



Regurgitant Lesions

**Bicol Hospital, Legazpi City, Philippines
July 2016**

**Gregg S. Pressman MD, FACC, FASE
Einstein Medical Center Philadelphia, USA**



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 $\geq 65\%$ of LVOT; ◦ Vena contracta >0.6 cm; ◦ Holodiastolic flow reversal in the proximal abdominal aorta ◦ RVol ≥ 60 mL/beat; ◦ RF $\geq 50\%$; ◦ ERO ≥ 0.3 cm²; ◦ 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 ≤ 50 mm) C2: Abnormal LV systolic function with depressed LVEF ($<50\%$) or severe LV dilation (LVESD >50 mm or indexed LVESD >25 mm/m²)	• 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 $\geq 65\%$ of LVOT; ◦ Vena contracta >0.6 cm, ◦ Holodiastolic flow reversal in the proximal abdominal aorta, ◦ RVol ≥ 60 mL/beat; ◦ RF $\geq 50\%$; ◦ ERO ≥ 0.3 cm²; ◦ 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 $<40\%$); • Moderate-to-severe LV dilation is present.	• Exertional dyspnea or angina or more severe HF symptoms

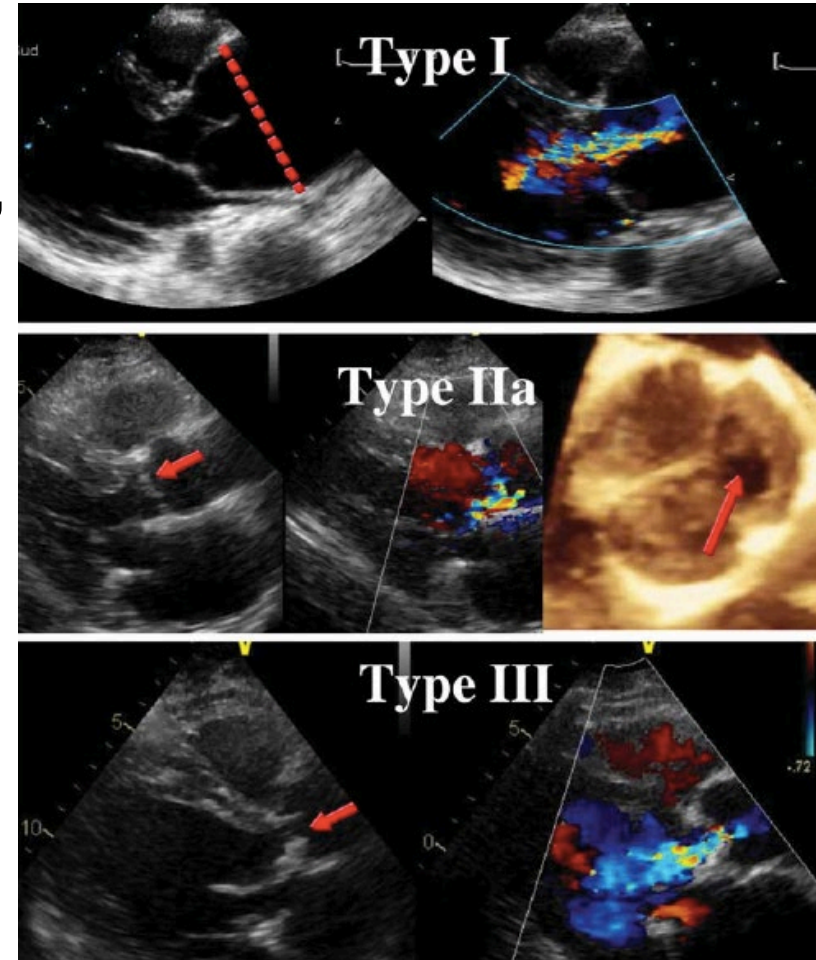
AHA/ACC 2014 Valve Guidelines



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)



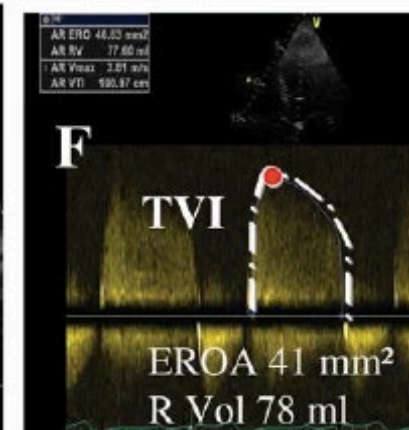
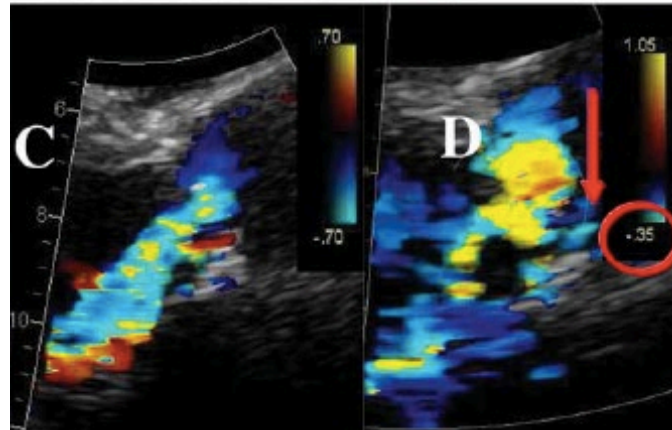
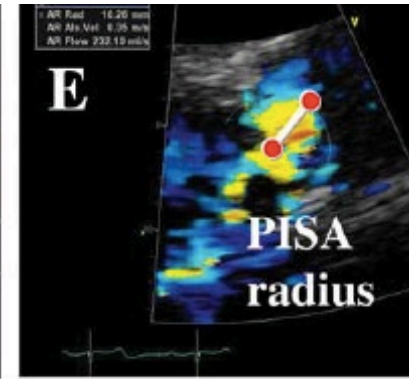
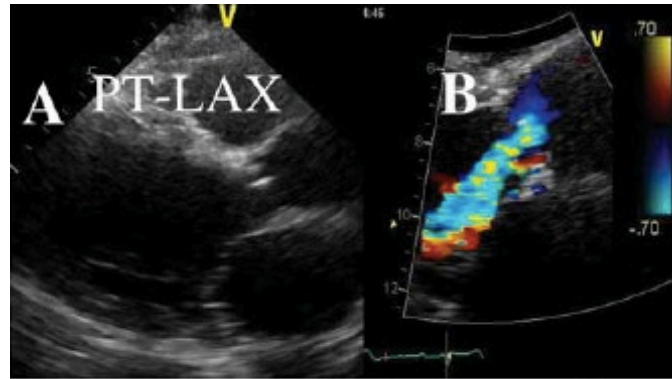
EAE Recommendations 2010



Aortic Insufficiency

➤ PISA Method:

- Similar drawbacks as VC method
- Assumes a hemispheric PISA



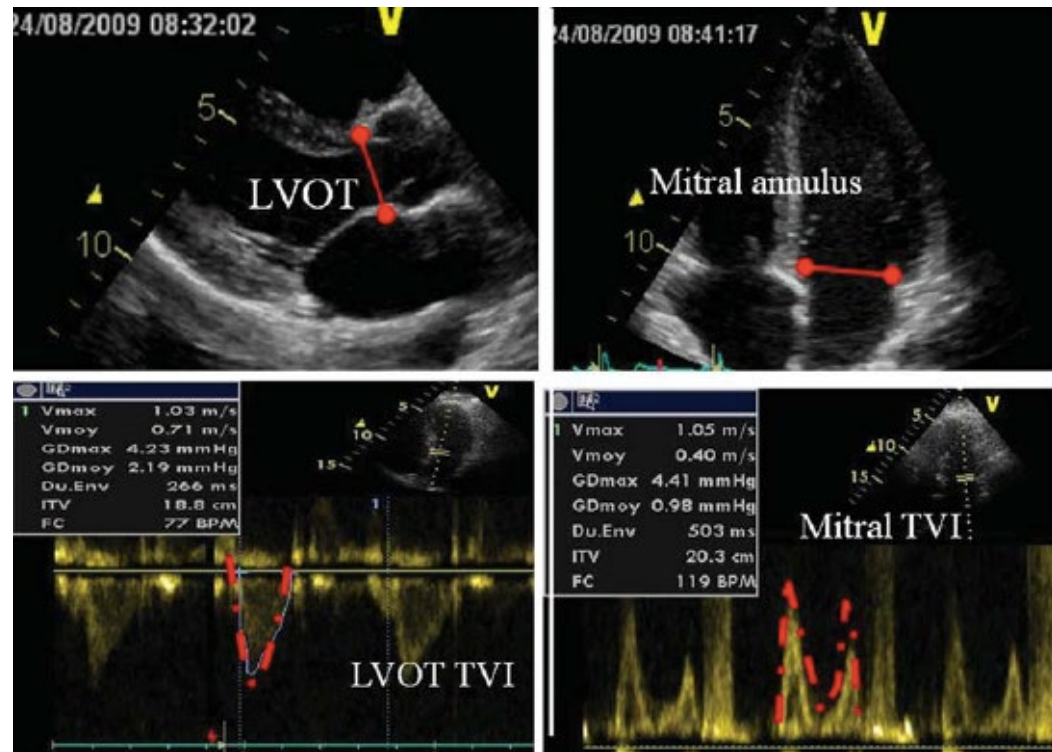
EAE Recommendations 2010



Aortic Insufficiency

➤ Volumetric Method:

