9th CHALLENGES in CARDIOLOGY
JUNE 28th - 29th 2019
Palace Hotel Monte Real

Cardiac resynchronization

Responders, non-responders, hyper-responders

Pedro Marques

Afonso Nunes Ferreira

Cardiology Department, Santa Maria University Hospital (CHULN), Lisbon Academic Medical Centre and Centro Cardiovascular da Universidade de Lisboa, Lisbon School of Medicine of the Universidade de Lisboa, Portugal

DEPARTAMENTO CORAÇÃO e VASOS   CENTRO HOSPITALAR LISBOA NORTE, EPE   HSM   HPV   U LISBOA UNIVERSIDADE DE LISBOA   FACULDADE DE MEDICINA LISBOA   CCUL CENTRO CARDIOVASCULAR DA UNIVERSIDADE DE LISBOA

CRT – Clinical Evidence

The Benefit from CRT is well established

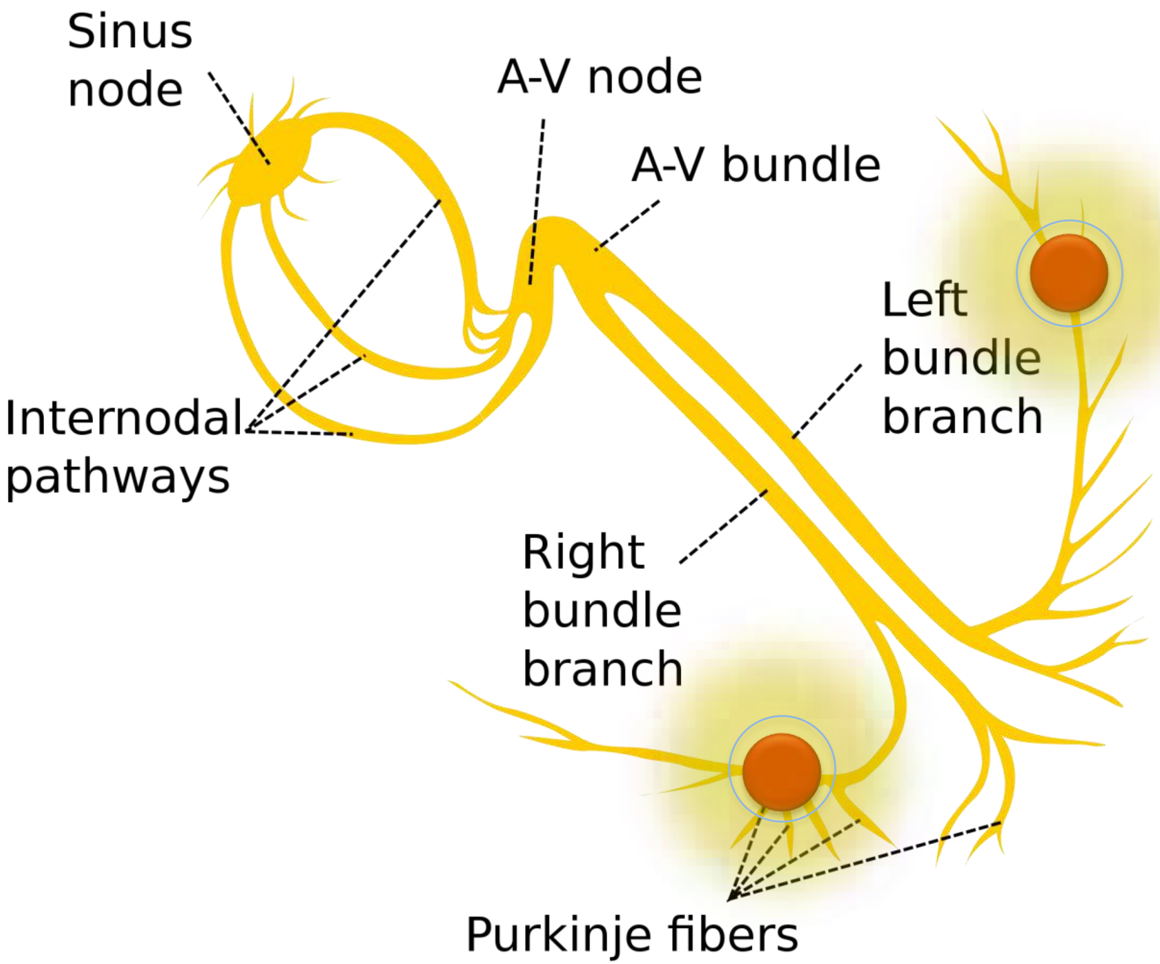
Clinical Studies Evaluating CRT in Heart Faillure

Trial (ref)	No.	Design	NYHA	LVEF	QRS	Primary endpoints	Secondary endpoints	Main Findings
MUSTIC-SR[52]	58	Single-blinded, crossover, randomized CRT vs. OMT, 6 months	III	<35%	≥150	6MWD	NYHA class, QoL, peak VO_2LV volumes, MR hospitalizations, mortality	CRT-P improved 6MWD, NYHA class, QoL, peak VO_2, reduced LV volumes and MR and reduced hospitalizations
PATH-CHF[51]	41	Single-blinded, crossover, randomized RV vs. LV vs. BiV, 12 months	III–IV	NA	≥150	Peak VO_2, 6MWD	NYHA class, QoL hospitalizations	CRT-P improved NYHA class, QoL and 6MWD and reduced hospitalizations
MIRACLE[49]	453	Double-blinded, randomized CRT vs. OMT, 6 months	III–IV	≤35%	≥130	NYHA class, 6MWD , QoL	Peak VO_2 LVEDD, LVEF, MR clinical composite response	CRT-P improved NYHA class, QoL and 6MWD and reduced LVEDD, MR and increased LVEF
MIRACLE-ICD[54]	369	Double-blinded, randomized CRT-D vs. ICD, 6 months	III–IV	≤35%	≥130	NYHA class, 6MWD , QoL	Peak VO_2 LVEDD, LVEF, MR clinical composite response	CRT-D improved NYHA class, QoL, peak VO_2
CONTAK-CD[53]	490	Double-blinded randomized CRT-D vs. ICD, 6 months	II–III–IV	≤35%	≥120	NYHA class, 6MWD , QoL	LV volume, LVEF composite of mortality, VT/VF, hospitalizations	CRT-D improved 6MWD, NYHA class, QoL, reduced LV volume and increased LVEF
MIRACLE-ICD II[60]	186	Double-blinded, randomized CRT-D vs. ICD, 6 months	II	≤35%	≥130	Peak VO_2	VE/VCO_2, NYHA, QoL, 6MWD, LV volumes and EF, composite clinical endpoint	CRT-D improved NYHA, VE/CO_2 and reduced LV volumes and improved LVEF
COMPANION[55]	1520	Double-blinded randomized OMT vs. CRT-P / or vs. CRT-D, 15 months	III–IV	≤35%	≥120	All-cause mortality or hospitalization	All-cause mortality, cardiac mortality	CRT-P and CRT-D reduced all-cause mortality or hospitalization
CARE-HF[56]	813	Double-blinded randomized OMT vs. CRT-P 29.4 months	III–IV	≤35%	≥120	All-cause mortality or hospitalization	All-cause mortality, NYHA class, QoL	CRT-P reduced all-cause mortality and hospitalization and improved NYHA class and QoL
REVERSE[61]	610	Double-blinded, randomized CRT-ON vs. CRT-OFF, 12 months	I–II	≤40%	≥120	% worsened by clinical composite endpoint	LVESV index, heart failure hospitalizations and all-cause mortality	CRT-P/CRT-D did not change the primary endpoint and did not reduce all-cause mortality but reduced LVESV index and heart failure hospitalizations.
MADIT-CRT[50]	1820	Single-blinded, randomized CRT-D vs. ICD, 12 months	I–II	≤30%	≥130	All-cause mortality or heart failure hospitalizations	All-cause mortality and LVESV	CRT-D reduced the endpoint heart failure hospitalizations or all-cause mortality and LVESV. CRT-D did not reduced all-cause mortality
RAFT[62]	1798	Double-blinded, randomized CRT-D vs. ICD 40 months	II–III	≤30%	≥120	All-cause mortality or heart failure hospitalizations	All-cause mortality and cardiovascular death	CRT-D reduced the endpoint all-cause mortality or heart failure hospitalizations. In NYHA III, CRT-D only reduced significantly all-cause mortality

More than 8000 patients included in randomized controlled trials

CRT – Clinical Evidence

The Benefit from CRT is well established



CRT – Clinical Evidence

The Benefit from CRT is well established

↓ **Hospitalizations**

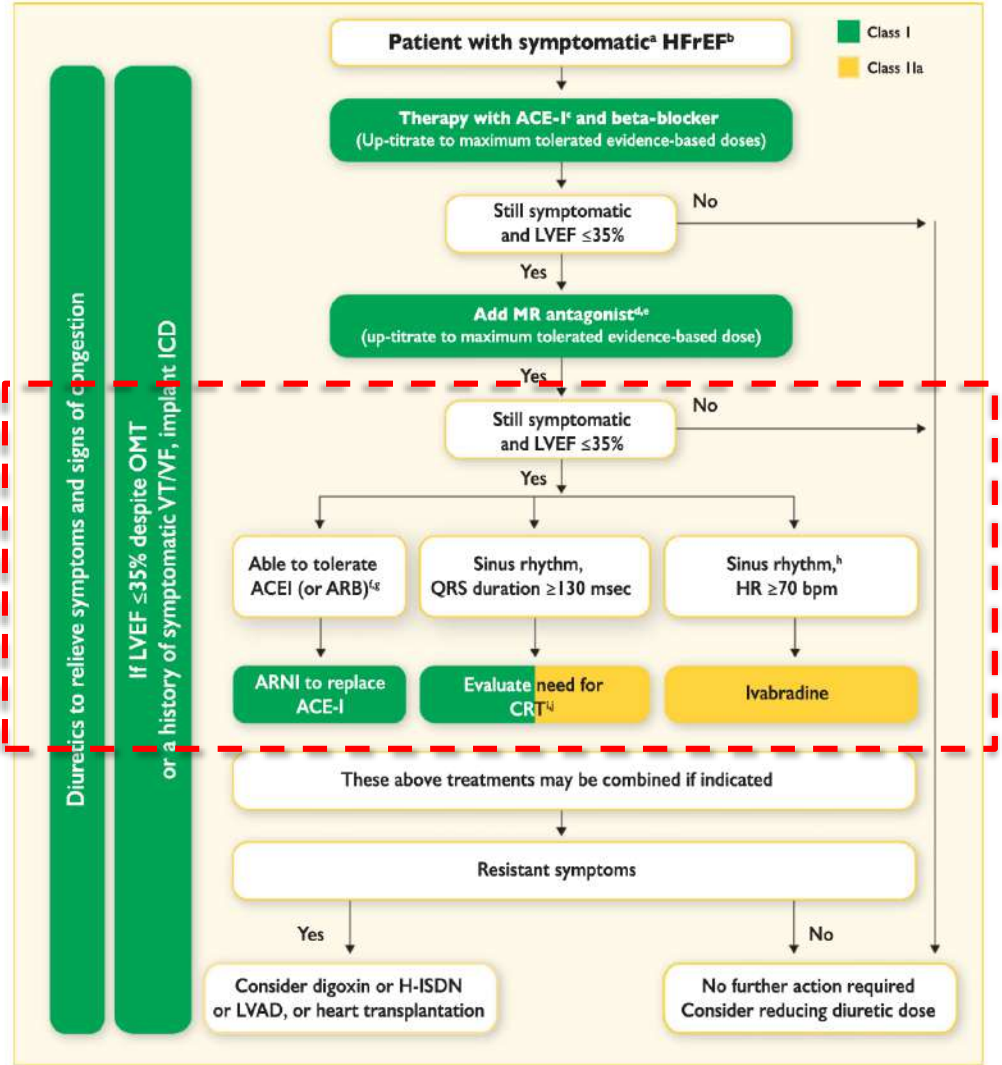
↓ **Symptoms**

↑ **QoL**

↓ **Mortality**

CRT – Clinical Evidence

The Benefit from CRT is well established



Recommendations for cardiac resynchronization therapy implantation in patients with heart failure

Recommendations	Class[a]	Level[b]	Ref[c]
CRT is recommended for symptomatic patients with HF in sinus rhythm with a QRS duration ≥150 msec and LBBB QRS morphology and with LVEF ≤35% despite OMT in order to improve symptoms and reduce morbidity and mortality.	I	A	261–272
CRT should be considered for symptomatic patients with HF in sinus rhythm with a QRS duration ≥150 msec and non-LBBB QRS morphology and with LVEF ≤35% despite OMT in order to improve symptoms and reduce morbidity and mortality.	IIa	B	261–272
CRT is recommended for symptomatic patients with HF in sinus rhythm with a QRS duration of 130–149 msec and LBBB QRS morphology and with LVEF ≤35% despite OMT in order to improve symptoms and reduce morbidity and mortality.	I	B	266, 273
CRT may be considered for symptomatic patients with HF in sinus rhythm with a QRS duration of 130–149 msec and non-LBBB QRS morphology and with LVEF ≤35% despite OMT in order to improve symptoms and reduce morbidity and mortality.	IIb	B	266, 273
CRT rather than RV pacing is recommended for patients with HFrEF regardless of NYHA class who have an indication for ventricular pacing and high degree AV block in order to reduce morbidity. This includes patients with AF (see Section 10.1).	I	A	274–277
CRT should be considered for patients with LVEF ≤35% in NYHA Class III–IV[d] despite OMT in order to improve symptoms and reduce morbidity and mortality, if they are in AF and have a QRS duration ≥130 msec provided a strategy to ensure bi-ventricular capture is in place or the patient is expected to return to sinus rhythm.	IIa	B	275, 278–281
Patients with HFrEF who have received a conventional pacemaker or an ICD and subsequently develop worsening HF despite OMT and who have a high proportion of RV pacing may be considered for upgrade to CRT. This does not apply to patients with stable HF.	IIb	B	282
CRT is contra-indicated in patients with a QRS duration < 130 msec.	III	A	266, 283–285

- **HFrEF ≤ 35%, QRS ≥ 130ms**
- **HFrEF, RV pacing**

Ponikowski P, *et al*. Eur Heart J, 2016; 37:2129-2200

Patient Selection

Magnitude of benefit from CRT

Highest (responders)

Lowest (non-responders)

Wider QRS
Left Bundle Branch Block
Females
Non-ischaemic cardiopathy

Males
Ischaemic cardiopathy

Narrower QRS
Non-Left Bundle Branch Block

Brignole M, *et al*. Eur Heart J, 2013; 34:2281-329

Responders vs Non-responders

Responders

- Clinical measures (functional & QoL)
- LV reverse remodelling
- Event-based measures

