

3<sup>rd</sup> stress echocardiography reading course

# Mitral stenosis and regurgitation

Lancellotti et al. EACVI/ASE recommendation 2017

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## Mitral stenosis

according European and American guidelines

<b>Severe mitral stenosis at rest</b>	<b>ESC/EACTS 2012</b>	<b>ACC/AHA 2014</b>
Mitral valve area [cm <sup>2</sup> ]	< 1.0	< 1.5 (very severe < 1.0) (progressive 1.5-2.0)
Mean pressure gradient [mm Hg]	>10	> 5-10

## Mitral stenosis

### Indication for stress echocardiography

- **non-severe ('progressive') mitral stenosis on rest echocardiography with symptoms**
  - **Exercise stress (dobutamine stress)**
  
- **Severe mitral stenosis, but 'asymptomatic'**
  - **Exercise ECG sufficient**

# Mitral stenosis

## diagnostic criteria for stress echocardiography

Rest	Stress
<b>Progressive mitral stenosis (ACC/AHA 2014 valvular heart disease guidelines)</b>	<b>Severe mitral stenosis (ASE 2017 stress echocardiography guidelines)</b>
<b>MVA 1.5 – 2 cm<sup>2</sup></b> <b>Pressure half time &lt;150 ms</b> <b>Mild–moderate LA enlargement</b>	
<b>Normal/elevated RV systolic pressure</b>	<b>RVSP rises to &gt;60 mm HG</b>
<b>Transvalvular gradient</b>	<b>&gt;15mmHg (exercise) or &gt;18mmHg (dobutamine)</b>

# Mitral stenosis

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## Mitral stenosis

### diagnostic criteria for stress echocardiography

PMBC may be considered in symptomatic patients with [non-severe] mitral stenosis at rest (MVA  $>1.5$  cm<sup>2</sup>) if there is evidence of hemodynamically significant MS during exercise (Class IIb, level of evidence C)”.

