Non Invasive Hemodynamic Optimization of Cardiac Resynchronization Therapy with Multipoint Left Ventricular Pacing: A Multicenter pilot Experience

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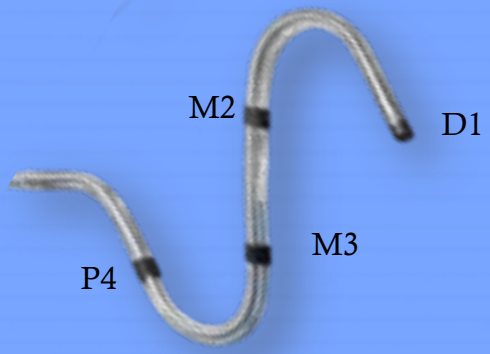
MultiPoint™ Pacing (MPP) Technology



distal D1

20 mm

M2

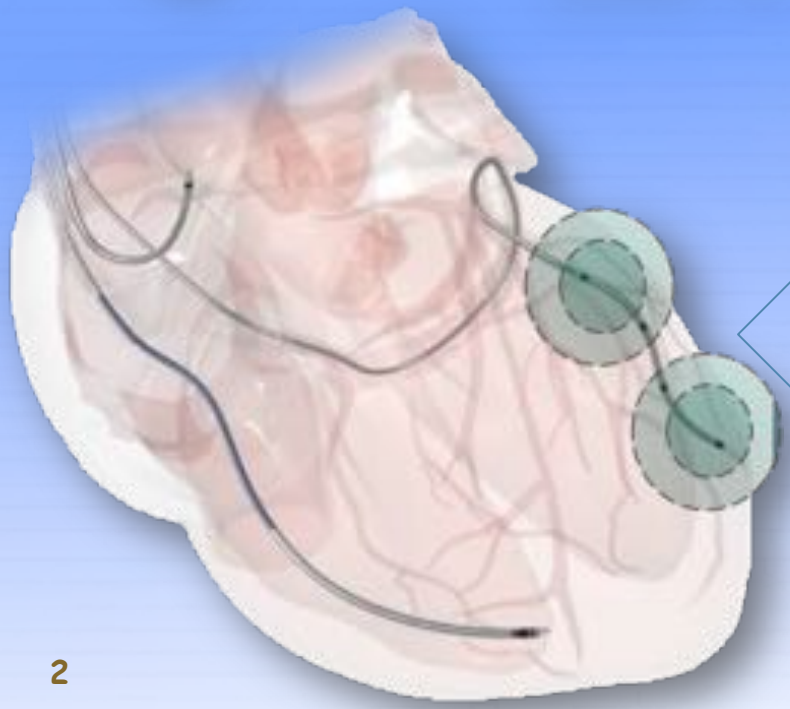
10 mm

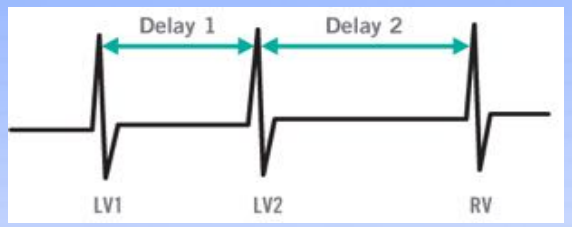
M3

17 mm

proximal P4

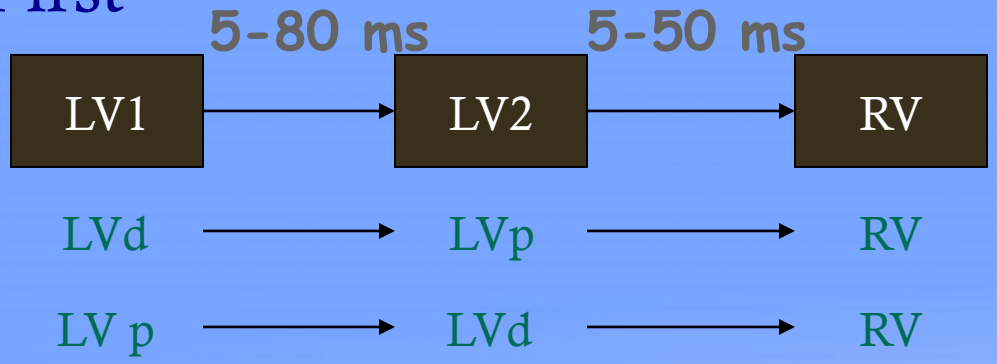
Vector	Cathode to Anode
1	D1 → M2
2	D1 → P4
3	D1 → RV Coil
4	M2 → P4
5	M2 → RV Coil
6	M3 → M2
7	M3 → P4
8	M3 → RV Coil
9	P4 → M2
10	P4 → RV Coil



