Abnormalities of the Four-Chamber View and Outflow Tracts

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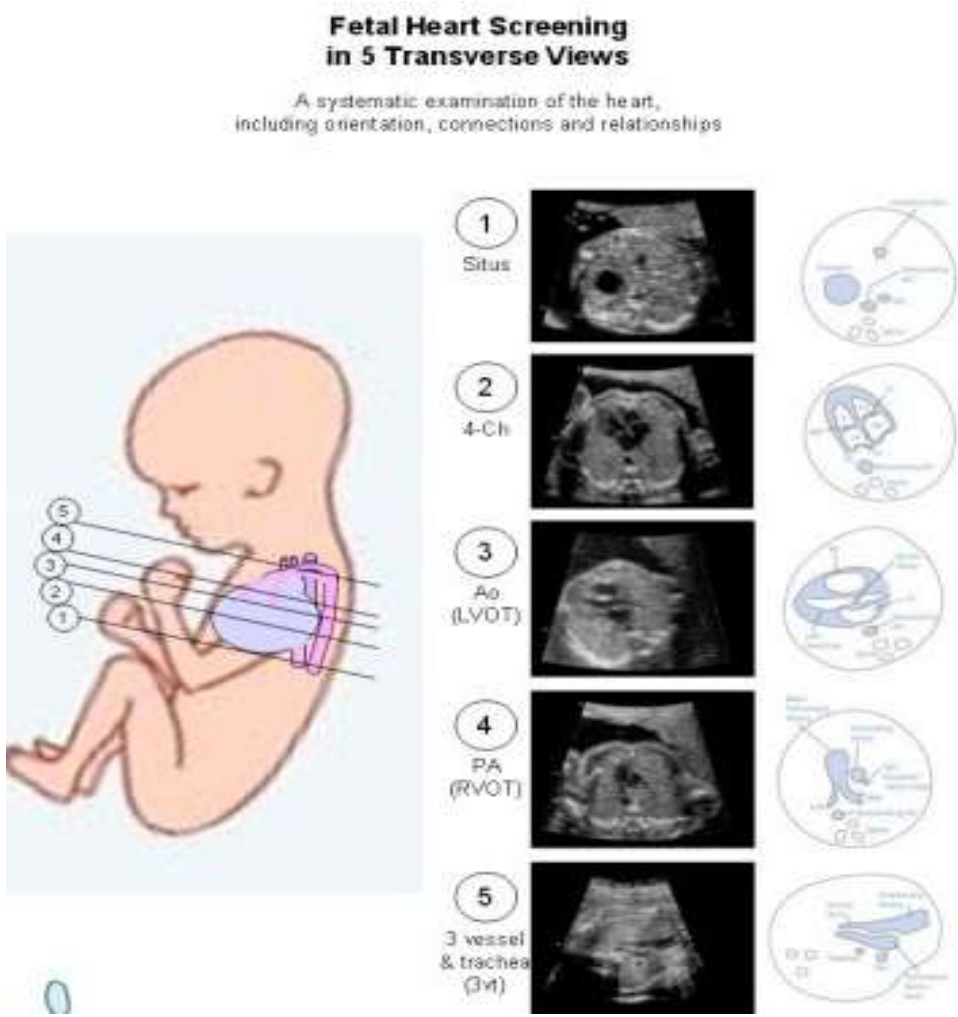
5 Transverse Views

- Situs
- 4 Chamber View
- LVOT
- RVOT
- 3 Vessel/Tracheal View



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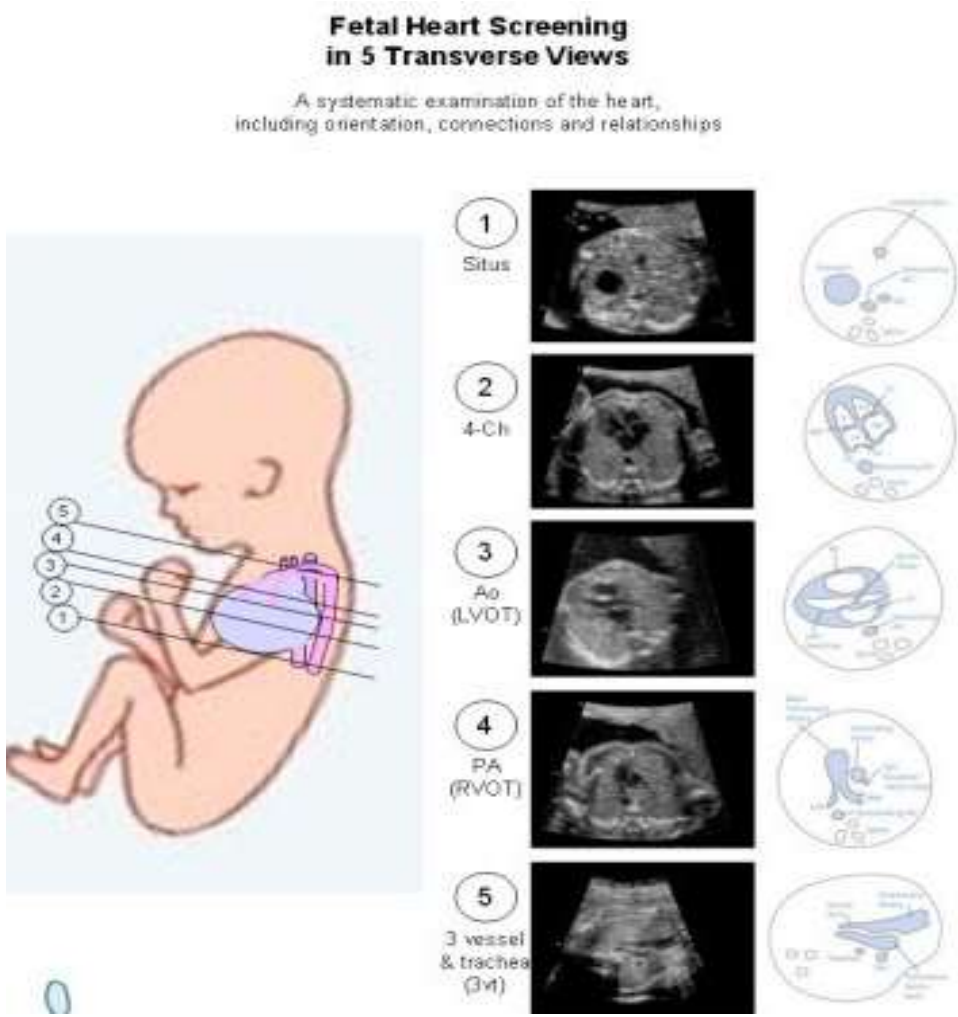
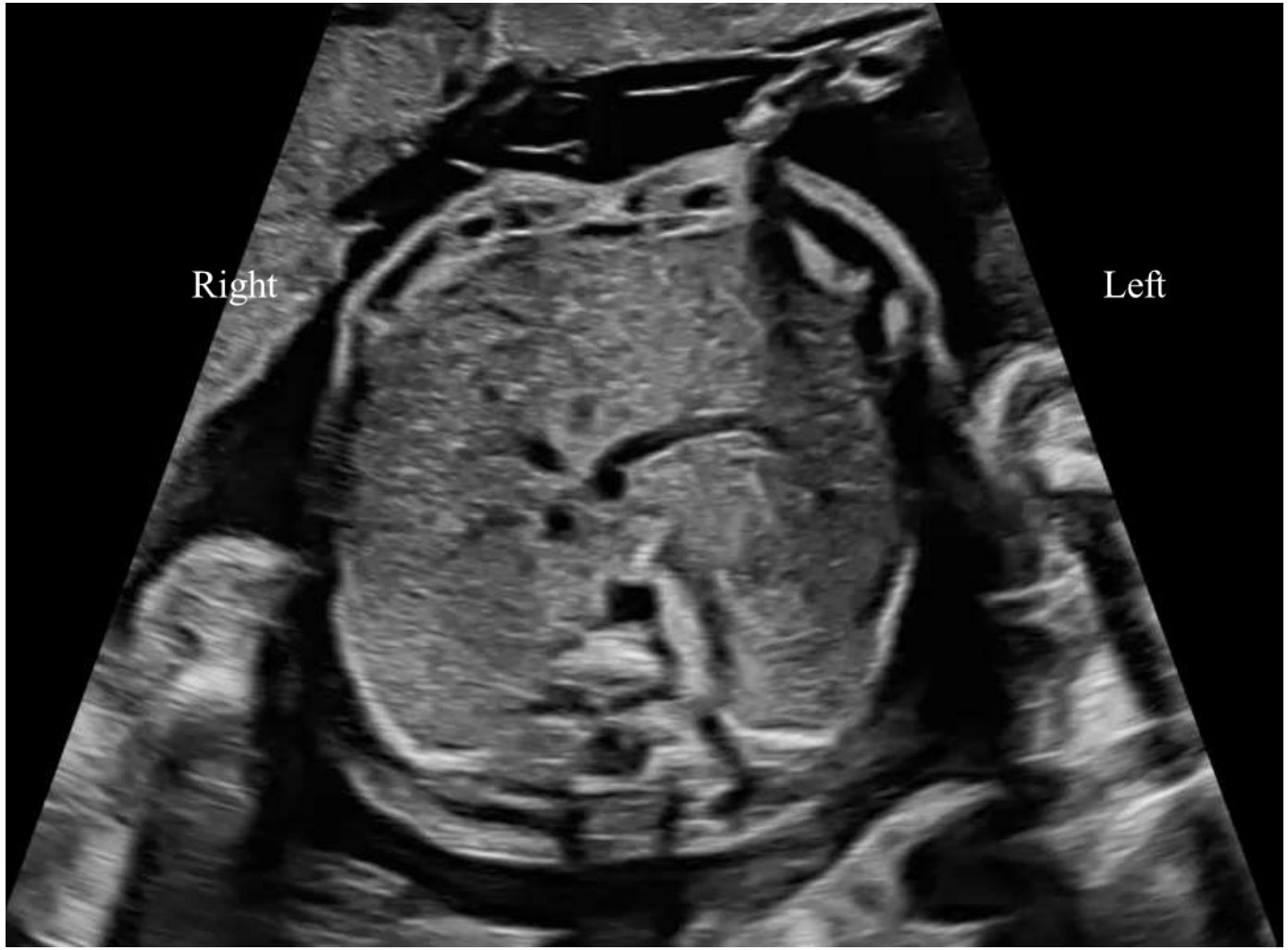


