**Left atrial function assessed by 3-dimensional echocardiography is an independent predictor for mortality in heart failure with reduced ejection fraction**

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**Funding Acknowledgements:** Type of funding sources: Public grant(s) – National budget only. Main funding source(s): Grant TE 137/2020

**Background.** Patients with heart failure and reduced ejection fraction (HFrEF) are at high risk for death. So far, left ventricular ejection fraction (LVEF) measured by 2-dimensional echocardiography (2DE) has been considered the main predictor of mortality in HFrEF. However, there are new echo parameters reflecting cardiac remodeling, assessed by 3-dimensional echocardiography (3DE), that might improve risk stratification in HFrEF.

**Aim.** To assess comparative prognostic value of left heart function and remodeling parameters, measured by 2DE versus 3DE, in patients with HFrEF.

**Methods.** 142 consecutive patients (60±17 years, 91 males), diagnosed with HFrEF, in sinus rhythm, were assessed by 2DE, using dedicated views for the LV and left atrium (LA), and by 3DE, with full-volume multi-beat acquisitions of the LV and LA. Left ventricular volumes (LVVs) were measured from 2DE views, using the modified Simpson biplane method, and from 3DE using dedicated software. Maximal and minimal indexed LAVs were measured from 2DE, using the biplane area-length formula (2D_LAVmax and 2D_LAVmin); and from 3DE, using dedicated software package (3D_LAVmax and 3D_LAVmin). Patients were followed for 5 years (57±11 months) after the index event. Primary outcome was mortality. Secondary outcomes were a composite endpoint (CE) of death and hospitalization for heart failure (HHF); HHF; and a composite cardiac events end-point (MACE) of death, HHF, myocardial infarction, coronary revascularization, arrhythmias, or cardiac resynchronization therapy.

**Results.** At 5 years we recorded 52 deaths, 70 CE, 36 HHF, and 73 MACE. At baseline, mean 2DE and 3DE LVEFs were 32±10% and 32±9%, respectively.

There was no significant difference between the LVVs or LVEF by 2DE or 3DE between survivors and non-survivors. However, there was a significant difference for total and indexed 2D_LAVmax, 3D_LAVmax, and 3D_LAVmin (Table 1) between survivors and non-survivors.

Similarly, there was no significant correlations with endpoints for the 2DE or 3DE LVVs. However, total and indexed 2D_LAVmax correlated with death, CE, HHF, and MACE, all with P < 0.03. Furthermore, total and indexed 3D_LAVmax, and 3D_LAVmin correlated with death, CE, HHF, and MACE, all with P < 0.05.

In a linear multivariate regression model, that included 2DE and 3DE LVEF, indexed 2D and 3D LAV max and min, only indexed 3D_LAVmin was an independent predictor for death (p = 0.001), CE (p = 0.005), HHF (p = 0.009) and MACE (p = 0.006).

Furthermore, by ROC analysis, an indexed LAV of 30 ml/m2 by 3DE was able to predict death (Sb 94%, Sp 80%, AUC 0.70), CE (Sb 98%, Sp 80%, AUC 0.67), HHF (Sb 96%, Sp 80%, 0.67), and MACE (Sb 93%, Sp 76%, AUC 0.66).

**Conclusion.** LVEF by 2DE and 3DE, while smaller in non-survivors, was unable to predict death in a small cohort of patients with HFrEF. However, LAVs, particularly by 3DE, were able to predict cardiac events, suggesting the potential key value of evolving cardiac substrate.

**Abstract Table 1**

<table>
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<th>PARAMETER</th>
<th>NON-SURVIVORS</th>
<th>SURVIVORS</th>
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<tr>
<td>2D_LAVmax (ml)</td>
<td>106±38</td>
<td>89±24</td>
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<td>Indexed 2D_LAVmax (ml/m2)</td>
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<td>47±13</td>
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<td>3D_LAVmax (ml)</td>
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<td>3D_LAVmin (ml)</td>
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<td>47±20</td>
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