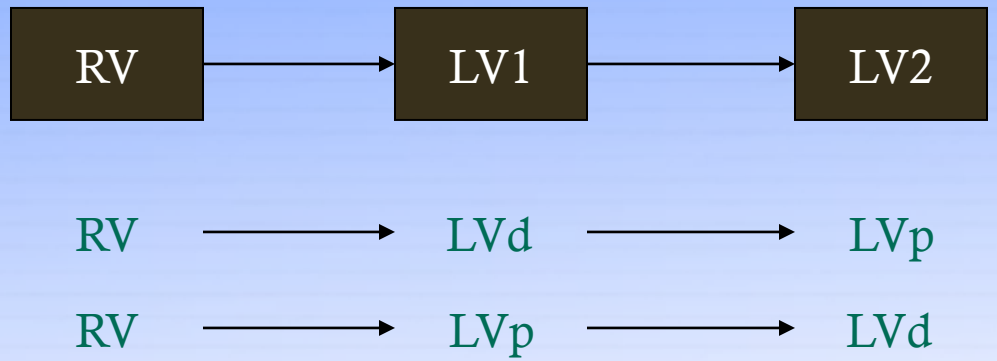


MultiPoint™ Pacing (MPP) Technology

LV First



RV First



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CLINICAL RESEARCH
Pacing and resynchronization therapy

Acute haemodynamic comparison of multisite and biventricular pacing with a quadripolar left ventricular lead

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Determining the optimal pacing vector and interventricular delay can be a challenge

Multipoint left ventricular pacing improves acute hemodynamic response assessed with pressure-volume loops in cardiac resynchronization therapy patients

