Sonographer's Guide to Evaluation of the Right Ventricle in Pulmonary Hypertension

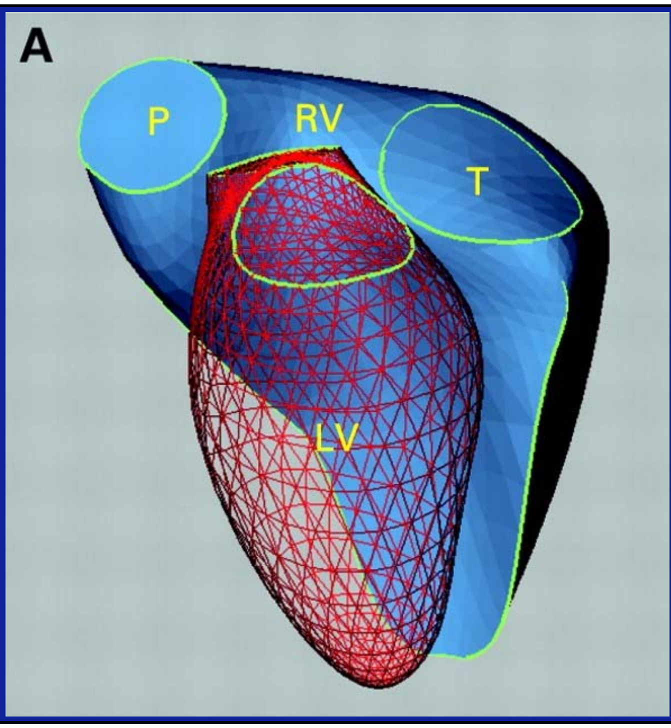
Sarah Roemer, BS, RDCS
Aurora St. Luke's Medical Center
Milwaukee, WI

- No disclosures or conflicts of interest.

"**Echocardiography** is the **first-line** diagnostic technique for the **assessment** of the right ventricle…"

Cardiac MRI is the considered the **gold standard** – limited by cost and availability.

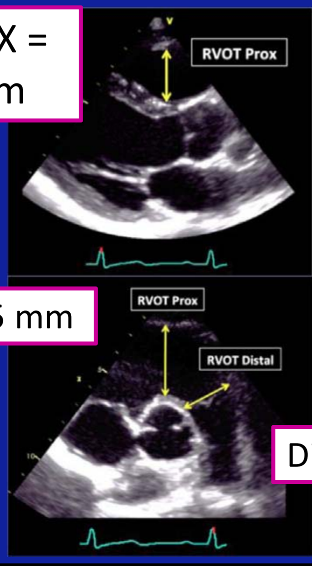
Longobardo, et al., 2017



Sheehan & Redington, 2008

Right ventricle linear dimensions: Outflow

RVOT PLAX = 20-30 mm



Prox = 21-35 mm

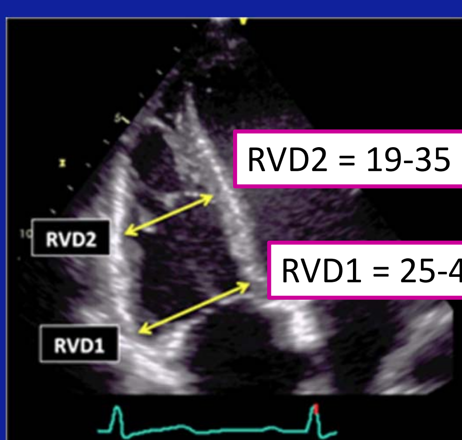
Distal = 17-27 mm

- Proximal RV outflow diameter (RVOT prox):
  - Anterior free wall to interventricular septal-aortic junction.
  - *End-diastole*
- Distal RV outflow diameter (RVOT distal):
  - Proximal to pulmonary valve at *end-diastole*.

Lang et al., 2015

Right ventricle linear dimensions: Inflow

RV focused view



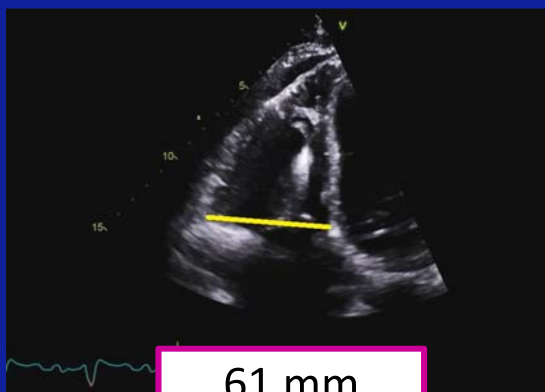
RVD2 = 19-35 mm

RVD1 = 25-41 mm

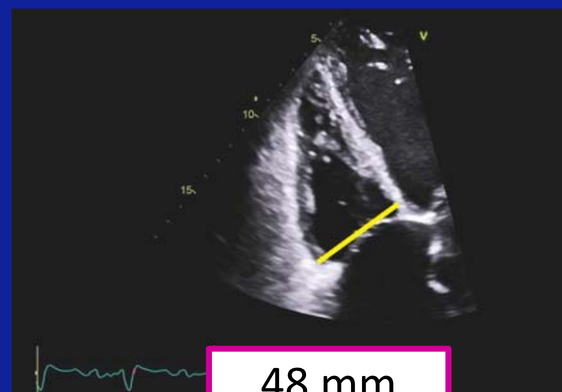
- Basal linear dimension (RVD1):
  - Maximal transversal dimension of the basal one-third of RV inflow at *end-diastole*.
- Mid-cavity linear dimension (RVD2):
  - Middle one-third of RV inflow.
  - Papillary muscle level at *end-diastole*.

Lang et al., 2015

Para apical | **Dedicated RV**

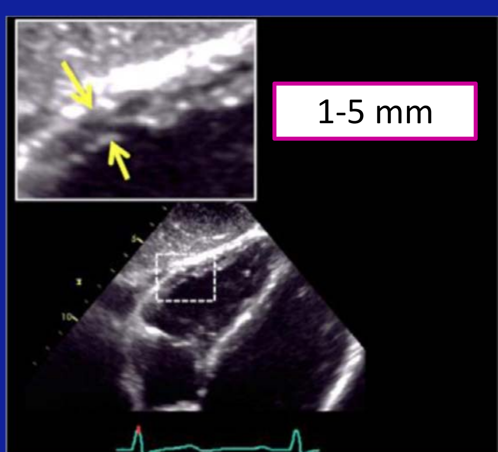


61 mm



48 mm

Right ventricle free wall thickness

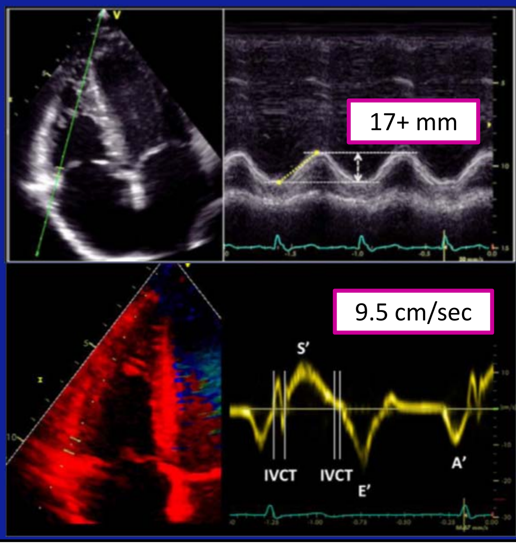


1-5 mm

- 2D or M-mode.
- Below tricuspid annulus - length of anterior leaflet when the valve is open.
- Trabeculations, papillary muscles, and epicardial fat excluded.
- Zoomed image.

