Insuffisance cardiaque diastolique

Dr Ben Romdhane Kaïs

Service de Réanimation Respiratoire

Hôpital A. Mami – Ariana - Tunisie

Introduction

- Insuffisance cardiaque longtemps assimilée à la seule dysfonction systolique ou valvulaire
- Depuis l'avènement de l'echographie doppler cardiaque :
  - la fonction diastolique est mieux connue
  - L'insuffisance cardiaque diastolique est mieux reconnue et identifiée

New Concepts in Diastolic Dysfunction and Diastolic Heart Failure: Part I : Diagnosis, Prognosis, and Measurements of Diastolic Function

Michael R. Zile and Dirk L. Brutsaert

Circulation. 2002;105:1387-1393

American Heart Association

Dysfonction diastolique ≠ Insuffisance cardiaque diastolique

« Incapacité du ventricule gauche à se relaxer, se laisser distendre ou se remplir correctement »

- Syndrome clinique d'insuffisance cardiaque
- Fonction systolique VG normale
- Dysfonction diastolique

Terminologie ?? Insuffisance cardiaque à fonction systolique conservée ou FE conservée, préservée…

ESC Guidelines for the diagnosis and treatment of acute and chronic heart failure 2008‡

ESC GUIDELINES
European Heart Journal (2008) **29**, 2388–2442

entities.[18] Other phrases have been used to describe diastolic HF, such as HF with preserved ejection fraction (HFPEF), HF with normal ejection fraction (HFNEF), or HF with preserved systolic function (HFPSF). We have elected to use the abbreviation HFPEF in this document.

Deux raisons pour utiliser ICFE Nl

- ICFE nl n'est pas tjs d'origine diastolique
- Insuffisance cardiaque diastolique /systolique serait plutôt un syndrome unique…?

TABLE 1. Etiologies of Heart Failure With Preserved Systolic Function (HFPSF)

Diseases associated with HFPSF, secondary to diastolic dysfunction
Hypertension
Coronary artery disease
Aortic stenosis
Hypertrophic cardiomyopathy
Restrictive cardiomyopathy
Idiopathic (familial)
Amyloidosis (primary, secondary, familial, and senial)
Sarcoidosis
Loeffler's endocarditis/endomyocardial fibrosis
Hemochromatosis
Glycogen storage diseases (Fabry's Disease)
Radiation carditis
Noncompaction cardiomyopathy
Atrial fibrillation

(*Cardiology in Review* 2012;20: 230–236)

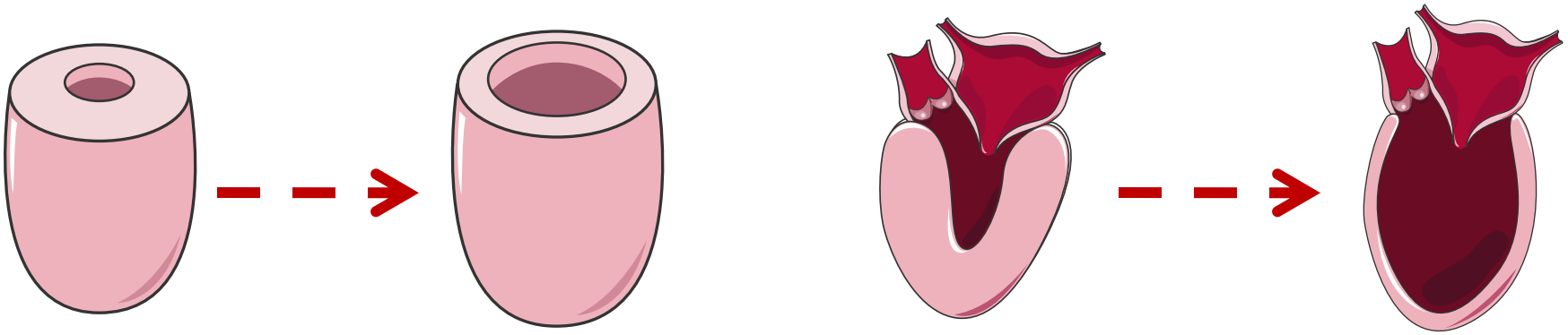
TABLE 1. Etiologies of Heart Failure With Preserved Systolic Function (HFPSF)

- Diseases associated with HFPSH, not primarily secondary to diastolic dysfunction
  - Right-heart failure
    - Pulmonary hypertension
    - Right ventricular infarction
    - Arrhythmogenic right ventricular dysplasia
    - Atrial septal defect
  - Pericardial disease
    - Constrictive pericarditis
    - Cardiac tamponade
  - High-output state
    - Anemia
    - Pregnancy
    - Thyrotoxicosis
    - Paget's Disease
    - Wet Beri-Beri (thiamine/vitamin B1 deficiency)
  - Valvular disease
    - Mitral regurgitation
    - Mitral stenosis
    - Aortic regurgitation

(*Cardiology in Review* 2012;20: 230–236)

Arguments en faveur d'un syndrome unique : dysfonction diastolique précède la dysfonction systolique

European Heart Journal (2007) **28**, 2539–2550
doi:10.1093/eurheartj/ehm037



- Progression excentrique du remodelage VG dans la cardiopathie hypertensive au stade terminal
- La diminution du raccourcissement en long axe du VG continu à progresser de l'ICFE conservée vers ICFE altérée
- Distribution unimodale de le FE VG dans les différents études

Arguments en faveur de deux syndromes distincts..

European Heart Journal (2007) **28**, 2539–2550
doi:10.1093/eurheartj/ehm037

- Remodelage VG :
  - concentrique : IC diastolique (ICD)
  - Excentrique : IC systolo-diastolique (ICSD)
- Ultrastrusture myocardique :
  - Prédominance de cardimyocytes hypertrophiques ICD
  - Diminution de la densité en myofilaments ICSD
- Persistance de la tension des cardimyocytes au repos in vitro au cours ICD
- Traitement actuel de l'IC : Amélioration du pronostic des ICS mais pas avec l'ICD

Incidence, pronostic il y a une quinzaine d'années….

Journal of the American College of Cardiology

Prevalence, Clinical Features and Prognosis of Diastolic Heart Failure: An Epidemiologic Perspective

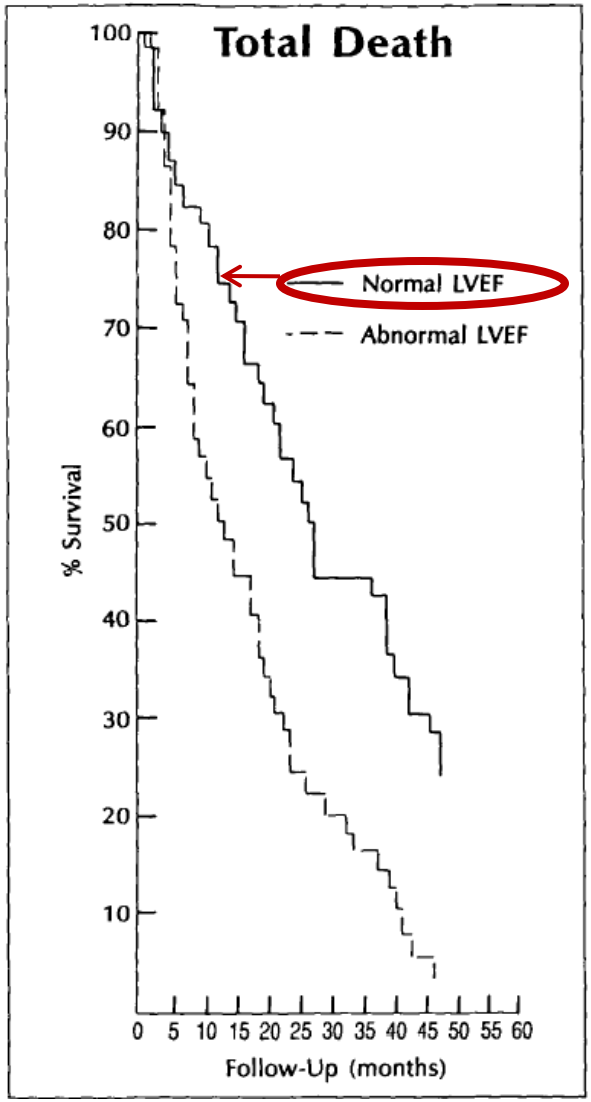
RAMACHANDRAN S. VASAN, MD,*† EMELIA J. BENJAMIN, MD, ScM, FACC,*†‡
DANIEL LEVY, MD, FACC*†§‖

Auteurs	Année	Type d'étude	Nombre total IC (n)	Prévalence ICFS conservée (%)
Dougherty et all	**1984**	Prospective	188	**37**
Bareiss et all	**1991**	Rétrospective	152	**26**
Stone et all	**1991**	Prospective	40	**27**
Cregler et all	**1991**	Rétrospective	372	**23**
Takarada et all	**1992**	Prospective	172	**24**
Iriarte et all	**1993**	Rétrospective	301	**29**
Duch et all	**1990**	Prospective	100	**36**

(J Am Coll Cardiol 1995;26:1565–74)

Prognosis of Congestive Heart Failure in Elderly Patients with Normal Versus Abnormal Left Ventricular Systolic Function Associated with Coronary Artery Disease

Wilbert S. Aronow, MD, Chul Ahn, PhD, and Itzhak Kronzon, MD



NOVEMBER 15, 1990

- Même un meilleur pronostique que IC avec FE altérée…!!

Les facteurs de risque ICFE Nle

JACC Vol. 47, No. 1, 2006
January 3, 2006:76–84

A Report From the Acute Decompensated Heart Failure National Registry (ADHERE) Database

Characteristic	Systolic Function		p*
	Preserved (n = 26,322)	Reduced (n = 25,865)	
Age (yrs, mean ± SD)	73.9 ± 13.2	69.8 ± 14.4	<0.0001
Women (%)	62	40	<0.0001
Admission at academic center (%)	30	35	<0.0001
Medicare/Medicaid insurance (%)	80	73	<0.0001
African American (%)	17	22	<0.0001
Hypertension, CAD, or diabetes (%)	91	88	<0.0001
Hypertension (%)	77	69	<0.0001
CAD (%)	50	59	<0.0001
Diabetes mellitus (%)	45	40	<0.0001
Chronic renal insufficiency (%)	26	26	0.98
History of heart failure (%)	63	72	<0.0001
Prior myocardial infarction (%)	24	36	<0.0001
COPD or asthma (%)	31	27	<0.0001
Cardiac valvular disease (%)	21	22	0.13
Peripheral vascular disease (%)	17	17	0.33
Ventricular tachycardia (%)	3	11	<0.0001

Changement des paramètres épidémiologiques….

JACC Vol. 47, No. 1, 2006
January 3, 2006:76–84

JACC Vol. 43, No. 3, 2004
February 4, 2004:317–27

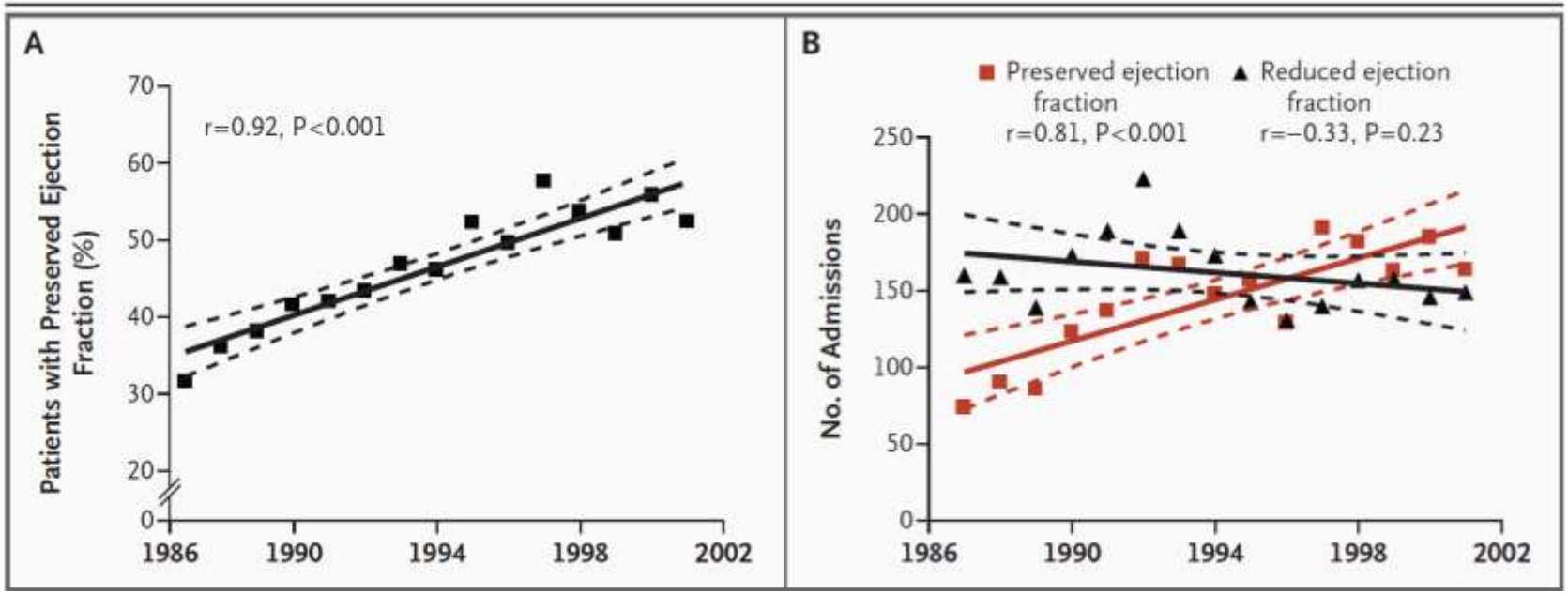
Pays	Année	Nombre patients	Age moyen	Sexe féminin (%)	Prévalence ICFS conservée (%)
USA	**2002**	782	-	69	**54**
USA	**2002**	438	-	69	**55**
Danemark	**2003**	5491	73	63	**42**
USA	**2003**	2258	73	49	**43**
USA	**2006**	52187	72	51	**50,3**

Trends in Prevalence and Outcome of Heart Failure with Preserved Ejection Fraction

Theophilus E. Owan, M.D., David O. Hodge, M.S., Regina M. Herges, B.S., Steven J. Jacobsen, M.D., Ph.D., Veronique L. Roger, M.D., M.P.H., and Margaret M. Redfield, M.D.

N Engl J Med 2006;355:251-9.

- 4796 patients hospitalisés pour IC (1987-2001), mayo clinic hospitals (USA)
- ICFEN 47% (n=2167)
- Augmentation du pourcentage de patients avec ICFEN durant l'étude
- Augmentation du nombre d'hospitalisation pour ICFEN durant la période d'étude

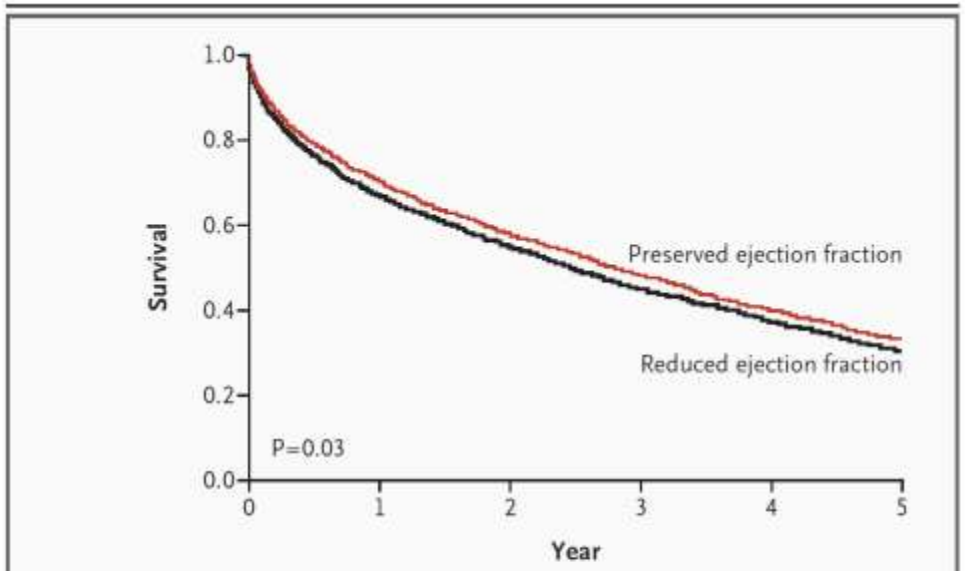


Trends in Prevalence and Outcome of Heart Failure with Preserved Ejection Fraction

Theophilus E. Owan, M.D., David O. Hodge, M.S., Regina M. Herges, B.S., Steven J. Jacobsen, M.D., Ph.D., Veronique L. Roger, M.D., M.P.H., and Margaret M. Redfield, M.D.

