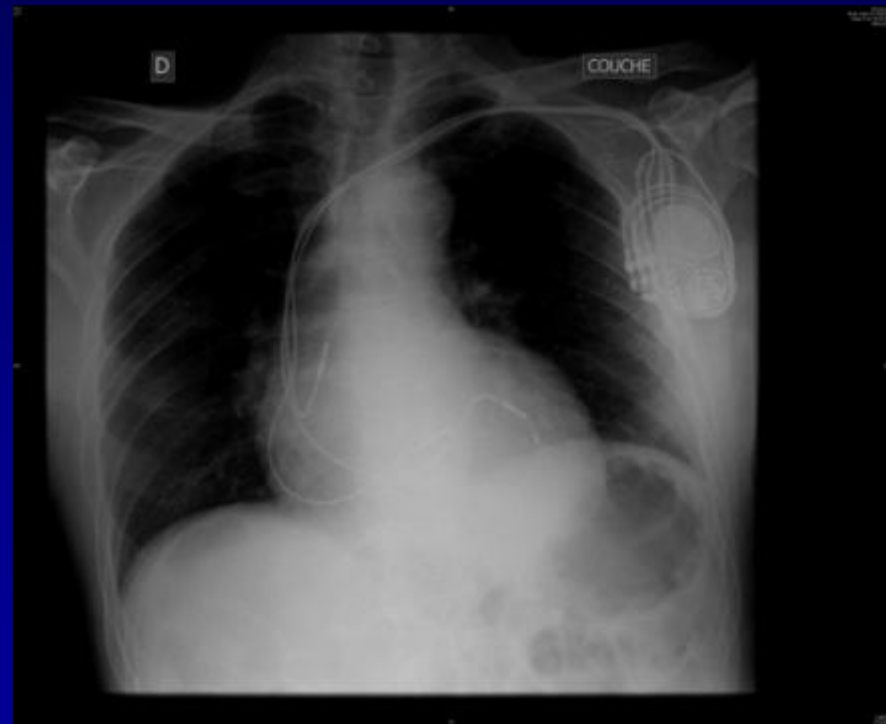
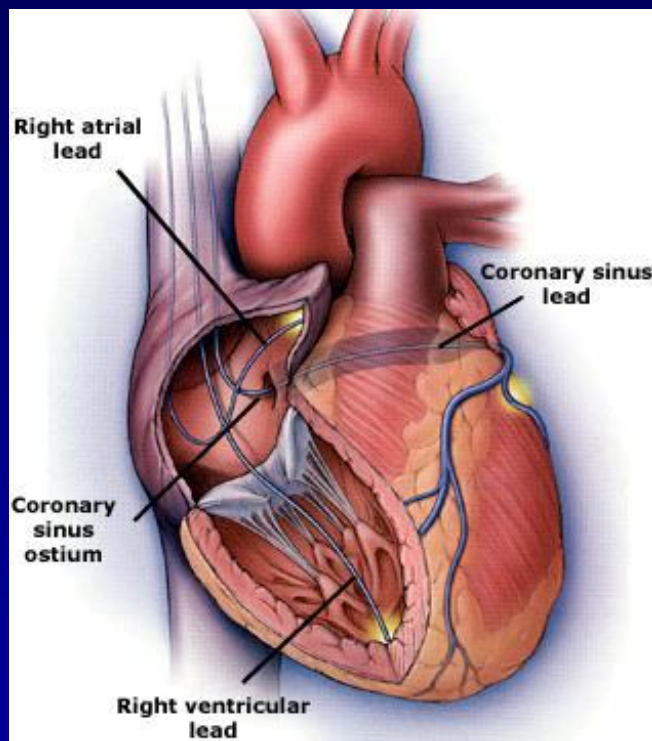


Cas clinique en électrophysiologie cardiaque

« Traitement électrique de l'insuffisance cardiaque: Resynchronisation myocardique »



Michaël Peyrol

Service de Cardiologie CHU Nord

Cas clinique

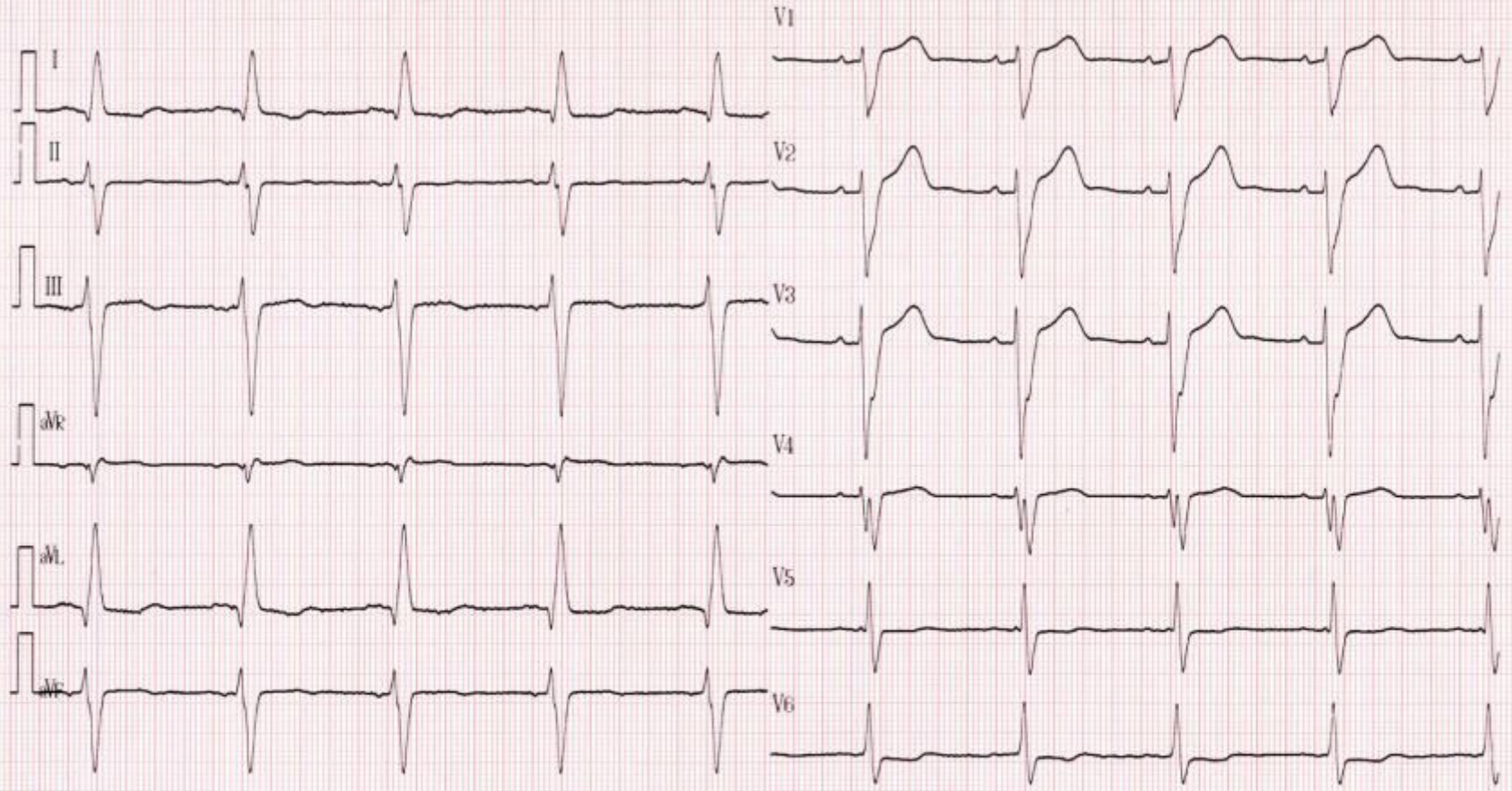
- Mr M. âgé de 75 ans, insuffisance cardiaque réfractaire en stade III NYHA
- Cardiomyopathie dilatée avec altération sévère de la FeVG à 25 %, IM fonctionnelle modérée
- Hospitalisation récente pour insuffisance cardiaque
- Optimisation du trt médical et régime désodé
 - Bisoprolol 5 mg / j
 - Périndopril 4 mg / j
 - Furosémide 125 mg /j
 - Aldactone 25 mg / j

