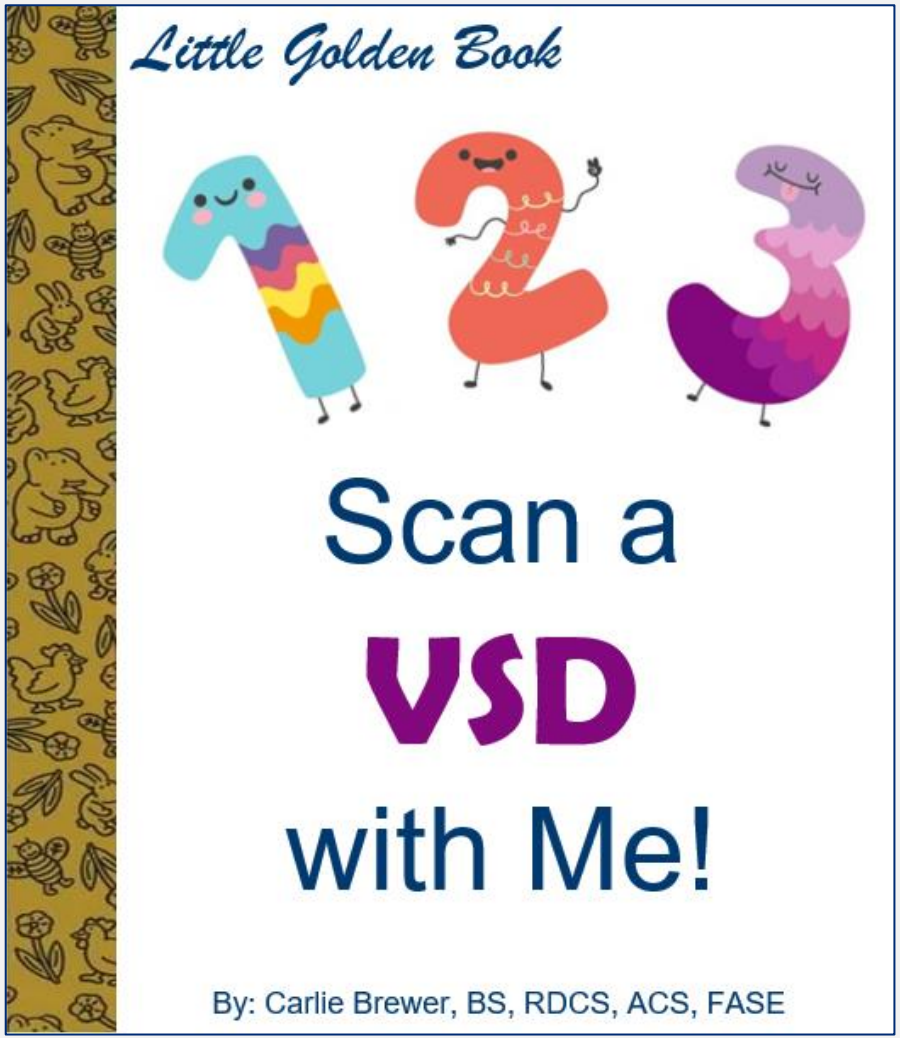
Welcome to Story Time!



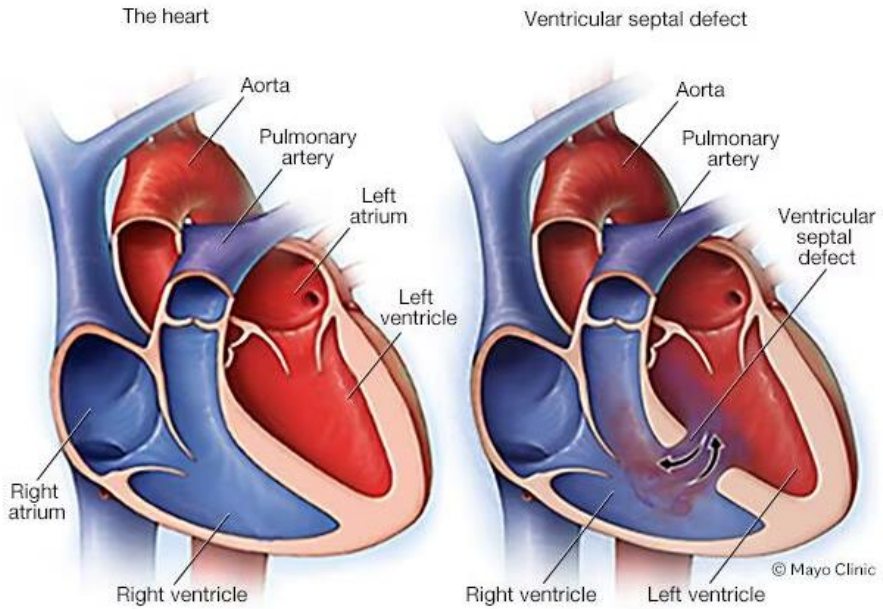
Children's Hospital Colorado
Here, it's different.

Affiliated with
University of Colorado
Anschutz Medical Campus

No disclosures

Once upon a time, **three** golden rules were established for scanning ventricular septal defects (VSDs). The three golden rules were:

1. Sweeps
2. Color Doppler
3. Spectral Doppler



Imaging goals for a patient with a VSD:

- Identify size, location and type
- Identify direction and peak velocity of shunting
- Evaluate the left heart size
- Search for other associated lesions including more VSDs
- Evaluate if surrounding structures are affected because of the VSD (TV, AR)

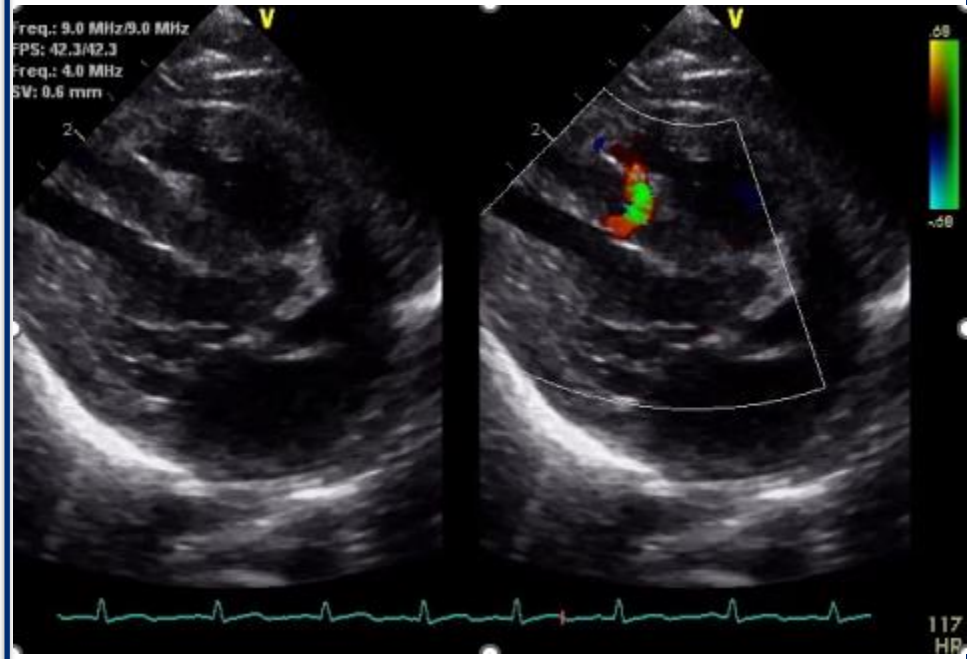
Imaging goals for a post-operative patient with VSD:

- Determine type of repair performed
  - Surgical (patch vs suture)
  - Device
- Evaluate for a residual defect
- Evaluate surrounding structures for insufficiency or impingement
- Evaluate for effusions

Golden Rule # 1: Sweep!

