I NON RESPONDERS ALLA CRT: UN PROBLEMA DI NON SEMPLICE SOLUZIONE

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S.C. CARDIOLOGIA

OSPEDALE DI CIRIE' & OSPEDALE DI IVREA

Today's Patient Selection for CRT

Patient Selection for Cardiac Resynchronization Therapy

From the Council on Clinical Cardiology Subcommittee on Electrocardiography and Arrhythmias and the Quality of Care and Outcomes Research Interdisciplinary Working Group, in Collaboration With the Heart Rhythm Society

Sinus rhythm

LVEF ≤0.35

Ischemic or nonischemic cardio

QRS complex duration ≥120 m

NYHA functional class III or IV

Maximal pharmacological therap

+AF and PM patients …

LVEF > 35 %: Echo ?

Echo Investigation in IHD ++

QRS < 150 ms (<130:Echo CRT)

Earlier CRT consideration

HF Hospitalization, BNP …

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

EUROPEAN SOCIETY OF CARDIOLOGY®

Recommendation in patients with heart failure in New York Heart Association function class III/IV

Recommendation	Patient population	Class[a]	Level[b]
CRT-P/CRT-D is recommended to reduce morbidity and mortality[d]	NYHA function class III/IV LVEF ≤35%, QRS ≥120 ms, SR Optimal medical therapy Class IV patients should be ambulatory[e]	I	A

[a]Class of recommendation.
[b]Level of evidence.
[c]References.
[d]Reasonable expectation of survival with good functional status for >1 year for CRT-D. Patients with a secondary prevention indication for an ICD should receive a CRT-D.
[e]No admissions for HF during the last month and a reasonable expectation of survival >6 months.
CRT = cardiac resynchronization therapy; CRT-P = CRT with pacemaker function; CRT-D = CRT with defibrillator function; ICD = implantable cardioverter defibrillator; LVEF = left ventricular ejection fraction; NYHA = New York Heart Association; SR = sinus rhythm.

LV dilatation no longer required compared to the 2007 ESC Guidelines.

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

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

Recommendation	Patient population	Class[a]	Level[b]
CRT preferentially by CRT-D is recommended to reduce morbidity or to prevent disease progression[d]	NYHA function class II LVEF ≤35%, QRS ≥150 ms, SR Optimal medical therapy	I	A

[a]Class of recommendation.
[b]Level of evidence.
[c]References.
[d]The guideline indication has been restricted to patients with HF in NYHA function class II with a QRS width ≥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.

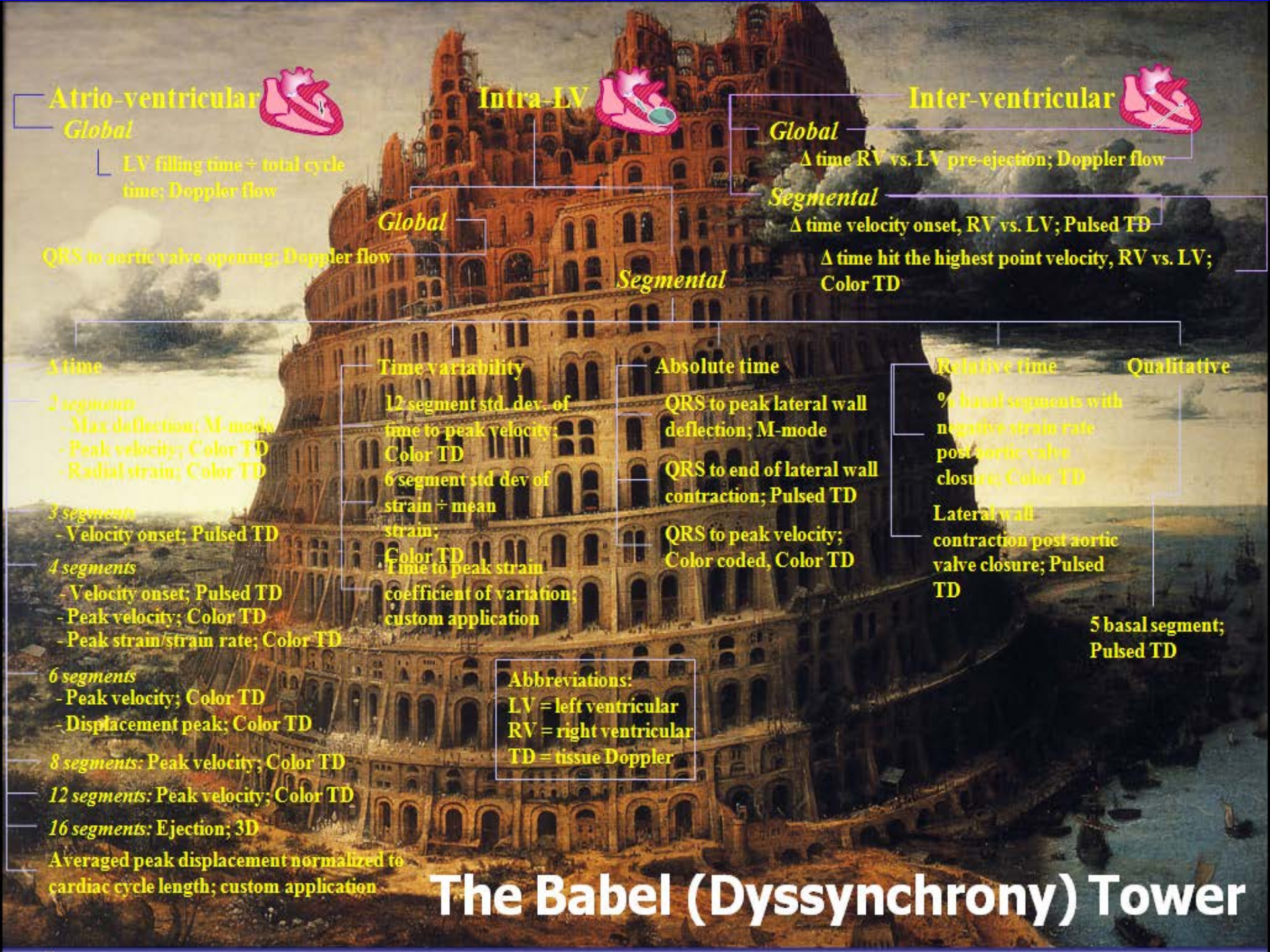
CRT FOR NYHA CLASS II-IV PATIENTS

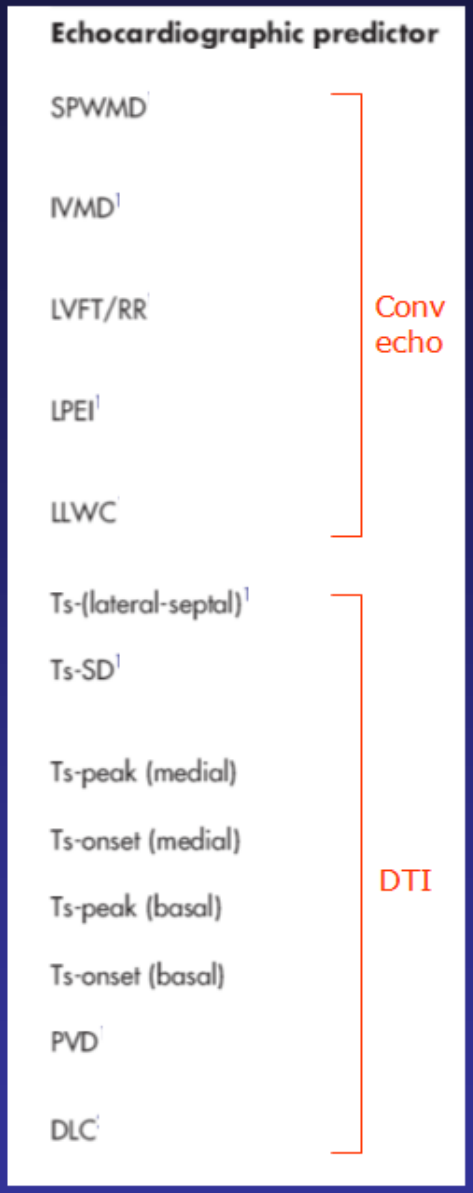
- The number of non-responders is high (about 30-50% depending on response definition and HF etiology).
- CRT is not without complications (11% periprocedural, 4% device-related according to the 2009 European CRT Survey).
- Economic resources are limited and a wise use of them is expected.

Therefore, today identification of CRT non-responders is a needed health care strategy.

CRT FOR NYHA CLASS II-IV PATIENTS

Can mechanical dyssynchrony help to identify CRT non-responders?


Atrio-ventricular
Global
LV filling time ÷ total cycle time; Doppler flow
Intra-LV
Global
QRS to aortic valve opening; Doppler flow
Segmental
Inter-ventricular
Global
Δ time RV vs. LV pre-ejection; Doppler flow
Segmental
Δ time velocity onset, RV vs. LV; Pulsed TD
Δ time hit the highest point velocity, RV vs. LV; Color TD
Δ time
2 segments
- Max deflection; M-mode
- Peak velocity; Color TD
- Radial strain; Color TD
3 segments
- Velocity onset; Pulsed TD
4 segments
- Velocity onset; Pulsed TD
- Peak velocity; Color TD
- Peak strain/strain rate; Color TD
6 segments
- Peak velocity; Color TD
- Displacement peak; Color TD
8 segments: Peak velocity; Color TD
12 segments: Peak velocity; Color TD
16 segments: Ejection; 3D
Averaged peak displacement normalized to cardiac cycle length; custom application
Time variability
12 segment std. dev. of time to peak velocity; Color TD
6 segment std dev of strain ÷ mean strain; Color TD
Time to peak strain coefficient of variation; custom application
Absolute time
QRS to peak lateral wall deflection; M-mode
QRS to end of lateral wall contraction; Pulsed TD
QRS to peak velocity; Color coded, Color TD
Relative time
% basal segments with negative strain rate post aortic valve closure; Color TD
Lateral wall contraction post aortic valve closure; Pulsed TD
Qualitative
5 basal segment; Pulsed TD
Abbreviations:
LV = left ventricular
RV = right ventricular
TD = tissue Doppler
The Babel (Dyssynchrony) Tower



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

Chung ES et al; Circulation 2008.

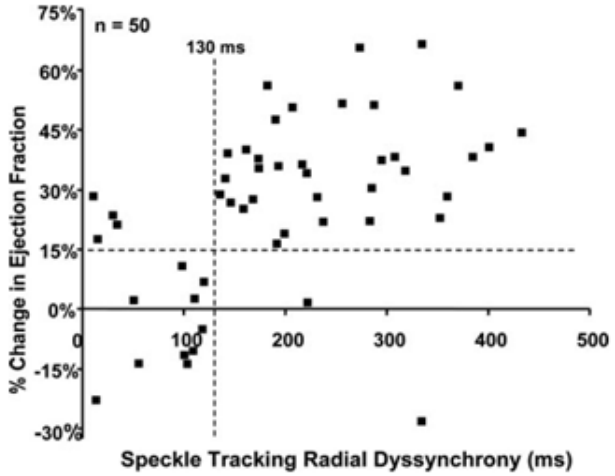
"Given the modest sensitivity and specificity in this multicenter setting despite training and central analysis, **no single echocardiographic measure of dyssynchrony may be recommended** to improve patient selection for CRT beyond current guidelines."

PREDICTIVE VALUE OF RADIAL STRAIN DYSSYNCHRONY

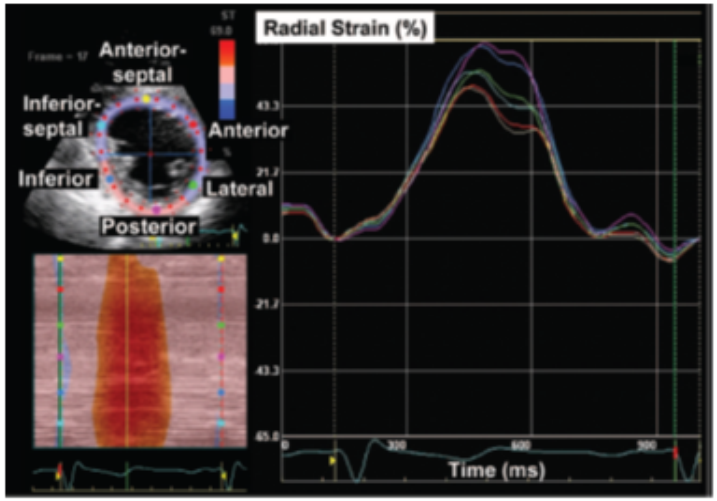
Novel Speckle-Tracking Radial Strain From Routine Black-and-White Echo Images to Quantify Dyssynchrony and Predict Response to CRT

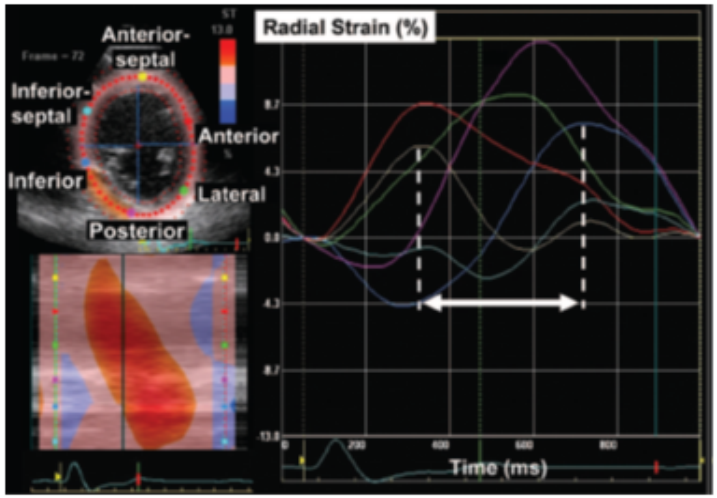
Suffoletto et al, Circulation 2006;113:960-968

6 mid-ventricle myocardial segments



Scatterplot of the relationship between baseline radial dyssynchrony by speckle tracking and change in EF at long-term follow-up after CRT in 50 patients. A cutoff of ≥130 ms of radial dyssynchrony was predictive of a significant improvement (defined as ≥15% increase) in EF with 89% sensitivity and 83% specificity.





