VENICE 2015 ARRHYTHMIAS

One year follow up of quadrifocal pacing for CRT

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Four Chamber Pacing in Dilated Cardiomyopathy

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CAZEAU, S., *et al.*: Four Chamber Pacing in Dilated Cardiomyopathy. *A 54-year-old man received a four chamber pacing system for severe congestive heart failure (NYHA functional Class IV). His ECG showed a left bundle branch block (200-msec QRS duration) with 260-msec PR interval, normal QRS axis, and 80-msec interatrial interval. An acute hemodynamic study with insertion of four temporary leads was performed prior to the implant, which demonstrated a significant increase in cardiac output and decrease of pulmonary capillary wedge pressure. A permanent pacemaker was implanted based on the encouraging results of the acute study. The right chamber leads were introduced by cephalic and subclavian approaches. The left atrium was paced with a coronary sinus lead, Medtronic SP 2188–58 model. An epicardial Medtronic 5071 lead was placed on the LV free wall. The four leads were connected to a standard bipolar DDD pacemaker, Chorus 4234. The two atrial leads were connected via a Y-connector to the atrial channel of the pacemaker with a bipolar pacing configuration. The two ventricular leads were connected in a similar fashion to the ventricular channel of the device. The right chamber leads were connected to the distal poles. The left chamber leads were connected to the proximal poles of the pacemaker. Six weeks later, the patient's clinical status improved markedly with a weight loss of 17 kg and disappearance of peripheral edema. His functional class was reduced to NYHA II. Four chamber pacing is technically feasible. In patients with evidence of interventricular dyssynchrony, this original pacing mode probably provides a mechanical activation sequence closer to the natural one. We doubt that this technique will have an impact on long-term survival, but it could be of major importance to improve the patient's well-being and control heart failure. (PACE 1994; 17(Pt. II):1974–1978)

CRT with ICD back up
First implant: August 1998 in Asti

Bocchiardo, Eur Heart J 2000; 2: J36-J40.

- **Cardiac resynchronization therapy using biventricular pacing relieves symptoms of heart failure, improves exercise capacity, induces positive cardiac remodelling, and reduces mortality [1-3].**
- **However, 30-40% of patients receiving CRT do not experience symptomatic improvement and up to 50% may not show echocardiographic evidence of positive remodelling [4].**

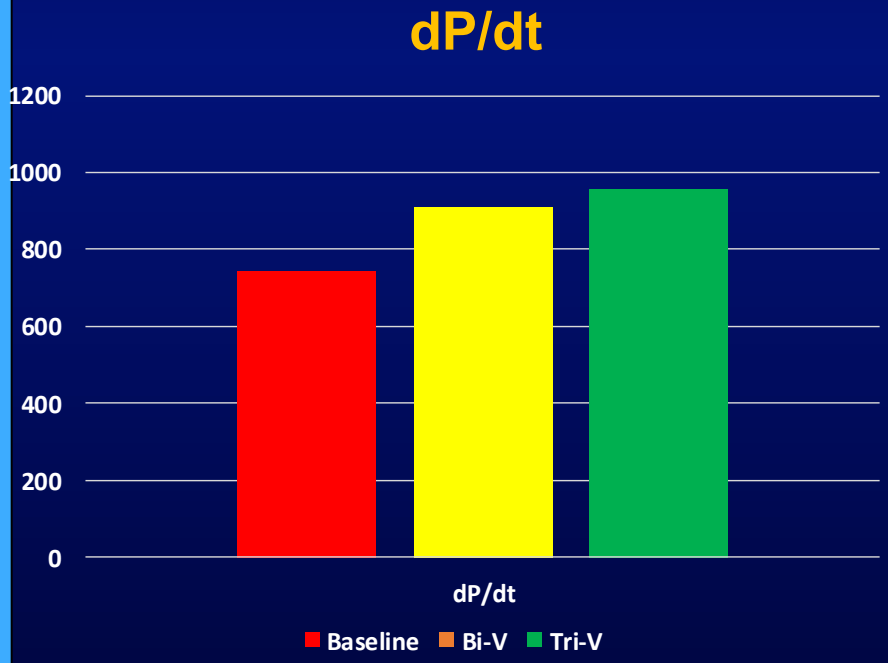
1. Cleland JG, N Engl J Med 2005; 352:1539-1549
2. Cazeau S, N Engl J Med 2001; 344: 873-880
3. Abraham WT, N Engl J Med 2002; 346:1845-1853
4. Bleeker GB, Am J Cardiol 2006; 97: 260-263

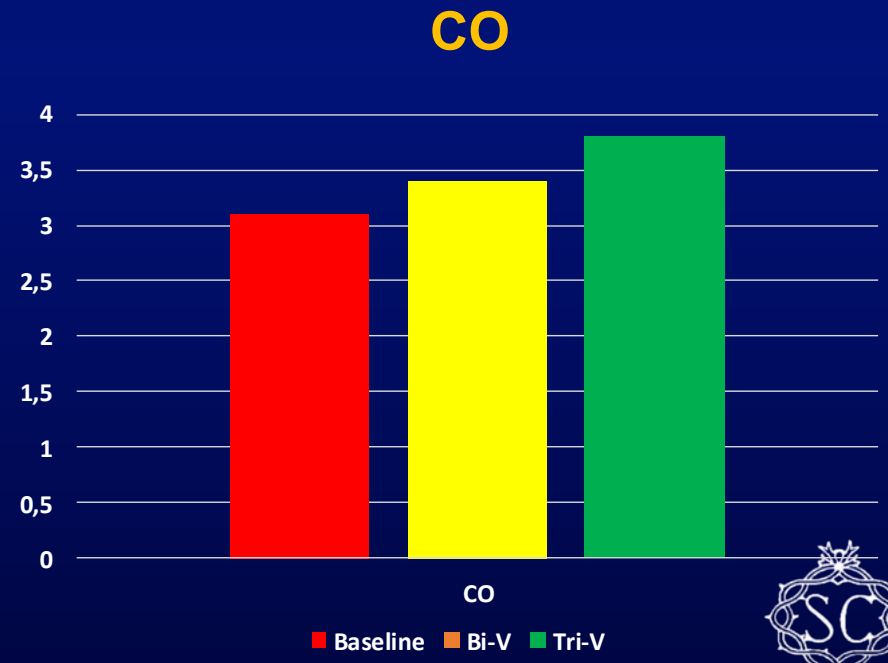
European Heart Journal (2007) 28, 2610–2619
doi:10.1093/eurheartj/ehm441

Clinical research
Arrhythmia/electrophysiology

Effect of triangle ventricular pacing on haemodynamics and dyssynchrony in patients with advanced heart failure: a comparison study with conventional bi-ventricular pacing therapy

Kentaro Yoshida†, Yoshihiro Seo*†, Hiro Yamasaki, Kazuyuki Tanoue, Nobuyuki Murakoshi, Tomoko Ishizu, Yukio Sekiguchi, Satoru Kawano, Sadanori Otsuka, Shigeyuki Watanabe, Iwao Yamaguchi, and Kazutaka Aonuma





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European Journal of Heart Failure (2012) **14**, 495–505
doi:10.1093/eurjhf/hfs004

A randomized double-blind crossover trial of triventricular versus biventricular pacing in heart failure

Dominic P.S. Rogers, Pier D. Lambiase, Martin D. Lowe, and Anthony W.C. Chow*

The Heart Hospital, Institute of Cardiovascular Medicine, UCLH, London W1G 8PH, UK

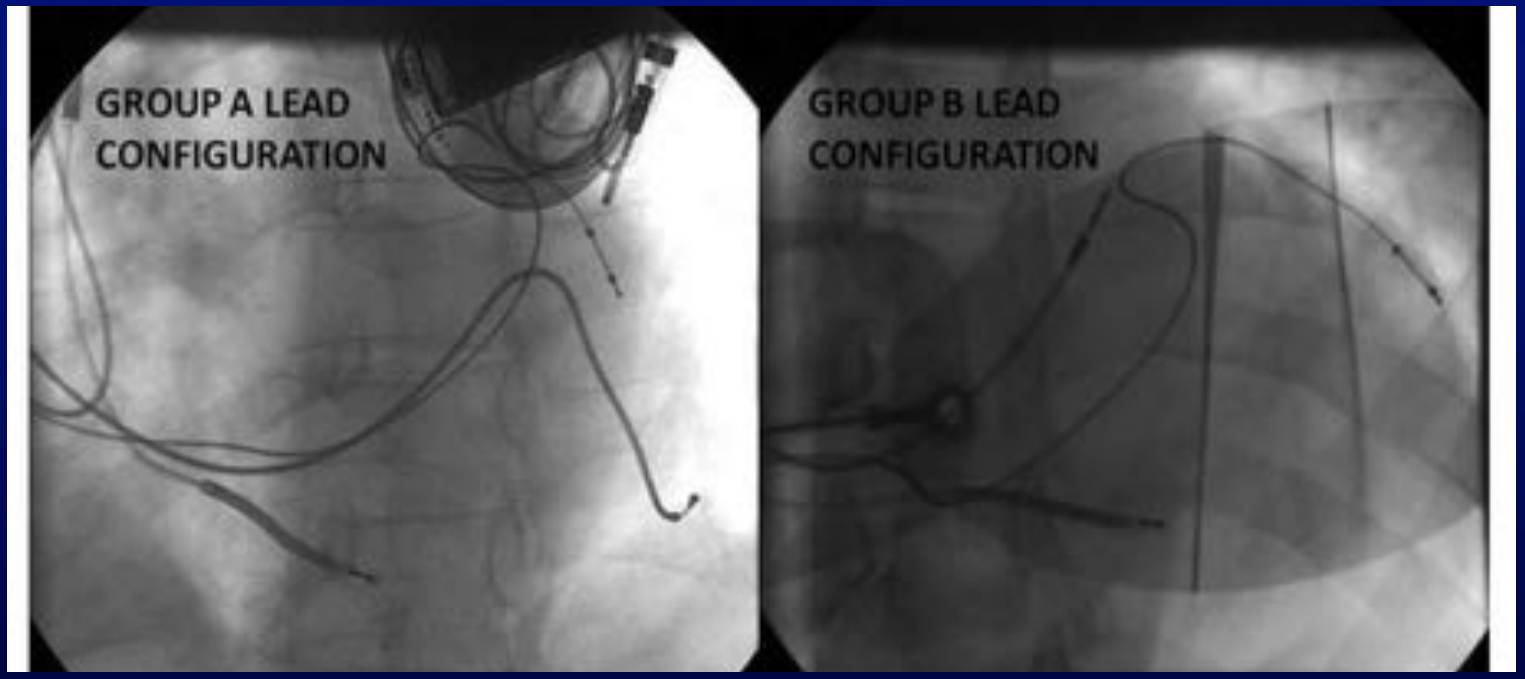

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Table 4A Group A clinical and echocardiographic results

