When Bubbles Make the Diagnosis

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Disclosure

- No disclosures

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Objectives

1. Provide information about the types of contrast used in echo labs today
2. Describe the utilization of UEAs and Saline Contrast
3. Demonstrate how contrast can make the diagnosis in the many cases I am about to present!

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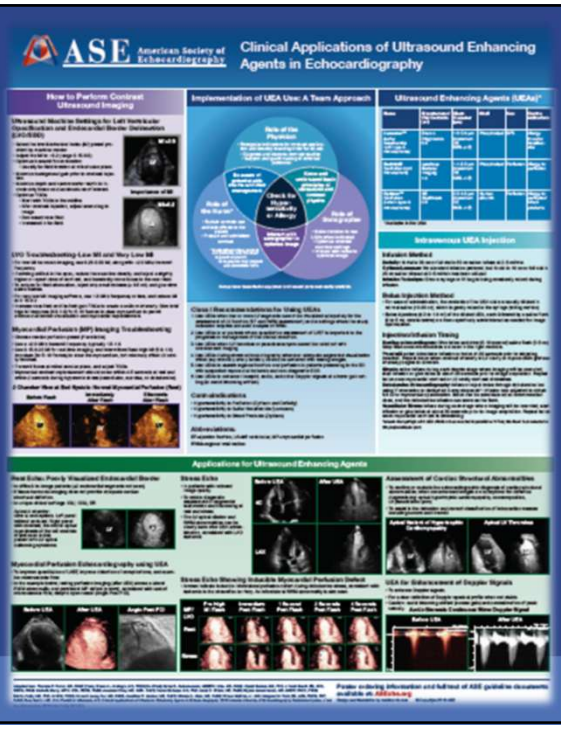

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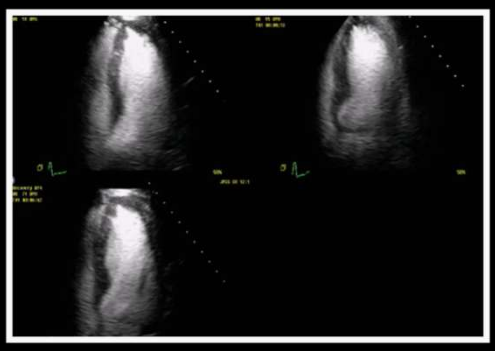
Indications for UEA's

- Stress Echo
  - Challenging images
- Transthoracic
  - Missing wall segments
  - Apical RWMA
  - Apical trabeculations
  - Tracing EF
  - Enhancement of pathology or Doppler
  - HCM
- Transesophageal
  - Clear LAA
  - Artifact vs dissection



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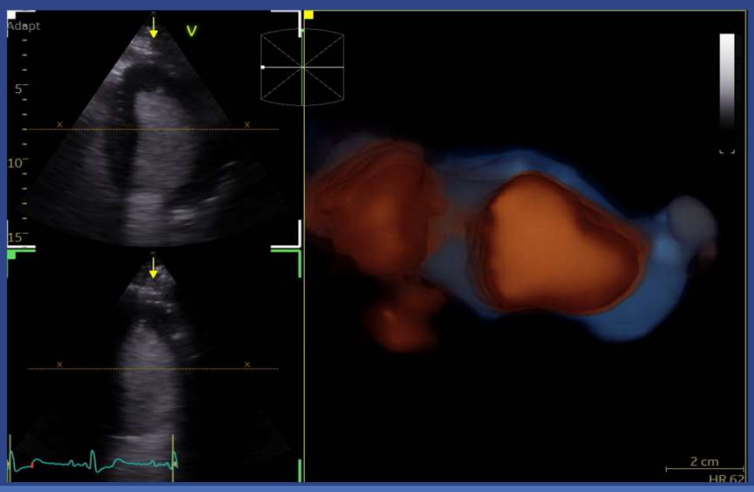
3D LV with Contrast



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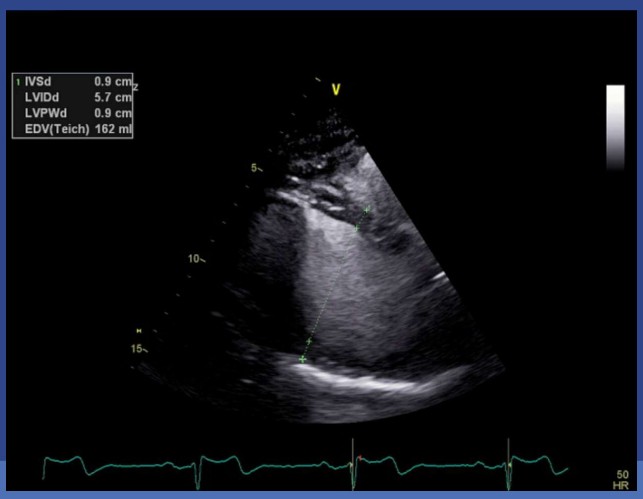
Left Ventricular Measurements



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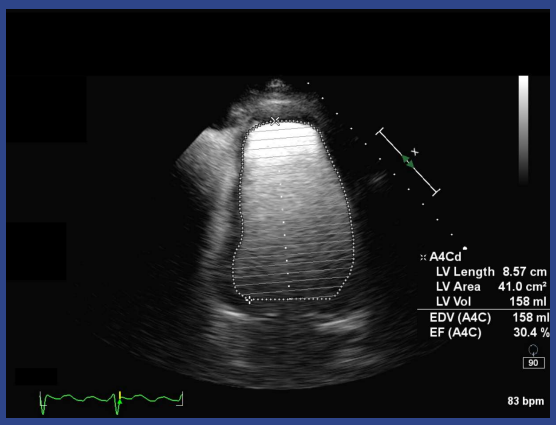
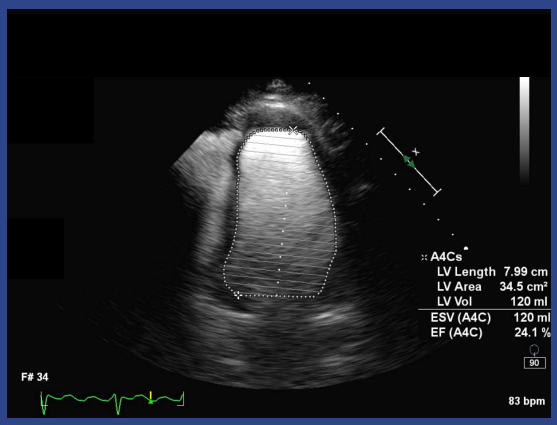
EF Trace With UEA