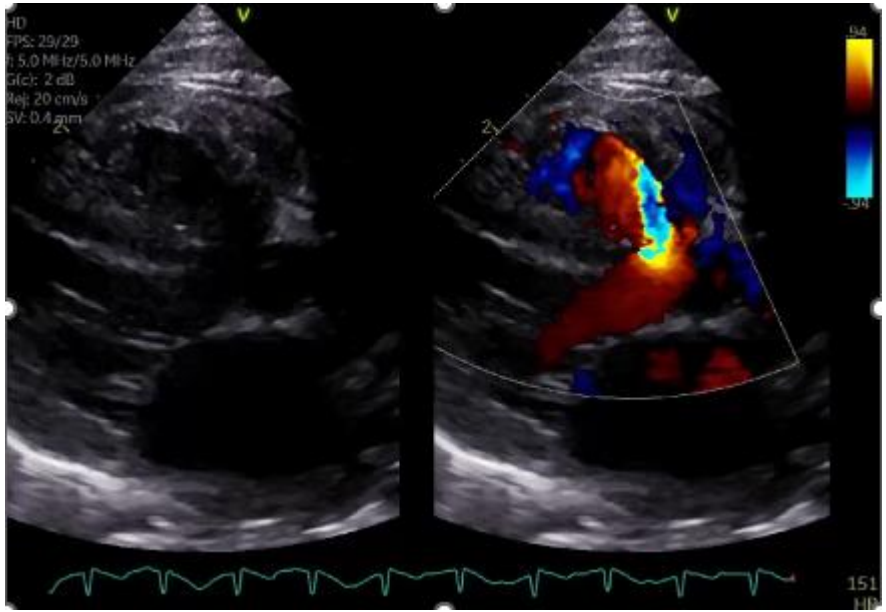
Sweeps are important because:

- The ventricular septum is a structure that spans from the anterior portion of the heart to the posterior portion of the heart in which all portions cannot be seen in a single view.
- Sweeps help us identify exactly where the defects are and what neighboring structures they may affect.
- If you find one VSD, the likelihood of finding another VSD is high, so sweep!
- Slow sweeps with color compare are ideal.
- Wherever a VSD can be seen, it should be swept and interrogated with color and spectral Doppler.



Parasternal long axis sweep with color compare showing a small muscular trabecular VSD in the mid septum

