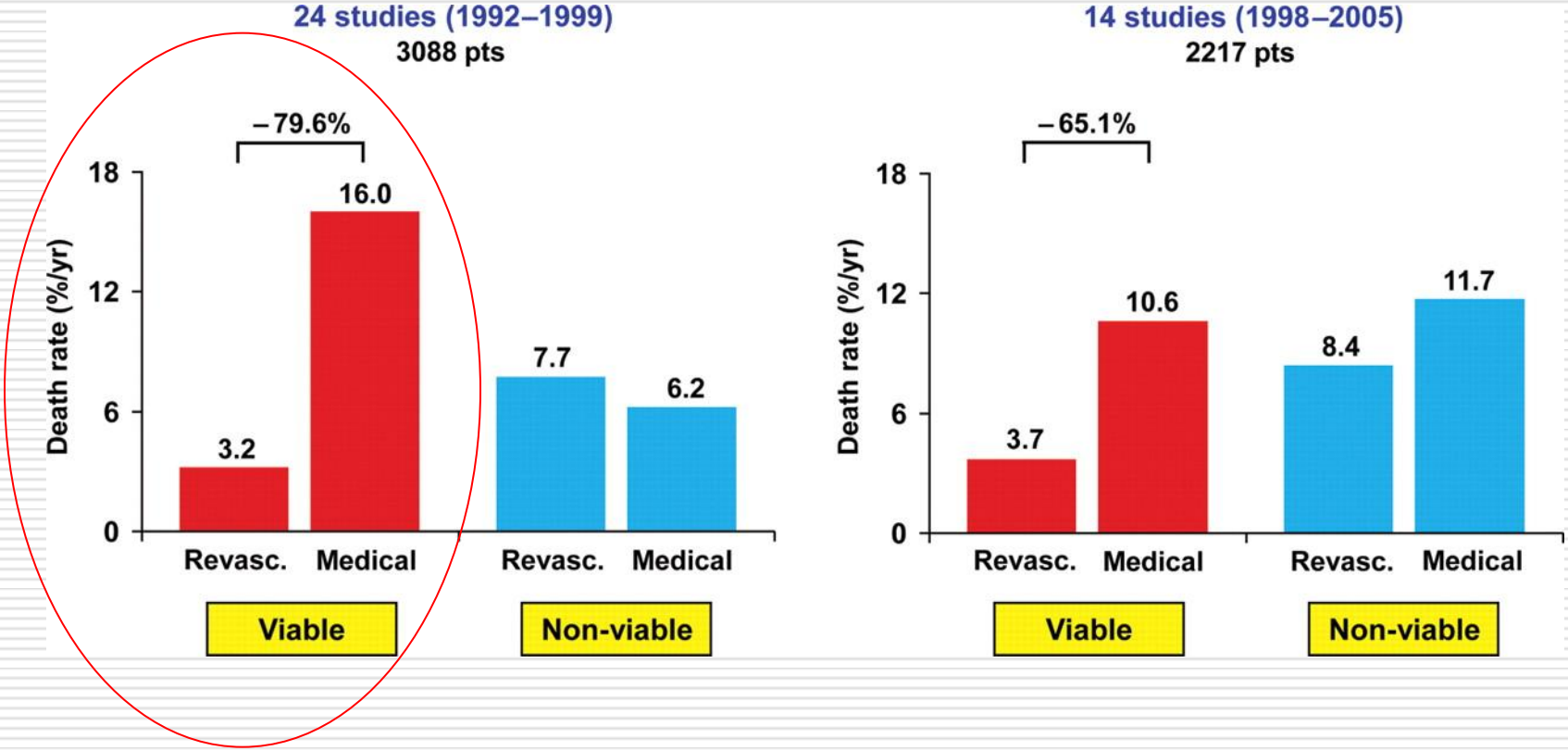
European Journal of Echocardiography
doi:10.1093/ehechocard/jer237

Is viability still viable after the STICH trial?