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Importance of UEA Utilization…

- Chemotherapy - >5% decrease
- CRT Indication - ≤ 35%
- ICD Indication - ≤ 35%

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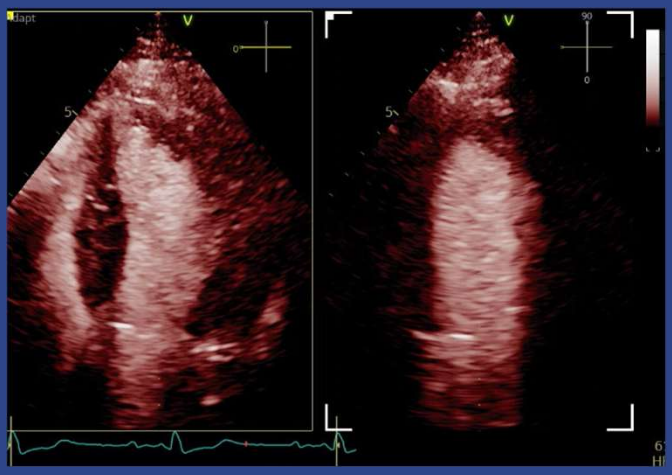
Biplane Left Ventricle



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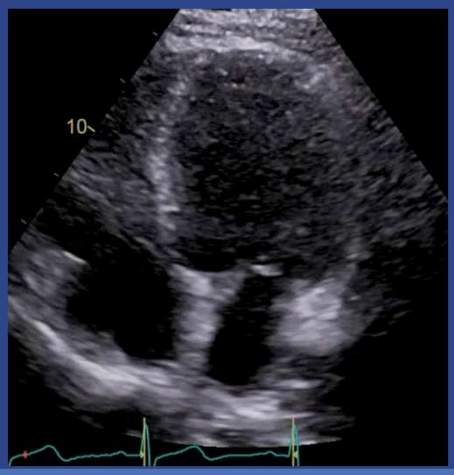
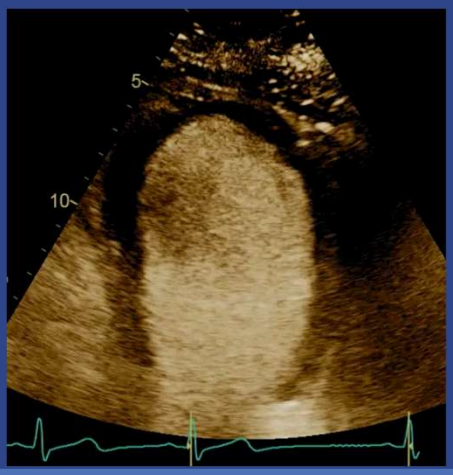
Endocardial Definition Issue





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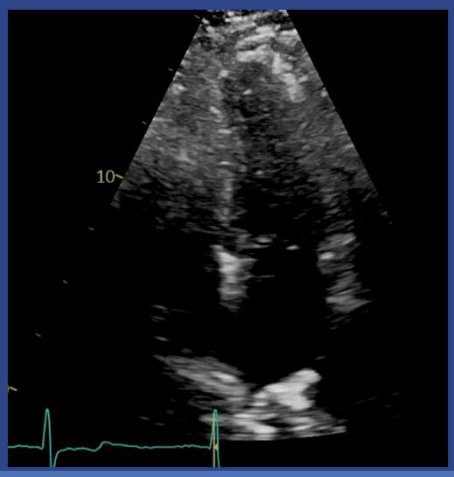
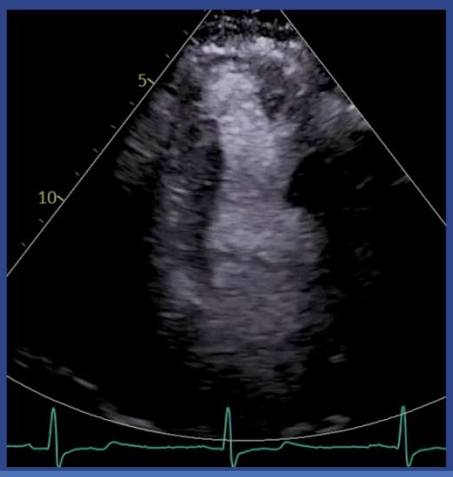
New Finding with UEA …





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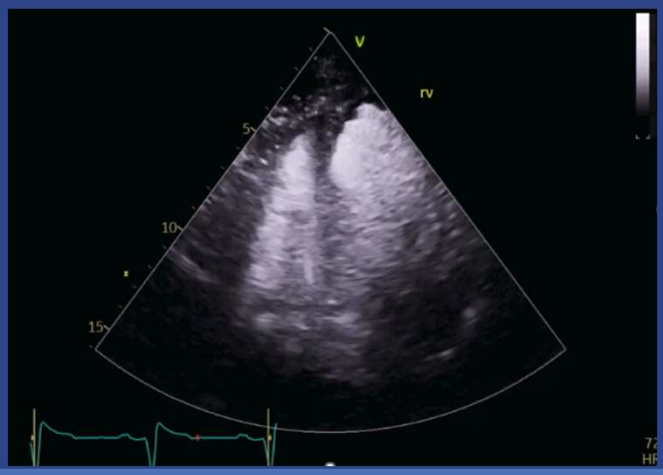
Right Ventricular Function



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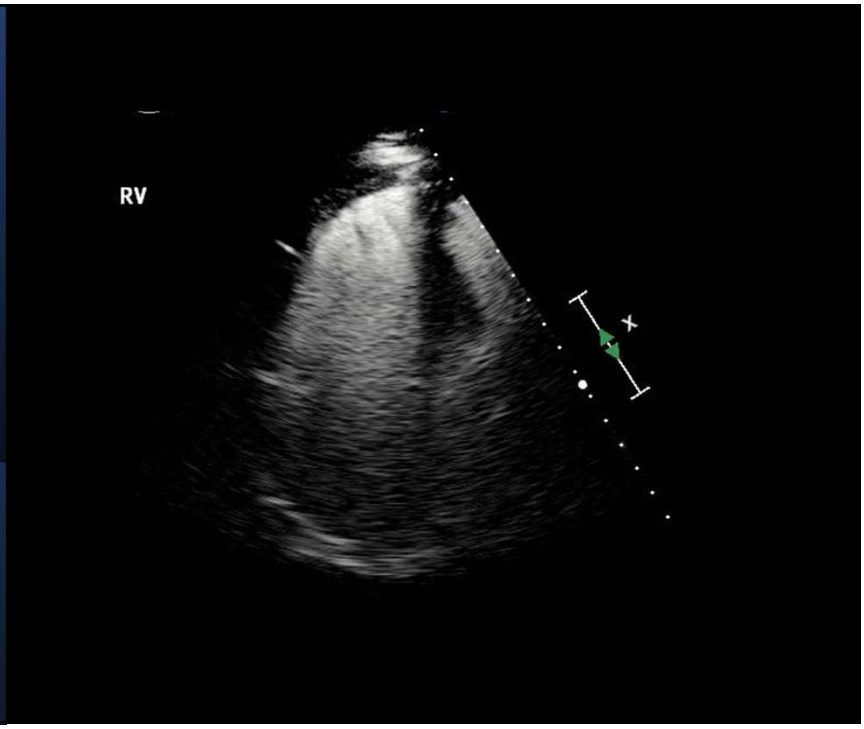
Right Ventricular Function



