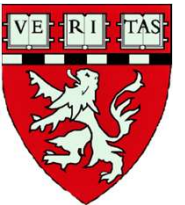


# Introduction to Point-of-care Ultrasound

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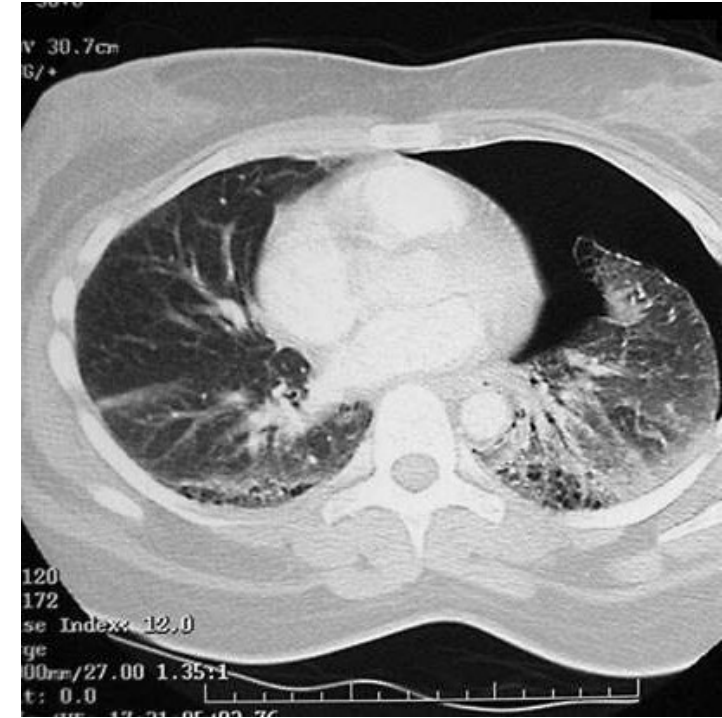


# Disclosures

- Consulting: Novartis, ScPharmaceuticals
- Research Grants: NIH



**Ultrasound  
Enthusiast**



# Overview

1. Introduction to POC ultrasound
2. Point-of-care echocardiography
3. Lung ultrasound



# Introduction to Point-of-care Ultrasound

# Terminology

- Point-of-care ultrasonography
- Bedside ultrasound
- Emergency ultrasound
- Clinician performed ultrasound
  
- Handheld ultrasound
- Pocket ultrasound
  
- Focused cardiac ultrasound
- Focused echocardiography



# POC ultrasound: What is it?

CURRENT CONCEPTS

## Point-of-Care Ultrasonography

Christopher L. Moore, M.D., and Joshua A. Copel, M.D.

*The NEW ENGLAND JOURNAL of MEDICINE*

Ultrasonography:

- brought to the patient
- performed & interpreted by provider in real time
- focused clinical questions

Moore C. NEJM 2011

# In good company...

**Table 1. Selected Applications of Point-of-Care Ultrasonography, According to Medical Specialty.\***

Specialty	Ultrasound Applications
Anesthesia	Guidance for vascular access, regional anesthesia, intraoperative monitoring of fluid status and cardiac function
Cardiology	Echocardiography, intracardiac assessment
Critical care medicine	Procedural guidance, pulmonary assessment, focused echocardiography
Dermatology	Assessment of skin lesions and tumors
Emergency medicine	FAST, focused emergency assessment, procedural guidance
Endocrinology and endocrine surgery	Assessment of thyroid and parathyroid, procedural guidance
General surgery	Ultrasonography of the breast, procedural guidance, intraoperative assessment
Gynecology	Assessment of cervix, uterus, and adnexa; procedural guidance
Obstetrics and maternal-fetal medicine	Assessment of pregnancy, detection of fetal abnormalities, procedural guidance
Neonatology	Cranial and pulmonary assessments
Nephrology	Vascular access for dialysis
Neurology	Transcranial Doppler, peripheral-nerve evaluation
Ophthalmology	Corneal and retinal assessment
Orthopedic surgery	Musculoskeletal applications
Otolaryngology	Assessment of thyroid, parathyroid, and neck masses; procedural guidance
Pediatrics	Assessment of bladder, procedural guidance
Pulmonary medicine	Transthoracic pulmonary assessment, endobronchial assessment, procedural guidance
Radiology and interventional radiology	Ultrasonography taken to the patient with interpretation at the bedside, procedural guidance
Rheumatology	Monitoring of synovitis, procedural guidance
Trauma surgery	FAST, procedural guidance
Urology	Renal, bladder, and prostate assessment; procedural guidance
Vascular surgery	Carotid, arterial, and venous assessment; procedural assessment