N Engl J Med 2006;355:251-9.

- 4796 patients hospitalisés pour IC (1987-2001)



No. at Risk						
Reduced ejection fraction	2424	1637	1350	1049	813	604
Preserved ejection fraction	2166	1539	1270	1001	758	574

Figure 2. Kaplan–Meier Survival Curves for Patients with Heart Failure and Preserved or Reduced Ejection Fraction.

Causes de DC d'origine cardiovasculaire++++

Mode of Death in Patients With Heart Failure and a Preserved Ejection Fraction

Results From the Irbesartan in Heart Failure With Preserved Ejection Fraction Study (I-Preserve) Trial

(*Circulation*. 2010;121:1393-1405.)

Table 6. Mode of Death Distribution in I-Preserve Compared With Previous RCTs

	HFPEF, n (%)				HFREF, mean % (range)	
	I-Preserve	CHARM-Preserved	PEP-CHF	DIG-Preserved	Drugs*	Devices†
Total	881	481	109	231		
Sudden death	231 (26)	134 (28)	NR	NR	42 (23–58)	28 (21–34)
Heart failure	125 (14)	102 (21)	NR	64 (28)	36 (27–56)	45 (34–63)
MI	44 (5)	13 (3)	NR	NR	7 (2–15)	6 (3–15)
Stroke	76 (9)	33 (7)	NR	NR	5 (3–6)	5 (3–6)
CV procedure	13 (1)	13 (3)	NR	NR	2 (1–3)	2 (1–3)
Other cardiac	10 (1)	35 (7)	NR	NR	7 (2–11)	6 (3–10)
Other vascular	32 (4)	NR	NR	NR	NR	NR
Noncardiovascular	268 (30)	141 (29)	31 (28)	69 (30)	14 (4–20)	15 (5–17)
Unknown	81 (9)	NR	NR	NR	NR	NR
	60 %	**70 %**				

Diastolic heart failure: Predictors of mortality

Saadia Sherazi[1], Wojciech Zaręba[2]

[1]Department of Medicine, Unity Health System, Rochester, NY, USA
[2]Department of Cardiology, University of Rochester Medical Center, Rochester, NY, USA

VIA MEDICA

Cardiology Journal 2011, Vol. 18, No. 3

Table 1. Summary of mortality rates from epidemiological studies in patients with heart failure with preserved ejection fraction.

Study	Design	N	Study population	Mortality	Follow-up
Vasan et al. [7]	Nested case control	CHF cases: 73 Age/gender control: 146	LVEF > 50 51% LVEF > 50 Outpatients	Cases normal EF *vs* control: 8.7% *vs* 3.0% Reduced EF *vs* control: 18.9% *vs* 4.1%	6.2 years (median)
Owan et al. [4] 1/87 to 12/01	Retrospective study	N = 4,596 Preserved EF: 2,167 Reduced EF: 2,429	LVEF ≥ 50 Hospitalized	29% *vs* 32%	10.0 ± 4.2 years (mean)
O'Connor et al. [21] 1/84 to 12/96	Prospective study	2,498	LVEF > 40 class II–IV Had cardiac catheterization	28% mortality	Five years
Smith et al. [6] 3/96 to 9/98	Prospective	413	LVEF ≥ 40 Hospitalized	Preserved EF *vs* reduced EF: 13% *vs* 21%	Six months
Bhatia et al. [9] 4/99 to 3/01	Retrospective	2,802	LVEF < 40 LVEF > 50%	22% *vs* 26%	One year
Tribouilloy et al. [8] 1/00 to 12/00	Prospective	799	LVEF ≥ 50% Hospitalized	Preserved EF *vs* reduced EF: 57% *vs* 54%	Five years

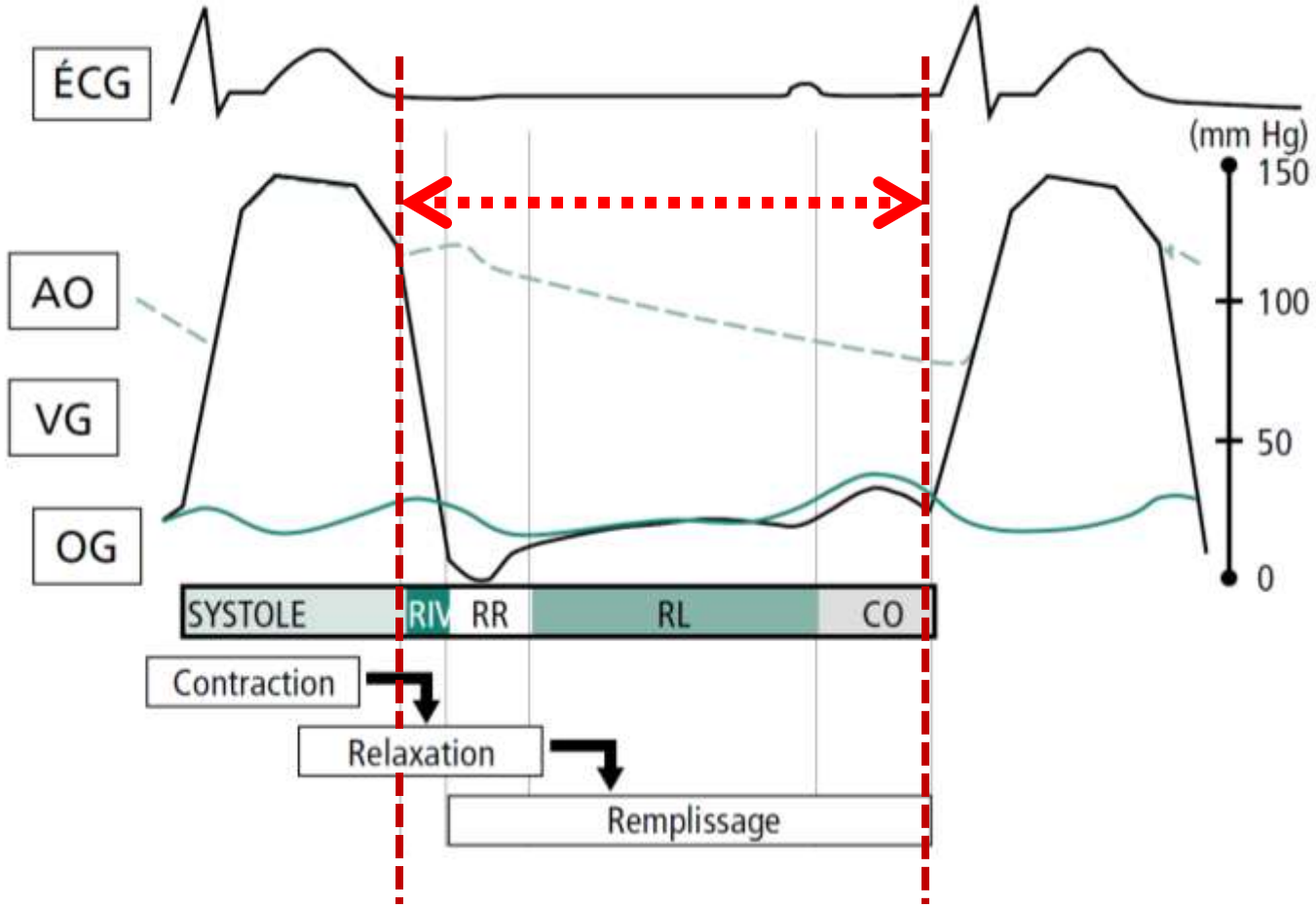
CHF — congestive heart failure; EF — ejection fraction; HF — heart failure; LVEF — left ventricular ejection fraction

Diastolic heart failure: Predictors of mortality

VIA MEDICA
Cardiology Journal 2011, Vol. 18, No. 3

Clinical parameter	Risk estimates
Age	
For every SD increase in the age[2] [20]	HR 1.28, p = 0.0019
5 year mortality [1]:	
< 50 years	15%
50–70 years	33%
> 70 years	50%
Male gender [20]	HR 1.71
Caucasian race (adjusted risk ratio) [21]	RR 0.75
Coronary artery disease (adjusted risk ratio) [21]	RR 1.1
AF	
Five-year survival sinus rhythm *vs* AF [25]	72% *vs* 56%, p = 0.0001
LVEF ≥ 55%	62% *vs* 78%, p < 0.0001
LVEF 41–54%	57% *vs* 72%, p = 0.02
LVEF ≥ 55% (n = 5130)	HR 1.29, p = 0.0002
Anemia (relative risk of death) [32]	HR 1.57, p = 0.015
BNP	
Adjusted OR to predict mortality [37]	OR 2.23, p < 0.0001
To predict the cardiac mortality and CHF re-hospitalization [39]	Chi-square =17, p < 0.0001
Pre-discharge BNP (for death and re-admission) (after adjusting for clinical variables) derivation study [38]	HR 1.14 (95% CI 1.02–1.28), p = 0.027
Pre-discharge BNP level > 350 ng/L related to death or readmission (validation study) [38]	HR 12.6 (95% CI 5.7–28.1), p = 0.0001
Echocardiographic parameters:	
LVEF	
10% reduction in the EF below 45% [44]	Risk for total mortality increased by up to 39%
E/Ea ratio ≥ 15	
Cardiac mortality and CHF re-hospitalization [39]	Chi-square = 13.6, p = 0.0001
Restrictive transmitral filling	
DT ≤ 140 ms [46]	HR 2 (95% CI 1.1–3.4), p = 0.02
Em < 3.5 cm/s [48]	HR 5.29 (95% CI 2.64–10.60)

Le cycle cardiaque



Heart failure

CURRENT PERSPECTIVES IN DIASTOLIC DYSFUNCTION AND DIASTOLIC HEART FAILURE

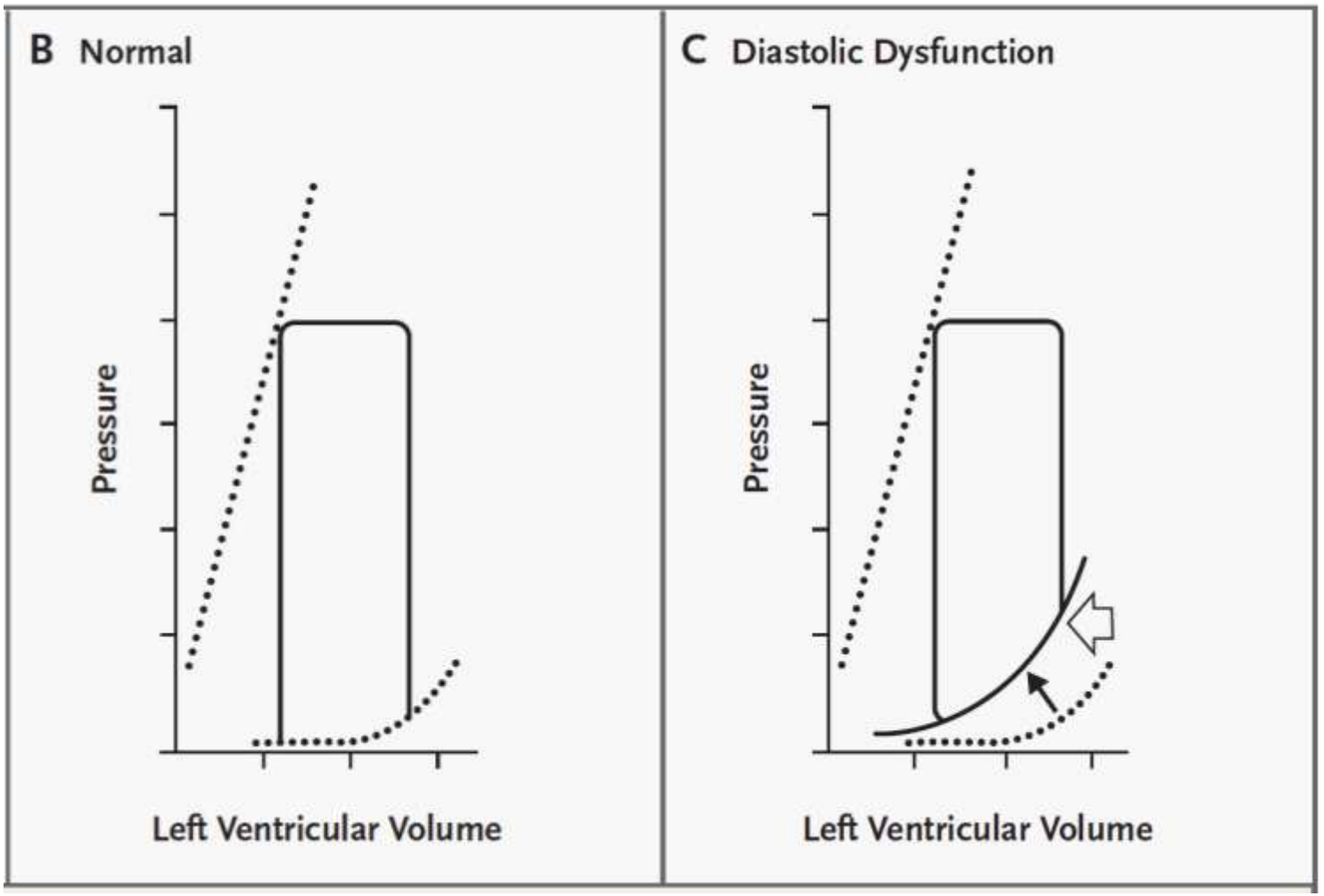
Adelino F Leite-Moreira

Heart 2006;**92**:712–718. doi: 10.1136/hrt.2005.062950

Les déterminants de la fonction diastolique

- Myocardial relaxation
  - load
  - inactivation (calcium homeostasis, myofilaments, energetics)
  - non-uniformity
- Passive properties of ventricular wall
  - myocardial stiffness (cytoskeleton, extracellular matrix)
  - wall thickness
  - chamber geometry
- Other determinants
  - structures surrounding the ventricle (pericardium, lungs, remaining cardiac chambers)
  - left atrium, pulmonary veins and mitral valve
  - heart rate

Dysfonction diastolique courbe pression volume



N Engl J Med 2004;351:1097-105.