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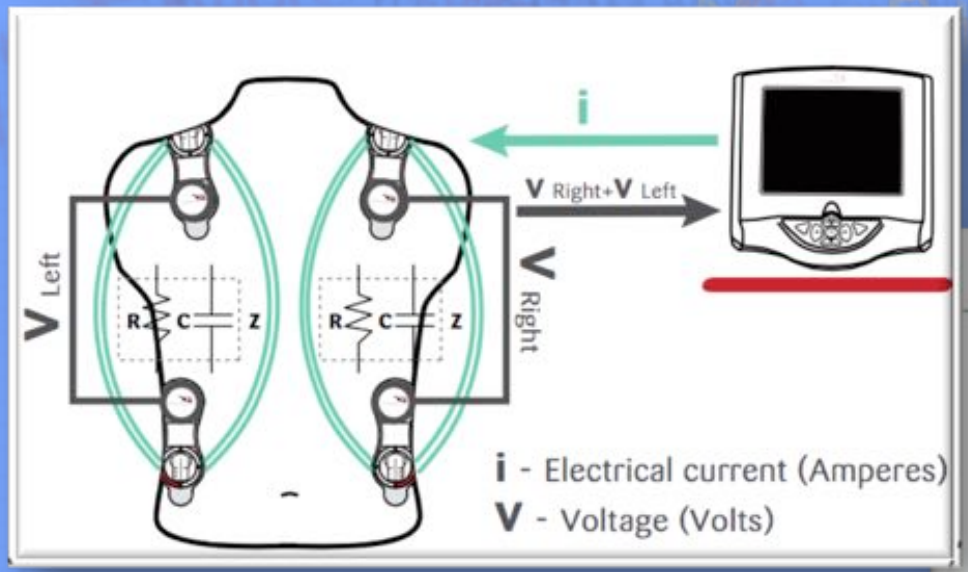
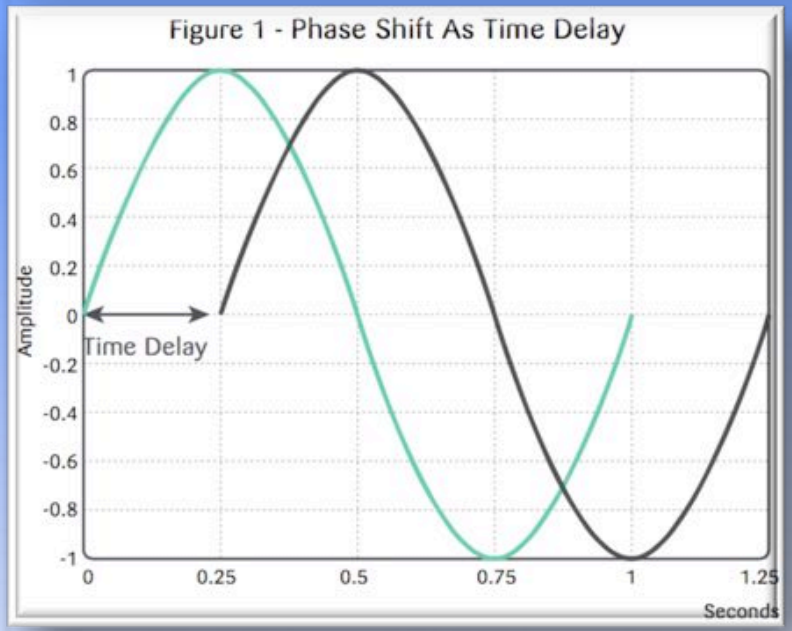
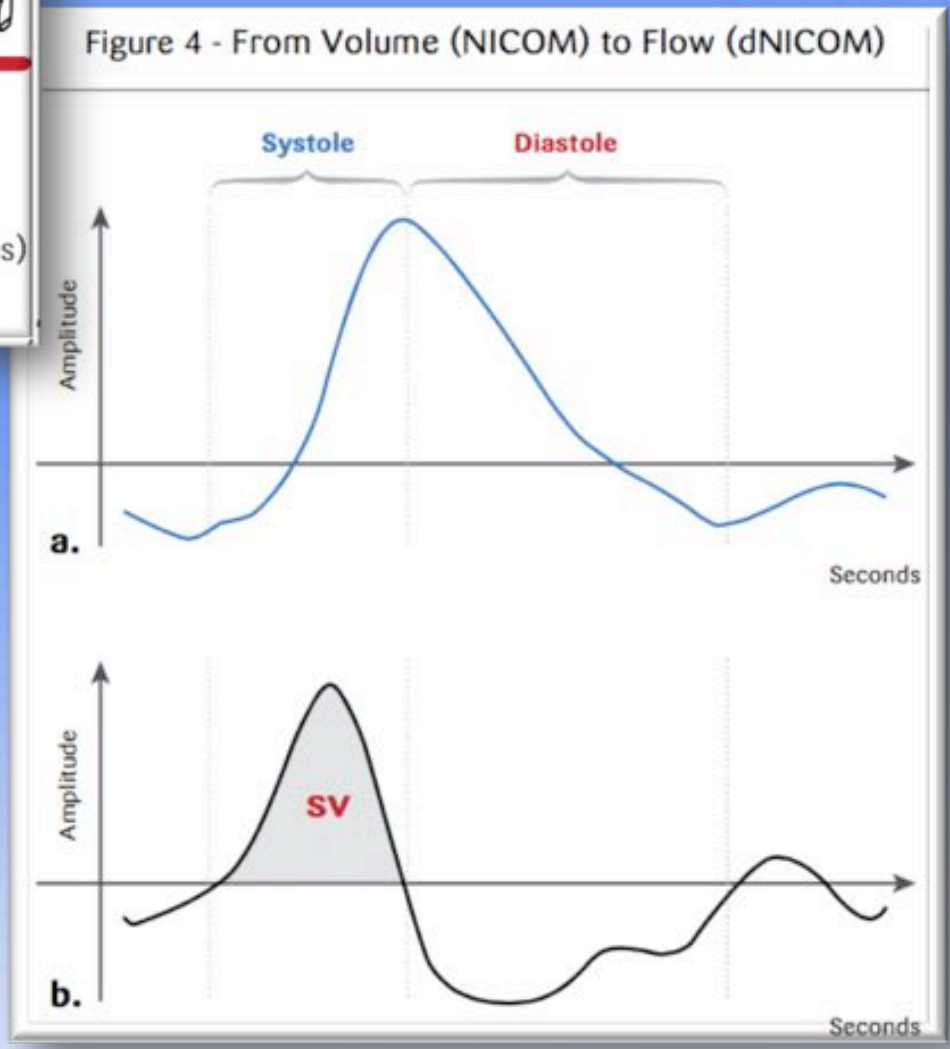






