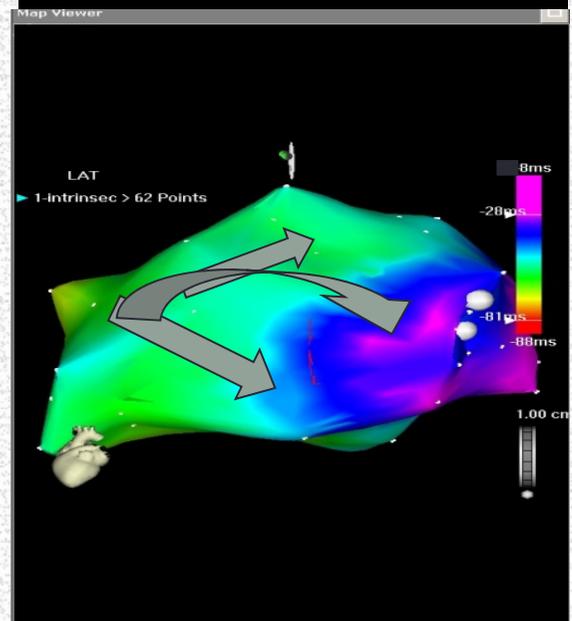
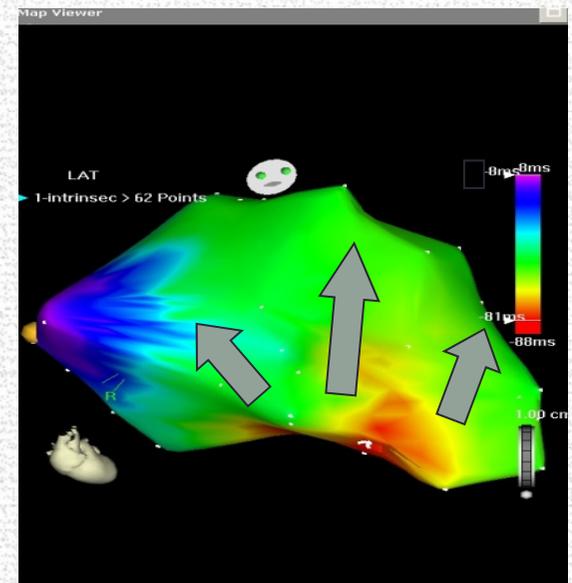
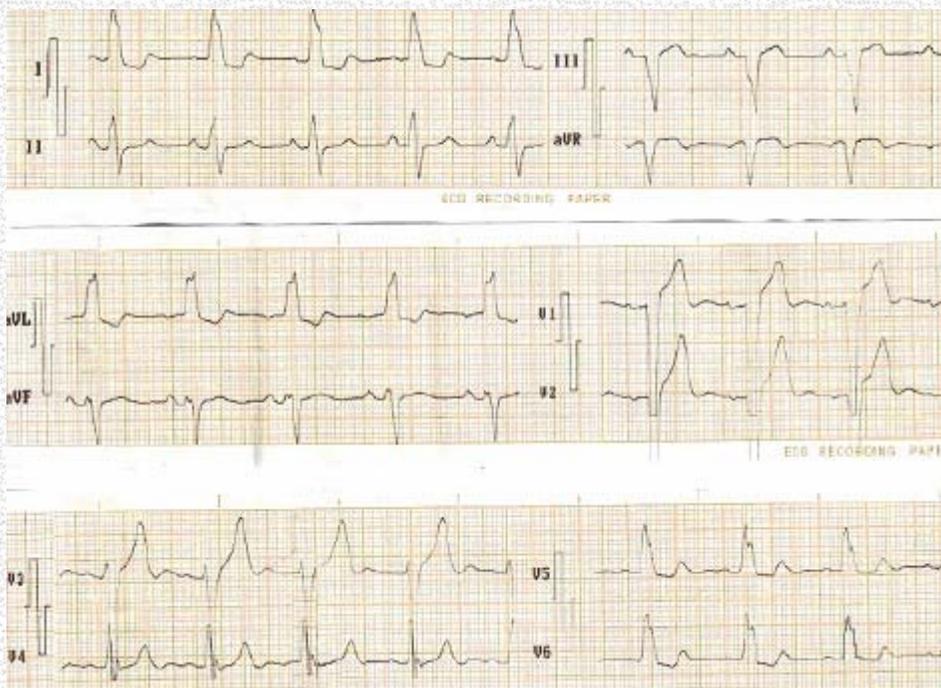
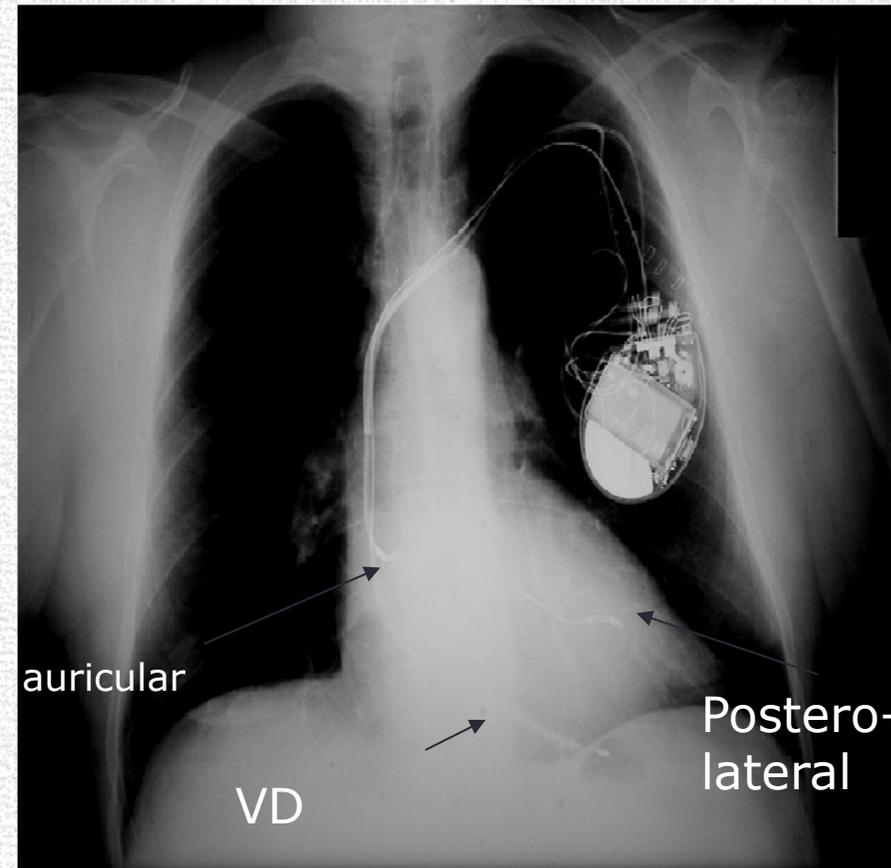
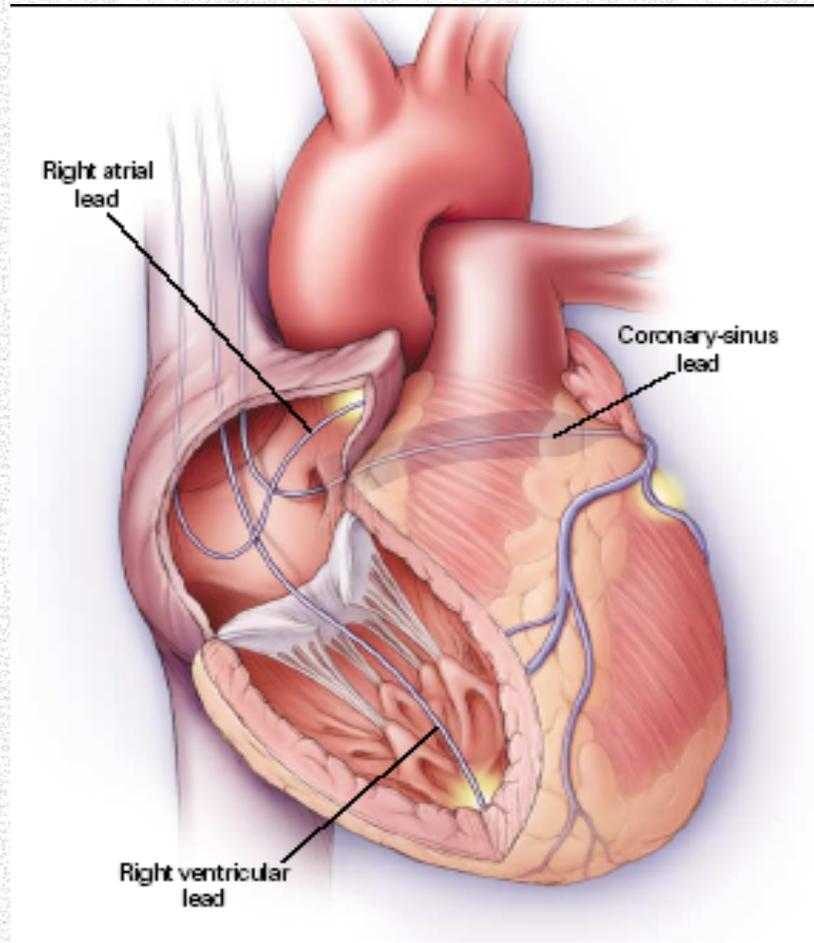