How to diagnose diastolic heart failure: a consensus statement on the diagnosis of heart failure with normal left ventricular ejection fraction by the Heart Failure and Echocardiography Associations of the European Society of Cardiology

European Heart Journal (2007) **28**, 2539–2550
doi:10.1093/eurheartj/ehm037

Three obligatory conditions for heart failure with normal left ventricular ejection fraction

1. Signs or symptoms of congestive heart failure
2. Normal or mildly abnormal systolic left ventricular function

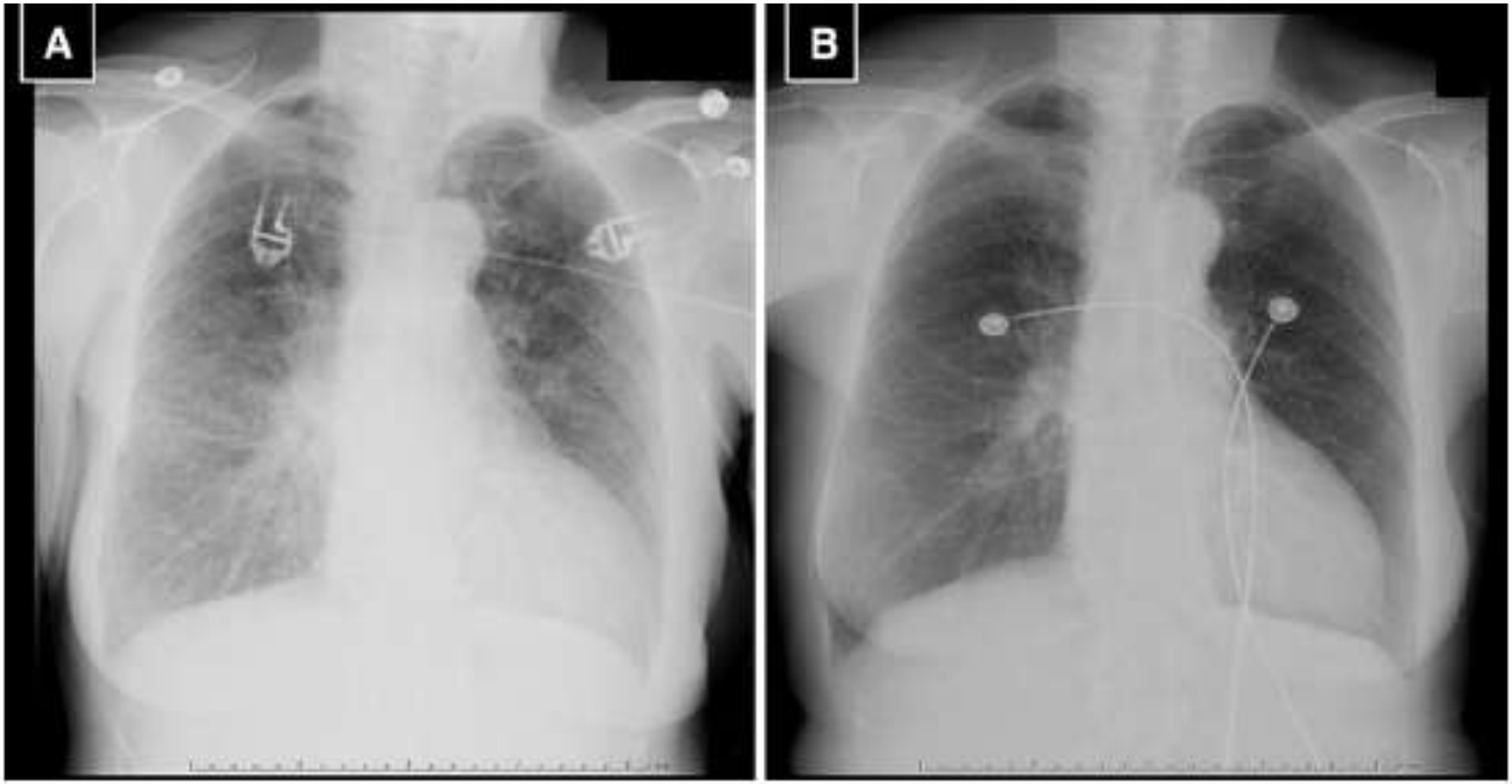
   LVEF > 50%
   and
   LVEDVI < 97 mL/m^2
3. Evidence of abnormal left ventricular relaxation, filling, diastolic distensibility, and diastolic stiffness

Souvent un tableau d'OAP « flash »..

- Surtout sur pic HTA
- Signes d'OAP
- Évolution immédiate spectaculairement favorable :
  - Régression rapide et complète des signes
- Évolution à distance :
  - Absence de symptomatologie (doute du clinicien, intérêt de la radiographie thoracique)

European Heart Journal (2007) **28**, 2539–2550
doi:10.1093/eurheartj/ehm037

Intérêt de la radiographie thoracique



Neth Heart J (2011) 19:482–485
DOI 10.1007/s12471-011-0185-2

Clinical Presentation, Management, and In-Hospital Outcomes of Patients Admitted With Acute Decompensated Heart Failure With Preserved Systolic Function

A Report From the Acute Decompensated Heart Failure National Registry (ADHERE) Database

JACC Vol. 47, No. 1, 2006
January 3, 2006:76–84

Characteristic	Systolic Function (n = 45,607)		
	Preserved (n = 26,322)	Reduced (n = 25,865)	p*
Admission to ED or observation unit (%)	79	75	<0.0001
Admission to intensive care unit (%)	14	18	<0.0001
Peripheral edema (%)	69	63	<0.0001
Rales (%)	69	67	0.0002
Systolic BP >140 mm Hg (%)	61	44	<0.0001
Systolic BP (mm Hg, mean ± SD)	152.5 ± 32.7	138.9 ± 30.9	<0.0001
Systolic BP ≤90 mm Hg (%)	1	4	<0.0001
Diastolic BP (mm Hg, mean ± SD)	78.7 ± 20.6	80.0 ± 20.4	<0.0001
Initial serum Cr (mg/dl, mean ± SD)	1.7 ± 1.5	1.6 ± 1.3	0.0281
Serum Cr >2 mg/dl (%)	17	18	0.57
BUN (mg/dl, mean ± SD)	29.3 ± 19.3	30.2 ± 19.8	<0.0001
Heart rate (beats/min, mean ± SD)	86.8 ± 22.0	92.9 ± 22.7	<0.0001
Dyspnea at rest (%)	34	34	0.19
Atrial fibrillation on first ECG (%)	21	17	<0.0001

L’echographie cardiaque : la clé du diagnostique…

- Examen essentiel
- Doit être réalisé systématiquement
- Permet de :
  - Évaluer la fonction systolique du VG : FE
  - Etudier la fonction diastolique du VG : étude doppler (pulsé, tissulaire)

Fonction VG systolique normale ou modérément altérée..

European Heart Journal (2007) **28**, 2539–2550
doi:10.1093/eurheartj/ehm037

- **Seuil : FE > 50 %**

- Exclure un élargissement significatif du VG :
  - **LVEDI < 97 ml/m²**
  - LVESI < 49 ml/m²

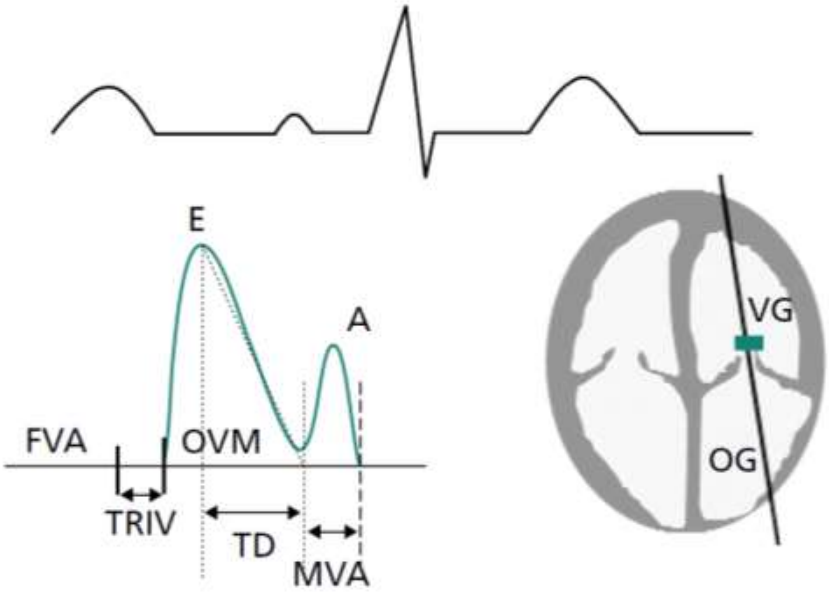
- Délai de réalisation de l'échographie : dans les trois jours suivant l'épisode de l'insuffisance cardiaque

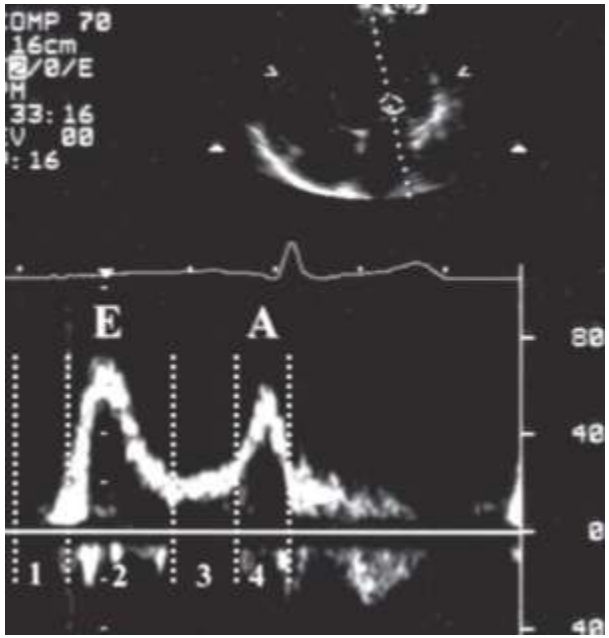
Etude de la fonction diastolique

- Doppler mitral : E, A, E/A, TDE, TRIVG
- Doppler veineux pulmonaire
- Doppler tissulaire de l'anneau mitral : E', A', E/E'
- Vitesse de propagation du flux mitral : Vp, E/Vp
- Volume, surface de l'OG

Doppler mitral **(DM)**

Profil normal : E/A > 1





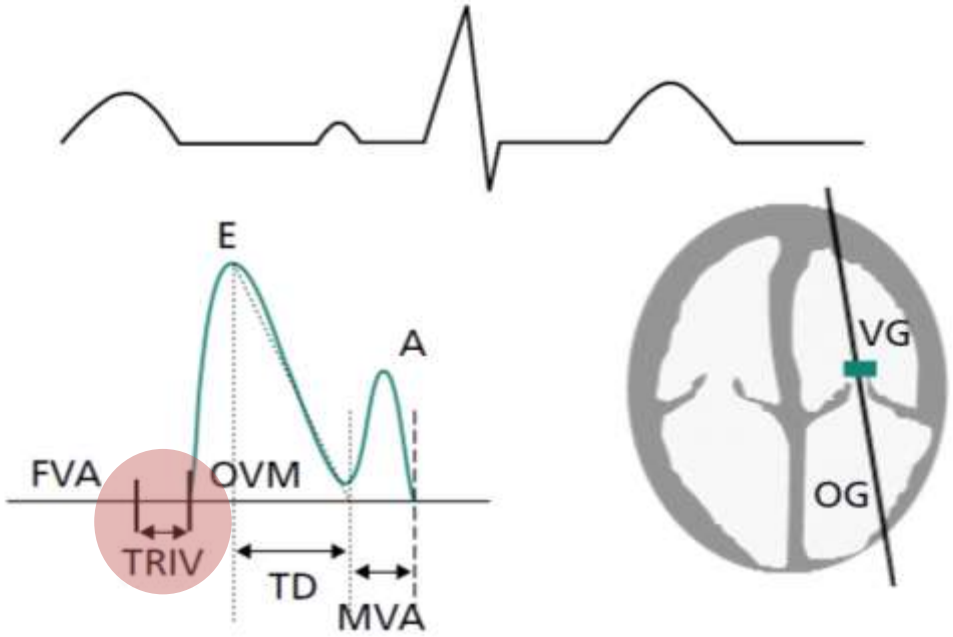
- Avantages :
  - Obtenu chez tous les patients
  - Diagnostic/pronostic
- Inconvénients
  - Hautement précharge dépendant
  - Valeurs dépendantes de la position du curseur
  - Peu contributif si : tachycardie, FA, BB, pace maker

Lester *et al.*
Unlocking the Mysteries of Diastolic Function

JACC Vol. 51, No. 7, 2008
February 19, 2008:679–89

Temps de relaxation iso volumique **(TRIVG)**

VN : 70 – 90 ms

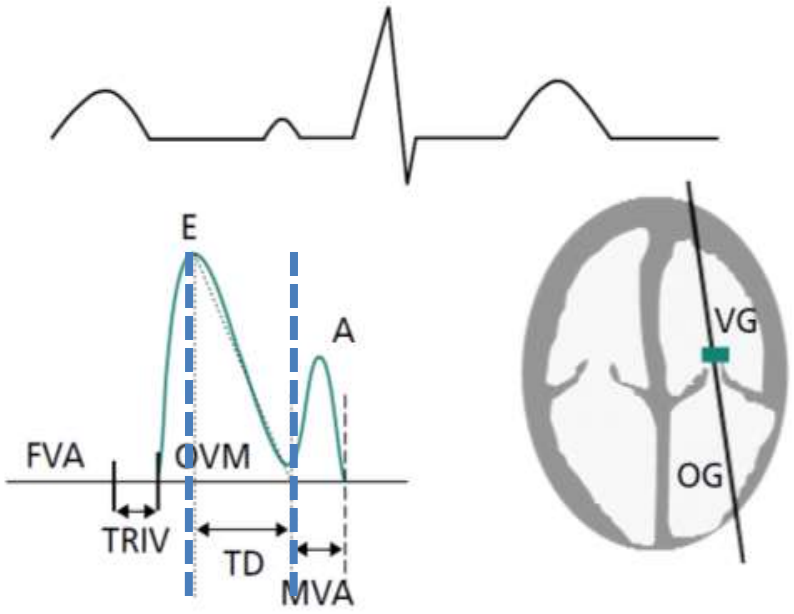


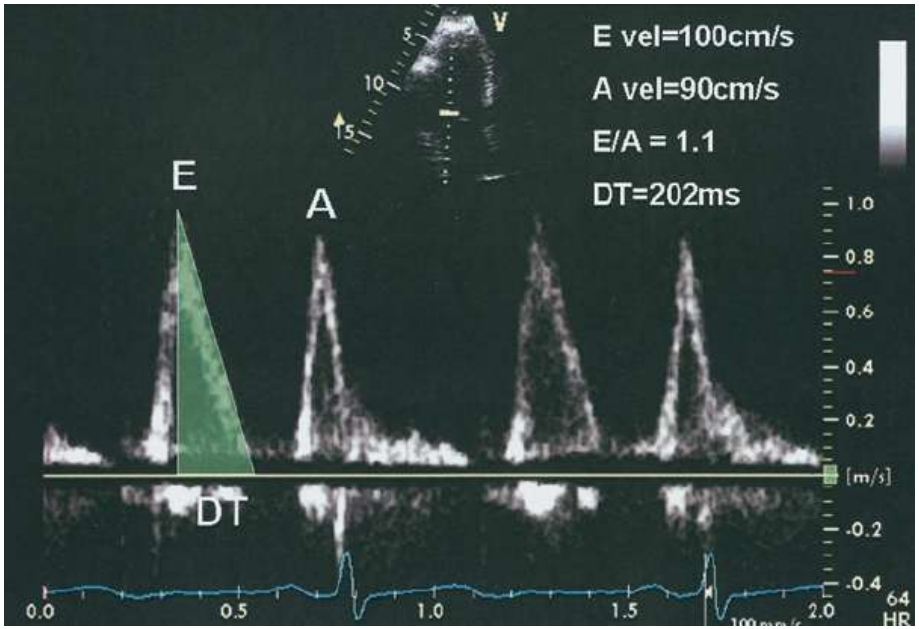
- Temps entre la fermeture de la valve aortique et l'ouverture de la valve mitrale

- Élargi si trouble de la relaxation
- Diminué si augmentation des pressions de remplissage

Temps de décélération E **(TDE)**

VN : 160 – 240 ms



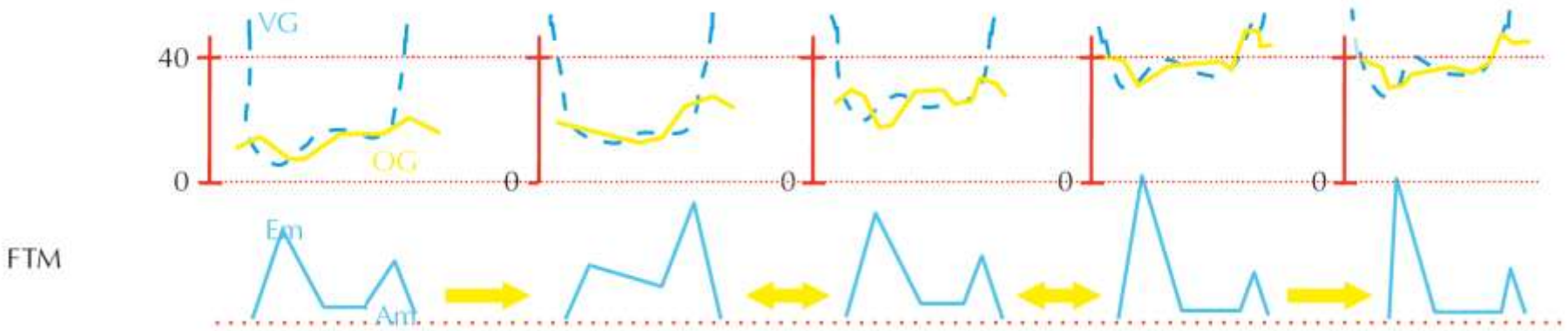


- Augmente si trouble de la relaxation
- Diminue si trouble de la compliance ou augmentation de la POG

