

Echo in Action

A Hands-On Guide to Echocardiographic Imaging and Interpretation

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Learning Objectives

- 1 Identify and interpret key echocardiographic findings in common disease states such as heart failure, valvular diseases, and myocardial infarction
- 2 Identify proper technique for obtaining high-quality echocardiographic images
- 3 Discuss application of echo results in clinical decision-making to guide patient care

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What is Echocardiography?

Definition Ultrasound imaging of the heart that uses high-frequency sound waves to create real-time images of cardiac structures and function. Non-invasive, radiation-free, and portable bedside capability.	Key Applications <ul style="list-style-type: none">• Assess chamber size and function• Evaluate valve structure and function• Detect wall motion abnormalities• Measure ejection fraction• Identify pericardial effusion• Assess hemodynamics
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Echo is cornerstone of cardiovascular diagnostics.

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Echocardiography Modalities

Transthoracic Echo (TTE)

Most common approach. Transducer placed on chest wall. Non-invasive, first-line diagnostic tool.

Transesophageal Echo (TEE)

Probe inserted into esophagus. Superior image quality for posterior structures, valves, and LA appendage.

Stress Echocardiography

Assesses cardiac function during physical or pharmacologic stress. Detects coronary artery disease and viability.

3D Echocardiography

Provides volumetric data for accurate chamber quantification and complex valve assessment.

⚠ Contrast Echo: Uses microbubbles to enhance endocardial border definition and assess myocardial perfusion

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Standard Echocardiographic Views

Parasternal Long Axis (PLAX)

Window: Left sternal border, 3rd-4th intercostal space
Visualizes: LV, LA, aortic root, mitral valve, IVS, posterior wall

Parasternal Short Axis (PSAX)

Window: Same as PLAX, rotated 90°
Visualizes: Cross-sectional LV, RV, aortic valve, papillary muscles

Apical Four-Chamber (A4C)

Window: Cardiac apex, midclavicular line
Visualizes: All 4 chambers, mitral & tricuspid valves, IAS, IVS

Apical Two-Chamber (A2C)

Window: Apex, rotated from A4C
Visualizes: LV, LA, mitral valve, anterior & inferior walls

Subcostal View

Window: Below xiphoid process
Visualizes: All 4 chambers, IVC, pericardial space. Ideal for effusions

Suprasternal View

Window: Suprasternal notch
Visualizes: Aortic arch, descending aorta, PA, SVC

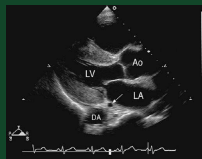
Multiple views are essential for comprehensive cardiac assessment and diagnostic accuracy.

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Parasternal Long-Axis views

Probe Placement:

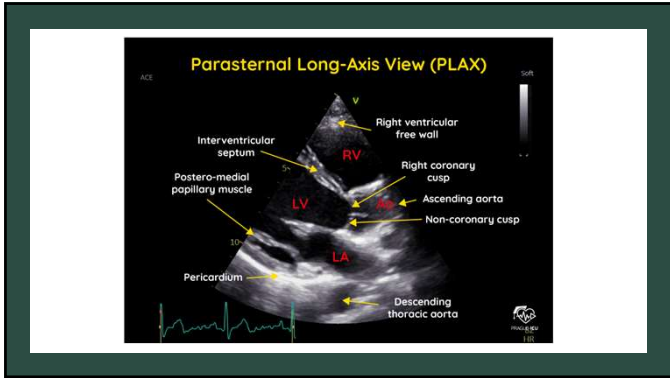
- Typically positioned in the 3rd and 5th intercostal spaces along the left side of the sternum.
- Optimal interspace varies based on patient anatomy, requiring adjustments for body habitus or thoracic conditions.



Alignment and Orientation:

- Plane is aligned parallel to the left ventricle's long axis but requires counterclockwise rotation to align with the aortic root's long axis.
- Slight medial-to-lateral angulation improves visualization of aortic valve components (leaflets, annulus, sinuses).

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Parasternal Short -Axis views

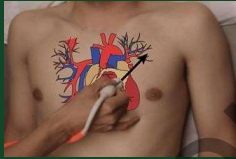
Probe Position and Orientation:

- From the parasternal long-axis view, rotate the transducer **clockwise** by
- approximately 90 degrees** to obtain the short-axis view.