Vs

Non-responders

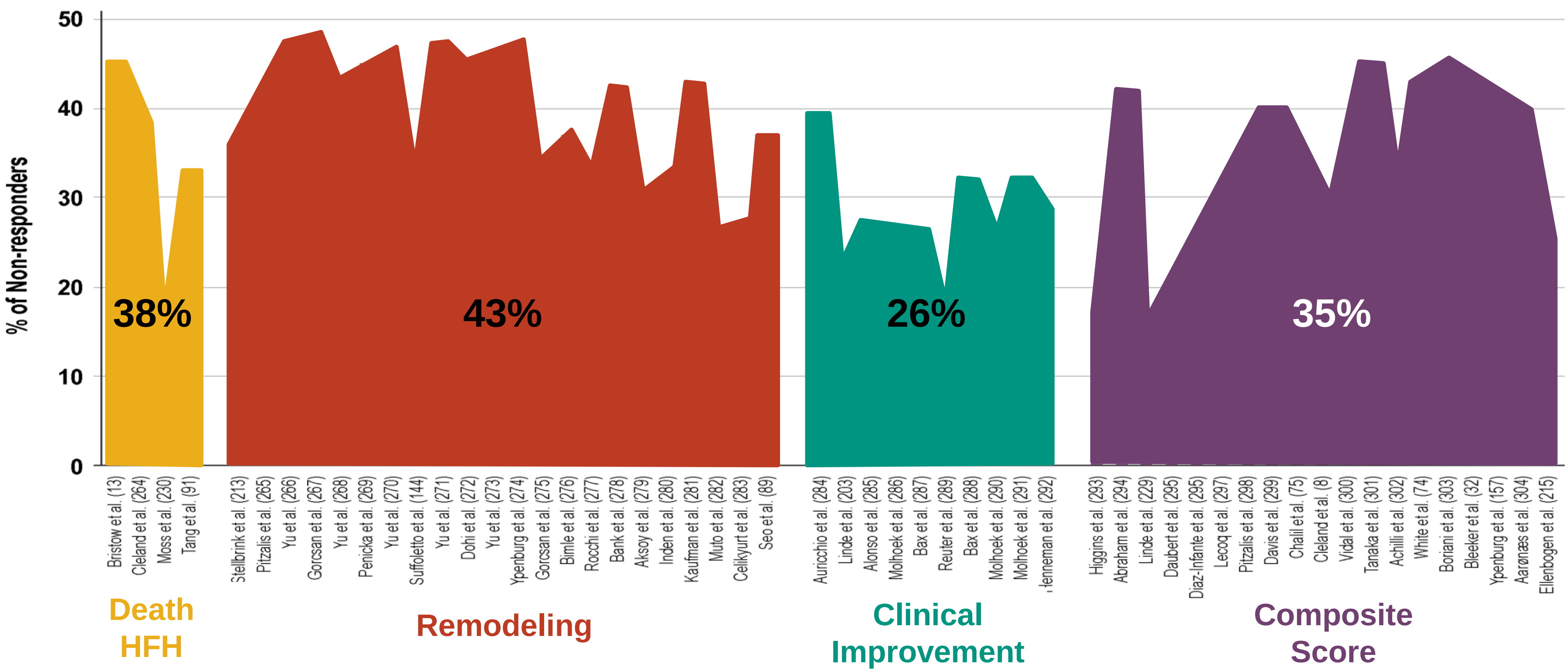
- ø clinical improvement
- ø LV reverse remodelling
- ø Event-based measures

- LVEF ≥ 5% and/or LVESV ≤ 15%
- ↓ NYHA ≥ 1 class
- Ø HF hospit, deaths

Magnitude of Non Response to CRT

Globaly 30-40% Non Responders

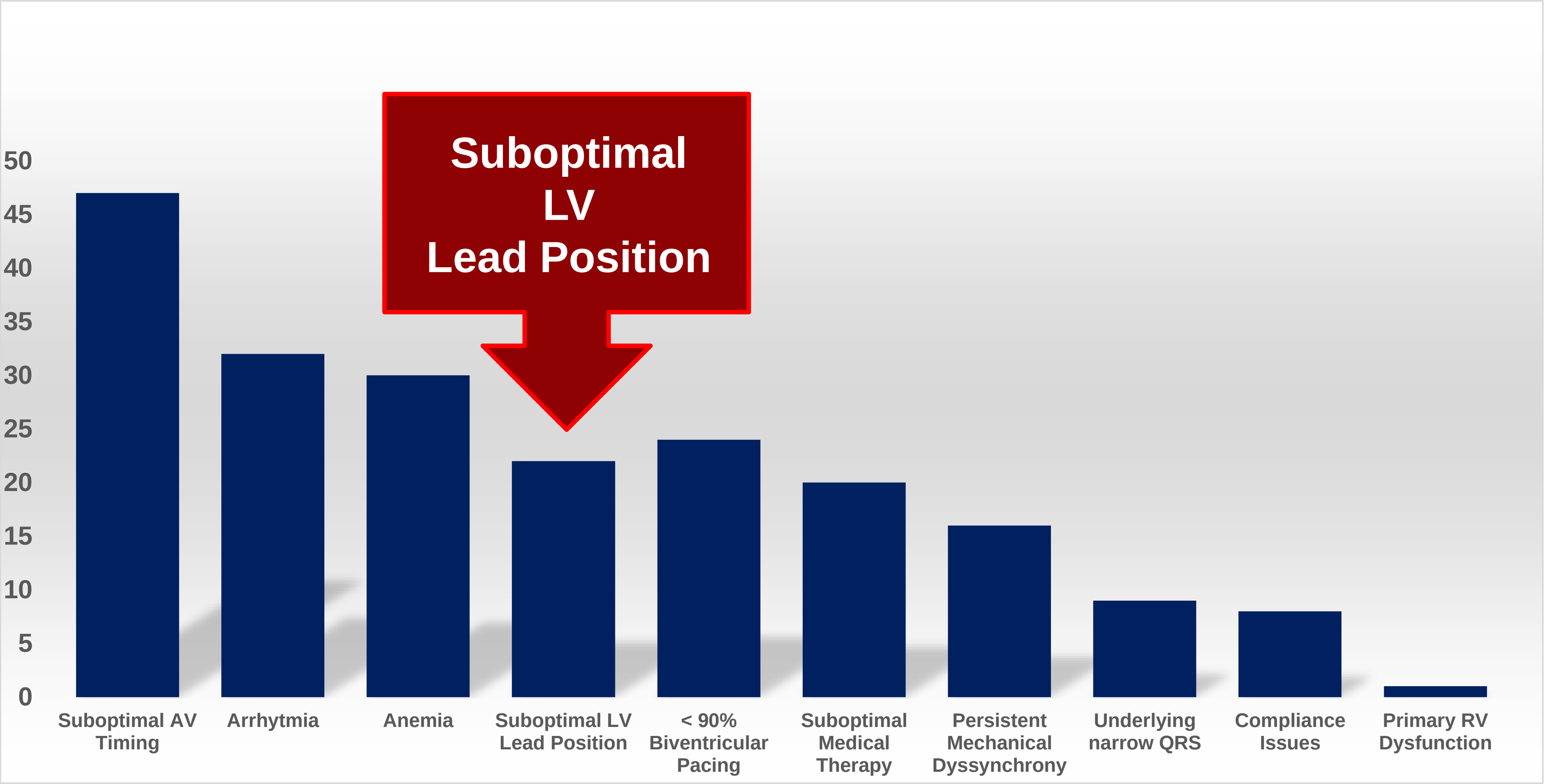
Non Responders per Clinical Study and Response Criteria



Daubert C, et al. Eur Heart Journal 2017;38:1463–1472

Follow up - Non Responders to CRT

Potential Reasons for Non Response



HOSPITAL DE SANTAMARIA

Implantation Failure

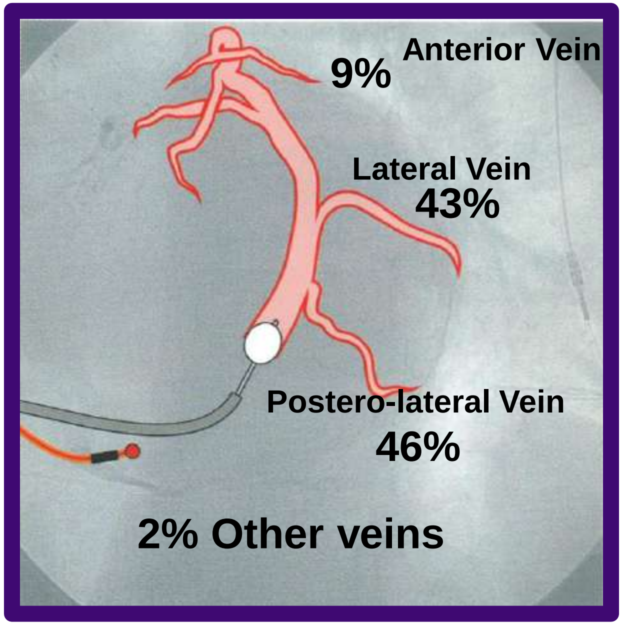
Inadequate LV Lead Position

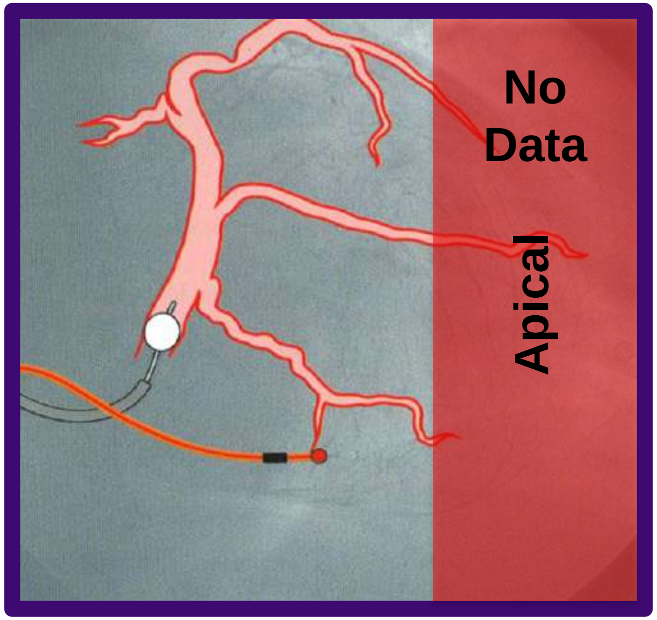
2013 ESC Guidelines on cardiac pacing and cardiac resynchronization therapy

European Heart Journal (2013) **34**, 2281–2329
doi:10.1093/eurheartj/eht150

ESC GUIDELINES

Preferred tools and techniques for implantation of cardiac electronic devices in Europe: results of the European Heart Rhythm Association survey

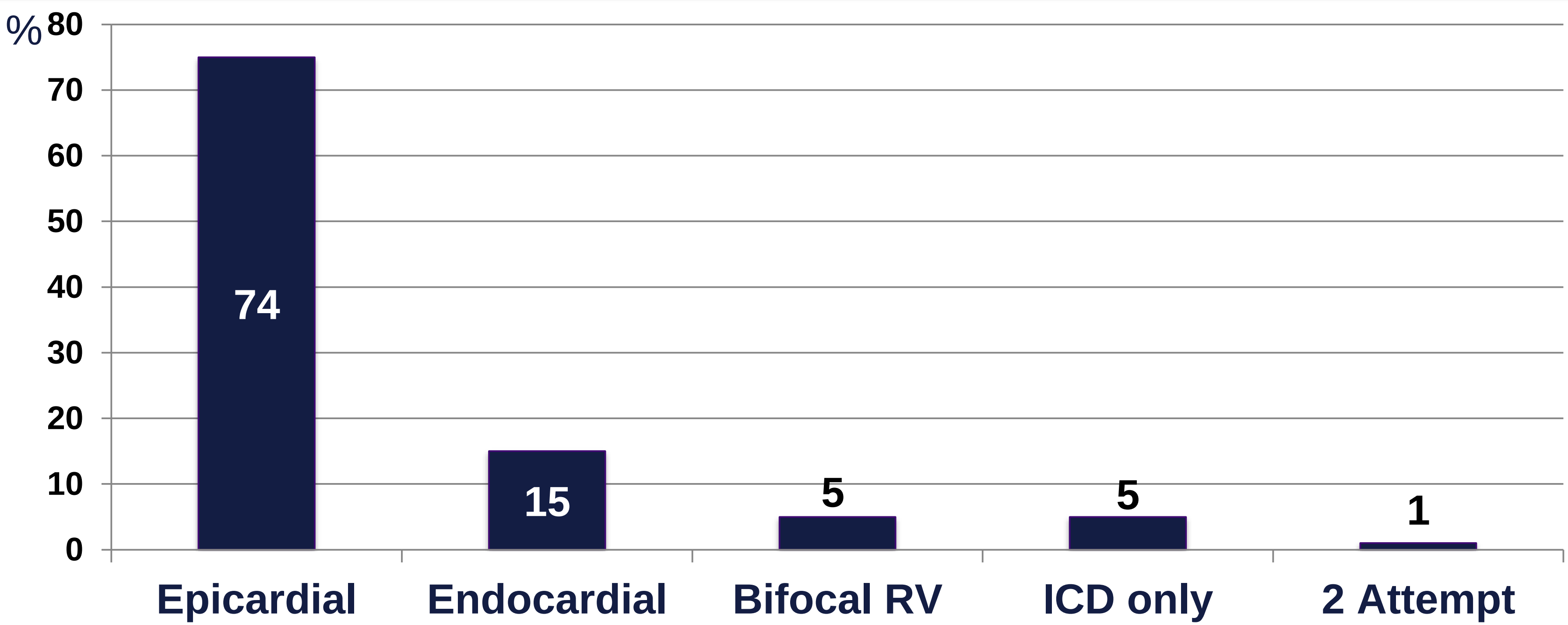




At least 11 % patients have suboptimal LV Lead Position

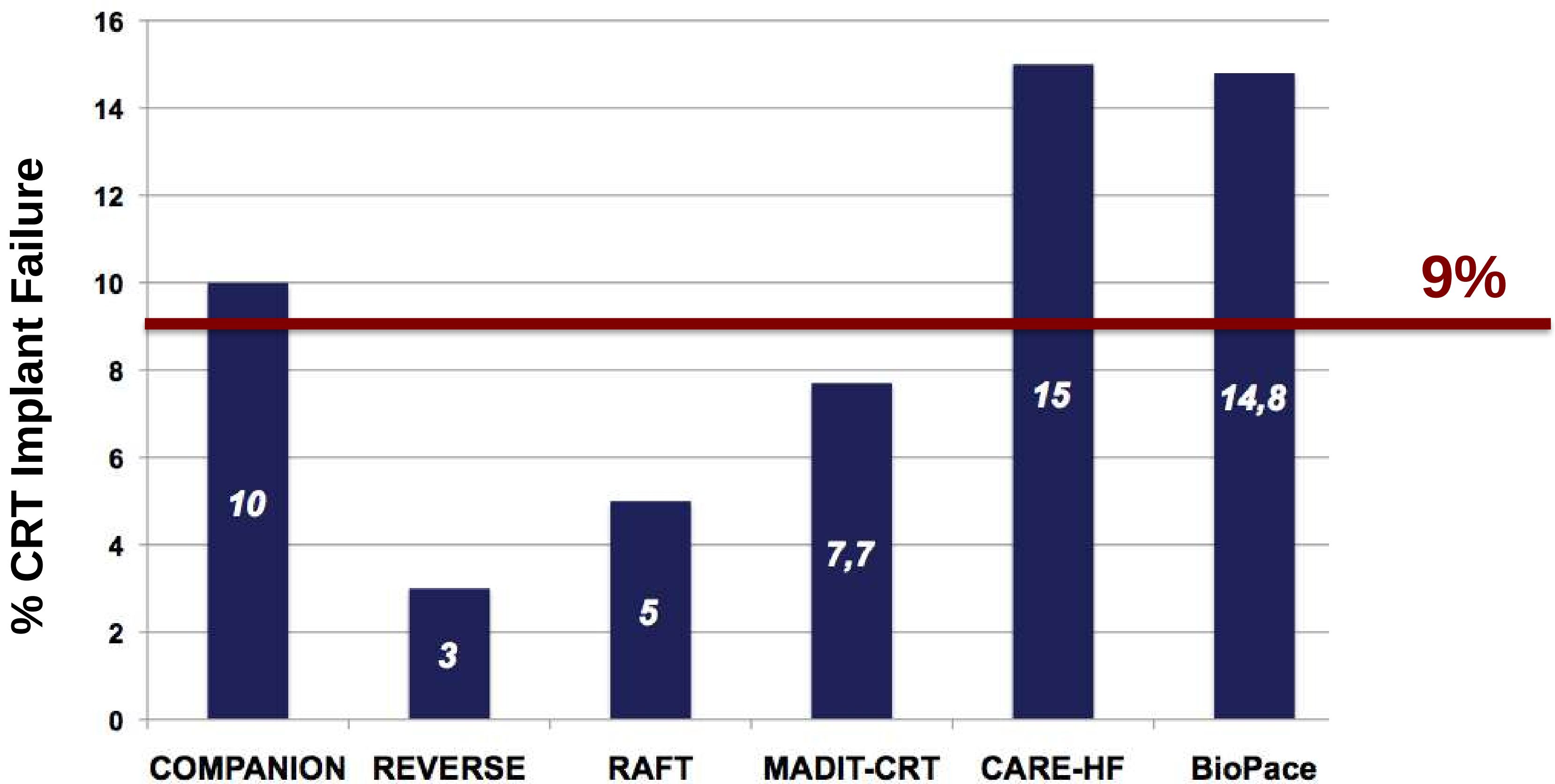
Second option for LV Lead Placement

Preferred tools and techniques for implantation of cardiac electronic devices in Europe: results of the European Heart Rhythm Association survey