	Group A patients ($n = 18$)				
	Baseline	BiV	TriV	2CS	1CS
6MW (m)	365 ± 110	411 ± 142*	433 ± 129‡	421 ± 147†	412 ± 145†
MLWHF	58 ± 22	45 ± 26†	37 ± 20‖	40 ± 23‡	41 ± 21†
LVEDV (mL)	273 ± 103	252 ± 106*	240 ± 108‖	218 ± 74†	242 ± 102*
LVESV (mL)	215 ± 92	191 ± 96*	174 ± 97‡¶	159 ± 60†	180 ± 92†
EF (%)	22 ± 5	26 ± 7*	30 ± 8‖	29 ± 7*	27 ± 6*

BiV, biventricular; CS, coronary sinus; EF, ejection fraction; LVEDV, left ventricular end-diastolic volume; LVESV, left ventricular end-systolic volume; MLWHF, Minnesota Living With Heart Failure; 6MW, 6 min walk distance; TriV, triventricular.
*$P < 0.05$ compared with baseline; †$P < 0.01$ compared with baseline; ‡$P < 0.001$ compared with baseline; ¶$P < 0.05$ compared with BiV; ‖$P < 0.01$ compared with BiV.

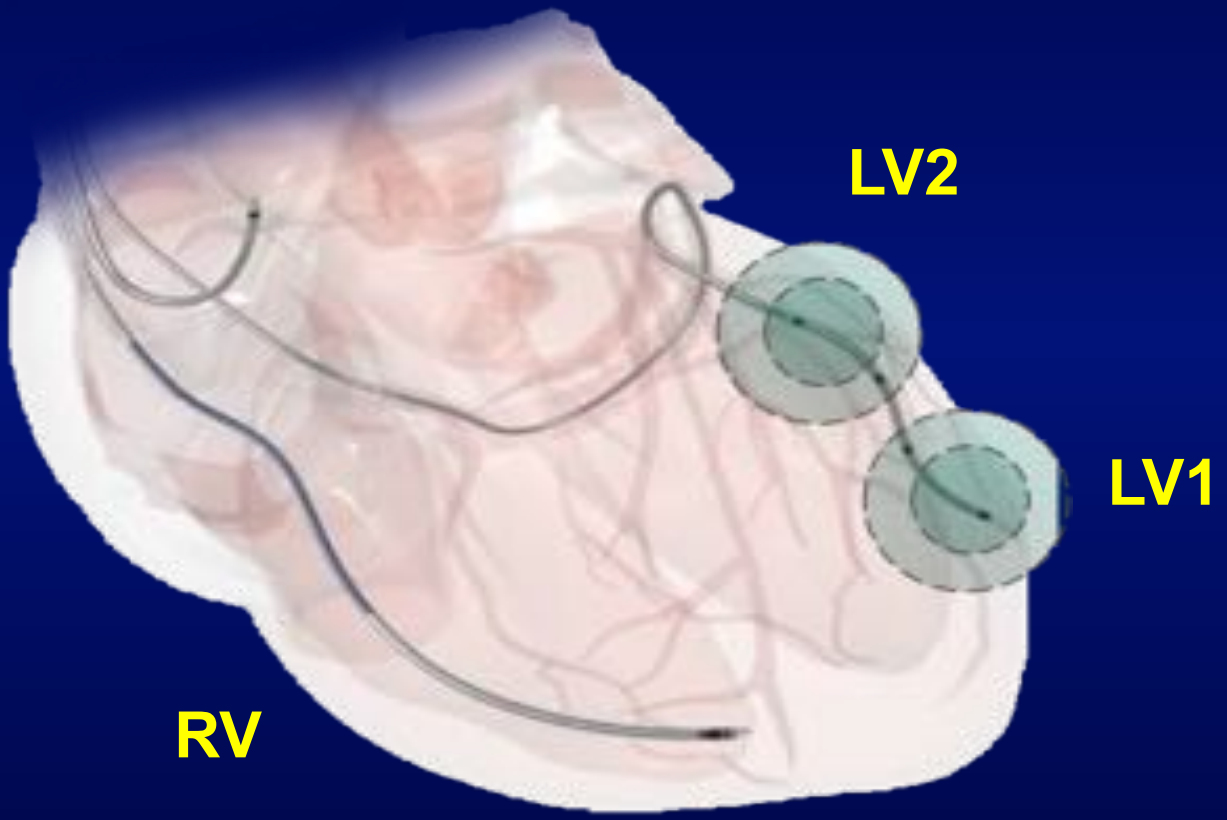
Table 4B Group B clinical and echocardiographic results

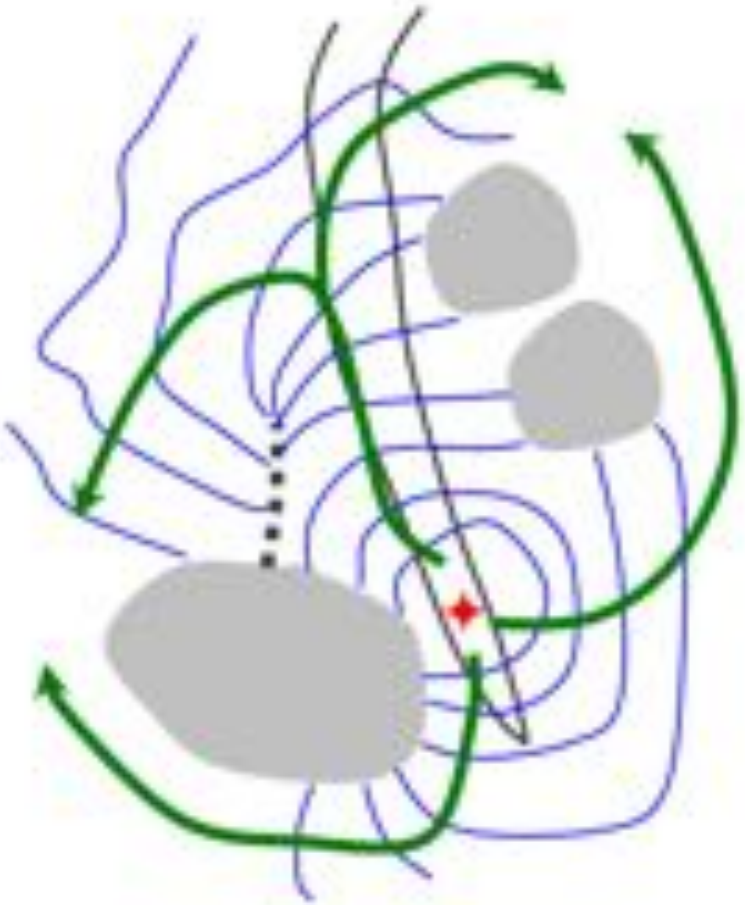
	Group B patients ($n = 19$)				
	Baseline	BiV	TriV	2RV	RVOT
6MW (m)	367 ± 104	410 ± 134‡	439 ± 139‡	426 ± 98‡	445 ± 104‡
MLWHF	54 ± 16	31 ± 20‡	28 ± 18‡	35 ± 21‡	31 ± 20‡
LVEDV (mL)	230 ± 60	205 ± 58†	202 ± 61†	217 ± 68*	208 ± 58*
LVESV (mL)	175 ± 60	147 ± 50†	143 ± 56‡	159 ± 60*	154 ± 56
EF (%)	25 ± 8	29 ± 8	31 ± 8†	28 ± 7	27 ± 10

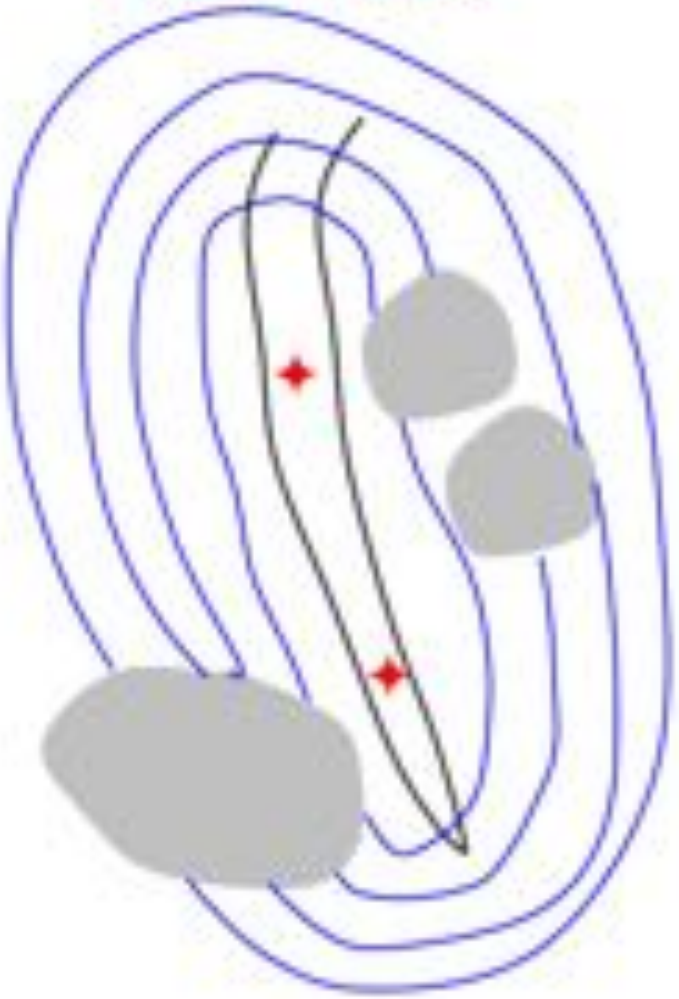
BiV, biventricular; EF, ejection fraction; LVEDV, left ventricular end-diastolic volume; LVESV, left ventricular end-systolic volume; MLWHF, Minnesota Living With Heart Failure; 6MW, 6 min walk distance; RV, right ventricular; RVOT, right ventricular outflow tract; TriV, triventricular.
*$P < 0.05$ compared with baseline; †$P < 0.01$ compared with baseline; ‡$P < 0.001$ compared with baseline.

