L'ECO da sforzo nello studio della cardiopatia ischemica. Il razionale dalla scelta con l'ecostress farmacologico. Come stabilire il test giusto per ogni paziente?

VII Congresso di Echocardiochirurgia, Milano, 5-7 maggio 2014

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Dipartimento di Ecocardiografia
Centro Cardiologico Monzino, IRCCS
Università di Milano

Centro Cardiologico Monzino

Cardiopatia ischemica
Accuratezza di ECO da sforzo

	sens	spec	acc d
Ryan ’88	78%	100%	
Marwick ’92	87%	86%	82%
Armstrong ’87		86%	
Quinones ’92	74%		
Roger ’94	91%		
Lumacher	91%	88%	
Mitsuhashi ’95	82%	88%	

Stress echocardiography, stress single-photon-emission computed tomography and electron beam computed tomography for the assessment of coronary artery disease: A meta-analysis of diagnostic performance

Majanka H. Heijenbrok-Kal, PhD,[a,b] Kirsten E. Fleischmann, MD, MPH,[c] and M.G. Myriam Hunink, MD, PhD
Rotterdam, The Netherlands; San Francisco, CA; and Boston, MA

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Table II. Pooled sensitivity, specificity, and log of the diagnostic odds ratio and corresponding 95% confidence intervals per type of test using a random effects meta-analysis

Test	No. of studies	Sensitivity % (95% CI)	Specificity % (95% CI)	lnDOR (95% CI)
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Dipyridamole echo	58	71.9 (68.6-75.2)	94.6 (92.9-96.3)*	3.0 (2.8-3.2)
Dobutamine echo	102	81.0 (79.1-82.9)	84.1 (82.0-86.1)*	2.9 (2.7-3.0)
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Exercise SPECT	48	88.1 (85.8-90.3)†	68.8 (62.8-74.8)	2.7 (2.6-3.0)
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CI, Confidence interval; *lnDOR*, natural logarithm of the diagnostic odds ratio.
*Nonoverlapping confidence intervals indicating a statistically higher specificity than the corresponding SPECT test.
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‡Nonoverlapping confidence intervals indicating a statistically higher sensitivity than all other tests, except for adenosine and dipyridamole SPECT and a statistically lower specificity than all other tests except for exercise SPECT.

Valutazione prognostica

J Am Coll Cardiol. 2007 Jan 16;49(2):227-37. Epub 2006 Dec 29.

The prognostic value of normal exercise myocardial perfusion imaging and exercise echocardiography: a meta-analysis.

Metz LD, Beattie M, Hom R, Redberg RF, Grady D, Fleischmann KE.

Department of Medicine, New York University School of Medicine, New York, New York, USA.

Metaanalisi (articoli dal ’90 al ’05)

9000 pazienti

Eco stress negativo bassissima incidenza di eventi (<1% anno nei successivi 4-5 anni, rischio annuale del 0,4-0,9% l’anno) Metz et Al, JACC 2007

ECHO stress

- Esercizio fisico
- treadmill
- cyclette (in ortostatismo, supina)
- esercizio isometrico
- Farmacologico
- dobutamina
- dipiridamolo
- adenosina
- ergonovina
- arbutamina
- Altri
- atrial pacing
- cold pressor test
- stress mentale
- iperventilazione

Test alla dobutamina

- E’ una catecolamina sintetica, agisce sui recettori beta-1adrenergici del miocardio inducendo aumento della frequenza, aumento della conduzione AV, aumento della contrattilità

- Effetto alfa-adrenerigico, con vasocostrizione
- Determina aumento d l consumo di O2 e alla dosi impiegate aumenta di 3 volte il flusso coronarico
- Breve emivita
- Valutazione della vitalità miocardica quando utilizzato a basse dosi

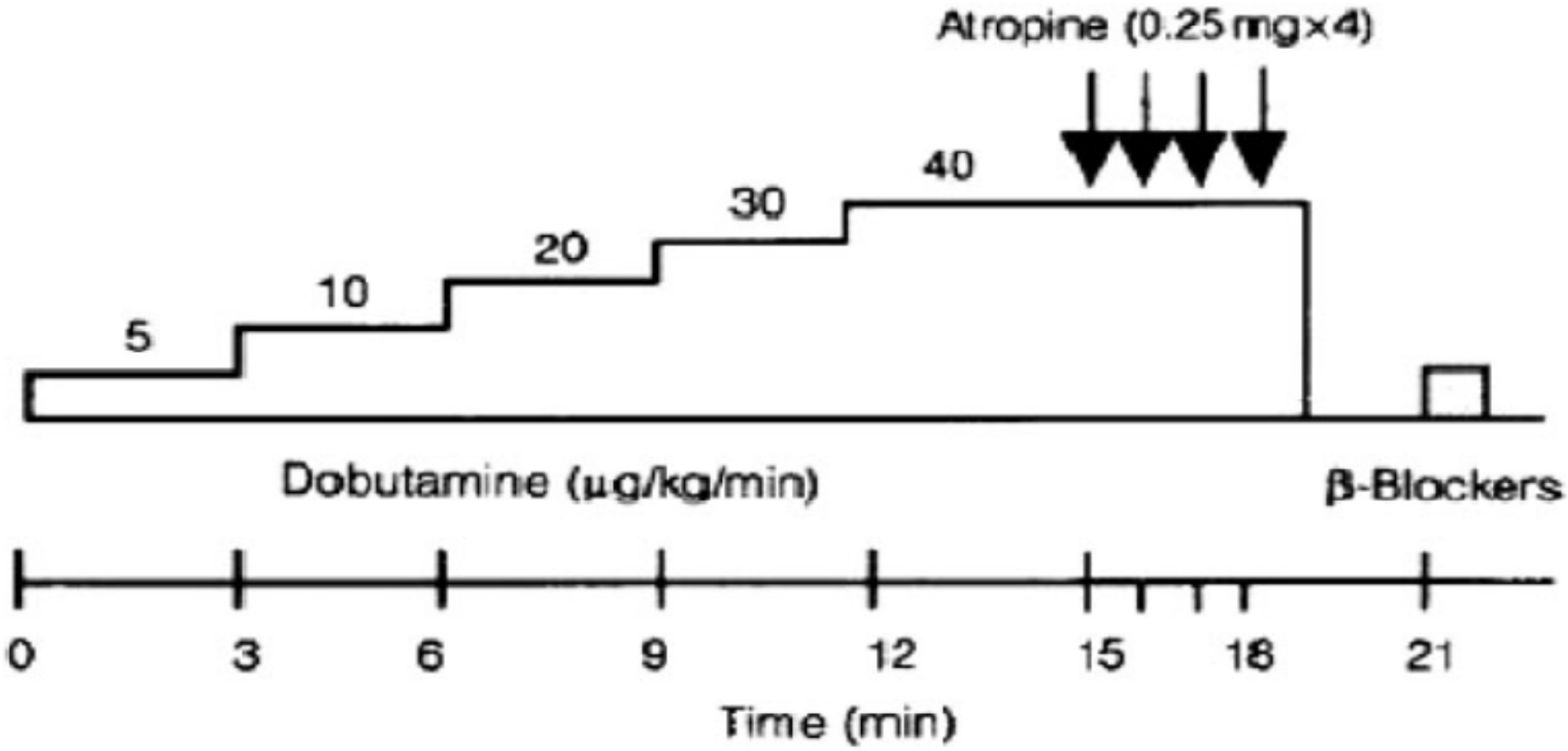


Figure 1 State-of-the art protocol of dobutamine stress echocardiography.

European Journal of Echocardiography. 2008 Jul;9(4):415-37

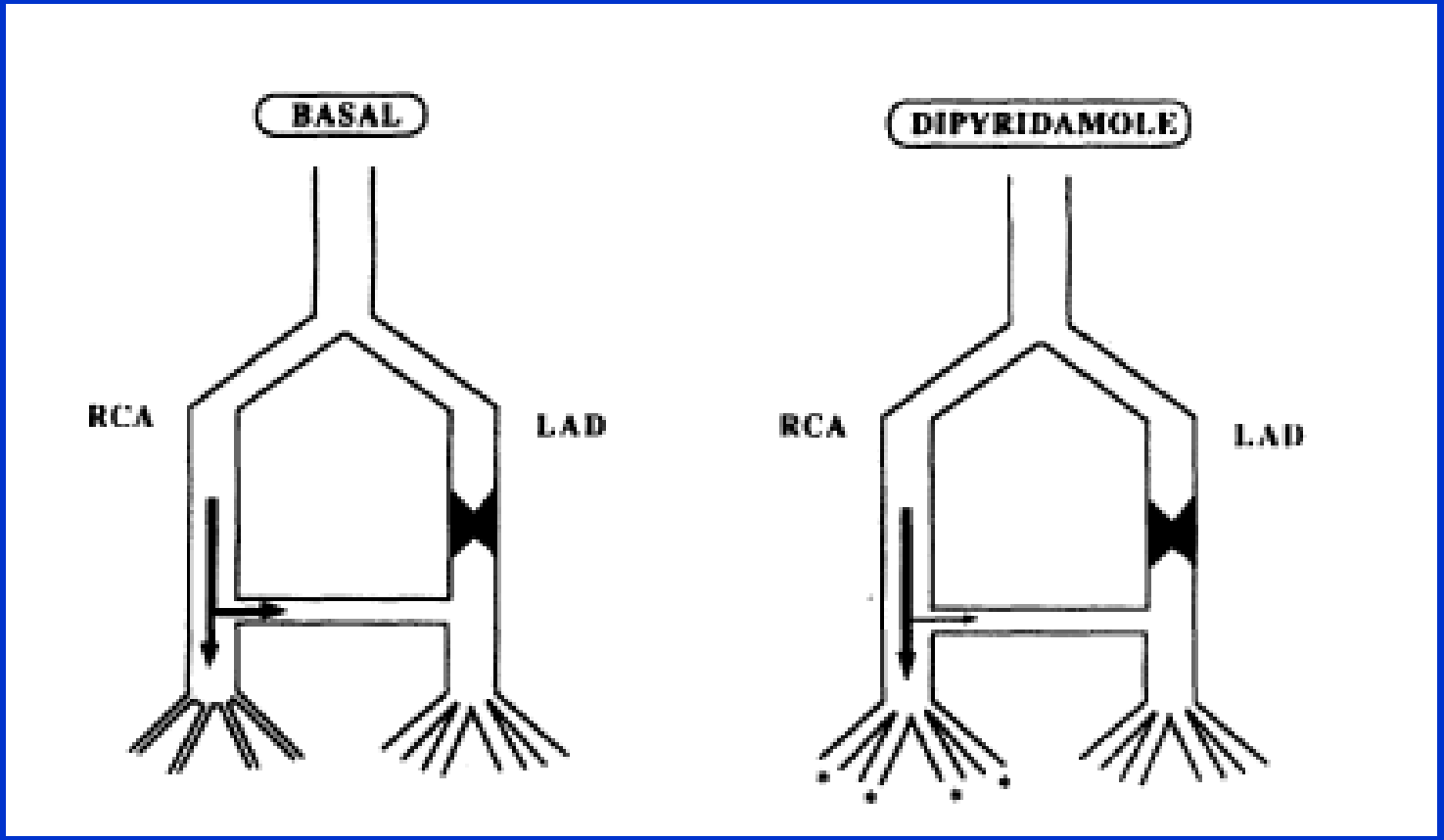
Effetti collaterali

- **Dobutamina:**
- aritmie ventricolari complesse
- Nausea
- Ipotensione (>30 mm Hg)
- Bradicardia
- Ipertensione
- Ostruzione intraventricolare
- Descritti eventi gravi: rottura di cuore, infarto miocardico, fibrillazione ventricolare, vasospasmo coronarico refrattario

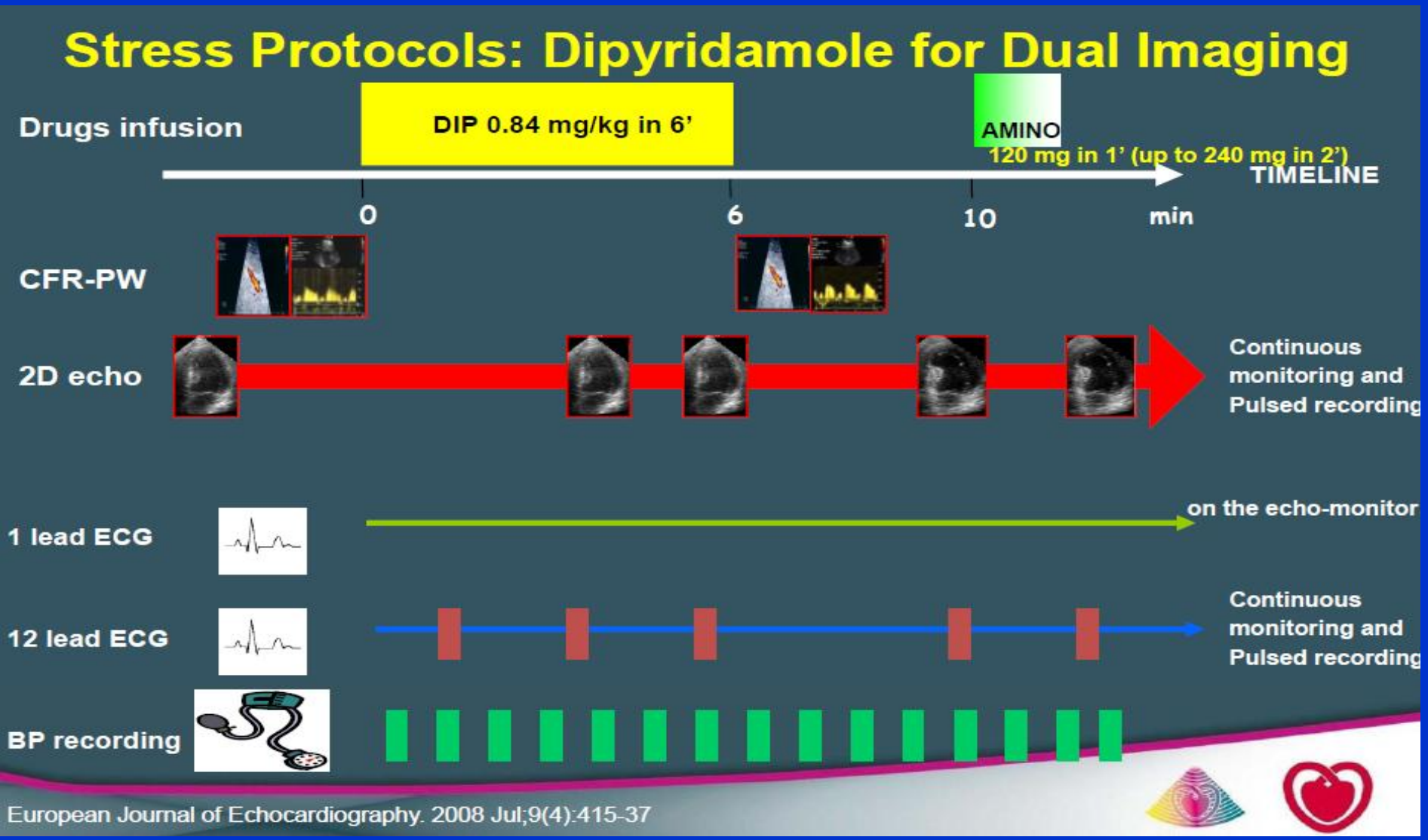
Test al dipiridamolo

- **Farmaco vasodilatatore che riduce la disponibilità di O2 attraverso fenomeni di maldistribuzione di flusso (furto); stimola i recettori adenosinergici A2a presenti su cellule endoteliali e muscolari lisce delle coronarie.**
- **La dose utilizzata per lo stress aumenta di 4 volte il flusso coronarico**

