

RADY 401 Case Presentation

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Focused patient history and workup

- 62-year-old man with ESRD, recently started hemodialysis (HD), cirrhosis, presented to UNC ED with lethargy and dyspnea
- BP 89/56 | Pulse 111 | Temp 36.3 °C (97.3 °F) | Resp 21 | SpO2 93% | BMI 27.5
- Physical Exam
 - CV: Tachycardic, cool extremities, 3+ pitting edema in all extremity, normal heart sounds
 - Pulm: Increased work of breathing on 6 L nasal cannula. Crackles in the bilateral bases
 - GI: Distended, significant gut wall edema. No tenderness, masses, organomegaly
- hsTroponin elevated, EKG with afib, Lactate elevated, WBC normal
- Has had trouble tolerating HD and has become more edematous at home

List of imaging studies

- Portable AP (anterior-posterior) Chest Radiograph
- POCUS (Cardiac, Abdomen)
- Formal Transthoracic Echocardiogram
- CT Abdomen

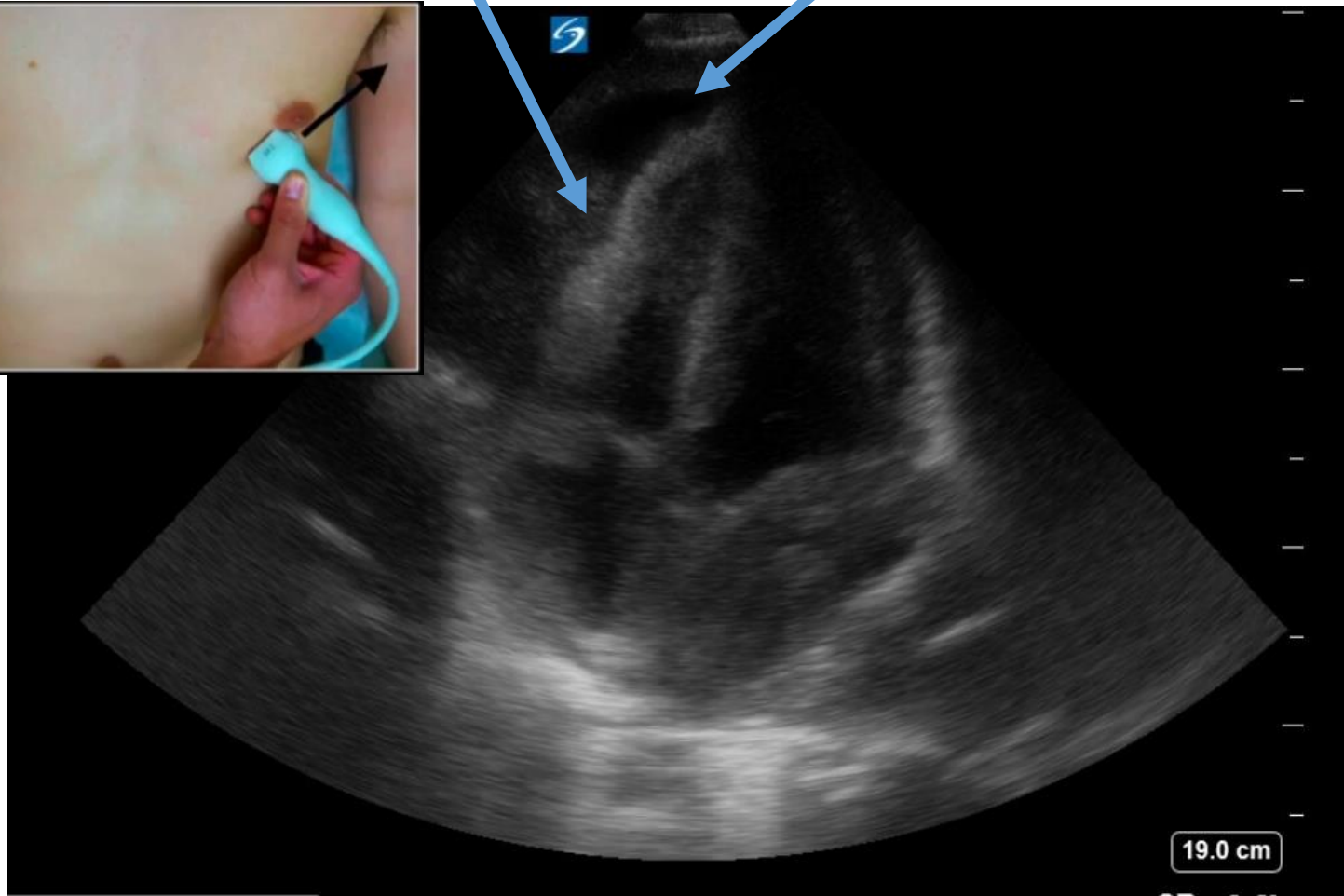
POCUS Echocardiogram in ED – Apical Four

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Compression of the
Right Ventricle

Possible
Pleural Effusion



Findings:

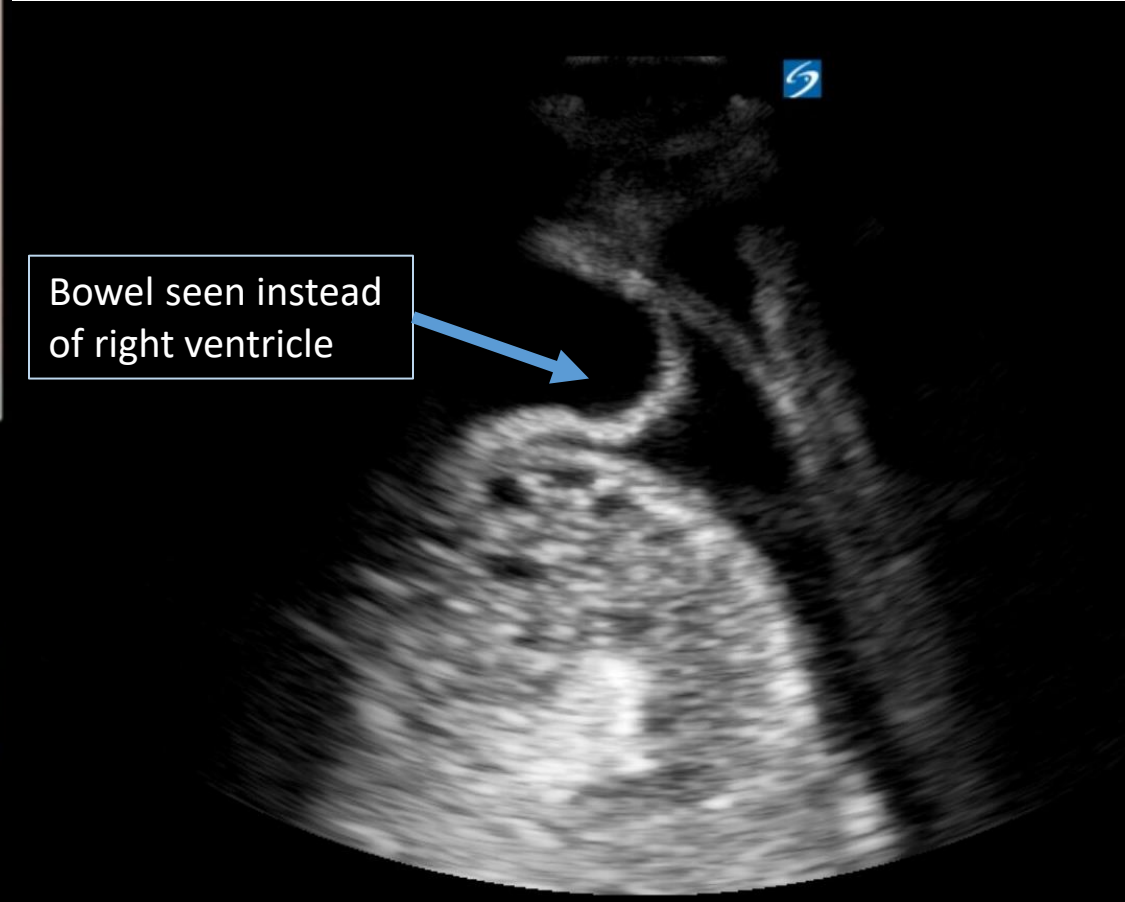
- Moderate Pericardial Effusion
- Hyperdynamic movement of the right ventricle, compression of apical aspect RV