22-Jan-2009 17:05:00
REPOS-EOG

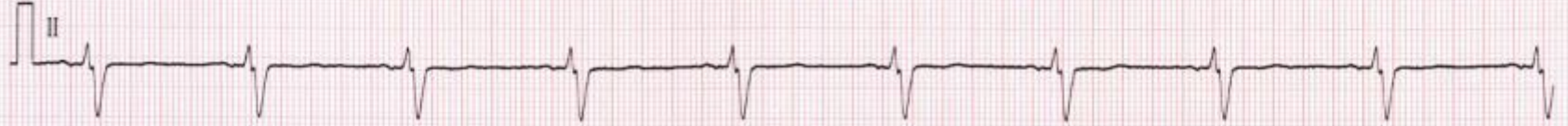
ID: 22/01/09
17h 20.
NAME:

QRS = 180 ms

HR: 56



0s 5s 10s
10mm/mV 25mm/s 10mm/mV



0s 5s 10s
10mm/mV 25mm/s FILTRE-CA FM FM

CHU NORD CARDIOLOGIE

A: PAC V: PVC
2-V02-02-S0

Indication d'implantation d'une
prothèse de resynchronisation
myocardique ou « stimulation bi-
ventriculaire »



Guidelines for cardiac pacing and cardiac resynchronization therapy

3.2.1. Recommendations for the use of cardiac resynchronization therapy by biventricular pacemaker (CRT-P) or biventricular pacemaker combined with an implantable cardioverter defibrillator (CRT-D) in heart failure patients

Heart failure patients who remain symptomatic in NYHA classes III–IV despite OPT, with LVEF $\leq 35\%$, LV dilatation [LV dilatation/different criteria have been used to define LV dilatation in controlled studies on CRT: LV end-diastolic diameter > 55 mm; LV end-diastolic diameter > 30 mm/m², LV end-diastolic diameter > 30 mm/m (height)], normal sinus rhythm and wide QRS complex (≥ 120 ms).

- Class I: level of evidence A for CRT-P to reduce morbidity and mortality.^{288,289,292,330}
- CRT-D is an acceptable option for patients who have expectancy of survival with a good functional status for more than 1 year; Class I: level of evidence B.²⁸⁸

Trois critères: clinique, échographique et électrique

1-Insuffisance cardiaque réfractaire au trt médical NYHA III-III

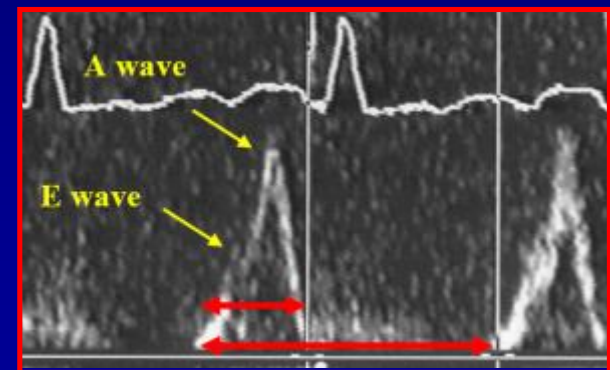
2- Altération de la FeVG $\leq 35\%$

3- Elargissement des QRS ≥ 120 ms (asynchronisme ventriculaire)