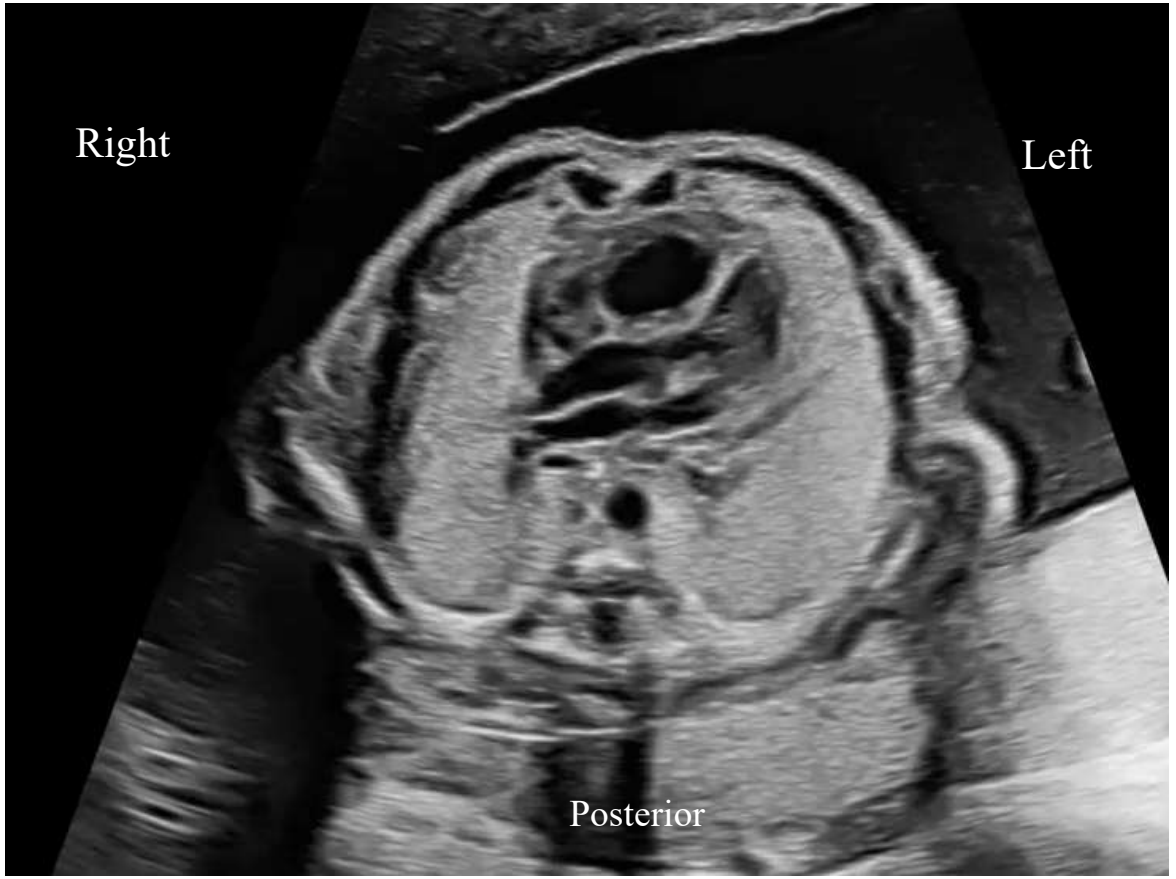
Normal Sweep



Four Chamber View

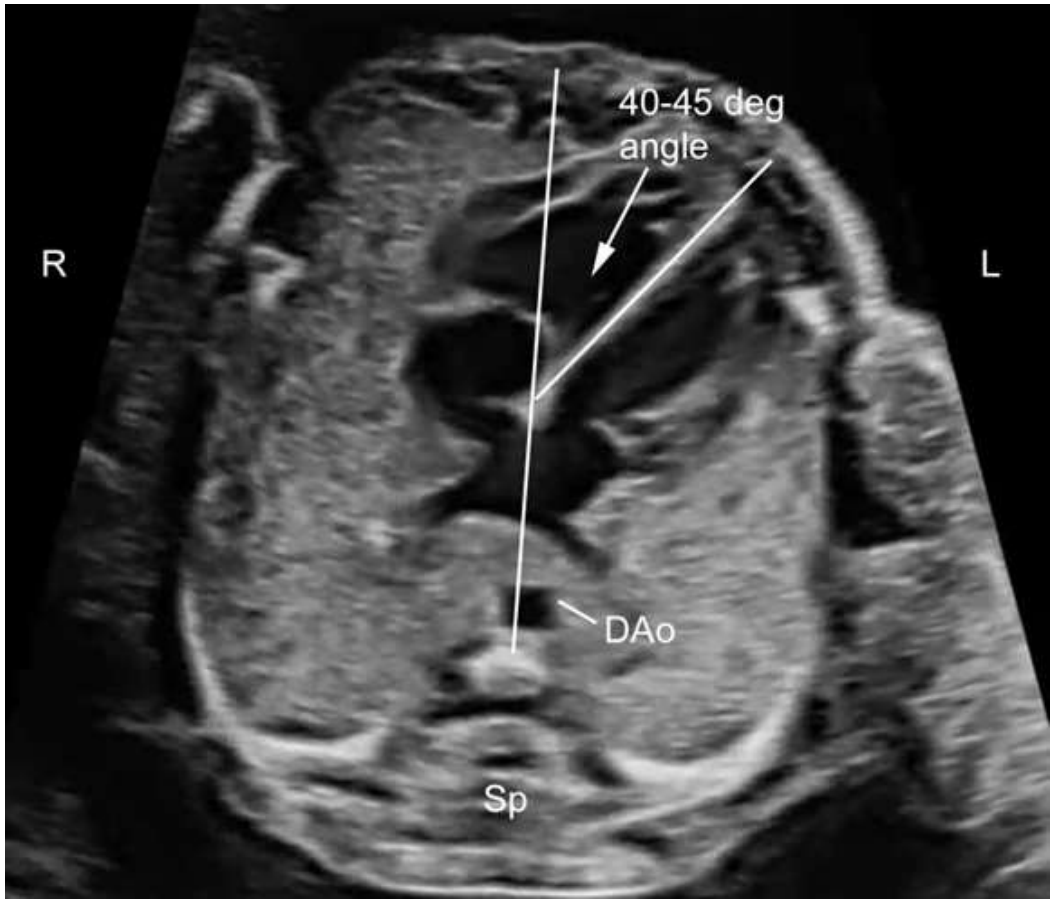
- Demonstrates substantial proportion of major cardiac defects
  - Plane of reference for obtaining other views systematically

- Heart size & position
- Two balanced atria
- Balanced ventricles with opening AV valves
- AV valve ‘offsetting’
- Ventricular septum
- Pulmonary venous drainage



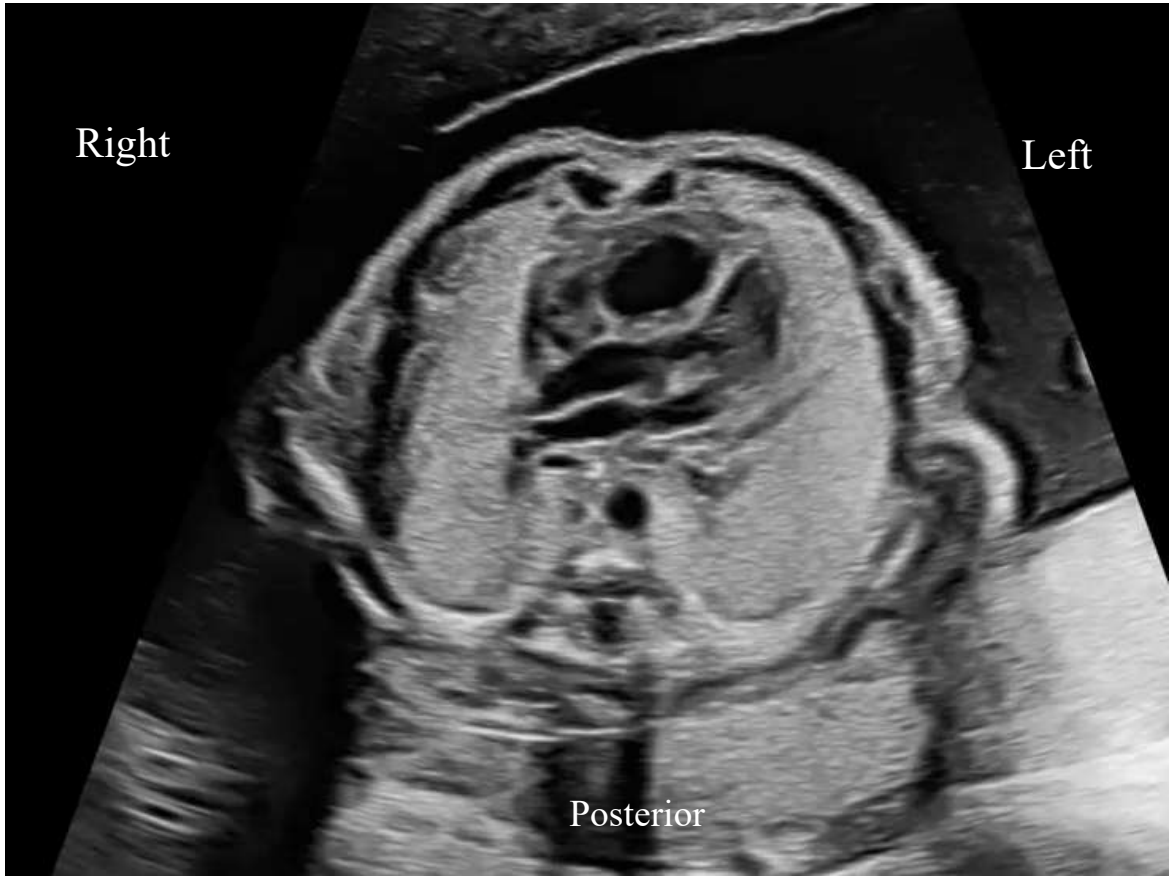
Four Chamber View

- **Heart size & position**
- Two balanced atria
- Balanced ventricles with opening AV valves
- Primum atrial septum
- AV valve ‘offsetting’
- Ventricular septum
- Pulmonary venous drainage



Four Chamber View

- Heart size & position
- **Two balanced atria**
- **Balanced apex forming ventricles with opening AV valves**
- Primum atrial septum
- AV valve ‘offsetting’
- Ventricular septum
- Pulmonary venous drainage

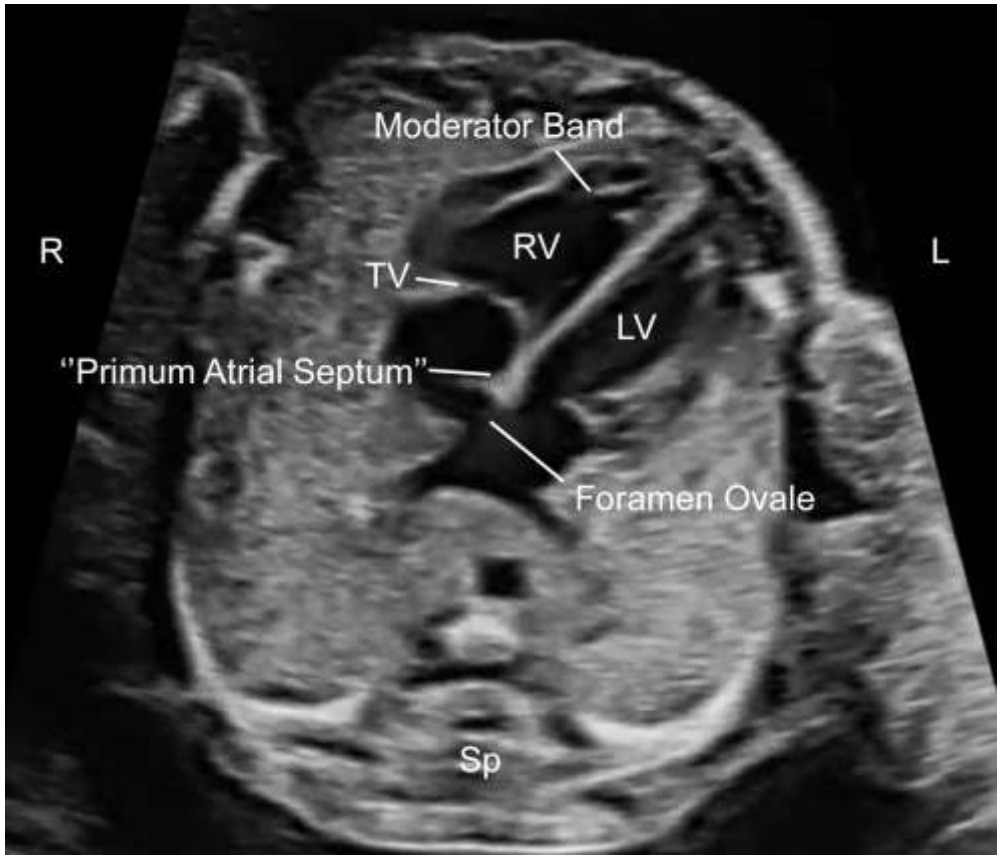


Four Chamber View – Colour Flow Doppler

- Antegrade flow across both mitral and tricuspid valves
- Two colour flows demonstrated
- Equal sized flows on colour
- No valvar regurgitation
- Colour is beneficial in challenging scans

Four Chamber View

- Heart size & position
- Two balanced atria
- Balanced ventricles with opening AV valves
- **Primum atrial septum**
- **AV valve ‘offsetting’**
- Ventricular septum
- Pulmonary venous drainage



What is the crux of the heart?

- Centre portion of the heart where the ventricular and atrial septum meet

- What is offsetting of the AV valves?

  - Normal offset – tricuspid valve (right) more apically placed than mitral valve (left)

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- Centre portion of the heart where the ventricular and atrial septum meet

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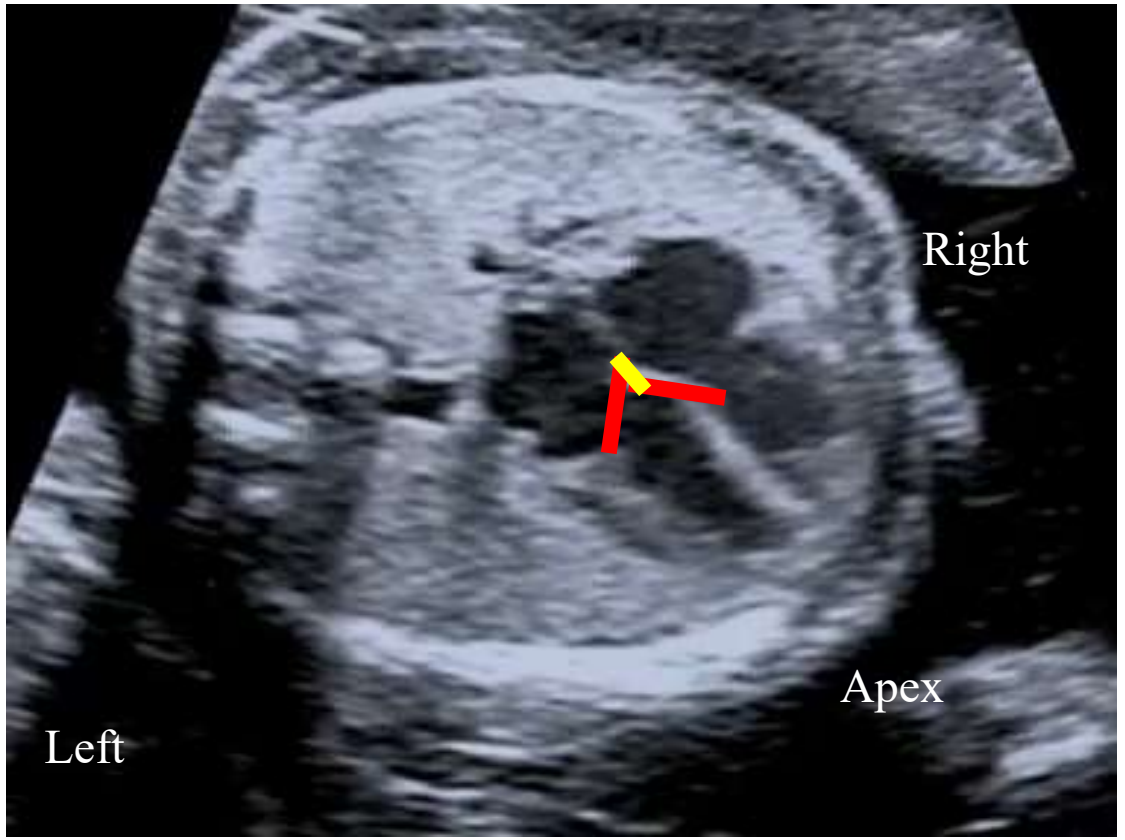
  - Normal offset – tricuspid valve (right) more apically placed than mitral valve (left)