EDITORIAL COMMENT

Cardiac Resynchronization Therapy

Are Modern Myths Preventing Appropriate Use?*

John G. F. Cleland, MD, FRCP, FACC,†
Luigi Tavazzi, MD, FESC‡
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Ahmed Tageldien, MBBS,† Nick Freemantle, PHD‖

cardiac resynchronization therapy (CRT). If someone with little evidence of cardiac disease is implanted with a CRT device, he or she will almost certainly have an excellent outcome, but it would be wrong to attribute this to the device. A patient who was otherwise destined to die soon, who survived because he or she received CRT, but who had little improvement in symptoms may be considered to have had a poor outcome but, nevertheless, has responded to

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treatment. Differentiation between outcome and response is

How to define Non Responders (?)

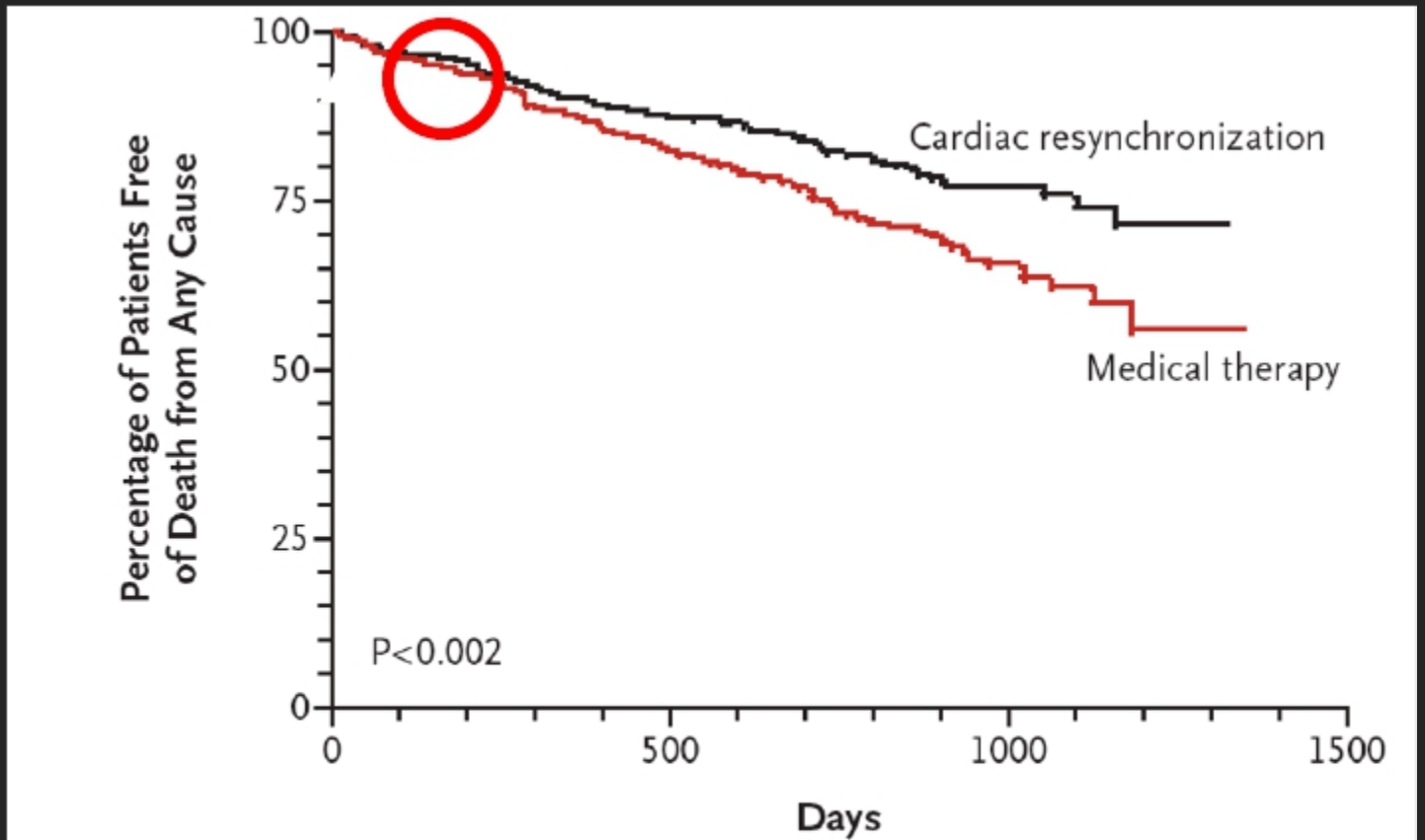
1. Follow-up: 6 months, 1 year, Longer…
2. Clinical (Soft): NYHA, QoL, 6 MNW, VO2
3. Clinical (Strong): Morbidity (HFH), Mortality
4. Echocardiography: LVESV -10 or 15%, LVEF
5. Combined: Clinical and Echocardiography
6. Device-related complications: never considered
7. Other ….

Table 1 Various published definitions of response

	Cutoff
Clinical variables	
NYHA functional class	↓ >1 class
6MWD	↑ >50 m
Both NYHA and 6MWD	↓ NYHA >1and ↑ 6MWD >25%
VO_2 max	↑ >10%
All-cause mortality	Any event
HF hospitalization	Any event
MLWHF	>10
QoL	↑ >10 or 15
Echocardiographic variables	
LVEF	↑ 5 (absolute), 15%
LVESV or LVESV index	↓ 10%, 15%
LVEDV	↓ 15%
LVIDs	↓ 15
LVIDd	↓ 15
Stroke volume	↑ 15%

MLWHF Minnesota Living with Heart Failure

Rethinq follow-up too short - Lessons from CARE-HF



No. at Risk						
Cardiac resynchronization	409	376	351	213	89	8
Medical therapy	404	365	321	192	71	5

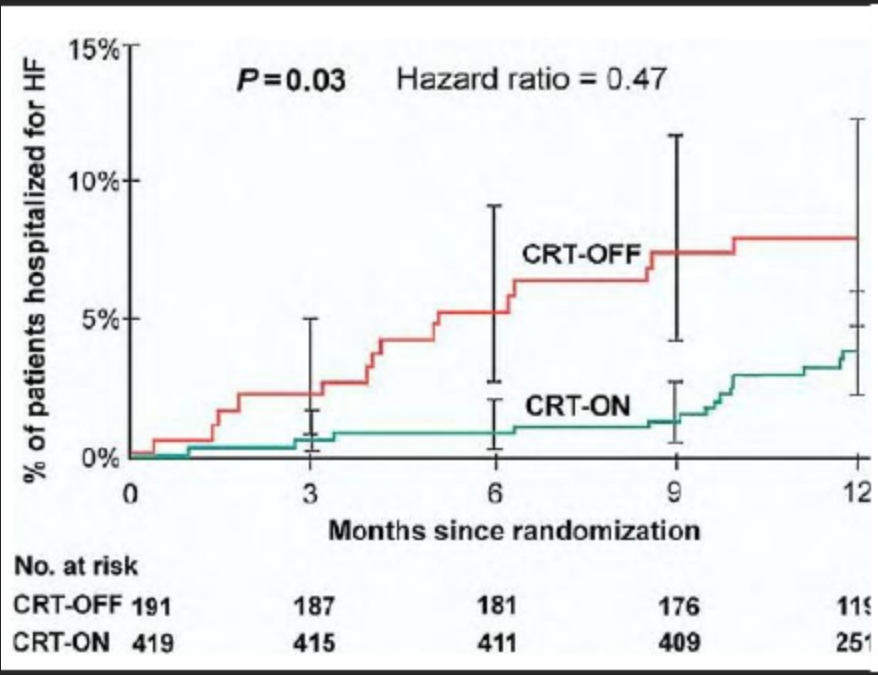
Cleland NEJM 2005

Consistency between REVERSE and MADIT CRT

REVERSE

Time to first heart failure hospitalization in the first 12 months (secondary end point)

RR - 53 %

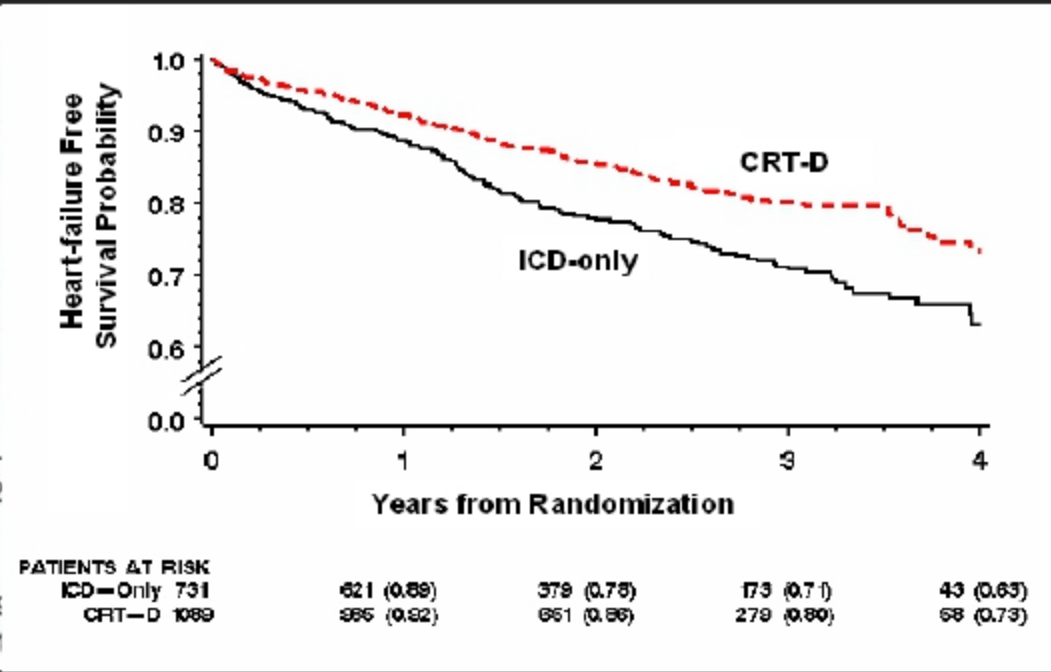


C. Linde et al., JACC 2008; 52: 1834-43

MADIT-CRT

Kaplan-Meier estimate of heart-failure free survival probability (part of primary end point)

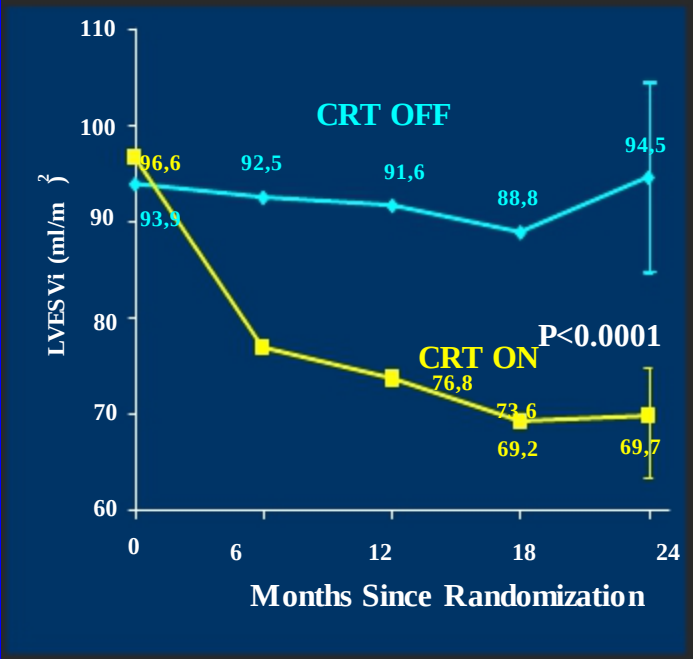
RR-34% and for HF only – 41 %



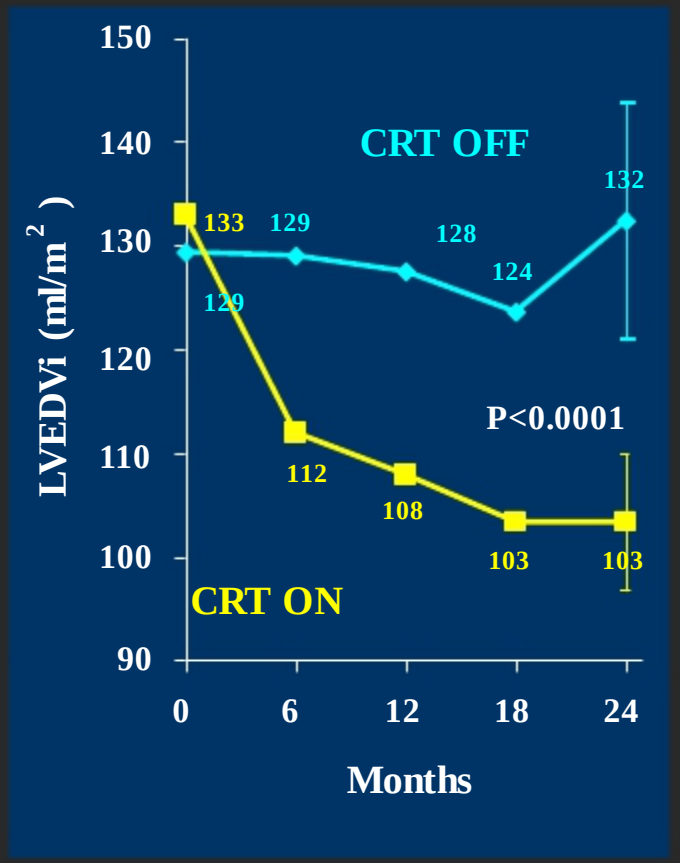
Moss, AJ, et al., NEJM 2009

REVERSE: Remodeling Parameters

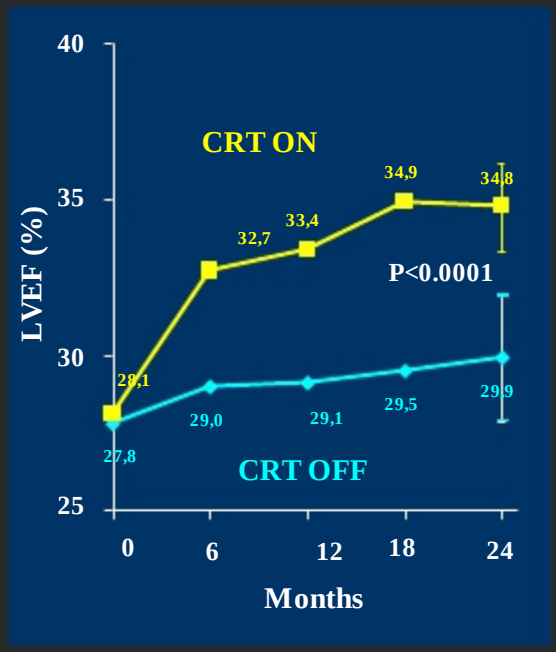
LVESVi



LVEDVi (ml/m2)