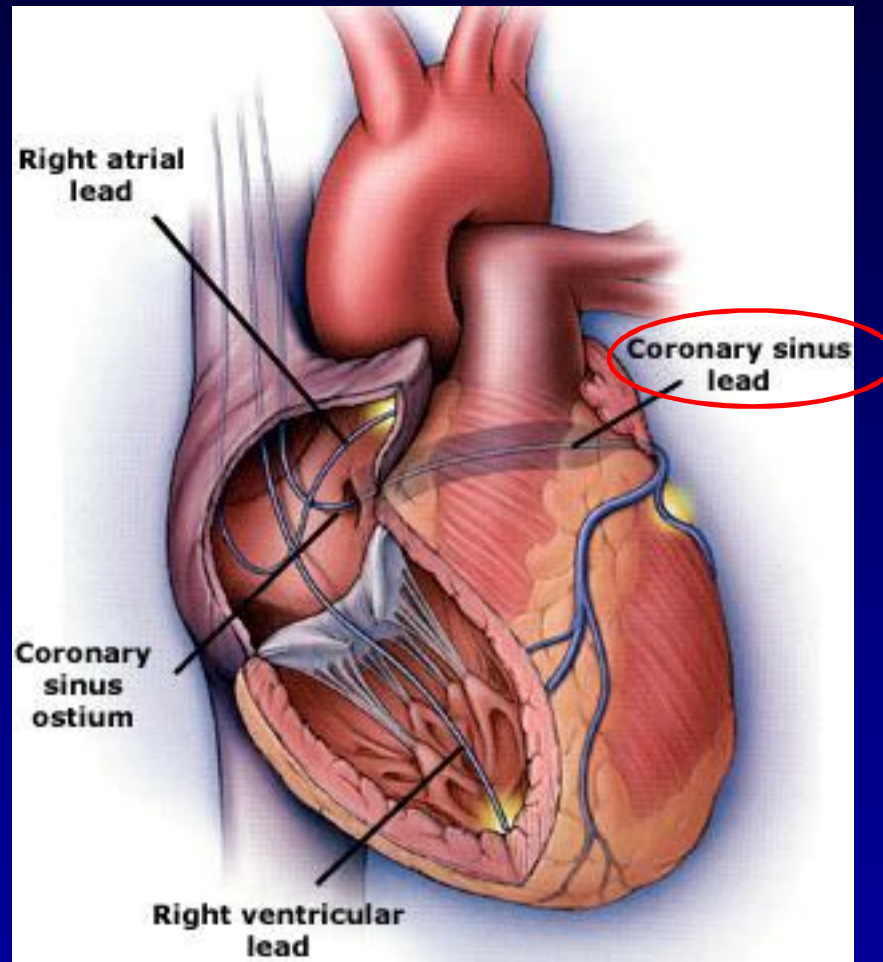
Les bases de la resynchronisation myocardique

Pourquoi la resynchronisation myocardique ?

- Asynchronisme intraventriculaire (QRS > 120 ms) fréquent chez les patients avec dysfonction systolique VG sévère
- Jusqu'à 35 % des patients avec FeVG basse ont un élargissement des QRS > 120 ms qui est un marqueur de risque de morbi-mortalité
- L'asynchronisme intra VG aggrave la dysfonction VG:
 - Altération de la séquence de contraction VG (retard de contraction de la paroi latérale)
 - Aggravation d'une insuffisance mitrale
 - Diminution du temps de remplissage VG (diastole < 40 % cycle RR)



- Détérioration de la fonction systolique VG, remodelage du VG, aggravation de l'IC = augmentation morbi-mortalité



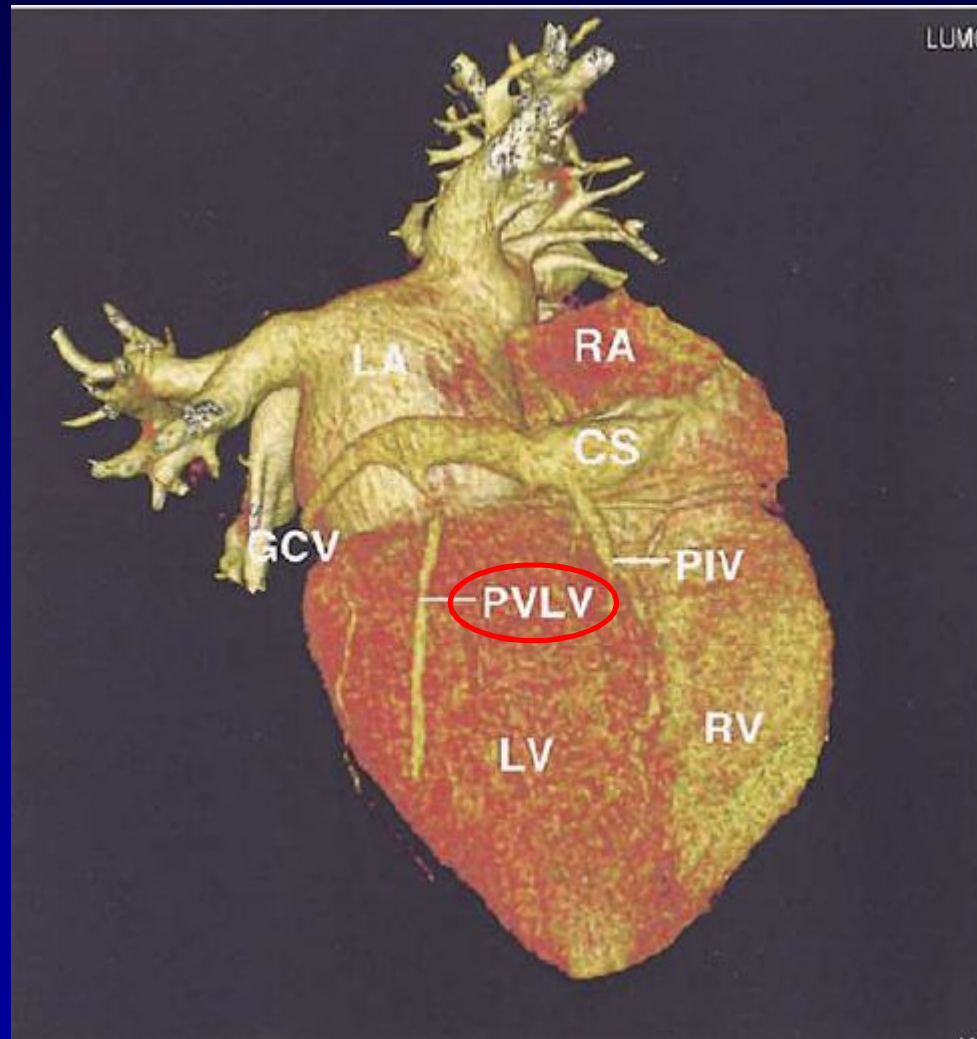
Stimulation synchrone entre un site endocardique VD et une veine épiscopardique postéro-latérale du sinus coronaire