Implant Failure

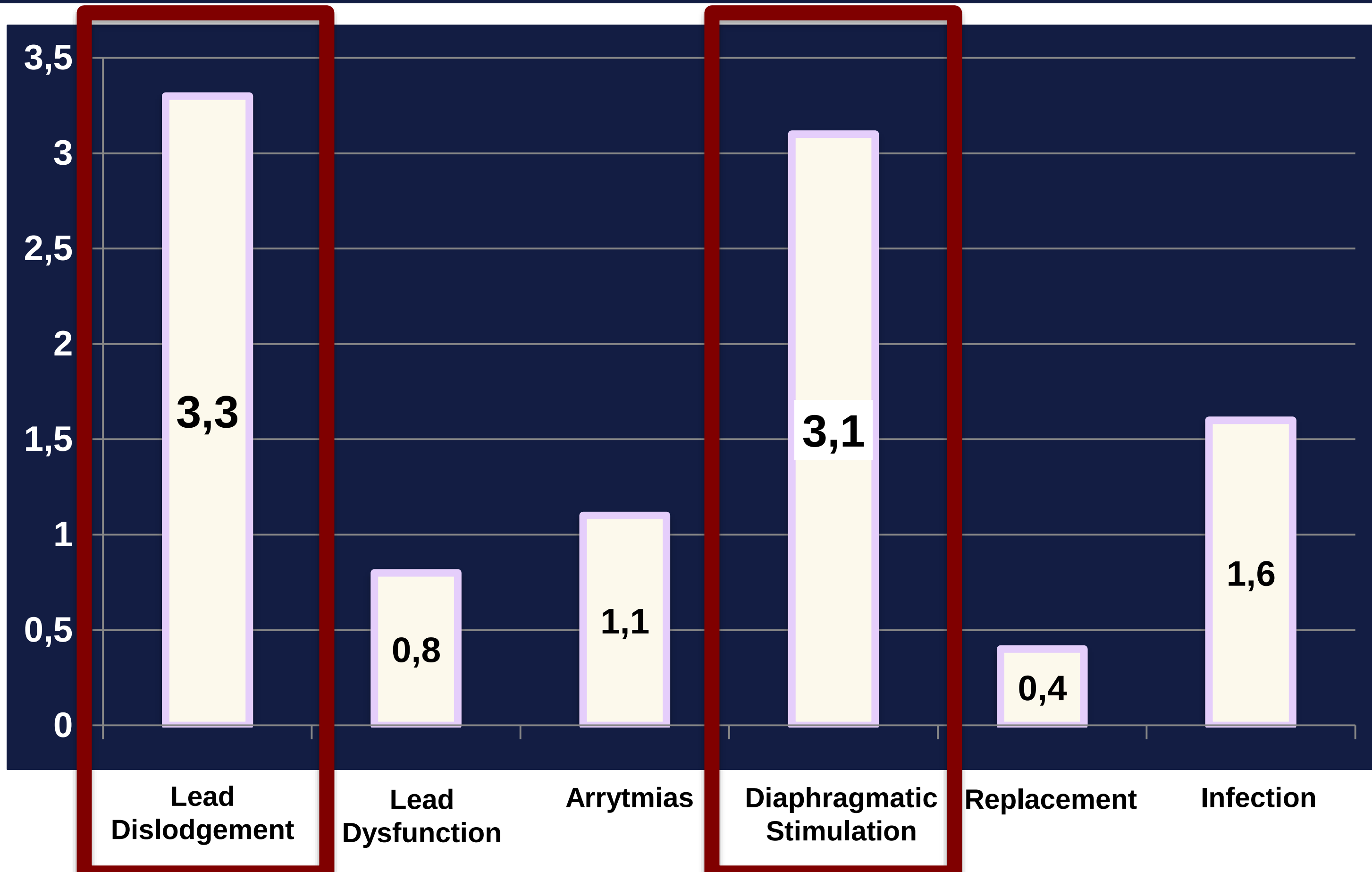
Implant Failure in Randomized Trials



N patients	1212	610	888	746	409	902

Implantation Failure

Short-mid term complications 9-15 months follow-up



6% Complications due to implant difficulties

How to increase the rate of responders ?

How to improve?

- Improvement in patient selection
- Optimization of medical therapy
- Assessment of dyssynchrony
- Assessment of latest activated areas and burden of myocardial scar
- Presence of suitable tributaries

How to improve?

Improvement in patient selection

Optimization of medical therapy

Assessment of dyssynchrony

Assessment of latest activated areas and burden of myocardial scar

Presence of suitable tributaries

How to improve?

Improvement in patient selection

Optimization of medical therapy

Assessment of dyssynchrony

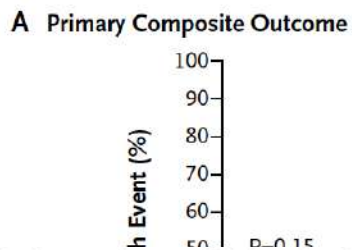
Assessment of latest activated areas and burden of myocardial scar

Presence of suitable tributaries

How to improve?

Assessment of dyssynchrony

- Evaluated pre-procedure?
- Large RCTs have failed to prove benefit evaluating dyssynchrony (EchoCRT, PROSPECT)



Conclusion—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. Efforts aimed at reducing variability arising from technical and interpretative factors may improve the predictive power of these echocardiographic parameters in a broad clinical setting. (***Circulation*. 2008;117:2608-2616.**)

Years since Randomization

No. at Risk								
CRT	404	297	223	155	103	65	42	19
Control	405	302	236	166	119	71	44	15

N Engl J Med 2013; 369:1395-1405

Circulation 2008; 117:2608-2616

How to improve?

Assessment of dyssynchrony

Assessment of latest activated areas and burden of myocardial scar

Presence of suitable tributaries

How to improve?

Assessment of latest activated areas and burden of myocardial scar

- Image-guided LV placement in latest activated areas (TARGET, STARTER)

	Target Group (n = 103)	Control Group (n = 104)	p Value
Latest site of activation, % (% basal/mid)			0.962
Inferior	13 (13) [4/9]	14 (15) [5/9]	
Posterior	38 (39) [14/24]	41 (43) [15/26]	
Lateral	32 (33) [13/19]	31 (32) [11/20]	
Anterior	9 (9) [3/6]	7 (7) [3/4]	
Anteroseptal	4 (4) [1/3]	4 (4) [1/3]	
Inferoseptal	4 (4) [1/3]	3 (3) [0/3]	
LV lead position, % (% basal/mid/apical)			0.442
Inferior	12 (12) [4/7/1]	6 (6) [1/4/1]	
Posterior	35 (36) [12/20/3]	38 (40) [14/22/2]	
Lateral	46 (47) [16/29/1]	47 (49) [13/31/3]	
Anterior	3 (3) [1/2]	6 (6) [2/4]	

	Echocardiographic-Guided CRT (n=96)	Routine Control CRT (n=69)	*P* Value
Distribution of LV lead location			
LAO projection			0.867
Anterolateral	17%	15%	
Lateral	40%	46%	
Posterolateral	36%	30%	
Posterior	7%	9%	
RAO projection			0.114
Basal	39%	17%	
Mid-ventricular	39%	43%	
Apical	23%	33%	

JACC Vol. 59, No. 17, 2012

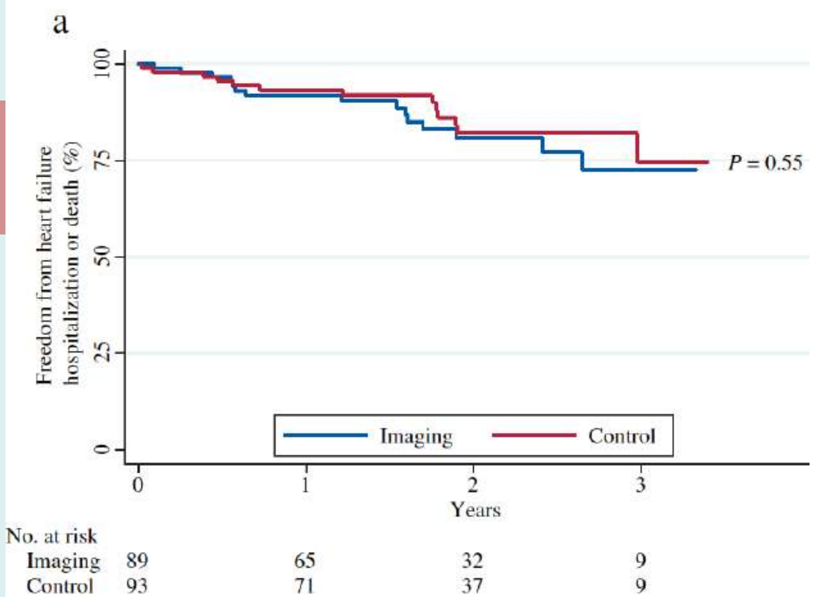
Circ Heart Fail. 2013;6:427-434

How to improve?

Assessment of latest activated areas and burden of myocardial scar

- Multimodality imaging-guided LV lead placement

	Imaging group (*n* = 89)	Control group (*n* = 93)	*P*
Optimal CS tributary			0.90
Anterior vein	1 (1)	1 (1)	
Left marginal vein	62 (70)	62 (67)	
Posterior vein	26 (29)	29 (31)	
Middle cardiac vein	0 (0)	1 (1)	
Optimal LV pacing site			0.75
Anterior	1 (1)	1 (1)	
Lateral	62 (70)	61 (66)	
Posterior	26 (29)	29 (31)	
Inferior	0 (0)	2 (2)	
Distribution of LV lead position by cardiac CT			0.11
LV short-axis			
Anterior	4 (5)	2 (2)	
Lateral	41 (47)	38 (42)	
Posterior	39 (44)	50 (56)	
Inferior	4 (5)	0 (0)	
LV long-axis			0.43
Basal	48 (55)	52 (58)	
Mid-LV	36 (41)	37 (41)	
Apical	4 (5)	1 (1)	
LV lead electrical delay, % of QRS	80 (72–85)	78 (68–84)	0.24
Relationship of LV lead to optimal CS branch			0.01
1. priority	74 (83)	60 (65)	
2. or 3. priority	15 (17)	32 (35)	
Relationship of LV lead to optimal pacing site			0.66
Concordant	43 (49)	39 (43)	
Adjacent	44 (50)	49 (54)	
Remote	1 (1)	2 (2)	
Scar at LV pacing site	3 (3)	2 (2)	0.68

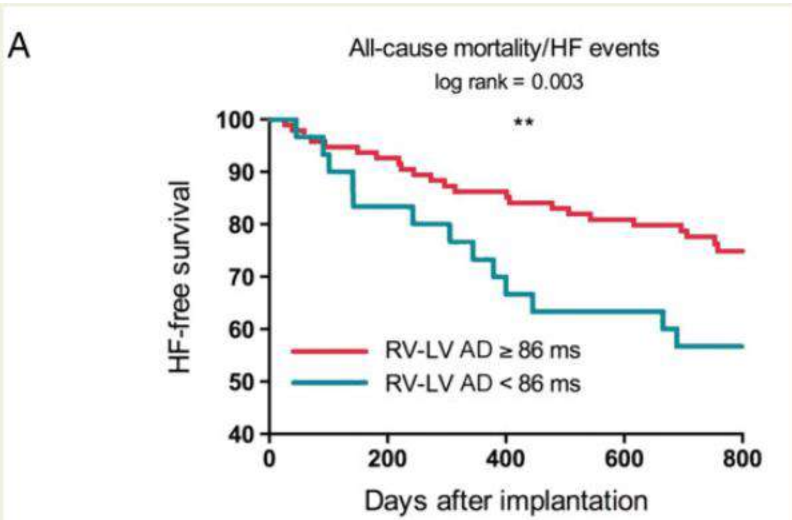


European Journal of Heart Failure (2016) 18, 1365–1374

How to improve?

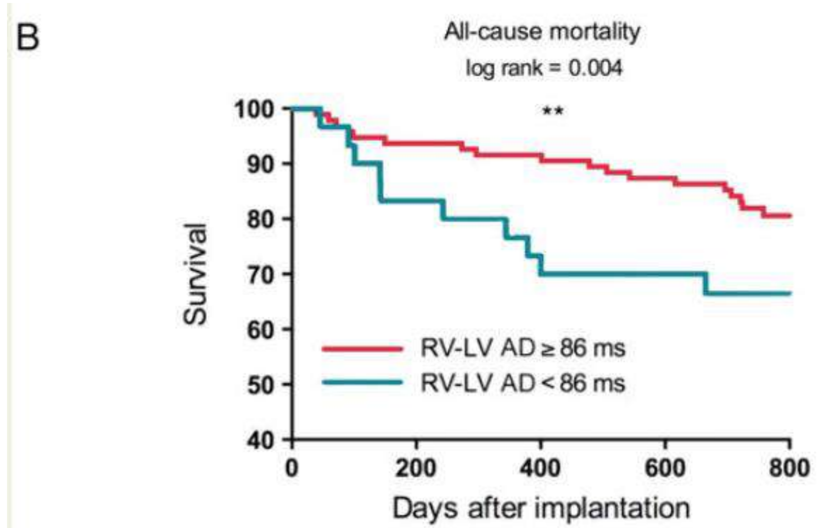
Assessment of latest activated areas and burden of myocardial scar

- LV lead implantation in LAD → reduction of all-cause mortality and HF events



Patients at risk

RV-LV AD ≥ 86 ms	95	87	82	76	38
RV-LV AD < 86 ms	30	26	21	20	12



Patients at risk

RV-LV AD ≥ 86 ms	95	90	88	83	43
RV-LV AD < 86 ms	30	25	22	22	14

How to improve?

Assessment of latest activated areas and burden of myocardial scar

- LV lead implantation in lateral/posterior wall, non-apical is associated with reduction in death/HF events.

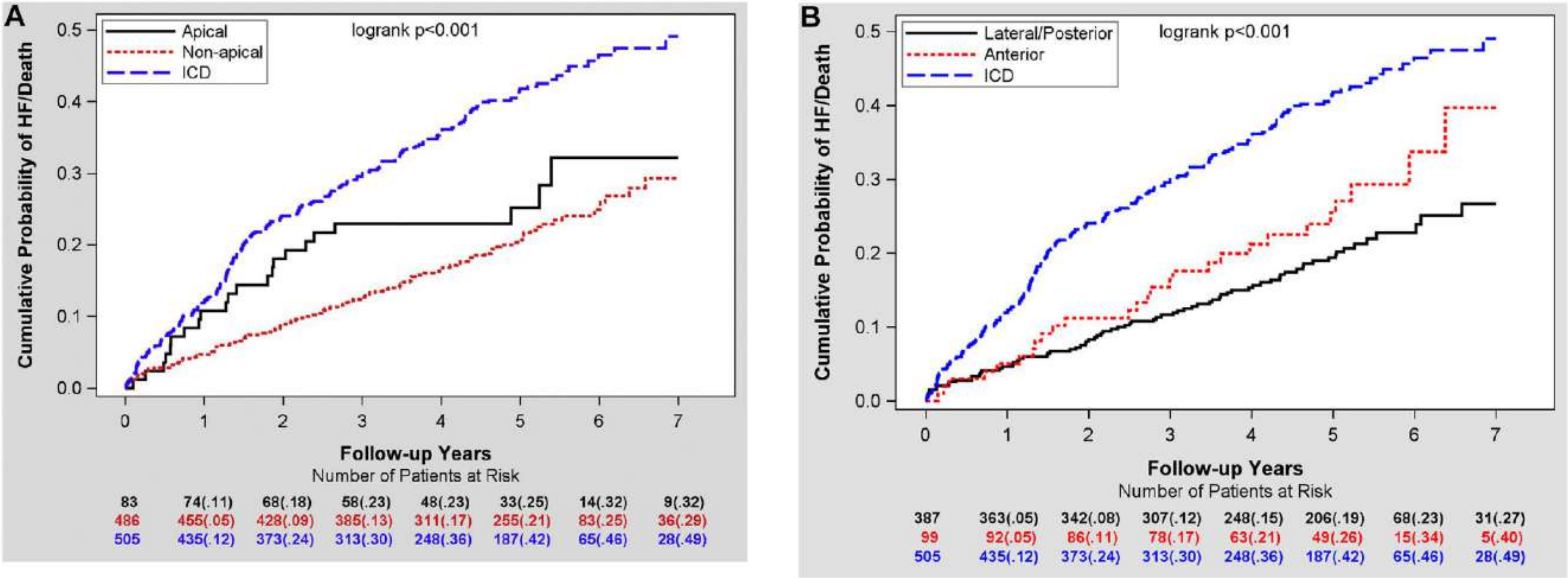


FIGURE 1 **Cumulative Probability of Heart Failure or Death in Patients With LBBB ECG Pattern by LV Lead Location**

Kutyifa et al.; JACC clinical electrophysiology 2018

HOSPITAL DE SANTA MARIA

How to improve?