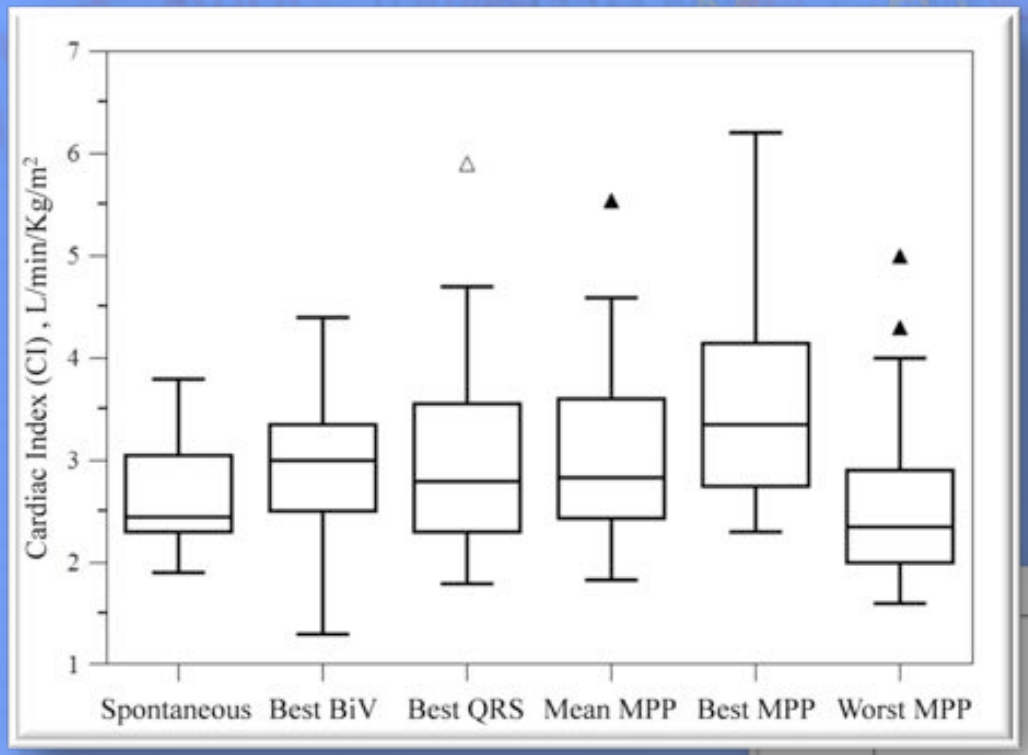
Cheetah Medical
Fluid Optimization Machines™

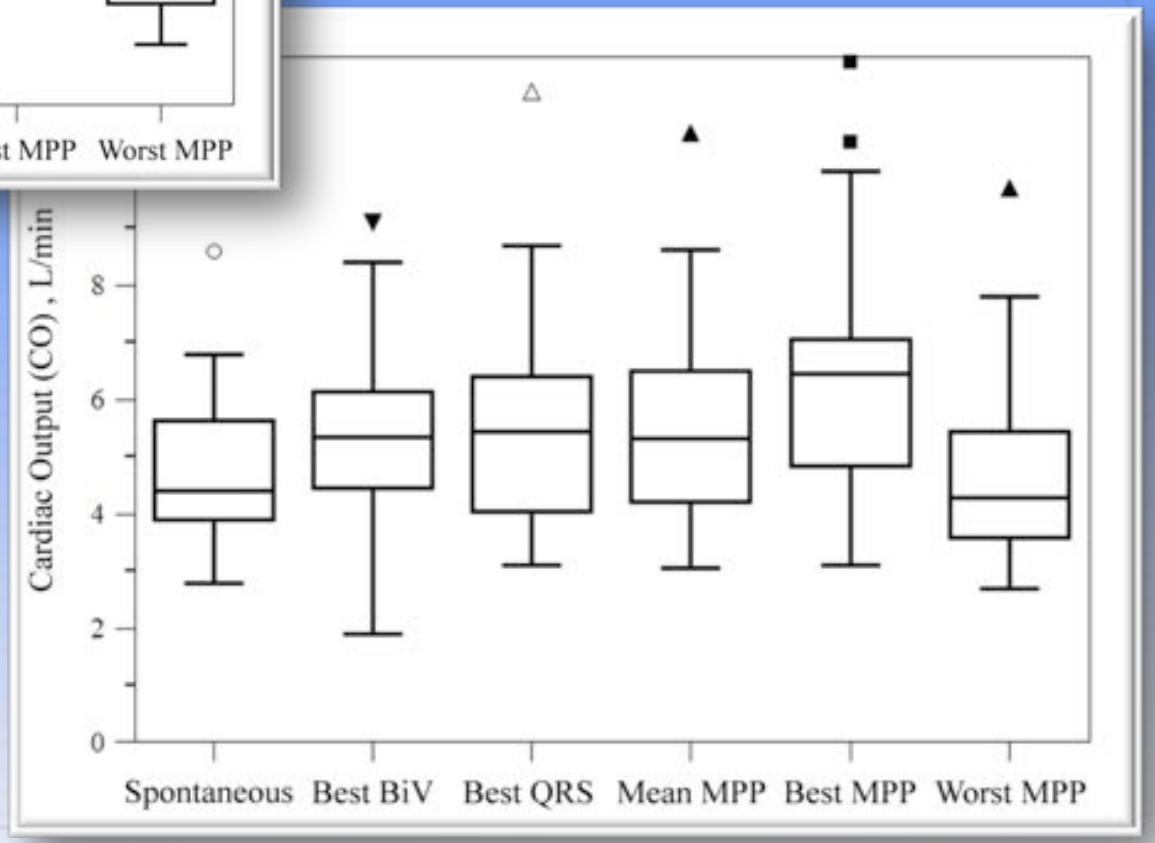
Total	**52 patients**
Non invasive hemodynamic measurement possible	**51 pts**
Age	**69.9±9.5 y**
Atrial Fibrillation	**4 pts (8.3%)**
QRS duration	**165.6±20.7 ms**
LBBB	**38 patient (73%)**
LV Ejection Fraction	**28.3±7.0%**
Ischemic Heart Disease	**30 pts (57.7%)**
Acceptable pacing dipoles per quadripolar lead (10 available)*	**6.3±2.8**