Rogers et Al. Eur J Heart Fail 2012

MPP







MPP

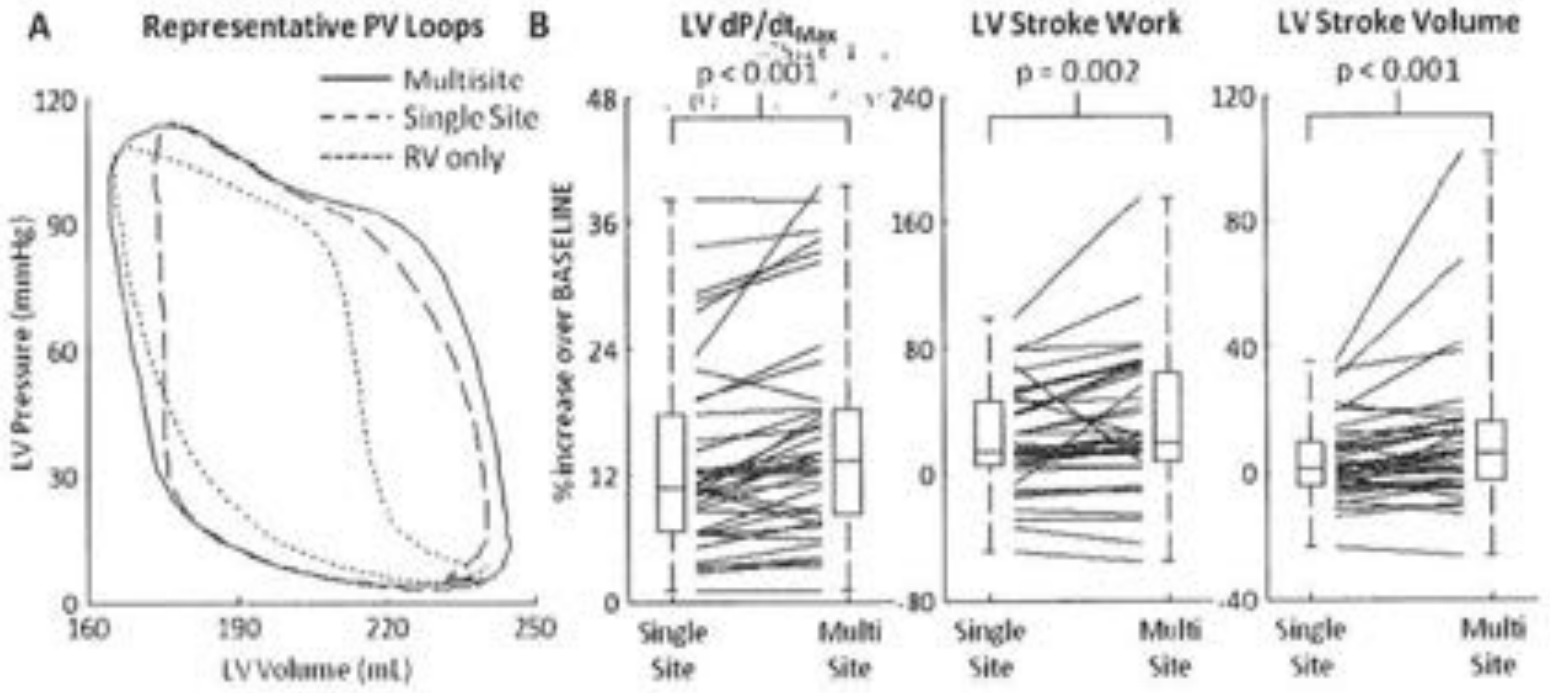
Captures a larger area
Improves transventricular activation time

Theis C JCE 2009

Cardiac Resynchronization Therapy With Multisite Left Ventricular Pacing Improves Acute Hemodynamic Response Assessed With Pressure-Volume Loops

Carlo Pappone[1], Zarko Calovic[1], Amarild Cuko[1], Luke C. McSpadden[2], Kyungmoo Ryu[2], Massimo Saviano[1], Mario Baldi[1], Alessia Pappone[1], Andrea Petretta[1], Cristiano Ciaccio[1], Luigi Giannelli[1], Bogdan Ionescu[1], Raffaele Vitale[1], Gabriele Vicedomini[1], and Vincenzo Santinelli[1]

Conclusion: Multisite LV pacing in a single CS branch can significantly improve acute LV hemodynamic properties relative to single site LV pacing.



HRS 2013

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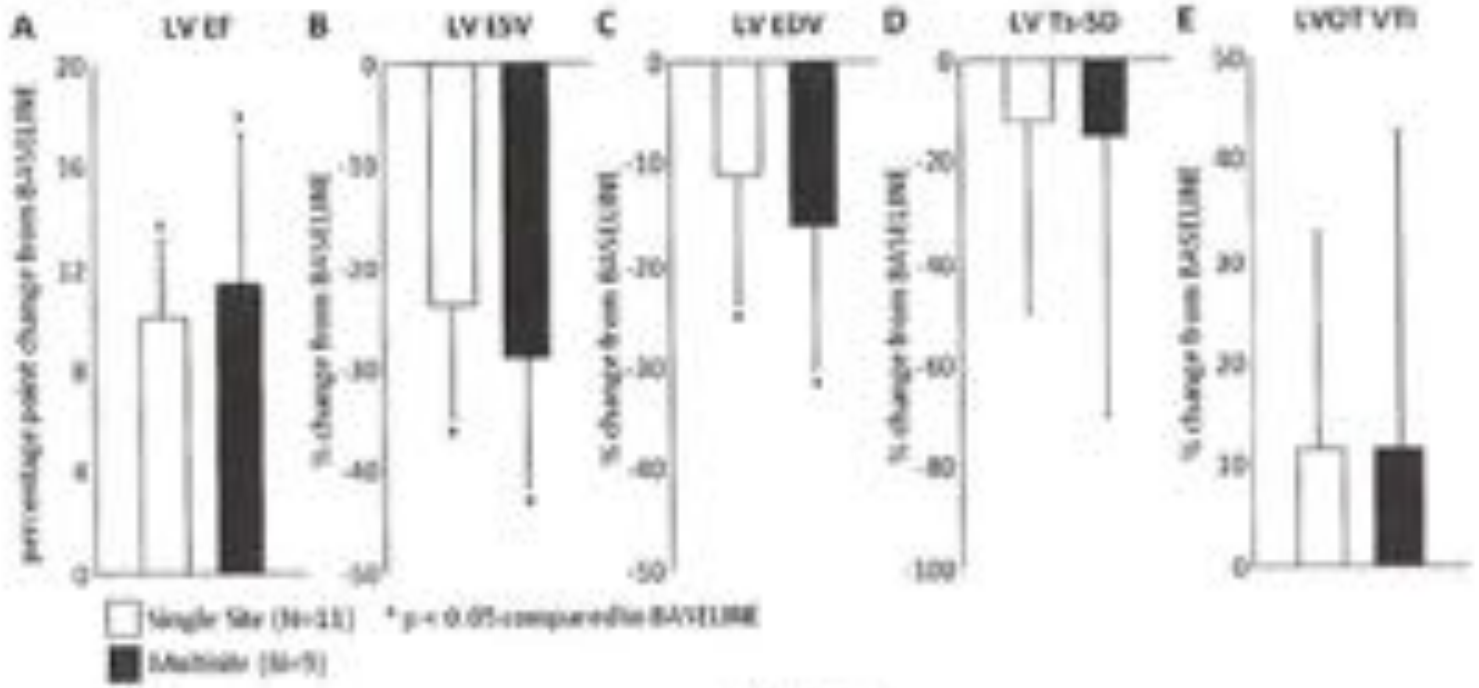
Improvement in 3-month Echocardiographic Response With Multisite Left Ventricular Pacing in Cardiac Resynchronization Therapy Patients

Carlo Pappone[1], Zarko Calovic[1], Amarild Cuko[1], Luke C. McSpadden[2], Kyungmoo Ryu[2], Mario Baldi[1], Alessia Pappone[1], Massimo Saviano[3], Luigi Giannelli[1], Cristiano Ciaccio[1], Andrea Petretta[1], Raffaele Virale[1], Bogdan Ionescu[2], Gabriele Vicedomini[1], and Vincenzo Santinelli[1]

Conclusion: Multisite LV pacing can improve LV reverse remodeling and cardiac function as characterized by echocardiography, and may result in a higher rate of response to CRT than with single site pacing.



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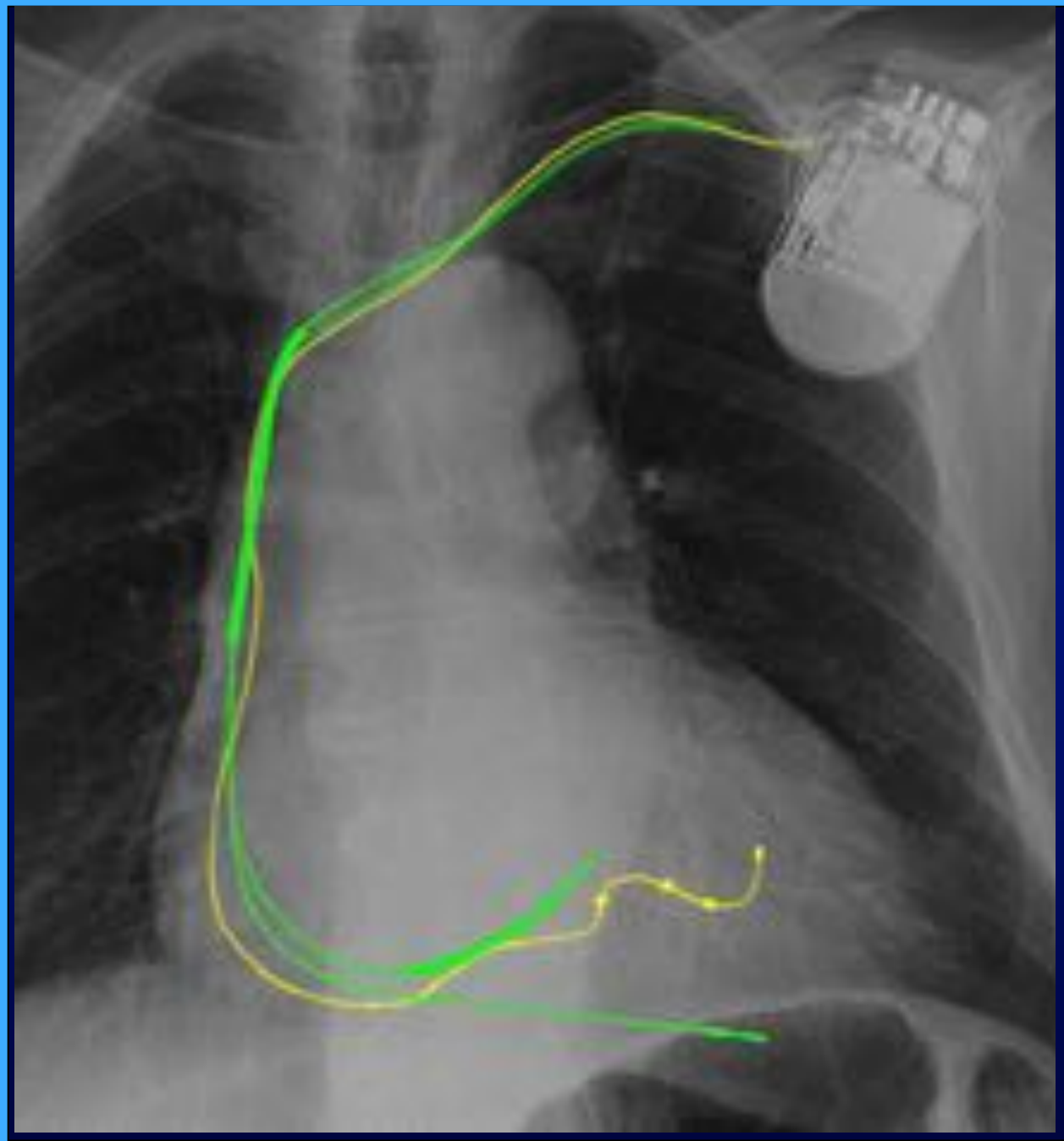
QUADRIFOCAL PACING