Lang et al., 2015

Right ventricular systolic function: TAPSE and TDI S’

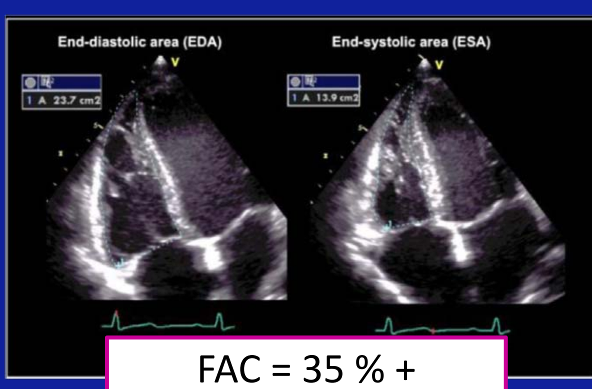


- Most used in routine evaluation.
- Easy to use and highly reproducible.
- Reflects basal function of RV free wall.
- Not valid when regional disfunction is involved.
- Should be used in conjunction with other parameters.

Lang et al., 2015; Longobardo et al., 2017

Fractional Area Change (FAC)

RV focused view

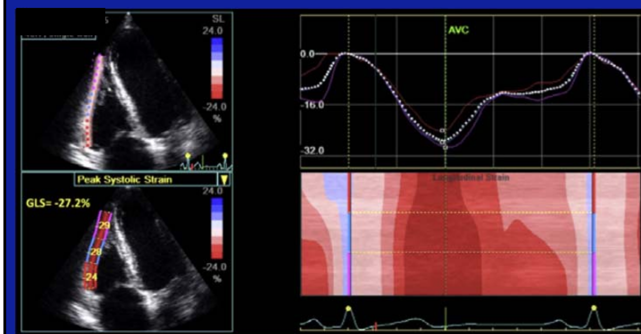


- RV FAC (%)= 100 x (EDA – ESA)/EDA
- Reflects both longitudinal and radial components of RV contraction.
- Good correlation with RVEF by CMRI.
- Main limitation is image quality.

Lang et al., 2015

Global Longitudinal Strain (GLS)

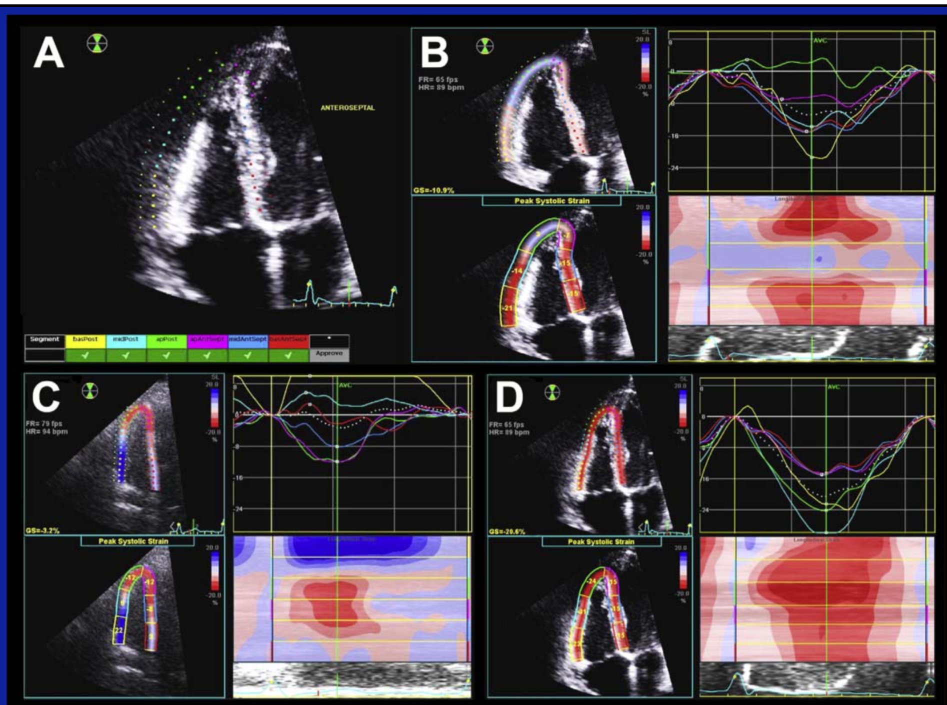
RV focused view



> -20 %

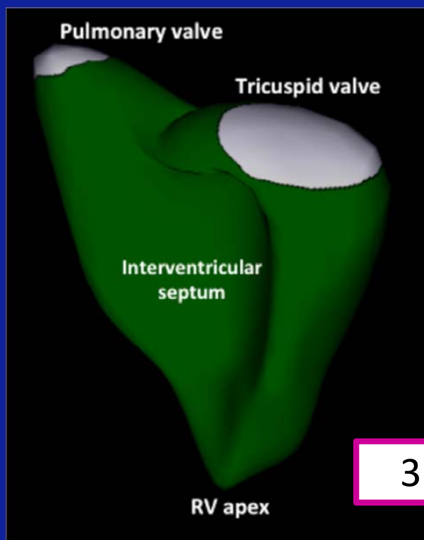
- Average between the three segments of the *RV free wall*.
- Very reproducible.
- Most sensitive in detecting subtle systolic abnormalities in PH patients.
- Vendor dependent.

Lang et al., 2015; Longbardo et al., 2017



Longobardo et al., 2017

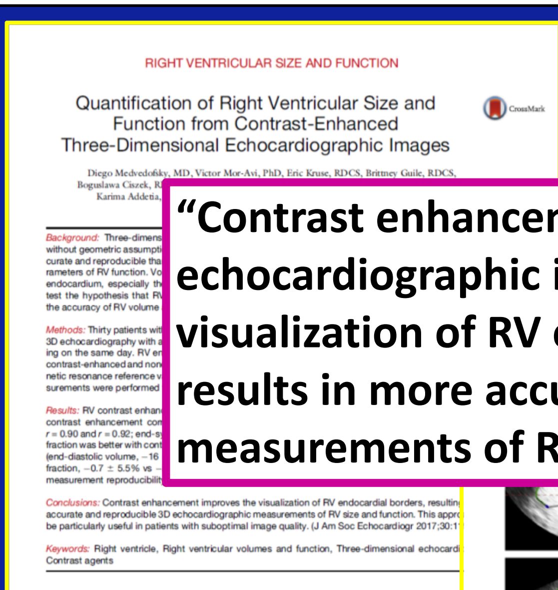
3D RV EF



- Great correlation to CMRI.
- More effective than 2D in patients with pulmonary hypertension.
- Includes RVOT in overall function.
- Image quality dependent.
- Contrast enhanced imaging (??)

