3D Echocardiography Assessment of the Right Ventricle

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CLINICAL QUESTIONS

- RV size
- Global systolic function
- Regional systolic function and RV mechanics
- RV shape
CHALLENGES IN RV ASSESSMENT BY ECHOCARDIOGRAPHY

- Unfavorable location within the thoracic cavity
- Complex 3D anatomy
- Prominent trabeculation
- Limited number of anatomical landmarks
- Complex mechanism of RV contraction

Minor alterations in 2D plane orientation – significant changes in RV diameters

Surkova E, et al.  
*The use of multimodality imaging to assess right ventricular size and function*  
Int J Cardiol, 2016
Reference values depend on age, gender and race

<table>
<thead>
<tr>
<th>Abnormality threshold</th>
<th>Gender</th>
<th>3DE</th>
</tr>
</thead>
<tbody>
<tr>
<td>RV EDVi (ml/m²)</td>
<td>men</td>
<td>&gt;87</td>
</tr>
<tr>
<td></td>
<td>women</td>
<td>&gt;74</td>
</tr>
<tr>
<td>RV ESVi (ml/m²)</td>
<td>men</td>
<td>&gt;44</td>
</tr>
<tr>
<td></td>
<td>women</td>
<td>&gt;36</td>
</tr>
<tr>
<td>RV EF (%)</td>
<td></td>
<td>&lt;45</td>
</tr>
</tbody>
</table>

Reference values depend on age, gender and race


Maffessanti F. et al. *Circulation CV Imaging 2013*
3D RV EF, EDVi and ESVi are significant predictors of all-cause mortality

$\chi^2 = 34.65, p < 0.0001$

**CLINICAL CASE 1: RV Function?**

- EF <45%
- EF >=45%

- RVEF: area under curve 0.8306; p<0.0001
- TAPSE: area under curve 0.7593; p<0.0001
- FAC: area under curve 0.6919; p<0.0001

E. Surkova, et al. 3DE right ventricular volumes and EF predict mortality in unselected patients with various cardiac diseases. EHJ-CVI, 2017
LONGITUDINAL & RADIAL FUNCTION: 3D ECHOCARDIOGRAPHY

Healthy volunteer
CCTGA: Systemic RV

RV Volume overload
LV Dilatation with rEF
The curvature of the RV inflow tract was a more robust predictor of death than RV EF, RV volumes, or other regional curvature Indices.

Reference values for the RV curvature are available

Insight into LV and RV shape and morphology with increasing pump speeds may have an impact on LVAD speed optimization.
Strengths and limitations of 3D echocardiography in assessing the RV

**Major advantages**
- Direct measurements of volumes and EF
- No geometric assumptions
- Higher accuracy and reproducibility than 2DE parameters
- Additive prognostic value in congenital and acquired heart diseases

- Novel 3DE-based methods allow to assess:
  - relative contribution of longitudinal and radial contractility to RV EF,
  - RV shape

**Major limitations**
- Need of stable cardiac rhythm and patients’ cooperation
- Severely dilated RV may be difficult to encompass in a 3D data set
- Requires good image quality

**TAKE HOME MESSAGES**

- 3DE should be performed in all patients’ categories where RV information is clinically/prognostically important:
  - PH,
  - Congenital heart disease,
  - Heart failure,
  - MI,
  - ARVC,
  - RV pathology/failure
THANK YOU FOR YOUR ATTENTION