Lester *et al.*
Unlocking the Mysteries of Diastolic Function

JACC Vol. 51, No. 7, 2008
February 19, 2008:679–89

Etude doppler mitral : 05 stades



E/A = 0,9-1,5
TDE = 160-240 ms
TRIVG = 70 – 90 ms

E/A < 0,9
TDE > 240 ms
TRIVG > 90 ms

E/A = 0,9-1,5
TDE = 160-240 ms
TRIVG < 90 ms

E/A > 2
TDE < 160 ms
TRIVG < 70 ms

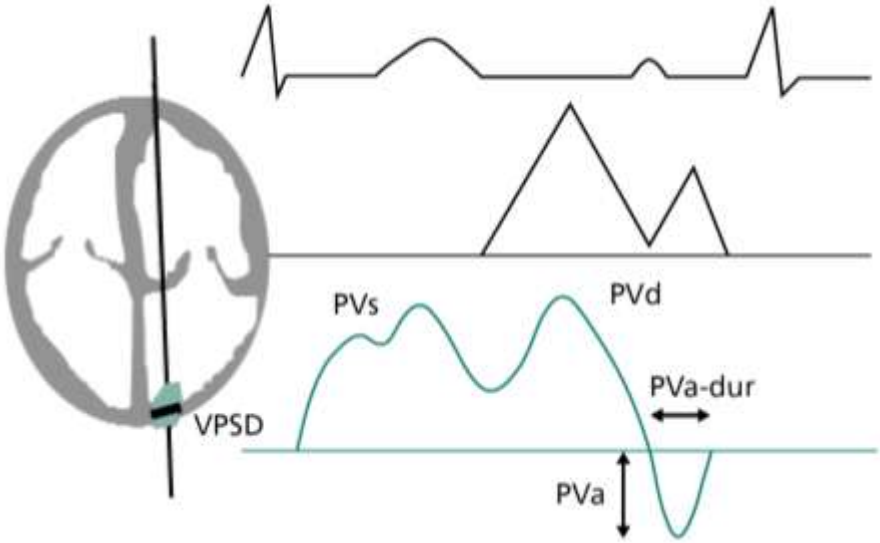
E/A > 2,5
TDE < 130 ms
TRIVG < 70 ms

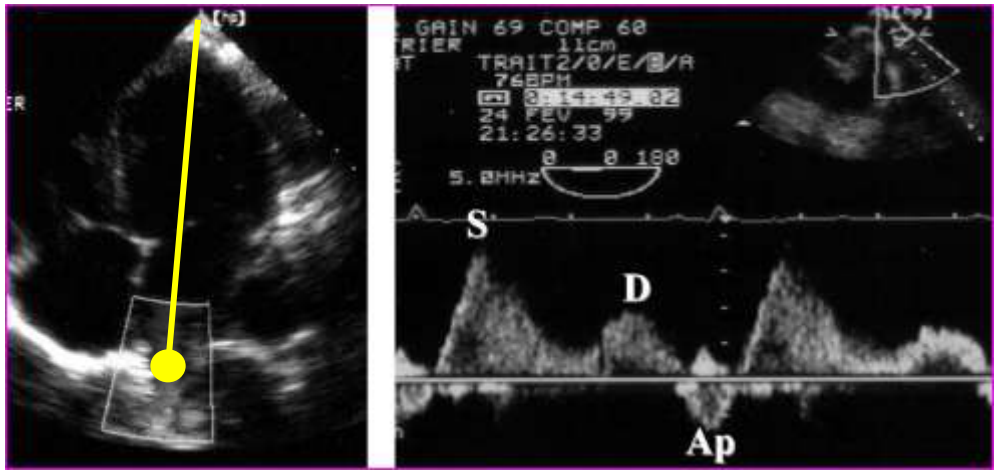
Nomenclature FTM	Normal	Anomalie relaxation	Pseudo normal	Restrictif	Restrictif
PRVG	Normales		↑	↑↑	↑↑↑
Fonction diastolique	Normale	Dysfonction modérée	Dysfonction moyenne	Dysfonction sévère (réversible)	Dysfonction sévère (irréversible)

mt cardio 2005 ; 1 : 97-103

Flux veineux pulmonaire (FVP)

Profil normal: S>D; Durée $A_{mitrale}$>Durée A_{pulm}



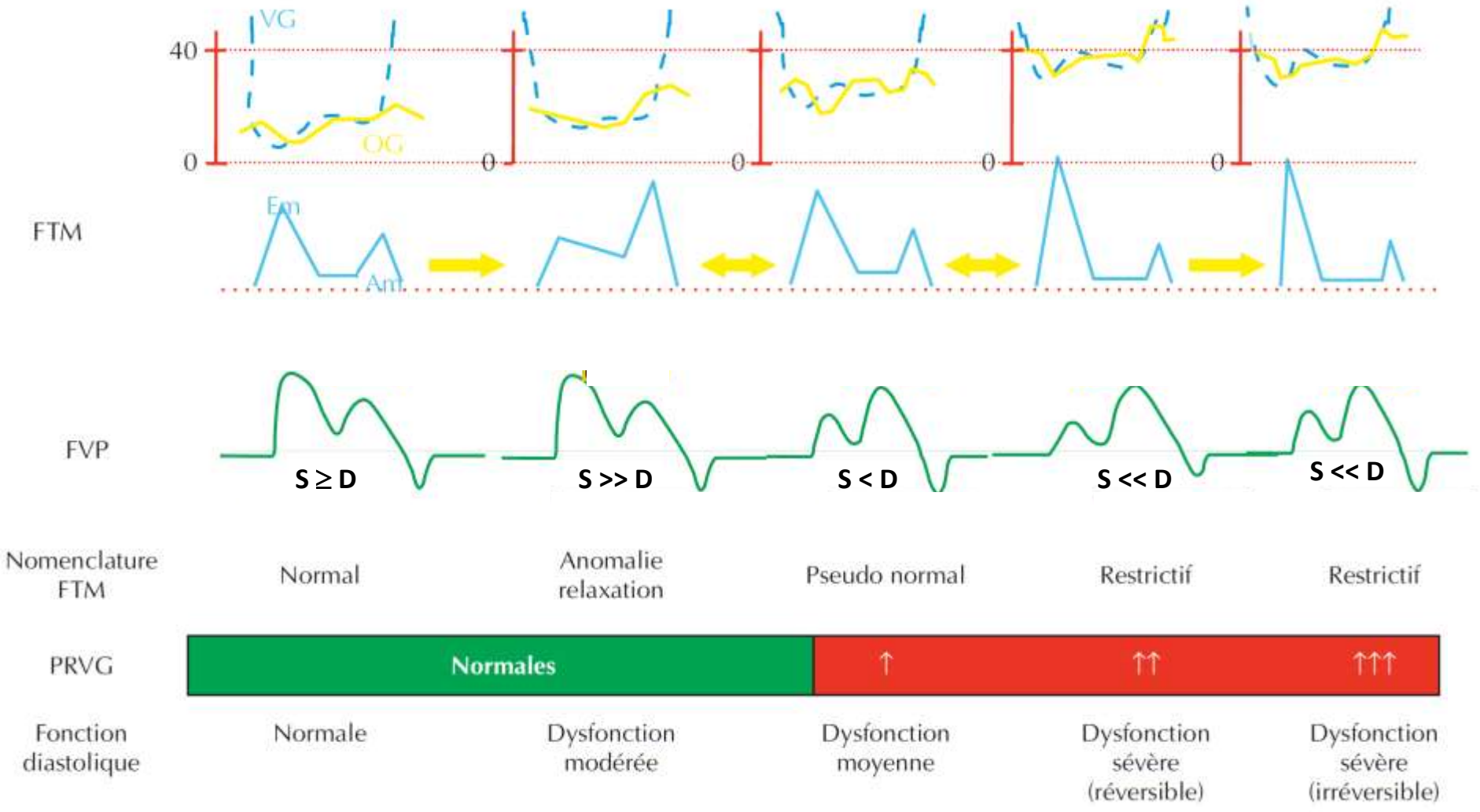


- Avantages :
  - Relation entre durée A pulmonaire/durée A mitrale : marqueur spécifique d'élévation PTDVG
  - Utile surtout encas de fusion E+A pour classer le remplissage diastolique.
- Inconvénients :
  - Peut être difficile à obtenir
  - Influencé par la modification du rythme (FA^{++++})

Lester *et al.*
Unlocking the Mysteries of Diastolic Function

JACC Vol. 51, No. 7, 2008
February 19, 2008:679–89

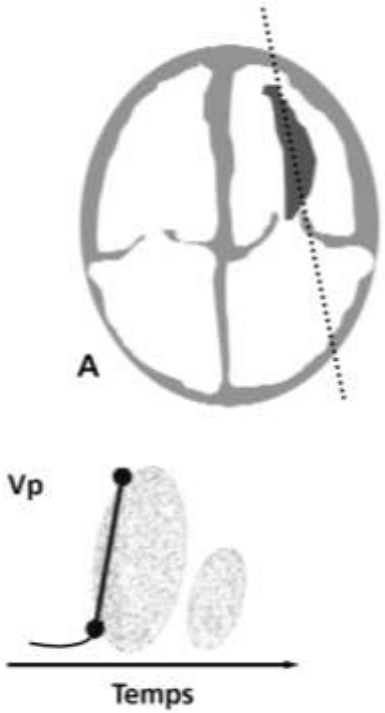
Doppler mitral + FVP

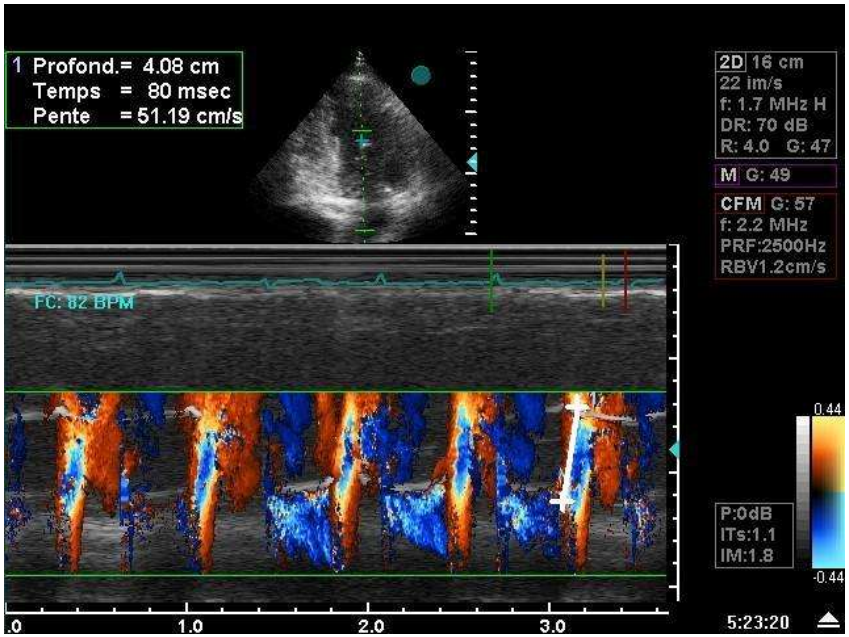


mt cardio 2005 ; 1 : 97-103

Vitesse de propagation du flux mitral **(Vp)**

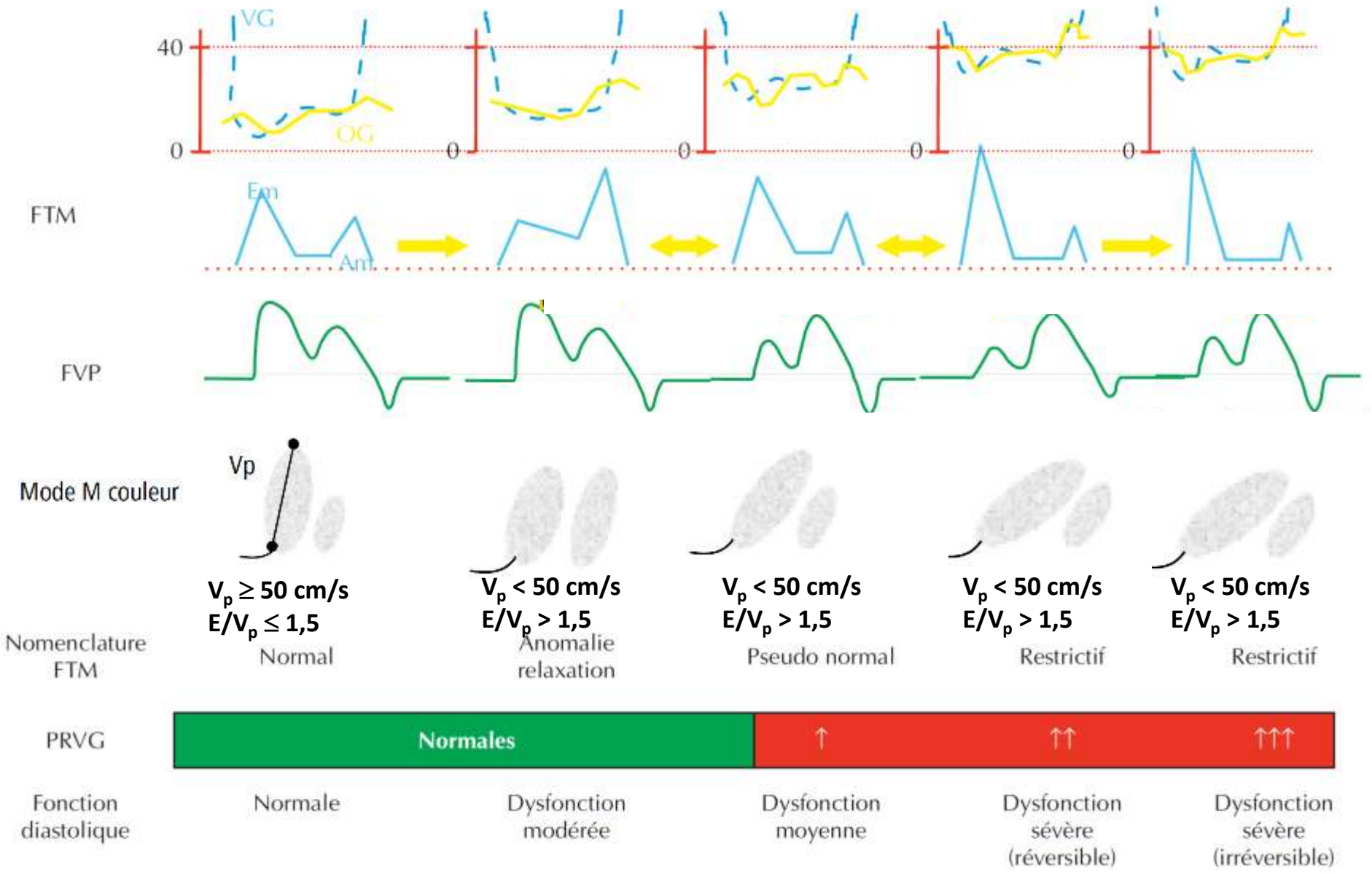
VN > 50 cm/s





- Inconvénients :
  - Reproductibilité
  - Précharge dépendant et de la taille des cavités cardiaque

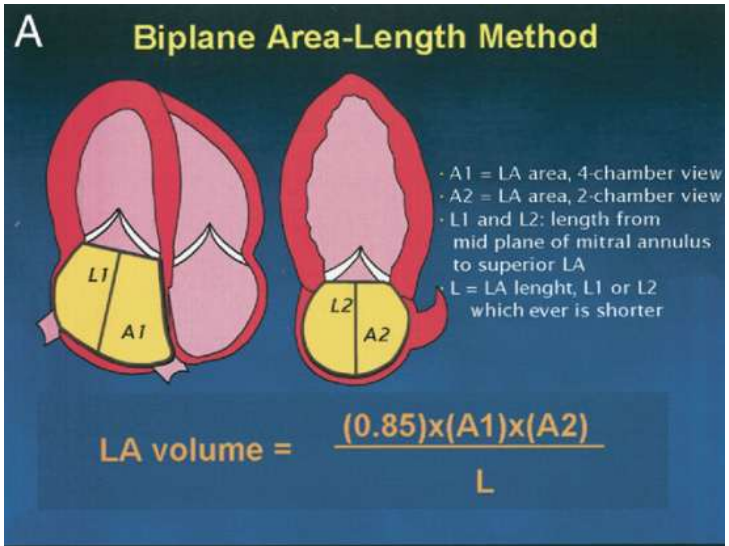
DM + FVP + Vp

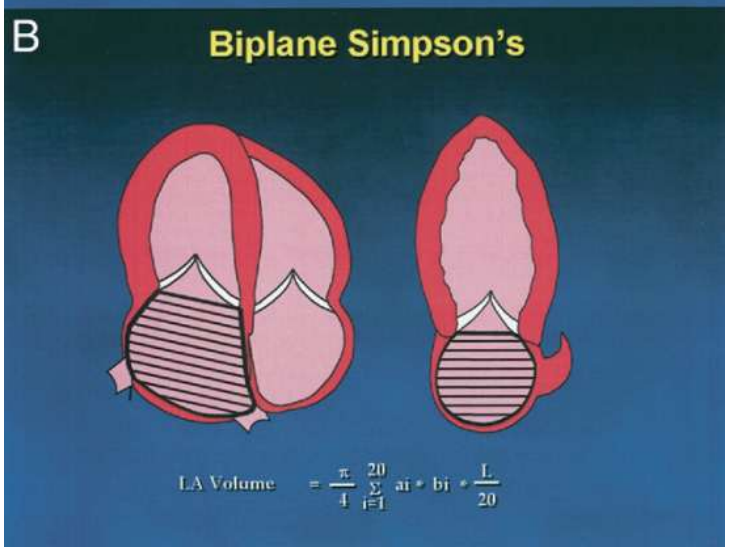


mt cardio 2005 ; 1 : 97-103

Volume de l'OG (OG)

