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

- Carpentier 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

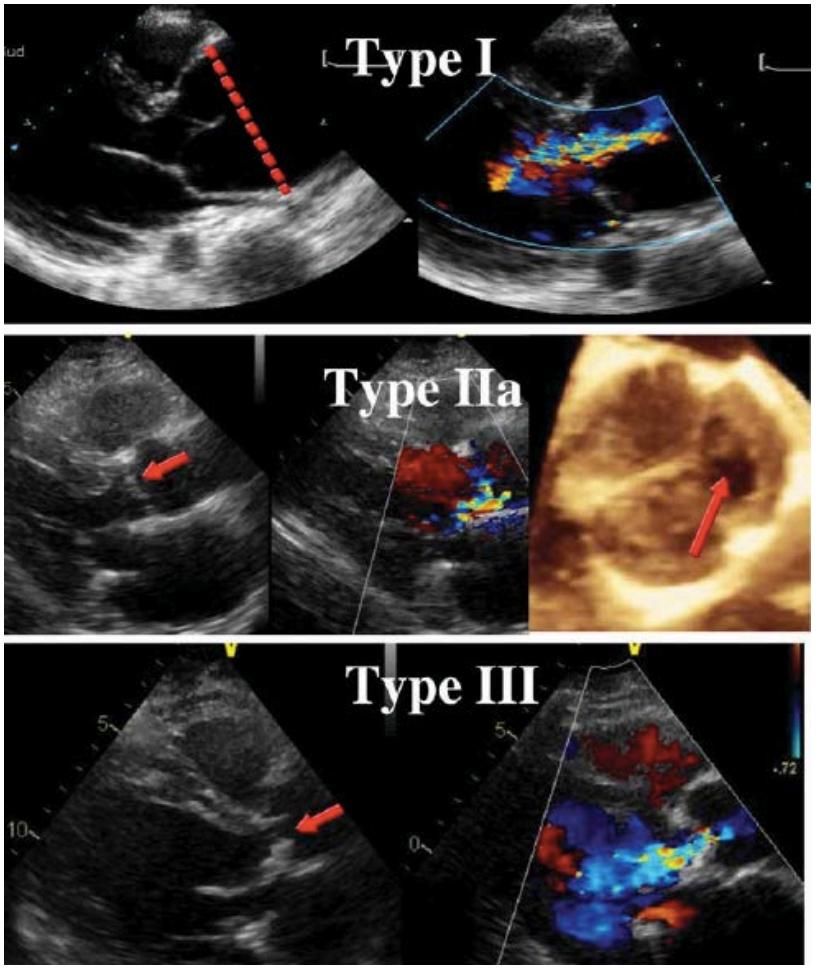
Aortic Insufficiency

C	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 ≥65% of LVOT; ○ Vena contracta >0.6 cm; ○ Holodiastolic flow reversal in the proximal abdominal aorta ○ RVol ≥60 mL/beat; ○ RF ≥50%; ○ ERO ≥0.3 cm^2; ○ Angiography grade 3+ to 4+; ○ In addition, diagnosis of chronic severe AR requires evidence of LV dilation	C1: Normal LVEF (≥50%) and mild-to-moderate LV dilation (LVESD ≤50 mm) C2: Abnormal LV systolic function with depressed LVEF (<50%) or severe LV dilatation (LVESD >50 mm or indexed LVESD >25 mm/m^2)	• None; exercise testing is reasonable to confirm symptom status
D	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 ≥65% of LVOT; ○ Vena contracta >0.6 cm, ○ Holodiastolic flow reversal in the proximal abdominal aorta, ○ RVol ≥60 mL/beat; ○ RF ≥50%; ○ ERO ≥0.3 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 ≥50%), mild-to-moderate LV dysfunction (LVEF 40%–50%), or severe LV dysfunction (LVEF <40%); • Moderate-to-severe LV dilation is present.	• Exertional dyspnea or angina or more severe HF symptoms

AHA/ACC 2014 Valve Guidelines

Aortic Insufficiency

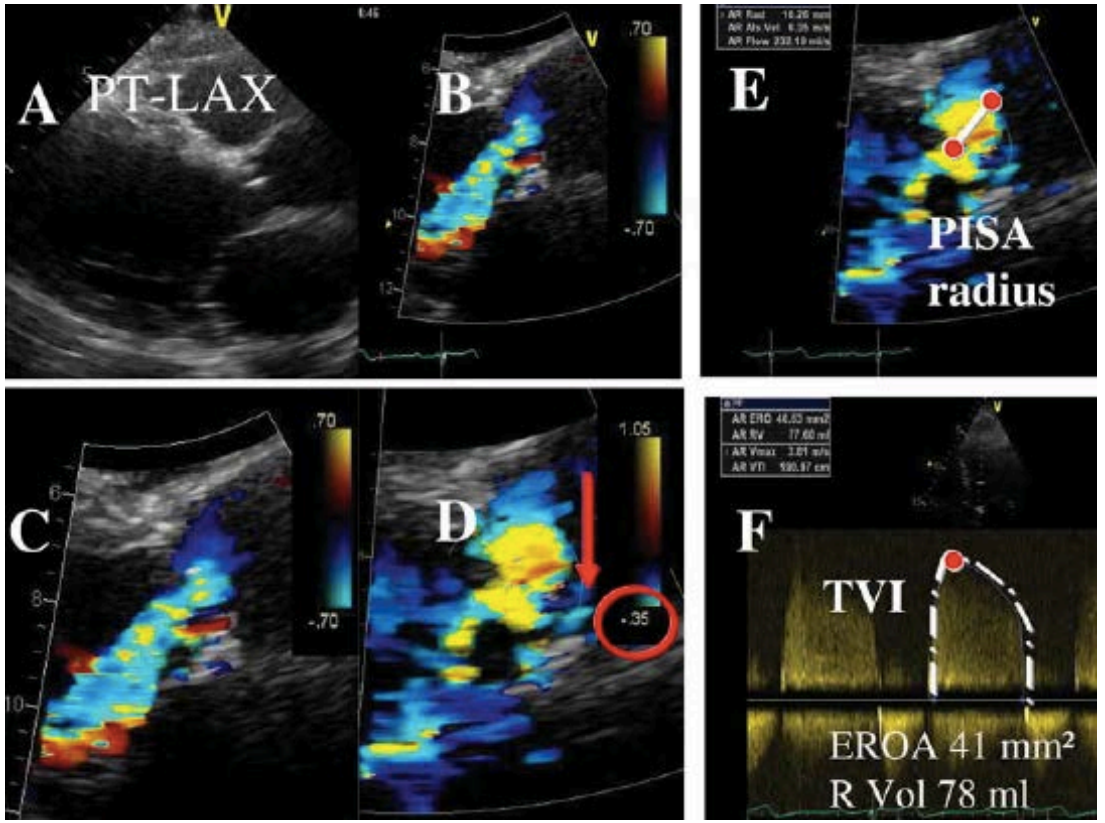
- Functional Classification
  - Type I: aortic root ⇧ (annulus, sinuses, sinotubular junction) with normal cusps
  - Type II: prolapse or free edge fenestration ⇒ eccentric AI
  - Type III: poor cusp tissue quality (retraction, calcification, endocarditis)



EAE Recommendations 2010

Aortic Insufficiency

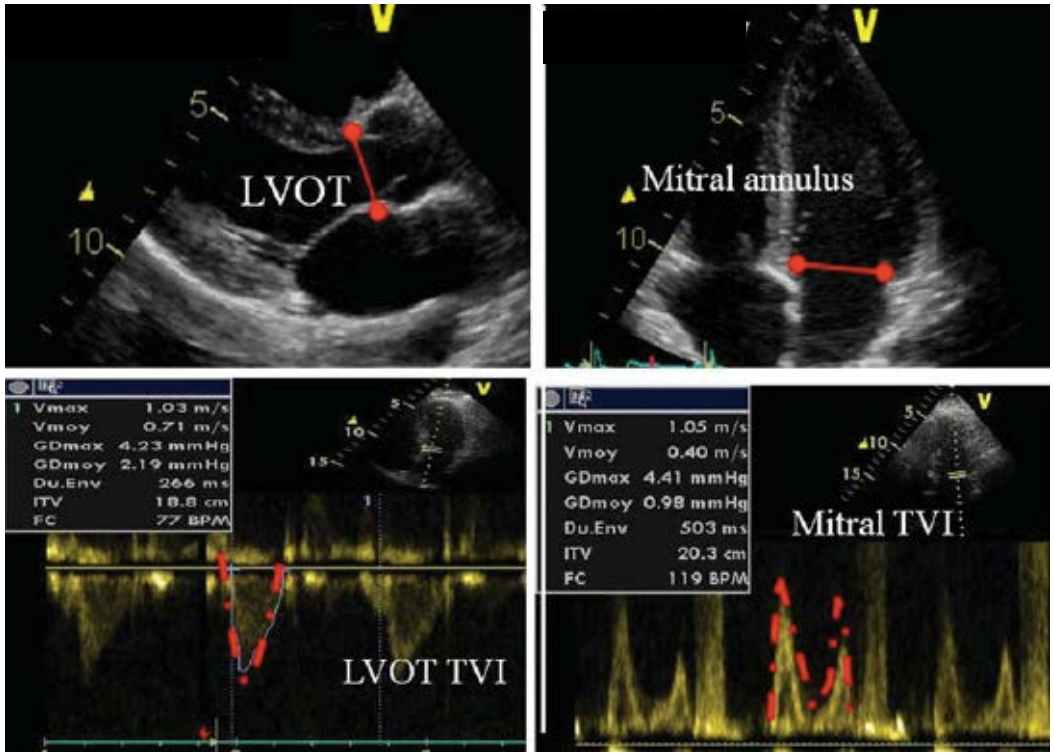
- PISA Method:
  - Similar drawbacks as VC method
  - Assumes a hemispheric PISA



