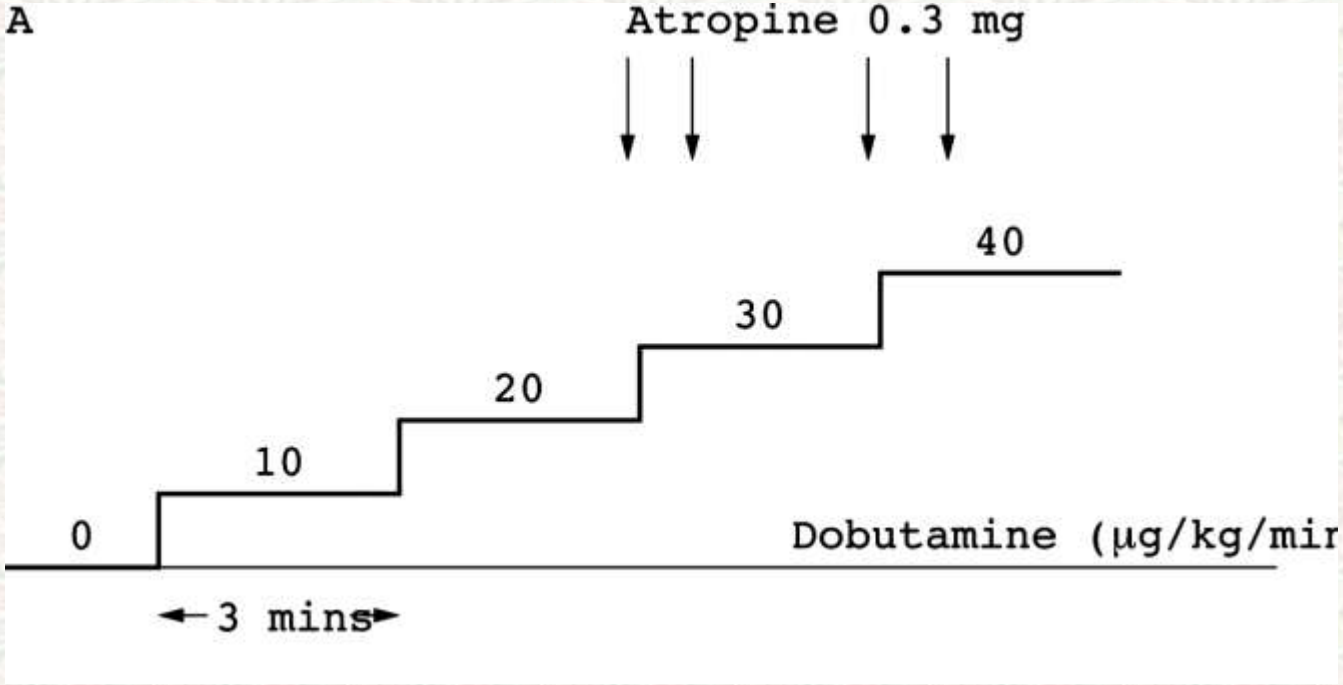
Apport de l'Echocardiographie de stress dans la recherche de l'ischémie myocardique

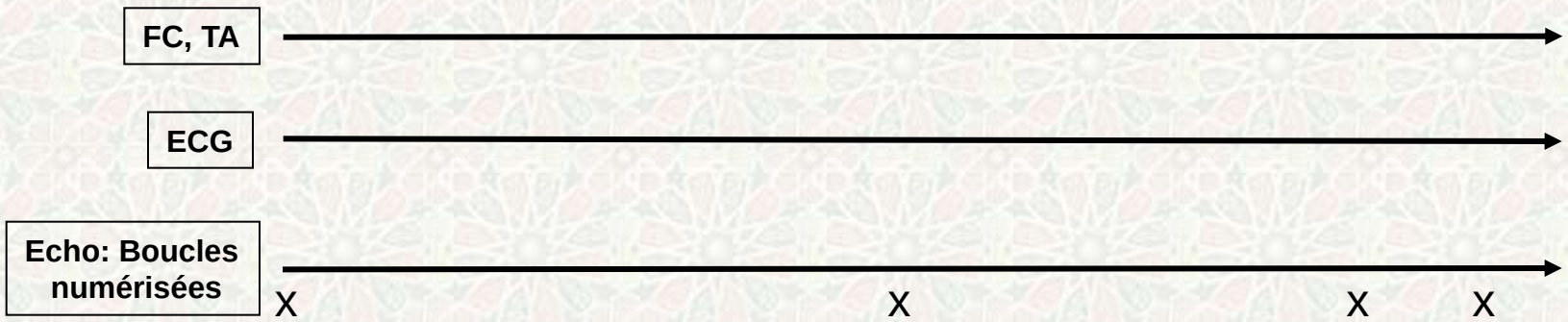
A. Darif

Assises de l'AMCAR Le 15 Mars 2018

Echo Dobutamine

Protocoles





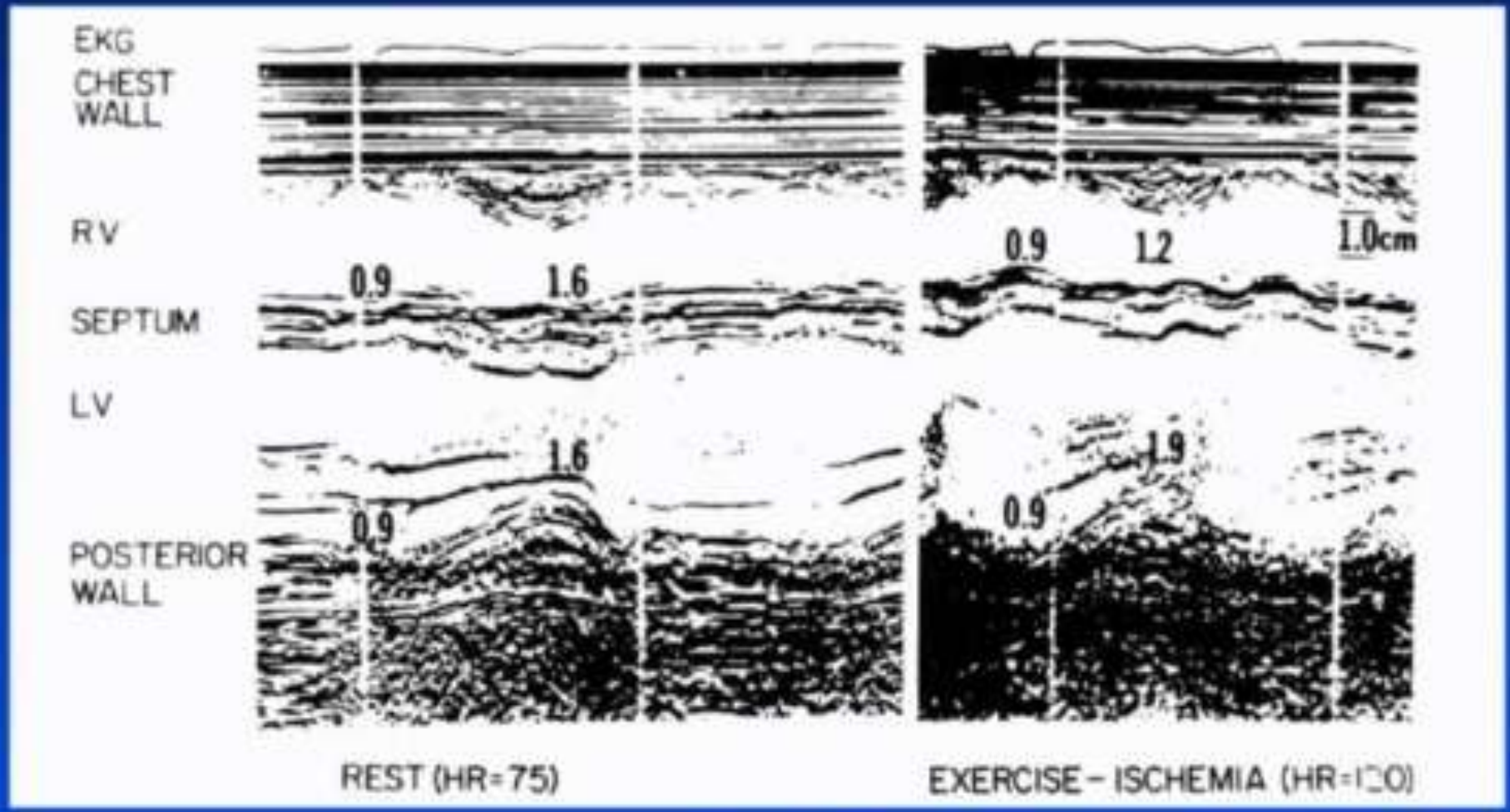
Becher, H et al. Heart 2004;90:vi23-vi30

Echo d’effort

Echo per-effort

La première ischémie en écho d'effort…

Pédalage couché. Vitesse 18 km/h (charge 300 kpm/mn)
Paliers de 300 kpm/mn durant 3 mn



Mason SJ et al. Circulation 1979;59:50-59

La première ischémie en écho d'effort 2D…

Charge constante
10 kg-m/sec
TNT systématique

Wann LS et al. Circulation 1979;60:1300-1308

Echo de stress

Contre-indications

Générales : celles d ’un test d ’effort :

– angor non stabilise

– infarctus récent (J5 classiquement, J3 pour certains)

– tension artérielle < 80 mm Hg de systolique ou > 200 / 120 mm Hg

– insuffisance cardiaque décompensée

Spécifiques d ’un type de stress :

