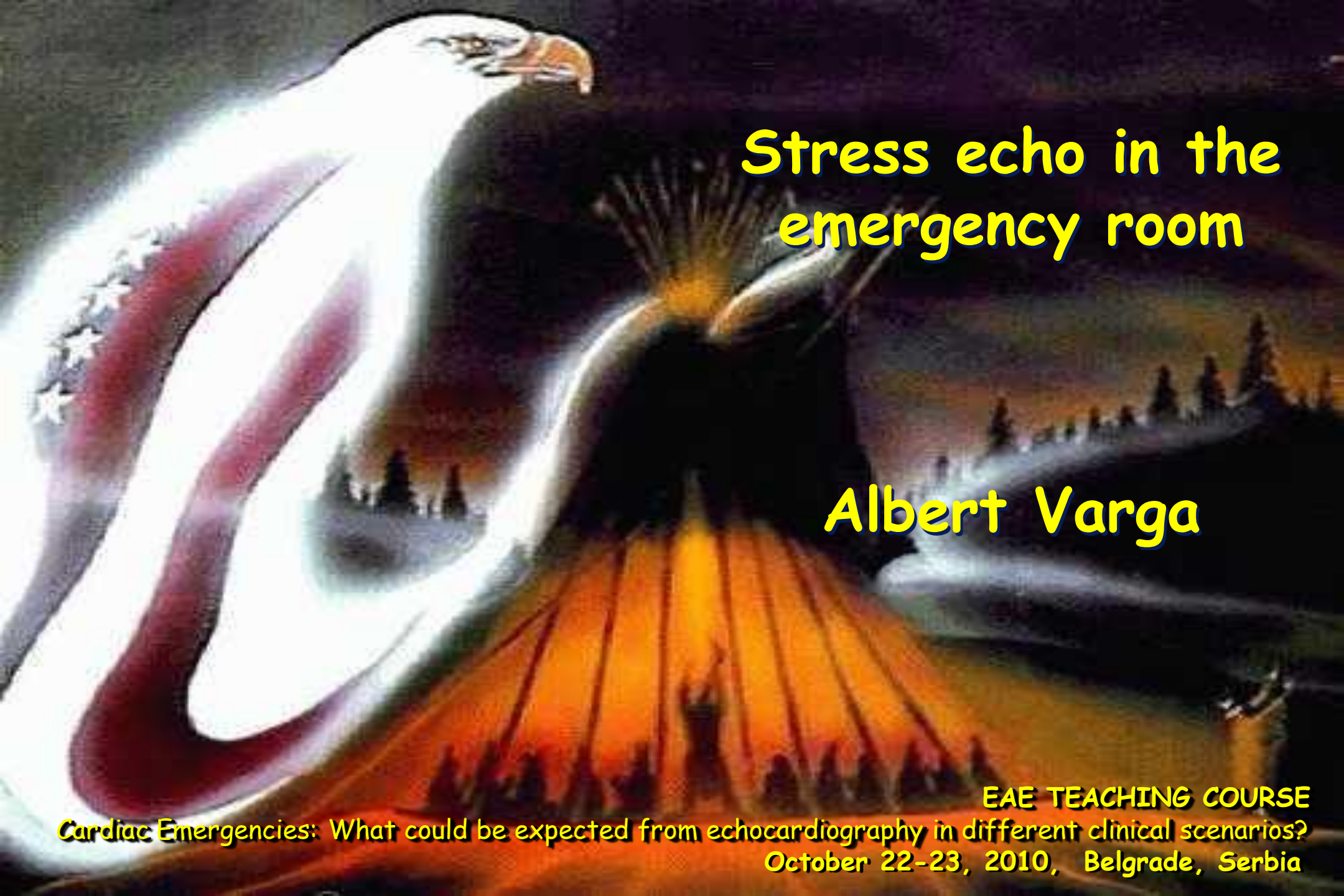


Stress echo in the emergency room

Albert Varga

EAE TEACHING COURSE
Cardiac Emergencies: What could be expected from echocardiography in different clinical scenarios?
October 22-23, 2010, Belgrade, Serbia

Chest pain is a challenge

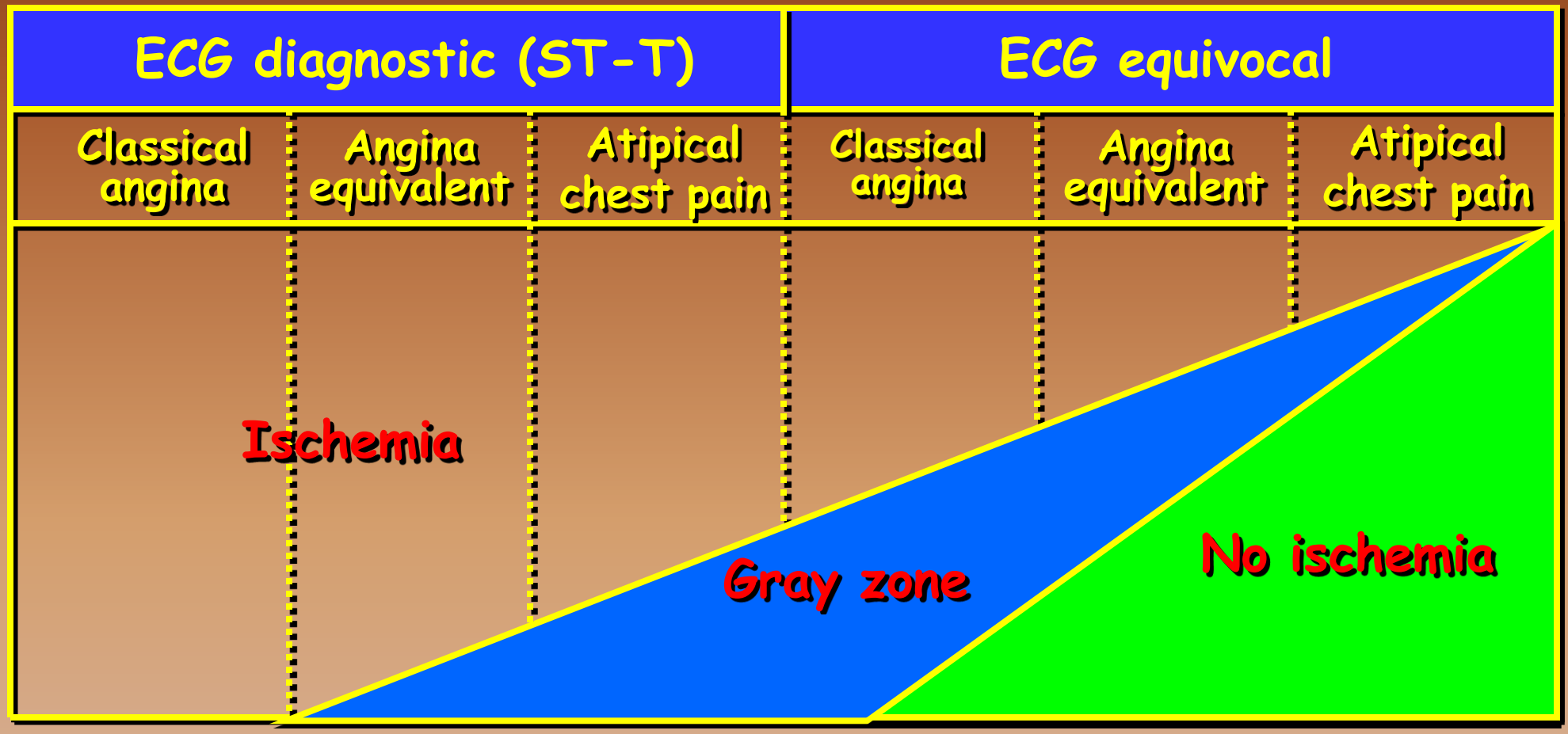
- 5 Million emergency department visits
- 2 million hospitalizations annually with cost of more than $8 billion
- Cardiac etiology found in less than one third
- 2% of patients with acute MI are unrecognized and discharged from the ED

US data)