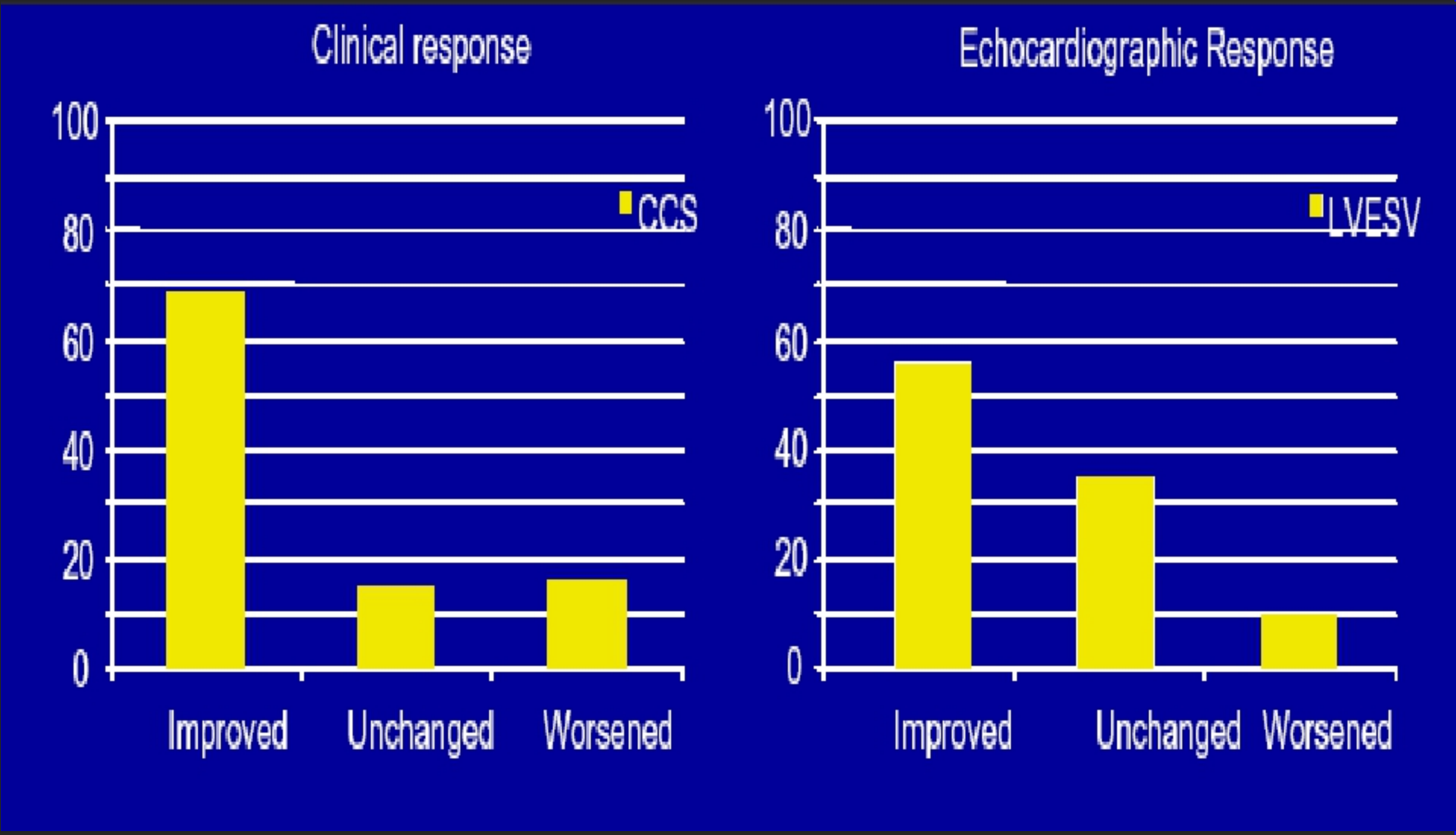


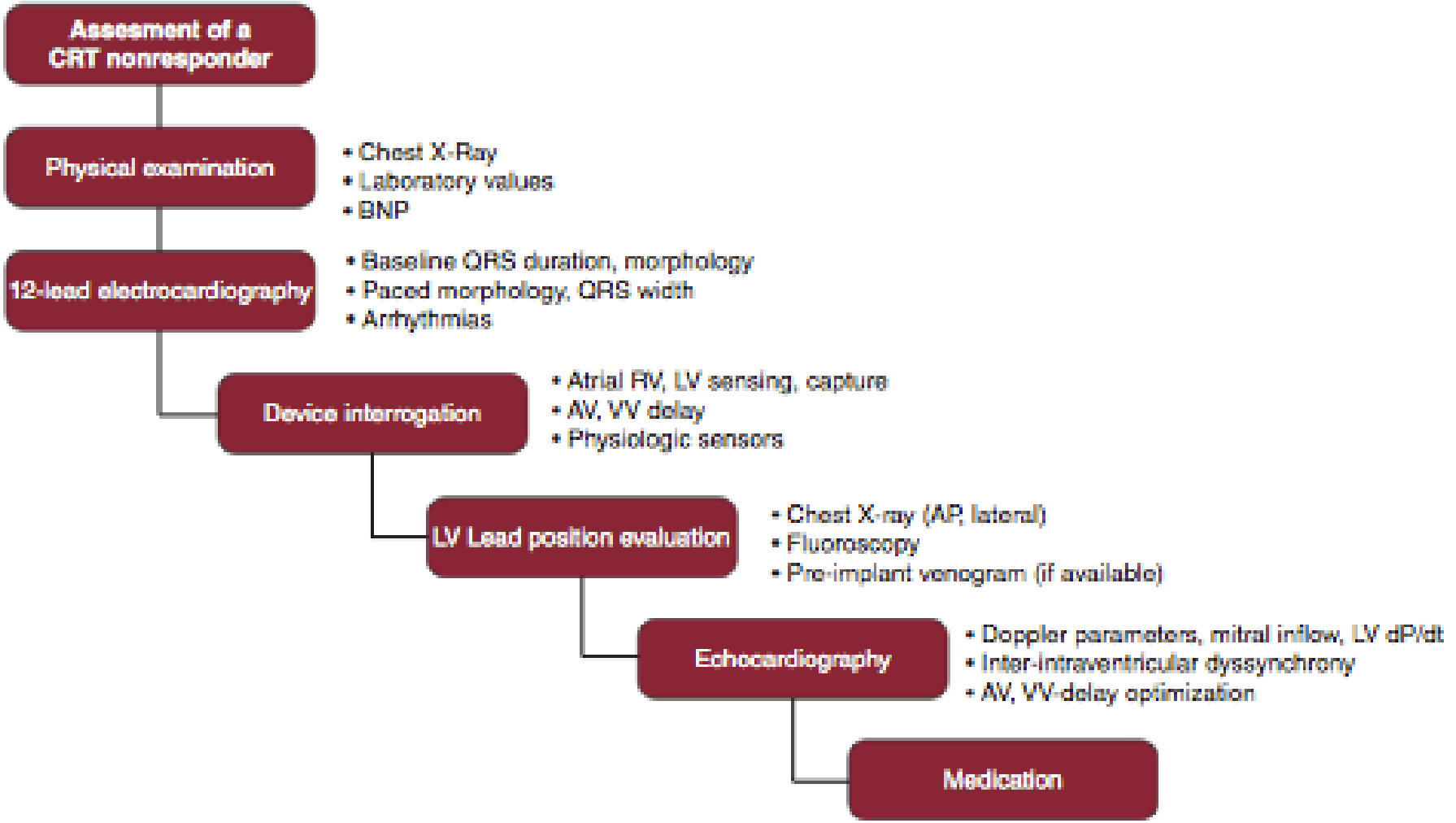
LVEF (%)



P-values compare 24-month changes.

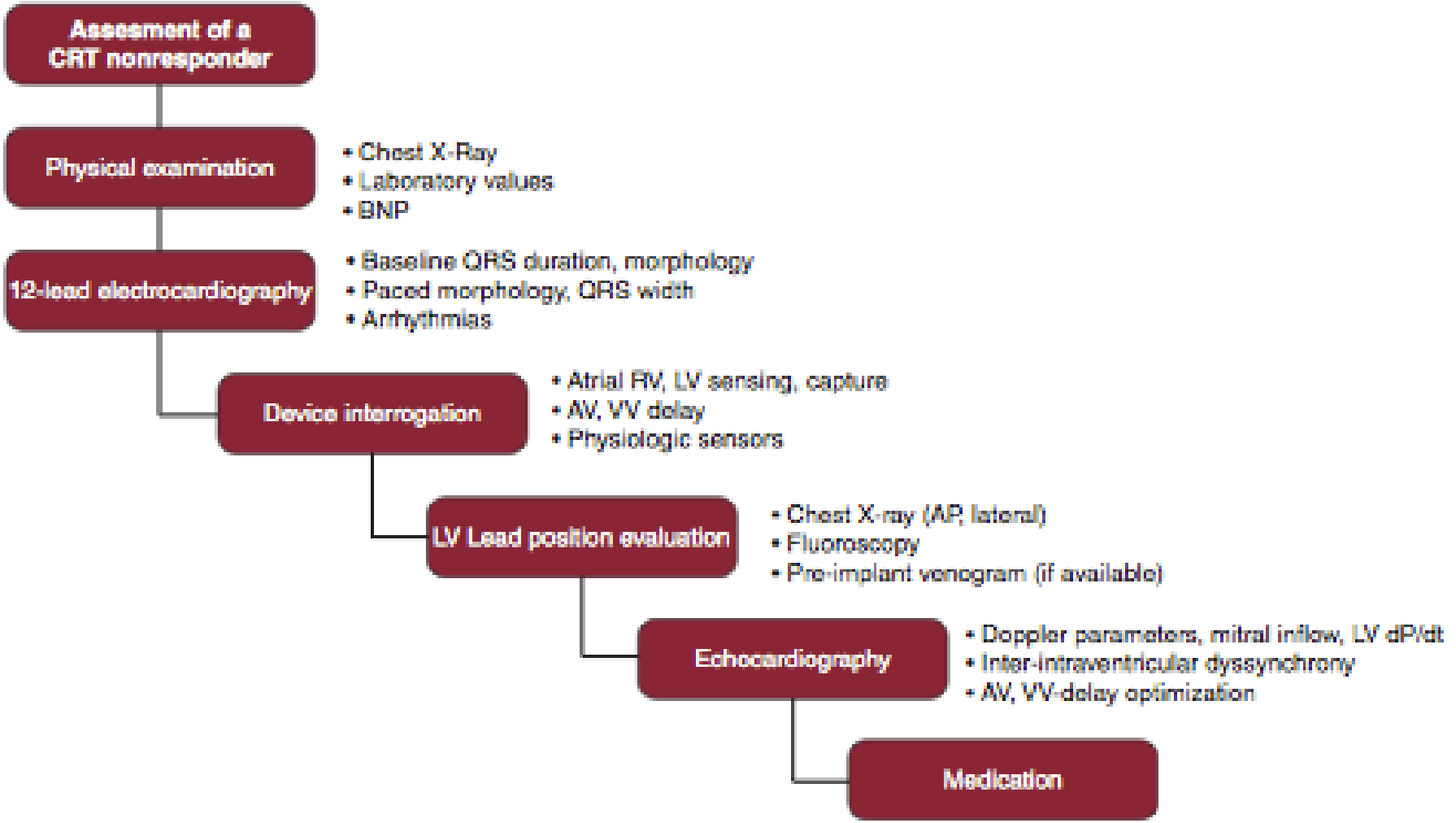
Prospect Study
CCS versus Echo Response




Assesment of a CRT nonresponder
Physical examination
• Chest X-Ray
• Laboratory values
• BNP
12-lead electrocardiography
• Baseline QRS duration, morphology
• Paced morphology, QRS width
• Arrhythmias
Device interrogation
• Atrial RV, LV sensing, capture
• AV, VV delay
• Physiologic sensors
LV Lead position evaluation
• Chest X-ray (AP, lateral)
• Fluoroscopy
• Pre-implant venogram (if available)
Echocardiography
• Doppler parameters, mitral inflow, LV dP/dt
• Inter-intraventricular dyssynchrony
• AV, VV-delay optimization
Medication