– trouble du rythme symptomatique récent: dobutamine

– glaucome a angle ferme, adénome prostatique : atropine

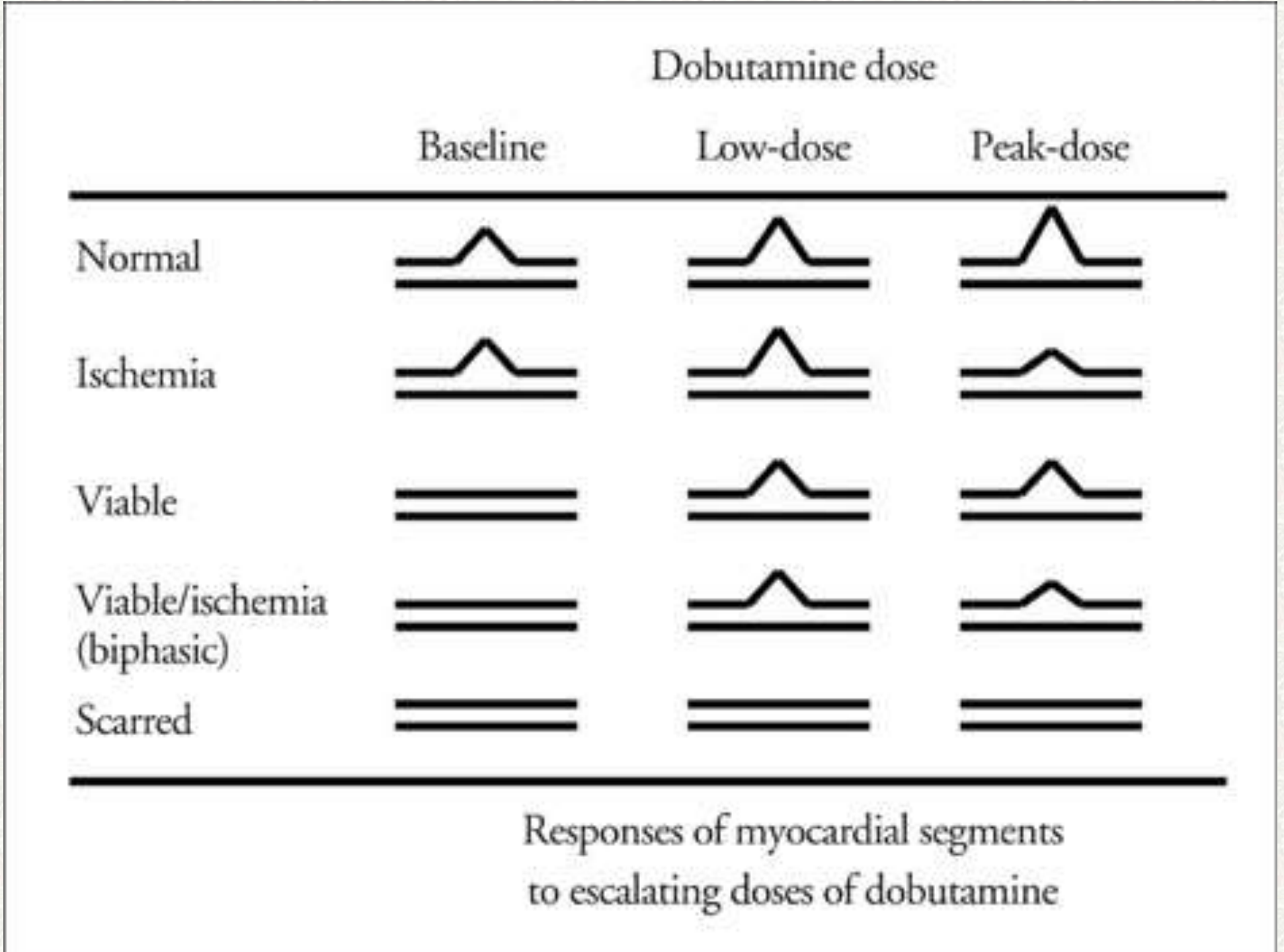
– bronchospasme : dipyridamole

– trouble conductif : adénosine

Echo de stress

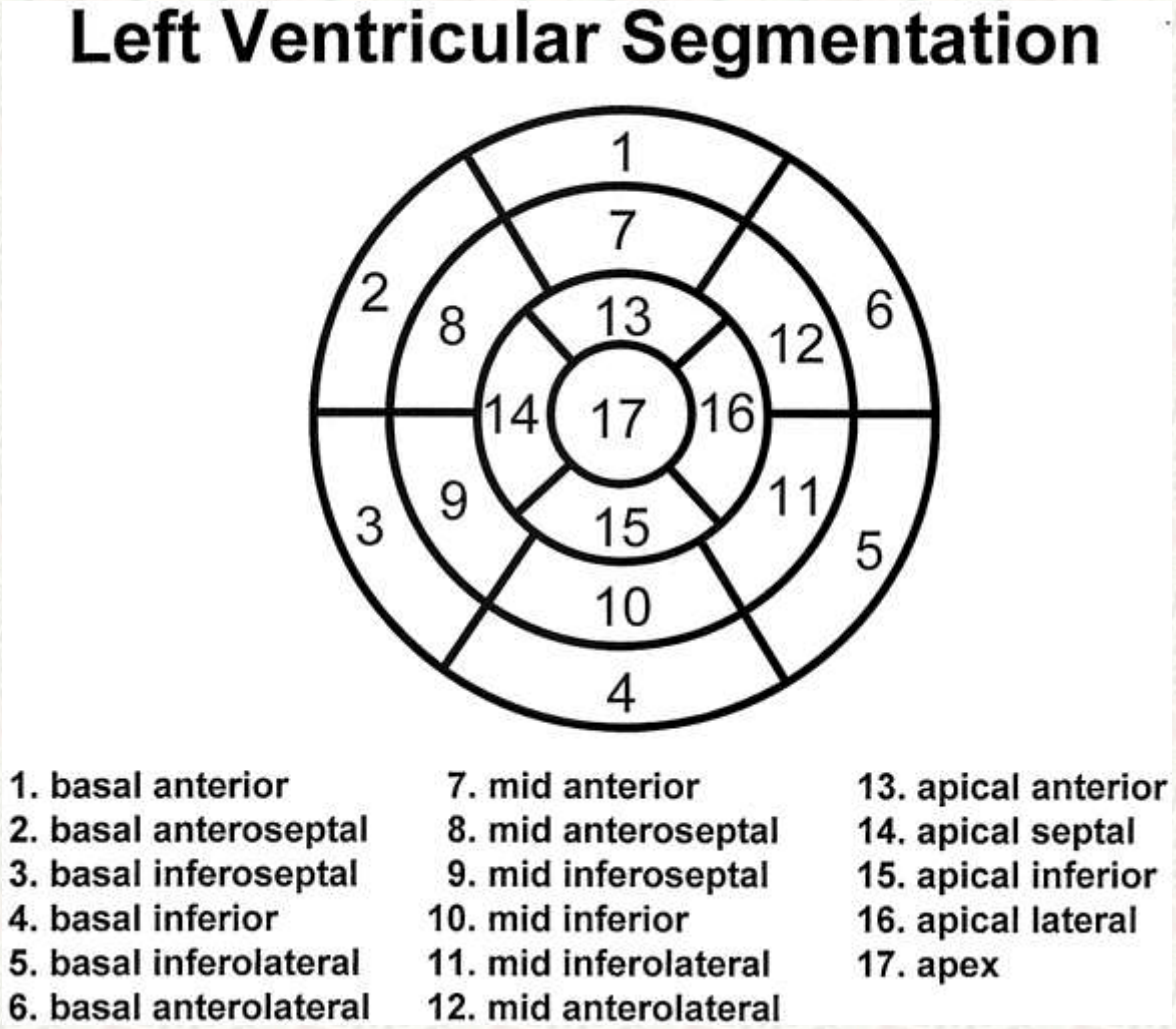
Critères d’arrêt du test

- Atteinte de la FMT (test juge valide a partir de 85% FMT)
- Douleur angineuse
- Sous décalage de ST de plus de 1 mm
- Sus-décalage de 2 mm ou plus (sauf dans le post-infarctus s ’il s ’agit du territoire nécrosé)
- Ischémie échographique étendue
- TA < 80 mm Hg ou chute rapide de TAS >30 mm Hg
- TAS > 220 mm Hg et/ou TAD > 120 mmHg
- Hyperexcitabilité auriculaire jugée menaçante
- ESV répétitives surtout si polymorphes et VG altéré
- Tachycardie ventriculaire
- Insuffisance ventriculaire gauche



Responses of myocardial segments to escalating doses of dobutamine

Analyse



Cerqueira, M. D. et al. Circulation 2002;105:539-542

Analyse

Description de la cinétique à chaque palier :

– basal
– faible dose (pharmacologique)
– pic
– récupération

Score segmentaire :

– 0 : non interprétable
– 1 : normal
– 2 : hypokinésie
– 3 : akinésie
– 4 : dyskinésie

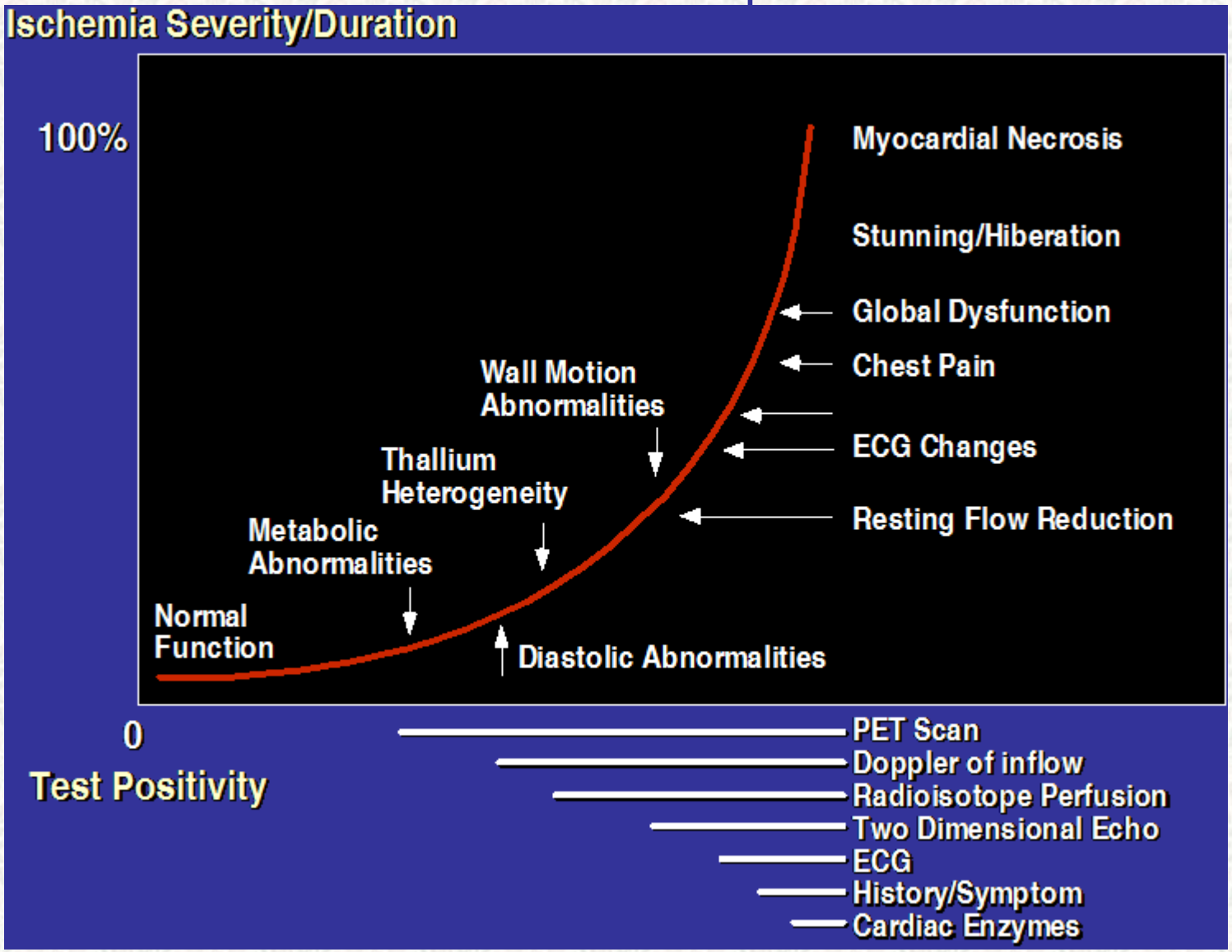
Indications dans la maladie coronaire

- **Coronaropathie méconnue** → **Détection de l'ischémie**
- **Evaluation du pronostique**
- **Coronaropathie connue** → **Diagnostic secondaire**
- **Recherche de viabilité myocardique**

Détection de l'ischémie myocardique

Fondements

Cascade Ischémique



Armstrong 1997

Echo de stress ou épreuve d'effort

- EE non concluante

  + Sous-maximale

  + Non réalisable

  + Douteuse (sexe féminin)

  - Aspects ECG rendant l'EE ininterprétable

  + BBG

  + HVG

  + Trouble de la repolarisation sur l'ECG de base

  + Stimulateur cardiaque

Détection de l'ischémie

Auteur	nPts	%St	ACS	Sens	Spéc	Sens 1Vx	Sens 2Vx	Sens 3 Vx
Sawada (91)	55	>50%	non	89%	85%			
Mazeika (92)	50	>70%	oui	78%	93%	50%	60%	86%
Marcovitz (92)	141	>50%	oui	96%	66%	95%	Pluri. : 97%	
Salustri (92)	46	>50%	non	79%	78%	40%	Pluri. : 67%	
Marwick (93)	97	>50%	oui	85%	82%	84%	Pluri. : 86%	
Marwick (93)	217	>50%	oui	72%	83%	66%	Pluri. : 77%	

Performance diagnostique des tests non invasifs pour détecter l'ischémie myocardique

Test	Sensibilité	Specificité	Etudes	Patients
ECG Effort	68	77	132	24 074
Scintigraphie	88 (73-98)	77 (53-96)	8	628
Echo Stress	76 (40-100)	88 (80-95)	10	1 174