**LA RESINCRONIZACIÓN
CARDIACA:
UNA FORMA INTELIGENTE DE
TRATAR A PACIENTES
SELECCIONADOS**

**Dra. María Ángeles Castel
Hospital Clínic**



RESINCRONIZACIÓN CARDIACA



Estudios clínicos



Evolución TRC

Efectos Terapia Resincronización Cardíaca



MEJORÍA

- ✓ **SÍNTOMAS**
- ✓ **CAPACIDAD
FUNCIONAL**
- ✓ **DISMINUCIÓN
INGRESOS**
- ✓ **DISMINUCIÓN
MORTALIDAD**

**LINDE C. MUSTIC j Am Coll Car 2002;
Abrahan WT NEJM 2002**

Remodelado inverso Ventrículo izquierdo

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

Variable				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
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 (cm ²)		-5.1 (-7.3 to -2.8)	<0.001	-4.2 (-7.0 to -1.4)	0.003
N-terminal pro-brain natriuretic peptide (pg/ml)‡		-223 (-293 to -153)	0.36	-1122 (-1813 to -429)	<0.001

Indicaciones Actuales TRC

Recommendation	Patient population	Class ^a	Level ^b	Ref. ^c
CRT-P/CRT-D is recommended to reduce morbidity and mortality ^d	NYHA function class III/IV LVEF \leq 35%, QRS \geq 120 ms, SR Optimal medical therapy Class IV patients should be ambulatory ^e	I	A	5–19

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

TRC en FA

Recommendations	Patient population	Class ^a	Level ^b	Ref. ^c
CRT-P/CRT-D ^d should be considered to reduce morbidity	NYHA function class III/IV LVEF \leq 35%, QRS \geq 130 ms Pacemaker dependency induced by AV nodal ablation	IIa	B	27–40
CRT-P/CRT-D ^d should be considered to reduce morbidity	NYHA function class III/IV LVEF \leq 35%, QRS \geq 130 ms Slow ventricular rate and frequent pacing ^e	IIa	C	—

Pacientes con marcapasos

Recommendations	Patient population	Class ^a	Level ^b	Ref. ^c
CRT-P/CRT-D ^d is recommended to reduce morbidity	NYHA function class III/IV LVEF \leq 35%, QRS \geq 120 ms	I	B	41–48
CRT-P/CRT-D ^d should be considered to reduce morbidity	NYHA function class III/IV LVEF \leq 35%, QRS $<$ 120 ms	IIa	C	—
CRT-P/CRT-D ^d may be considered to reduce morbidity	NYHA function class II LVEF \leq 35%, QRS $<$ 120 ms	IIb	C	—

Evitar la estimulación continua del ventrículo derecho en pacientes con disfunción ventricular

PROBLEMAS en la RESINCRONIZACIÓN

- ✓ 30 % de los pacientes no mejoran clínicamente
- ✓ Alrededor de 40% de los pacientes no mejoran ecocardiográficamente (remodelado inverso).

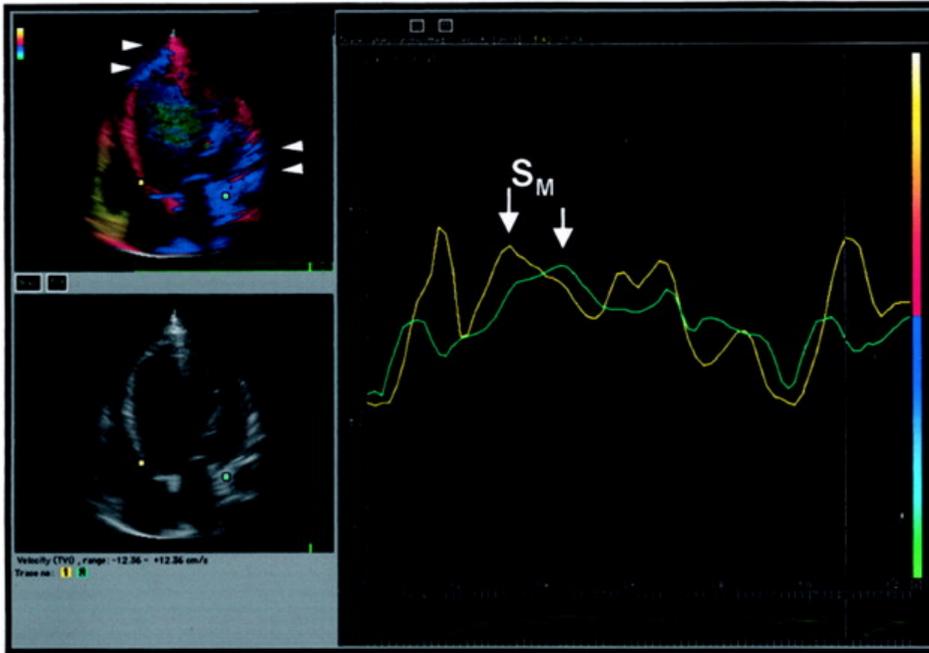
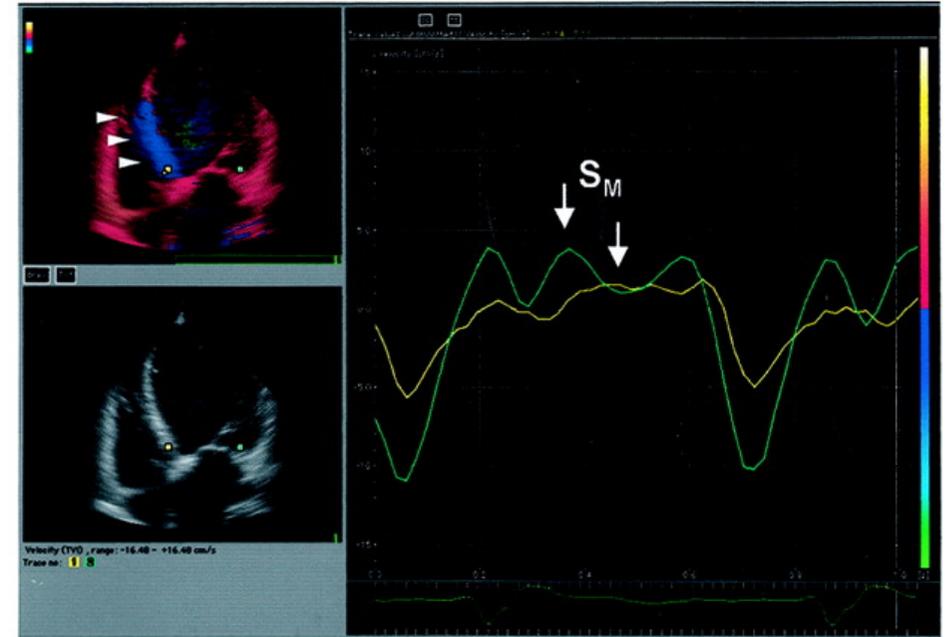
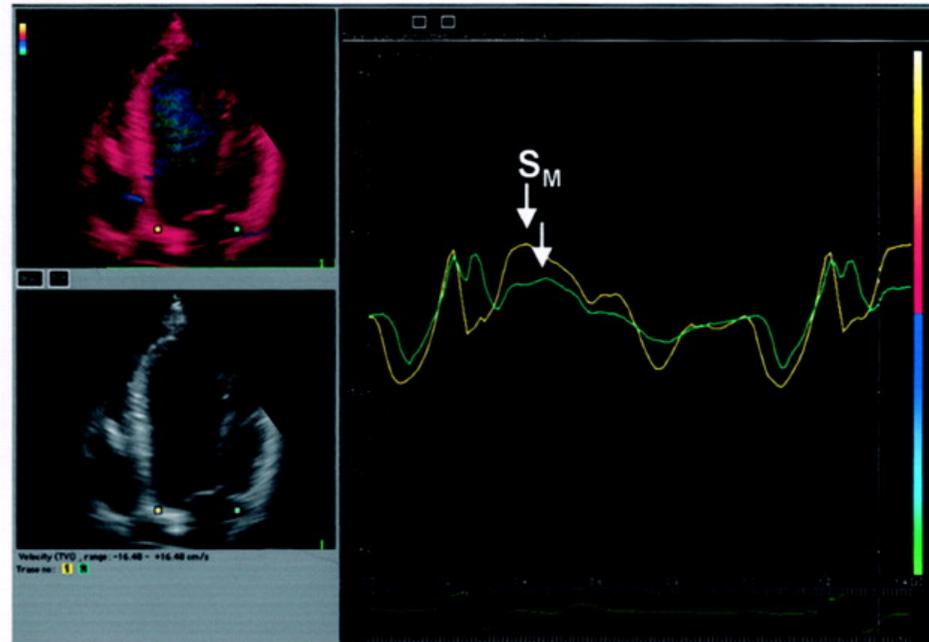
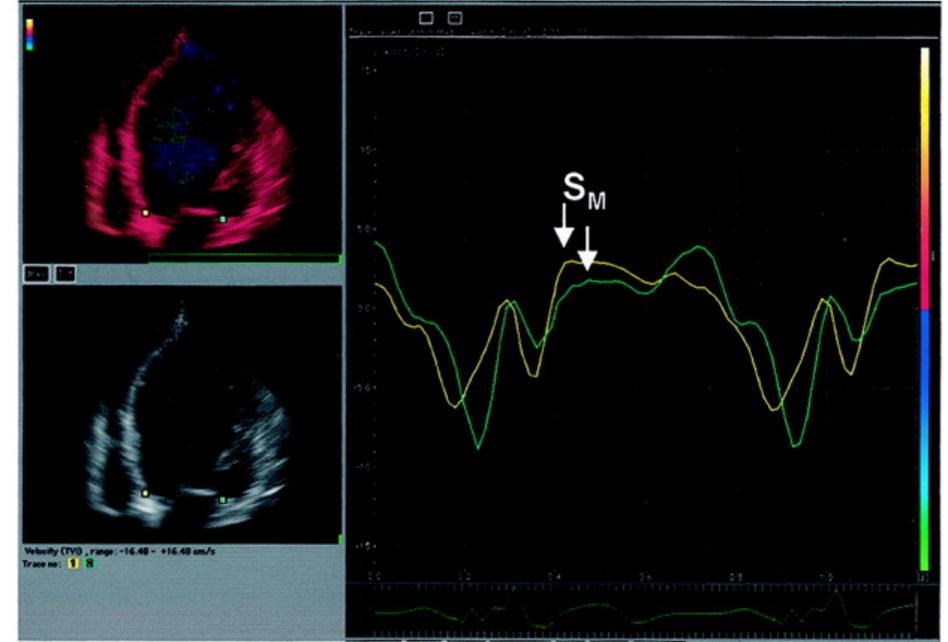
Falta de respuesta a TRC