Randomized Cardiac Resynchronization Therapy Clinical Trials

Trials	Patients, no.	Female, %	Primary end points	Secondary end points	Etiology, ischemic %	LVEF, %	QRS, ms
PATH-CHF	41	50	6MWT, peak VO_2	NHYA class, QOL, hospitalizations	29	21±7	175
MUSTIC-SR	58	26	6MWT	NYHA, QOL, Peak VO2, MR, LV, hospitalizations, total mortality	37	23±7	174
MIRACLE	453	32	6MWT, NHYA, QOL	Peak VO_2, LVEF, LVEDD, MR, clinical composite response	54	22±6	166
MIRACLE ICD	555	23	6MWT, NYHA, QOL	Peak VO_2, LVEF, LV volumes, MR, clinical composite score	70	24±6	164
COMPANION	1520	22	All-cause mortality or hospitalization	All-cause mortality and cardiac mortality	56	21	159
CARE-HF	814	26	All-cause mortality	NYHA, QOL, LVEF, LVESV, hospitalization for heart failure	38	25	160
REVERSE	610	21	HF clinical composite score	LVESV	54	27±7	153
MADIT-CRT	1820	25	HF or death	LVESV, LVEDV change, multiple HF events	57	24±5	162
RAFT	1798	17	All-cause mortality or HF hospitalization	All-cause mortality, cardiac mortality, HF hospitalization	67	23±5	158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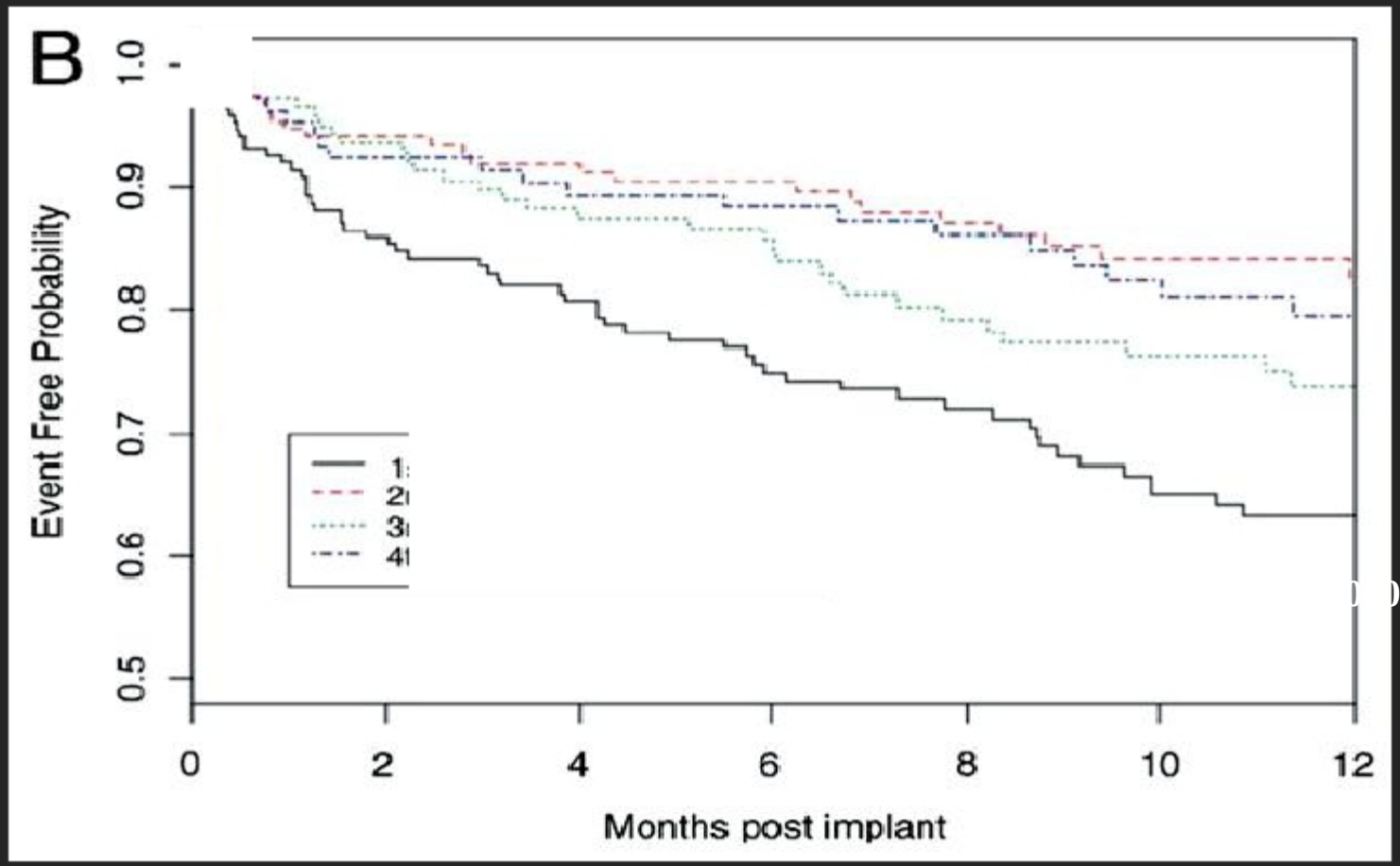
How Much CRT Pacing is Really Needed?

Pts. with AT (n=617)

HF hospitalization/mortality



BiVpacing

100%

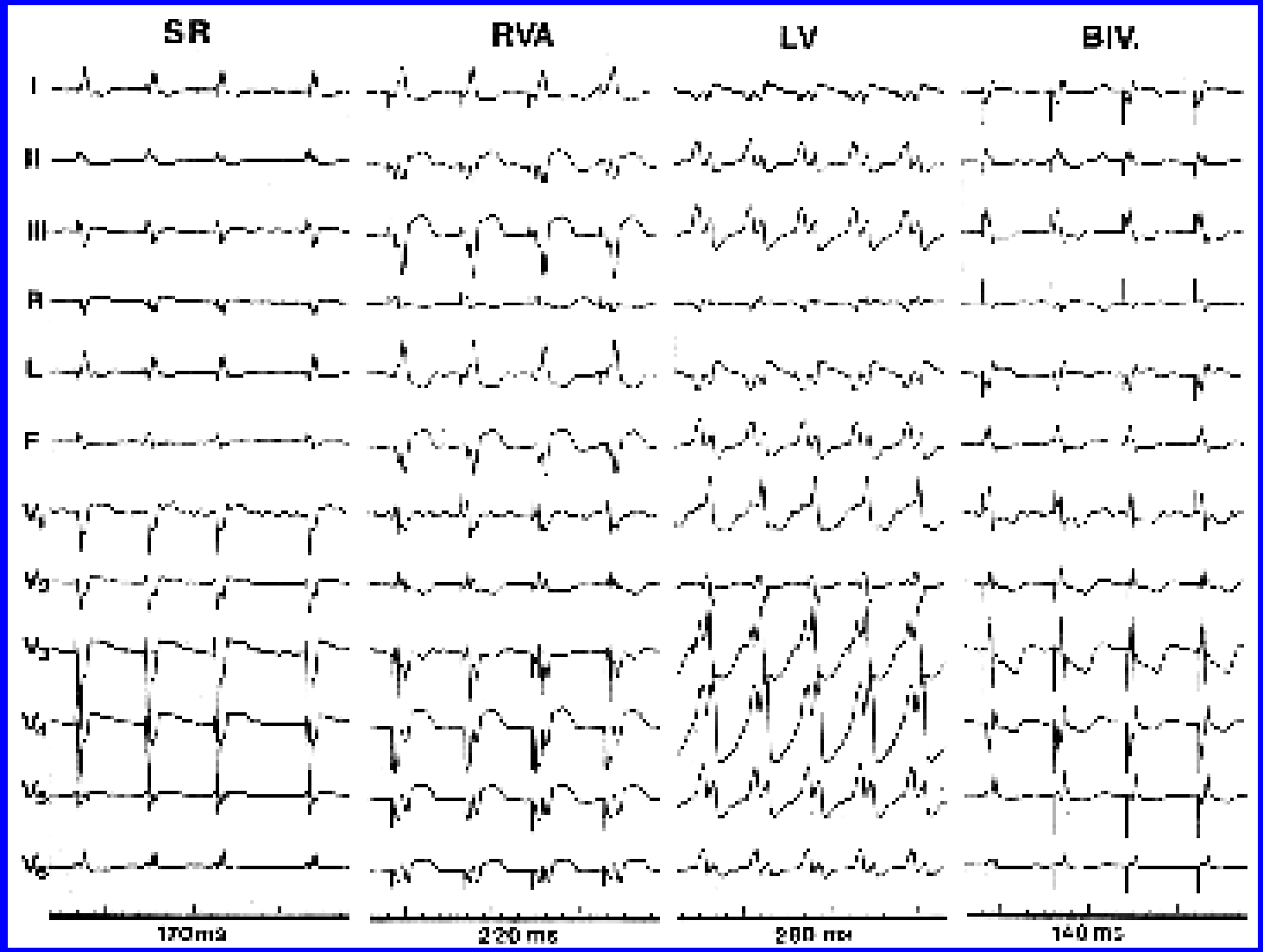
98-99%

93-97%

0-92%

001

Koplan et al., JACC 2009



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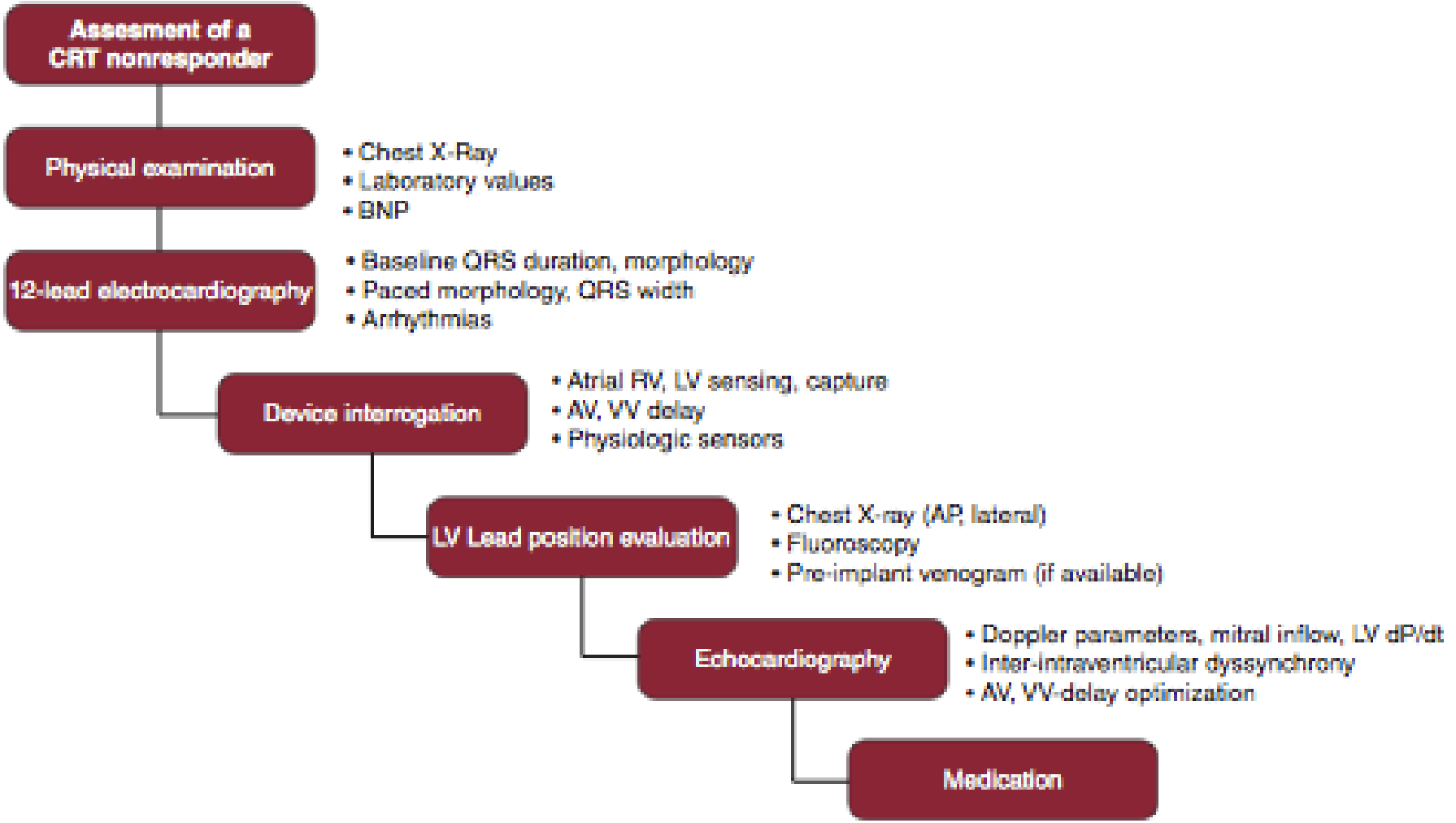
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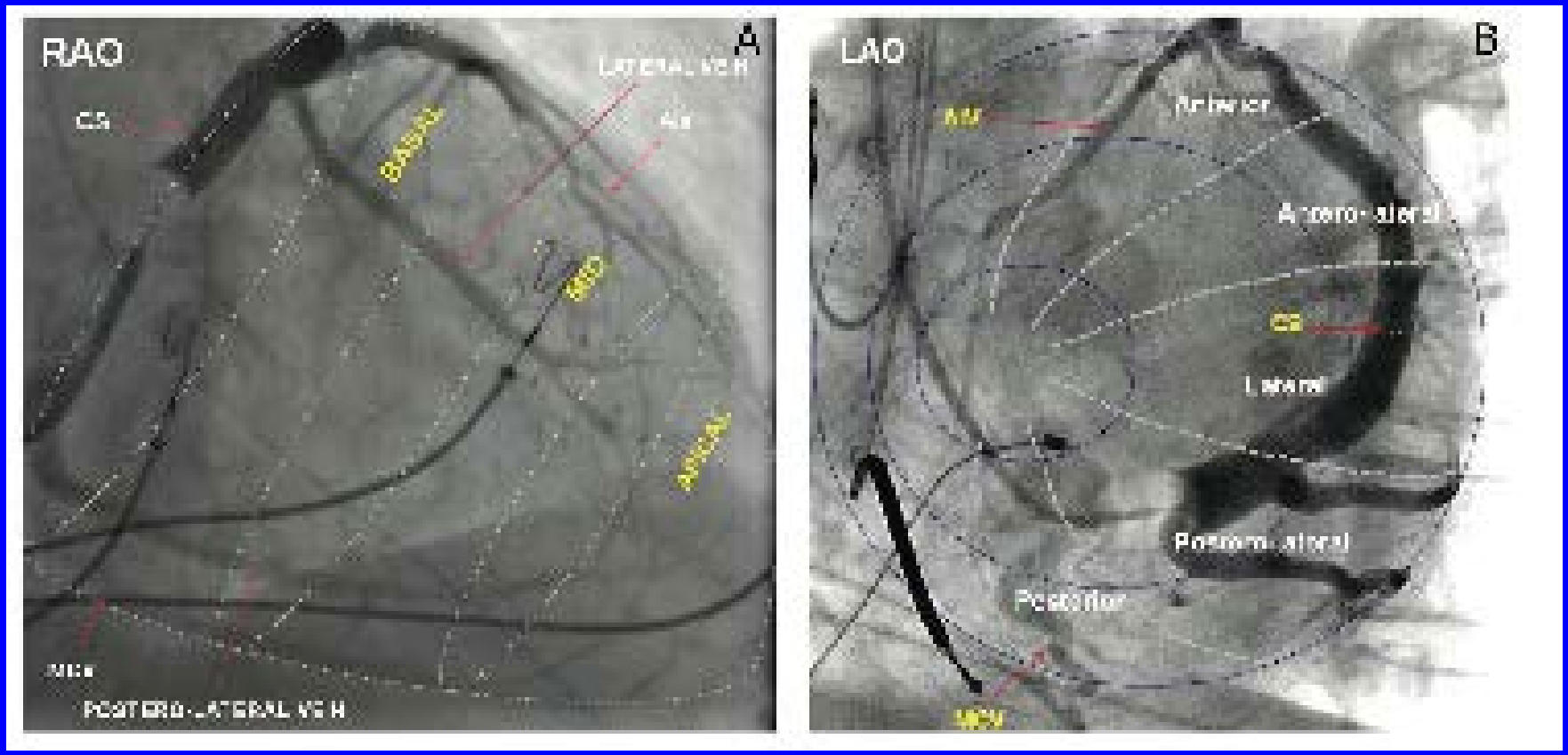