AHA 2014 Valvular Disease guidelines

# Mitral stenosis

## diagnostic criteria for stress echocardiography

**Protocol:** Exercise bicycle

**Maximum Predicted HR:** 179 bpm

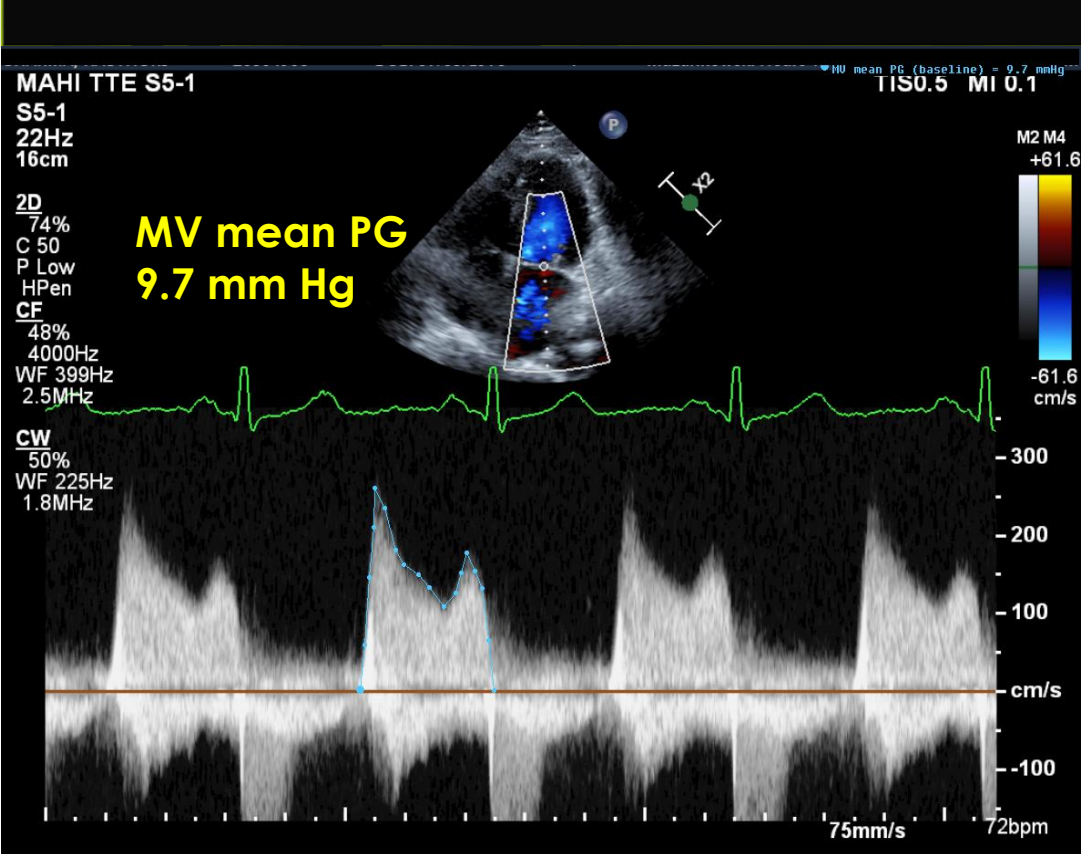
**Target HR:** 152 bpm

**% Maximum Predicted HR:** 89 %

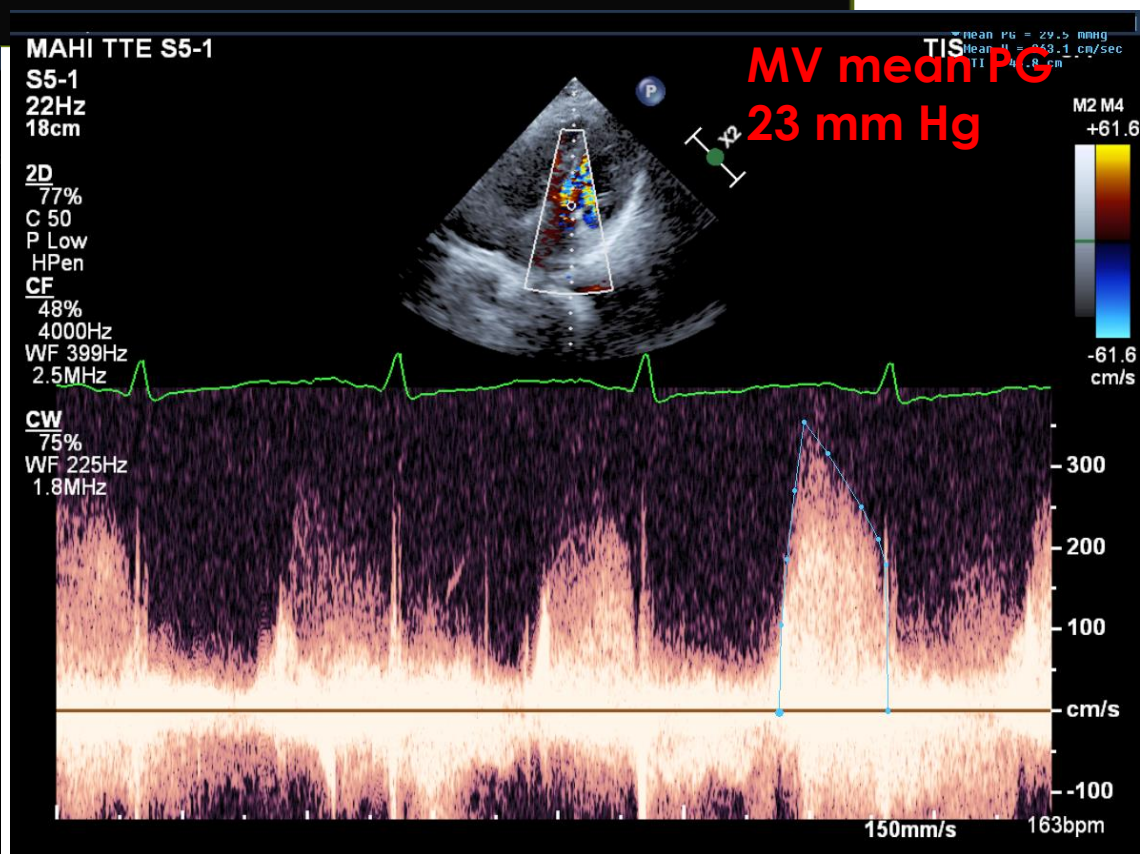
<b>Stage</b>	<b>Heart Rate (bpm)</b>	<b>BP</b>	<b>Comment</b>
<b>Rest</b>	72	142/85	no symptoms
<b>25 WATTS</b>	107	167/117	no symptoms
<b>50 WATTS</b>	160	188/107	severe dyspnea, no chest pain
<b>Recovery</b>	83	101/83	dyspnea resolved