POCUS Echocardiogram in ED - Subxiphoid

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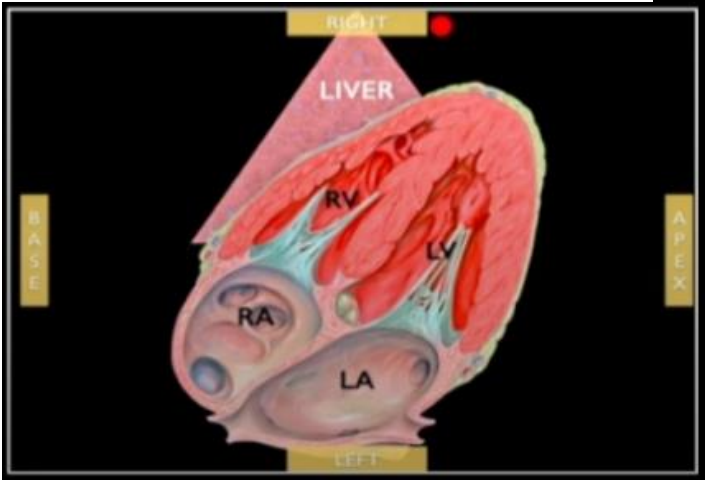


Bowel seen instead
of right ventricle



Findings:

There appears to be potential gastric contents located more superiorly than expected



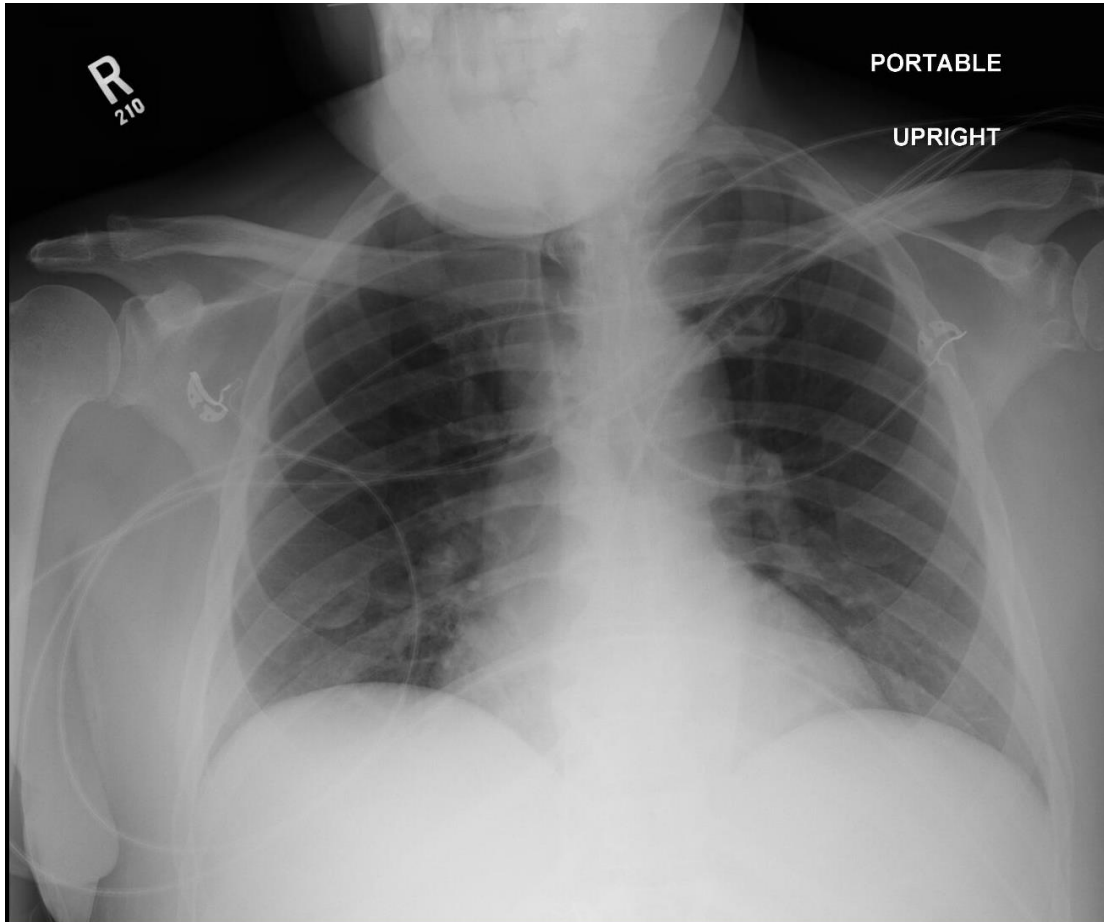
Portable AP Chest Radiograph

- **TECHNIQUE:** Single View AP Chest Radiograph.
- **COMPARISON:** Chest radiograph 6/20/2023
- **FINDINGS:**
 - **Right IJ hemodialysis catheter with tip overlying the superior cavoatrial junction.**
 - **Hypoinflated lungs with bibasilar atelectasis. No pleural effusion or pneumothorax.**
 - **Stable cardiomeastinal silhouette.**



Comparison

2 Months Prior



Admission



Given the significant diaphragmatic hernia, has multiple loops of bowel in close proximity to his heart so subxiphoid pericardiocentesis would not be technically feasible...