- Multiple sources of error
- Time consuming

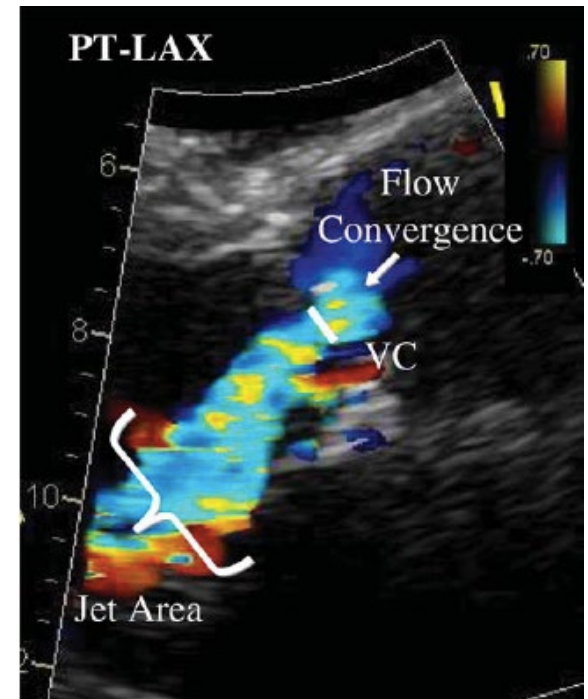


EAE Recommendations 2010



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

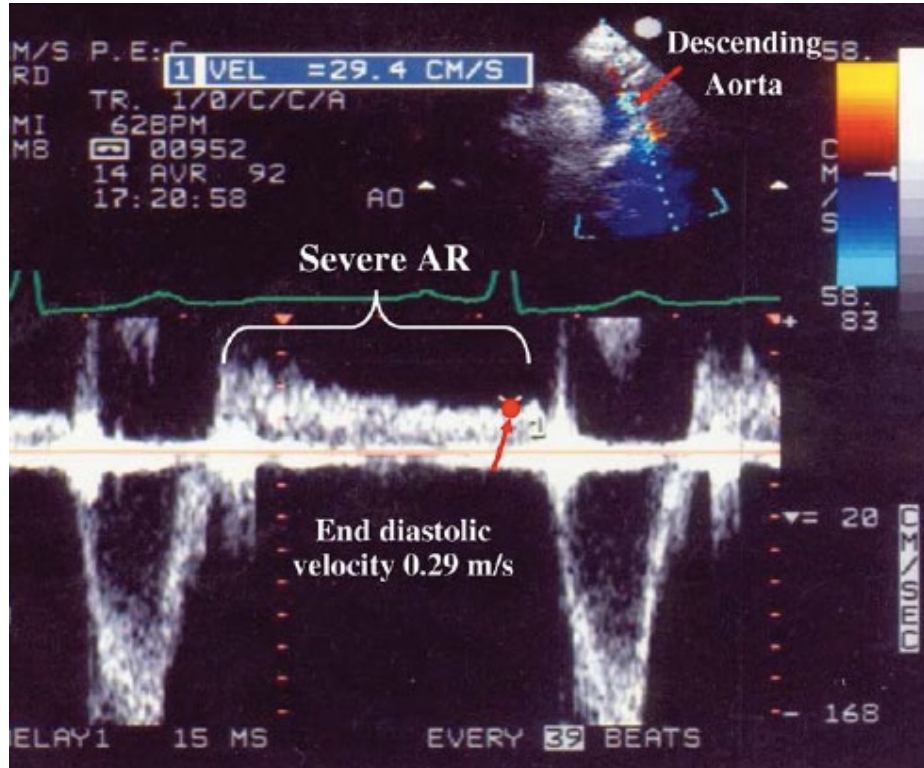


EAE Recommendations 2010



Aortic Insufficiency

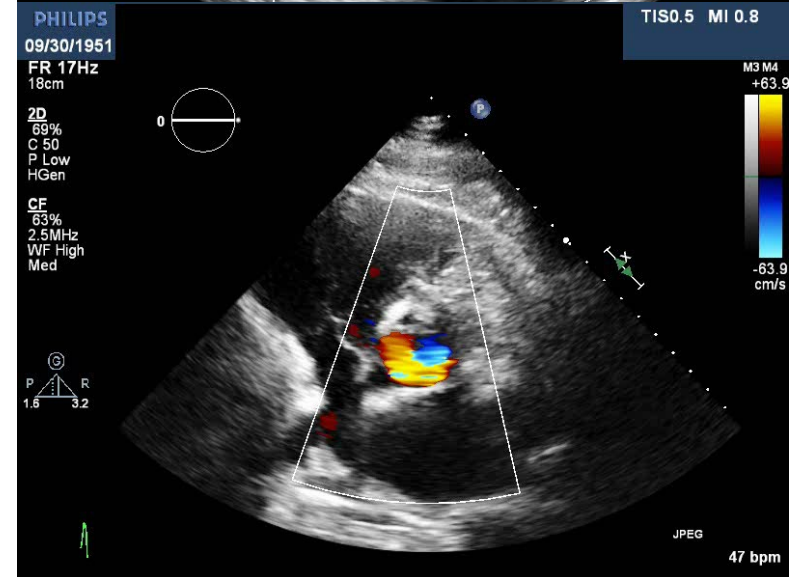
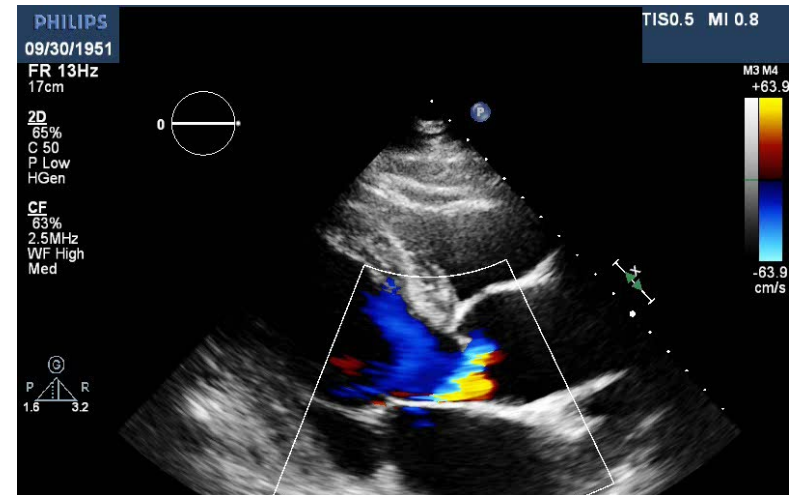
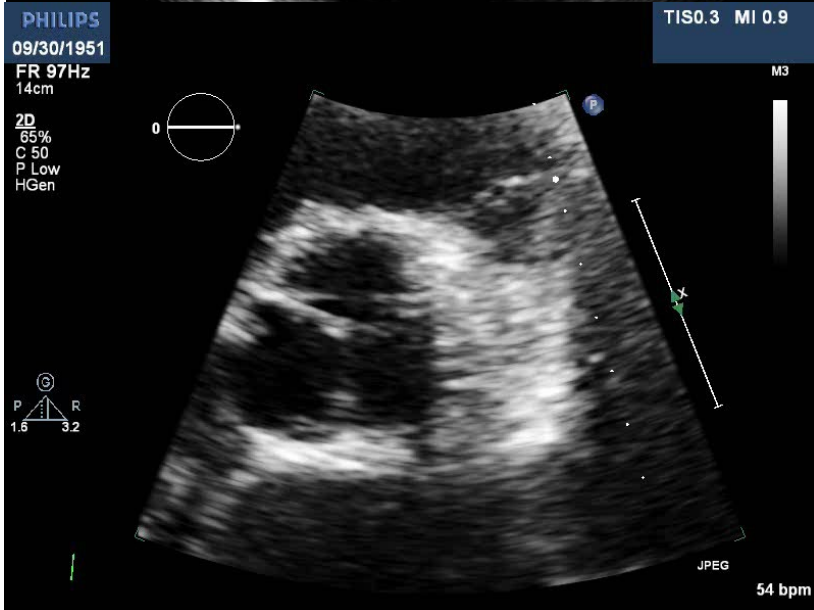
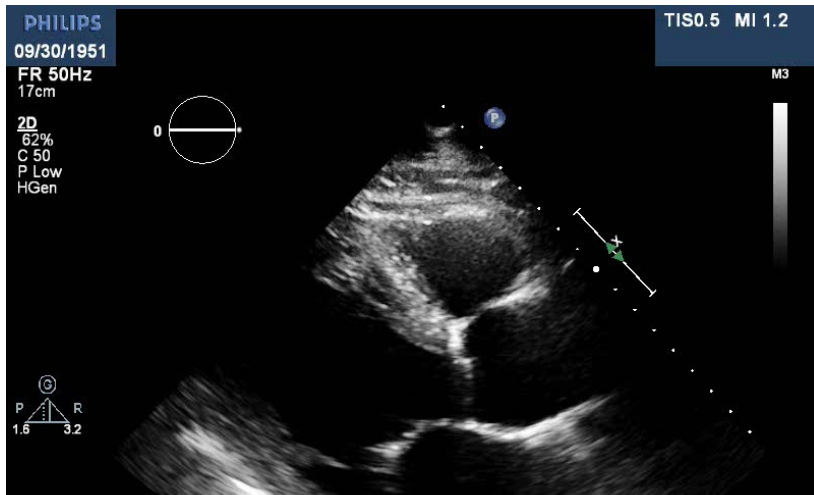
- Other Doppler Findings:
 - Holodiastolic reversal in the descending aorta > 20 cm/s
 - Pressure $\frac{1}{2}$ time < 200 ms
 - Increased forward TVI