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LV Noncompaction

- Increasingly recognized abnormality
- Due to alterations of myocardial structure with thickened, hypokinetic segments
- Consists of 2 layers:
  - Thin, compacted subepicardial myocardium
  - Thicker, non-compacted subendocardial myocardium
- Contrast helps identify the characteristic deep trabecular recesses

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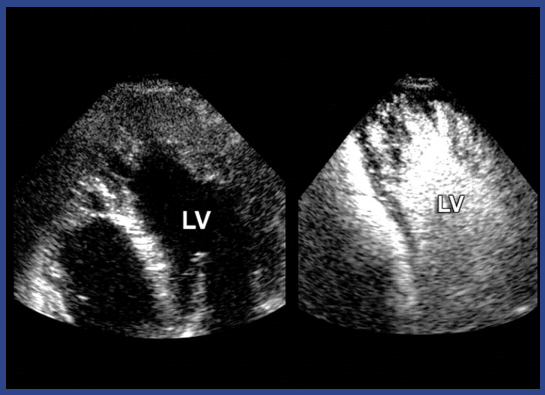
LV Non-Compaction with a UEA

- Non enhanced image shows myocardial thickening at the apex
- UEA enhancement clearly delineates the deep trabeculations at the apex that have filled with contrast



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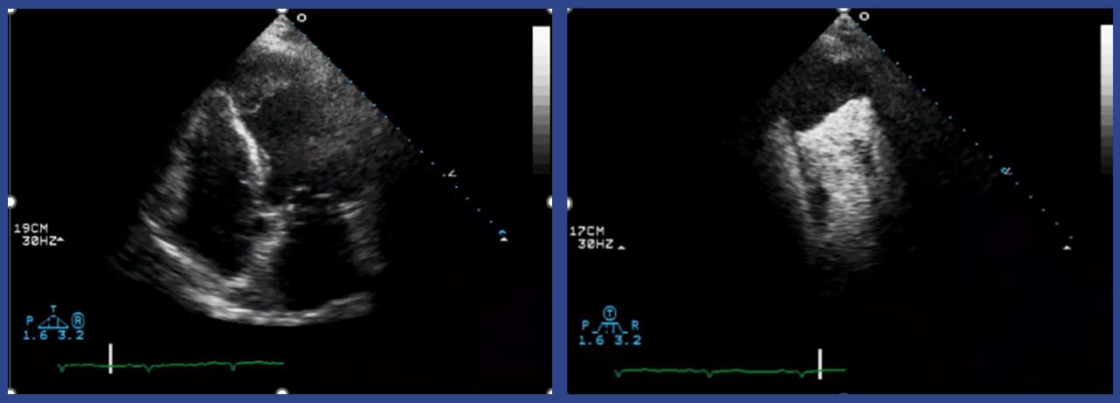
Thrombus with UEA



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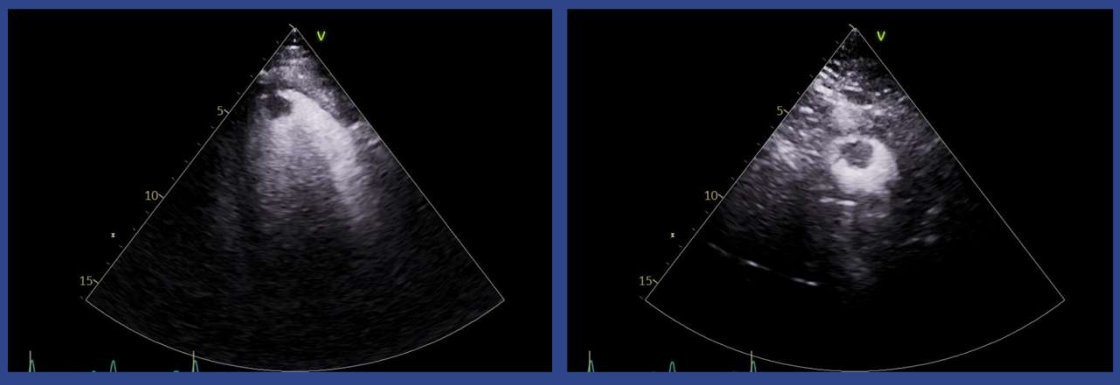
Another apical thrombus…



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Left Ventricular Mass

- 44 y/o female with history of metastatic breast CA
- Patient had a sudden onset of shortness of breath even during rest
- EMS called and patient admitted to hospital
- EKG revealed SVT
- Portable echo ordered to evaluate left ventricular function

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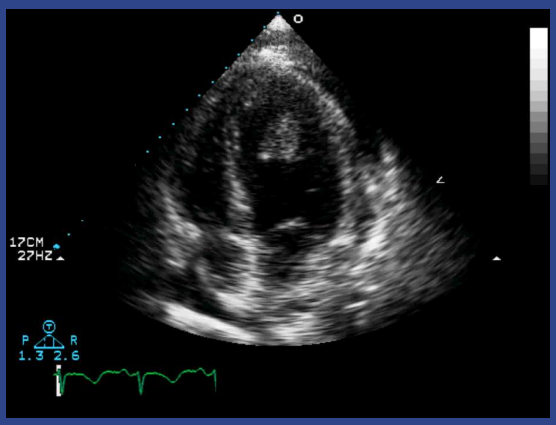
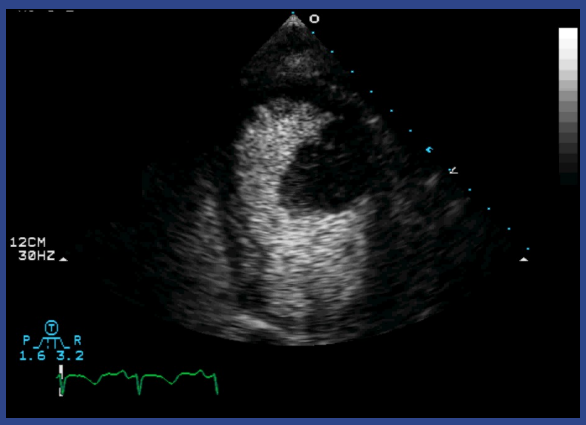
Cardiac Mass with UEA