EAE Recommendations 2010

Aortic Insufficiency

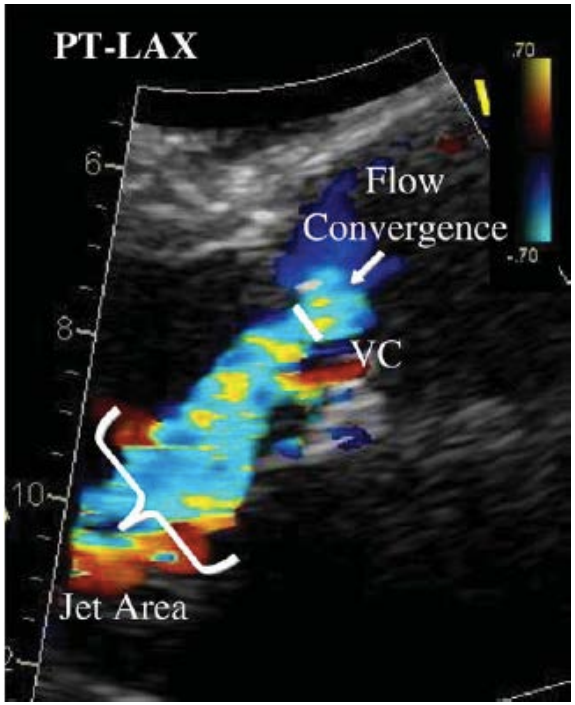
- Volumetric Method:
  - Multiple sources of error
  - Time consuming



EAE Recommendations 2010

Aortic Insufficiency

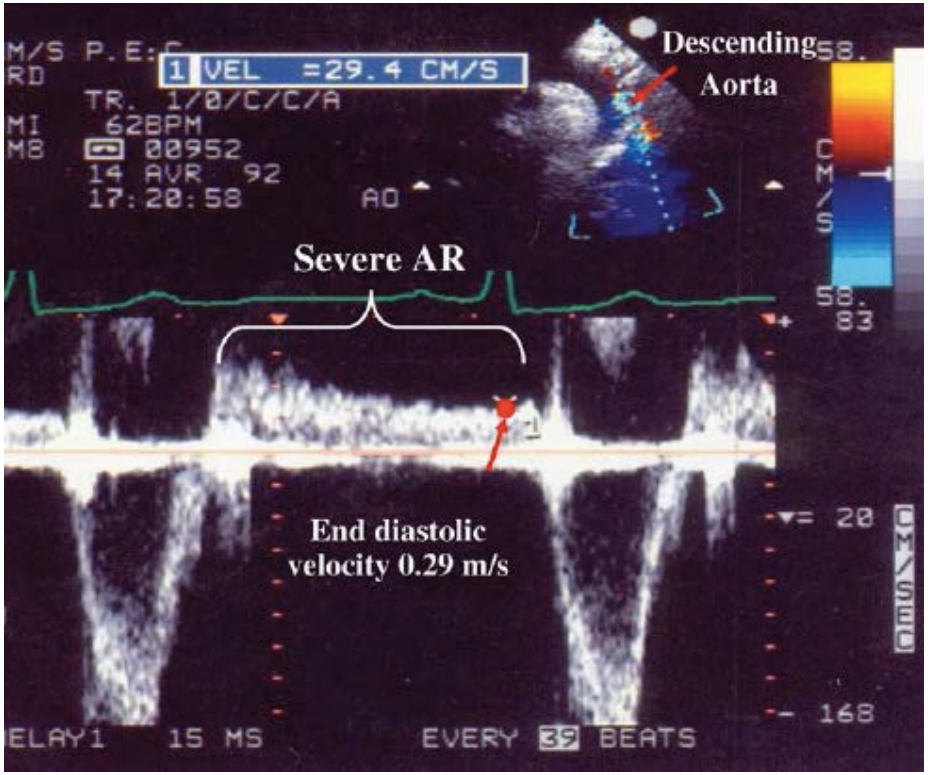
- Echo Markers of Severe AI:
- Vena contracta width > 6 mm
  - Important to zoom image
  - Can be difficult to define
  - Prone to measurement error



EAE Recommendations 2010

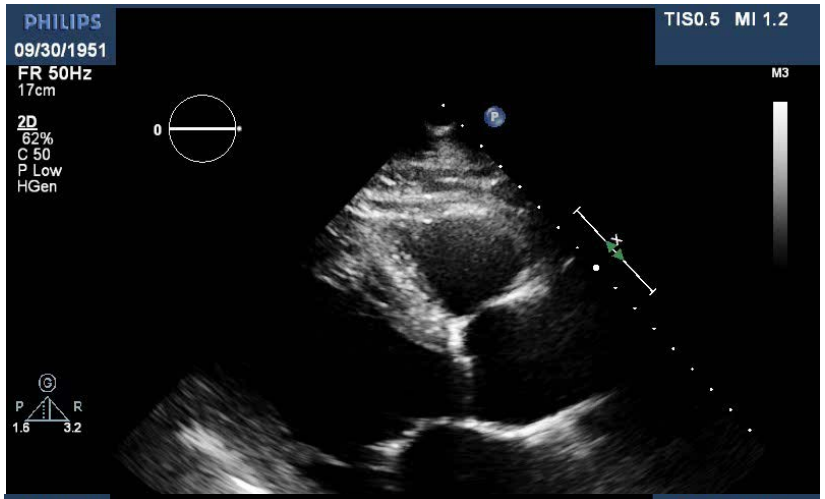
Aortic Insufficiency

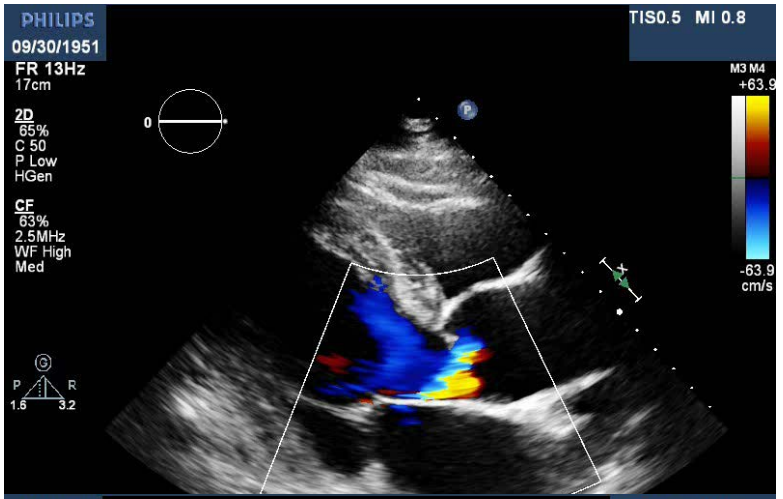
- Other Doppler Findings:
  - *Holodiastolic* reversal in the descending aorta > 20 cm/s
  - Pressure ½ time < 200 ms
  - Increased forward TVI