EAE Recommendations 2010

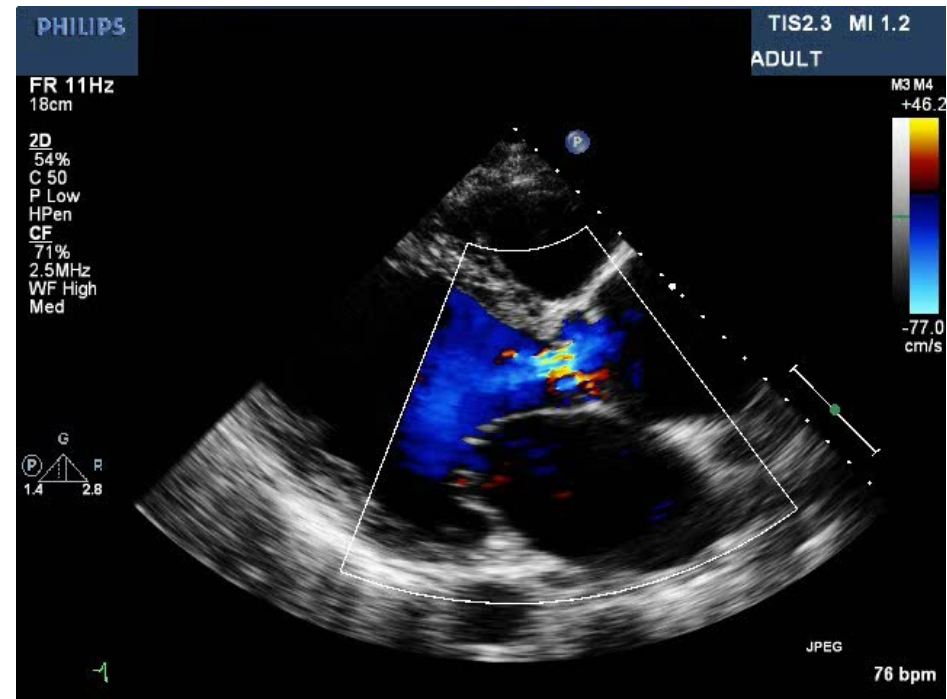
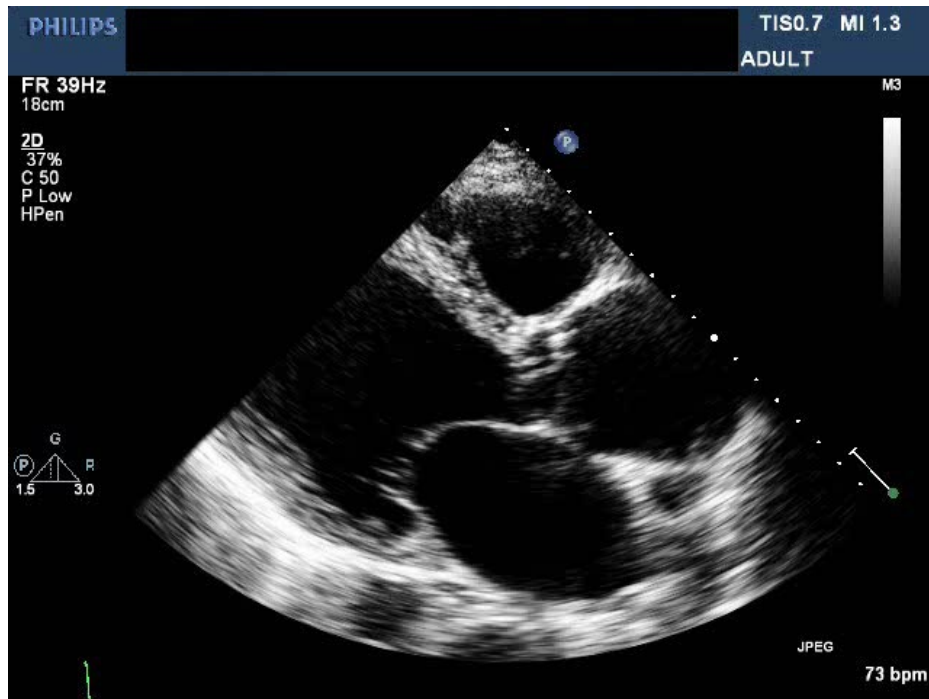