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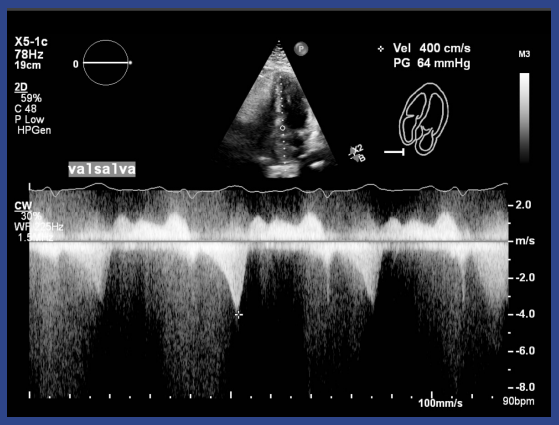
HOCM Doppler with UEA



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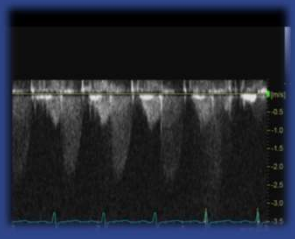
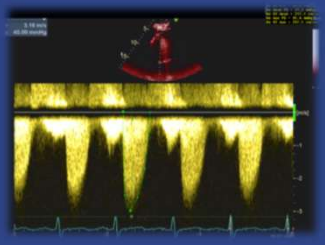
Doppler Contrast Enhancement

- 60 year old obese female
- S/P Mitral & Tricuspid Valve Repair
- H/O left ventricular dysfunction
- Contrast utilized to better define endocardial borders for EF assessment
- Technically difficult aortic gradient noted on unenhanced Doppler



AS Gradient Without Contrast Enhancement



AS Gradient With Contrast Enhancement

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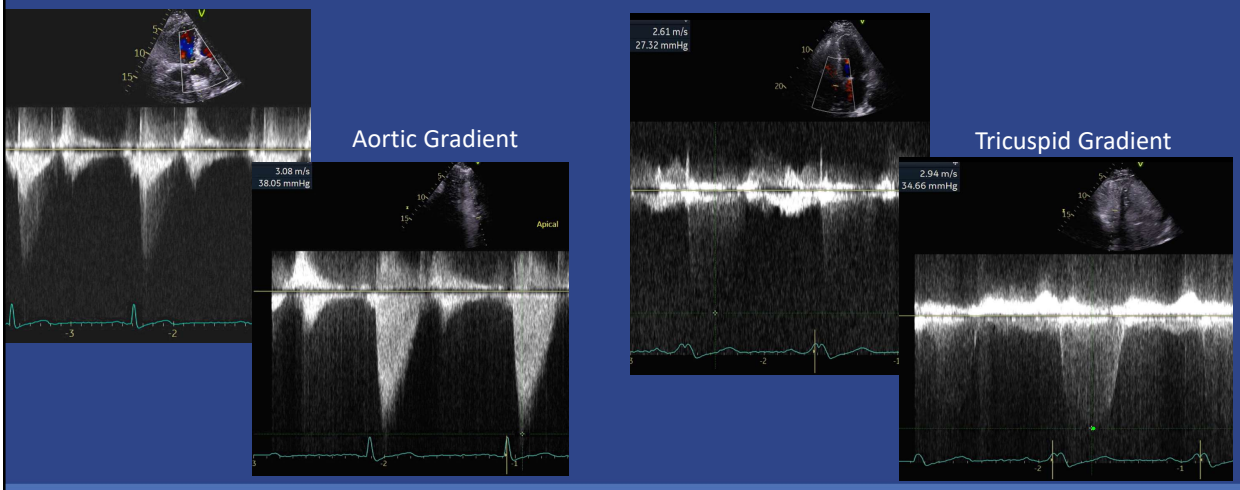
UEA Doppler Enhancement



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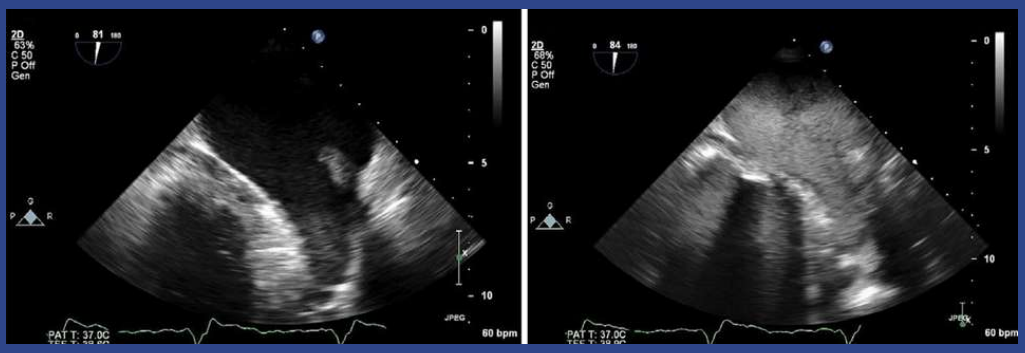
TEE and UEAs



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UEA Utilization Summary

- Accurate Left ventricular Global and Regional wall assessment
  - Accuracy with tracing EFs
  - LV Non-Compaction
  - Aneursyms
  - HCM
  - Thrombus
  - Intra-Cardiac mass
- Right ventricular function assessment
- Doppler waveform enhancement – AS, HOCM, TR
- TEE – Clear LAA and artifacts - Dissection

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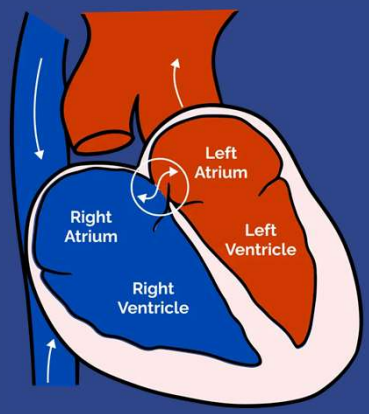
Saline Contrast with Echo