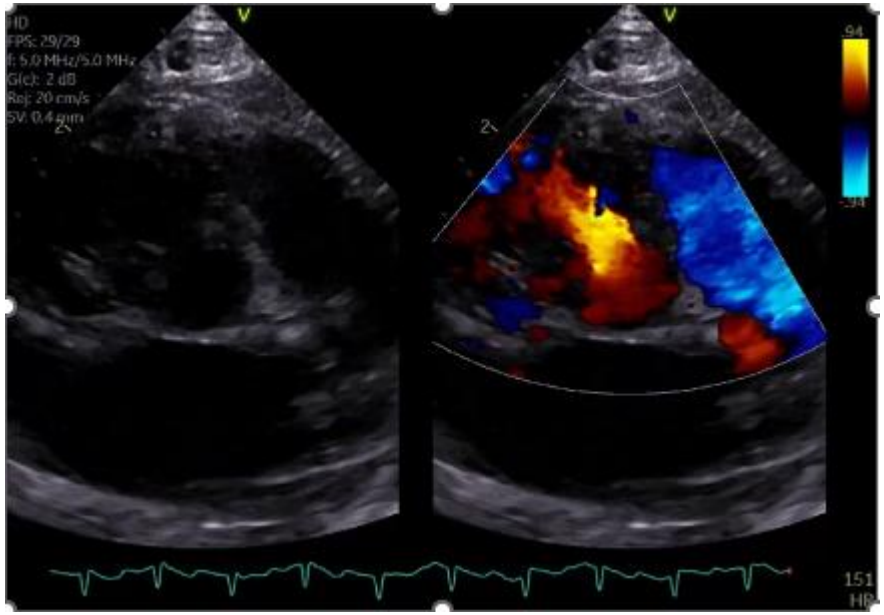
Sweep with Style- PLAX



Starting Point: Ao/MV LAX
Destination: Ao/MV LAX
Cursor*: Right shoulder

* = probe indicator

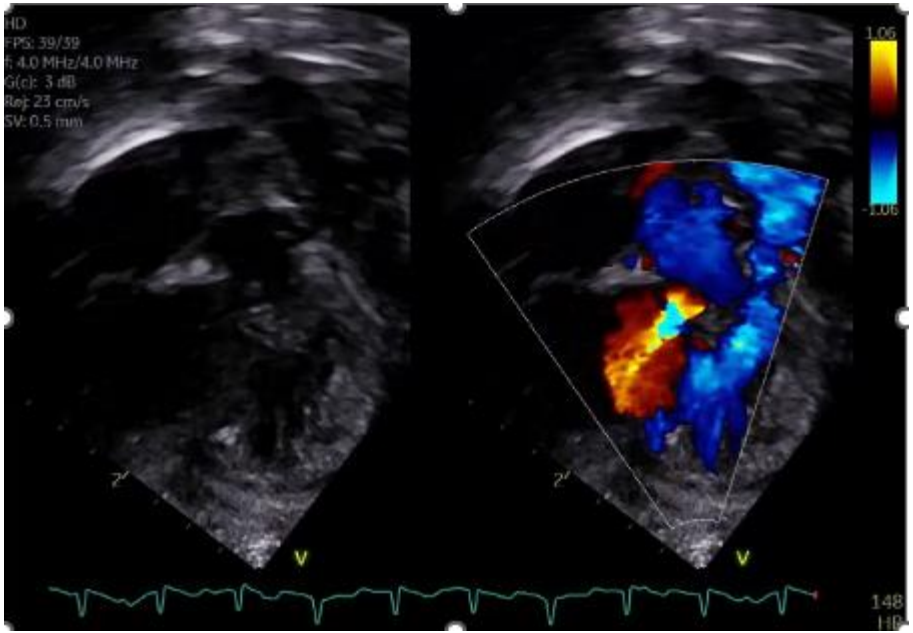
Sweep with Style- PSAX



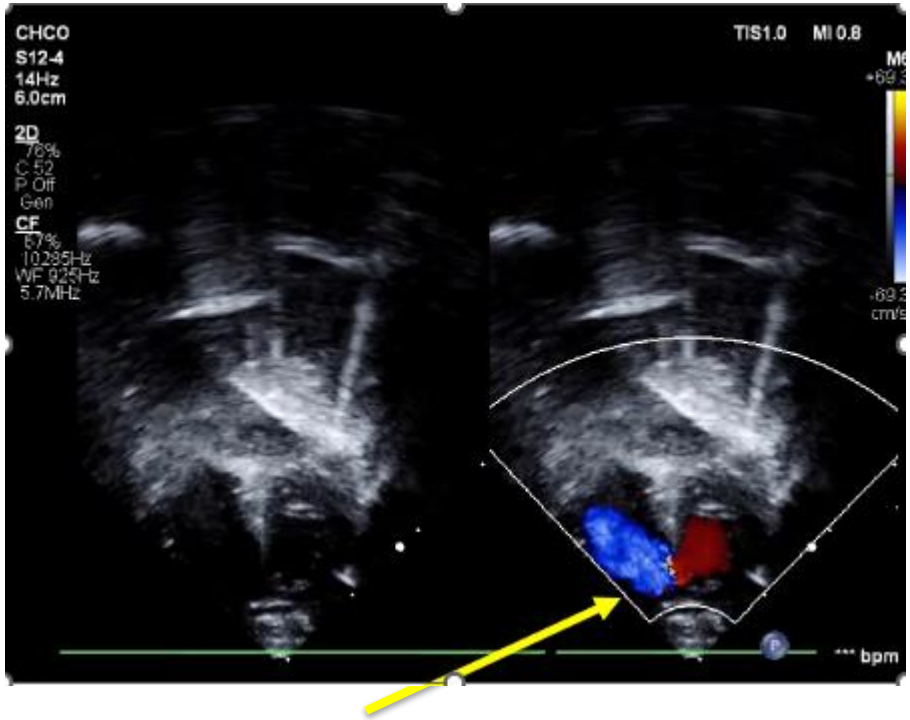
Starting Point: Mid left ventricle
Destination: Base (TV, AoV, PV)
Cursor*: Left shoulder

* = probe indicator

Sweep with Style- Apical

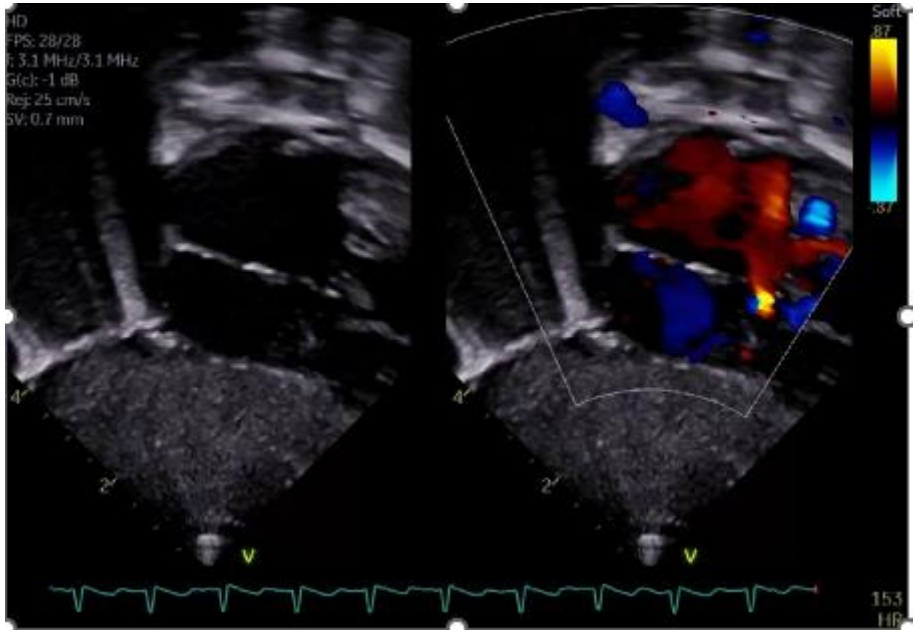


Starting Point: Apical 4 chamber
Destination: PV
Cursor (indicator): 3 o' clock



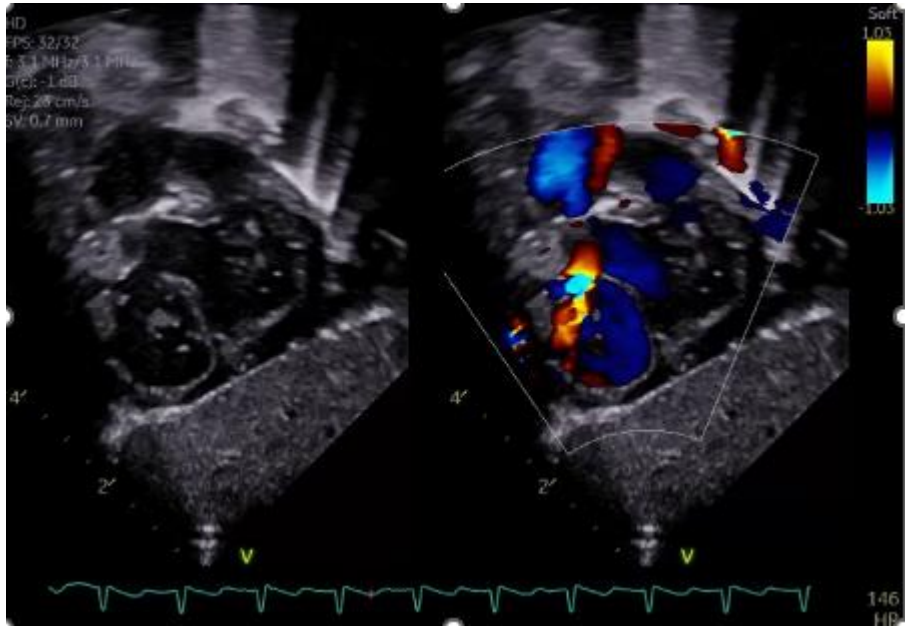
Don't forget about the apex! Some defects are tucked very far into the apex and can be significant.

Sweep with Style- Subcostal LAX



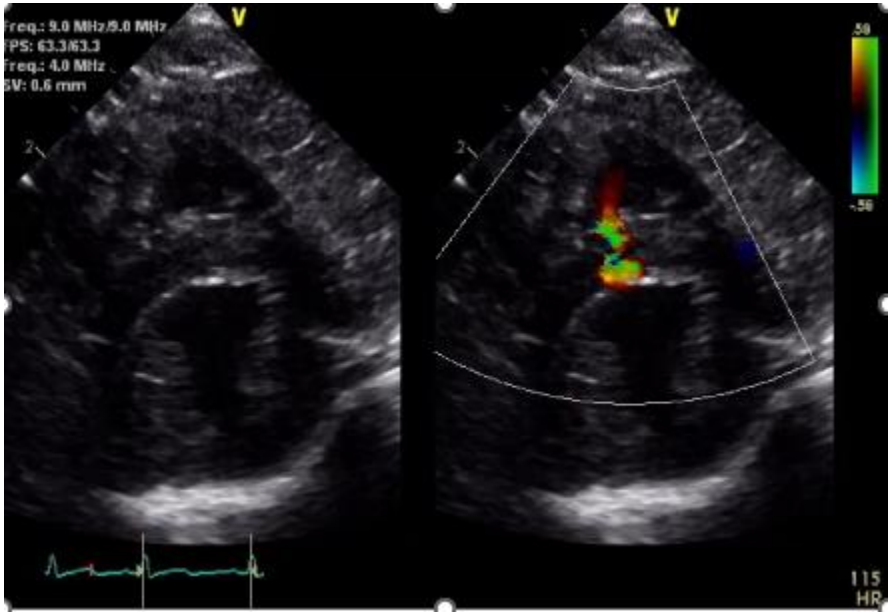
Starting Point: Cross section of belly
Destination: PV
Cursor (indicator): 3 o' clock