Aortic Insufficiency



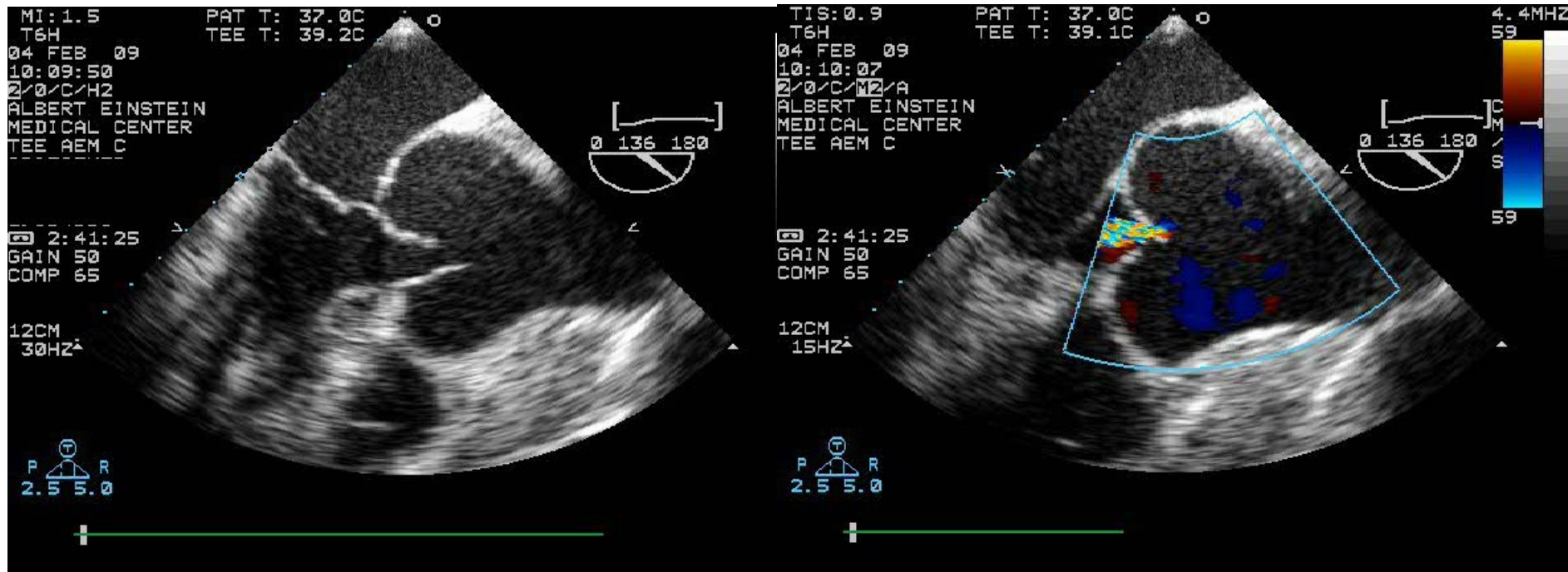


Aortic Insufficiency



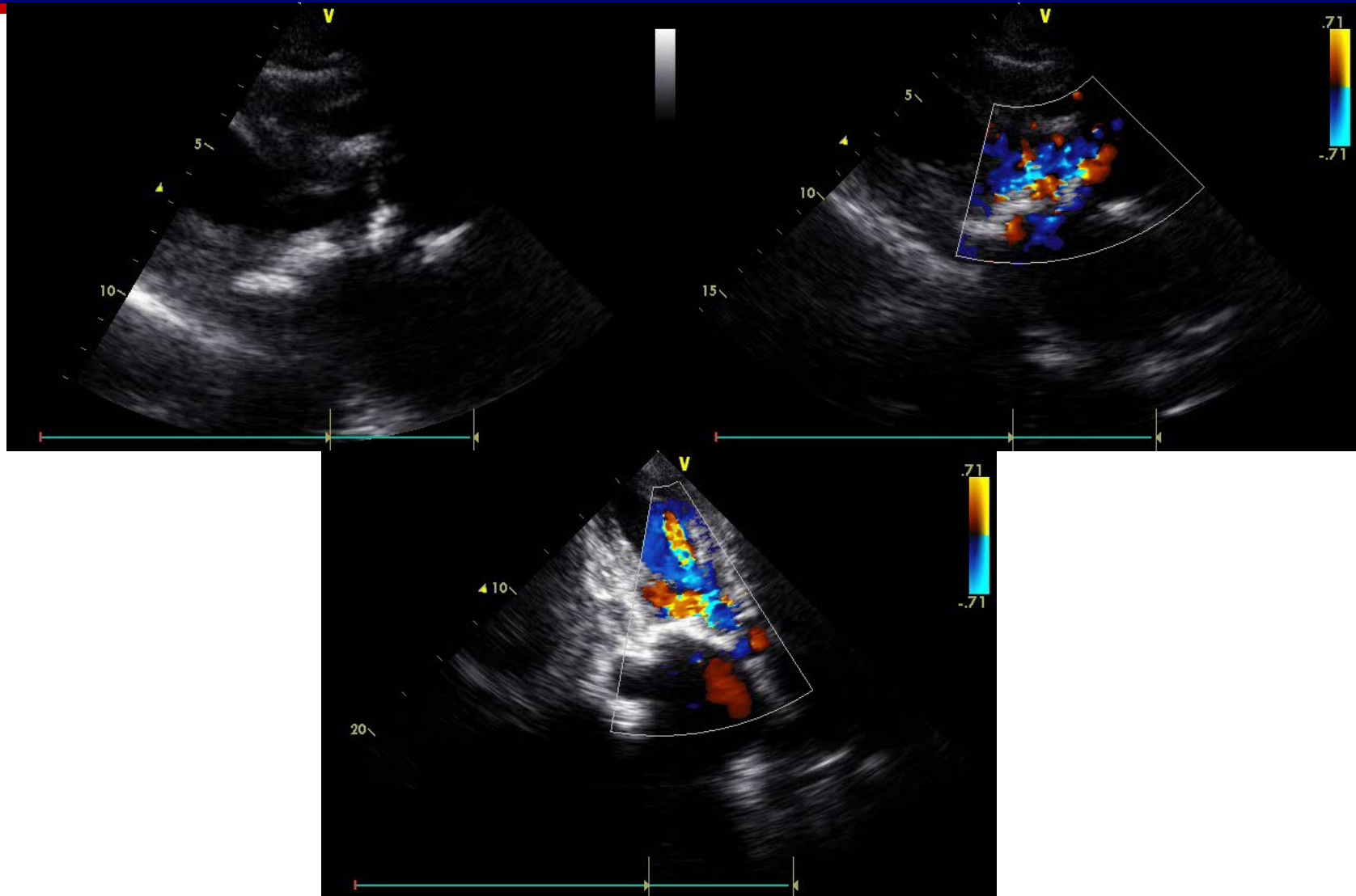


Aortic Insufficiency



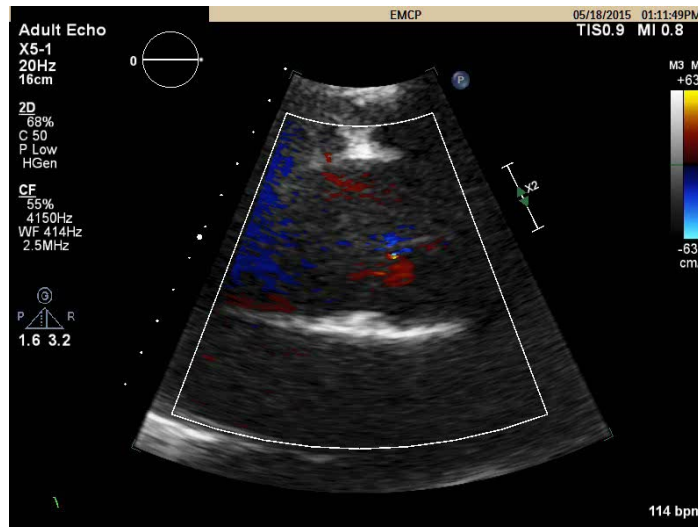
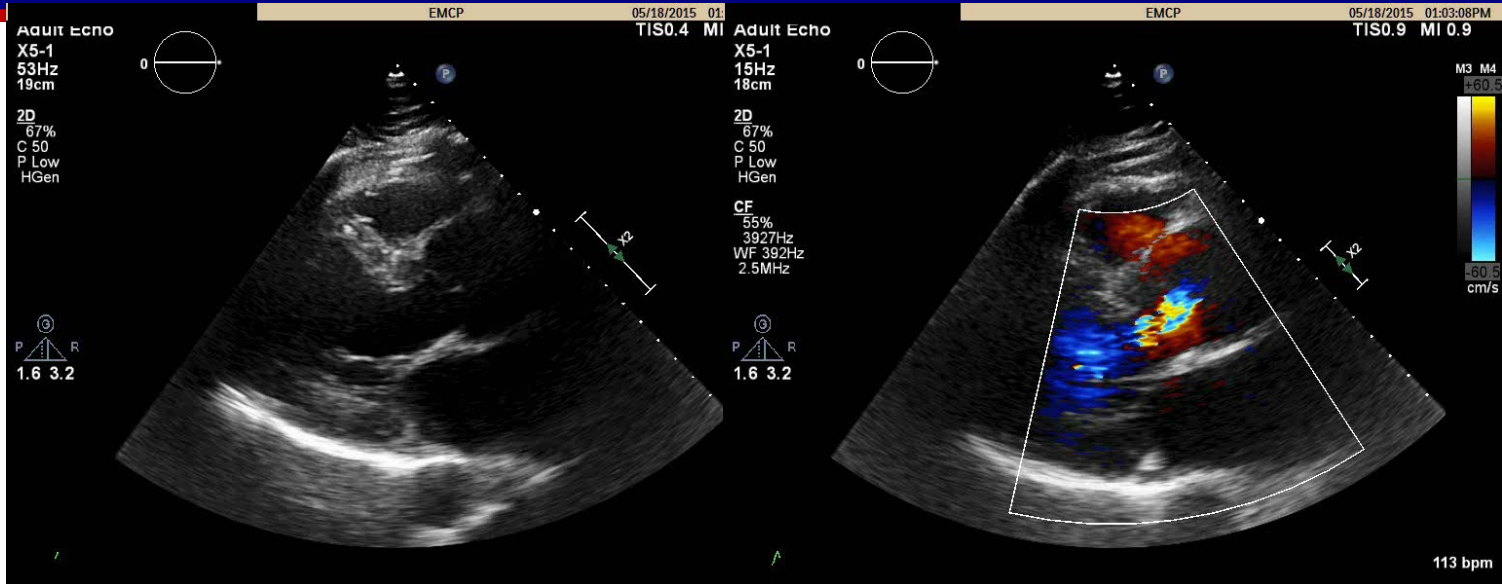