**Maximum Stress HR:** 160 bpm

# Mitral stenosis transvalvular gradients



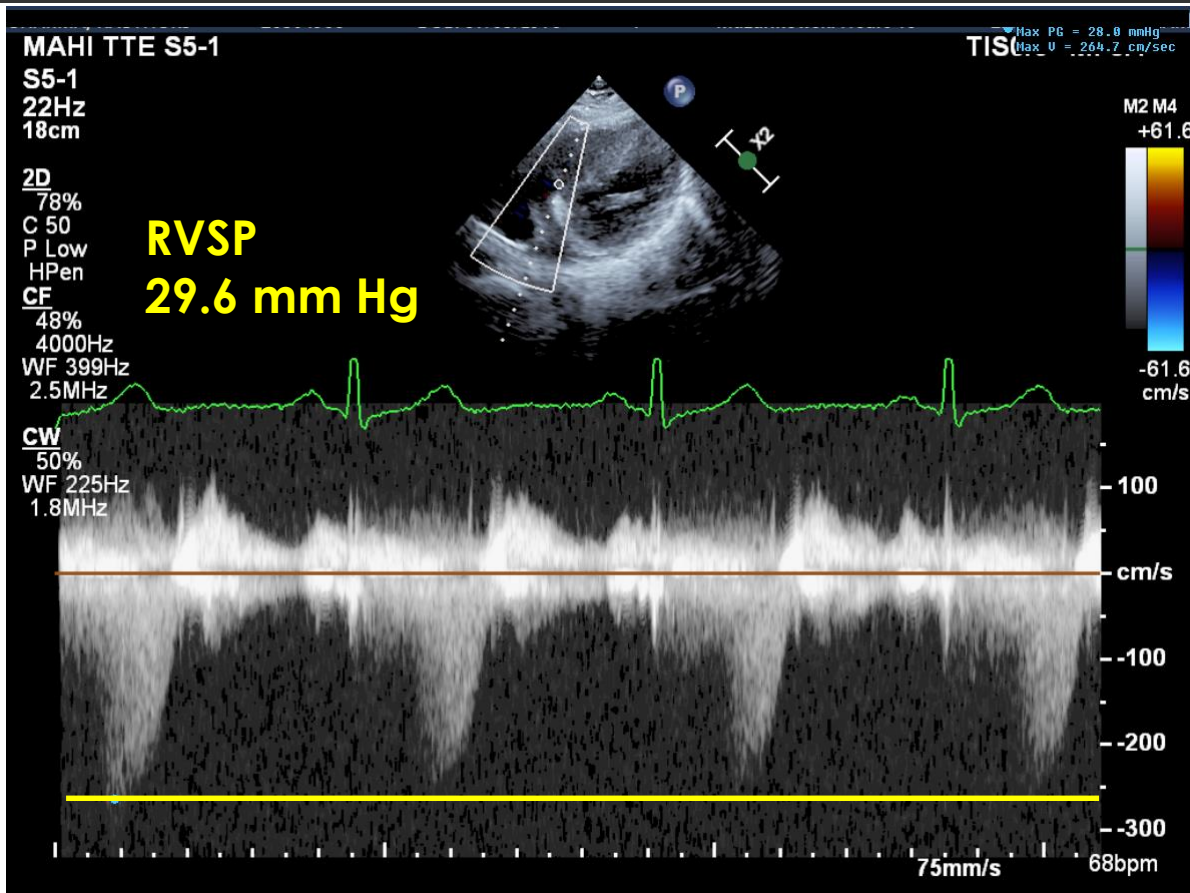
Rest 75 mm/s



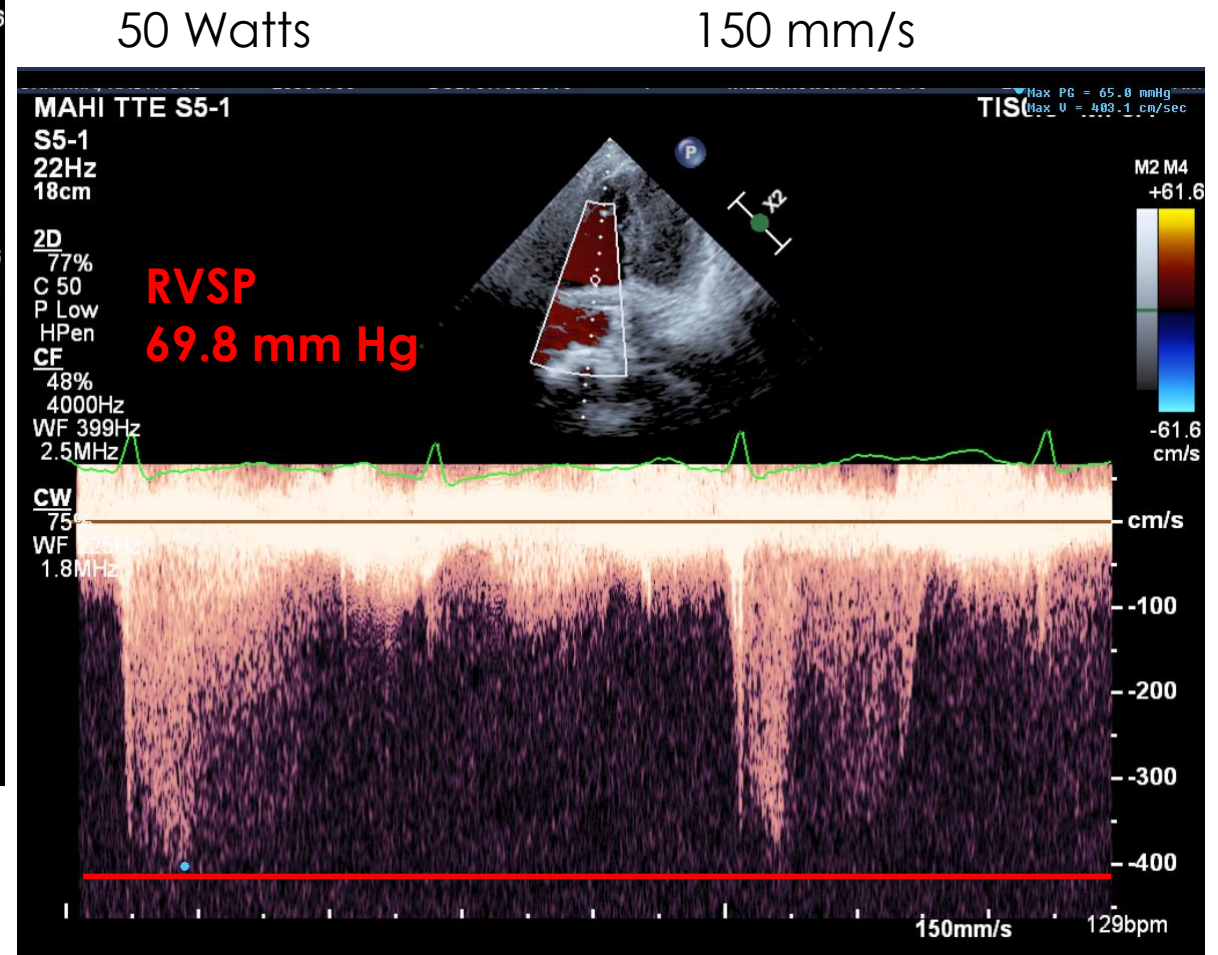
50 Watts 150 mm/s



# Mitral stenosis tricuspid regurgitation (CW Doppler)



Rest 75 mm/s



# Mitral stenosis

## results of stress echocardiography

	Rest	Peak Stress
RVSP	29.6 mmHg	69.8 mmHg

### Mitral Stenosis

	Rest	Peak Stress
Mean pressure gradient	10.0 mmHg	23.4 mmHg

Normal/elevated RV systolic pressure

Transvalvular gradient

RVSP rises to >60 mm HG

>15mmHg (exercise) or  
>18mmHg (dobutamine)

## Mitral regurgitation

### Indication for stress echocardiography I

- **non-severe primary mitral regurgitation on rest echocardiography with symptoms**
  - **Exercise stress echo (dobutamine stress echo)**
  
- **Severe primary mitral regurgitation, but 'asymptomatic'**
  - **Exercise ECG** usually sufficient to demonstrate normal or abnormal exercise tolerance (exercise stress may be considered to demonstrate increase in PAP >60 mm Hg)