# Why use POC ultrasound?

Life saving

Improved diagnostic accuracy



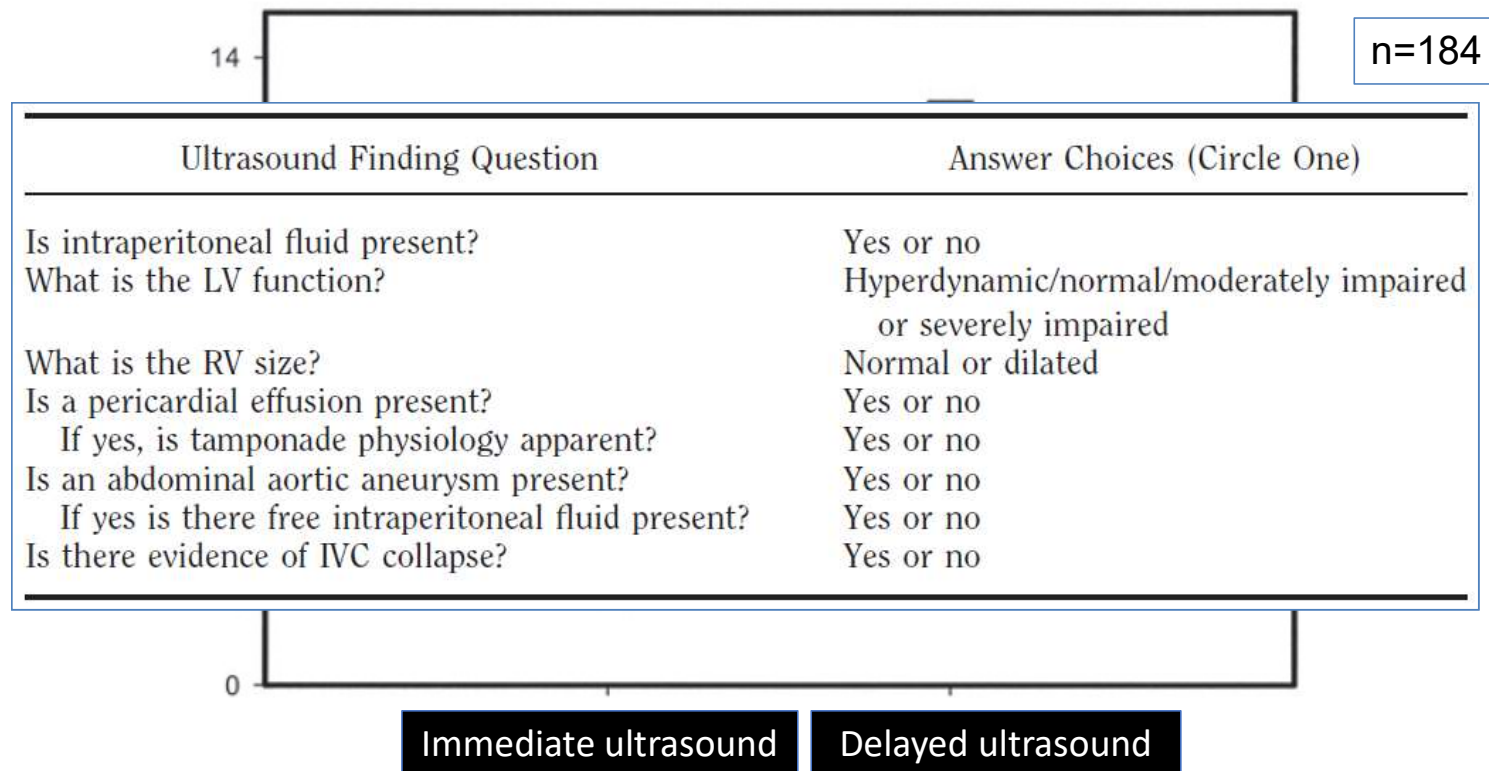
Time saving

Expedited care



Goal: Better clinical outcomes

# More rapid diagnosis in hypotensive, non-trauma ED patients



# Quality aspects

- Training
- Documentation:
  - Images
  - Report
- Continuous quality improvement

ACEP Policy Statement.  
Emergency Ultrasound Guidelines 2016



# POC ultrasound training

Medical students	Residents & Fellows	Midlevel Providers	Faculty
<ul style="list-style-type: none"><li>• Anatomy</li><li>• Physical exam course</li><li>• ED ultrasound elective</li></ul>	<ul style="list-style-type: none"><li>• Ultrasound rotation (1 month)</li><li>• ED rotations</li><li>• Ultrasound fellowship (1-2 years)</li></ul>	<ul style="list-style-type: none"><li>• Ultrasound course</li><li>• Hands-on training in ED</li></ul>	<ul style="list-style-type: none"><li>• Residency</li><li>• Fellowship</li><li>• Ultrasound course</li><li>• Hands-on training in ED</li><li>• CME</li></ul>





# General Principles of POC Echocardiography



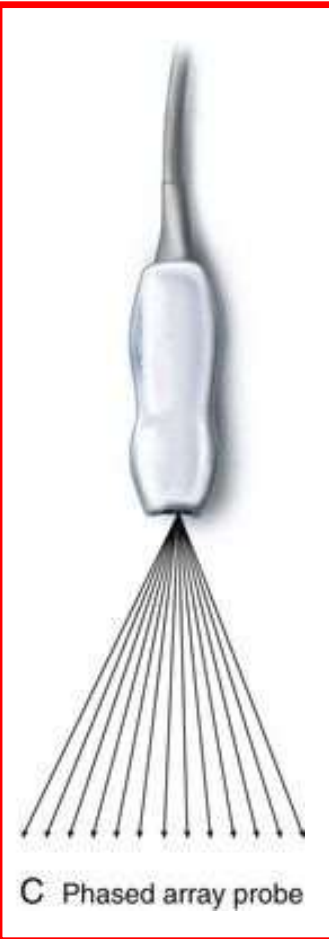
# Which transducer?