- **Disomogenea distribuzione del flusso coronarico**



Stress Protocols: Dipyridamole for Dual Imaging



European Journal of Echocardiography. 2008 Jul;9(4):415-37

Controindicazioni ed effetti collaterali

- **Dipiridamolo:**
- **Assunzione di cibi contenenti caffeina e farmaci contenenti teofillina**
- **BAV 2 e 3°**
- **Asma bronchiale**
- **Effetti collaterali minori nel 5% dei pazienti (ipotensione, bradicardia, nausea, mal di testa)**

UNIVERSITY of York
Centre for Reviews and Dissemination

NHS
National Institute for
Health Research

A meta-analytic comparison of echocardiographic stressors

Noguchi Y, Nagata-Kobayashi S, Stahl J E, Wong J B

Authors' conclusions

The authors conclude that Tap-TEE is a very accurate test for both ruling in and ruling out CAD, although its invasiveness may limit its clinical acceptability. Exercise is a well-balanced satisfactory test for both ruling in and ruling out CAD, but performance might be lower in the elderly. Dobutamine offers a reasonable compromise to exercise. Dipyridamole might be good for ruling in but not for ruling out CAD. Adenosine was the least useful stressor in diagnosing CAD.

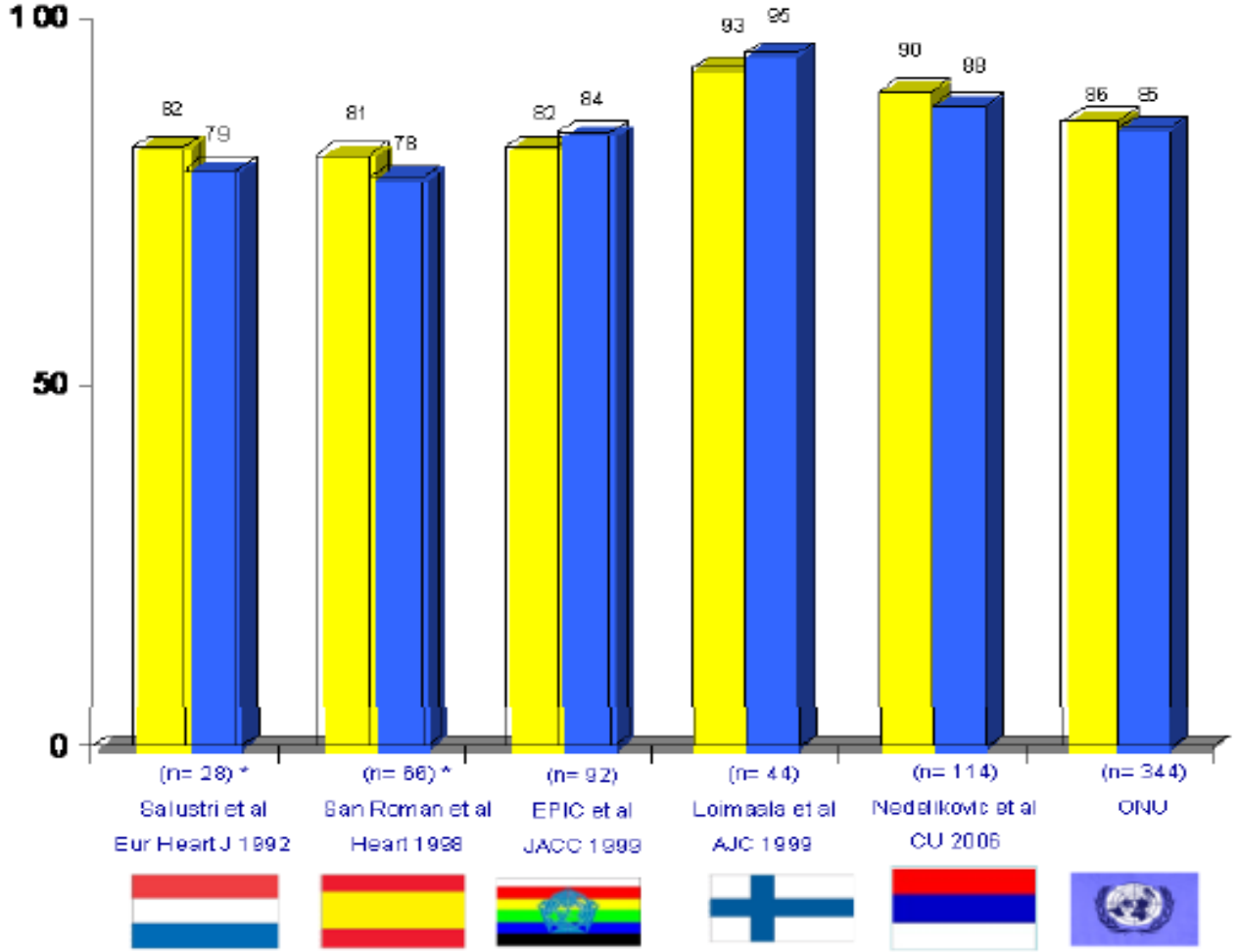
Confronto tra diverse metodiche

- 117 pts, senza alterazioni della cinetica ventricolare e candidati a coronarografia, sottoposti a esercizio, test al dipiridamolo e test con dobutamina:

	DOBATRO	DIPATRO	EX (Bruce)
Sens	96%	93%	90%
Spec	92%	92%	87%

- Nedeljkovic et Al, Cardiovascular Ultrasound, 2006

The Stressors: Dip and Dob*
0.84 in 6'* or 0.84 in 10' + atropine



*Ref 36

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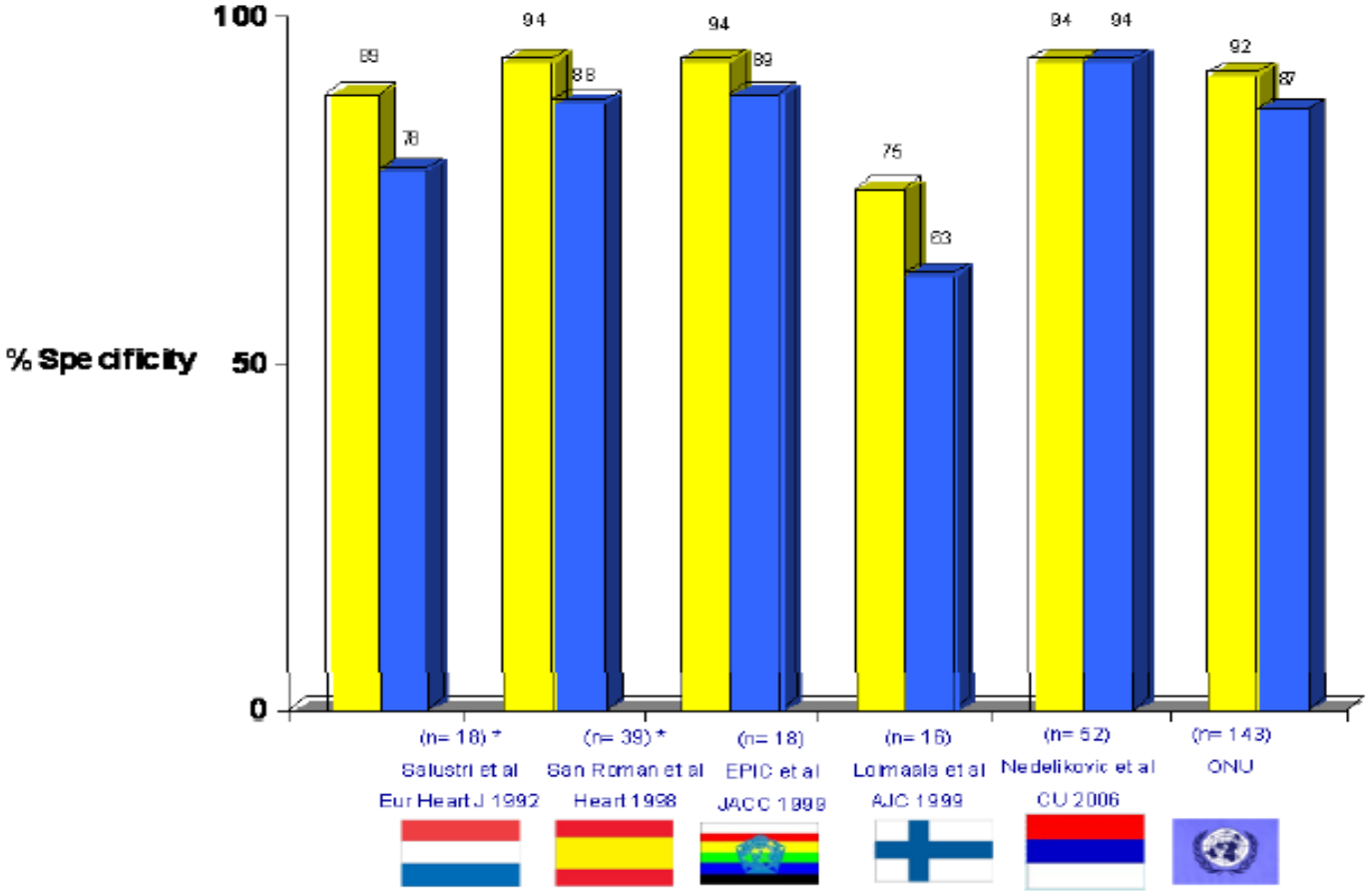
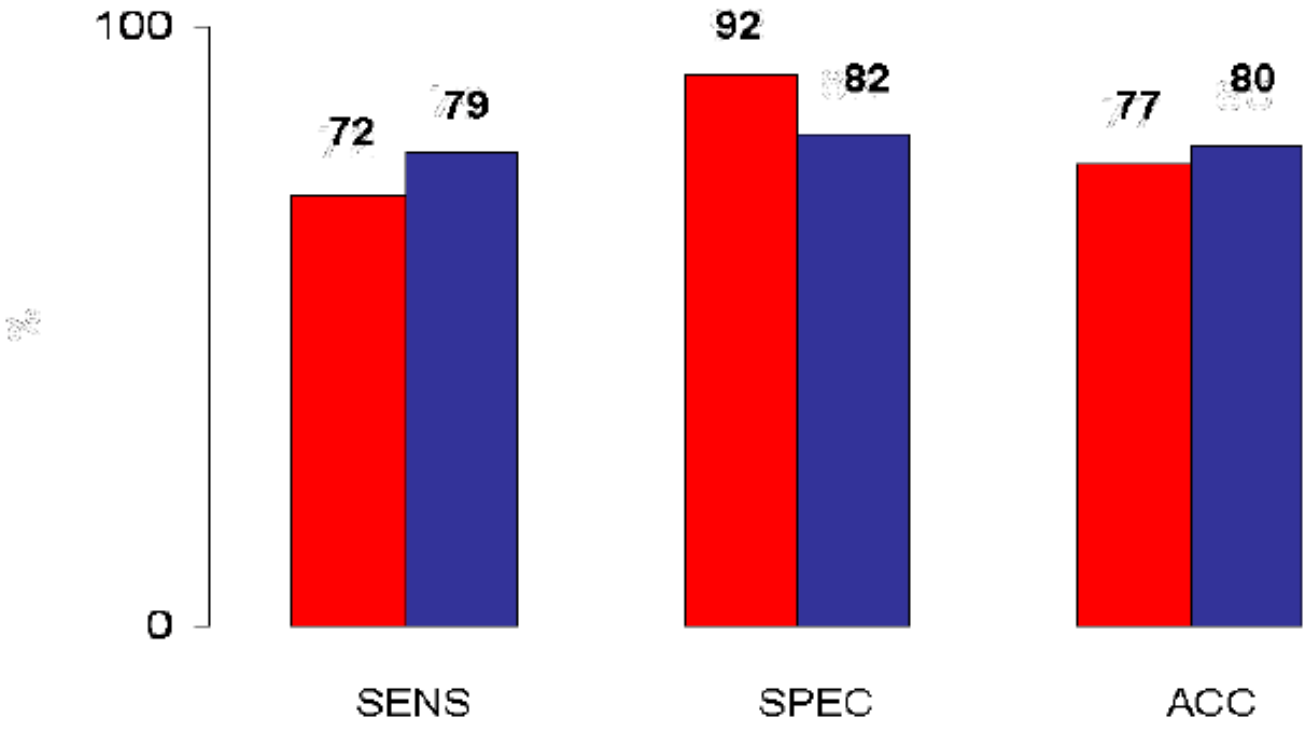


Key point: Both dobutamine and dipyridamole should be performed with high-dose protocols to obtain high sensitivities, comparable with maximal exercise.

