Quantification of Severity of Mitral regurgitation
With the New ASE Guidelines
Case Studies

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ASE GUIDELINES AND STANDARDS

Recommendations for Noninvasive Evaluation of Native Valvular Regurgitation
A Report from the American Society of Echocardiography
Developed in Collaboration with the Society for Cardiovascular Magnetic Resonance

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Released
The same day in March 2017!
What is New?

- Emphasis on identification of Etiology/Mechanism of regurgitation
- 2D/3D TTE—an integrative approach & algorithms to assess severity
- When is TEE needed
- Important role of CMR & CMR methodology
- The challenge of co-existing valvular lesions
- A clinical perspective...
- Library of case studies on the web: www.asecho.org/vrcases

Mitral Valve Anatomy

A Complex Apparatus

- Annulus
- Leaflets
- Chords
  - Primary, secondary & tertiary
- Papillary muscles
- Ventricular function geometry
Mitral Regurgitation

Indicators of Severity

- Mitral valve pathology
- LV/ LA size
- Color Doppler:
  - Vena contracta, Jet Area, Flow convergence
- Mitral E; Pulmonary vein pattern
- Regurgitant flow/fraction
- CW density and contour

Mitral Regurgitation- Color Doppler

3 Components of the Jet
Mitral Regurgitation

Mild Central  Severe Central  Severe Eccentric

Flow Convergence (PISA)

Flow Convergence Method

\[ \text{Reg Flow} = 2\pi r^2 \times V_a \]
\[ \text{EROA} = \frac{\text{Reg Flow}}{PKV_{\text{Reg}}} \]
\[ \text{R Vol} = \text{EROA} \times \text{VTI}_{\text{Reg}} \]
Flow Convergence

- Can be used semi-quantitatively
- Assumptions of hemispheric geometry
- EORA may be underestimated in 2nd MR
- Less accurate in eccentric jets
- Variability during the cardiac cycle and limitations in non-holosystolic MR

MR is not always Holosystolic

*MR Duration Needs to be Accounted for*
Late Systolic MR

Cannot Use
Color Doppler Single frame measures of severity:
Jet area, VC, VCA, Flow Convergence, EROA

Mitral Regurgitation
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Pulsed Doppler Volumetric Quantitation

Regurgitant Volume & Fraction

**Advantages**
- Quantitative, valid in multiple jets and eccentric jets
- Provides both lesion severity and volume overload

**Limitations**
- Needs training; Cumbersome; wide (20%) confidence limits
- Measurement of flow at MV annulus is less reliable in calcific MV and/or annulus
**Chronic Mitral Regurgitation by Doppler Echocardiography**

**Does MR meet specific criteria for mild or severe MR?**

- Yes, mild
  - Perform quantitative methods whenever possible
  - Intermediate Values: MR Probably Moderate
  - Specific Criteria for Mild MR
    - Small, narrow central jet
    - EROA ≤ 0.2 cm²
    - RVol ≤ 30 ml
    - RF ≤ 30%
    - MR Grade I
  - Specific Criteria for Moderate MR
    - EROA 0.2-0.29 cm²
    - RVol 30-44 ml
    - RF 30-39%
    - MR Grade II
  - Specific Criteria for Severe MR
    - EROA ≥ 0.4 cm²
    - RVol ≥ 60 ml
    - RF ≥ 50%
    - MR Grade IV

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- Indeterminate MR
  - Consider further testing: TEE or CMR for quantitation
  - 2-3 specific criteria for severe MR or elliptical orifice
  - Poor TTE quality or low confidence in measured Doppler parameters
  - Discordant quantitative and qualitative parameters and/or clinical data

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* Beware of underestimation of MR severity in eccentric, wall impinging jet; quantitation is advised

** All values for EROA by PISA assume holosystolic MR; single frame EROA by PISA, VCW, and VCA overestimate non-holosystolic MR

† Regurgitant volume for severe MR may be lower in low flow conditions.

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**Case 1**
65 yo female -- BP 160/67 mmHg -- BSA 2 m²

EDD 4.8 cm

EDV 132 mL

VCW 0.5 cm

PISA radius 0.9 cm at Va 39 cm/s

Chronic Mitral Regurgitation by Doppler Echocardiography

Does MR meet specific criteria for mild or severe MR?

- EDD > 4.8 cm
- EDD > 4.8 cm at max systolic flow
- EDD > 4.8 cm at end diastole
- EDD > 4.8 cm at both systole and diastole
- EDD > 4.8 cm with left bundle branch block
- EDD > 4.8 cm with atrial fibrillation

Mild MR

Moderate MR

Severe MR

Indeterminate MR

- Poor TEE quality or low confidence in measured Doppler parameters
- Discordant quantitative and qualitative parameters and clinical data

* Presence of incriminating left ventricular wall motion abnormalities
** All values for MR on multiplane and/or four-chamber views
† Regurgitant volume for severe MR may be lower in low flow conditions.
RVolMVinflow = MV SV - LVOT SV = 95 - 76 = 19 mL
RF = 19/MV SV = 20%

RVolLV SV = LV SV - LVOT SV = 89 - 76 = 13 mL
RF = 13/MV SV = 14%

MV SV = 0.785*MV diam²*MV VTI = 0.785*2.8²*15.4 = 95 mL
LV SV = EDV - ESV = 132 - 43 = 89 mL (LVEF 67%)

LVOT SV = 0.785*LVOT diam²*LVOT VTI = 0.785*2²*24.2 = 76 mL

EROA = 2*π*PISA²*Va/PkVel = 6.28*0.9²*39/529 = 0.38 cm²

RVol = EROA*MR VTI = 0.38*60 = 23 mL

PISA radius 0.9 cm
MR PkVel 529 cm/s
MR VTI 60 cm

Case 2
44 yo male -- BP 128/66 mmHg -- BSA 2 m²

Chronic Mitral Regurgitation by Doppler Echocardiography

Does MR meet specific criteria for mild or severe MR?

2/20/2018
RVolMV = MV SV – LVOT SV = 121 - 50 = 71 mL
RF = 71/MV SV = 59%

RVolLV = LV SV – LVOT SV = 135 -50 = 85 mL
RF = 85/MV SV = 70%

LV SV = EDV - ESV = 221 - 86 = 135 mL (LVEF 61%)

MV SV = 0.785*MVdiam^2*MVVTI = 0.785*2.9^2*18.3 = 121 mL

LVOT SV = 0.785*LVOTdiam^2*LVOTVTI = 0.785*2.1^2*14.3 = 50 mL

EROA = 2*π*PISA2*Va/PkVel = 6.28*1.32*34/514 = 0.7 cm^2

MR VTI = 86 cm

RVol = EROA*MRVTI = 0.7*86 = 60 mL

RVol MV flow = MV SV – LVOT SV = 121 - 50 = 71 mL

PISA radius 1.3 cm

Pka = 514 cm/s

MV diam 2.9 cm

LVOT diam 2.1 cm
Case 3

54 yo female – BP 114/62 mmHg – BSA 1.9 m²
RVolMVinflow = MV SV – LVOT SV = 73 – 35 = 38 mL

RF = 38/MV SV = 52%

RVolLV SV = LV SV – LVOT SV = 65 – 35 = 30 mL

RF = 30/MV SV = 41%
New ASE Valvular Regurgitation Guidelines - Endorsed by SCMR

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