3D EF = 45 %

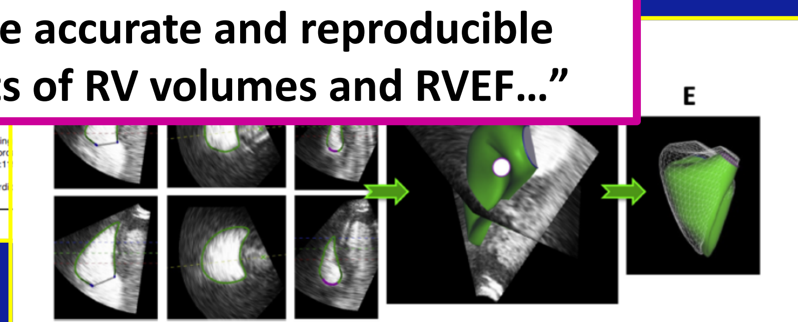
Lang et al., 2015; Longobardo et al., 2017


RIGHT VENTRICULAR SIZE AND FUNCTION

Quantification of Right Ventricular Size and Function from Contrast-Enhanced Three-Dimensional Echocardiographic Images

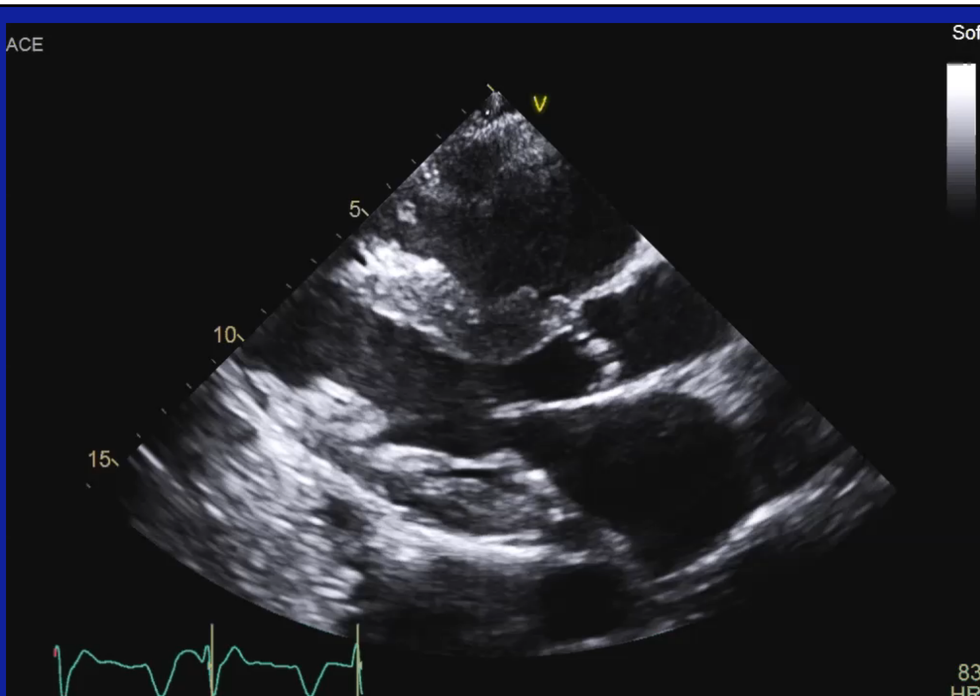
Diego Medvedofsky, MD, Victor Mor-Avi, PhD, Eric Kruse, RDCS, Brittney Guile, RDCS,

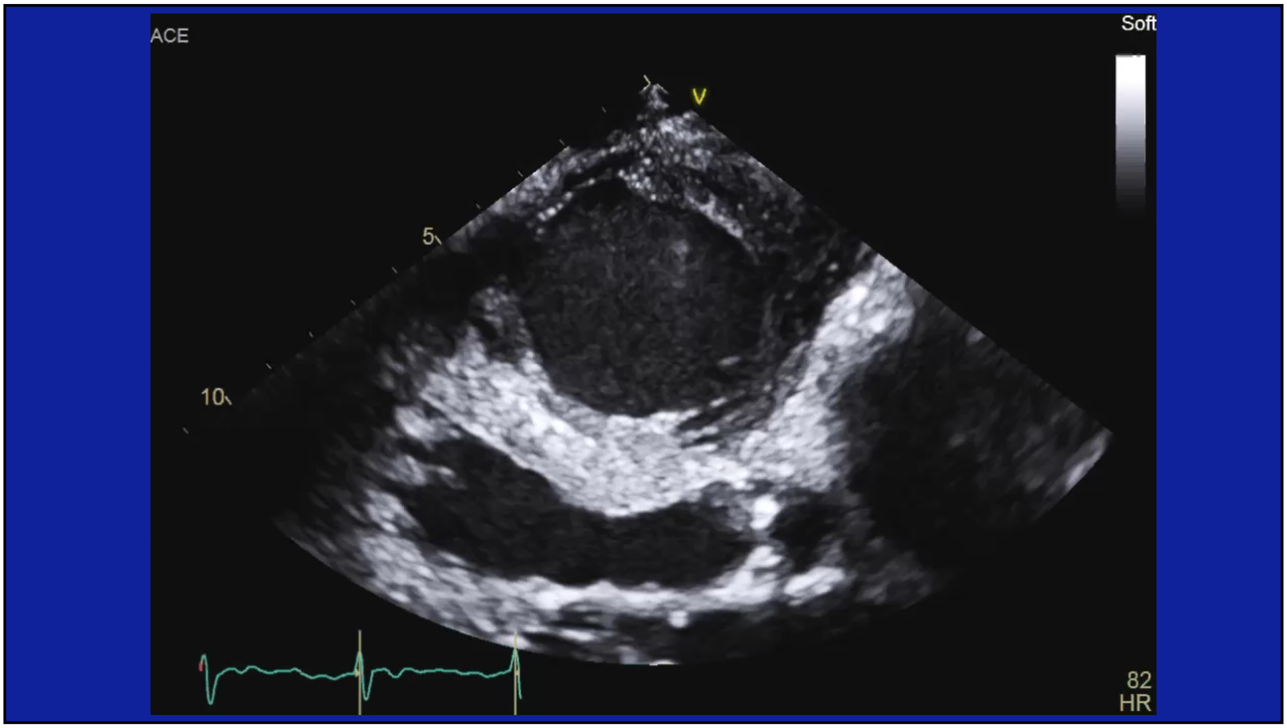
"Contrast enhancement during 3D echocardiographic imaging improves visualization of RV endocardial borders and results in more accurate and reproducible measurements of RV volumes and RVEF…"