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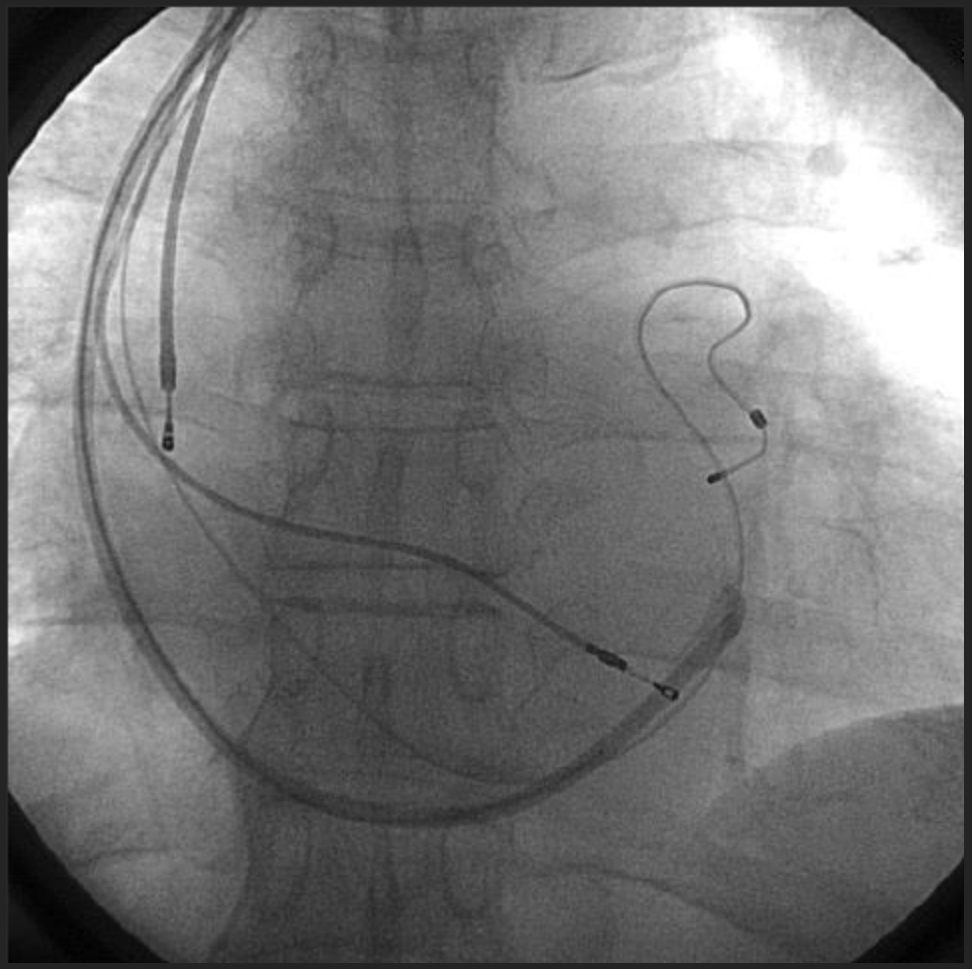
CRT failed to benefit
Key importance of CRT lead Placement



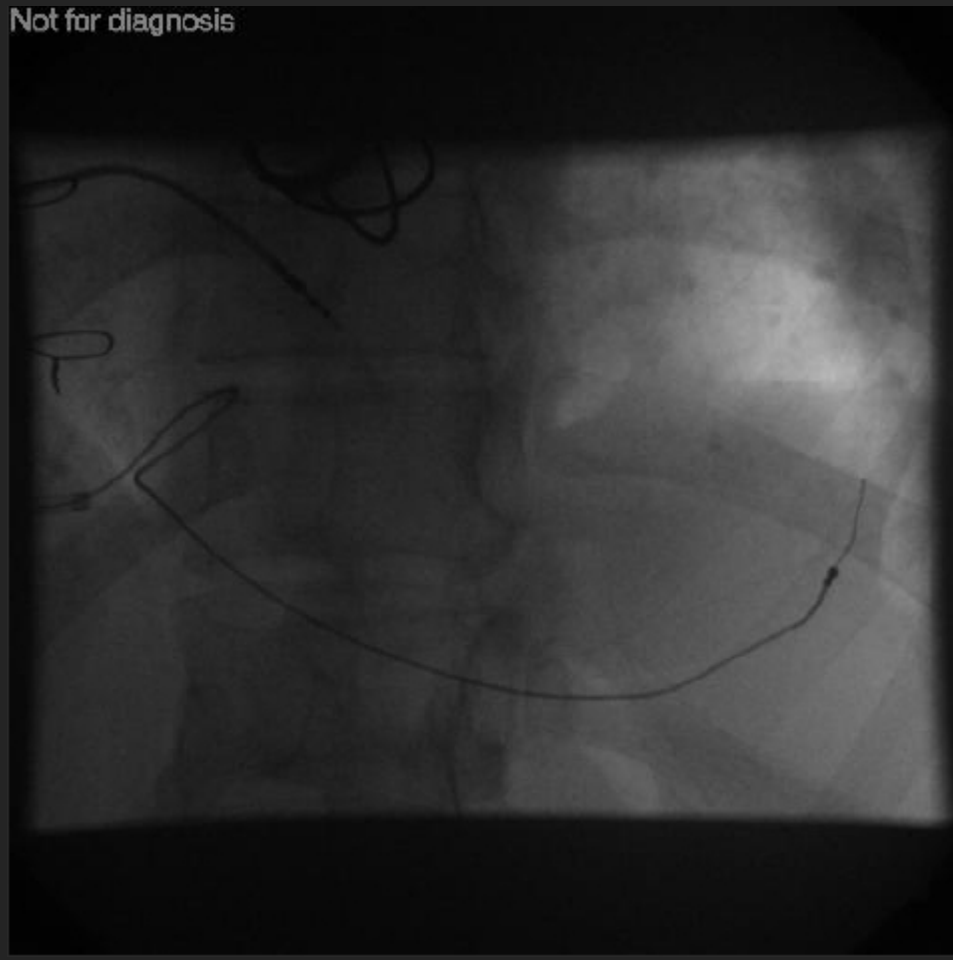


Table 4 Conditions limiting transvenous LV lead placement

Anatomical limitations	• Subclavian or SVC occlusion • Very dilated RA • Abnormal position of CS ostium • Abnormally small (<2 mm in diameter) and/or short CS (<1 cm in length) • Prominent and/or rigid Eustachian valve impeding CS access • CS valve • Severe CS dissection • Severely dilated CS due to congenital or acquired cardiac disease • Angulated take-off of target vein • Short vein (<1 cm in length) • Tiny vein (<1.2 mm in diameter) • Significant vein tortuosity • Vein stenosis or significant narrowing with inability to perform venoplasty • Vein thrombosis • Vein dissection • Chronic vein occlusion • Persistent Left SVC
Lead-related issues	• Lead instability with repeated dislodgment • High pacing threshold (pacing safety margin <1 V) • PNS despite electronic or physical repositioning
Systemic conditions	• Lack of significant response to resynchronization therapy

Europace (2012) 14, 1236–1286
doi:10.1093/europace/eus222

EHRA/HRS CONSENSUS STATEMENT

2012 EHRA/HRS expert consensus statement on cardiac resynchronization therapy in heart failure: implant and follow-up recommendations and management

Parameters influencing CRT Response

1. Comorbidities: age-related, COPD, anemia …
2. Advanced CM vs Early Stage CM
3. Ischemic vs non ischemic origin
4. RV dysfunction
5. Lead Position, difficult anatomy
6. Device settings: AV & VV delays
7. Others ….

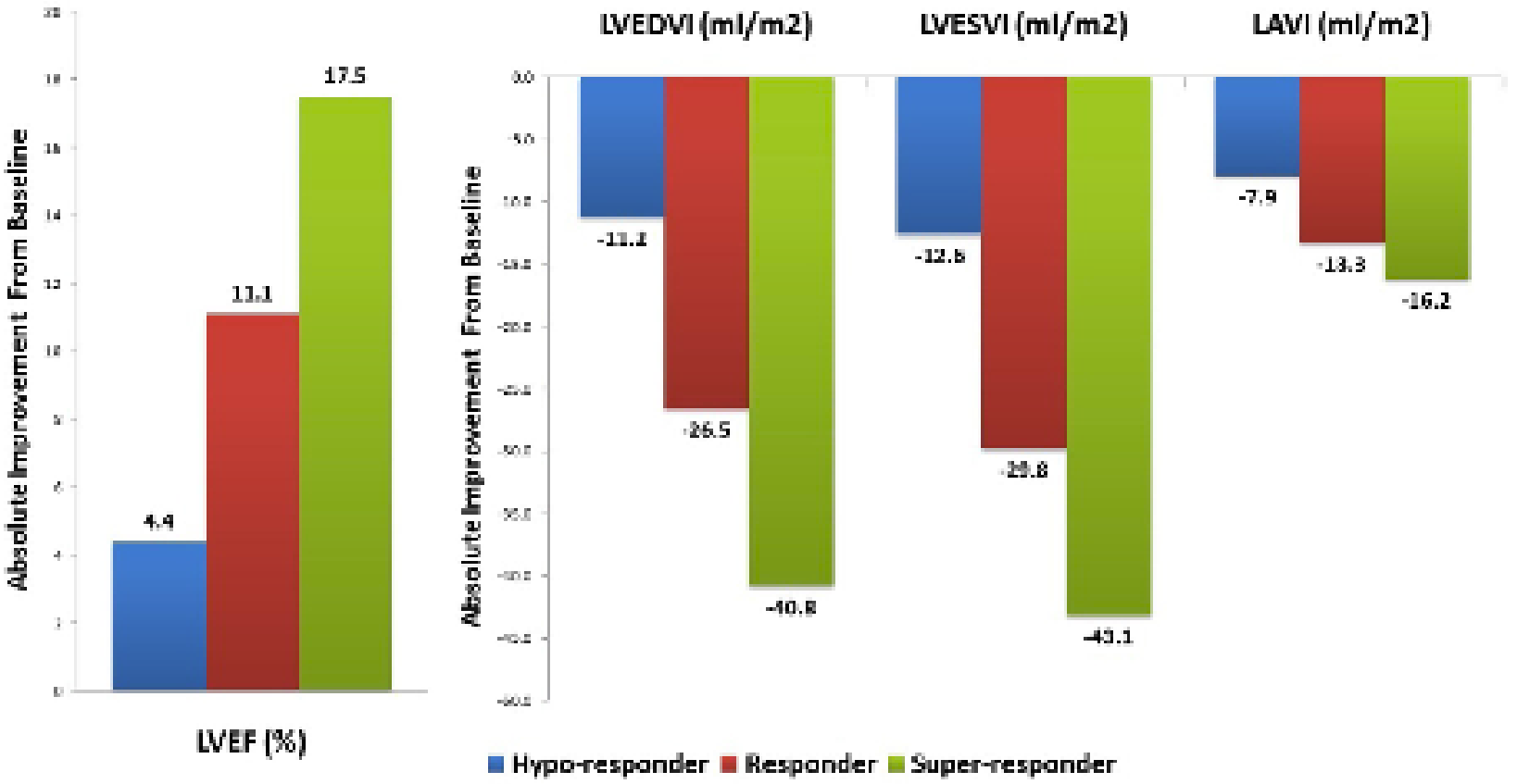


Figure 1 Changes in Echocardiographic Parameters in Super-Responder, Responder, and Hypo-Responder Categories

Table 1 Baseline Clinical Characteristics of MADIT-CRT Patients With Paired Echocardiograms at Baseline and 12 Months by Responder Category