- Características basales de los pacientes
- Mala colocación electrodos estimulación (LV anterior)
- Defectuosa programación dispositivo
 - ✓ Fallo captura VI
 - ✓ Estimulación frénica
- Arritmias post-implante dispositivo
 - ✓ Fibrilación auricular
 - ✓ Extrasistoles ventriculares
 - ✓ Disfunción sinusal
- Mala adherencia al tratamiento médico del paciente

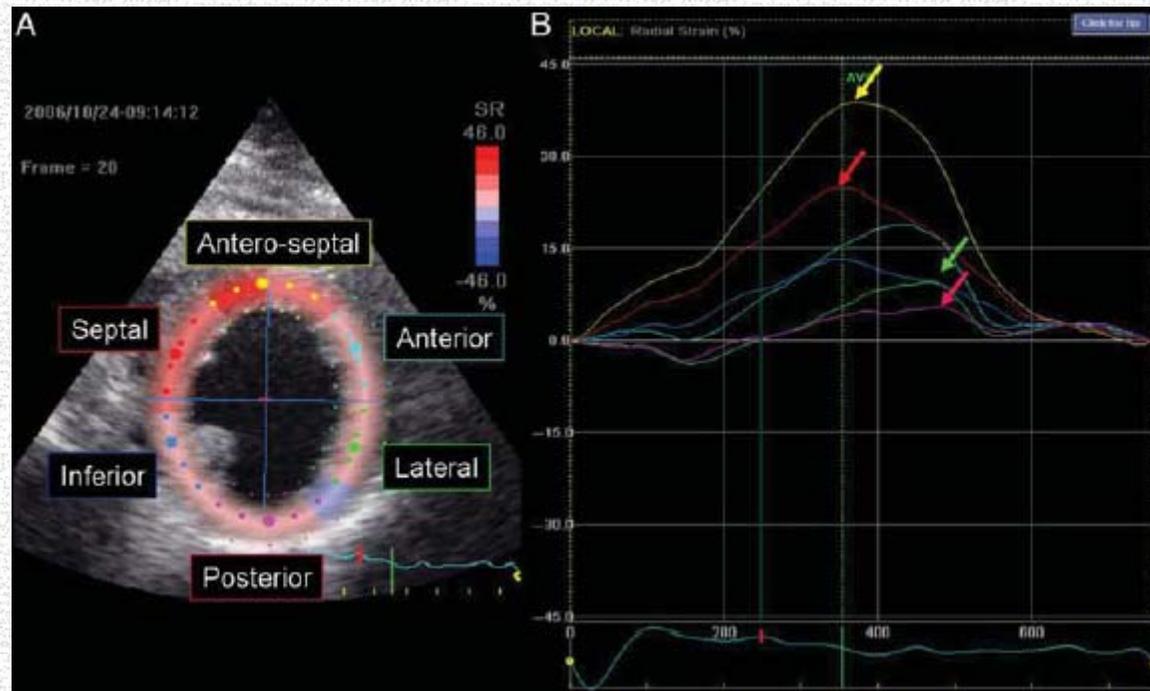
Falta de respuesta a TRC

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- Mala colocación electrodos estimulación (LV anterior)
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 - ✓ Fallo captura VI
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- Mala adherencia al tratamiento médico del paciente.

SELECCIÓN PACIENTES TRC

A**C****B****D**

Speckel-Tracking



Results of the Predictors of Response to CRT (PROSPECT) Trial

Eugene S. Chung, MD; Angel R. Leon, MD; Luigi Tavazzi, MD; Jing-Ping Sun, MD; Petros Nihoyannopoulos, MD; John Merlino, MD; William T. Abraham, MD; Stefano Ghio, MD; Christophe Leclercq, MD; Jeroen J. Bax, MD; Cheuk-Man Yu, MD, FRCP; John Goresan III, MD; Martin St John Sutton, FRCP; Johan De Sutter, MD, PhD; Jaime Murillo, MD

Table 1. Summary of Echocardiographic Predictors of Response to CRT

Table 1. Summary of Echocardiographic Predictors of Response to CRT

SPV	Echocardiographic Predictor	Description of Method	Echocardiography Method	Cutoff
NM	SPWMD ¹⁶	Septal-posterior wall motion delay; M mode measured by parasternal short-axis view	M mode	≥130 ms
	SPMD ¹⁶	Intersegmental mechanical delay defined as the difference between the presence of overlap between the end of lateral wall contraction (via M mode) and onset of LV filling (by Doppler echocardiography)	Doppler	≥40 ms
Ts-	Ts-(lateral-septal) ¹⁵	Delay between time to peak systolic velocity in ejection phase at basal septal and basal lateral segments	TDI	≥60 ms
Ts-	Ts-SD ^{11,13}	SD of time from QRS to peak systolic velocity in ejection phase for 12 left ventricular segments (6 basal and 6 middle)	TDI	≥32 ms
PVD	PVD ¹⁶	Peak velocity difference derived from subtracting the maximal from the minimal difference of time to peak velocity (excluding velocities occurring during isovolumic contraction time) for 6 segments at basal level	TDI	≥110 ms
DLC	DLC ^{17,18}	Delayed longitudinal contraction measured in the 6 basal left ventricular segments with a systolic contraction component in early diastole by TDI and confirmed with strain rate imaging	TDI+SRI	≥2 basal segments
Ts-	Ts-peak displacement	Maximum difference of time to peak systolic displacement for 4 segments	TDI	≥Median
Ts-	Ts-peak (basal)	Maximum difference of time to peak systolic velocity for 6 segments at basal level	TDI	≥Median
Ts-	Ts-onset (basal)	Maximum difference of time to onset of systolic velocity for 6 segments at basal level	TDI	≥Median

La variabilidad en la medida de los 12 parámetros ecocardiográficos para predecir la respuesta clínica y ecocardiográfica fue muy alta: 3.8% intra-observador y 14,5% inter-observador

Predictores respuesta a la TRC

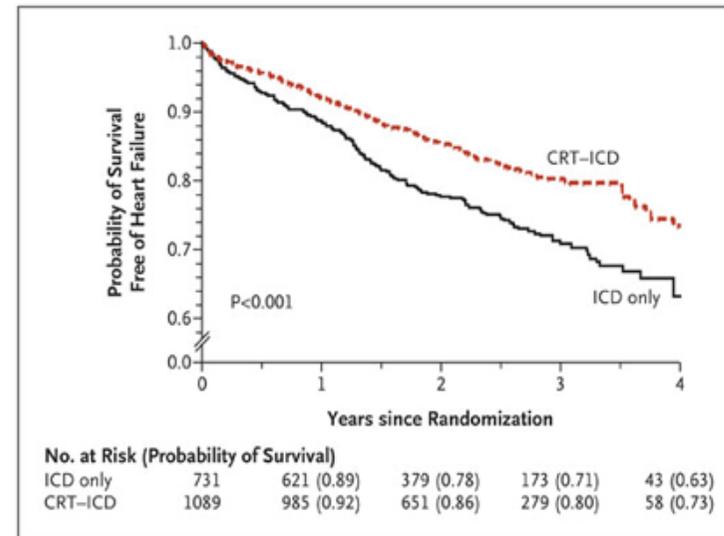
- ✓ Clase funcional NYHA y evolución enfermedad
- ✓ ECG basal
 - Morfología QRS
 - Anchura QRS
- ✓ Tipo de cardiopatía
 - Isquémica vs. No isquémica
- ✓ Disfunción Biventricular

Predictores respuesta a la TRC

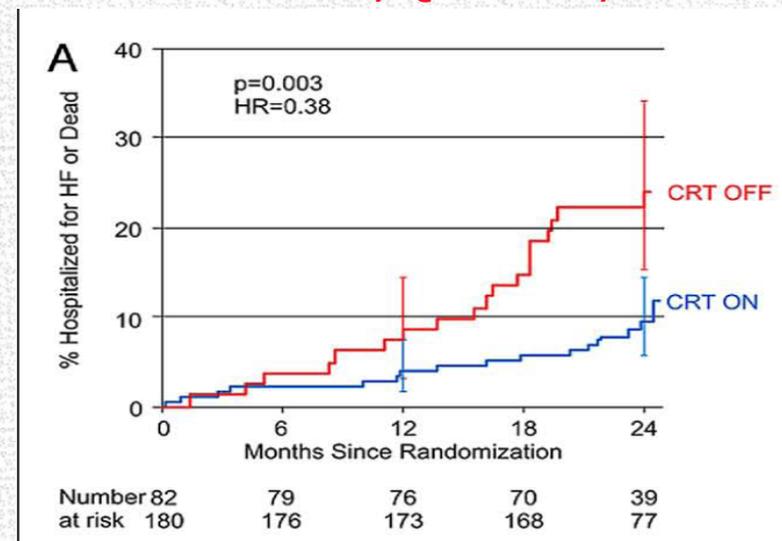
- ✓ Clase funcional NYHA y evolución enfermedad
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Resincronización en clase funcional NYHA II