Cardiac Resynchronization Therapy

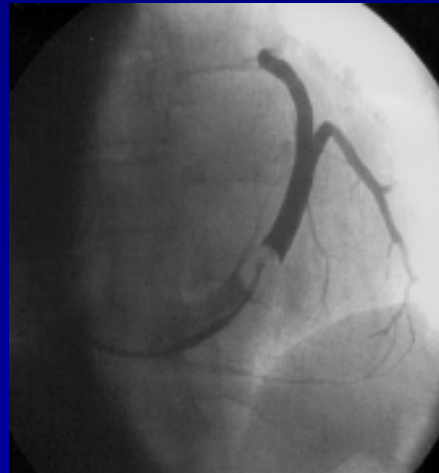
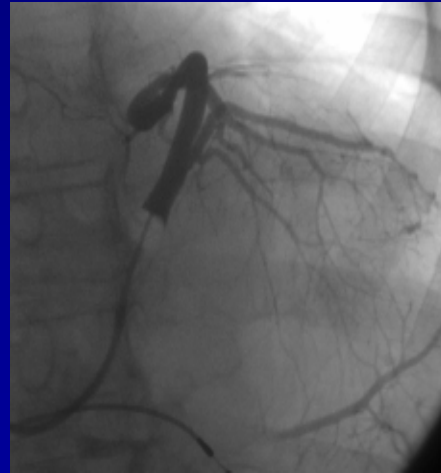
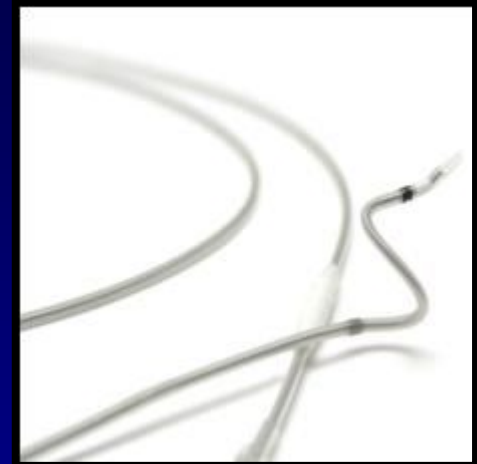
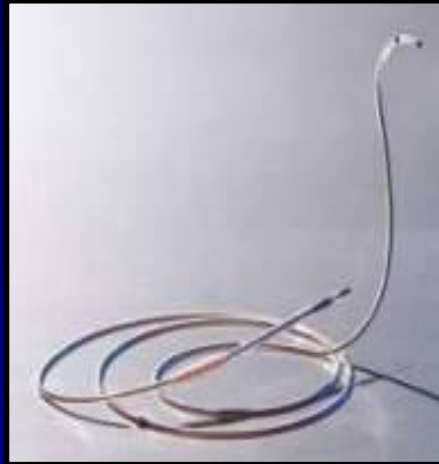
Part 1—Issues Before Device Implantation

(J Am Coll Cardiol 2005;46:2153–67)

Veine « cible »



Le choix de la sonde ventriculaire gauche dépend de l'anatomie du sinus coronaire et de ses branches



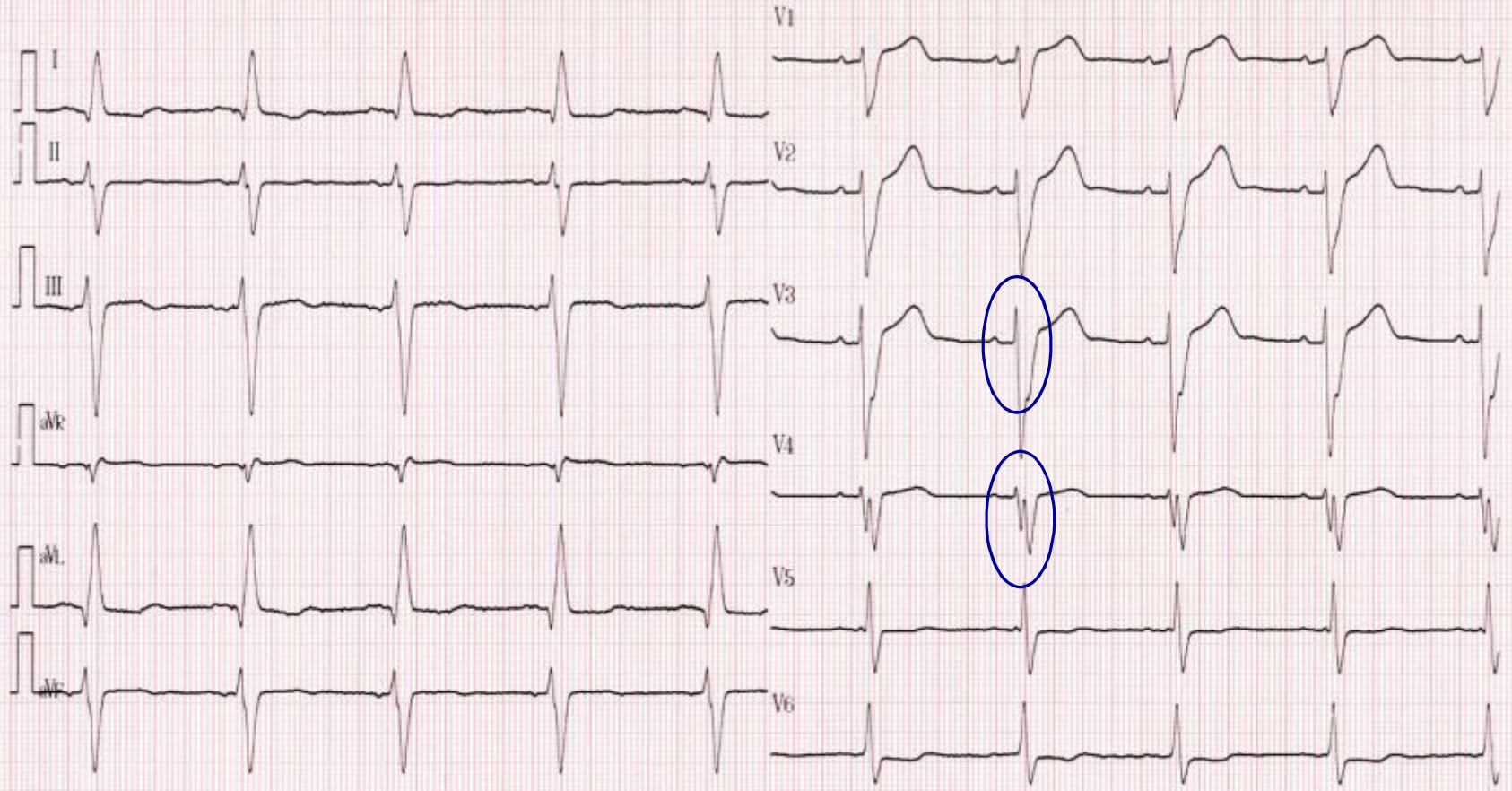
22-Jan-2009 17:05:00
REPOS-EOG

ID: 22/01/09
17h 20.