- **Tricuspid valve more apically placed**

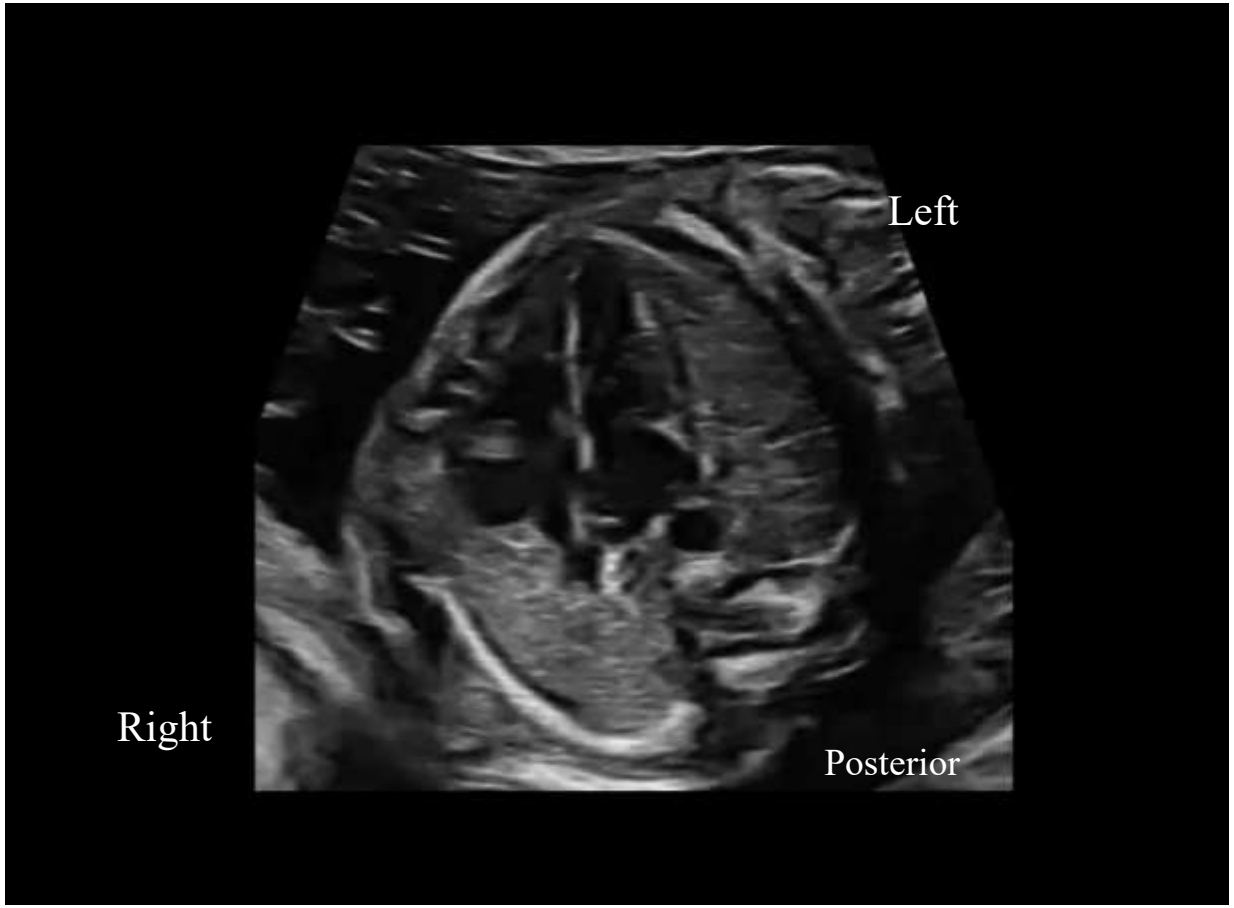
- **Ventricular septum continuous**

- **Presence of primum atrial septum**



Four Chamber View

- Heart size & position
- Two balanced atria
- Balanced ventricles with opening AV valves
- Primum atrial septum
- AV valve ‘offsetting’
- **Ventricular septum**
- Pulmonary venous drainage



Four Chamber View

- Heart size & position
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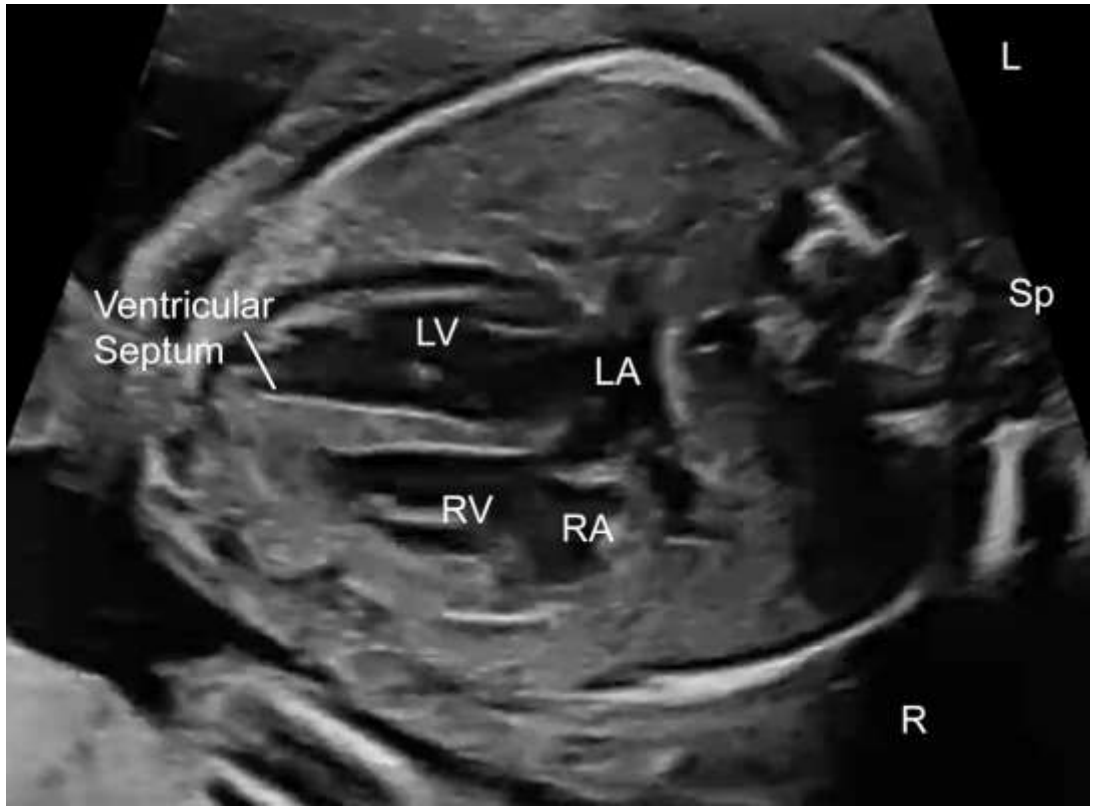
- **Ventricular septum**
- Pulmonary venous drainage

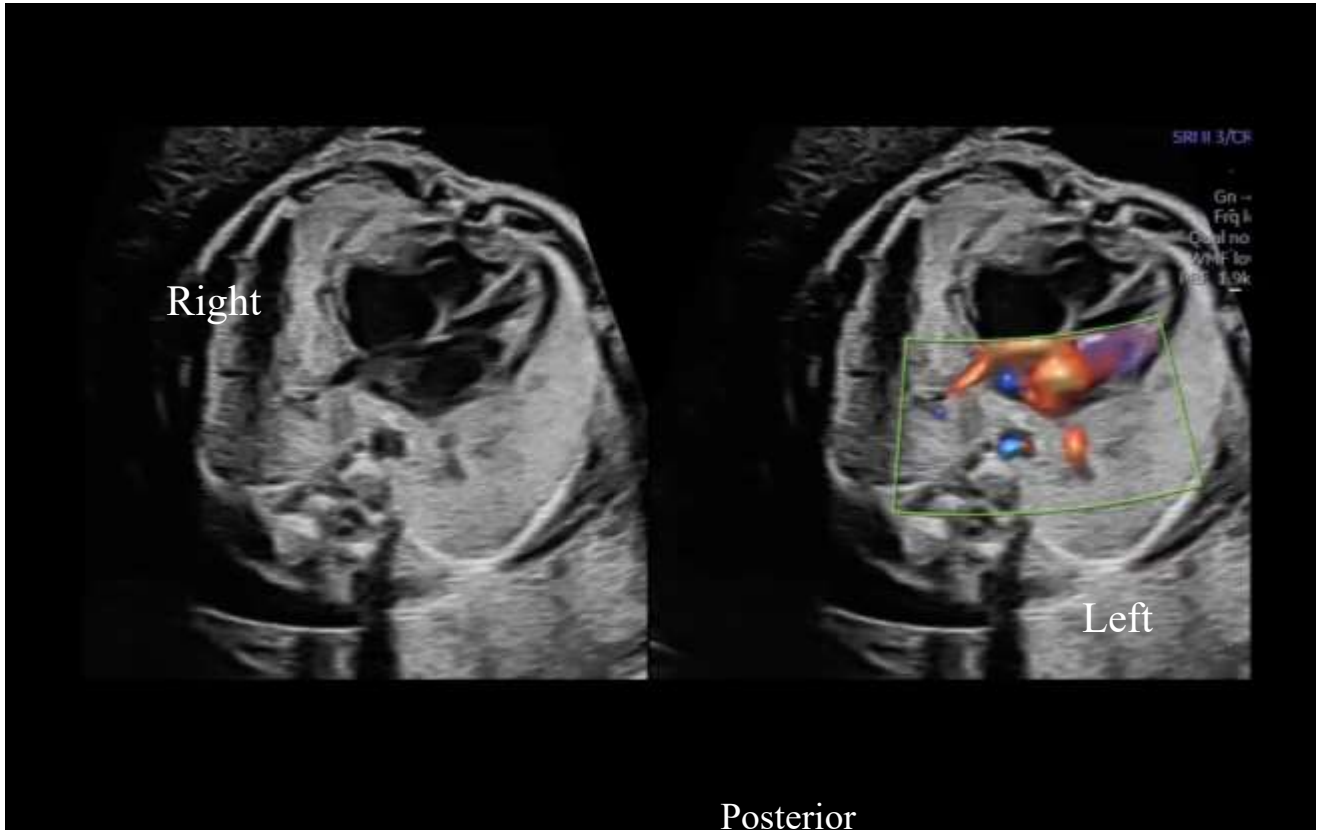


Abnormality of the Ventricular Septum (VSD)

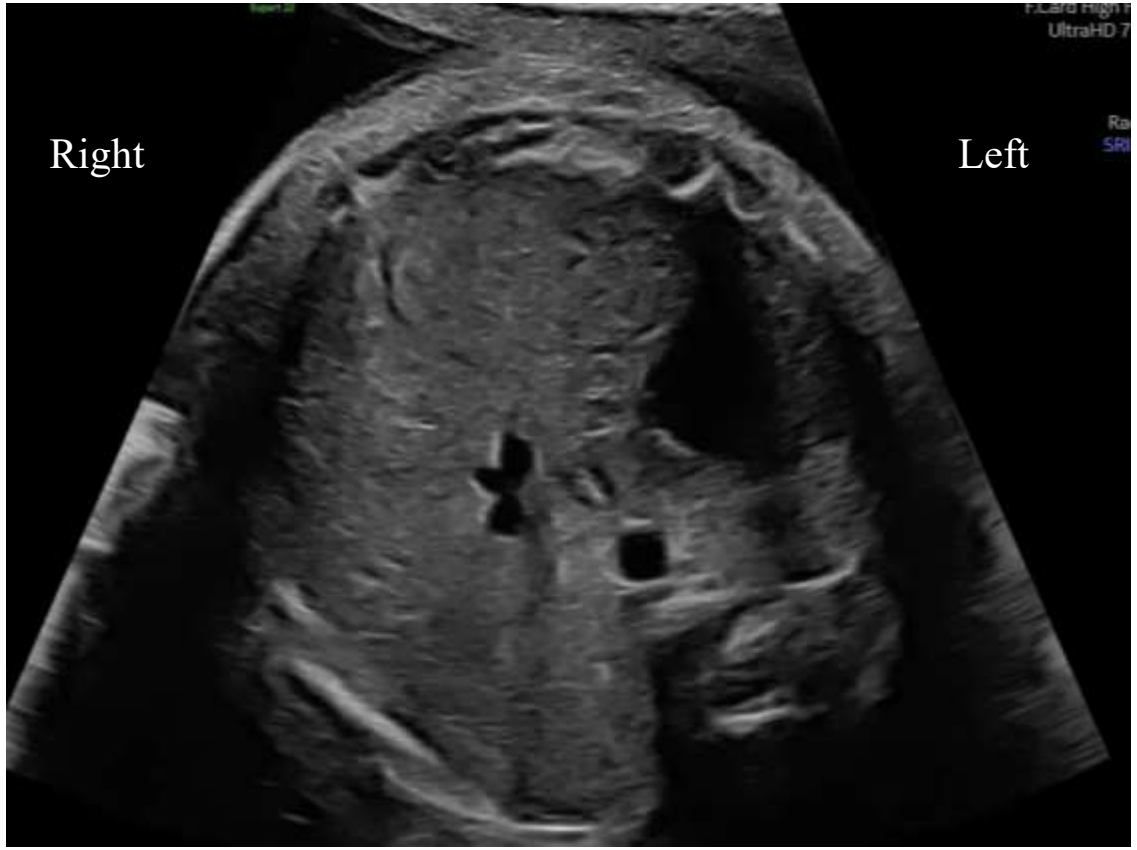
- Heart size & position
- Two balanced atria
- Balanced ventricles with opening AV valves
- Primum atrial septum
- AV valve ‘offsetting’
- **Ventricular septum**
- Pulmonary venous drainage

Four Chamber View

- Heart size & position
- Two balanced atria
- Balanced ventricles with opening AV valves
- Primum atrial septum
- AV valve ‘offsetting’
- Ventricular septum
- **Pulmonary venous drainage**
  - **No vessel between the descending aorta and the left atrial wall**