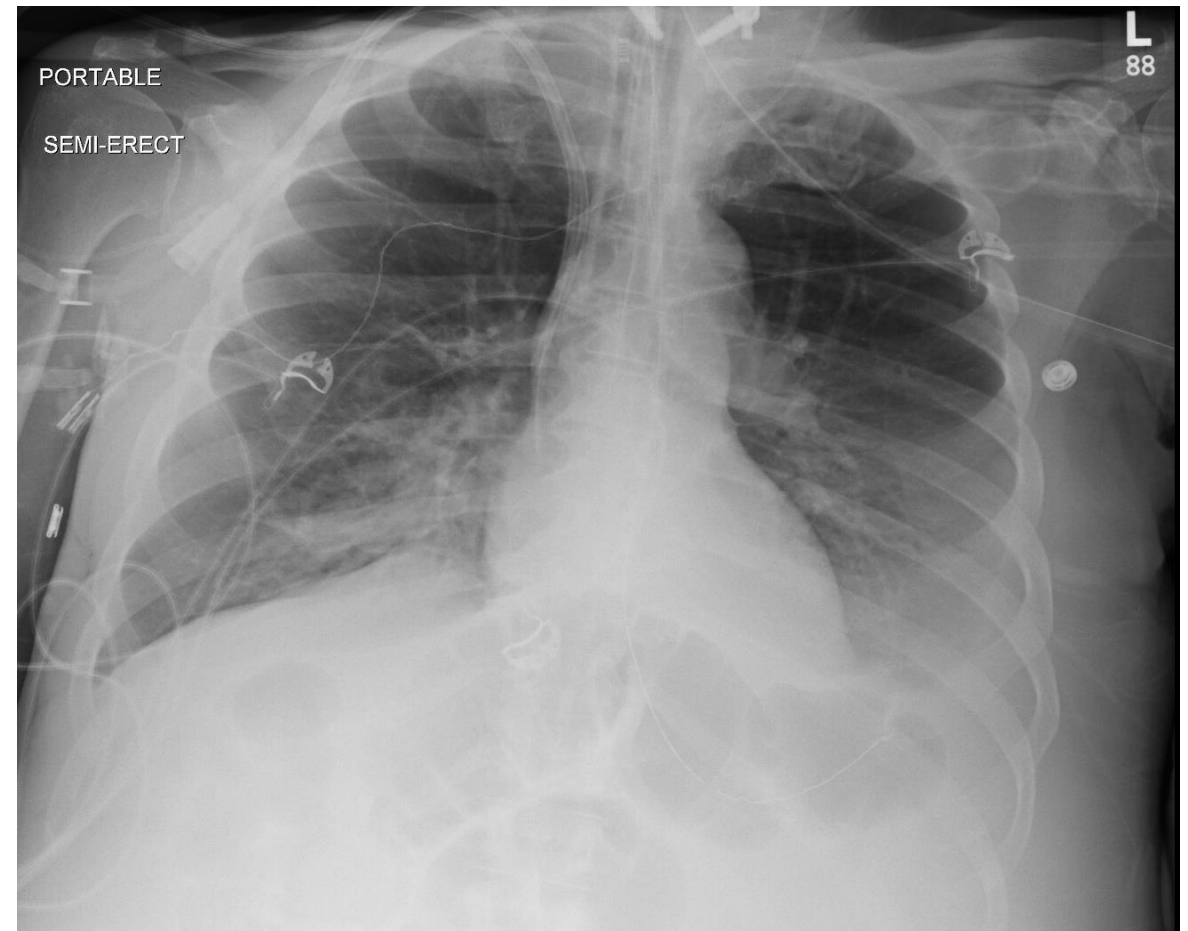
One Large Volume Paracentesis later...

CXR Comparison

Admission

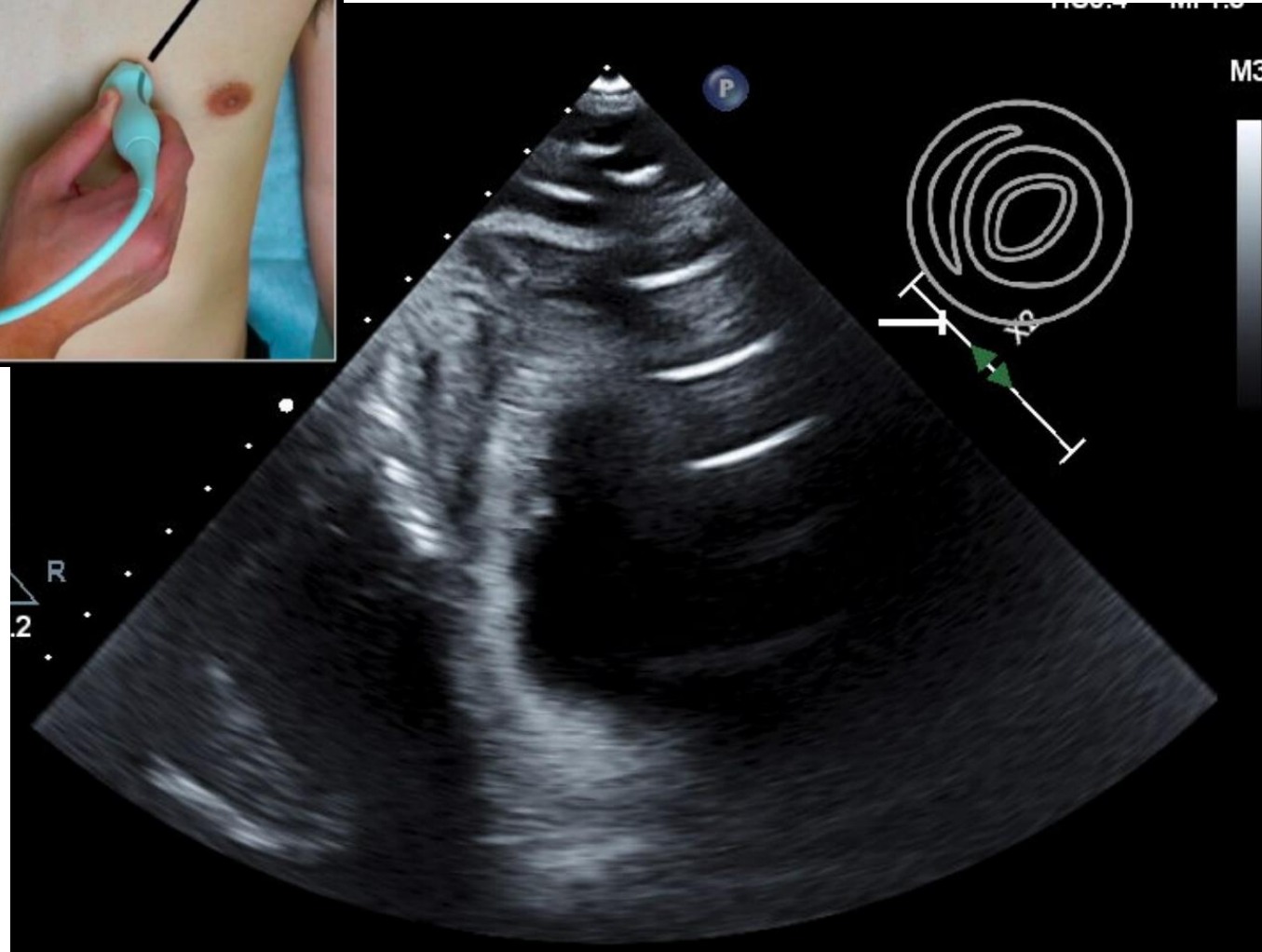
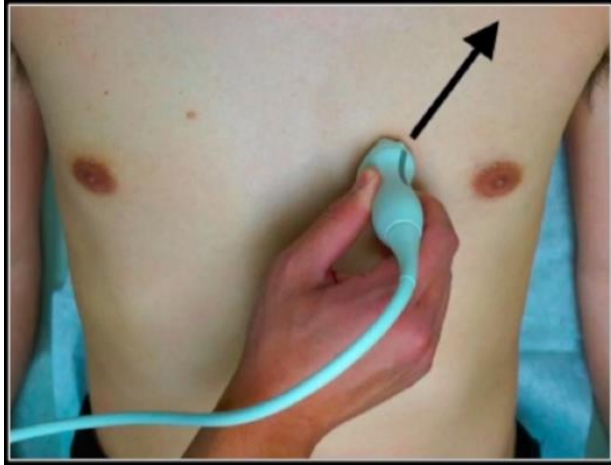