*Ref 36

European Journal of Echocardiography. 2008 Jul;9(4):415-37

DIP vs. EXE*



Am J Cardiol. 2001 May 15;87(10):1193-6; A4.

Comparison of dipyridamole and exercise stress echocardiography for detection of coronary artery disease (a meta-analysis).

de Albuquerque Fonseca L, Picano E.

CNR-Institute of Clinical Physiology, Pisa, Italy.

Key point: Physical or pharmacological (inotropic or vasodilator) stress echocardiography have comparable diagnostic accuracies. The choice of one test over the other will depend on relative contraindications. Large volume laboratories should be fully acquainted with all the three main forms of stress in order to apply the test in all patients. In the presence of a submaximal first-line stress for limiting side effects, the second choice should be applied, since submaximal (physical or pharmacological) stresses have suboptimal diagnostic value.

Stress echocardiography, stress single-photon-emission computed tomography and electron beam computed tomography for the assessment of coronary artery disease: A meta-analysis of diagnostic performance

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Vantaggi dei test farmacologici

- -organizzativi (non necessitano di laboratorio dedicato con ergometro)
- -possibiltà di valutare la riserva di flusso coronarico (quando si usano vasodilatatori)
- -possibilità di utilizzare nuove metodiche
- -qualità delle immagini (nessuna interferenza del respiro né del movimento; possibilità di monitorare le immagini per l'intera durata dell'esame)

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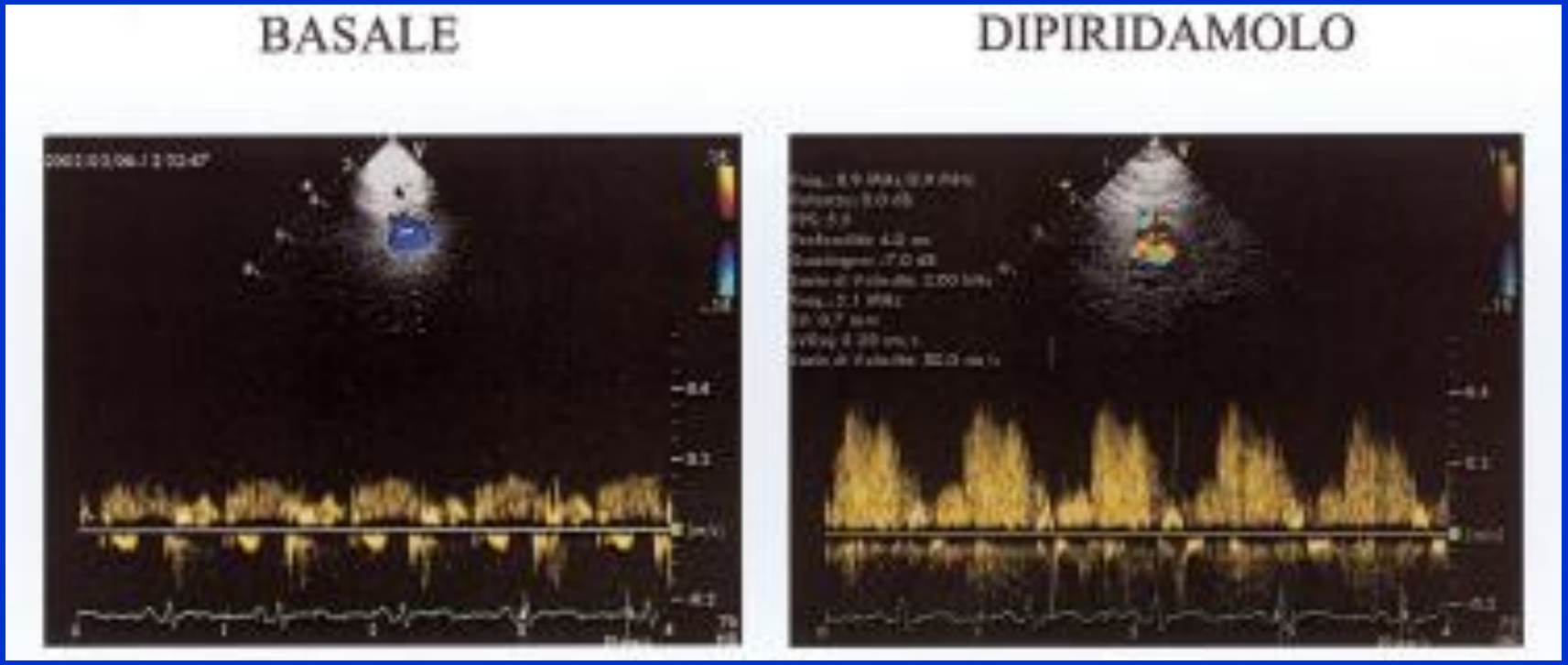
Eco stress con vasodilatatori



Valutazione della riserva di flusso coronarico

- **Valutazione limitata alla IVA**
- **Impossibilità a distinguere la componente legata al macro- e al microcircolo**
- **Valutazione di flusso e di cinetica (la alterazione della cinetica parietale è più efficiente per identificare la presenza di stenosi coronarica significativa, la normalità della riserva di flusso coronarico è più efficace nell'escluderla).**

Valutazione prognostica

Potere prognostico addizionale combinando la valutazione della riserva di flusso coronarico e le modificazioni della cinetica durante test al dipiridamolo (Cortigiani, JACC 2007; Rigo, Eur Heart J 2007)

In 460 pts con echo dipiridamolo negativo per alterazioni della cinetica regionale, lo studio della riserva di flusso coronarica su IVA permetteva di identificare pattern prognostici diversi: riserva di flusso ridotta, in particolare su IVA, forte capacità predittiva di eventi maggiori.

Cortigiani et Al, Heart 2009.

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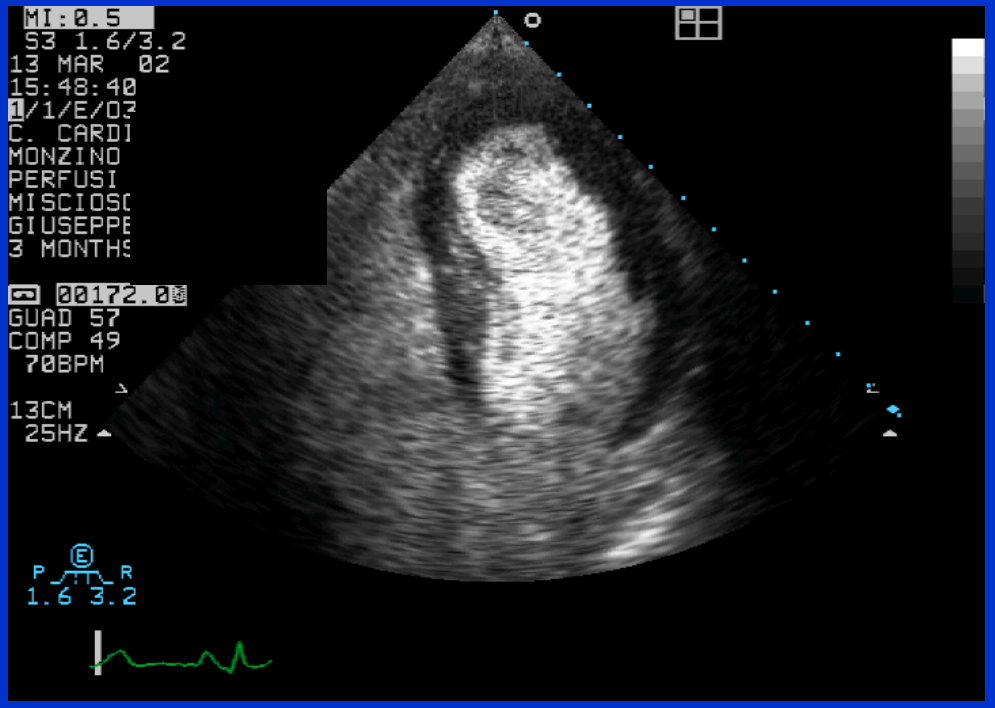
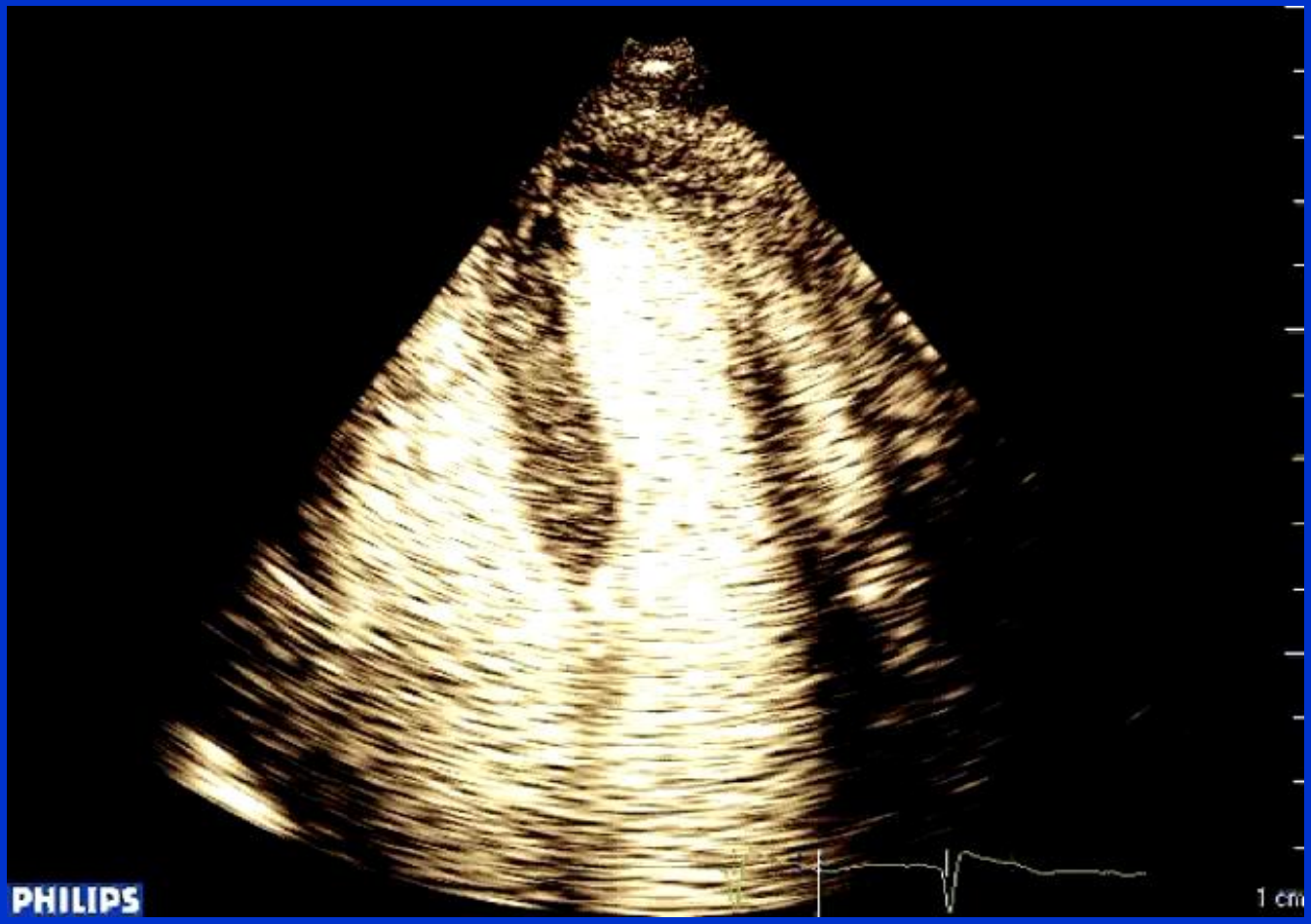
Nuove tecnologie applicate a stress Echo: Ecocontrasto

- Migliore visualizzazione dell'endocardio con opacizzazione di LV (nei pazienti con finestra ecocardiografica di scarsa qualità)



Valutazione della perfusione



Incremental value of contrast myocardial perfusion to detect intermediate versus severe coronary artery stenosis during stress-echocardiography