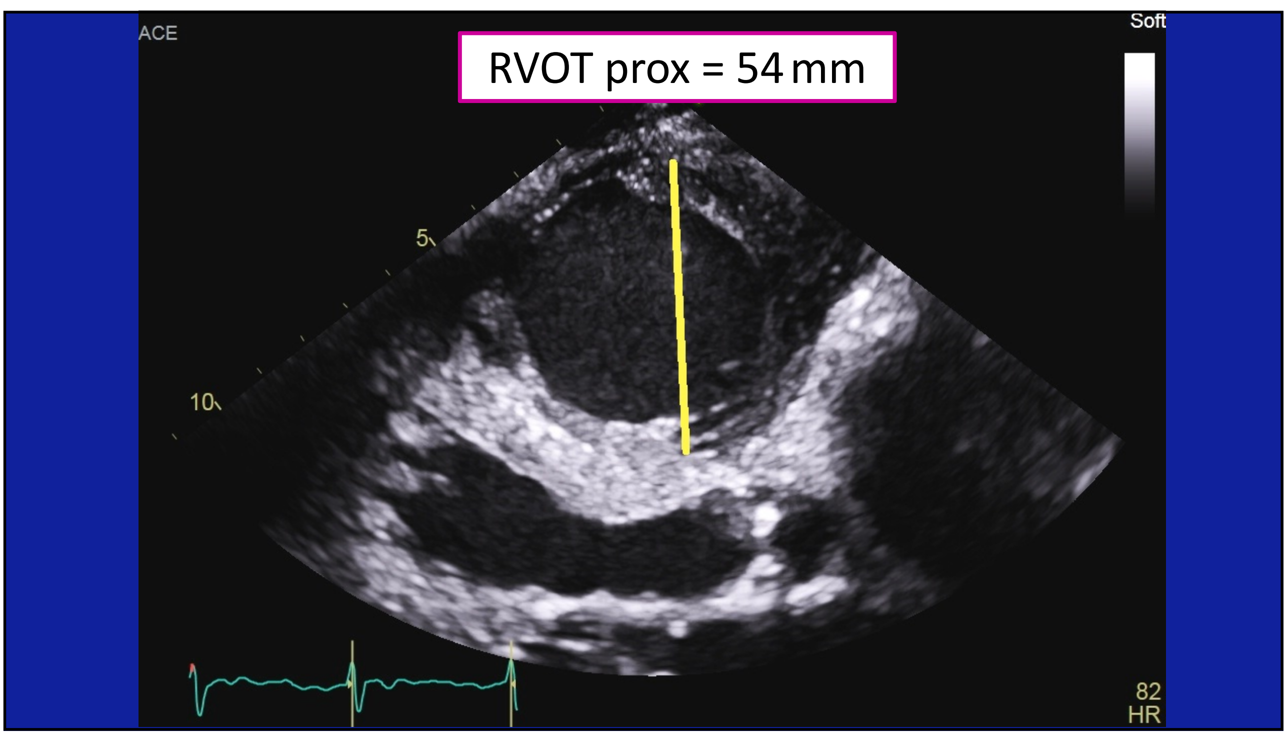


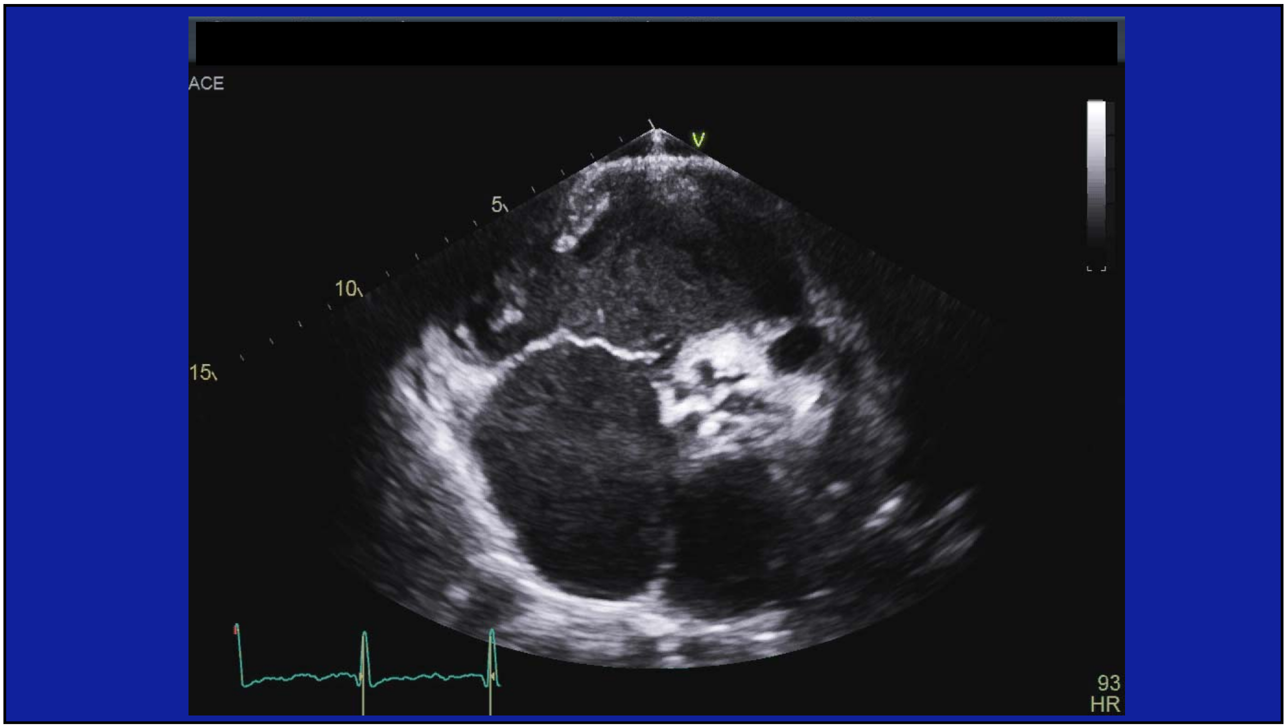
Medvedofsky, et al., 2017

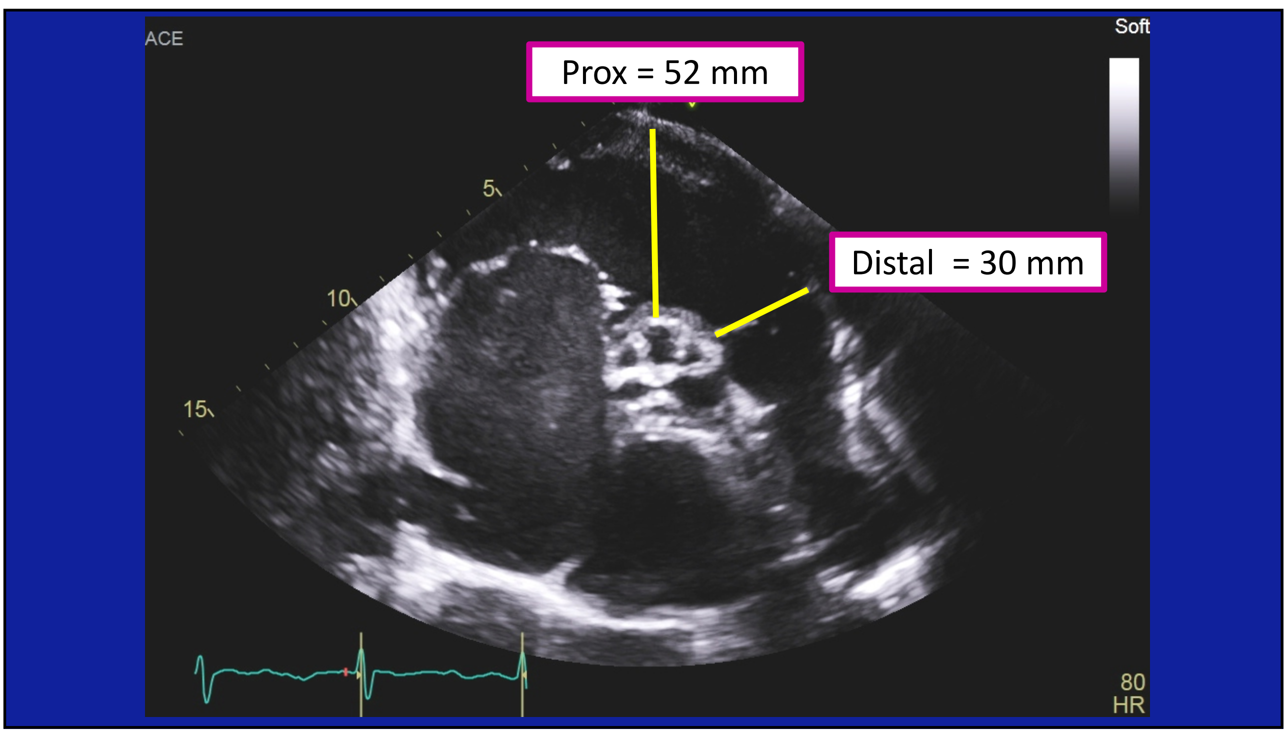
CASE STUDY

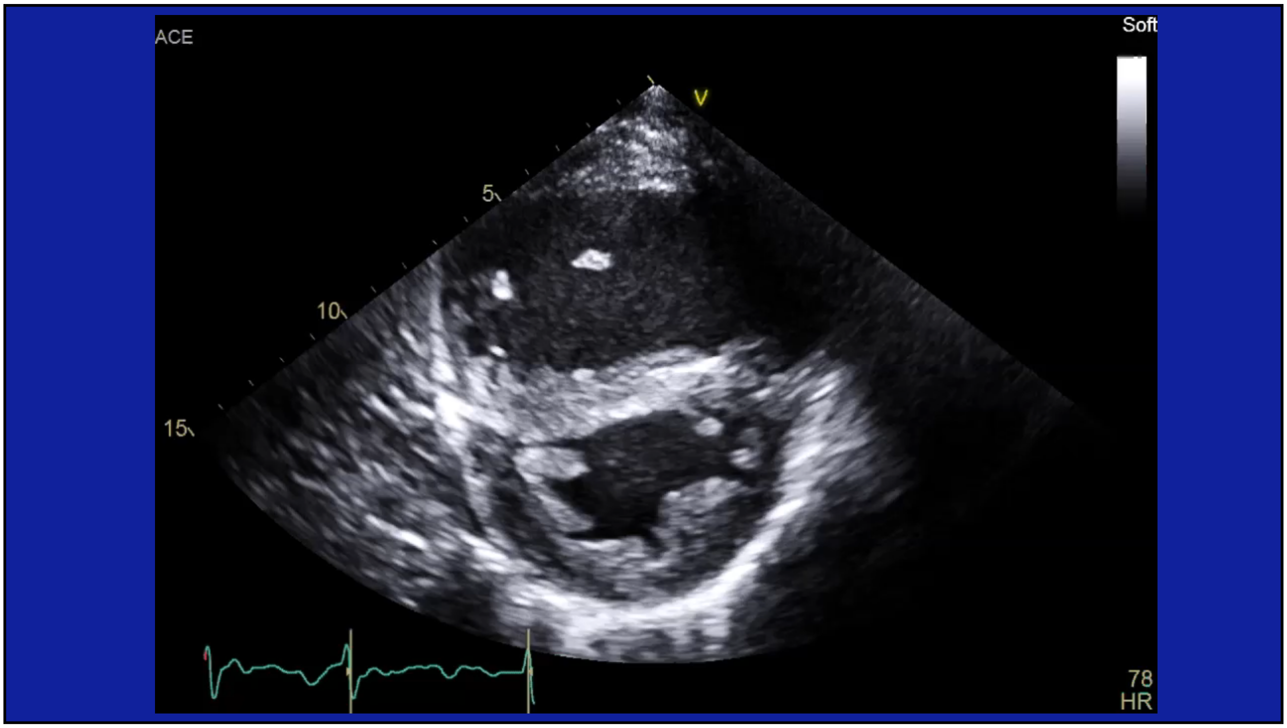


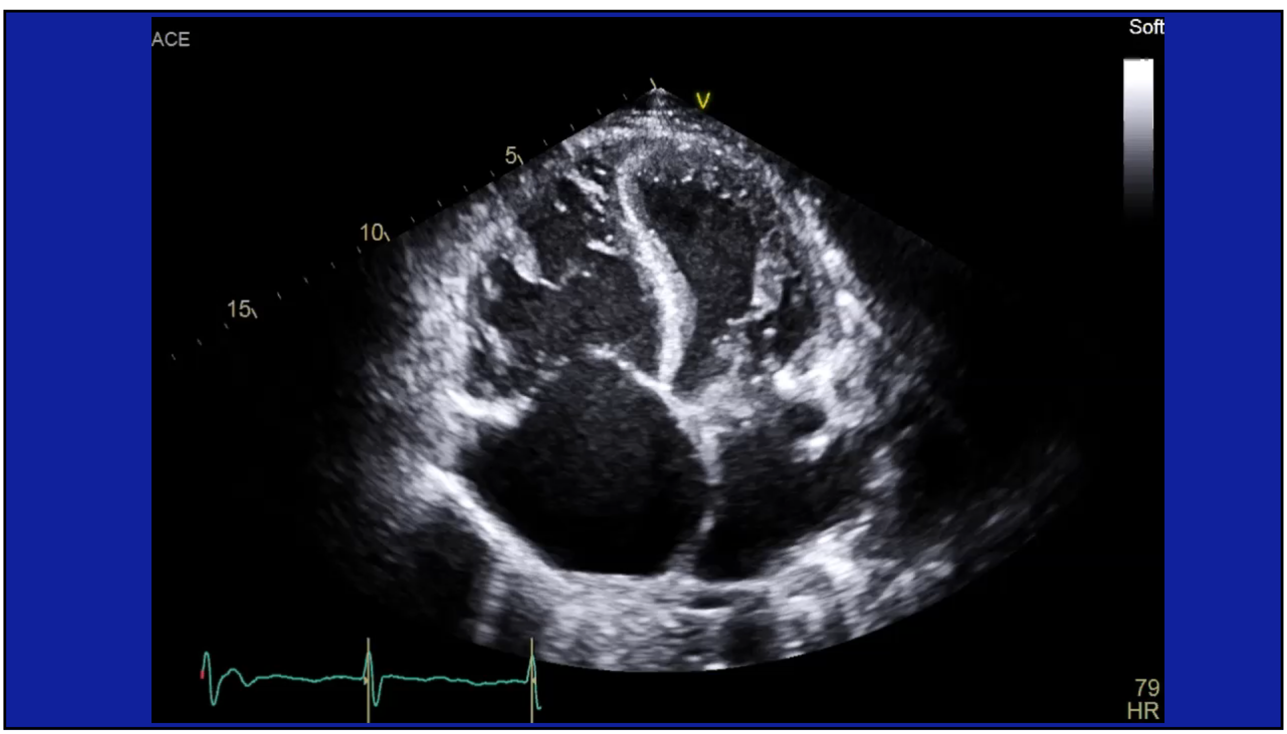

ACE
Soft
V
5
10
82
HR

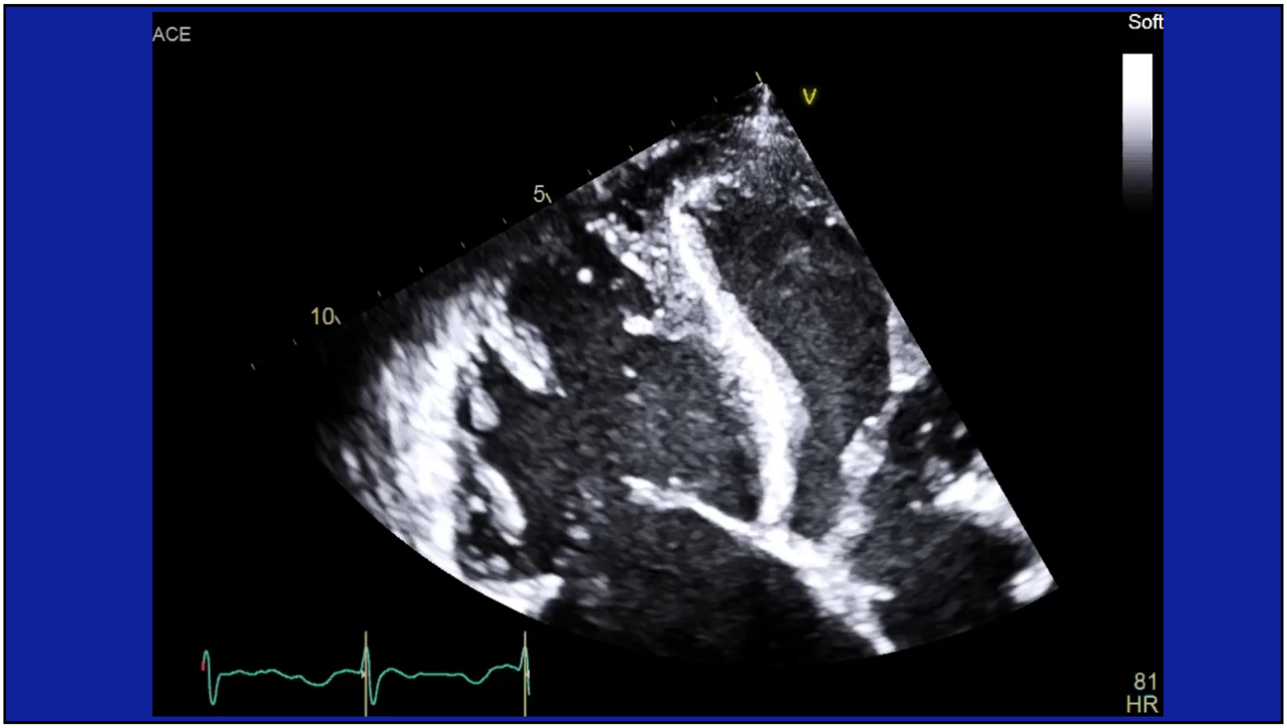

ACE
Soft
RVOT prox = 54 mm
5
10