Assessment of dyssynchrony

Assessment of latest activated areas and burden of myocardial scar

Yes, but...

How to improve?

Assessment of dyssynchrony

Assessment of latest activated areas and burden of myocardial scar

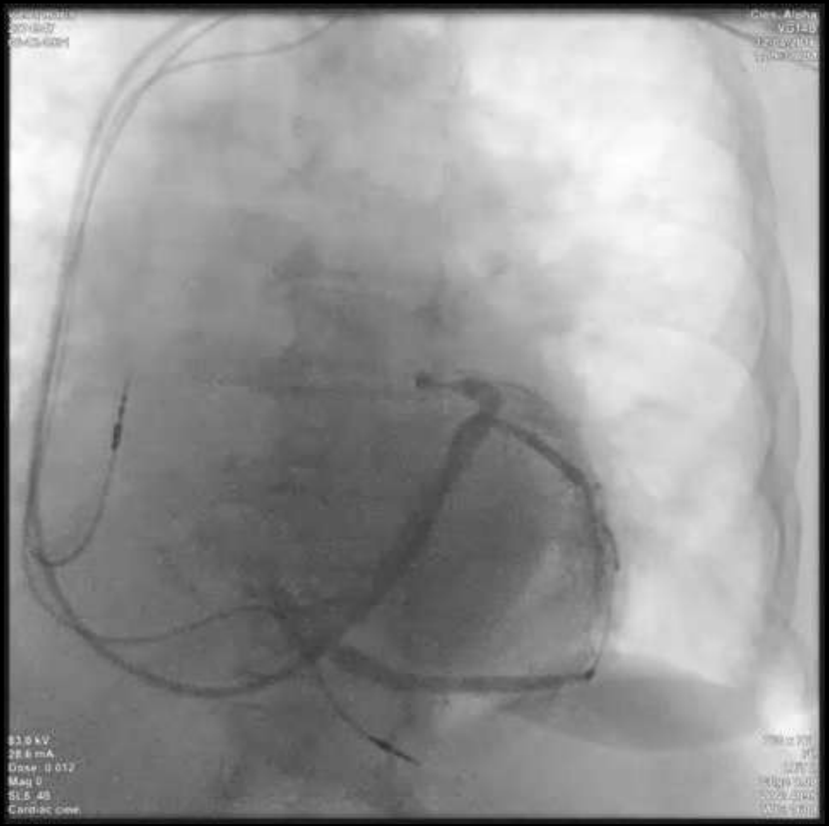
Presence of suitable tributaries

Delivery of CRT

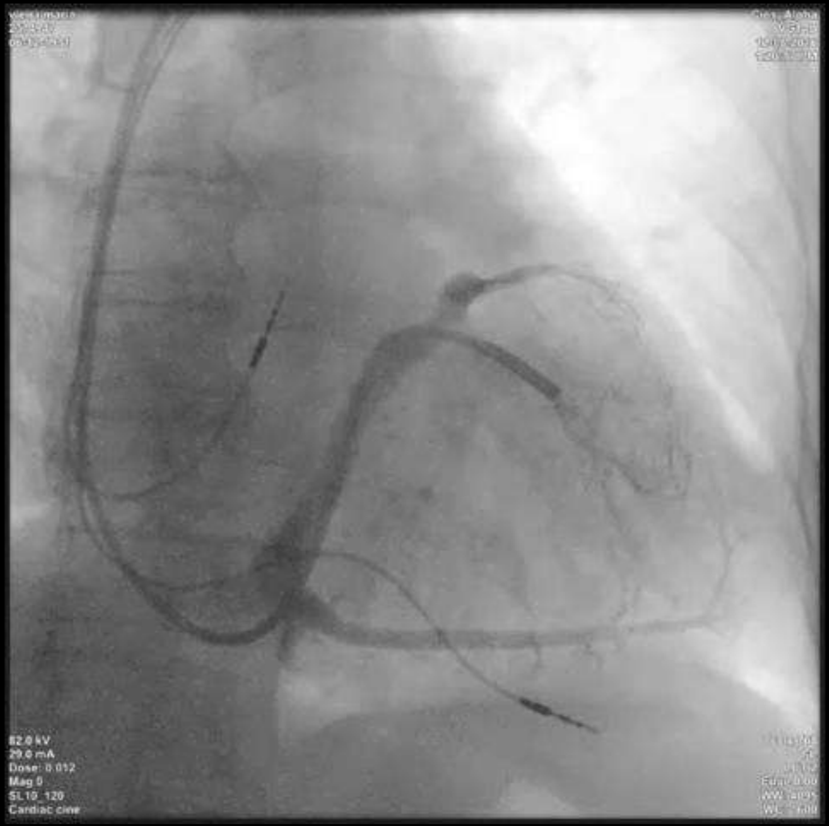
- **Technical challenges of LV lead implantation**
- Latest activated areas
- Multisite pacing
- Multipoint pacing