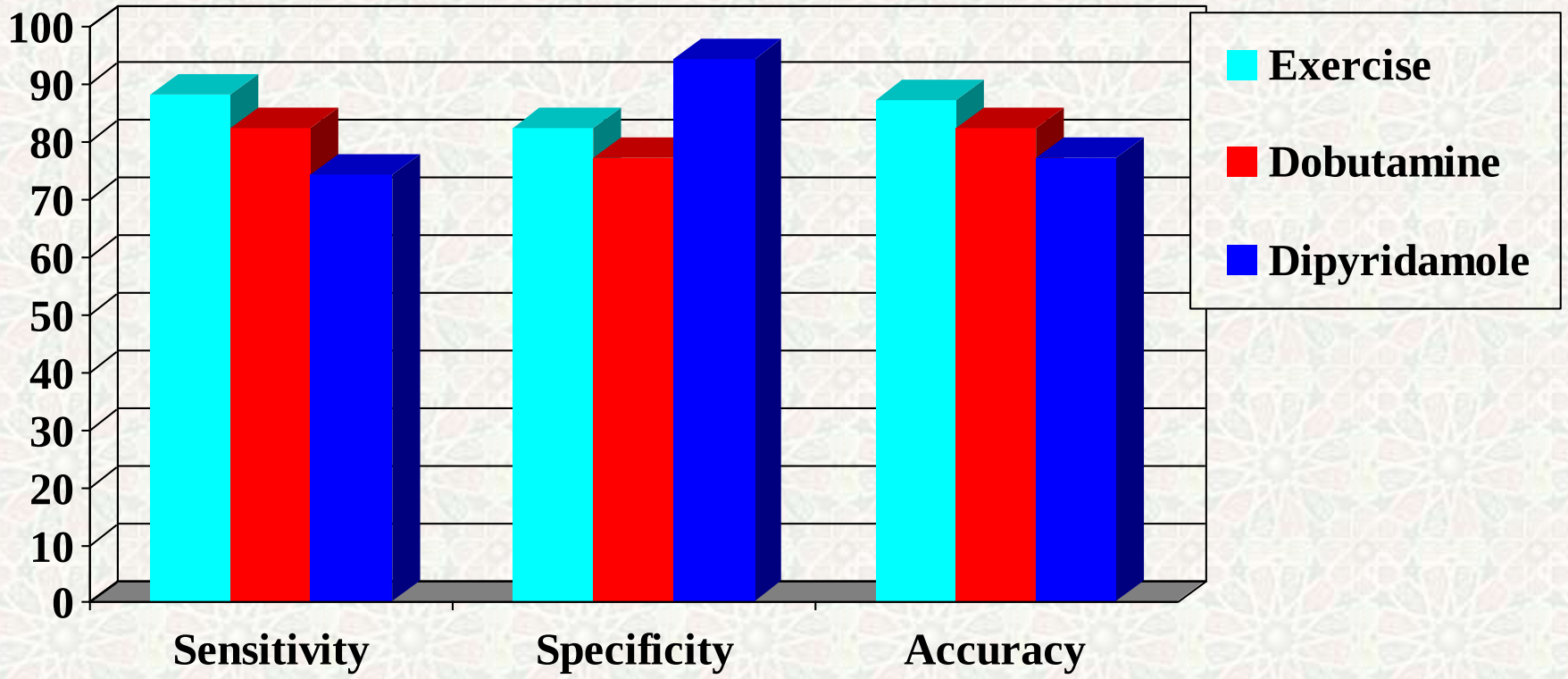
Lee TH ,Boucher CA. *N Eng J Med*. 2001; 344: 1840

Détection de la maladie coronaire. Performance diagnostique

Technique	Sensibilité (%)	Spécificité (%)
ECG effort	45-50	85-90
Echo effort	80-85	80-88
Scintigraphie effort	73-92	63-87
Echo Dobutamine	79-83	82-86
Scintigraphie vasodilatateur	90-91	75-84
IRM stress	67-94	61-85
Scanner coronaire	95-99	64-83

ESC 2013

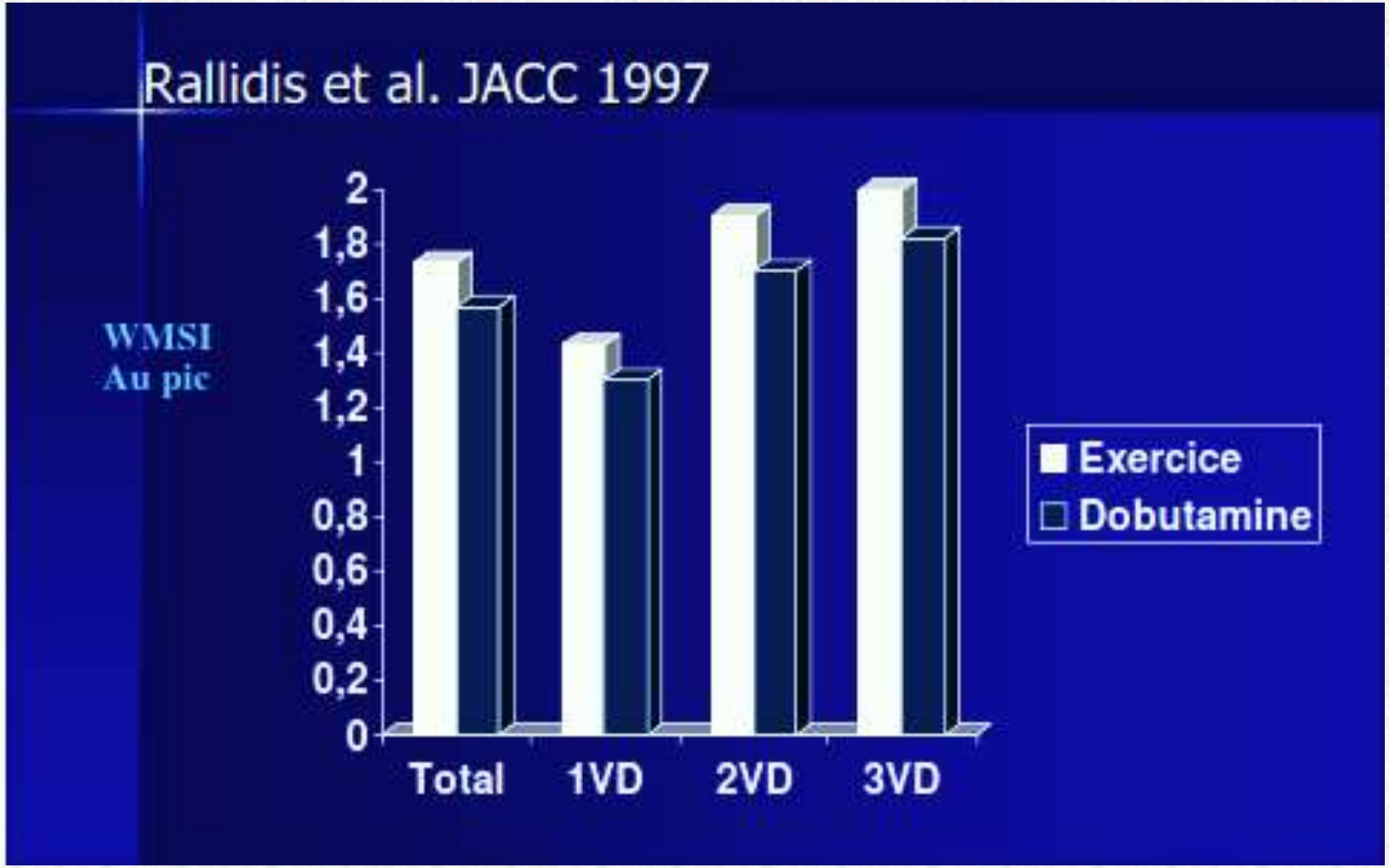
Effort Vs Dobutamine



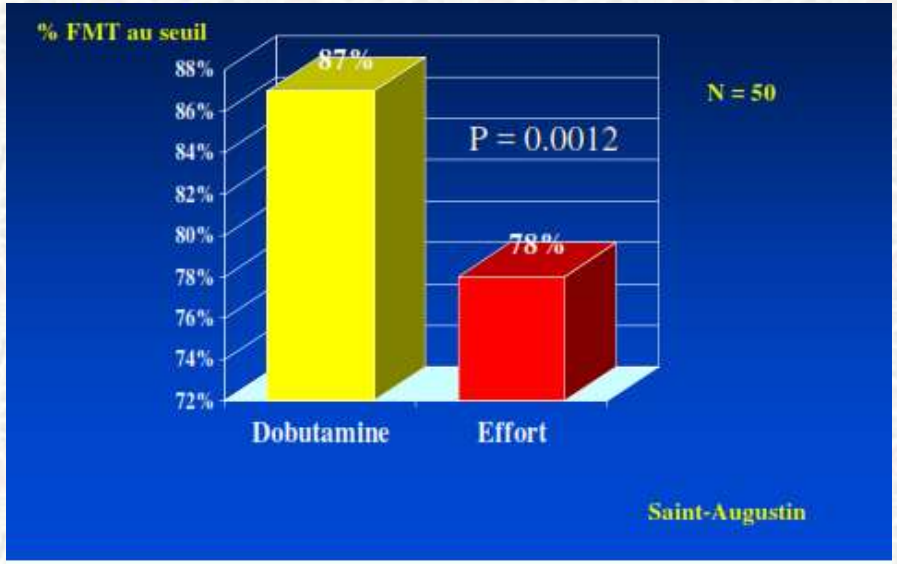
N = 136

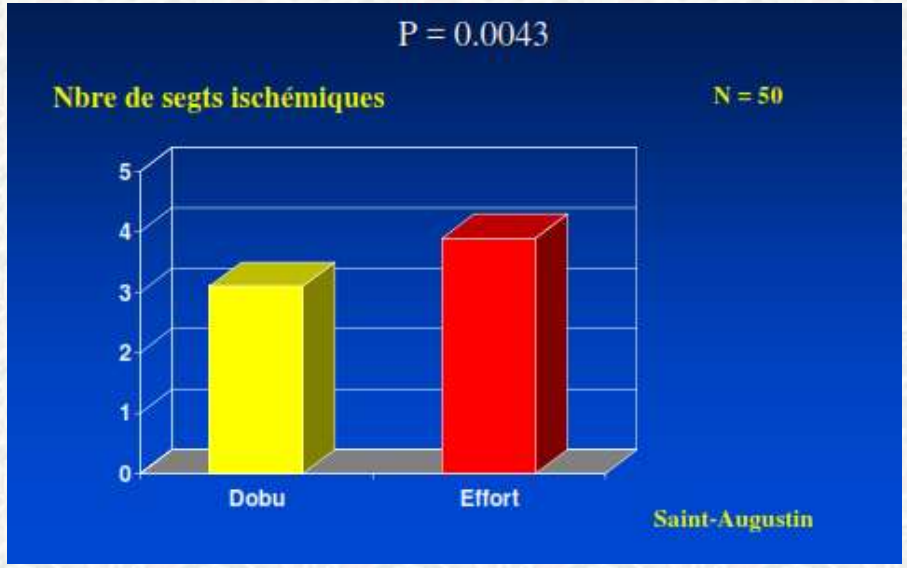
Beleslin Circ 1994

Effort Vs Dobutamine



Effort Vs Dobutamine





Effort Vs Dobutamine

Limites

Effort :

– Sous-maximal (sélection)

– Qualité des images

– Faux positifs (HTA d'effort)

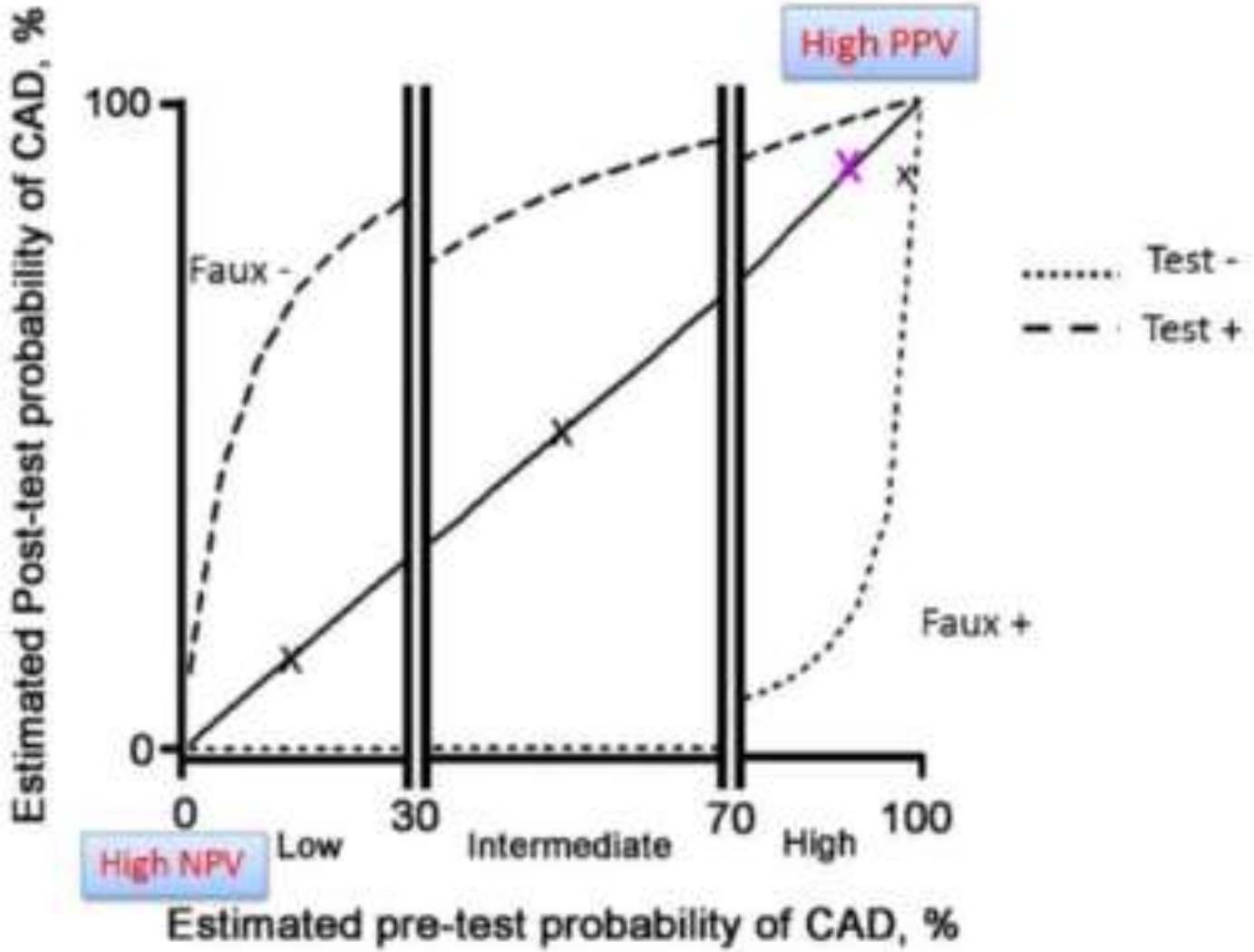
• Dobutamine:

– Tolérance (arythmies)

– Remodelage VG (sensibilité plus faible?)