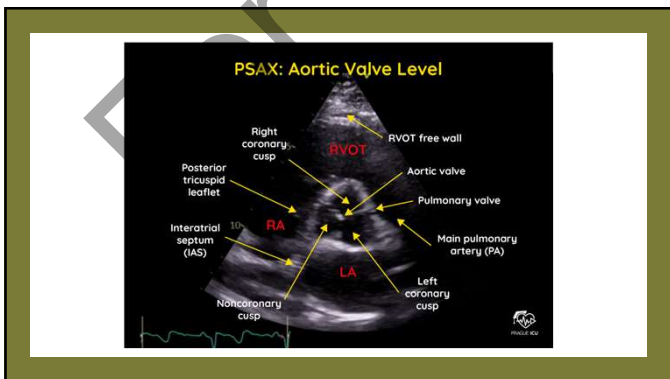
Patient orientation:
Lateral wall is on the observer's right, and the medial wall is on the left.

Intercostal Spaces:

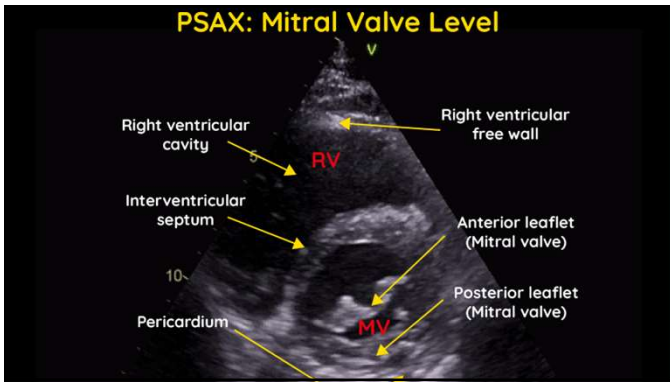
- Transducer is typically moved between the **2nd and 4th intercostal spaces** for optimal imaging of various short-axis planes.



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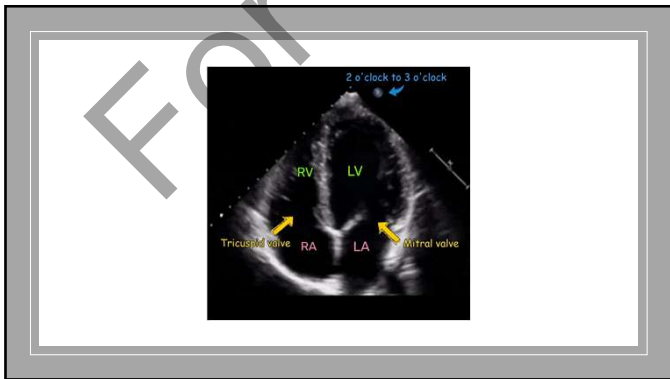
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Apical views

Probe Position and Orientation:

- Place the transducer at the **cardiac apex** with the patient in the **left lateral decubitus position**.
- Rotate and tilt the transducer to achieve optimal views of the heart.

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Subcostal view

Inferior Vena Cava & Hepatic Veins:

- Direct visualization of the IVC and hepatic veins.
- Hepatic vein flow assessed using pulsed Doppler, useful for evaluating right heart function and cirrhosis.

Doppler Applications:

- Facilitates quantitative Doppler analysis of the right ventricular outflow tract and pulmonary artery.
- Hepatic vein flow provides insights into right heart function and venous return.

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Proper Technique for High-Quality Images

<p>Patient Preparation</p> <ul style="list-style-type: none"> • Position left lateral decubitus • Quiet respiration or breath-hold • Remove chest clothing • Explain procedure 	<p>Image Optimization</p> <ul style="list-style-type: none"> • Depth: Include structure with minimal extra space • Gain: Balance brightness, avoid saturation • Focus: Position at depth of interest • Sector width: Narrow improves frame rate • 2D: See all cardiac borders clearly • Artifacts: Avoid reverberation, shadowing
<p>Transducer Selection</p> <ul style="list-style-type: none"> • Adults: 2-4 MHz phased array • Pediatrics: 5-7 MHz 	

Poor image quality can lead to misdiagnosis.