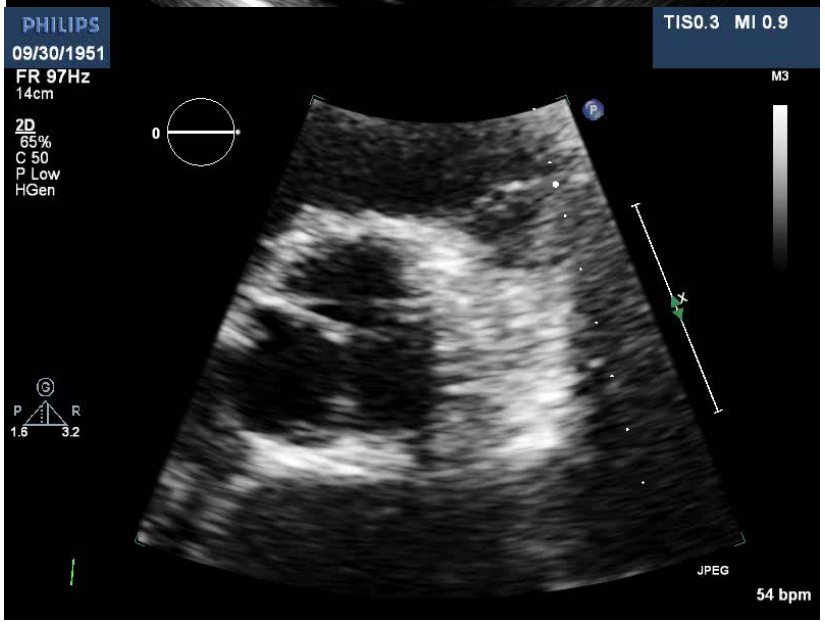


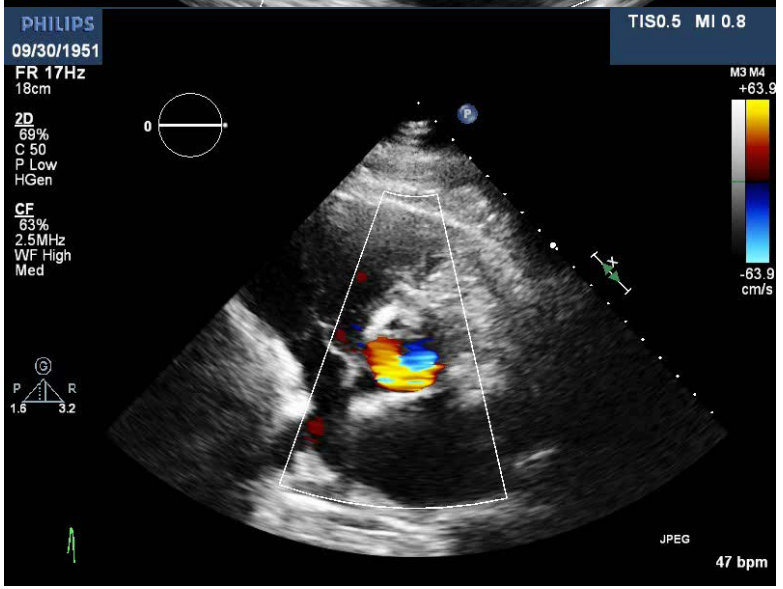
EAE Recommendations 2010

Aortic Insufficiency

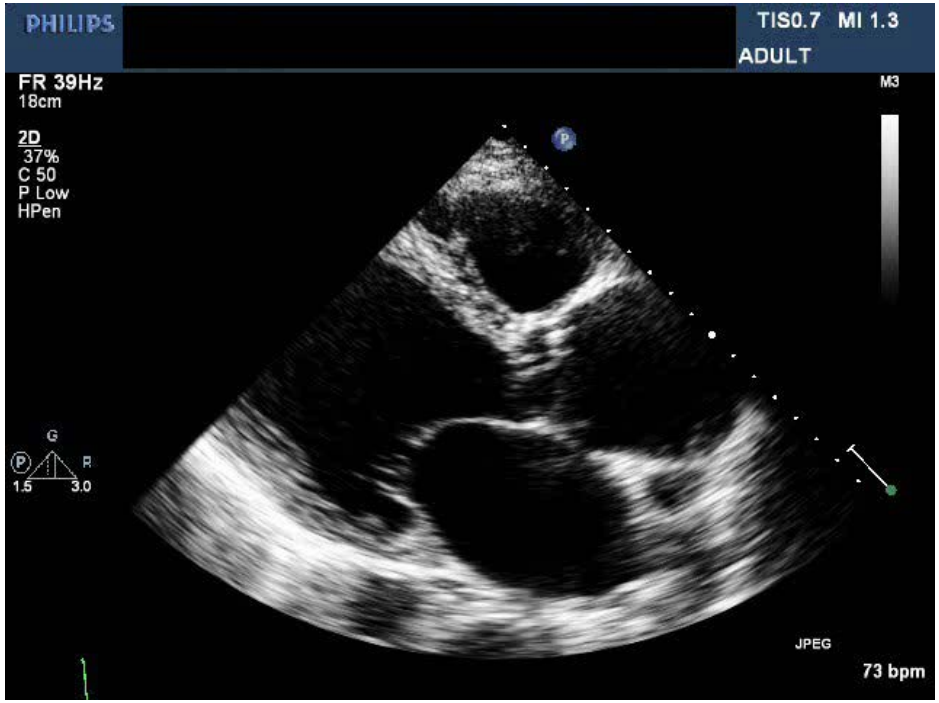


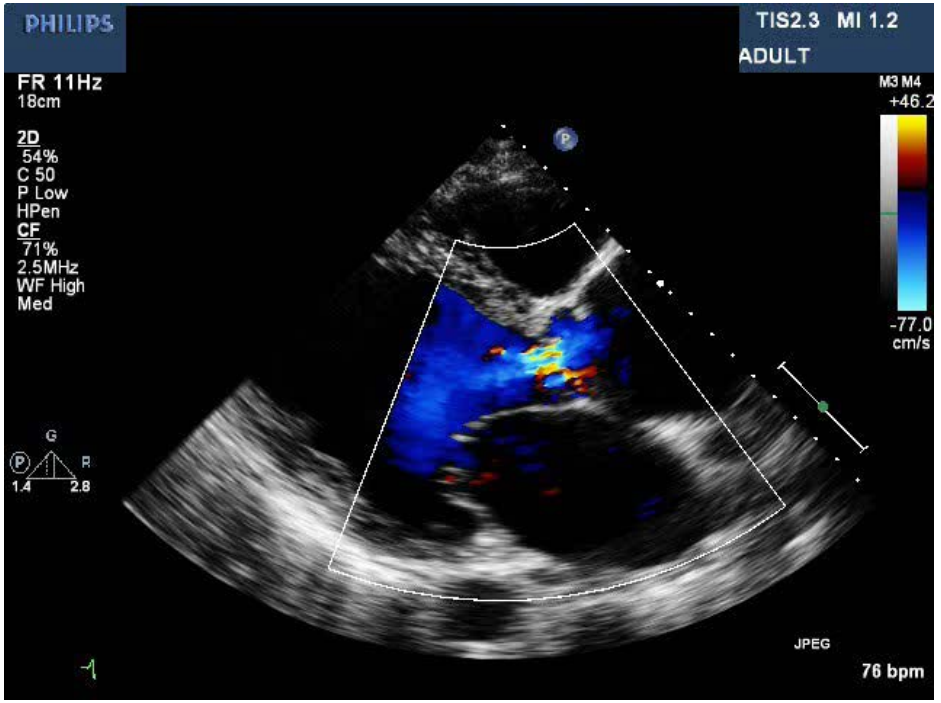






Aortic Insufficiency





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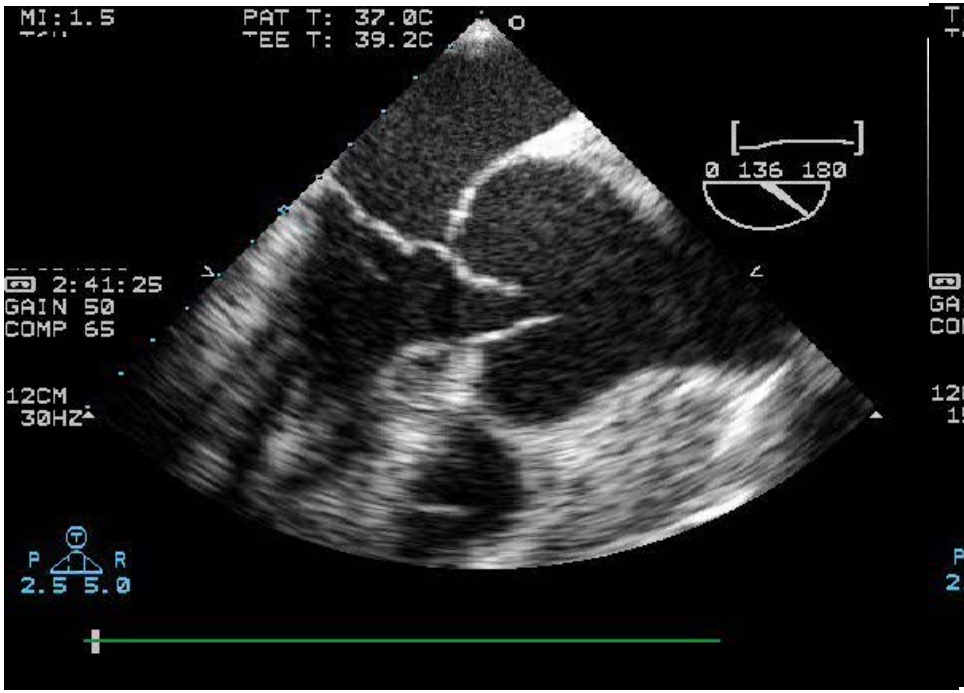