Atrioventricular Septal Defect (AVSD)



- 4-7% of all congenital cardiac defects
- Abnormality of the crux of the heart
- Lack of offsetting of the AV Valves
- Discontinuity of the ventricular septum
- Single inlet to the ventricular mass

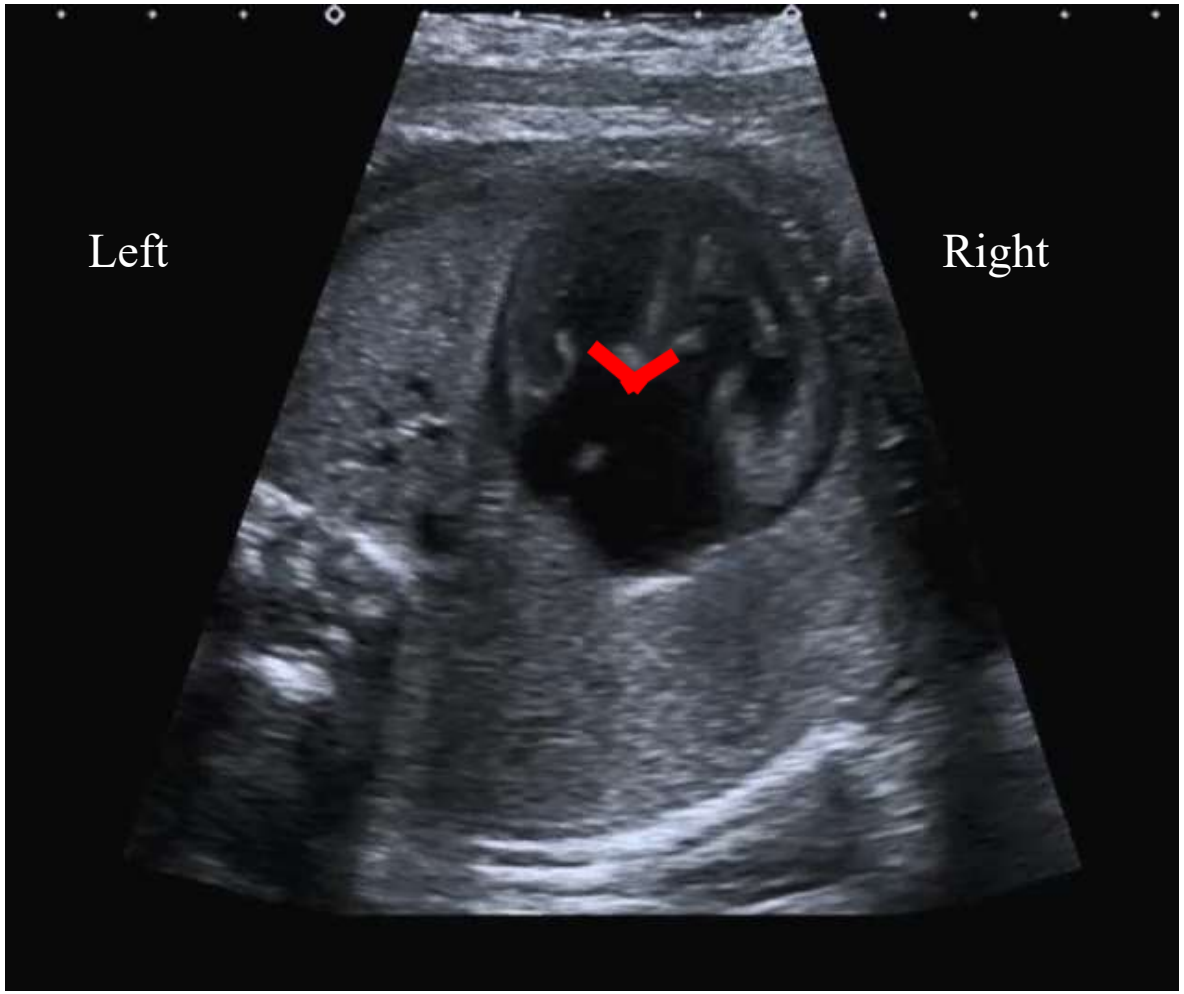
Balanced AVSD

U v M

Partial AVSD

- Lack of AV valve offsetting of the AV valves
- Absence of primum atrial septum t
- Can be difficult to assess if no or small ventricular defect
- Prognosis is different but associations similar

Partial AVSD



- Lack of AV valve offsetting of the AV valves
- Absence of primum atrial septum t
- Can be difficult to assess if no or small ventricular defect
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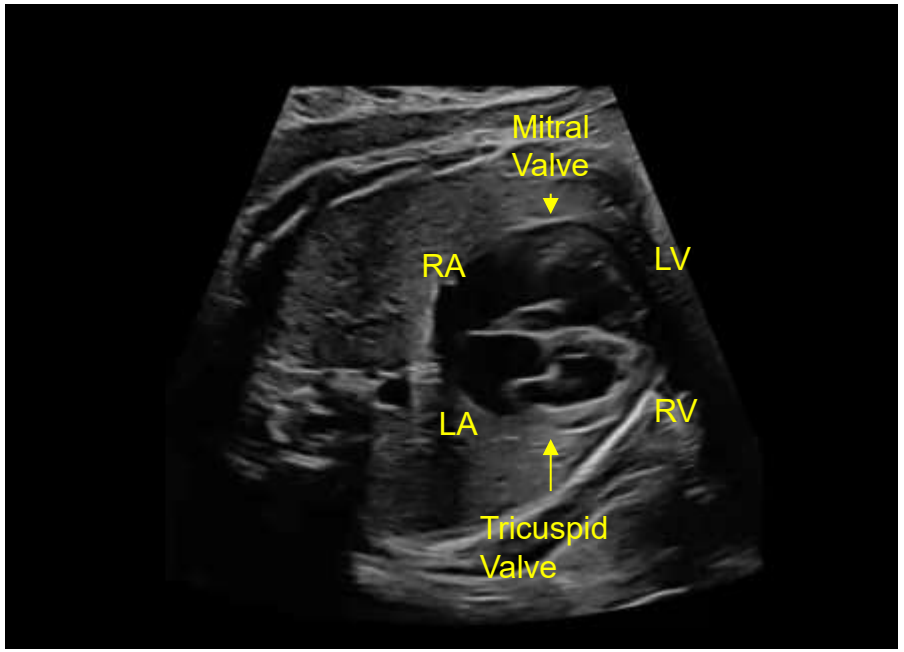
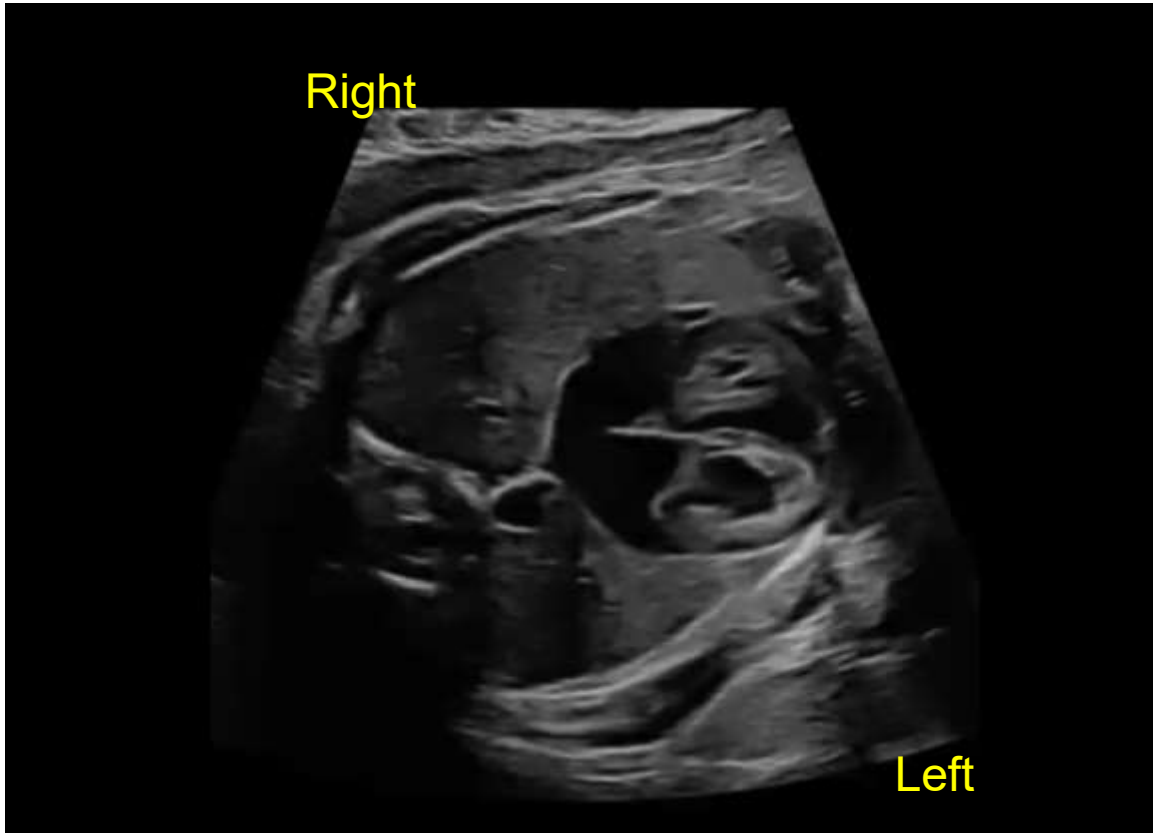
Reversed Offset
CCTGA

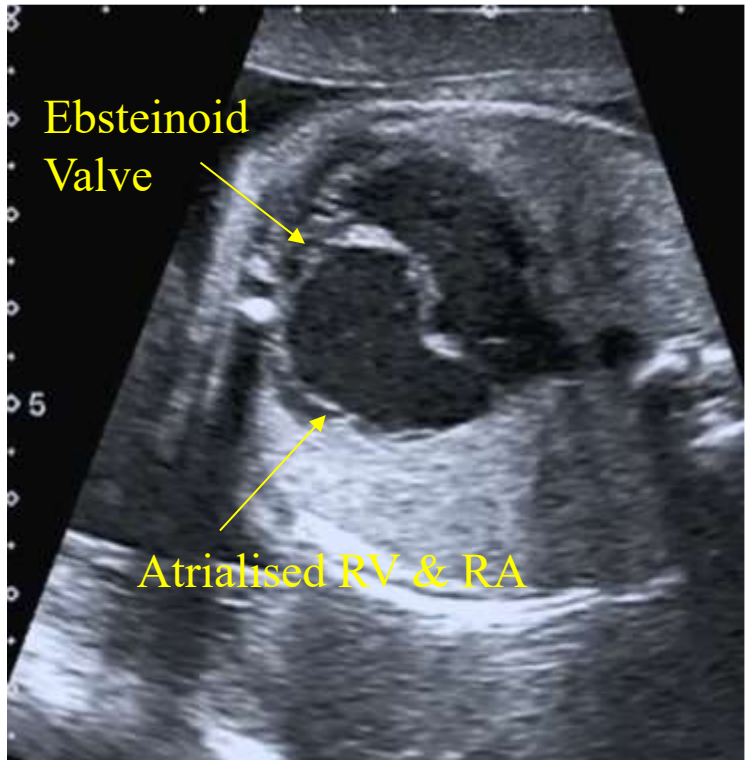
- Congenitally corrected transposition of the great arteries
- Ventricular Discordance



