

ECHOCARDIOGRAPHY – CHAPTER 2

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VALVULAR HEART DISEASES

- Classification of Valvular Heart disease:
- 1, Rheumatic heart disease
- 2, Coronary heart disease
- 3, Age related heart disease
- 4, Infectious heart disease
- 5, Drug induced heart disease

1- RHEUMATIC HEART DISEASE

- Classified into two:
 - 1, Valvular stenosis- causes Pressure over load related changes
 - 2, Valvular regurgitation- causes volume overload related changes in the cardiac chambers

VALVULAR STENOSIS

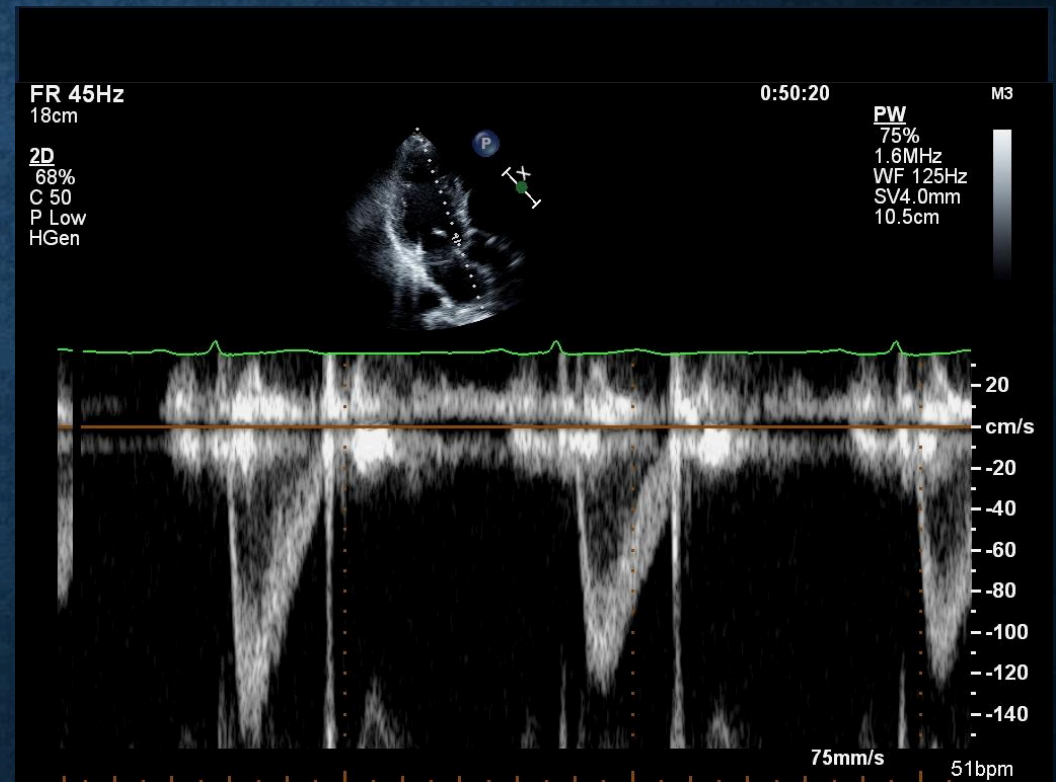
Higher prevalence to lower

- 1, Mitral Stenosis
- 2, Aortic Stenosis
- 3, Pulmonary Stenosis
- 4, Tricuspid Stenosis

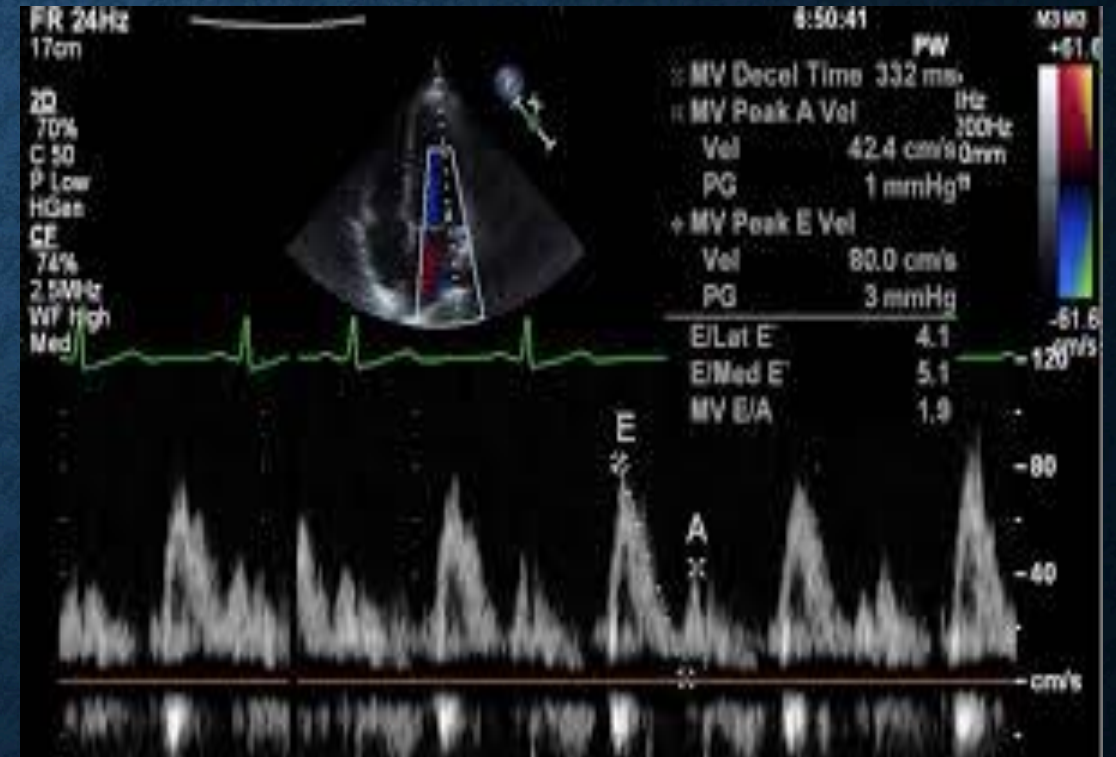
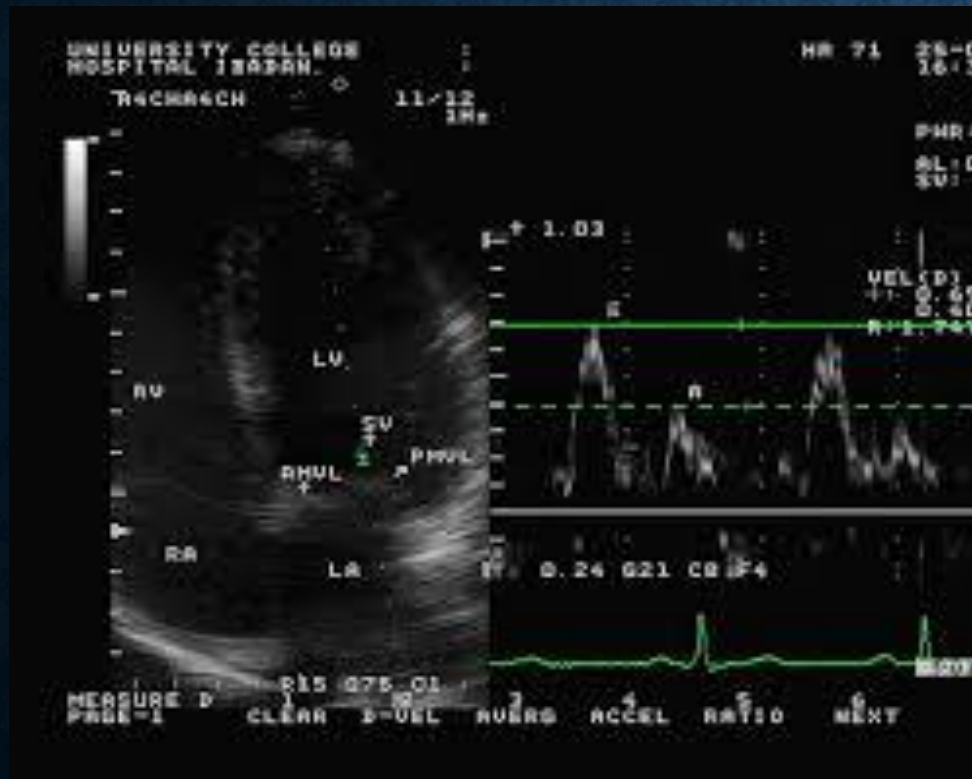
IMPORTANT MEASUREMENTS IN ECHO

- B- mode- to assess chambers size
- M- mode to measure dimension.
- Color Flow Mode- to assess quantification of regurgitation.
- CW Doppler – to measure Valvular gradient.
- PW Doppler- to measure the velocity of blood flow through the valve.

