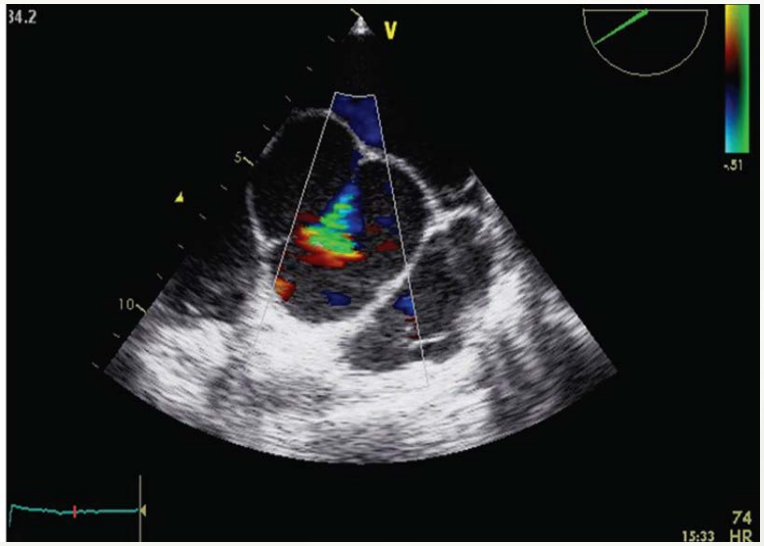
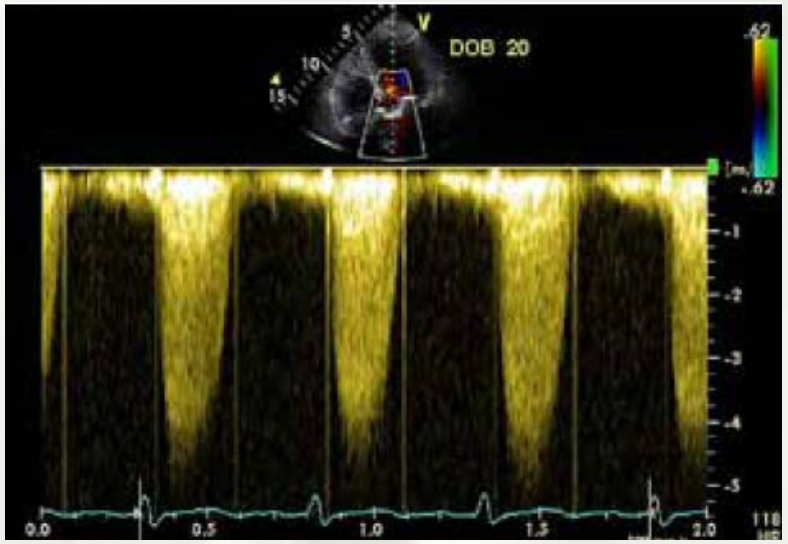
ECHOCARDIOGRAPHIC EVALUATION OF VALVULAR STENOSIS

MELISSA R. CUNDANGAN, MD, FPCP, FPCC, FPSE

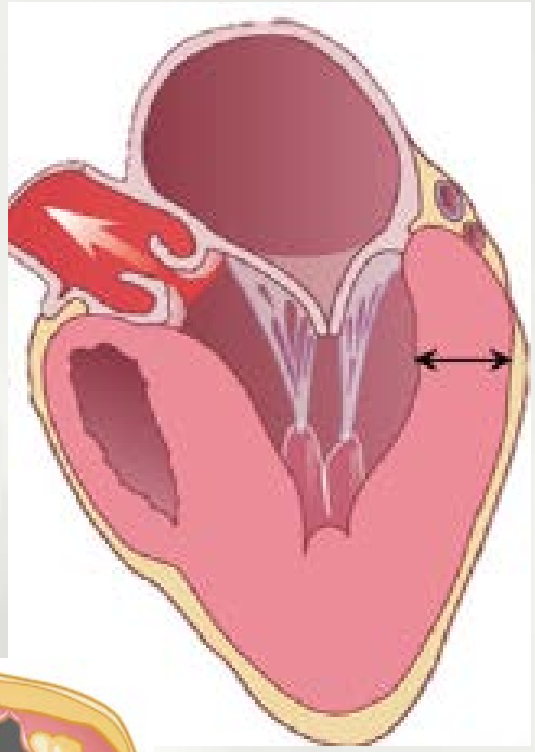


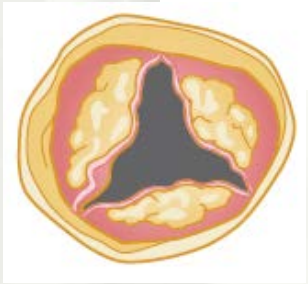


AORTIC STENOSIS

AORTIC STENOSIS

- Obstruction to LV outflow
- Decrease in aortic valve area
  - Normal: 3.0 – 4.0 cm^2
  - Mild : 1.5-2.0 cm^2
  - Moderate : 1.0 – 1.5 cm^2
  - Severe: < 1.0 cm^2



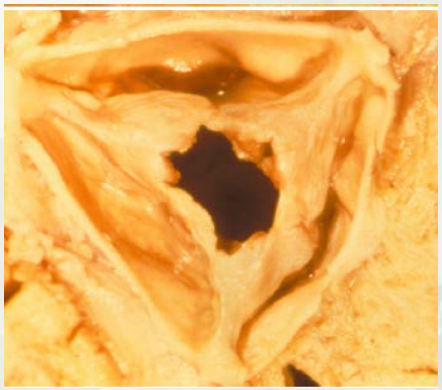


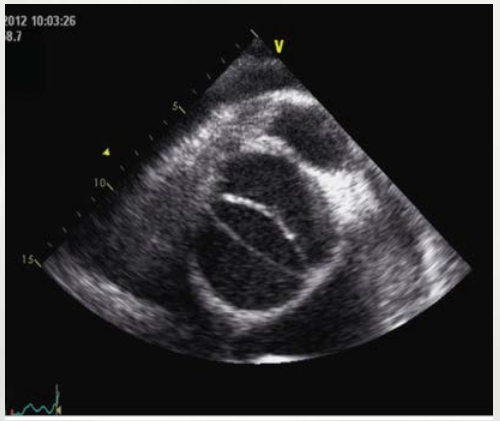
Valvular Hear Disease, Chapter 63, Braunwarld's Heart Disease 10th Edition 2014

AORTIC STENOSIS

Causes:

- Congenital (unicuspal, bicuspal, quadricuspal)
- Rheumatic
- Calcific/ Degenerative

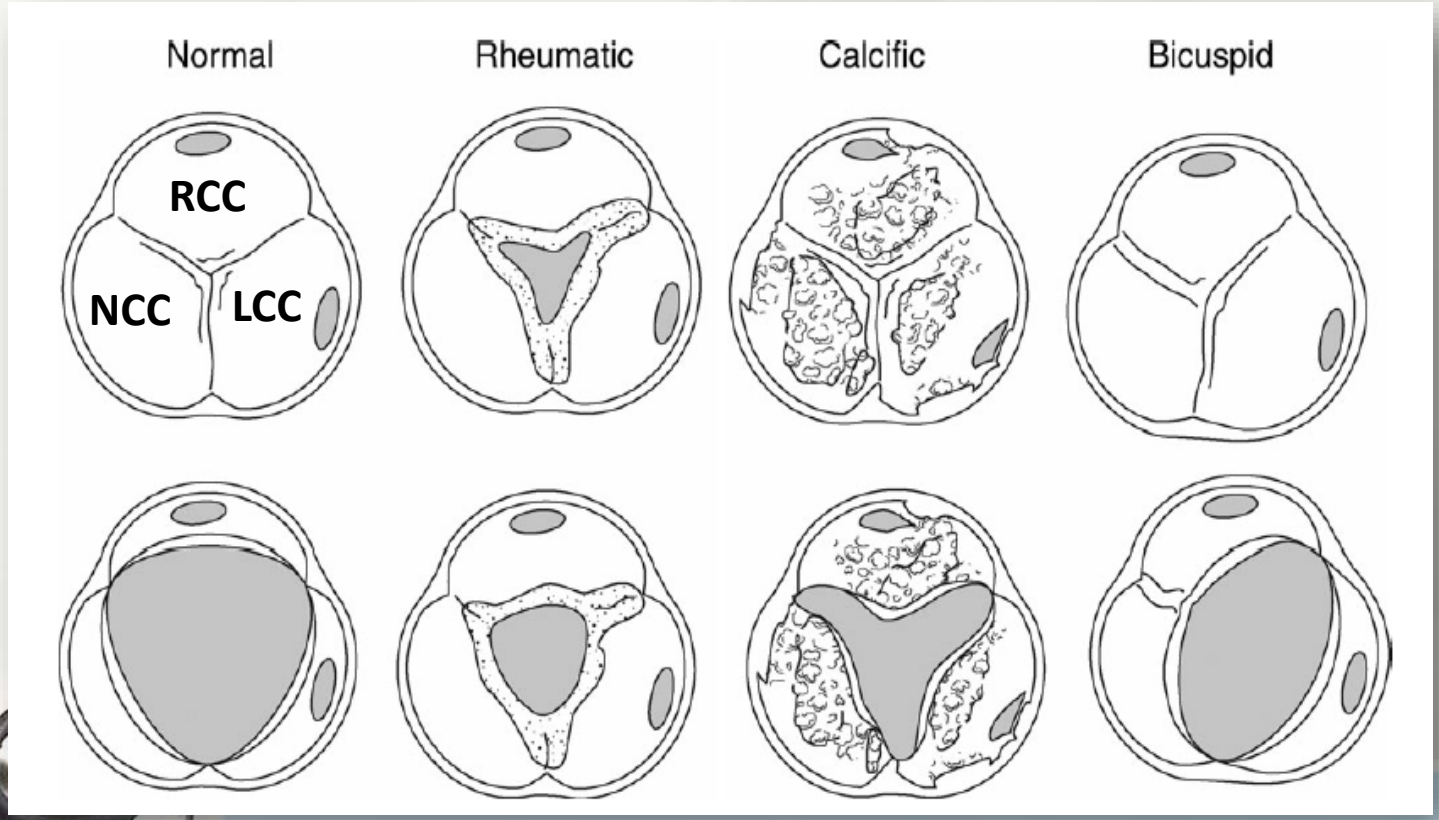




EAE/ASE recommendations for Echocardiographic assessment of valve stenosis, European Journal of Echocardiography 2009