Sweep with Style- Subcostal SAX

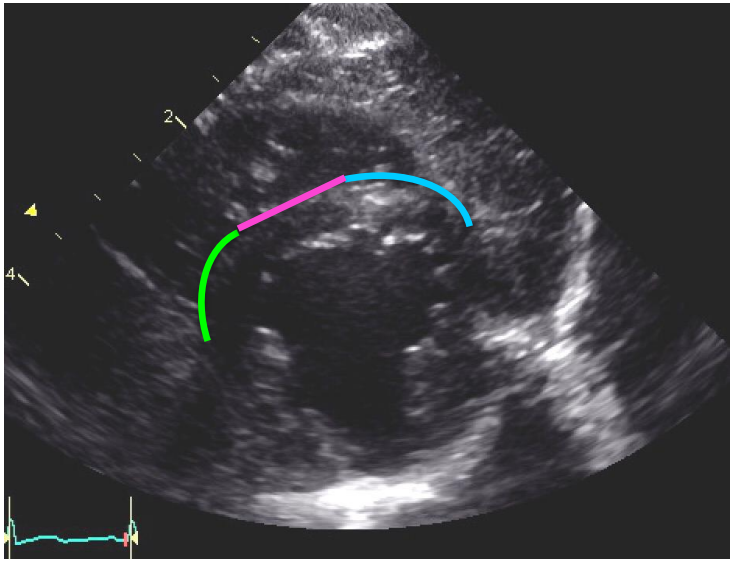


Starting Point: Mid left ventricle
Destination: Bicaval (SVC/IVC)
Cursor (indicator): 6 o' clock

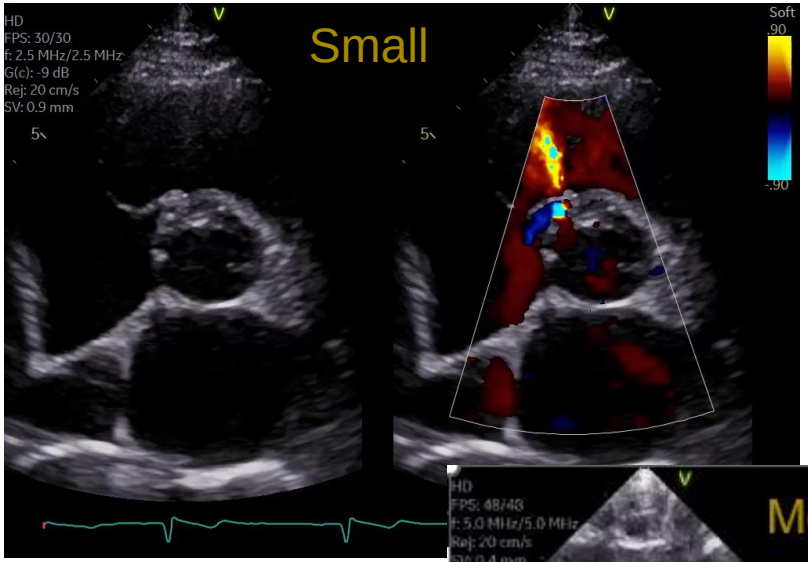
Determining VSD Size and Location (trabecular muscular)