LV position

Venogram



LAO view

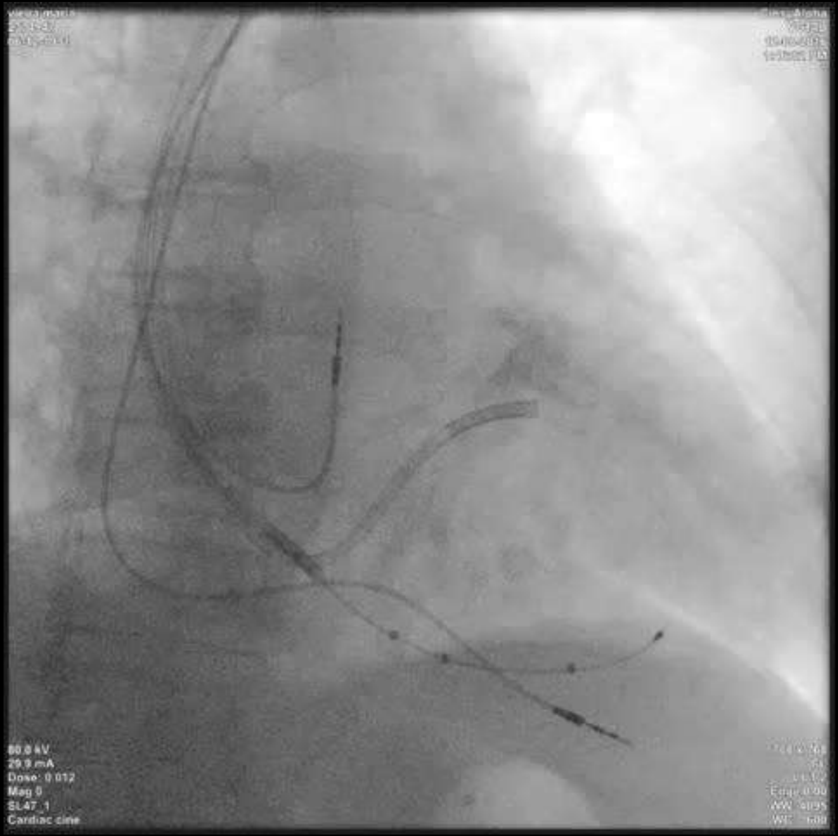


RAO view

HOSPITAL DE SANTAMARIA

LV position

Snare

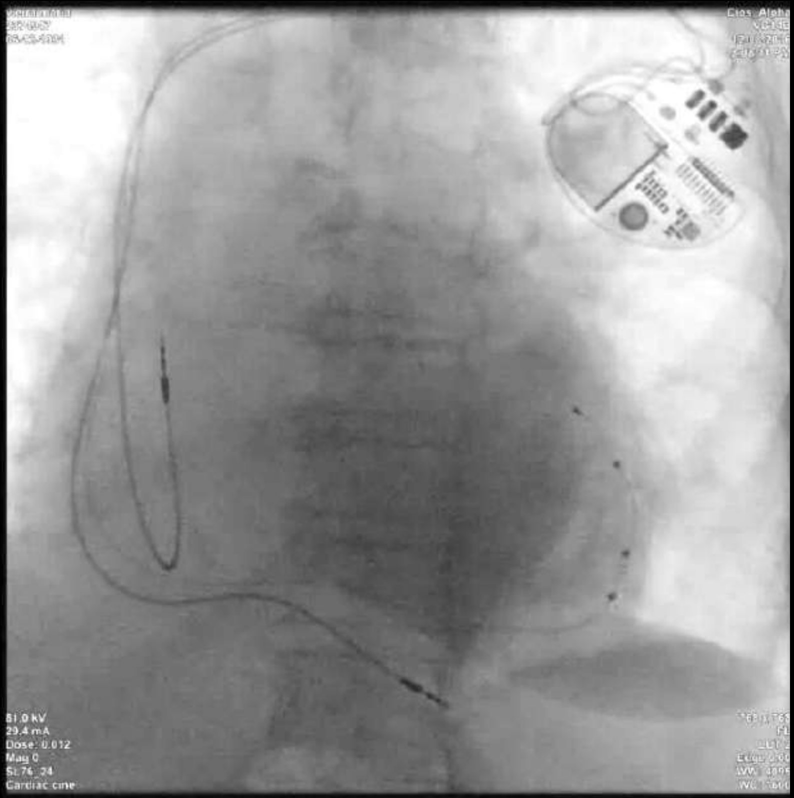


LV lead traction

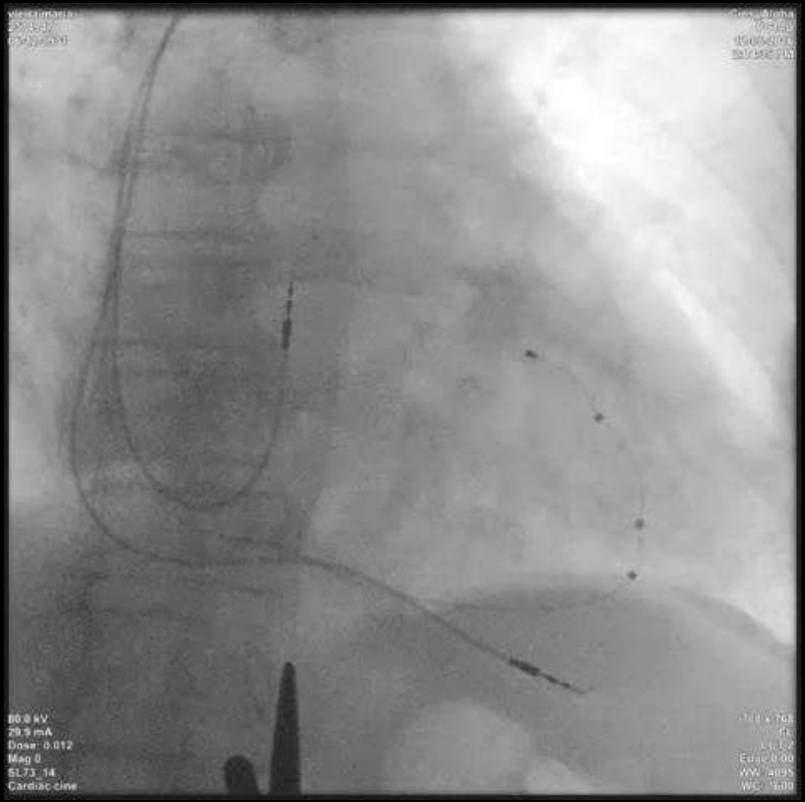
HOSPITAL DE SANTAMARIA

LV position

Final Position

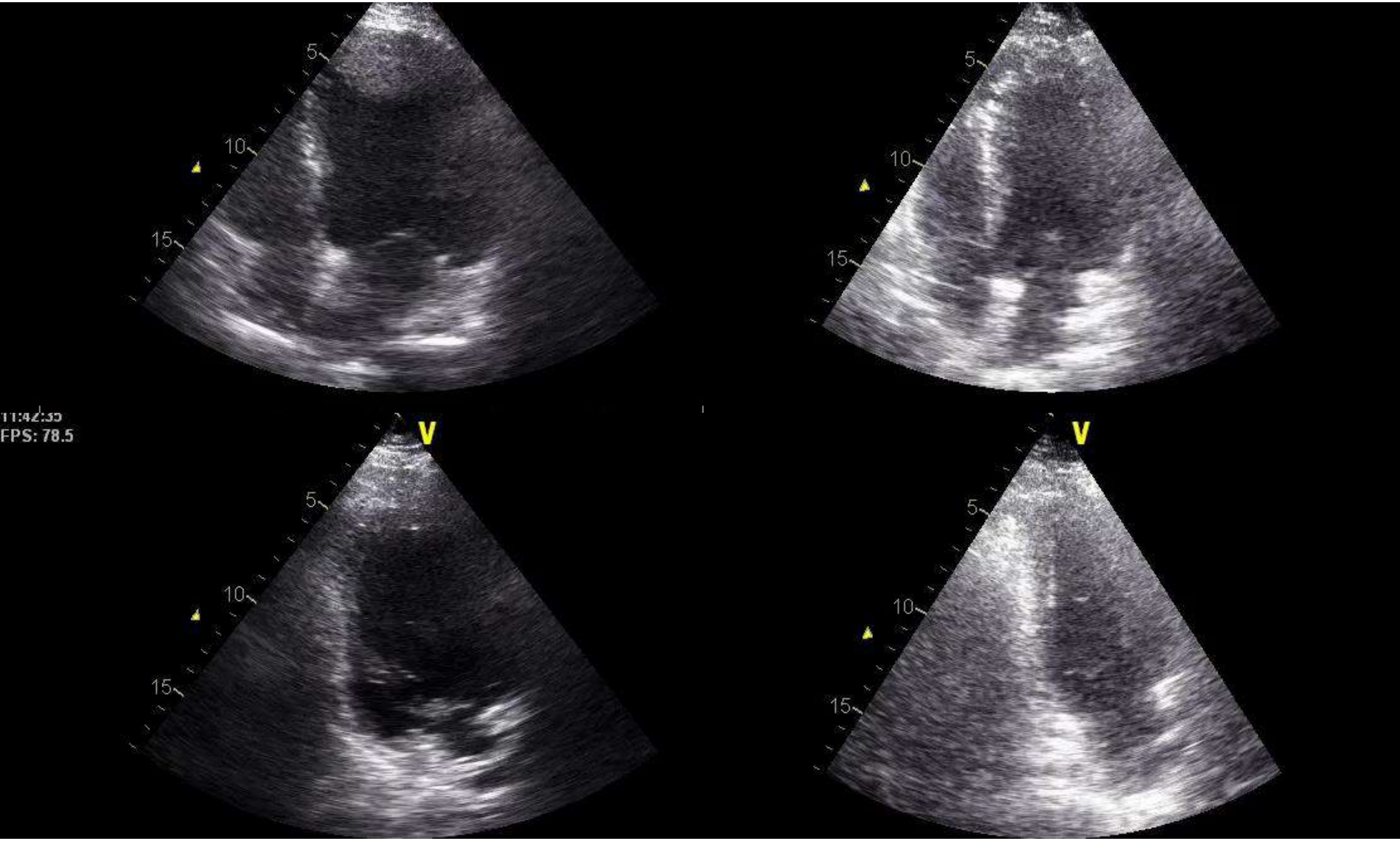


LAO view



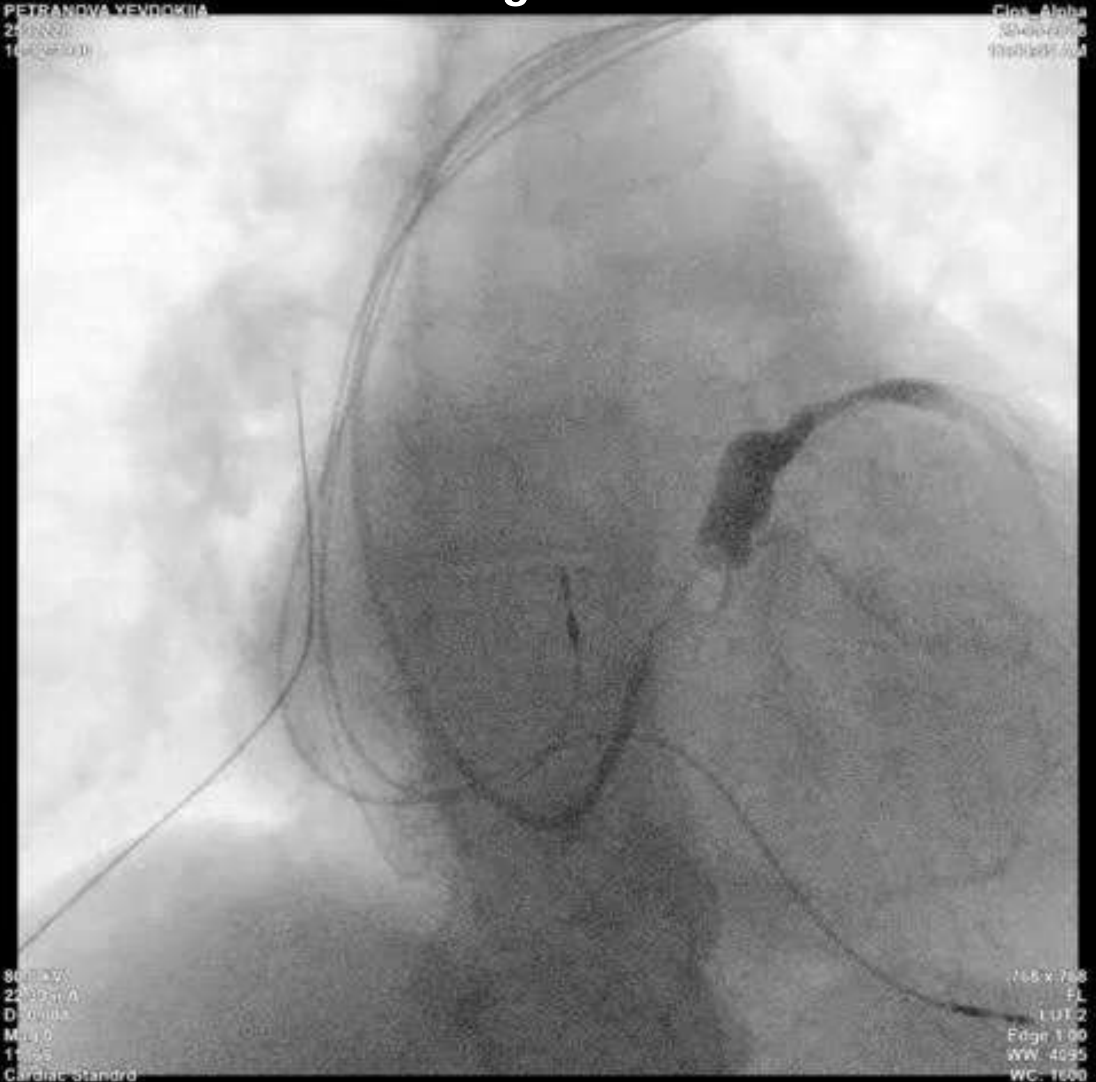
RAO view

Echo – Basal – 6 Months



LV position

Venogram



HOSPITAL DE SANTAMARIA

LV position

Selective Venogram

HOSPITAL DE SANTAMARIA

LV position

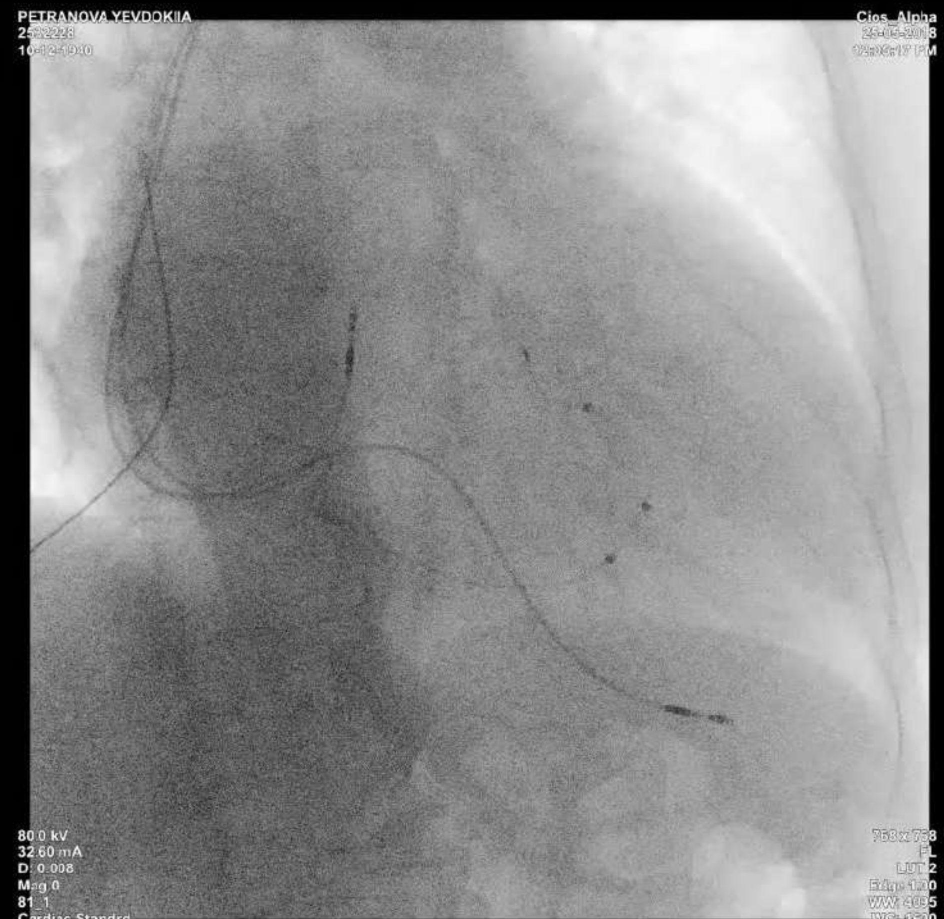
Selective Venogram

LV position

LV position

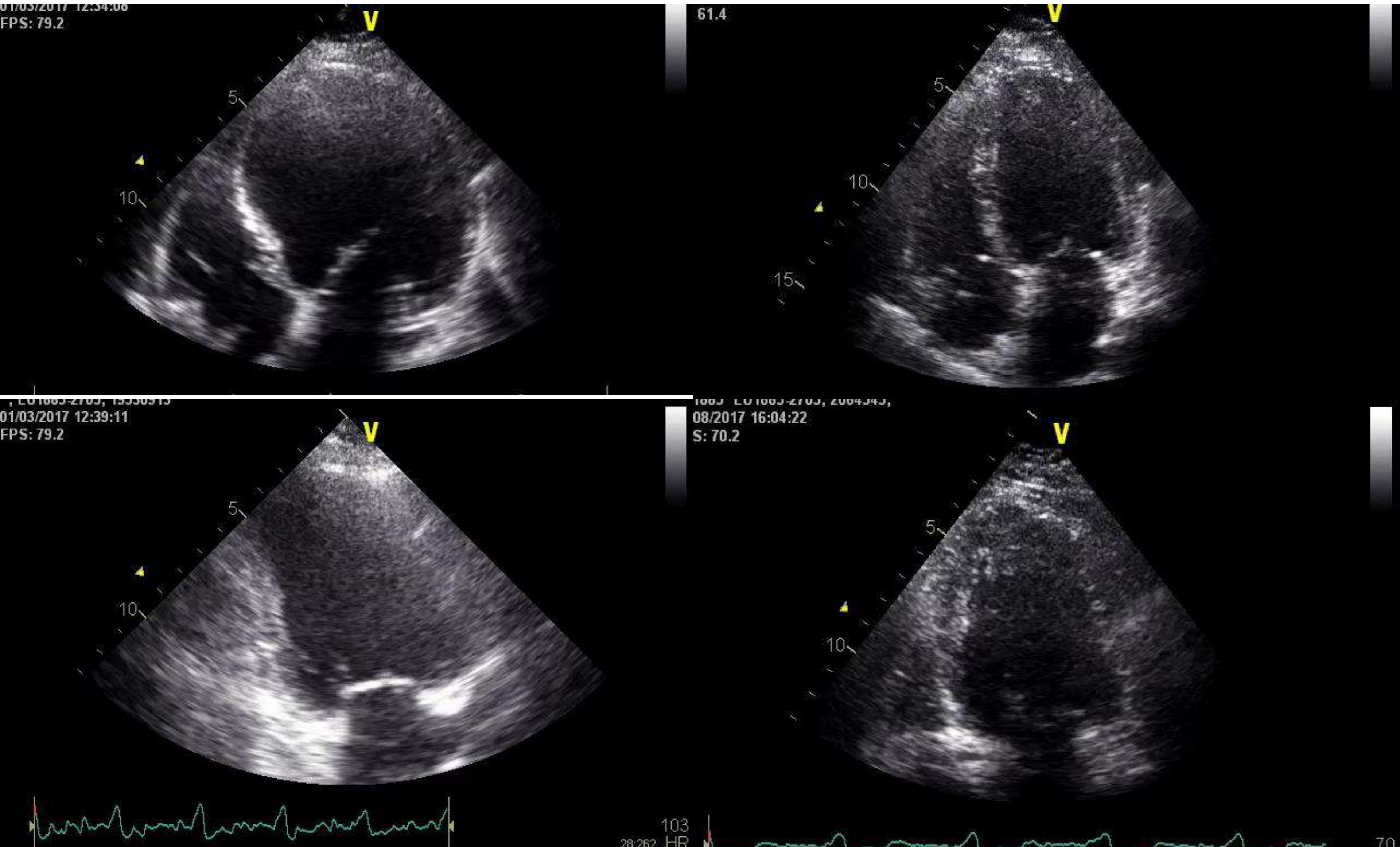
Final Position

LAO view



RAO view

Echo – Basal – 6 Months

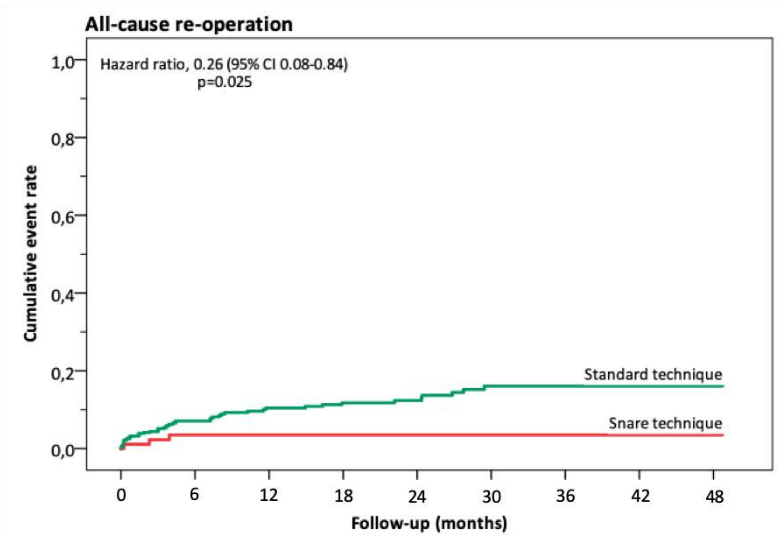


HOSPITAL DE SANTA MARIA

How to improve?

Snare technique after standard technique failure

- 566 CRTs implanted since 2015, 16.6% with snare (n=94).
- Snare technique ↓ all-cause surgical revision with a NNT of 14



Number at risk:									
Snare technique	94	69	61	57	45	37	25	8	3
Standard technique	472	296	219	185	132	97	72	38	17

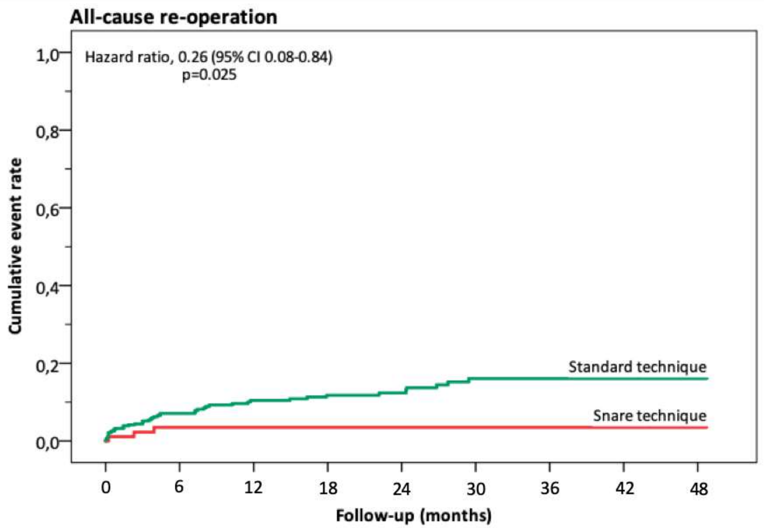
Causes of re-operation	Snare group (N=3)	Standard group (N=50)	Total (N=53)
LV lead implant failure or dislodgment	0	25	25 (47.2%)
RV lead dislodgment	1	9	10 (18.9%)
RA lead dislodgment	1	6	7 (13.2%)
Infection	0	6	6 (11.3%)
Device extrusion	1	4	5 (9.4%)

Unpublished data

How to improve?

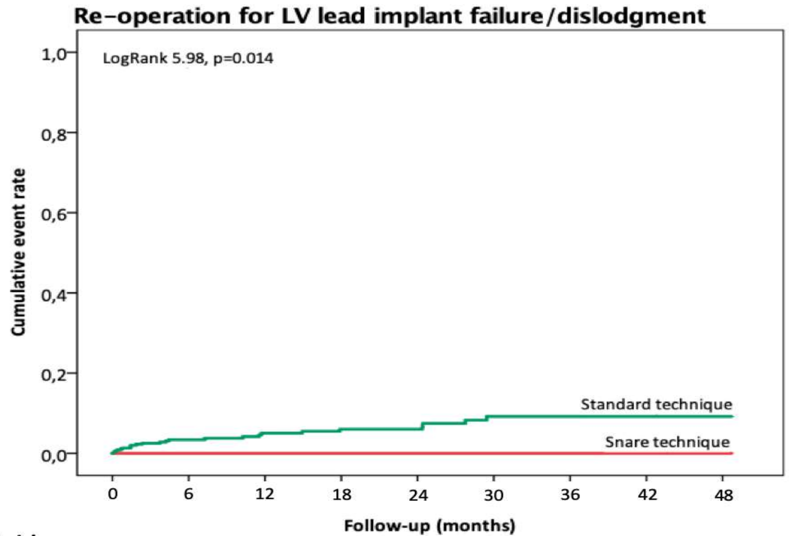
Snare technique after standard technique failure

- 566 CRTs implanted since 2015, 16.6% with snare (n=94).
- Snare technique ↓ all-cause surgical revision with a NNT of 14.
- ↓ surgical revision due to LV lead implant failure/dislodgement



Number at risk:

Snare technique	94	69	61	57	45	37	25	8	3
Standard technique	472	296	219	185	132	97	72	38	17



Number at risk:

Snare technique	94	69	61	57	45	37	25	8	3
Standard technique	472	296	219	185	132	97	72	38	17

Unpublished data

How to improve?

