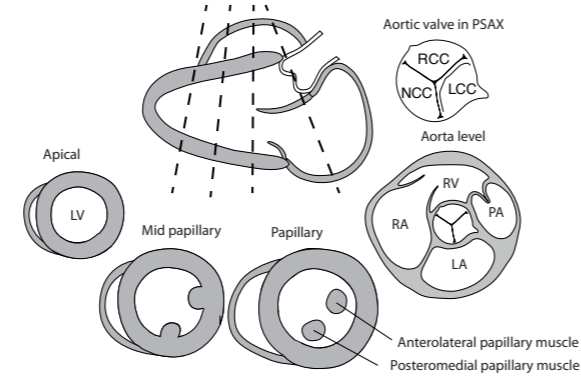
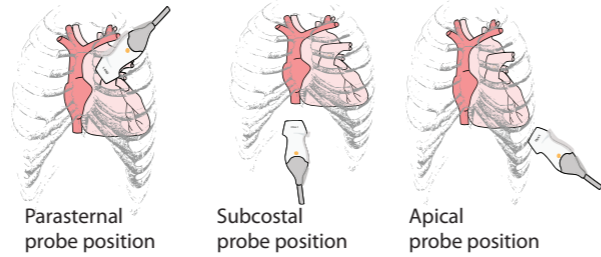
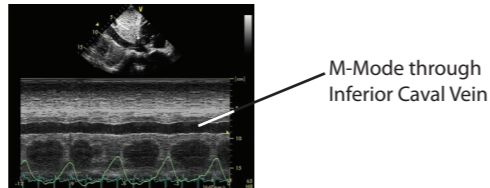


STANDARD PARASTERNAL TTE VIEWS



SUBCOSTAL VIEW



BEFORE YOU START AN ECHOCARDIOGRAPHIC EXAMINATION:

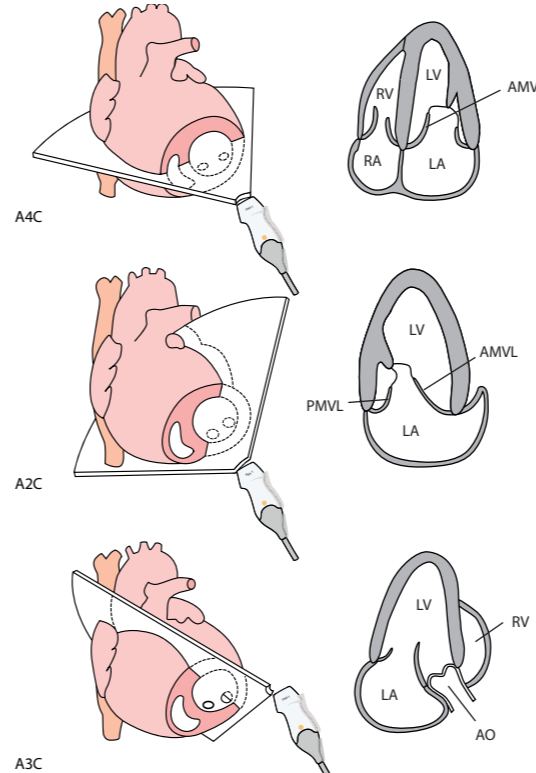
- Insert patient data.
- Check for a stable ECG recording.
- Ask the patient to turn to a left lateral position.

STANDARD EXAMINATION

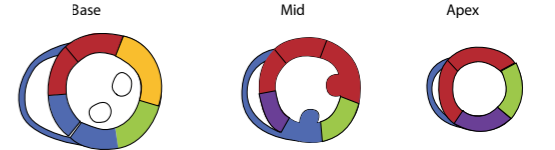
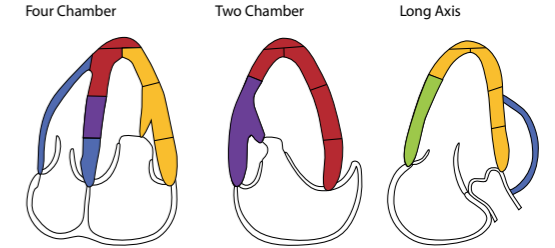
- Optimize the image using total gain, time gain compensation and depth.
- Pay attention to dynamic range and frequency.
- Set machine to record three consecutive heart cycles

1. Start with the parasternal long axis (PLAX). Record the mitral valve(MV), aortic valve(AV), septum and posterior wall. The aorta should be visible from AV to ascending aorta.
2. Record the MV and AV with color Doppler. When using color Doppler decrease the total gain. Note Nyquist limit and color gain.
3. Record MMode, perpendicular to the ventricular septum just below the tips of the MV leaflets for LV dimensions or measure 2D.
4. Rotate the probe 90° clockwise for the short axis (PSAX) and record on aortic level, then tilt the probe cranially for the MV, papillary muscles and apical levels. Record color Doppler in the pulmonic valve (PV), AV and tricuspid valve (TV).
5. Record the apical 4 chamber (A4C).
6. Tilt the probe for the 5 chamber view with the aorta(A5C).
7. Rotate the probe counterclockwise to the 2 chamber view (A2C).
8. Rotate the probe counterclockwise to the 3 chamber view (A3C) (same structures visible as PLAX).
9. Record color Doppler in the MV and AV in the A3C, the MV in the A2C and the MV, AV, TV in A4C and A5C.
10. Record a pulsed wave (PW) doppler just at the tips of the MV leaflets for E/A ratio and record an PW tissue velocity imaging signal(TVI) of the interventricular septum.
11. Record a continuous wave (CW) in the AV and PW in LVOT.
12. Record a tricuspid annular plane systolic excursion (TAPSE) for right ventricular function.
13. Record a subcostal view and the Inferior Caval Vein asking the patient to sniff.
14. Record a supraxiphoidal view for the ascending aorta, arch and descending aorta.