MADIT-CRT: FE ≤ 30%, QRS ≥ 130, NYHA I-II

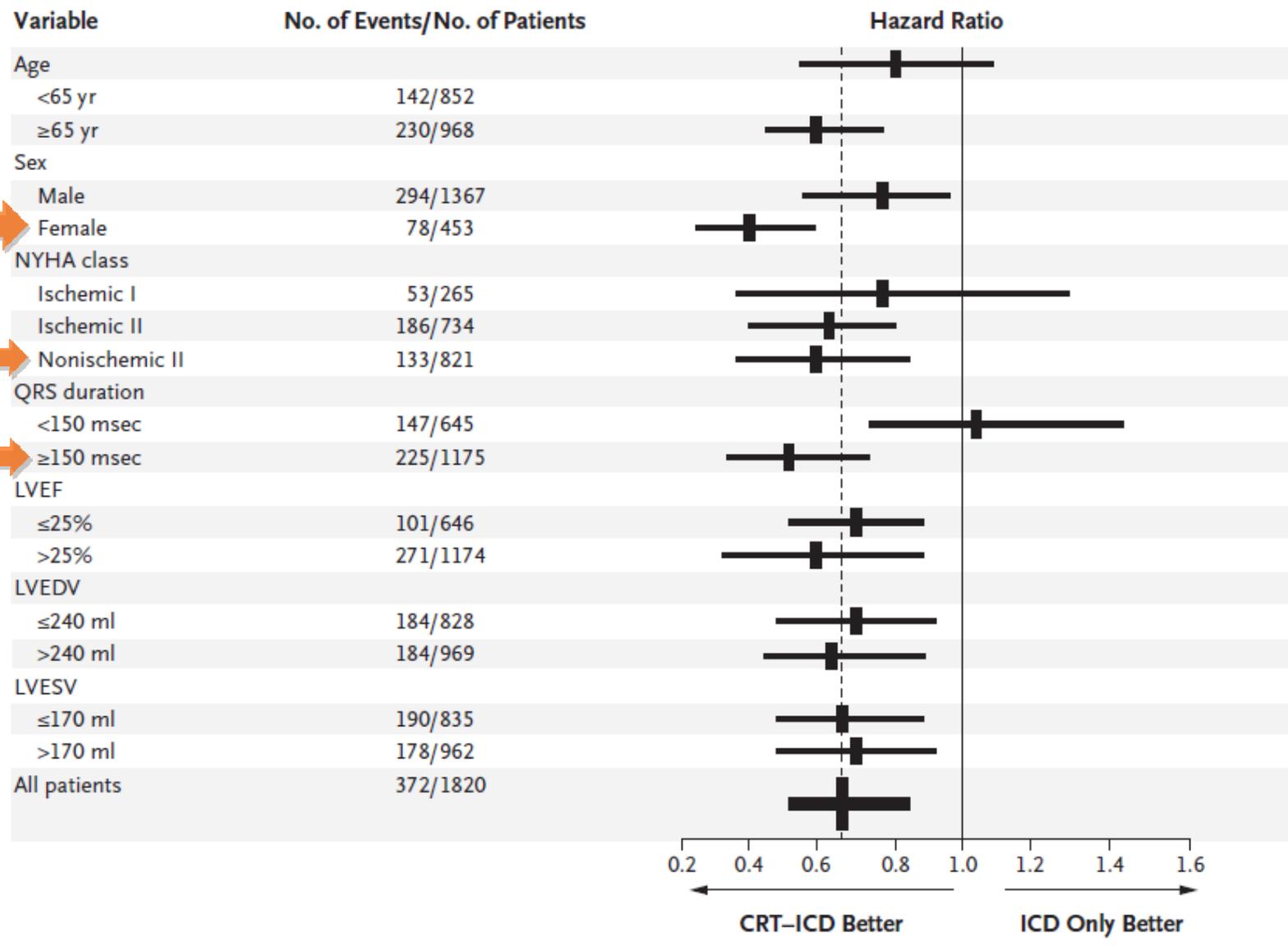


REVERSE: FE ≤ 40%, QRS ≥ 120, NYHA I-II



Linde et al. REVERSE. JACC 2009

MADIT CRT- N Engl J Med 2009



MADIT CRT- N Engl J Med 2009

Remodelado inverso en CF I/II

Table. Comparison of Echocardiographic Indicators of Reverse Remodeling

NYHA Class	MIRACLE ^B III/IV	CARE-HF ⁷ III/IV	REVERSE ²⁺ VII	MADIT-CRT ⁴ VII
Time interval of follow-up, mo	6	18	24	12
Improvement in EF, %	16	28	25	46
Change in LV ESV, %	16	25	28	33
Change in LV EDV, %	12	Not available	23	21

TRC en clase IV

➤ COMPANION subanálisis NYHA IV

La mortalidad total y hospitalizaciones por ICC a los 2 años fue similar:

55% CRT-D; 45% CRT-P
y 62% en el grupo control

TRC en Clase NYHA IV

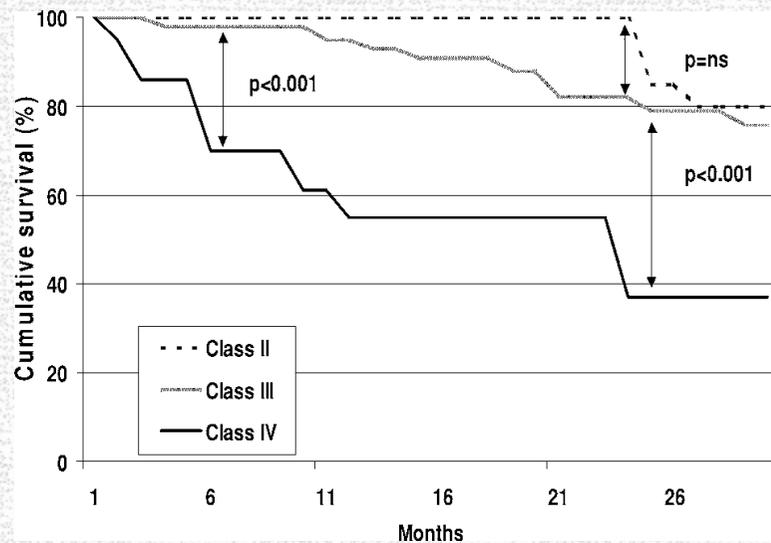


Figure 1. Death from any cause depending on baseline NYHA Class.

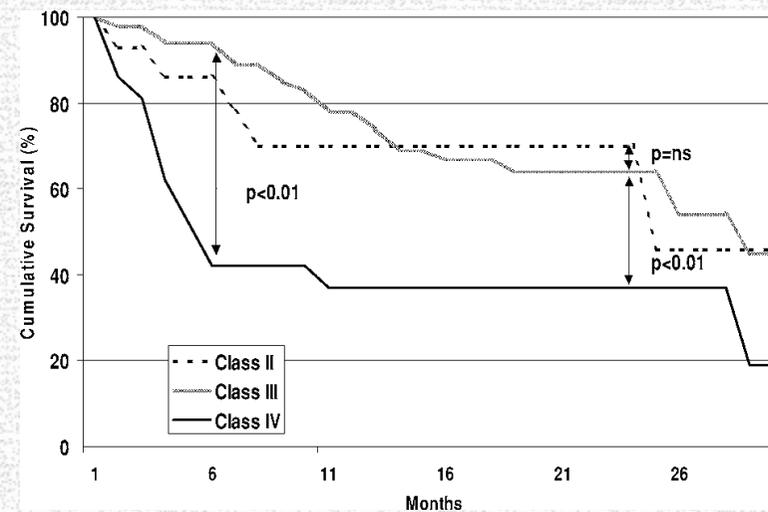
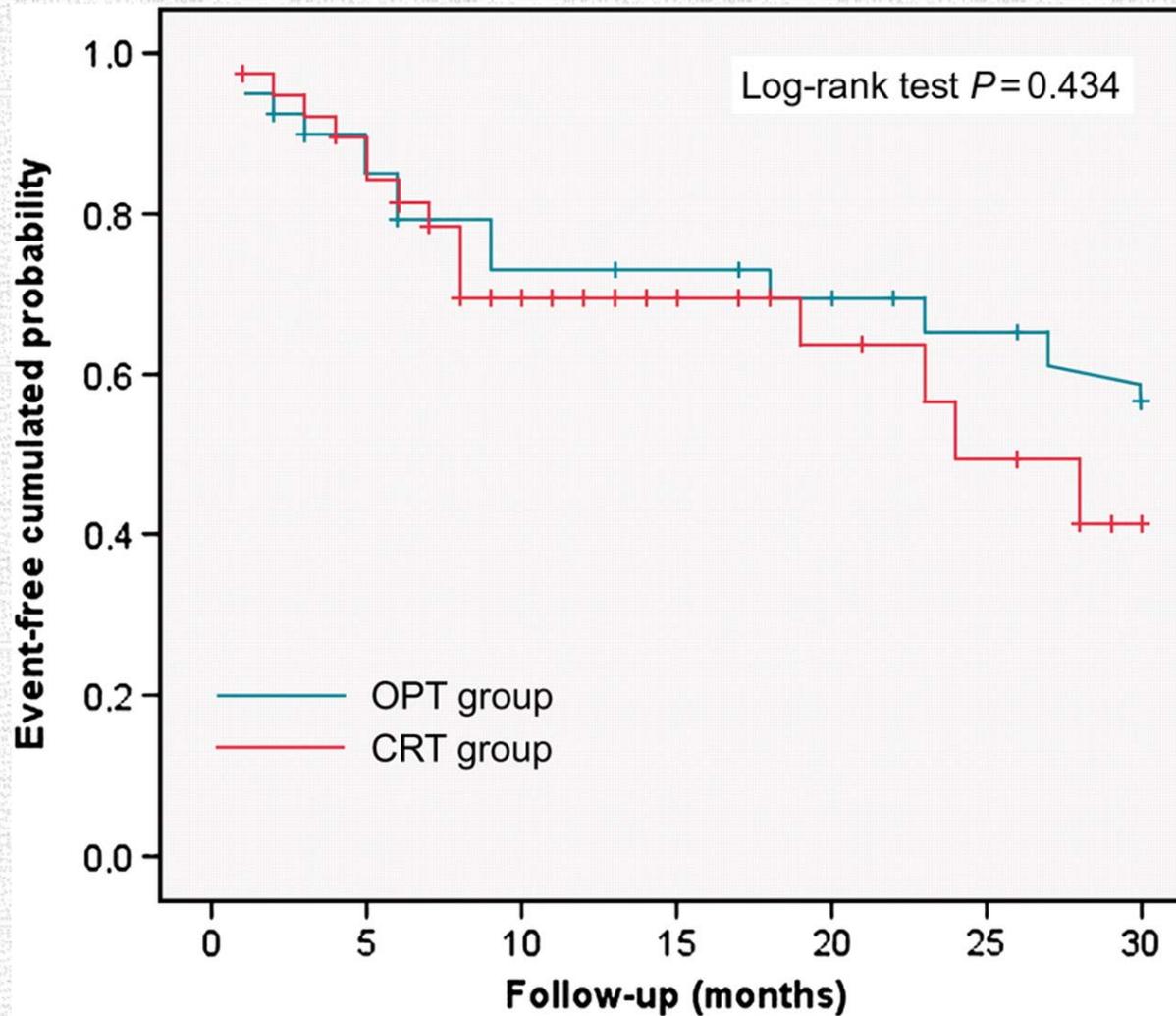