81 years old patient with ischemic cardiomyopathy (previous anterior MI, LVEDV 201 ml, LVESV 150 ml, LVEF 25%), permanent atrial fibrillation, LBBB, previously implanted with a VVIR pacemaker with a passive-fixation lead positioned in the RV apex (RVA), NYHA class III despite optimal medical therapy.

He was upgraded to CRT-Defibrillator (Quadra Assura MP™, St. Jude Medical, Sylmar, CA) with the ability to deliver MPP. A dual coil high voltage lead was screwed in the basal septum (IVS) and a quadripolar LV lead (Quartet™, St. Jude Medical, Sylmar, CA) was positioned in a postero-lateral coronary sinus branch. The old RV apical lead was connected to the IS1 atrial port of the CRT-D.



PA VIEW

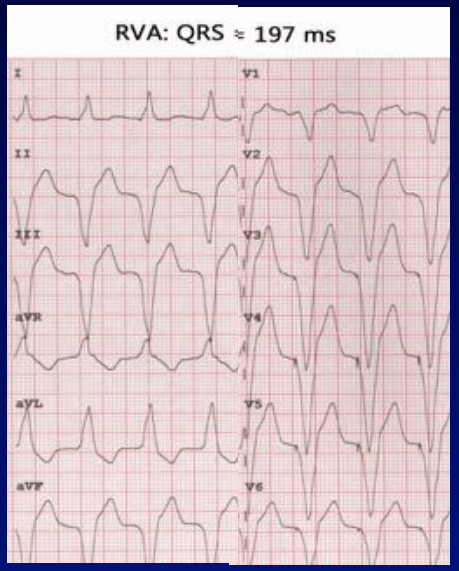
Before discharge, QRS width and aortic VTI were evaluated pacing from one to four sites:

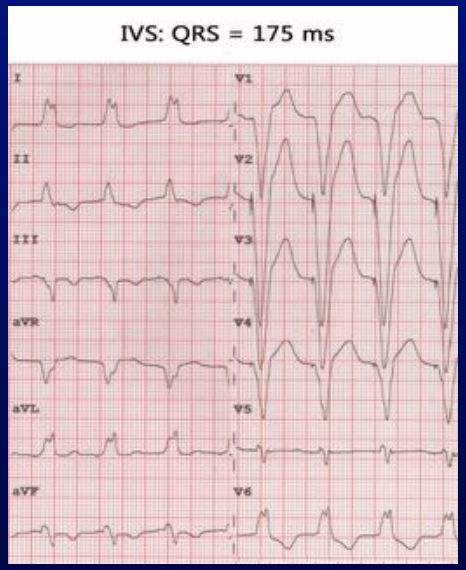
1. **RVA, IVS, LVd, LVp,**
2. **IVS+RVA, IVS+LVd, IVS+LVp, RVA+LVd, RVA +LVp,**
3. **IVS+RVA+LVd, IVS+RVA+LVp, IVS+LVd+LVp, RVA+LVd+LVp**
4. **IVS+RVA+LVd+LVp.**

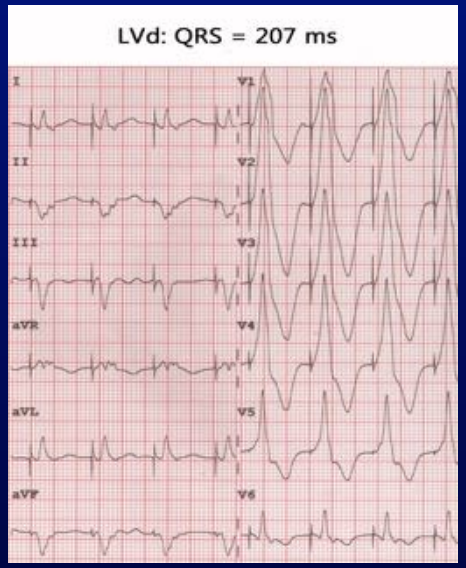
QRS WIDTH AND AORTIC VTI WITH DIFFERENT PACING MODES

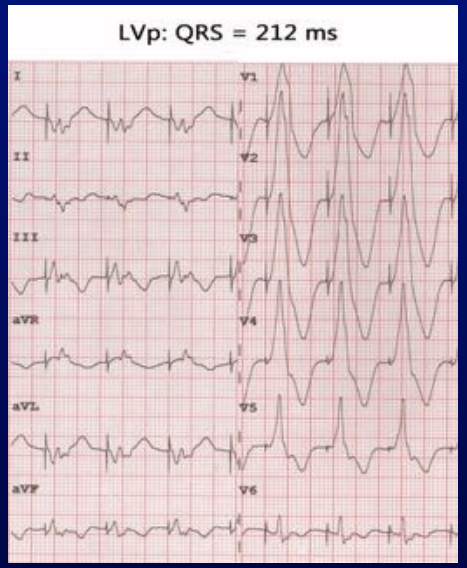
		ONE SITE				TWO SITES						THREE SITES				FOUR SITES
		RVA	IVS	LVd	LVp	RVA + IVS	IVS+ LVd	IVS+ LVp	RVA + LVd	RVA + LVp	LVd+ LVp§	RVA + IVS+ LVd	RVA + IVS+ LVp	RVA + LVd+ LVp§	IVS+ LVd+ LVp	RVA+ IVS+ LVd+ LVp
	QRS	197	175	207	212	173	148	147	140	157	206	151	146	160	139	148
	VTI*	13.9	13.5	13.1	13.9	13.9	13.7	14.2	14.2	14.0	14.0	14.3	13.9	15.7	15.2	16.9