Goals

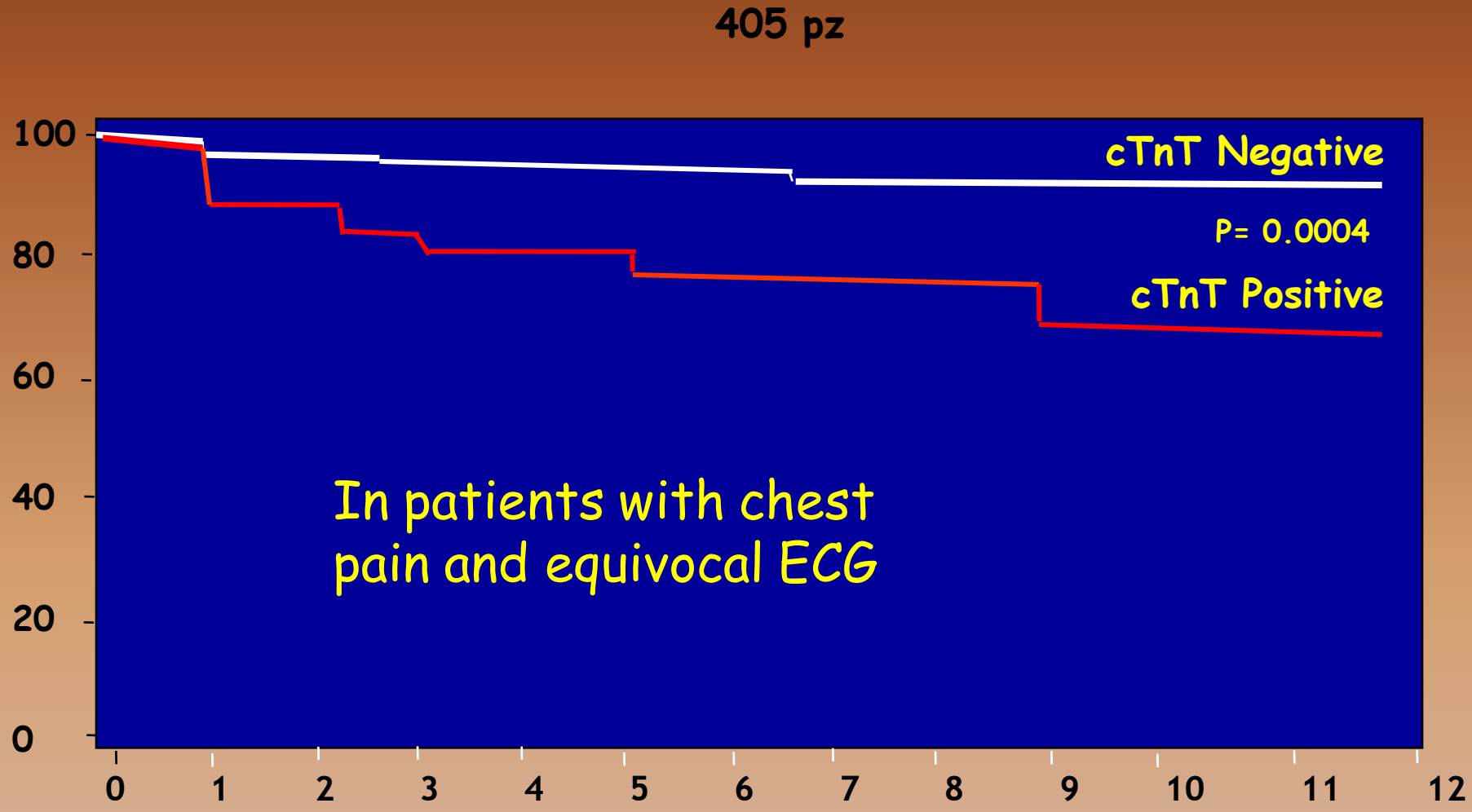
1. Rapid recognition of management of true ACS
2. Recognition of other life-threatening causes of chest pain
   - Aortic dissection
   - Pulmonary embolism
   - Pericarditis, etc..
3. Minimize cost and hospitalization in patients with chest pain of benign etiology.

The role of ECG



Braunwald E., Heart Disease

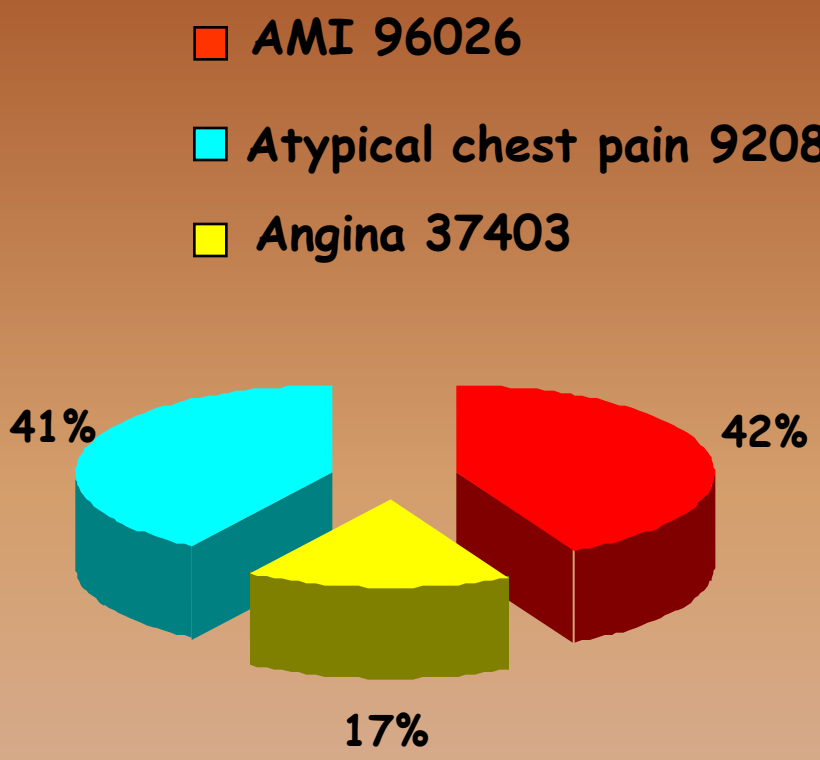
The prognostic value of Troponine T

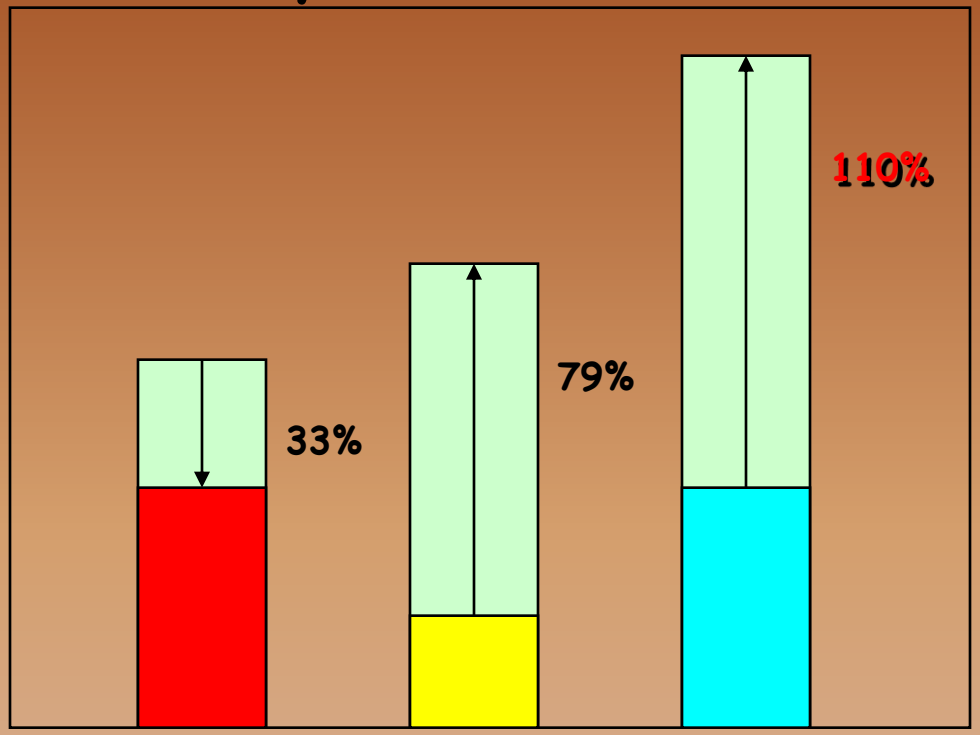


de Filippi et al., JACC 35, 7; 2000:1827-34

Discharge rates for suspected ACS between 1990 and 2000

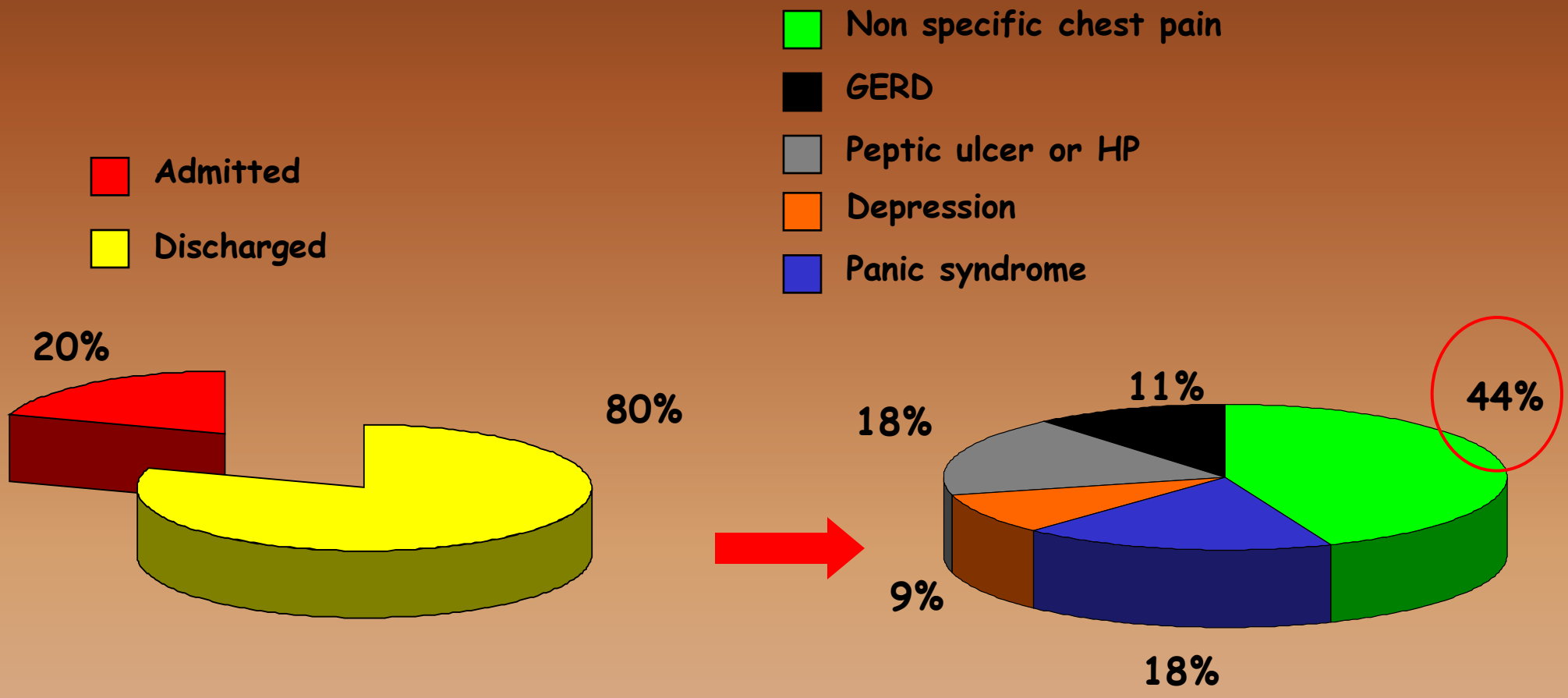
225 512 first visits for suspected ACS
(25% increase in 10 years)