*pacing threshold ≤3 V at 0.5 ms and phrenic nerve stimulation threshold ≥ 2 x capture threshold

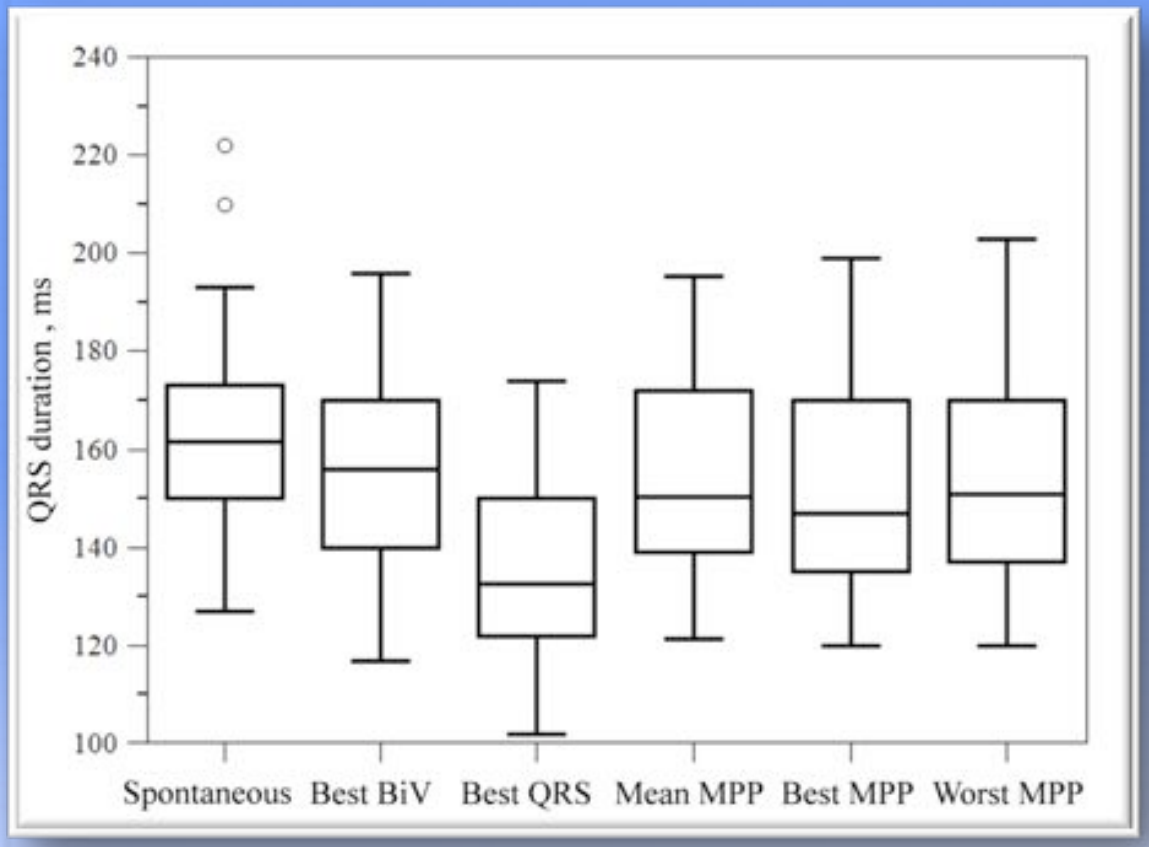
Configuration	**Stim 1**	*delay 1*	**Stim 2**	*delay 2*	**Stim 3**
MP 1	**RV**	*5 ms*	**LV +**	5 ms	**LV -**
MP 2	**RV**	*5 ms*	**LV +**	30 ms	**LV -**
MP 3	**RV**	*30 ms*	**LV +**	5 ms	**LV -**
MP 4	**LV +**	*5 ms*	**LV -**	5 ms	**RV**
MP 5	**LV +**	*5 ms*	**LV -**	30 ms	**RV**
MP 6	**LV +**	*30 ms*	**LV -**	5 ms	**RV**
MP 7	**RV**	*5 ms*	**LV -**	5 ms	**LV +**
MP 8	**RV**	*5 ms*	**LV -**	30 ms	**LV +**
MP 9	**RV**	*30 ms*	**LV -**	5 ms	**LV +**
MP 10	**LV -**	*5 ms*	**LV +**	5 ms	**RV**
MP 11	**LV -**	*5 ms*	**LV +**	30 ms	**RV**
MP 12	**LV -**	*30 ms*	**LV +**	5 ms	**RV**