Aortic Insufficiency





Aortic Insufficiency





Mitral Regurgitation

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

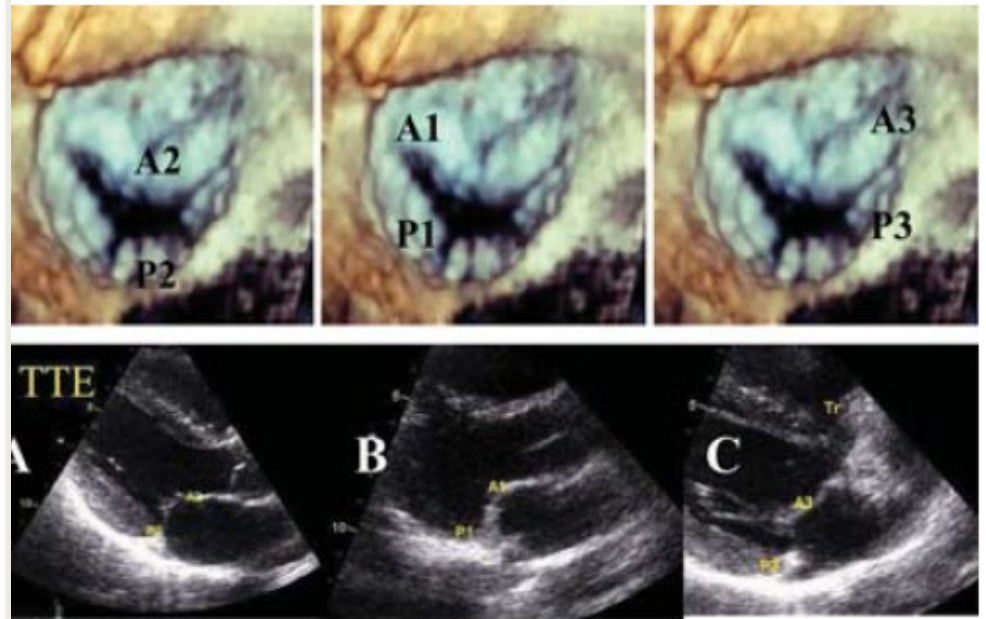
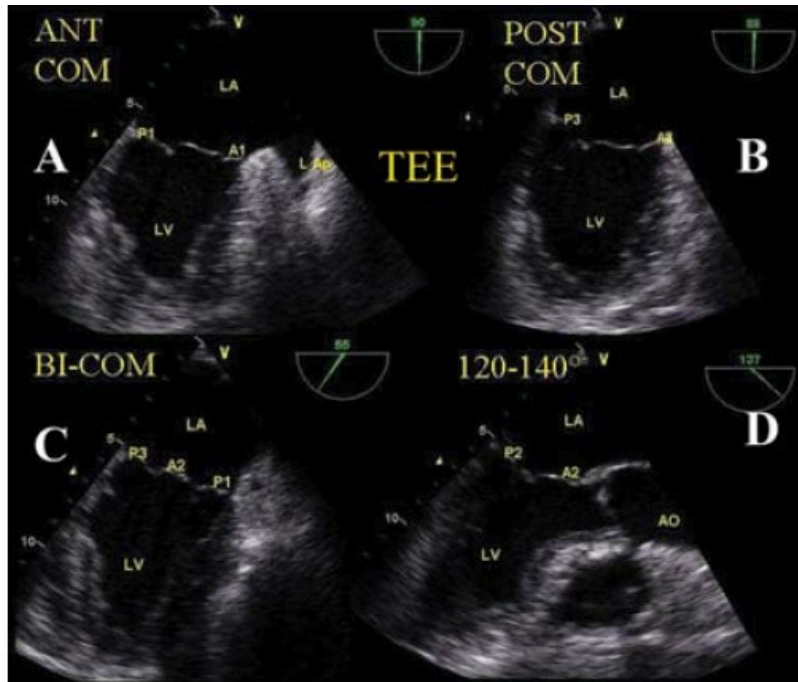


Mitral Regurgitation

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



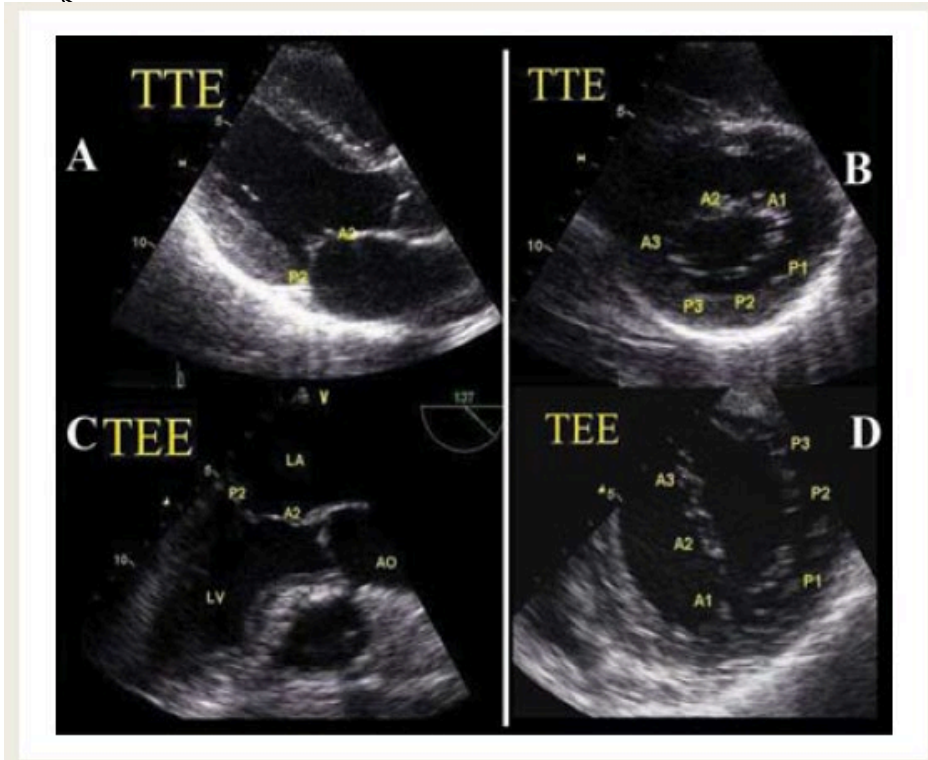
Mitral Regurgitation



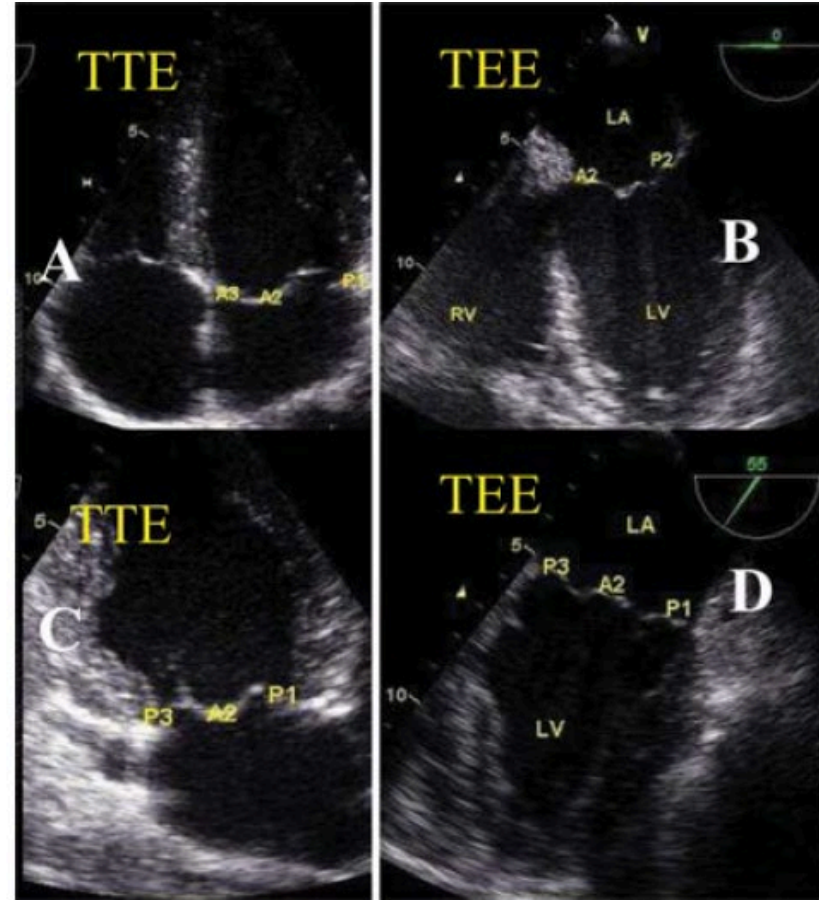
EAE Recommendations 2010



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

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 $\geq 50\%$ • 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 $\leq 60\%$ 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 $\geq 50\%$ • ERO ≥ 0.40 cm² • 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:
 - $ERO \geq 0.40 \text{ cm}^2$, Regurg vol $\geq 60 \text{ ml}$,
EF $> 60\%$, LVESD $\geq 40 \text{ mm}$ (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