- In fetal life there is a communication between the right & left atria – foramen ovale
- Shunt allowing blood in the right side to skip the lungs & go directly to the left heart & back to the body
- After birth, the lungs are functioning , the foramen ovale should close
- It can leave a flap-like opening, or PFO
- Occurs in about 25% of the population & in up to 40% with stroke



Ghosh AK, Jain A. Diagnosis and management of patent foramen ovale. Br J Hosp Med (Lond). 2015;76:C98–C102

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Saline Contrast Studies

- The most common agent for the right heart to detect intracardiac shunt
- IV agitated Bacteriostatic saline should not cross the pulmonary circulation due to the size and short half life
- Most common use is to detect patent foramen ovale (PFO), atrial septal defects (ASDs) and pulmonary arteriovenous shunts

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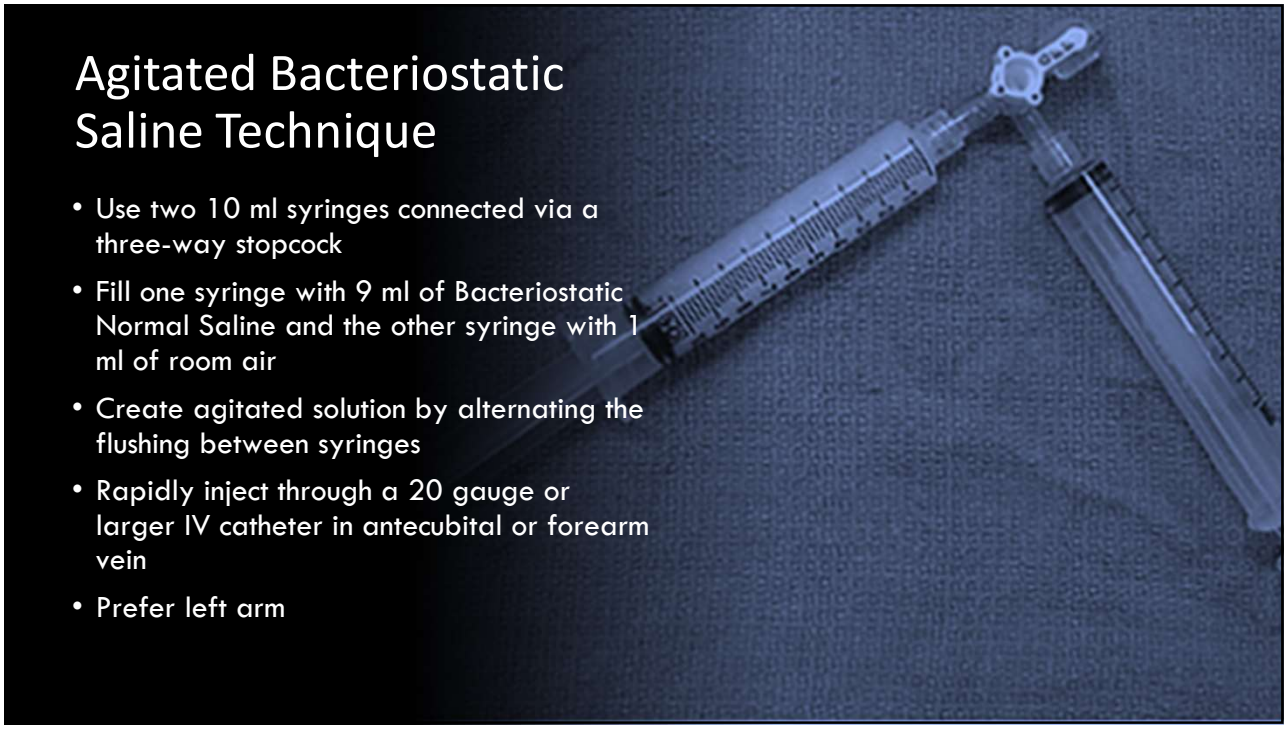
Agitated Bacteriostatic Saline Technique



- Use two 10 ml syringes connected via a three-way stopcock
- Fill one syringe with 9 ml of Bacteriostatic Normal Saline and the other syringe with 1 ml of room air
- Create agitated solution by alternating the flushing between syringes
- Rapidly inject through a 20 gauge or larger IV catheter in antecubital or forearm vein
- Prefer left arm

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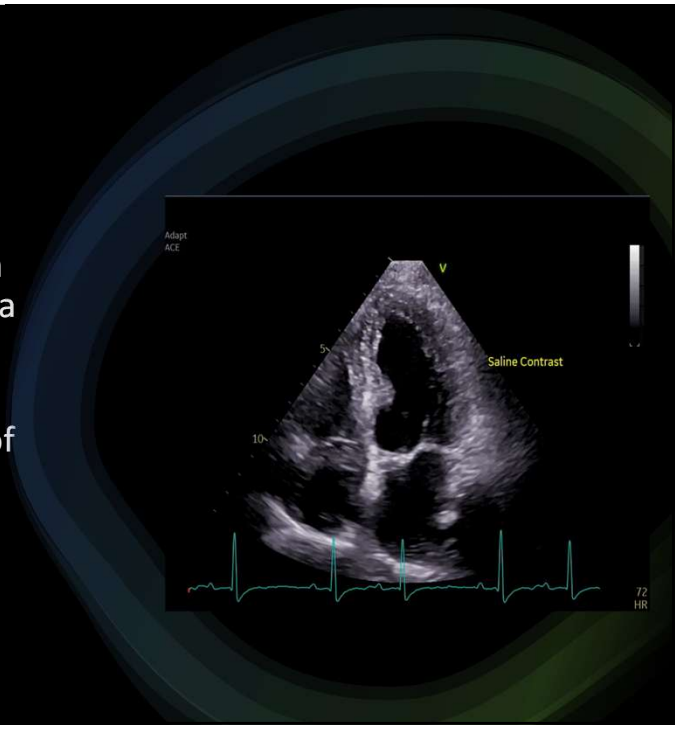
Agitated Saline Technique

- Echocardiographic imaging is centered on the intra-atrial septum while viewing the left and right atria (Apical 4 chamber view)
- Acquisition should begin with at least 2-3 beats prior to the arrival of the saline contrast into the Right Atrium and continued for 10 beats after visualization
- Perform at rest and ask the patient to perform a Valsalva maneuver



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Agitated Saline Diagnostic Findings

