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Sonographer Scanning Cheat Sheet: Echo US

Procedure Overview: An echocardiogram can be used to evaluate the function of the heart chambers, valves and potential abnormalities.

Required Pre-Procedure Prep:

- Obtain patient verbal consent.
- Obtain patient history including but not limited to symptoms and previous cardiovascular surgery.
- Instruct patient to lie supine and left lateral decubitus depending on views.
- ECG Stickers Must be Used to track heart rate and monitor QRS signal

Proper Probe: Sector probe with a frequency of 2.5 - 5 MHz that has tri-duplex capabilities.

Protocol for Transthoracic Echocardiogram Complete

This protocol aligns with the Mindray I-Works protocol: Imagen Cardiac

You may “Suspend” the protocol at any time to take additional images or handle pathology, then restart I-Works. Pay careful attention to the I-works prompts to “suspend” for specific measurements, then be sure to “restart i-works” to get back into protocol.

Begin Exam with PLAX:

1. Clip: PLAX
2. Clip: PLAX Depth at 30cm
3. M-mode: Aortic Valve measure AoCusp, AoValve, and LA
4. M-mode: Mitral Valve
5. M-mode: Left Ventricle
6. “Suspend” i-works, Obtain a good PLAX window of several beats. Freeze, roll back to Diastole on the QRS signal (valve should be closed) and measure Diastolic IVS, LV, & PW. Hit measure again, and roll forward in the same heart cycle to systole (valve will be closed just before opening). Measure Systolic IVS, LV, & PW.
7. “Restart i-works” Clip: PLAX LVOT Zoom
8. LVOT zoom w/Measurement (valve will be open, measure inside to inside)
9. AoRoot Measurement (valve will be closed- measure leading edge to leading edge)
10. LA Measurement (largest diameter, in line with AoRoot, leading edge to leading edge)
11. Clip: LVOT Zoom w/Color
12. Ascending Aorta Measurement (leading edge to leading edge)
13. Clip: Mitral Valve Zoom
14. Clip: Mitral Valve Zoom w/Color
15. Clip: Tricuspid Valve
16. Clip: Tricuspid Valve w/Color
17. Tricuspid Valve CW (measure regurgitation below baseline if present)
18. Clip: Pulmonic Valve
19. Clip: Pulmonic Valve w/Color
20. Pulmonic Valve CW (measure regurgitation above baseline if present)

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PSAX Images:

21. Clip: PSAX Apex of LV
22. Clip: PSAX LV Papillary muscle
23. Clip: PSAX MV
24. Clip: PSAX MV w/Color
25. Clip: PSAX AoV
26. Clip: PSAX AoV ZOOM
27. Clip: PSAX AoV Zoom w/Color
28. Clip: PSAX Pulmonic Valve
29. Clip: PSAX Pulmonic Valve w/Color
30. RVOT PW- VTI Trace (below baseline)
31. Pulmonic Valve CW- VTI Trace (below baseline)
32. Pulmonic Valve CW (measure regurgitation above baseline if present)
33. Clip: Tricuspid Valve
34. Clip: Tricuspid Valve w/color
35. Tricuspid Valve CW (measure regurgitation below baseline if present)

Apical Images:

36. Clip: Apical 4-Ch
37. Clip: Apical 4-Ch Increased Depth
38. Clip: Apical 4-Ch with zoomed focus on LV
39. "Suspend i-works" Obtain a good 4Ch, LV window of several beats. Freeze, roll back to Diastole on the QRS signal (valve should be closed) and measure Diastolic Simpsons. Hit measure again, and roll forward in the same heart cycle to systole (valve will be closed just before opening). Measure Systolic Simpsons.
40. "Restart i-works" Measure LA Volume (Simpsons...Valve will be closed, LA at fullest capacity)
41. Clip: 4-Ch MV
42. Clip: 4-Ch MV w/Color
43. MV CW (measure regurgitation below baseline if present) (measure E/A VTI above baseline if Mitral Stenosis present)
44. MV PW, measure E, A, and Slope
45. If Severe Mitral Regurgitation is present, perform PISA
46. If Severe Mitral Regurgitation is present, 4-Ch Pulmonary Vein PW (measure S-above baseline, D-above baseline and A-below baseline)
47. If Severe Mitral Regurgitation is present, 4-Ch Pulmonary Vein (2) PW (measure S-above baseline, D-above baseline and A-below baseline)
48. Clip: 4-Ch LV Tissue Doppler
49. 4-Ch LV Tissue Doppler PW Lateral Annulus (measure E & A)
50. 4-Ch LV Tissue Doppler PW Septal Annulus (measure E & A)
51. Clip: 4-Ch RIGHT Heart (RV focus)
52. M-mode: Rt Heart Lateral Annulus TAPSE measurement
53. 4-Ch Rt Heart, measure RV and RA if enlarged
54. Clip: Tricuspid Valve w/Color
55. Tricuspid CW (measure regurgitation below baseline if present)
56. If Severe Tricuspid Regurgitation is present, perform PISA
57. Clip: 5-Ch
58. Clip: 5-Ch w/Color over LVOT