## Mitral regurgitation

### Indication for stress echocardiography II

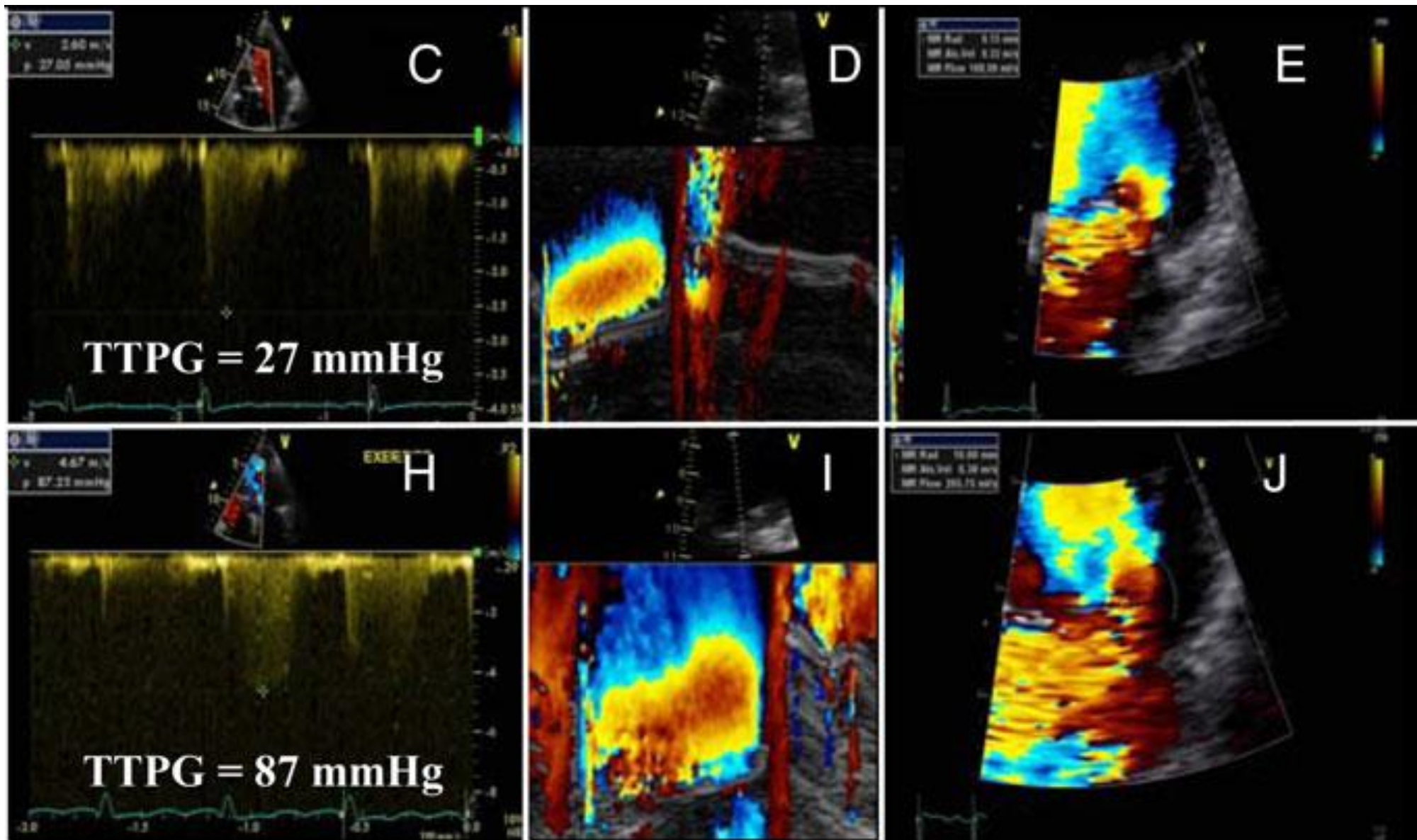
- **non-severe functional mitral regurgitation on rest echocardiography but recurrent unexplained pulmonary edema**
- **Exercise stress (dobutamine stress) for assessment of**
  - myocardial ischemia,
  - Severity of mitral regurgitation
  - LV function
  - LVOT gradient