STANDARD APICAL TTE VIEWS



ASSESSMENT OF SYSTOLIC FUNCTION



- Scoring:
- 0: Not visualized
 - 1: Normokinesia
 - 2: Hypokinesia
 - 3: Akinesia
 - 4: Dyskinesia
 - 5: Aneurysmatic



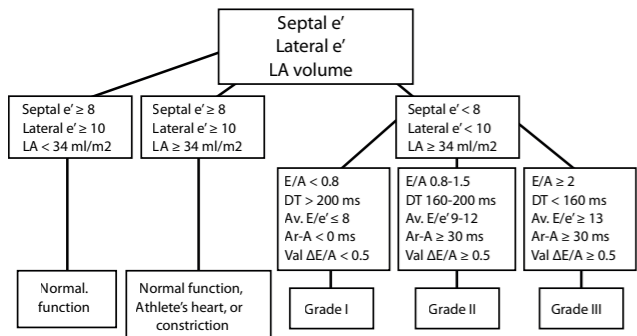
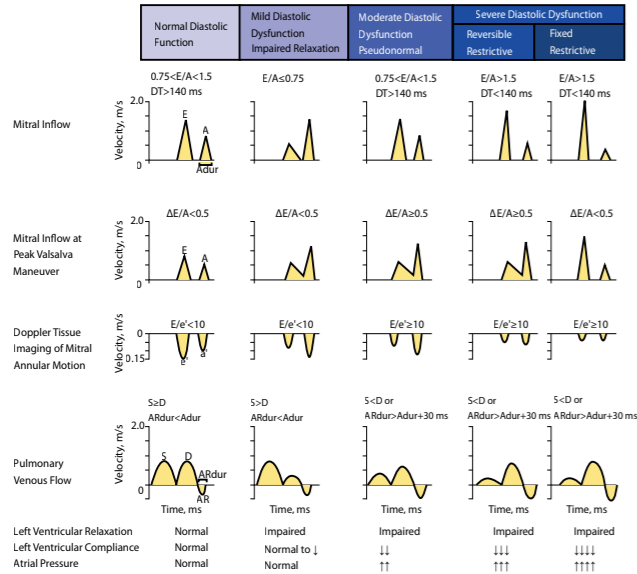
1. basal anterior 7. mid anterior 13. apical anterior
 2. basal anteroseptal 8. mid anteroseptal 14. apical septal
 3. basal inferoseptal 9. mid inferoseptal 15. apical inferior
 4. basal inferior 10. mid inferior 16. apical lateral
 5. basal inferolateral 11. mid inferolateral 17. apex
 6. basal anterolateral 12. mid anterolateral

Coronary Territory

LAD: Segments 1, 7, 8, 9, 13, 14, 15, 16, 17
 RCA: Segments 5, 6, 11, 12
 RCA: Segments 2, 3, 4, 10

■ LAD ■ RCA or CX
■ RCA ■ LAD or CX
■ RCA or LAD

ASSESSMENT OF DIASTOLIC FUNCTION



LEFT VENTRICULAR FUNCTION

LV function	Normal	Mild	Moderate	Severe
Ejection Fraction(%)	>54	45-54	30-44	<30
Fractional Shortening				
Endocardial(%)	25-45	20-26	15-21	≤14
Midwall(%)	12-23	12-14	10-12	≤10

RIGHT VENTRICULAR FUNCTION

RV function	Normal	Mild	Moderate	Severe
RV diastolic area, cm ²	11-28	29-32	33-37	≥38
RV systolic area, cm ²	7.5-16	17-19	20-22	≥23
fractional area change	32-60	25-31	18-24	≤17
TAPSE (cm)	1.5-2.0	1.3-1.5	1.0-1.2	<1.0

AORTIC VALVE STENOSIS SEVERITY

	Sclerosis	Mild	Moderate	Severe
Aortic jet velocity(m/s)	≤2.5	2.6-2.9	3.0-4.0	>4
Mean gradient (mmHg)	-	>20	20-40	>40
AVA(cm ²)	-	>1.5	1.0-1.5	<1
AVI=AVA/BSA(cm ² /m ²)	-	>0.85	0.6-0.85	<0.6