NORMAL AORTIC VELOCITY



NORMAL MITRAL FLOW



MITRAL ABNORMAL VELOCITY

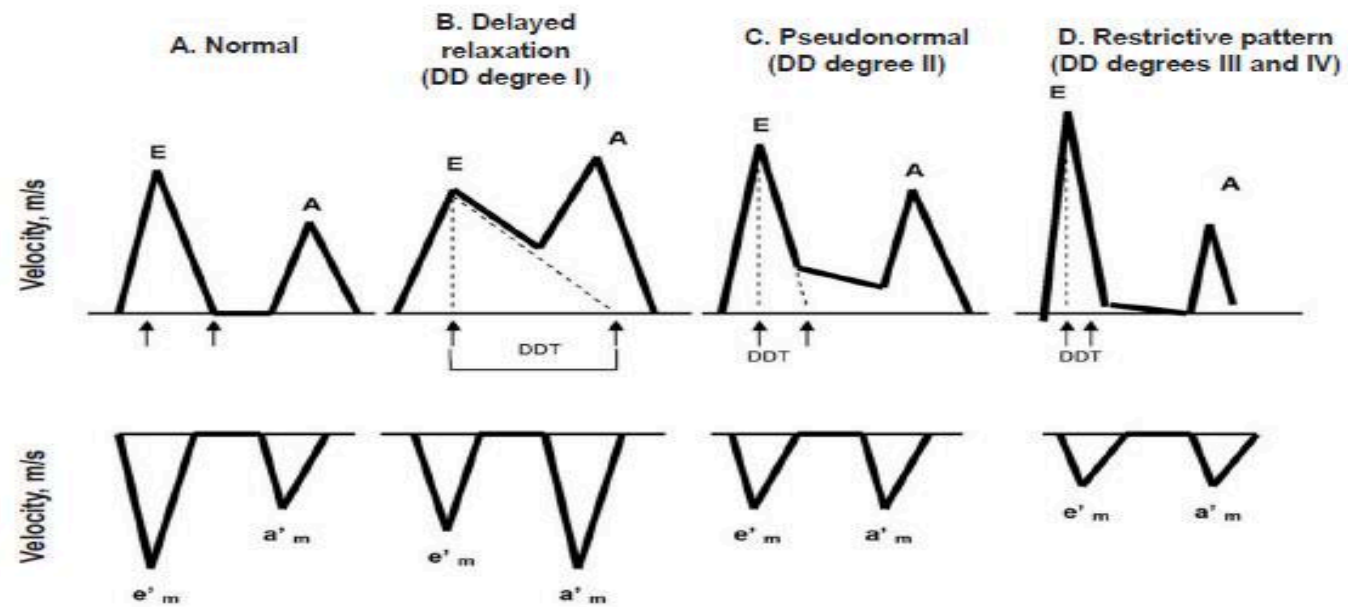
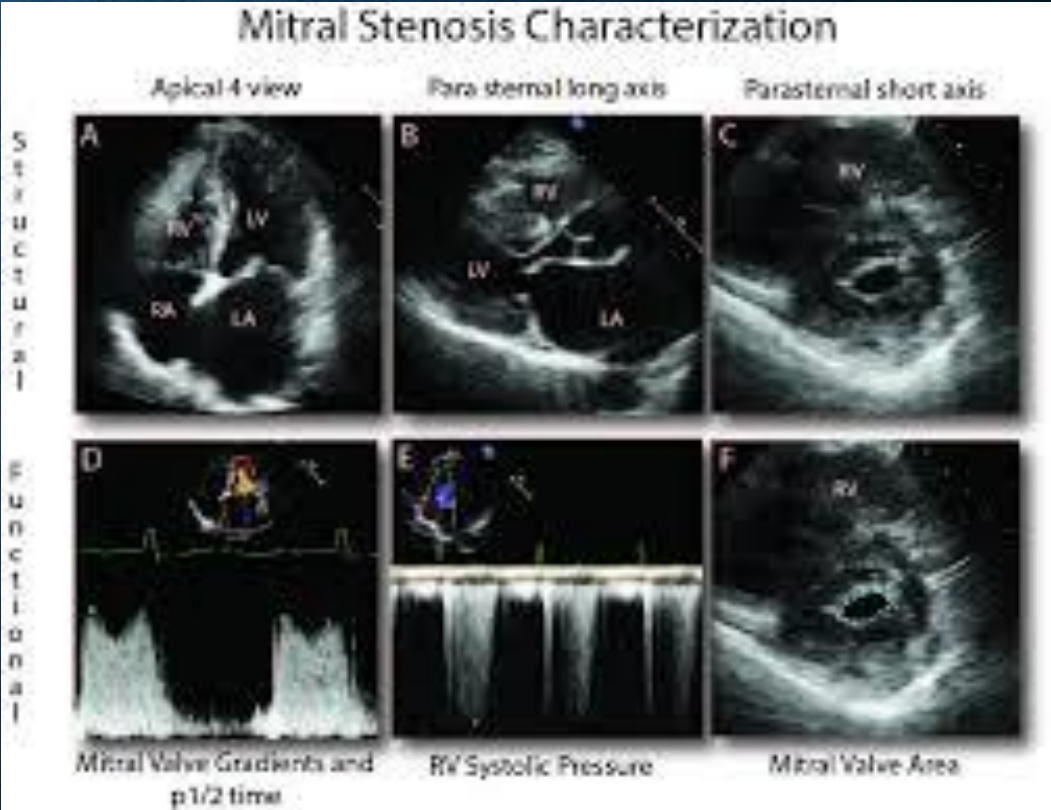
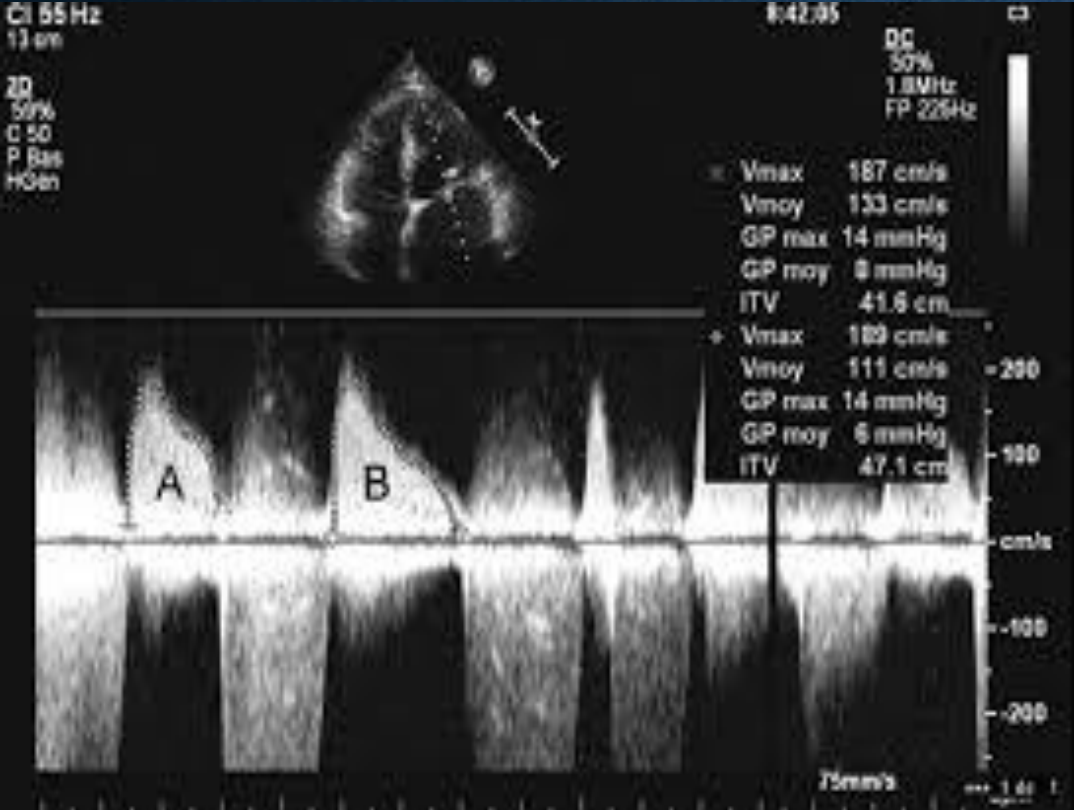