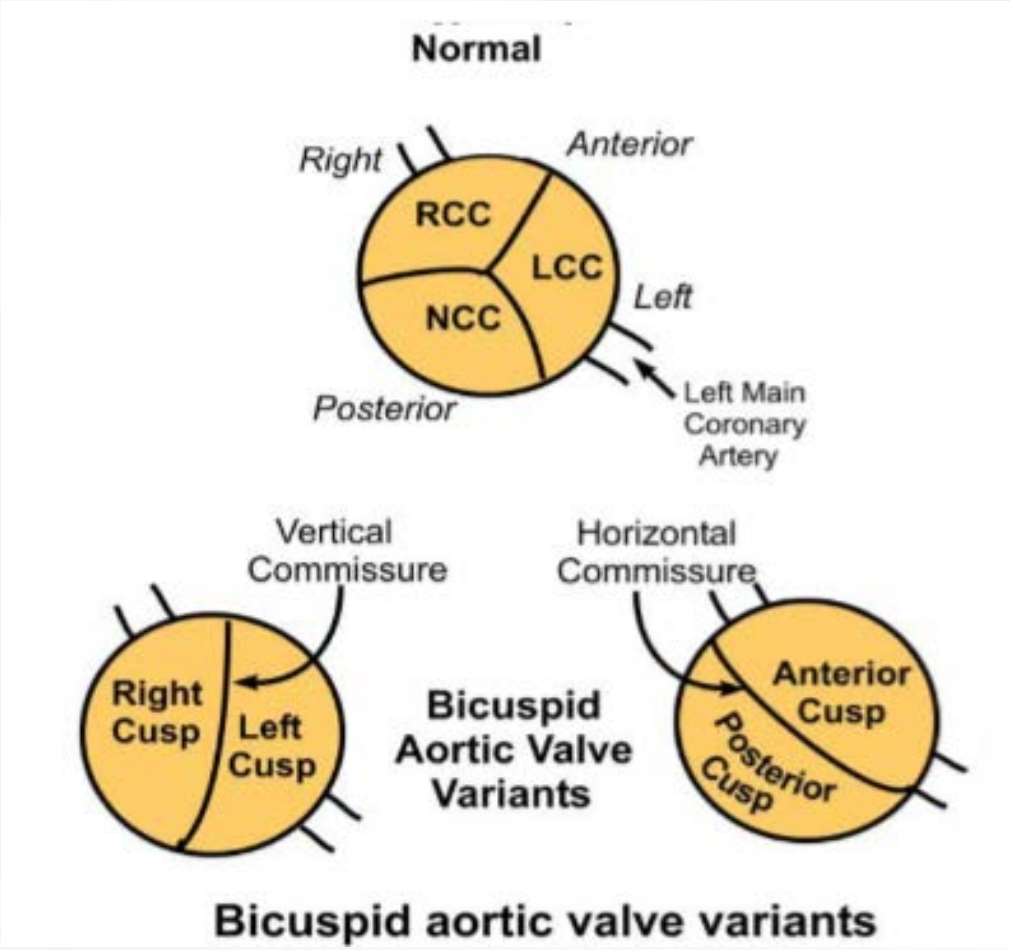
ECHO EVALUATION OF AORTIC STENOSIS

A. Evaluate the anatomy of the AV



EAE/ASE recommendations for Echocardiographic assessment of valve stenosis, European Journal of Echocardiography 2009