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POINT-OF-CARE CARDIAC ULTRASOUND(POCUS): Indications for Echocardiography by Nurses and Midwives

- Identifying pericardial effusion or cardiac tamponade.
- Assessing global cardiac function (ejection fraction).
- Evaluating for right heart strain in pulmonary embolism.
- Identifying gross valvular abnormalities.

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Cardiac POCUS Interpretation Basics:

Assessing Heart Function:

- Left ventricular size and function (e.g., global hypokinesis).
- Presence of pericardial effusion.
- Right ventricular enlargement or dysfunction (e.g., pulmonary embolism).

Valvular Function:

- Basic assessment of valve opening and closing.

Volume Status and Fluid Assessment:

- Collapsibility of the inferior vena cava (IVC) as an indicator of fluid status.

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Key Normal Measurements

IVC Diameter 1.5 to 2.5cm Key Points: Plethoric	LV Ejection Fraction 55-70% Normal systolic function
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Key Terminology and Definitions

- **Collapsibility Index**
 - How much IVC narrows with inspiration
- **Plethora/Plethoric**
 - Dilated IVC that does not collapse during inspiration
- **Respiratory Variation**
 - Change in IVC diameter through breathing cycle
- **Inspiratory Collapse**
 - Narrowing of the vessel diameter during inspiration

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Heart Failure: Echocardiographic Findings

HFrEF (Reduced EF)

Definition: EF <40%

Key Findings:

- Dilated LV chamber
- Global hypokinesis
- Decreased wall thickening
- Reduced fractional shortening
- Mitral regurgitation (functional)
- Elevated filling pressures

Clinical Correlation: Often ischemic or dilated cardiomyopathy

HFpEF (Preserved EF)

Definition: EF ≥50%

Key Findings:

- Normal or small LV cavity
- Normal systolic function
- LV hypertrophy (common)
- Diastolic dysfunction
- LA enlargement
- Elevated E/e' ratio (>14)

Clinical Correlation: Hypertension, aging, diabetes

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Valvular Disease Assessment

Aortic Stenosis

- Thickened, calcified leaflets
- Restricted opening
- LV hypertrophy

Severity: Mild >1.5 | Mod 1.0-1.5 | Severe <1.0 cm²

Mitral Regurgitation

- Color Doppler jet into LA
- LA and LV enlargement
- Leaflet prolapse or flail

Severity: Mild <20 | Mod 20-40 | Severe ≥40 mm²

Mitral Stenosis

- Thickened, domed leaflets
- Restricted mobility
- LA enlargement

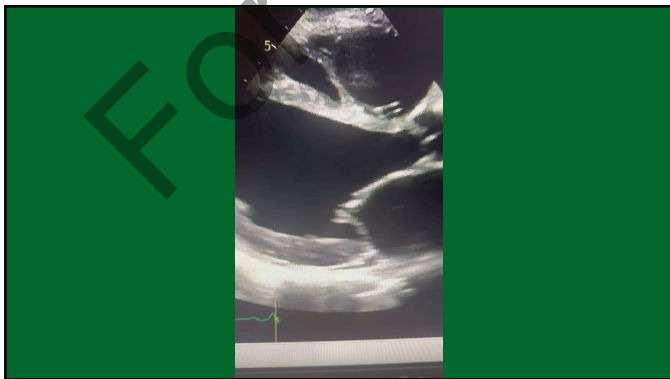
Severity: Mild >1.5 | Mod 1.0-1.5 | Severe <1.0 cm²

Aortic Regurgitation

- Regurgitant jet into LV
- Diastolic flow reversal
- LV dilatation (chronic)