1 SITE PACING

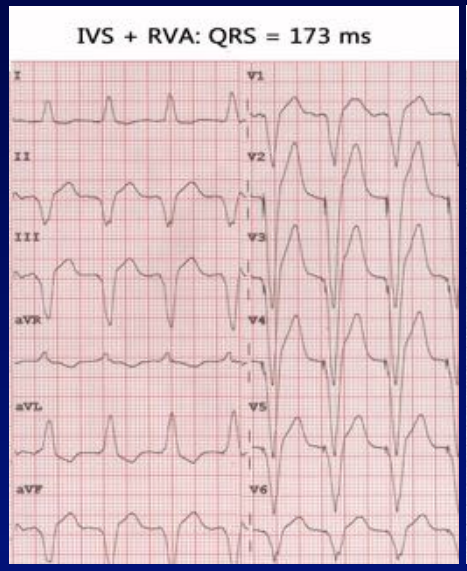


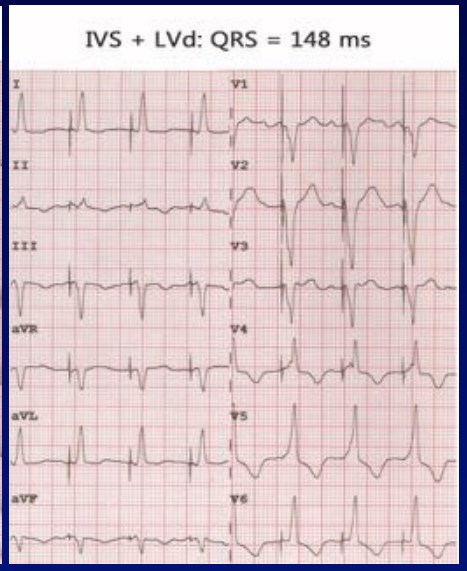


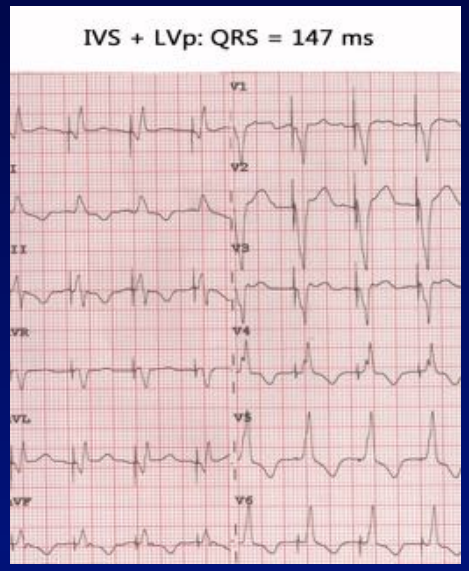


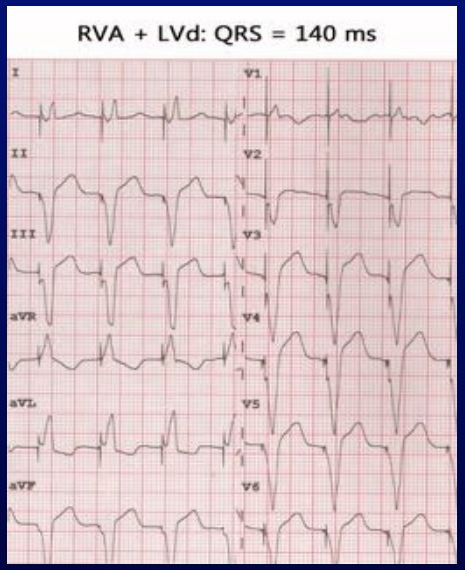


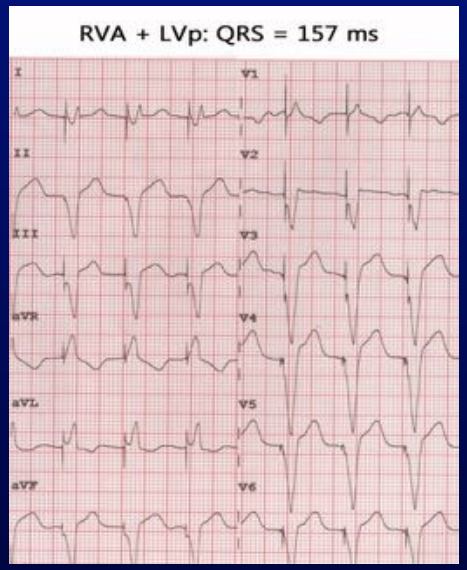
2 SITES PACING

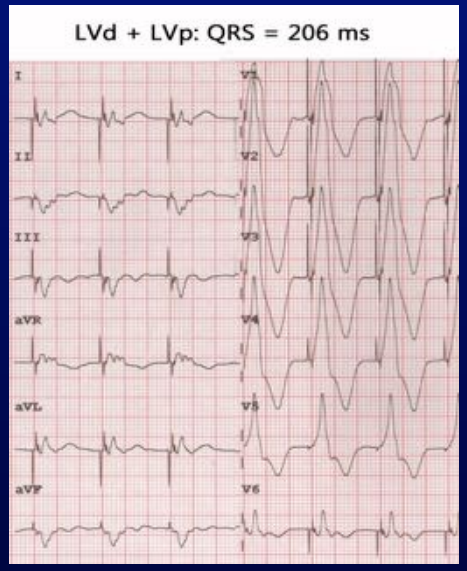






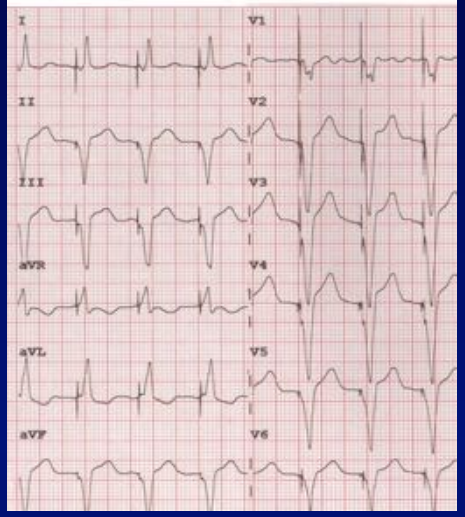




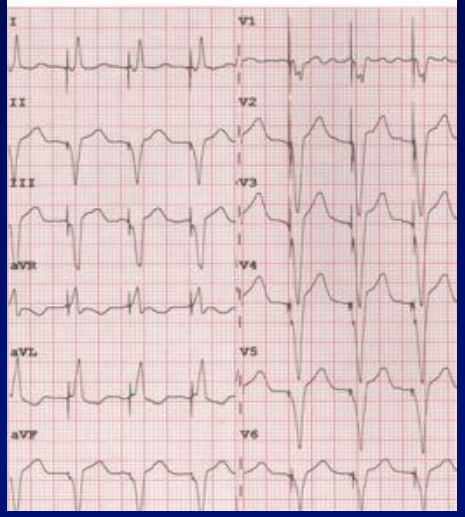


3 SITES PACING

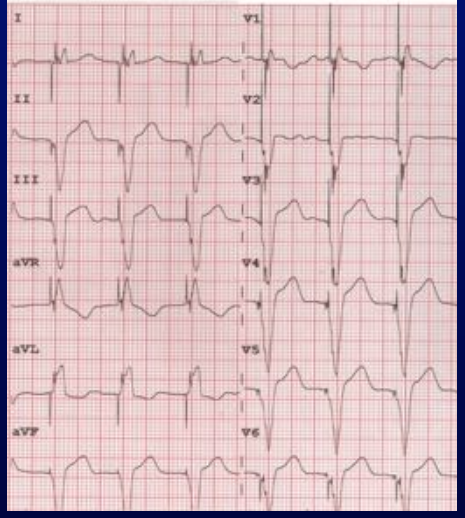
IVS + RVA + LVd: QRS = 151 ms



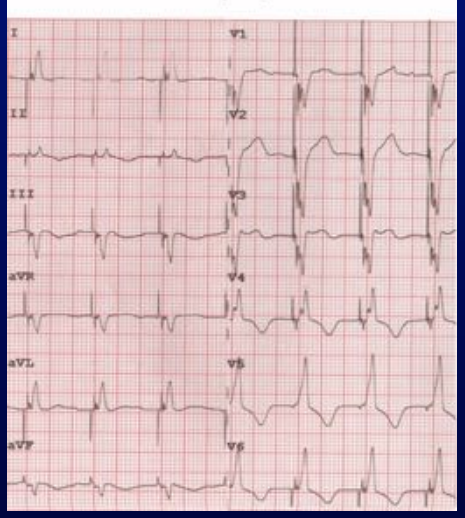
IVS + RVA + LVp: QRS = 146 ms



RVA + LVd + LVp: QRS = 160 ms