A few days after LVP



Formal Echo - Parasternal Short (MV Level)

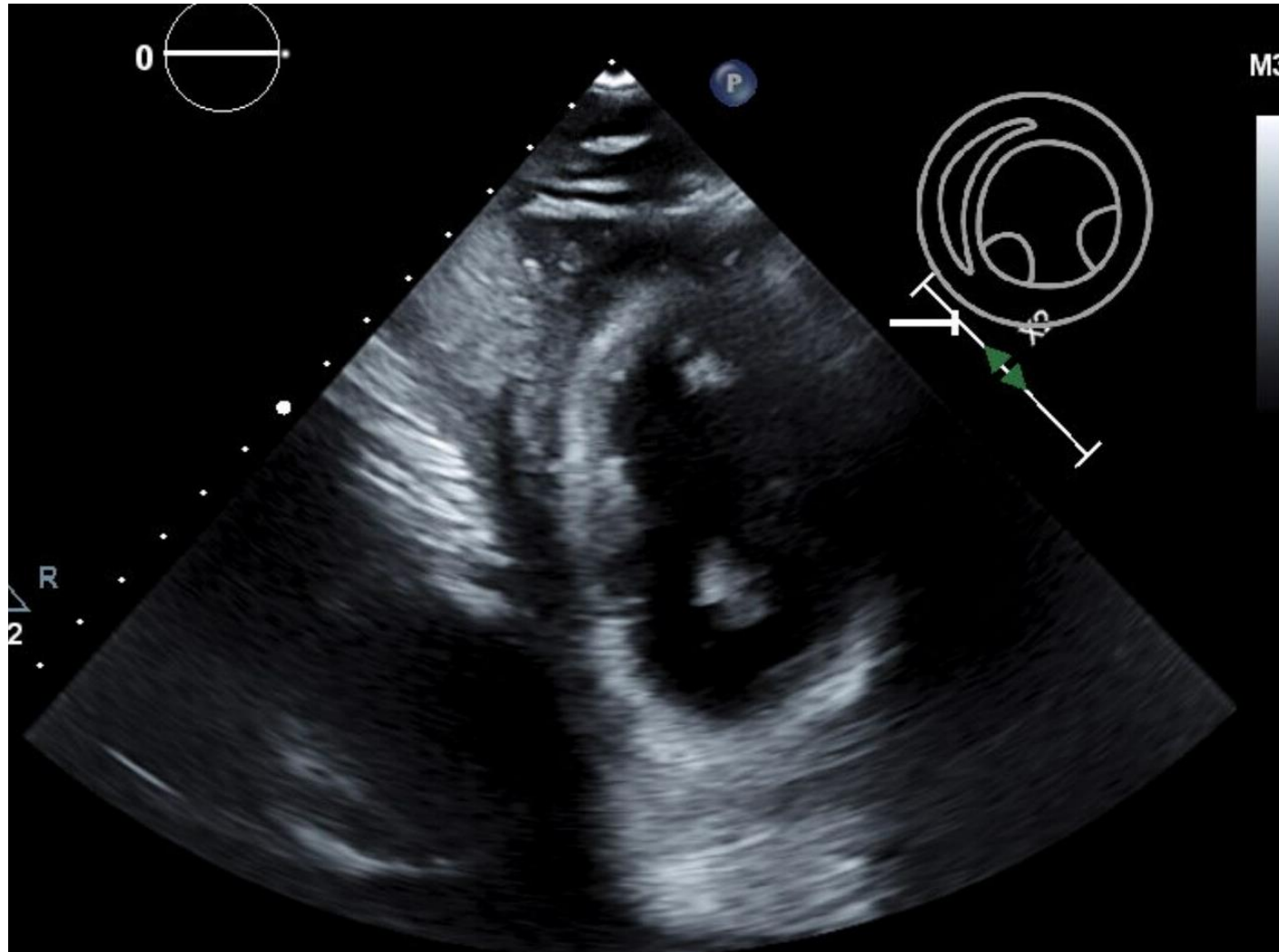
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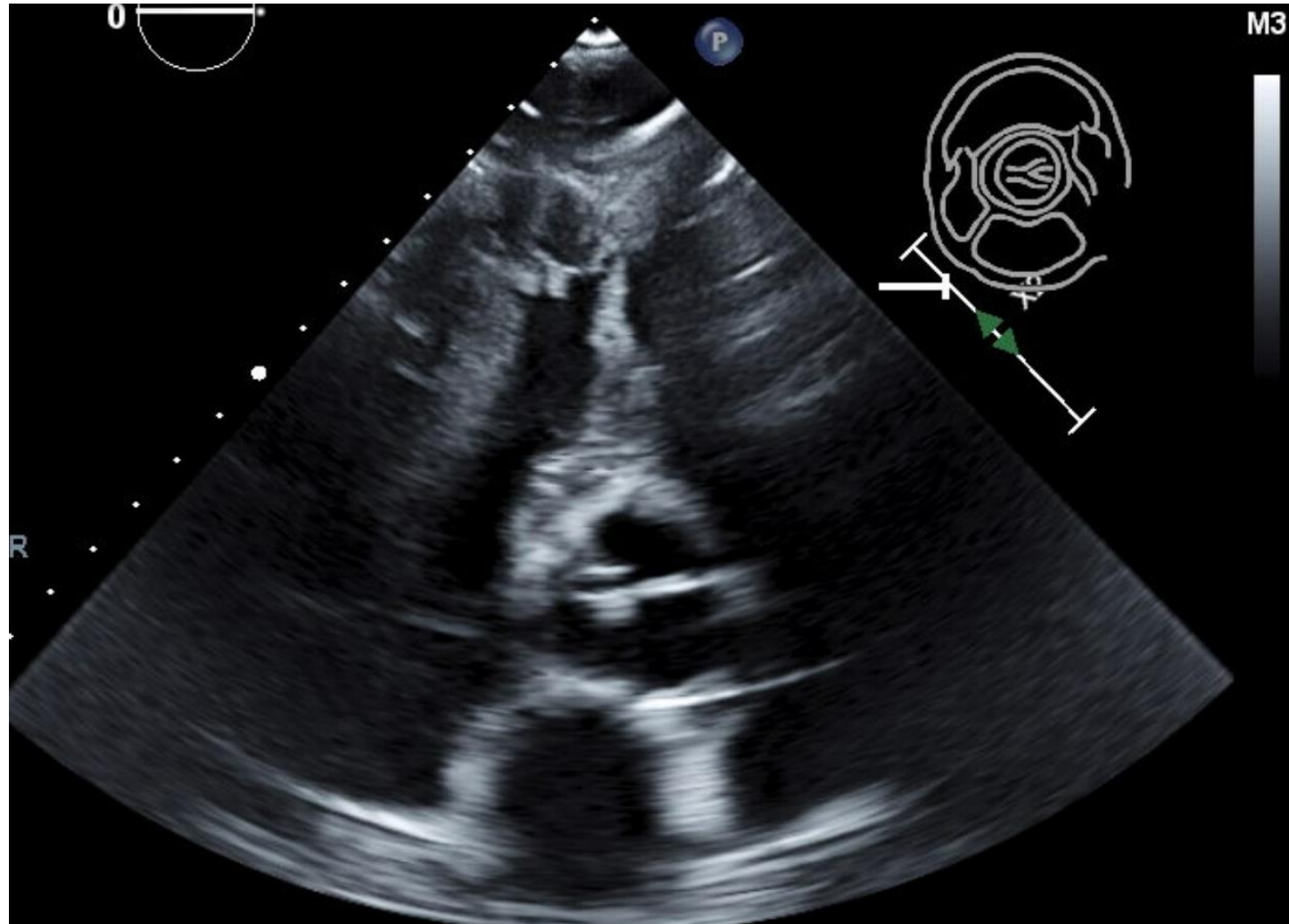
Findings:

Limited study to assess pericardial effusion. Technically difficult study.

Formal Echo - Parasternal Short (Papillary Muscles)

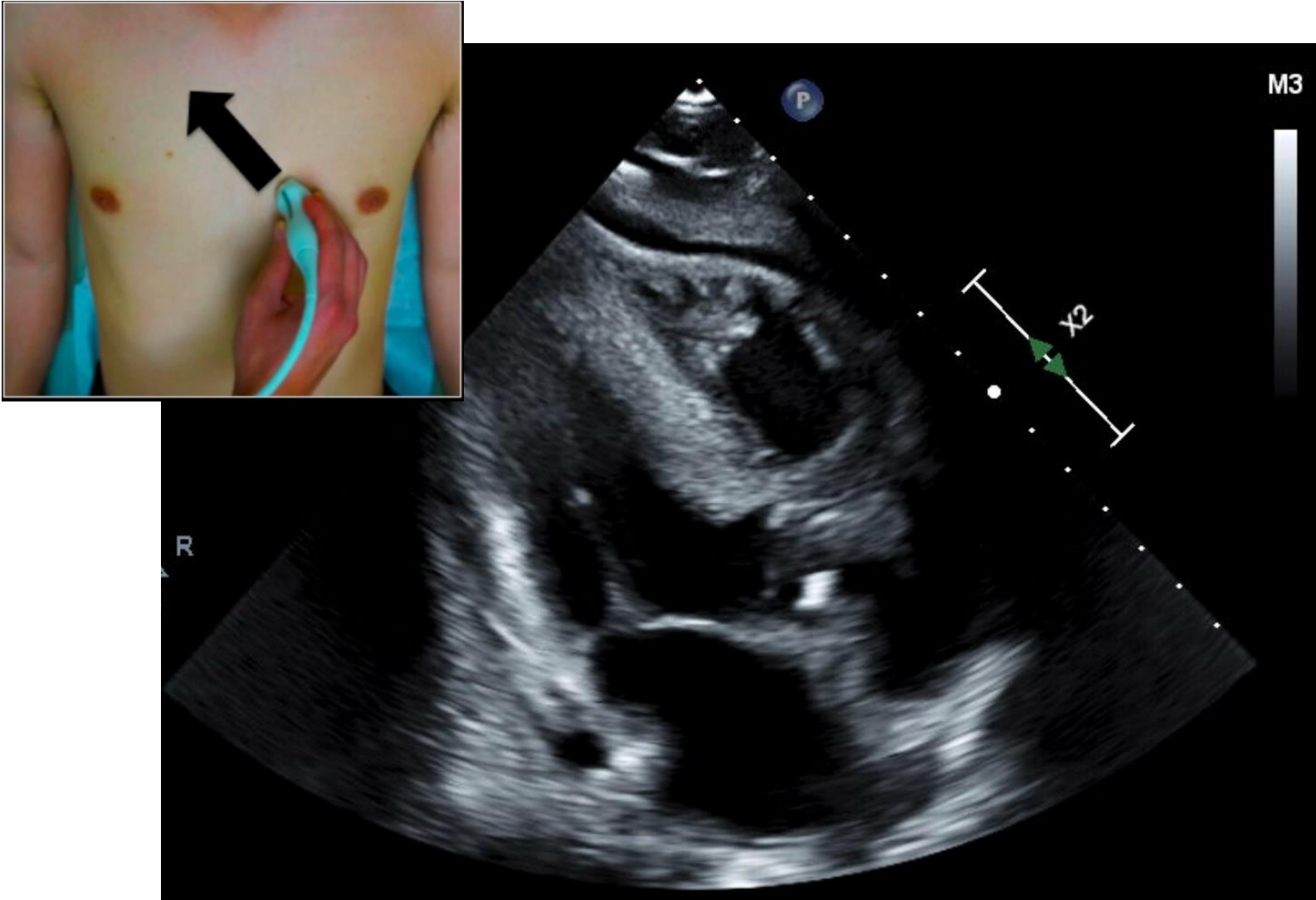


Formal Echo - Parasternal Short (Great Vessels)