## Mitral regurgitation

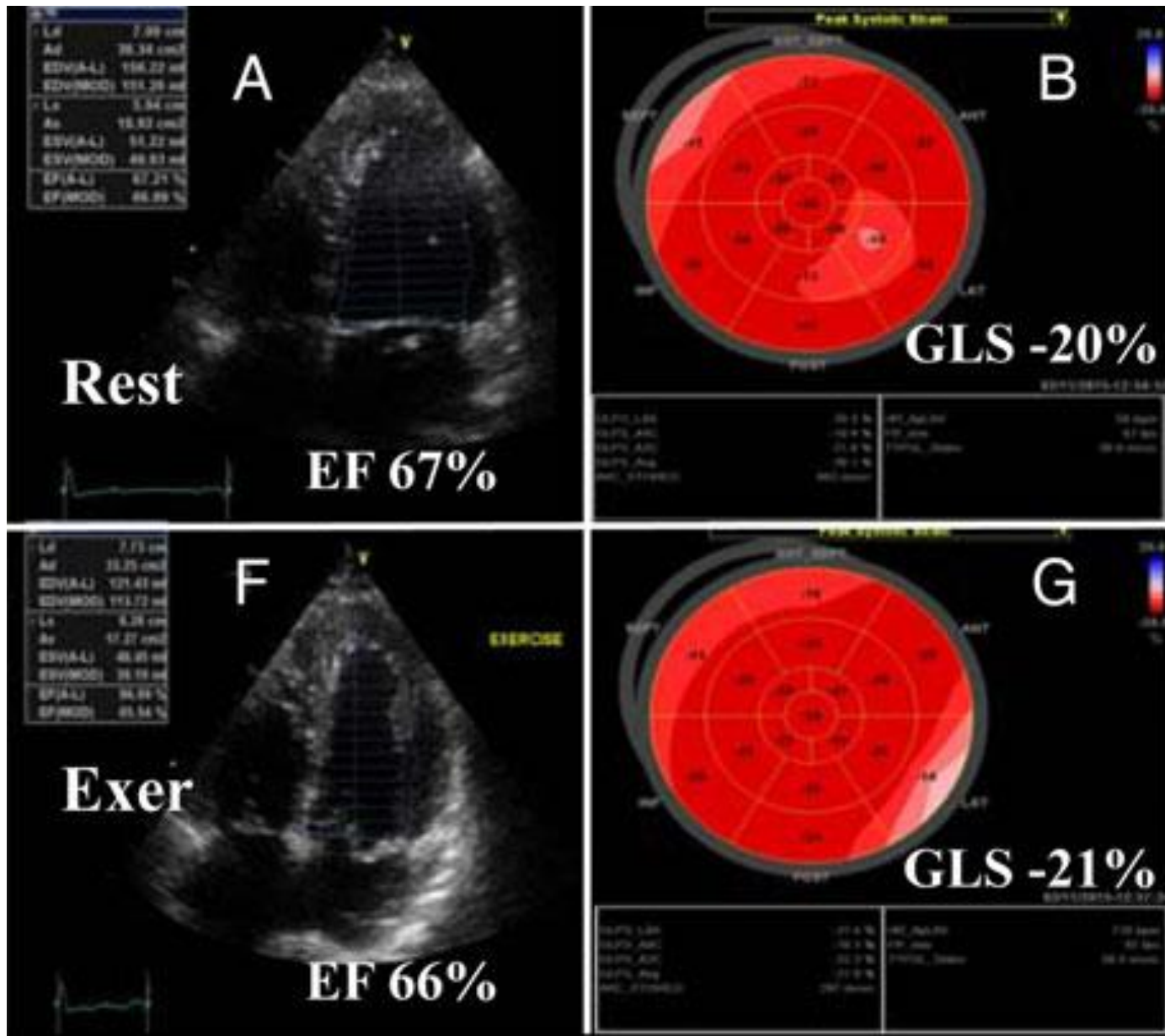
marker of poor prognosis which favor consideration of surgery

	Change during exercise
Severity of regurgitation*	Increase by $>1$ grade (from moderate to severe)
RV systolic pressure	Increases to $\geq 60$ mm Hg
Contractile reserve EF GLS	$<5\%$ increase $<2\%$ increase

\*severity of regurgitation should be assessed by effective orifice area EOA, vena contracta, pulmonary venous flow



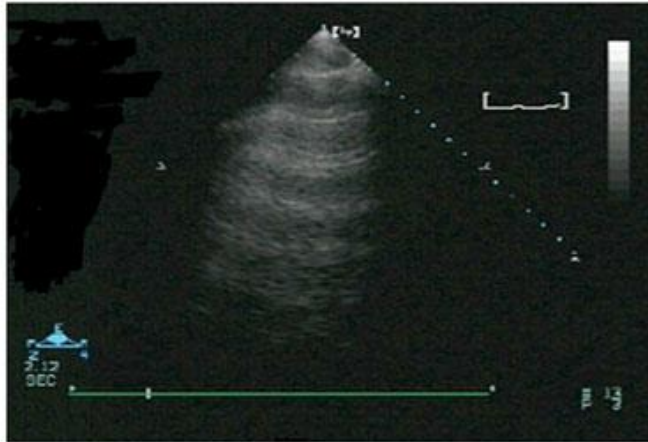
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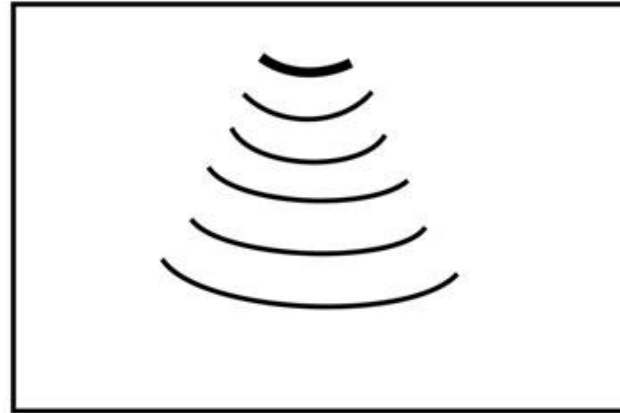
# Lung ultrasound