Baseline Characteristics	Hypo-responder (LVEF Change <7.9%) (n = 190)	Responder (LVEF Change 7.9%–14.4%) (n = 371)	Super-Responder (LVEF Change ≥14.5%) (n = 191)	p Value
Age, yrs	63.6 ± 11.8	64.9 ± 10.5	64.2 ± 10.5	0.401
Women	33 (17)	77 (21)	75 (39)	<0.001
Race				
White	167 (88)	341 (92)	177 (93)	0.138
Black	18 (9)	24 (6)	10 (5)	0.242
Body mass index ≥30 kg/m^2	67 (36)	142 (39)	58 (31)	0.190
Enrolled from outside the United States	69 (36)	133 (36)	48 (25)	0.022
Ischemic NYHA functional class I	33 (17)	57 (15)	19 (10)	0.096
Ischemic NYHA functional class II	97 (51)	151 (41)	55 (29)	<0.001
Nonischemic NYHA functional class II	60 (32)	163 (44)	117 (61)	<0.001
Hypertension	120 (63)	241 (65)	115 (61)	0.586
Diabetes mellitus	54 (28)	118 (32)	45 (24)	0.117
Prior CABG surgery	71 (37)	103 (28)	36 (19)	<0.001
Prior PCI	64 (34)	103 (28)	41 (22)	0.031
Prior myocardial infarction	108 (57)	161 (44)	50 (27)	<0.001
Cerebrovascular accident	12 (6)	22 (6)	4 (2)	0.093
Previous cigarette smoking	104 (55)	215 (59)	90 (48)	0.050
Prior ventricular arrhythmias requiring treatment	20 (11)	28 (8)	7 (4)	0.035
Creatinine ≥1.4 mg/dl	44 (23)	87 (24)	37 (19)	0.527
LBBB	106 (56)	263 (71)	165 (86)	<0.001
RBBB	38 (20)	32 (9)	13 (7)	<0.001
QRS duration, ms	153.9 ± 18.1	159.7 ± 20.8	160.9 ± 17.4	<0.001
QRS duration ≥150 ms	107 (56)	238 (64)	148 (77)	<0.001
LVEDV index, ml/m^2	122.5 ± 26.5	126.4 ± 27.0	124.0 ± 24.7	0.215
LVESV index, ml/m^2	85.9 ± 20.3	90.2 ± 21.9	87.6 ± 20.6	0.064
LAV index, ml/m^2	44.5 ± 9.4	46.9 ± 10.2	43.7 ± 9.2	<0.001
Aldosterone antagonists	57 (30)	121 (33)	61 (32)	0.819
Amiodarone	14 (7)	28 (8)	8 (4)	0.286
Angiotensin-converting enzyme inhibitors	147 (77)	284 (77)	147 (77)	0.976
Angiotensin receptor blockers	39 (21)	82 (22)	37 (19)	0.740
Beta-blockers	173 (91)	348 (94)	185 (97)	0.061
Digitalis	57 (30)	96 (26)	47 (25)	0.446
Diuretics	136 (72)	262 (71)	120 (63)	0.109
Lipid-lowering statin drugs	131 (69)	270 (73)	109 (57)	<0.001

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Prior CABG surgery	71 (37)	103 (28)	36 (19)	<0.001
Prior PCI	64 (34)	103 (28)	41 (22)	0.031
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Creatinine ≥1.4 mg/dl	44 (23)	87 (24)	37 (19)	0.527
LBBB	106 (56)	263 (71)	165 (86)	<0.001
RBBB	38 (20)	32 (9)	13 (7)	<0.001
QRS duration, ms	153.9 ± 18.1	159.7 ± 20.8	160.9 ± 17.4	<0.001
QRS duration ≥150 ms	107 (56)	238 (64)	148 (77)	<0.001
LVEDV index, ml/m^2	122.5 ± 26.5	126.4 ± 27.0	124.0 ± 24.7	0.215
LVESV index, ml/m^2	85.9 ± 20.3	90.2 ± 21.9	87.6 ± 20.6	0.064
LAV index, ml/m^2	44.5 ± 9.4	46.9 ± 10.2	43.7 ± 9.2	<0.001
Aldosterone antagonists	57 (30)	121 (33)	61 (32)	0.819
Amiodarone	14 (7)	28 (8)	8 (4)	0.286
Angiotensin-converting enzyme inhibitors	147 (77)	284 (77)	147 (77)	0.976
Angiotensin receptor blockers	39 (21)	82 (22)	37 (19)	0.740
Beta-blockers	173 (91)	348 (94)	185 (97)	0.061
Digitalis	57 (30)	96 (26)	47 (25)	0.446
Diuretics	136 (72)	262 (71)	120 (63)	0.109
Lipid-lowering statin drugs	131 (69)	270 (73)	109 (57)	<0.001

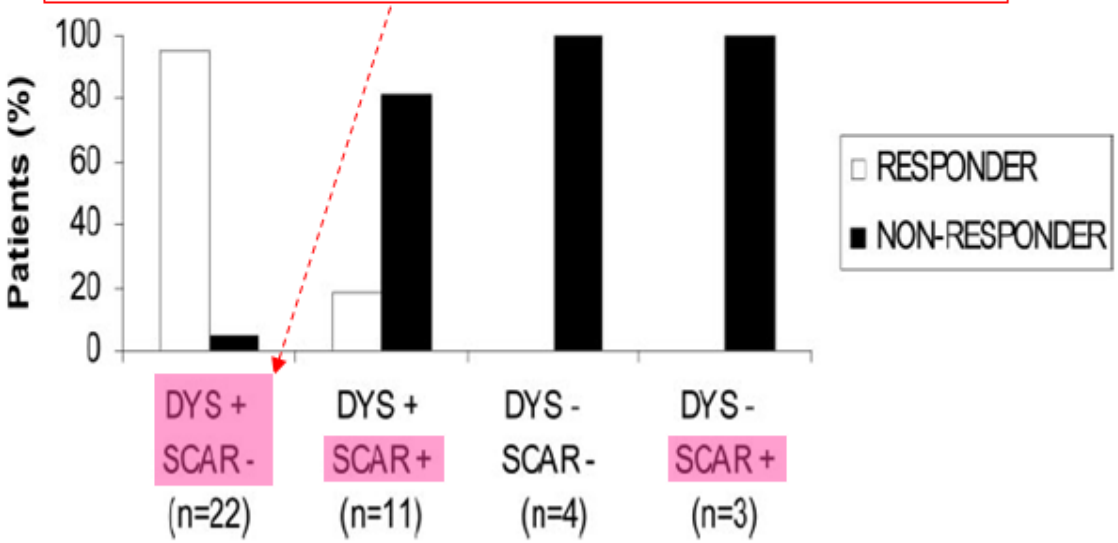
Effect of Posterolateral Scar Tissue on Clinical and Echocardiographic Improvement After CRT

Bleeker et al - Circulation 2006;113:969-976

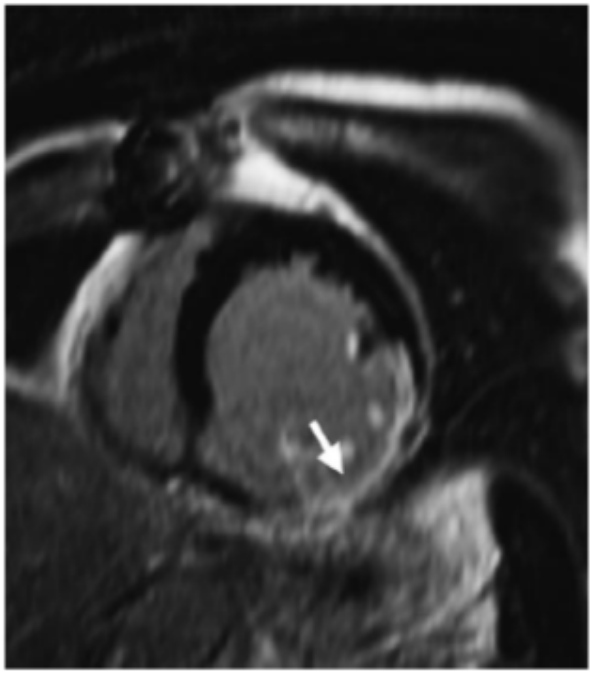
40 ischemic HF pts, NYHA class III-IV, LV-EF≤35%, QRS>120 msec, LBBB

Transmural scar: hyperenhancement 51-100% of LV wall thickness

Combined assessment of scar tissue and LV dyssynchrony is needed for best prediction of CRT response.



Percentages of responders to CRT for 4 different patient categories based on the presence or absence of transmural posterolateral scar tissue (Scar+/Scar-) in combination with the presence or absence of baseline LV dyssynchrony ≥65 ms (Dys+/Dys-).



Contrast-enhanced MRI of a patient with transmural scar tissue in the posterolateral wall.

Table 1 Baseline Clinical Characteristics of MADIT-CRT Patients With Paired Echocardiograms at Baseline and 12 Months by Responder Category

Baseline Characteristics	Hypo-responder (LVEF Change <7.9%) (n = 190)	Responder (LVEF Change 7.9%–14.4%) (n = 371)	Super-Responder (LVEF Change ≥14.5%) (n = 191)	p Value
Age, yrs	63.6 ± 11.8	64.9 ± 10.5	64.2 ± 10.5	0.401
Women	33 (17)	77 (21)	75 (39)	<0.001
Race				
White	167 (88)	341 (92)	177 (93)	0.138
Black	18 (9)	24 (6)	10 (5)	0.242
Body mass index ≥30 kg/m^2	67 (36)	142 (39)	58 (31)	0.190
Enrolled from outside the United States	69 (36)	133 (36)	48 (25)	0.022
Ischemic NYHA functional class I	33 (17)	57 (15)	19 (10)	0.096
Ischemic NYHA functional class II	97 (51)	151 (41)	55 (29)	<0.001
Nonischemic NYHA functional class II	60 (32)	163 (44)	117 (61)	<0.001
Hypertension	120 (63)	241 (65)	115 (61)	0.586
Diabetes mellitus	54 (28)	118 (32)	45 (24)	0.117
Prior CABG surgery	71 (37)	103 (28)	36 (19)	<0.001
Prior PCI	64 (34)	103 (28)	41 (22)	0.031
Prior myocardial infarction	108 (57)	161 (44)	50 (27)	<0.001
Cerebrovascular accident	12 (6)	22 (6)	4 (2)	0.093
Previous cigarette smoking	104 (55)	215 (59)	90 (48)	0.050
Prior ventricular arrhythmias requiring treatment	20 (11)	28 (8)	7 (4)	0.035
Creatinine ≥1.4 mg/dl	44 (23)	87 (24)	37 (19)	0.527
LBBB	106 (56)	263 (71)	165 (86)	<0.001
RBBB	38 (20)	32 (9)	13 (7)	<0.001
QRS duration, ms	153.9 ± 18.1	159.7 ± 20.8	160.9 ± 17.4	<0.001
QRS duration ≥150 ms	107 (56)	238 (64)	148 (77)	<0.001
LVEDV index, ml/m^2	122.5 ± 26.5	126.4 ± 27.0	124.0 ± 24.7	0.215
LVESV index, ml/m^2	85.9 ± 20.3	90.2 ± 21.9	87.6 ± 20.6	0.064
LAV index, ml/m^2	44.5 ± 9.4	46.9 ± 10.2	43.7 ± 9.2	<0.001
Aldosterone antagonists	57 (30)	121 (33)	61 (32)	0.819
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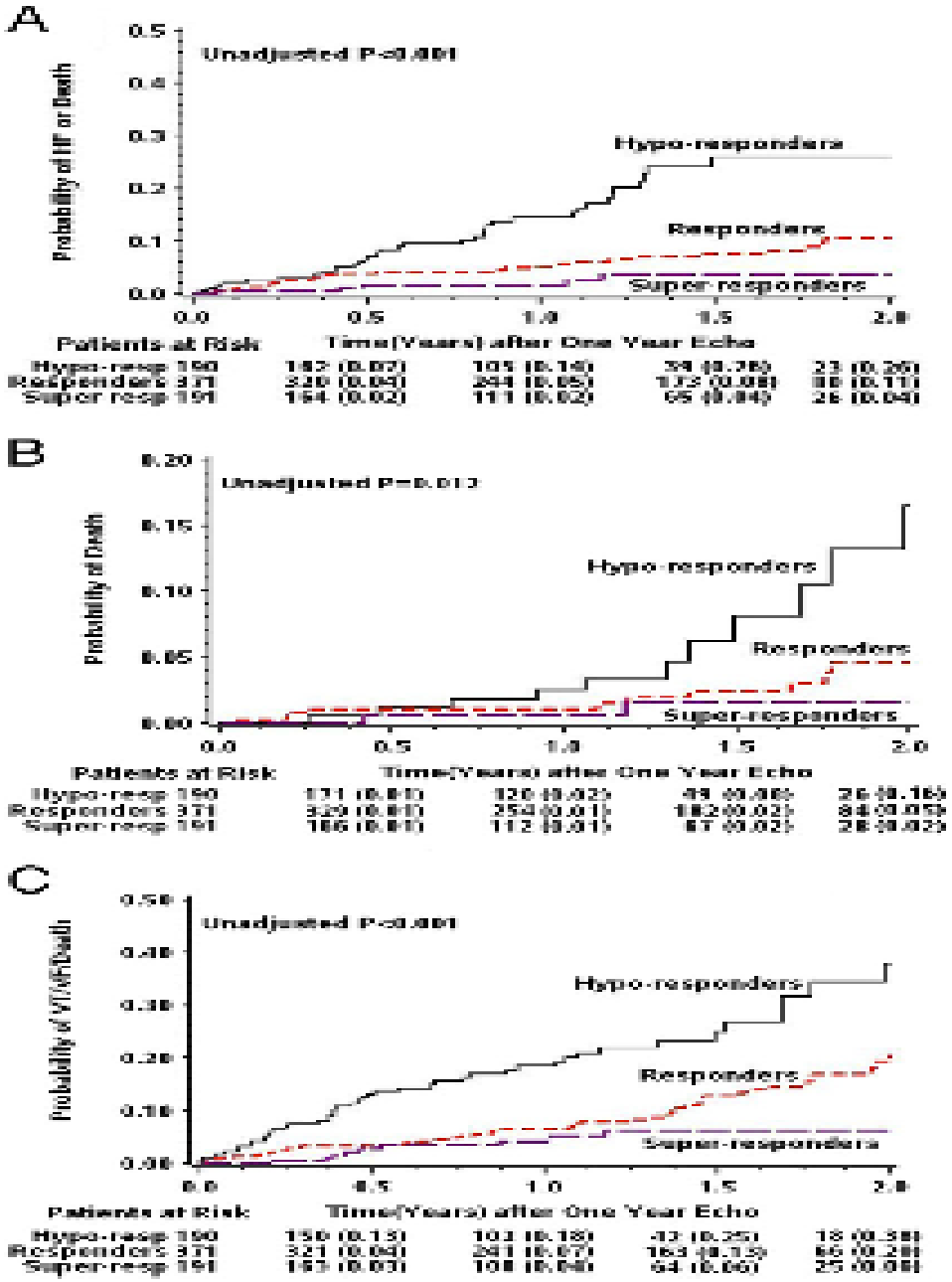
Angiotensin receptor blockers	39 (21)	82 (22)	37 (19)	0.740
Beta-blockers	173 (91)	348 (94)	185 (97)	0.061
Digitalis	57 (30)	96 (26)	47 (25)	0.446
Diuretics	136 (72)	262 (71)	120 (63)	0.109
Lipid-lowering statin drugs	131 (69)	270 (73)	109 (57)	<0.001