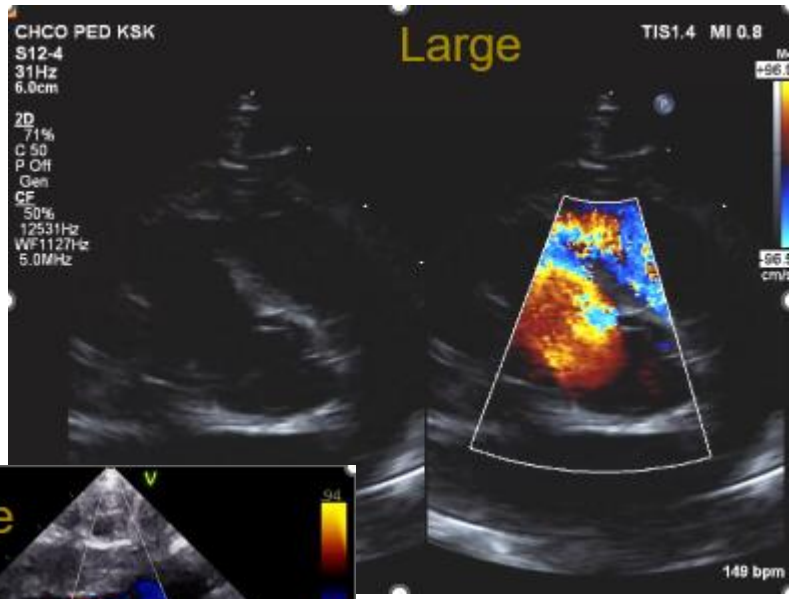


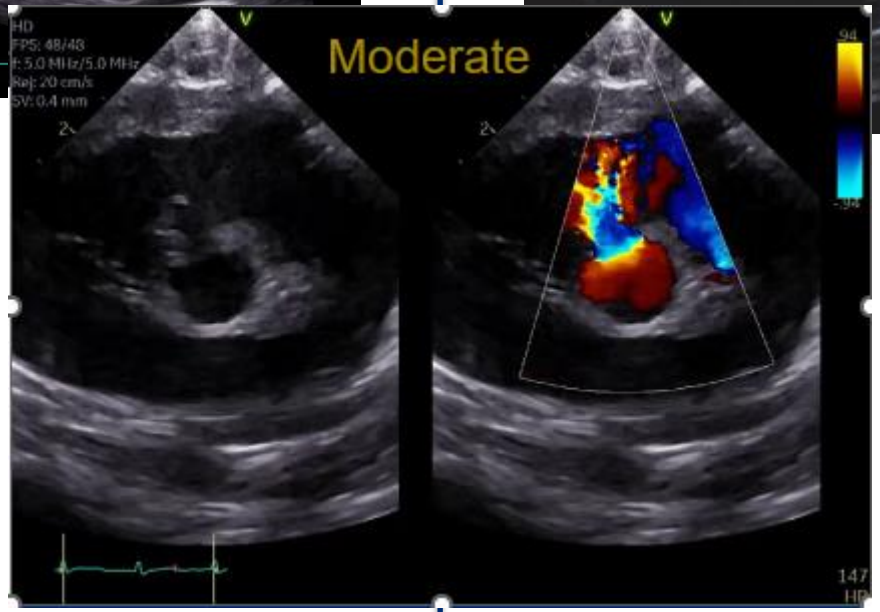
Small mid-trabecular muscular VSD



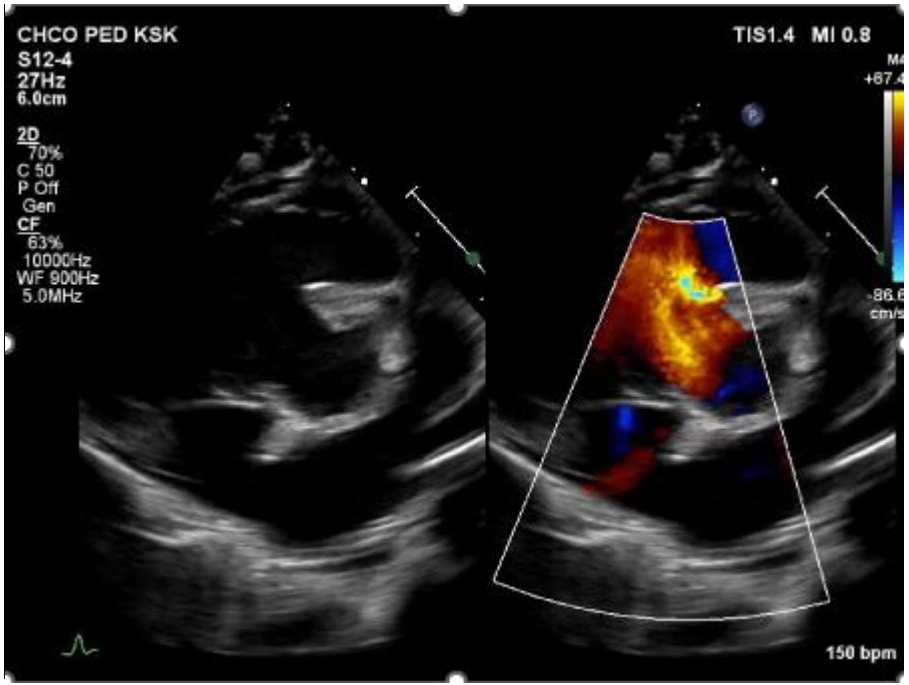
Anterior- closer to the pulmonary valve
Mid- central portion of septum
Posterior- closer to the tricuspid valve
Apical- inferior to the moderator band
Swiss Cheese- four or more muscular defects







Perimembranous central VSD



Anterior malalignment VSD
(associated with TOF)

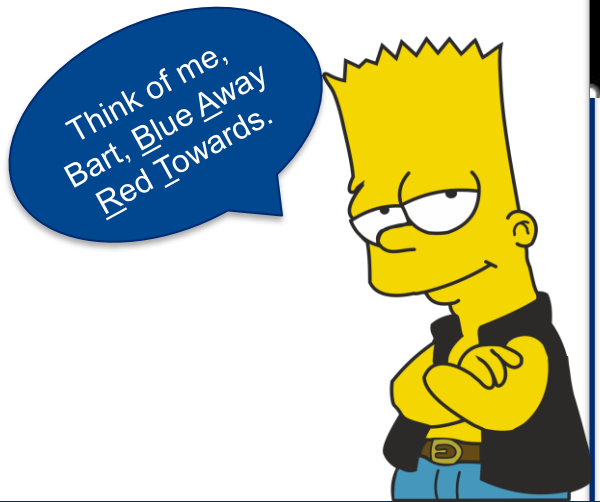
Versus

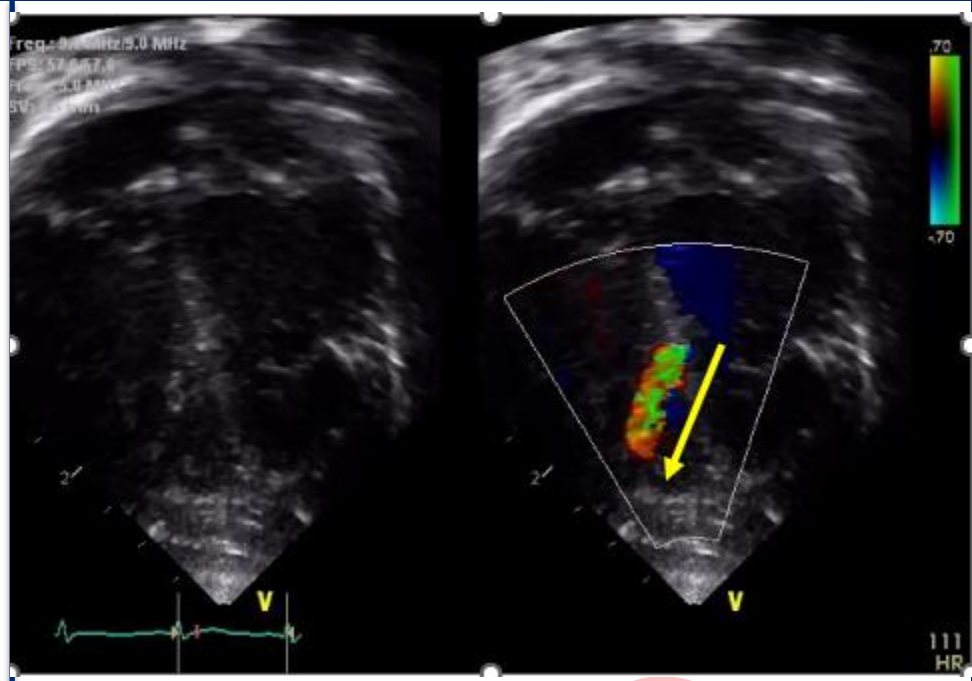
Posterior malalignment VSD
(associated with IAA)

Golden Rule #2: Color Doppler!

Color Doppler is important because:

- It helps us see defects when they can't be seen by 2D (smaller defects).
- It helps us identify what direction the blood is shunting.



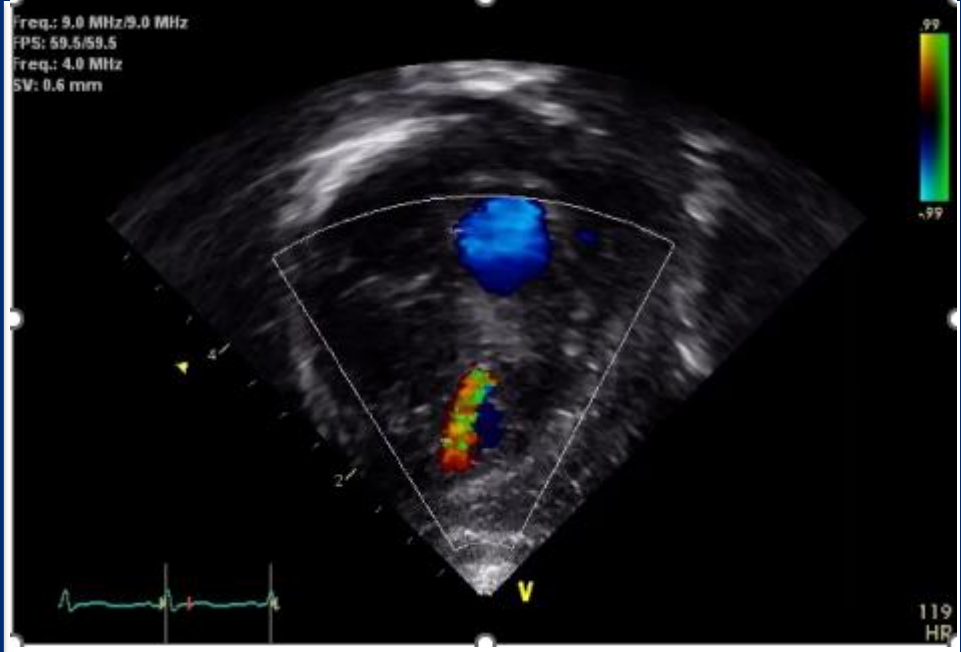


As always, blood flows to the path of least resistance!