A Linear array probe

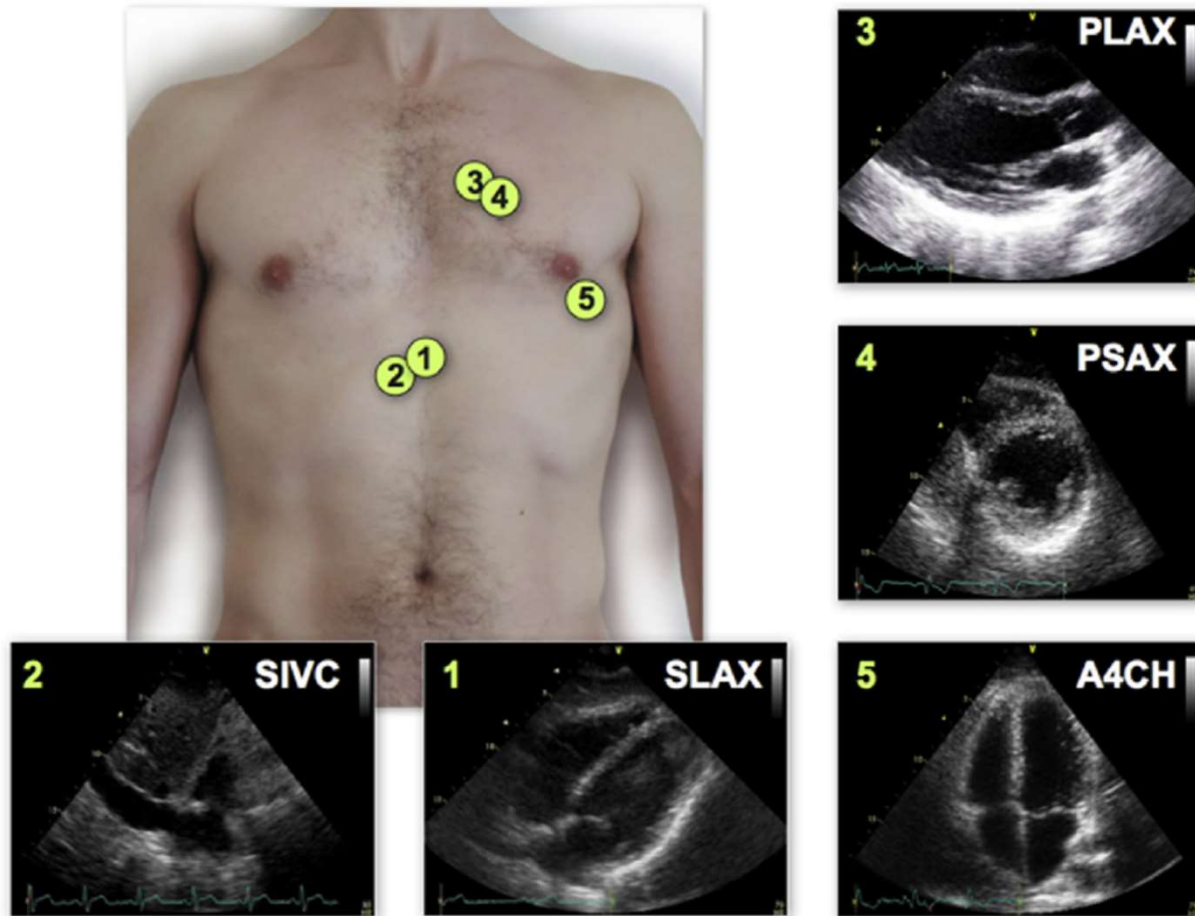


B Curved array probe



C Phased array probe

# Point-of-care echocardiography: Views



Via et al. JASE 2014

# Indications for POC echo

## Scenarios

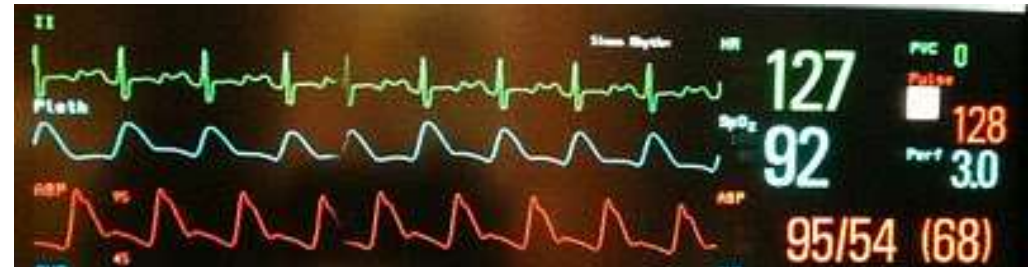
- Chest trauma
- Cardiac arrest (PEA)

## Symptoms

- Syncope
- Shortness of breath
- Chest pain

## Signs

- Hypotension/shock
- Hypoxia



Adapted from: Via et al. JASE 2014

# Point-of-care echo consensus statements

	<b>ASE/ACEP (2010)</b>	<b>ILC-Focus (2014)</b>	<b>ESC HFA/EuSEM/ SAEM: AHF in ED (2015)</b>
Pericardial effusion	+	+	-
LV systolic function/ dilation	+	+	-
RV systolic function/ dilation	+	+	-
<i>Gross</i> signs of chronic HD /valvular abnormalities/ intra-cardiac masses	-	+(Level C)	-
IVC	+	+	+
Lung ultrasound (B-lines)			+
Comment	Recommended for procedural guidance	Referral for comprehensive echo if concerning findings	Immediate echo only if unstable

# Focused Echo: What to look for?

## 4 E'S

**Effusion**

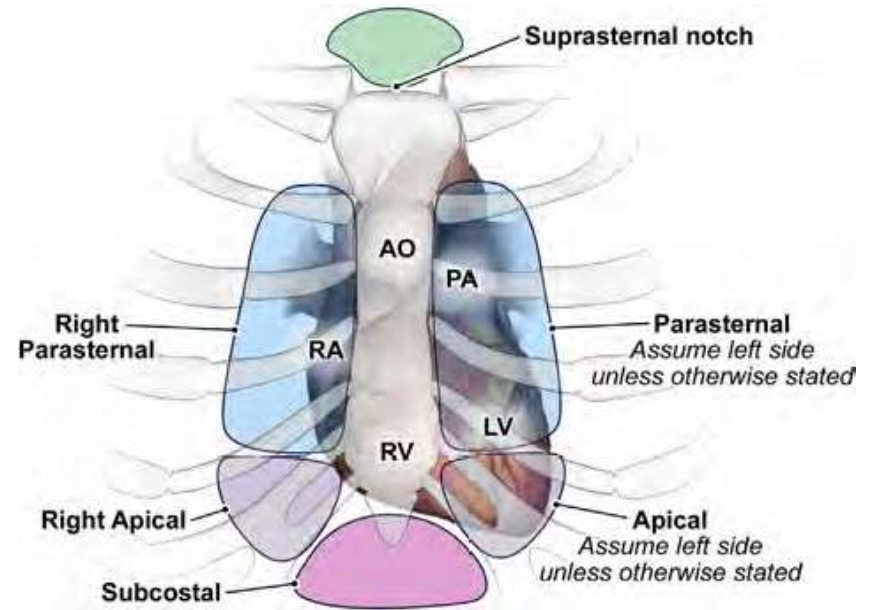
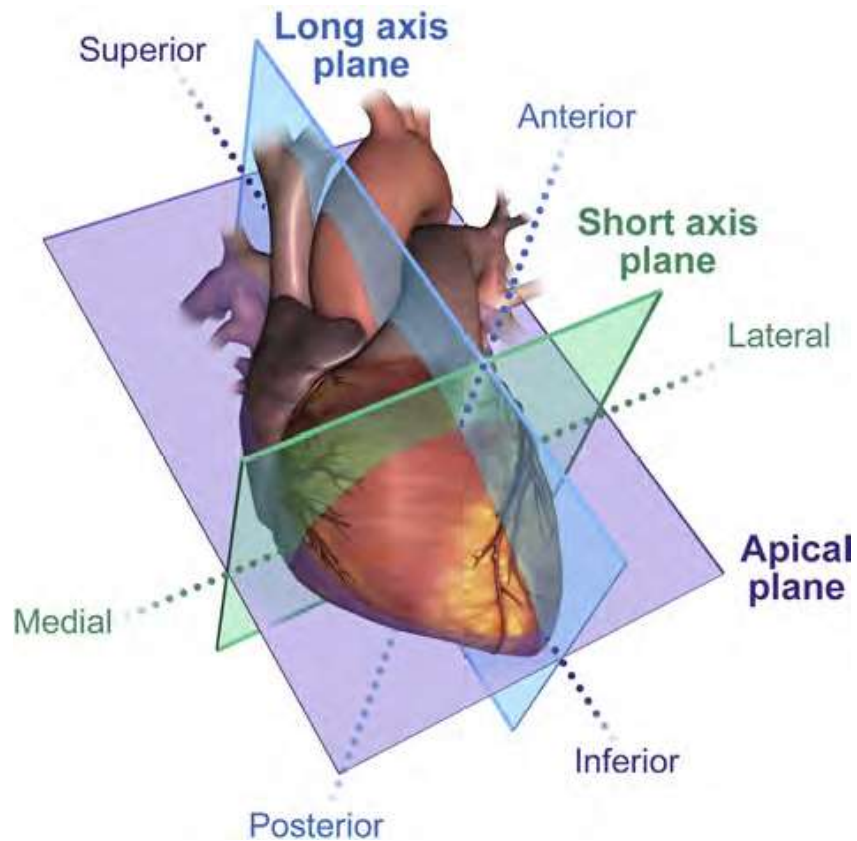
**EF**