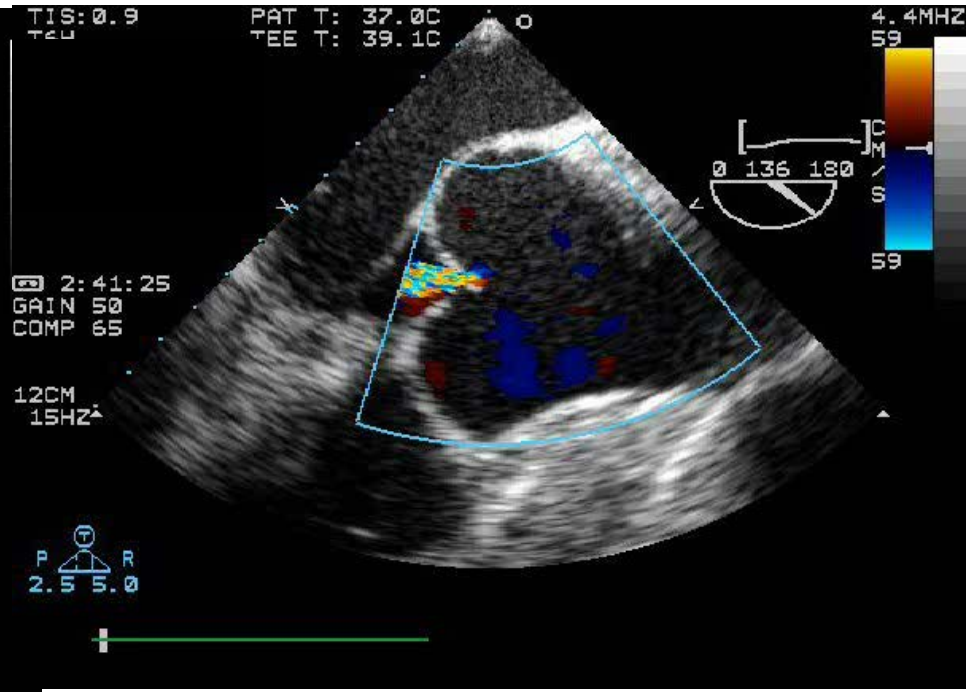

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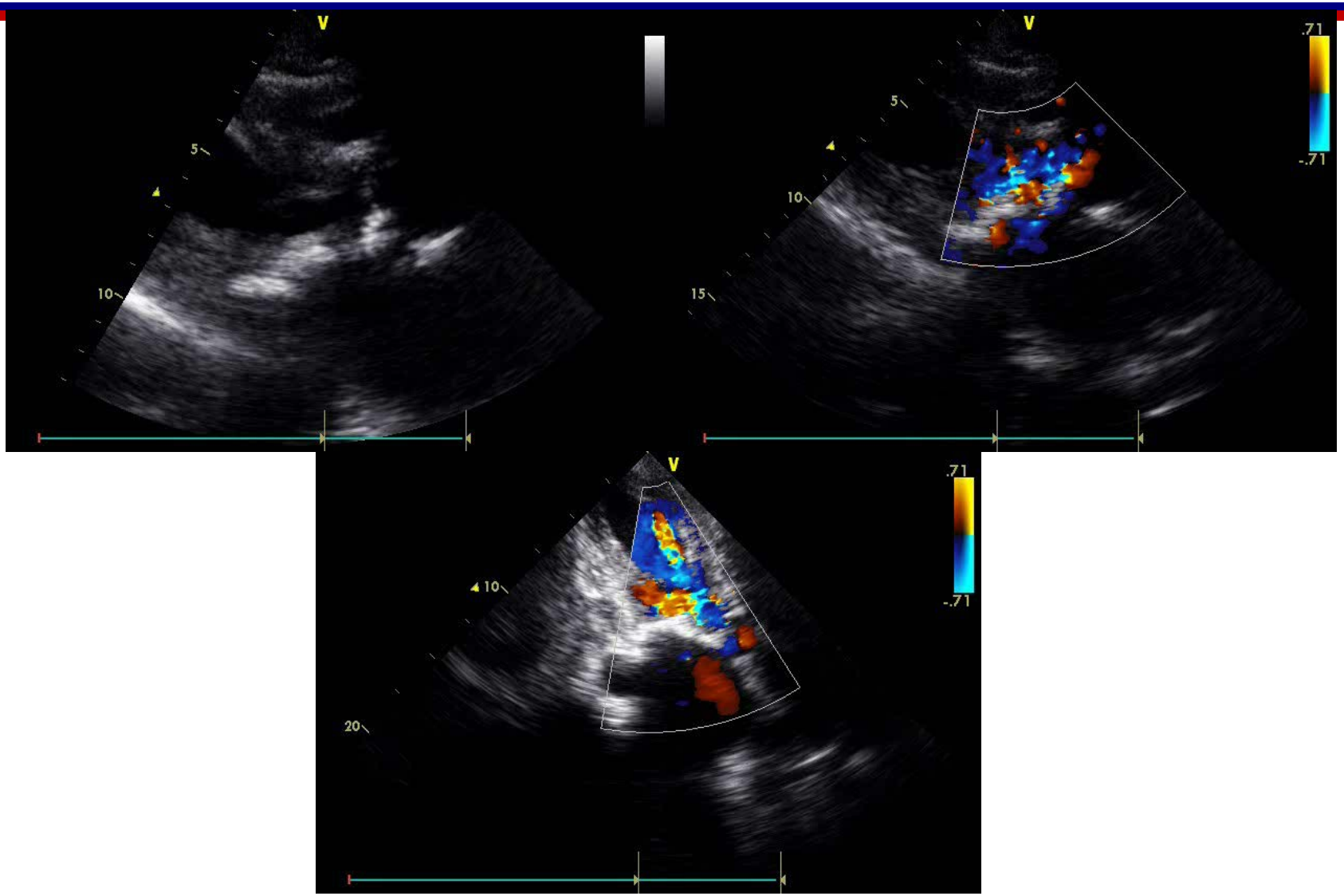
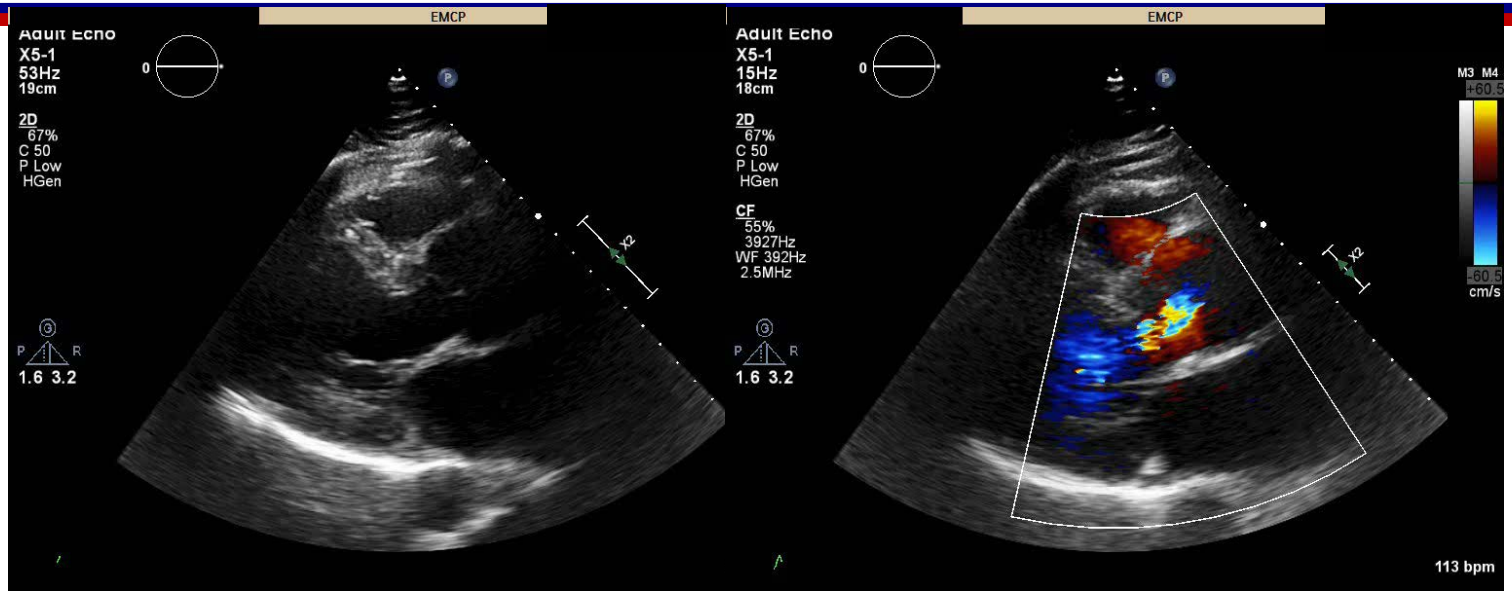
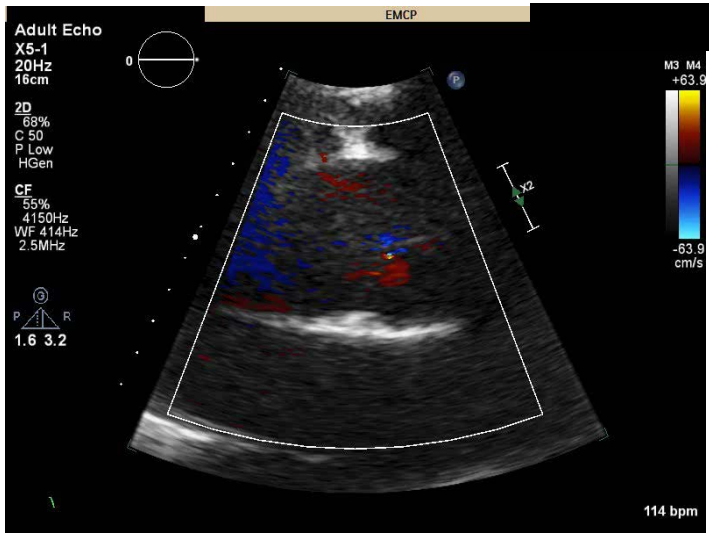


