Poster session: 3D-Echography

Robustness of new RT-3D echocardiography quantification of left ventricular volumes and ejection fraction by novices

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Background.— Real-time tridimensional echocardiography (RT3DE) has previously demonstrated good capacities in the quantification of left ventricular (LV) volumes and ejection fraction (EF) but it is limited by time-consuming analysis and the need of learning curve. Aims.— First, to evaluate the robustness of a new RT3DE semi-automatic analysis of LV volumes and EF, by a novice investigator. Second, to compare this new RT3DE LV quantification technique against two-dimensional echocardiography (2DE), and cardiac magnetic resonance imaging (CMRI).

Methods.— One hundred and ninety-one subjects (151 patients hospitalised in cardiology and 40 controls) were investigated by RT3DE and 2DE. Intra-observer reproducibility (novice), inter-observer reproducibility (novice vs expert), and repeatability (novice) were evaluated with linear regression and Bland-Altman analyses. Thirty patients were investigated the same day by 2DE, 3DE and CMRI.

Results.— Thirty-five patients were excluded because three LV segments or more were not correctly visualized in 2DE and 10 segments or more were not correctly visualized in 2DE and CMRI. Fifty patients were excluded because three LV segments or more were not correctly visualized in RT3DE and 2DE. Intra-observer reproducibility (novice), inter-observer reproducibility (novice vs expert), and repeatability (novice) were evaluated with linear regression and Bland-Altman analyses. Thirty patients were investigated the same day by 2DE, 3DE and CMRI.

Conclusion.— This new semi-automated algorithm of LV endocardial borders detection from RT3DE data is suitable for clinical use by novice investigator with greater reproducibility than 2DE. It allows rapid online, easy, accurate, and reproducible measurements of LV volumes, and EF, well correlated with CMRI.

New RT3DE quantification of global longitudinal, circumferential, radial and area strains: Reproducibility, correlations to cardiac output, and clinical applications

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Background.— Two-dimensional (2D) speckle tracking echocardiographic strain analysis has demonstrated good capacities in the quantification of left ventricular (LV) contraction but it is limited by LV geometric modelling and the assumption that speckles can be tracked from frame to frame, despite their out of plane motion. Aims.— First, to evaluate the reproducibility of 2D and real-time tridimensional echocardiography (RT3DE) analysis of global longitudinal (GLS), circumferential (GCS), radial (GRS), and area (GAS) systolic strains. Second, to study values in different populations: healthy subjects, hypertrophic cardiomyopathy (HCM), dilated cardiomyopathy (DCM), and ischemic cardiomyopathy (ICM).

Methods and results.— After exclusion of 54 patients for poor quality window or arrhythmia, GLS, GCS, GRS, and GAS were determined in 171 subjects (40 healthy individuals, 30 HCM, 34 DCM, 30 ICM, and 37 others indications) by 2D and RT3DE. Mean intra-observer (novice) and inter-observer (novice vs expert) variabilities were 7% and 10% for 3D GLS, 6% and 12% for GCS, 5% and 10% for GRS, and 8% for GAS. The best correlations with LV output were obtained for GAS ($y = -0.11x + 1.27$, $r = 0.78$, $P < 0.001$). Values obtained in controls and in the different populations of patients (HCM, ICD, DCM) are presented in the Table. Patients with HCM and normal EF had significant decrease in GLS, GCS and GAS but not GRS (compared to controls). In ICM and DCM, all strains were significantly decreased compared to controls.

Conclusion.— New RT3DE strain analysis is robust and accurate with greater reproducibility than 2DE particularly concerning radial strain. Area strain is the greatest parameter correlated to LV output. The reference values for 3D global strains were obtained in a healthy population and is available for use in a wide clinical setting.

### Table

<table>
<thead>
<tr>
<th>Strain Type</th>
<th>Controls (n=40)</th>
<th>HCM (n=30)</th>
<th>ICM (n=30)</th>
<th>DCM (n=34)</th>
</tr>
</thead>
<tbody>
<tr>
<td>GLS (%)</td>
<td>19.2 ± 2.1</td>
<td>16.0 ± 2.5</td>
<td>10.9 ± 3.3</td>
<td>9.6 ± 3.3</td>
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<tr>
<td>GCS (%)</td>
<td>19.5 ± 4.7</td>
<td>21.5 ± 3.7</td>
<td>11.7 ± 3.1</td>
<td>4.9 ± 3.8</td>
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<tr>
<td>GRS (%)</td>
<td>53.4 ± 10.4</td>
<td>47.1 ± 10.4</td>
<td>28.7 ± 12.7</td>
<td>32.3 ± 9.3</td>
</tr>
<tr>
<td>GAS (%)</td>
<td>32.7 ± 3.4</td>
<td>29.7 ± 3.3</td>
<td>19.7 ± 7.0</td>
<td>17.1 ± 6.1</td>
</tr>
</tbody>
</table>

$P < 0.05$ vs controls.


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