82
HR

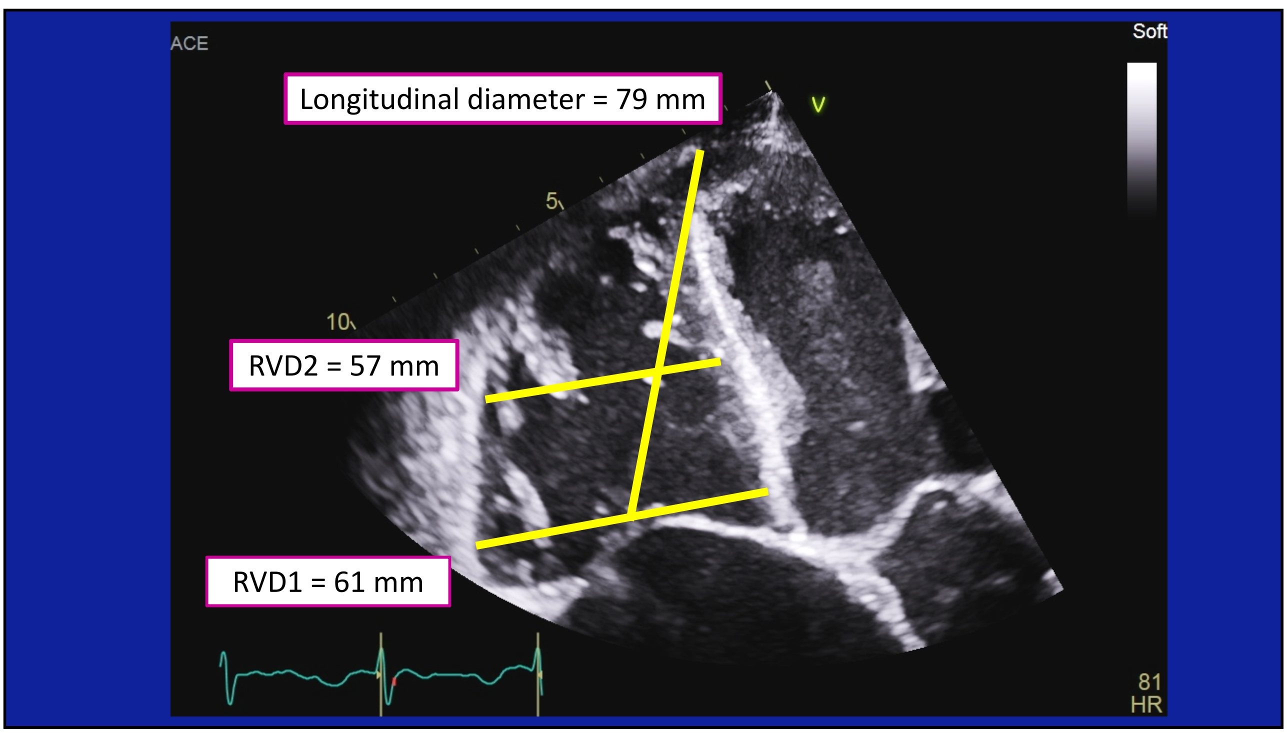

ACE
5
10
15
93
HR

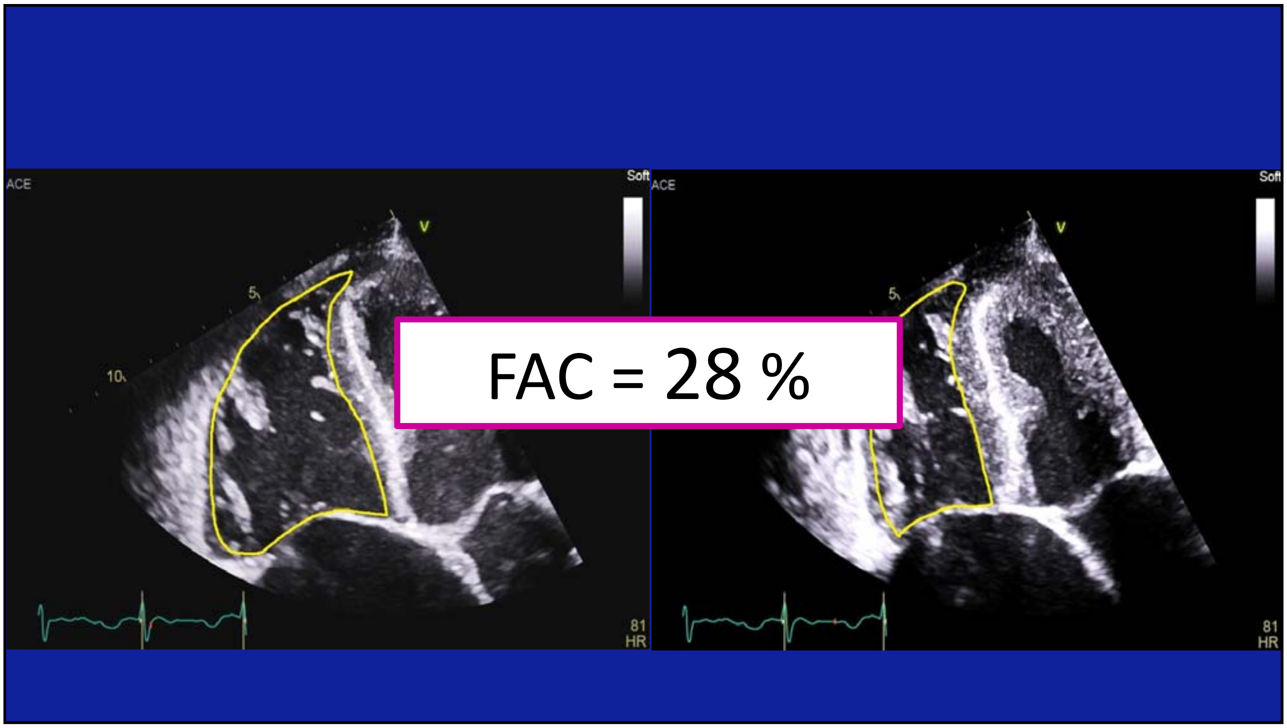

ACE
Soft
Prox = 52 mm
Distal = 30 mm
5
10
15
80
HR

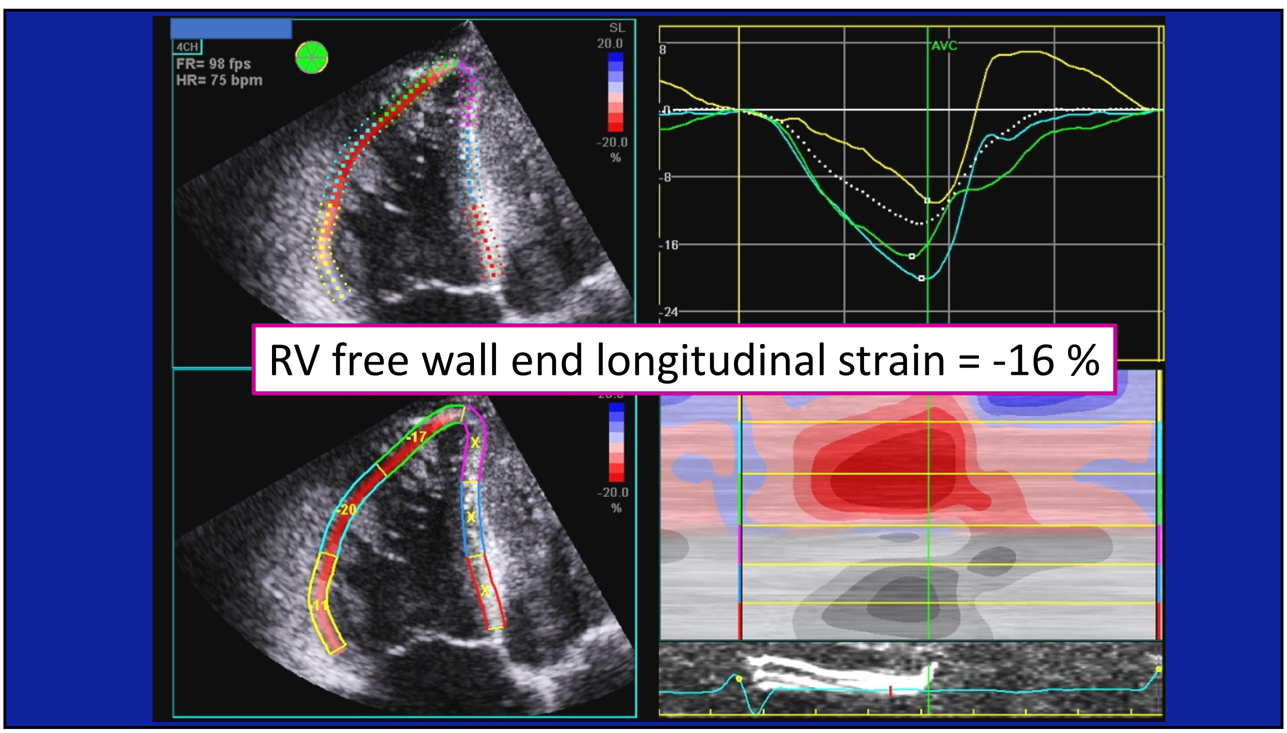

ACE
Soft
V
5
10
15
78
HR

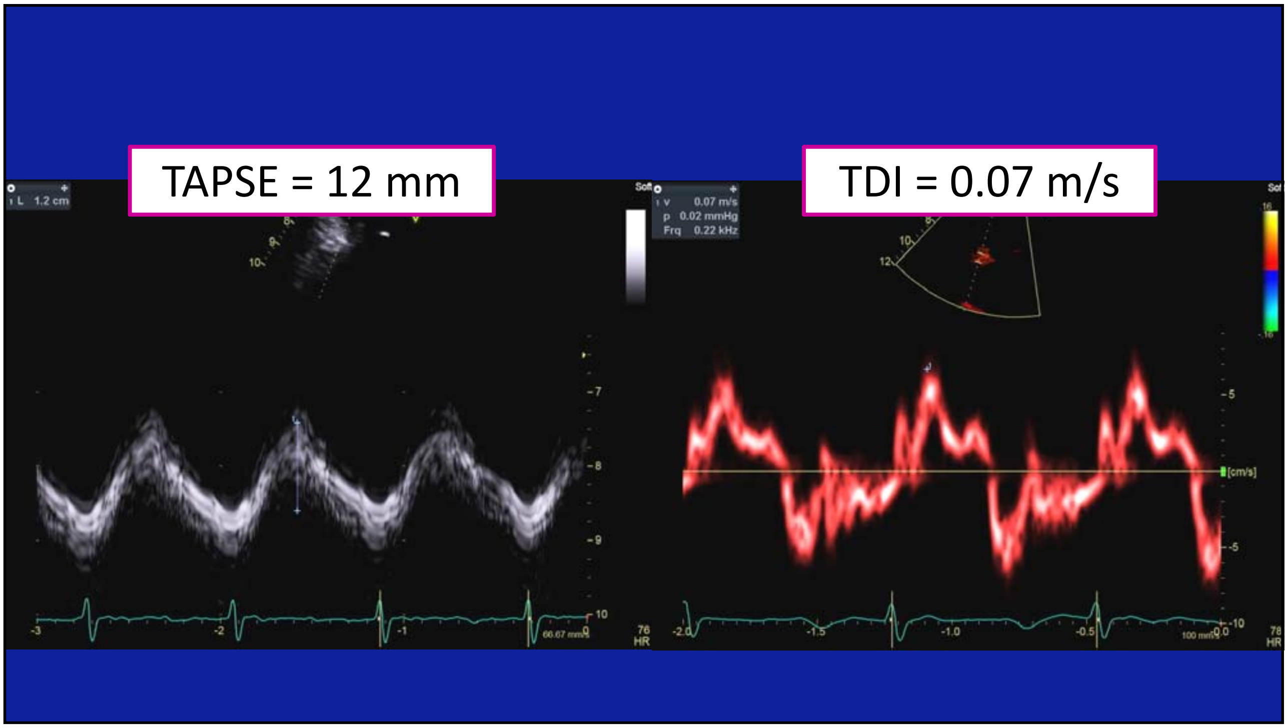

ACE
Soft
V
5
10
15
79
HR

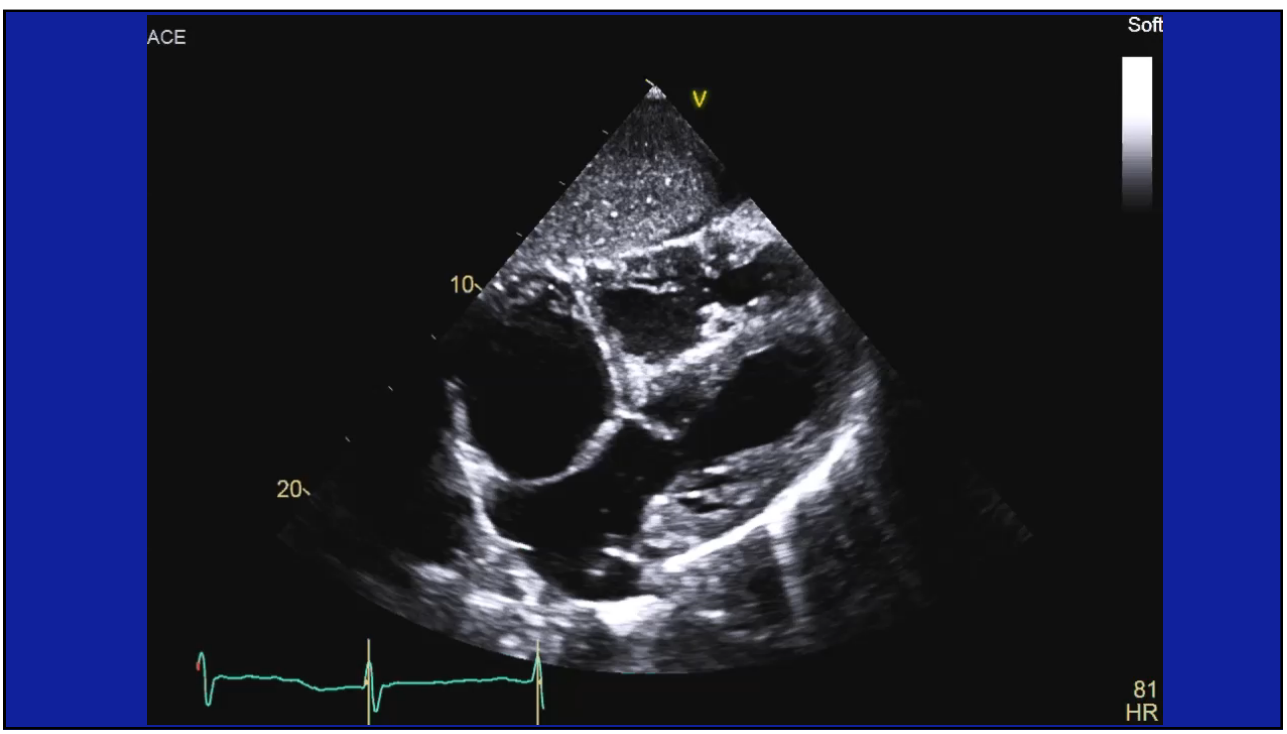

ACE
Soft
V
5
10
81
HR


ACE
Soft
Longitudinal diameter = 79 mm
V
5
10
RVD2 = 57 mm
RVD1 = 61 mm
81
HR


ACE
Soft
FAC = 28 %
81
HR


4CH
FR= 98 fps
HR= 75 bpm
SL
20.0
-20.0
%
AVC
RV free wall end longitudinal strain = -16 %


TAPSE = 12 mm
TDI = 0.07 m/s


ACE
Soft
V
10
20
81
HR

Which of these measurements is NOT used to assess right ventricular longitudinal function?

1. TDI S’
2. Fractional area change
3. Global longitudinal strain
4. They all assess longitudinal function

Which of these measurements is NOT used to assess right ventricular longitudinal function?

1. TDI S'
2. Fractional area change
3. Global longitudinal strain
4. They all assess longitudinal function

How many segments do we average when assessing right ventricular global longitudinal strain?

1. Two
2. Three
3. Five
4. Six

How many segments do we average when assessing right ventricular global longitudinal strain?

1. Two
2. Three
3. Five
4. Six

Special thanks to…

Thank you

Kinnikinic River, Aurora St. Luke's Medical Center

Photo cred: McKenzie Schweitzer