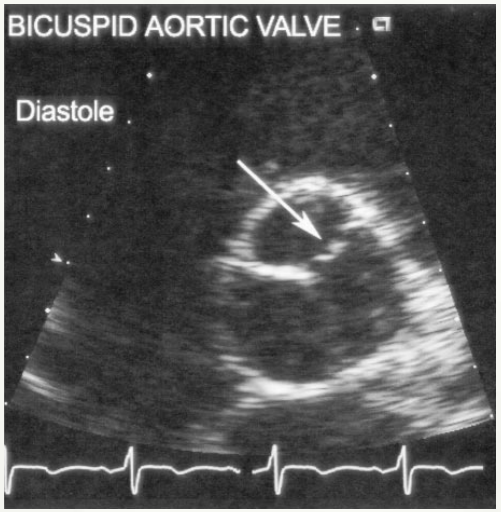
ECHO EVALUATION OF AORTIC STENOSIS

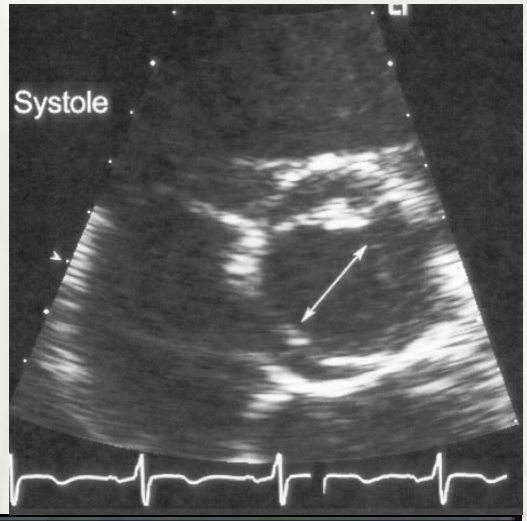


fusion of RCC and NCC

fusion of RCC and LCC

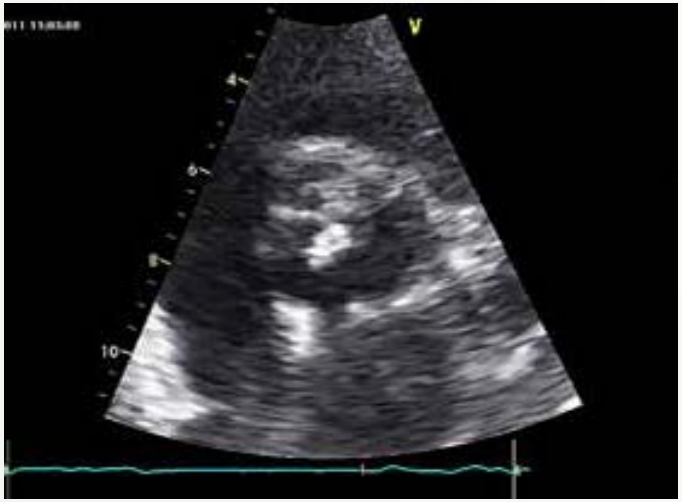
ECHO EVALUATION OF AORTIC STENOSIS

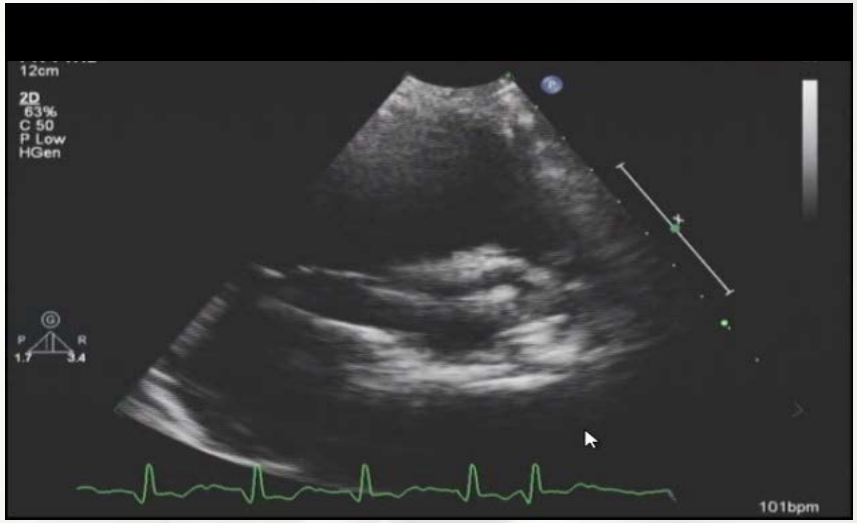


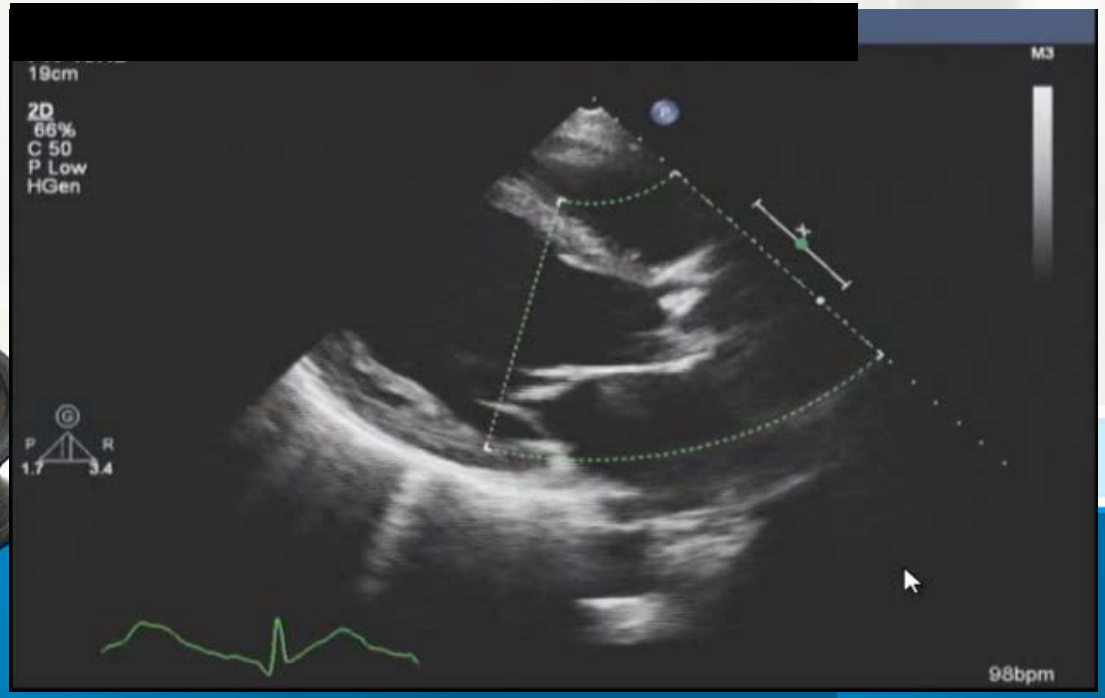


ECHO EVALUATION OF AORTIC STENOSIS

ECHO EVALUATION OF AORTIC STENOSIS







ECHO EVALUATION OF AORTIC STENOSIS

B. Determine the aortic valve area by Continuity Equation

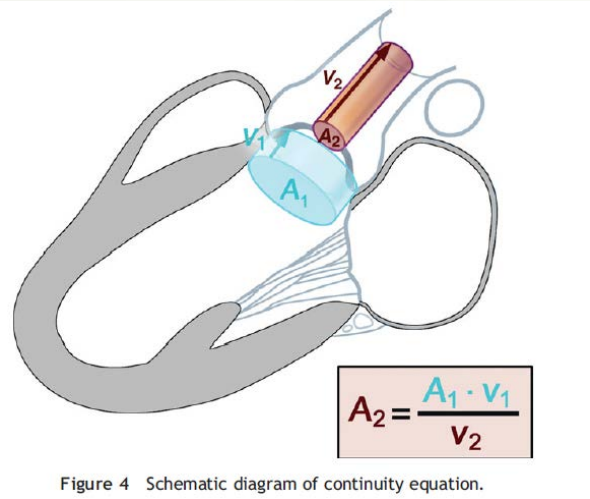
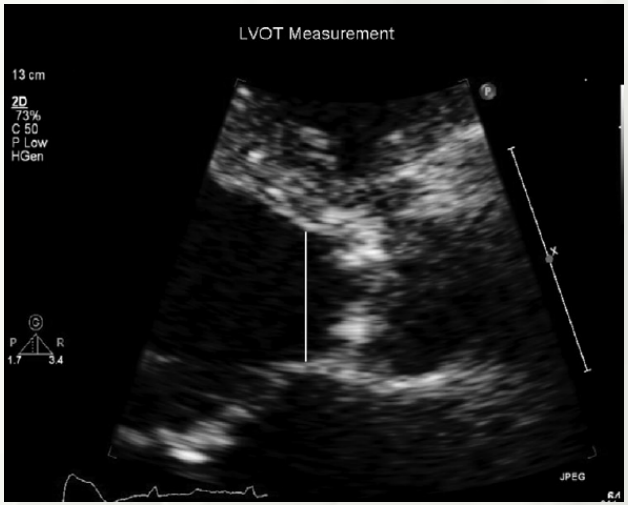
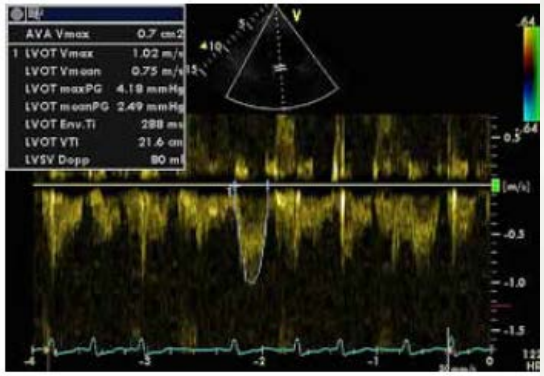
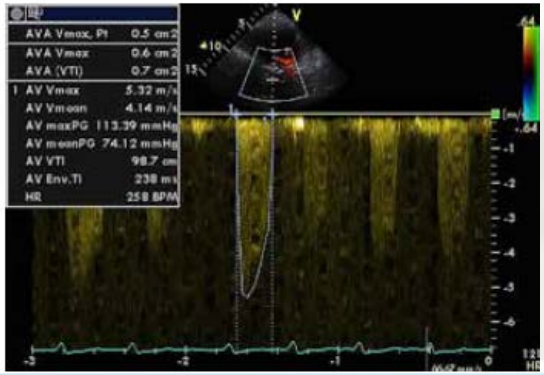


Figure 4 Schematic diagram of continuity equation.





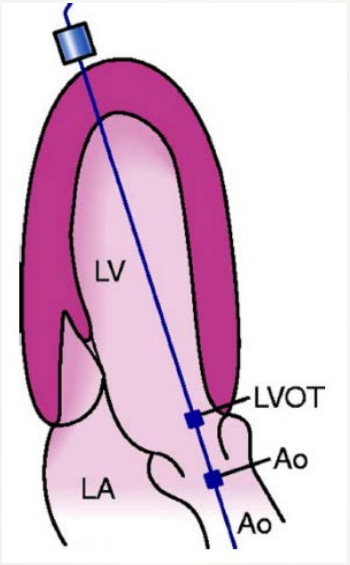


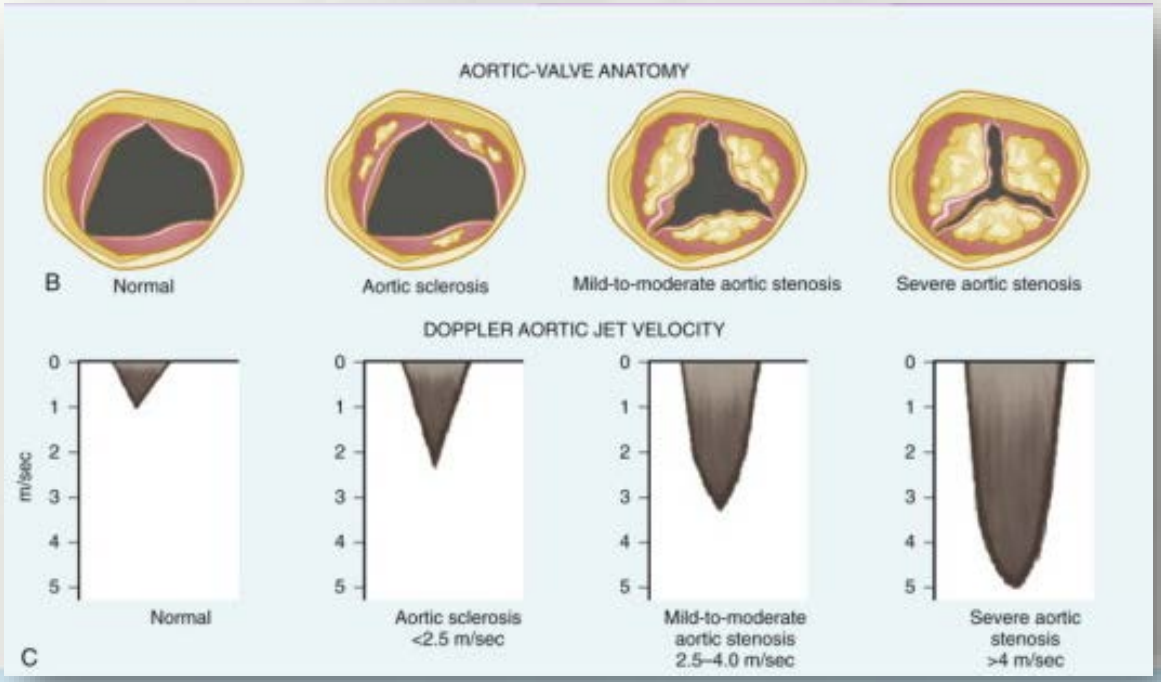
EAE/ASE recommendations for Echocardiographic assessment of valve stenosis, European Journal of Echocardiography 2009

ECHO EVALUATION OF AORTIC STENOSIS

C. Determine the transaortic jet velocity

- measured using continuous-wave (CW) Doppler



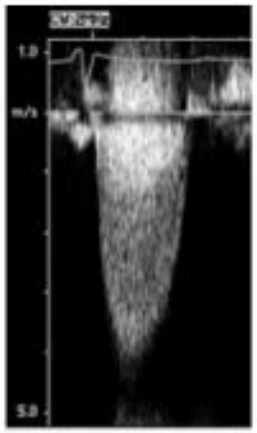


Valvular Hear Disease, Chapter 63, Braunwarld's Heart Disease 10th Edition 2014

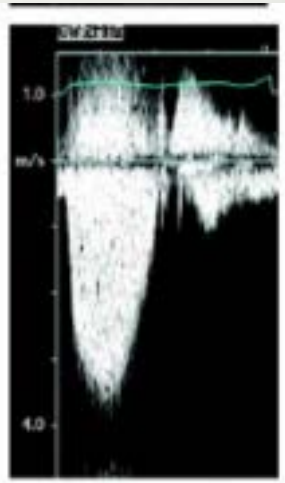
ECHO EVALUATION OF AORTIC STENOSIS

D. Determine the transaortic gradient

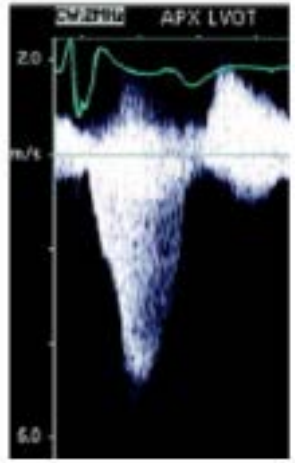
Valvular aortic stenosis



Subaortic membrane



Hypertrophic cardiomyopathy



EAE/ASE recommendations for Echocardiographic assessment of valve stenosis, European Journal of Echocardiography 2009