– Gradient intra-VG

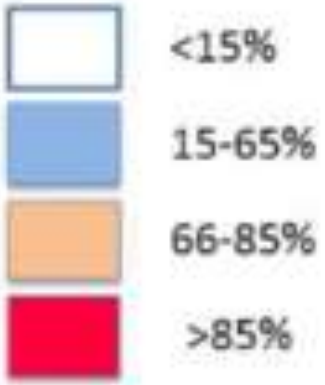
Probability of CAD as function of pre-test probability
Bayesian approach



Meijboom. JACC 2007; 50 : 1469-75

ESC guidelines 2013. Stable CAD. Clinical pre-test probabilities

	Typical angina		Atypical angina		Non-anginal pain	
Age	Men	Women	Men	Women	Men	Women
30–39	59	28	29	10	18	5
40–49	69	37	38	14	25	8
50–59	77	47	49	20	34	12
60–69	84	58	59	28	44	17
70–79	89	68	69	37	54	24
>80	93	76	78	47	65	32

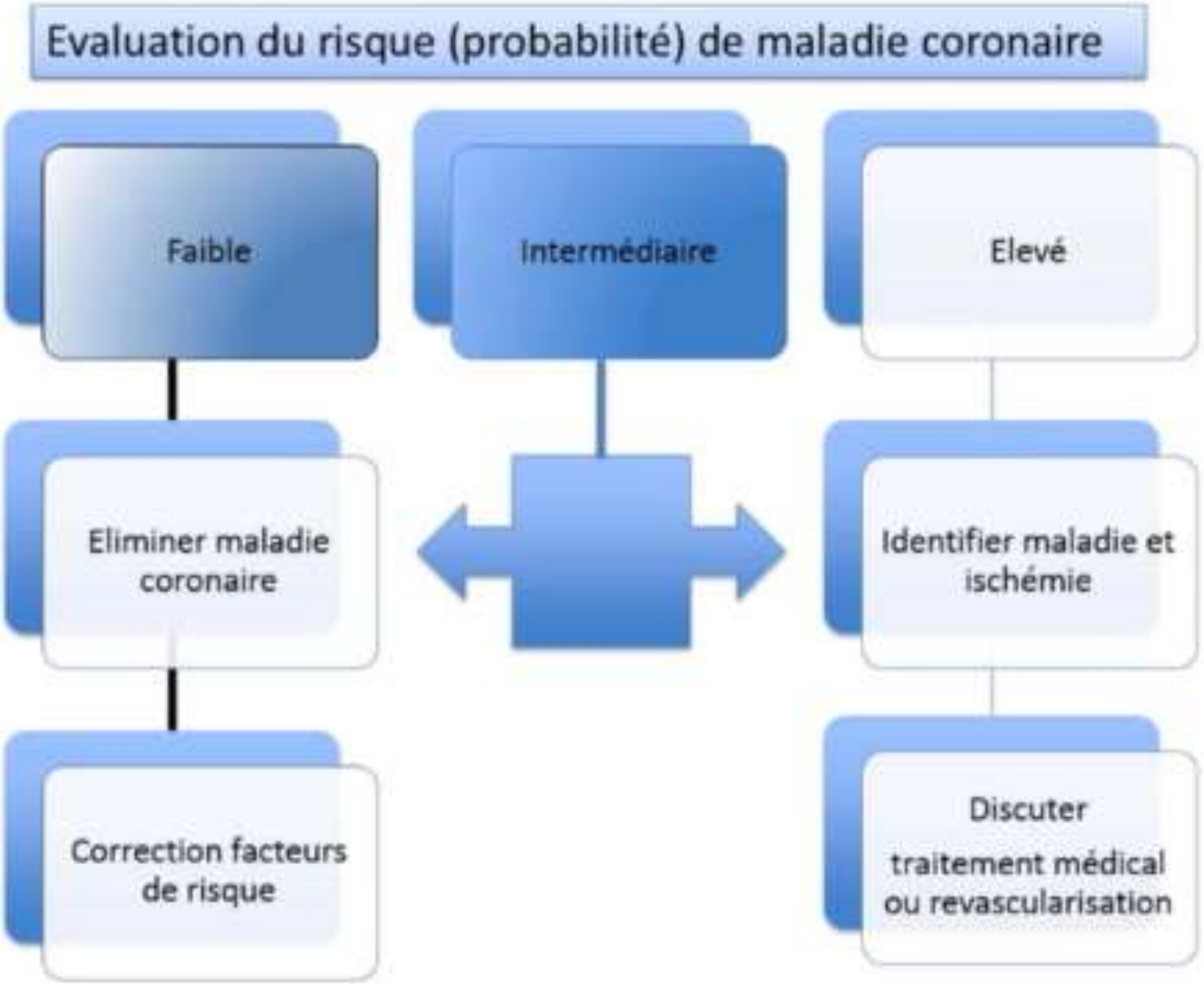


Risk factors and rest ECG not taken into consideration

Indications for diagnostic testing in patients with suspected CAD and stable symptoms. ESC guidelines 2014 (revascularization)

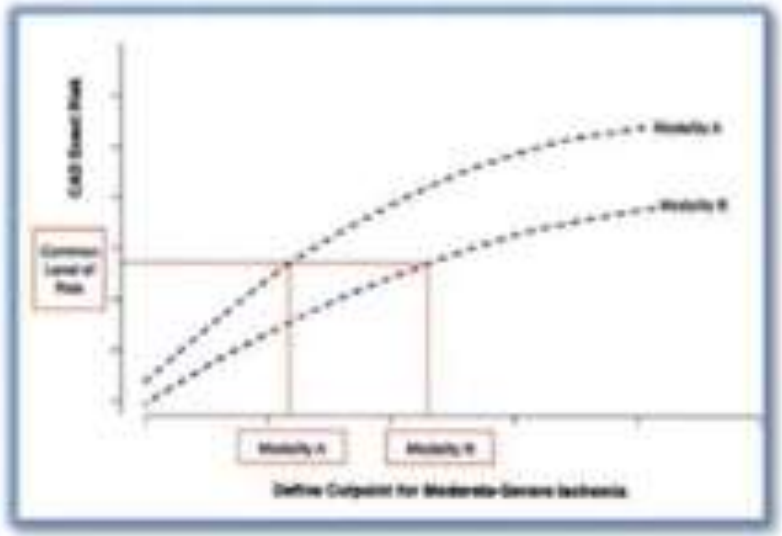
	Asymptomatic[a]		Symptomatic						
			Probability of significant disease[b]						
			Low (<15%)		Intermediate (15–85%)		High (>85%)		
	Class[c]	Level[d]	Class[c]	Level[d]	Class[c]	Level[d]	Class[c]	Level[d]	Ref[e]
Anatomical detection of CAD									
Invasive angiography	III	A	III	A	IIb	A	I	A	50-52,54
CT angiography[f,g]	III	B	III	C	IIa	A	III	B	57-62
Functional test									
Stress echo	III	A	III	A	I	A	III	A	63-65
Nuclear imaging	III	A	III	A	I	A	III	A	60,66-70
Stress MRI	III	B	III	C	I	A	III	B	71-75
PET perfusion	III	B	III	C	I	A	III	B	67,69,70,76,77
Combined or hybrid imaging test									
	III	C	III	C	IIa	B	III	B	78-83

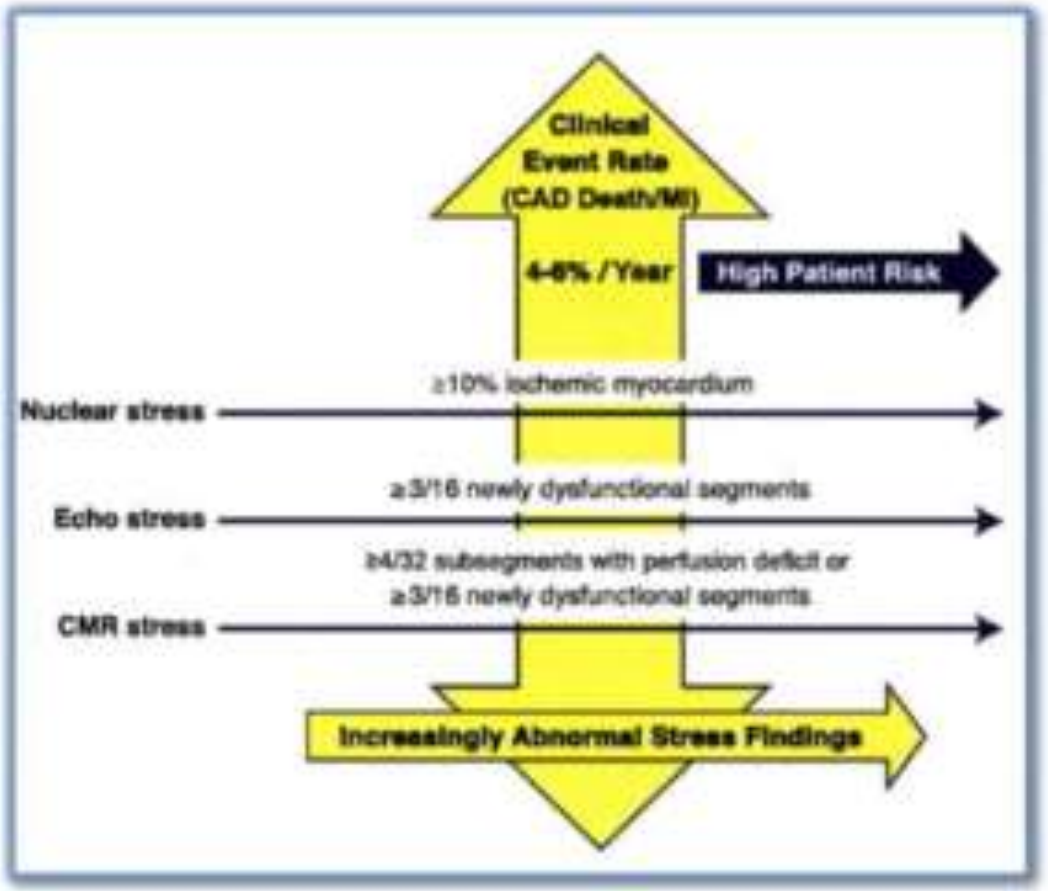
Eur. Heart. J. August 29, 2014


Evaluation du risque (probabilité) de maladie coronaire
Faible
Intermédiaire
Elevé
Eliminer maladie coronaire
Identifier maladie et ischémie
Correction facteurs de risque
Discuter traitement médical ou revascularisation