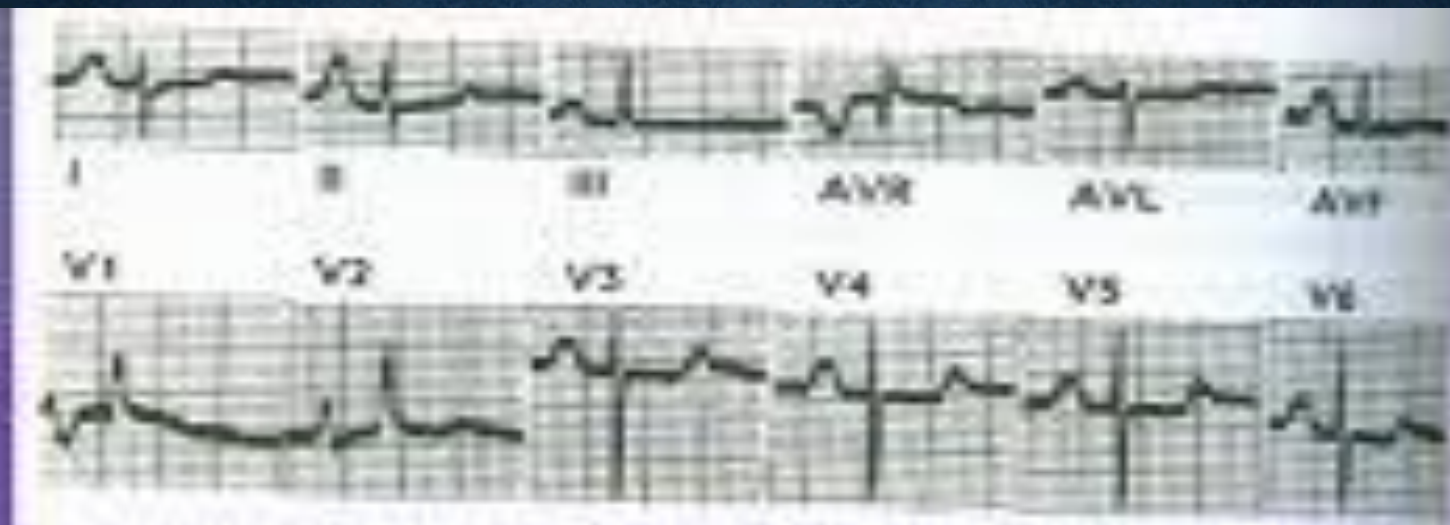
Figure 3 - Evaluation of different degrees of diastolic dysfunction using data obtained from the transmitral flow pattern (top) and analysis of tissue Doppler at the mitral annulus level (bottom). Legend: DD - diastolic dysfunction; DDT - diastolic deceleration time; E - transmitral flow velocity during early ventricular filling; A - transmitral flow velocity during atrial contraction; e' - Tissue Doppler velocity at the mitral annulus level during early ventricular filling.

MITRAL STENOSIS



GRADATION OF MITRAL STENOSIS

- Normal Mitral Valve Area- 4-6 sqcm
- Mild MS- 2-4 sqcm
- Moderate MS- 1-2 Sqcm
- Severe MS- <1 Sqcm
- Severe MS criteria: MVA <1 Sqcm, Mean Gradient >10mmhg, PHT- >200ms, PASP- >35mmhg.



Mitral Stenosis + Tricuspid Stenosis

- LAE: - Wide notched P wave in II, III, AVF, V2 – V6.
- P terminal force $3 \times 0.08 = 0.24 \text{ mm sec}$.
- RAE: - Tall and volcano like P waves in I, II, AVF, V3 – V6,
- qR in V1 also connotes RAE.
- First degree AV block - PR interval 0.22 sec.
- RVH: - Tall R wave in V1 – V2 right axis deviation,
clockwise rotation. RVH reflects PH.
- Very tall wide and notched P wave are characteristically associated with Tricuspid Stenosis.

MITRAL REGURGITATION

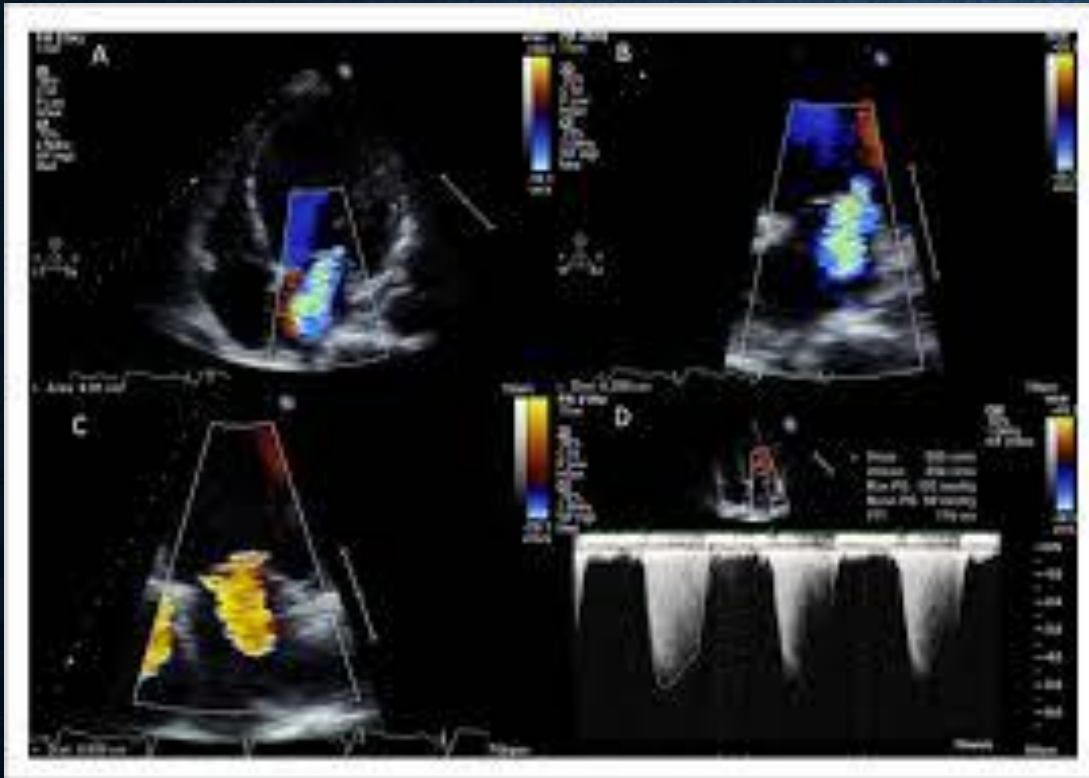
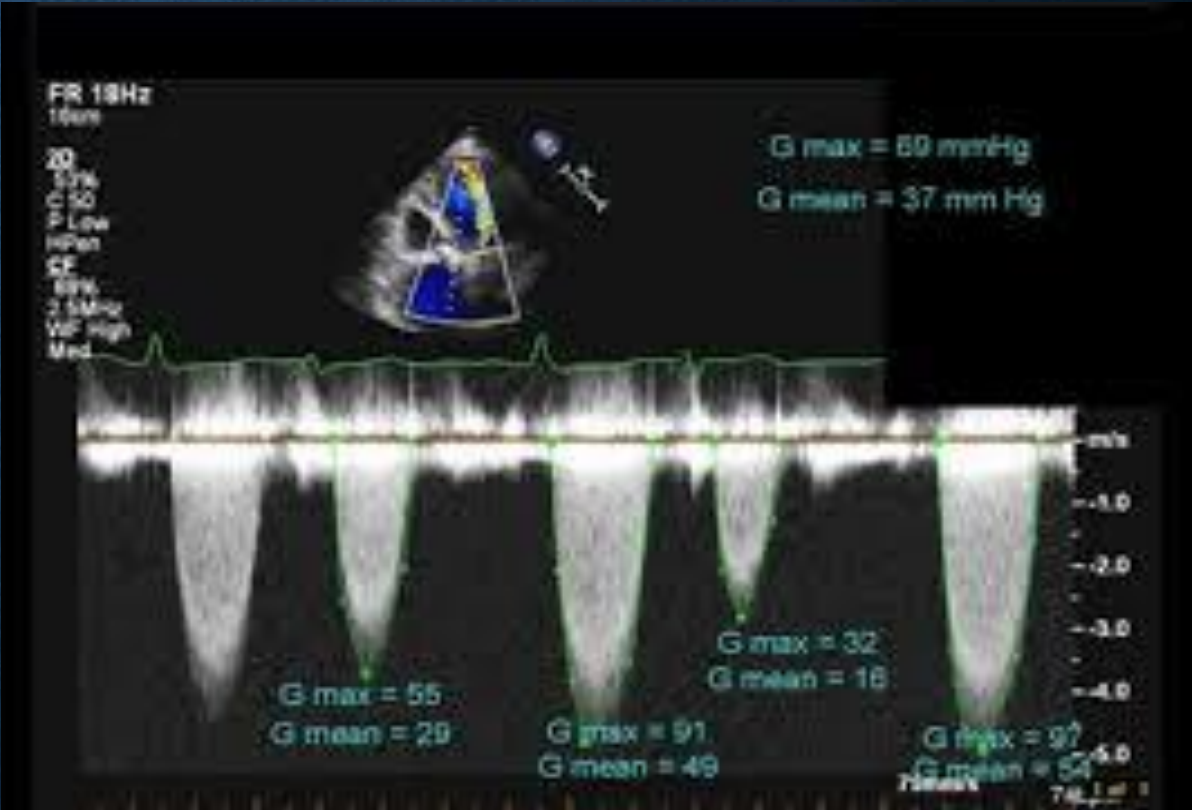
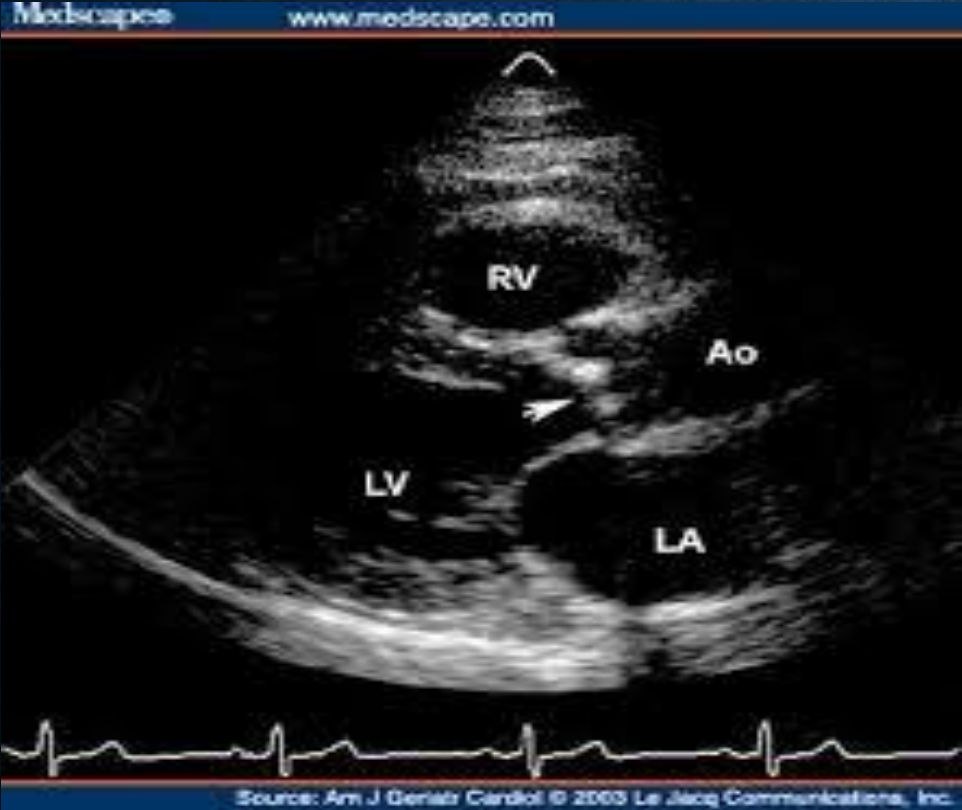