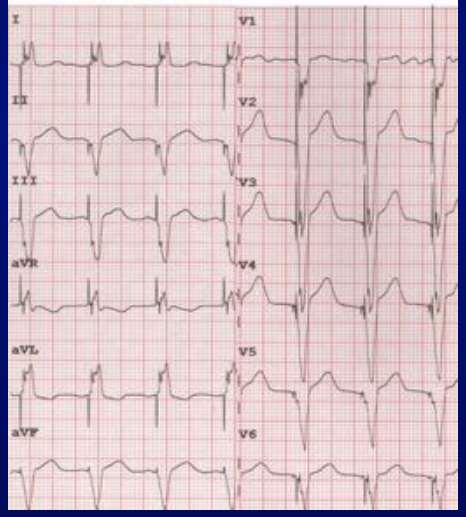


IVS + LVd + LVp: QRS = 139 ms



4 SITES PACING

IVS + RVA + LVd +LVp: QRS = 148 ms



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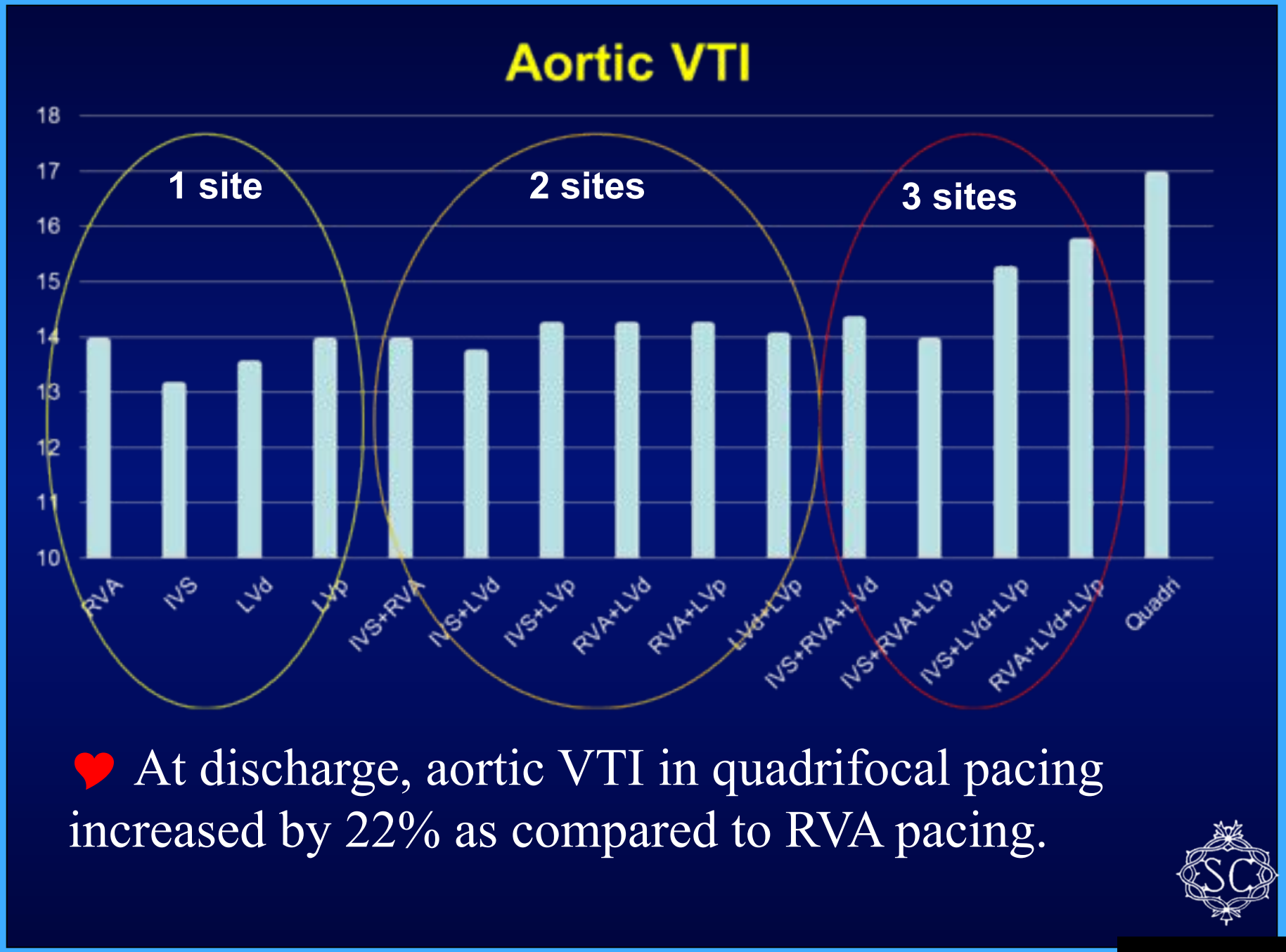
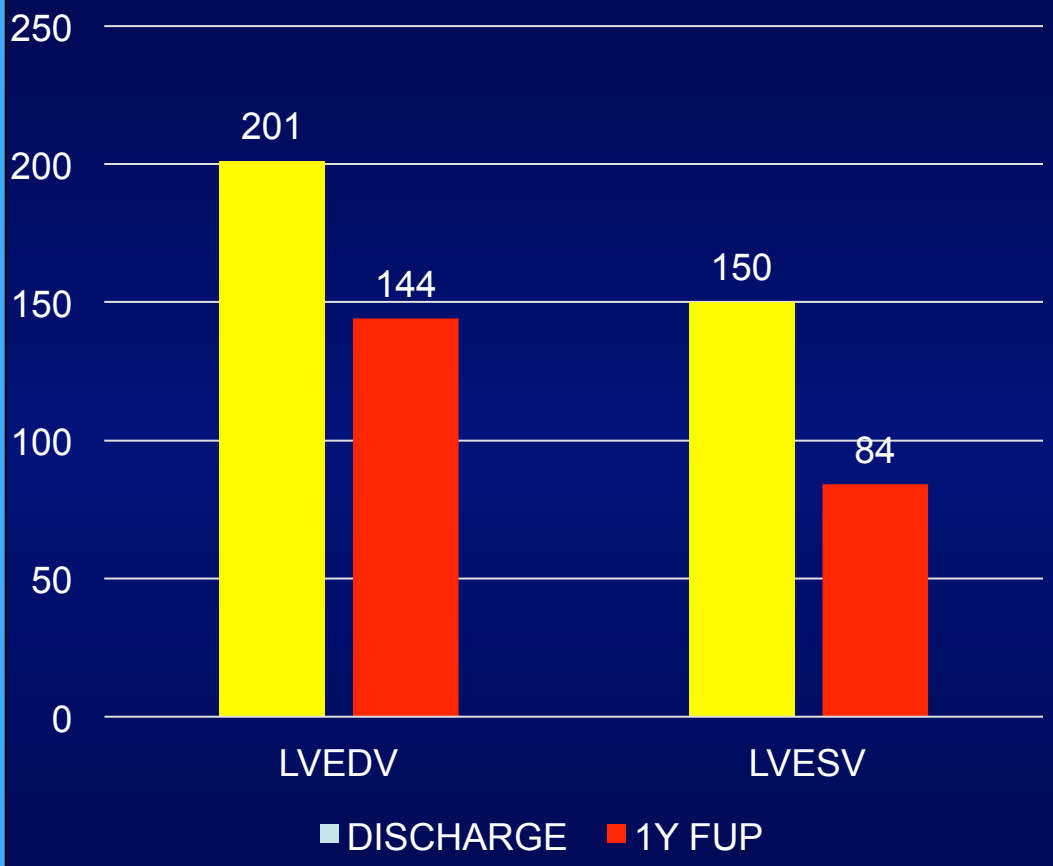
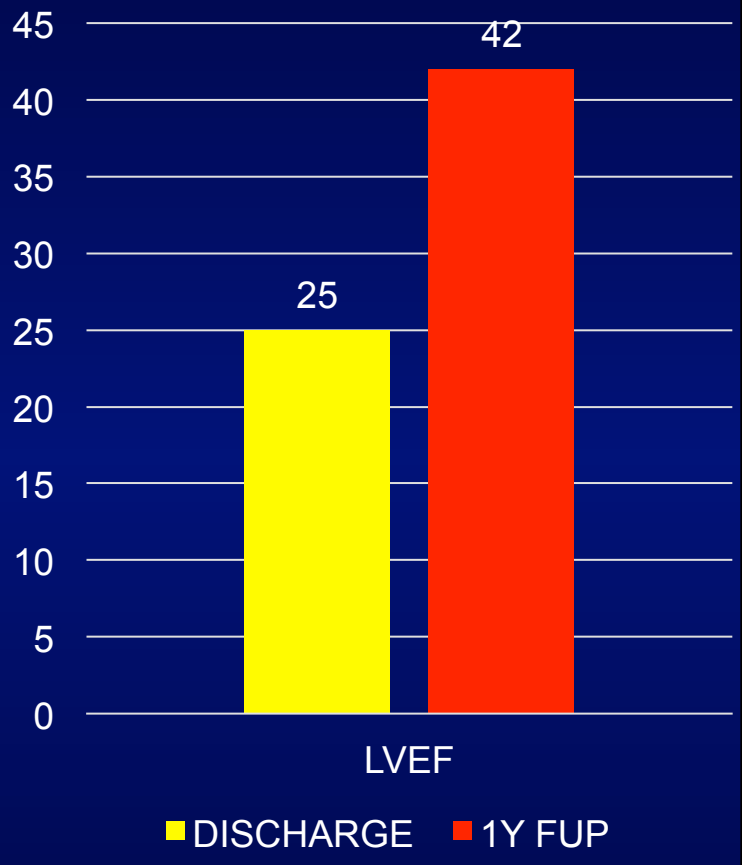


- At discharge, aortic VTI in quadrifocal pacing increased by 22% as compared to RVA pacing.

LV VOLUMES AND EF



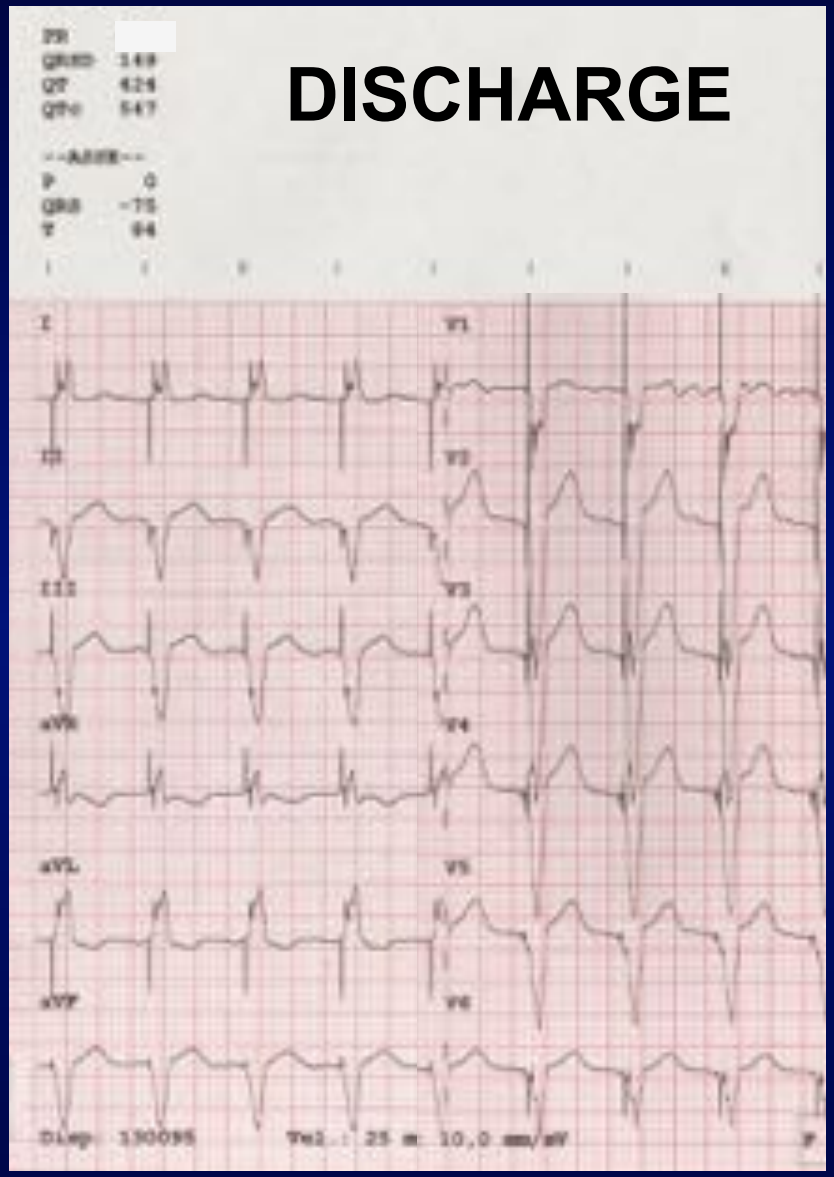


NYHA class improved to II

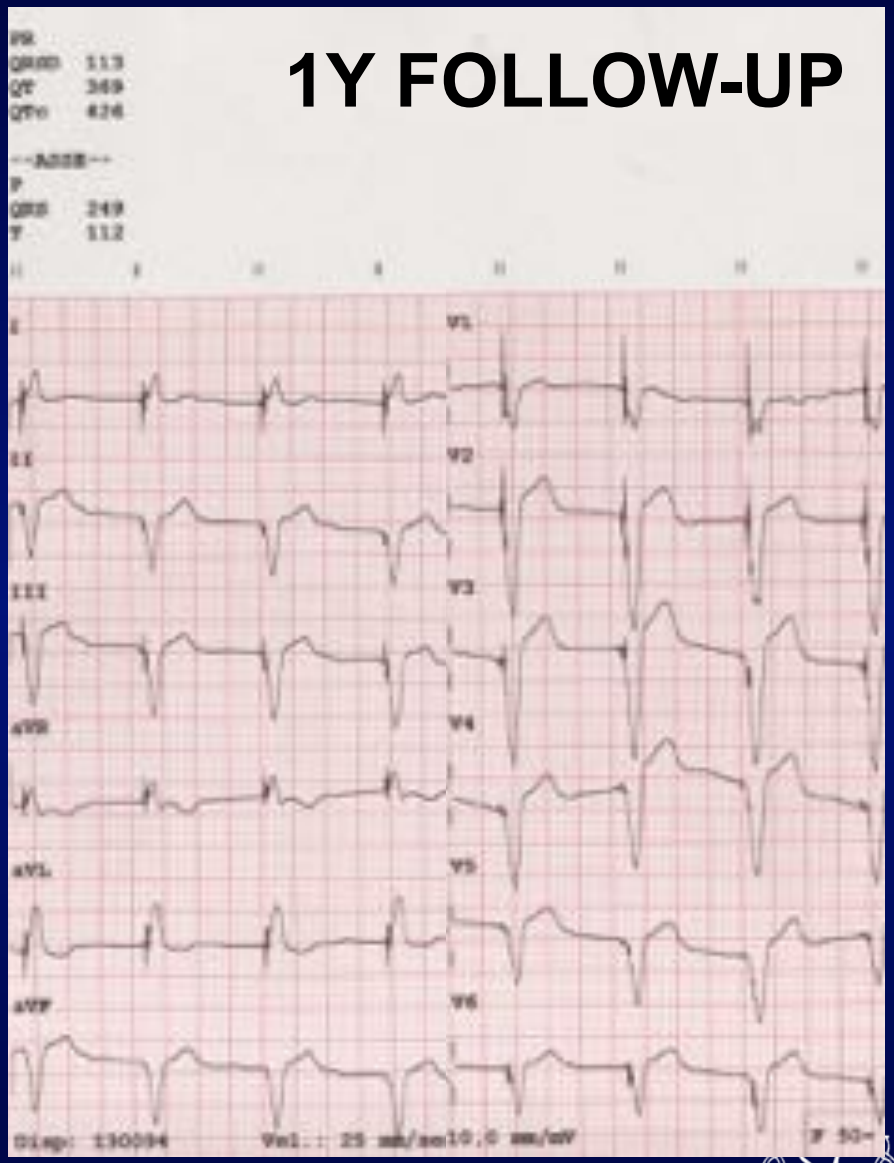
QRS WIDTH AND AORTIC VTI AT IMPLANT AND AT 1 Y F-UP