Table 3 Multivariate Analysis of Predictors of LVEF Super-Response

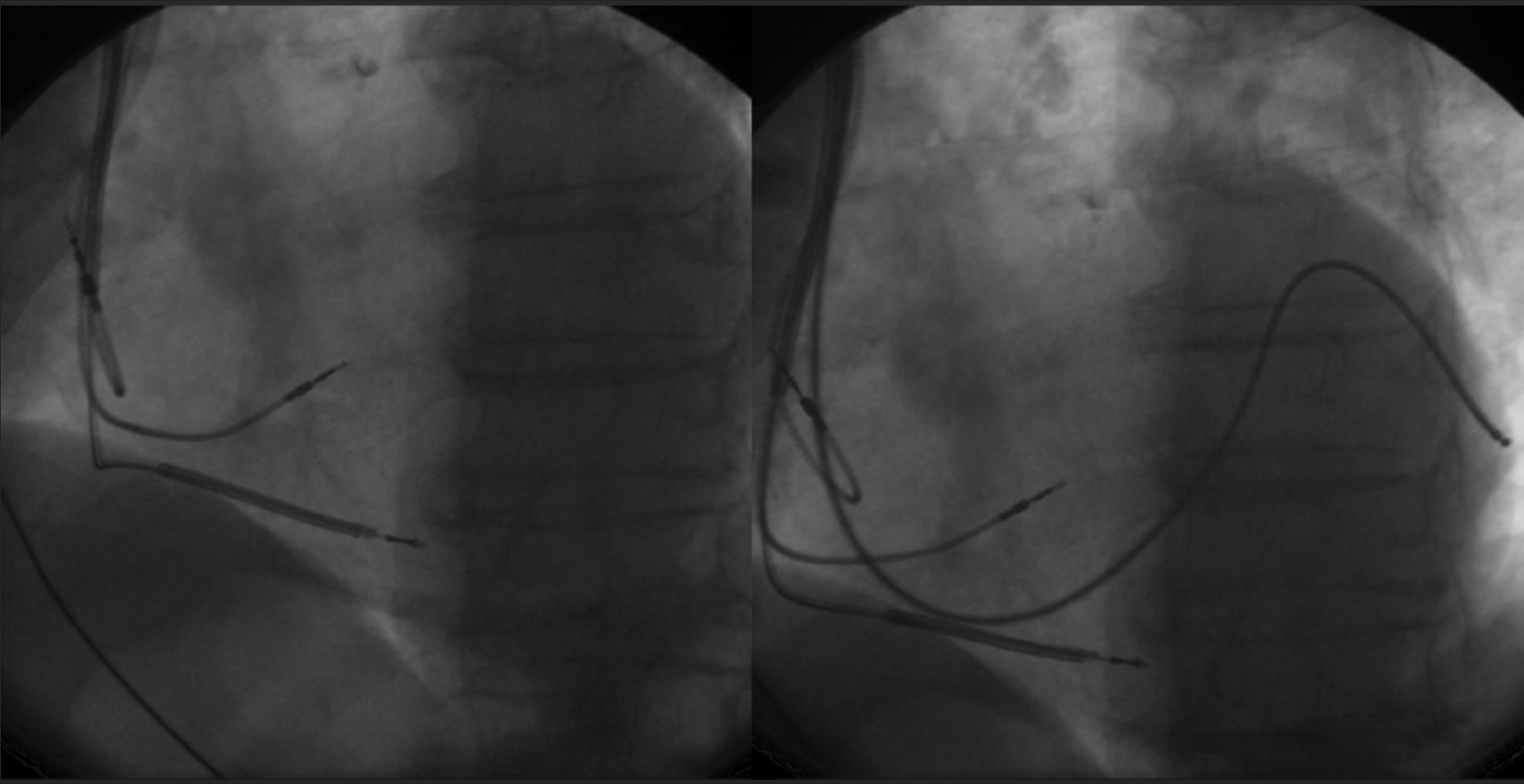
Variable	Odds Ratio	95% Confidence Interval	p Value
Female	1.96	1.32–2.90	0.001
QRS duration ≥150 ms	1.79	1.17–2.73	0.007
LBBB	2.05	1.24–3.40	0.006
Body mass index <30 kg/m^2	1.51	1.03–2.20	0.035
No prior myocardial infarction	1.80	1.20–2.71	0.005
Left atrial volume index, SD*	1.47	1.21–1.79	<0.001


A
Unadjusted P<0.001
Probability of HF or Death
Hypo-responders
Responders
Super-responders
Patients at Risk
Time(Years) after One Year Echo
Hypo-resp 190 182 (0.07) 105 (0.14) 34 (0.28) 23 (0.26)
Responders 371 320 (0.04) 244 (0.05) 132 (0.08) 80 (0.11)
Super-resp 191 164 (0.02) 111 (0.02) 65 (0.04) 26 (0.04)
B
Unadjusted P=0.013
Probability of Death
Hypo-responders
Responders
Super-responders
Patients at Risk
Time(Years) after One Year Echo
Hypo-resp 190 171 (0.01) 120 (0.02) 49 (0.06) 26 (0.16)
Responders 371 329 (0.01) 254 (0.01) 182 (0.02) 84 (0.05)
Super-resp 191 186 (0.01) 112 (0.01) 67 (0.02) 28 (0.02)
C
Unadjusted P<0.001
Hypo-responders
Responders
Super-responders
Patients at Risk
Time(Years) after One Year Echo
Hypo-resp 190 150 (0.13) 103 (0.18) 42 (0.25) 18 (0.38)
Responders 371 321 (0.04) 241 (0.07) 163 (0.13) 86 (0.28)
Super-resp 191 163 (0.03) 108 (0.04) 64 (0.06) 25 (0.08)

Unsolved issues after CRT device implant
Non Responders

- Background
- How to Define non Responders ?
- Parameters Influencing CRT Response
- Potential Solutions to Optimize CRT

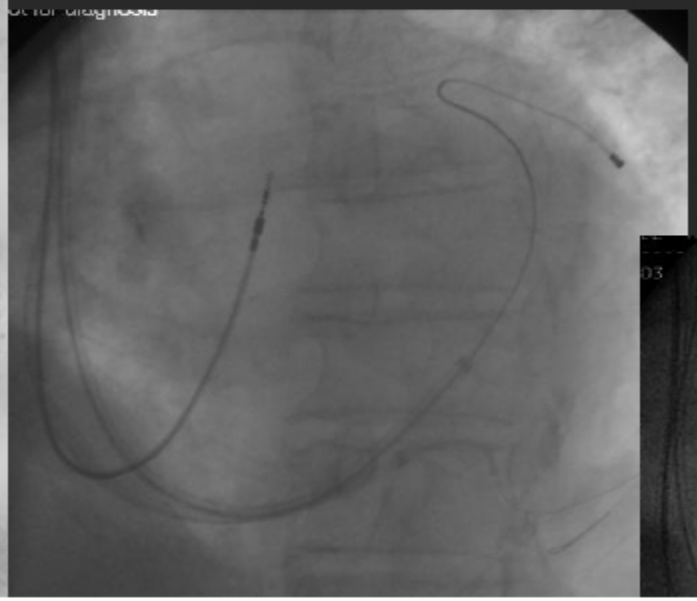
Dual site RV Pacing to optimize CRT

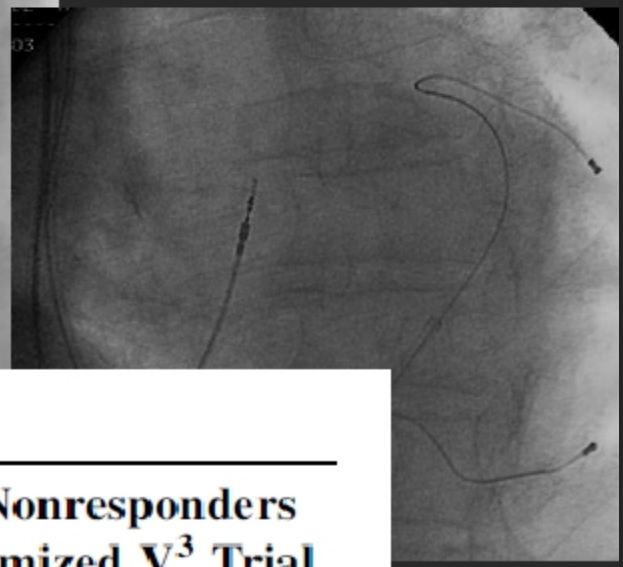


A randomized comparison of triple versus dual site ventricular stimulation in patients with congestive heart failure

Christophe Leclercq[1], MD, PhD, Fredrik Gadler[2], MD, PhD, Wolfgang Kranig[3], MD, Sue Ellery[4], MD, Daniel Gras[5], MD, Arnaud Lazarus[6], MD, Jacques Clémenty[7], MD, Eric Boulogne[8], MSc, Jean-Claude Daubert[1], MD, for the Triple Resynchronization In Paced Heart Failure Patients (TRIP-HF) study group

J Am Coll Cardiol 2008;51:1455-62



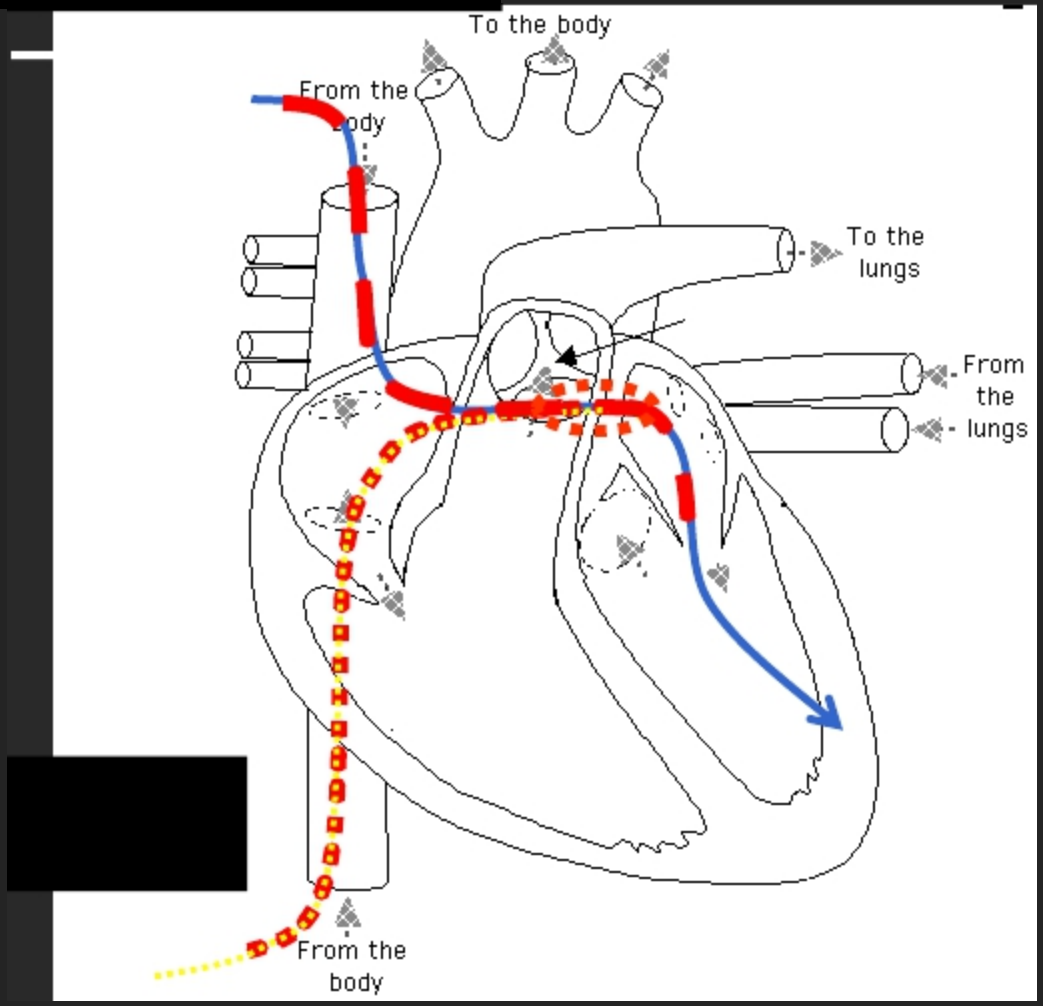


Clinical Trials

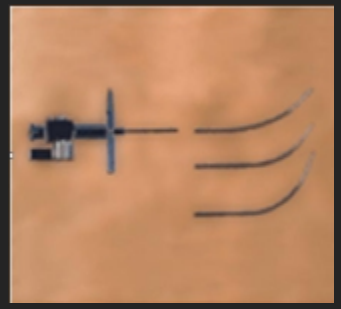
Addition of a Second LV Pacing Site in CRT Nonresponders Rationale and Design of the Multicenter Randomized V³ Trial

PIERRE BORDACHAR, MD,[1] CHRISTINE ALONSO, MD,[2] FREDERIC ANSELME, MD,[3] SERGE BOVEDA, MD,[4] PASCAL DELAYE, MD,[5] STEPHANE GARRIGUE, MD,[6] DANIEL GRAS, MD,[7] ISABELLE LIAS, MD,[8] OLIVIER PIOT, MD,[9] NICOLAS SADOUL, MD,[10] AND CHRISTOPHE LECLERCQ, MD[11]