VN : 22 ± 6 ml/m²





- Avantages :
  - Offre des arguments morphologiques et physiologiques de l'élévation chronique des PRVG
  - Marqueur robuste du pronostic

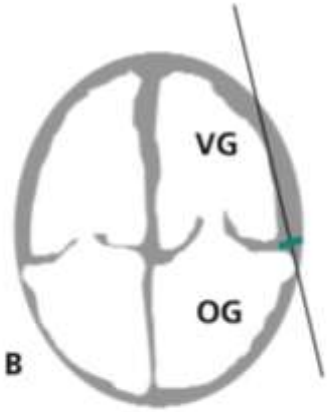
- Inconvénients :
  - Peut être élevé en dehors d'une augmentation des PRVG (anémie, cœur d'athlete, cardiopathie valvulaire non décompensée)

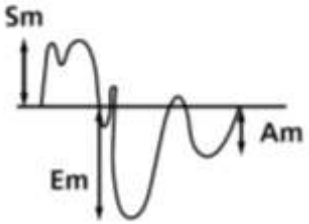
Lester *et al.*
Unlocking the Mysteries of Diastolic Function

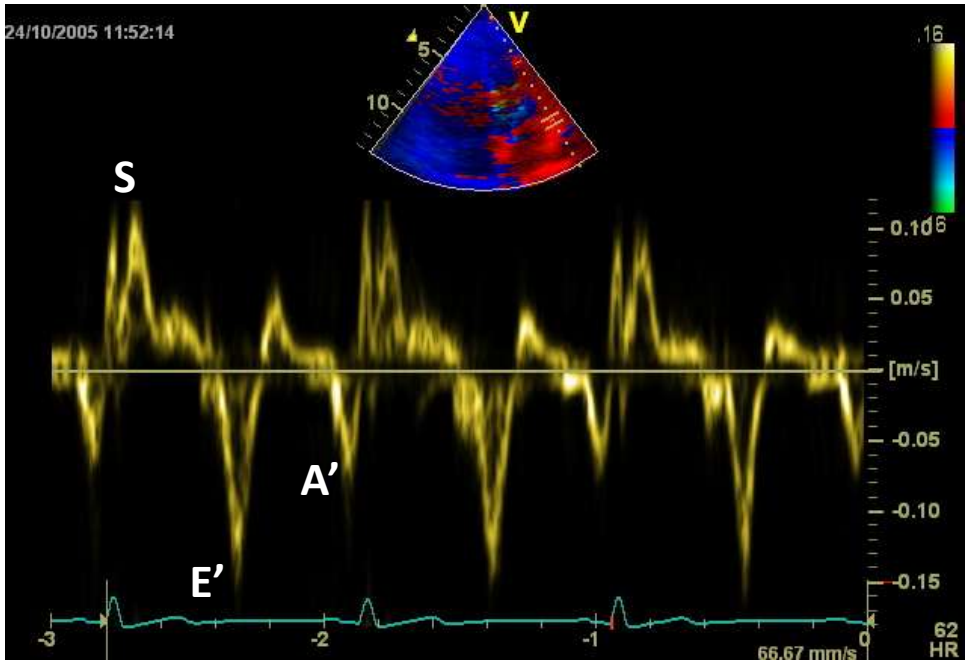
JACC Vol. 51, No. 7, 2008
February 19, 2008:679–89

Doppler tissulaire (DTI) anneau mitral

S > 6 cm/s, E_l' > 15 cm/s, E'>A'







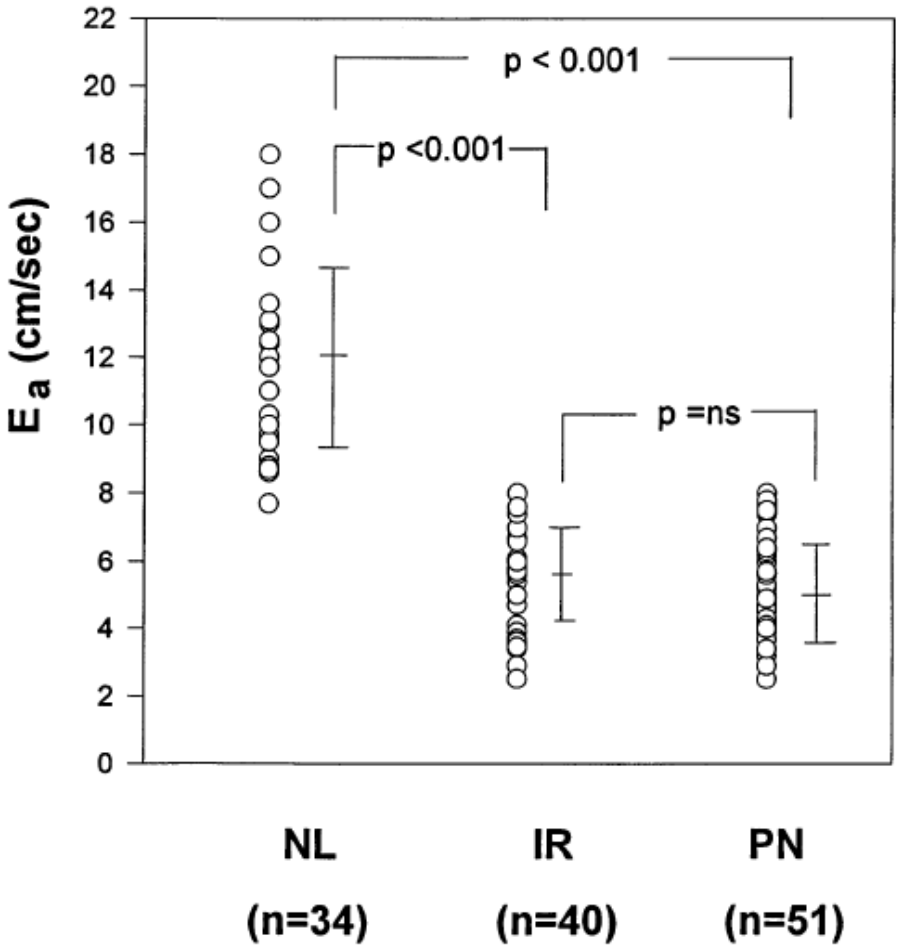
- Avantages :
  - Obtenu chez tous les patients
  - Marqueur précoce de dysfonction diastolique
  - Non modifié par les changement du rythme cardiaque
  - Pré charge indépendant

- Inconvénients
  - Influencé par les troubles de la cinétique segmentaire locale
  - Non contributif si pathologie valvulaire mitrale

Doppler Tissue Imaging: A Noninvasive Technique for Evaluation of Left Ventricular Relaxation and Estimation of Filling Pressures

SHERIF F. NAGUEH, MD, KATHERINE J. MIDDLETON, RCT, HELEN A. KOPELEN, RDMS,
WILLIAM A. ZOGHBI, MD, FACC, MIGUEL A. QUIÑONES, MD, FACC
Houston, Texas

JACC Vol. 30, No. 6
November 15, 1997:1527–33



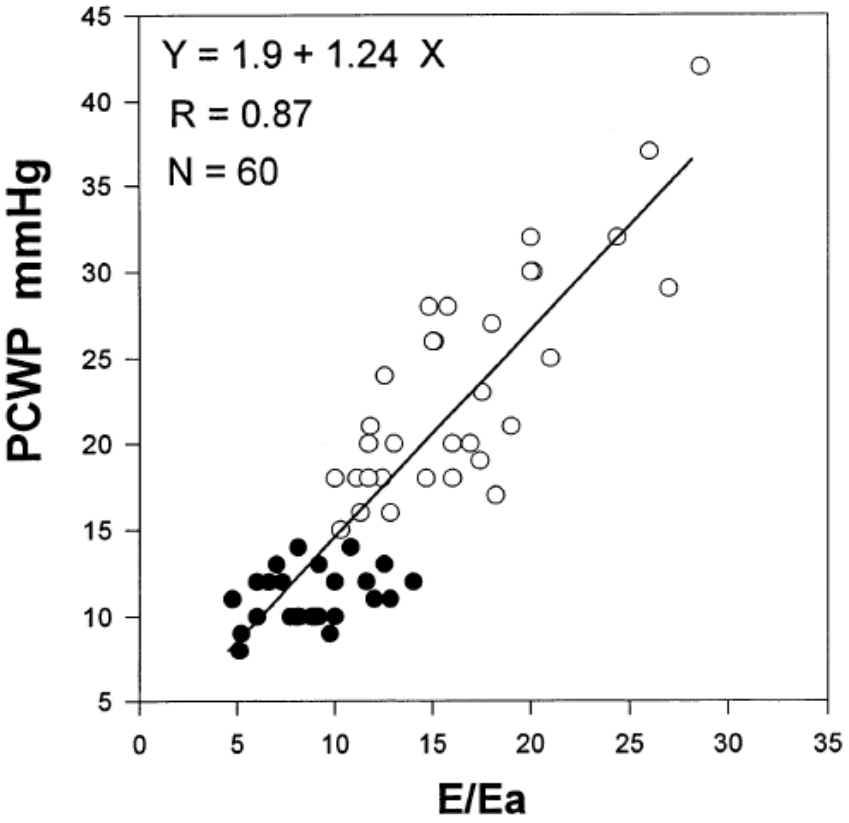
Tr. relaxation Pseudo normal

Corrélation E/E' - PAPO

Doppler Tissue Imaging: A Noninvasive Technique for Evaluation of Left Ventricular Relaxation and Estimation of Filling Pressures

SHERIF F. NAGUEH, MD, KATHERINE J. MIDDLETON, RCT, HELEN A. KOPELEN, RDMS,
WILLIAM A. ZOGHBI, MD, FACC, MIGUEL A. QUIÑONES, MD, FACC
Houston, Texas

JACC Vol. 30, No. 6
November 15, 1997:1527–33



- **E/E' > 10 → PAPO > 15 mmHg (Se = 97%; Sp = 78%)**

E/E', zone grise….?

Clinical Utility of Doppler Echocardiography and Tissue Doppler Imaging in the Estimation of Left Ventricular Filling Pressures : A Comparative Simultaneous Doppler-Catheterization Study

S. R. Ommen, R. A. Nishimura, C. P. Appleton, F. A. Miller, J. K. Oh, M. M. Redfield and A. J. Tajik

Circulation. 2000;102:1788-1794

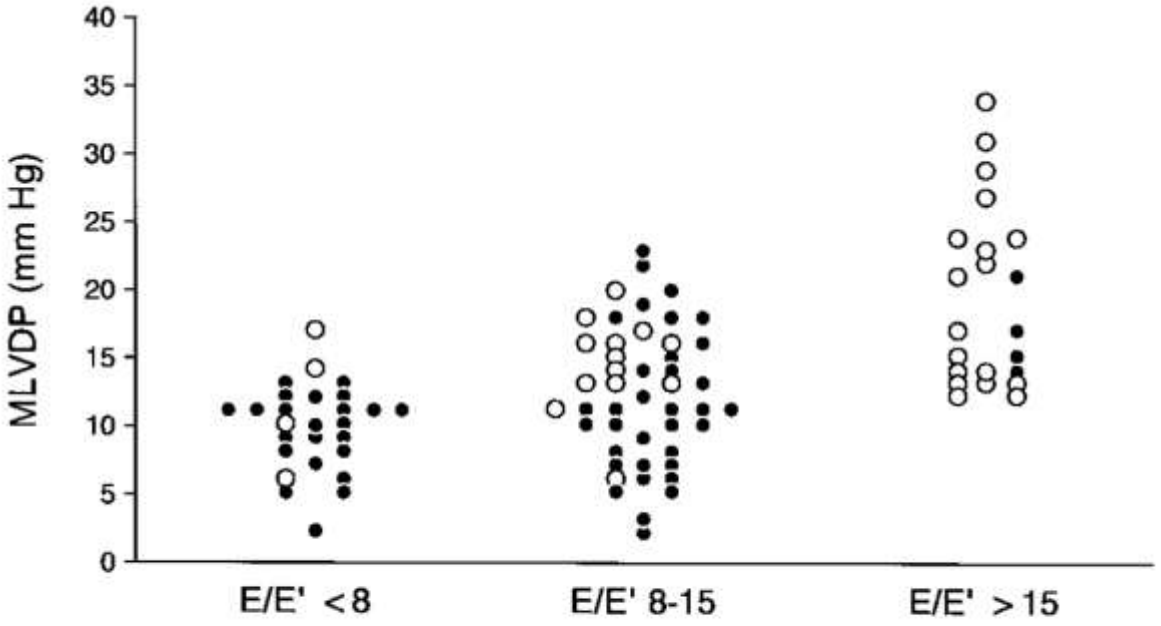
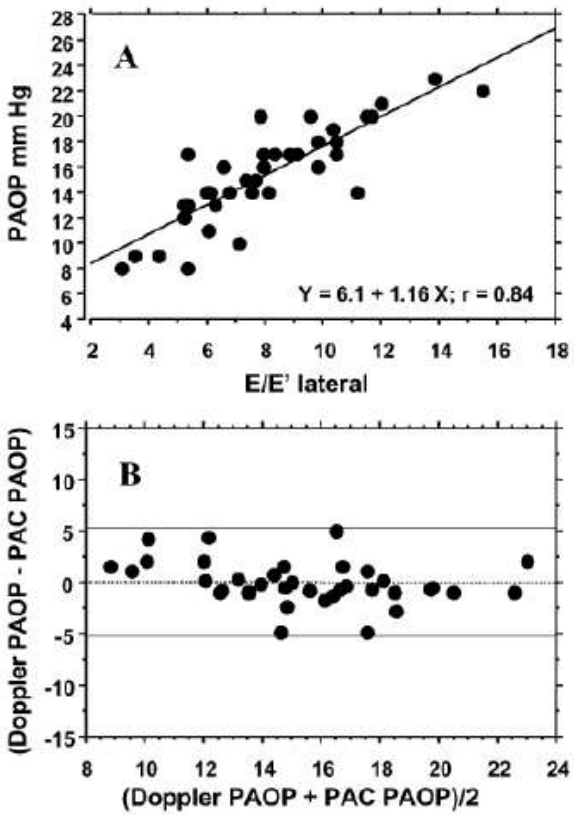


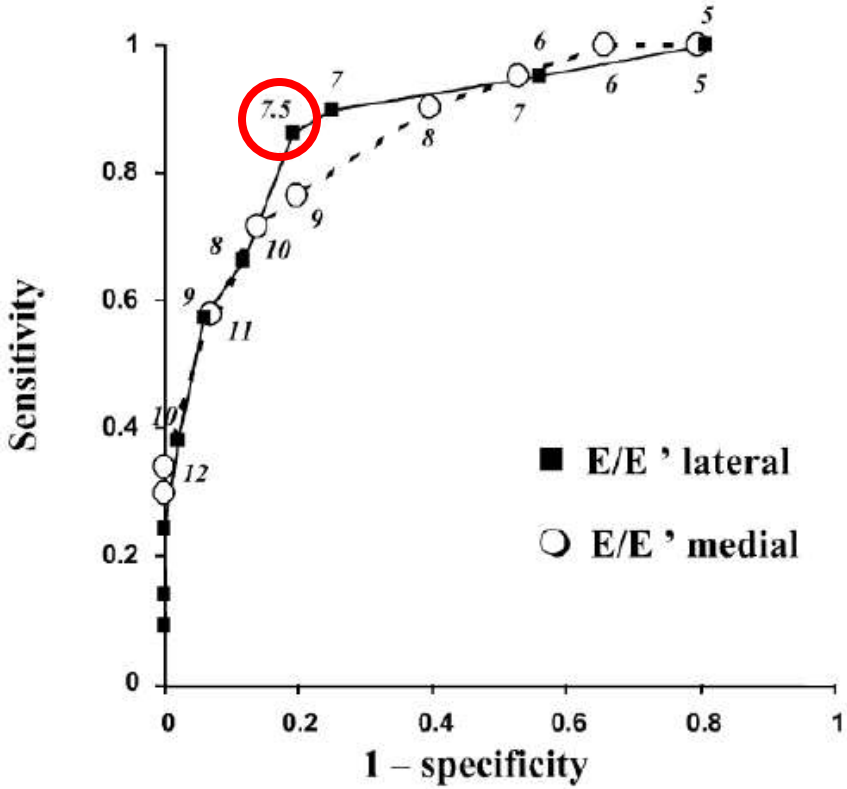
Figure 6. M-LVDP versus groups defined by values of septal E/E'. ○ Indicates patients with EF <50%; ●, patients with EF >50%.