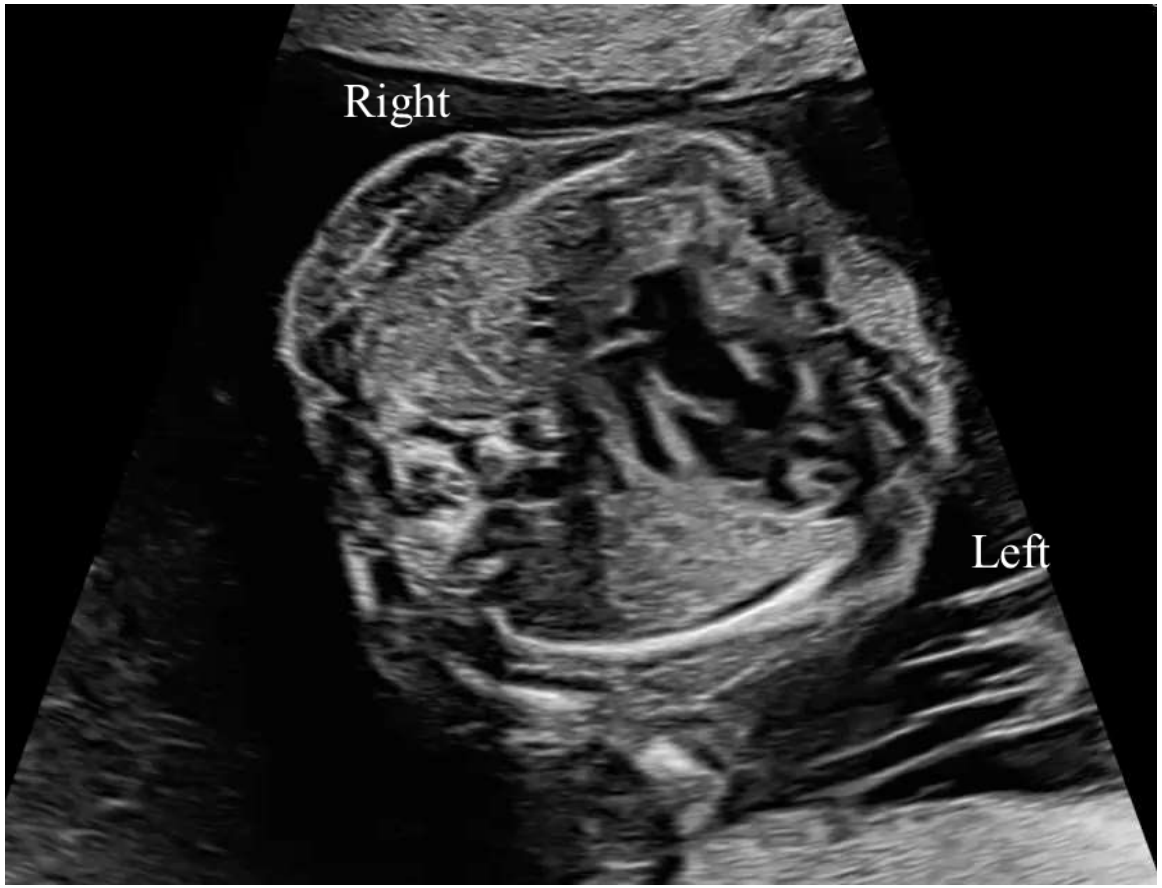


Exaggerated Offset

Ebstein Anomaly of the Tricuspid Valve



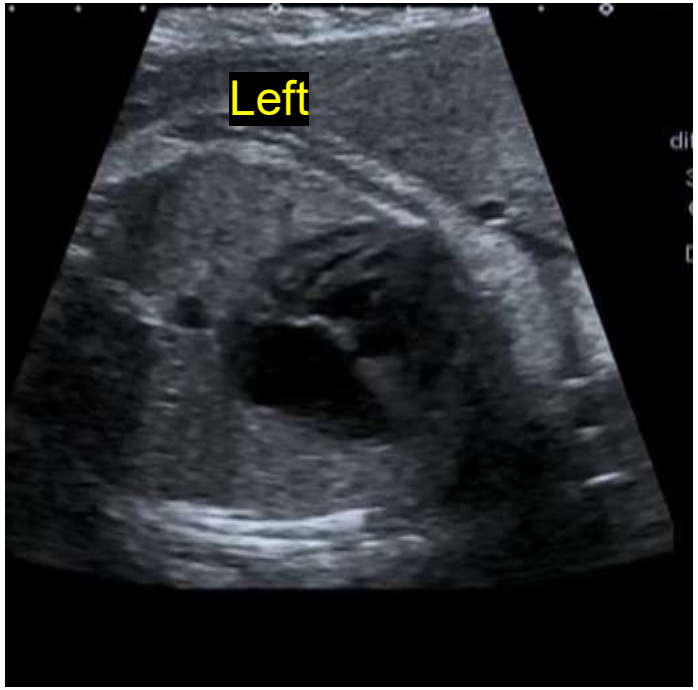
Hypoplastic Left Heart Syndrome (HLHS)



- Single moving AV valve on the right
- Single ventricle
  - No discernible left ventricle
- Dilated pulmonary veins
- Disease spectrum
  - Mitral Atresia + Aortic Atresia

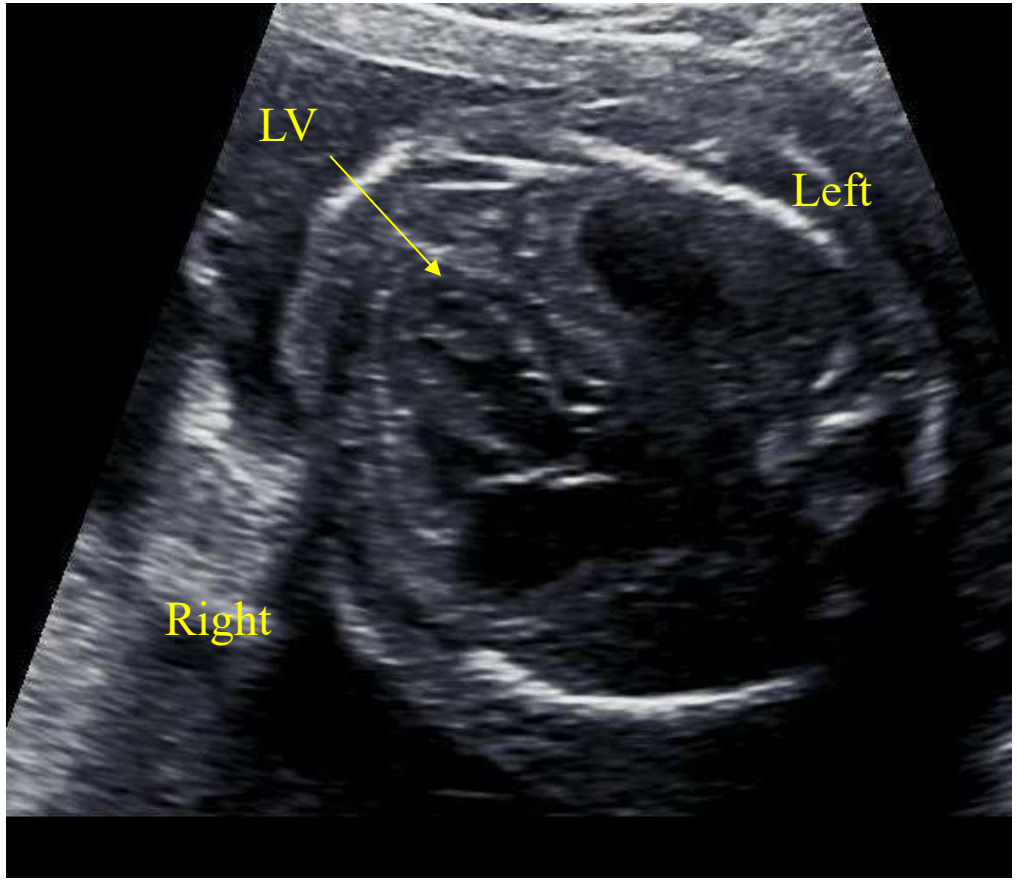
    v
  - Mitral Stenosis + Aortic Atresia

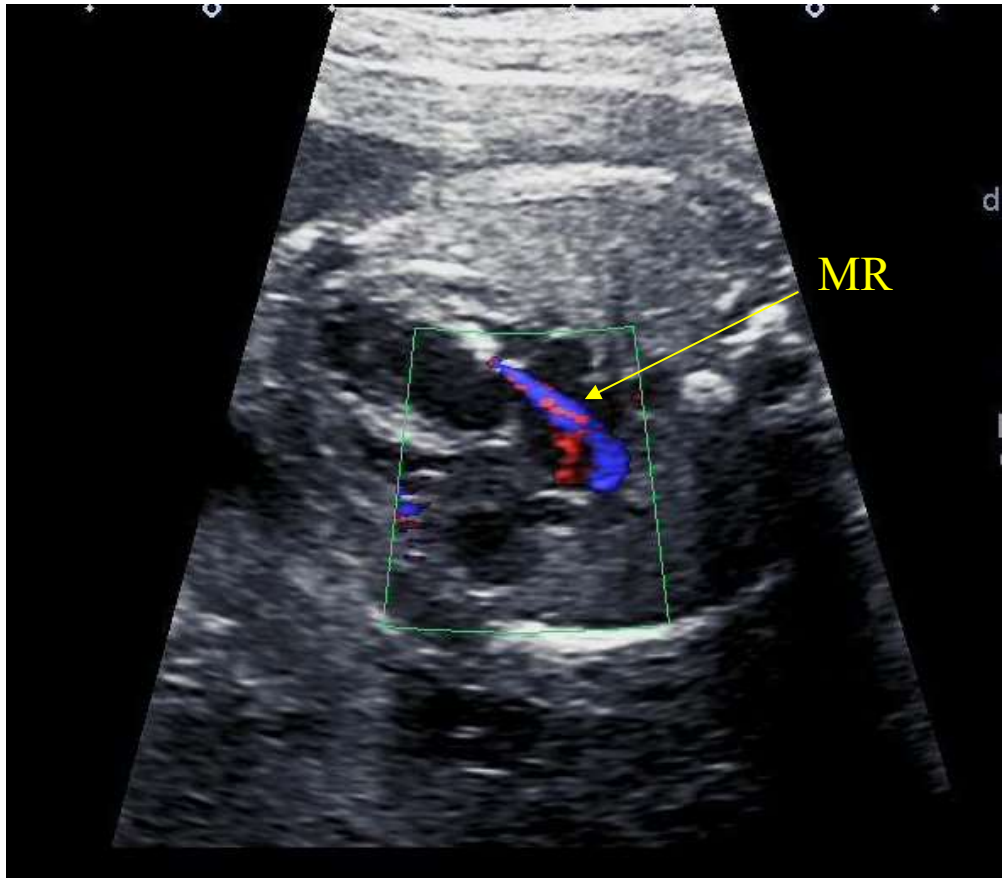
Morphology of HLHS



- Left heart unable to support the systemic circulation independently after birth
- Palliative single ventricle circulation

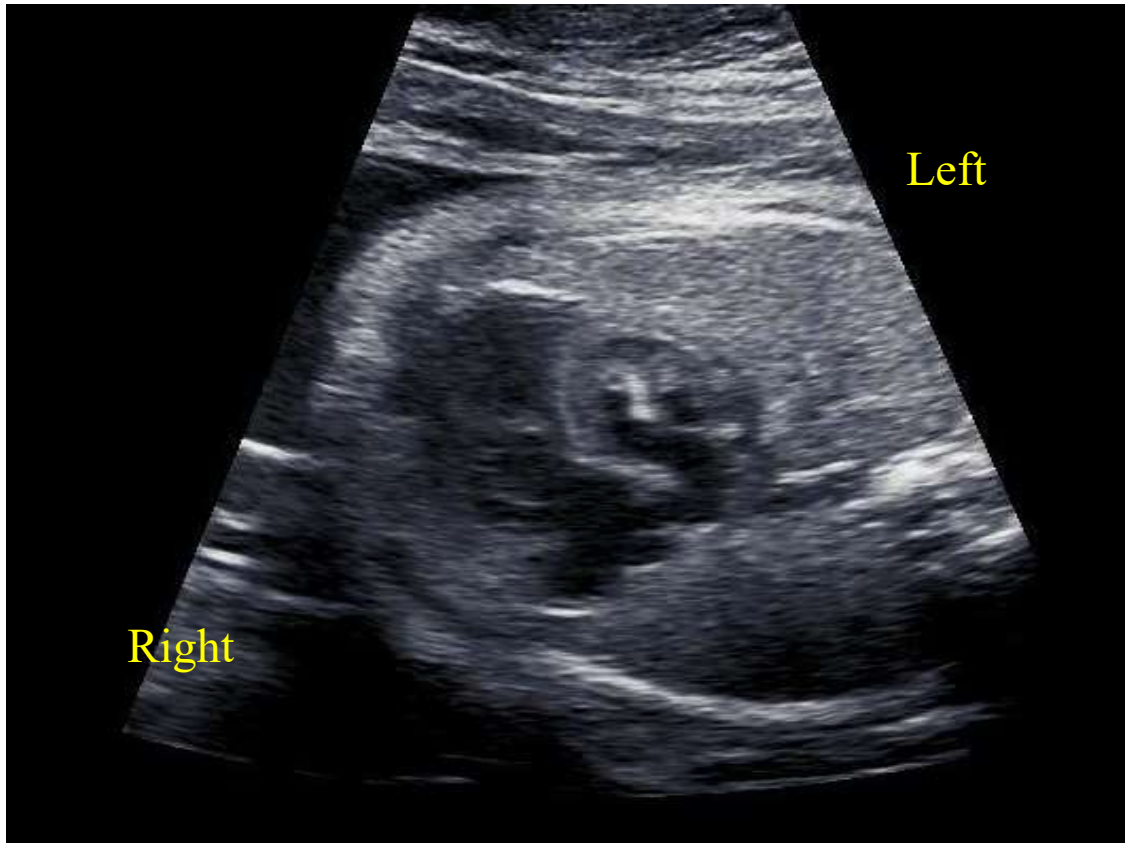
Critical Aortic Stenosis (AS) - 21 Weeks Gestation





- Dilated/poorly contracting left ventricle
- Unequal colour flow across the AV valves
- Mitral Regurgitation

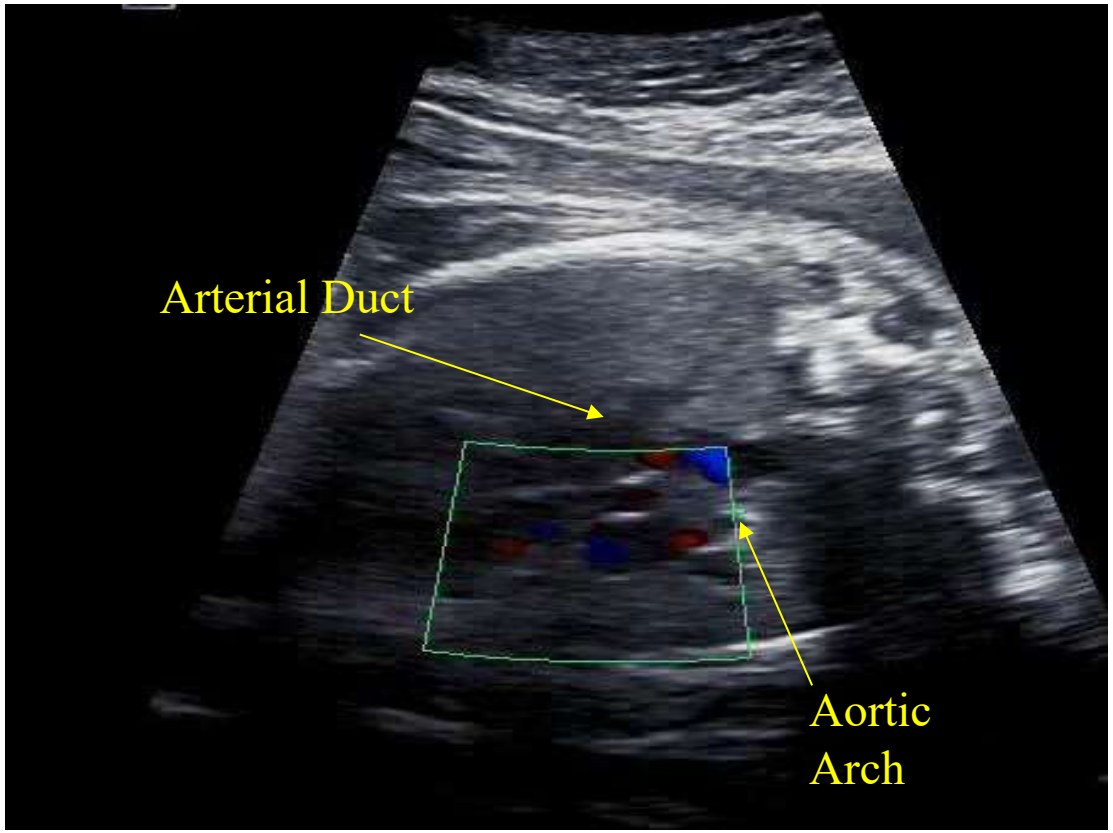
Critical Aortic Stenosis (AS) – 34 Weeks Gestation