ECHO EVALUATION OF AORTIC STENOSIS

Table 3 Recommendations for classification of AS severity

	Aortic sclerosis	Mild	Moderate	Severe
Aortic jet velocity (m/s)	≤2.5 m/s	2.6-2.9	3.0-4.0	>4.0
Mean gradient (mmHg)	–	<20 (<30[a])	20-40[b] (30-50[a])	>40[b] (>50[a])
AVA (cm^2)	–	>1.5	1.0-1.5	<1.0
Indexed AVA (cm^2/m^2)		>0.85	0.60-0.85	<0.6
Velocity ratio		>0.50	0.25-0.50	<0.25

EAE/ASE recommendations for Echocardiographic assessment of valve stenosis, European Journal of Echocardiography 2009

- LOW FLOW LOW GRADIENT AORTIC STENOSIS
- PARADOXICAL LOW FLOW LOW GRADIENT AORTIC STENOSIS

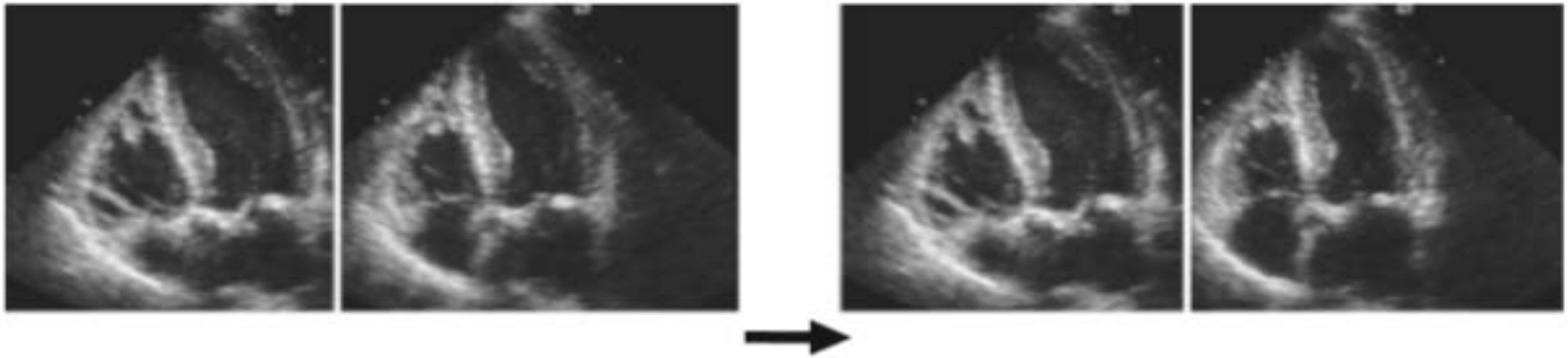
Baseline echo

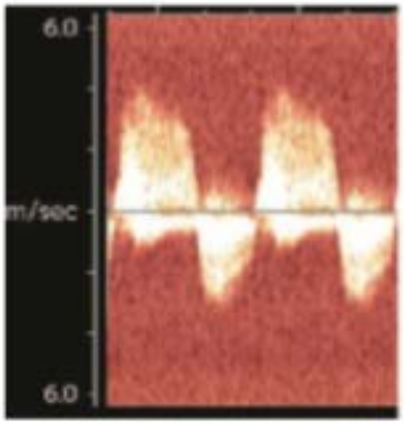
AVA: 0.96 cm2

PIG: 57mmHg

MG: 38 mmHg

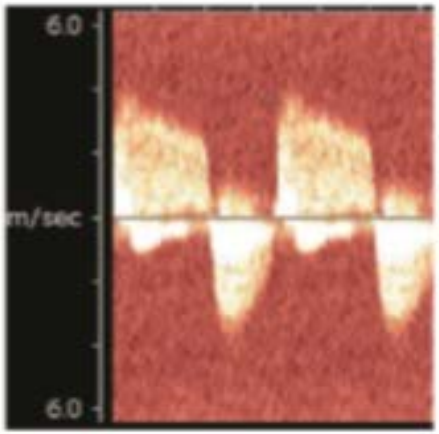
EF 31%





REST

Peak V = 3.5 m/s
Mean ΔP = 32 mmHg
AVA = 0.7 cm2



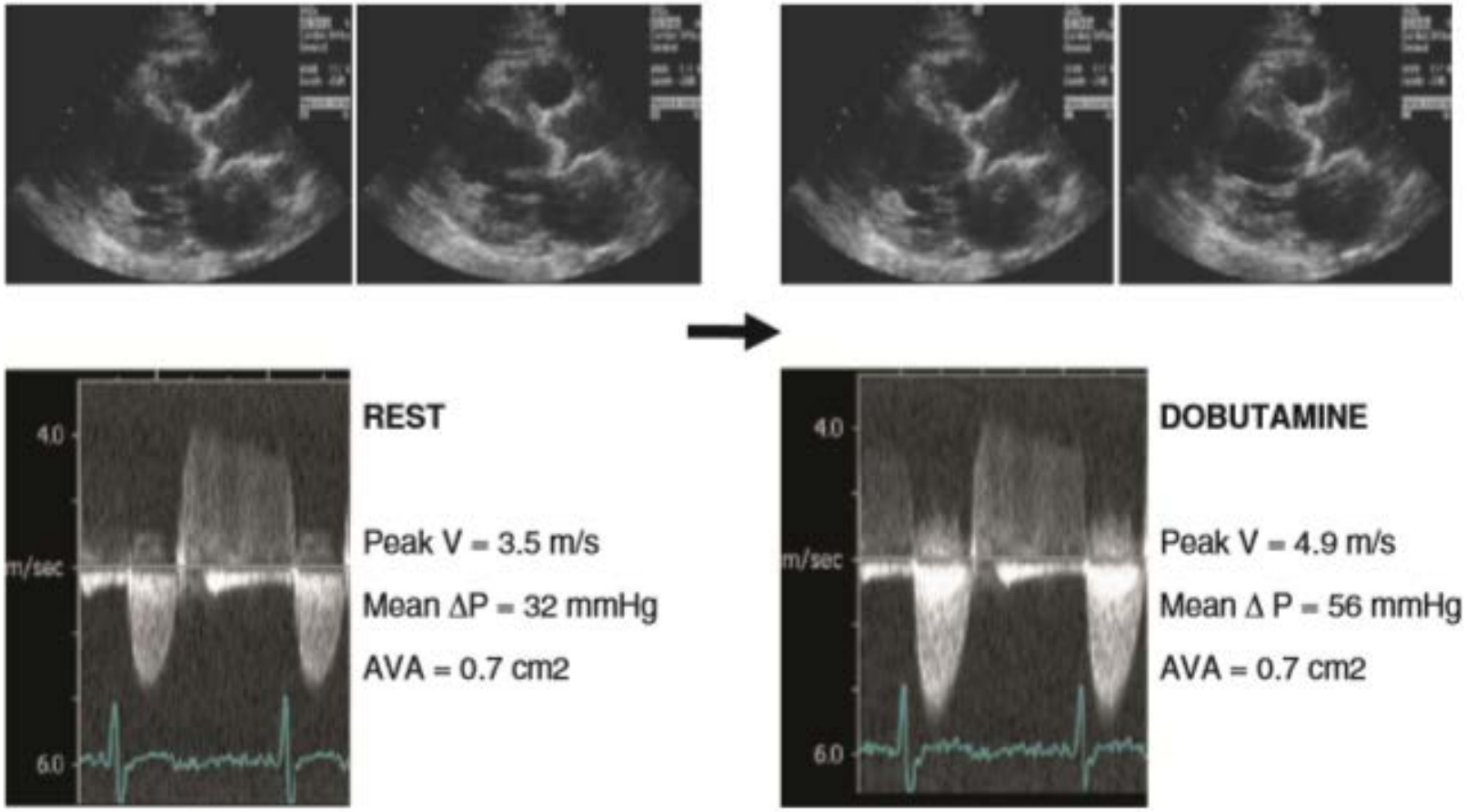
DOBUTAMINE

Peak V = 4.0 m/s
Mean ΔP = 36 mmHg
AVA = 1.1 cm2

Low flow, low gradient, pseudo-severe aortic stenosis

PSEUDOSEVERE AORTIC STENOSIS

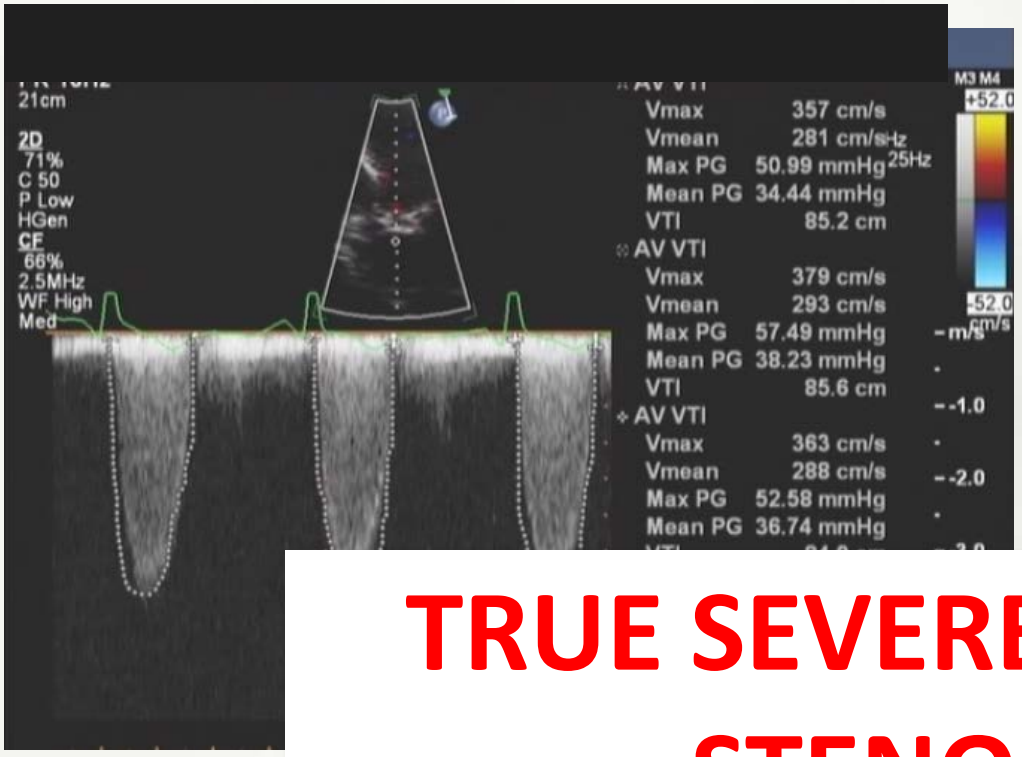
- will exhibit an increase in the AVA
- little change in transvalvular gradient in response to the increase in transvalvular flow rate



Low flow, low gradient true-severe aortic stenosis