Lauro Cortigiani[1], Riccardo Bigi[2], and Rosa Sicari[3]*

[1]Cardiovascular Unit, Campo di Marte Hospital, Lucca, Italy; [2]Department of Cardiovascular Sciences, University School of Medicine, Milan, Italy; and [3]Institute of Clinical Physiology, CNR, Via G. Moruzzi 1, 56124 Pisa, Italy

Received 26 August 2011; accepted after revision 17 October 2011



Results of two meta-analysis on 3088 and 2217 patients with ischaemic cardiomyopathy, assessing the effect of revascularization and medical therapy according to the presence of viability at dobutamine echo or nuclear techniques

Allman KC. et al. Myocardial Viability Testing and Impact of Revascularization on Prognosis in Patients With Coronary Artery Disease and Left Ventricular Dysfunction: A Meta-Analysis. J Am Coll Cardiol 2002;39:1151-8
Cortigiani L, Bigi R, Sicari R. Is viability still viable after the STICH trial? Eur J Echocardiogr 2011;ejechocard.jer237

Int J Cardiovasc Imaging (2011) 27:343–353
DOI 10.1007/s10554-010-9677-1

ORIGINAL PAPER

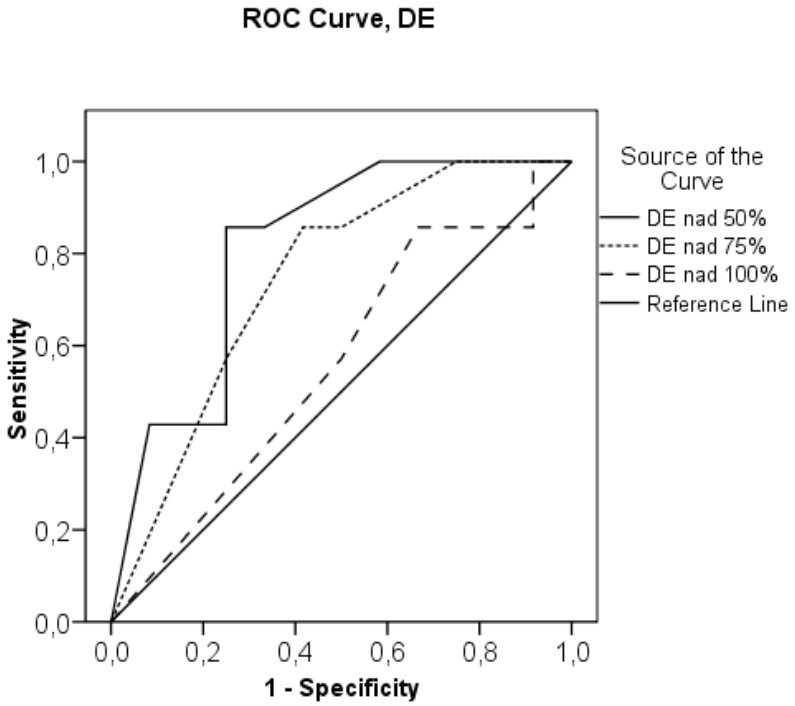
Prediction of long-term reverse left ventricular remodeling after revascularization or medical treatment in patients with ischemic cardiomyopathy: a comparative study between SPECT and MRI

Tomas Skala · Martin Hutyra · Jan Vaclavik · Milan Kaminek · David Horak · Josef Novotny · Jana Zapletalova · Jan Lukl · Dan Marek · Milos Taborsky

Received: 19 March 2010 / Accepted: 24 July 2010 / Published online: 20 August 2010

Predikce reverzní remodelace (MR)

CMR – LGE (DE)



- **≤5** segments with delayed enhancement/wall thickness ratio **≥50%**

Sensitivity 86%, specificity 75% (AUC 0,81)

- **≤2** segments with delayed enhancement/wall thickness ratio **≥75%**

Sensitivity 71%, specificity 67% (AUC 0,75)