**Entrance**

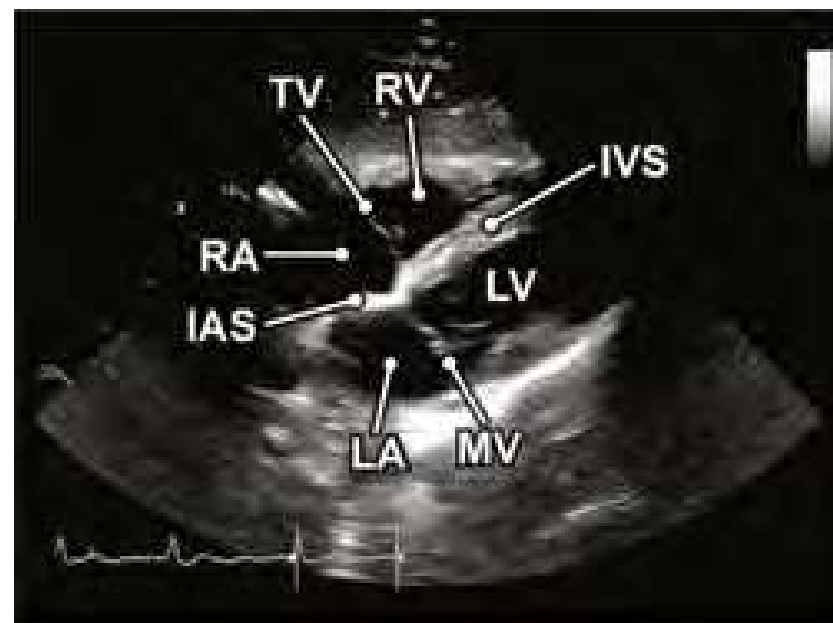
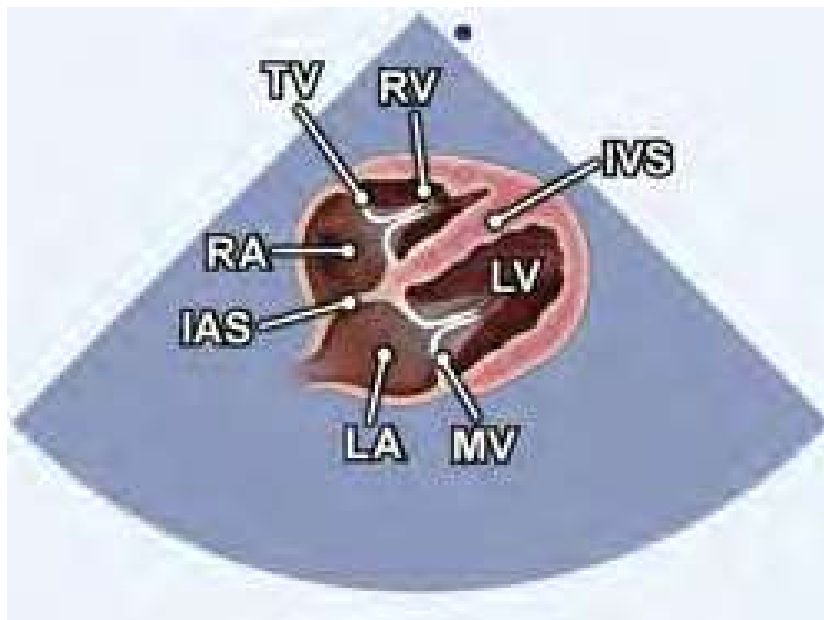
**Equality**