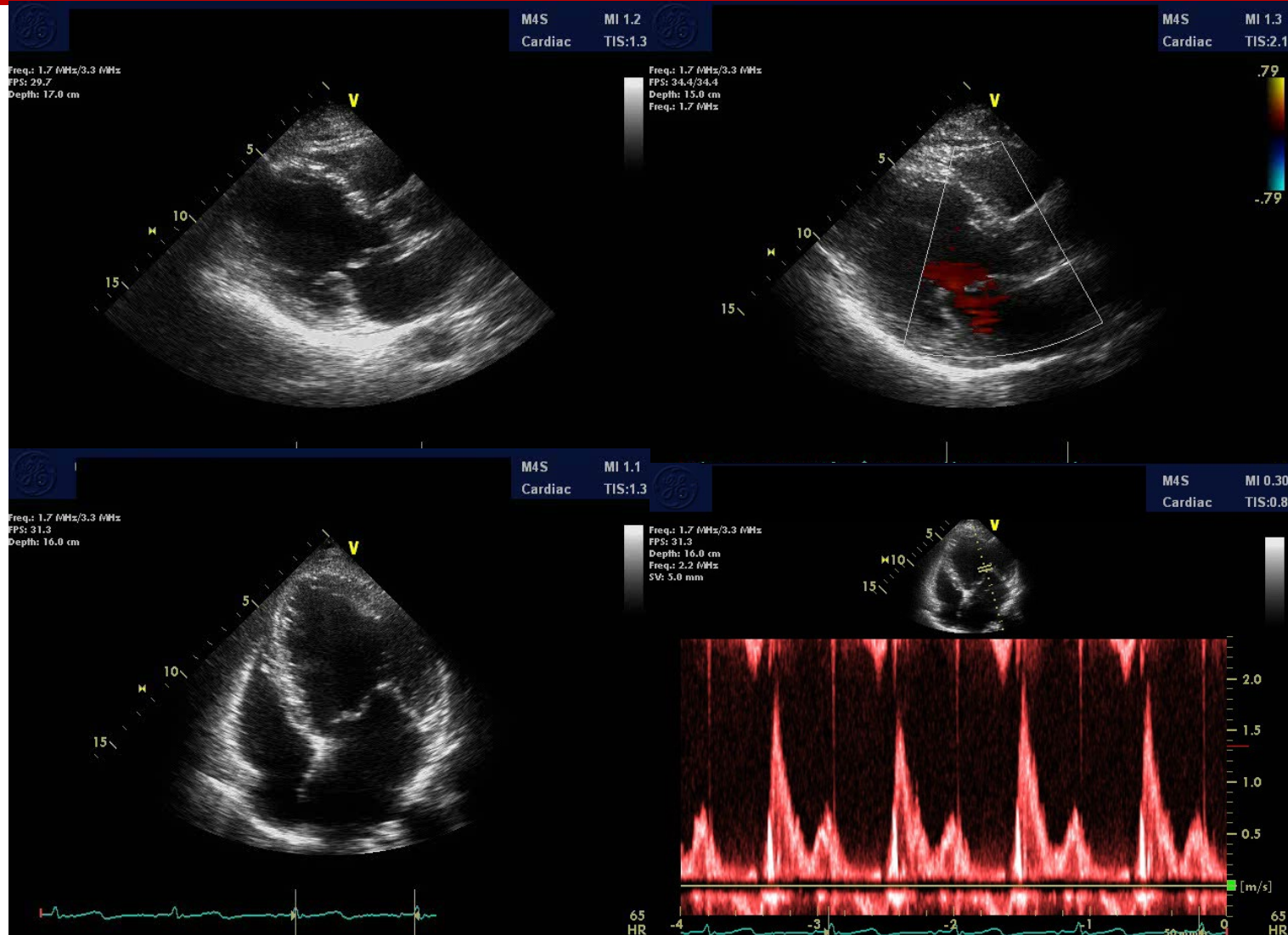


Mitral Regurgitation

- 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

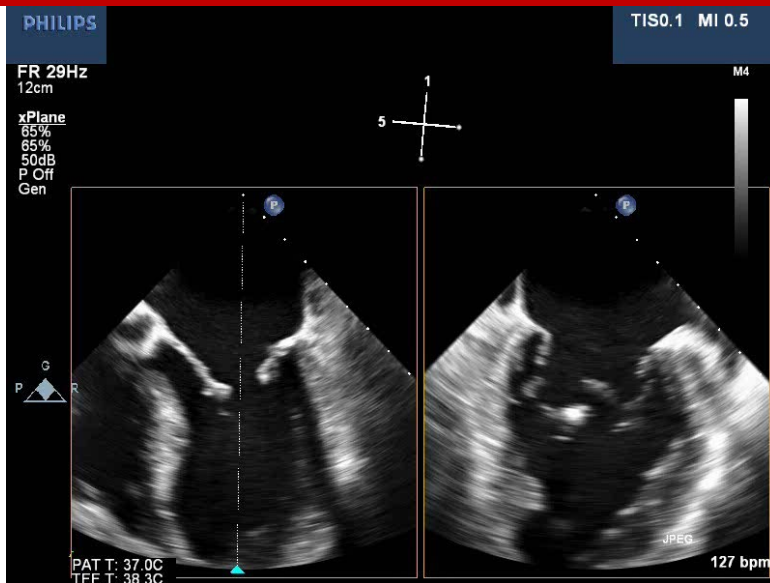


Mitral Regurgitation



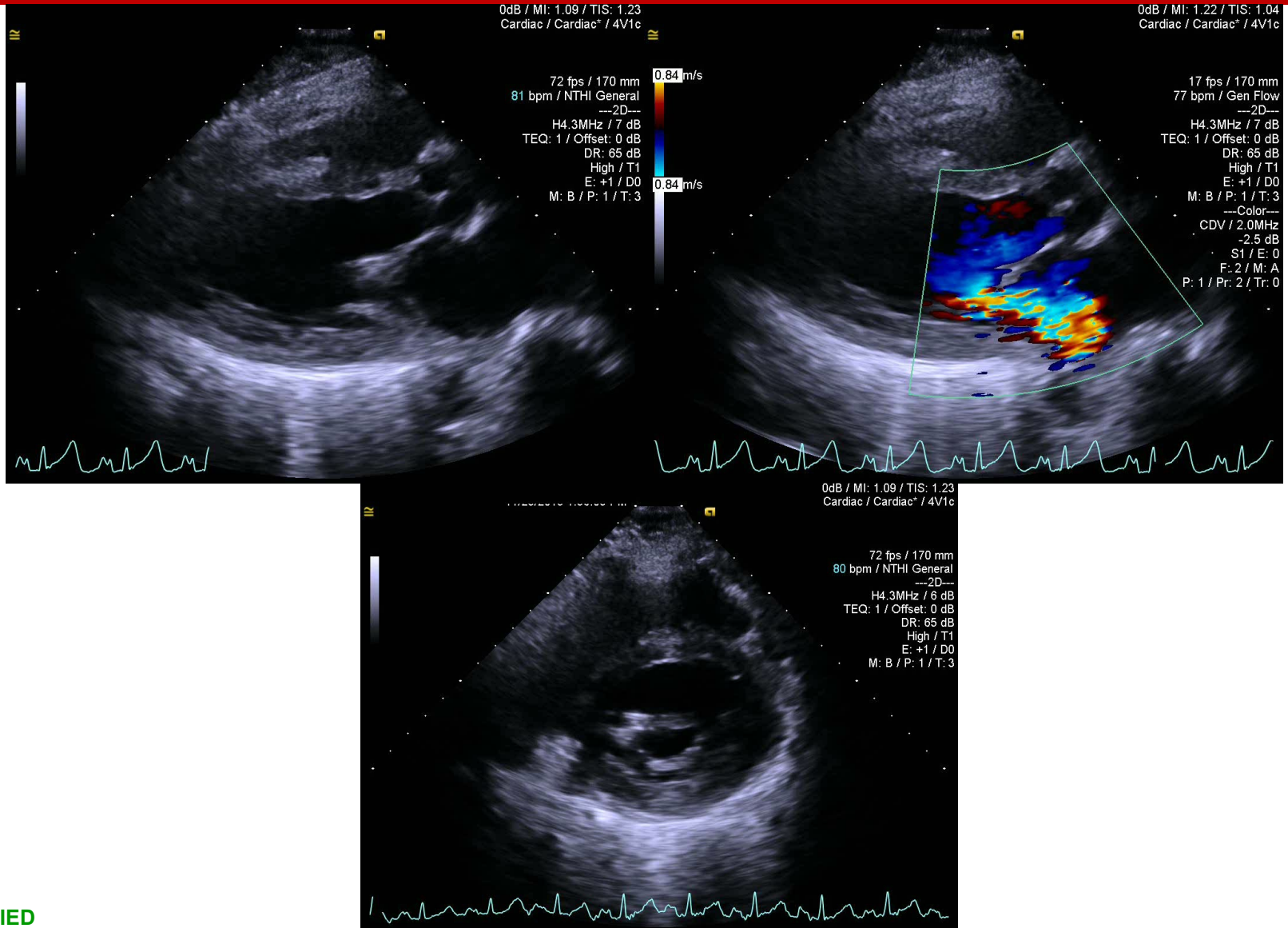


Mitral Regurgitation





Mitral Regurgitation





Mitral Regurgitation

- For secondary MR severe defined by:
 - $ERO \geq 0.20 \text{ cm}^2$, Regurg vol $\geq 30 \text{ ml}$
- Treatment less well defined

EAE Recommendations 2010

2014 AHA/ACC Valvular Heart Disease Guideline



Mitral Regurgitation

Secondary MR

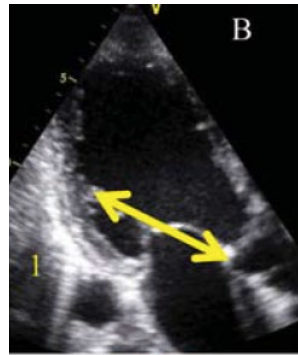
C Asymptomatic severe MR	• Regional wall motion abnormalities and/or LV dilation with severe tethering of mitral leaflet • Annular dilation with severe loss of central coaptation of the mitral leaflets	• $ERO \geq 0.20 \text{ cm}^2$† • Regurgitant volume $\geq 30 \text{ mL}$ • Regurgitant fraction $\geq 50\%$	• 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	• $ERO \geq 0.20 \text{ cm}^2$† • Regurgitant volume $\geq 30 \text{ mL}$ • 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”