Aortic Insufficiency





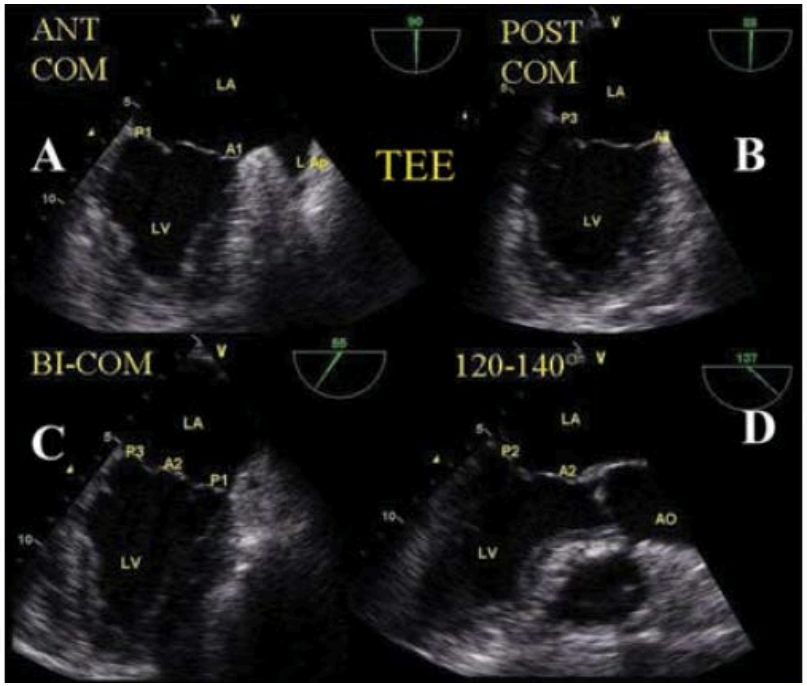
Mitral Regurgitation

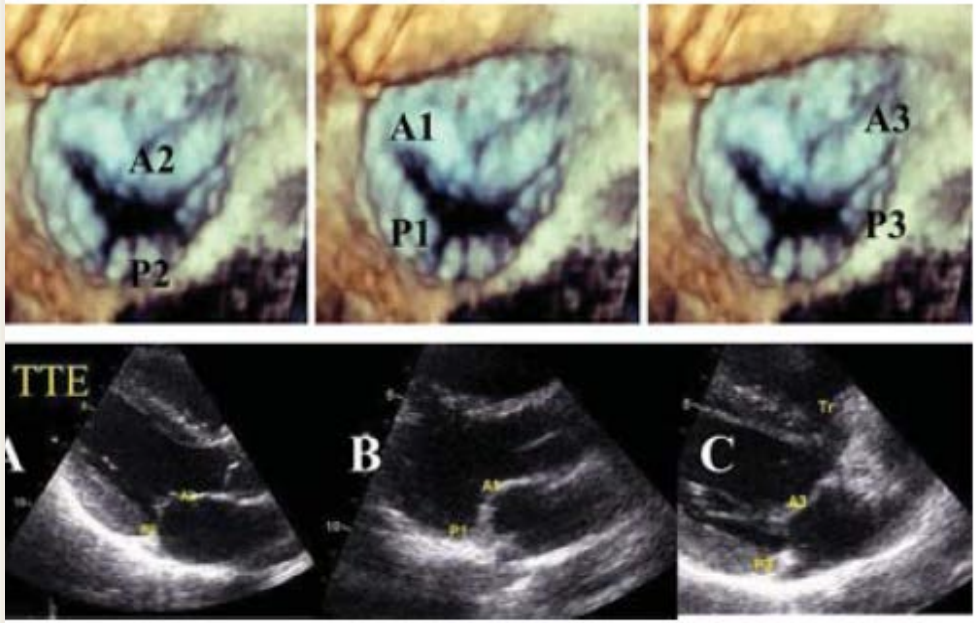
- Echo provides info on:
  - Valve Anatomy
  - Mechanism of Regurgitation (primary or secondary)
  - Etiology
  - Allows Quantitation of MR
  - Repairability

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

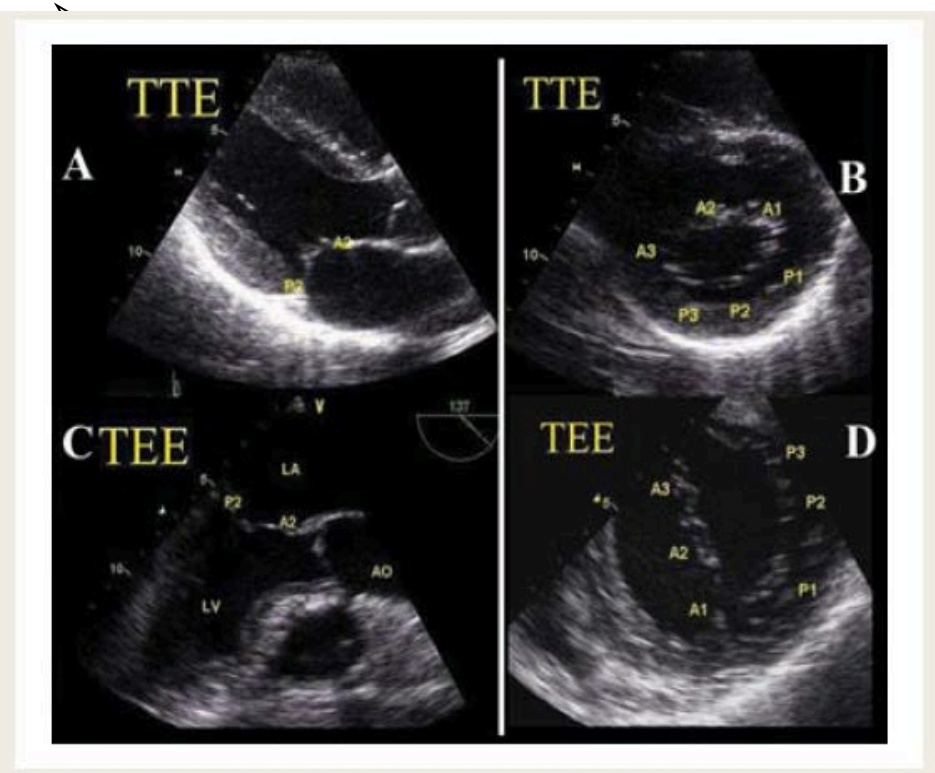
Mitral Regurgitation



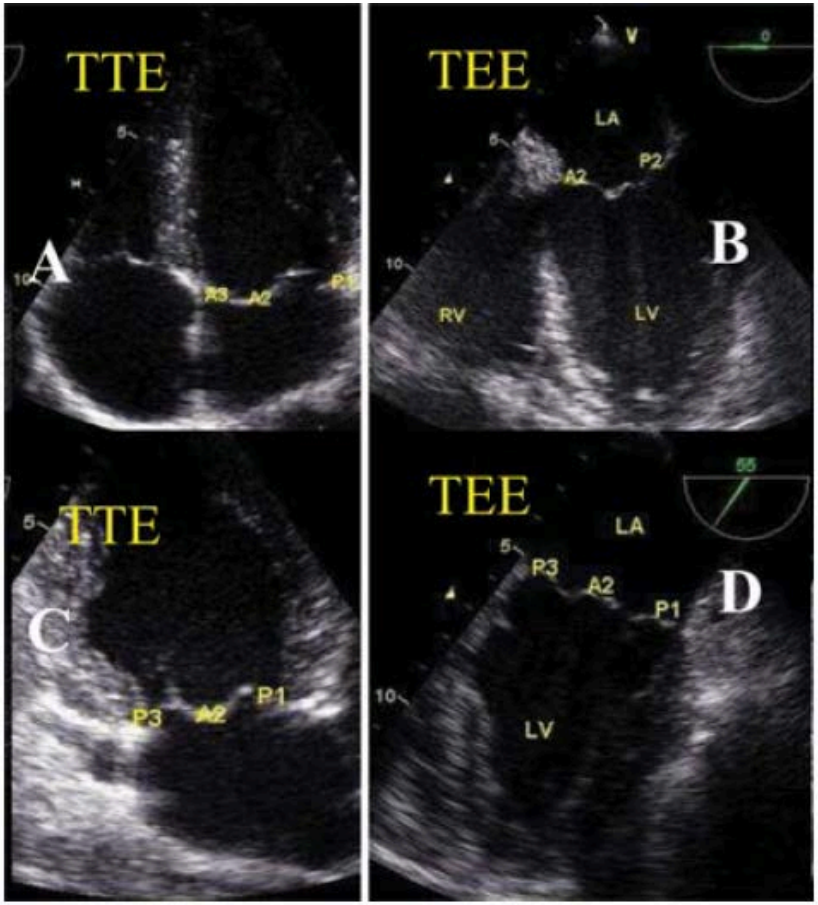


EAE Recommendations 2010

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

C	**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	• 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 cm^2 • 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
D	**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 cm^2 • Angiographic grade 3–4+	• Moderate or severe LA enlargement • LV enlargement • Pulmonary hypertension present	• Decreased exercise tolerance • Exertional dyspnea

2014 AHA/ACC Valvular Heart Disease Guideline

Mitral Regurgitation

- Wherever possible quantitation is important
- Most often done using PISA
- For primary MR severe defined by:
  - ERO ≥ 0.40 cm^2, Regurg vol ≥ 60 ml, EF > 60%, LVESD ≥ 40 mm (stage C2)