TRUE SEVERE AORTIC STENOSIS

- will have no or minimal increase in AVA
- marked increase in gradient when flow is increased



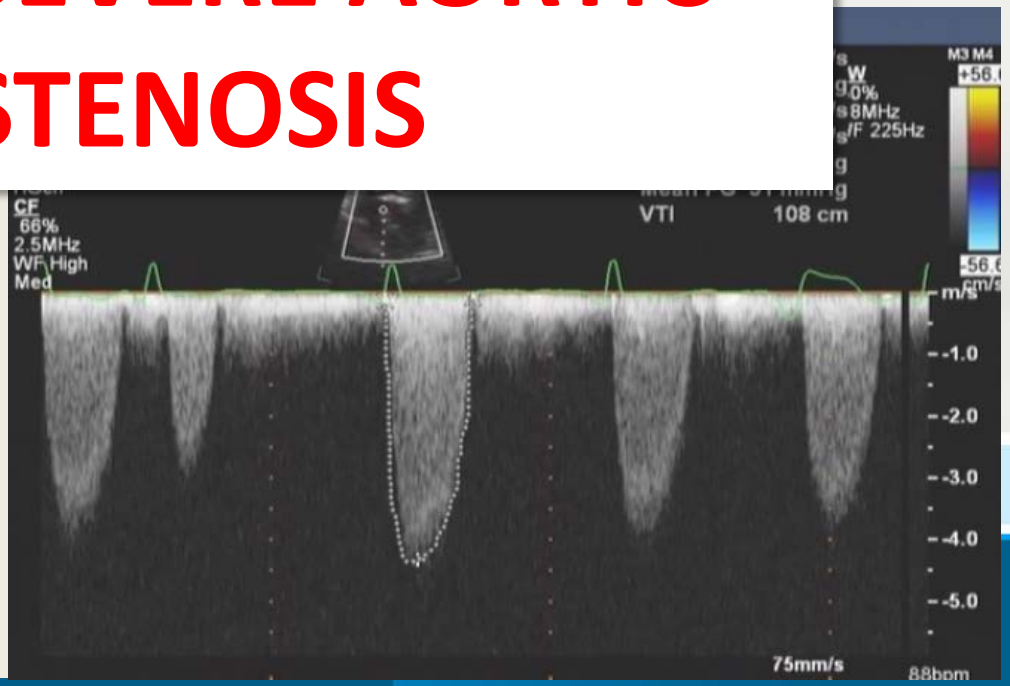
REST

- AVA: 0.96cm2
- MG 38
- PIG: 57
- EF: 31%

TRUE SEVERE AORTIC STENOSIS

LOW DOSE DOBU

- AVA: 0.99cm2
- MG: 51
- PIG: 76
- EF: 41% (32% inc)

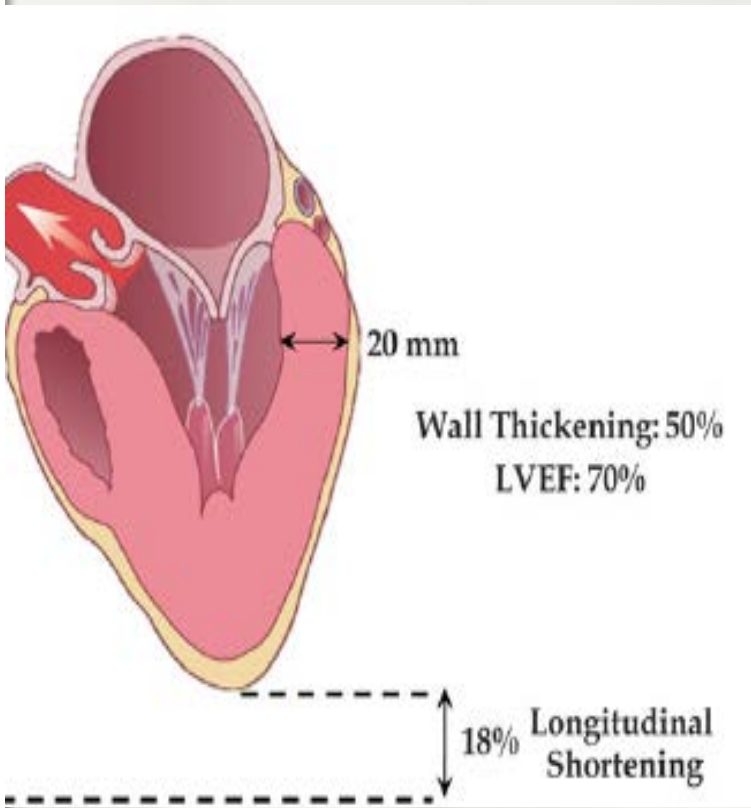


Paradoxical Low flow Low gradient AS

- Elderly female
- Associated with HTN, DM

Echo Characteristics

- Severely thickened and calcified AV
- AVA < 1.0; MVG <40mmHg
- EF ≥ 50%
- Small LV cavity size (LVEDD <47mm, LVEDV <55mL
- RWT of >0.5
- Impaired global longitudinal strain <15%
- SV index of <35mL/m2



SE's Comprehensive Echocardiography 2nd ed , 2016

ECHO EVALUATION OF AORTIC STENOSIS

Hemodynamic Progression

- annual decrease in valve area : 0.12 cm^2/year
- annual increase in jet velocity of 0.32 m/sec/year

Follow-up Echo

- every year: severe AS
- every 1 to 2 years for moderate AS
- every 3 to 5 years for mild AS.

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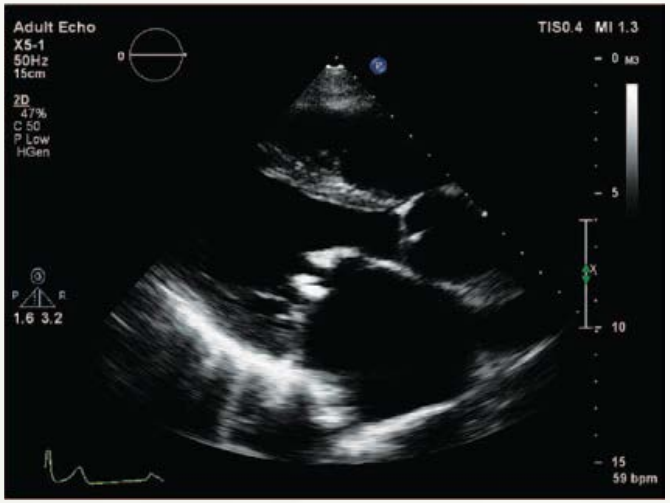


MITRAL STENOSIS

MITRAL STENOSIS

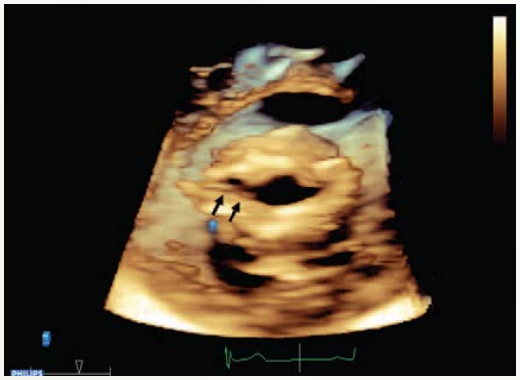
- most frequent valvular complication of rheumatic fever