Int J Cardiovasc Imaging (2011) 27:343–353
DOI 10.1007/s10554-010-9677-1

ORIGINAL PAPER

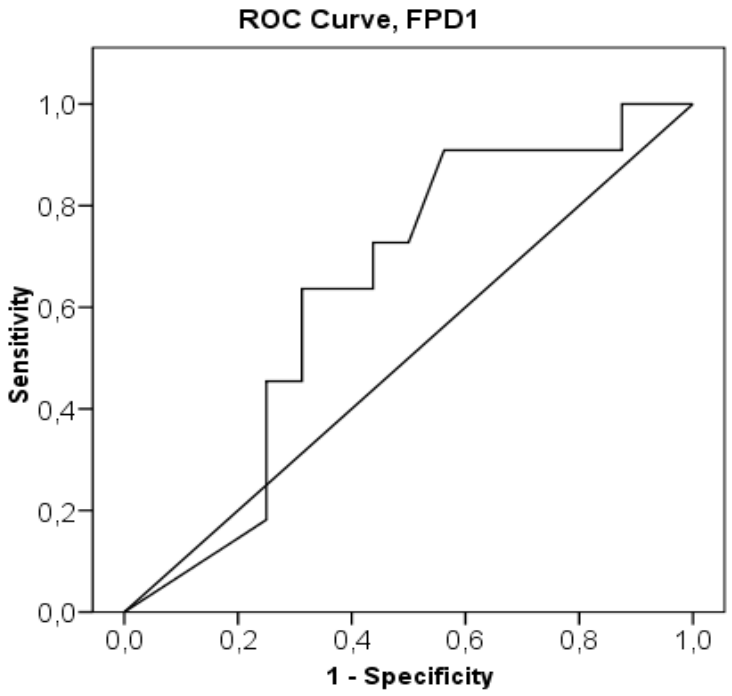
Predikce reverzní remodelace (SPECT)

Prediction of long-term reverse left ventricular remodeling after revascularization or medical treatment in patients with ischemic cardiomyopathy: a comparative study between SPECT and MRI

Tomas Skala · Martin Hutyra · Jan Vaclavik · Milan Kaminek · David Horak · Josef Novotny · Jana Zapletalova · Jan Lukl · Dan Marek · Milos Taborsky

Received: 19 March 2010 / Accepted: 24 July 2010 / Published online: 20 August 2010

SPECT – fixed perfusion defect



91% **responders**: FPD <25,5% LV

75% **nonresponders:** FPD >35% LV

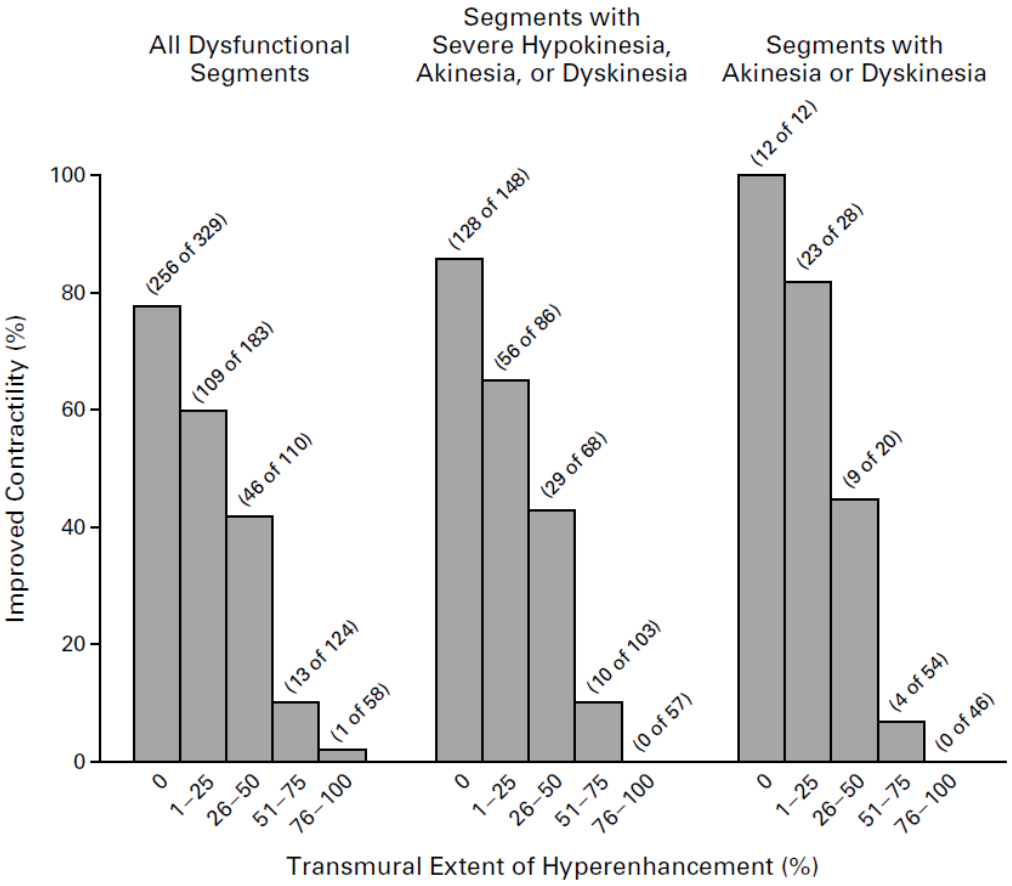
FPD extent <16,5% of LV
(in prediction of reverse remodeling presence after revascularization):