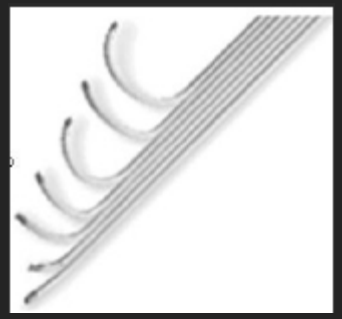
Existing Clinical Experience in Transseptal LV Endocardial Lead Implant



Brockenbrough needle



Mullins transseptal sheath/dilator



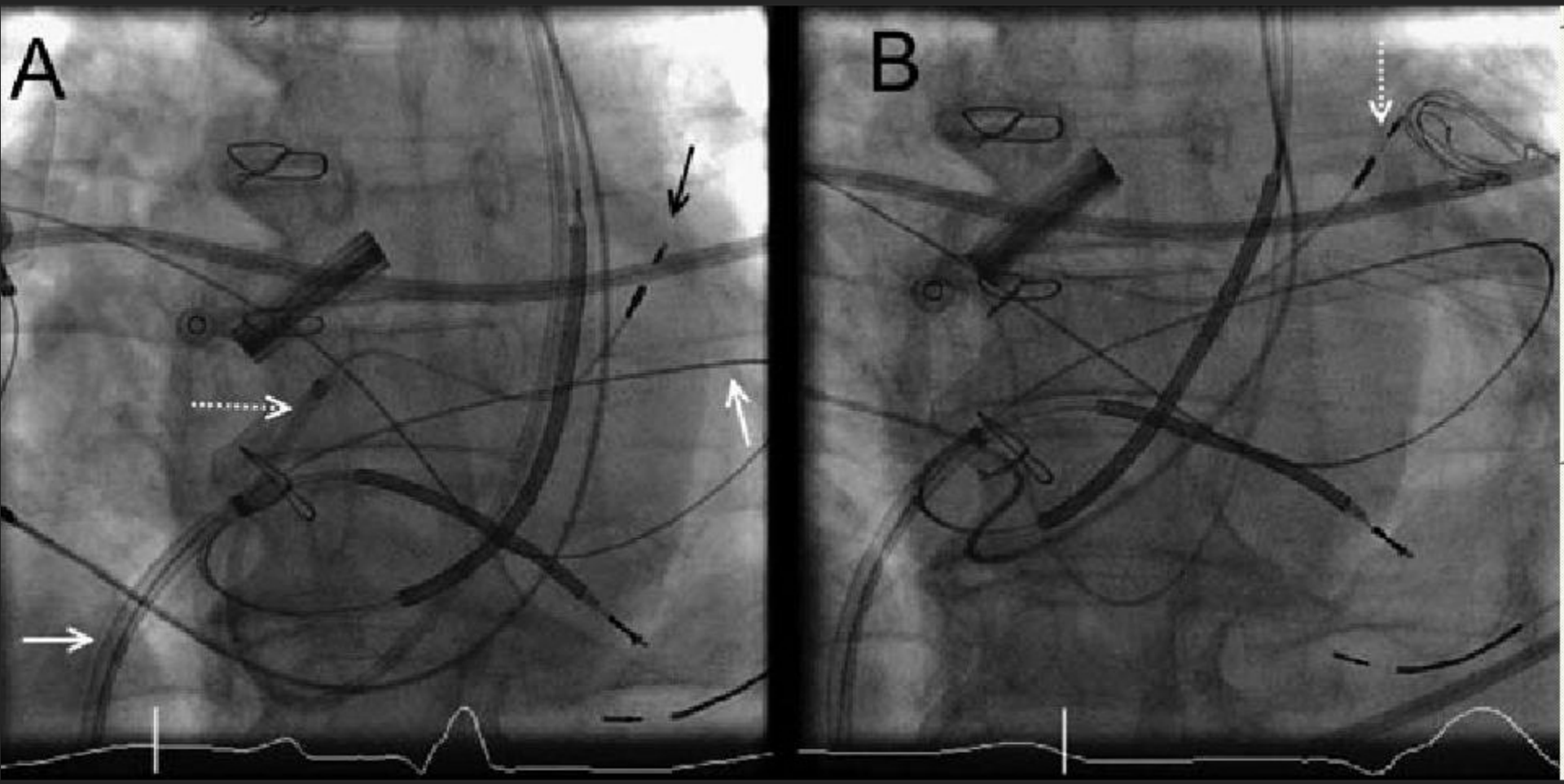
Guidewire

6226 DEF or C304

- Jais P et al, PACE, 1998
- VanGelder BM et al, Heart Rhythm, 2007
- Morgan et al, EuroPace, 2009
- Lau E, J Interv Card Electrophysiol.,2009

Trans-septal left ventricular endocardial pacing through a persistent left-sided superior vena cava

Paul A. Scott[1,2*], Paul R. Roberts[1,2], and John M. Morgan[1,2]

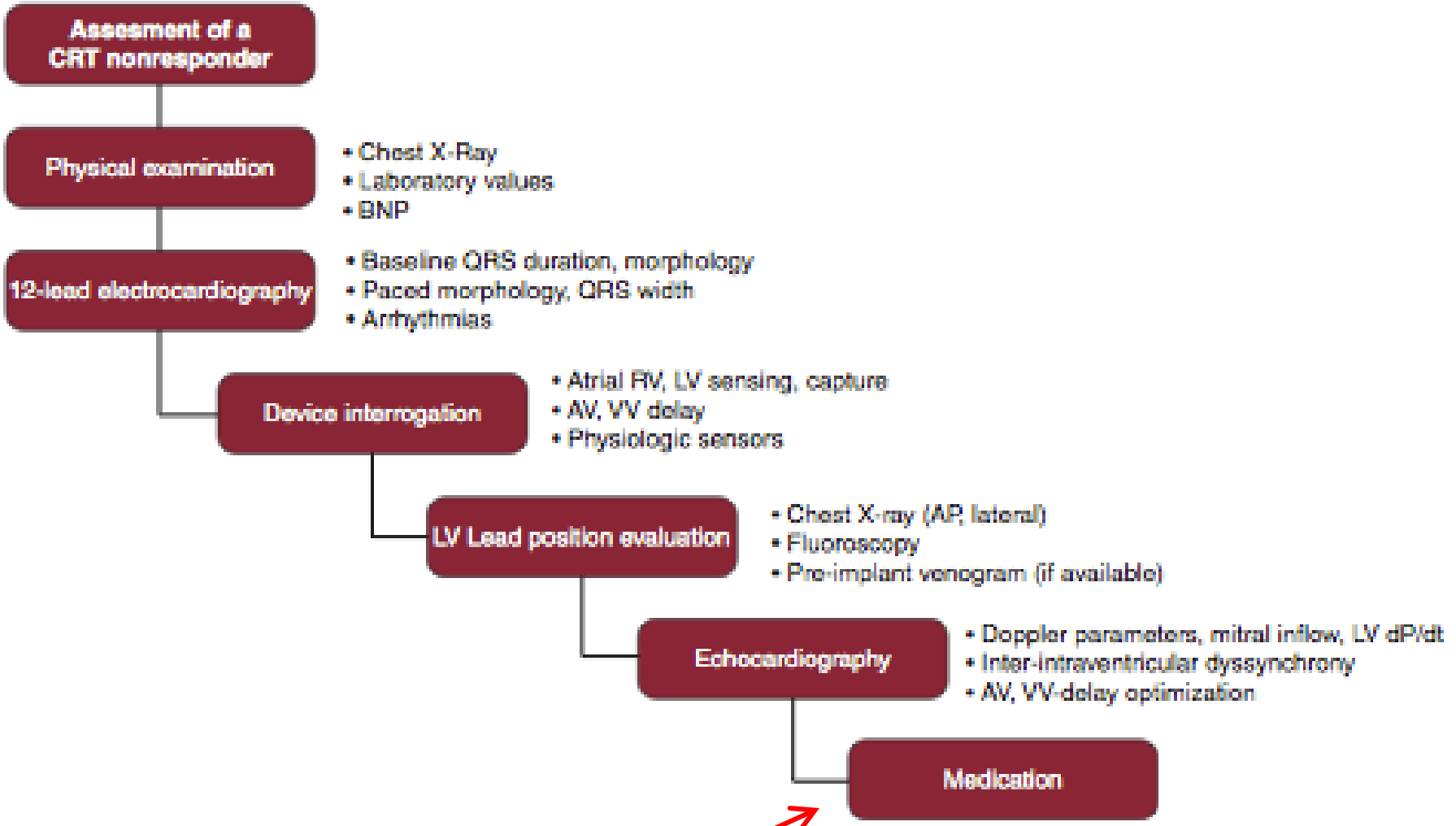


Unsolved issues after CRT device implant
Non Responders

- **Response to CRT:**
  - **CCS, Hospitalization, LV Reverse Remodeling, Mortality..**

- **Limitations to CRT**
  - **Age and Comorbidities, advanced CM, Ischemic origin, Anatomical, RV Dysfunction, Lead Placement..**

- **Management of non responders:**
  - **Earlier CRT Consideration: Madit CRT, Reverse, Raft …**
  - **Appropriate Lead Placement**
  - **Optimized CRT Settings (Automaticity, Telemonitoring …)**
  - **Triple site RV/LV CRT, LV Endocardial Pacing …**


Assesment of a CRT nonresponder
Physical examination
• Chest X-Ray
• Laboratory values
• BNP
12-lead electrocardiography
• Baseline QRS duration, morphology
• Paced morphology, QRS width
• Arrhythmias
Device interrogation
• Atrial RV, LV sensing, capture
• AV, VV delay
• Physiologic sensors
LV Lead position evaluation
• Chest X-ray (AP, lateral)
• Fluoroscopy
• Pre-implant venogram (if available)
Echocardiography
• Doppler parameters, mitral inflow, LV dP/dt
• Inter-intraventricular dyssynchrony
• AV, VV-delay optimization
Medication

- **957 pts (597M, 340F), mean age 68.2yrs (49-81)**
  - **Responder 75%**
  - **Sopravvivenza a 5 anni 65%**

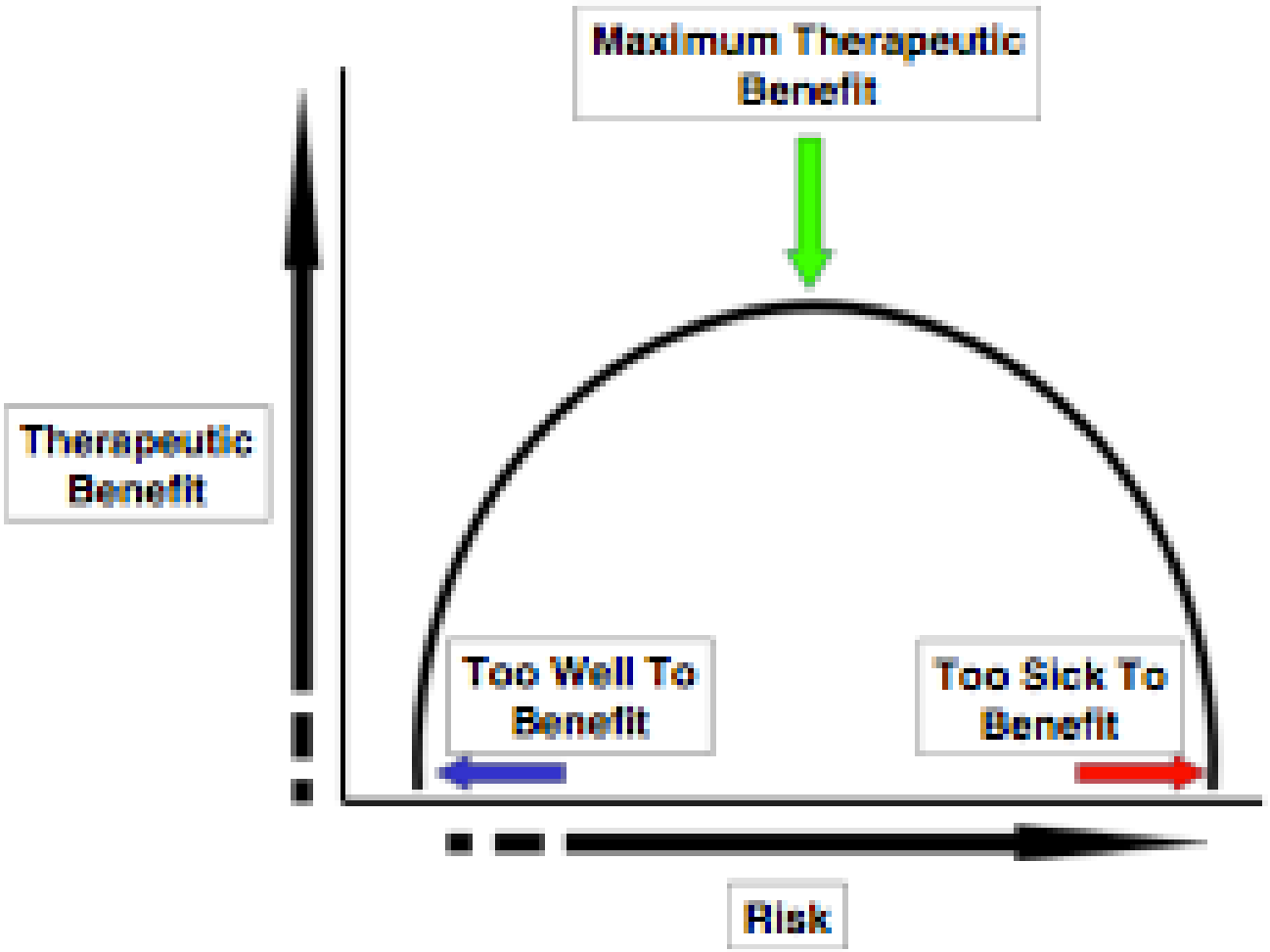


Figure 1 The Goldilocks Effect

ARE WE DOCTORS OR ELECTRICIANS?