- Visualization of microbubbles in the left atrium(LA) suggests the presence of an intracardiac or transpulmonary shunt
- **Early**- microbubbles appear in the LA within 3-5 beats strongly suggests PFO or ASD**.**
- **A sinus venosus ASD** may result in LA opacification simultaneous with(or before) RA opacification
- **Late**- late microbubbles(>5 beats)suggests transpulmonic shunting

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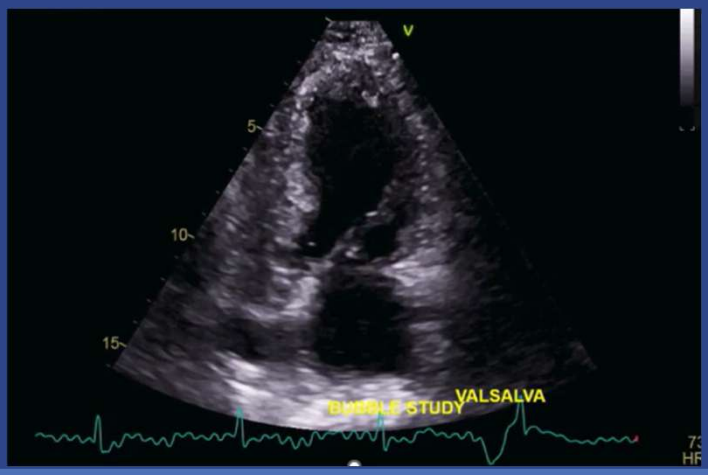
Positive Saline Contrast with Valsalva



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Negative Saline Contrast

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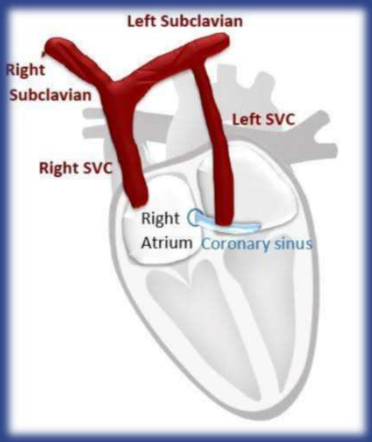
Persistent Left Superior Vena Cava (PLSVC)

- A congenital anomaly where a vein that normally disappears during fetal development persists on the left side
- Most common congenital anomaly of the thoracic venous system with a prevalence of 0.3-0.5% in the general population
- Usually asymptomatic and found incidentally
- May complicate catheter placement within the right side of the heart



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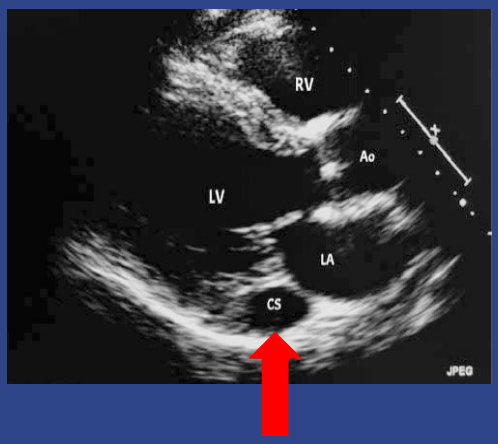
Persistent Left Superior Vena Cava

- Usually an incidental finding on echo
- Dilate Coronary Sinus noted on PLAX View
- Saline contrast needed to confirm
- Performed with IV in left arm



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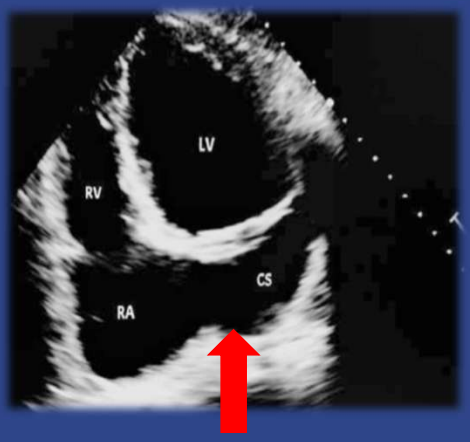
PLSVC

- Perform in left arm IV
- Document in report location of IV
- Prior to injecting saline contrast have coronary sinus in view
- Apical 4 chamber view with a slight tilt anteriorly to view coronary sinus



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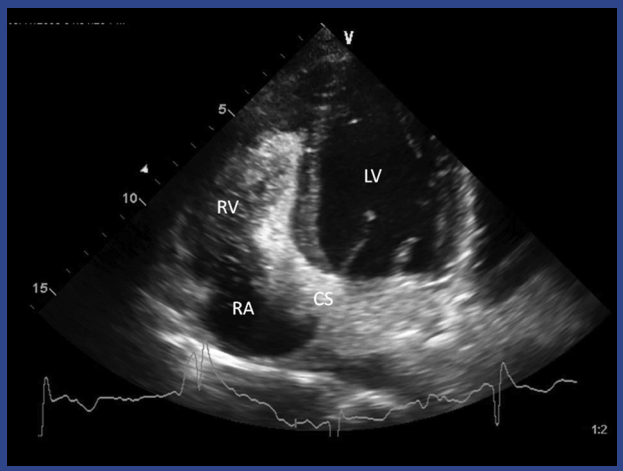
PLSVC



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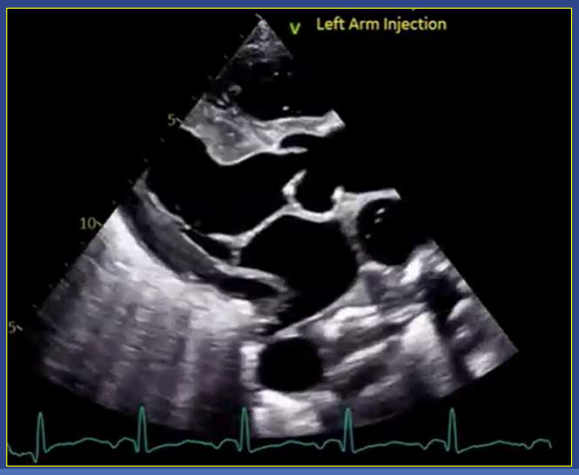
Left Persistent Superior Vena Cava w/Saline Contrast Injected in Left Arm



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Suspected unroofed CS (Type 1) with Persistent LSVC

- 38 year old female
- History of stroke 1 year prior
- No prior cardiac history
  - Previous echo showed no shunt
- Woke up with hands & arms numb
- Stroke work up
  - Echo Ordered with saline contrast study