Snare technique after standard technique failure

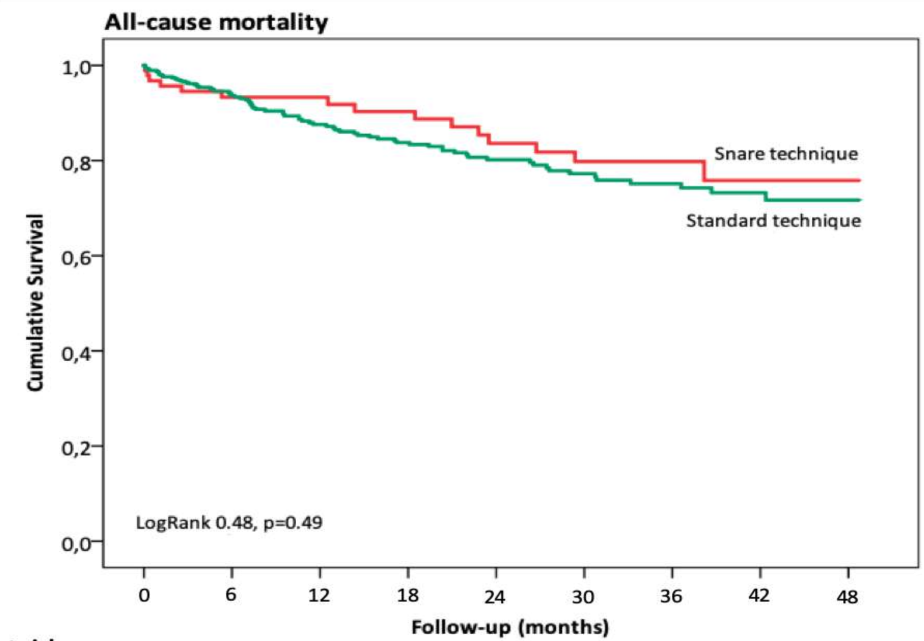
- The rate of major complications, 30-day mortality and all-cause mortality (15.9% vs 15.5%, p = 0.49) were similar between groups.

Major complications

Snare technique	Vs	Standard technique
7.4%		3.8%

P=0.12

++ pericardial efusion and contrast nephropathy



Number at risk:

Snare technique	94	69	61	57	45	37	25	8	3
Standard technique	472	296	219	185	132	97	72	38	17

Unpublished data

HOSPITAL DE SANTA MARIA

How to improve?

Snare technique after standard technique failure

- Response to CRT in 64% of patients who would not benefit from the therapy otherwise.

Reverse *remodeling*

Responders Vs **Hyper responders**

64% **29%**

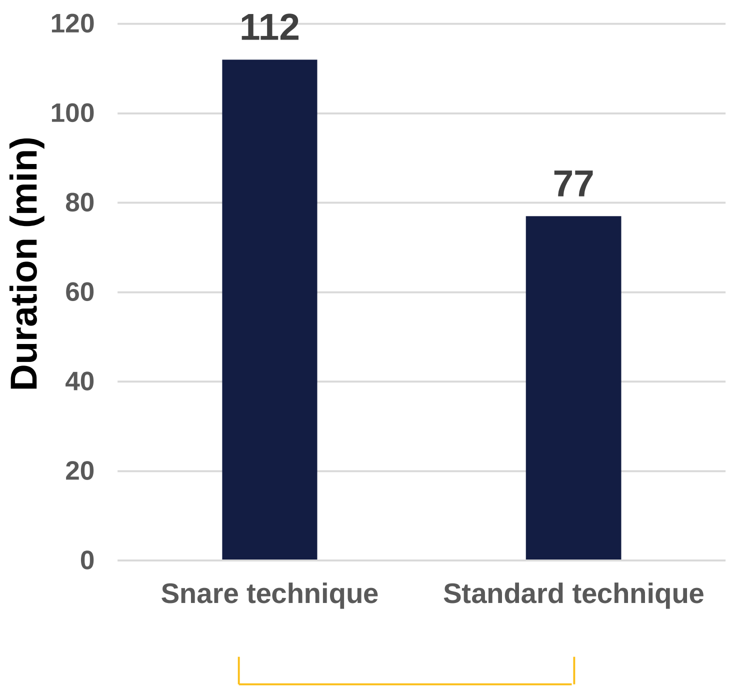
Unpublished data

How to improve?

Snare technique after standard technique failure

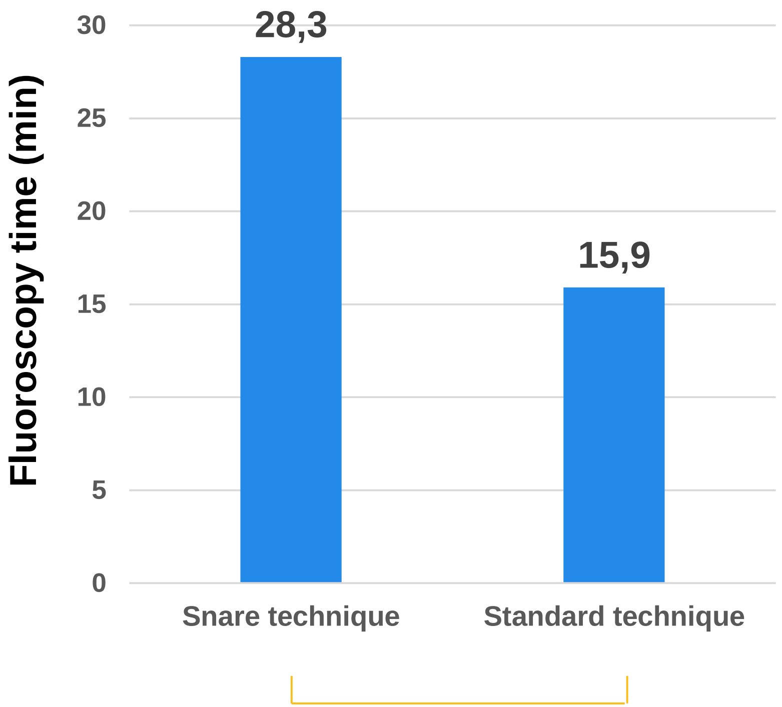
- Snare technique with longer procedure duration and fluoroscopy time.

Procedure duration



P<0.01

Fluoroscopy time



P<0.01

Unpublished data

How to improve?

Assessment of dyssynchrony

Assessment of latest activated areas and burden of myocardial scar

Presence of suitable tributaries

Delivery of CRT

- Technical challenges of LV lead implantation
- **Latest activated areas**
- Multisite pacing
- Multipoint pacing

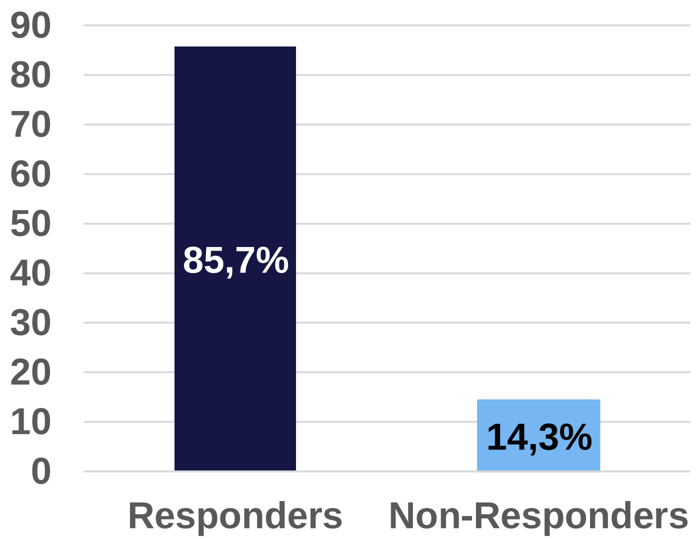
HOSPITAL DE SANTA MARIA

iBox-CRT: Can we do it better?

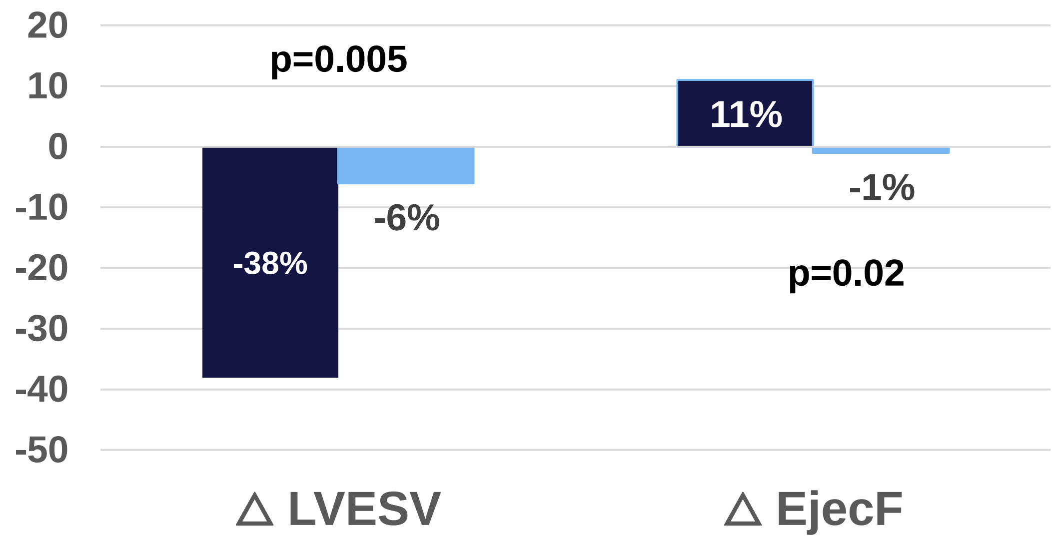
Automatically, *operator-independent*, assess the conduction delay between RV pacing and the LV available veins to select the LV pacing site.
Evaluate the impact of LV site on clinical and remodeling outcomes.

Response Rate Overall population

Reduction LVESV > 15%
Increase EF > 10%



LVESV and Ejection Fraction Variations 0-6 Months



Unpublished data

How to improve?

Assessment of dyssynchrony

Assessment of latest activated areas and burden of myocardial scar

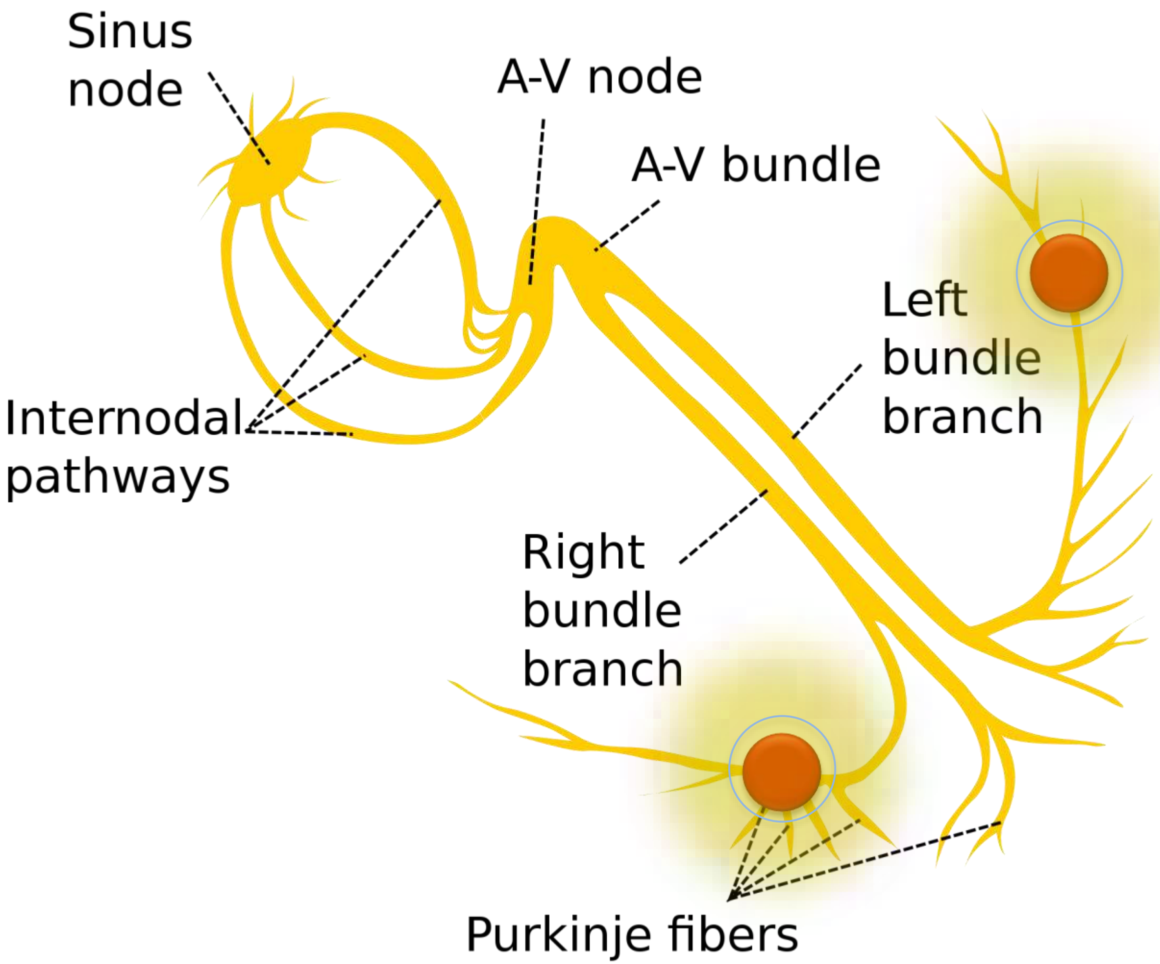
Presence of suitable tributaries

Delivery of CRT

- Technical challenges of LV lead implantation
- Latest activated areas
- **Multisite pacing**
- Multipoint pacing

CRT – Clinical Evidence

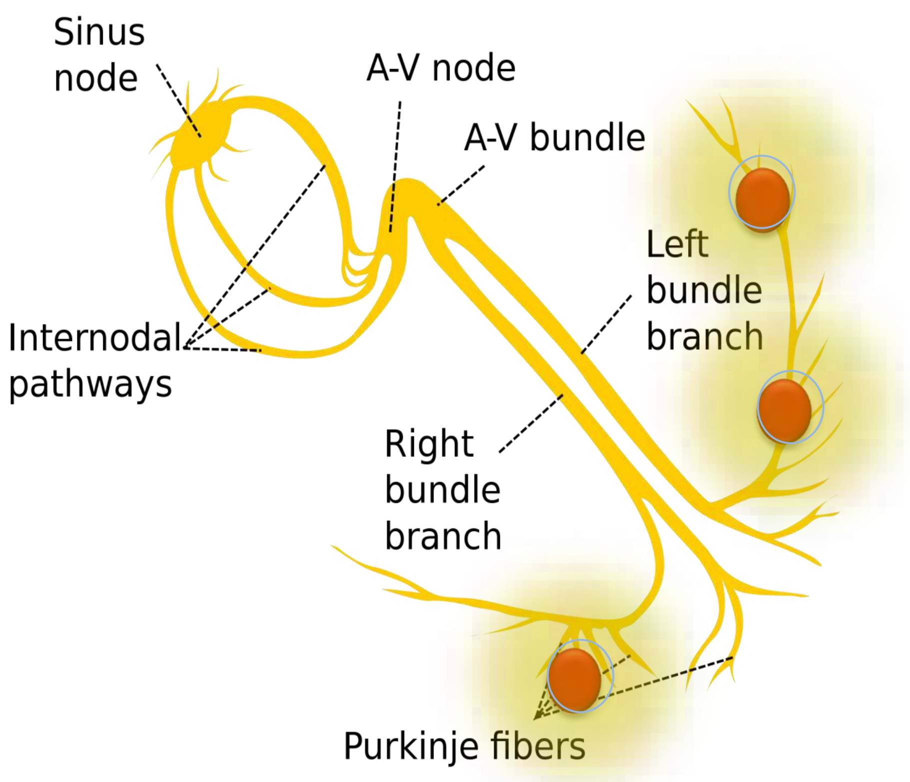
The Benefit from CRT is well established