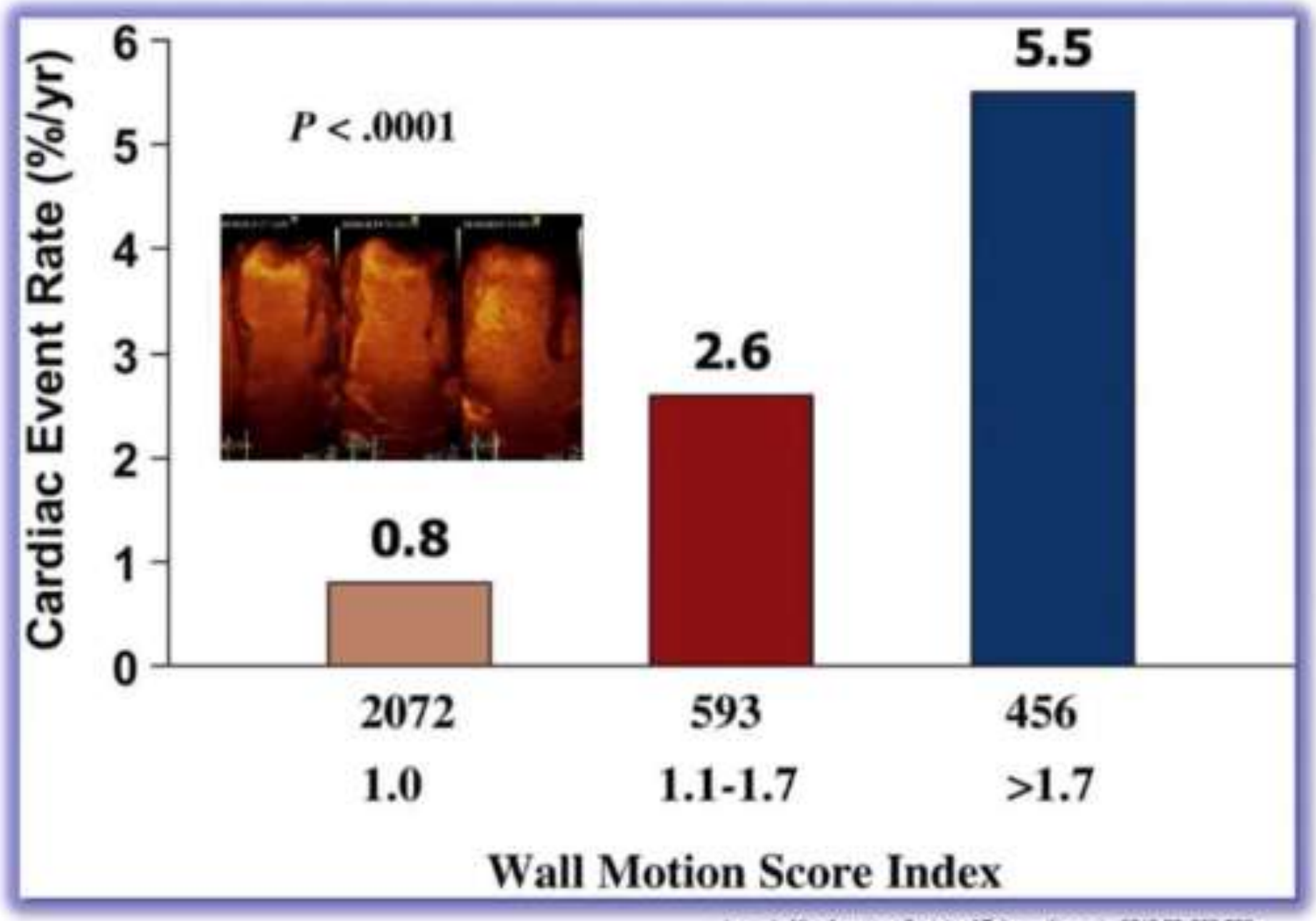
Evaluation pronostic

Comparative definition of ischaemia (CAD event risk)



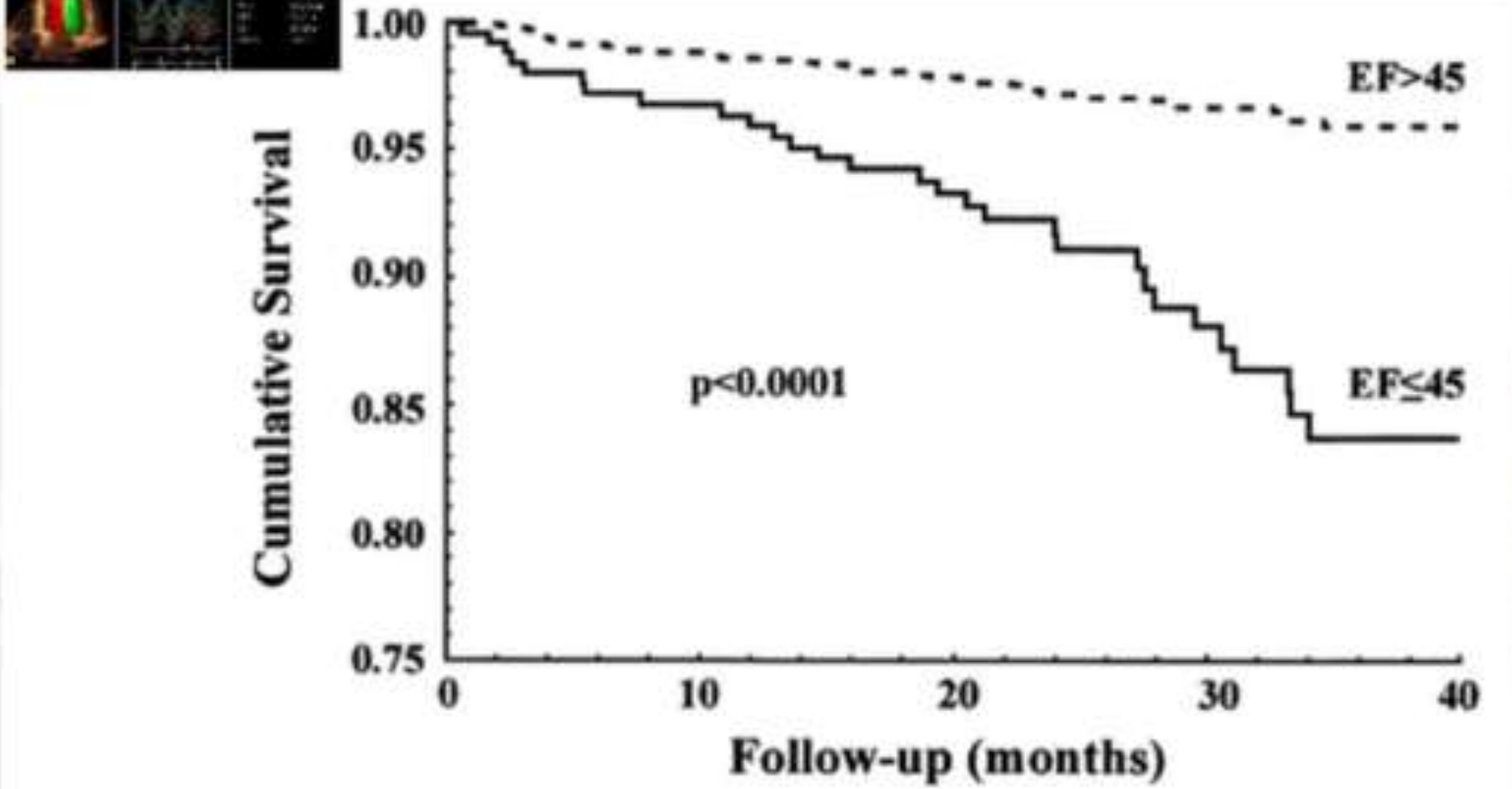


Shaw et al. JACC Cardiol Img 2014; 7: 593

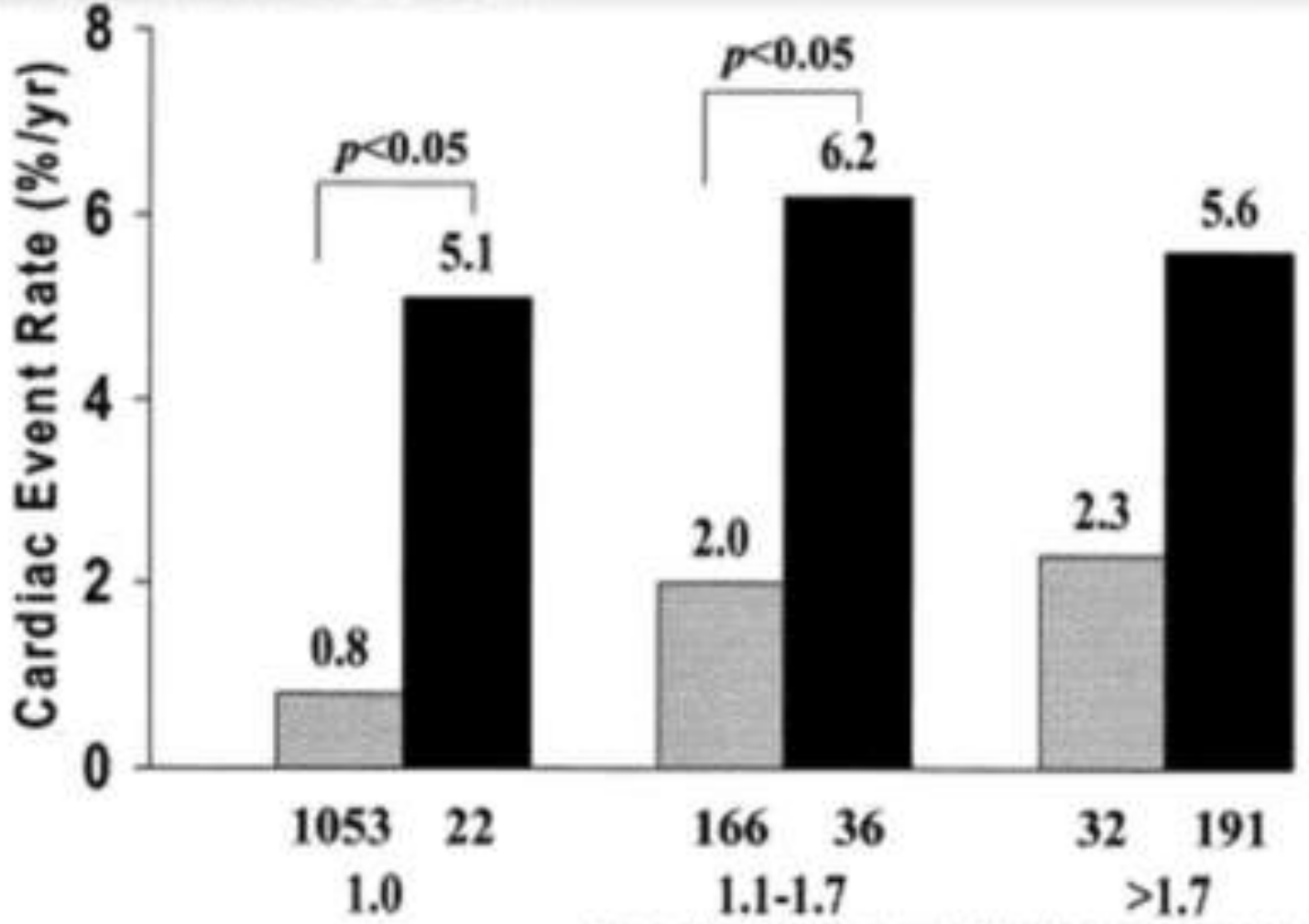


Journal of the American Society of Echocardiography 2010 23 832-839

Practical Applications in Stress Echocardiography Risk Stratification and Prognosis in Patients With Known or Suspected Ischemic Heart Disease

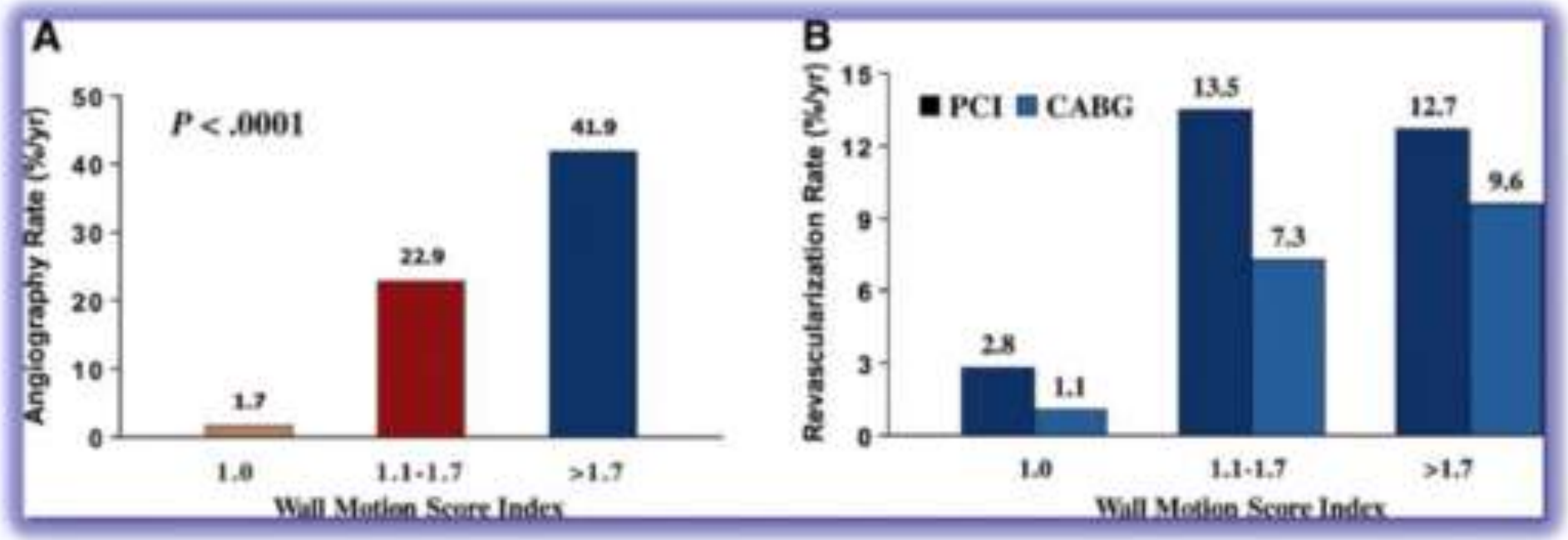


Cardiac event rate per year as a function of WMSI and LVEF. solid columns = EF ≤45%.