		ONE SITE				TWO SITES						THREE SITES			FOUR SITES
		RVA	IVS	LVd	LVp	IVS+ RVA	IVS+ LVd	IVS+ LVp	RVA+ LVd	RVA+ LVp	LVd+ LVp	IVS+ RVA + LVd	IVS+ RVA + LVp	RVA+ LVd+ LVp	IVS+ RVA+ LVd+ LVp
QRS	IMP	197	175	207	212	173	148	147	140	157	206	151	146	160	148
	1Y FU-P	185	165	227	208	187	142	139	170	171	208	140	150	129	113
A-VTI	IMP	13.9	13.5	13.1	13.9	13.9	12.7	14.2	14.2	14.0	14.0	14.3	13.9	15.7	16.9
	1Y FU-P	16.6	16.1	17.0	17.4	15.6	16.9	15.3	17.4	17.3	16.8	16.2	16.7	15.1	19.1

DISCHARGE



1Y FOLLOW-UP



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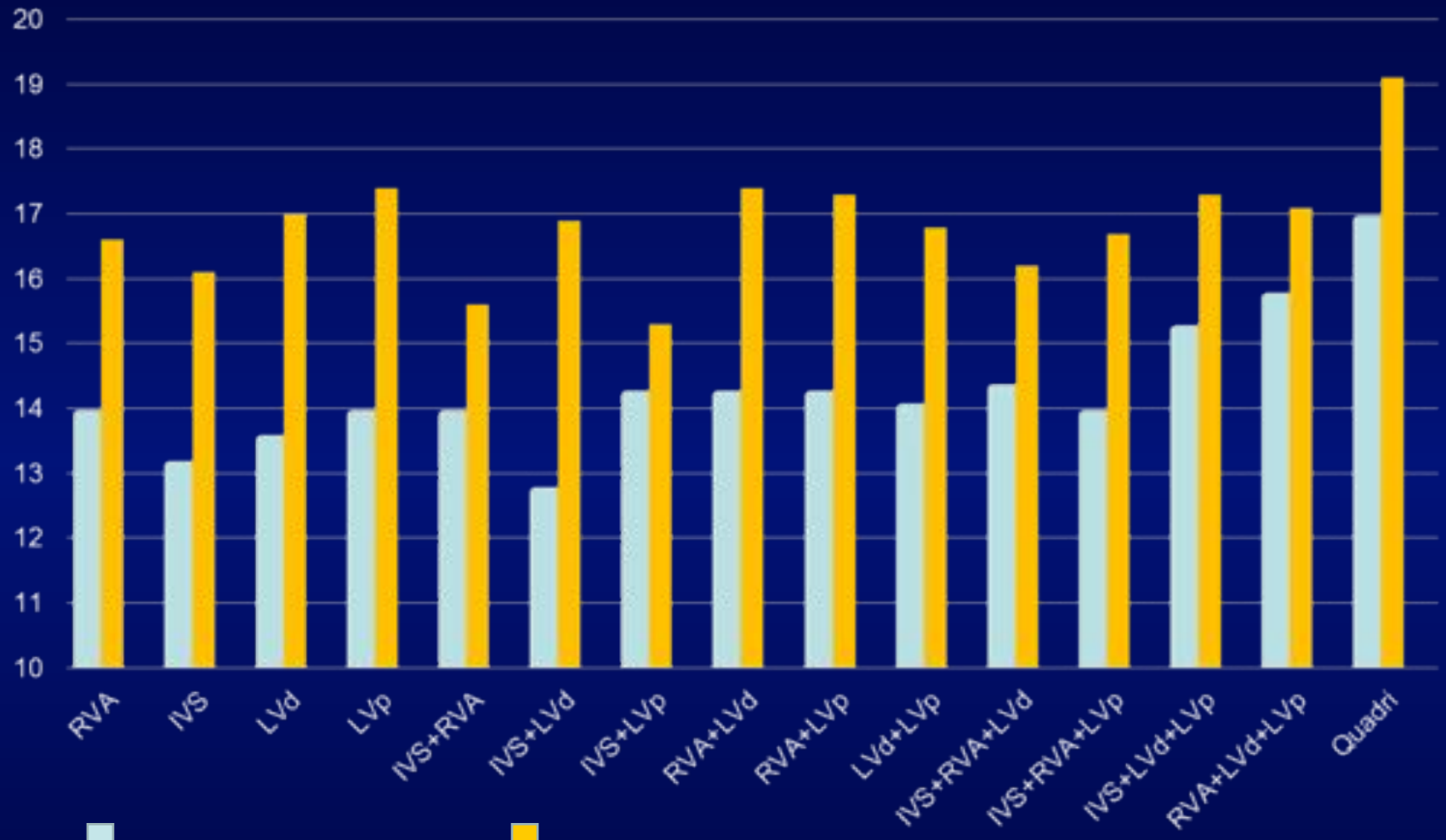
Aortic VTI



DISCHARGE

1 Y FOLLOW-UP

CONCLUSIONS

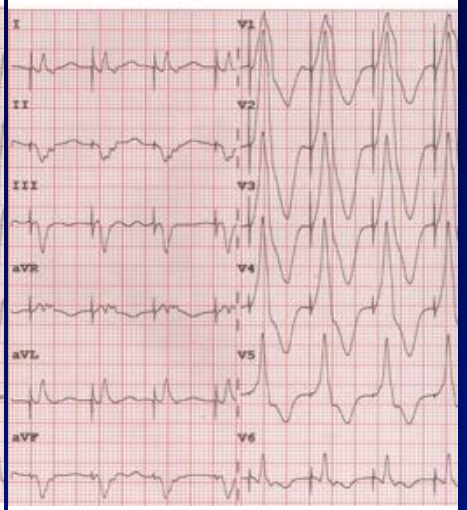
- Quadrifocal pacing is feasible
- Quadrifocal pacing can increase aortic VTI more than biventricular and triangle pacing
- Clinical and echocardiographic improvements are still present at 1 year follow-up
- QRS width decreased after 1 year of quadrifocal pacing
- This is only a case-report, but can be the starting point for randomized studies

