Regurgitant Lesions

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Aortic Insufficiency

- Valve anatomy and function
  - LVOT and annulus, valve leaflets and commissures, aortic root (Sinuses of Valsalva), and ascending aorta
- Ventricular size and function

EAE Recommendations 2010
Aortic Insufficiency

➢ Carpenter Classification
  ➢ Normal leaflet motion
  ➢ Excessive leaflet motion
  ➢ Restricted leaflet motion

EAE Recommendations 2010
Aortic Insufficiency

- **Important Etiologies:**
  - Leaflet disease (rheumatic, prolapse, VSD, fenestrations, endocarditis, rheumatologic, calcific)
  - Bicuspid AV
  - Dilated aorta (hypertension, Marfan, bicuspid AV, annuloaortic ectasia, collagen vascular disease, syphilis)
  - Dissection

EAE Recommendations 2010
Aortic Insufficiency

- Echo Allows Evaluation of:
  - AV/root anatomy
  - LV size and systolic function
  - Quantitation of AI
  - Supportive findings when severe AI suspected
Aortic Insufficiency

- Echo is Essential in Decision Making
- No adequate medical Rx for AI
- Therefore, severe AI requires valve replacement
Aortic Insufficiency

**AHA/ACC 2014 Valve Guidelines**

**Asymptomatic severe AR**
- Calcific aortic valve disease
- Bicuspid valve (or other congenital abnormality)
- Dilated aortic sinuses or ascending aorta
- Rheumatic valve changes
- IE with abnormal leaflet closure or perforation

**Severe AR**
- Jet width $\geq 65\%$ of LVOT;
- Vena contracta $>0.6\, \text{cm}$;
- Holodiastolic flow reversal in the proximal abdominal aorta
- RVol $\geq 60\, \text{mL/beat}$;
- RF $\geq 50\%$
- ERO $\geq 0.3\, \text{cm}^2$
- Angiography grade 3+ to 4+
- In addition, diagnosis of chronic severe AR requires evidence of LV dilation

**C1:** Normal LVEF ($\geq 50\%$) and mild-to-moderate LV dilation (LVESD $\leq 50\, \text{mm}$)

**C2:** Abnormal LV systolic function with depressed LVEF ($<50\%$) or severe LV dilatation (LVESD $>50\, \text{mm}$ or indexed LVESD $>25\, \text{mm/m}^2$)

**Symptomatic severe AR**
- Calcific valve disease
- Bicuspid valve (or other congenital abnormality)
- Dilated aortic sinuses or ascending aorta
- Rheumatic valve changes
- Previous IE with abnormal leaflet closure or perforation

**Severe AR**
- Doppler jet width $\geq 65\%$ of LVOT;
- Vena contracta $>0.6\, \text{cm}$,
- Holodiastolic flow reversal in the proximal abdominal aorta,
- RVol $\geq 60\, \text{mL/beat}$;
- RF $\geq 50\%$
- ERO $\geq 0.3\, \text{cm}^2$
- Angiography grade 3+ to 4+
- In addition, diagnosis of chronic severe AR requires evidence of LV dilation

**Symptomatic severe AR may occur with normal systolic function (LVEF $\geq 50\%$), mild-to-moderate LV dysfunction (LVEF 40%-50%), or severe LV dysfunction (LVEF $<40\%$);**

**Exertional dyspnea or angina or more severe HF symptoms**

**None; exercise testing is reasonable to confirm symptom status**
Aortic Insufficiency

- **Functional Classification**
  - **Type I**: aortic root (annulus, sinuses, sinotubular junction) with normal cusps
  - **Type II**: prolapse or free edge fenestration $\Rightarrow$ eccentric AI
  - **Type III**: poor cusp tissue quality (retraction, calcification, endocarditis)

EAE Recommendations 2010
Aortic Insufficiency

- PISA Method:
  - Similar drawbacks as VC method
  - Assumes a hemispheric PISA

EAE Recommendations 2010
Aortic Insufficiency

- Volumetric Method:
  - Multiple sources of error
  - Time consuming

EAE Recommendations 2010
Aortic Insufficiency

- Echo Markers of Severe AI:
  - Vena contracta width > 6 mm
    - Important to zoom image
    - Can be difficult to define
    - Prone to measurement error

EAE Recommendations 2010
Aortic Insufficiency

- Other Doppler Findings:
  - *Holodiastolic* reversal in the descending aorta > 20 cm/s
  - Pressure ½ time < 200 ms
  - Increased forward TVI

EAE Recommendations 2010
Aortic Insufficiency
Aortic Insufficiency

[Images of echocardiograms showing aortic insufficiency]
Aortic Insufficiency
Aortic Insufficiency
Aortic Insufficiency
Mitral Regurgitation

- Echo provides info on:
  - Valve Anatomy
  - Mechanism of Regurgitation (primary or secondary)
  - Etiology
  - Allows Quantitation of MR
  - Repairability
Mitral Regurgitation