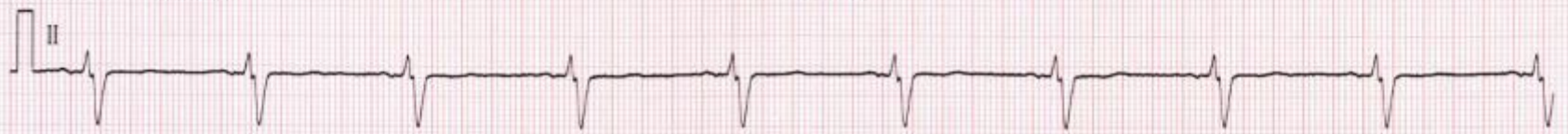
NAME:

QRS = 180 ms

HR: 56



0s 5s 10s
10mm/mV 25mm/s 10mm/mV



0s 5s 10s
10mm/mV 25mm/s FILTRE-CA FM FM

CHU NORD CARDIOLOGIE

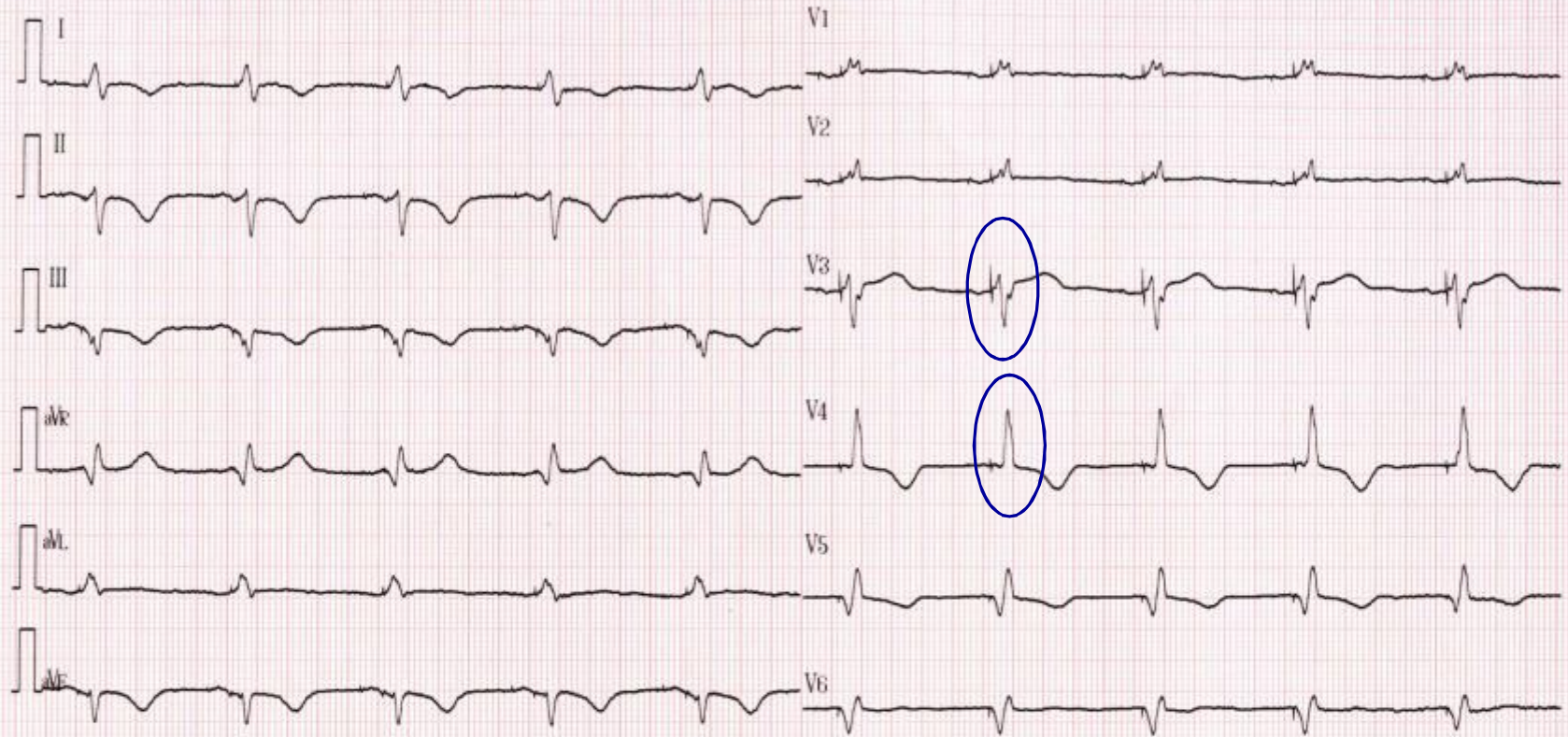
A: PAC V: PVC
2-V02-02-S0

23-Jan-2009 10:40:14
REPOS-ECG

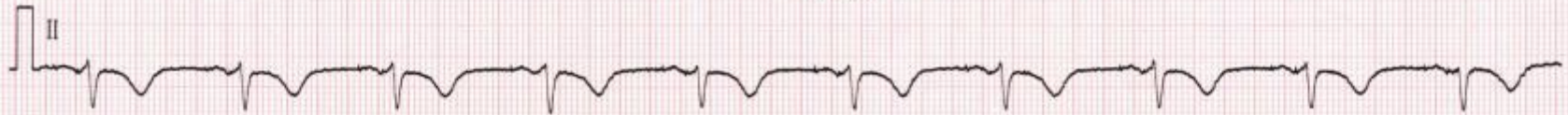
ID:
23/01/09

NAME:

