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EGYPTIAN SOCIETY OF CARDIOLOGY  
**CardioEgypt 2018**

## 3D Echocardiography Assessment of the Right Ventricle

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### CLINICAL QUESTIONS

- RV size



- Global systolic function

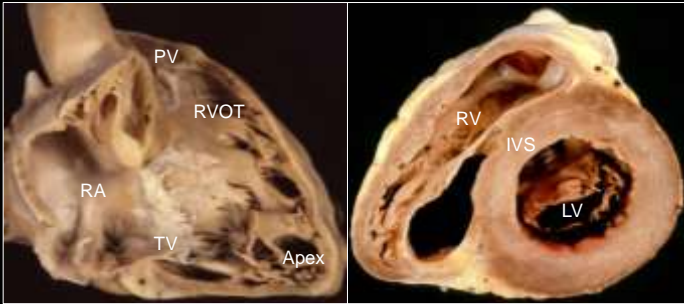


- Regional systolic function and RV mechanics

- RV shape

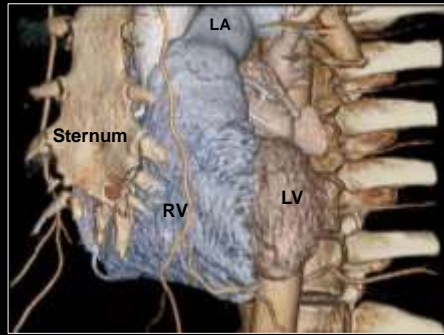


## CHALLENGES IN RV ASSESSMENT BY ECHOCARDIOGRAPHY

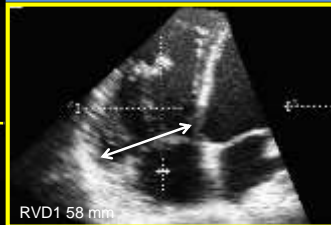
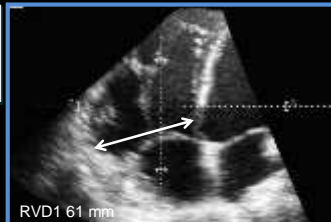
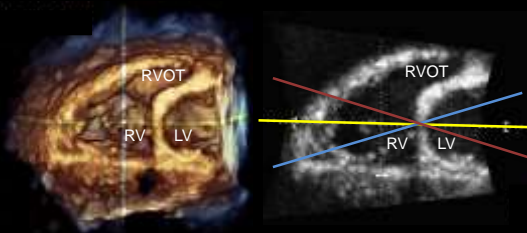


Images: courtesy of Dr. F. Paletra and Dr. C. Basso

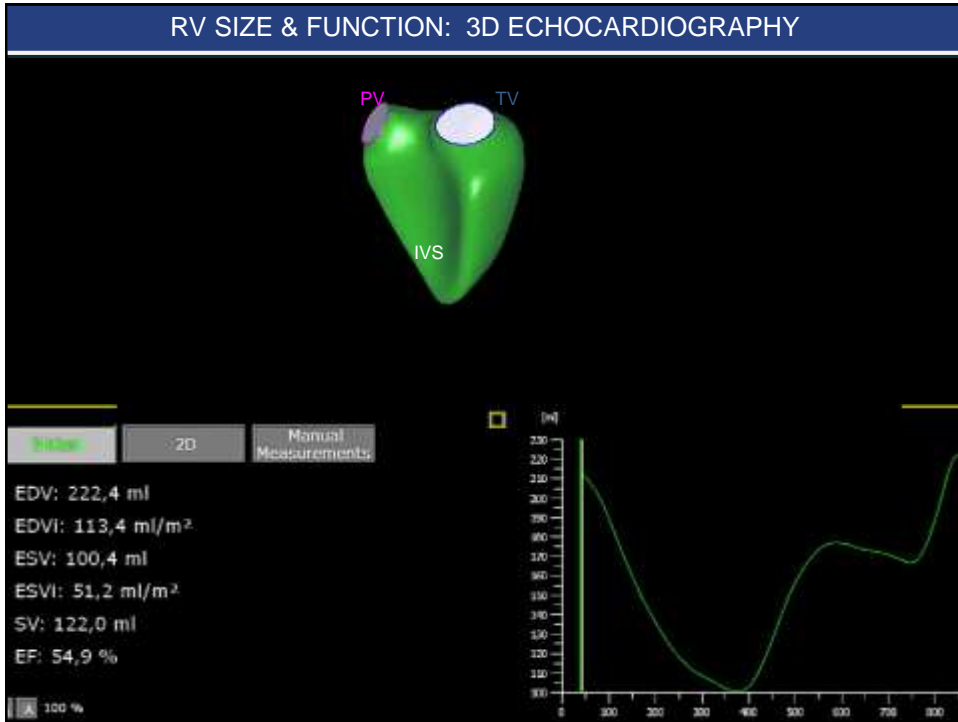
- Unfavorable location within the thoracic cavity
- Complex 3D anatomy
- Prominent trabeculation
- Limited number of anatomical landmarks
- Complex mechanism of RV contraction