Table 1. Echocardiographic Assessment of Mitral Regurgitation Severity (ASE Guidelines²⁰)

Parameter	Mild	Moderate	Severe
Regurgitation fraction (%)	< 30	30-50	> 50
Regurgitation volume (ml)	< 30	30-60	> 60
Vena contracta (cm)	< 0.3	0.3-0.7	> 0.7
Regurgitation orifice area (cm ²)	< 0.2	0.2-0.4	> 0.4
Jet area (% of LA area)	< 20 %	20% to 40%	> 40%

cm: centimeter; LA: left atrium; ml: milliliter.

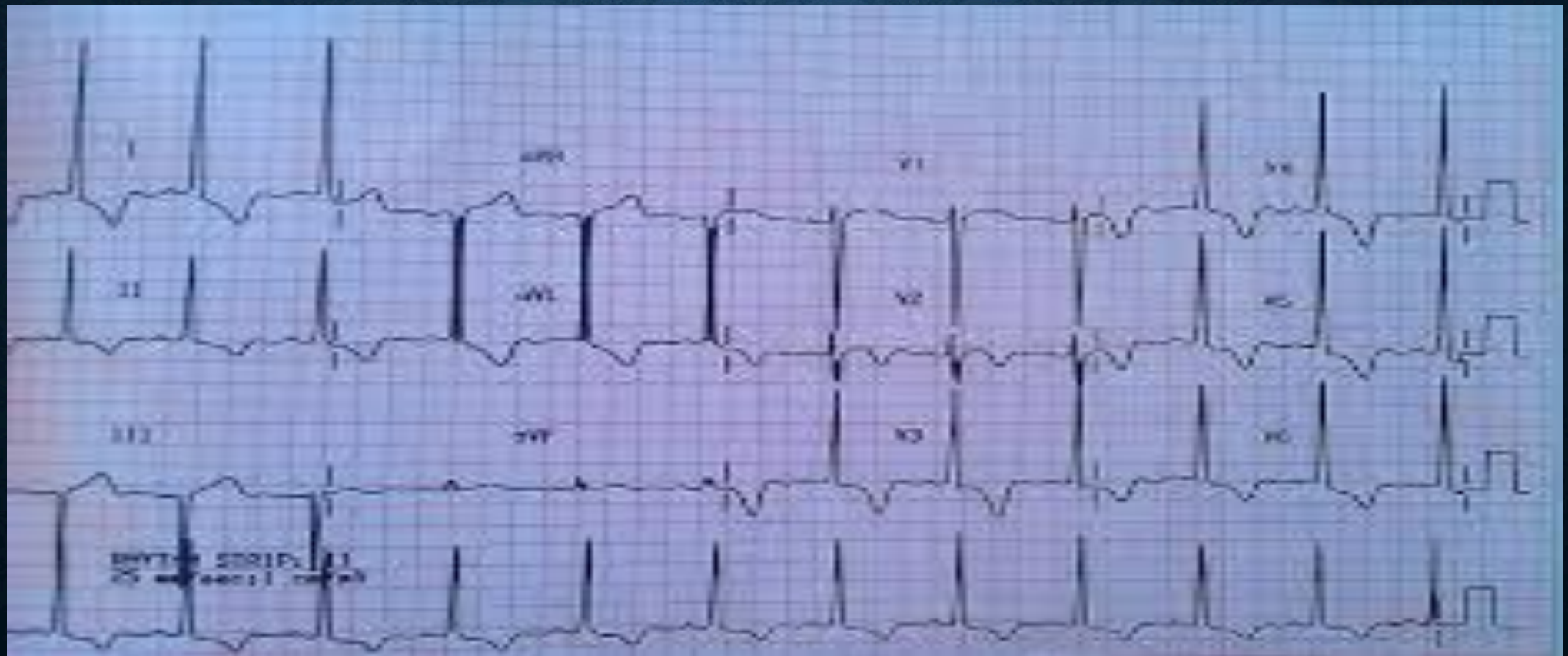
AORTIC STENOSIS



GRADATION OF AORTIC STENOSIS

AHA Guidelines for Severity of Aortic Stenosis			
	Valve Area (cm ²)	Maximum Aortic Velocity (mmHg)	Mean Pressure Gradient (mmHg)
Mild	1.5-2	2.5-3.0	< 25
Moderate	1.0-1.5	3.0-4.0	25-40
Severe	0.6-1.0	>4.0	>40
Critical	< 0.6		