Figure 3. Death from any cause/rehospitalization for a major cardiovascular event depending on baseline NYHA Class.

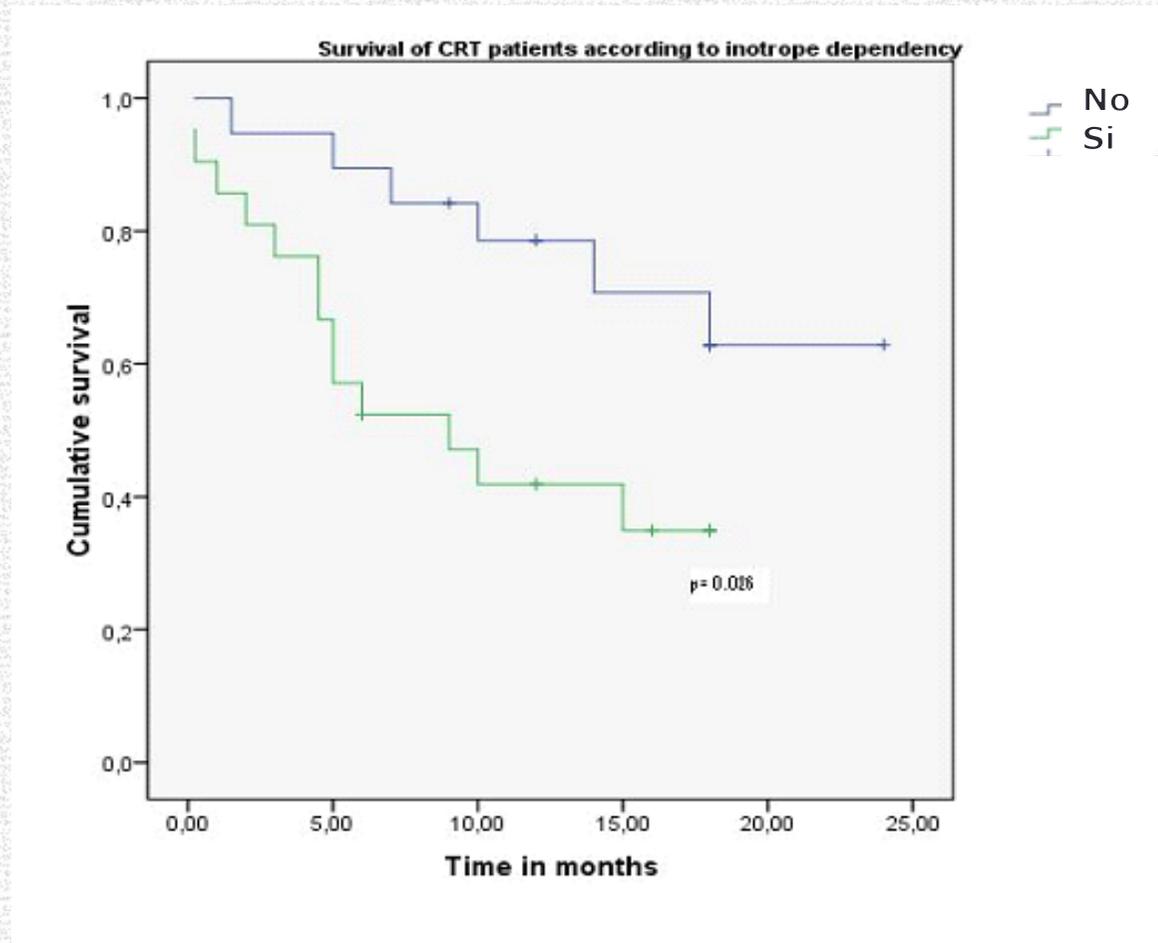
*Supervivencia a 24 m: 85% in Class II
80% in Class III
37% in Class IV
(II vs III, P= ns; III vs IV, P < 0.001)*

Time to all-cause mortality or urgent heart transplantation.



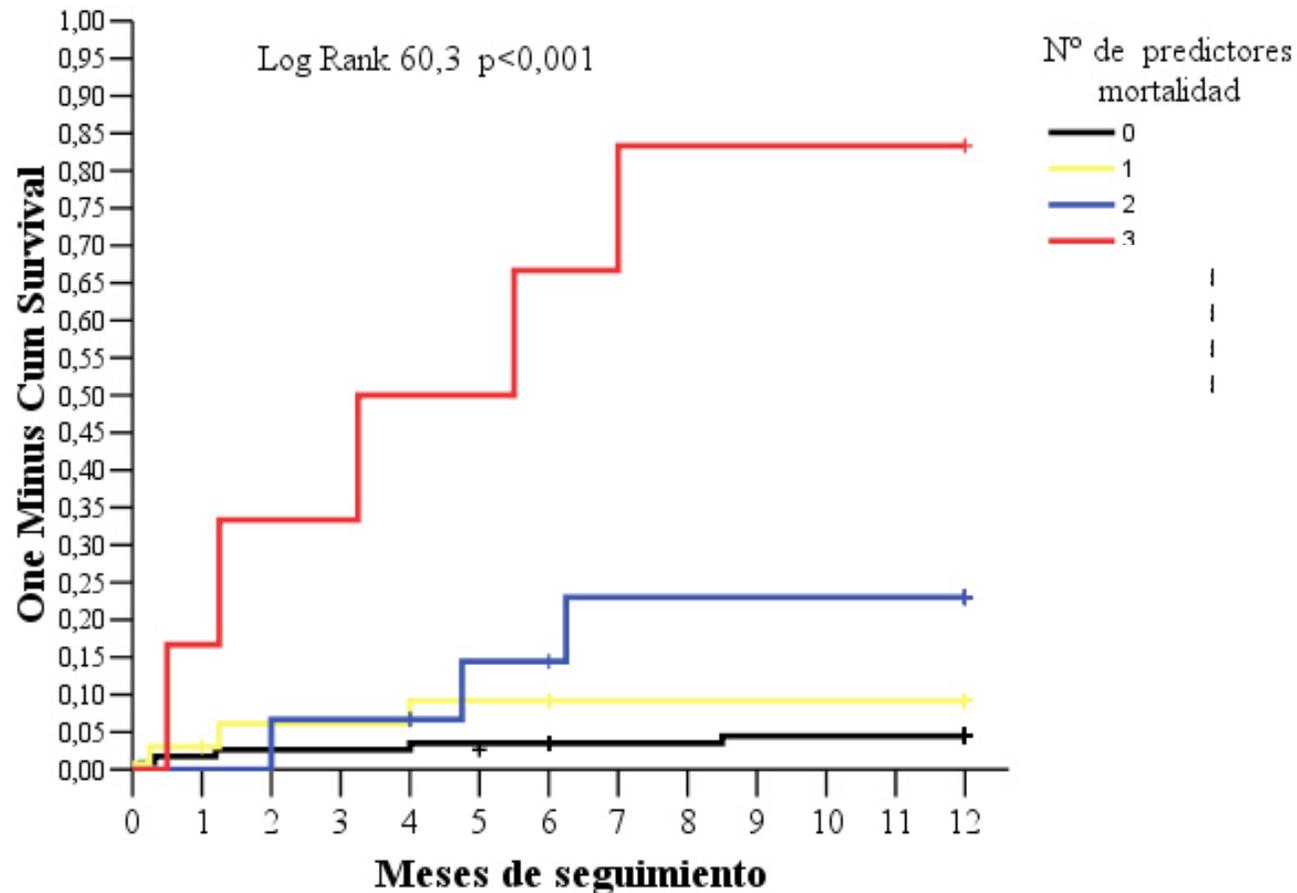
TRC en NYHA IV con y sin dobutamina

42 pacientes NYHA IV de 486 total implantados
23 (55%): dependientes de dobutamina