Golden Rule #3: Spectral Doppler!

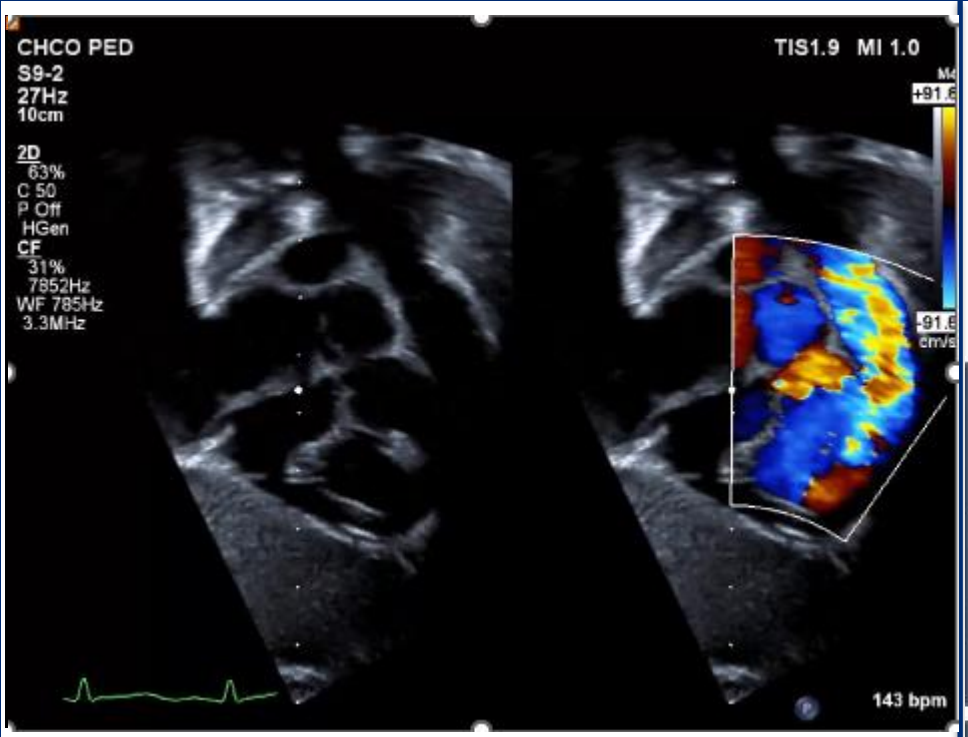
Spectral Doppler is important because:

- It's crucial to identify if the VSD is pressure restrictive.
- It helps us determine what direction the VSD is shunting.
- It will give us the peak pressure gradient which can help us determine size, restriction and pressures in the left and right heart.
- Utilize continuous wave (CW) Doppler to obtain the peak pressure gradient across the VSD.
- Pulsed wave Doppler (PW) can help us identify if there is a bidirectional aspect of the shunt.



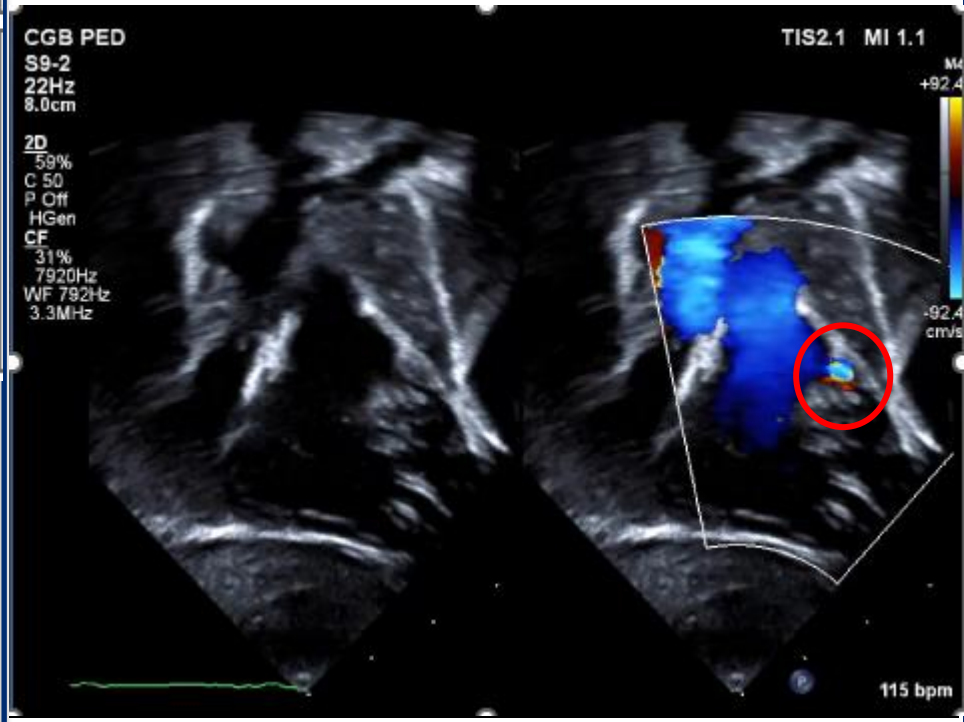
Apical inflow/outflow view

Utilize non-traditional imaging planes to get the best angle for spectral Doppler interrogation!