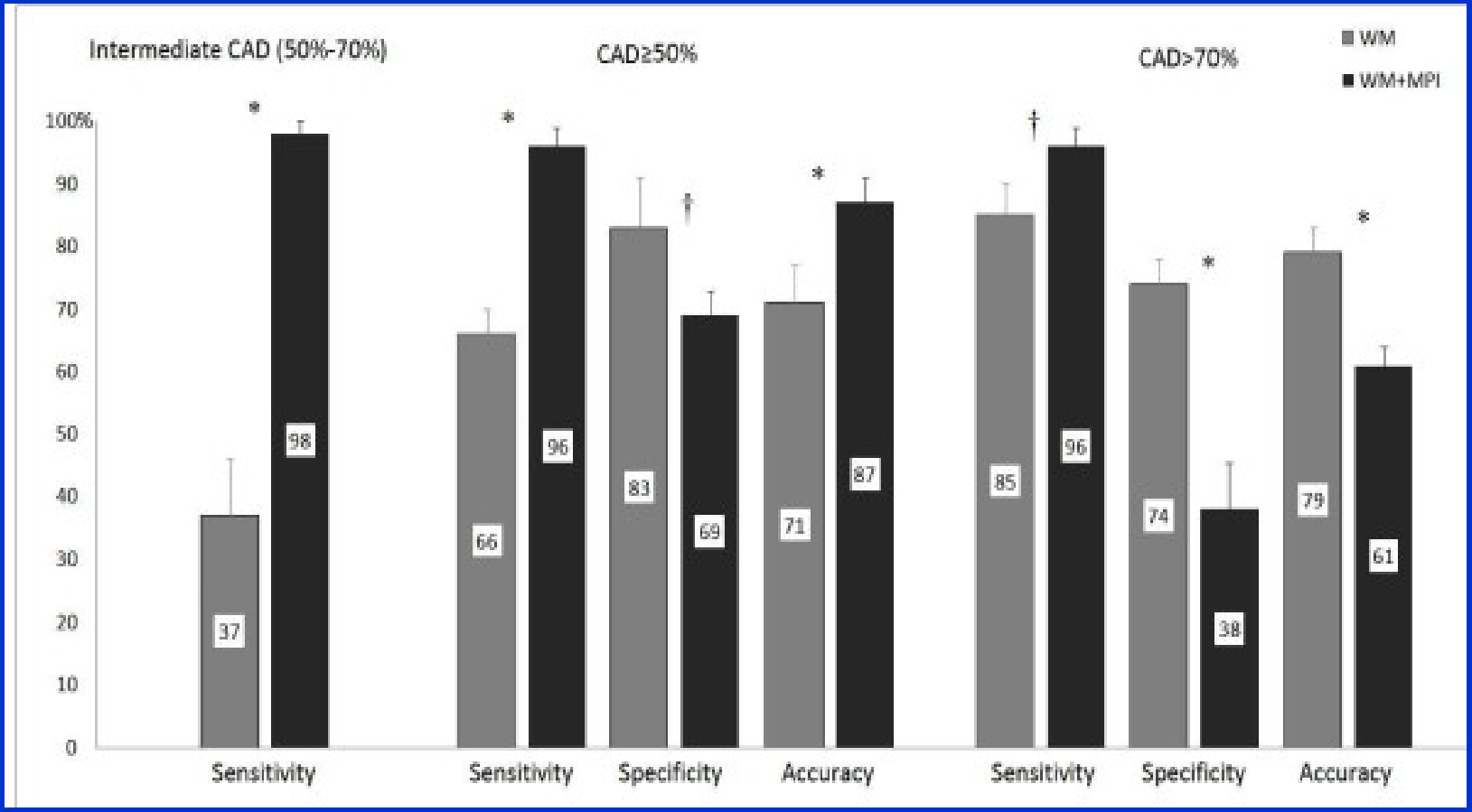
Nicola Gaibazzi[1*], **Fausto Rigo**[2*], **Angelo Squeri**[1*], **Fabrizio Ugo**[1*] and **Claudio Reverberi**[1*]

1 Cardiology Division, Azienda Ospedaliero-Universitaria di Parma, Parma, Italy

2 Cardiology Division, Umberto I° Hospital, Mestre-Venice, Italy

author email corresponding author email * Contributed equally

Cardiovascular Ultrasound 2010, **8**:16 doi:10.1186/1476-7120-8-16



J Am Coll Cardiol. 2004 Dec 7;44(11):2185-91.

Comparative accuracy of real-time myocardial contrast perfusion imaging and wall motion analysis during dobutamine stress echocardiography for the diagnosis of coronary artery disease.

Elhendy A, O'Leary EL, Xie F, McGrain AC, Anderson JR, Porter TR.

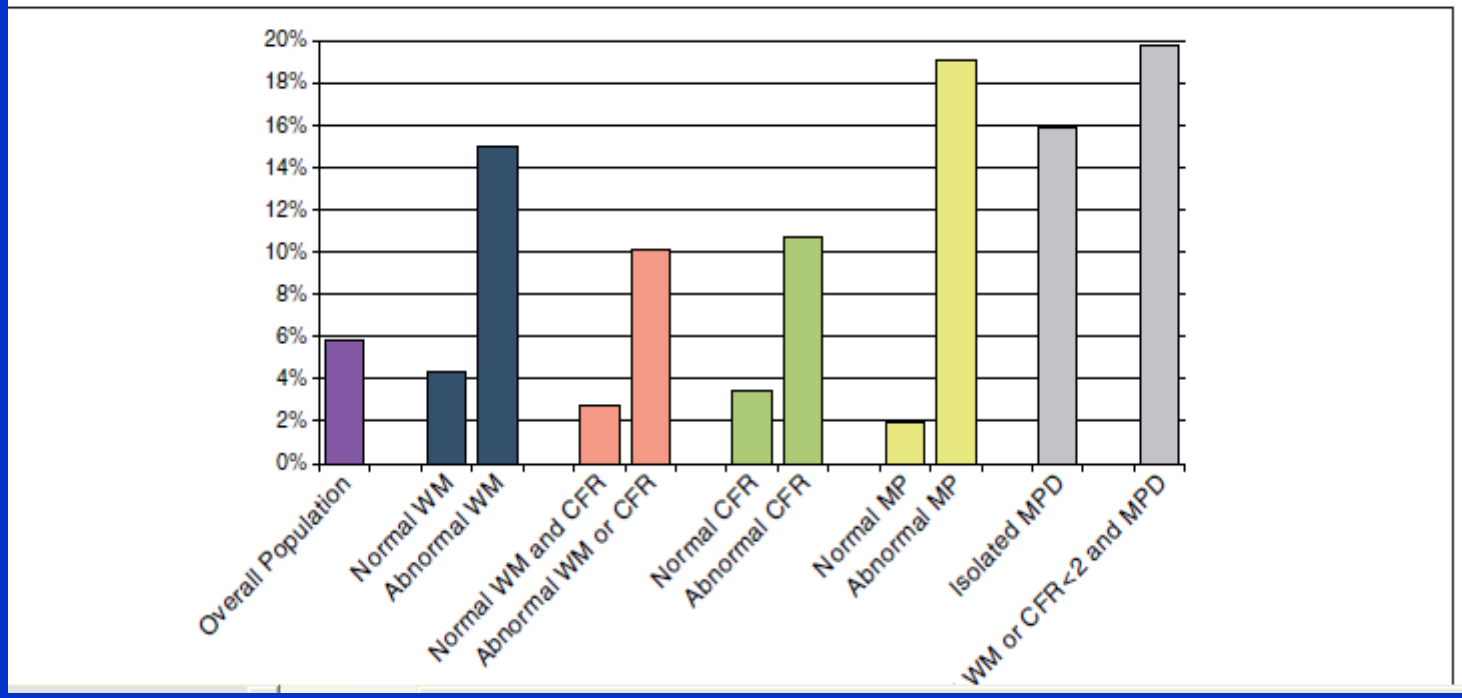
Department of Internal Medicine, Section of Cardiology, University of Nebraska Medical Center, Omaha, Nebraska, USA.

Sensitivity of MCE was higher than that of WMA at maximal stress (91% vs. 70%; p = 0.001) and at intermediate stress (84% vs. 20%; p = 0.0001). Specificity was lower for MCE compared with WMA (51% vs. 74%; p = 0.01). Overall accuracy was higher for MCE than for WMA (81% vs. 71%; p = 0.01). Sensitivity for detection of CAD based on abnormalities in >/=2 vascular regions was higher for

MCE than for WMA (67% vs. 28%; p < 0.01).

Selezione e zoom

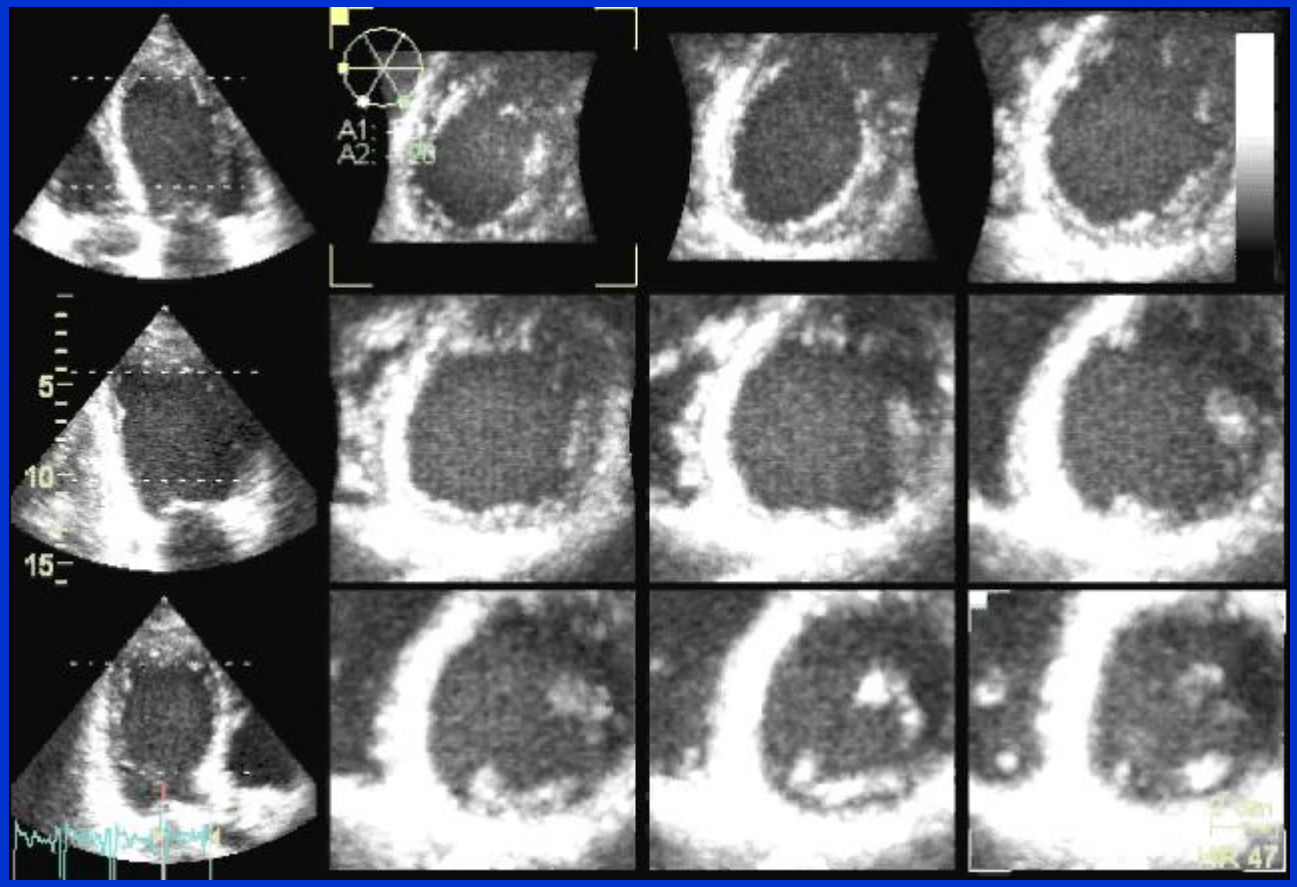
CC: CARDIOVASCULAR IMAGING, VOL. 6, NO. 1, 2013
JANUARY 2013:1–12



interobserver agreement : 80% per la perfusione

95% per le alterazioni della cinetica parietale

Ecocardiografia tridimensionale



High Volume-Rate Three-Dimensional Stress Echocardiography to Assess Inducible Myocardial Ischemia: A Feasibility Study

Luigi P. Badano, MD, Denisa Muraru, MD, Fausto Rigo, MD, Lorenzo Del Mestre, RS, Davide Ermacora, MD, Pasquale Gianfagna, MD, and Alessandro Proclemer, MD, *Udine and Mestre-Venice, Italy; Bucharest, Romania*

(J Am Soc Echocardiogr 2010;23:628-35.)

Table 3 Sensitivity and specificity of 3DE and 2DE for the detection of coronary artery disease

	Sensitivity (%)			Specificity (%)		
Coronary artery territory	3DE	2DE	*P*	3DE	2DE	*P*
All	80	78	NS	87	91	NS
Left anterior descending	87	78	.011	90	93	NS
Right	82	77	NS	85	88	NS
Left circumflex	65	63	NS	94	92	NS