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59. LVOT PW- VTI Trace (below baseline)
60. AoValve CW-VTI Trace (below baseline)
61. AoValve CW (measure regurgitation above baseline if present)
62. Clip: 2-Ch
63. Clip: 2-Ch w/Color
64. 2-Ch Mitral Valve PW
65. 2-Ch Mitral Valve CW (measure regurgitation below baseline if present) (measure E/A VTI above baseline if Mitral Stenosis present)
66. "Suspend i-works" Obtain a good 2-Ch, LV window of several beats. Freeze, roll back to Diastole on the QRS signal (valve should be closed) and measure Diastolic Simpsons. Hit measure again, and roll forward in the same heart cycle to systole (valve will be closed just before opening). Measure Systolic Simpsons.
67. "Restart i-works" 2-Ch LA (measure volume again if enlarged)
68. Clip: 3-Ch
69. Clip: 3-Ch w/Color
70. LVOT PW VTI Trace (below baseline)
71. AoV CW VTI Trace (below baseline if AI, measure regurgitation above baseline)
72. Clip: 3-Ch MV w/Color
73. 3-Ch MV CW (measure regurgitation below baseline if present)

Subcostal Images:

74. Clip: Subcostal 4-Ch
75. Clip: Subcostal 4-Ch w/Color over Ventricular Septum
76. Clip: Subcostal 4-Ch w/Color over Atrial Septum
77. Clip: Subcostal 5-Ch
78. Clip: Subcostal 5-Ch w/Color over LVOT
79. Clip: Subcostal Short Axis
80. Clip: Subcostal Sweep Apex to Base
81. IVC w/max measurement
82. Clip: IVC w/Sniff
83. M-mode: IVC w/Sniff (measure max and min)

Suprasternal Notch Images:

84. Clip: Suprasternal Notch Aortic Arch/Descending Aorta
85. Clip: Descending Aorta w/Color
86. Descending Aorta PW (will be below baseline)
87. Descending Aorta CW (if Aortic Stenosis and aliasing, will be below baseline)

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- If walls are not adequately visualized, do not attempt measurements where you cannot clearly see.

- If Severe MR/TR, obtain PISA measurements:

Proximal Isovelocity Surface Area (PISA)

The effective regurgitant orifice and volume of mitral regurgitation are best obtained with the PISA method, which is based on the principle of conservation of flow and the continuity equation.

Steps for Quantifying:

1. Determine the best apical view of MR with color (usually apical 4)
2. Zoom up on leaflets
3. Color on
4. Decrease the color scale baseline to 30's
5. Increase color gain to sparkle, decrease to just below
6. Freeze, scroll back through, measure PISA radius (r)

The Aliasing Velocity needs to be recorded in the machine.

$$EROA = 2\pi r^2 \times \text{Alias Velocity}$$

- Suspend the I-Works protocol any time you need to demonstrate pathology or take extra clips for Cardiologist to have better visualization of any area you are concerned about.

Imagen Echo Pathology GUIDE:



Quick Guide, Need to Know ECHO Measurements

	Normal	Mild	Moderate	Severe
Left Atrium	<4cm <34 ml/m ²	4 – 5cm	5 – 6cm	>6cm
	● if the volume measurement is over 34ml in 4ch measure volume in 2ch			
IVS & PW	<11mm			
EF	55 – 70%	41 – 50%	30 – 40%	<30%

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Velocity	Peak Gradient (mmHg)	Mean Gradient (mmHg)
Aortic Valve	<2.5m/s	<10
• 20mmHg is a significant gradient • Normal AVA = 2.5 – 3.5cm² • Severe AVA = <1cm²	>64	
Mitral Valve	4.0 – 6.0cm²	1 -6 – 2.0cm²
PHT Valves	30 -60ms	90 – 150ms
		150 – 219ms
		>220ms

$$\text{PHT} = \text{DT} \times 0.29$$

$$\text{MVA} = 220/\text{PHT}$$

Diastolic Dysfunction

1. TR velocity >2.8m/s
2. LA volume >34ml
3. TDI septal e' <7cm/s or lateral e' <10cm/s
4. Average E/e' >14

<2 of above findings = Normal diastolic function

2 of above findings = Indeterminate diastolic function

3+ of above findings = Positive for diastolic dysfunction

Mitral Regurgitation

MITRAL VALVE

Severity of Mitral Regurgitation (MR) – ASE Guidelines

	MILD	MODERATE	SEVERE
Jet Area	<4cm ² or <20%LA _{AREA}	20 - 40% LA _{AREA}	>40% LA _{AREA}
Vena contracta width*	<0.3cm	0.3 - 0.7cm	>0.7cm
Regurgitant Volume	<30mL	30 - 59mL	>60mL
Regurgitant fraction	<30%	30 - 49%	>50%
Regurgitant orifice area	<0.2cm ²	0.2 - 0.39cm ²	>0.4cm ²

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Calculating Pulmonary Hypertension:

$$RVSP = 4V^2 + RAP$$

*V= peak TR & RAP = right atrial pressure

IVC

- <2.1cm with > 50% collapse = 3mmHg
- <2.1cm with < 50%collapse = 8mmHg
- >2.1cm with > 50% collapse = 8mmHg
- >2.1cm with < 50% collapse = 15mmHg

Pulmonary Hypertension Severity Values

Severity	RVSP(mmHg)
Normal	18 - 30
Mild	35 - 50
Moderate	50 - 75
Severe	> 75