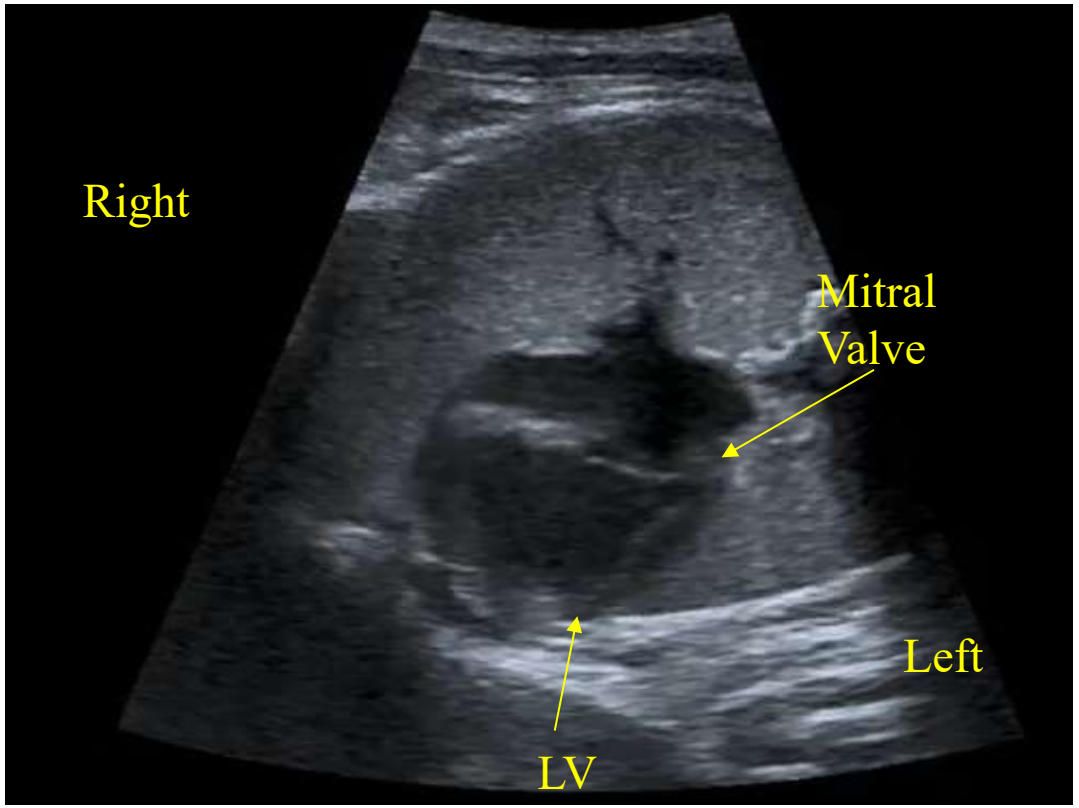
- Left ventricle no longer dilated
  - Small and echogenic
  - Poorly contractile
  - Bright mitral valve papillary muscles
- Progresses to single ventricle pathology
  - Norwood intervention postnatally
- Prognosis as of HLHS

Abnormal 3VT View

- Antegrade flow in larger arterial duct (red)
- Retrograde flow in smaller aortic arch (blue)

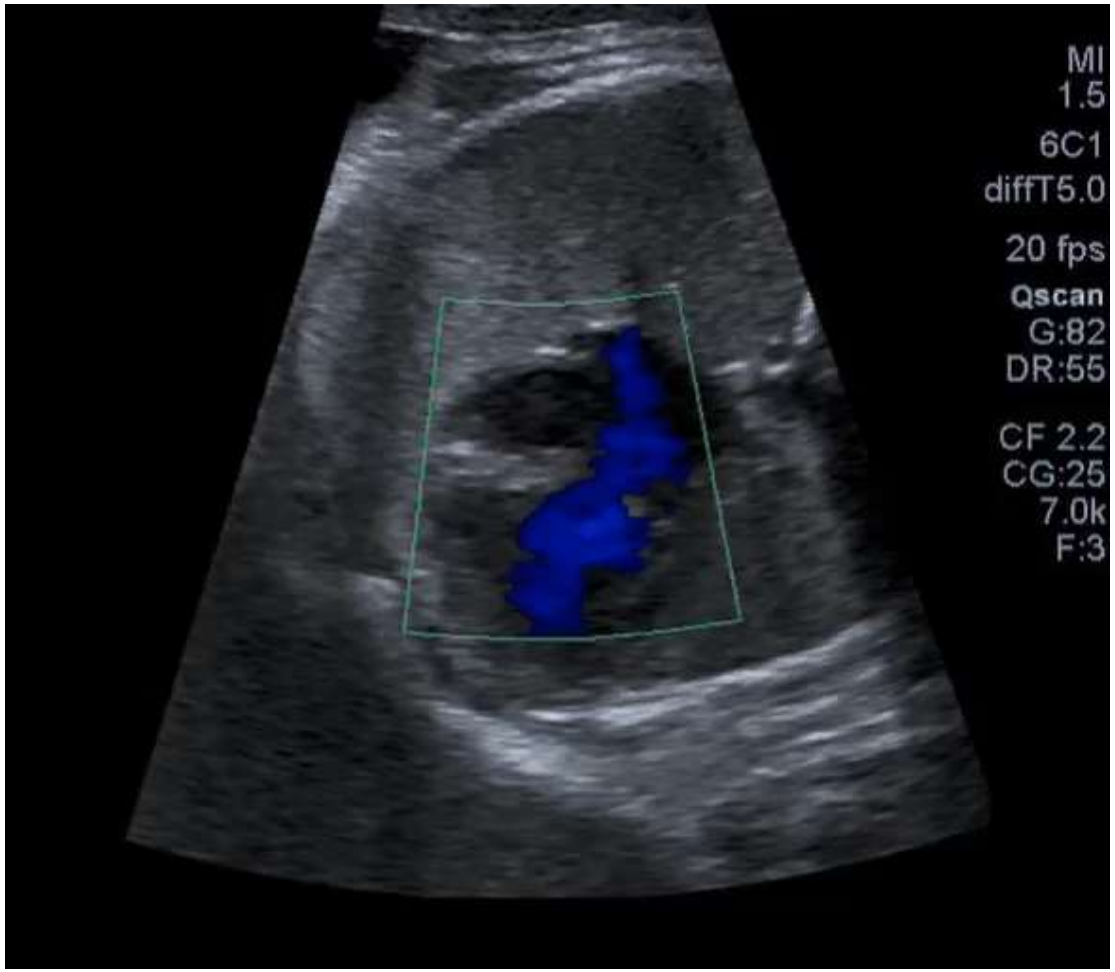


Tricuspid Atresia



- Two atria but a single AV valve on the left (mitral valve)
- Echogenic tissue in the area of the tricuspid valve
- Single ventricle
  - No ventricular septum

Tricuspid Atresia



- **Single colour flow of the mitral valve**
- Echogenic tissue in the area of the tricuspid valve
- Single ventricle
  - No ventricular septum

Normal Four Chamber View

Four Chamber View Checklist

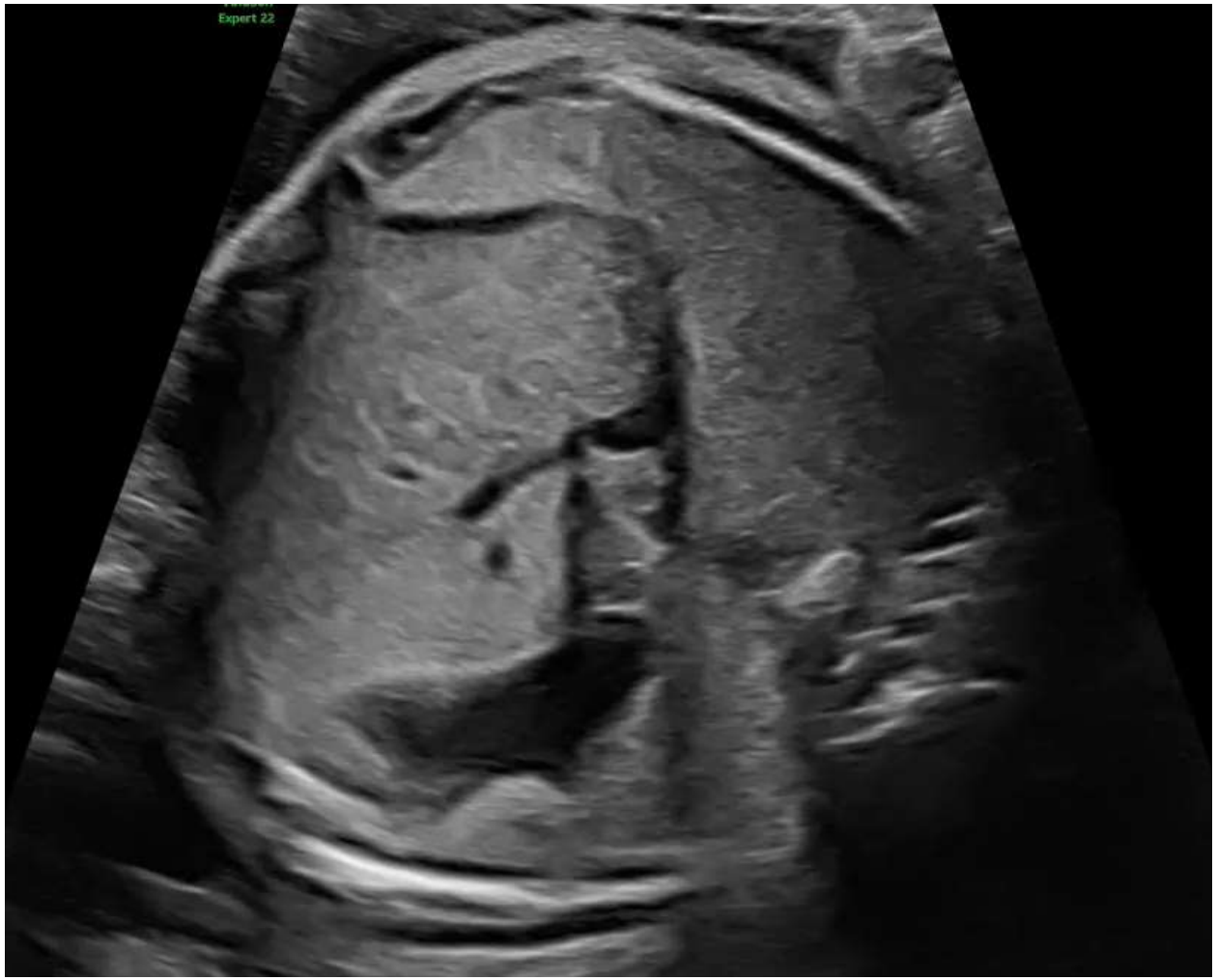
- ✓Four Cardiac Chambers
  - ✓Two atria and two ventricles
- ✓Ventricles Equal in Size
- ✓Atria Equal in Size

- ✓Two separate AV valve orifices
- ✓Normal AV valve offset
- ✓AV valves moving normally
- ✓Presence of AV valve regurgitation
- ✓Ventricular & Atrial Septum Complete

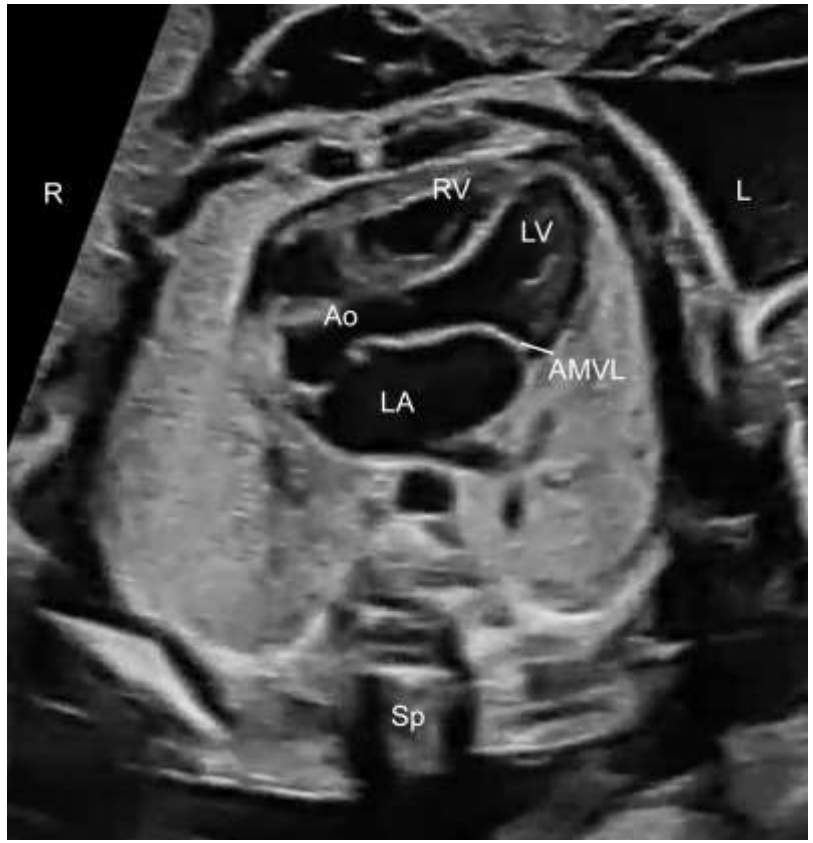
- ✓Normal Ventricular Contraction

Left Ventricular Outflow Tract (LVOT)