2014 AHA/ACC Valvular Heart Disease Guideline

Mitral Regurgitation

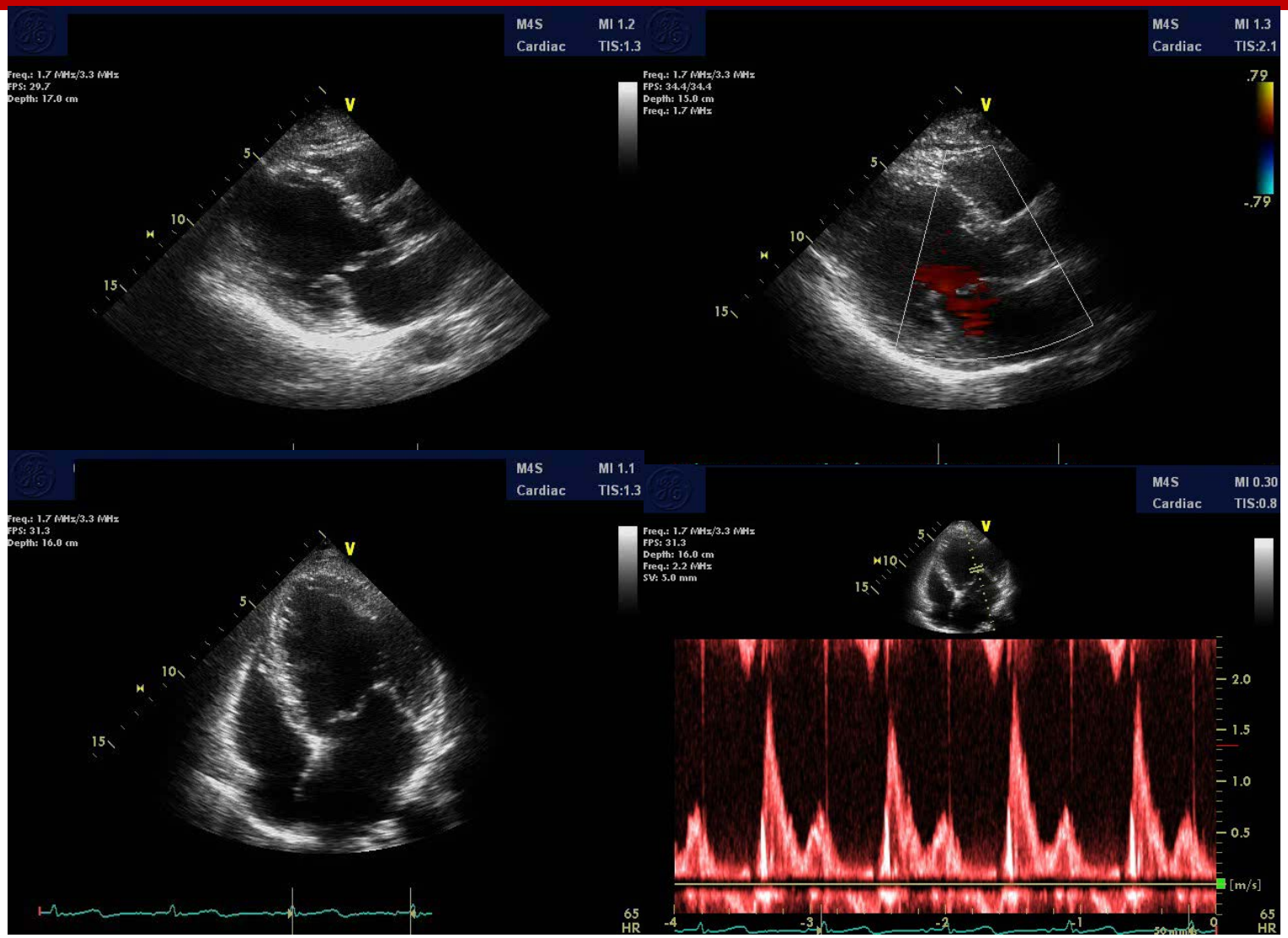
- In absence of MS, E vel > 1.5 m/s suggests severe MR
- MV VTI (pulsed)/LVOT VTI > 1.4 suggests severe MR
- Vena contracta ≥ 7 mm suggests severe MR
- Systolic reversal of flow in pulmonary vein(s) also suggests severe MR

EAE Recommendations 2010

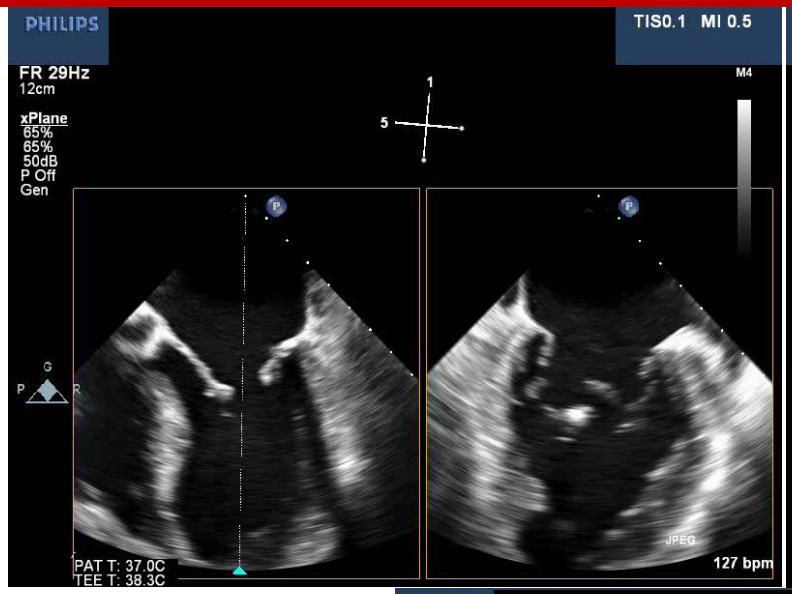
Mitral Regurgitation

- 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

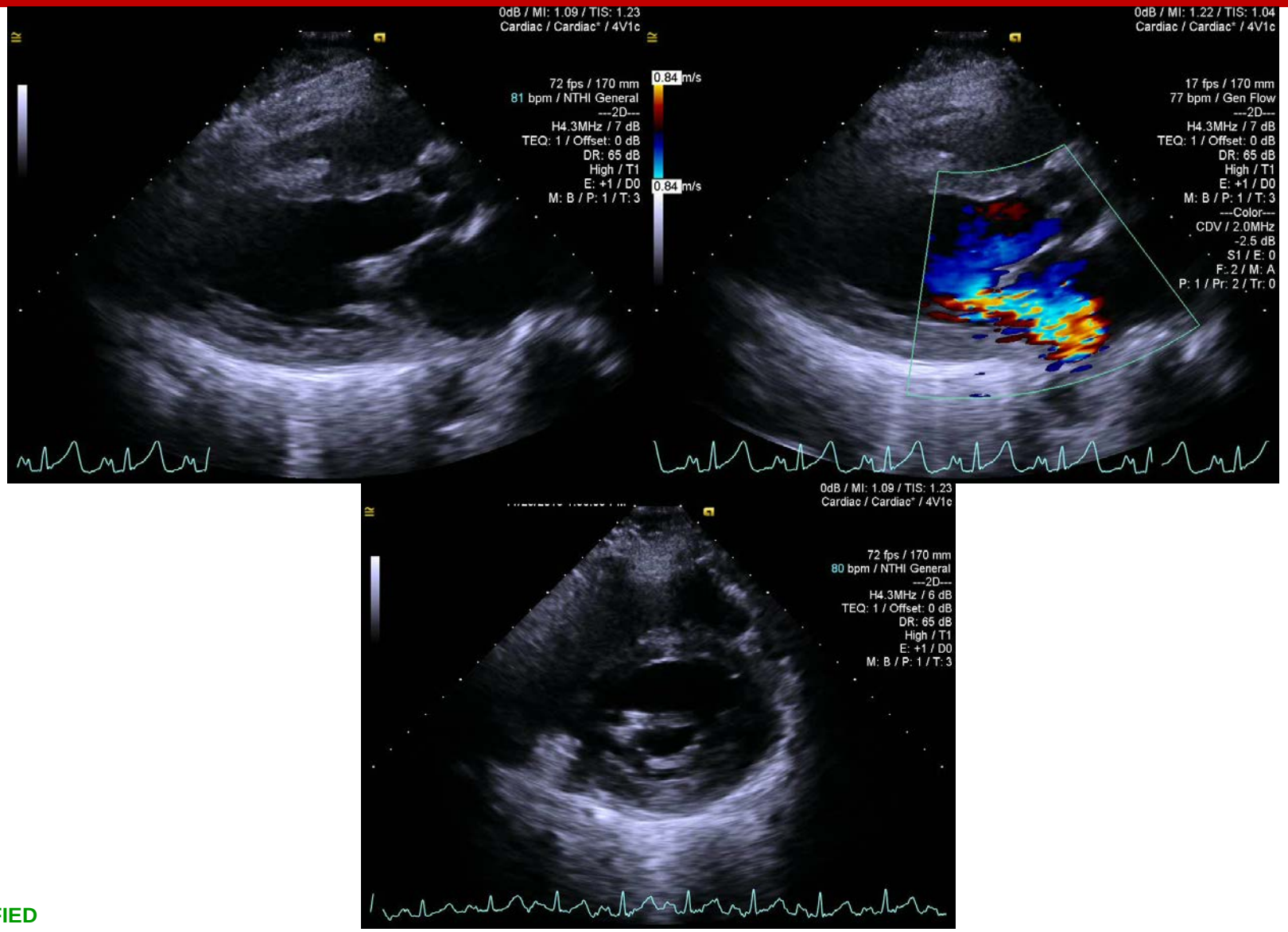
Mitral Regurgitation



Mitral Regurgitation



Mitral Regurgitation



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

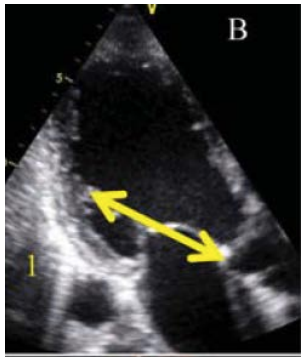
Secondary MR

C	**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 $\geq$0.20 cm^2† • Regurgitant volume $\geq$30 mL • Regurgitant fraction $\geq$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
D	**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 $\geq$0.20 cm^2† • Regurgitant volume $\geq$30 mL • Regurgitant fraction $\geq$50%	• Regional wall motion abnormalities with reduced LV systolic function • LV dilation and systolic dysfunction due to primary myocardial disease	• HF symptoms due to MR persist even after revascularization and optimization of medical therapy • Decreased exercise tolerance • Exertional dyspnea