Murphy NF et al. BMJ May 2004

Alternative diagnoses in patients discharged from the CPU

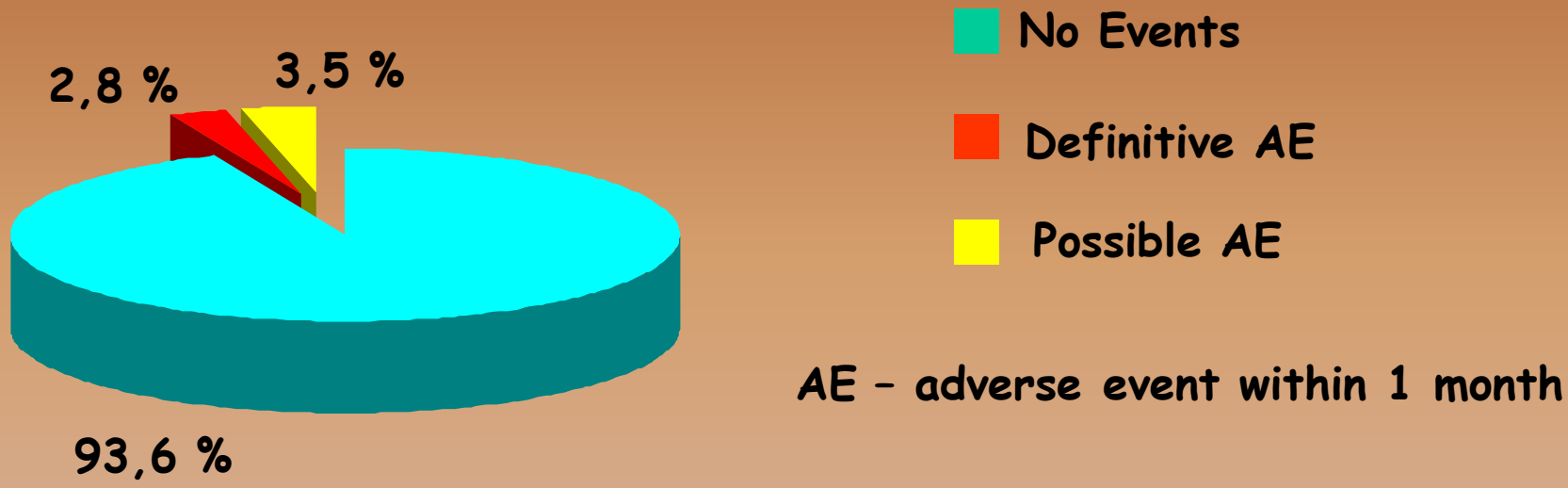


Conti A et al, Am Heart J 2002; 144: 630-635

Internet Tracking Registry for Acute Coronary Syndromes

N =17.737

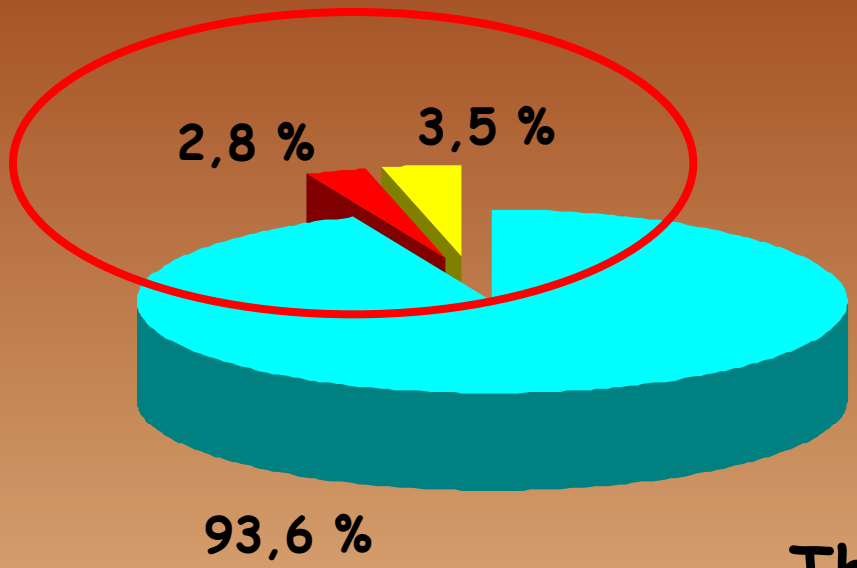
Initial emergency physician impression of noncardiac chest pain n=2992 (17%)



AE – adverse event within 1 month

Miller CD et al. Ann Emerg Med 2004; 44: 565-574

Angry lawyers ante portas



The missed diagnoses account for 20% of indemnity for malpractice in the United States!

Option 1.

- Never manage anyone complaining of chest pain!

Option 2.

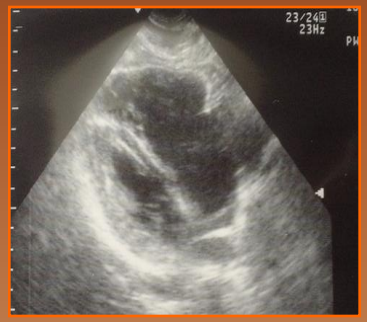
- Never send anyone home!

Option 3.

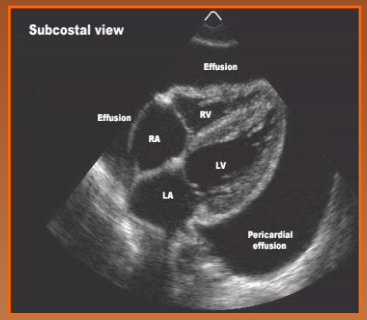
- Perform coronary angiography in everyone!

