The effect of multipoint pacing on the left ventricular mechanics in heart failure patients

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Disclosure

• This study is a sub-study by St. Jude Medical: MORE-CRT MPP {MOre REspone on Cardiac Resynchronization Therapy (CRT) with MultiPoint Pacing (MPP)}

• The sub-study was funded by St. Jude Medical
Purpose of the Investigation

The purpose of this clinical investigation is to assess the impact of the MultiPoint Pacing (MPP) feature at 12 months in the treatment of patients not responding to standard Cardiac Resynchronization Therapy (CRT) after 6 months.

The primary endpoint of this clinical investigation is evaluated at 12 months after enrollment and it is defined as the percentage of non-responder patients converted to responders after 6 months of MPP feature turned ON compared to baseline, as measured by Left Ventricular End Systolic Volume (LVESV) reduction of at least 15%.

The secondary endpoints of this clinical investigation are evaluated at 12 months after enrollment and are defined as:

- Reduction of LVESV between baseline and 6 Months visit
- Packer’s Clinical Composite Score evaluation between baseline and 12 Months visit and between 6 Months and 12 Months visits
- Reverse LV remodeling, measured as changes in LVESV, LVEDD and LVEF
- NYHA Class changes
- 6 minutes walking test changes
- Quality of Life (MLWHF and EQ-5D) changes
Inclusion Criteria

Eligible patients will meet ALL the following criteria:

• Meets the current ESC Guidelines or ACCF/AHA/HRS Class I or Class IIa indications for CRT implant (including upgrades from single or dual chamber ICDs)

• Must be willing and able to comply with study requirements

• Must indicate their understanding of the study and willingness to participate by signing an appropriate informed consent form
Project Flow Chart
(follow-up of Qualified subjects)
Protocol Requirements – MultiPoint™ Pacing

- The Quartet™ LV lead can be programmed with a combination of 10 possible pacing vectors using the Merlin™ PCS programmer:

<table>
<thead>
<tr>
<th>Vector Number</th>
<th>Vector</th>
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<tbody>
<tr>
<td>1</td>
<td>D1 – M2</td>
</tr>
<tr>
<td>2</td>
<td>D1 – P4</td>
</tr>
<tr>
<td>3</td>
<td>D1 – RVCoil</td>
</tr>
<tr>
<td>4</td>
<td>M2 – P4</td>
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<tr>
<td>5</td>
<td>M2 – RVCoil</td>
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<tr>
<td>6</td>
<td>M3 – M2</td>
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<td>7</td>
<td>M3 – P4</td>
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<tr>
<td>8</td>
<td>M3 – RVCoil</td>
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<tr>
<td>9</td>
<td>P4 – M2</td>
</tr>
<tr>
<td>10</td>
<td>P4 – RVCoil</td>
</tr>
</tbody>
</table>
Purpose

• Our objective was to compare the basic underlying LV mechanics (BL) to RV pacing (R), single point LV biventricular pacing (B) & MPP (M), and to evaluate contractility & dyssynchrony, in heart failure patients after primary MPP implantation or CRT upgrading.

• Study the patients at implantation time and observe at 6 months to evaluate the possibility of responsiveness prediction ability.
Background

Functional Motion of the Heart

• Heart muscle shortens in three directions, **Longitudinal, Circumferential, and Radial**

• Regional differences between shortening in these three directions lead to ventricular **torsion**

• LV base and apex rotate in opposite directions
Background

Strain & Strain Rate, Rotation, Torsion

Strain: “deformation” of the measured dimension, lengthening or shortening which is expressed as % dimension length change over time.

Strain Rate: Strain change over time (%/sec²)

Rotation: Angular displacement along the circumference.

Torsion: Net difference between apical and basal rotation.
Background – STE Example

• LV longitudinal shortening can be calculated (Citro et al., J CV Ultras, 2008)
Torsion and rotation measurements

Short axis views

Tracking Points
endocard
mid
epicard

Rotation Angle [deg]

Global Strain

Time [sec]
Study Protocol

• Patients Enrolled to the MORE-CRT MPP are asked to enroll to the SPKLS-CRT-MPP

• After implantation, in the first 24 h each patient is echoed by the GE vivid6 and the short axis and apical views are documented
Results

• 15 HF patients, 67±9 y.o., were implanted with a CRTD device in a single center & echoed with in 24 h.

• The cines were analyzed using speckle tracking methods for LV circumferential & longitudinal strain, rotation & torsion evaluation.

• The patients were discharged with single CRT point pacing & followed in 6 months.
Results

• LV longitudinal strain measurements showed an average global strain of:

  • -6.5±1.9% (RV), -7.6±2.3% (Single) & -6.2±2.2% (MPP) in the 4 chamber view

  • -6.0±1.7% (RV), -7.0±2.0% (Single) & -6.5±2.1% (MPP) in the 3 chamber view

  • -6.5±2.3% (RV), -7.2±1.1% (Single) & -6.8±1.7% (MPP) in the 2 CV,

  • showing a mild improvement of strain using CRT; (P=NS). No differences were observed in the radial & circumferential strains.
Results

• The segmental rotation showed an average apical rotation (APR) of 3.2±5.1° (RV), 4.7±6° (Single) & 5.1±5.1° (MPP)

• The mitral valve rotations of -1.6±3.5° (RV), -2.0±3.8° (Single) & -1.7±3.8° (MPP).

• The torsion improved from 3.5±4.9° (RV), to 5.7±5.1° (Single) & 6.6±5.4° (MPP), (P<0.08, suggestive).
Results

• 11 patient reached 6 months follow up.

• 6 patients showed above 17% decrease in LV end systolic volume & were defined as responders.

• Cross section analysis showed there were no indicative changes in the longitudinal or circumferential strains which could predict long term LV response.
Results

• Torsion analysis showed responding patients had better initial LV synchrony with apical rotation of 4.5±1.5° (RV), 4.8±1.5° (Single) & 5.6±1.7° (MPP) & minor torsion changes of 5.7±1.7° (RV), 6.6±1.7° (Single) & 6.8±2.0° (MPP)

• While non responders had initial dyssynchrony with apical rotation of 2.2±1.9° (RV), growing to 5.2±1.9° (Single) & 7.0±1.9° (MPP) and torsion going up from 2±2.1° (RV) to 6.5±2.1° (Single) & 9.7±2.1° (MPP) with mild MVR changes.
Results

• short term increased longitudinal strain did not correspond with long term LV responsiveness.

• LV dyssynchrony defined by decreased apical rotation & LV torsion during RV pacing, which improved significantly using CRT pacing, correlated with 6 months non-response.
Questions?

THANKS