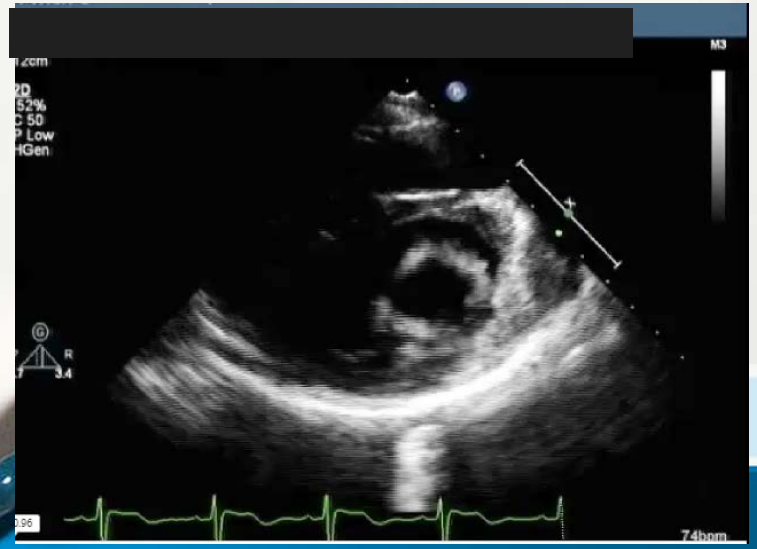
Other causes:

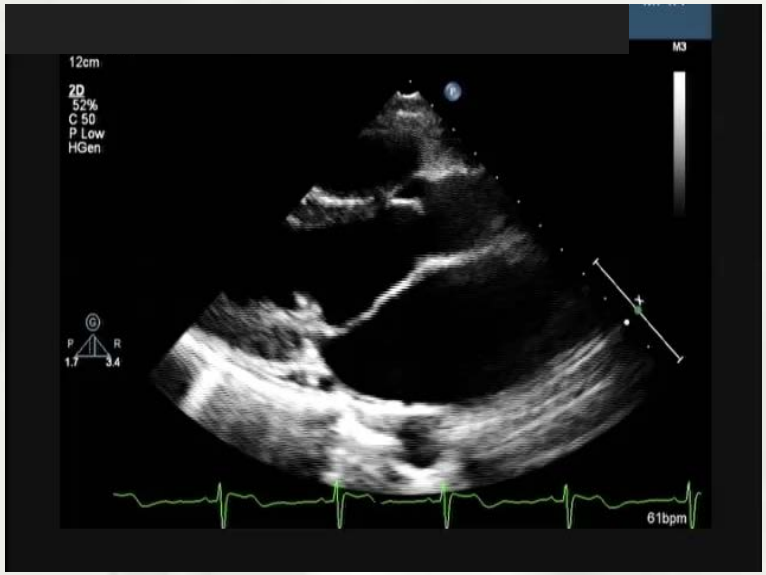
- Congenital
- Obstruction of LV inflow by LA tumor/mass (myxoma, thrombus, vegetation)
- extensive mitral annular calcification

ECHO EVALUATION OF MITRAL STENOSIS

A. Appearance of the MV and the mobility of its leaflets







EAE/ASE recommendations for Echocardiographic assessment of valve stenosis, European Journal of Echocardiography 2009

ECHO EVALUATION OF MITRAL STENOSIS

B. Determine the valve area

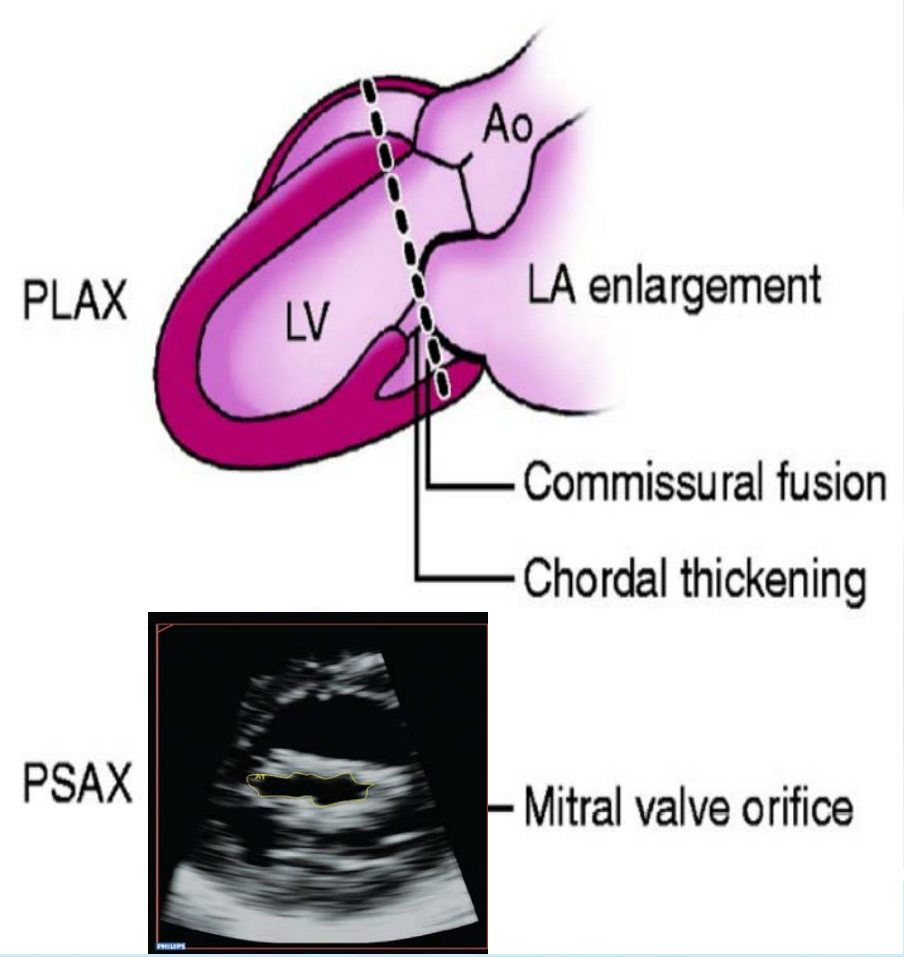
1. Planimetry

2. Pressure Half Time

   MVA = 220/PHT

3. Continuity Equation

4. PISA



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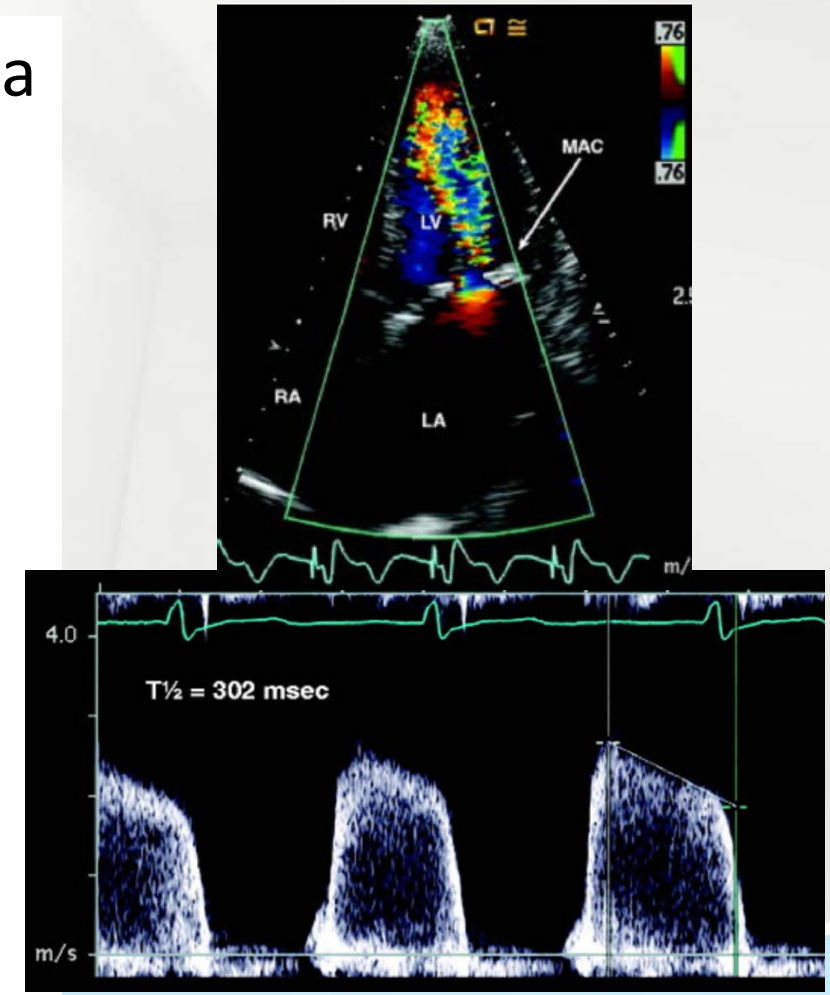