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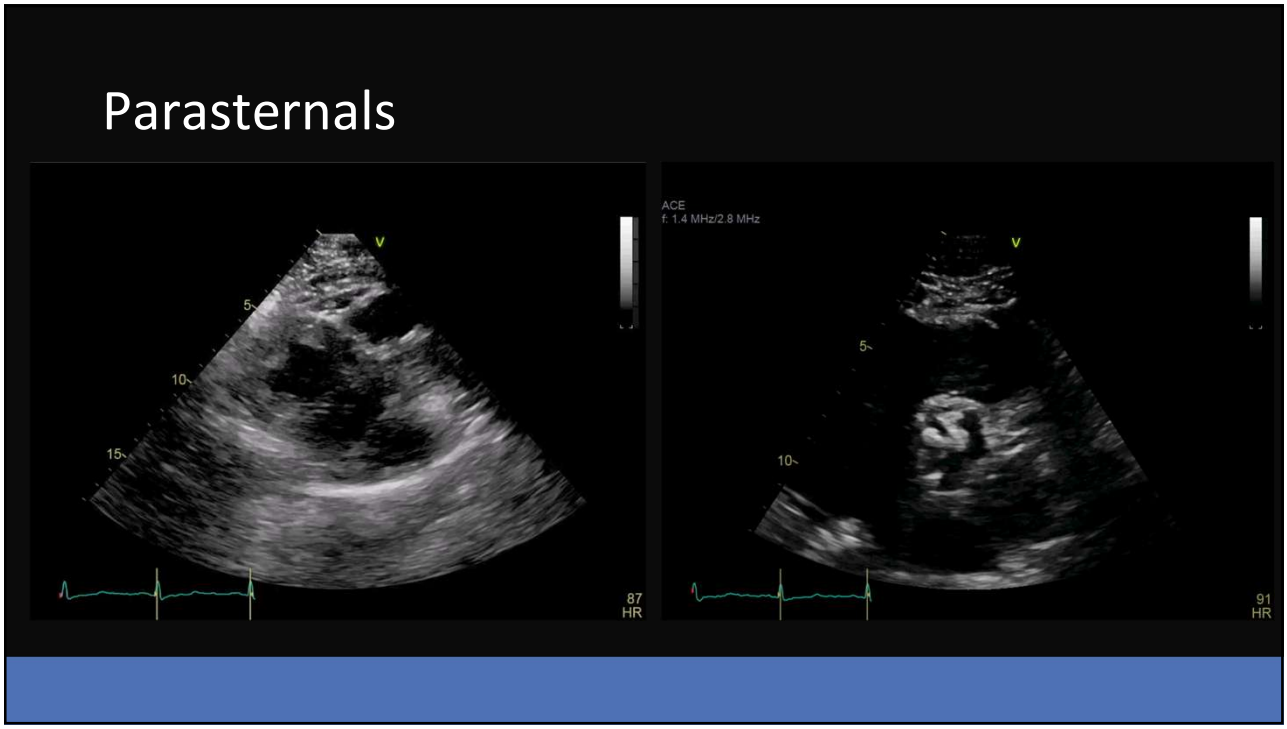

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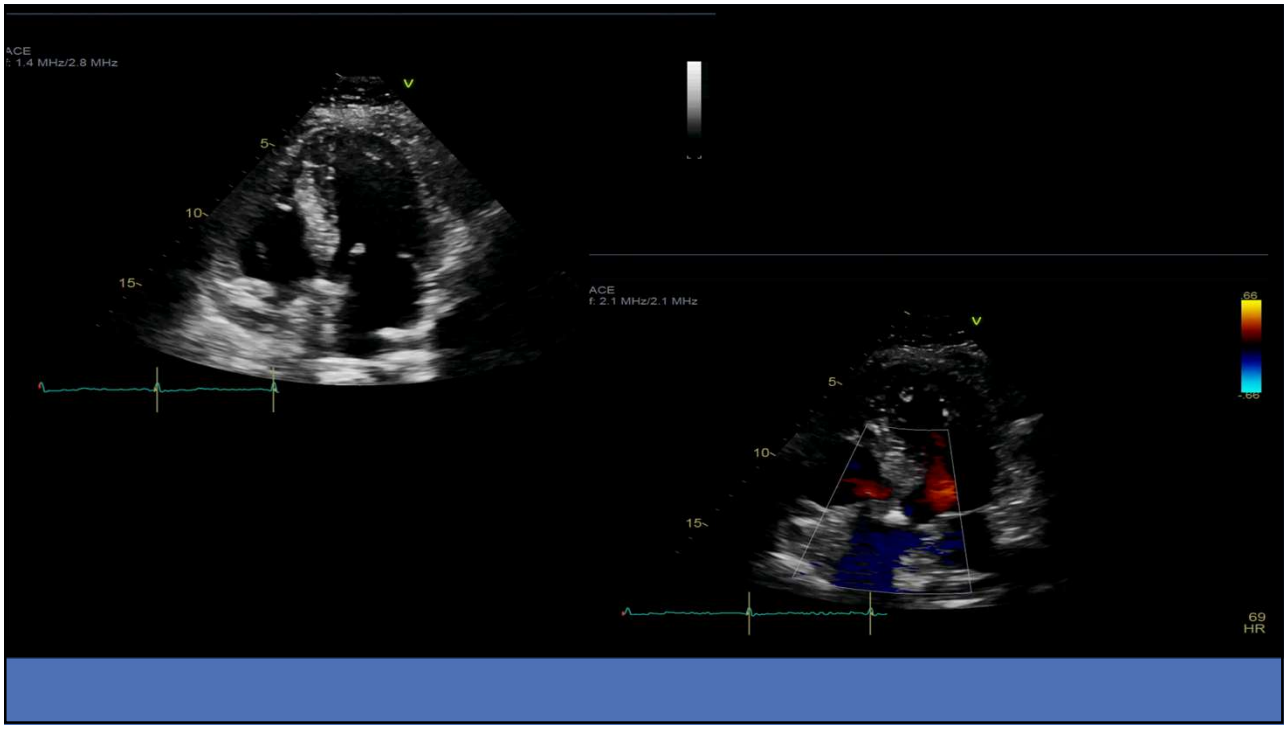