Sia-Sun Yao , Ehtasham Qureshi , Mark V Sherrid , Farooq A Chaudhry
Journal of the American College of Cardiology. Volume 42, Issue 6, 2003, 1054 - 1060

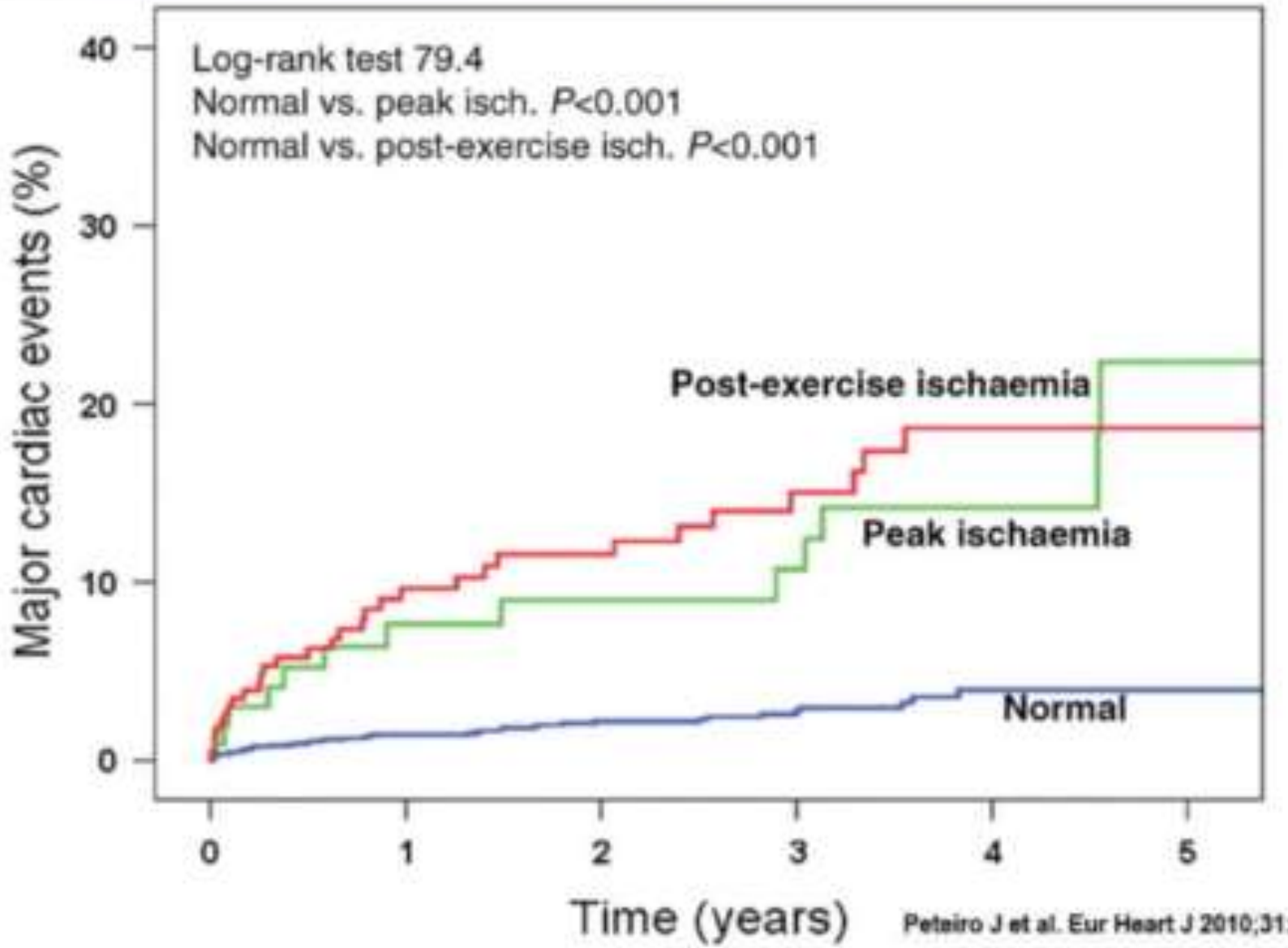
Prognostic Implications of Stress Echocardiography and Impact on Patient Outcomes: An Effective Gatekeeper for Coronary Angiography and Revascularization



3121 patients, 41 treadmill, 59 % dobutamine. Follow-up = 2.8±1.1 y.

Journal of the American Society of Echocardiography 2010

Major cardiac events curves in patients without ischaemia, patients with peak ischaemia alone, and patients with post-exercise ischaemia.



Petairo J et al. Eur Heart J 2010;31:187-195

Diagnostic secondaire

Diagnostic secondaire : coronaropathie connue

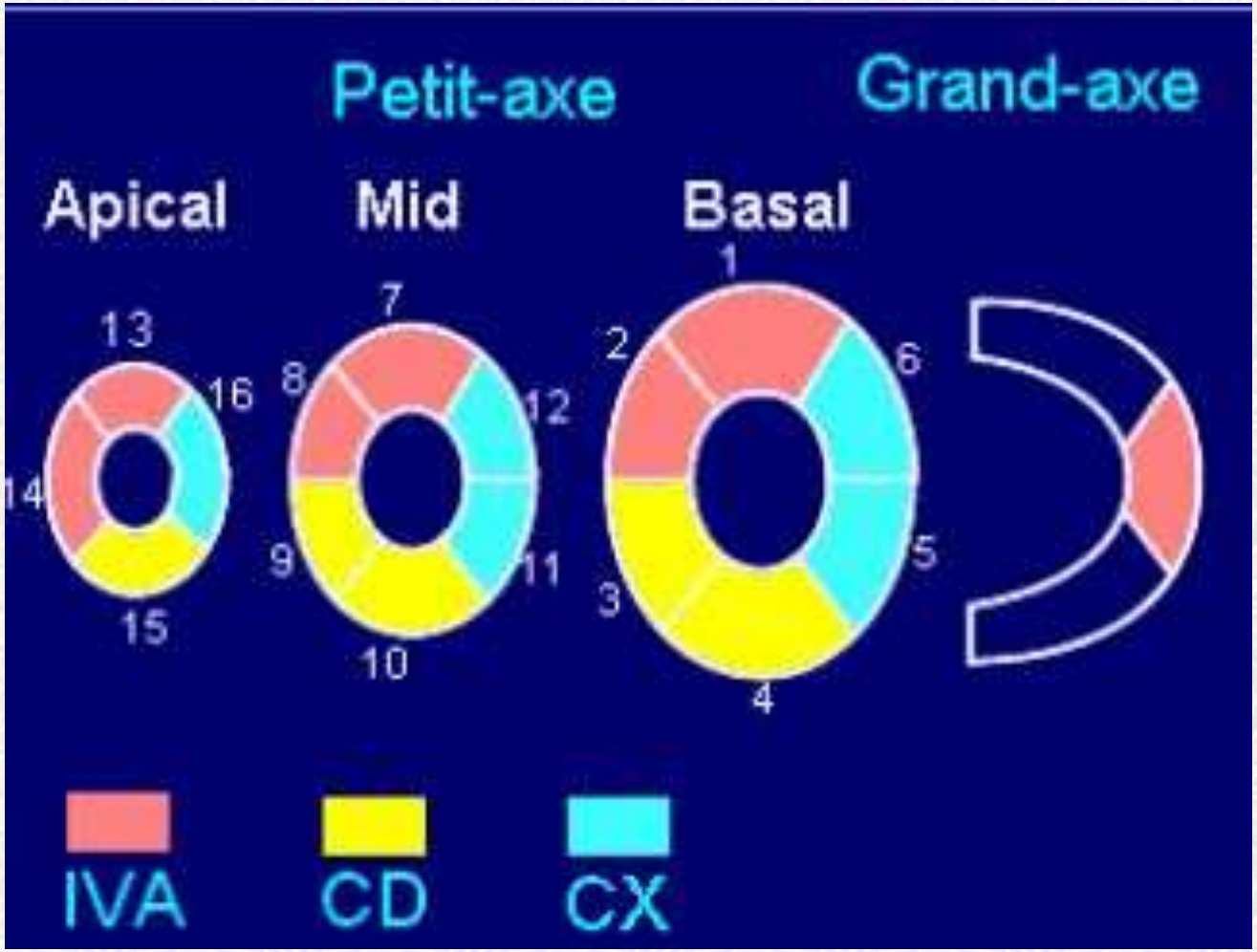
+ Evaluation fonctionnelle d'une lésion limite