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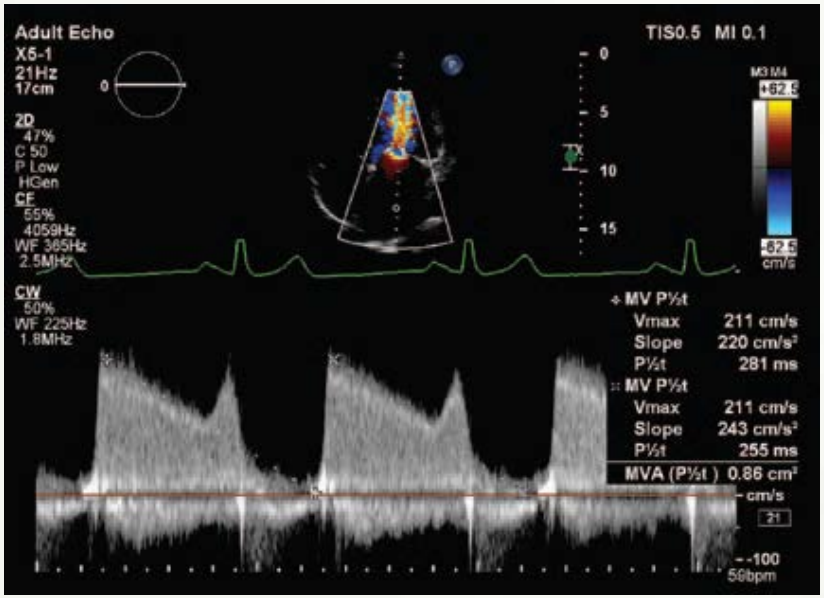
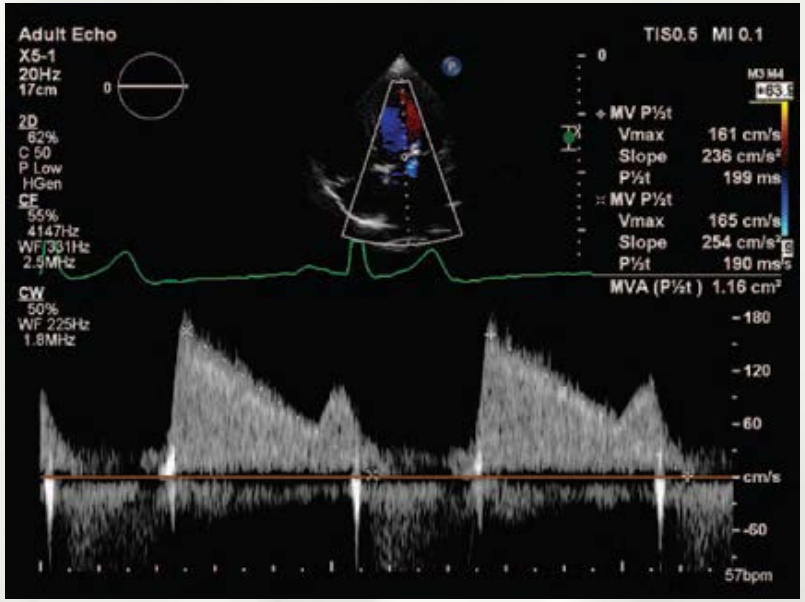


PHT = 211

MVA = 1.04cm^2

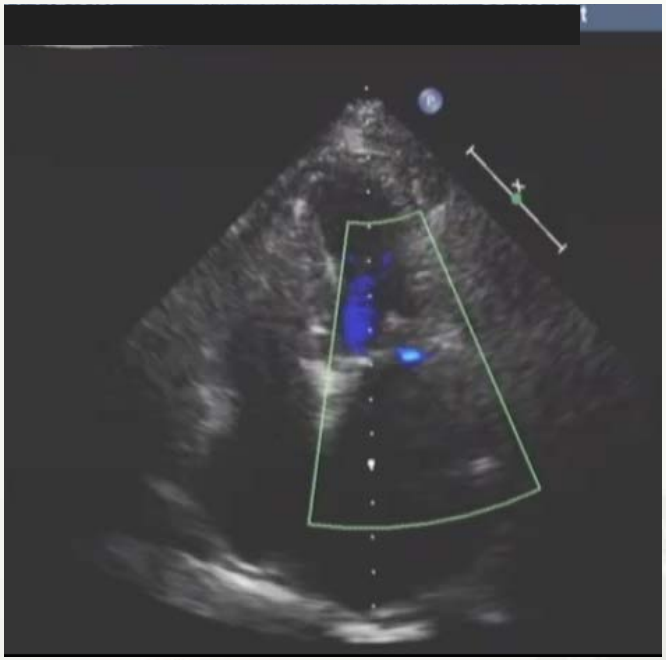


PHT = 159

MVA = 1.38cm^2

ECHO EVALUATION OF MITRAL STENOSIS

C. Determine the Mean Valve gradient



ECHO EVALUATION OF MITRAL STENOSIS

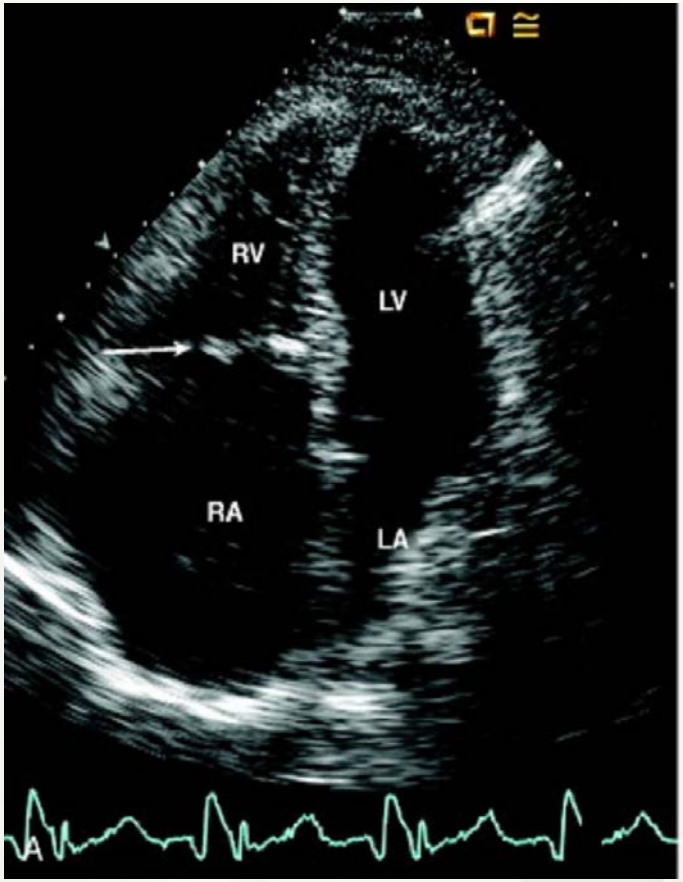
Table 9 Recommendations for classification of mitral stenosis severity

	Mild	Moderate	Severe
Specific findings			
Valve area (cm^2)	>1.5	1.0–1.5	<1.0
Supportive findings			
Mean gradient (mmHg)[a]	<5	5–10	>10
Pulmonary artery pressure (mmHg)	<30	30–50	>50

ECHO EVALUATION OF MITRAL STENOSIS

ASSOCIATED FINDINGS:

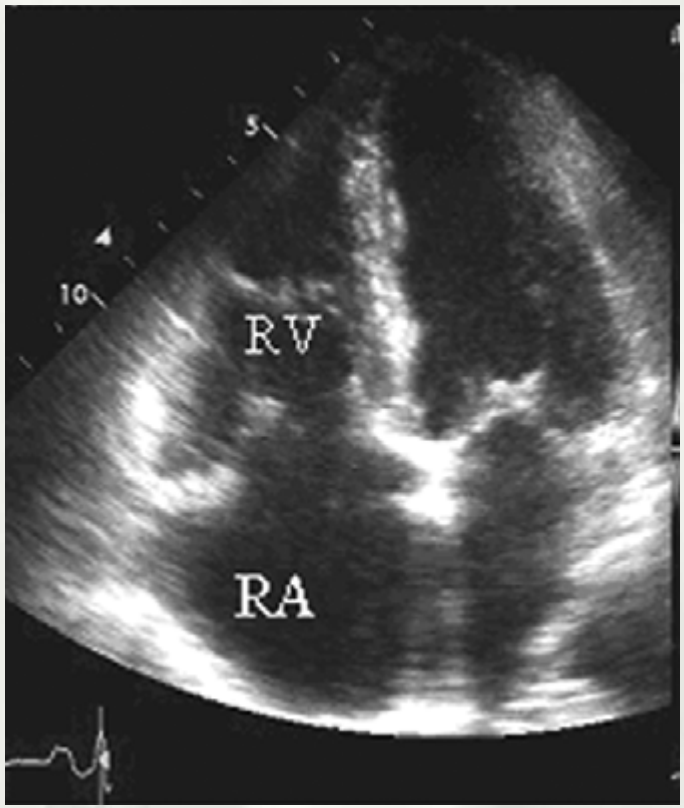
- Left atrial enlargement
- LA/ LAA thrombus
- RV dilatation and dysfunction
- Pulmonary hypertension



TRICUSPID STENOSIS

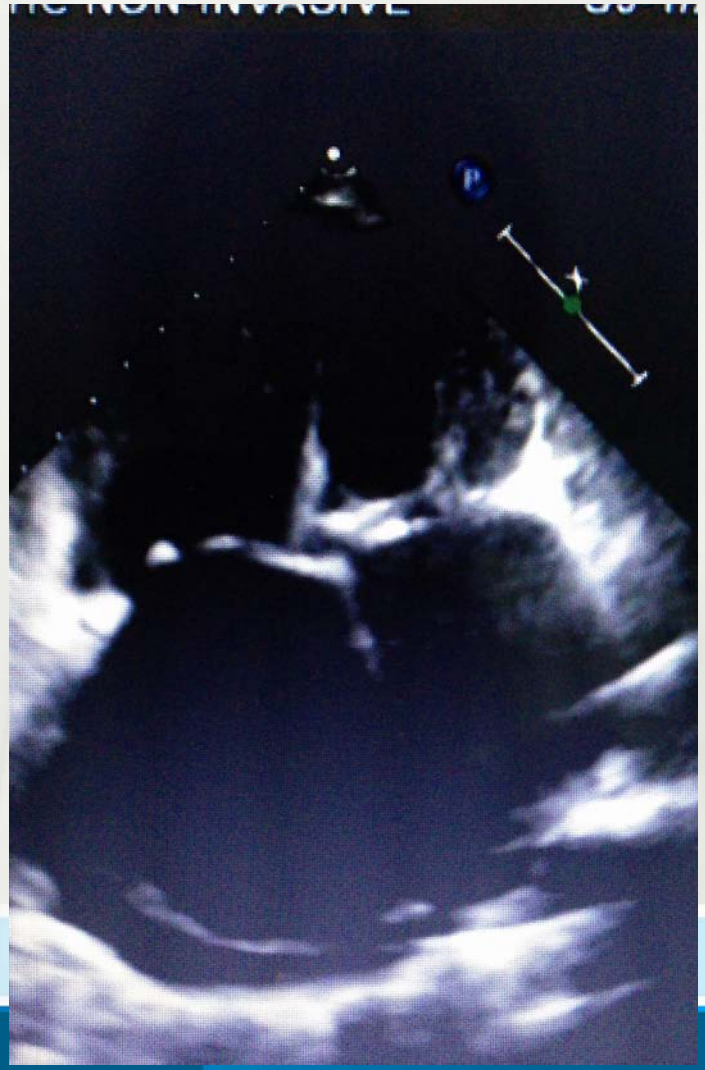
TRICUSPID STENOSIS

- Uncommon
- Almost always due to RHD
- Other causes:
- Congenital tricuspid atresia
- RA tumor/mass (myxoma, thrombus, vegetation)
- Carcinoid Syndrome