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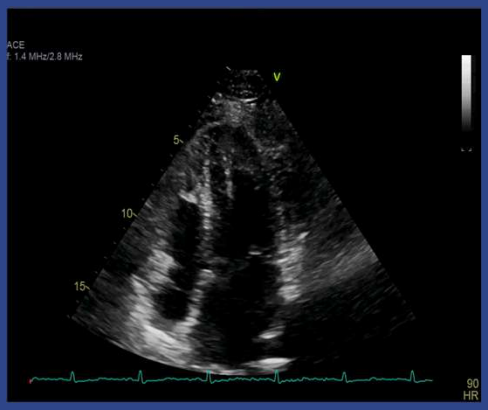
Saline Contrast Study

- Left cubital vein for saline contrast injection
- Flows to brachial cephalic
- To Left Subclavian
- Left Superior Vena Cava
- Coronary Sinus
- To Left Atrium



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Echo Summary

- Normal left & right ventricular function
- Aortic valve is thickened with restricted cusp opening.
- Moderate to severe aortic stenosis – AVA -0.95cm² & Dimensionless Index – 0.28.
- Normal left & right atrial size
- Saline contrast injected through left arm IV: Immediately filled the left atrium, suggestive of a large right to left shunt
- Suspected unroofed CS (Type 1) with Persistent LSVC
- CMR ordered for further evaluation

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Cardiac MR

- CMR – more accurate assessment of posterior structures than transthoracic echo and with viewing vascular structures outside the heart
- Indication: Abnormal echocardiogram suggestive of an Unroofed Coronary Sinus with Persistent Left Superior Vena Cava
- CMR in agreement with echo findings and confirmed LPSVC and unroofed coronary sinus findings

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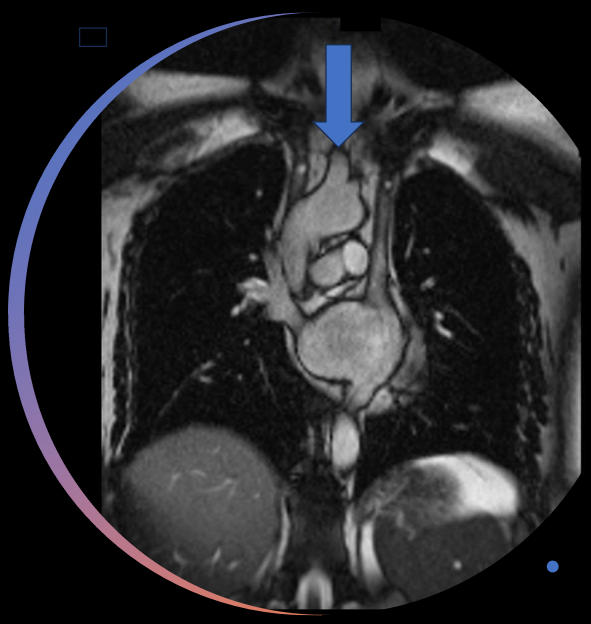

CMR Findings:

- Prominent left superior vena cava

CMR – Axial Cine Stack

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Case Summary

- Patient had clean coronaries
- Patient received an AVR
- S/P reconstruction of coronary sinus to repair left superior vena cava to left atrium communication

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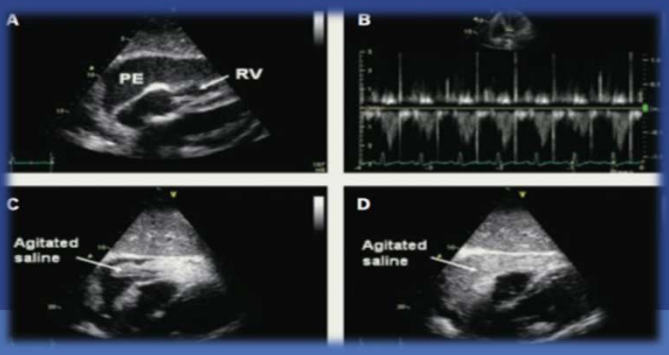
Other indications for Saline Contrast

Pericardialcentesis

- Ensures exploratory needle is within the pericardial space
- Prevents inadvertly placing catheter in right ventricle



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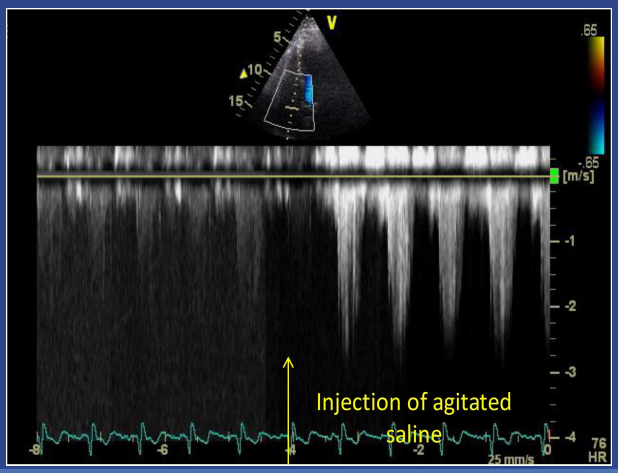
TR Gradient Enhancement with Saline Contrast



- Saline may bloom out the Doppler signal
- Wait until saline dilutes out
- Measure to the chin and not the beard!

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Saline Contrast Summary

- There are several indications for Saline Contrast other than PFOs & ASDs
- Think about your echo as you complete it and see if there are any additional indications:
  - Atrial communication
  - Persistent LSVC
  - Right heart Doppler enhancement
  - Location for Pericardialcentesis
  - IAC protocol requirement for TEE
  - Remember to note location of IV – Left arm preferred

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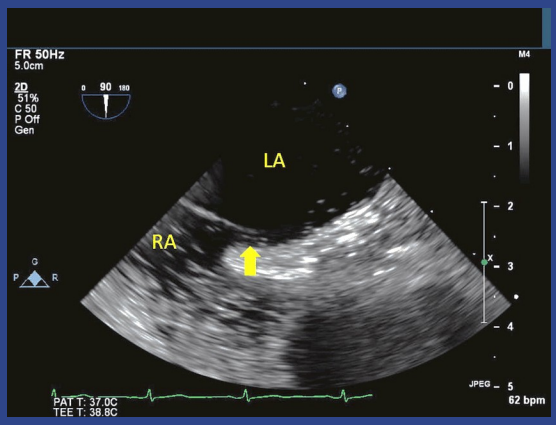
TEE with right to left shunt via PFO



IAC TEE Standards:

- Multiple imaging planes of the atrial septum and foramen ovale with appropriate Doppler.
- In cases of suspected cardiac source of emboli, when no obvious intracardiac shunt is identified with color Doppler, injection of agitated saline is required unless contraindicated.

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Questions??

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