- Normal MV function involves complex interaction between:
  - MV leaflets
  - Subvalvular apparatus (chordae, pap muscles)
  - Mitral annular geometry and motion
  - LV size and function
Mitral Regurgitation

EAE Recommendations 2010
Mitral Regurgitation

EAE Recommendations 2010
Mitral Regurgitation

- Valve analysis should integrate etiology and type of dysfunction
- Distinction between primary and secondary MR is mandatory

EAE Recommendations 2010
Mitral Regurgitation

- Primary MR (“organic”) = leaflet disease
  - Barlow, FE deficiency, rheumatic, endocarditis, Marfan, Ehler’s-Danlos, MAC
- Secondary MR (“functional”) = LV disease
  - Ischemic & Non-Ischemic Cardiomyopathy
# Mitral Regurgitation

## Primary MR

### Asymptomatic severe MR
- Severe mitral valve prolapse with loss of coaptation or flail leaflet
- Rheumatic valve changes with leaflet restriction and loss of central coaptation
- Prior IE
- Thickening of leaflets with radiation heart disease

### Symptomatic severe MR
- Severe mitral valve prolapse with loss of coaptation or flail leaflet
- Rheumatic valve changes with leaflet restriction and loss of central coaptation
- Prior IE
- Thickening of leaflets with radiation heart disease

### Central jet MR >40% LA or holosystolic eccentric jet MR
- Vena contracta ≥0.7 cm
- Regurgitant volume ≥60 mL
- Regurgitant fraction ≥50%
- ERO ≥0.40 cm²
- Angiographic grade 3–4+

### Moderate or severe LA enlargement
- LV enlargement
- Pulmonary hypertension may be present at rest or with exercise
- C1: LVEF >60% and LVESD <40 mm
- C2: LVEF ≤60% and LVESD ≥40 mm

### None
- Decreased exercise tolerance
- Exertional dyspnea

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2014 AHA/ACC Valvular Heart Disease Guideline
Wherever possible quantitation is important

Most often done using PISA

For primary MR severe defined by:

- ERO ≥ 0.40 cm², Regurg vol ≥ 60 ml,
- EF > 60%, LVESD ≥ 40 mm (stage C2)

2014 AHA/ACC Valvular Heart Disease Guideline
Mitral Regurgitation

- In absence of MS, E vel > 1.5 m/s suggests severe MR
- MV VTI (pulsed)/LVOT VTI > 1.4 suggests severe MR
- Vena contracta ≥ 7 mm suggests severe MR
- Systolic reversal of flow in pulmonary vein(s) also suggests severe MR

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Mitral Regurgitation

- MVP defined on long-axis views:
  - Movement of coaptation line beyond annulus, or leaflet displacement >2 mm beyond annular line
  - Can involve an isolated segment (FE deficiency) or multiple segments (Barlow)
  - Best defined on 3D imaging
Mitral Regurgitation
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Mitral Regurgitation

- For secondary MR severe defined by:
  - ERO ≥ 0.20 cm², Regurg vol ≥ 30 ml
  - Treatment less well defined

EAE Recommendations 2010
2014 AHA/ACC Valvular Heart Disease Guideline
## Mitral Regurgitation

### Secondary MR

**Asymptomatic severe MR**
- Regional wall motion abnormalities and/or LV dilation with severe tethering of mitral leaflet
- Annular dilation with severe loss of central coaptation of the mitral leaflets
- ERO ≥0.20 cm²
- Regurgitant volume ≥30 mL
- Regurgitant fraction ≥50%

**Symptomatic severe MR**
- Regional wall motion abnormalities and/or LV dilation with severe tethering of mitral leaflet
- Annular dilation with severe loss of central coaptation of the mitral leaflets
- ERO ≥0.20 cm²
- Regurgitant volume ≥30 mL
- Regurgitant fraction ≥50%

- Regional wall motion abnormalities with reduced LV systolic function
- LV dilation and systolic dysfunction due to primary myocardial disease
- Symptoms due to coronary ischemia or HF may be present that respond to revascularization and appropriate medical therapy

- HF symptoms due to MR persist even after revascularization and optimization of medical therapy
- Decreased exercise tolerance
- Exertional dyspnea

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2014 AHA/ACC Valvular Heart Disease Guideline
**Mitral Regurgitation**

- Functional usually involves papillary muscle displacement and valve “tenting”

- Prominent bend in AML and loss of line of coaptation

- Annular dilation can play a role but usually less important

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EAE Recommendations 2010
Mitral Regurgitation

- Can be due to LV/pap muscle dysfunction post MI (usually inferior)

Circulation. 2005;112:745-758
Mitral Regurgitation
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JACC 64:1867
Mitral Regurgitation

EHJ – Cardiovascular Imaging 16:290
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The End