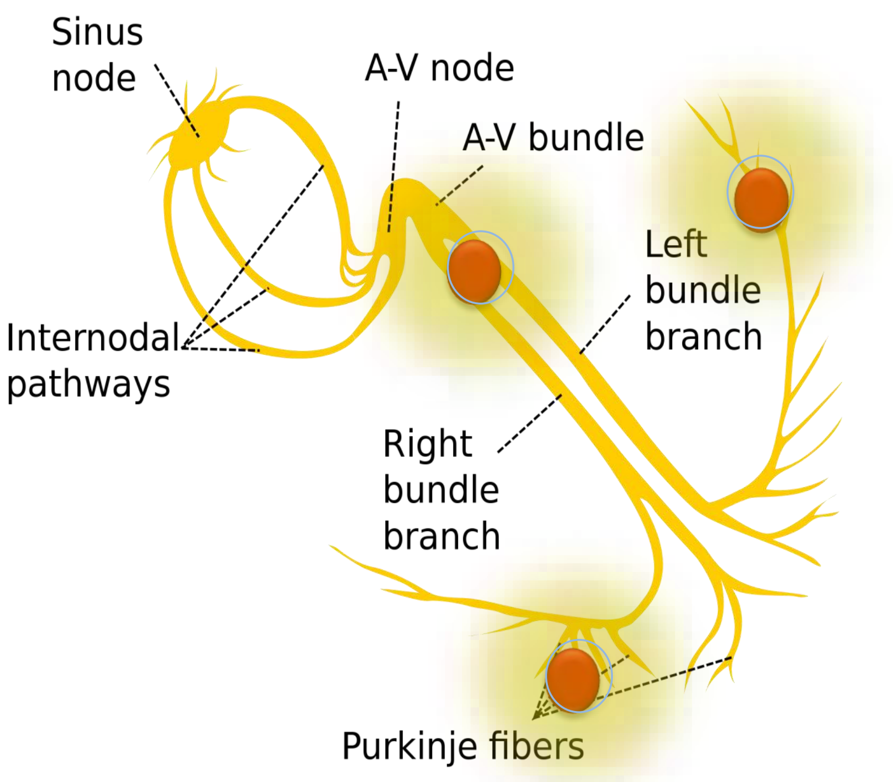
CRT – Clinical Evidence

Multisite pacing

- **1 RV lead + 2 LV leads**



- **2 RV leads + 1 LV lead**



How to improve?

Multisite pacing

- Multisite pacing improves symptoms, QoL, LVEF

Table 1 Patient baseline characteristics

Group	Global	Tri-V
N	40	33
Age (years, mean ± SD)	73 ± 11	72 ± 10
Male sex (*N*, %)	37 (97.5)	28 (85)
Ischemic cardiomyopathy (*N*, %)	10 (25)	7 (21)
NYHA I (*N*, %)	3 (7.5)	2 (6)
NYHA II (*N*, %)	14 (34)	12 (36)
NYHA III (*N*, %)	24 (58.5)	19 (58)
NYHA IV (*N*, %)	0 (0)	0 (0)
Angiotensin conversion enzyme inhibitor (*N*,%)	34 (85)	28 (85)
Aldosterone receptor blocker (*N*,%)	3 (7.5)	3 (9)
Mineralocorticoid receptor antagonist (*N*,%)	23 (57.5)	19 (57.5)
Beta-blocker (*N*,%)	34 (85)	27 (82)
Diuretic (*N*,%)	36 (90)	29 (88)
Digoxin (*N*,%)	11 (27.5)	8 (245)
Amiodarone (*N*,%)	7 (17.5)	6 (18)
Antithrombotics (*N*,%)	6 (15)	4 (12)
Vitamin K antagonist (*N*,%)	24 (60)	21 (64)
Novel oral anticoagulant (*N*,%)	11 (27.5)	9 (27.5)
Pre-implantation QRS (ms)	170 ± 25	169 ± 27
Left bundle branch block pattern (*N*, %)	34 (85)	29 (87.9)
Pre-implantation ejection fraction (%,mean ± SD)	25 ± 8	26 ± 7
CRT-D (*N*, %)	26 (65)	26 (58)
CRT-P (*N*, %)	14 (35)	14 (42)
AV node ablation (*N*, %)	6 (17.5)	6 (18.2)

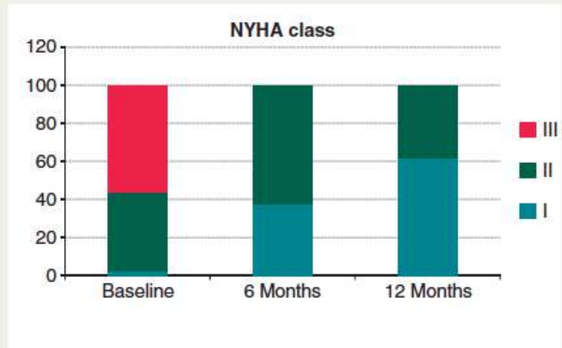


Figure 2 NYHA class distribution (%) at the various time points among all Tri-V patients.

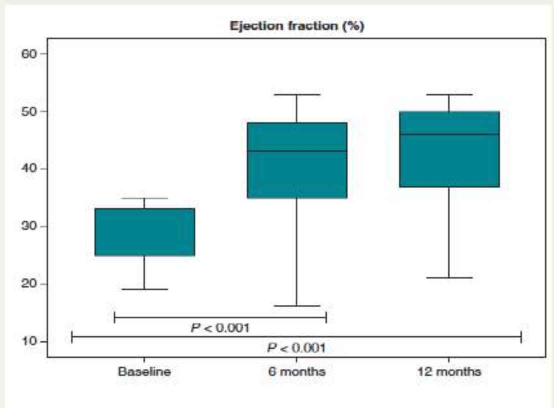


Figure 3 Mean ejection fraction during follow-up.

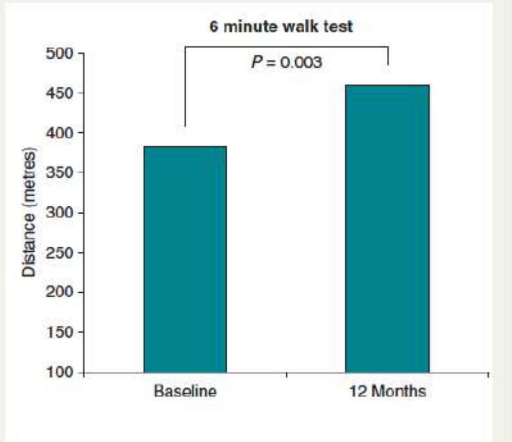


Figure 5 Six-minute walking test distance.

Marques P, et al. Europace (2018) 20, 986–992

How to improve?

Assessment of dyssynchrony

Assessment of latest activated areas and burden of myocardial scar

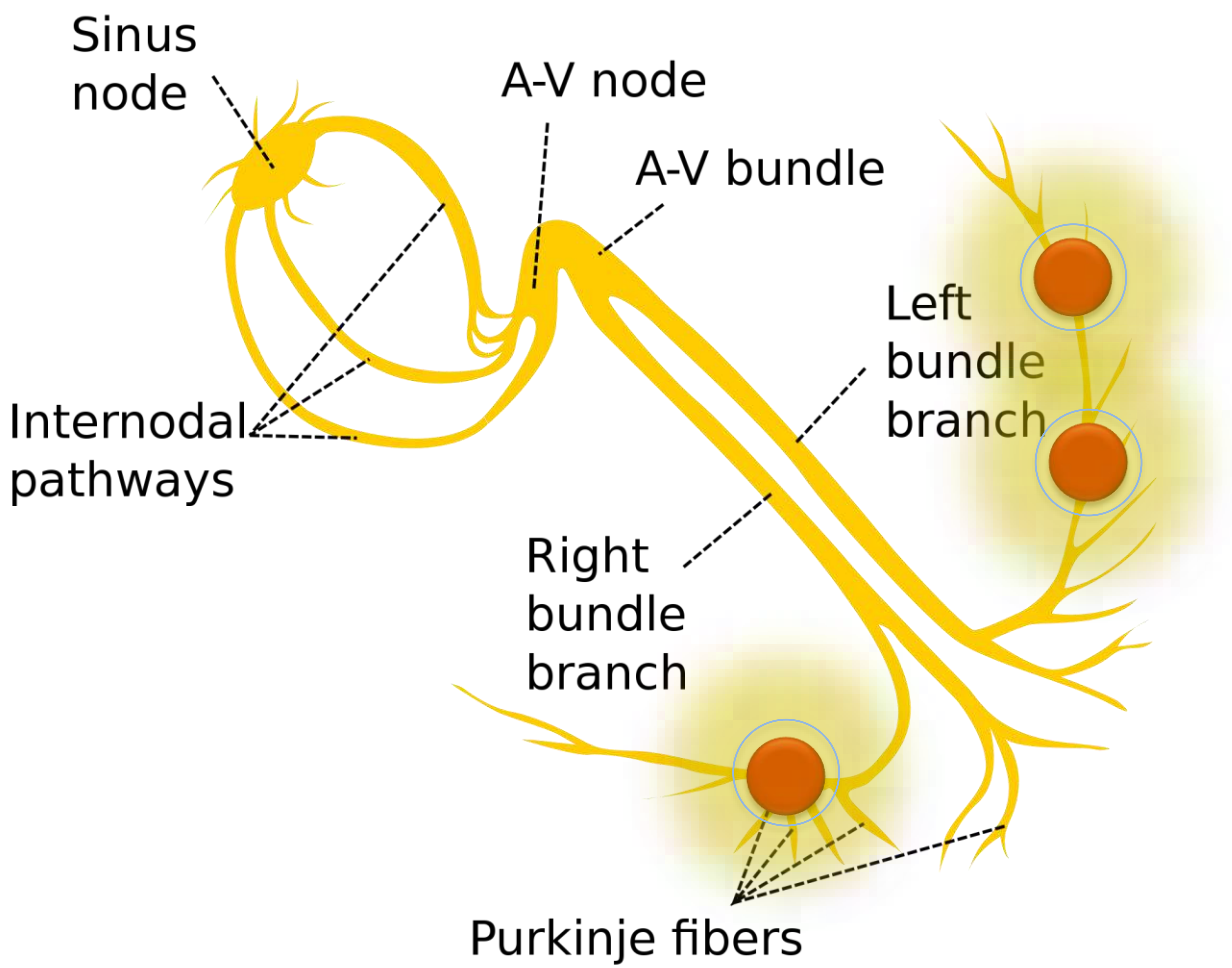
Presence of suitable tributaries

Delivery of CRT

- Technical challenges of LV lead implantation
- Latest activated areas
- Multisite pacing
- **Multipoint pacing**

CRT – Clinical Evidence

Multipoint pacing



CRT – Clinical Evidence

Quadripolar Pacing Technology MultiPoint™ Pacing

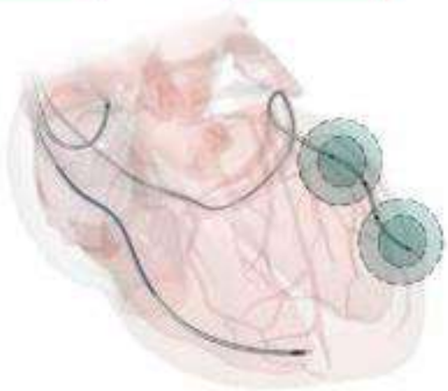
Quartet™ LV Lead 1458Q

Electrode naming and spacing

distal	D1	
		20 mm
	M2	
		10 mm
	M3	
		17 mm
proximal	P4	

Ability to pace from **2 LV sites** with **programmable delays**

LV1 → Delay 1 → **LV2** → Delay 2 → **RV**



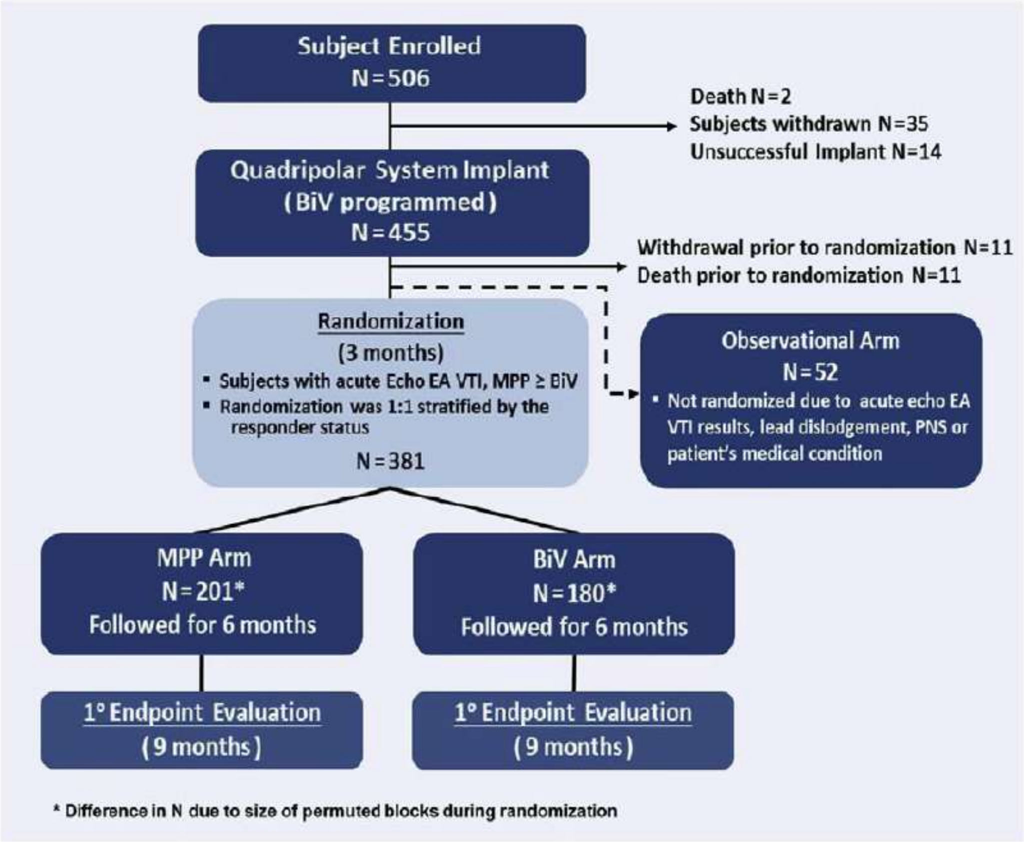
LV1 and LV2 VectSelect™ options

Vector	Cathode to Anode
Vector 1	Distal 1 to Mid 2
Vector 2	Distal 1 to Proximal 4
Vector 3	Distal 1 to RV Coil
Vector 4	Mid 2 to Proximal 4
Vector 5	Mid 2 to RV Coil
Vector 6	Mid 3 to Mid 2
Vector 7	Mid 3 to Proximal 4
Vector 8	Mid 3 to RV Coil
Vector 9	Proximal 4 to Mid 2
Vector 10	Proximal 4 to RV Coil

How to improve?

MPP IDE trial

- MPP-AS may improve response to CRT



How to improve?