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



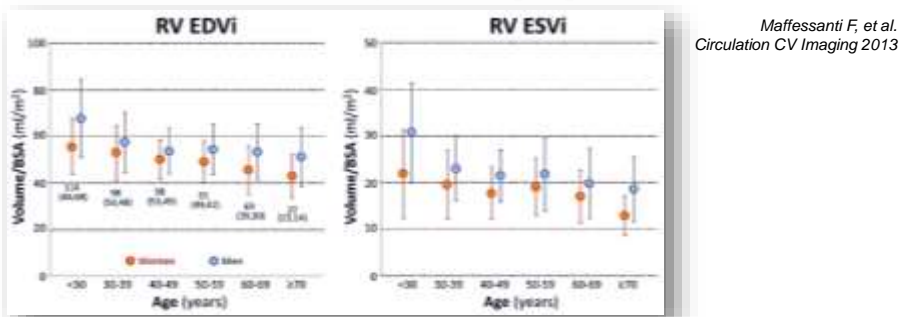
Surkova E, et al.  
*The use of multimodality imaging to assess right ventricular size and function*  
 Int. Journal of Cardiol. 2016



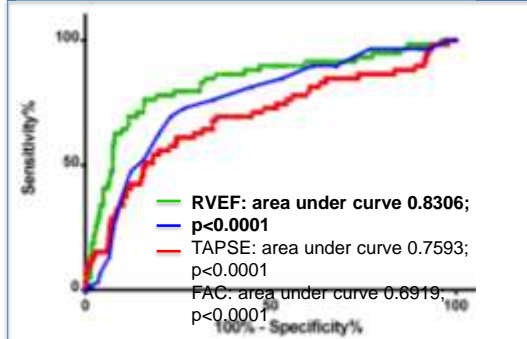
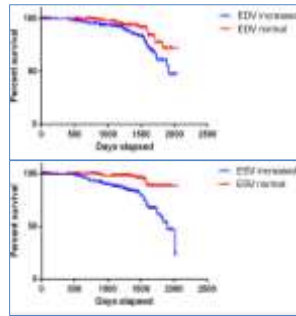
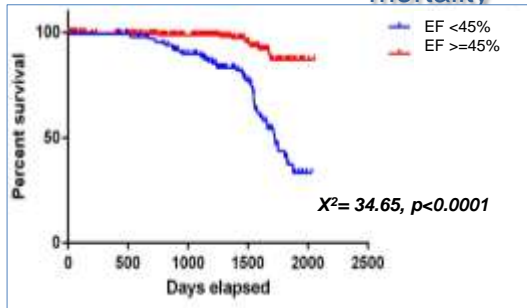
## Reference values

Abnormality threshold	Gender	3DE	
RV EDVi (ml/m <sup>2</sup> )	men	>87	Lang RM, et al. <i>Recommendations for cardiac chamber quantification.</i> EHJ Cardiovasc Imaging, 2015
	women	>74	
RV ESVi (ml/m <sup>2</sup> )	men	>44	
	women	>36	
RV EF (%)		<45	