an additional method for stress echocardiography

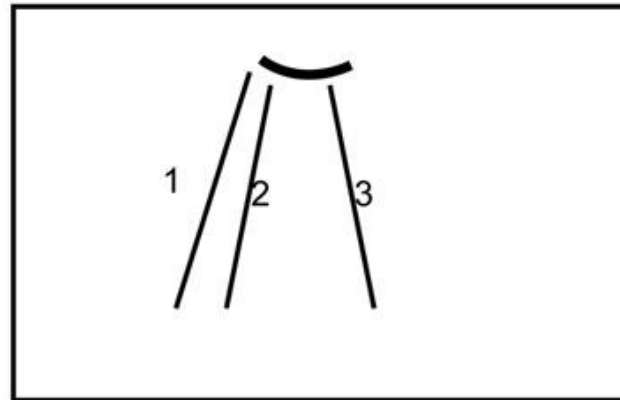
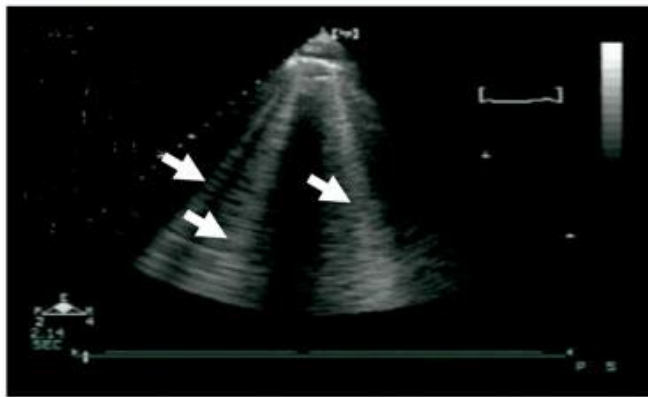
REST



A-lines

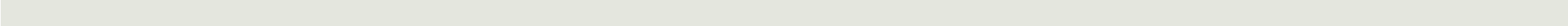
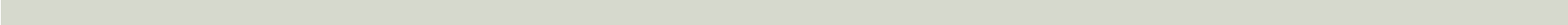


POST-EXERCISE



B-lines





# Mitral valve prosthesis

## Indication for stress echocardiography

- **mild to moderate elevation of resting transprosthetic gradients** - 5-10 mm Hg are suspicious of stenosis or patient/prosthesis mismatch
  - **Exercise stress echo (dobutamine)**
  - **Same criteria as for mitral stenosis**
  
- **Mild to moderate regurgitation at rest and symptoms**
  - **Exercise stress echo**
  - **Same criteria as for primary mitral regurgitation**