QRS = 140 ms



0s 5s 10s
10mm/mV 25mm/s 10mm/mV



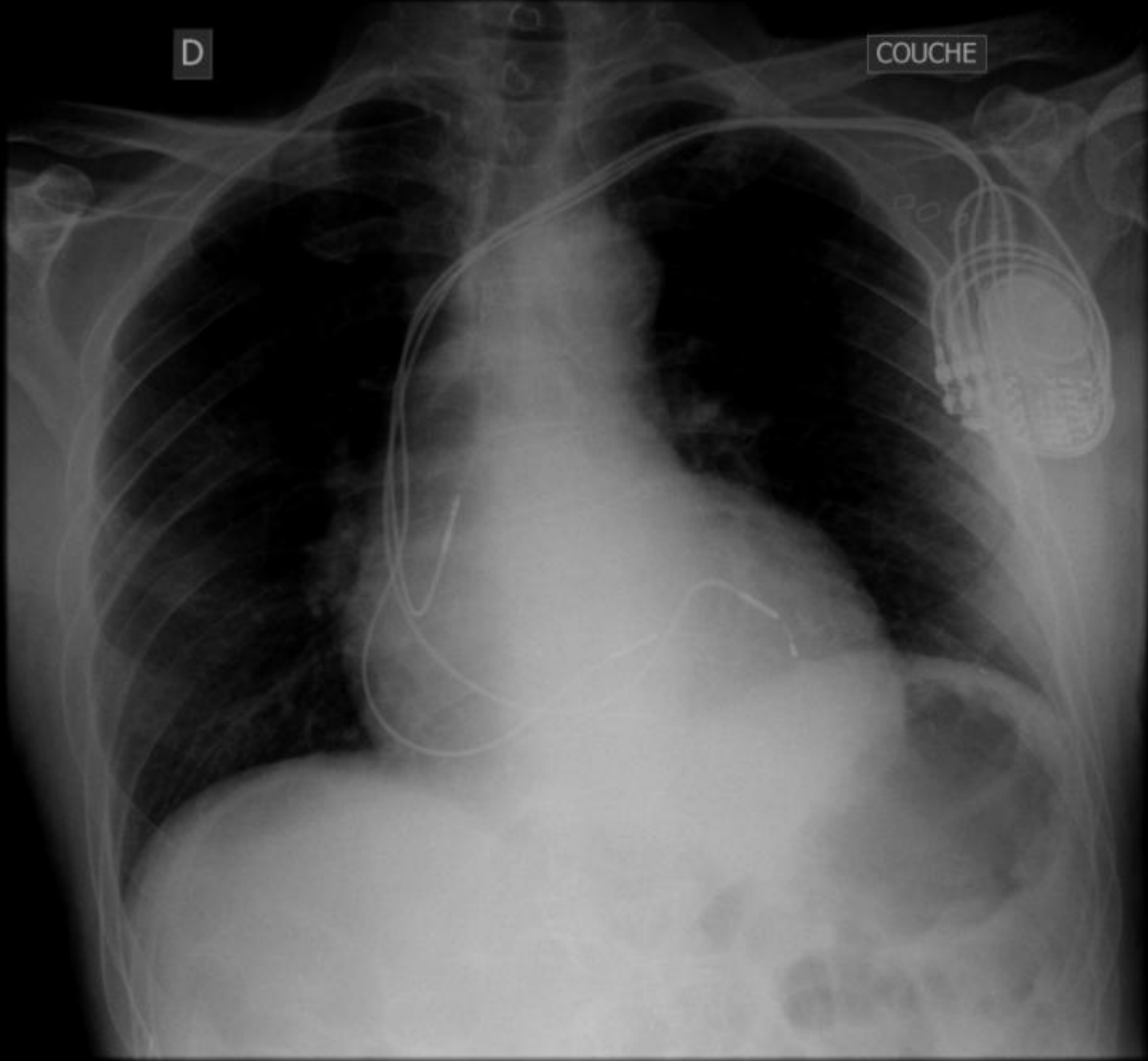
0s 5s 10s
10mm/mV 25mm/s FILTRE:CA FM FM A: PAC V: PVC

CHU NORD CARDIOLOGIE

FX- 02-02-S0

D

COUCHE



Les essais cliniques

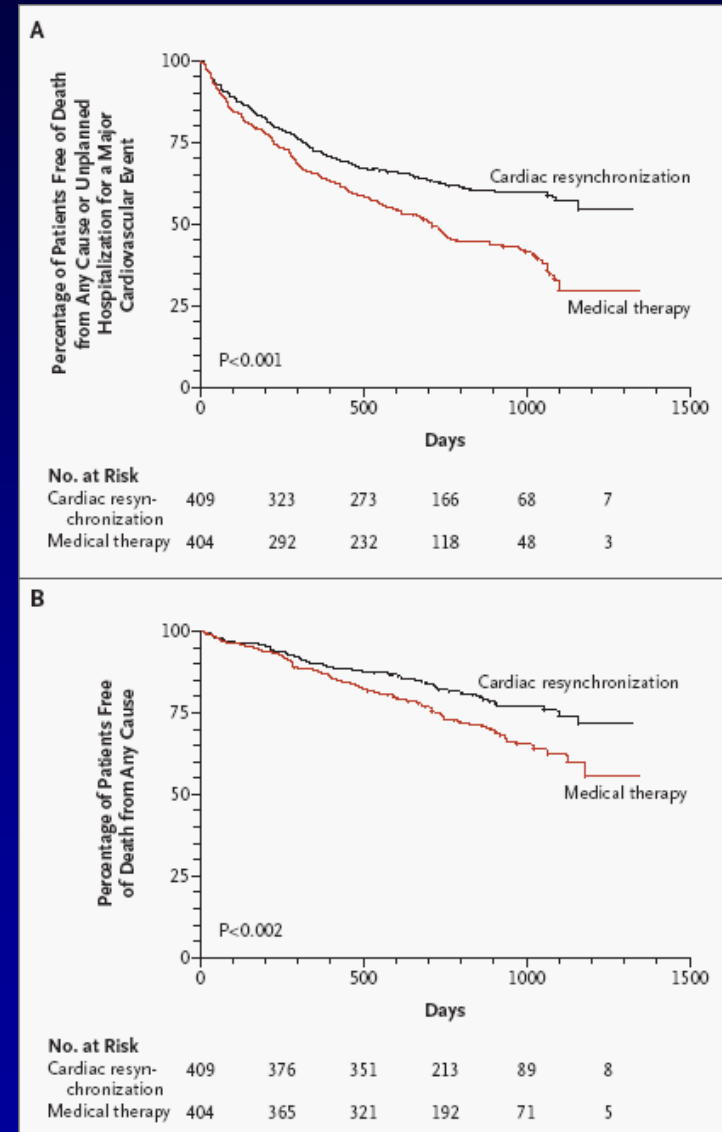
Table 1. CRT in Randomized Clinical Trials