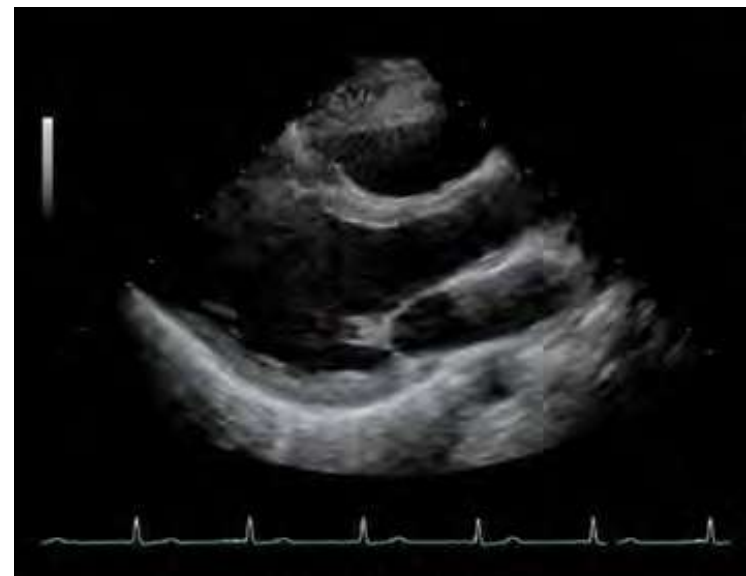
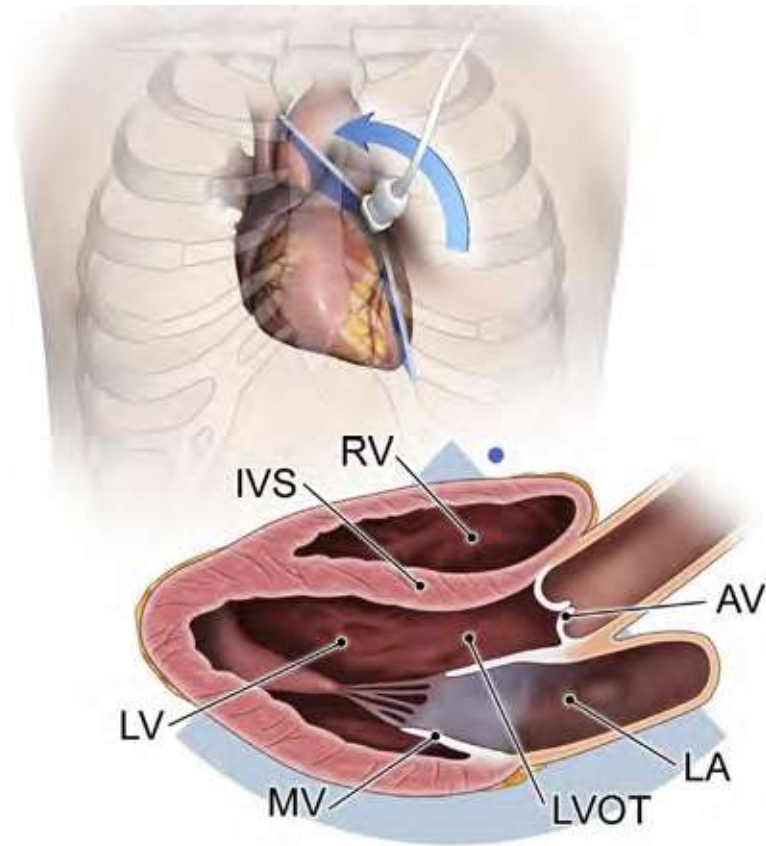
# Echo imaging planes



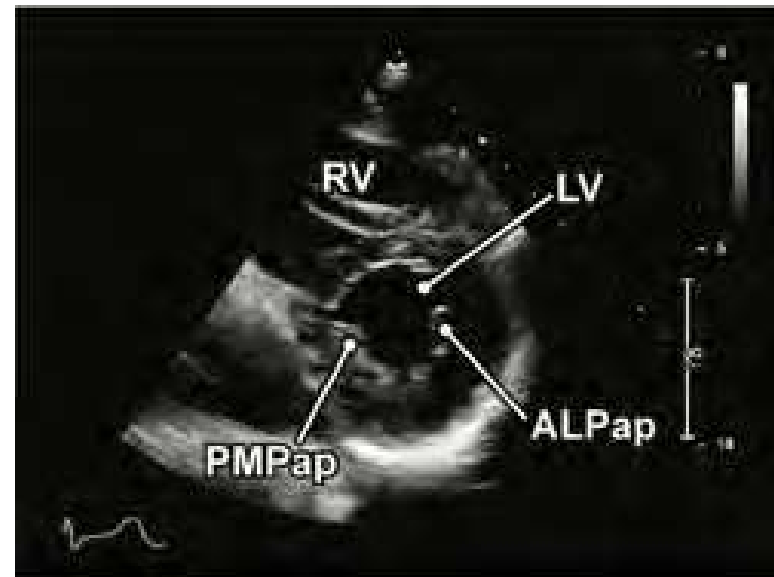
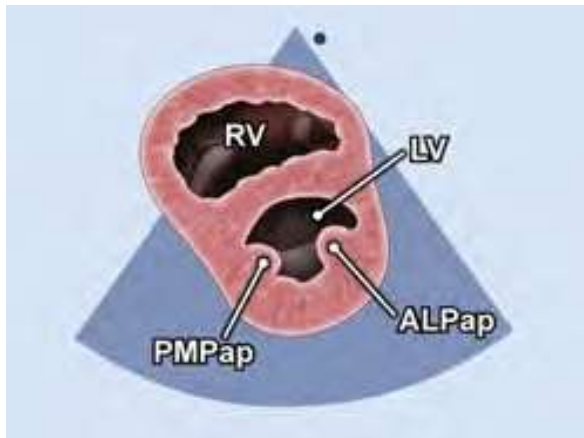
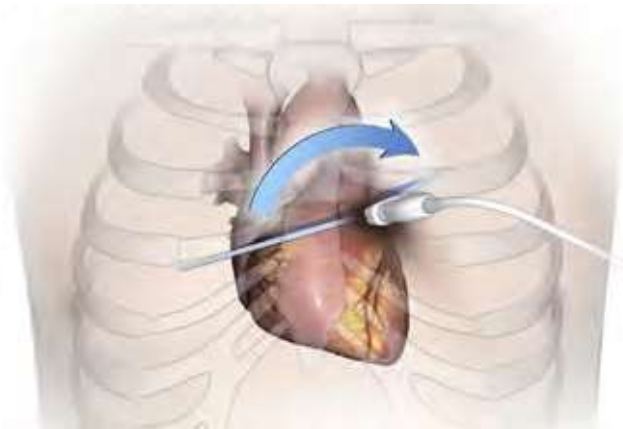
# Subxiphoid view