### Reference values depend on age, gender and race

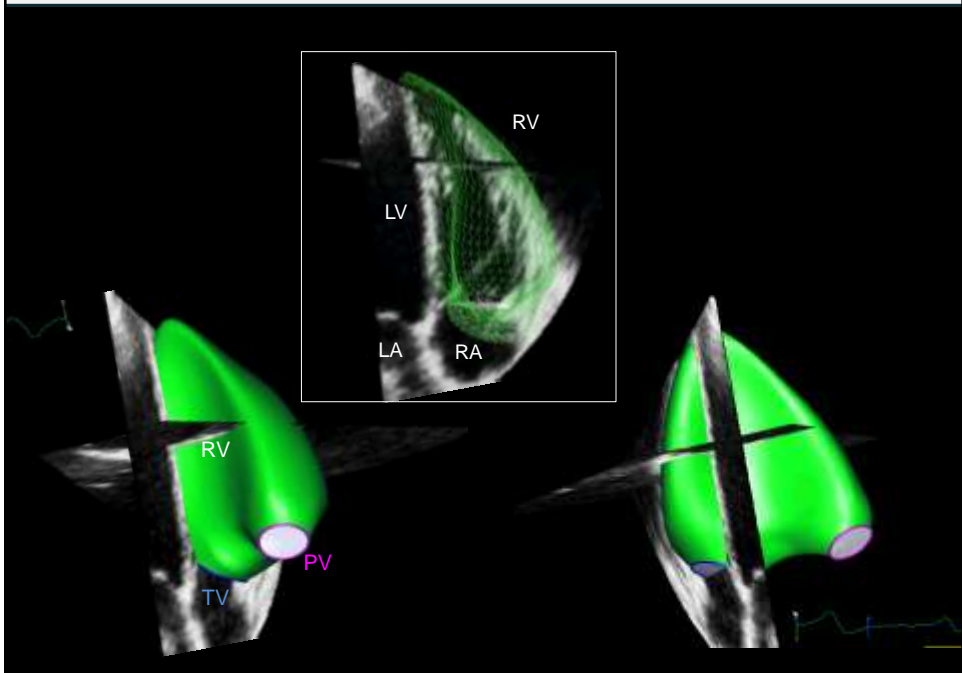


3D RV EF, EDVi and ESVi are significant predictors of all-cause mortality

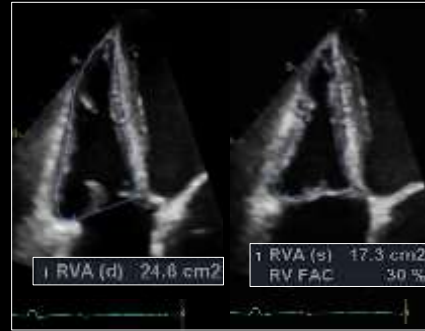
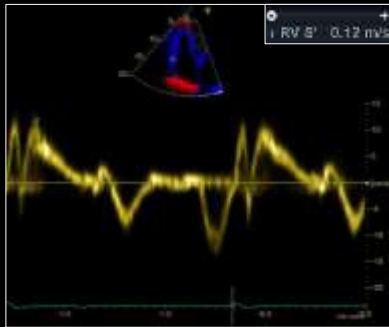
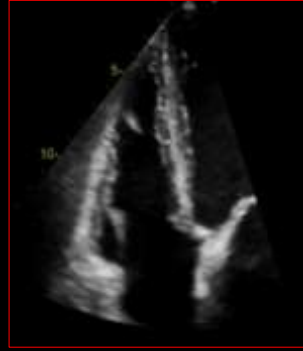
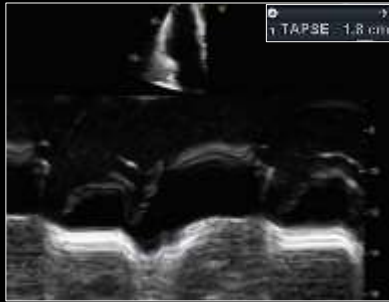


*E. Surkova, et al. 3DE right ventricular volumes and EF predict mortality in unselected patients with various cardiac diseases EHI-CVI, 2017*

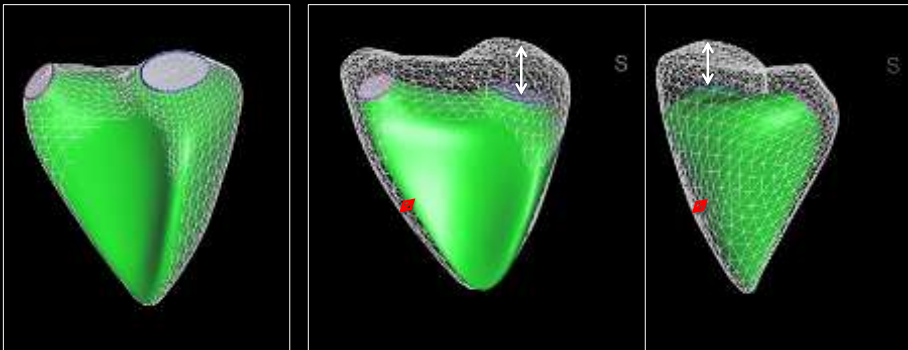
ARE THE 2D PARAMETERS ACCURATE ENOUGH?