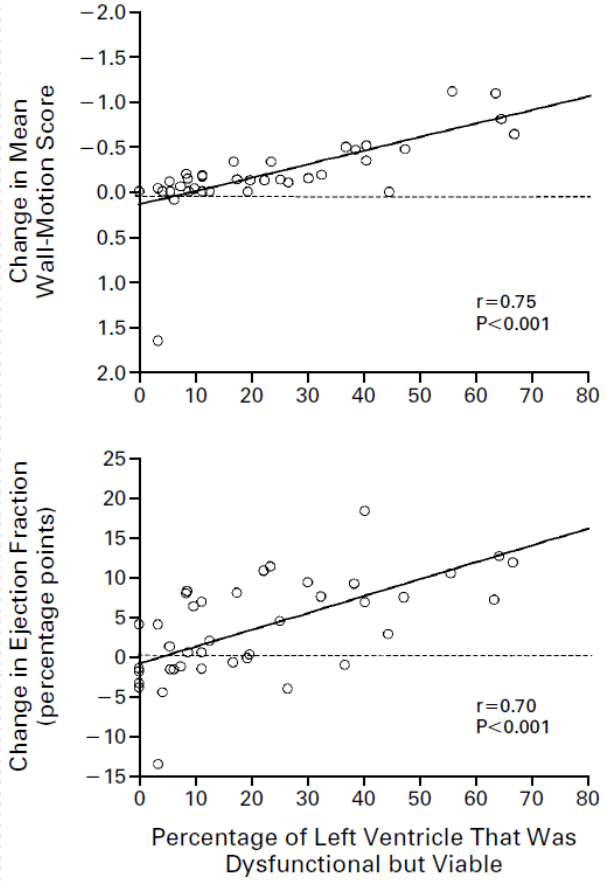
Sensitivity 64%, specificity 69% (AUC 0,64)

CMR

THE USE OF CONTRAST-ENHANCED MAGNETIC RESONANCE IMAGING TO IDENTIFY REVERSIBLE MYOCARDIAL DYSFUNCTION

RAYMOND J. KIM, M.D., EDWIN WU, M.D., ALLEN RAFAEL, M.D., ENN-LING CHEN, PH.D., MICHELE A. PARKER, M.S., ORLANDO SIMONETTI, PH.D., FRANCIS J. KLOCKE, M.D., ROBERT O. BONOW, M.D., AND ROBERT M. JUDD, PH.D.