Configuration analysed	Explanation
Best MPP	Multipoint configuration with highest CI measured
Worst MPP	Multipoint configuration with the lowest CI measured
Mean MPP	Average value of the 12 multipoint configuration analysed
Best BiV	Biventricular configuration with the highest CI measured
Best QRS	MPP or BiV configuration with the narrowest QRS measured

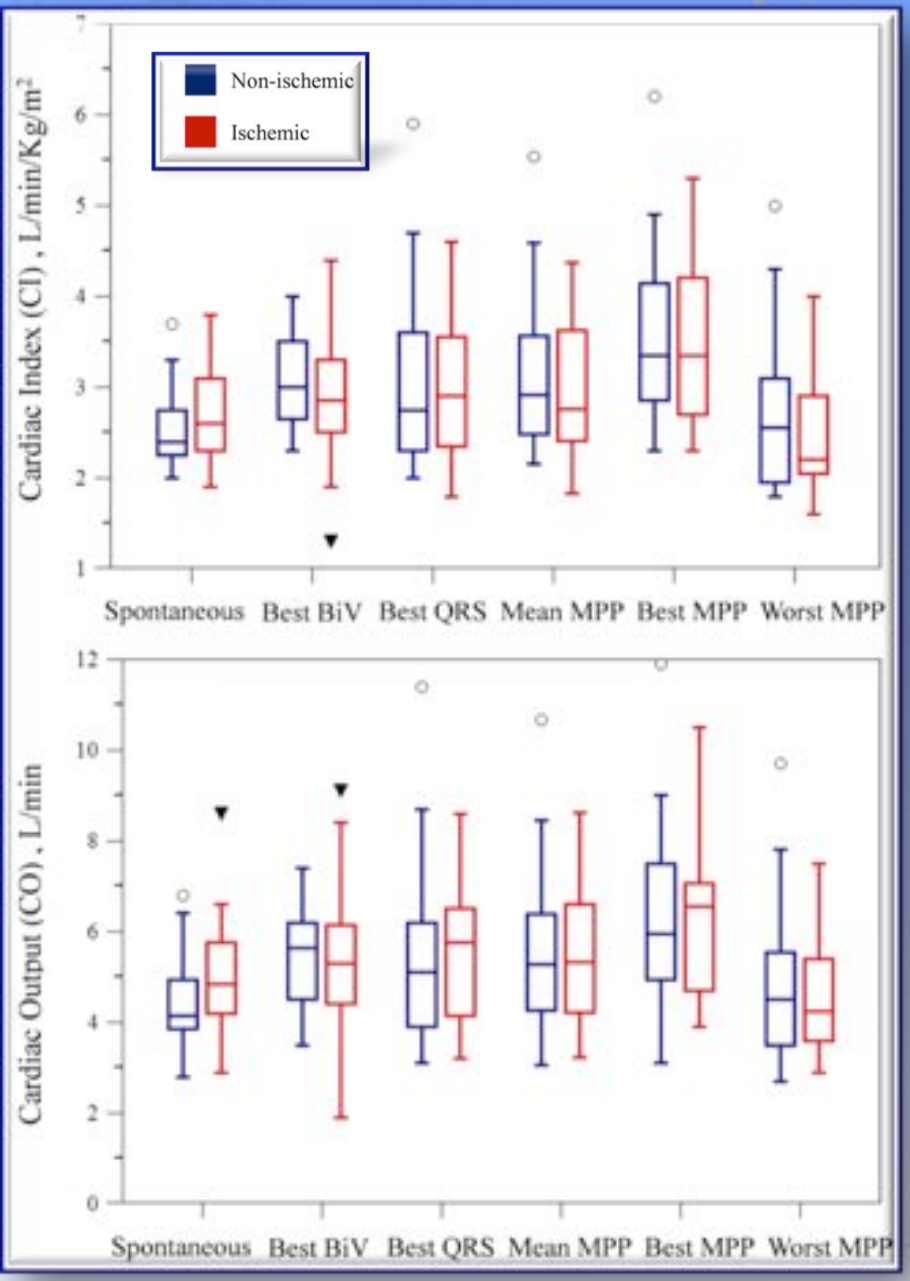

Cardiac Index (CI) , L/min/Kg/m²
7
6
5
4
3
2
1
Spontaneous
Best BiV
Best QRS
Mean MPP
Best MPP
Worst MPP


Cardiac Output (CO) , L/min
8
6
4
2
0
Spontaneous
Best BiV
Best QRS
Mean MPP
Best MPP
Worst MPP