ECHO in Chest Pain: versatility and serendipity

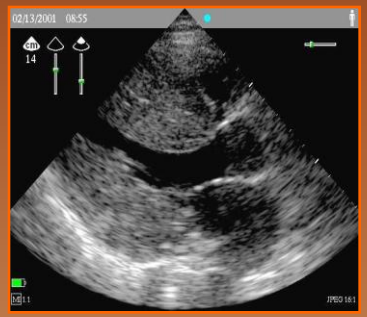
Cardiac



Pulmonary Embolism

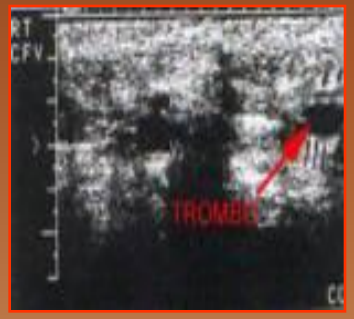


Pericardial Effusion



Cardiomyopathy

Vascular

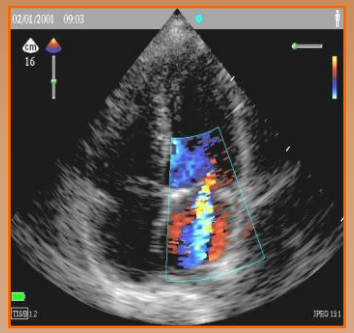


Deep venous thrombosis

Chest

Extravascular Lung Water

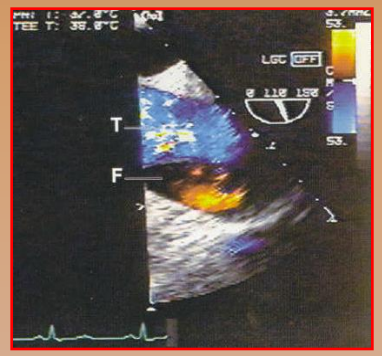
Aortic Dissection



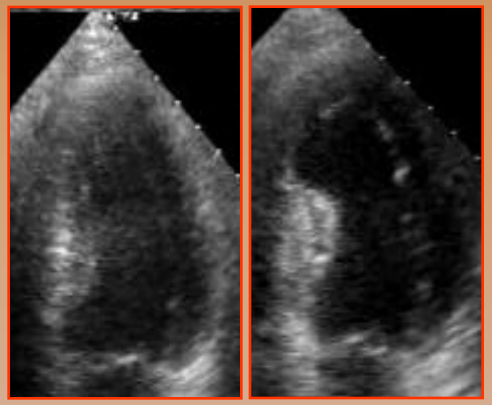
Mitral Insufficiency

Acute Coronary Syndrome

TEE Echo



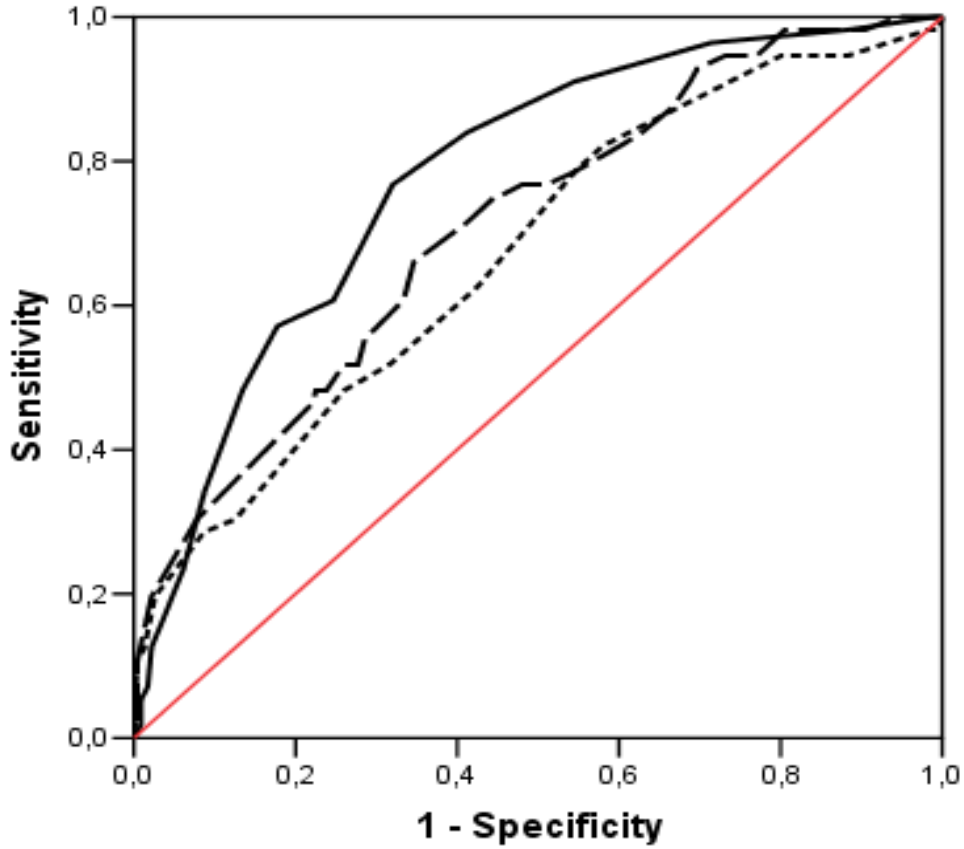
Stress Echo



From diagnosis to prognosis: the Echo score

Score	0	1	2	3
EF	≥50%	49-40%	39-30%	<30%
DD	normal	abnormal relaxation	pseudonormal	restrictive
MR	minimal	mild	moderate	severe
TAPSE	>20 mm	20-15 mm	14-10 mm	<10 mm
ULCs	<5	5-15	16-30	>30

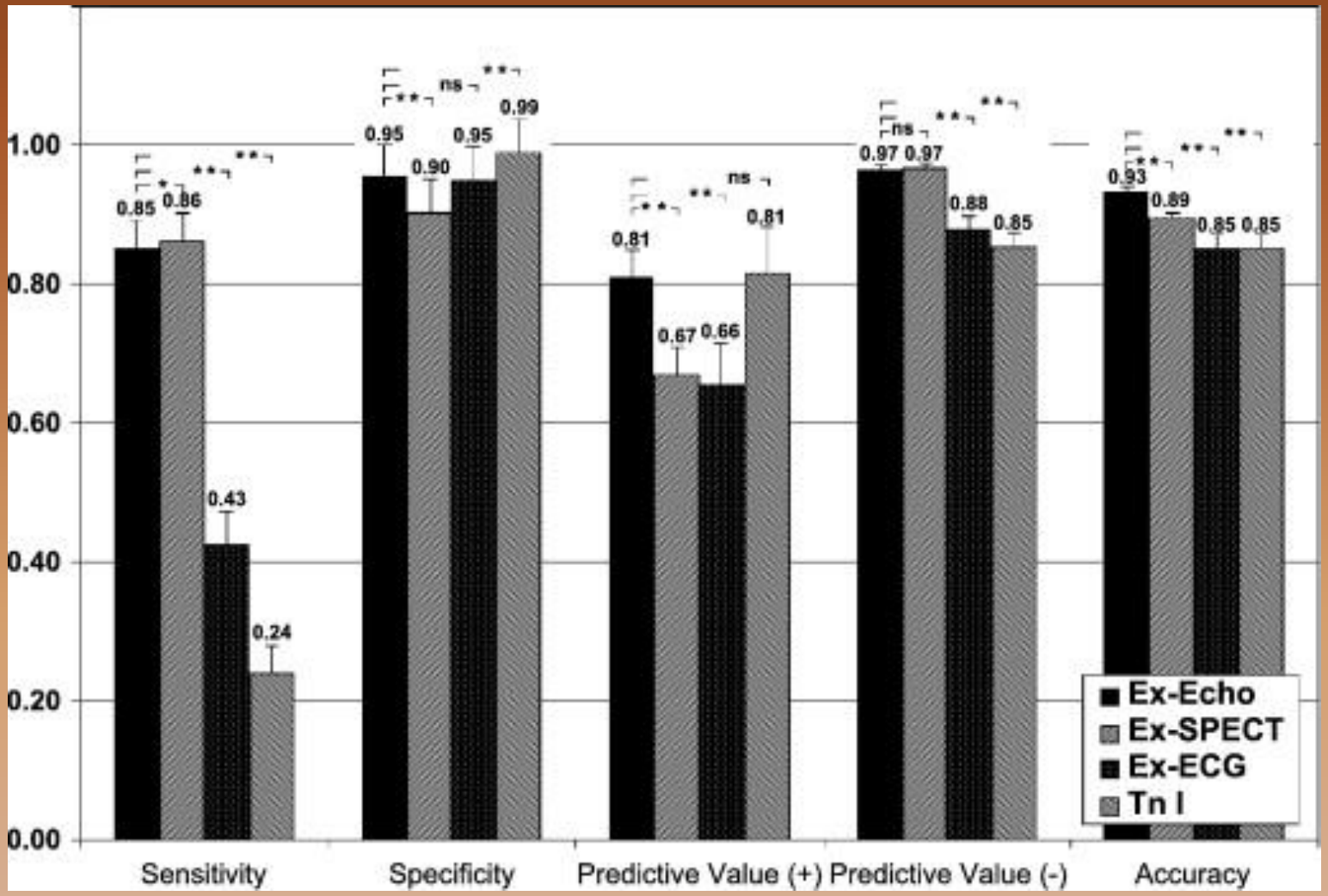
Performance of the tests



Comparison ROC curves

GRACE-TIMI	z=0.96	p=.339
GRACE-ECHO	z=-1.77	p=.074
ECHO-TIMI	z=2,47	p=.013

Imaging modalities in the ED



Conti et al, Am Heart J, 2005

Stress echo in ED

- Stress-induced segmental wall motion abnormalities in coronary artery disease patients can be readily detected by conventional two-dimensional echocardiography. Moreover, echocardiography is the only technique available that allows real-time assessment of stress-induced reduction in systolic wall thickening, a highly specific sign of myocardial ischemia.
- Any form of stress echocardiography should be performed in the echocardiography laboratory at the ED only after an AMI has been completely ruled out.