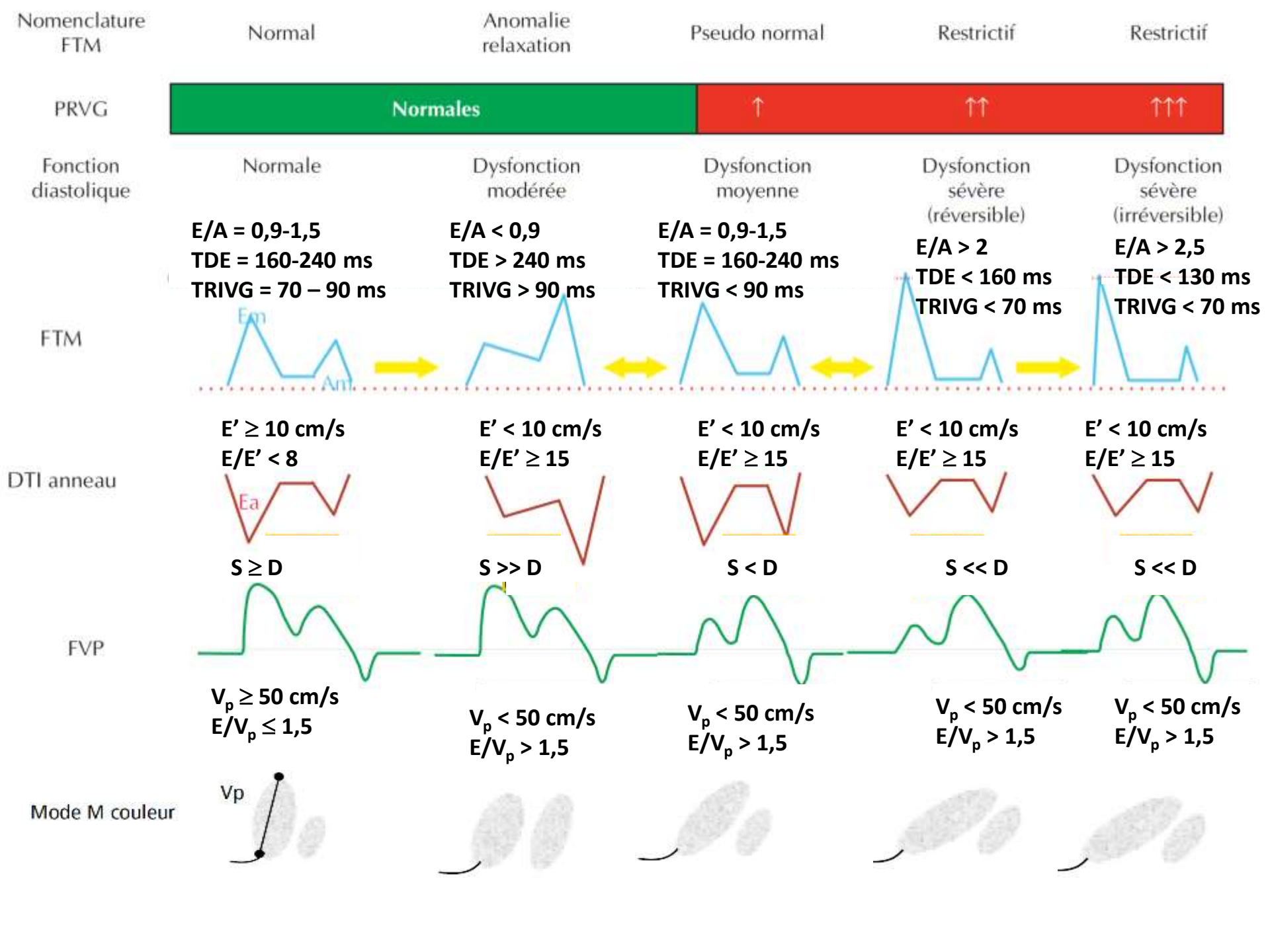
Tissue Doppler imaging estimation of pulmonary artery occlusion pressure in ICU patients

Alain Combes
Florence Arnoult
Jean-Louis Trouillet

Intensive Care Med (2004) 30:75–81



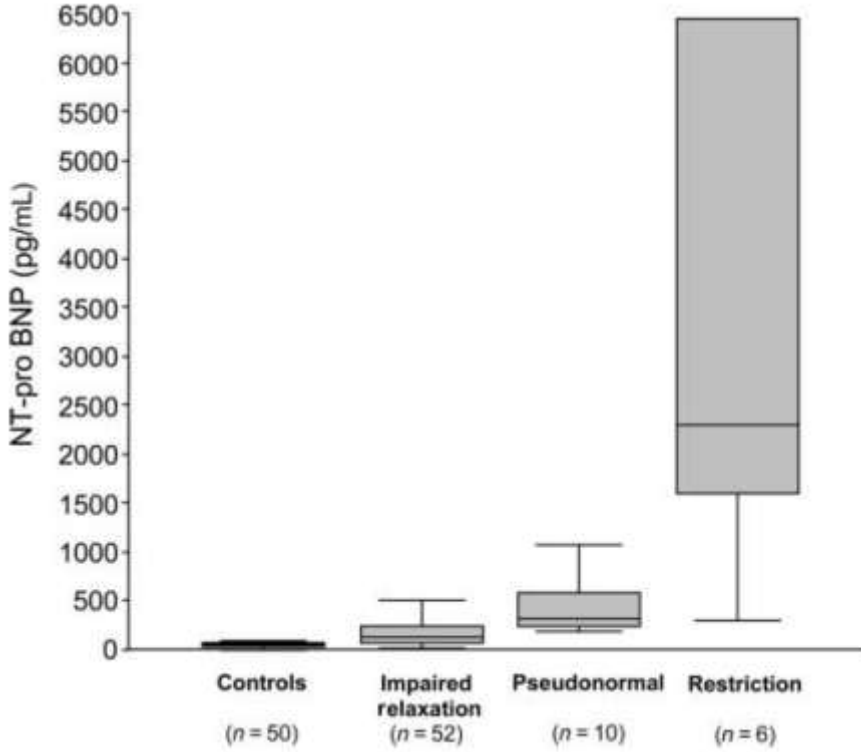


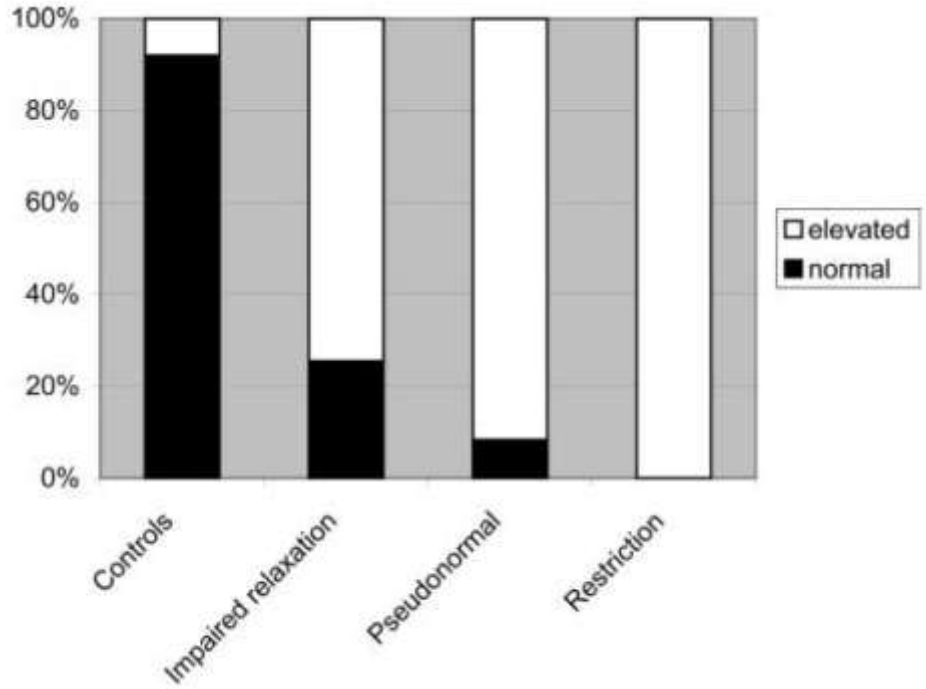

Nomenclature FTM
Normal
Anomalie relaxation
Pseudo normal
Restrictif
Restrictif
PRVG
Normales
↑
↑↑
↑↑↑
Fonction diastolique
Normale
Dysfonction modérée
Dysfonction moyenne
Dysfonction sévère (réversible)
Dysfonction sévère (irréversible)
E/A = 0,9-1,5
TDE = 160-240 ms
TRIVG = 70 – 90 ms
E/A < 0,9
TDE > 240 ms
TRIVG > 90 ms
E/A = 0,9-1,5
TDE = 160-240 ms
TRIVG < 90 ms
E/A > 2
TDE < 160 ms
TRIVG < 70 ms
E/A > 2,5
TDE < 130 ms
TRIVG < 70 ms
FTM
Em
Am
E' ≥ 10 cm/s
E/E' < 8
E' < 10 cm/s
E/E' ≥ 15
E' < 10 cm/s
E/E' ≥ 15
E' < 10 cm/s
E/E' ≥ 15
E' < 10 cm/s
E/E' ≥ 15
DTI anneau
Ea
S ≥ D
S >> D
S < D
S << D
S << D
FVP
Vp ≥ 50 cm/s
E/Vp ≤ 1,5
Vp < 50 cm/s
E/Vp > 1,5
Vp < 50 cm/s
E/Vp > 1,5
Vp < 50 cm/s
E/Vp > 1,5
Vp < 50 cm/s
E/Vp > 1,5
Mode M couleur
Vp

The role of NT-proBNP in the diagnostics of isolated diastolic dysfunction: correlation with echocardiographic and invasive measurements

European Heart Journal (2005) **26**, 2277–2284
doi:10.1093/eurheartj/ehi406

Corrélation taux NT-pro BNP et la sévérité de la dysfonction diastolique





The role of NT-proBNP in the diagnostics of isolated diastolic dysfunction: correlation with echocardiographic and invasive measurements

European Heart Journal (2005) **26**, 2277–2284
doi:10.1093/eurheartj/ehi406

NT-pro BNP : facteur prédictif de l'identification de la dysfonction diastolique

Indicator	OR	*P*-value	95% CI
Sex	1.902	0.467	0.336–10.765
Age	1.102	0.067	0.997–1.194
Dyspnoea	0.840	0.848	0.141–5.000
Diabetes mellitus	1.042	0.914	0.340–4.710
Hypertension	1.644	0.533	0.337–8.026
LV mass index	1.028	0.143	0.991–1.067
CAD	1.382	0.355	0.611–3.050
NT-proBNP	1.240	0.001	1.086–1.416
BMI	1.167	0.206	0.918–1.484

The role of NT-proBNP in the diagnostics of isolated diastolic dysfunction: correlation with echocardiographic and invasive measurements

European Heart Journal (2005) **26**, 2277–2284
doi:10.1093/eurheartj/ehi406

NT-pro BNP : intérêt essentiellement dans sa valeur prédictive négative en cas de ICFE Nle (Cut-off (pg/ml) = 120 pg/ml)

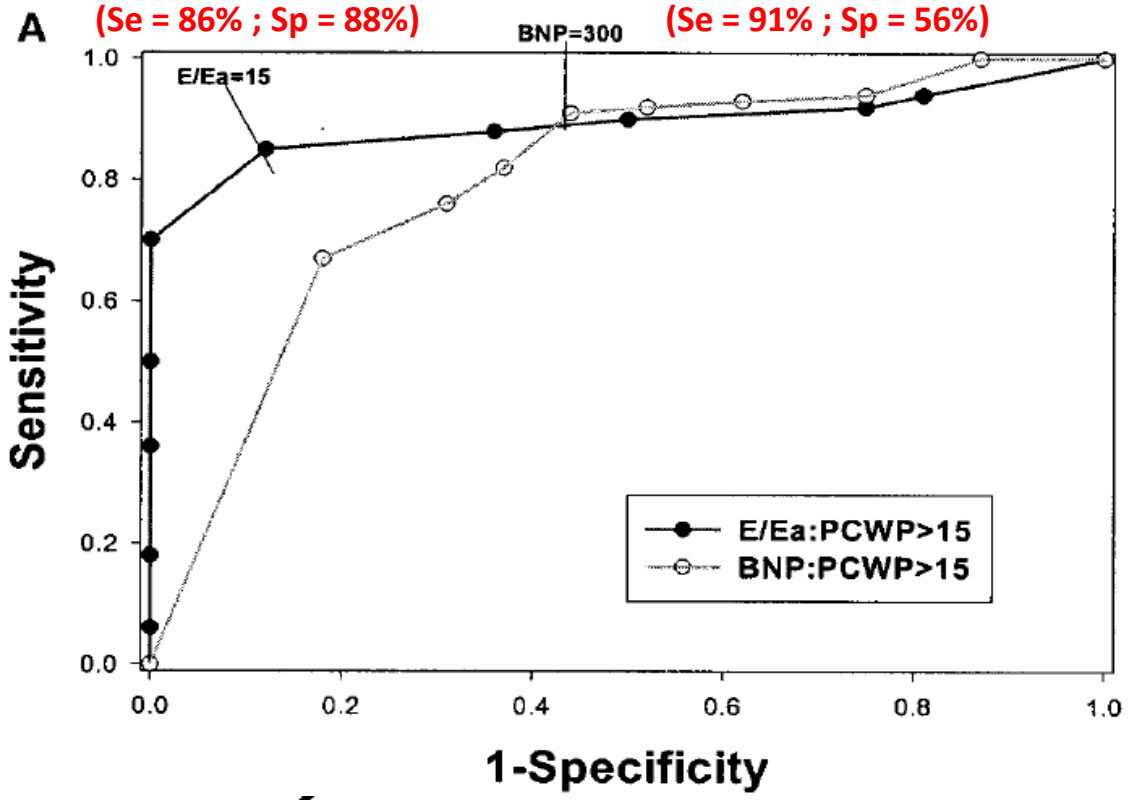
NT-proBNP cut-off (pg/mL)	Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)
90	75	86	54	94
100	74	88	58	94
110	72	90	61	94
120	69	91	63	93
130	56	92	61	91
140	53	92	59	90
304	19	100	100	85

Optimal Noninvasive Assessment of Left Ventricular Filling Pressures

A Comparison of Tissue Doppler Echocardiography and B-Type Natriuretic Peptide in Patients With Pulmonary Artery Catheters