Vena Contracts: Mild <3 | Mod 3-6 | Severe >6 mm

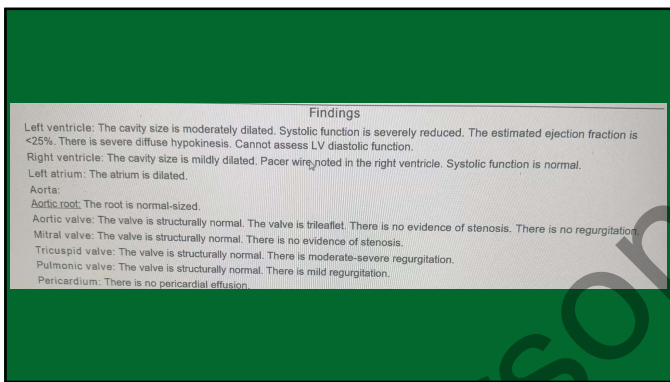
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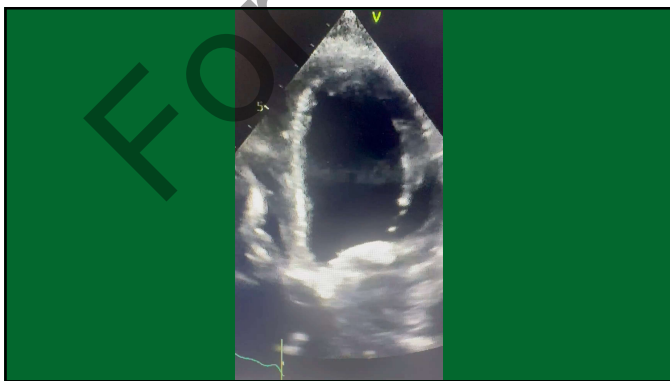
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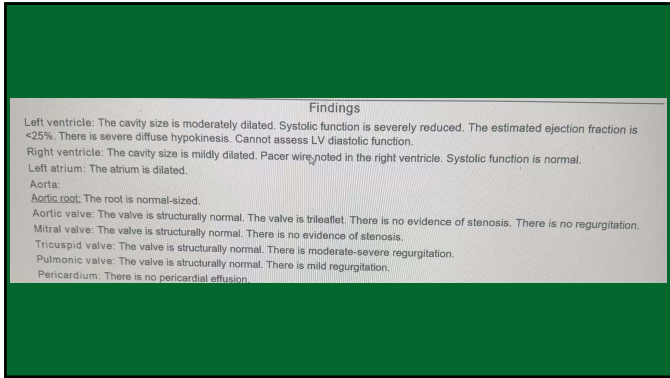
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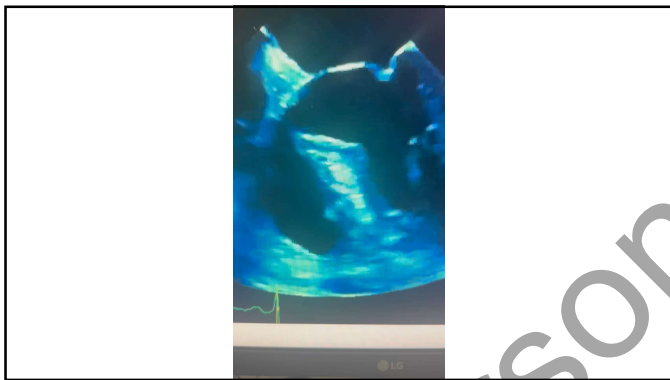
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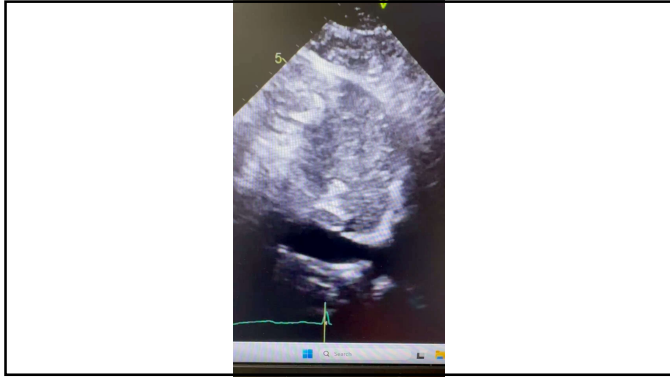
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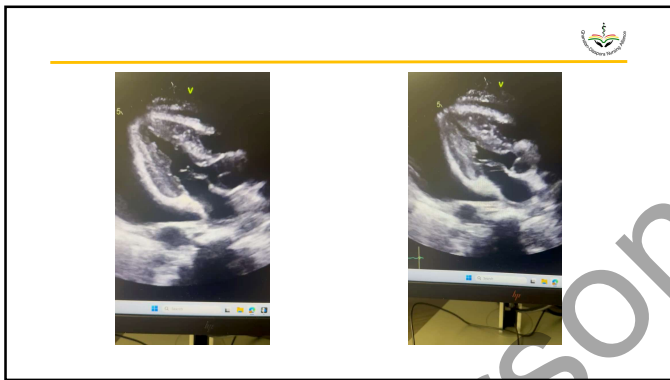
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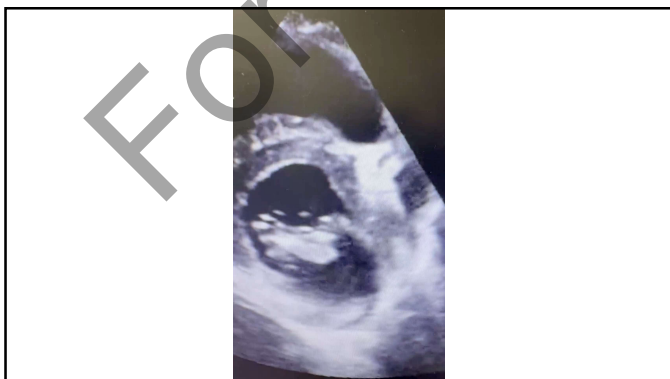
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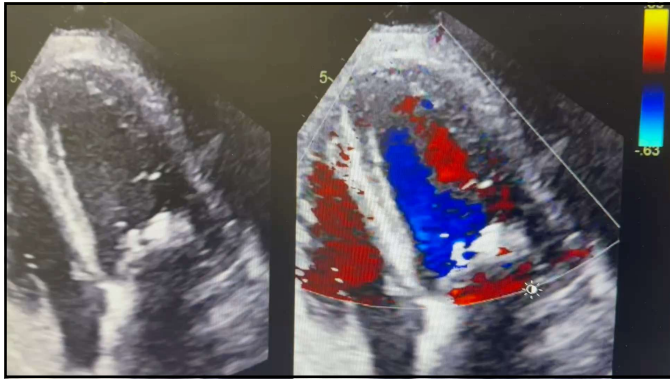