# Parasternal long axis view

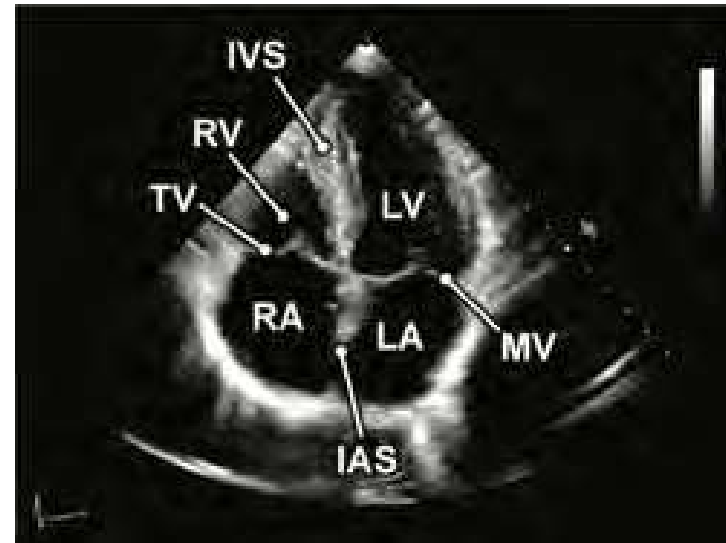
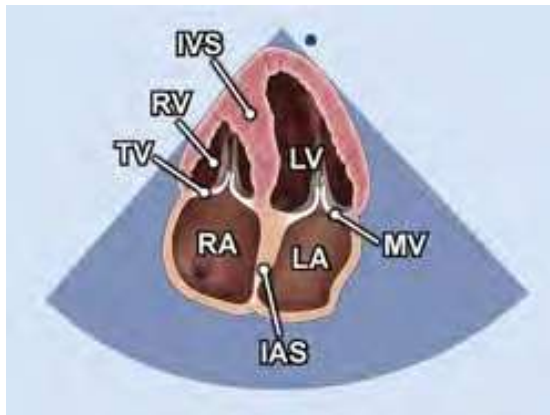
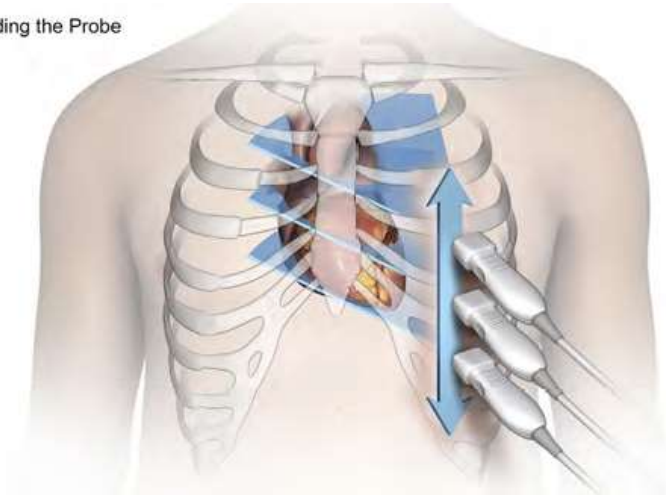


# Parasternal short axis view



# Apical 4 chamber view

Sliding the Probe



# Take home points: Point-of-care ultrasound

Point-of-care cardiopulmonary ultrasound is useful diagnostic tool which can:

- Improve diagnostic accuracy
- Expedite patient care (not only in the ED)

# Focused Echo: What to look for?

## 4 E's

**Effusion**

**EF**

**Entrance**

**Equality**



# Case 1: Shortness of breath

- **HPI:** 50 y/o smoker without PMH c/o SOB x 2-3 wks. Has cough without chest pain/ fever/ lower extremity swelling/ weight changes. Seen twice in ED within 2 weeks for same.
- Afebrile, **HR 115**, BP119/76, 100% RA, peak flow 330  
Lungs: **Rhonchi**  
Extr.: No edema
- **ECG:** No acute ST/T changes