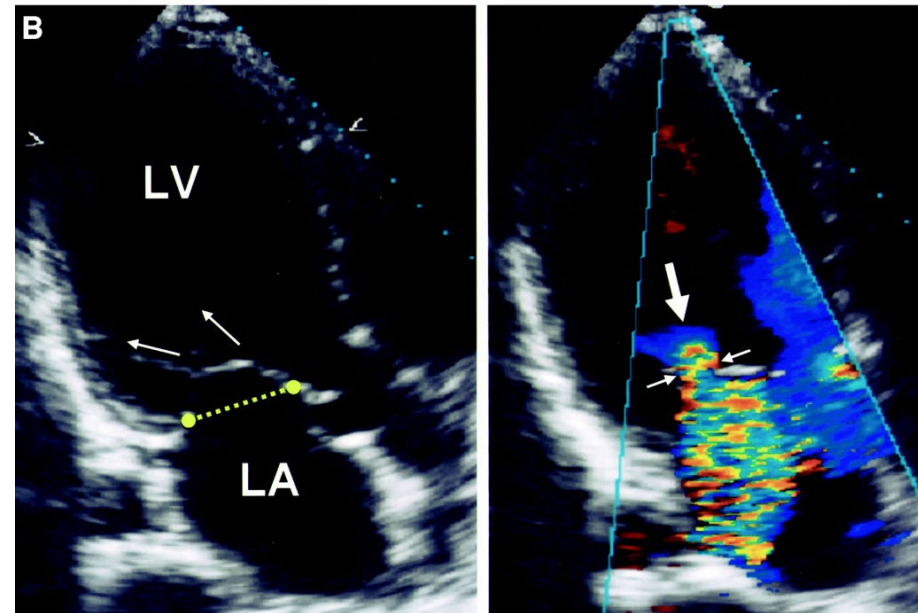
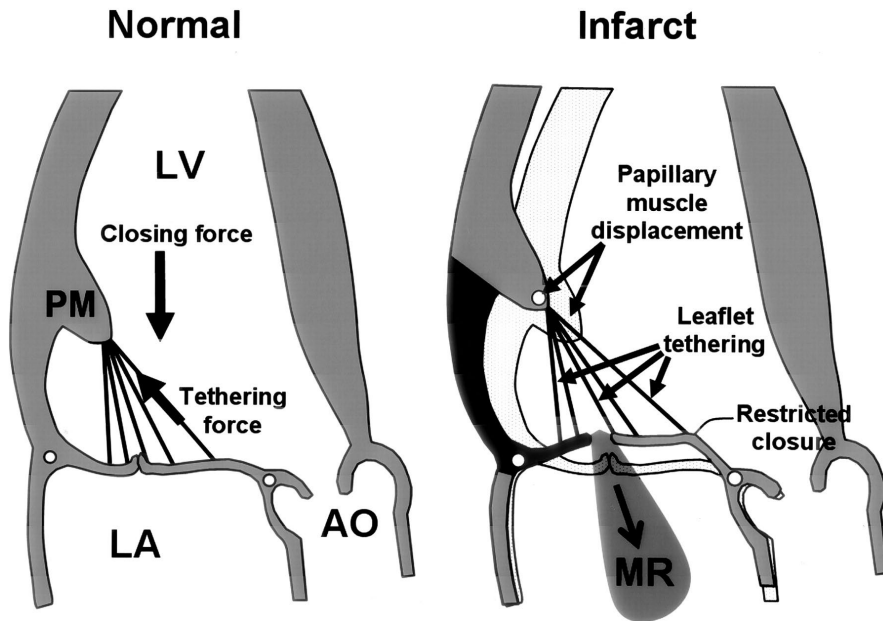


- Prominent bend in AML and loss of line of coaptation
 - Annular dilation can play a role but usually less important
- EAE Recommendations 2010



Mitral Regurgitation

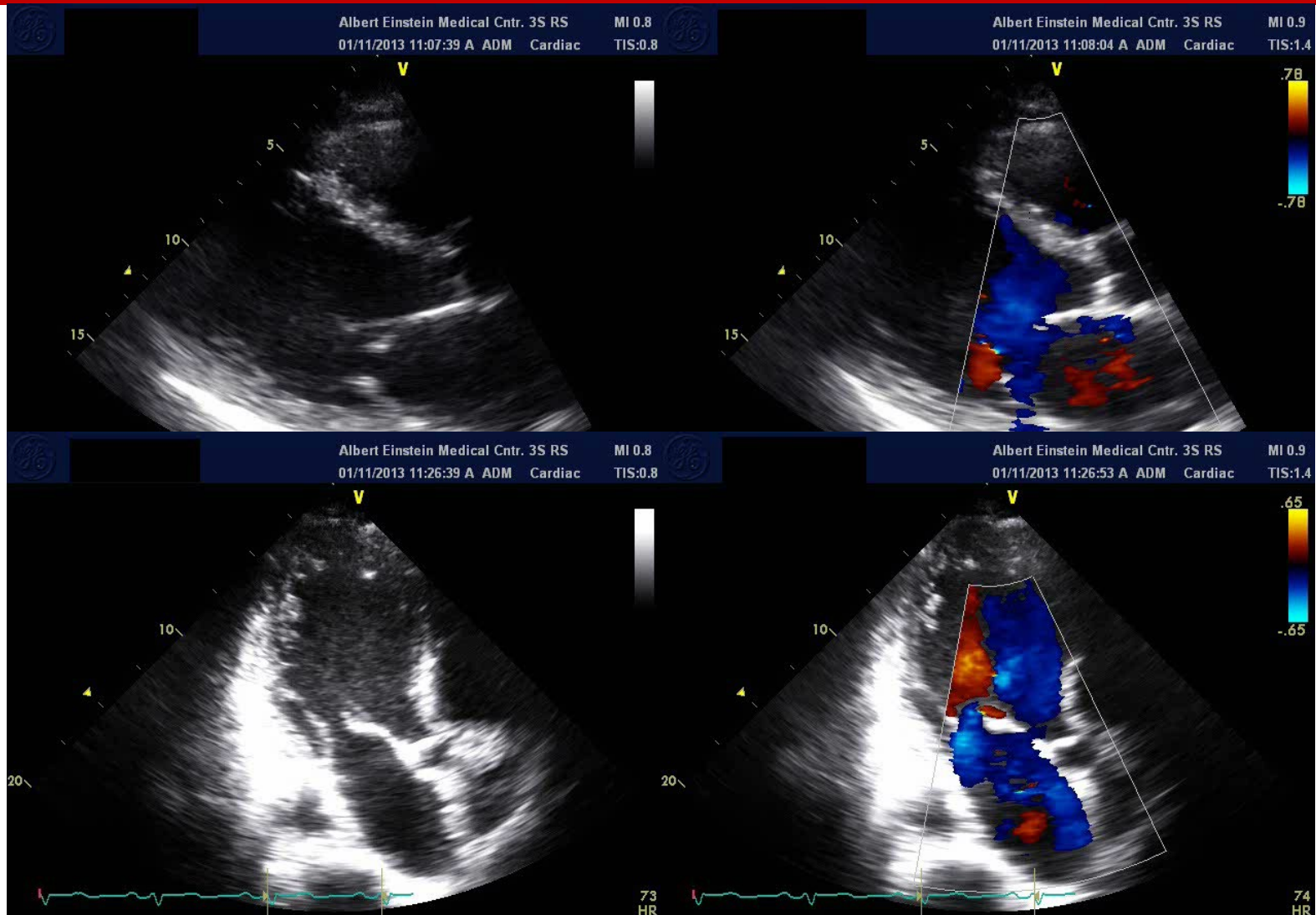
- Can be due to LV/pap muscle dysfunction post MI (usually inferior)



Circulation. 2005;112:745-758

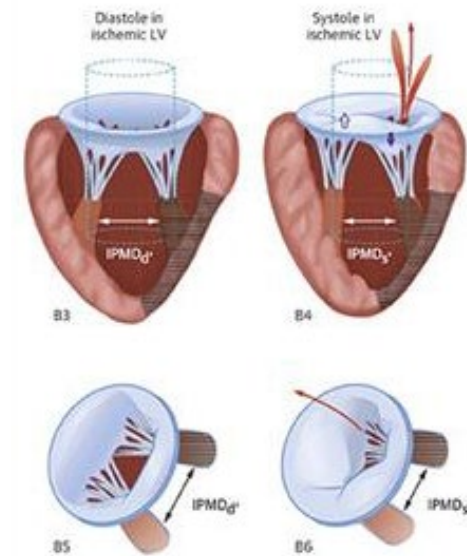
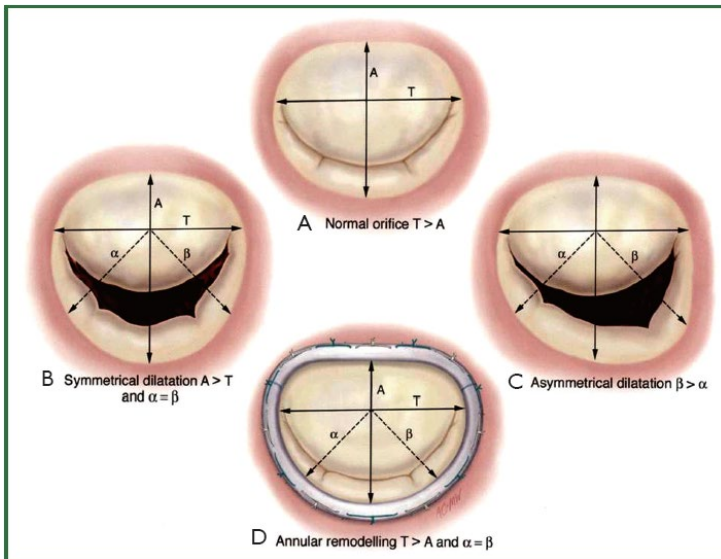