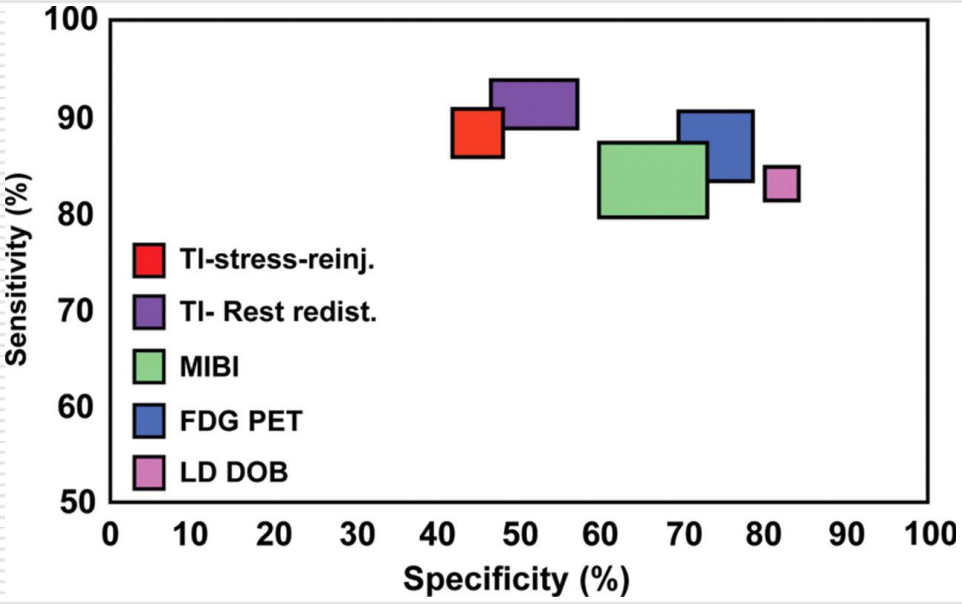


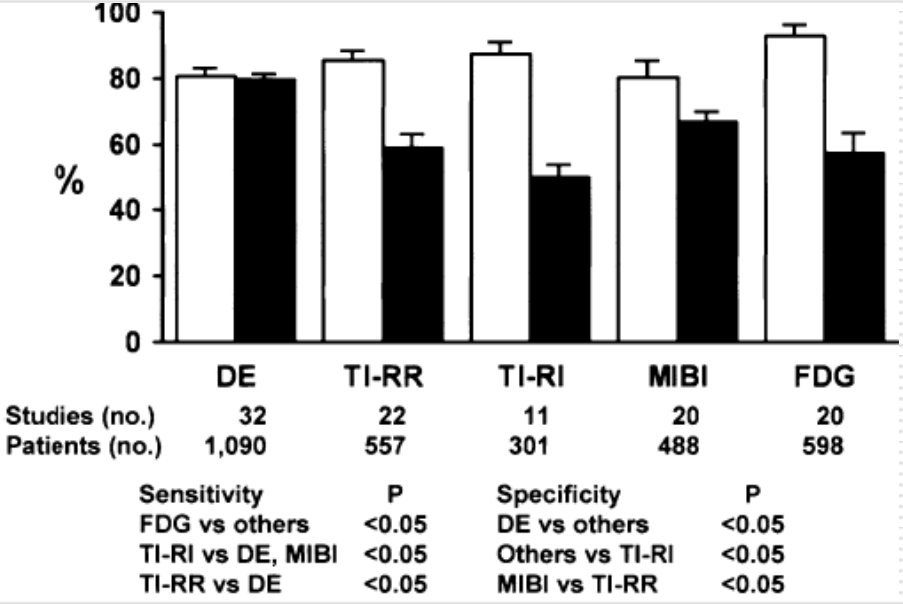


Kim RJ, Wu E, Rafael A, Chen EL, Parker MA, Simonetti O et al. The use of contrast-enhanced magnetic resonance imaging to identify reversible myocardial dysfunction. NEJM 2000;343:1445–53.

Diagnostická přesnost zobrazovacích metod

Sensitivity/specificity of nuclear techniques and DSE in predicting functional recovery after revascularization in patients with ischemic LV dysfunction.





Cortigiani L et al. Eur J Echocardiogr 2011;ejechocard.jer237
Bax JJ, Cornel JH, Visser FC, Fioretti PM, van Lingen A, Reijs AE et al. Prediction of recovery of myocardial dysfunction after revascularization. Comparison of fluorine-18 fluorodeoxyglucose/thallium-201 SPECT, thallium-201 stress-reinjection SPECT and dobutamine echocardiography. J Am Coll Cardiol 1996;28:558–64.
Chareonthaitawee P. Revascularization in Severe Left Ventricular Dysfunction: The Role of Viability Testing. JACC, 2005;46;567-574

The NEW ENGLAND JOURNAL of MEDICINE

ORIGINAL ARTICLE

Myocardial Viability and Survival in Ischemic Left Ventricular Dysfunction

Robert O. Bonow, M.D., Gerald Maurer, M.D., Kerry L. Lee, Ph.D.

Dg.: ICHS, EF LK ≤ 35%
Parametry: viabilita myokardu (SPECT, DSE)
EP: mortalita
FU: 5,1r

Ninety-nine sites in 22 countries enrolled 1221 patients on a time span of almost 10 years.
Analyzable subset with myocardial viability was of only 601 patients.
The results from echo and SPECT were lumped together.
The long-time span of enrolment may have changed surgical techniques, but mostly medical therapy.