Formal Echo - Parasternal Long

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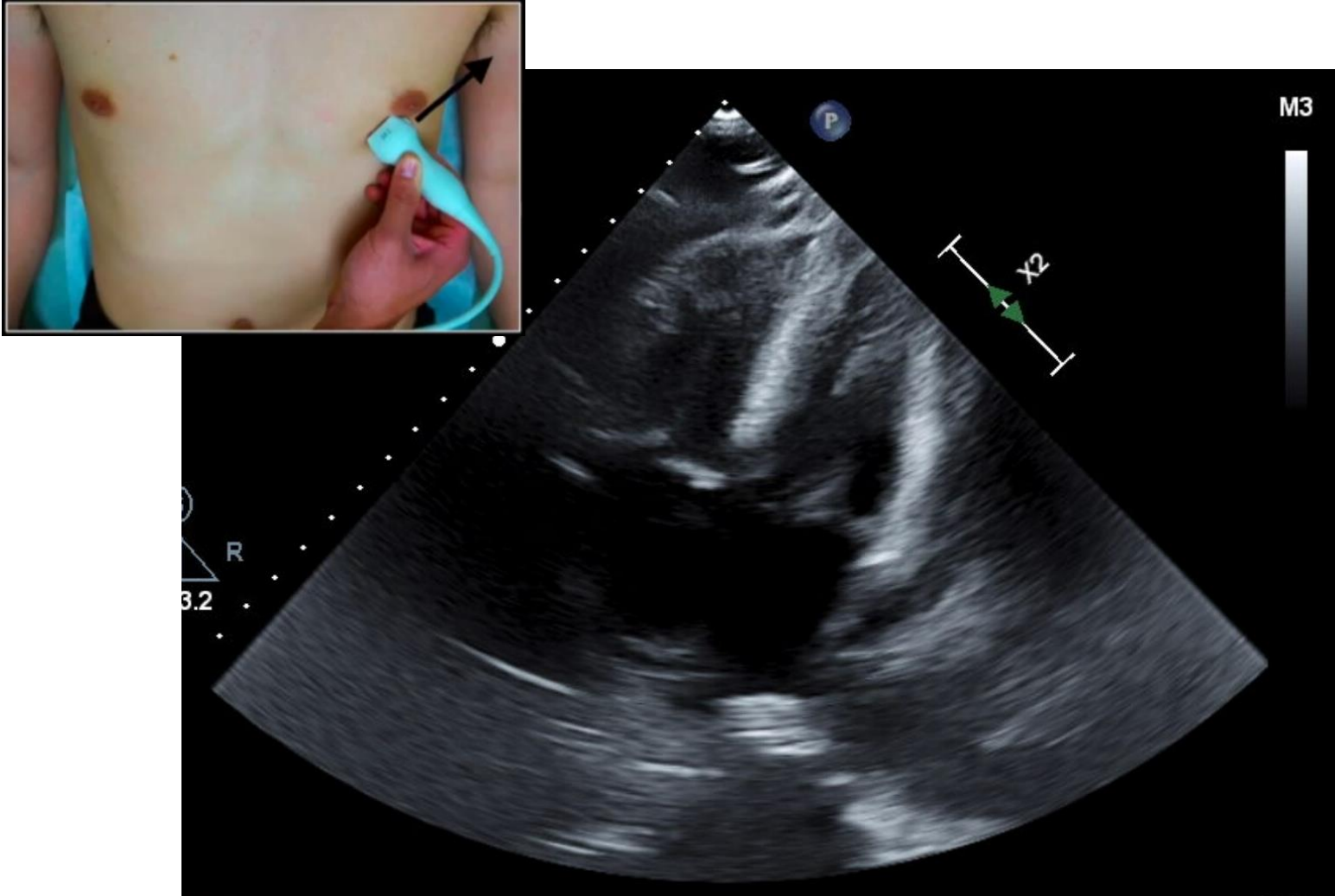


Findings:

- There is a **small, circumferential pericardial effusion**, slightly improved from prior study on 7/13/2023.
- There is **no echocardiographic evidence of tamponade physiology**.

Formal Echo - Apical Four

1



Findings:

- The left ventricular **systolic function is normal with no obvious regional wall motion abnormalities**
- LVEF is estimated at **> 55%**.
- The right ventricle/left atrium/right atrium are not well visualized but **probably normal in size**.

Patient treatment or outcome

- Patient intubated for acute hypoxic respiratory failure
- Did have significant improvements in hemodynamics after draining 5L of fluid and albumin
 - No pericardiocentesis was performed
- Later had worsening pressor requirement and workup shifted more towards cirrhosis/sepsis, but no clear etiology found
- Patient was ultimately compassionately extubated once family present

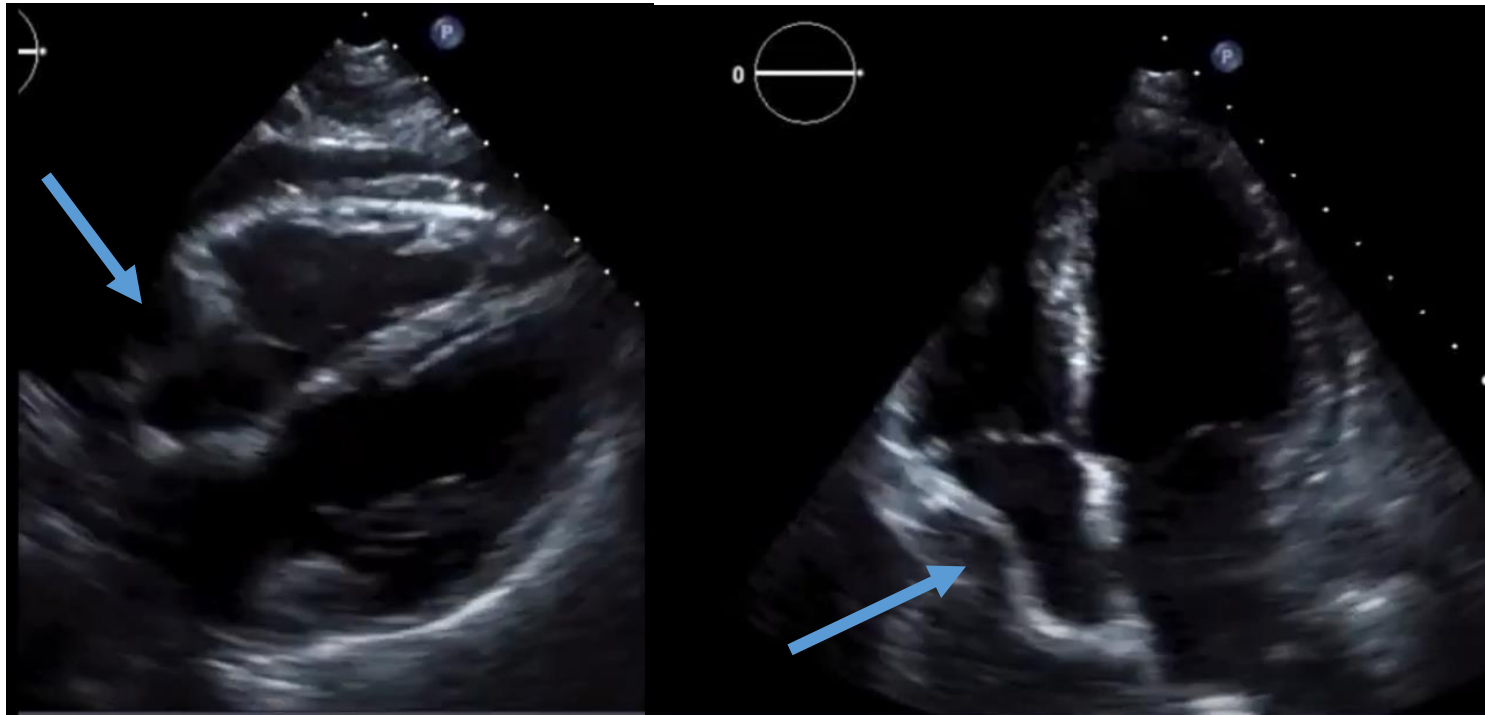
Pericardial Tamponade

Accumulation of pericardial fluid leading to impaired cardiac filling and hemodynamic compromise

Right Atrial Systolic Collapse

- 94% sensitivity and 100% specificity ²
- Duration > one-third of the cardiac cycle
- Best Views: Apical 4 and subxiphoid
- Typically earliest sign