Zabalgoitia M, Ismaeil M, Echocardiography. 2000 Jul;17(5):479-93

How to - Diagnostic algorithms

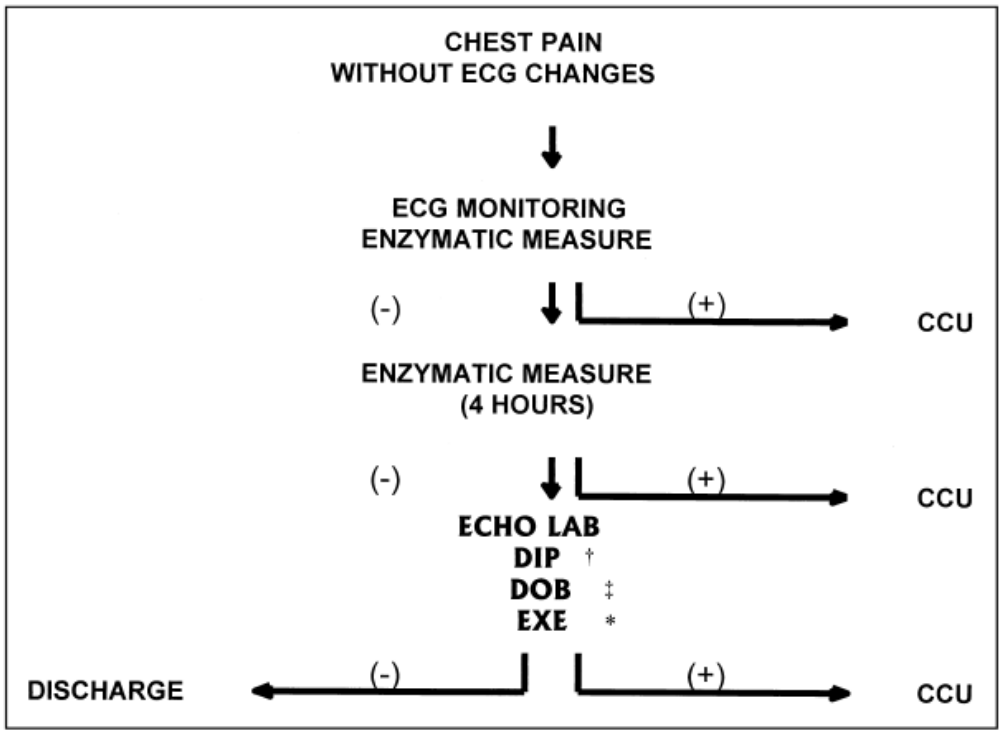
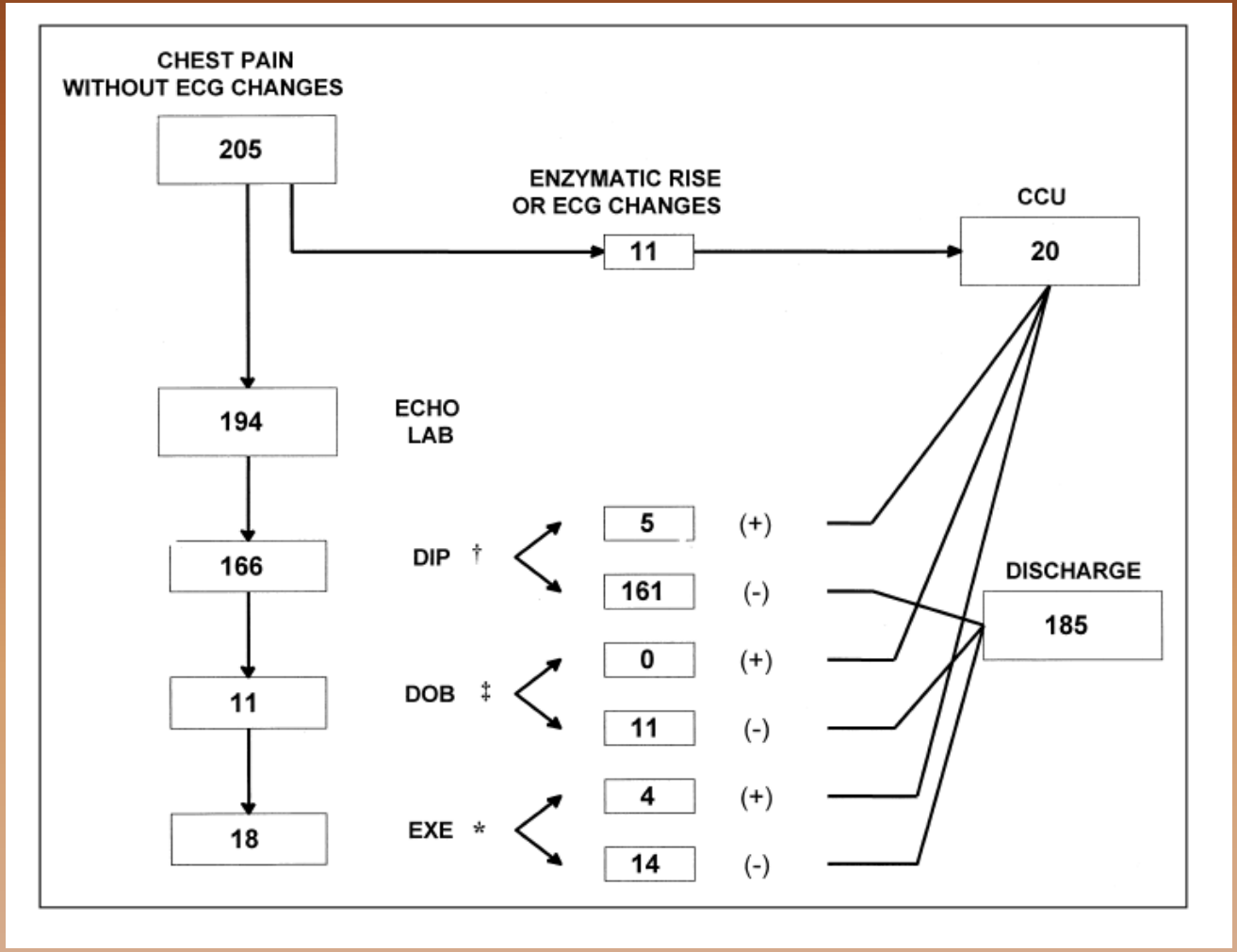


FIGURE 1. Diagnostic algorithm. CCU = coronary care unit; DIP = dipyridamole/atropine stress echocardiography; ECG = electrocardiographic; ECHO LAB = echocardiography laboratory; EXE = exercise electrocardiographic test; DOB = dobutamine/atropine stress echocardiography.

Orlandini A, Am J Cardiol 2000

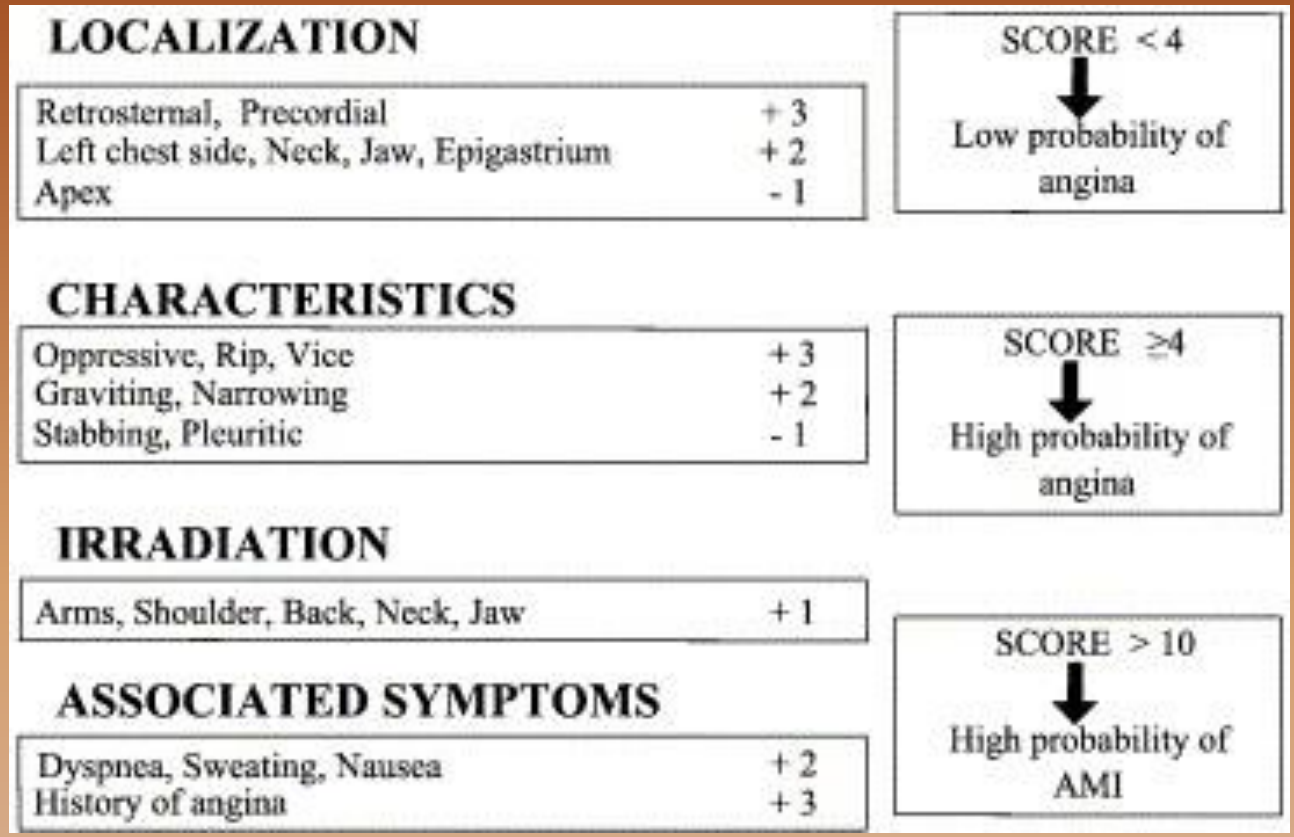
Diagnostic success



Orlandini A, Am J Cardiol 2000

Chest pain score used for clinical triage – SPEED trial

628 Patients



LOCALIZATION	
Retrosternal, Precordial	+ 3
Left chest side, Neck, Jaw, Epigastrium	+ 2
Apex	- 1

CHARACTERISTICS	
Oppressive, Rip, Vice	+ 3
Graviting, Narrowing	+ 2
Stabbing, Pleuritic	- 1