Characteristic	All Patients (N=601)	Patients with Myocardial Viability (N=487)			Patients without Myocardial Viability (N=114)		
		Medical Therapy (N=243)	CABG (N=244)	P Value	Medical Therapy (N=60)	CABG (N=54)	P Value
Age — yr	60.7±9.4	60.0±9.7	61.5±9.2	0.05	61.6±8.5	60.0±9.2	0.34
Male sex — no. (%)	521 (87)	205 (84)	211 (86)	0.51	55 (92)	50 (93)	1.00
Previous myocardial infarction	481 (80)	190 (78)	183 (75)	0.41	56 (93)	52 (96)	0.68
Current Canadian Cardiac Society angina class — no. (%)				0.60			0.03
0	236 (39)	101 (42)	101 (41)		18 (30)	16 (30)	
I	94 (16)	34 (14)	34 (14)		19 (32)	7 (13)	
II	253 (42)	104 (43)	99 (41)		23 (38)	27 (50)	
III	14 (2)	3 (1)	8 (3)		0	3 (6)	
IV	4 (1)	1 (<1)	2 (1)		0	1 (2)	
Highest New York Heart Association functional class in 3 previous mo — no. (%)				0.51			0.25
I	27 (4)	15 (6)	9 (4)		0	3 (6)	
II	212 (35)	94 (39)	88 (36)		14 (23)	16 (30)	
III	275 (46)	100 (41)	111 (45)		36 (60)	28 (52)	
IV	87 (14)	34 (14)	36 (15)		10 (17)	7 (13)	
Risk-at-randomization score†	12.5±8.8	11.9±8.4	12.8±9.0	0.28	13.7±9.8	12.0±8.8	0.37
Medications at baseline — no. (%)							
Beta-blocker	534 (89)	221 (91)	216 (89)	0.38	52 (87)	45 (83)	0.62
ACE inhibitor	514 (86)	202 (83)	210 (86)	0.37	54 (90)	48 (89)	0.85
ARB	46 (8)	20 (8)	20 (8)	0.99	3 (5)	3 (6)	1.00
ACE inhibitor or ARB	554 (92)	219 (90)	227 (93)	0.25	57 (95)	51 (94)	1.00
Statin	508 (85)	212 (87)	193 (79)	0.02	56 (93)	47 (87)	0.26
Aspirin	513 (85)	209 (86)	205 (84)	0.54	56 (93)	43 (80)	0.03
Coronary artery disease distribution — no. (%)							
No. of diseased vessels with ≥75% stenosis				0.79			0.45
0	12 (2)	6 (2)	3 (1)		2 (3)	1 (2)	
1	152 (25)	62 (26)	62 (25)		17 (28)	11 (20)	
2	221 (37)	87 (36)	92 (38)		18 (30)	24 (44)	
3	215 (36)	88 (36)	86 (35)		23 (38)	18 (33)	
Left ventricular ejection fraction — %	26.7±8.6	28.1±8.4	27.0±8.2	0.30	22.6±8.5	23.3±9.1	0.50
Left ventricular end-diastolic volume index — ml/m² of body-surface area	122.8±41.9	117.8±37.9	116±35.1	0.63	152.3±51.3	140.0±53.8	0.16
Left ventricular end-systolic volume index — ml/m² of body-surface area	91.7±38.9	85.8±34.3	86.0±32.1	0.97	120.8±49.6	111.2±50.8	0.25

Definice viabilního myokardu:
SPECT myokardu (≥ 11 viabilních segmentů)
Zátěžová echokardiografie (≥ 5 segmentů s abnormální klidovou systolickou funkcí a kontraktilní rezervou)

Bonow RO et al. Myocardial Viability and Survival in Ischemic Left Ventricular Dysfunction. N Engl J Med 2011;364:1617-25.