MPP IDE trial

- MPP-AS may improve response to CRT

FIGURE 2 Impact of MPP Programming on Cardiac Resynchronization Therapy Responder Classification

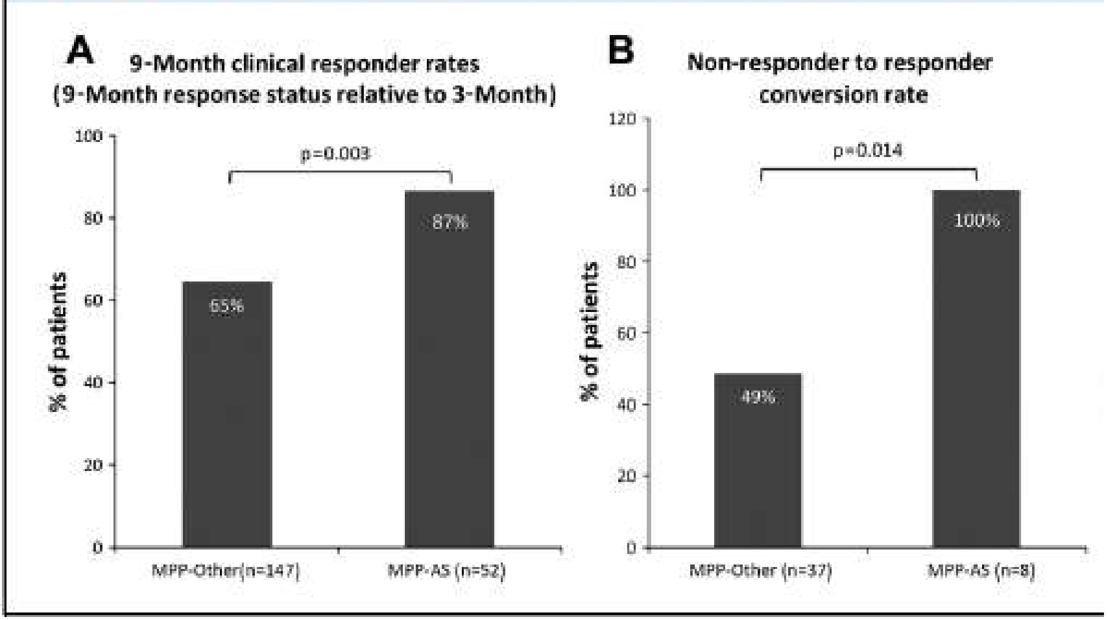
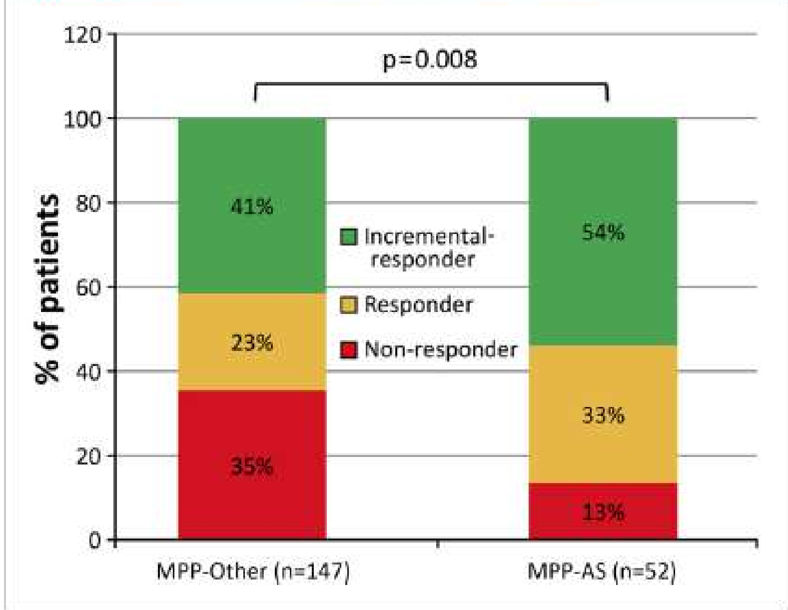


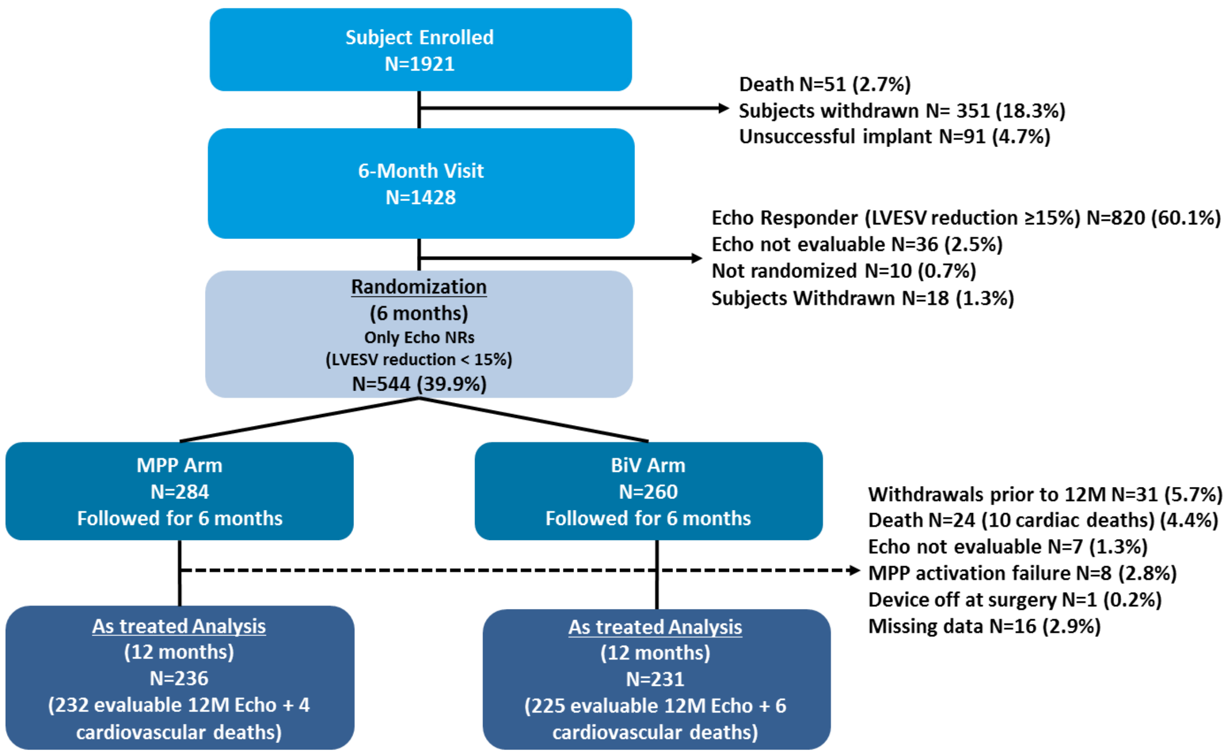
FIGURE 3 Impact of MPP Programming on Incremental Response



How to improve?

MORE CRT MPP trial

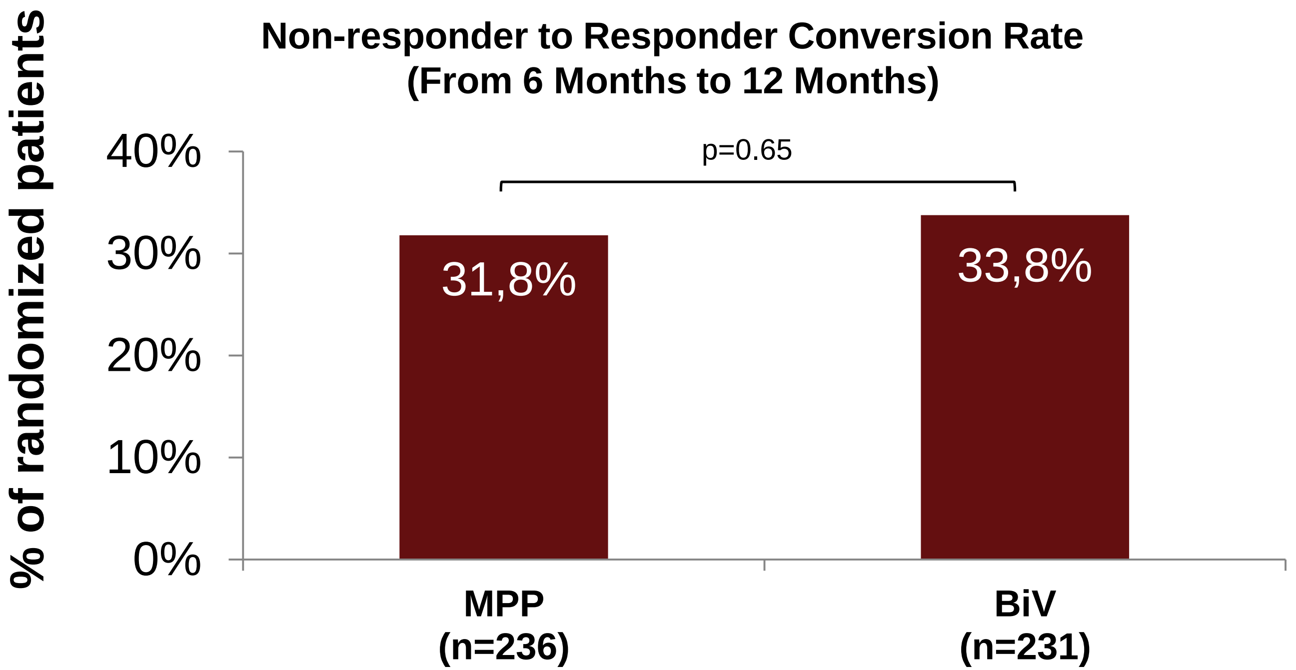
- MPP-AS may improve response to CRT?



How to improve?

MORE CRT MPP trial

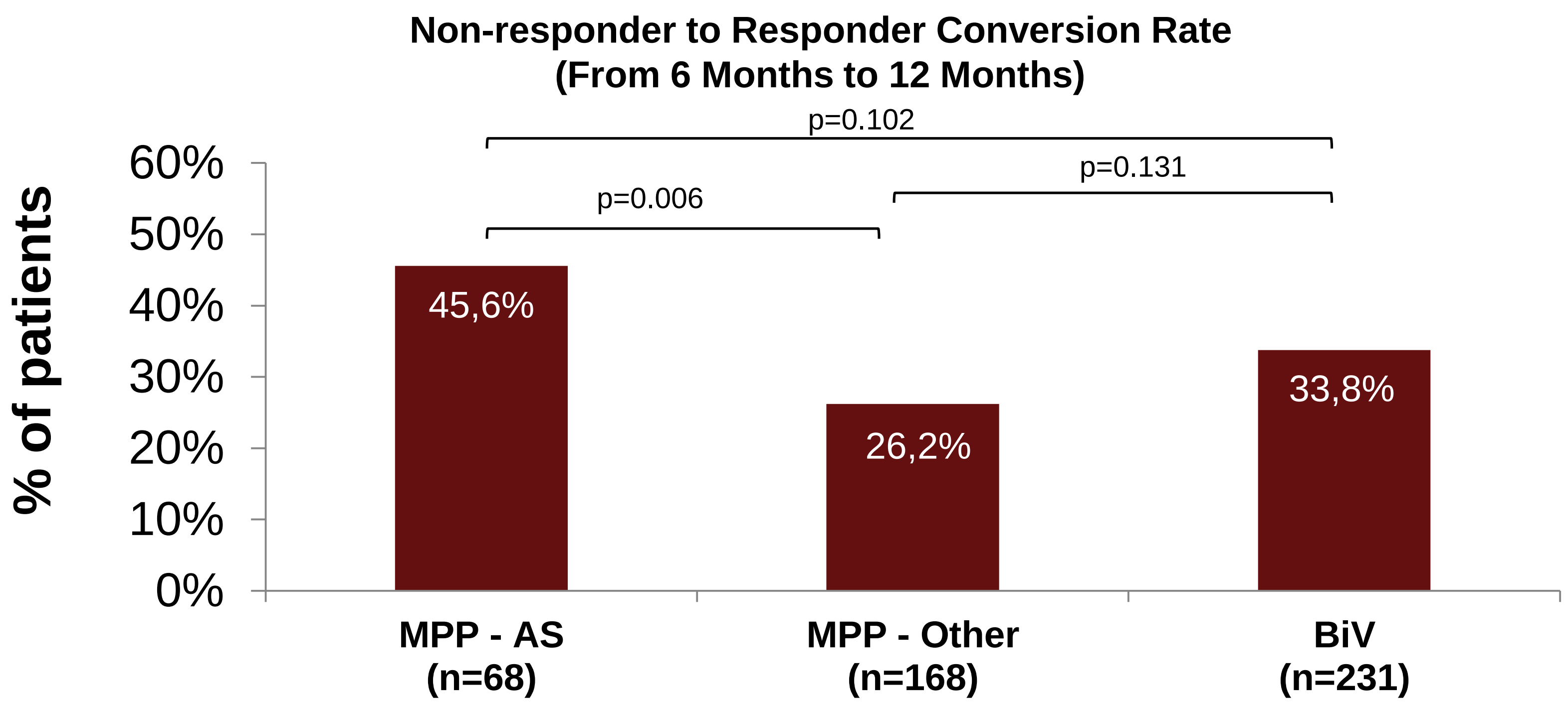
- MPP-AS may improve response to CRT?



How to improve?

MORE CRT MPP trial

- MPP-AS may improve response to CRT?



HOSPITAL DE SANTAMARIA

MultiPoint Pacing

Optimization of left ventricular pacing site plus multipoint pacing improves remodeling and clinical response to cardiac resynchronization therapy at 1 year

Francesco Zanon, MD, FESC, FHRS,* Lina Marcantoni, MD,* Enrico Baracca, MD,* Gianni Pastore, MD,* Daniela Lanza, MD,† Chiara Fraccaro, MD, PhD,† Claudio Picariello, I Luca Conte, MD,† Silvio Aggio, MD,† Loris Roncon, MD,† Domenico Pacetta, Eng,‡ Nima Badie, PhD,§ Franco Noventa, MD,‖ Frits W. Prinzen, PhD, FESC¶

Zannon F, et al. Heart Rhythm. 2016 Aug;13(8):1644-51

Single Center, non randomized
110 patients 1 year follow-up

Objective:
Compare Clinical and Echocardiographic response between standard Biv, Optimized Biv (Q-LV), Optimized + MPP

Response	STD	OPT	OPT + MPP
Ecocardiographic	55.6% (42.4-68.0)	72.2% (56.0-84.2)	90% (69.9-97.2)
Clinical	66.7% (46.0-71.3)	77.8% (61.9-88.3)	95% (76.4-99.1)

Combining MPP with optimal positioning of the LV lead on the basis of electrical delay and hemodynamics enhances reverse remodeling and improves clinical outcomes beyond the effect due to conventional CRT.

Responders vs Non-responders

Responders

- Clinical measures (functional & QoL)
- LV reverse remodelling
- Event-based measures

Non-respo

- ø clinical impro
- ø LV reverse rem
- ø Event-base asur

Responders vs Non-responders

Responders

- Clinical measures (functional & QoL)
- LV reverse remodelling
- Event-based measures

Hyper-responders

- Ø symptoms
- LVEF ≥ 50%; ↓ LVESV ≥ 30%

HOSPITAL DE SANTAMARIA

Conclusion

CRT improves prognostic and clinical outcomes

Patient selection: ♀, LBBB, wide QRS, NI cardiopathy

30-40% non-responders

Alternative techniques to implant LV lead

New technologies to assess latest activated areas LV lead

↓

Lateral or postero-lateral wall of the LV, non-apical

Conclusion

CRT improves prognostic and clinical outcomes

Patient selection: ♀, LBBB, wide QRS, NI cardiopathy

30-40% non-responders

- Alternative techniques to implant LV lead
- New technologies to assess latest activated areas LV lead
- Multisite pacing
- Multipoint pacing

9th CHALLENGES in CARDIOLOGY
JUNE 28th - 29th 2019
Palace Hotel Monte Real

Cardiac resynchronization

Responders, non-responders, hyper-responders

Afonso Nunes Ferreira
afonsonunesferreira@gmail.com
@A_NunesFerreira

DEPARTAMENTO CORAÇÃO e VASOS
CENTRO HOSPITALAR LISBOA NORTE, EPE
HSM HPV
U LISBOA UNIVERSIDADE DE LISBOA
FACULDADE DE MEDICINA LISBOA
CCUL CENTRO CARDIOVASCULAR DA UNIVERSIDADE DE LISBOA