2014 AHA/ACC Valvular Heart Disease Guideline

Mitral Regurgitation

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

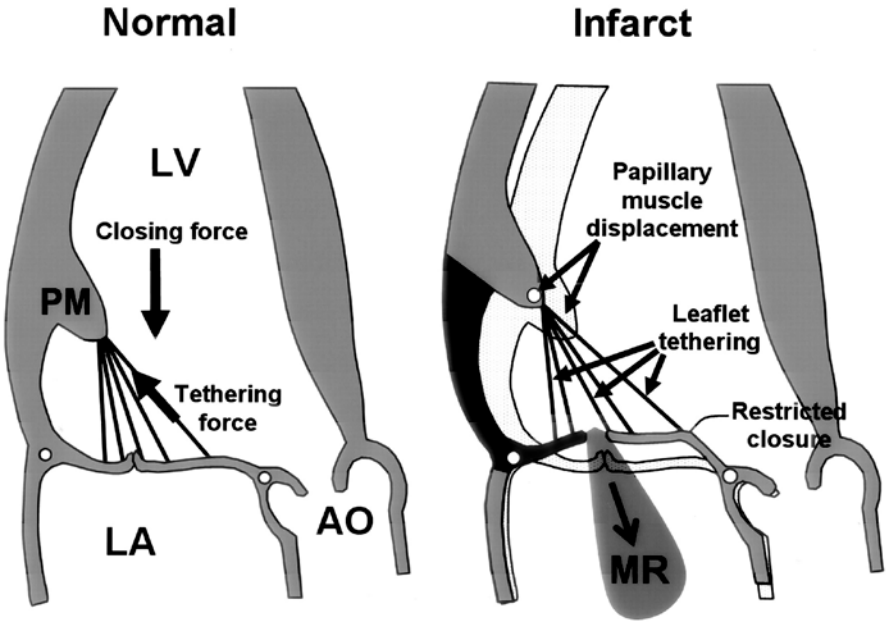


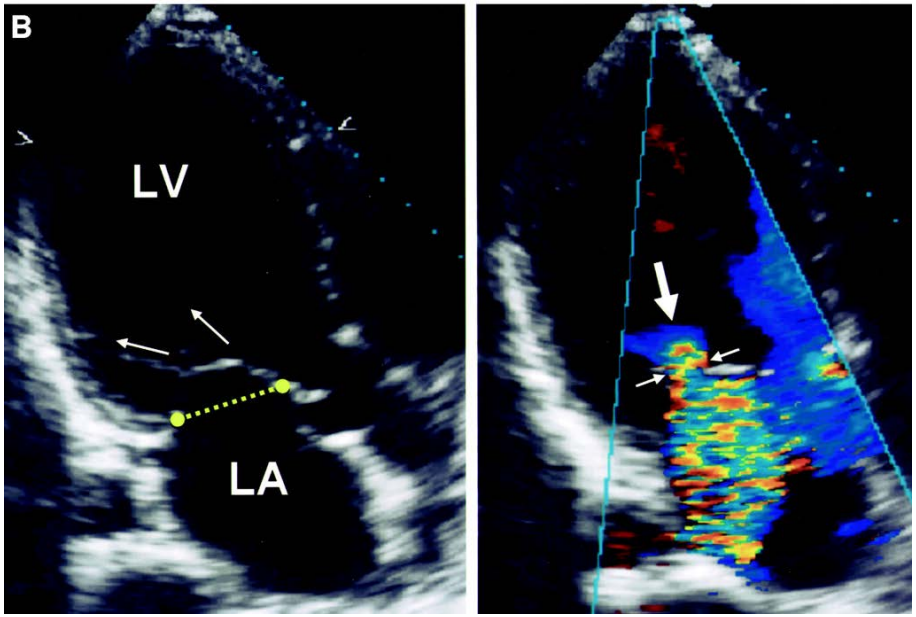
- Prominent bend in AML and loss of line of coaptation
- Annular dilation can play a role but usually less important

EAE Recommendations 2010

Mitral Regurgitation

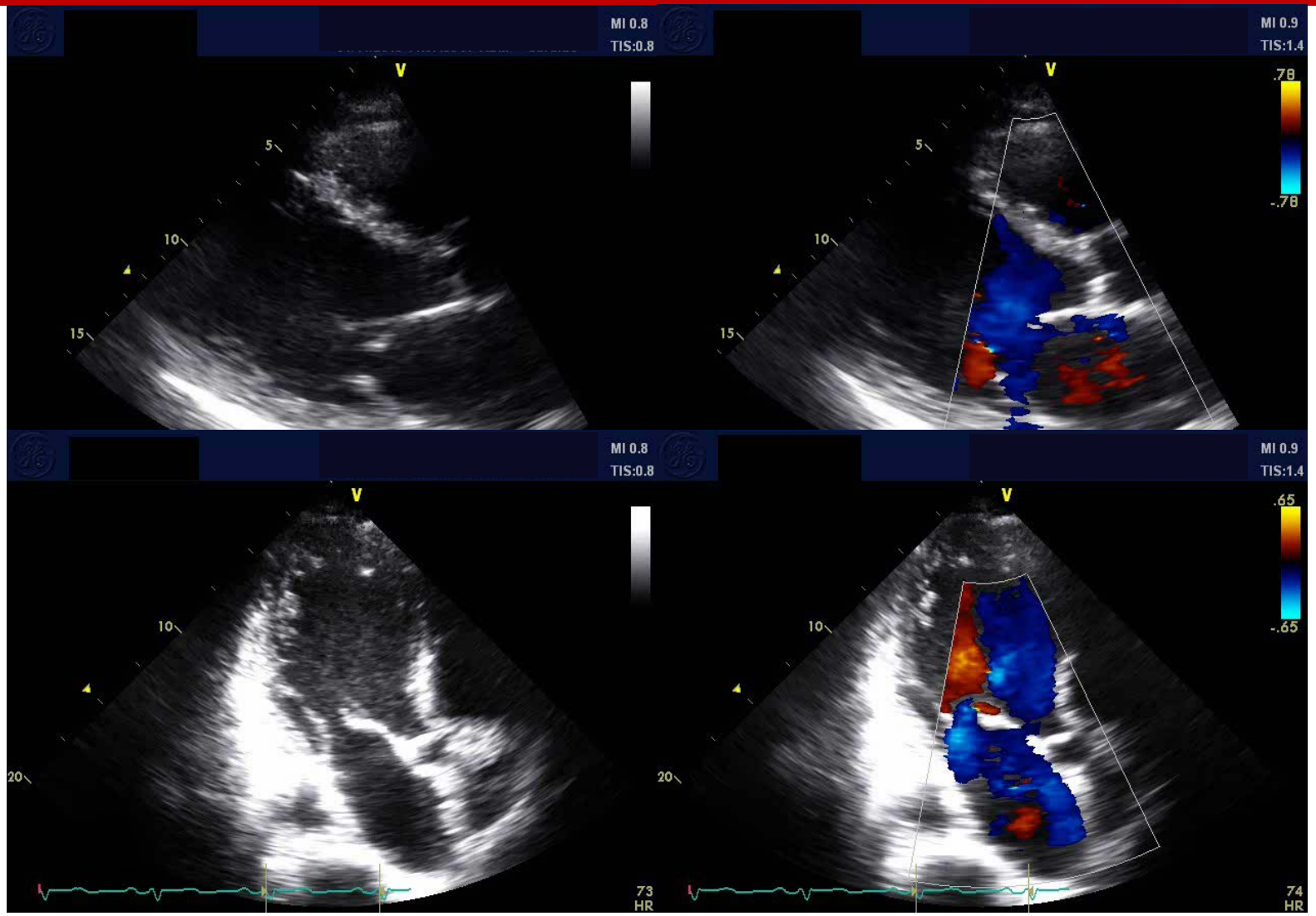
- Can be due to LV/pap muscle dysfunction post MI (usually inferior)