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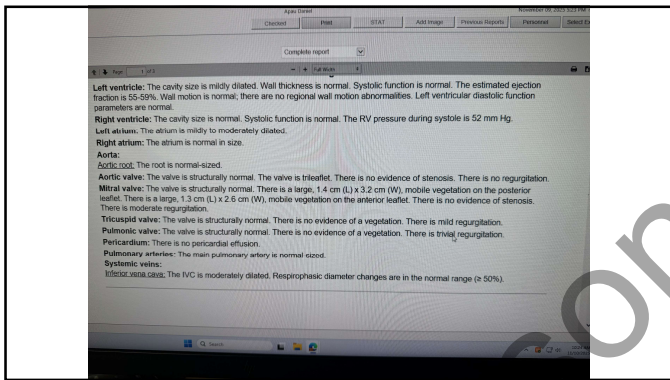


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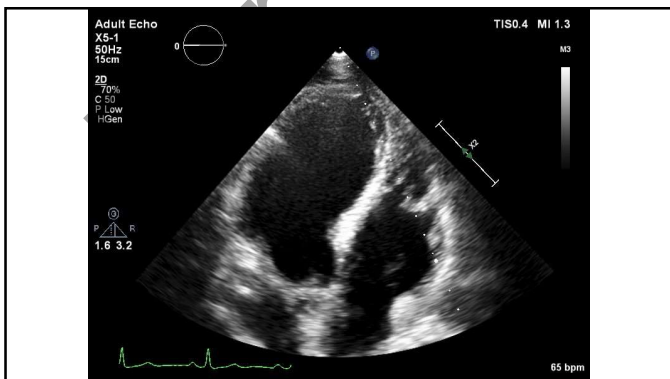
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 - of fluid status.

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Questions?

Thank you for your dedication to advancing cardiovascular nursing care through echocardiographic expertise.

Echo in Action: Empowering Nurses to Deliver Evidence-Based Cardiac Care

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