Trials	Design	Patients (n)	End Points		Results Summary
			Primary	Secondary	
PATH-CHF (1)	Crossover	41	6MWT Peak VO ₂	NYHA functional class QOL Hospitalizations	Improvement in 6MWT NYHA functional class QOL Less hospitalizations
MUSTIC-SR (2)	Crossover	58	6MWT	NYHA functional class QOL Peak VO ₂ LV volumes MR Hospitalizations Total mortality	Improvement in 6MWT NYHA functional class QOL Peak VO ₂ LV volumes MR Less hospitalizations
MIRACLE (3)	Parallel arms	453	6MWT NYHA functional class QOL	Peak VO ₂ LVEF LVEDD MR Clinical composite response	Improvement in 6MWT NYHA functional class QOL LVEF LVEDD MR
MIRACLE-ICD (4)	Parallel arms	555	6MWT NYHA functional class QOL	Peak VO ₂ LVEF LV volumes	Improvement in NYHA functional class QOL
COMPANION (5)	Parallel arms	1,520	All-cause mortality or hospitalization	All-cause mortality and cardiac morbidity	Reduced all-cause mortality/hospitalization
CARE-HF (6)	Open label, randomized	814	All-cause mortality	NYHA functional class QOL LVEF LVESV Hospitalization for heart failure	Reduced mortality/morbidity Improvement in NYHA functional class QOL LVEF LVESV
PATH-CHF II (7)	Crossover (no pacing vs. LV pacing)	86	6MWT Peak VO ₂	NYHA functional class QOL	Improvement in 6MWT QOL Peak VO ₂
CONTAK-CD (8)	Crossover, parallel controlled	490	6MWT NYHA functional class QOL	LVEF LV volumes Composite of mortality, hospitalizations, VT/VF	Improvement in 6MWT NYHA functional class QOL LVEF LV volumes

The Effect of Cardiac Resynchronization on Morbidity and Mortality in Heart Failure

N Engl J Med 2005;352:1539-49.

- Patients en stade III ou IV NYHA malgré trt Med. opt.
- FeVG < 35 %, DTD VG > 30 mm/m²
- QRS > 120 ms,
- 404 patients assignés au trt Med. et 409 trt Med + CRT
 - End point 1: Mortalité toute cause ou hospitalisation pour MACE
 - End point 2: Mortalité toute cause
- Suivi moyen de 29,4 mois



The Effect of Cardiac Resynchronization on Morbidity and Mortality in Heart Failure

N Engl J Med 2005;352:1539-49.

Table 2. Study Outcomes in Analyses Stratified According to NYHA Class.*

Outcome	Medical Therapy Alone (N=404)	Medical Therapy plus Cardiac Resynchronization (N=409)	Hazard Ratio (95% CI)	P Value
	<i>no. of patients (%)</i>			
Primary outcome				
Death or unplanned hospitalization for a cardiovascular event	224 (55)	159 (39)	0.63 (0.51 to 0.77)	<0.001
Unplanned hospitalization for a cardiovascular event†	184 (46)	125 (31)	0.61 (0.49 to 0.77)	<0.001
Secondary outcome				
Death from any cause	120 (30)	82 (20)	0.64 (0.48 to 0.85)	<0.002
Death from any cause or unplanned hospitalization with worsening heart failure	191 (47)	118 (29)	0.54 (0.43 to 0.68)	<0.001
Unplanned hospitalization with worsening heart failure‡	133 (33)	72 (18)	0.48 (0.36 to 0.64)	<0.001
Outcome	Medical Therapy Alone (N=404)	Medical Therapy plus Cardiac Resynchronization (N=409)	Difference in Means (95% CI)§	P Value
	<i>value at 90 days</i>			
Continuous outcome				
NYHA class	2.7±0.9	2.1±1.0	0.6 (0.4 to 0.7)	<0.001
Minnesota Living with Heart Failure score¶	40±22	31±22	-10 (-8 to -12)	<0.001
EuroQoL EQ-5D score¶¶	0.63±0.29	0.70±0.28	0.08 (0.04 to 0.12)	<0.001

* Plus-minus values are means ±SD. The analysis was adjusted according to study center. NYHA denotes New York Heart Association, and CI confidence interval.

† These events contributed to the primary or secondary outcome.

‡ The difference shown is for the cardiac-resynchronization group as compared with the medical-therapy group.

§ Scores on the Minnesota Living with Heart Failure questionnaire range from 0 to 105, with higher scores reflecting a poorer quality of life.

¶ Scores on the European Quality of Life-5 Dimensions (EuroQoL EQ-5D) instrument range from -0.594 to 1.000, with 1.000 indicating fully healthy and 0 dead.

The Effect of Cardiac Resynchronization on Morbidity and Mortality in Heart Failure

N Engl J Med 2005;352:1539-49.

Table 3. Hemodynamic, Echocardiographic, and Biochemical Assessments.*

Variable	Difference in Means at 3 Mo (95% CI)	P Value	Difference in Means at 18 Mo (95% CI)	P Value
Heart rate (beats/min)	+1.1 (-1.2 to 3.4)	0.33	+1.0 (-1.5 to 3.6)	0.43
Systolic blood pressure (mm Hg)	+5.8 (3.5 to 8.2)	<0.001	+6.3 (3.6 to 8.9)	<0.001
Diastolic blood pressure (mm Hg)	+1.5 (0.1 to 2.9)	0.03	+1.3 (-1.8 to 4.4)	0.42
Interventricular mechanical delay (msec)	-21 (-25 to -18)	<0.001	-21 (-25 to -17)	<0.001
Left ventricular ejection fraction (%)	+3.7 (3.0 to 4.4)	<0.001	+6.9 (5.6 to 8.1)	<0.001
Left ventricular end-systolic volume index (ml/m ²)	-18.2 (-21.2 to -15.1)	<0.001	-26.0 (-31.5 to -20.4)	<0.001
Mitral-regurgitation area†	-0.051 (-0.073 to -0.028)	<0.001	-0.042 (-0.070 to -0.014)	0.003
N-terminal pro-brain natriuretic peptide (pg/ml)‡	-225 (-705 to 255)	0.36	-1122 (-1815 to -429)	<0.002

* Differences were not adjusted for the higher mortality rate in the medical-therapy group. A plus sign indicates a greater value, and a minus sign a smaller value, in the cardiac-resynchronization group than in the medical-therapy group. CI denotes confidence interval.

† The area was calculated as the area of the color-flow Doppler regurgitant jet divided by the area of the left atrium in systole, both in square centimeters.

‡ To convert the values for N-terminal pro-brain natriuretic peptide to picomoles per liter, divide by 8.457.

2010 Focused Update of ESC guidelines on device therapy in heart failure

An update of the 2008 ESC guidelines for the diagnosis and treatment of acute and chronic heart failure and the 2007 ESC guidelines for cardiac and resynchronization therapy

European Heart Journal Advance Access published August 27, 2010

Recommendation in patients with heart failure in New York Heart Association function class II

Recommendation	Patient population	Class ^a	Level ^b	Ref. ^c
CRT preferentially by CRT-D is recommended to reduce morbidity or to prevent disease progression ^d	NYHA function class II LVEF \leq 35%, QRS \geq 150 ms, SR Optimal medical therapy	I	A	9, 20–22

^aClass of recommendation.