IRRADIATION	
Arms, Shoulder, Back, Neck, Jaw	+ 1

ASSOCIATED SYMPTOMS	
Dyspnea, Sweating, Nausea	+ 2
History of angina	+ 3

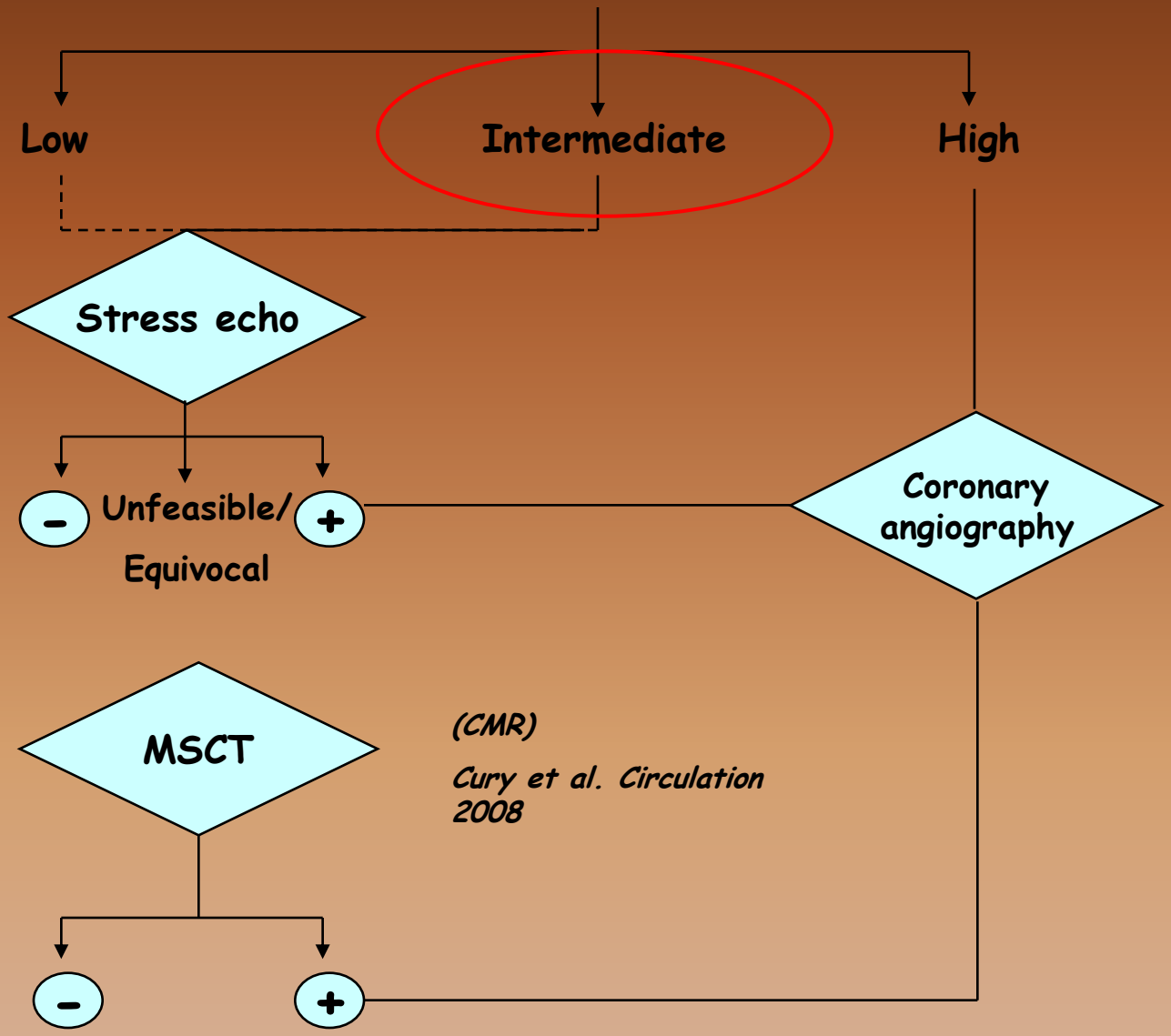
SCORE < 4 ↓ Low probability of angina

SCORE ≥4 ↓ High probability of angina

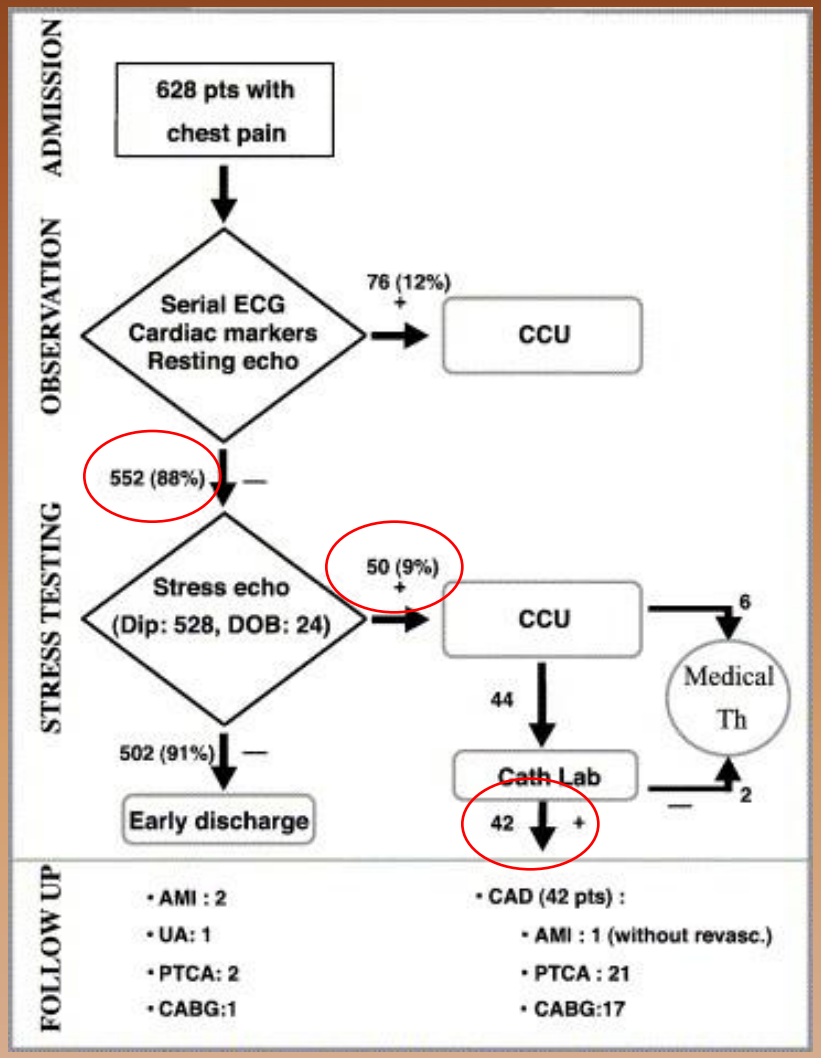
SCORE > 10 ↓ High probability of AMI

Bedetti et al. Int J Cardiol 2005;102:461-7.

Pre-test probability



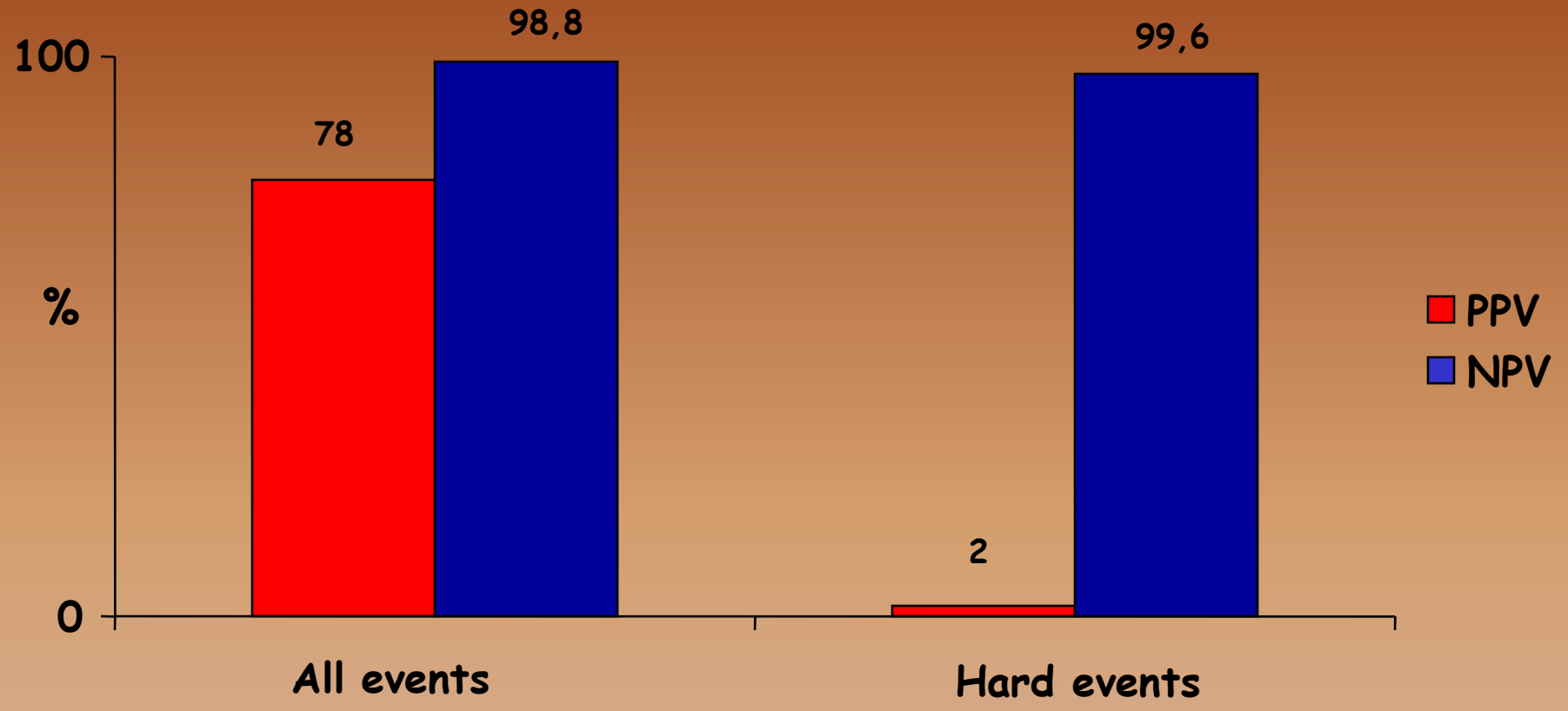
SPEED – flow chart



Bedetti et al. Int J Cardiol 2005;102:461-7.