## Mitral valve prosthesis

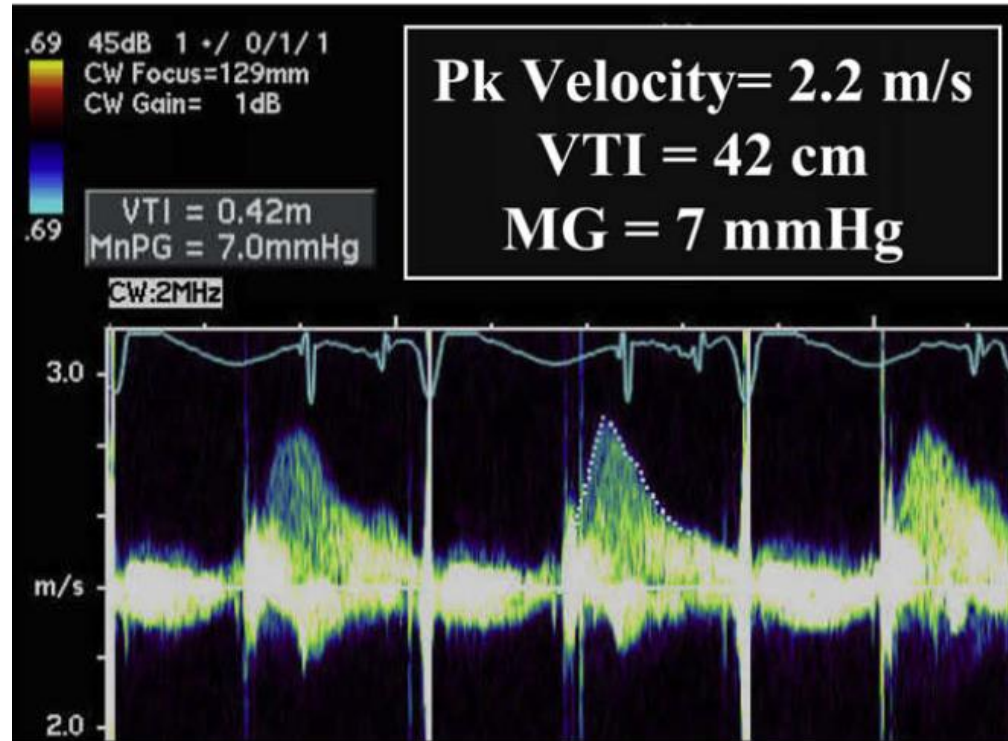
Indication for stress echocardiography

- **Small resting effective orifice area (EOA) or abnormal Doppler velocity index combined with reduced LV function**
  - **Low dose dobutamine**

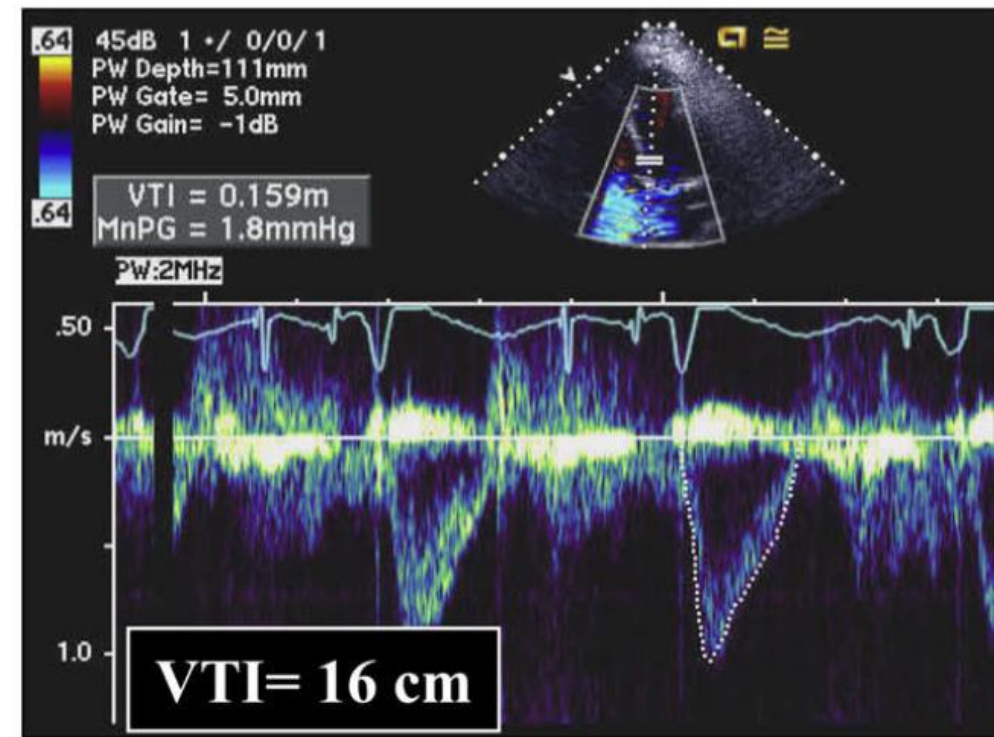
**Table 8** Doppler parameters of prosthetic mitral valve function

	Normal*	Possible stenosis <sup>‡</sup>	Suggests significant stenosis* <sup>‡</sup>
Peak velocity (m/s) <sup>† §</sup>	<1.9	1.9-2.5	≥2.5
Mean gradient (mm Hg) <sup>† §</sup>	≤5	6-10	>10
VTI <sub>PrMv</sub> /VTI <sub>LVO</sub> <sup>† §</sup>	<2.2	2.2-2.5	>2.5
EOA (cm <sup>2</sup> )	≥2.0	1-2	<1
PHT (ms)	<130	130-200	>200

## Prosthetic MV Jet



## LVOT flow



DVI (Doppler velocity index)

$$\frac{\text{VTI}_{\text{PrMV}}}{\text{VTI}_{\text{LVO}}} = \frac{42}{16} = 2.6$$

**SVI (stroke volume index)**

LVOT diameter

LVOT VTI

BSA

**$\Delta Q$**

$$\frac{\text{VTI (LVOT)}_{\text{stress}} - \text{VTI (LVOT)}_{\text{rest}}}{\text{VTI (LVOT)}_{\text{rest}}}$$

**EOA (effective orifice area)**