Mortalidad según número predictores

FA – Clase NYHA IV- I. Renal



Predictores respuesta a la TRC

- ✓ Clase funcional NYHA y evolución enfermedad
- ✓ ECG basal
 - Morfología QRS
 - Anchura QRS
- ✓ Tipo de cardiopatía
 - Isquémica vs. No isquémica
- ✓ Disfunción Biventricular

Anchura QRS y Respuesta a la TRC

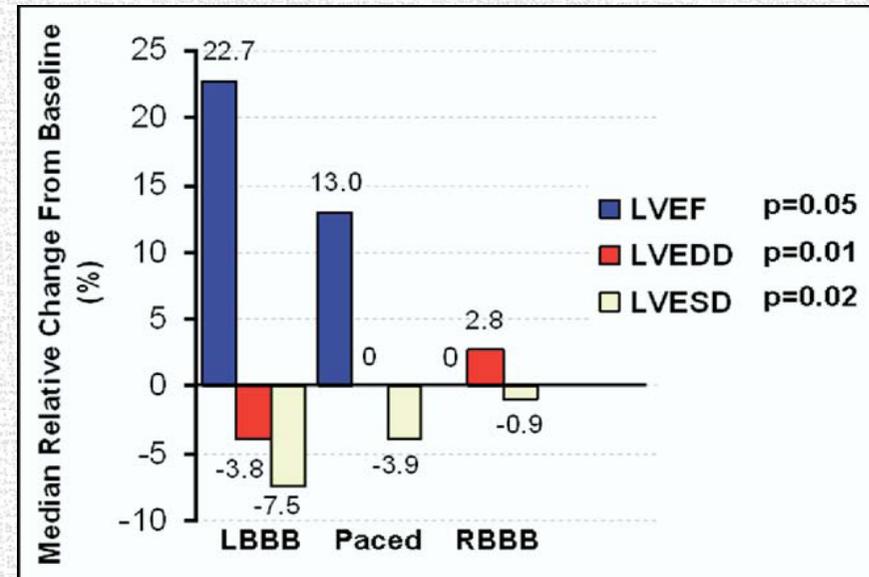
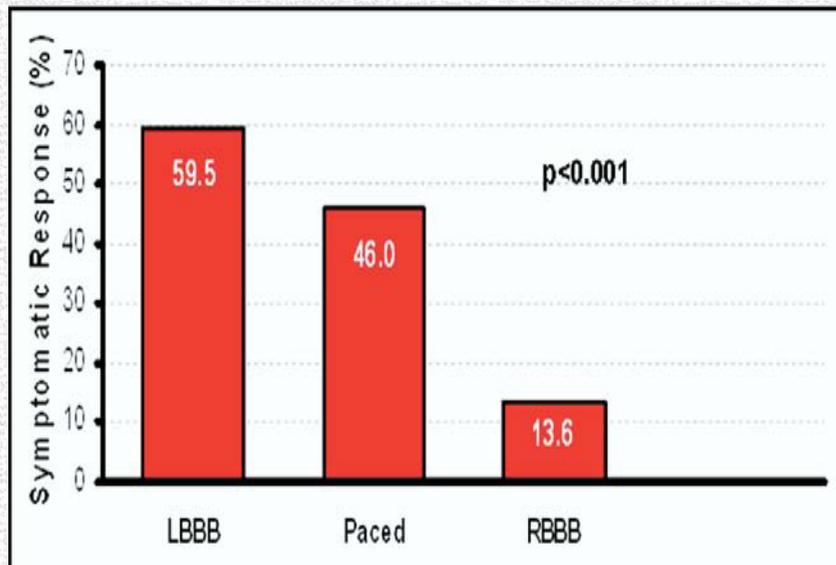
- COMPANION
- CARE- HF
- RETHIN Q
- MADIT CRT
- REVERSE
- RAFT

PERDIDA de EFECTIVIDAD a la TRC al disminuir la anchura QRS

- ✓ REDUCCIÓN VTSVI
- ✓ REDUCCIÓN HOSPITALIZACIÓN
- ✓ REDUCCIÓN MORTALIDAD

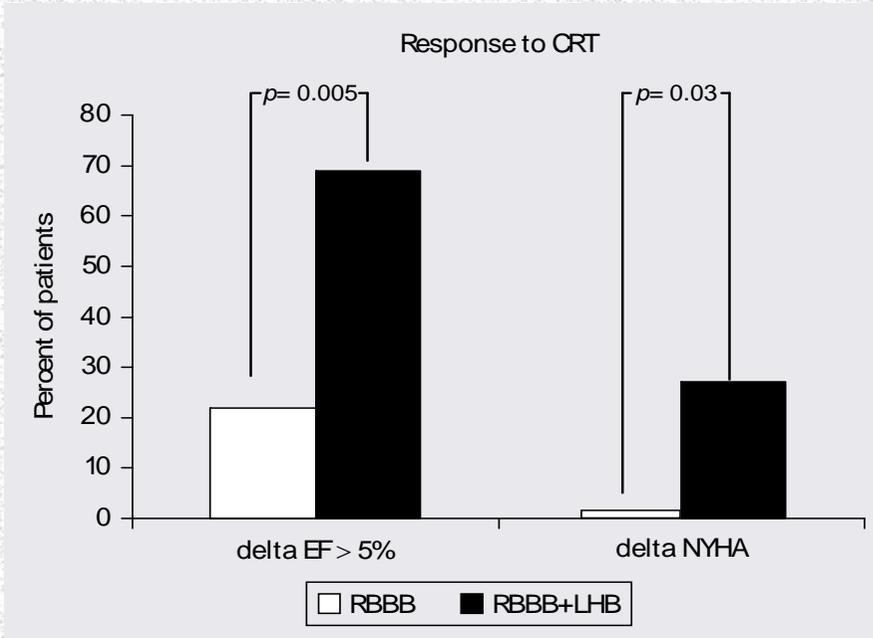
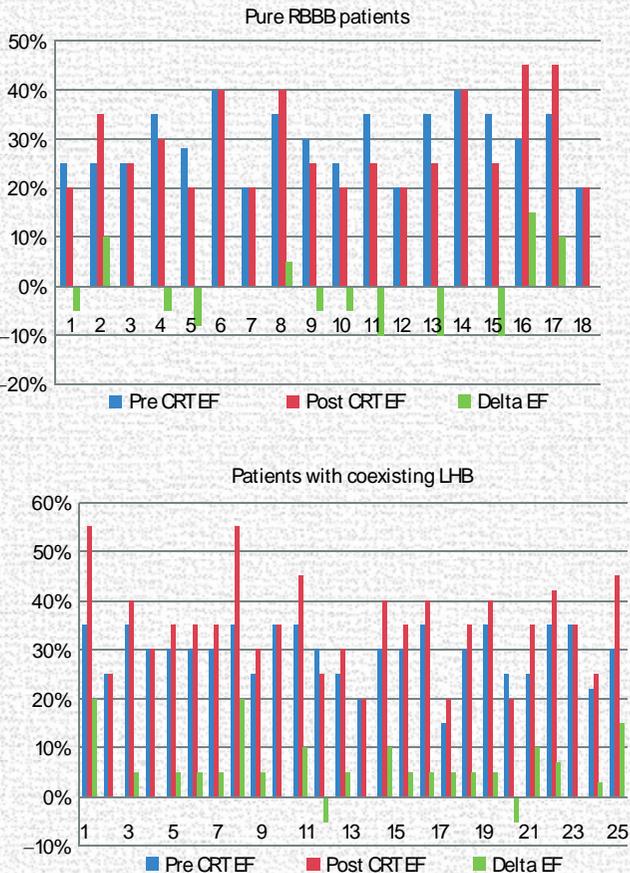
Entre 120-140 mm OR para mortalidad u hospitalización es cercano a 1 →
El remodelado inverso es mínimo

Bloqueo Rama Derecha y Respuesta a la TRC



Sweeney et al Circulation 2010; 121: 626 – 634
Adelstein EC et al. Am J Cardiol 2009;103:238 –242)

RBBB vs. RBBB + Hemiblock.