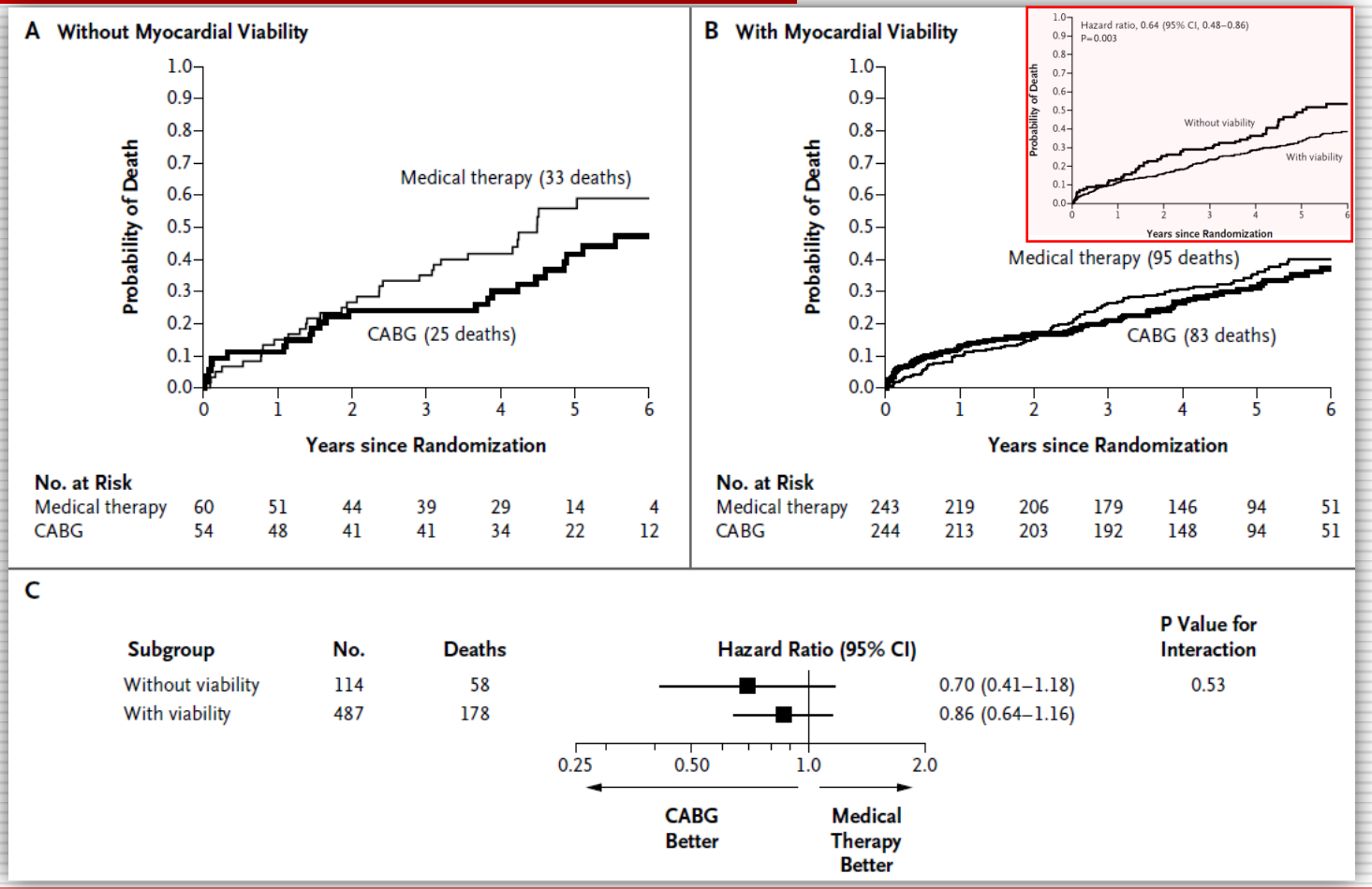
The NEW ENGLAND JOURNAL of MEDICINE

ORIGINAL ARTICLE

Dg.: ICHS, EF LK 32±8%
Parametry: viabilita myokardu (SPECT, DSE)
EP: mortalita
FU: 5,1r

Myocardial Viability and Survival in Ischemic Left Ventricular Dysfunction

Robert O. Bonow, M.D., Gerald Maurer, M.D., Kerry L. Lee, Ph.D.



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European Heart Journal (2010) 31, 2501–2555
doi:10.1093/eurheartj/ehq277

Guidelines on myocardial revascularization

The Task Force on Myocardial Revascularization of the European Society of Cardiology (ESC) and the European Association for Cardio-Thoracic Surgery (EACTS)

Revaskularizace

Table 26 Recommendations for patients with chronic heart failure and systolic left ventricular dysfunction (ejection fraction ≤35%), presenting predominantly with anginal symptoms

	Class[a]	Level[b]	Ref.[c]
CABG is recommended for: • significant LM stenosis • LM equivalent (proximal stenosis of both LAD and LCx) • proximal LAD stenosis with 2- or 3- vessel disease.	I	B	158
CABG with SVR may be considered in patients with LVESV index ≥60 mL/m² and scarred LAD territory.	IIb	B	159, 160
PCI may be considered if anatomy is suitable, in the presence of viable myocardium.	IIb	C	—

Table 27 Recommendations for patients with chroni heart failure and systolic left ventricular dysfunction (ejection fraction ≤35%), presenting predominantly with heart failure symptoms (no or mild angina: Canadian Cardiovascular Society 1–2)