^bLevel of evidence.

^cReferences.

^dThe guideline indication has been restricted to patients with HF in NYHA function class II with a QRS width \geq 150 ms, a population with a high likelihood of a favourable response. CRT = cardiac resynchronization therapy; CRT-D = CRT with defibrillator function; HF = heart failure; LVEF = left ventricular ejection fraction; NYHA = New York Heart Association; SR = sinus rhythm.

Les perspectives

Cardiac-Resynchronization Therapy for the Prevention of Heart-Failure Events

N Engl J Med 2009;361.

- Patients en stade I ou II NYHA
- FeVG < 30 %,
- QRS > 130 ms,
- 731 patients assignés au DAI seul et 1089 au DAI + CRT
 - End point : Mortalité toute cause ou hospitalisation pour insuffisance cardiaque
- Suivi moyen de 2,4 ans

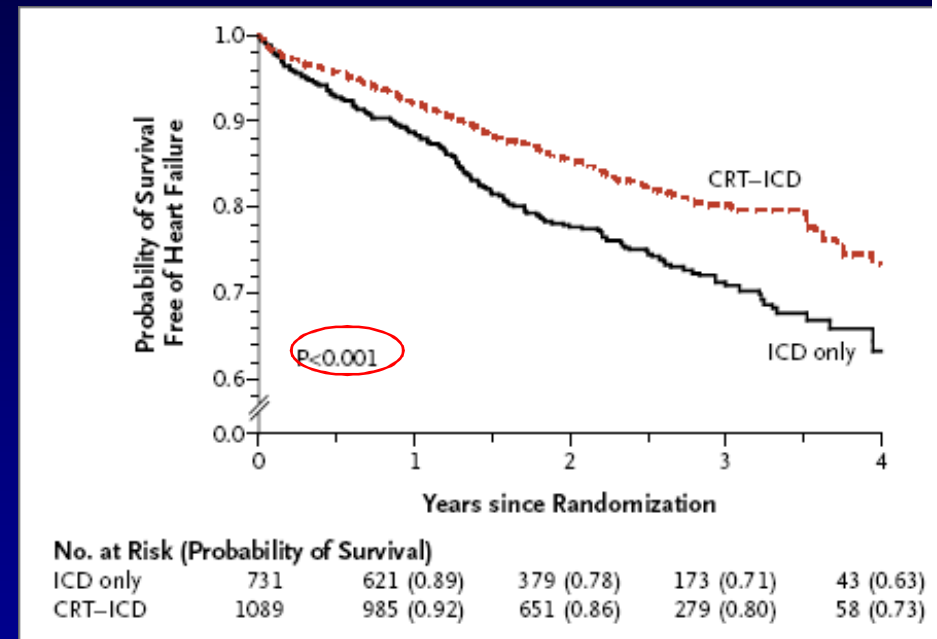


Figure 2. Kaplan–Meier Estimates of the Probability of Survival Free of Heart Failure.

There was a significant difference in the estimate of survival free of heart failure between the group that received cardiac-resynchronization therapy plus an implantable cardioverter–defibrillator (CRT–ICD) and the group that received an ICD only (unadjusted $P < 0.001$ by the log-rank test).

Cardiac-Resynchronization Therapy for the Prevention of Heart-Failure Events

N Engl J Med 2009;361.

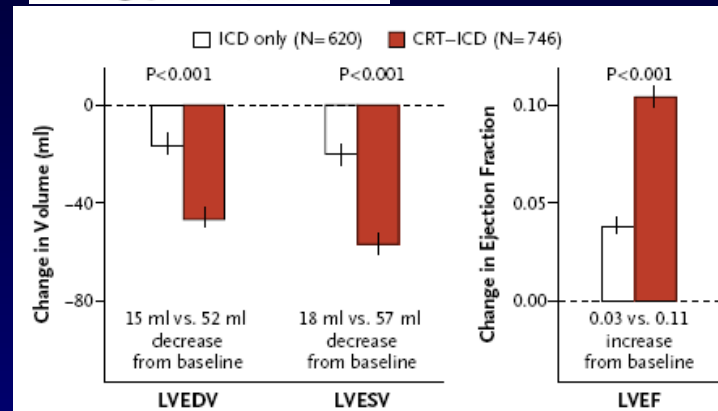


Table 2. Risk of Death or Heart Failure.*

Variable	ICD-Only Group no. (%)	CRT-ICD Group no. (%)	Hazard Ratio (95% CI) [†]	P Value
All patients	731	1089		
Death or heart failure [‡]	185 (25.3)	187 (17.2)	0.66 (0.52–0.84) [§]	0.001 [§]
Heart failure only	167 (22.8)	151 (13.9)	0.59 (0.47–0.74)	<0.001
Death at any time [¶]	53 (7.3)	74 (6.8)	1.00 (0.69–1.44)	0.99
Patients with ischemic cardiomyopathy (NYHA class I or II)	401	598		
Death or heart failure [‡]	117 (29.2)	122 (20.4)	0.67 (0.52–0.88)	0.003
Heart failure only	105 (26.2)	96 (16.1)	0.58 (0.44–0.78)	<0.001
Death at any time [¶]	35 (8.7)	53 (8.9)	1.06 (0.68–1.64)	0.80
Patients with nonischemic cardiomyopathy (NYHA class II)	330	491		
Death or heart failure [‡]	68 (20.6)	65 (13.2)	0.62 (0.44–0.89)	0.01
Heart failure only	62 (18.8)	55 (11.2)	0.59 (0.41–0.87)	0.01
Death at any time [¶]	18 (5.5)	21 (4.3)	0.87 (0.44–1.70)	0.68

Figure 4. Changes in Mean Echocardiographic Left Ventricular Volumes and Ejection Fraction between Baseline and 1-Year Follow-up.

Conclusion

- La resynchronisation myocardique est une thérapeutique à proposer aux patients insuffisants cardiaque avec FeVG < 35 %, QRS > 120 ms et symptomatique III-IV NYHA malgré un traitement médical optimal

L'Ablation Endocavitaire de la

- Indication de classe I ^{Fibrillation Atriale} niveau de preuves A

- Amélioration des symptômes et réduction de morbidité et mortalité

- Extension de l'indication aux patients NYHA II malgré le traitement médical avec FeVG < 35 % et QRS > 150 ms