Thank You for Your Attention

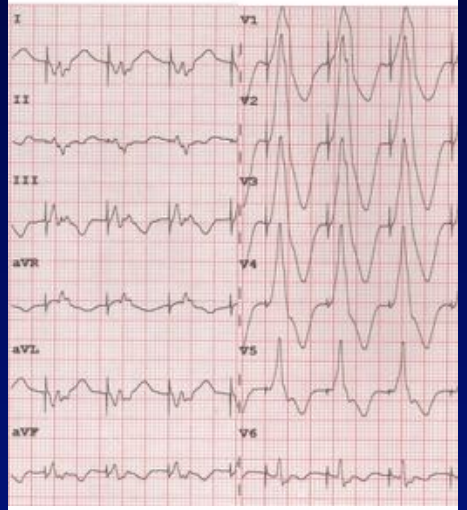
mariobocchiardo@libero.it

= 175 ms

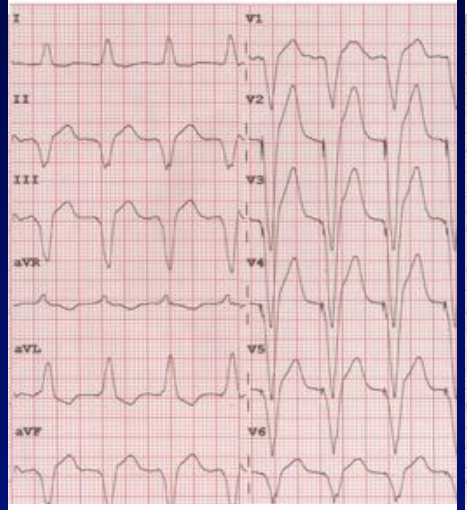
LVd: QRS = 207 ms



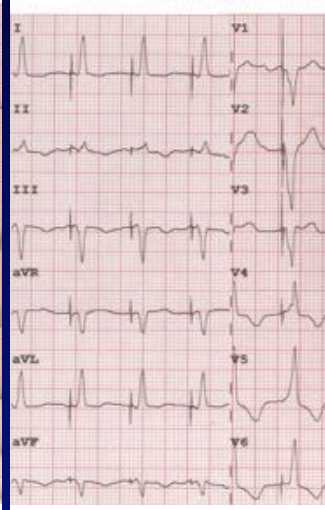
LVp: QRS = 212 ms



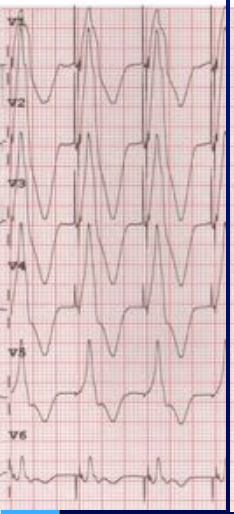
IVS + RVA: QRS = 173 ms



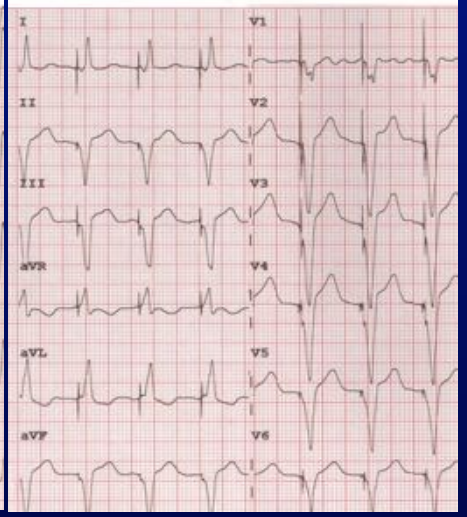
IVS + LVd: QRS = 148



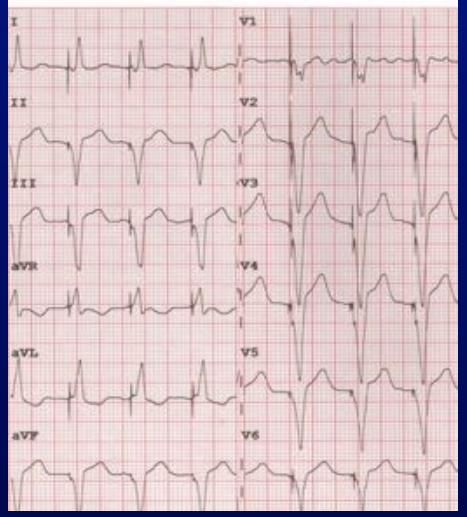
RS = 206 ms



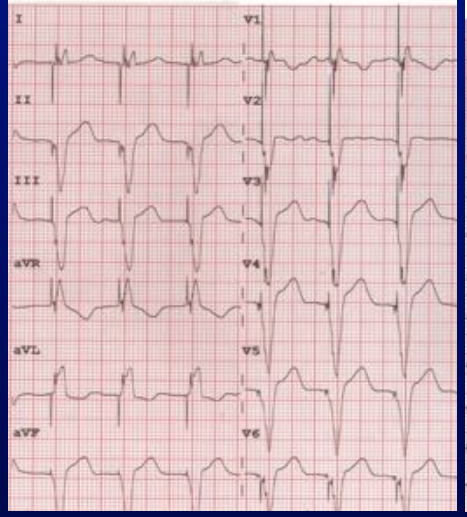
IVS + RVA + LVd: QRS = 151 ms



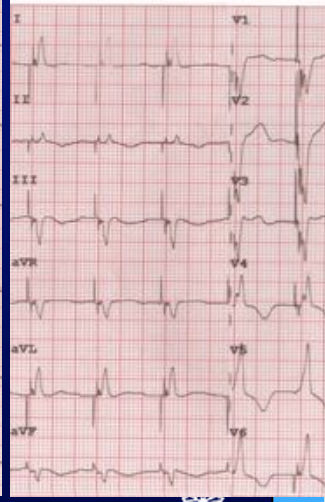
IVS + RVA + LVp: QRS = 146 ms



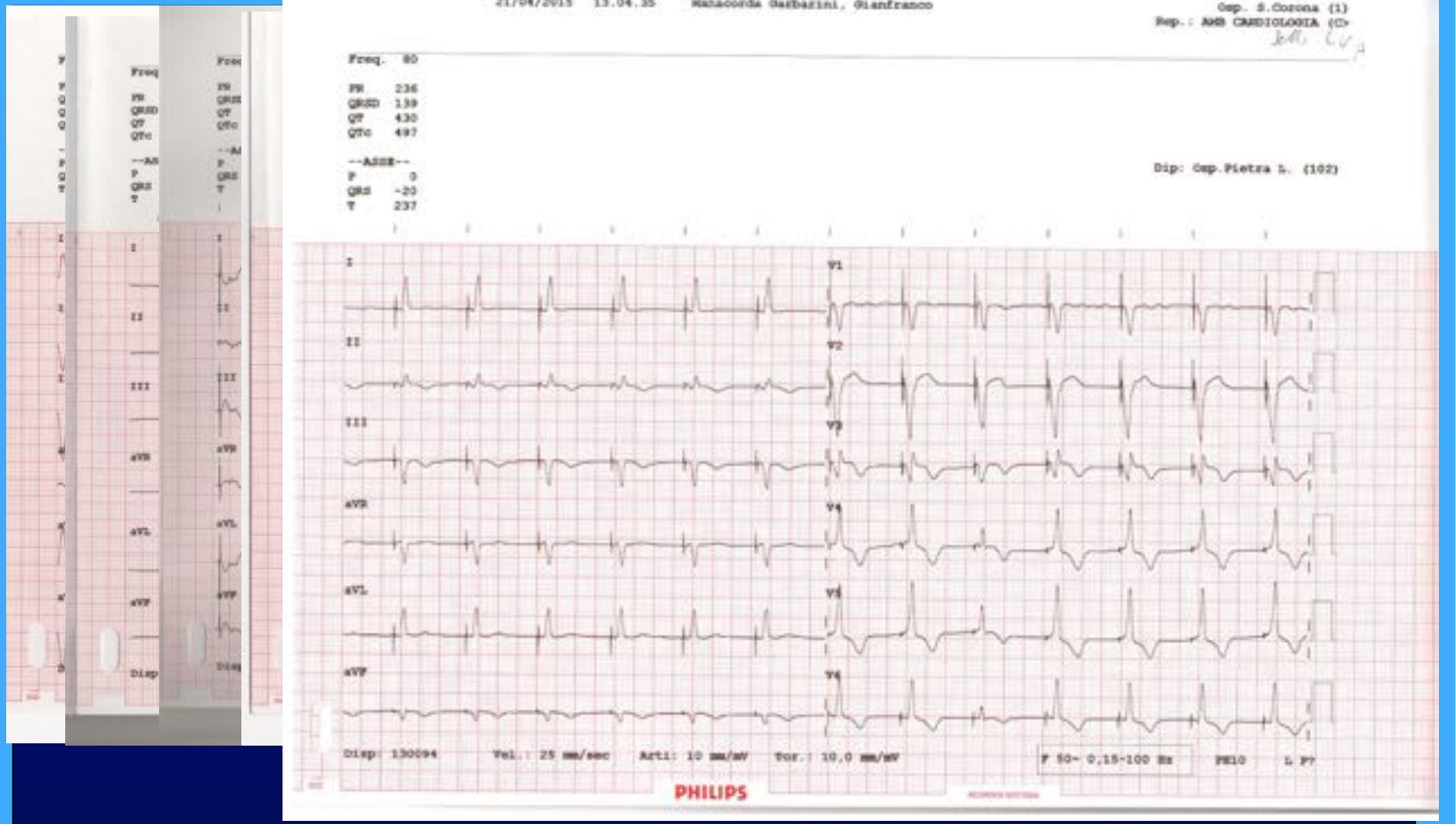
RVA + LVd + LVp: QRS = 160 ms



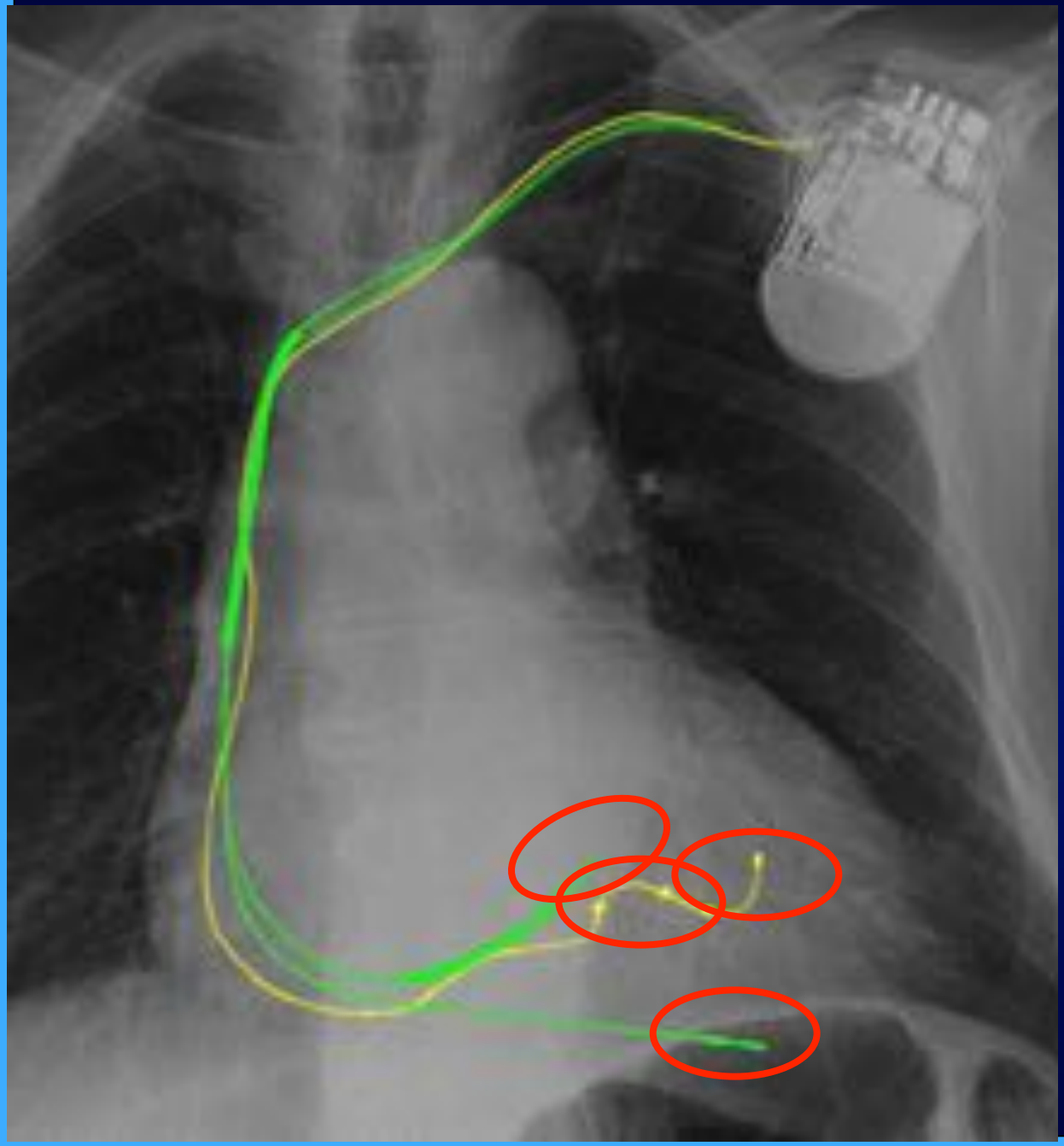
IVS + LVd + LVp: QRS =



Pietra Ligure



Pietra Ligure



PA VIEW

Pietra Ligure