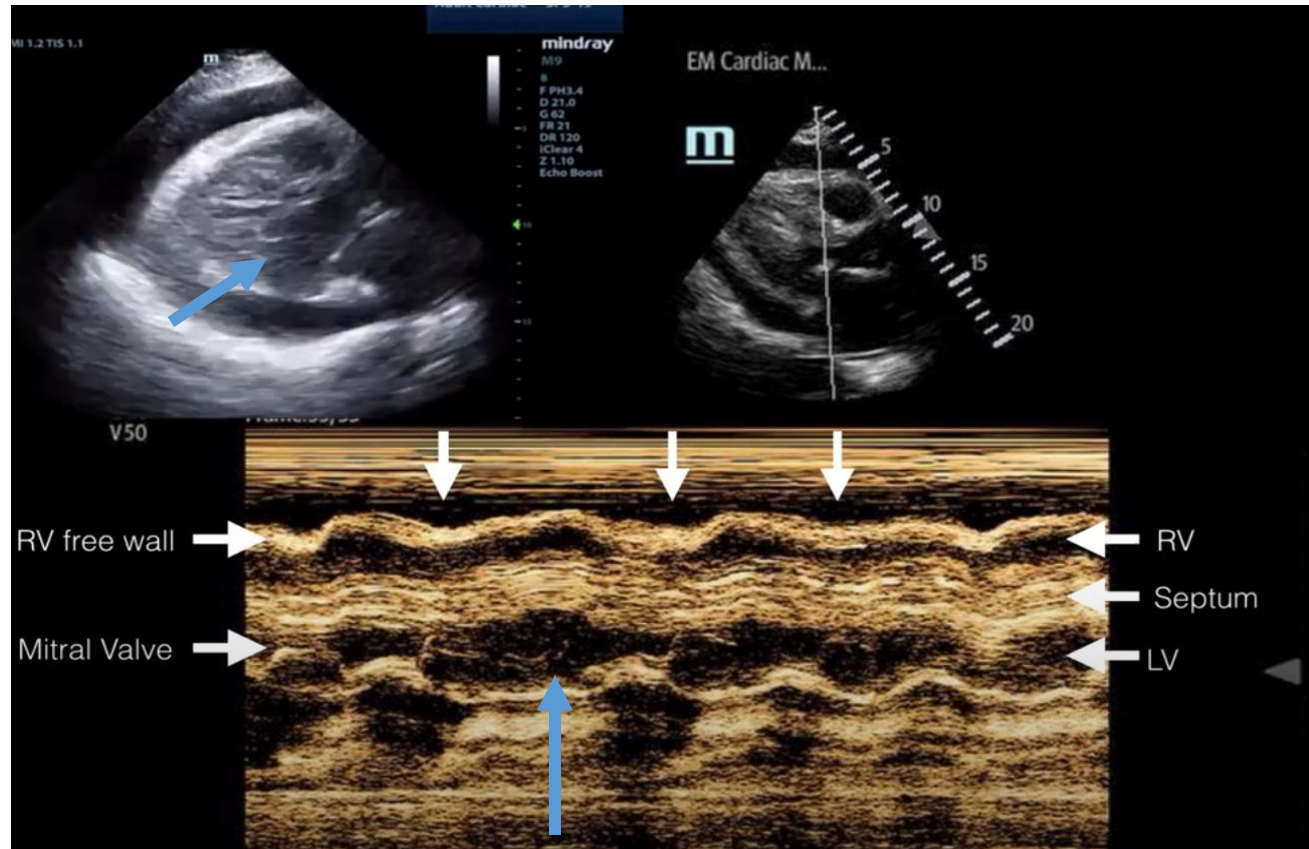
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Right Ventricular Diastolic Collapse

- 60%-90% sensitivity and 95%-100% specificity ²
- If RV filling pressures elevated at baseline, collapse less likely ⁴
- Using M-mode, can see correlate compression of RV with opening of mitral valve (diastole)

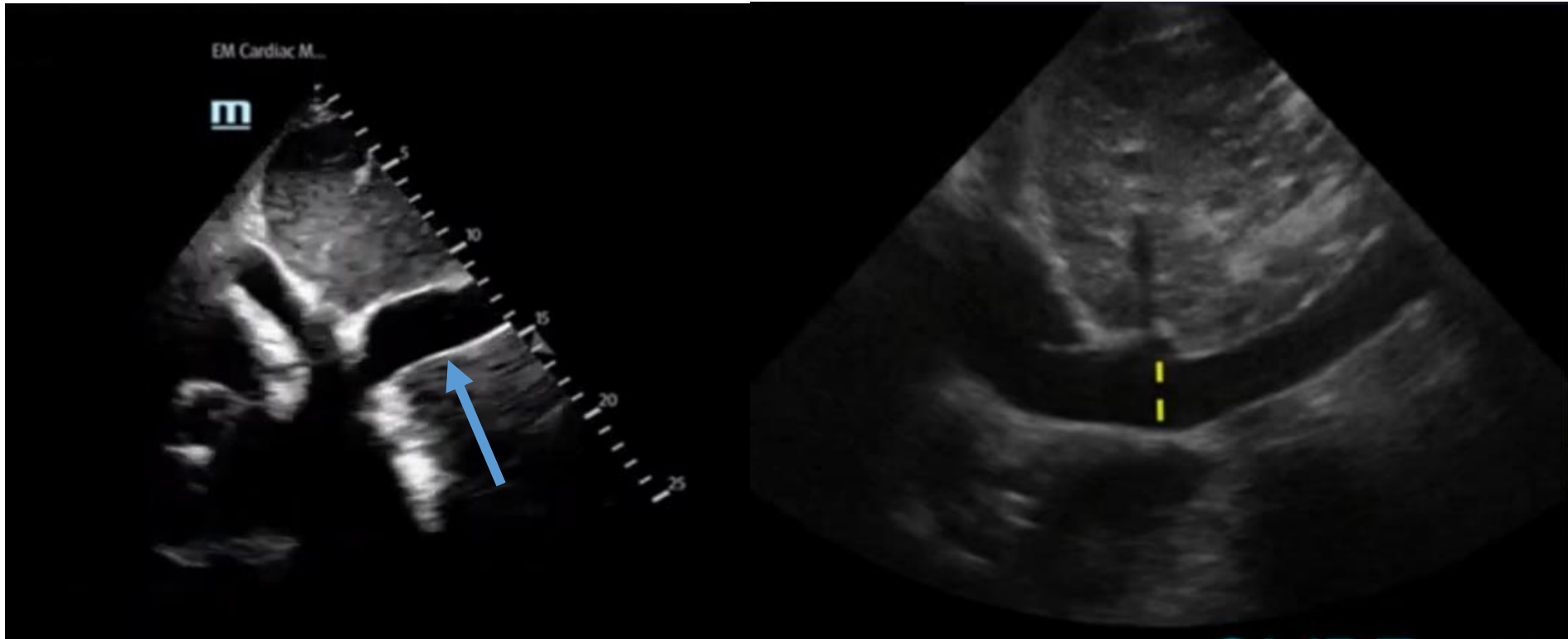
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IVC Plethora

- Distended inferior vena cava without respiratory variation ²
- Sensitivity 97% and Specificity 40% ⁵
- >2cm diameter with <50% inspiratory reduction

3



Role of other Modalities

CXR

- Can show cardiomegaly suggesting a pericardial effusion. -> "Water bottle sign"
- In tamponade can have a decrease in the cardiac silhouette -> "Small heart sign"

CT

- Can help assess vena cava/pericardial thickening
- Broad coverage of other pathologies

MRI

- Limited role given speed but can characterize the nature of the pericardial effusion and general cardiac function and structure

How scary is an effusion?