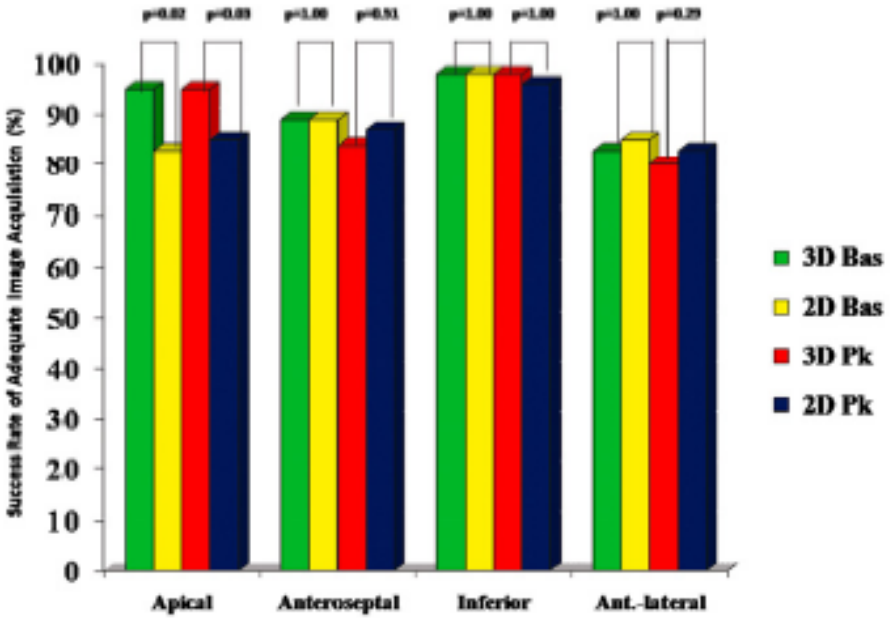
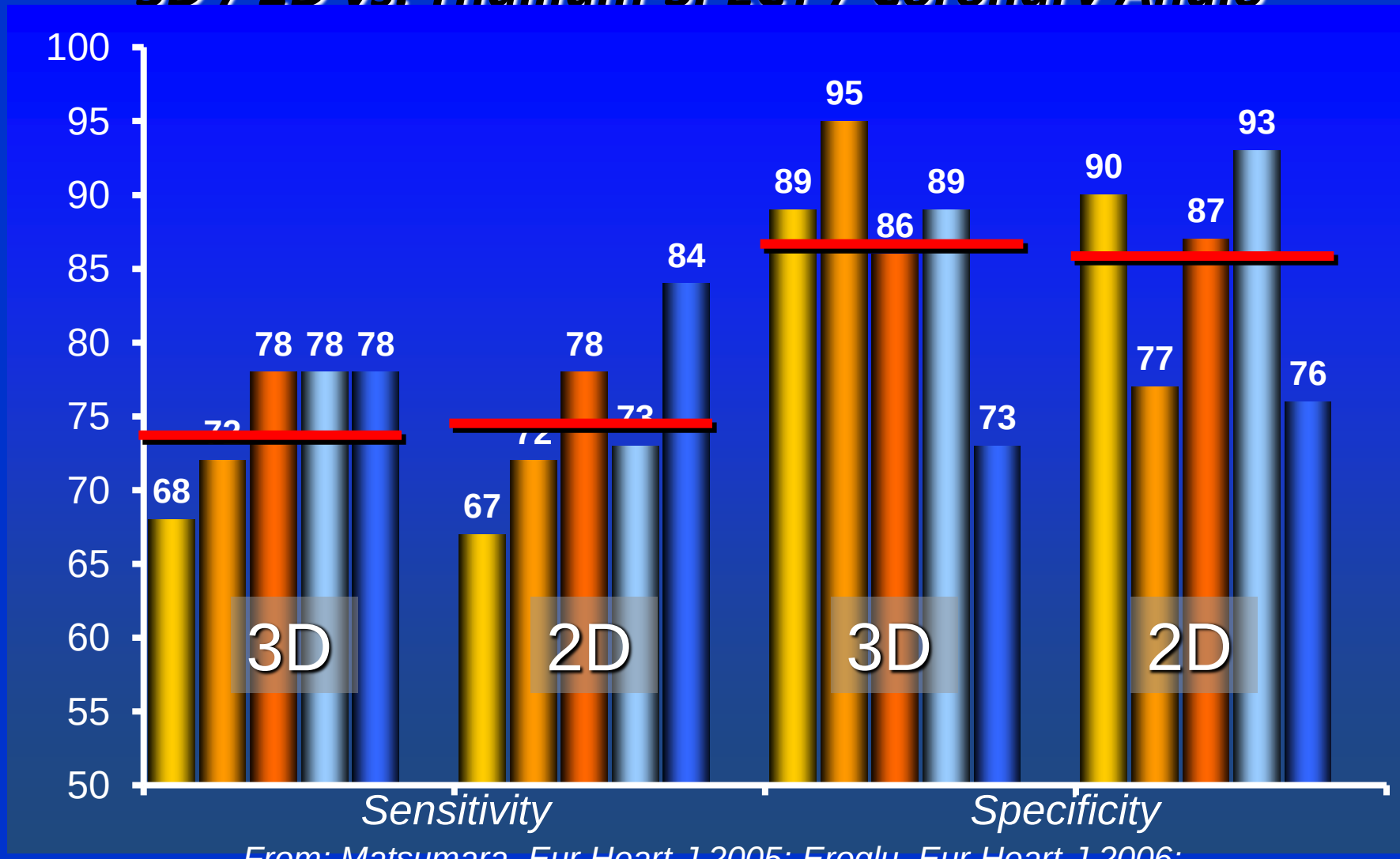


Figure 4 Success rate of adequate LV segment visualization at baseline (Bas) and during peak stress (Pk) using 3DE and 2DE in 4 left ventricular regions. The only significant difference could be detected in the apical region.

Accuracy of Stress Echo

3D / 2D vs. Thallium-SPECT / Coronary Angio



From: Matsumara, Eur Heart J 2005; Eroglu, Eur Heart J 2006; Peteiro, JASE 2007; Aggeli Heart 2007; Yoshitani, JASE 2009

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Lettoergometro

- Permette il monitoraggio continuo ecocardiografico

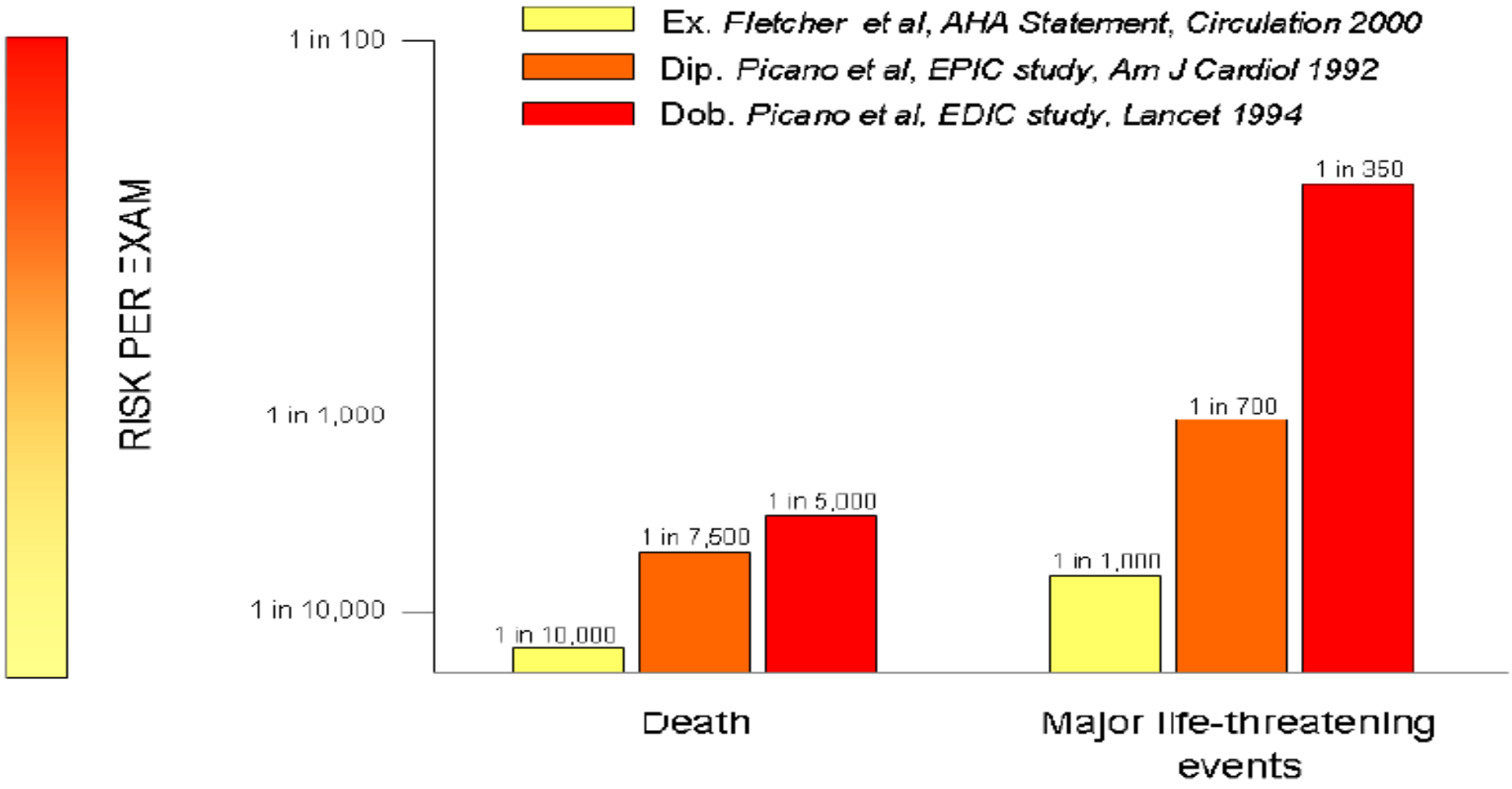
- Valutazione della cinetica durante e al picco dello sforzo (20% delle alterazioni della cinetica parietale regrediscono entro 1')

Valutazione dei volumi
Valutazione della pressione sistolica polmonare (che diminuisce rapidamente dopo la cessazione dell'esercizio)

Vantaggi dell'ecocardiografia da sforzo

1) Fisiologica correlazione dell'ischemia con l'esercizio e significato ai diversi carichi
2) Possibilità di valutare meglio i sintomi lamentati dal paziente
3) Eventuale comparsa di aritmie durante l'esercizio
4) Semplicità di esecuzione, sicurezza

Acute risks of stress



European Journal of Echocardiography. 2008 Jul;9(4):415-37

Stress Echocardiography Expert Consensus Statement—Executive Summary

European Association of Echocardiography (EAE) (a registered branch of the ESC)

Rosa Sicari[1]*, Petros Nihoyannopoulos[2], Arturo Evangelista[3], Jaroslav Kasprzak[4], Patrizio Lancellotti[5], Don Poldermans[6], Jens-Uwe Voigt[7], and Jose Luis Zamorano[8] on behalf of the European Association of Echocardiography

[1]Institute of Clinical Physiology, Pisa, Italy; [2]Hammersmith Hospital, NHLI, Imperial College, London, UK; [3]Hospital Vall d'Hebron, Barcelona, Spain; [4]Department of Cardiology, Medical University of Lodz, Lodz, Poland; [5]Department of Cardiology, University Hospital Sart Tilman, Liège, Belgium; [6]Erasmus Medical Center, Rotterdam, The Netherlands; [7]Catholic University, Leuven, Belgium; and [8]Instituto Cardiovascular, Hospital Clínico San Carlos, Madrid, Spain

DIPIRIDAMOLO

Author, year	Patients	Complications
Multicentre registry		
Picano *et al.*, 1992	10 451	1 cardiac death, 1 asystole, 2 AMI, 1 pulmonary oedema, 1 sustained VT
Varga *et al.*, 2006	24 599	19 (1 death)
Total	35 050	25

AMI, acute myocardial infarction; VT, ventricular tachycardia.

DOBUTAMINA e DIPIRIDAMOLO

	Dobutamine	Dipyridamole
% submaximal tests	10%	5%
Side effects	1/300 exams	1/1000
VT, VF	++	+
High grade AV block	+	++
Death	1/5000	1/10000

AV, arteriovenous; VF, ventricular fibrillation; VT, ventricular tachycardia.

Ecocontrasto: 1:10000 reazione allergica o pericolosa
10% effetti collaterali minori

Attrezzatura del laboratorio
Esperienza dell'operatore

Caratteristiche del paziente

Table 4. Stress echo: which test for which patient.

Pt characteristics	Exercise	Dipyridamole	Dobutamine
Inability to exercise	3	1	1
Contraindication to exercise	3	1	1
Positive EET in hypertensives, women, baseline ECG changes	1	2	2
Asthmatic patient	2	3	1
Under theophylline therapy	1	3	1
Severe hypertension	3	1	3
Well controlled hypertension	2	1	2
Relative hypotension	1	3	3
Ventricular ectopy	1	1	3
2nd–3rd degree atrioventricular block	1	3	2
Suboptimal acoustic window	3	1	2
Evaluation of anti-ischemic therapy efficacy	1	2	3
Unstable carotid disease	2	2	2
Permanent pacemaker		Pacemaker stress echo	

1: Especially indicated; 2: Relatively contraindicated; 3: Contraindicated.
ECG: Electrocardiogram; EET: Exercise-electrocardiography test.

Table 4. Stress echo: which test for which patient.

Pt characteristics	Exercise	Dipyridamole	Dobutamine
Inability to exercise	3	1	1
Contraindication to exercise	3	1	1
Positive EET in hypertensives, women, baseline ECG changes	1	2	2
Asthmatic patient	2	3	1
Under theophylline therapy	1	3	1
Severe hypertension	3	1	3
Well controlled hypertension	2	1	2
Relative hypotension	1	3	3
Ventricular ectopy	1	1	3
2nd–3rd degree atrioventricular block	1	3	2
Suboptimal acoustic window	3	1	2
Evaluation of anti-ischemic therapy efficacy	1	2	3
Unstable carotid disease	2	2	2
Permanent pacemaker		Pacemaker stress echo	

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Suboptimal acoustic window	3	1	2
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ECG: Electrocardiogram; EET: Exercise-electrocardiography test.

nature publishing group

Non-Invasive Diagnostic Testing for Coronary Artery Disease in the Hypertensive Patient: Potential Advantages of a Risk Estimation-Based Algorithm

Diana Chin[1], Allegra Battistoni[1], Giuliano Tocci[2], Jasmine Passerini[1], Gianfranco Parati[3] and Massimo Volpe[1,2]

Table 1 | Comparison of non-invasive diagnostic tests for detection of coronary artery disease in hypertensive subjects

	Sensitivity	Specificity	PPV	NPV	Cost	Biological impact	Indications	Not recommended
EET	+++	++	+++	++++	+	0	Pts at **intermediate risk** of CAD	**In women, young pts, or unable to exercise, or with resting ECG abnormalities**
Dipyridamole echocardiography	++++	++++	++++	++++	++	+	Pts at **intermediate risk** of CAD **unable to exercise/ with positive EET** (especially women and >75 aa)/**with interfering abnormalities ECG (LVH, LBBB)**	In pts with **poor acoustic window**, or with **resting abnormal wall motion**; or with **contraindication to pharmacologic stressor agents**
Dobutamine echocardiography	++++	++++	++++	++++	++	+		
Exercise echocardiography	++++	++++	++++	++++	++	0		
MPS	++++	++	+++	++++	++++	++++	Pts at **intermediate risk** of CAD **unable to exercise/ with positive EET** (especially women and >75 aa)/ **with interfering abnormalities ECG (LVH, LBBB)**; asymptomatic pts at **high risk of CAD** or with a **strong familiarity** for CAD	In **young and women**; in pts with **contraindication to pharmacologic stressor agents**
CCT	++++	++++	++++	++++	+++	++++	Pts at **intermediate risk** of CAD **with positive EET pts and low/intermediate risk unable to exercise/ with interfering abnormalities ECG (LVH, LBBB)**;	**Women or young pts or with serum creatinine >1,5 mg/dl**
CMR	n.a.	n.a.	n.a.	n.a.	++++	+	Pts at **intermediate risk** of CAD **unable to exercise/ with positive EET/with interfering abnormalities ECG (LVH, LBBB)**	**In claustrophobic pts, or with ferromagnetic objects, or with creatinine clearence <30 ml/min;** in pts with **contraindication to pharmacologic stressor**

Paziente	esercizio	dipiridamolo	dobutamina
Impossibilità ad eseguire esercizio	no	si	si
Controindicazione esercizio	no	si	si
Scarsa qualità della finestra acust	no	si	si
Asma	possibile	no	si
Assunzione di teofillinici	si	no	si
Blocco AV avanzato	si	no	possibile
Ipotensione	si	no	no
Aritmie ventricolari	si	si	no
Valutazione efficacia terapia	si	possibile	no
Valutazione vitalità			si

Ipertensione

- 2200 ipertesi, sottoposti ad eco dipiridamolo o dobutamina
- fattibilità
- Dobutamina
- ipertesi 88,8%
- normotesi 93,4%

- Dipiridamolo
- ipertesi 97%
- normotesi 97,5%

- Complicanze più frequenti con dobutamina negli ipertesi.