AORTIC STENOSIS ECG CHANGES



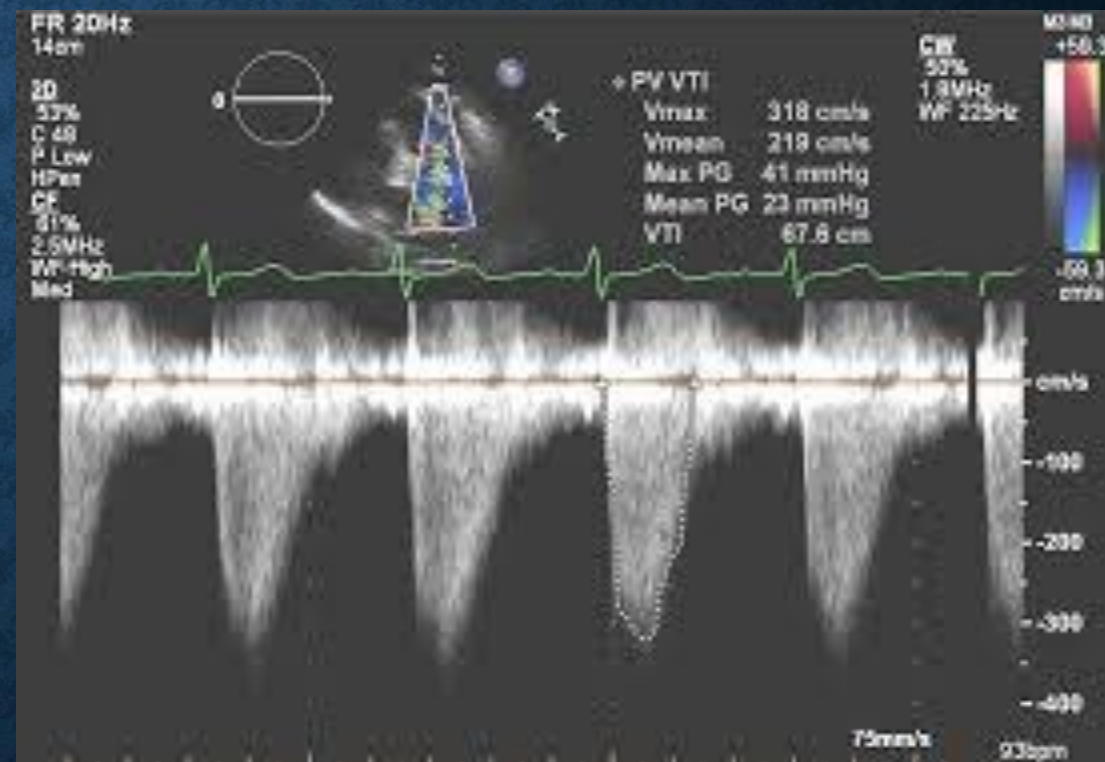
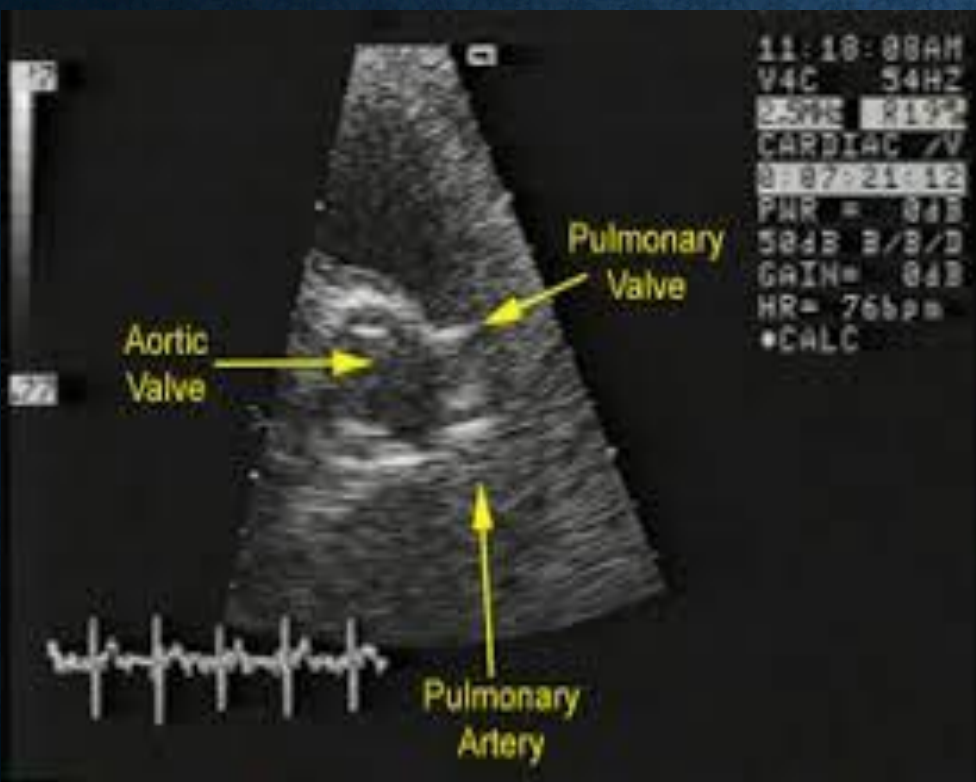
AORTIC REGURGITATION



Severity of Regurgitation

Method of Evaluation (View)	Trivial (0-1°)	Mild (1°-2°)	Moderate (2°-3°)	Severe (3°-4°)
AJ jet height/LVOT diameter (ME AV LAX)	1%-24%	25%-40%	47%-54%	>55%
AJ area/LVOT area (ME AV SAX)	<4%	4%-24%	25%-50%	>50%
Vena contracta mapping (ME LAX, ME AV SAX)	< 3 mm	3-6 mm		Width >6 mm Area >7.5 mm ²
Slope of AR jet decay (TG LAX; deep TE LAX)			≥2 m/s	≥3 m/s
Pressure half-time (Deep TG LAX, TG LAX)		>500 ms	200-500 ms	<200 ms

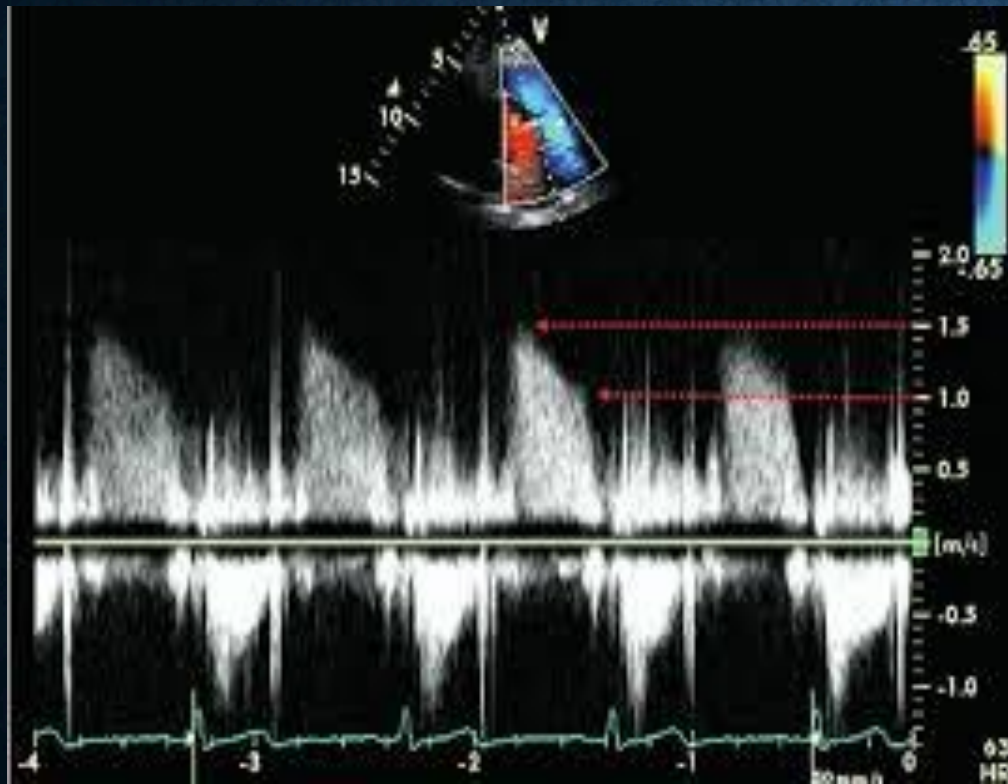
PULMONARY STENOSIS



GRADING OF PULMONARY STENOSIS

	Mild	Moderate	Severe
Valve area (cm ²)	>1.5	1.0-1.5	<1.0
Mean gradient (mm Hg)	>5	5-10	>10
Pulmonary artery systolic pressure (mm Hg)	>30	30-50	>50