+ Evaluation fonctionnelle post ACT

+ Evaluation fonctionnelle après IDM

*** Sidération myocardique**

*** Ischémie à distance de la nécrose**

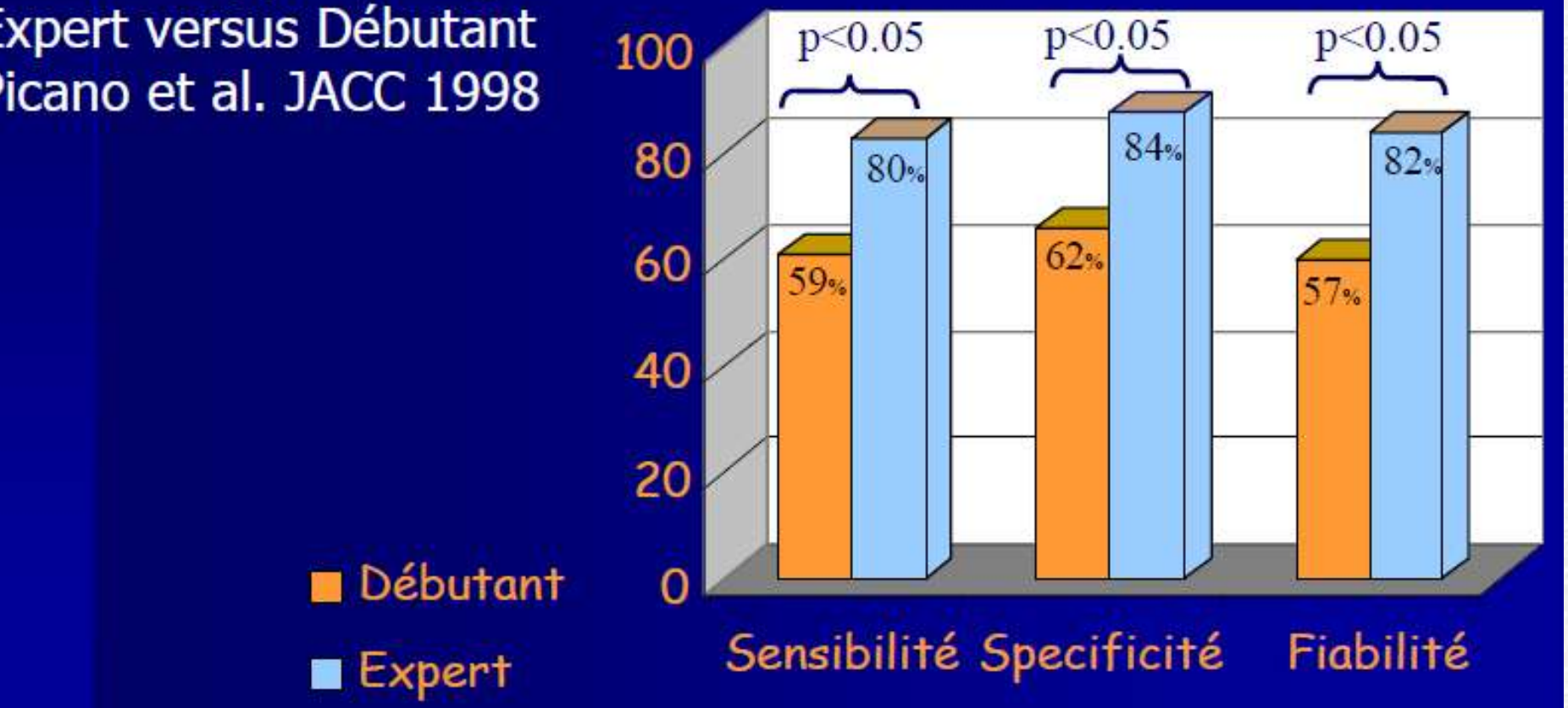


Pereztol-Valdes, O. et al. Eur Heart J 2005 26:2637-2643

Courbe d’apprentissage

Echo de stress dans le diagnostic

Courbe d'apprentissage
Expert versus Débutant
Picano et al. JACC 1998



Écho de stress

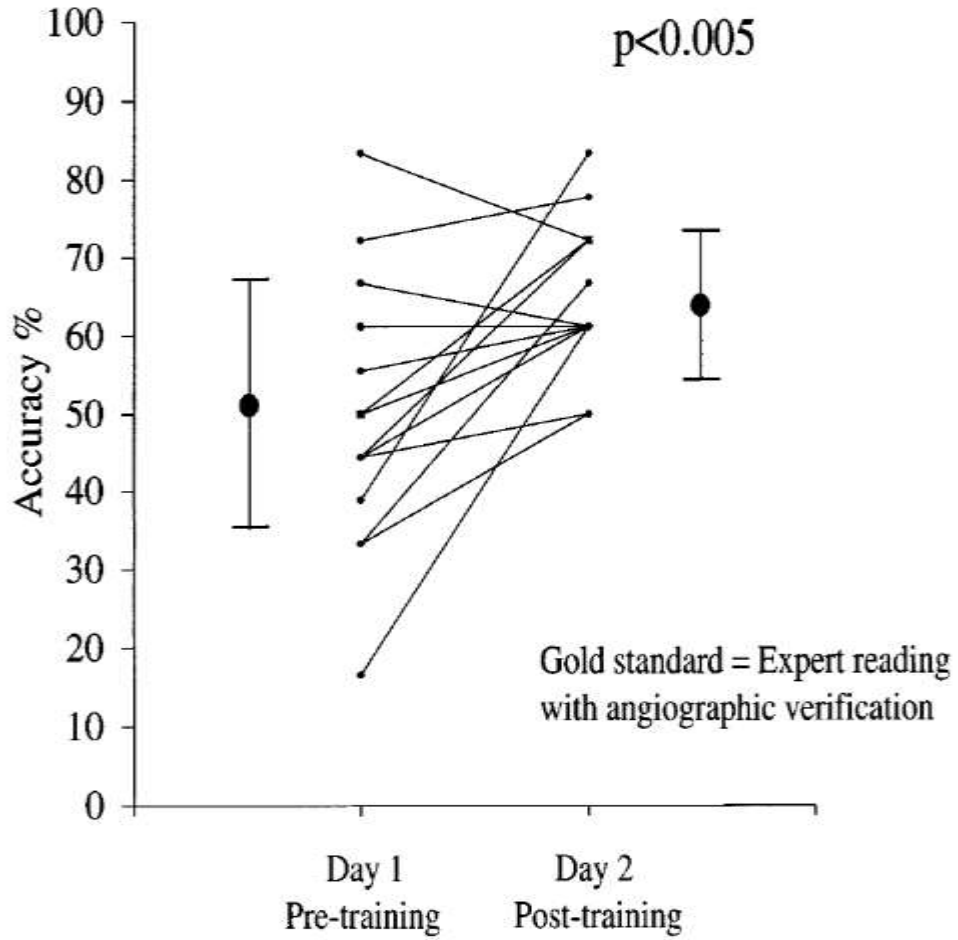


Figure 1 Individual diagnostic accuracy of the 'students' (cardiologist beginners in stress echo) attending the school at the beginning (day 1, pre-training) and at the end (day 2, post-training) of the 2 days' training. There is a highly significant increase in diagnostic accuracy.

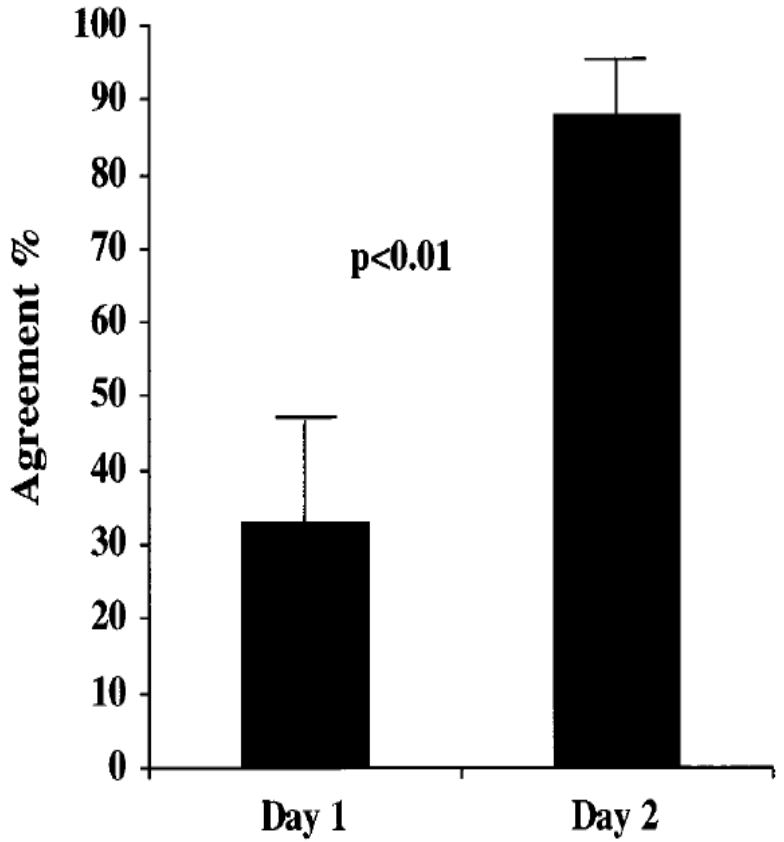
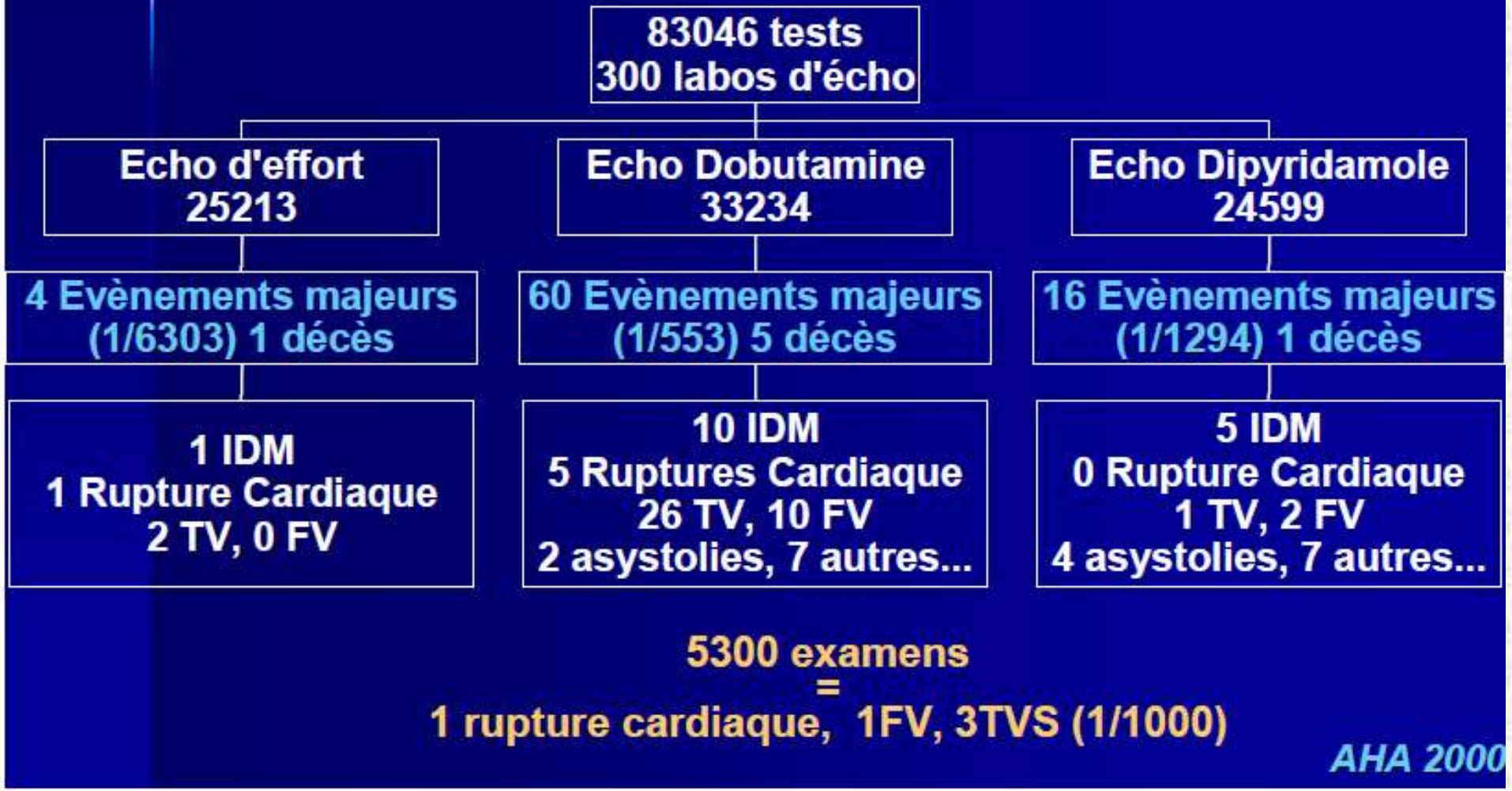


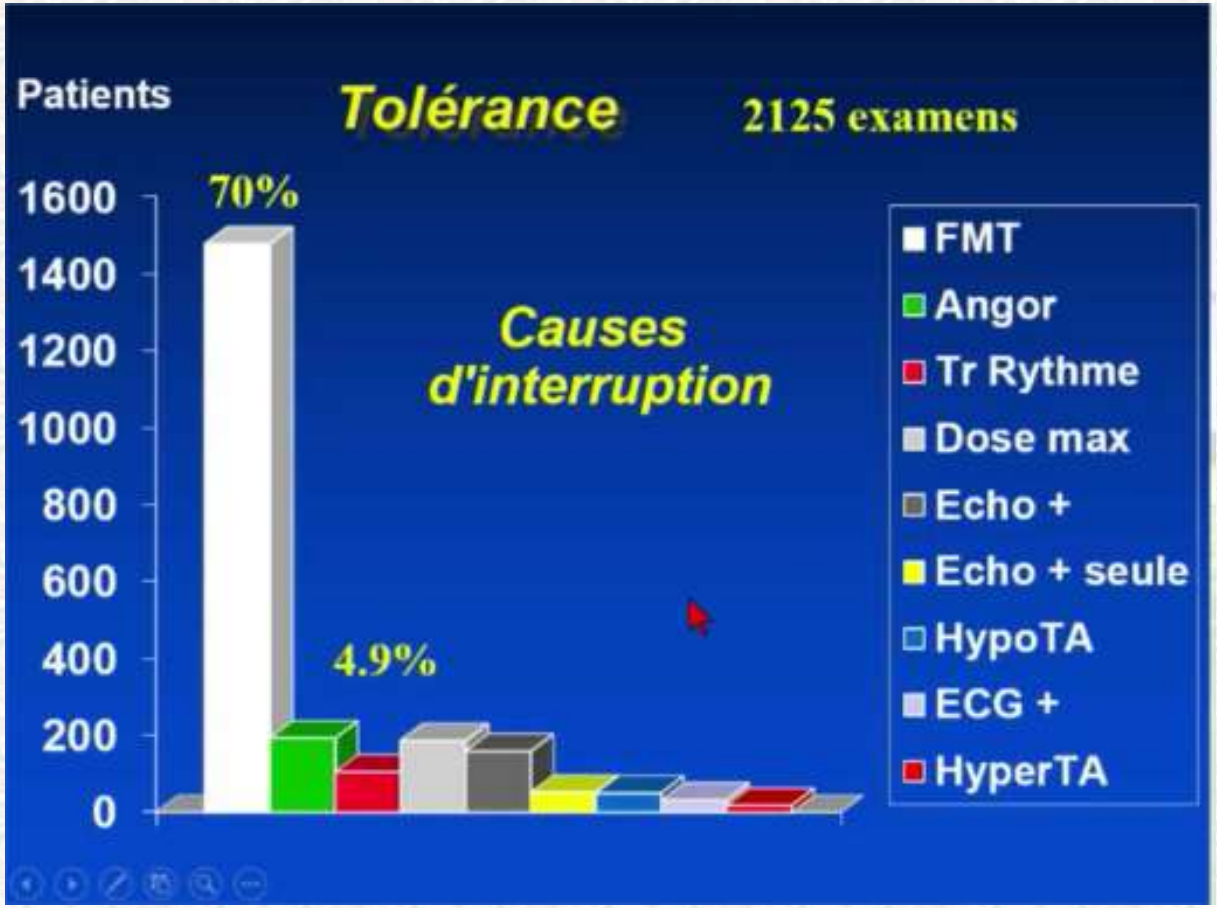
Figure 2 Bar histogram showing the class concordance in interpreting the studies at the beginning (day 1, pre-training) and at the end (day 2, post-training) of the 2 days' training. There is a highly significant increase in the number of concordant interpretations.