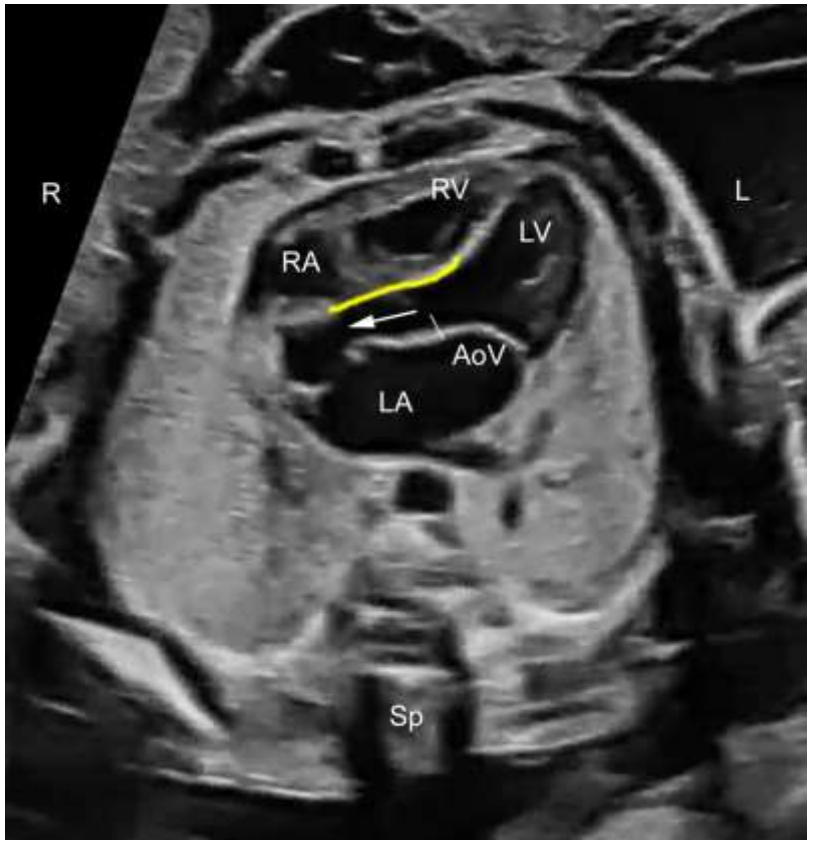
- The LVOT and aortic valve arise from the centre of the heart
- Vessel from LV sweeping towards right shoulder, no branches = Aorta
- Thin mobile leaflets of the aortic valve



Left Ventricular Outflow Tract (LVOT)

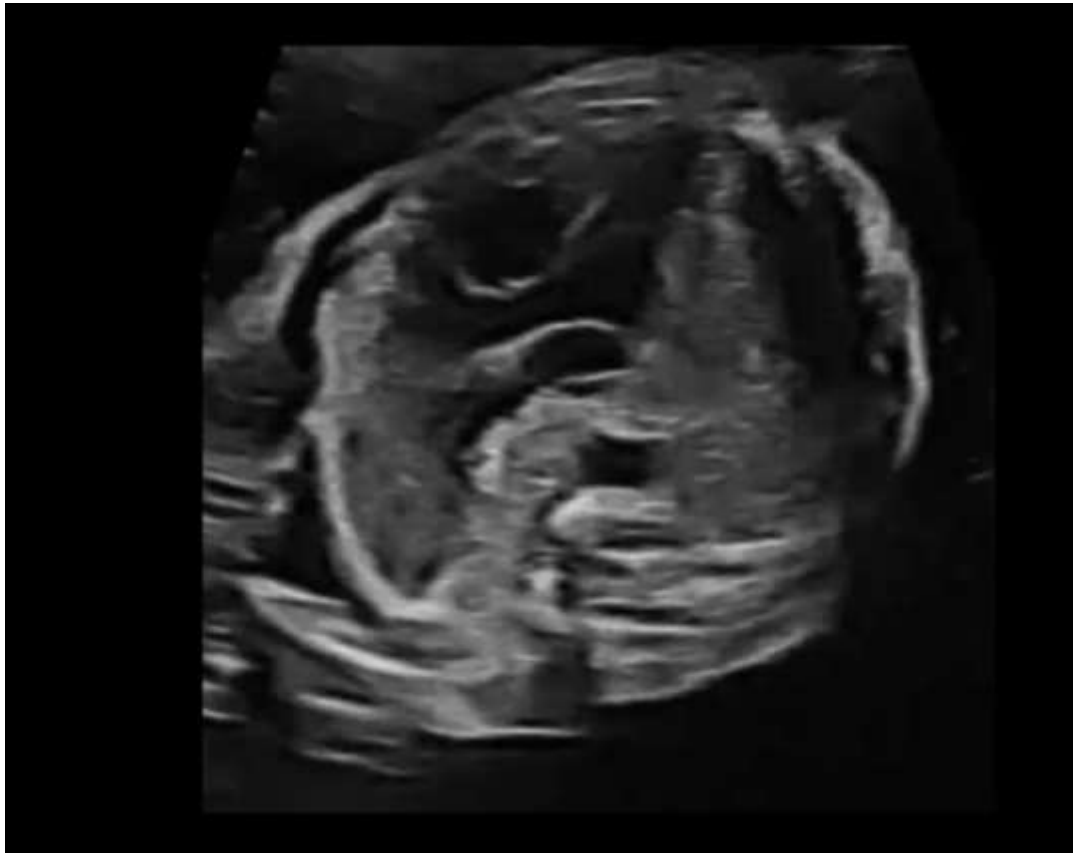


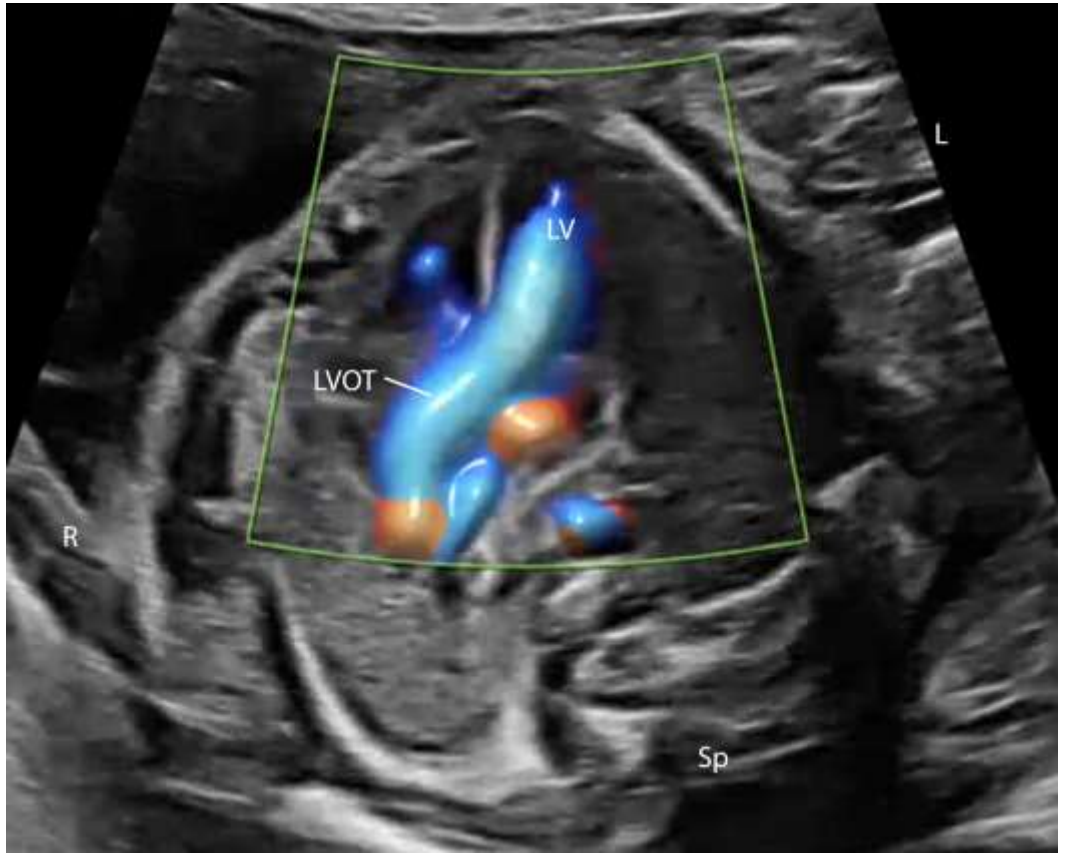
The LVOT and aortic valve arise from the centre of the heart



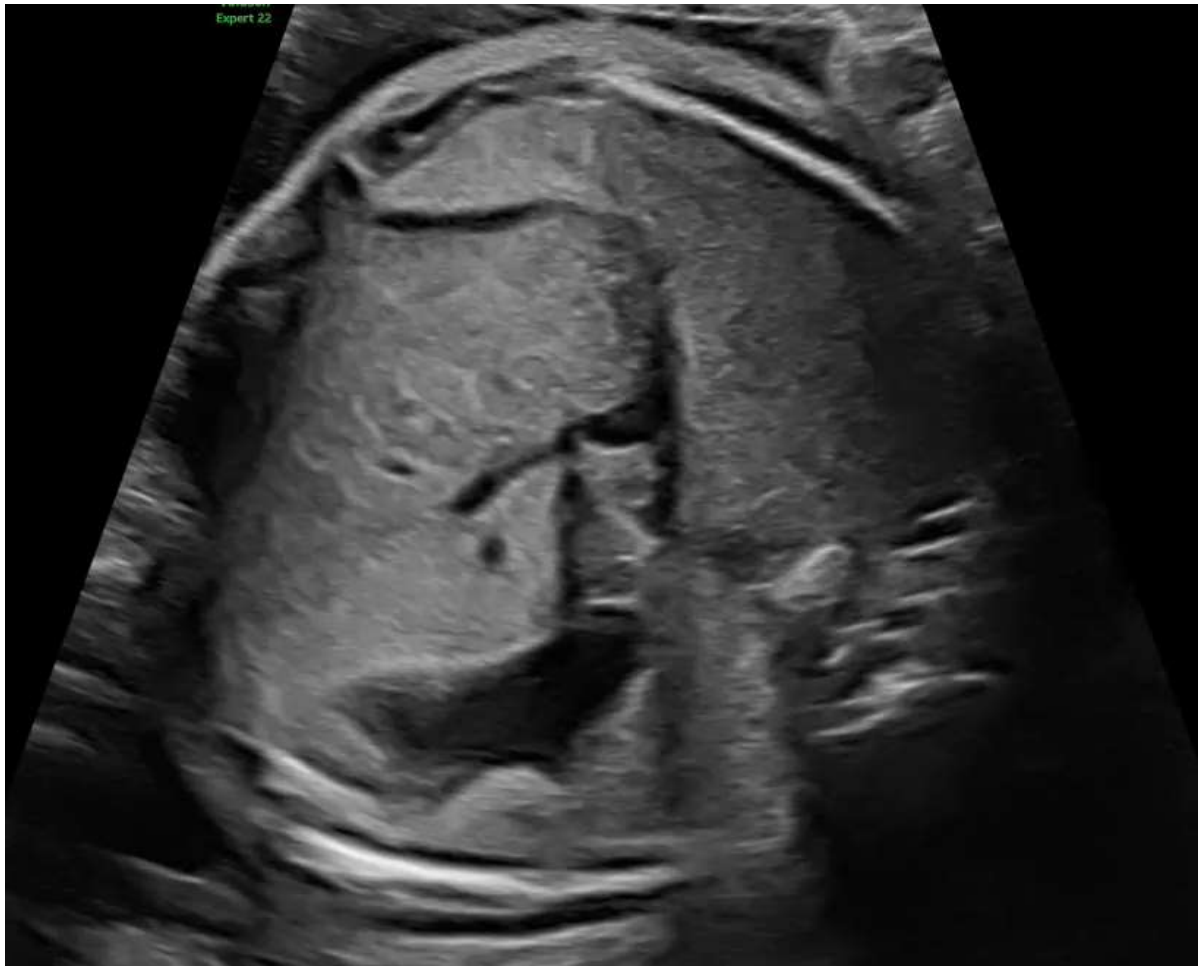
Continuity of the ventricular septum and anterior wall of the aorta

Left Ventricular Outflow Tract (LVOT)