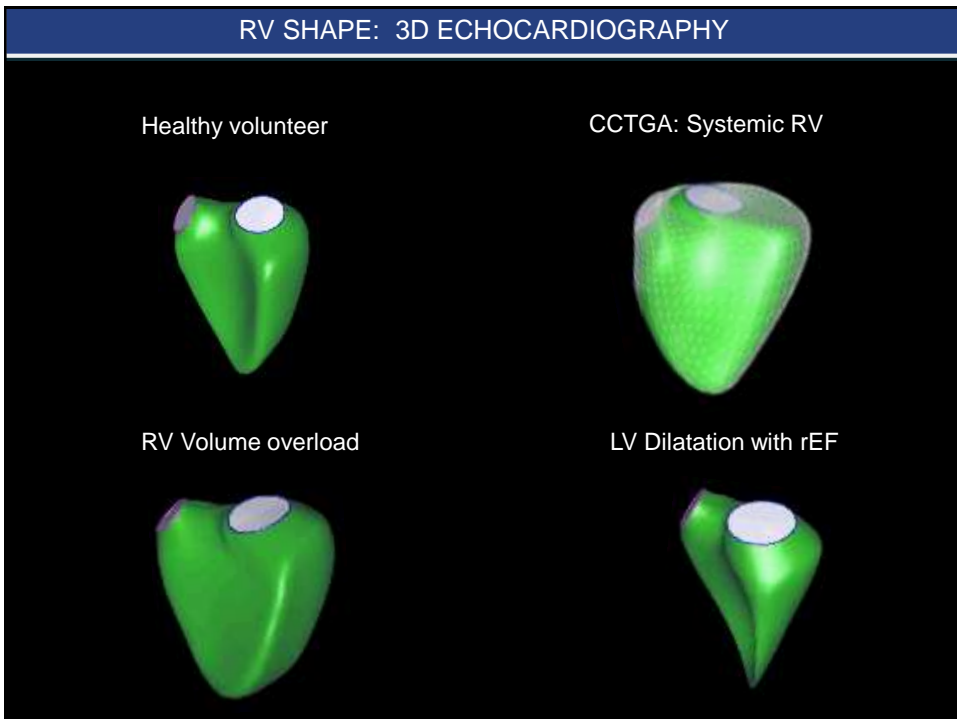
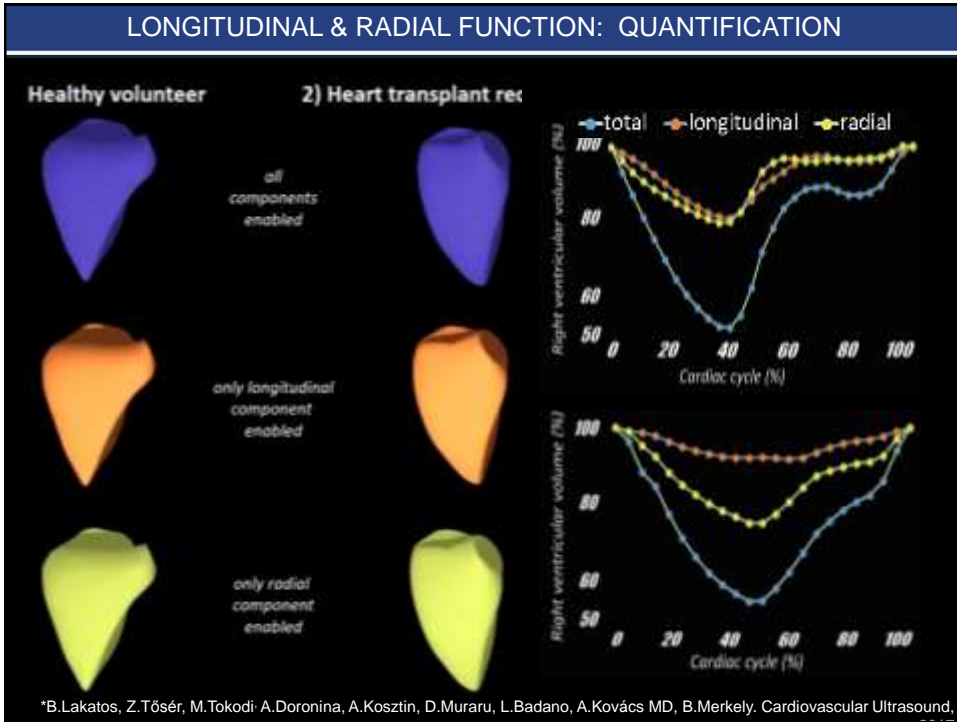