	Class[a]	Level[b]	Ref.[c]
LV aneurysmectomy during CABG is indicated in patients with a large LV aneurysm.	I	C	—
CABG should be considered in the presence of viable myocardium, irrespective of LVESV.	IIa	B	16
CABG with SVR may be considered in patients with a scarred LAD territory.	IIb	B	159, 160
PCI may be considered if anatomy is suitable, in the presence of viable myocardium.	IIb	C	—
Revascularization in the absence of evidence of myocardial viability is not recommended.	III	B	16

Table 19 Recommendations for combined valve surgery and coronary artery bypass grafting

Combined valve surgery and:	Class[a]	Level[b]
CABG is recommended in patients with a primary indication for aortic/mitral valve surgery and coronary artery diameter stenosis ≥70%.	I	C
CABG should be considered in patients with a primary indication for aortic/mitral valve surgery and coronary artery diameter stenosis 50–70%.	IIa	C
Combined CABG and:	**Class[a]**	**Level[b]**
Mitral valve surgery is indicated in patients with a primary indication for CABG and severe[c] ischaemic mitral regurgitation and EF >30%.	I	C
Mitral valve surgery should be considered in patients with a primary indication for CABG and moderate ischaemic mitral regurgitation provided valve repair is feasible, and performed by experienced operators.	IIa	C
Aortic valve surgery should be considered in patients with a primary indication for CABG and moderate aortic stenosis (mean gradient 30–50 mmHg or Doppler velocity 3–4 m/s or heavily calcified aortic valve even when Doppler velocity 2.5–3 m/s).	IIa	C

Table 17 Recommendations for prevention of contrast-induced nephropathy

Intervention	Dose	Class[a]	Level[b]	Ref.[c]
All patients with CKD				
OMT (including statins, ß-blockers, and ACE inhibitors or sartans) is recommended.	According to clinical indications.	I	A	123
Hydration with isotonic saline is recommended.	1 mL/kg/h 12 h before and continued for 24 h after the procedure (0.5 mL/kg/h if EF <35% or NYHA >2).	I	A	127–130

European Heart Journal (2014) 35, 2541–2619
doi:10.1093/eurheartj/ehu278

2014 ESC/EACTS Guidelines on myocardial revascularization

The Task Force on Myocardial Revascularization of the European Society of Cardiology (ESC) and the European Association for Cardio-Thoracic Surgery (EACTS)

Recommendations	Class[a]	Level[b]
CABG is recommended for patients with significant LM stenosis and LM equivalent with proximal stenosis of both LAD and LCx arteries.	I	C
CABG is recommended for patients with significant LAD artery stenosis and multivessel disease to reduce death and hospitalization for cardiovascular causes.	I	B
LV aneurysmectomy during CABG should be considered in patients with a large LV aneurysm, if there is a risk of rupture, large thrombus formation or the aneurysm is the origin of arrhythmias.	IIa	C
Myocardial revascularization should be considered in the presence of viable myocardium.	IIa	B
CABG with surgical ventricular restoration may be considered in patients with scarred LAD territory, especially if a post-operative LVESV index <70 mL/m² can be predictably achieved.	IIb	B
PCI may be considered if anatomy is suitable, in the presence of viable myocardium, and surgery is not indicated.	IIb	C

5.3 Detection of myocardial viability

Non-invasive assessment of myocardial viability has been used to guide the management of patients with chronic ischaemic systolic LV dysfunction. Multiple imaging techniques, including PET, SPECT, and dobutamine stress echocardiography, have been evaluated for assessment of viability and prediction of clinical outcome after myocardial revascularization.[55] In general, nuclear imaging techniques have a high sensitivity, whereas techniques evaluating contractile reserve have a somewhat lower sensitivity but higher specificity. MRI has a high diagnostic accuracy for assessing the transmural extent of myocardial scar tissue and can also assess contractile reserve, but its ability to detect viability and predict recovery of wall motion is no better than other imaging techniques. The differences in performance between the various imaging techniques are small, and experience and availability commonly determine which technique is used. The evidence is mostly based on observational studies or meta-analyses. One RCT, relating to PET imaging, showed that patients with a substantial amount of dysfunctional but viable myocardium are likely to benefit from myocardial revascularization.[56]

Závěry a otázky

1. Viabilita myokardu – **kámen do mozaiky** indikace k revaskularizaci
2. Jaká je **optimální metoda** s ohledem na cenu, časovou náročnost, dostupnost, reprodukovatelnost, přesnost, operator dependence?
3. Nutnost další **evidence** - ?


Děkuji za pozornost