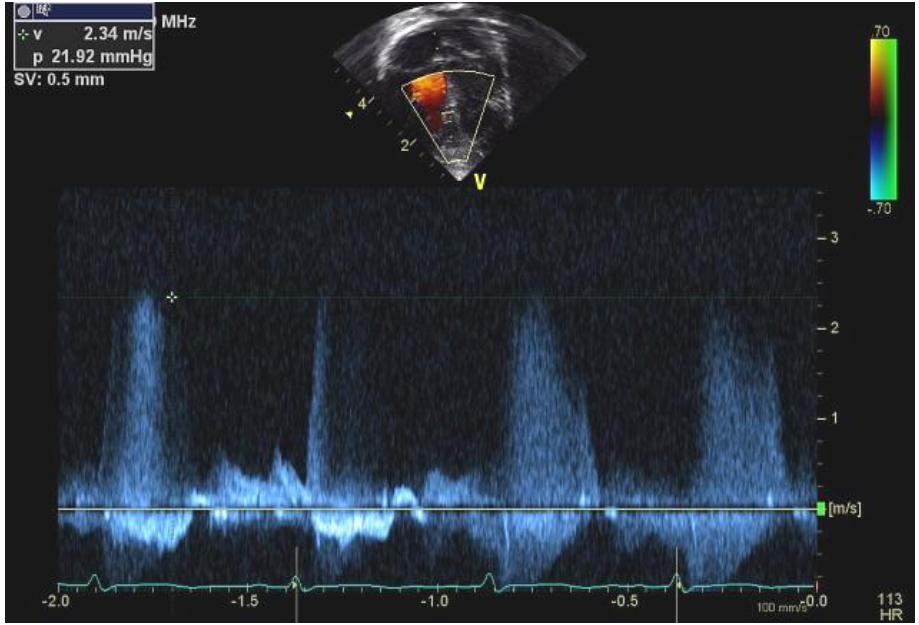
Subcostal outflow view demonstrating a large perimembranous VSD

Subcostal long axis view (tilted very anterior) demonstrating a small anterior muscular trabecular VSD

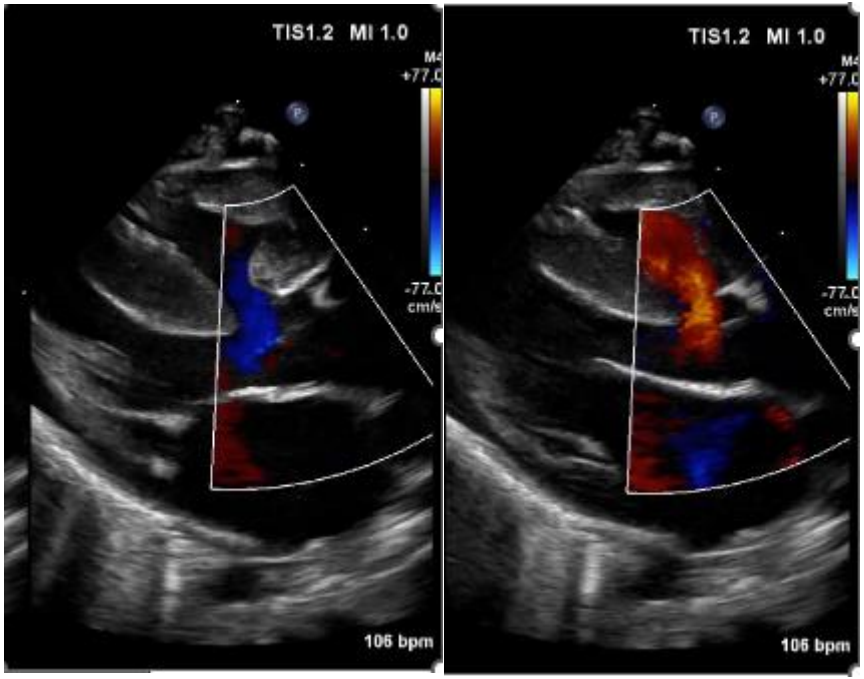


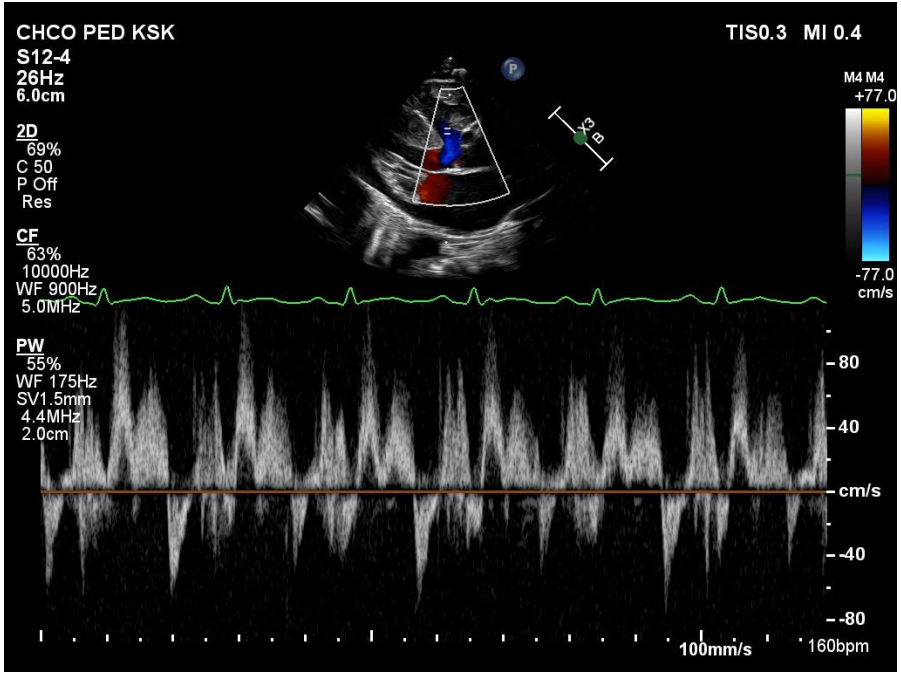
Simple Spectral Doppler Concepts

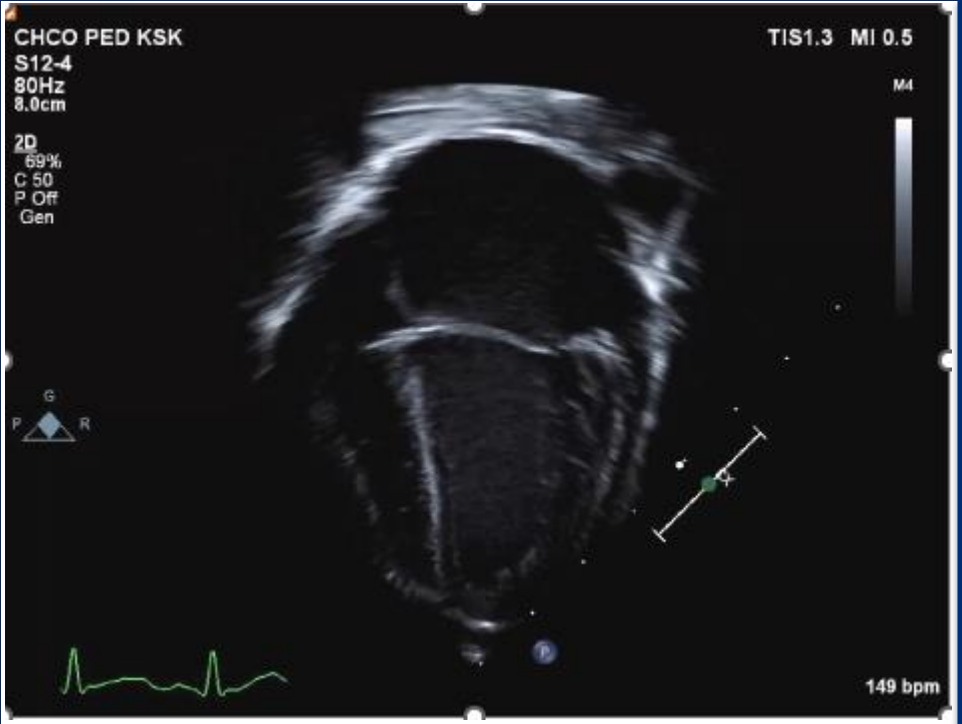
- As a reminder, VSDs shunt in systole and should be left-to right unless the right sided pressures are higher than the left sided pressures. Some causes for right-to-left shunting include:
  - High pulmonary vascular resistance of the newborn
  - Pulmonary hypertension
  - Eisenmenger syndrome- quite rare
- Restrictive is above 2 m/s and unrestrictive is below 2 m/s.
- When a defect decreases in size, the pressure should increase assuming normal right heart pressures



What can two images give us?