## CLINICAL CASE 1: RV Function?

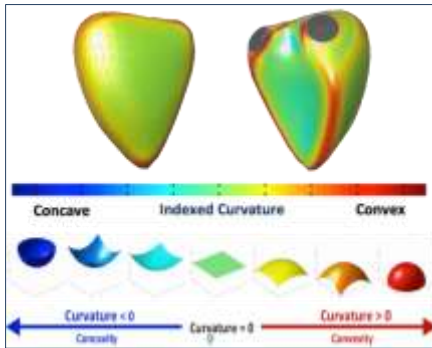


## LONGITUDINAL &amp; RADIAL FUNCTION: 3D ECHOCARDIOGRAPHY

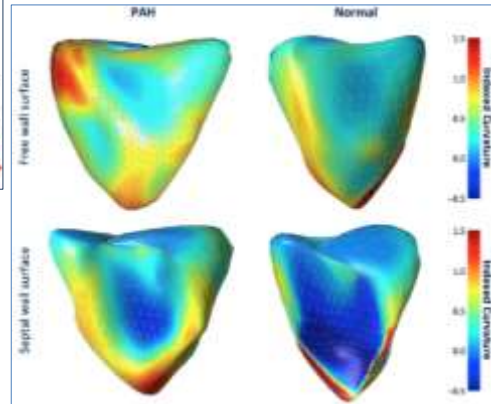




RV SHAPE & CURVATURE: 3D ECHOCARDIOGRAPHY



The curvature of the RV inflow tract was a more robust predictor of death than RV EF, RV volumes, or other regional curvature Indices.



K. Addetia, et al. *3DE-based analysis of RV shape in pulmonary arterial hypertension. EHJ-CVI, 2015.*

RV SHAPE & CURVATURE: 3D ECHOCARDIOGRAPHY

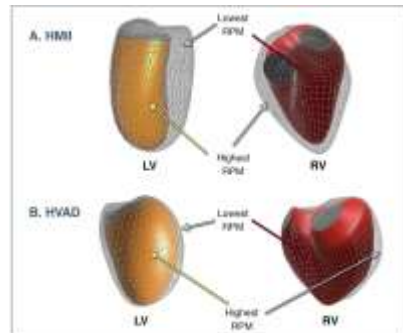
Reference values for the RV curvature are available

Table 2 Normal values for regional curvature

Region	Overall		
	ED	ES	P
Apical free wall	2.38 ± 0.24	2.45 ± 0.34	<.01
Body free wall	1.17 ± 0.06	1.13 ± 0.10	<.01
Apical septum	0.51 ± 0.34	0.52 ± 0.43	.55
Body septum	0.24 ± 0.15	0.25 ± 0.18	.11
RVOT	1.42 ± 0.11	1.31 ± 0.12	<.01
RVIT	1.27 ± 0.16	1.20 ± 0.13	<.01

K. Addetia, ... E.Surkova, et al. *Morphologic Analysis of the Normal RV Using 3DE-Derived Curvature Indices. JASE, 2018.*

Insight into LV and RV shape and morphology with increasing pump speeds may have an impact on LVAD speed optimization.



K. Addetia, et al. *3D Morphological Changes in LV and RV During LVAD Ramp Studies. JACC-CVI,*

## 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

**Recommendations.** RV size should be routinely assessed by conventional 2DE using multiple acoustic windows, and the report should include both qualitative and quantitative parameters. In laboratories with experience in 3DE, when knowledge of RV volumes may be clinically important, 3D measurement of RV volumes is recommended.



- 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  
ATTANTION