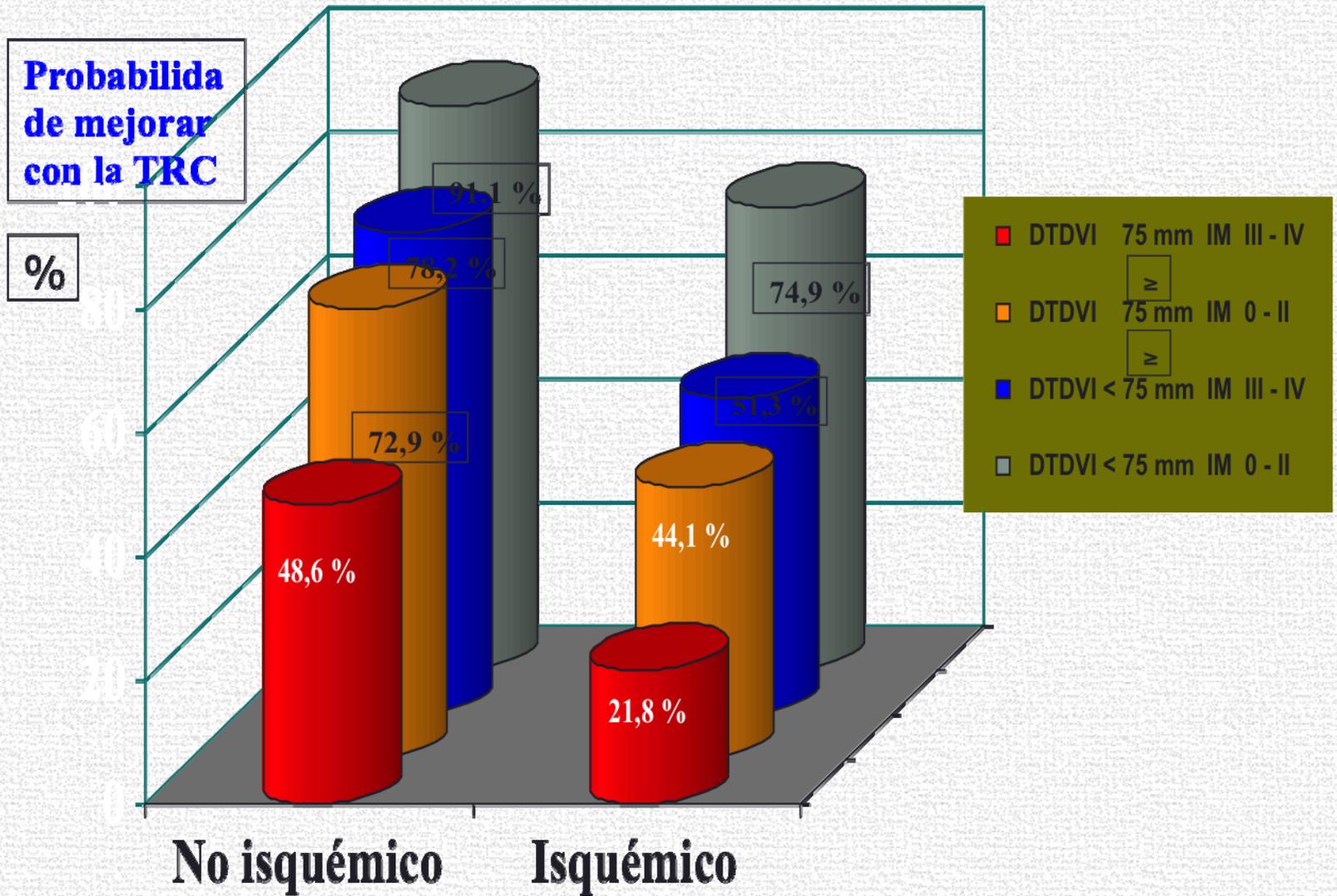
Chandra R, Clin. Cardiol. 33, 2, 89 – 93 (2010)

Predictores respuesta a la TRC

- ✓ Clase funcional NYHA y evolución enfermedad
- ✓ ECG basal
 - Morfología QRS
 - Anchura QRS
- ✓ Tipo de cardiopatía
 - Isquémica vs. No isquémica
- ✓ Disfunción Biventricular

FACTORES NO RESPUESTA

	OR	IC 95 %	p
Cardiopatía isquémica	3.4	1.4 – 8	0.006
IM III-IV	2.8	1.1 – 7.4	0.03
DTDVI \geq 75 mm	3.8	1.5 – 9.3	0.004



Predictores respuesta a la TRC

- ✓ Clase funcional NYHA y evolución enfermedad
- ✓ ECG basal
 - Morfología QRS
 - Anchura QRS
- ✓ Tipo de cardiopatía
 - Isquémica vs. No isquémica
- ✓ Disfunción Biventricular

Disfunción biventricular

Table 2 Published data on effect of cardiac resynchronization therapy on right ventricular size and systolic function

Study	Patients (n)	Follow-up (months)	Imaging mode	Results
Bleeker <i>et al.</i> ¹⁰	56	6	Echo	Improvement in RV size (diameters), tricuspid regurgitation, and PAP
Boriani <i>et al.</i> ¹³	15	3	RNA	No improvement in RVEF
Rajagopalan <i>et al.</i> ¹¹	35	>3 (mean 6 ± 3)	Echo	Improvement in RV TDI velocities (no difference between ICM and NICM). Non-significant improvement in PAP
Donal <i>et al.</i> ⁹	15	Acute effect	Echo	Improvement in lateral tricuspid annulus TDI velocity. No change in TAPSE or MPI
Donal <i>et al.</i> ¹⁷	50	3	Echo	Improvement in RV TDI velocity and strain. No change in TAPSE and RV size (diameters)
Scuteri <i>et al.</i> ¹²	44	6	Echo	No improvement in TAPSE or RV size (surface area)
D'Andrea <i>et al.</i> ¹⁸	110	6	Echo	Improvement in RV size (diameter), TDI velocities and 2D strain in patients with ICM, but not with NICM
Present study	44	Acute effect + >6 (mean 9 ± 5)	RNA	No acute improvement in RVEF or RV dyssynchrony (n = 21). Mild improvement in RVEF and RV dyssynchrony at follow-up

Echo, echocardiography; ICM, ischaemic cardiomyopathy; NICM, non-ischaemic cardiomyopathy; PAP, pulmonary artery systolic pressure; RV, right ventricular; RVEF, right ventricular ejection fraction; TAPSE, tricuspid annulus plane systolic excursion; TDI, tissue-Doppler imaging; MPI, myocardial performance index.

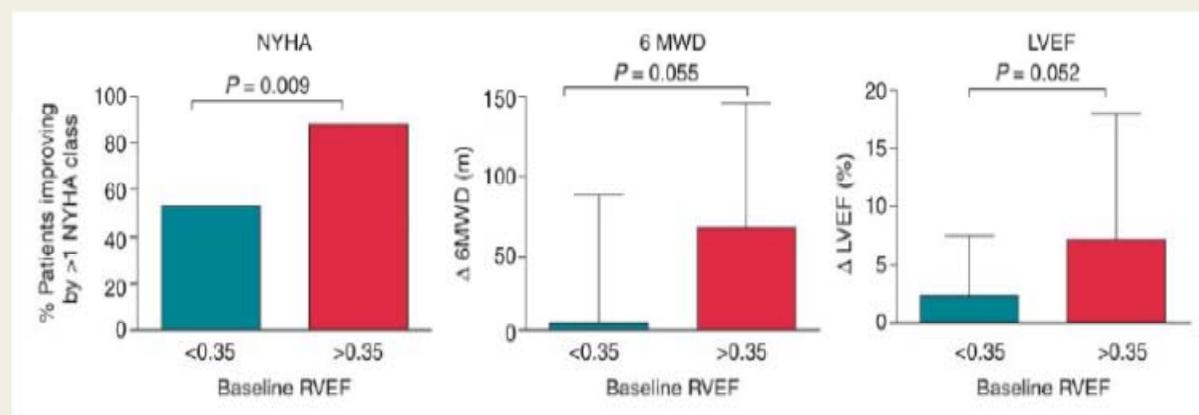
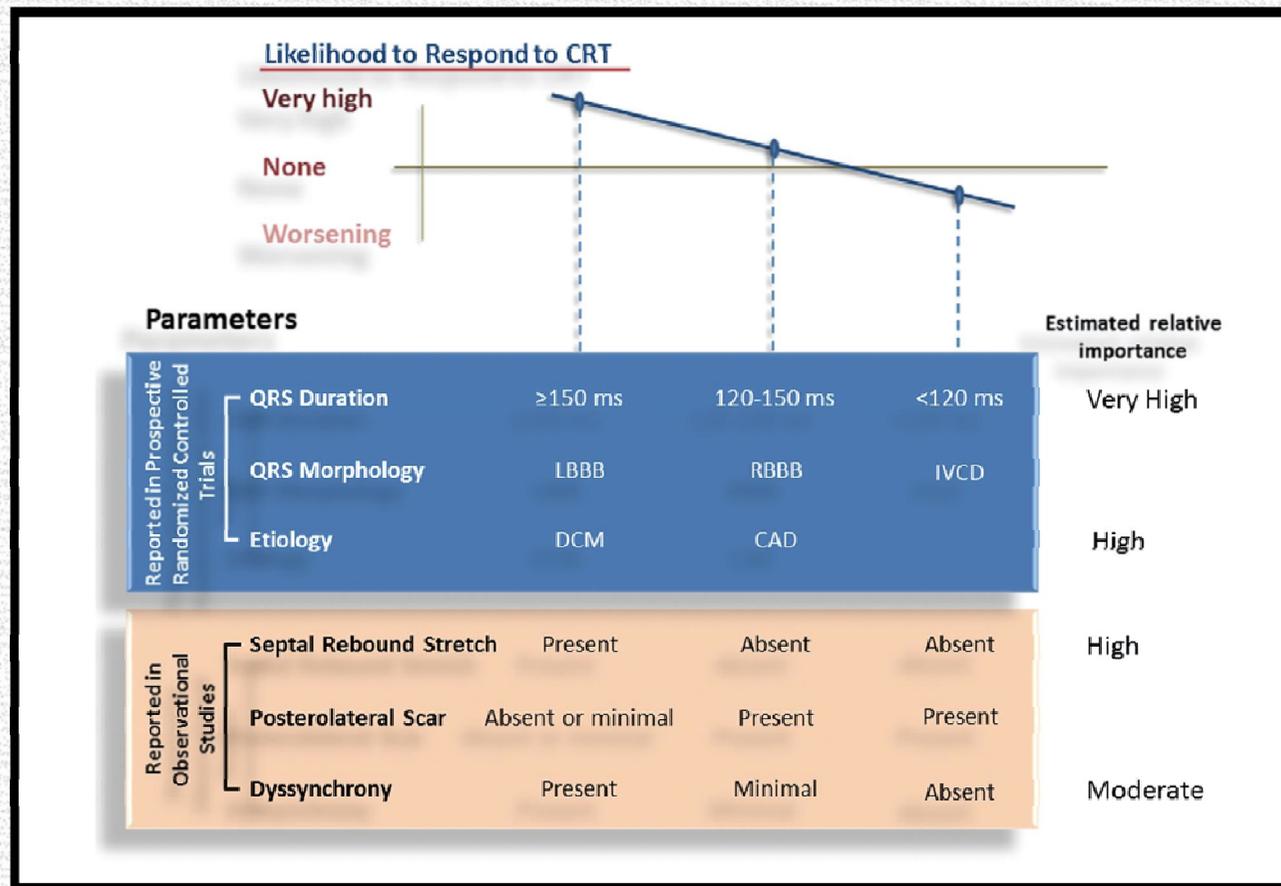


Figure 3 Effect of baseline right ventricular systolic dysfunction on response to CRT.