PULMONARY REGURGITATION

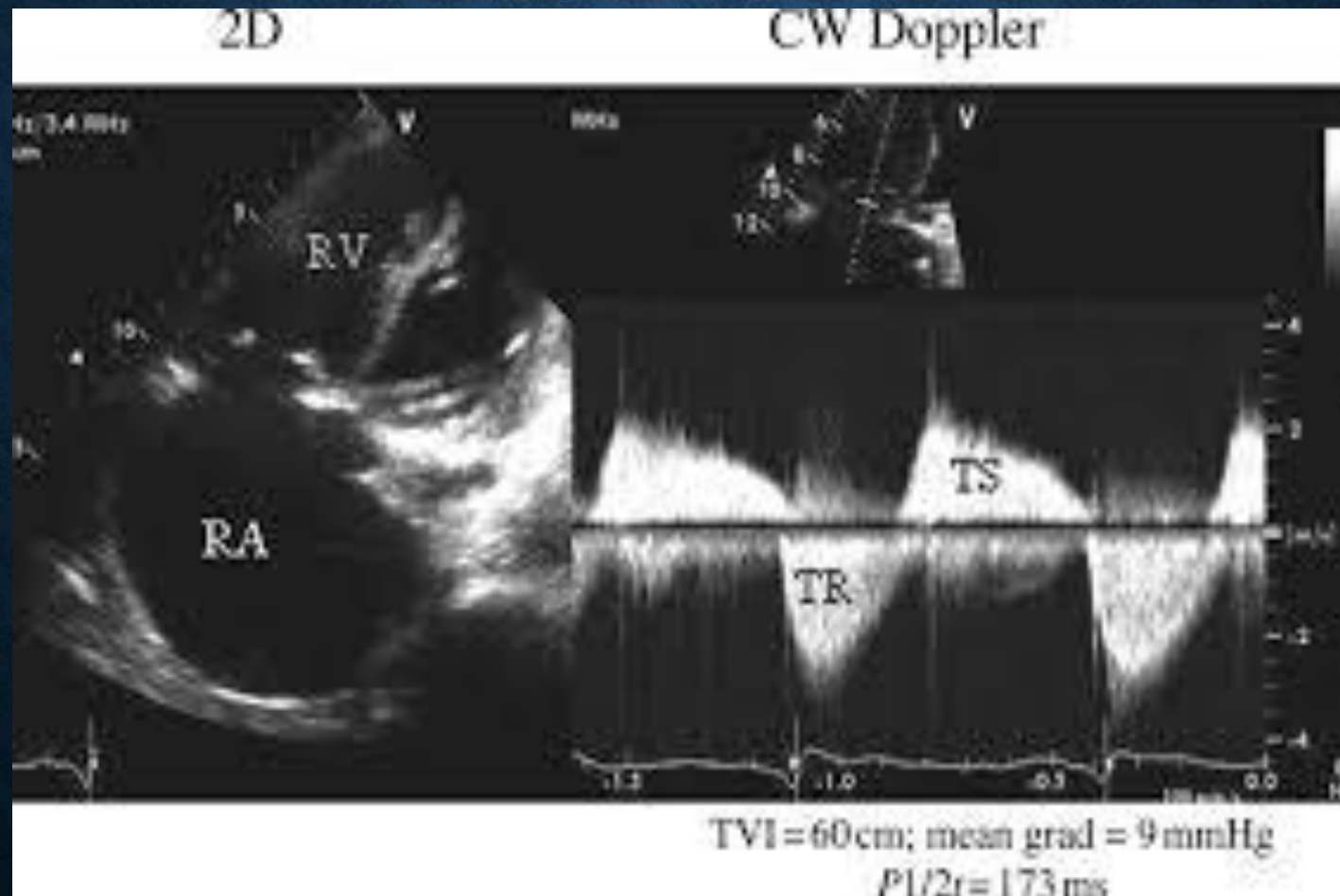


Grading of Pulmonary Regurgitation Severity

Parameter	Mild	Moderate	Severe
Pulmonic valve	Normal	Normal or abnormal	Abnormal
RV size	Normal 1	Normal or dilated	Dilated 2
Jet size by color Doppler	Thin (usually < 10 mm in length) with a narrow origin	Intermediate	Usually large, with a wide origin; may be brief in duration
Jet density and deceleration rate- CW ³	Soft; slow deceleration	Dense; variable deceleration	Dense; steep deceleration, early termination of diastolic flow
Pulmonic systolic flow compared to systemic flow -PW	Slightly increased	Intermediate	Greatly increased

1. Unless there are other reasons for RV enlargement. 2. Exception: acute PR. 3. Steep deceleration is not specific for severe PR. CW = continuous wave Doppler; PR = pulmonic regurgitation; PW = pulsed wave Doppler; RV = right ventricle.

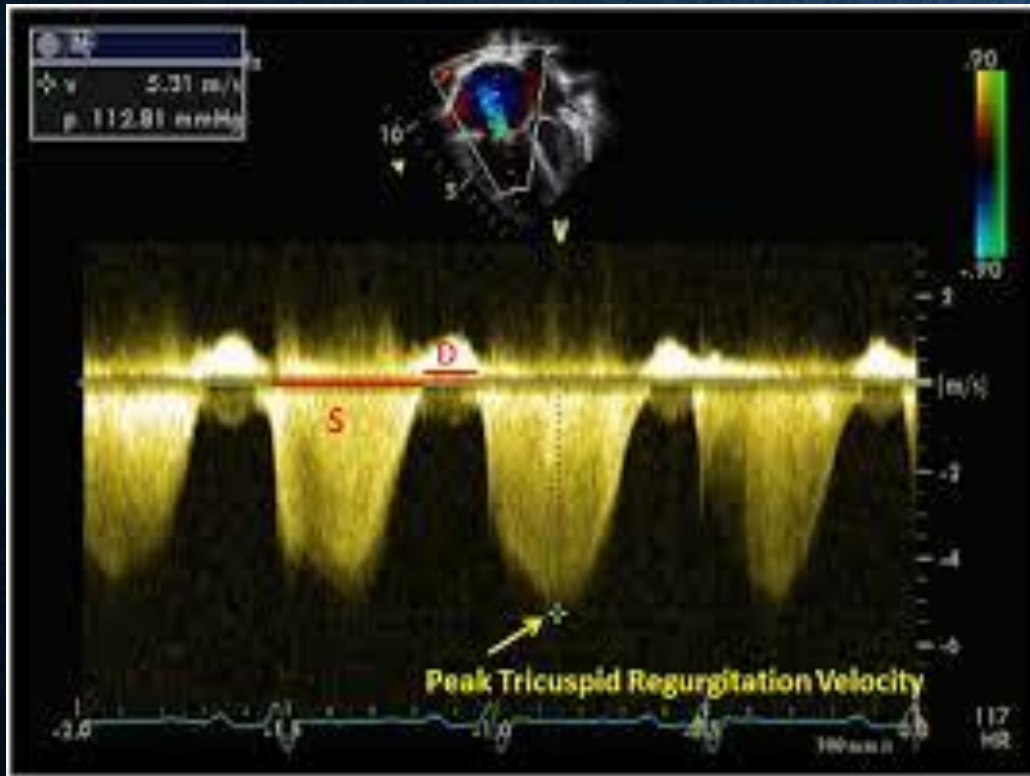
TRICUSPID STENOSIS



Tricuspid stenosis

- Always rheumatic in origin and when present accompanies mitral valve involvement.
- The anatomical changes and physiological principles are similar to those of mitral stenosis.
- The low cardiac output state causes fatigue; abdominal discomfort may occur due to hepatomegaly and ascites.
- The diastolic murmur of tricuspid stenosis is augmented by inspiration.
- Medical management includes salt restriction and diuretics.
- Surgical treatment should be carried out in patients with a valve area $<2.0\text{cm}^2$ and a mean pressure gradient $>5\text{mmHg}$.