Sécurité

Registre Européen d'écho de stress

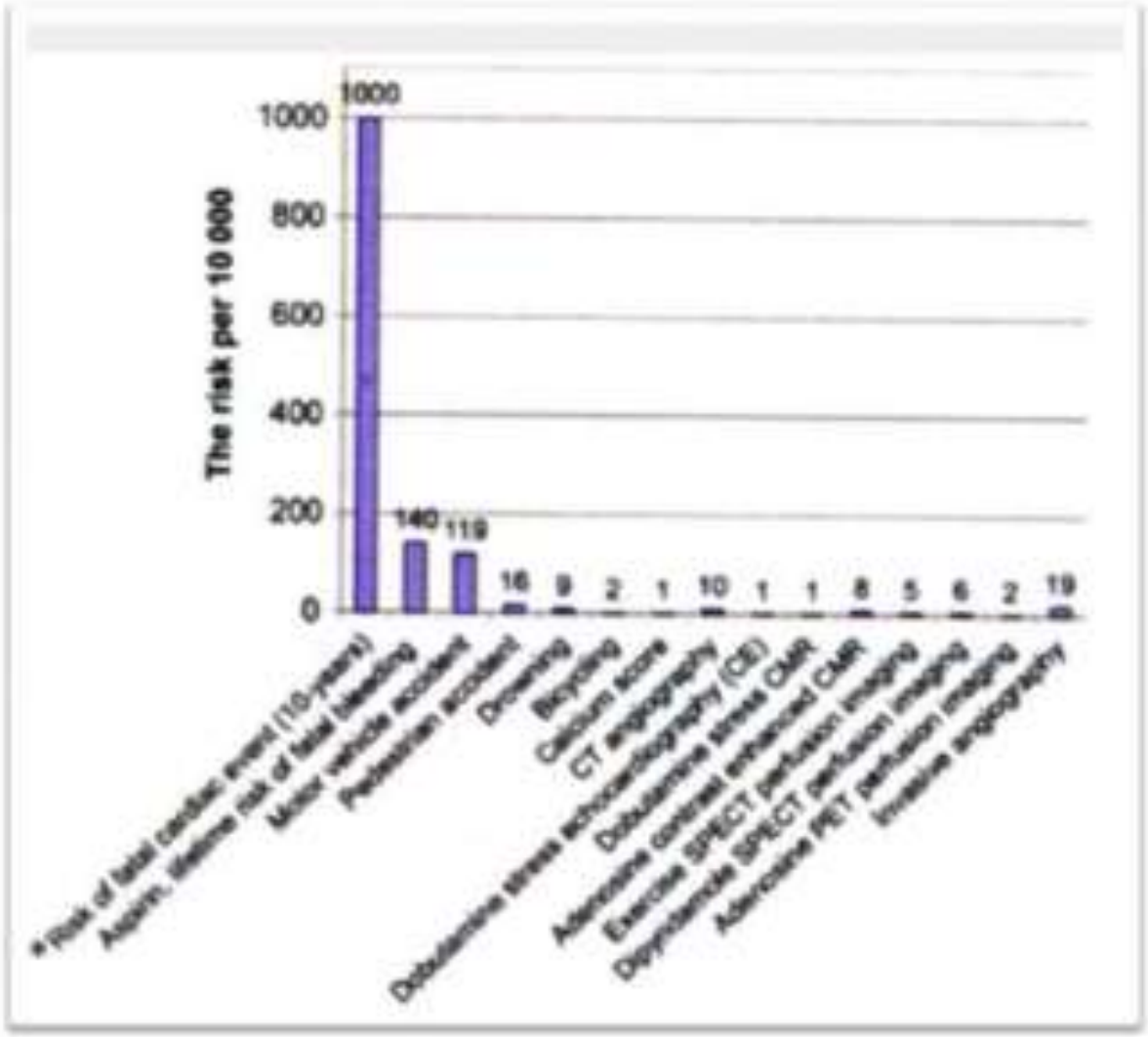


Sécurité



- Mortalité: 1/14000
- Evènements majeurs 0,19 à0,3 %

Risk of fatal events after imaging



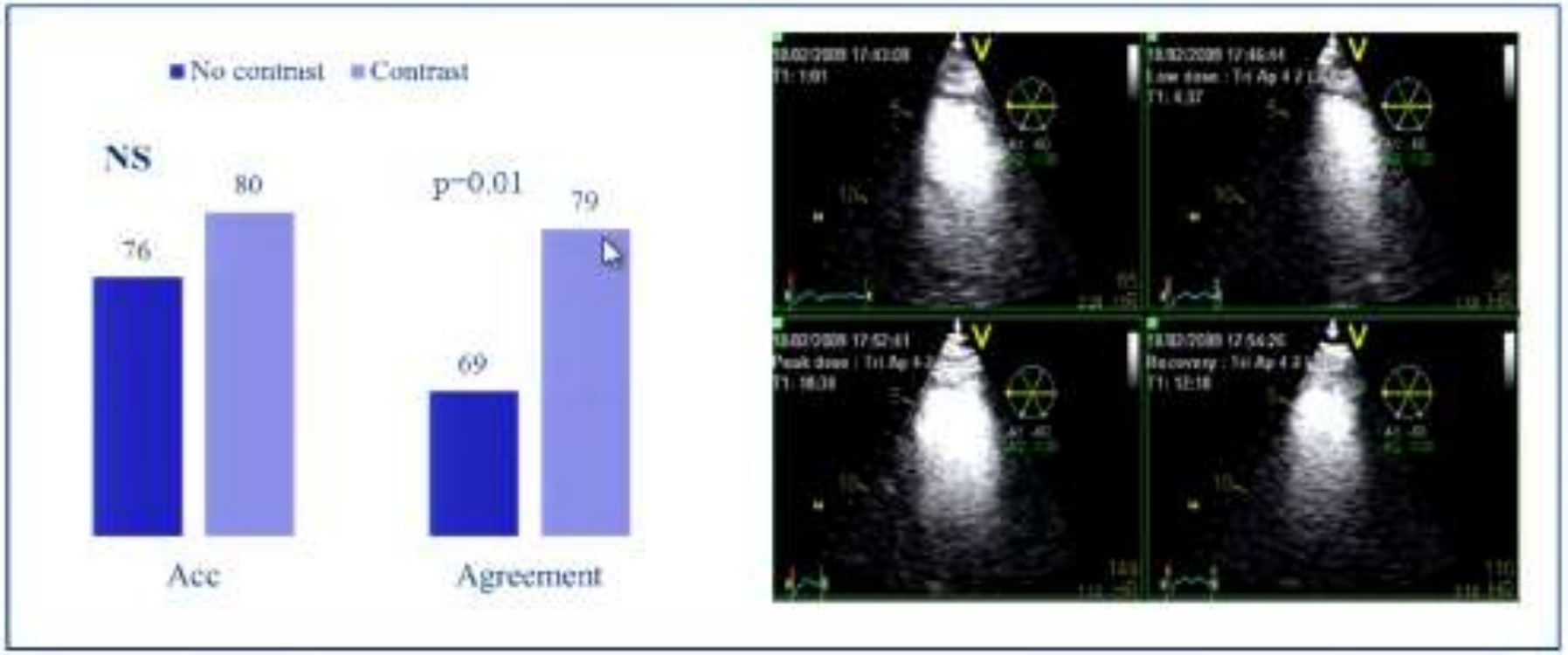
*: asymptomatic 50-60 man with > 1 risk factor

Knuuti et al. Eur. Heart. J. 2014

Perspectives

Ultrasound Contrast Agent

229 patients (112 without USC - 117 with USC)
Similar accuracy but better reproducibility



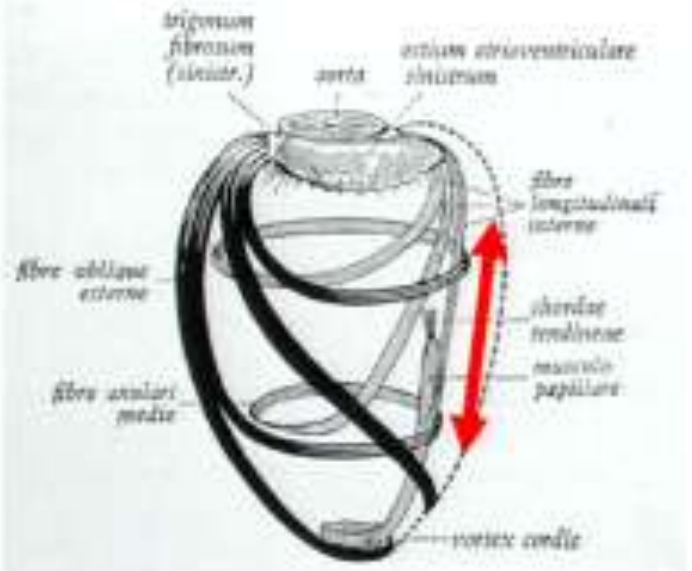
Melda S. Dolan, Am Heart J 2001

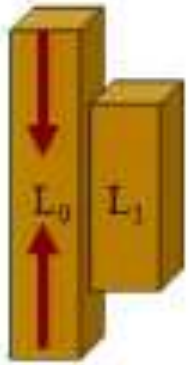
2D Strain and stress echocardiography

	Sensitivity (%)	Specificity (%)	Accuracy (%)
Mean radial strain (RS)	78	57	70
Global circumferential strain (CS)	74	79	76
Global longitudinal strain at peak (LGS>-20%)	**84**	**88**	**85**
Expert wall motion analysis (WMA)	76	93	82
Combination mean RS and expert WMA	96	57	81
Combination global CS and expert WMA	83	79	81
Combination mean global LS and expert WMA	**100**	**88**	**96**

Ng A. Am Heart J 2009

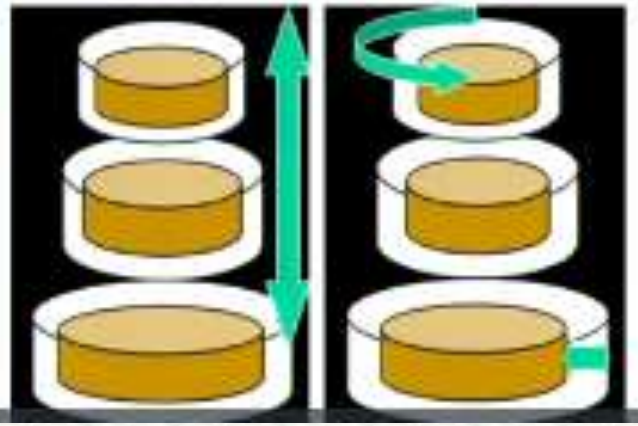
Complexity of LV motion





EF% = (ESV-EDV)/EDV

Strain% = $(L_1 . L_0)/ L_0$



Sondes multiplans

Conclusion

- Echo de stress = outil simple, disponible, rentable

- Faible risque

-Courbe d’apprentissage

- Nécessite d’une collaboration avec cathéteriseur

- Possibilité de plusieurs interprétations croisées

- Echo d’effort (valvulopathies)…..