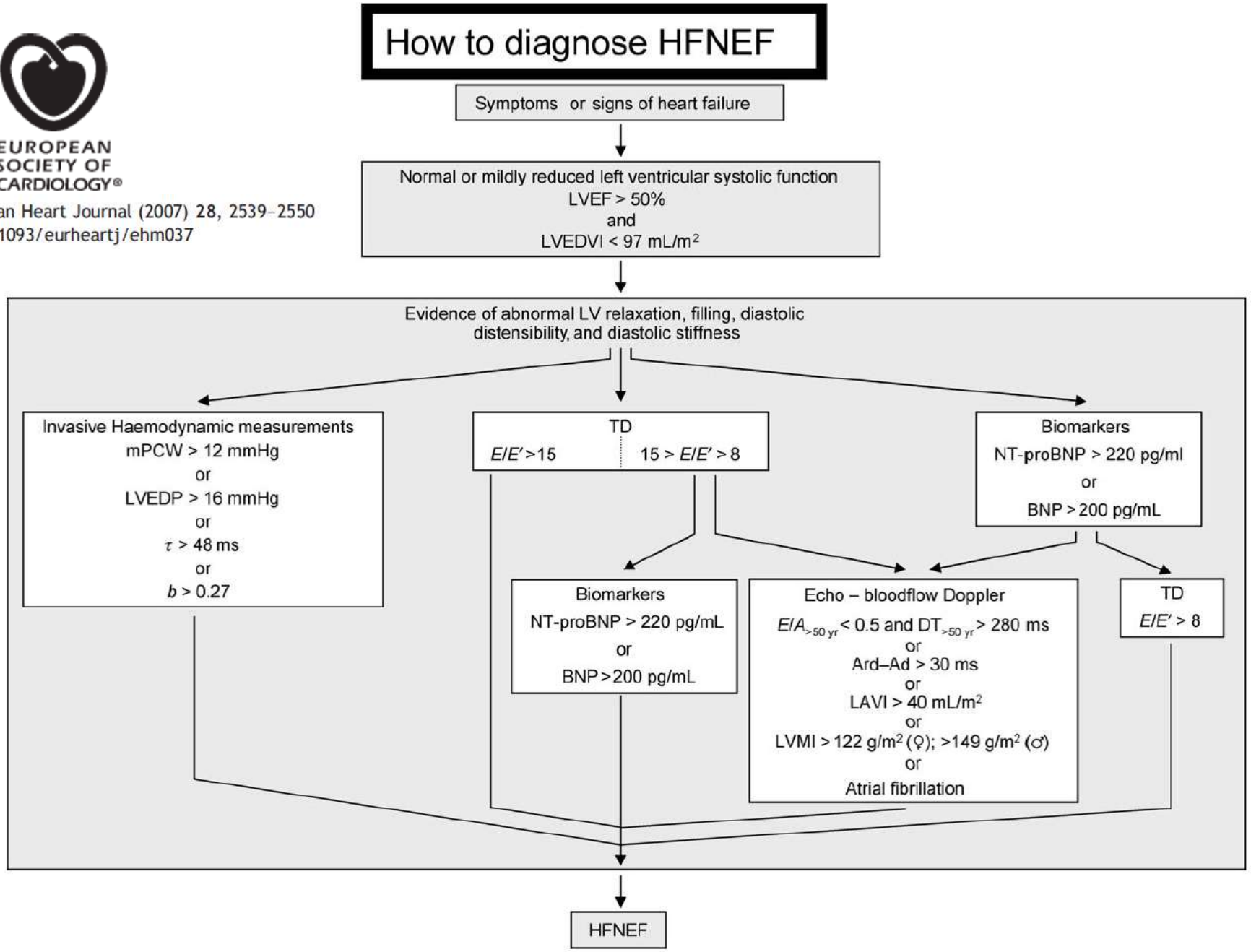
Hisham Dokainish, MD, FRCPC; William A. Zoghbi, MD; Nasser M. Lakkis, MD; Faiz Al-Bakshy, MD; Meeney Dhir, MD; Miguel A. Quinones, MD; Sherif F. Nagueh, MD

(*Circulation*. 2004;109:2432-2439.)



EUROPEAN SOCIETY OF CARDIOLOGY®
European Heart Journal (2007) 28, 2539–2550
doi:10.1093/eurheartj/ehm037

How to diagnose HFNEF



Et en réanimation…?

- Incidence ICFE conservée et son impact sur le pronostic : imprécis
  - Littérature essentiellement cardiologique^{+++}
- En réanimation :
  - Coexistence de plusieurs facteurs influençant la fonction diastolique :
    - ATCD : HTA, âge, Diabète, IRC, CPI….
    - Désordres aigus : TR, hypovolémie, hypoxie, sepsis…
    - Thérapeutiques : VM, PEEP, remplissage vasculaire
  - Population différente
    - Haute incidence de comorbidités non cardiaques contrairement à l'USIC

⇒ • Différencier une dyspnée d'origine cardiaque d'une autre origine est d'une importance capitale

Et en réanimation…?

- Manifestations cliniques I. cardiaque : difficilement identifiables
- Méthodes pour évaluer la fonction diastolique souffrent de plusieurs inconvénients (invasif ou non invasif)
  - PAPO/volémie…!
  - Indices doppler de dysfonction diastolique au cours des ICFE conservée sont modérément corrélés à la PAPO en réanimation
  - Problème d'échogénicité, opérateur, appareillage…..
- Interprétation des éléments de la fonction diastolique en réanimation est très délicate

Dysfonction diastolique en réanimation situations pratiques

- Sevrage de la ventilation mécanique

- Choc septique

Dysfonction diastolique VG : facteur d’échec du sevrage de la VM?

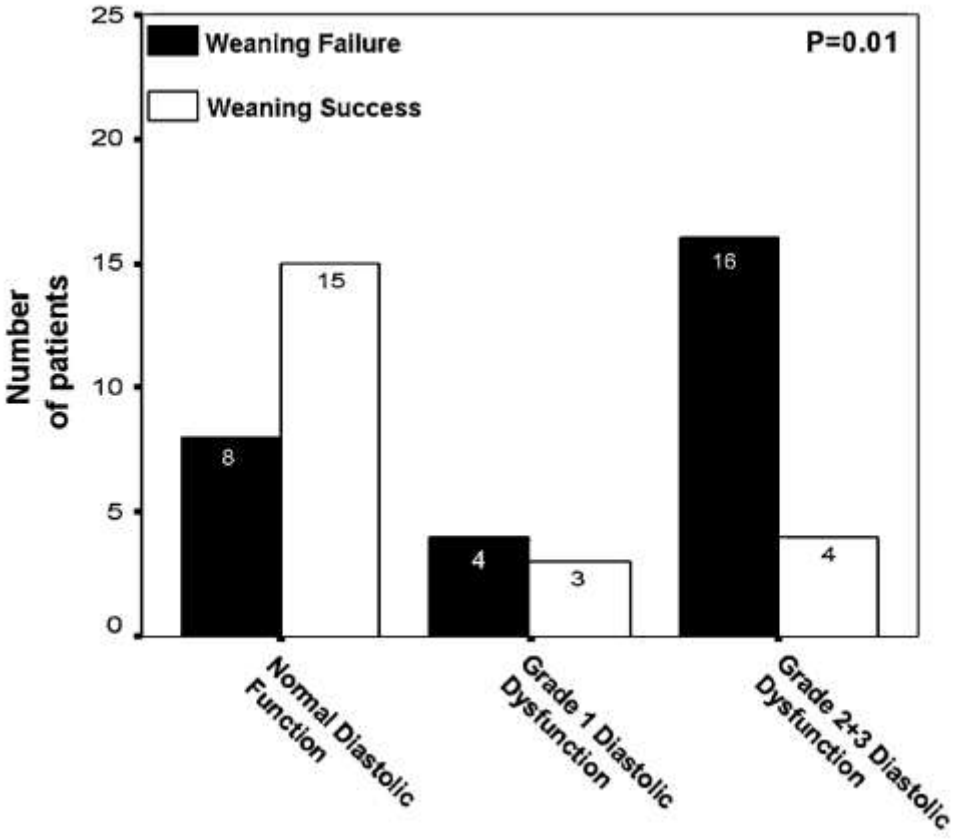
Intensive Care Med (2011) 37:1976–1985
DOI 10.1007/s00134-011-2368-0

ORIGINAL

John Papanikolaou
Demosthenes Makris
Theodosios Saranteas
Dimitrios Karakitsos
Elias Zintzaras
Andreas Karabinis
Georgia Kostopanagiotou
Epaminondas Zakynthinos

New insights into weaning from mechanical ventilation: left ventricular diastolic dysfunction is a key player

- Etude prospective
- 50 patients inclus sans cardiopathie
- 28 patients (échec du sevrage)
- Echec du sevrage :
  - Dysfonction grade III^{++++}
  - dysfonction diastolique gde I



Intensive Care Med (2011) 37:1976–1985
DOI 10.1007/s00134-011-2368-0

ORIGINAL

John Papanikolaou
Demosthenes Makris
Theodosios Saranteas
Dimitrios Karakitsos
Elias Zintzaras
Andreas Karabinis
Georgia Kostopanagiotou
Epaminondas Zakynthinos

New insights into weaning from mechanical ventilation: left ventricular diastolic dysfunction is a key player

Facteurs prédictifs d'échec du sevrage

	AUC (95% CI)	Cutoff value	Se (%)	Sp (%)	PPV (%)	NPV (%)	Ac (%)
Age (years)	0.76 (0.62–0.9)**	>53	75	73	81	71	76
APACHE II	0.67 (0.51–0.82)*	>18.5	61	73	74	59	66
f/V_T (RSBI)	0.75 (0.61–0.88)**	>58.5	64	81	82	64	72
PFP	0.76 (0.62–0.89)**	>287	71	68	74	65	70
Lateral E_m (cm/s)	0.8 (0.68–0.92)**	<12.5	75	64	72	67	70
Averaged E_m (cm/sec)	0.78 (0.65–0.91)**	<10.5	71	73	77	67	72
Septal S_m (cm/s)	0.74 (0.6–0.88)**	<9.5	82	64	64	82	72
Lateral E/E_m	0.86 (0.75–0.96)**	>7.8	79	100	100	79	88
Septal E/E_m	0.81 (0.68–0.93)**	>7.93	86	73	80	80	80
Averaged E/E_m	0.86 (0.75–0.97)**	>8	79	96	96	78	86
E/V_p	0.74 (0.6–0.87)**	>1.51	75	73	78	70	74

AUC area under the curve; *Se* sensitivity; *Sp* specificity; *PPV* positive predictive value; *NPV* negative predictive value; *Ac* accuracy; f/V_T ratio of respiratory frequency to tidal volume; other abbreviations as per Tables 1, 2, and 3
* $P < 0.05$, ** $P < 0.01$

Echocardiography: a help in the weaning process

Vincent Caille[1,2], Jean-Bernard Amiel[3,4,5], Cyril Charron[1,2], Guillaume Belliard[1,2], Antoine Vieillard-Baron[1,2] and Philippe Vignon*[3,4,5]

CRITICAL CARE

Caille *et al. Critical Care* 2010, **14**:R120

- Etude prospective
- 117 patients ayant rempli les critères de sevrage
- ETT avant et à la fin de 30 minutes vs-tube
- Echec sevrage : 23 patients et 20 (87%) d'origine cardiaque

		LVEF > 50% (n = 58)	LVEF 50-35% (n = 30)	LVEF < 35% (n = 29)
Echec		**N=10 (17%)**	**N=4 (13%)**	**N=9 (31%)***
E/A				
	PS/PEEP	0.97 (0.81-1.09)	0.82 (0.74-1.0)	1.0 (0.78-1.47)
	SBT	0.99 (0.85-1.20)	0.89* (0.76-1.32)	1.0* (0.86-1.89)
DTE (ms)				
	PS/PEEP	174 (152-193)	187 (144-224)	119¶ (90-153)
	SBT	163 (155-181)	140* (112-177)	96* (80-137)
E/E'				
	PS/PEEP	5.2 (4.7-6.0)	6.0 (5.3-9.0)	7.9¶ (5.4-9.1)
	SBT	5.8 (4.9-6.6)	6.9 (4.9-9.3)	7.8 (6.7-9.7)

Echocardiography: a help in the weaning process

Vincent Caille[1,2], Jean-Bernard Amiel[3,4,5], Cyril Charron[1,2], Guillaume Belliard[1,2], Antoine Vieillard-Baron[1,2] and Philippe Vignon*[3,4,5]

CRITICAL CARE

Caille *et al. Critical Care* 2010, **14**:R120

Facteurs prédictifs d'échec du sevrage

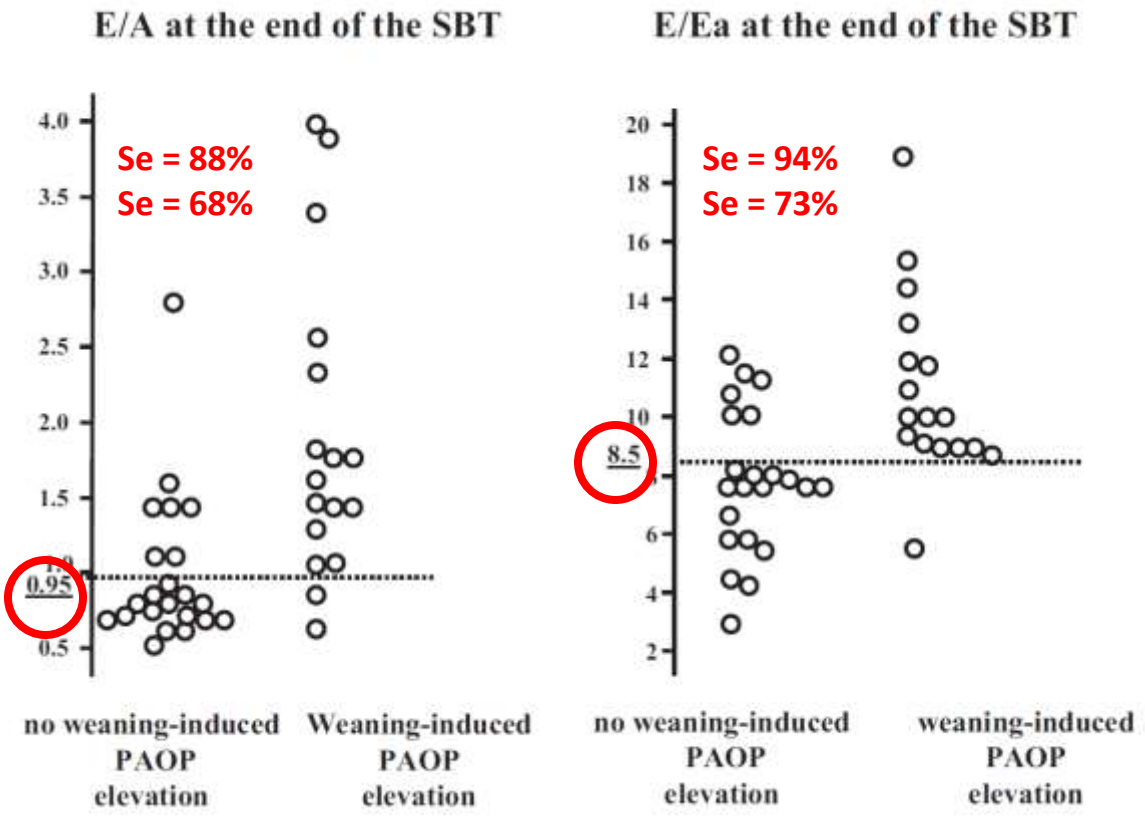
	Weaning success (n = 94)	Weaning failure (n = 23)	*P* value
SAP (mmHg)	139 (133-147)	132 (115-149)	0.28
HR (bpm)	92 (86-97)	110 (95-120)	**0.007**
SV (mL)	63 (57-70)	60 (39-66)	0.06
CO (L/min/m²)	5.8 (5.2-6.3)	5.4 (3.3-6.5)	0.19
LVEF (%)	51 (43-55)	36 (27-55)	**0.04**
E/A	0.94 (0.82-1.03)	0.88 (0.68-1.65)	0.7
DTE (ms)	170 (150-189)	138 (98-195)	0.07
E/E'	5.6 (5.2-6.3)	7.0 (5.0-9.2)	**0.038**
RVEDA/LVEDA	0.47 (0.44-0.51)	0.48 (0.43-0.52)	0.99

Echocardiographic diagnosis of pulmonary artery occlusion pressure elevation during weaning from mechanical ventilation

Bouchra Lamia, MD, MPH, PhD; Julien Maizel, MD; Ana Ochagavia, MD; Denis Chemla, MD, PhD; David Osman, MD; Christian Richard, MD; Jean-Louis Teboul, MD, PhD