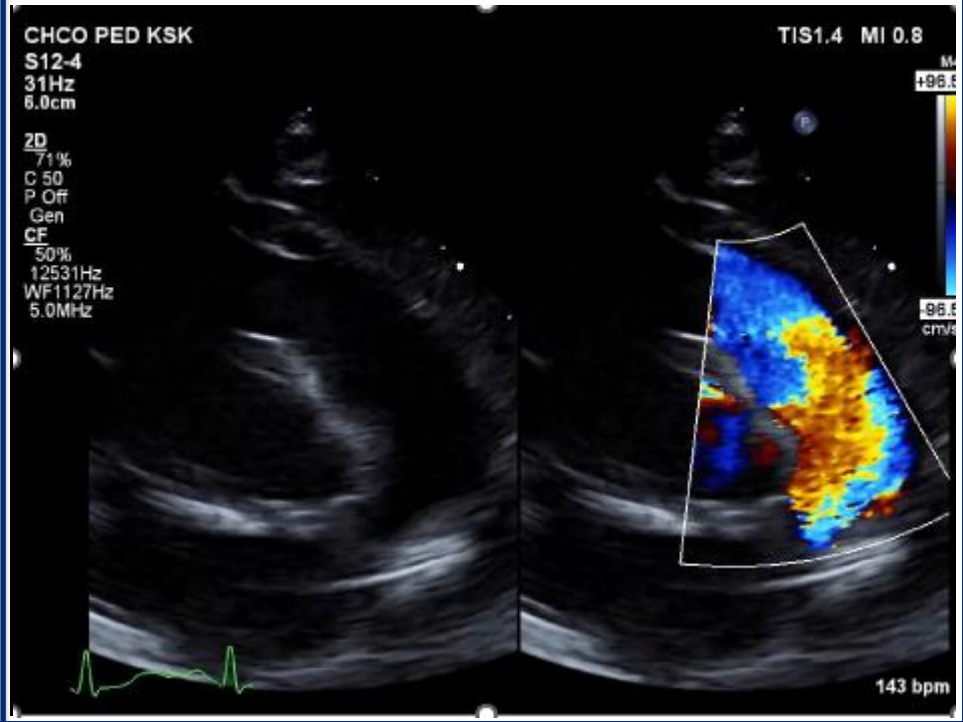






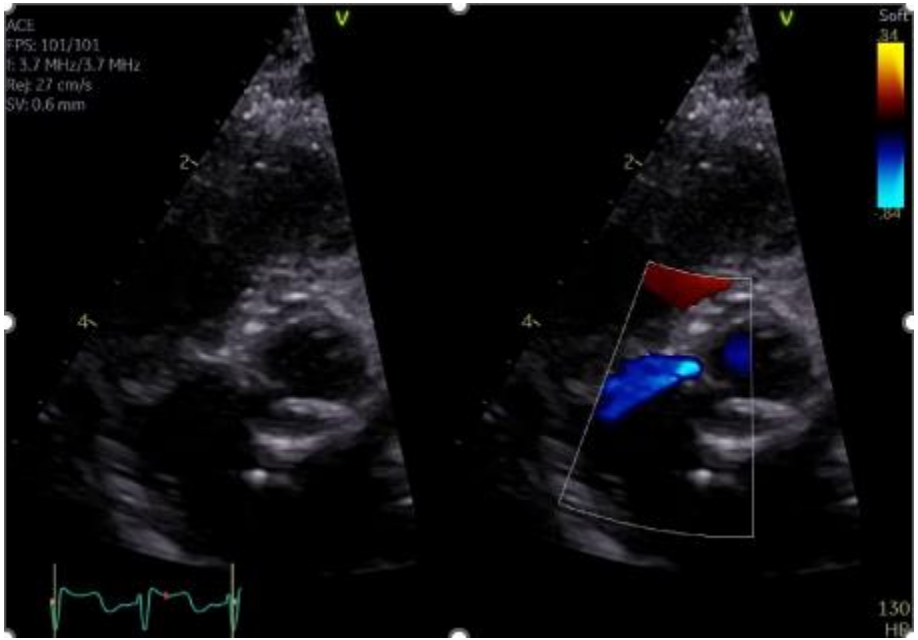
Dilated left heart secondary to volume overload from a large VSD

Turbulent pulmonary valve flow secondary to increased volume from a large VSD

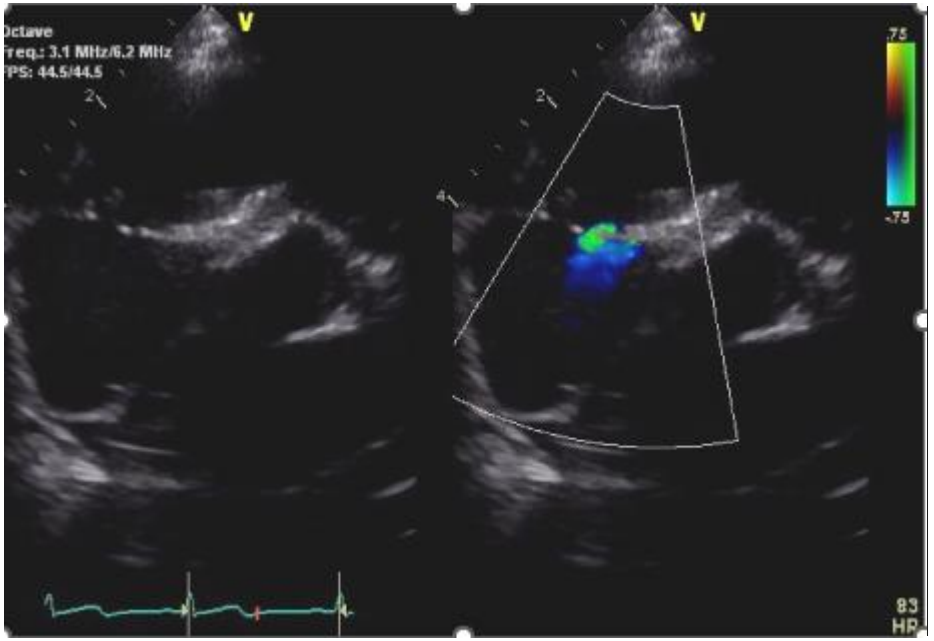


Post-Operative Checklist:

- ✓ Type- suture, patch, device
- ✓ Residual defects
- ✓ Surrounding structures
- ✓ Effusions



Patch repair of perimembranous VSD with residual defect



Device closure of perimembranous VSD with no residual defect and mild TR

Thank you!