- Cortigiani et Al, J Hypertension 2002
-

DOI: 10.1111/j.1540-8175.2011.01623.x

Echocardiography

Intracranial Hemorrhage as a Complication of Dobutamine Stress Echocardiography: Case Report and Review of the Literature

Sachin P. Shah, M.D. and G. Muqtada Chaudhry, M.D.

BMJ Case Rep. 2014 Mar 18;2014. pii: bcr2013201891. doi: 10.1136/bcr-2013-201891.

Intraparenchymal haemorrhage and uncal herniation resulting from dobutamine stress echocardiography.

Bennin CL[1], Ramoutar V, Velarde G.

Author information

Ipertensione arteriosa

- 59 pazienti ipertesi
- 59 normotesi
- Sottoposti a coronarografia per dolore toracico
- Sottoposti ad ecocardiogramma da sforzo in assenza di terapia e, negli ipertesi, dopo normalizzazione dei valori di P.A. con nifedipina.
- CAD significativa (stenosi>50% in 22 ipertesi e 41 normotesi)

- Maltagliati et al, Hypertension, 2000

	ipertesi					
	WO		Nif		normotesi	
	Echo	ECG	Echo	ECG	Echo	ECG
Sensibilità	95%*	68%	91%*	45%	87%*	51%
Specificità	94%*	70%	100%	81%	72%	72%
Acc diagn	94%*	69%*	96%*	67%	83%*	57%

- Maltagliati et Al, Hypertension, 2000

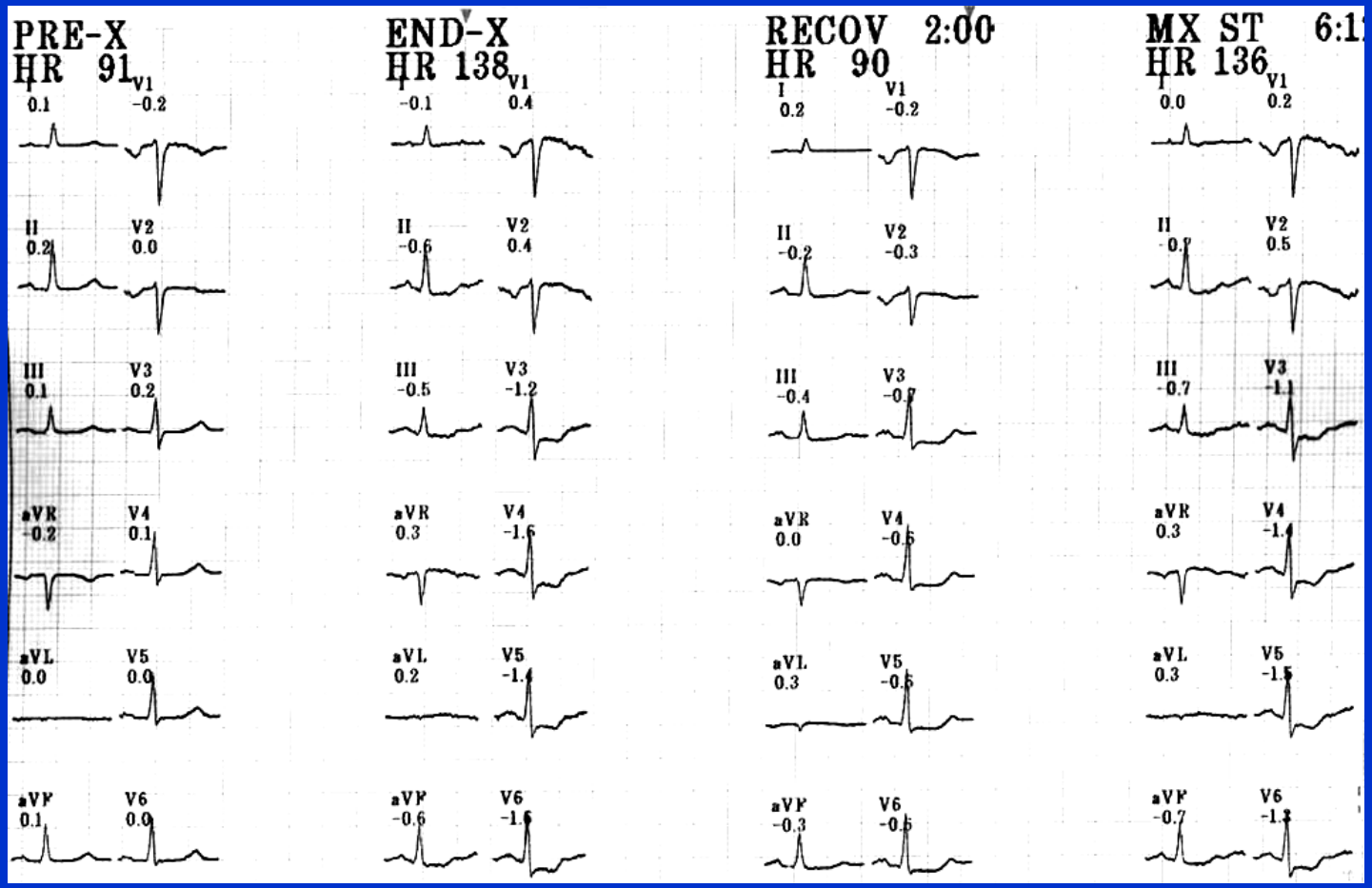
CASO CLINICO n° 1

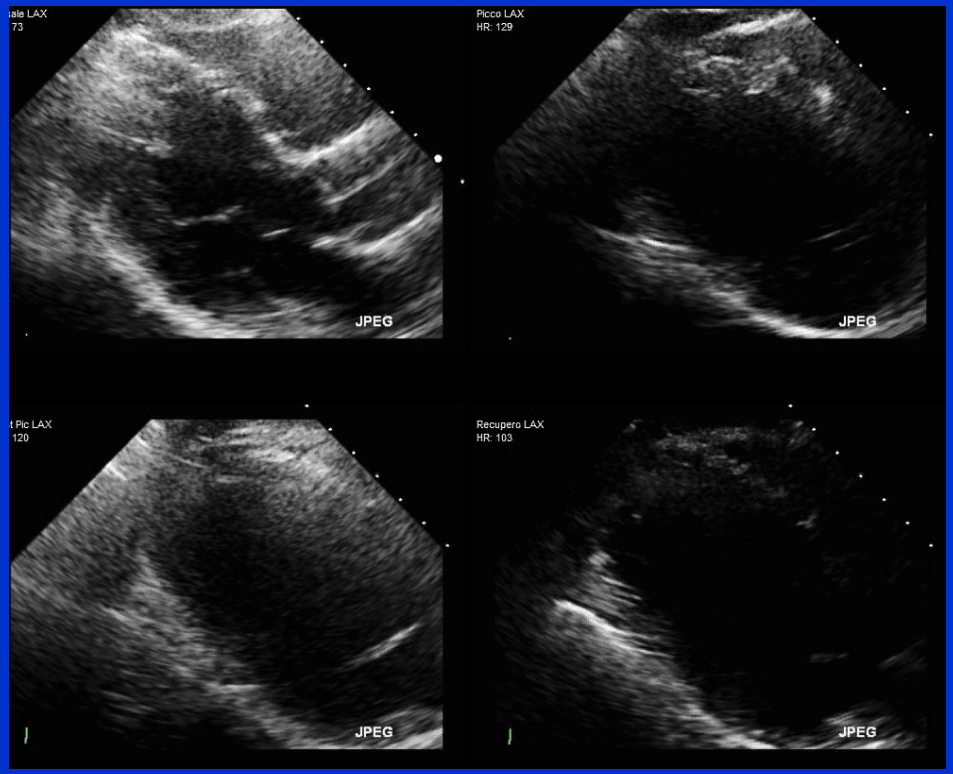
- P.G., maschio, anni 64
- ipertensione nota da anni
- comparsa di precordialgie da sforzo tipiche per angor da 2 anni

CASO 1.
PROVA DA SFORZO

- Carico di lavoro 175 Watts
- frequenza cardiaca massima 168 bt/’ (100%)
- pressione al picco 200/100 mm Hg
- doppio prodotto 36300
- comparsa di angor al picco