Crit Care Med 2009 Vol. 37, No. 5

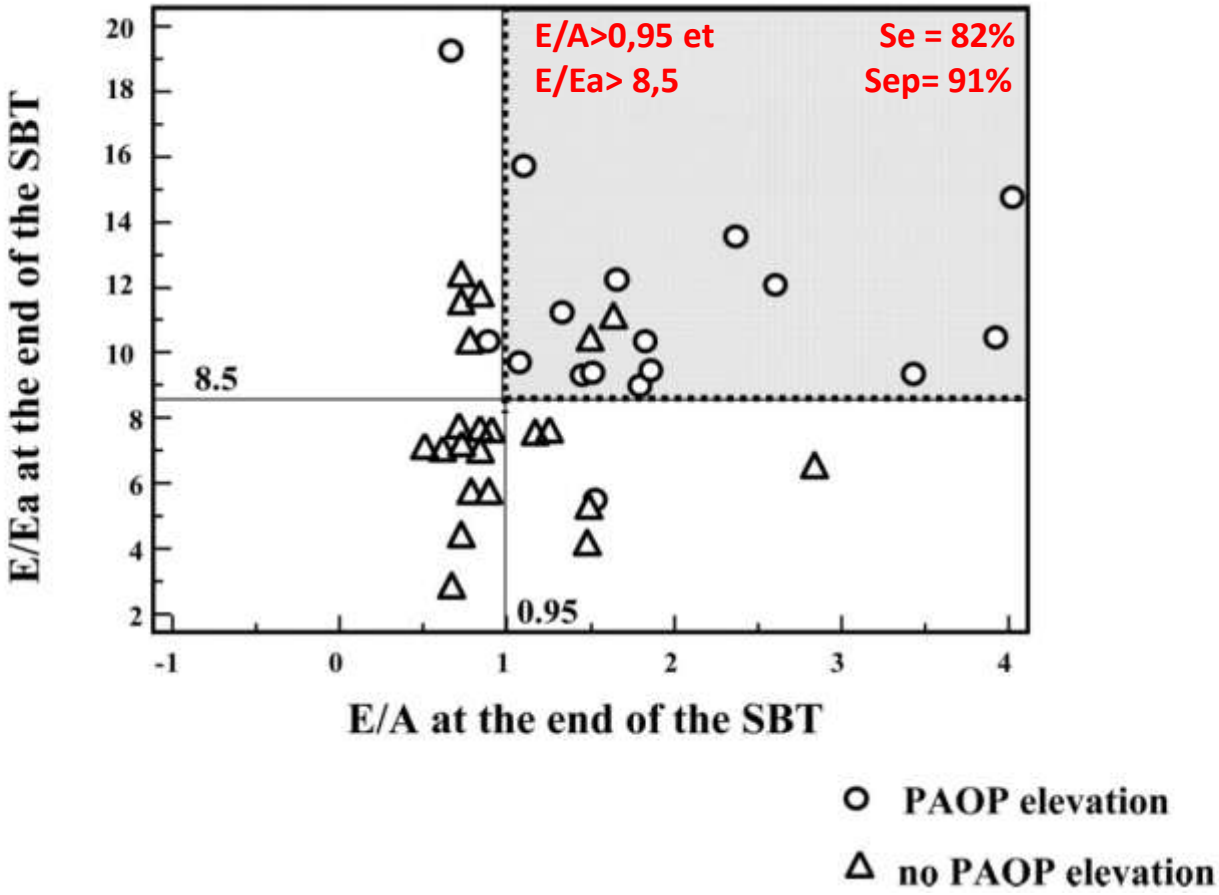
- Etude prospective, 39 patients ayant échoué à deux tentatives de sevrage
- 3éme séance vs-tube : ETT avant et après 1 heure vs-tube
- OAP sevrage : 17 patients



Echocardiographic diagnosis of pulmonary artery occlusion pressure elevation during weaning from mechanical ventilation

Bouchra Lamia, MD, MPH, PhD; Julien Maizel, MD; Ana Ochagavia, MD; Denis Chemla, MD, PhD; David Osman, MD; Christian Richard, MD; Jean-Louis Teboul, MD, PhD

Crit Care Med 2009 Vol. 37, No. 5



Isolated and reversible impairment of ventricular relaxation in patients with septic shock*

Bélaïd Bouhemad, MD; Armelle Nicolas-Robin, MD; Charlotte Arbelot, MD; Martine Arthaud, PharmD; Frédéric Féger, PharmD, PhD; Jean-Jacques Rouby, MD, PhD

Crit Care Med 2008 Vol. 36, No. 3

- Etude prospective observationelle, 54 patients en choc septique
- Receuil : E', Vp, FRS, Troponine à J1,2,3,4,7,10

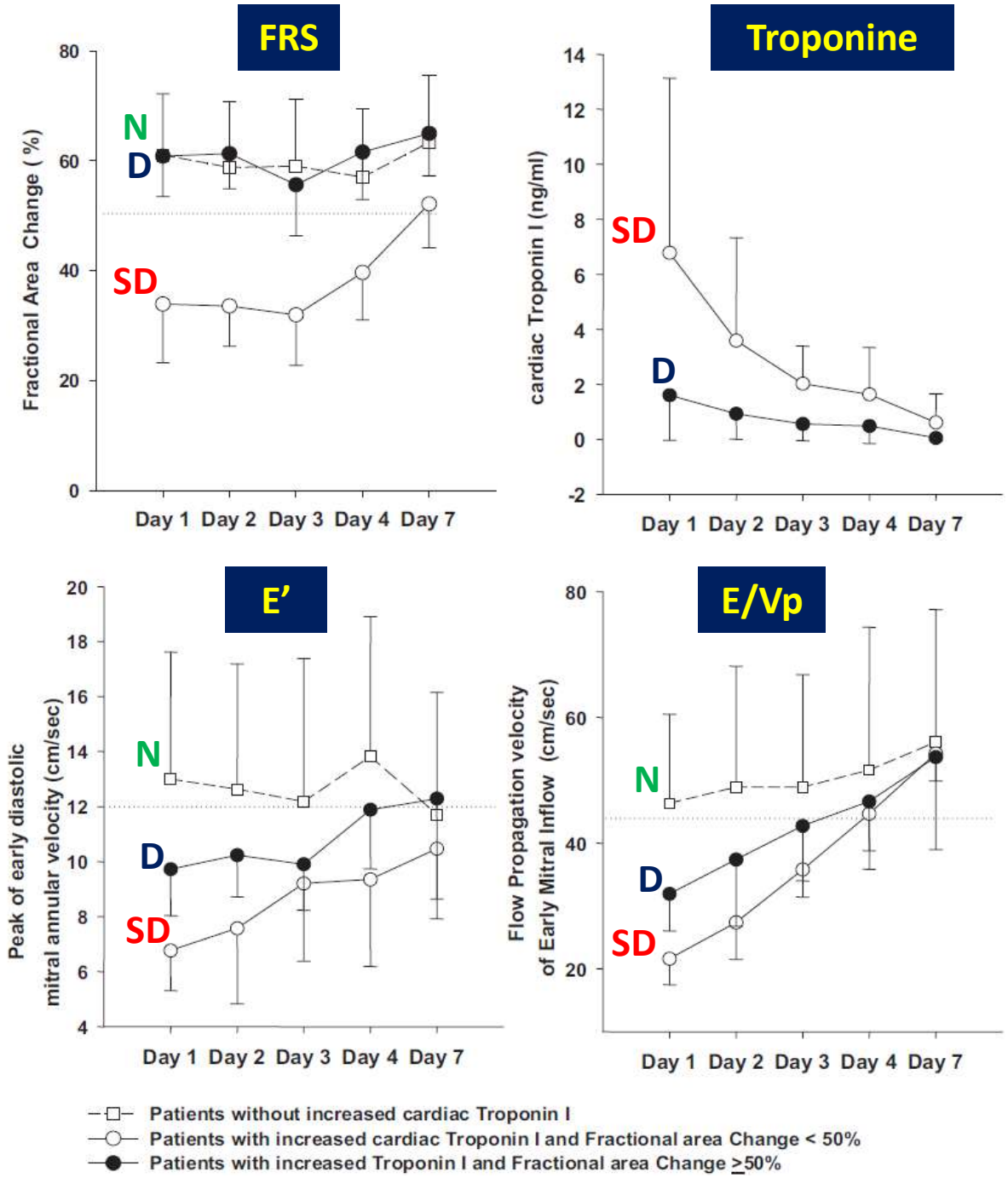
Dysfonction systolo-diastolique

Dysfonction diastolique

Table 2. Hemodynamic characteristics of the patients at day 1

	Patients Without Increased Cardiac Troponin I (n = 32) Group 1	Patients with Increased Cardiac Troponin I (n = 22)	
		Fractional Area Change of <50% (n = 11) Group 2	Fractional Area Change of ≥50 (n = 11) Group 3
Mean arterial pressure, mm Hg	82 ± 12	80 ± 17	74 ± 14
Heart rate, beats/min	101 ± 23	111 ± 25	99 ± 21
Cardiac index, $L \cdot min^{-1} \cdot m^{-2}$	4.2 ± 1.2	3.2 ± 1.2[a]	3.7 ± 0.8
Mean pulmonary arterial pressure, mm Hg	25 ± 7	25 ± 4	24 ± 5
Right atrial pressure, mm Hg	9 ± 3	13 ± 4	9 ± 2
Pulmonary occlusion pressure, mm Hg	10 ± 4	11 ± 5	9 ± 2

(20,3%)


FRS
Fractional Area Change (%)
80
60
40
20
0
N
D
SD
Day 1 Day 2 Day 3 Day 4 Day 7
Troponine
cardiac Troponin I (ng/ml)
14
12
10
8
6
4
2
0
-2
SD
D
Day 1 Day 2 Day 3 Day 4 Day 7
E'
Peak of early diastolic mitral annular velocity (cm/sec)
20
18
16
14
12
10
8
6
4
N
D
SD
Day 1 Day 2 Day 3 Day 4 Day 7
E/Vp
Flow Propagation velocity of Early Mitral Inflow (cm/sec)
80
60
40
20
N
D
SD
Day 1 Day 2 Day 3 Day 4 Day 7
Patients without increased cardiac Troponin I
Patients with increased cardiac Troponin I and Fractional area Change < 50%
Patients with increased Troponin I and Fractional area Change ≥50%

Diastolic dysfunction and mortality in severe sepsis and septic shock

Giora Landesberg[1*], Dan Gilon[2], Yuval Meroz[1], Milena Georgieva[1], Phillip D. Levin[1], Sergey Goodman[1], Alexander Avidan[1], Ronen Beeri[2], Charles Weissman[1], Allan S. Jaffe[3], and Charles L. Sprung[1]

European Heart Journal (2012) **33**, 895–903
doi:10.1093/eurheartj/ehr351

- Etude prospective, cohorte
- 262 patients [(62%)choc septique, 38% sepsis sévère]
- Phase précoce : dysfonction VG dans 63,8% des cas
- Mortalité 59 (36%) patients
- 04 groupes de patients :
  - Fonction systolo-diastolique normale (FE ≥ 50% et E'>8cm/s) **[N=95 (36.2%)]**
  - Dysfonction systolique seulement (FE < 50% et E'>8cm/s) **[N=24 (09.1%)]**
  - **Dysfonction diastolique seulement (FE ≥ 50% et E'<8cm/s)** **[N=106 (40.4%)]**
  - Fonction systolo-diastolique normale (FE < 50% et E'<8cm/s) **[N=37(14.1%)]**

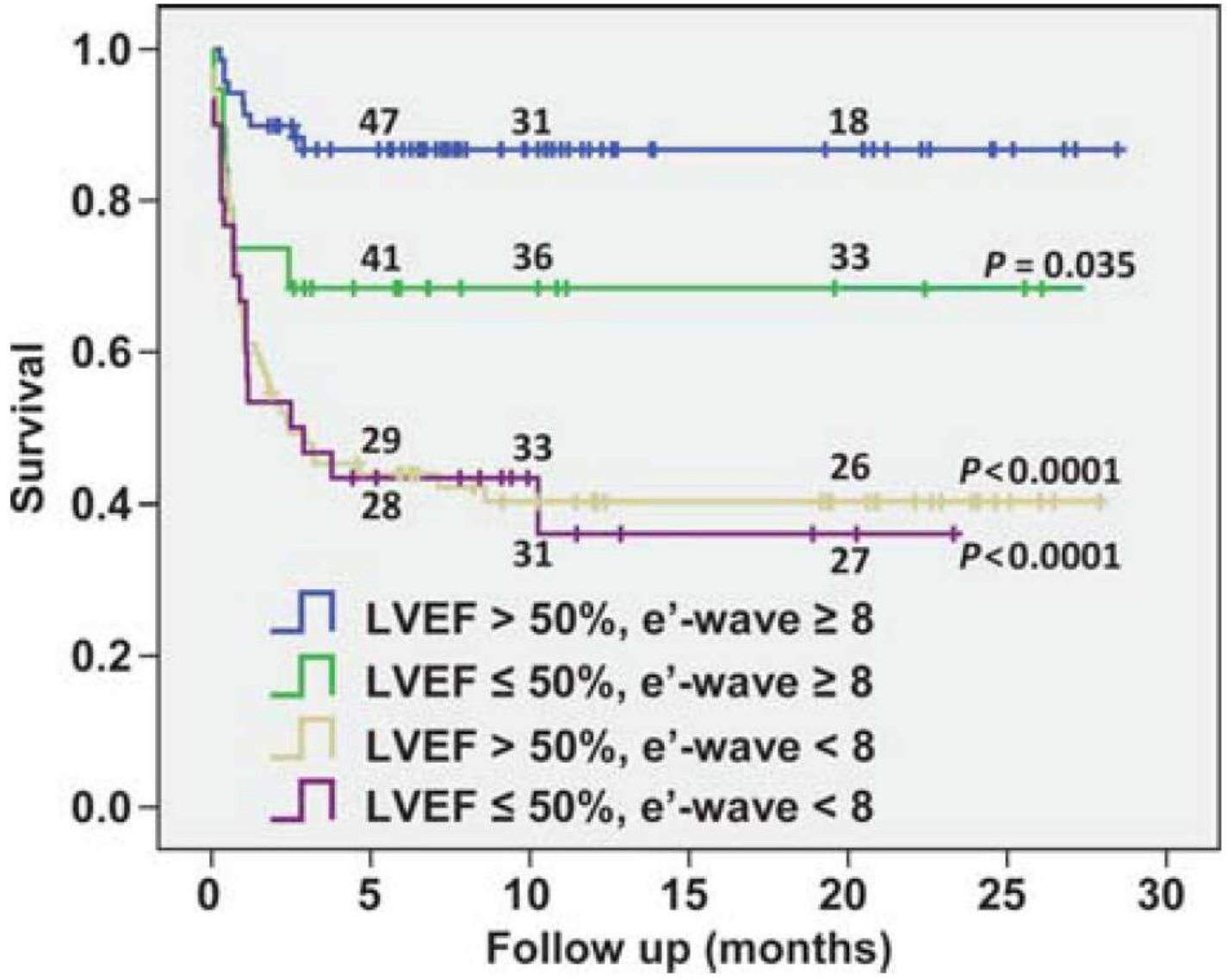

1.0
0.8
0.6
0.4
0.2
0.0
Survival
47
31
18
41
36
33
P = 0.035
29
33
26
P<0.0001
28
31
27
P<0.0001
LVEF > 50%, e'-wave ≥ 8
LVEF ≤ 50%, e'-wave ≥ 8
LVEF > 50%, e'-wave < 8
LVEF ≤ 50%, e'-wave < 8
0
5
10
15
20
25
30
Follow up (months)

Table 3 The independent predictors of in-hospital and overall mortality

	In-hospital mortality, multivariate logistic regression			Overall mortality, multivariate Cox's regression		
	Odds ratio [95% CI*]	Wald stat.	*P*-value	Hazard ratio (95% CI*)	Wald stat.	*P*-value
e′-wave (TDI)	0.70 (0.59–0.84)	15.1	<0.001	0.76 (0.68–0.99)	21.5	<0.001
E/e′ ratio	1.16 (1.07–1.26)*		<0.001	1.08 (1.04–1.13)*		<0.001
APACHE-II score	1.06 (1.01–1.12)	5.7	0.017	1.06 (1.03–1.09)	16.3	<0.001
Urine output (L/24 h/m^2)	0.54 (0.28–0.99)	9.1	0.003	0.65 (0.42–0.99)	9.91	0.002
LVSV index	0.95 (0.91–0.98)	3.9	0.040	0.96 (0.93–0.99)	7.0	0.008
Lowest SaO_2 (%)				0.93 (0.87–0.98)	6.6	0.010
Positive blood culture	2.72 (1.28–5.80)	7.1	0.007			

*CI, confidence interval.

conclusion

- Prévalence ICFE Nle en augmentation croissante
- Les moyens diagnostiques ont été largement améliorés par l'apport de l'échographie cardiaque
- Interprétation difficile et délicate en milieu de réanimation
  - Intérêt en phase de sevrage de la VM
  - Phase précoce du choc septique