TRICUSPID REGURGITATION



Grading of Tricuspid Regurgitation Severity

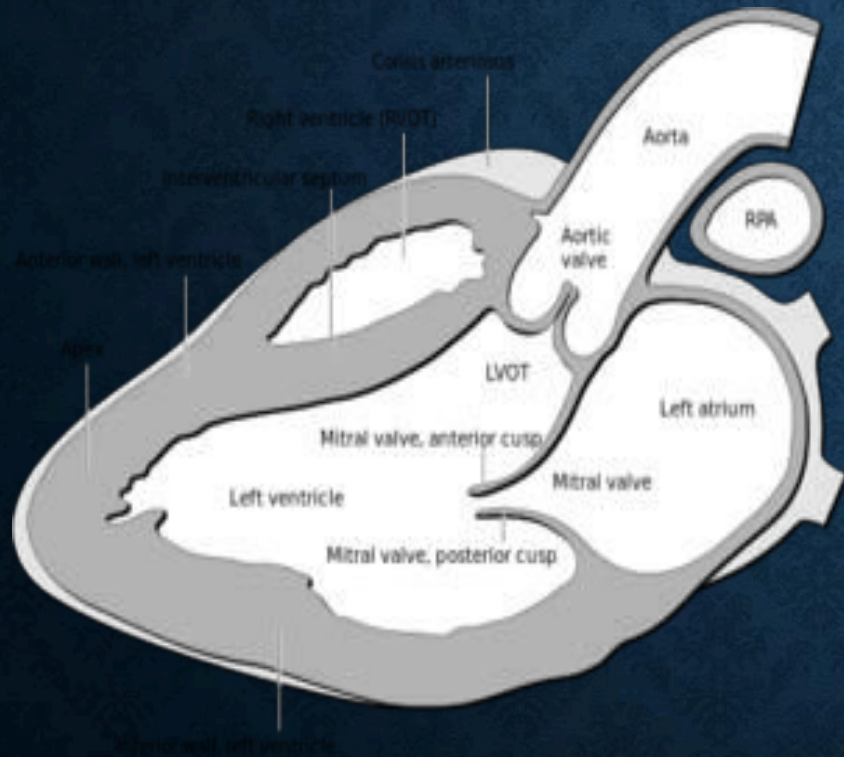
Parameter	Mild	Moderate	Severe
Tricuspid Valve	Usually normal	Normal or abnormal	Abnormal / flail leaflet / poor coaptation
RV / RA / IVC size	Normal 1	Normal or dilated	Usually dilated 2
Jet area - Central jets (cm ²) 3	< 5	5 – 10	> 10
PISA radius (cm) 4	< 0.5	0.6 – 0.9	> 0.9
Jet density and contour – CW	Soft and parabolic	Dense, variable contour	Dense, triangular with early peaking
Hepatic vein flow 5	Systolic dominance	Systolic blunting	Systolic reversal

1. Unless there are other reasons for RA or RV dilatation. **2.** Exception: acute TR. **3.** At a Nyquist limit of 50-60 cm/s. **4.** Baseline shift with Nyquist limit of 28 cm/s. **5.** Other conditions may cause systolic blunting (e.g. atrial fibrillation, elevated RA pressure). CW = continuous wave Doppler; IVC = inferior vena cava; RA = right atrium; RV = right ventricle; VC = Vena contracta width.

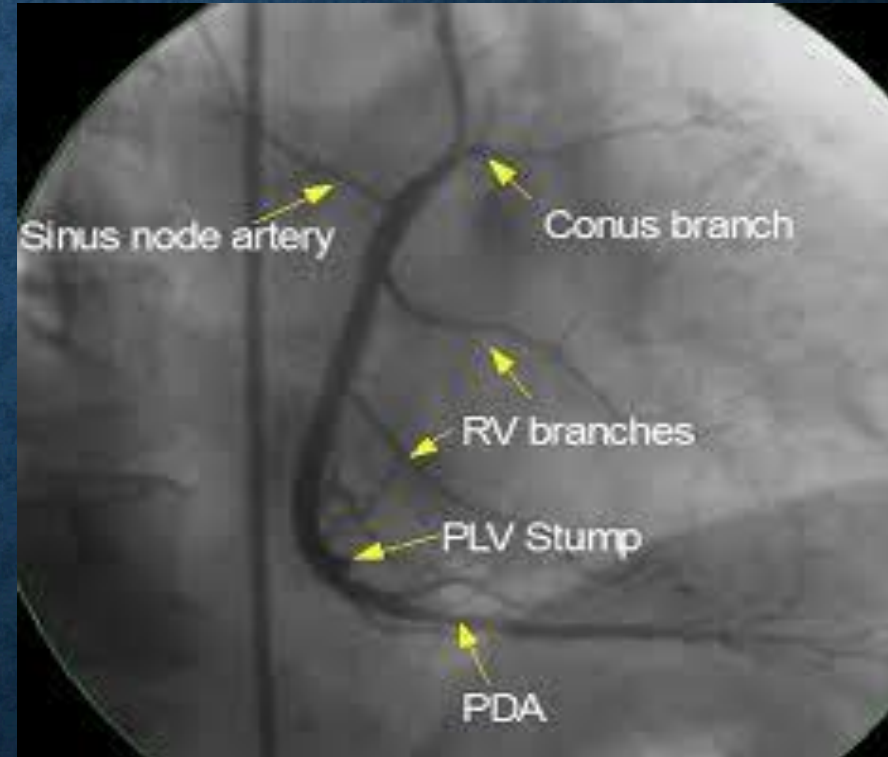
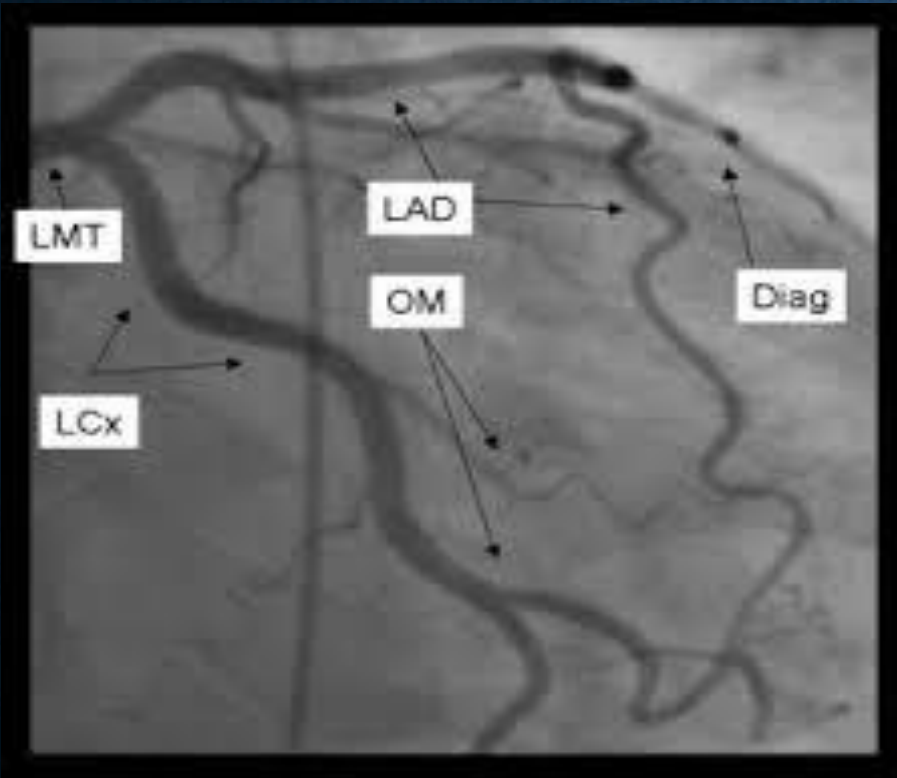
CORONARY ARTERY DISEASE

- 90% of Echocardiogram has been used for coronary artery disease diagnosis, treatment and management.
- Echo is the only diagnostic tool to assess the outcome of the critical care in respect of cardiovascular status of the critically ill patient.

