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

### Reference values

<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.

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**Lang RM, et al.**

*Recommendations for cardiac chamber quantification.*

EHJ Cardiovasc Imaging, 2015

**Maffessanti F, et al.**

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

\[ X^2 = 34.65, \ p < 0.0001 \]

E. Surkova, et al.
3D right ventricular volumes and EF predict mortality in unselected patients with various cardiac diseases
EHJ-CVI, 2017

ARE THE 2D PARAMETERS ACCURATE ENOUGH?

3D RV EF, EDVi and ESVi are significant predictors of all-cause mortality
CLINICAL CASE 1: RV Function?

LONGITUDINAL & RADIAL FUNCTION: 3D ECHOCARDIOGRAPHY
LONGITUDINAL & RADIAL FUNCTION: QUANTIFICATION

[Diagram showing healthy volunteer and heart transplant recipient with graphs of ventricular function over the cardiac cycle.]

RV SHAPE: 3D ECHOCARDIOGRAPHY

[Images of healthy volunteer heart, RV volume overload, and CCTGA systemic RV with 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

<table>
<thead>
<tr>
<th>Major advantages</th>
<th>Major limitations</th>
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<tbody>
<tr>
<td>• Direct measurements of volumes and EF</td>
<td>• Need of stable cardiac rhythm and patients’ cooperation</td>
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<tr>
<td>• No geometric assumptions</td>
<td>• Severely dilated RV may be difficult to encompass in a 3D data set</td>
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<td>• Higher accuracy and reproducibility than 2DE parameters</td>
<td>• Requires good image quality</td>
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<td>• Additive prognostic value in congenital and acquired heart diseases</td>
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<td>• Novel 3DE-based methods allow to assess:</td>
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<tr>
<td>✓ relative contribution of longitudinal and radial contractility to RV EF,</td>
<td></td>
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<tr>
<td>✓ RV shape</td>
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</table>

## 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

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*Lang R., et al., 2015*
THANK YOU FOR YOUR ATTENTION