AORTIC VALVE REGURGITATION SEVERITY

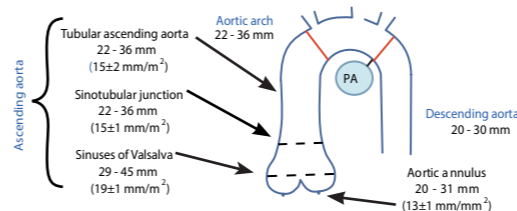
	Mild	Moderate	Severe
Specific	Central Jet, width>25% LVOT ² Vena contracta <0.3 cm ² No/brief early diastolic flow reversal in descending aorta	Signs of AR>mild present but no criteria for severe AR	Central Jet, width ≥ 65% of LVOT ² Vena contracta > 0.6cm ²
Supportive	Pressure half time > 500 ms Normal LV size ¹	Intermediate values	Pressure half-time < 200 ms Holodiastolic aortic flow reversal in descending aorta Moderate or greater LV enlargement ³
Quantitative⁵	EROA ⁵ <0.10 RF (%) <30 R vol (ml/beat) <30	0.10-0.19 30-39/40-49 30-44/45-59	≥0.30 ≥50 ≥60

MITRAL VALVE REGURGITATION SEVERITY

	Mild	Moderate	Severe
Specific	Small central jet <4 cm ² or <20% of LA area ² Vena contracta width <0.3 cm No or minimal flow convergence	Signs of MR>mild present but no criteria for severe MR	V. contracta ≥ 0.7cm, central MR jet(area < 40% of LA) or with a wall-impinging jet, swirling in LA ² . Large flow convergence ⁵ Syst. pulm. vein reversal
Supportive	Systolic dominant flow in pulmonary veins A-wave dominant mitral inflow ⁴ Soft density, parabolic CW Doppler MR signal Normal LV size ¹	Intermediate signs/findings	Dense, triangular CW Doppler MR jet E-wave dominant mitral inflow (E > 1.2m/s) ⁴ . Dilated LV/LA ³ .
Quantitative⁵	EROA(cm ²) <0.20 RF (%) <30 R vol (ml) <30	0.2-0.29/0.3-0.4 30-39/40-49 30-44/45-59	≥0.40 ≥50 ≥60

MITRAL VALVE STENOSIS SEVERITY

	Mild	Moderate	Severe
Specific	>1.5	1.0-1.5	<1.0
Valve area(cm ²)			
Supportive	Mean gradient(mmHg) <5 Pulmonary artery pressure(mmHg) <30	5-10 30-50	>10 >50



MITRAL VALVE STENOSIS WILKINS SCORE

Grade	Mobility	Leaflet Thickening	Calcification	Subvalvular thickening
1	Mobile valve, only leaflet tip restricted	4-5 mm	Single aea	minimal
2	Leaflet mid and basal normal	5-8 mm, midleaflet normal	Scattered areas	Extending 1/3 of chordal length
3	Valve continues to move forward in diastole, mainly from the base	5-8 mm, extending through entire leaflet	Calcium extending into mid portion of leaflet	Extending to distal third of chords
4	No or minimal forward movement of the leaflets in diastole	>8-10 mm	Extensive throughout most of the leaflet	Extensive, extending to papillary muscle

REFERENCE VALUES

	Normal	Normal	Normal
Ejection Fraction(%)	>54	LVOT(cm)	1.8-2.4
LV mass/BSA(g/m ²)	43-95	RVOT(above AV)(cm)	2.5-2.9
Septal thickness(mm)	<12	TAPSE(cm)	1.5-2.0
Posterior wall thickness(mm)	0.6-1.0	LA volume/BSA(ml/m ²)	22 ±6
LV diast. vol/BSA(ml/m ²)	35-86	LA diameter/BSA(cm/m ²)	1.5-2.3
LV syst. vol/BSA(ml/m ²)	12-30	RA diameter/BSA(cm/m ²)	1.7-2.5
LVEDD(cm)	3.9-5.9	Ascending aorta diam (normal/Marfan (mm))	<50/<45
LV diast. volume/BSA(ml/m ²)	35-75		
LV syst. volume/BSA(ml/m ²)	12-30		

AVA, Aortic valve area; AR, Aortic regurgitation; EROA, effective regurgitant orifice area; LV, left ventricle; L(R)VOT, left(right) ventricular outflow tract; R Vol, regurgitant volume; RF, regurgitant fraction; LVEDD, LV end diastolic diameter; TAPSE, tricuspid annular plane systolic excursion; LA, left atrium; RA Right atrium; BSA, Body Surface Area. CW, Continuous wave.

¹LV size applied only to chronic lesions.

²At a Nyquist limit of 50-60 cm/s.

³In the absence of other etiologies of LV dilatation.

⁴Usually above 50 years of age or in conditions of impaired relaxation, without elevated LA pressure(MS).

⁵Minimal and large flow convergence defined as a flow convergence radius < 0.4 cm and ≤ 0.9 cm for central jets, respectively, with a baseline shift at a Nyquist of 40 cm/s; Cut-off for eccentric jets are higher, and should be angle corrected (see text).

⁶Quantitative parameters can help sub-classify the moderate regurgitation group into mild-to-moderate and moderate-to-severe as shown.