LV FUNCTION MEASUREMENT

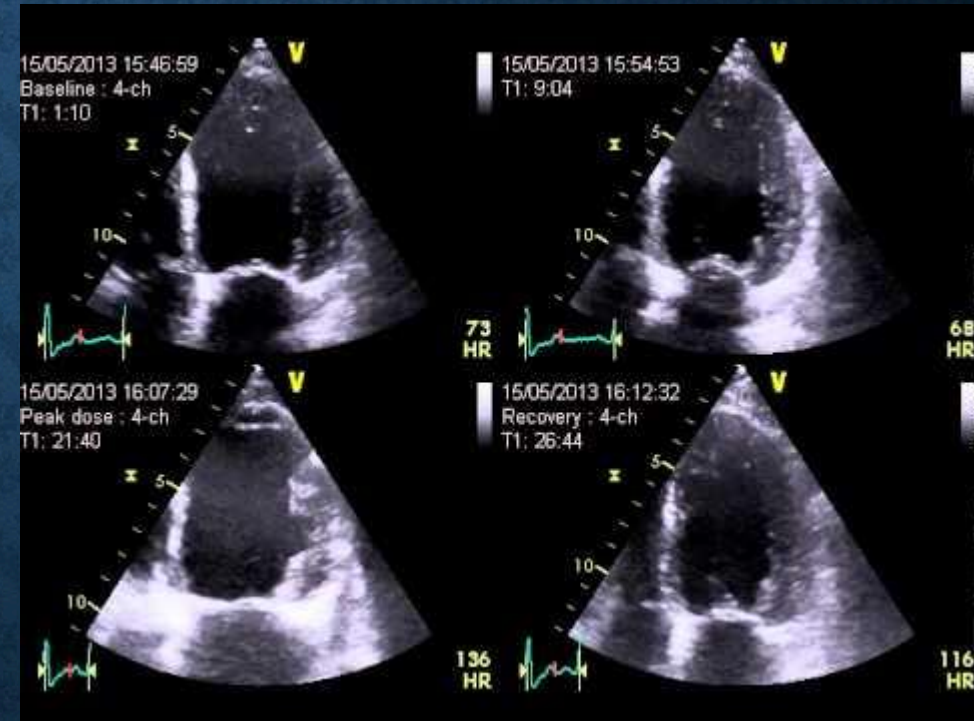
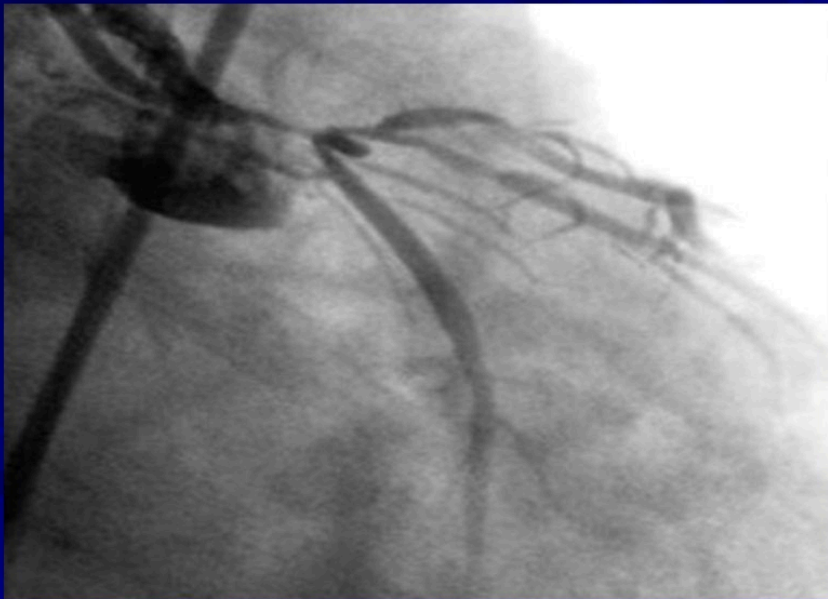


CORONARY ANATOMY

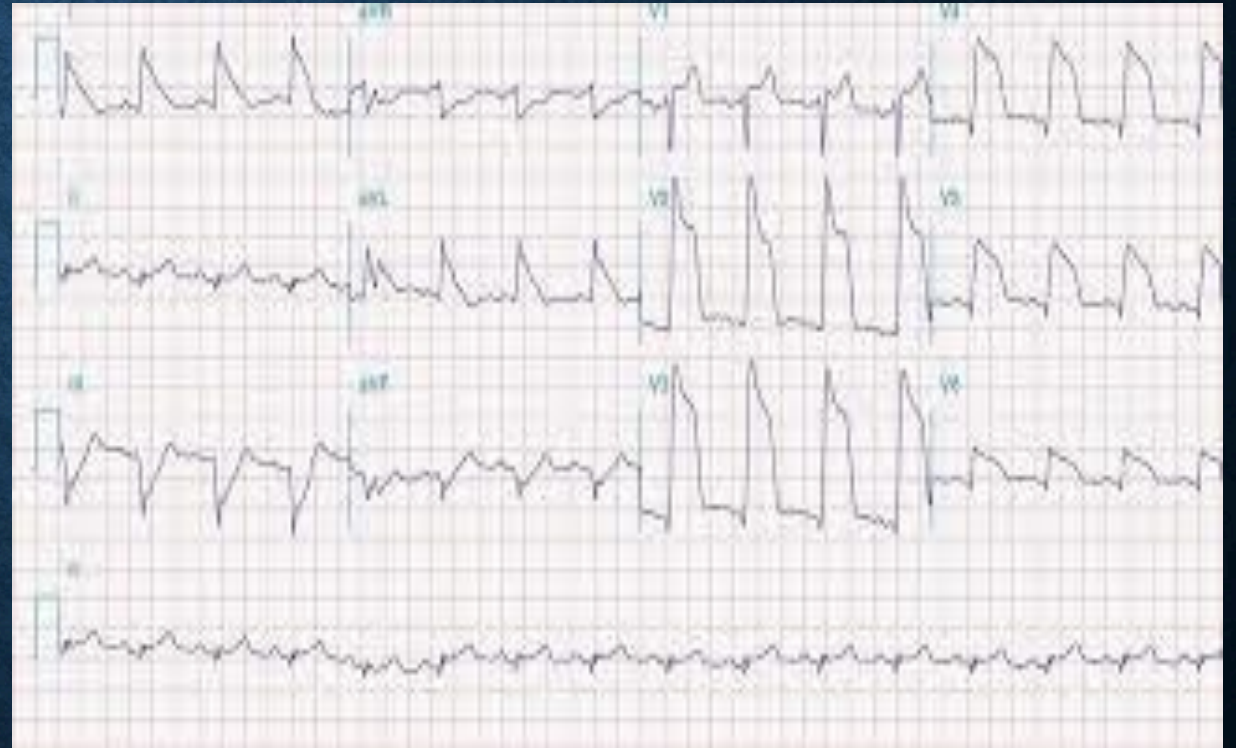


LAD TERRITORY DISEASE

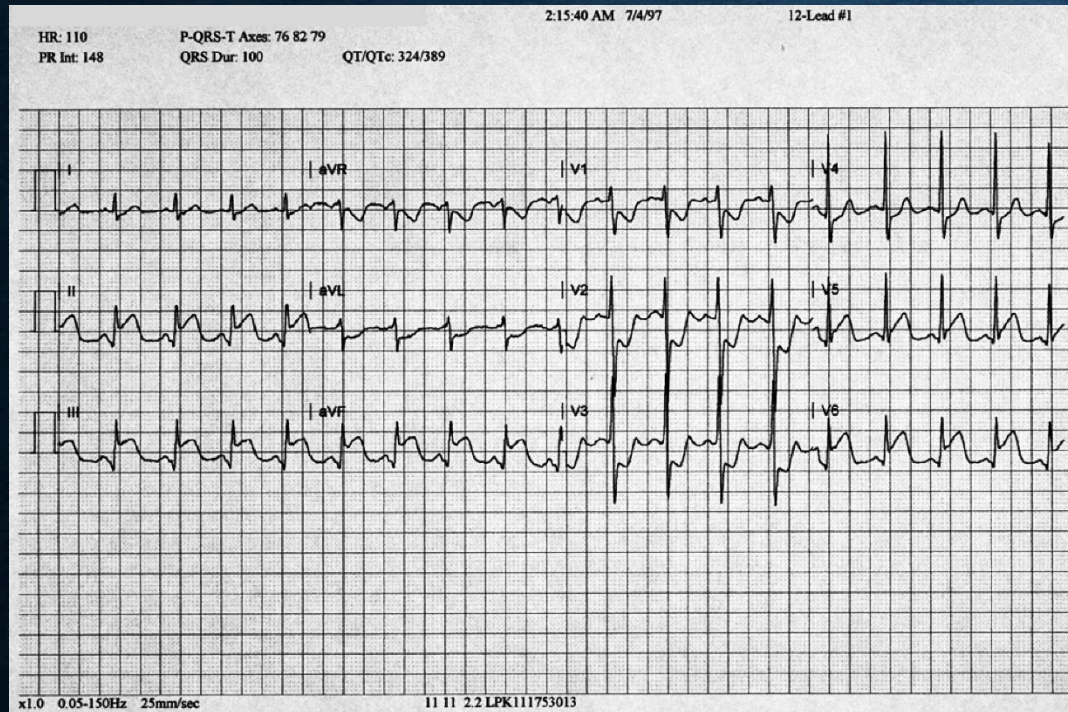
Extensive Anterior wall MI



LAD OR LM INVOLVEMENT IN EX AWTMI

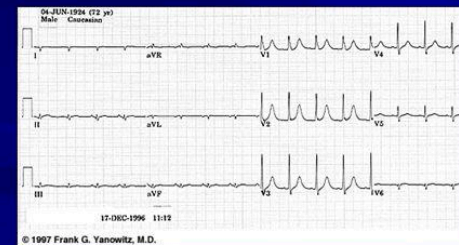


LCX TERRITORY MI



Lateral MI- Left circumflex

- ST elevation in I, aVL, V5, V6- coronary artery of OM or LCX



RCA TERRITORY MI