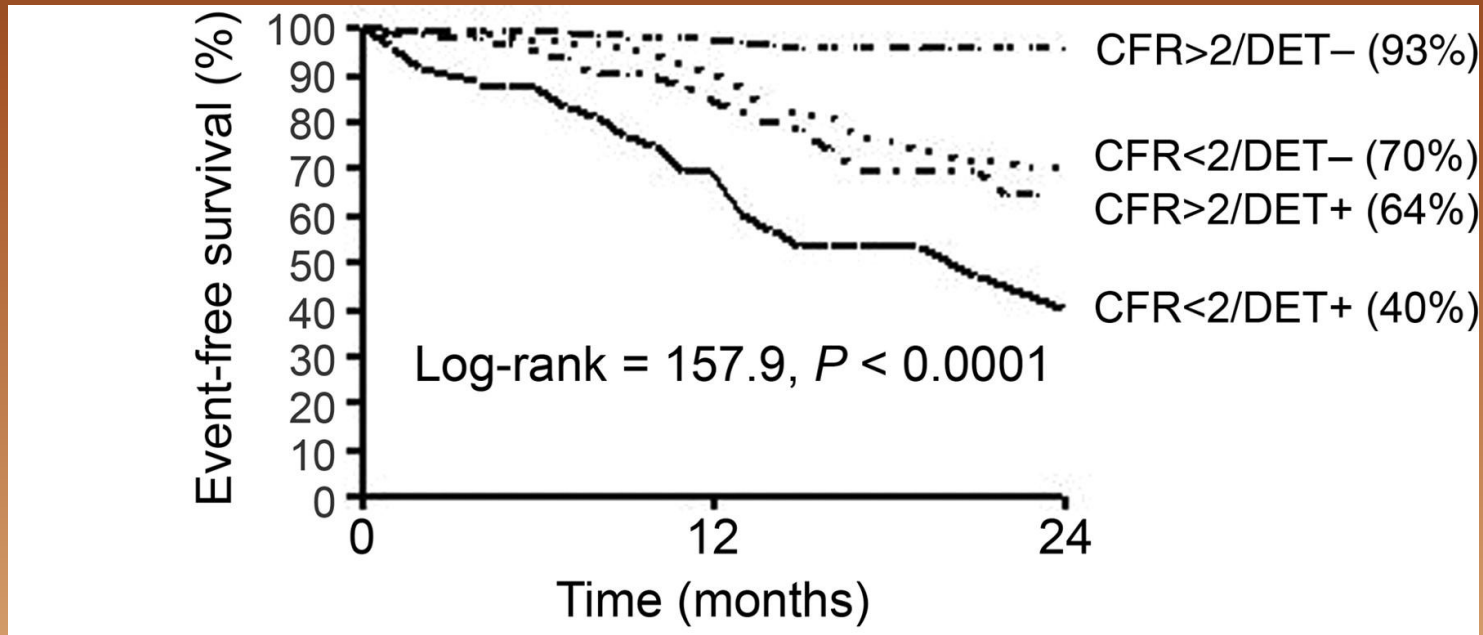
The prognostic value of stress echo in the ED

N=552 patients, follow-up 1 year



Bedetti et al. Int J Cardiol 2005;102:461-7.

The prognostic value of stress echo + CFR



Subjects at risk

CFR>2/DET–	598	313	135
CFR<2/DET–	256	114	42
CFR>2/DET+	104	34	40
CFR<2/DET+	187	24	7

Rigo, Sicari, Djordjevic-Dikic et al. Eur Heart J 2008;29:79-88

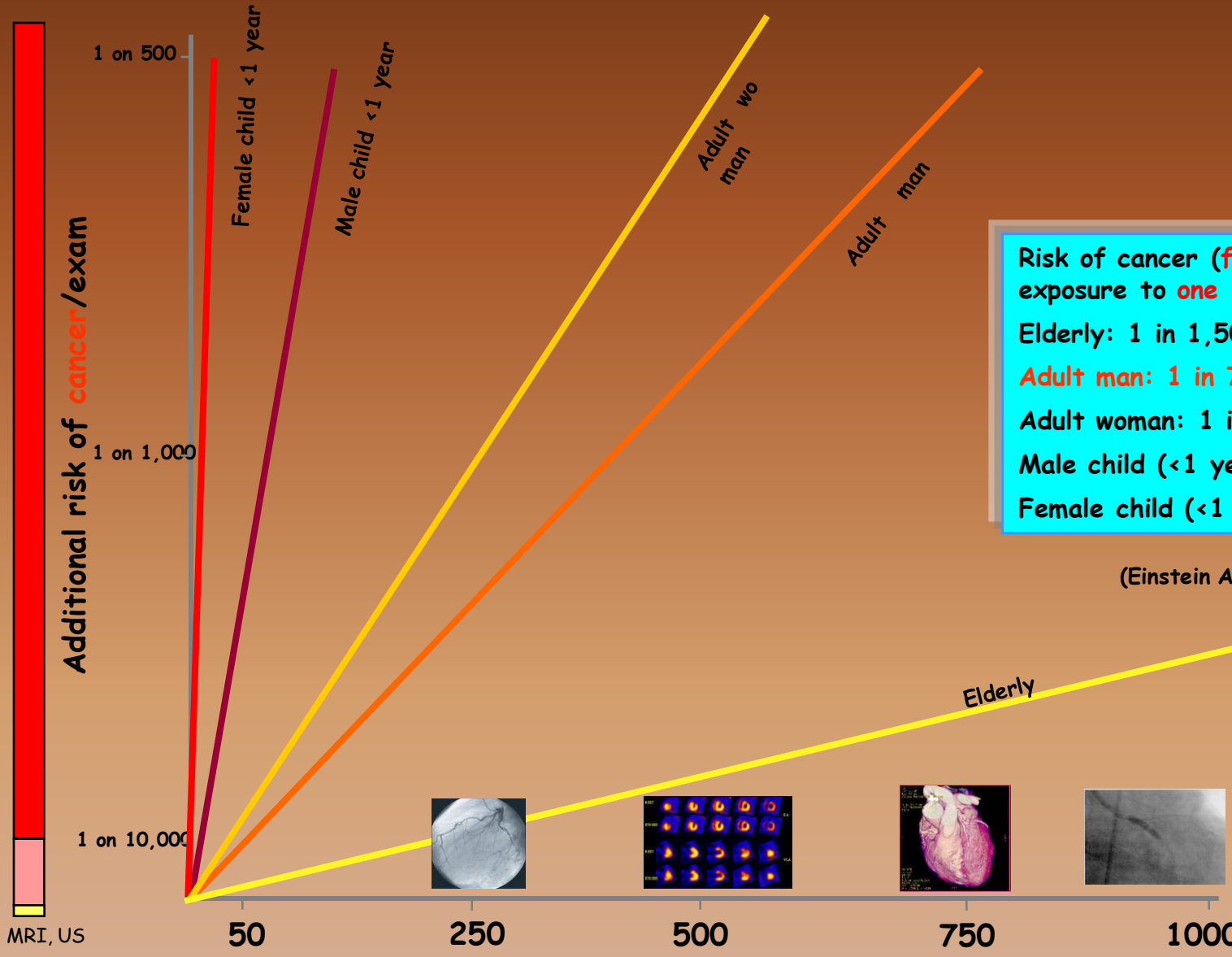
Imaging in stress pain unit: the prognostic value

Authors	Stress	Pts (n)	FU (months)	PPV (%)	NPV (%)	Positivity (%)
STRESS ECHO						
Trippi, JACC 1997	Dobutamine	139	3	5.15	98.5	5
Colon, Am J Cardiol 1998	Exercise	108	12.8	45	99	7
Gelejinse, Eur Heart J 2000	Dobutamine	80	6	44.5	95	45
Orlandini et al, 2000	Dipyridamole	177	6		99	5/177 (%)
Buchsbaum, Ac Em M 2001	Exercise	145	6	43	99.3	3
Bholasingh, JACC 2003	Dobutamine	377	6	31	96	7
Bedetti, Int J Cardiol 2005	Dipyridamole	552	13	78	98.8	9
Conti, Am Heart J 2005	Exercise	503	6	81	97	20
SPECT						
Conti, Am Heart J 2005	Exercise	503	6	67	97	24
Goldstein, JACC 2007	Pharmacol	98	6	50	95.7	5
Gallagher, Ann Em M 2007	Pharmacol	85	1	38	97	15
64-MDCT						
Goldstein, JACC 2007		99	6	50	98.9	9
Gallagher, Ann Em Med 2007		85	1	50	88	14
Rubinstein, Circulation 2007		58	15	52	97	40
RM						
Cury RC, Circulation 2008		62	1	86	96	21