ECHO EVALUATION OF TRICUSPID STENOSIS

A. Determine valve morphology and mobility of the leaflets

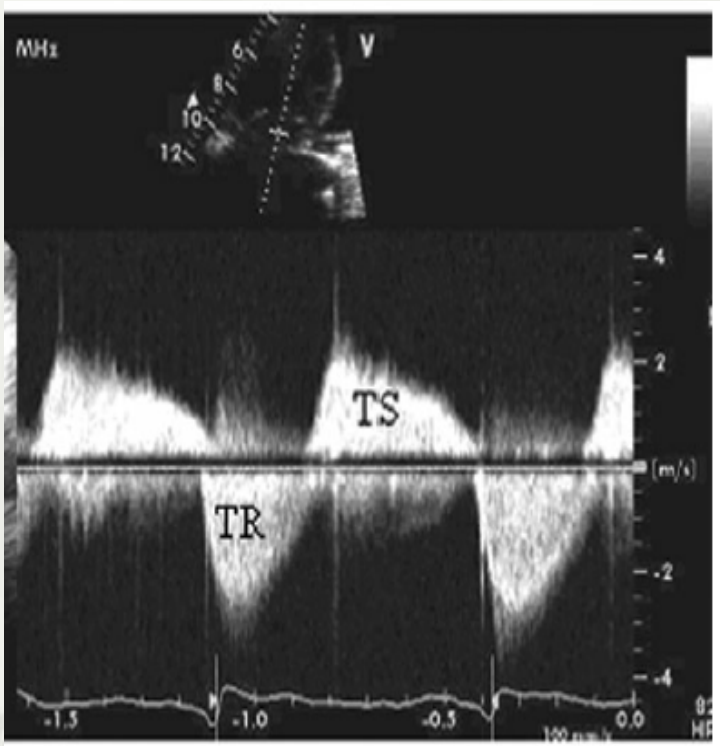


ECHO EVALUATION OF TRICUSPID STENOSIS

B. Measure the valve area

TVA = 190 ÷ PHT

C. Measure the mean gradient



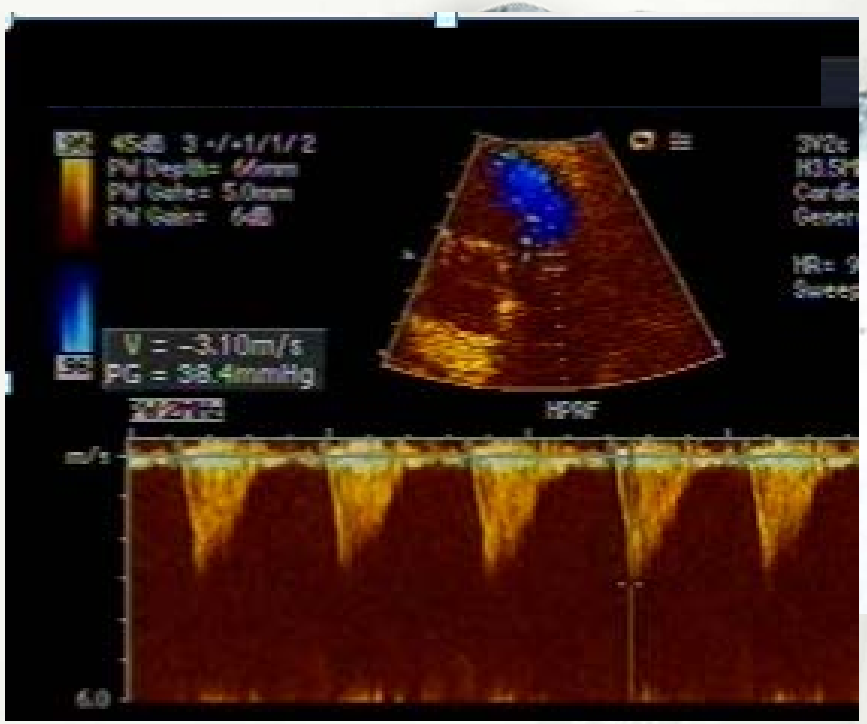
TVI = 60 cm; mean grad = 9 mmHg

P1/2t = 173 ms

ECHO EVALUATION OF TRICUSPID STENOSIS

Table 10 Findings indicative of haemodynamically significant tricuspid stenosis

Specific findings	
Mean pressure gradient	≥5 mmHg
Inflow time–velocity integral	>60 cm
$T_{1/2}$	≥190 ms
Valve area by continuity equation[a]	≤1 cm^{2a}
Supportive findings	
Enlarged right atrium ≥moderate	
Dilated inferior vena cava	



PULMONIC STENOSIS

PULMONIC STENOSIS

Causes:

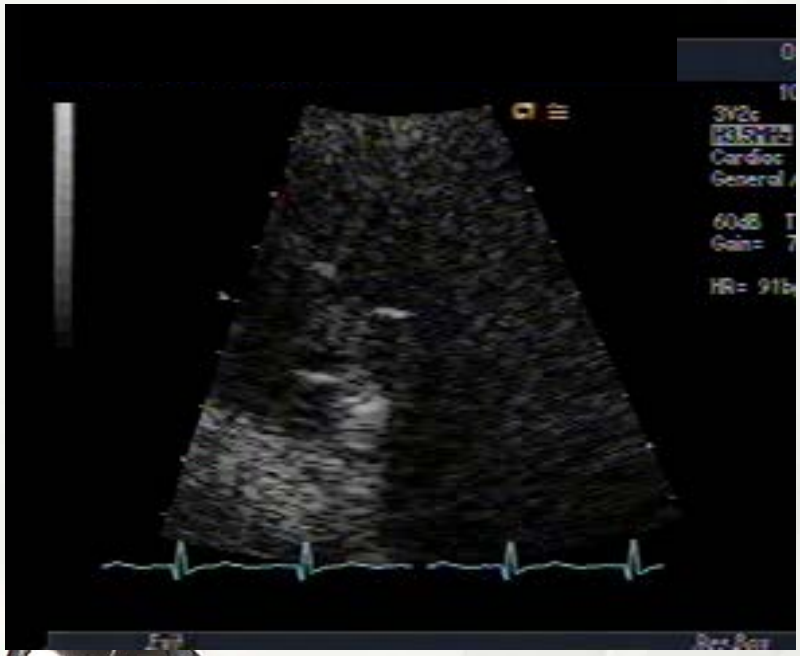
- Congenital
- Rheumatic
- Carcinoid Syndrome

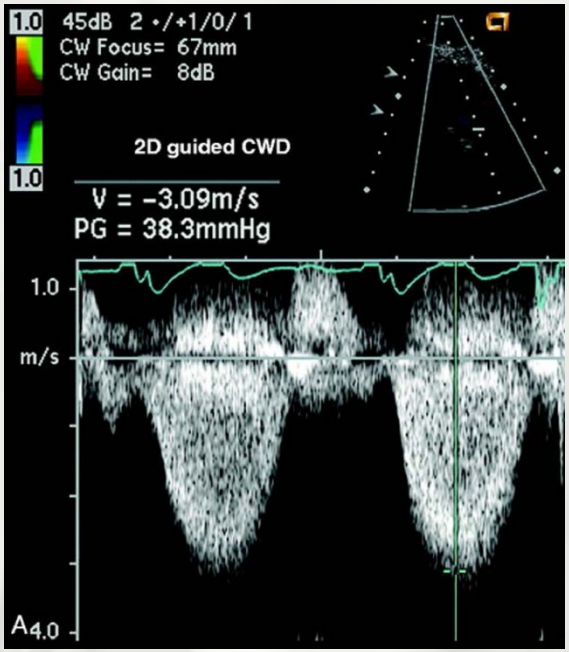
ECHO EVALUATION OF PULMONIC STENOSIS

A. Determine valve morphology and mobility of the leaflets

ECHO EVALUATION OF PULMONIC STENOSIS

B. Measure the peak velocity and gradient across the valve





ECHO EVALUATION OF PULMONIC STENOSIS

Table 11 Grading of pulmonary stenosis

	Mild	Moderate	Severe
Peak velocity (m/s)	<3	3–4	>4
Peak gradient (mmHg)	<36	36–64	>64

- Echocardiography is the primary non invasive imaging tool for the assessment of valve stenosis

- Echocardiographic evaluation should include determination of valve morphology, measurement of valve area, transvalvular gradient and velocity as well as to look for other associated abnormalities

- It is essential to combine all 2D and Doppler data in grading the severity of stenosis and not relying only in one specific parameter.

SUMMARY