Mitral Regurgitation





Mitral Regurgitation

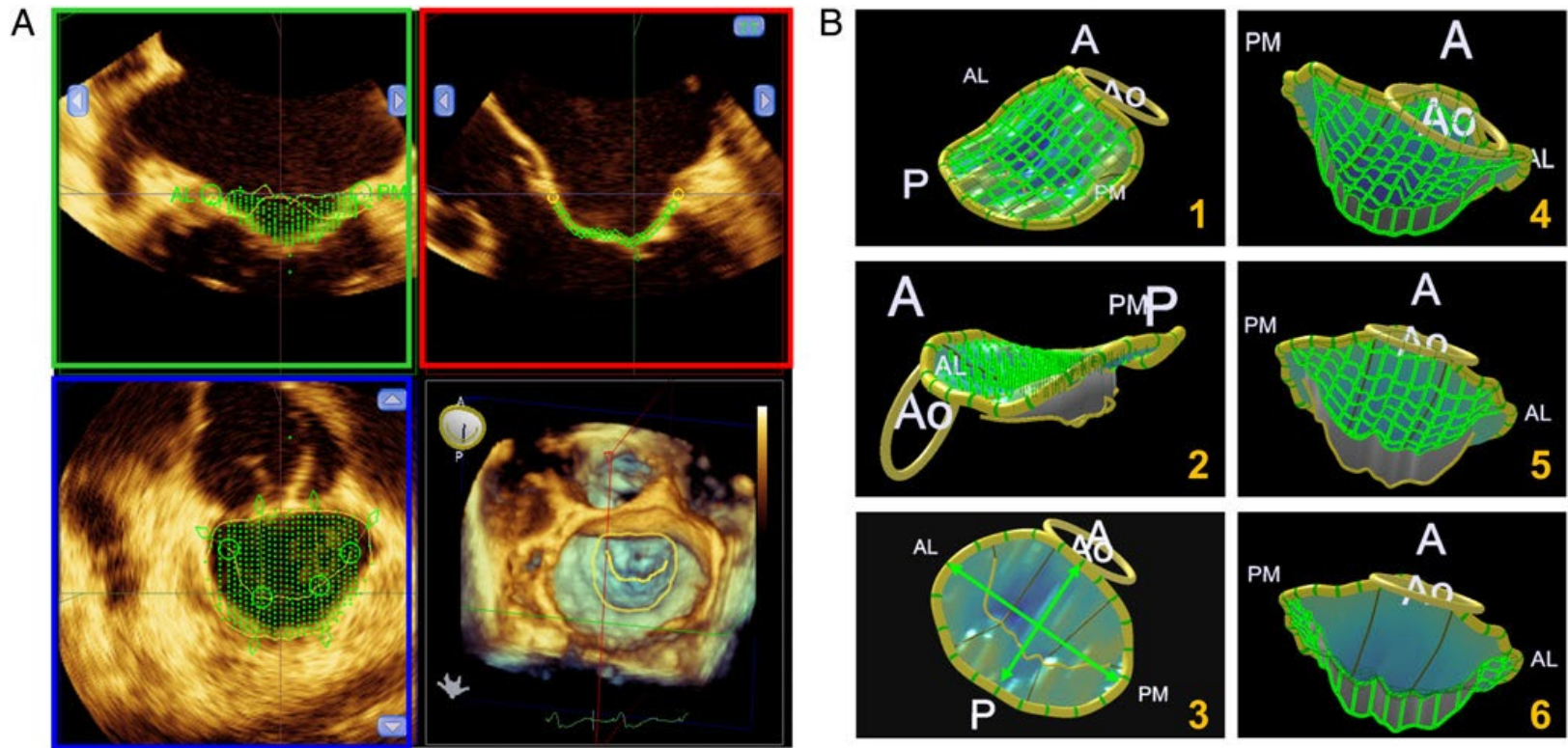


Carpentier A, Adams DH, Filsoufi
F. *Carpentier's Reconstructive Valve
Surgery*. 2010 Saunders Elsevier

JACC 64:1867



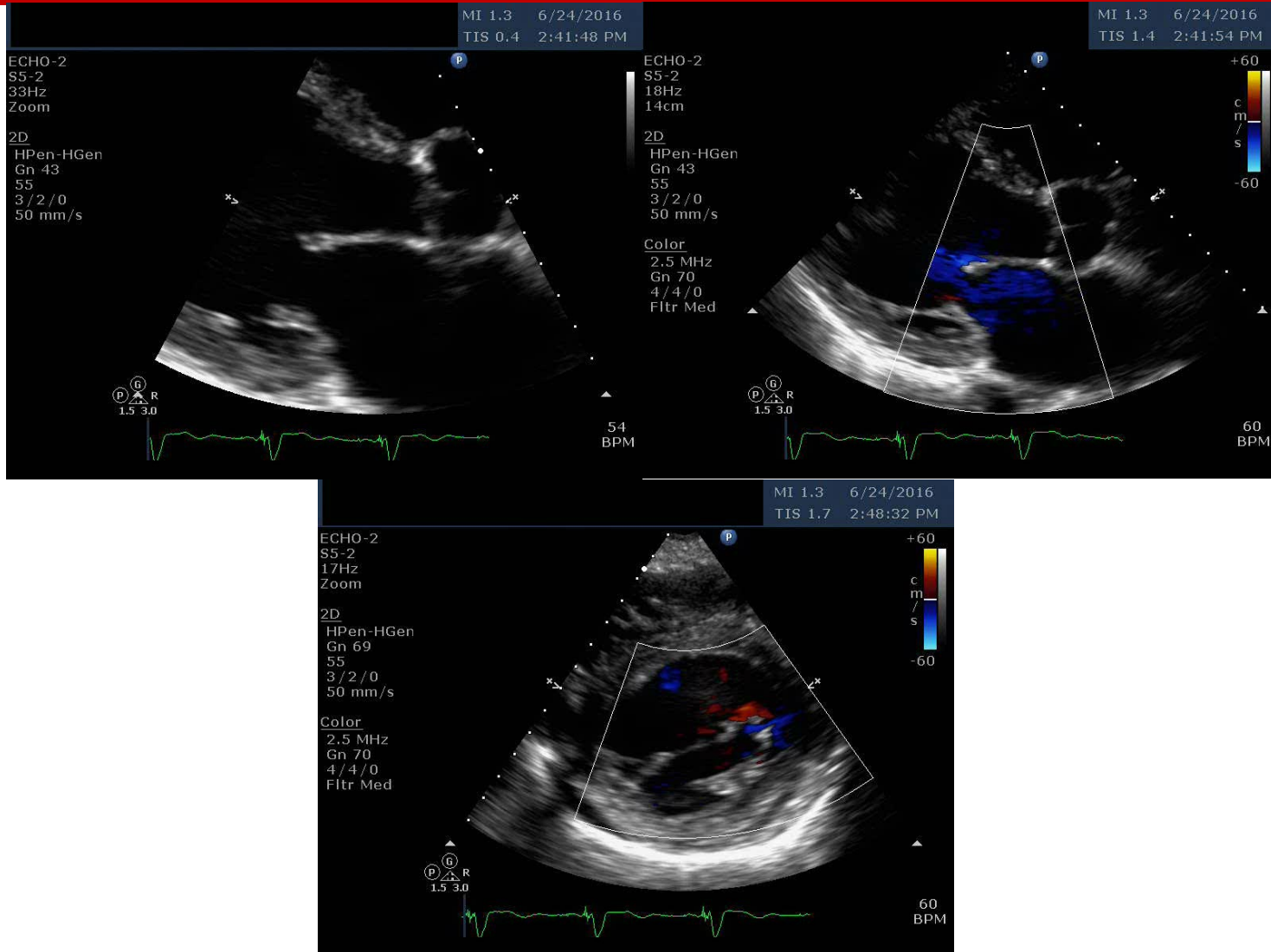
Mitral Regurgitation



EHJ – Cardiovascular Imaging 16:290



Mitral Regurgitation





Mitral Regurgitation

The End