- In a study of 100 patients with idiopathic chronic large pericardial effusion, 8% developed cardiac tamponade during follow-up ⁶
- In a series of 1108 patients who presented with pericarditis, 58% developed cardiac tamponade during 3-year follow-up. ⁷
- In a study of 153 patients with pericardial effusion, none of the patients with effusion or tamponade had all signs of Beck's triad. ⁸
 - The sensitivity of Beck's triad was found to be 0 (0%–19.4%).
 - The sensitivity for one finding of Beck's triad for pericardial tamponade was 50% (28.0%–72.0%).

Pregnancy Considerations

- Pericardial effusion has been reported in the 1st/2nd trimester in ~15-20% and in ~40% of pregnant women during the third trimester ⁹
 - Generally asymptomatic, benign, transient, and resolve spontaneously without therapy.
- Serial echocardiograms and work-up similar to general population
- For any pericarditis, treat with glucocorticoids after 20 weeks instead of NSAIDS

ACR Criteria for Pericardial Tamponade

10 **Variant 3:** **Dyspnea due to suspected pericardial disease. Ischemia excluded. Initial imaging.**

| Procedure | Appropriateness Category | Relative Radiation Level |
|--|-----------------------------------|--------------------------|
| US echocardiography transthoracic resting | Usually Appropriate | ○ |
| Radiography chest | Usually Appropriate | ⦿ |
| CT heart function and morphology with IV contrast | Usually Appropriate | ⦿⦿⦿⦿ |
| MRI heart function and morphology without and with IV contrast | Usually Appropriate | ○ |
| US echocardiography transesophageal | May Be Appropriate | ○ |
| CT chest with IV contrast | May Be Appropriate | ⦿⦿⦿ |
| CT chest without IV contrast | May Be Appropriate | ⦿⦿⦿ |
| CTA chest with IV contrast | May Be Appropriate | ⦿⦿⦿ |
| MRI heart function and morphology without IV contrast | May Be Appropriate | ○ |
| FDG-PET/CT heart | May Be Appropriate (Disagreement) | ⦿⦿⦿⦿ |
| US echocardiography transthoracic stress | Usually Not Appropriate | ○ |
| Arteriography coronary with ventriculography | Usually Not Appropriate | ⦿⦿⦿ |
| CT chest without and with IV contrast | Usually Not Appropriate | ⦿⦿⦿ |
| CT coronary calcium | Usually Not Appropriate | ⦿⦿⦿ |
| CTA coronary arteries with IV contrast | Usually Not Appropriate | ⦿⦿⦿ |
| MRI heart function with stress without and with IV contrast | Usually Not Appropriate | ○ |
| MRI heart function with stress without IV contrast | Usually Not Appropriate | ○ |
| Rb-82 PET/CT heart | Usually Not Appropriate | ⦿⦿⦿⦿ |
| SPECT or SPECT/CT MPI rest and stress | Usually Not Appropriate | ⦿⦿⦿⦿ |

Radiograph Rads/Cost?

PA film = 0.01-0.02 mSv

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Chest X-ray in North Carolina

Save by purchasing this procedure online.

What does a Chest X-ray include? ^

This includes a frontal, frontal and lateral, or complete chest x-ray.

How much does a Chest X-ray cost in North Carolina? ^

On MDsave, the cost of a Chest X-ray in North Carolina, ranges from \$73 to \$171.

What is MDsave, and who can use MDsave? v

Similar Procedures: [Complex X-ray](#), [X-ray](#)

Estimated
National Average ⓘ

\$280

MDsave
Regional Average

\$127

Save \$153

Shop Nearby Providers ↓

Echocardiogram Cost?

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| Echocardiogram Prices Among All U.S. Providers | | | Email rick@hospitalpricingspecialists.com to obtain custom pricing reports. |
|--|----------------|-------|--|
| Permission to Print with following attribution: | | | Source: Hospital Pricing Specialists Proprietary Database (2014) |
| Hospital Pricing Specialists, LLC, based in Silicon Valley, California, provides price benchmarking data to hospital chief financial officers to enable them to set prices that are in line with the local market. | | | CPT Code 93306 |
| Facility | City | State | Echocardiogram Price |
| University North Carolina Hosp | Chapel Hill | NC | \$1,241.00 |
| Sampson Regional Medical Center | Clinton | NC | \$1,234.00 |
| Columbus Regional Healthcr Sys | Whiteville | NC | \$1,206.00 |
| PROFESSIONAL ULTRASOUND & IMAGING | CHADBOURN | NC | \$1,200.00 |
| Alleghany Memorial Hospital | Sparta | NC | \$1,190.50 |
| Mcdowell Hospital | Marion | NC | \$1,179.49 |
| Brunswick Novant Medical Center | Bolivia | NC | \$1,126.00 |
| Wayne Memorial Hospital | Goldsboro | NC | \$1,109.00 |
| Halifax Regional Medical Center | Roanoke Rapids | NC | \$1,063.00 |
| Maria Parham Medical Center | Henderson | NC | \$1,039.78 |
| Wilson Medical Center | Wilson | NC | \$1,014.50 |
| Randolph Hospital | Asheboro | NC | \$1,000.00 |
| On Slow Memorial Hospital | Jacksonville | NC | \$974.97 |
| Granville Health System | Oxford | NC | \$967.90 |
| Carolinaeast Medical Center | New Bern | NC | \$945.00 |
| Albemarle Hospital | Elizabeth City | NC | \$940.00 |
| Rex Healthcare | Raleigh | NC | \$923.00 |
| Caldwell Memorial Hospital | Lenoir | NC | \$912.00 |
| INSIGHT IMAGING LLC | CHARLOTTE | NC | \$871.48 |
| Highlands-Cashiers Hospital | Highlands | NC | \$804.00 |
| WACCAMAW ULTRASOUND & DIAGNOSTICS, INC. | WHITEVILLE | NC | \$800.00 |
| PIEDMONT IMAGING LLC | WINSTON-SALEM | NC | \$750.00 |
| Wakemed Raleigh Campus | Raleigh | NC | \$558.00 |
| MEDICAL IMAGING CENTER, LLC | FAYETTEVILLE | NC | \$545.00 |
| 2D DIAGNOSTIC, INC | ALEXIS | NC | \$510.00 |
| Davie County Hospital | Mocksville | NC | \$501.00 |
| Forsyth Medical Center | Winston Salem | NC | \$498.00 |
| Presbyterian Hospital | Charlotte | NC | \$498.00 |
| Carteret General Hospital | Morehead City | NC | \$487.87 |
| SONOCARE LLC | MORGANTON | NC | \$474.93 |

UNC Top Three (or Test Yourself or Wrap Up)

1. Transthoracic echocardiogram is your first-line imaging test for pericardial effusion/tamponade.
2. Know your ultrasound windows and associated pathologies.
3. Physical exam is important, even if only one part of the puzzle.

References

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