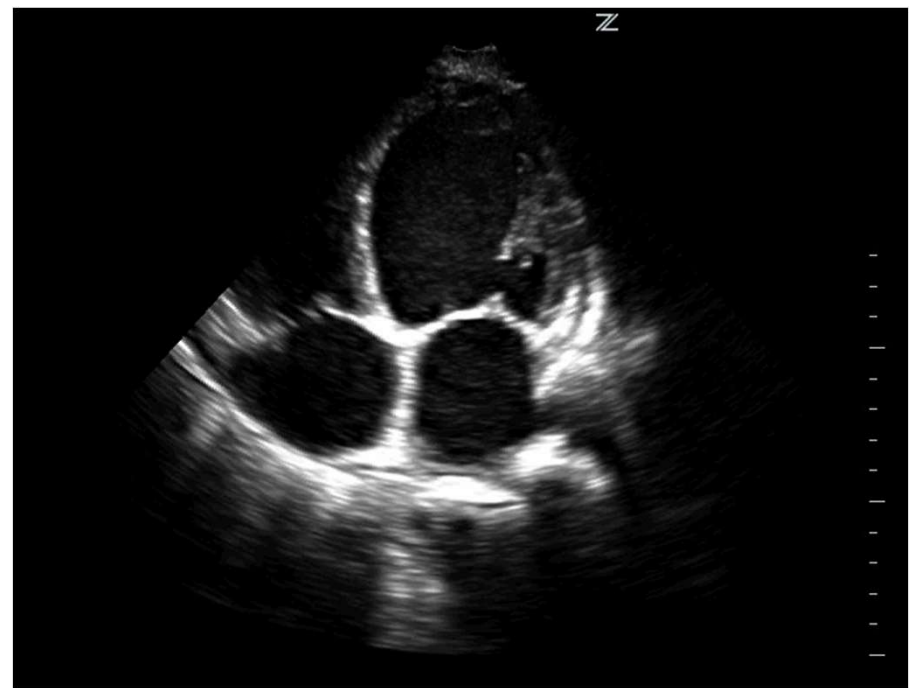
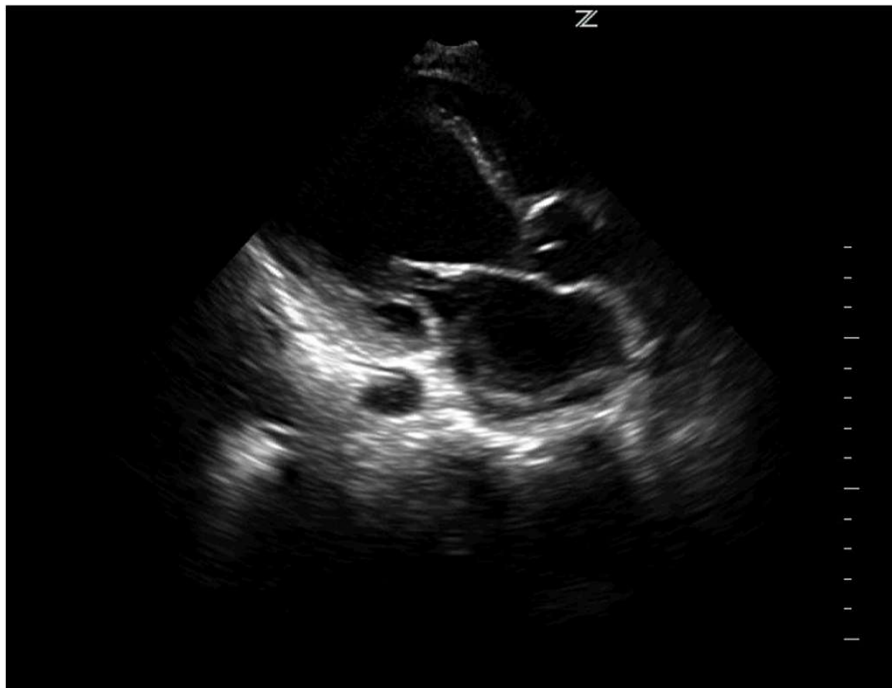


**Impression:** Hyperinflated lungs.  
No acute cardiopulmonary process.

# ED course

- Nebulizer treatments
- **A/P:** Admitted to ED Observation Unit for persistent bronchitis/COPD

# POC echo



# Global LV systolic function

## Visual estimation criteria:

- Endocardial wall motion
- Wall thickening
- Max. mitral valve opening (PSLX view)
- (E-point septal separation)

## Reference values for LVEF:

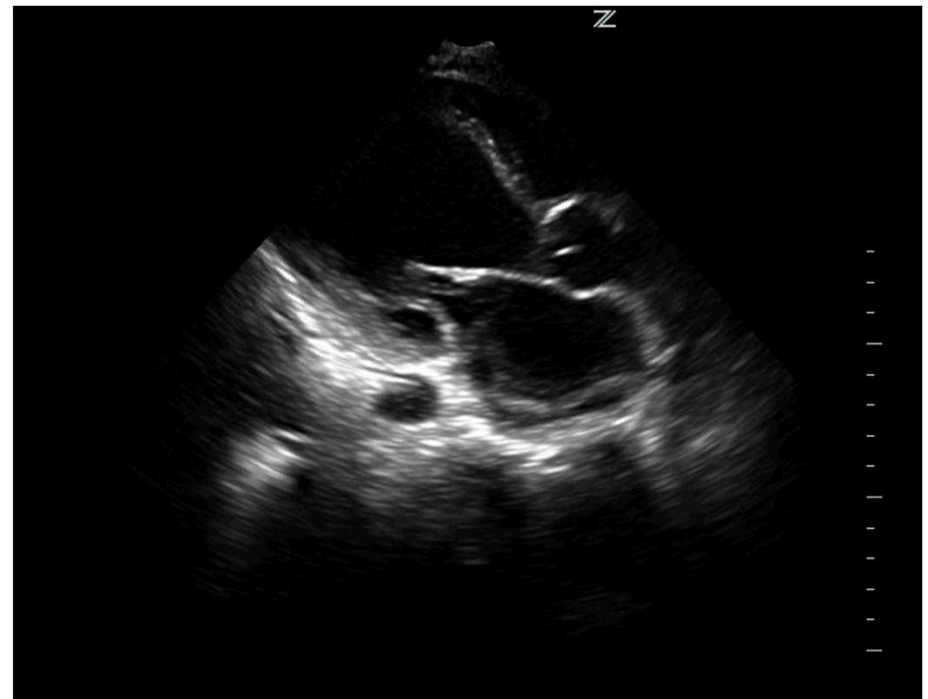
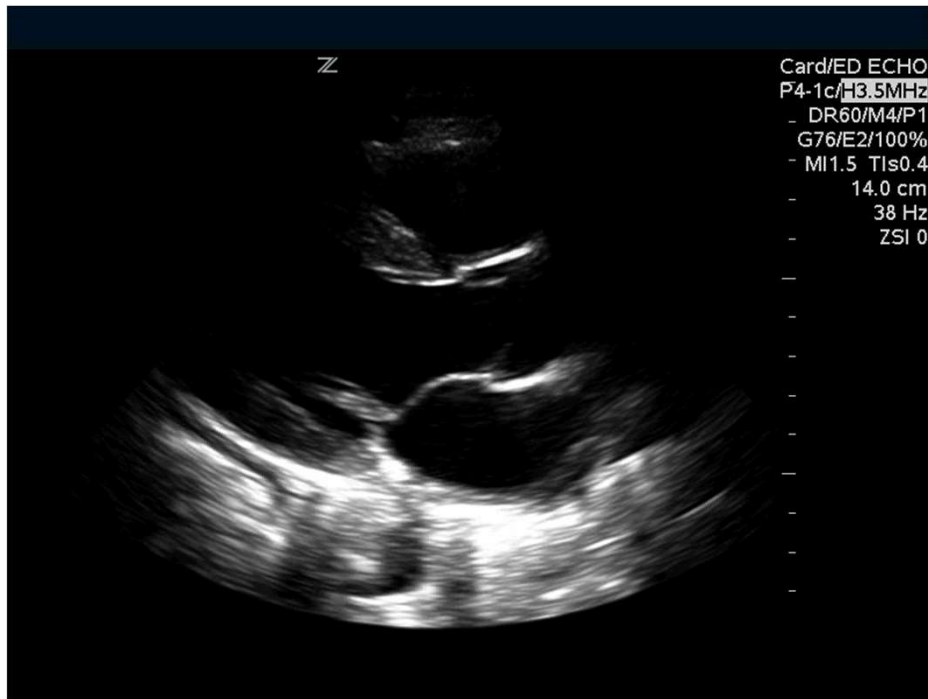
	<b>LVEF</b>
Hyperdynamic	>65%
Normal	55-65%
Mildly depressed	45-55%
Moderately depressed	30-45%
Severely depressed	<30%