CASO 1.
ECG DA SFORZO

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HR: 103
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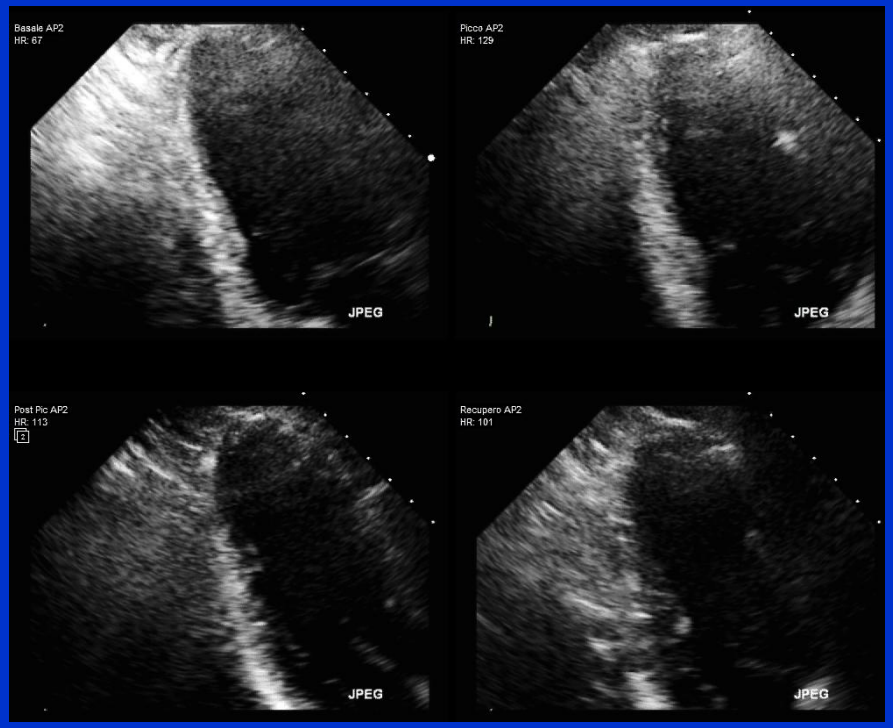
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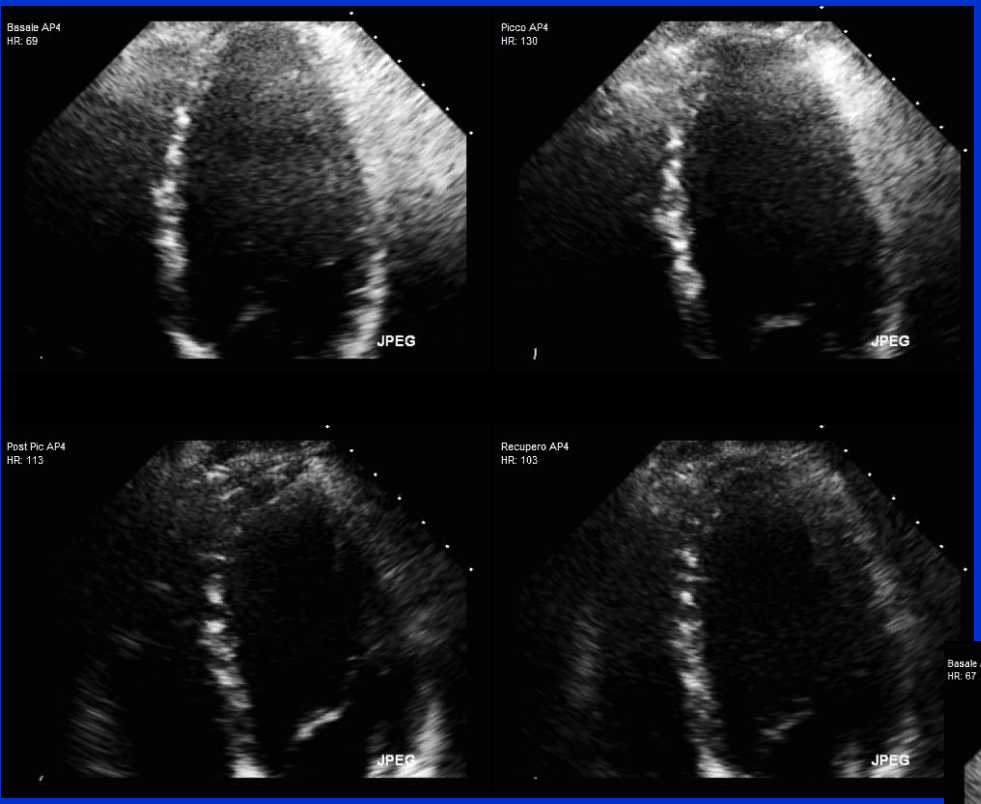
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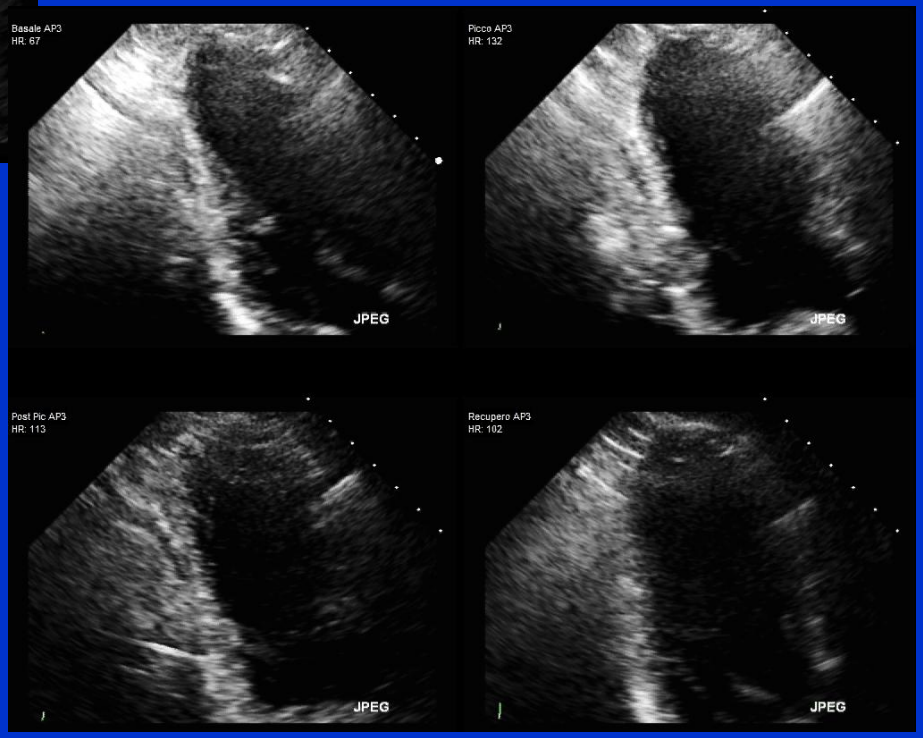
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HR: 102
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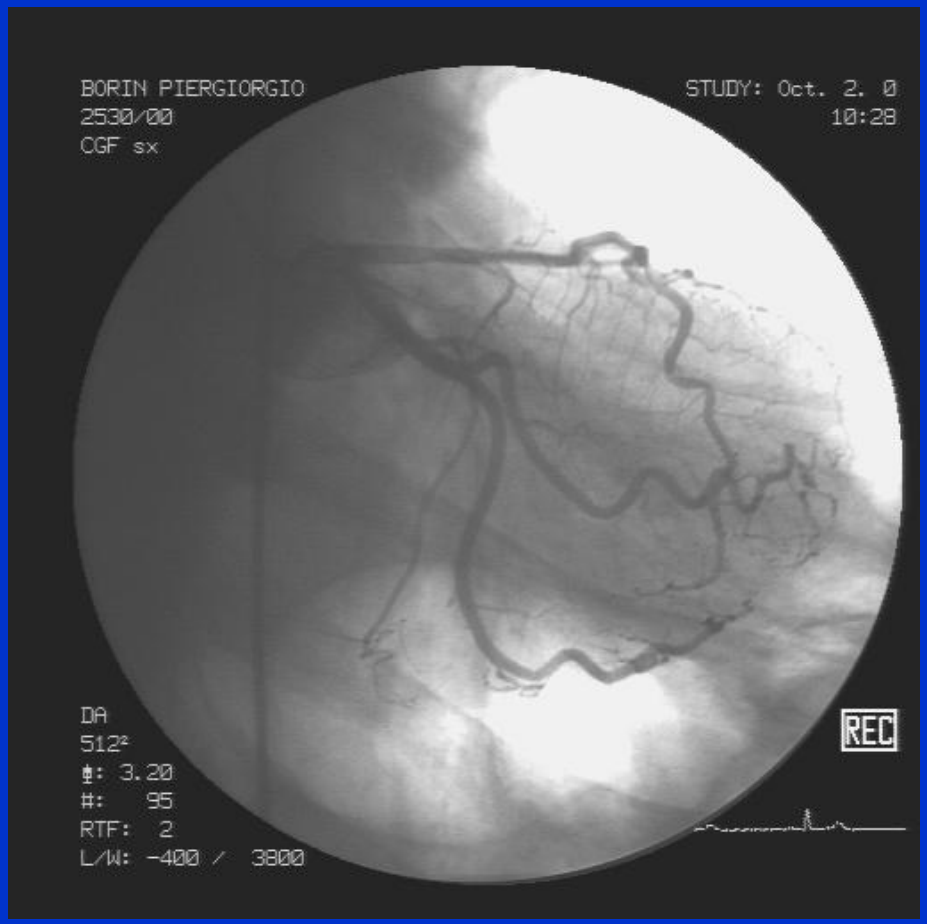
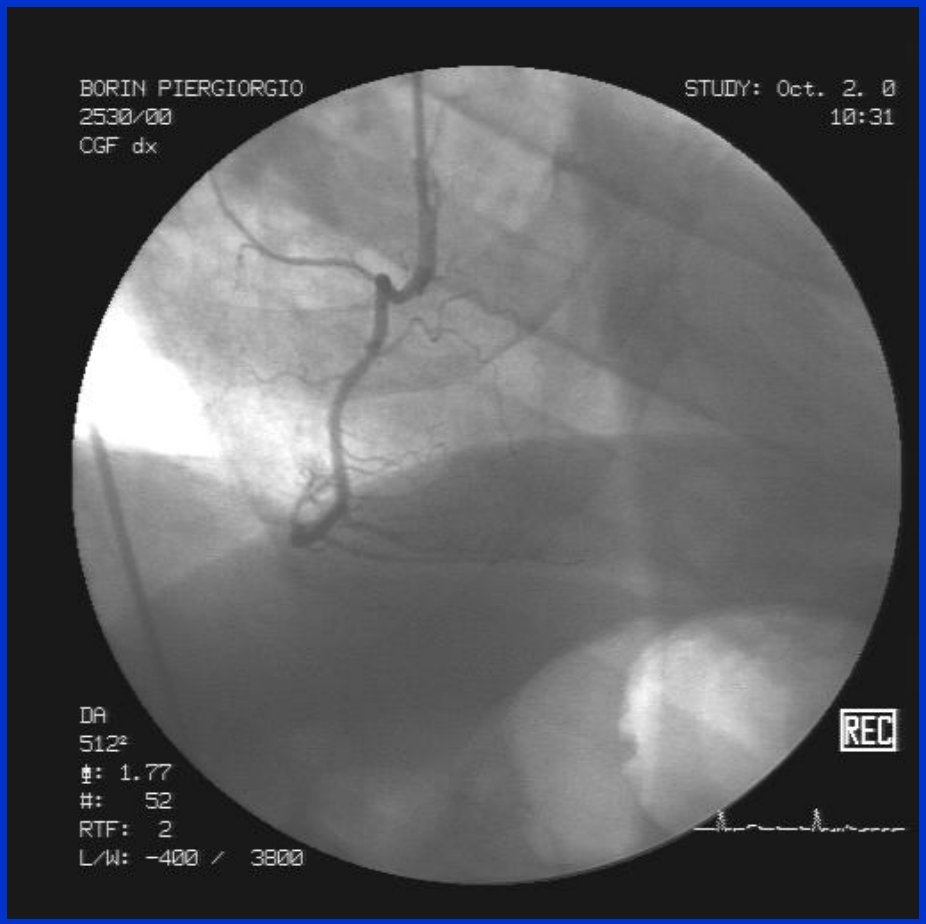
CASO 1.
ANGIOGRAFIA CORONARICA





CASO CLINICO n° 2

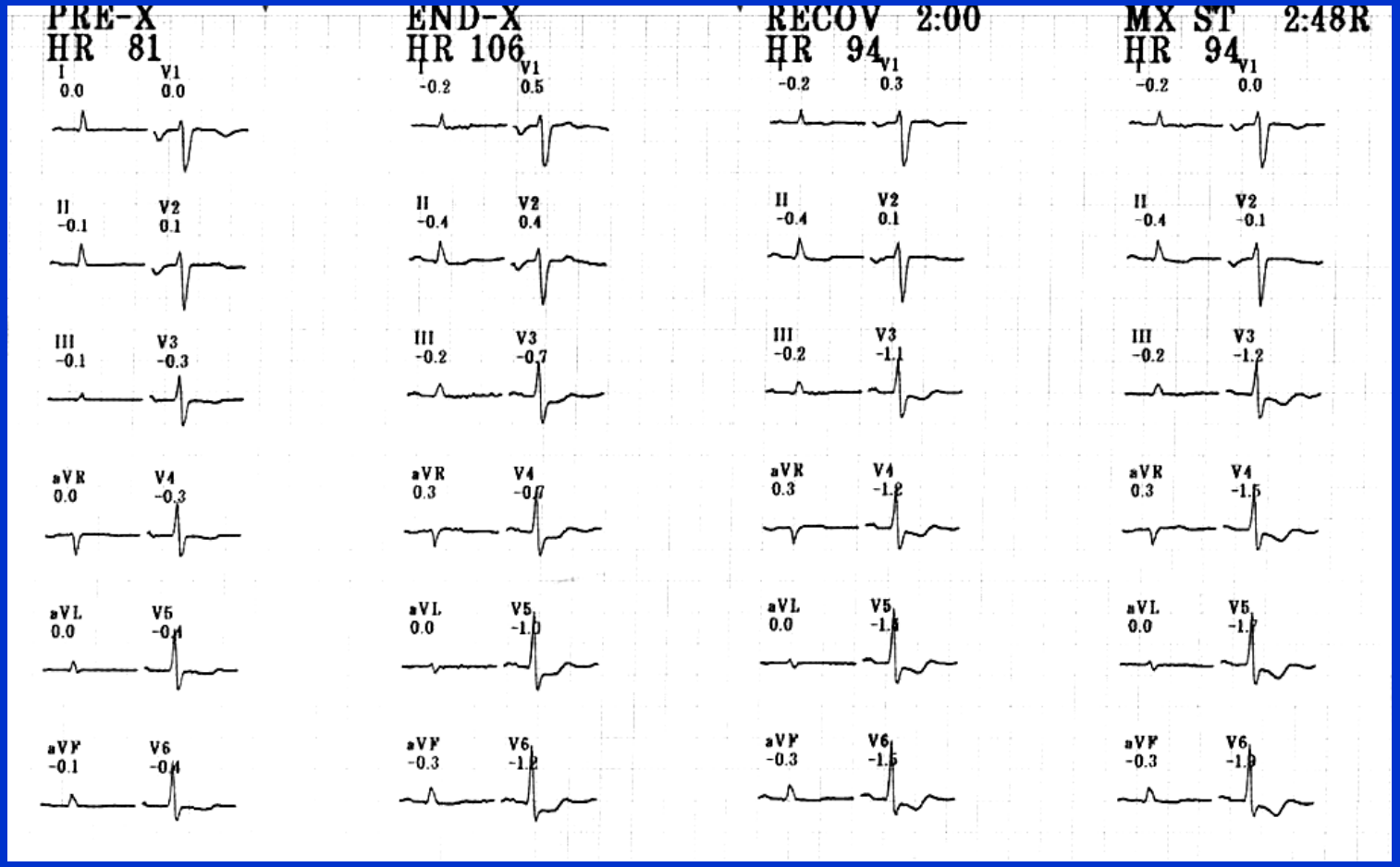
- L.M:, maschio, anni 62
- svolge regolare attivita' sportiva
- Lieve ipertensione arteriosa
- da 20 gg "bruciore" retrosternale sotto sforzo

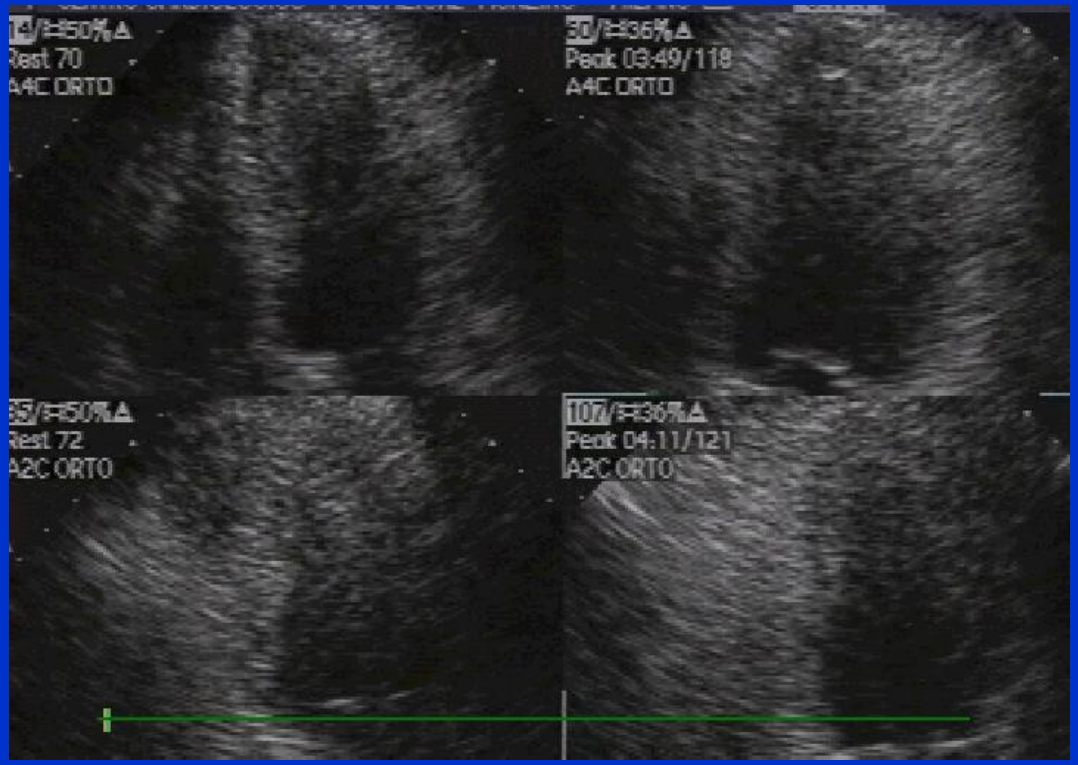
PROVA DA SFORZO

- Carico di lavoro 75 watts
- Frequenza cardiaca massima 124 bt/’ (72%)
- pressione al picco 210/110
- doppio prodotto 26040
- comparsa di angor al picco

CASO 2.