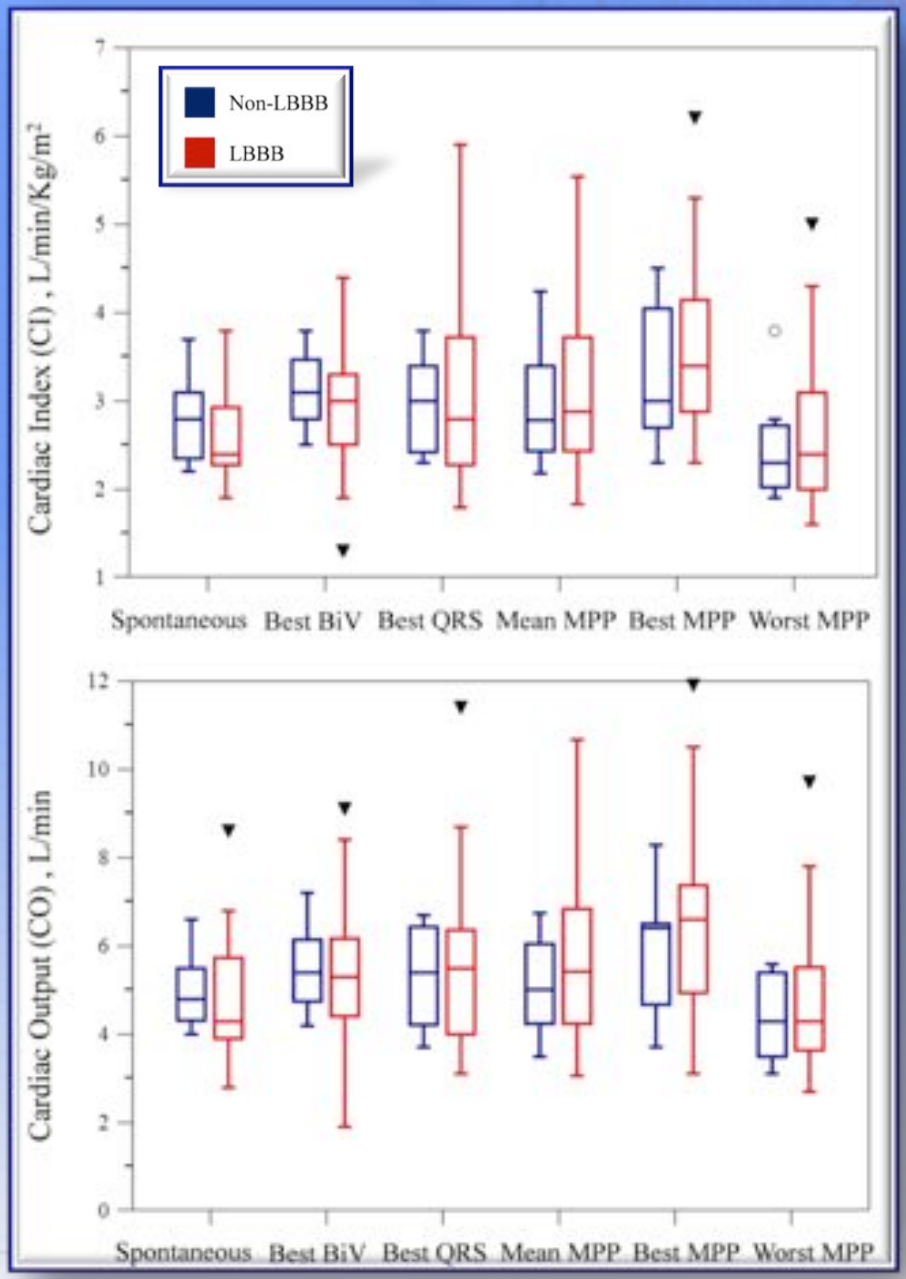
Variations in QRS duration

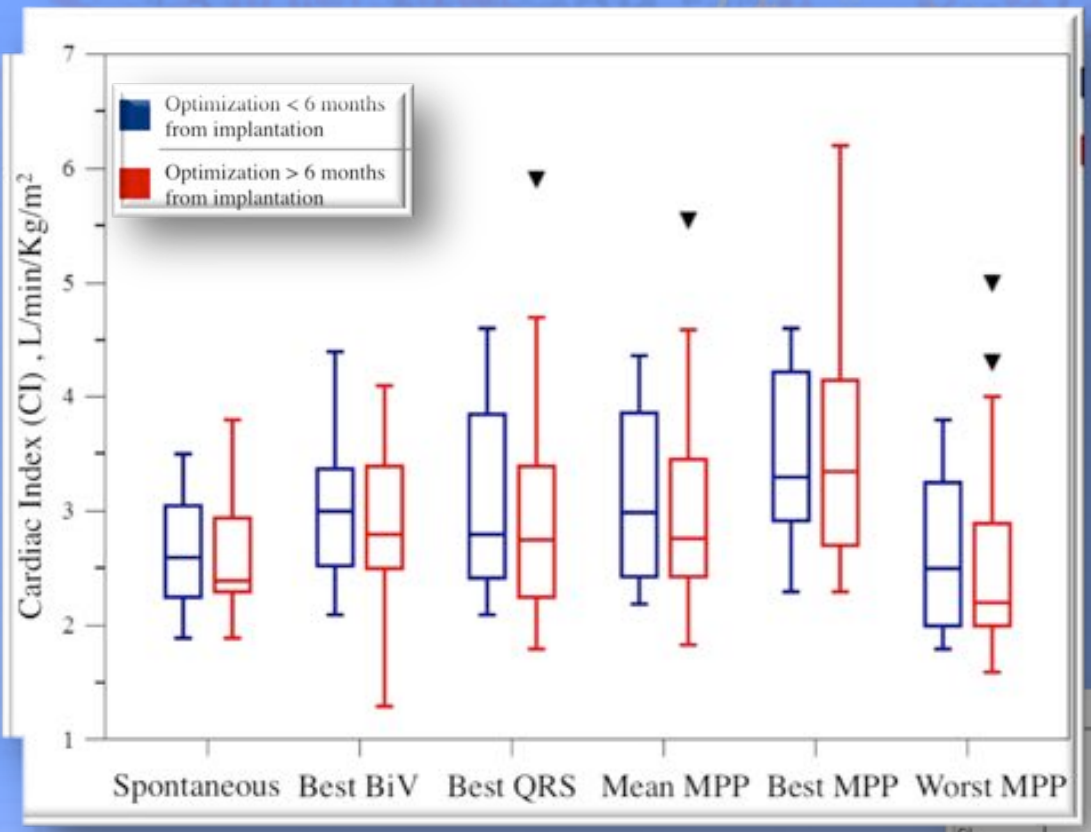


Comparison between ischemic and non-ischemic patients



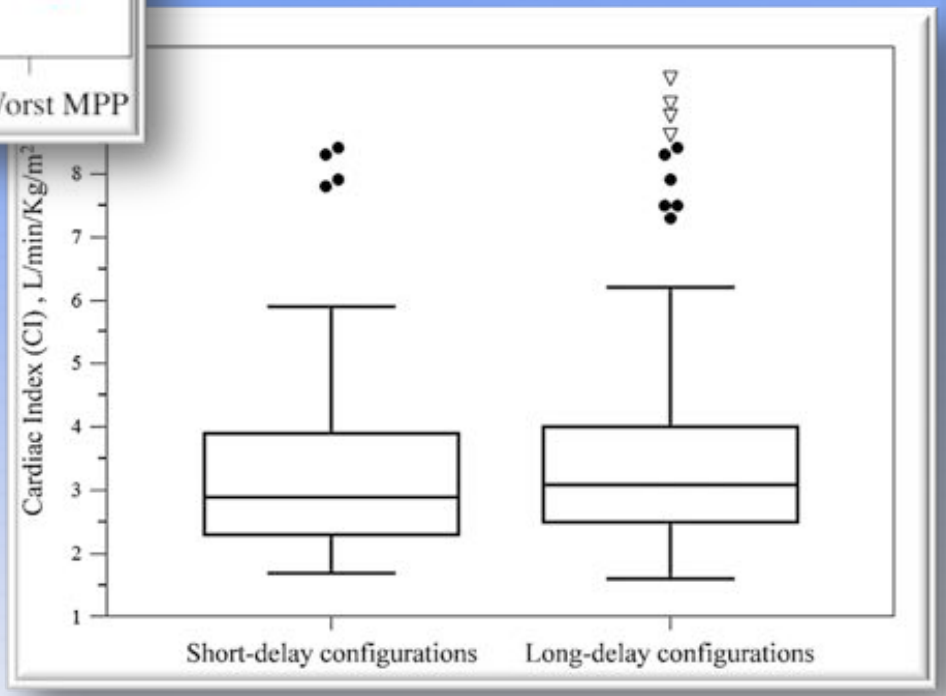
Comparison between LBBB and non-LBBB patients





Implantation-Optimization Time

Short Delays 5-5 ms
Vs
Long Delays 5-30: 30-5 ms



Key Messages

MPP and BiV stimulation increased the cardiac output compared to spontaneous rhythm, but not every MPP configuration presents an amelioration of hemodynamics compared to baseline, best BiV or the narrowest QRS

The narrowest QRS almost never corresponds to the best Cardiac Index

Key Messages

Our study demonstrates the need for a customization of biventricular pacing of multisite stimulation device by measuring hemodynamic parameters.

Different MPP configurations were analysed with significant modifications of cardiac index and this was not related to the QRS morphology.

Evaluating the best hemodynamic condition of patients implanted with this device can guide programming at the time of implantation or re-programming in case of non-responders.

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