ACC Latin America
Conference 2017

MEXICO CITY
JUNE 22 – 24, 2017

GLOBAL EXPERTS, LOCAL LEARNING
Utilizing Echo Guidelines for Everyday Practice

Gustavo Restrepo MD, FACC
ACC Colombia Chapter Governor
President Elect Interamerican Society of Cardiology
Clinica Medellin. Medellin, Colombia
Incorporating the New Echo Guidelines Into Everyday Practice

Clinical Case

RIGHT VENTRICULAR FAILURE

Gustavo Restrepo MD
ACC – Colombia Chapter Governor
Medellín, Colombia
Clinical Case

• 65 years old male, farmer
• 2 years history of progressive dyspnea, fatigue, severe exercise intolerance
• PMH: severe COPD
• PE: BP 120/70 HR 90, RR 20, \(\text{SaO}_2\) 90%
• Neck veins distended, bilateral hypoventilation, systolic murmur (tricuspid area), bilateral leg oedema
3D RVEF ≥ 45%

3D endocardial surface of the right ventricle
## RV Function in PAH

<table>
<thead>
<tr>
<th>RV Function Parameter</th>
<th>CC with MRI RVEF (r)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3D RVEF</td>
<td>0.85</td>
</tr>
<tr>
<td>2D</td>
<td>0.67</td>
</tr>
<tr>
<td>RV strain</td>
<td>0.63</td>
</tr>
<tr>
<td>2D FAC</td>
<td>0.52</td>
</tr>
<tr>
<td>S’</td>
<td>0.47</td>
</tr>
<tr>
<td>2D TAPSE</td>
<td>0.37</td>
</tr>
<tr>
<td>2D RV TEI</td>
<td></td>
</tr>
</tbody>
</table>

Recommendations for Cardiac Chamber Quantification by Echocardiography in Adults: An Update from the American Society of Echocardiography and the European Association of Cardiovascular Imaging

Roberto M. Lang, MD, FASE, FESC, Luigi P. Badano, MD, PhD, FESC, Victor Mor-Avi, PhD, FASE, Jonathan Afilalo, MD, MSc, Anderson Armstrong, MD, MSc, Laura Emane, MD, PhD, Frank A. Flachskampf, MD, FESC, Elyse Foster, MD, FASE, Steven A. Goldstein, MD, Tatiana Kuznetsova, MD, PhD, Patrizio Lancellotti, MD, PhD, FESC, Denisa Muraru, MD, PhD, Michael H. Picard, MD, FASE, Ernst R. Rietzschel, MD, PhD, Lawrence Rudski, MD, FASE, Kirk T. Spencer, MD, FASE, Wendy Tsang, MD, and Jens-Uwe Voigt, MD, PhD, FESC, Chicago, Illinois; Padua, Italy; Montreal, Quebec and Toronto, Ontario, Canada; Baltimore, Maryland; Créteil, France; Uppsala, Sweden; San Francisco, California; Washington, District of Columbia; Leuven, Liège, and Ghent, Belgium; Boston, Massachusetts
Apical 4-chamber

Focused Apical 4-chamber

RV Modified Apical 4-chamber
RV systolic function evaluation

- FRACTIONAL AREA CHANGE (FAC)
- S WAVE OF THE TRICUSPID ANNULUS (S’)
- TRICUSPID ANNULAR SYSTOLIC EXCURSION (TAPSE)
- RV INDEX OF MYOCARDIAL PERFORMANCE (RVIMP, TEI INDEX)
- RV EJECTION FRACTION 3D EVALUATION
RIGHT VENTRICULAR INDEX OF MYOCARDIAL PERFORMANCE (RIMP)
Ratio of isovolumic time divided by ET
(IVRT + IVCT) / ET

ABNORMAL FINDING > 0.55
(Tissue Doppler)
**RV \frac{dP}{dt}**

numerator is 15 mmHg

**Velocity Range 0.5-2 m/sec**

\[
\text{dP/dt} : 15/35 = 428 \text{ mmHg/s}
\]

**Recommendations:** Because of the lack of data in normal subjects, RV \(\frac{dP}{dt}\) cannot be recommended for routine uses. It can be considered in subjects with suspected RV dysfunction.
RV FRACTIONAL AREA CHANGE (%)

100 x (END DIASTOLIC AREA – END SYSTOLIC AREA) / END DIASTOLIC AREA

Abnormal RV Systolic function FAC < 35%
Relationship between MRI-derived RVEF and echo derived RVFAC, Fractional Shortening, and Tricuspid Annular Motion

Anavekar NS. Echocardiography 2007:24:452-456
**RV Longitudinal Systolic Function**

**TAPSE**
Tricuspid annular longitudinal excursion by M-mode (mm), measured between end-diastole and peak systole

Proper alignment of M-mode cursor with the direction of RV longitudinal excursion should be achieved from the apical approach.

24 ± 3.5, mm
<17, mm

**Pulsed Tissue Doppler S Wave**
Peak systolic velocity of tricuspid annulus by pulsed-wave DTI (cm/s), obtained from the apical approach, in the view that achieves parallel alignment of Doppler beam with RV free wall longitudinal excursion

14.1 ± 2.3, cm/s
<9.5, cm/s

**Global Longitudinal RV Free-Wall Strain**
Peak value of 2D longitudinal speckle tracking derived strain, averaged over the 3 segments of the RV free wall in RV-focused apical 4-chamber view (%)

-29 ± 4.5, %
> -20, %
Global RV Longitudinal Strain
Free wall RV Longitudinal Strain
RV SPECKLE TRACKING

Normal RV

Severe RV Dysfunction

Global RV Longitudinal Strain - 25%

Global RV Longitudinal Strain – 8.8%
Free Wall RV Longitudinal Strain: Sensitivity 96%, Specificity 93% to predict RVEF <45% (MRI) using a cut-off value of less than -17.0%
Traditional measures of right ventricular systolic function

- Fractional area shortening (FAC)
- Tricuspid annular plane systolic excursion (TAPSE)
- Pulsed tissue Doppler of the tricuspid lateral annular systolic velocity (S’)
- Myocardial performance index (MPI)
- RV Global Longitudinal Strain / RV Free Wall Longitudinal Strain
- 3D RV EF

Combining more than one measure of RV function, may more reliable distinguish normal from abnormal function
RVOT Acceleration time

Mean PAP = 79 - (0.45 \times \text{AcT})

Normal AcT > 120\text{msec}

If AcT<90\text{msec}, peak PA systolic pressure is more than 60 mmHg

Mean PAP = 79 - (0.45 \times 90) = 79 - 40 = 39 \text{mmHg}
PMAP = Pico temprano Insuf Pulm + Presión AD

PMAP = 0,61 x PSAP + 1,95. JASE 2013; 26: 464-468
Pulmonary Vascular Resistance

\[ PVR = \frac{\text{mean PAP} - \text{mean PCWP}}{\text{C.O.}} \]

Normal = 2 Wood’s units

Another method

\[ PVR = 10 \left( \frac{\text{Peak TR Velocity}}{\text{RVOT VTI}} + 0.16 \right) \]

PVR = Wood’s units
TR Velocity = m/sec
RVOT TVI = cm