# Can emergency physicians assess LV systolic function?

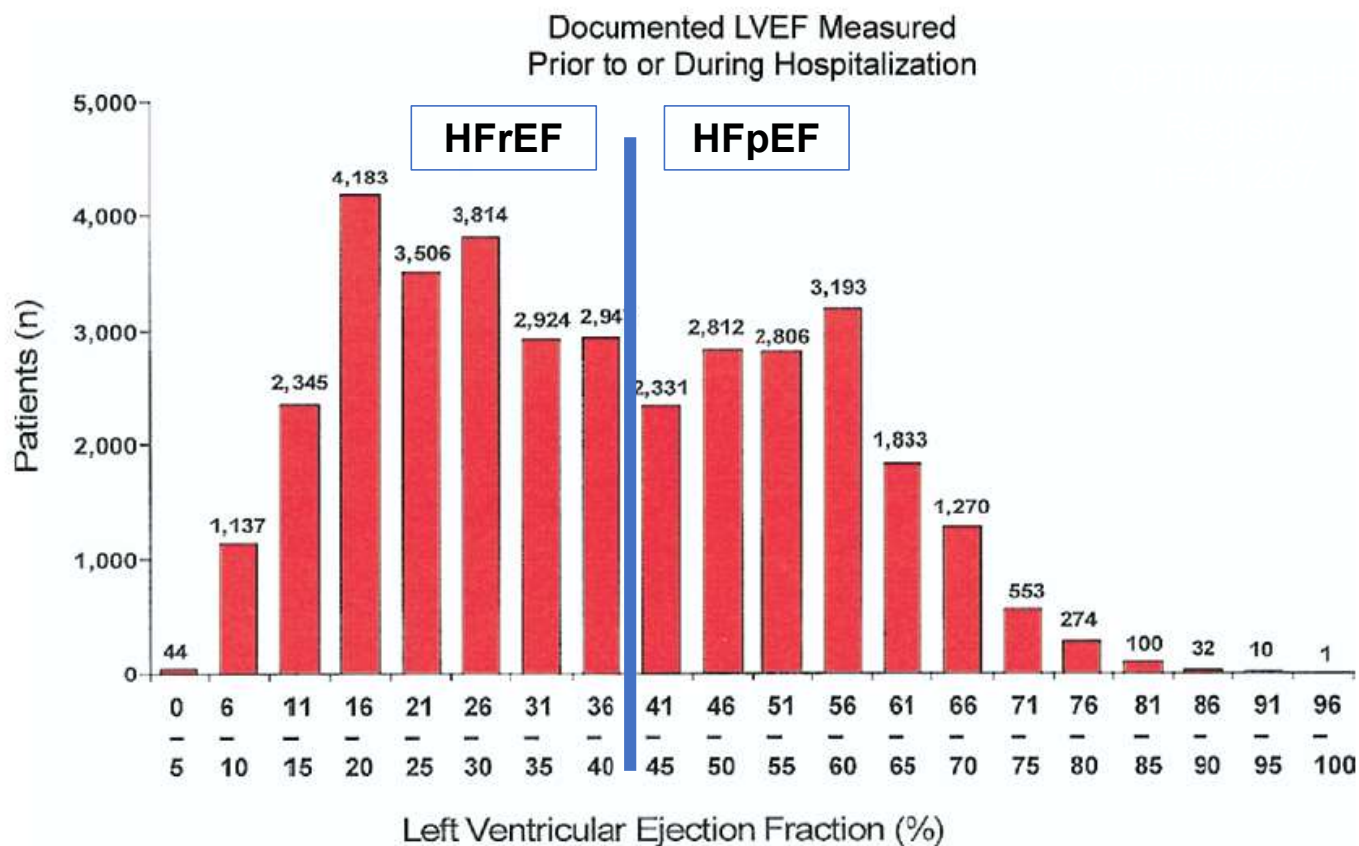
		EP LVF Category			TOTAL
		1	2	3	
Cardiologist LVF Category	1	17	5	0	22
	2	7	9	2	18
	3	0	2	8	10
TOTAL		24	16	10	50

LVF: 1=normal/hyperdynamic  
2=moderately depressed  
3=severely depressed

# Global LV systolic function



# ~50% of HF admissions are with preserved EF



# My thoughts on ED assessment of global LV systolic function...



- Takes practice
- Non-experts:  
Normal vs. severely depressed
- Useful: New onset HFrEF
- ↓ EF ≠ Acute heart failure

# Question

You are called to evaluate a 65 y/o male with h/o HTN, CAD and colon cancer who was just admitted from the Emergency Department to the ICU for presumed sepsis. On arrival in the ICU his vital signs are:

T 99F, HR 110, BP 90/60 mmHg, SpO2 96% RA

Point-of-care echocardiography may aid in the rapid bedside identification of:

- a) A pericardial effusion
- b) Right ventricular dilation
- c) The degree of aortic stenosis
- d) Both a) and b) are correct

# Free Online Resources

## **Free online lectures**

(Point of care ultrasound):

[www.emergencyultrasoundteaching.com](http://www.emergencyultrasoundteaching.com)

[www.coreultrasound.com/5ms/](http://www.coreultrasound.com/5ms/)