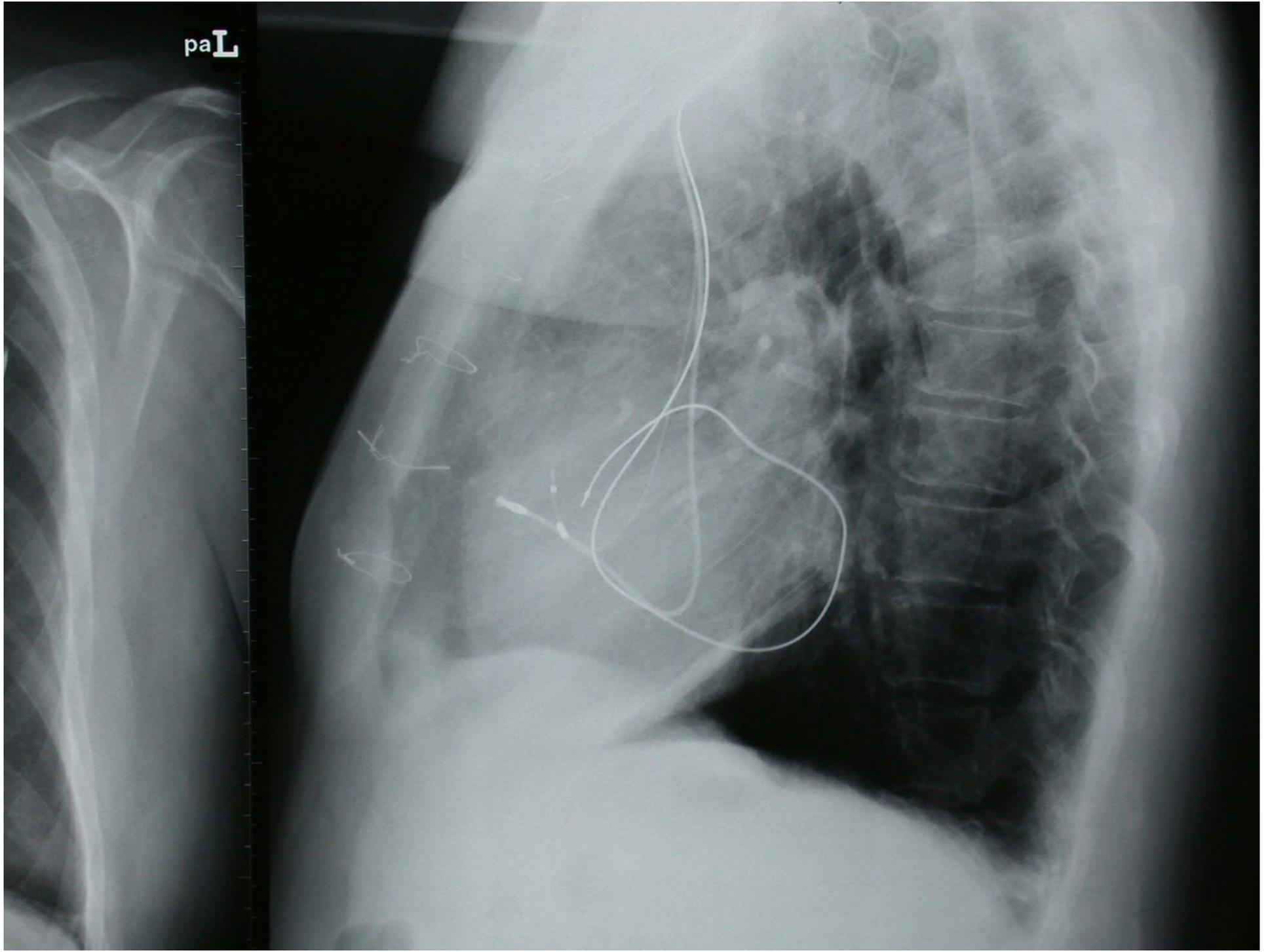
Posibilidad de respuesta a la TRC



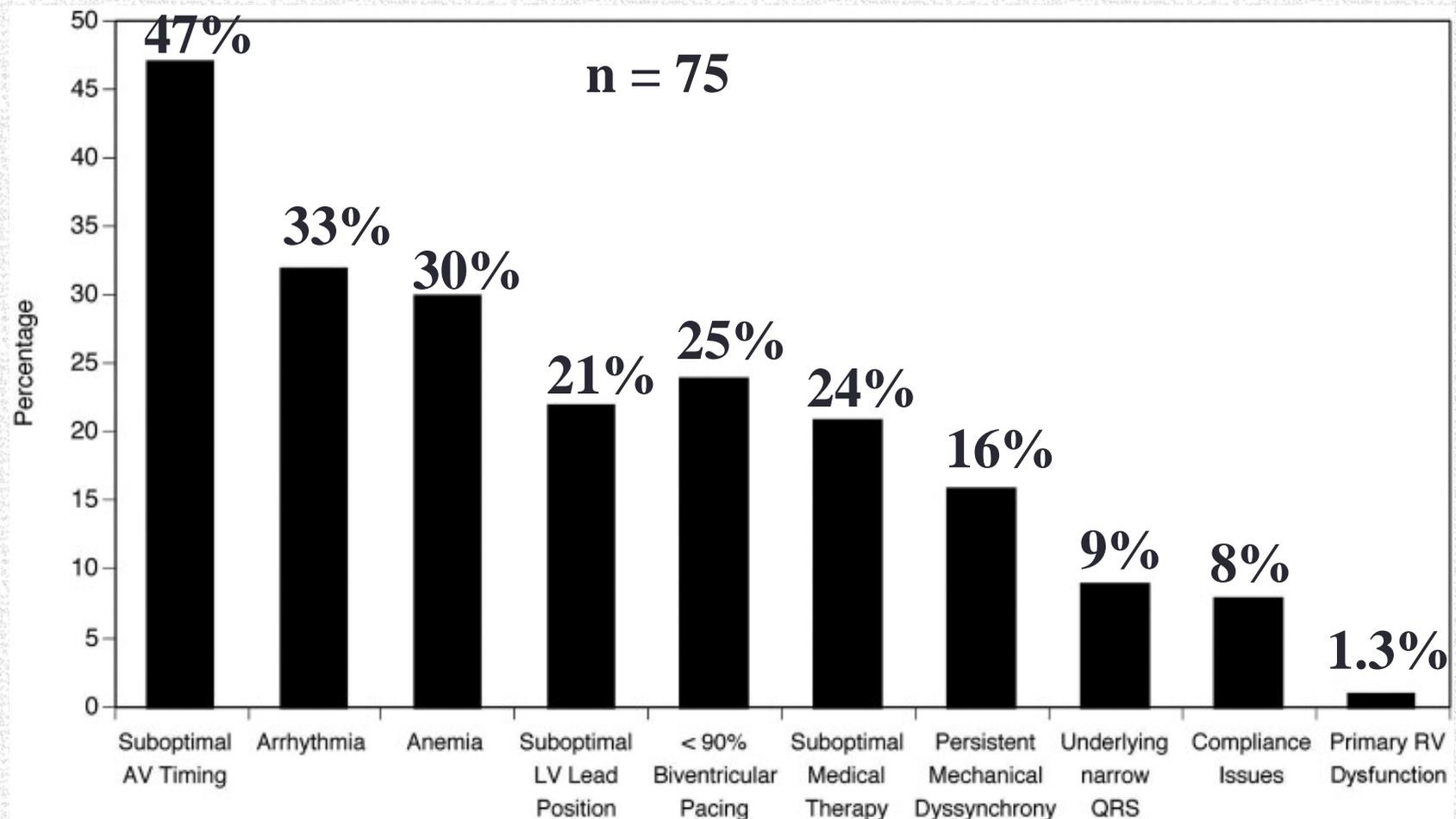
Falta de respuesta a TRC

- Características basales de los pacientes
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- Defectuosa programación dispositivo
 - ✓ Fallo captura VI
 - ✓ Estimulación frénica
- Arritmias post-implante dispositivo
 - ✓ Fibrilación auricular
 - ✓ Extrasistoles ventriculares
 - ✓ Disfunción sinusal
- Mala adherencia al tratamiento médico del paciente

paL



Posibles causas de falta de respuesta a la TRC



Conclusiones

- ✓ Indicar la TRC en fases más precoces de la enfermedad (Clase II NYHA) y con menos remodelado (DTDVI < 75 mm)
- ✓ Evitar TRC en pacientes con BRDHH: poca probabilidad de respuesta
- ✓ No indicación actual de TRC en pacientes QRS estrecho