Head-to-head comparison between MSCT and stress echo

	MSCT	Stress echo
Approach	Anatomic	Functional
Direct alternative	Coronary angiography	MPI
Radiation exposure	500-1500 chest x-rays	Ø
Stress required	No	Yes
Contrast required	Yes	No
Relative cost	3	1
High predictive value	Negative	Negative (positive)
Next generation	CT-PET	2D-Doppler (CFR)

Cardiological imaging: the safety issue



Risk of cancer (fatal and non-fatal) for exposure to one 64-slice coro-CT

Elderly: 1 in 1,500

Adult man: 1 in 750

Adult woman: 1 in 500

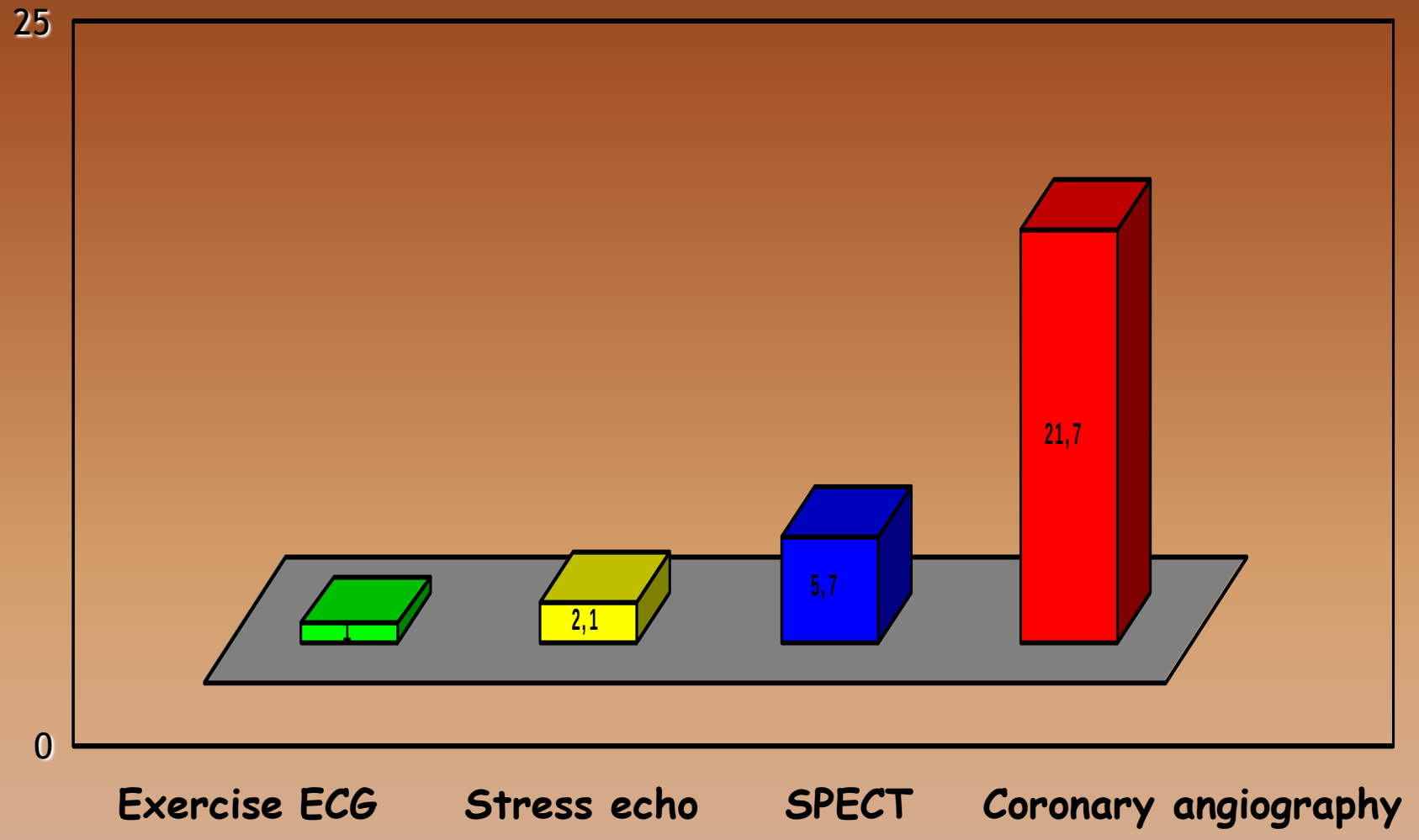
Male child (<1 year): 1 in 200

Female child (<1 year): 1 in 100

(Einstein A, et al. JAMA 2007)

Picano E, BMJ 9 October 2004, updated with BEIR VII, 2006

Advantage - price



Bedetti G, 6:21, Cardiovascular Ultrasound 2008

Limitations of stress echo in ED

- Availability
- Accessibility
- Equipment
- Exam time
- Expertise

Stress echo in acute coronary syndrome

Indication	Appropriate	Uncertain	Inappropriate
Appropriateness Score (1-9)	7-9	4-6	1-3
Intermediate pre-test probability (no dynamic ST changes AND serial cardiac enzymes negative)	√		
Risk assessment without recurrent symptoms or signs of heart failure	√		
Low pre-test probability, ECG interpretable and able to exercise			√
Routine evaluation prior to hospital discharge (in asymptomatic post-PCI)			√
High pre-test probability of CAD			√
ECG ST elevation			√

Douglas P. et al., ACCF Guidelines, Circulation 2008

Circulation
JOURNAL OF THE AMERICAN HEART ASSOCIATION

American Heart Association®
Learn and Live℠

Safety and Utility of Exercise Testing in Emergency Room Chest Pain Centers : An Advisory From the Committee on Exercise, Rehabilitation, and Prevention, Council on Clinical Cardiology, American Heart Association

Richard A. Stein, Bernard R. Chaitman, Gary J. Balady, Jerome L. Fleg, Marian C. Limacher, Ileana L. Pina, Mark A. Williams and Terry Bazzarre

Circulation 2000;102;1463-1467
Circulation is published by the American Heart Association. 7272 Greenville Avenue, Dallas, TX

Exercise ECG testing should be used in most chest pain centers as the first-line noninvasive stress test for ambulatory patients when the resting ECG is normal and the patient is not on digoxin therapy. In patients who do not meet these criteria, stress imaging should be considered.

In patients with suspected ACS, if the follow-up 12-lead ECG and cardiac biomarkers measurements are normal, a stress test (exercise or pharmacological) to provoke ischemia should be performed in the ED, in a chest pain unit, or on an outpatient basis in a timely fashion (within 72 h) as an alternative to inpatient admission. Low-risk patients with a negative diagnostic test can be managed as outpatients.

(CLASS I Level of Evidence: C)

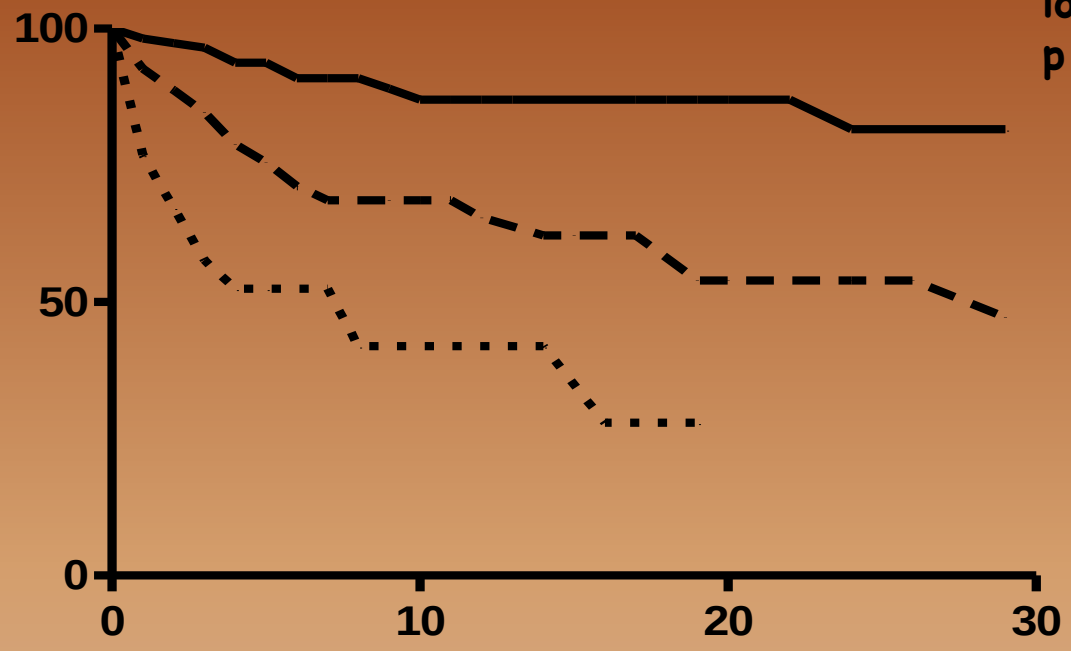
Conclusion

- Stress echocardiography is a good additional diagnostic tool for CAD in the ED,
- Has an excellent negative predictive value,
- Appropriatness criteria,
- Needs expertise, experince (training),time
- Fast track for discharge reduces costs and has no risk to the patients.

Hvala vam lepo na pažnji!

Echo score follow-up

56 hard events: 36 deaths; 20 non-fatal MI



log rank = 35.9
p < .0001

median follow-up:
5 months
(1st quartile 1, 3st quartile 10)

Subjects at risk

Echoscore 0-4	165	45	22	10
Echoscore 5-9	96	25	12	8
Echoscore 10-15	26	5	2	2