Circulation. 2005;112:745-758

Mitral Regurgitation



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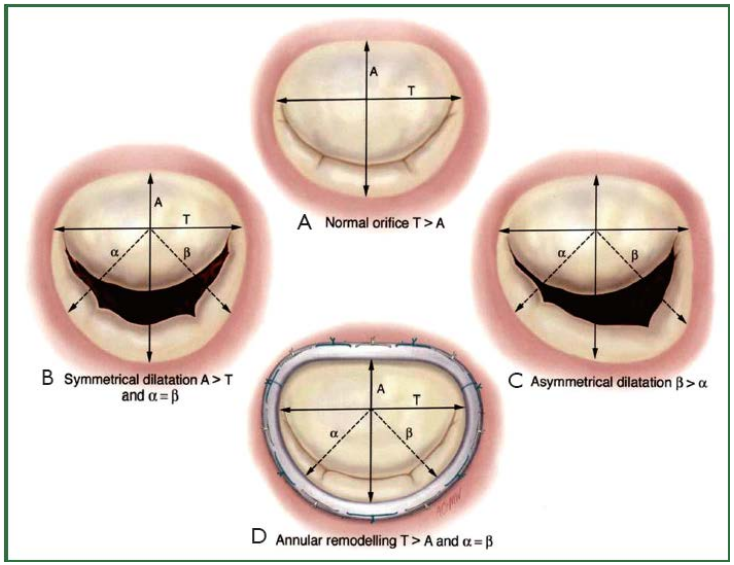
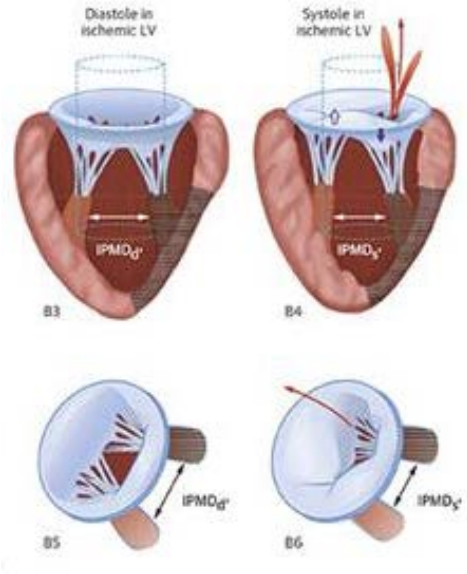
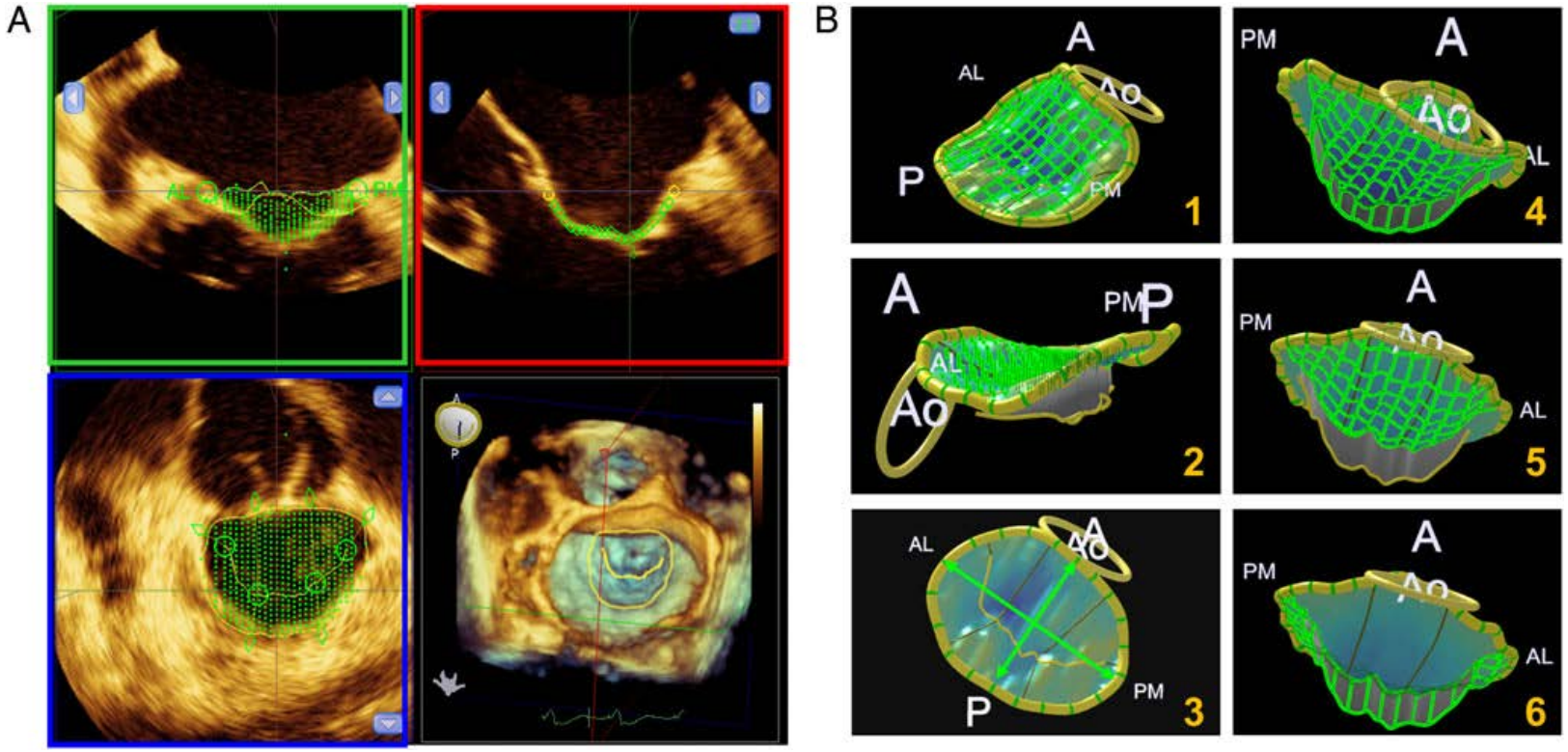


Carpentier A, Adams DH, Filsoufi F. *Carpentier's Reconstructive Valve Surgery. 2010 Saunders Elsevier*



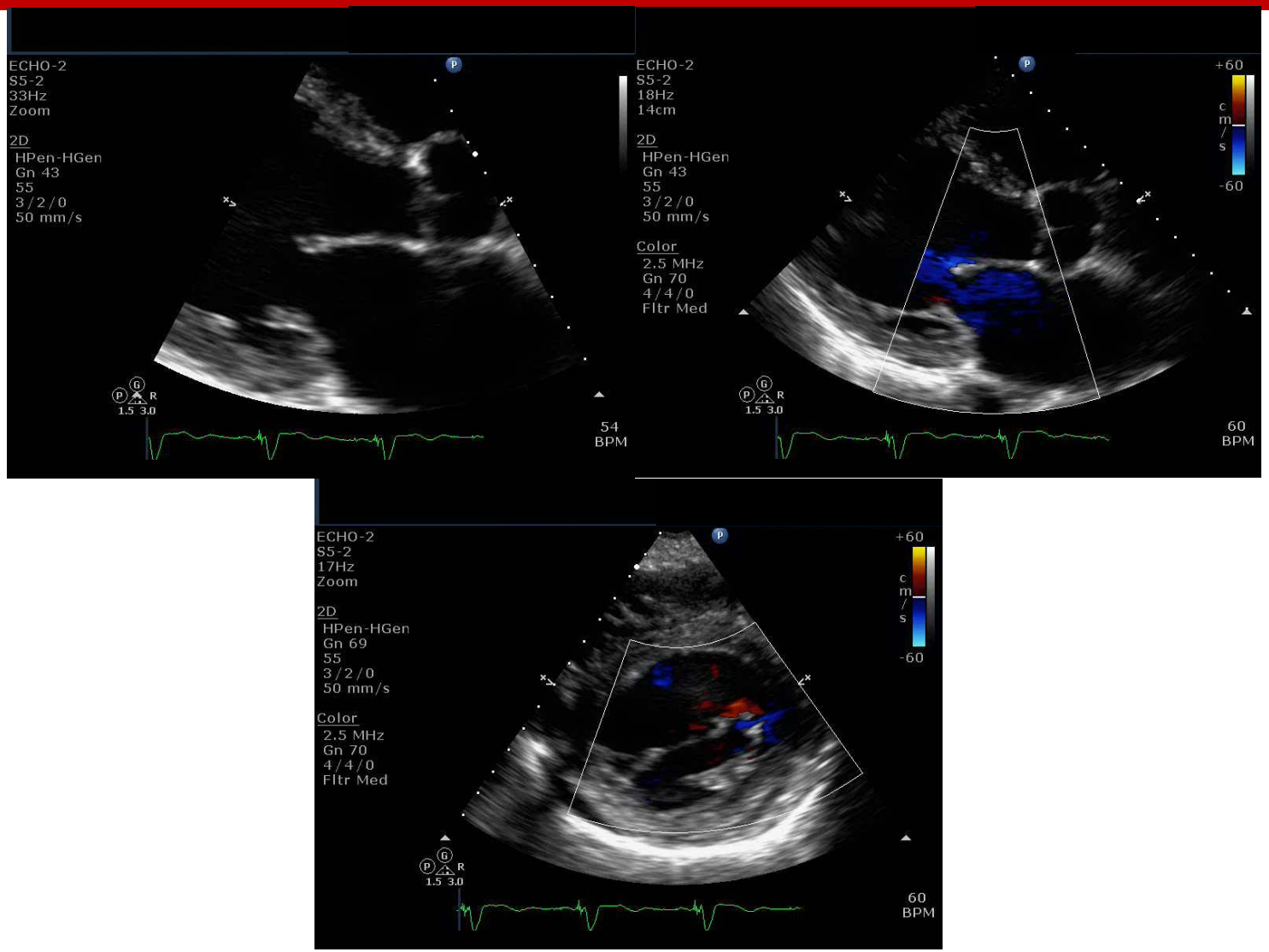
JACC 64:1867

Mitral Regurgitation



EHJ – Cardiovascular Imaging 16:290

Mitral Regurgitation



Mitral Regurgitation

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