ECG DA SFORZO

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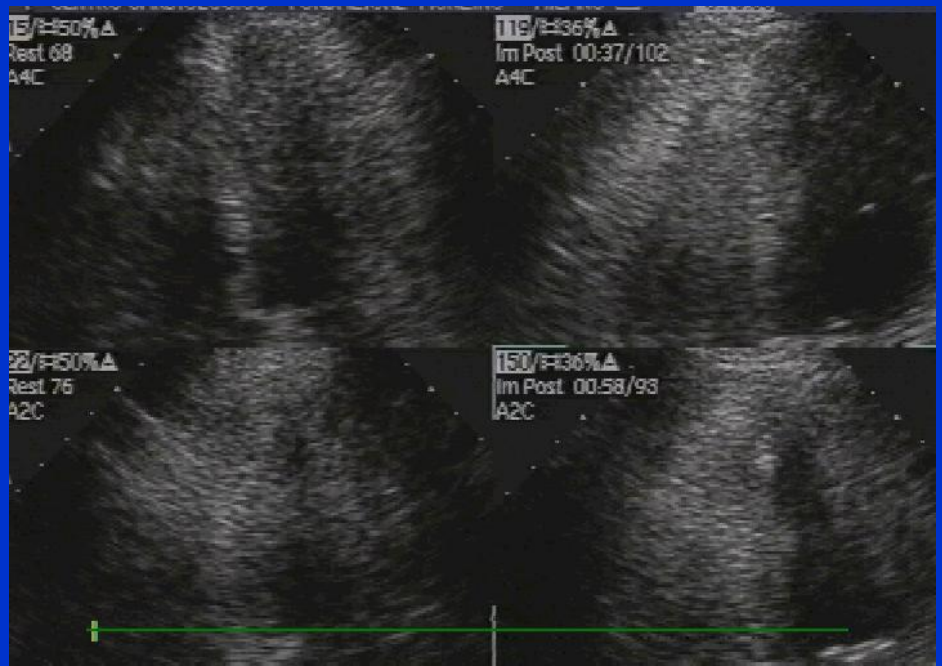
Peak 03:49/119
A4C ORTO
Rest 72
A2C ORTO
Peak 04:11/121
A2C ORTO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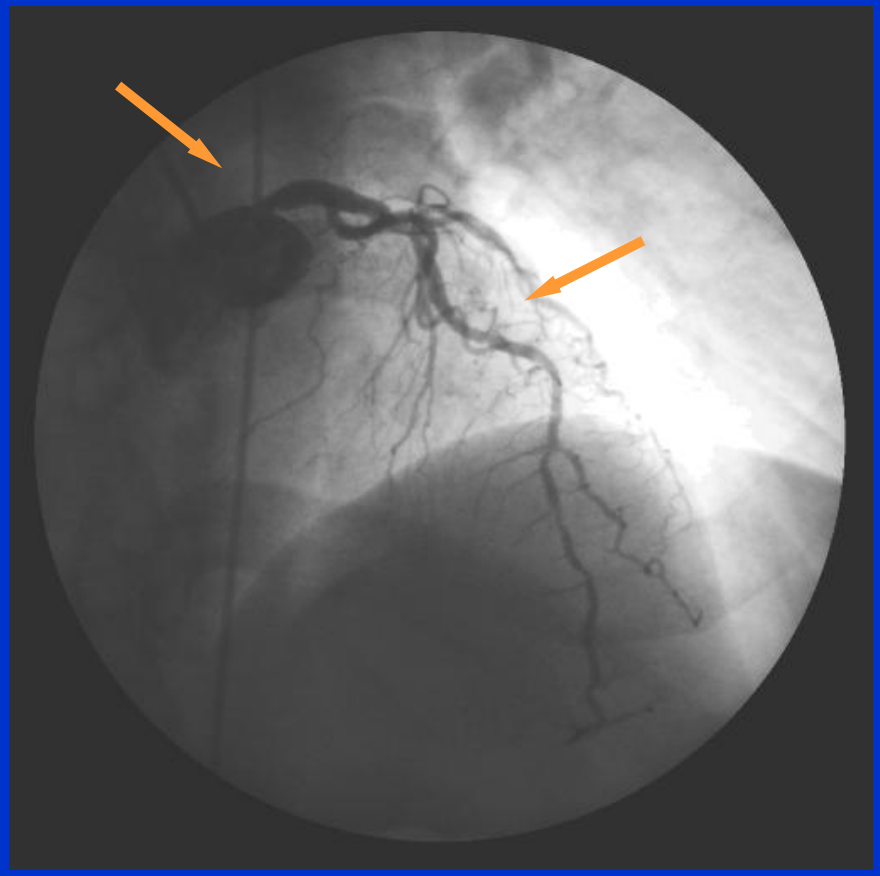
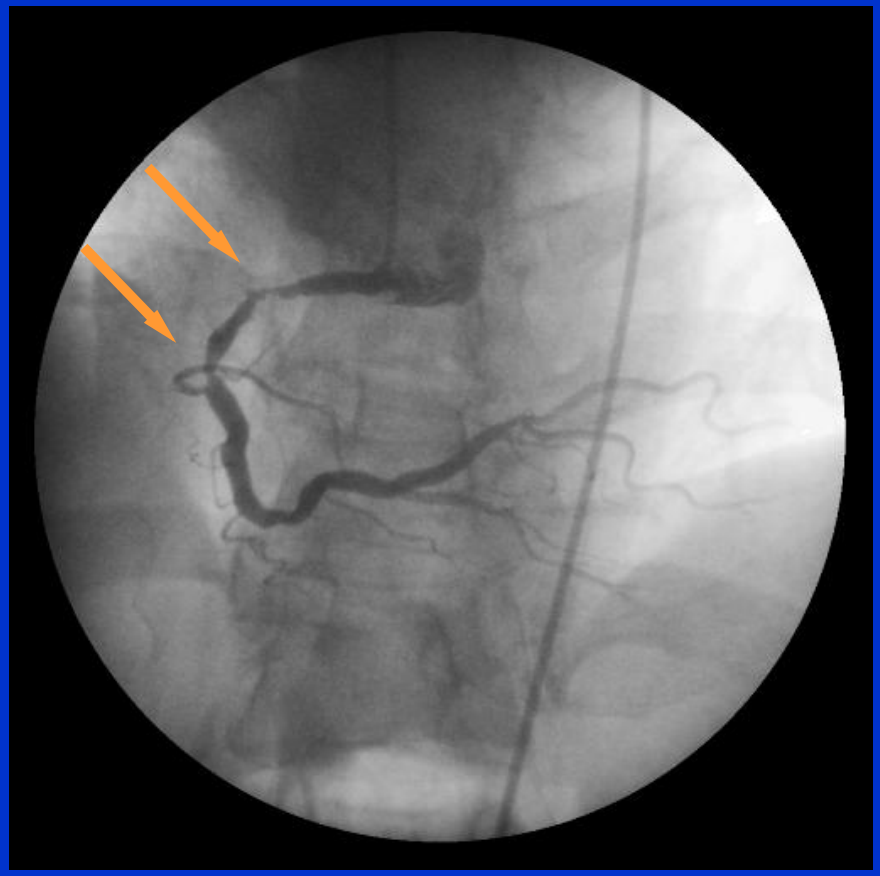
A4C
Im Post 00:37/102
A4C
Rest 76
A2C
Im Post 00:58/93
A2C

CASO 2
ANGIOGRAFIA CORONARICA





Ipertensione arteriosa: falsi positivi

- 548 pts sottoposti a coronarografia ed eco da sforzo
- 132 (24%) risposta ipertensiva allo sforzo
- (PA sist>220 mm Hg, incremento della P.A
- diastolica >10 mm Hg), di essi

- 108 avevano ECHO stress positivo; il 22% non aveva stenosi coronarica significativa.

- Pellikka et Al, J Am Coll Cardiol. 2002
-

J Am Soc Echocardiogr. 2012 Oct;25(10):1113-9. doi: 10.1016/j.echo.2012.07.001. Epub 2012 Aug 1.

An Exaggerated Blood Pressure Response to Treadmill Exercise does not Increase the Likelihood that Exercise Echocardiograms are Abnormal in Men or Women.

Jurrens TL, From AM, Kane GC, Mulvagh SL, Pellikka PA, McCully RB.
Division of Cardiovascular Diseases, Mayo Clinic, Rochester, Minnesota.

RESULTS: Among the 7,015 patients (mean age, 61 ± 13 years), 3,992 were men (57%). The likelihood of patients' having abnormal exercise echocardiographic results was similar at all levels of exercise blood pressure, except in men who had low peak systolic blood pressures (<120 mm Hg); they had the highest rate of abnormal exercise echocardiographic findings. Of the 3,225 patients without histories of hypertension or coronary artery disease, 3,098 had peak systolic blood pressures of 120 to 219 mm Hg (a "normal" blood pressure response), and 59 had peak systolic blood pressures ≥ 220 mm Hg (an exaggerated blood pressure response). These patients with exaggerated blood pressure responses were just as likely to have normal exercise echocardiographic results as those who had normal blood pressure responses (85% vs 83%, P > .99). A subgroup of 508 patients underwent coronary angiography. The rate of false-positive findings was similar for patients who had exaggerated blood pressure responses and those who had normal blood pressure responses. The false-positive rate tended to be lower in patients who had low blood pressure responses.

CONCLUSIONS: Patients who have exaggerated blood pressure responses to exercise are not more likely to have abnormal exercise echocardiographic findings than those with normal blood pressure responses. The majority of patients who have echocardiographic abnormalities and subsequently undergo coronary angiography have substantial (≥50% stenosis) coronary artery disease.

Attrezzatura del laboratorio
Esperienza dell'operatore
Caratteristiche del paziente

Nel nostro laboratorio:

1700 esami/anno
> 95% test con esercizio

Impossibilità all'esercizio
Controindicazione esercizio (es aneurisma aortico)
Scarsa qualità della finestra acustica

Prognostic Implication of Appropriateness Criteria for Pharmacologic Stress Echocardiography Performed in an Outpatient Clinic

Lauro Cortigiani, Riccardo Bigi, Francesco Bovenzi, Sabrina Molinaro, Eugenio Picano and Rosa Sicari

Circ Cardiovasc Imaging. 2012;5:298-305; originally published online March 30, 2012;

Indicazioni appropriate

Indication 116 Evaluation of ischemic equivalent (nonacute) in patients with intermediate pre-test probability of CAD who have an interpretable ECG and who are able to exercise
Indication 118 Evaluation of ischemic equivalent (nonacute) in patients with high pre-test probability of CAD regardless of ECG interpretability and ability to exercise
Indication 169 Evaluation of ischemic equivalent in patients with prior PCI or CABG
Indication 117 Evaluation of ischemic equivalent (nonacute) in patients with intermediate pre-test probability of CAD who have an uninterpretable ECG or unable to exercise
Indication 115 Evaluation of ischemic equivalent (nonacute) in patients with low pre-test probability of CAD who have an uninterpretable ECG or unable to exercise
Indication 119 Evaluation of acute chest pain in patients with no ECG ischemic changes or with LBBB or electrically paced ventricular rhythm changes who have low-risk TIMI score and negative troponin levels
Other indications

Indicazioni inappropriate

Indication 114 Evaluation of ischemic equivalent (nonacute) in patients with low pre-test probability of CAD who have an interpretable ECG and able to exercise
Indication 173 Risk assessment in asymptomatic patients < 2 years after PCI
Indication 124 Detection of CAD and risk assessment in asymptomatic (without ischemic equivalent) general patient populations with low global CAD risk
Indication 144 Evaluation of patients with intermediate to high global CAD risk having a normal prior stress imaging study who are asymptomatic or with stable symptoms and who underwent last stress imaging study <2 years ago
Indication 156 Risk assessment before non cardiac intermediate-risk surgery in patients with no clinical risk factors
Indication 171 Risk assessment in asymptomatic patients < 5 years after CABG
Indication 125 Detection of CAD and risk assessment in asymptomatic (without ischemic equivalent) general patient populations with intermediate global CAD risk who have an interpretable ECG
Indication 146 Evaluation of patients with known CAD on coronary angiography or prior abnormal stress imaging study who are asymptomatic or with stable symptoms and who underwent last stress imaging study <2 years ago

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Su 1552 pazienti ambulatoriali (2001-2007)
63% indicazione appropriata
9% indicazione incerta
27% inappropriata

CLINICAL INVESTIGATIONS
STRESS ECHOCARDIOGRAPHY: APPROPRIATE USE

Comparison of the 2008 and 2011 Appropriate Use Criteria for Stress Echocardiography

R. Sacha Bhatia, MD, MBA, Vishesh Kumar, MD, Michael H. Picard, MD, and Rory B. Weiner, MD, *Boston, Massachusetts*

146 pazienti
69% indicazione appropriata
22% inappropriata

JACC: CARDIOVASCULAR IMAGING
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ORIGINAL RESEARCH

Appropriate Use Criteria for Stress Echocardiography

Impact of Updated Criteria on Appropriateness Ratings, Correlation With Pre-Authorization Guidelines, and Effect of Temporal Trends and an Educational Initiative on Utilization

Howard J. Willens, MD,*† Katarina Nelson, MD,* Robert C. Hendel, MD*
Miami, Florida

208 pazienti nel 2008
1/3 indicazione inappropriata

209 pazienti del 2011
1/3 indicazione inappropriata

Fig. 1: Diagnostic triage of patients with suspected coronary artery disease.