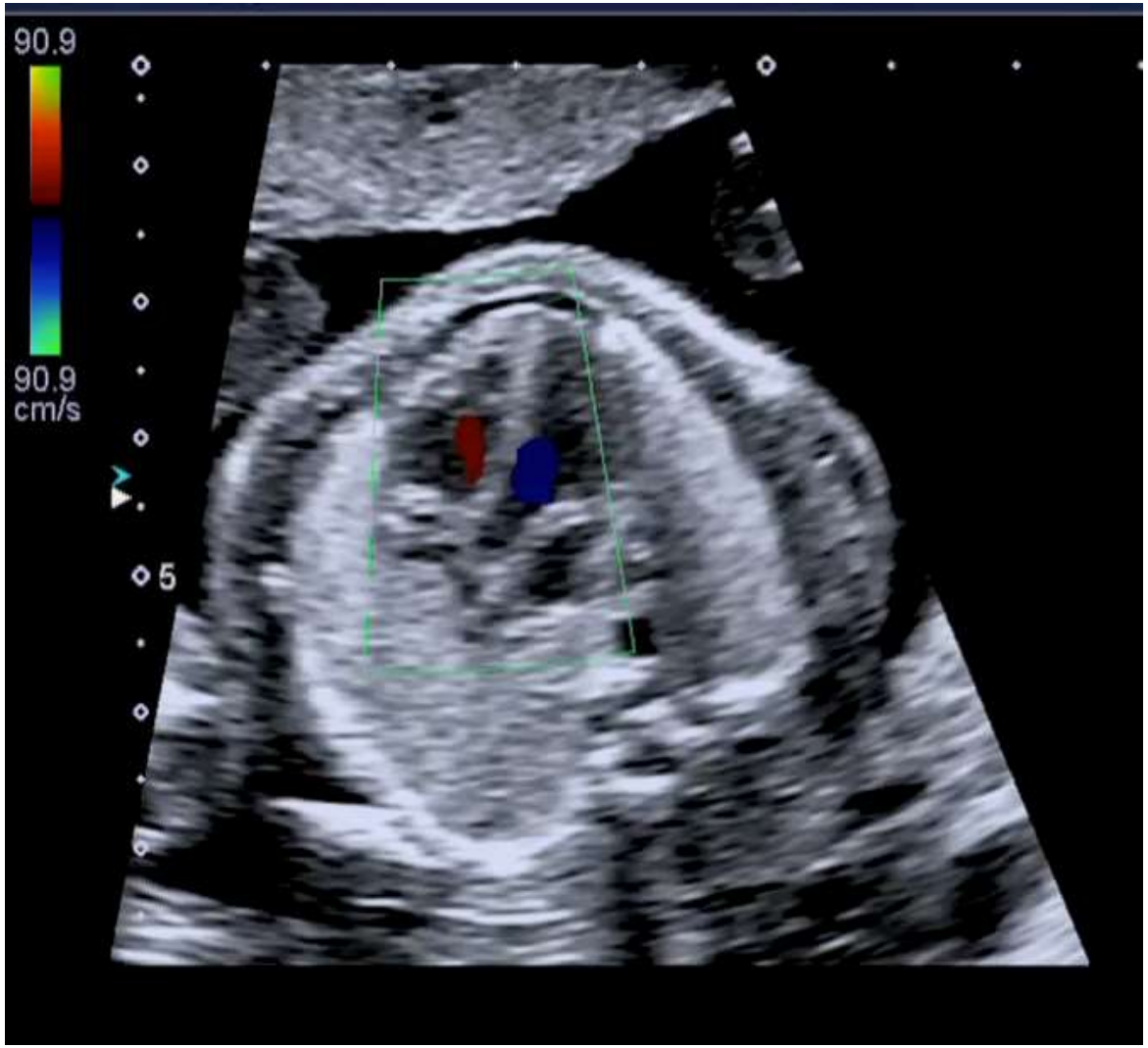




Normal Sweep

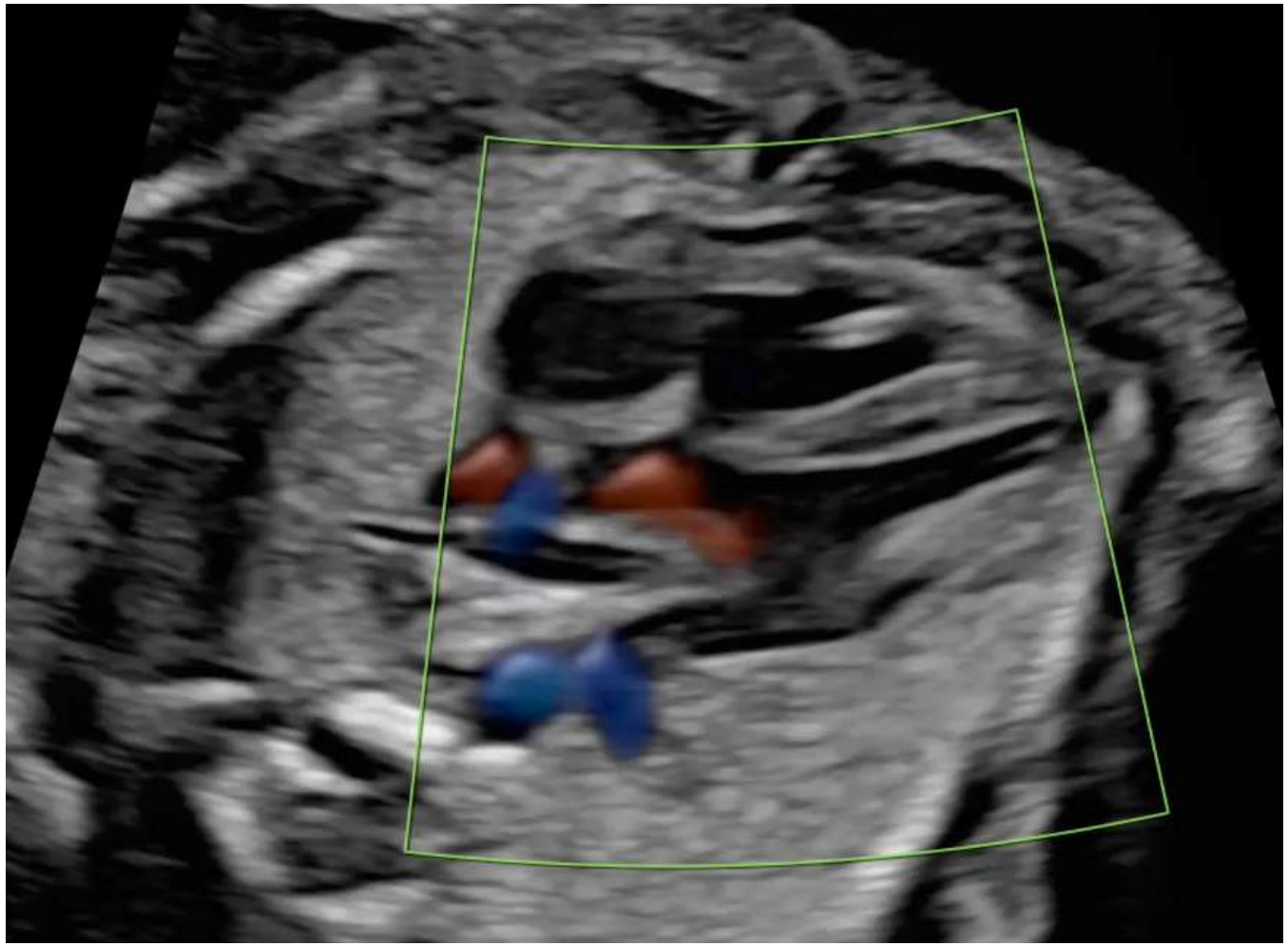


Colour Flow Doppler of the Outlets



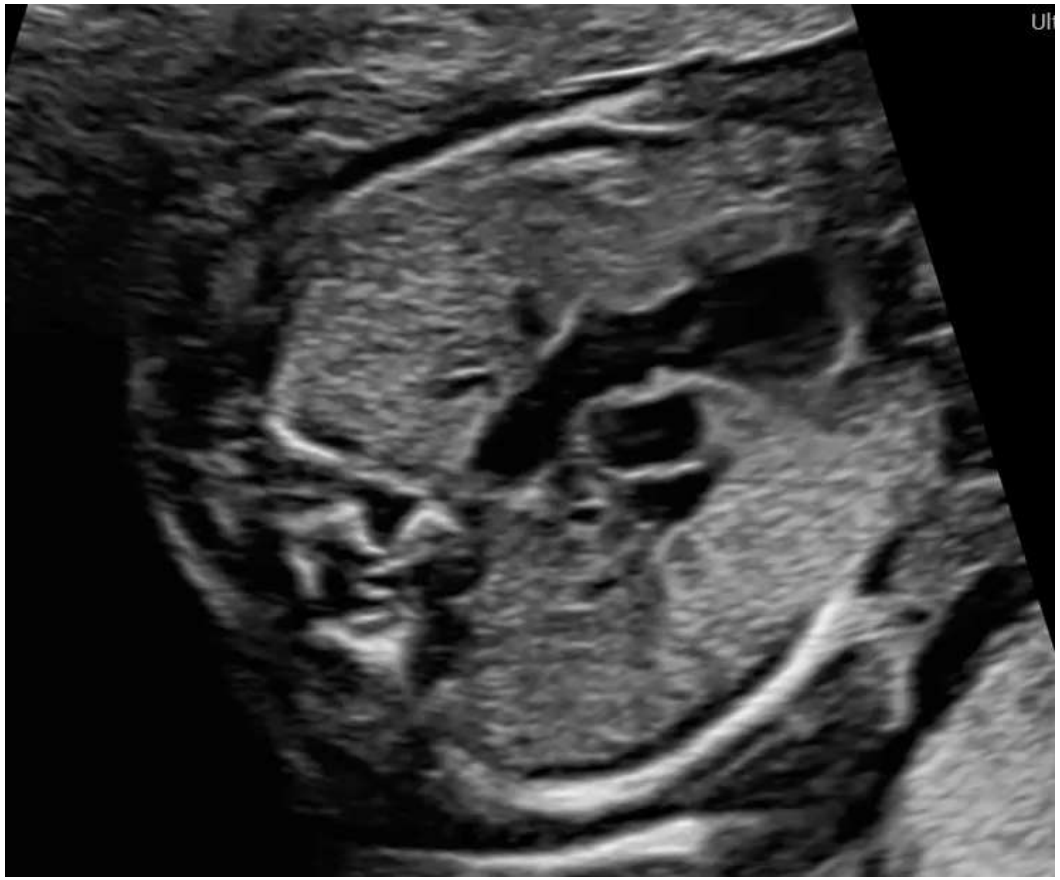
- Forward flow in both great arteries
  - Colour is the same
- Crossing great arteries
- Aortic valve and pulmonary valve not visualised at the same time

- Colour dependent on the probe direction and fetal lie
- Antegrade flow across the aortic valve in red
- Antegrade flow across the pulmonary valve in blue



Right Ventricular Outflow Tract (RVOT)

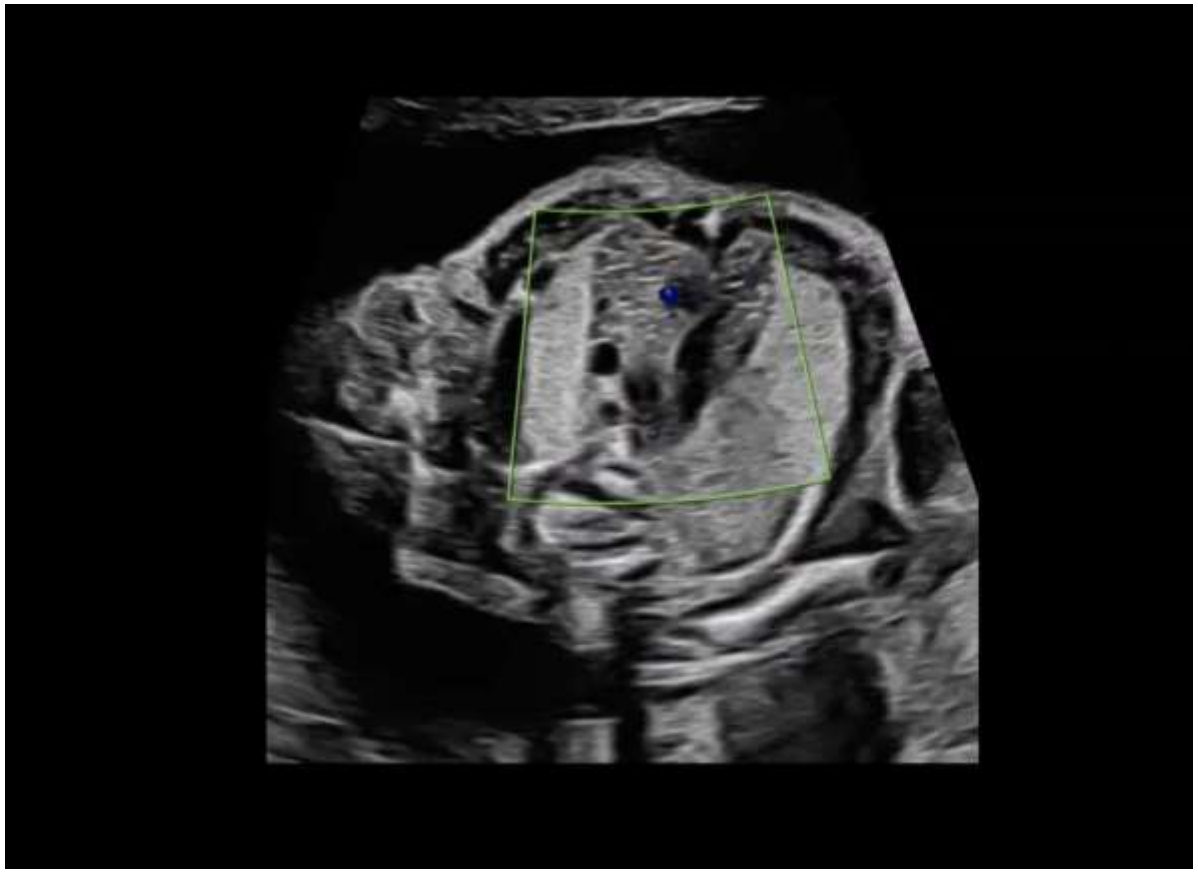
- RVOT, pulmonary valve and main pulmonary artery (MPA) arise anteriorly from the RV
- Pulmonary valve thin and mobile
- Main PA continues as the arterial duct straight back towards the spine to meet the descending aorta



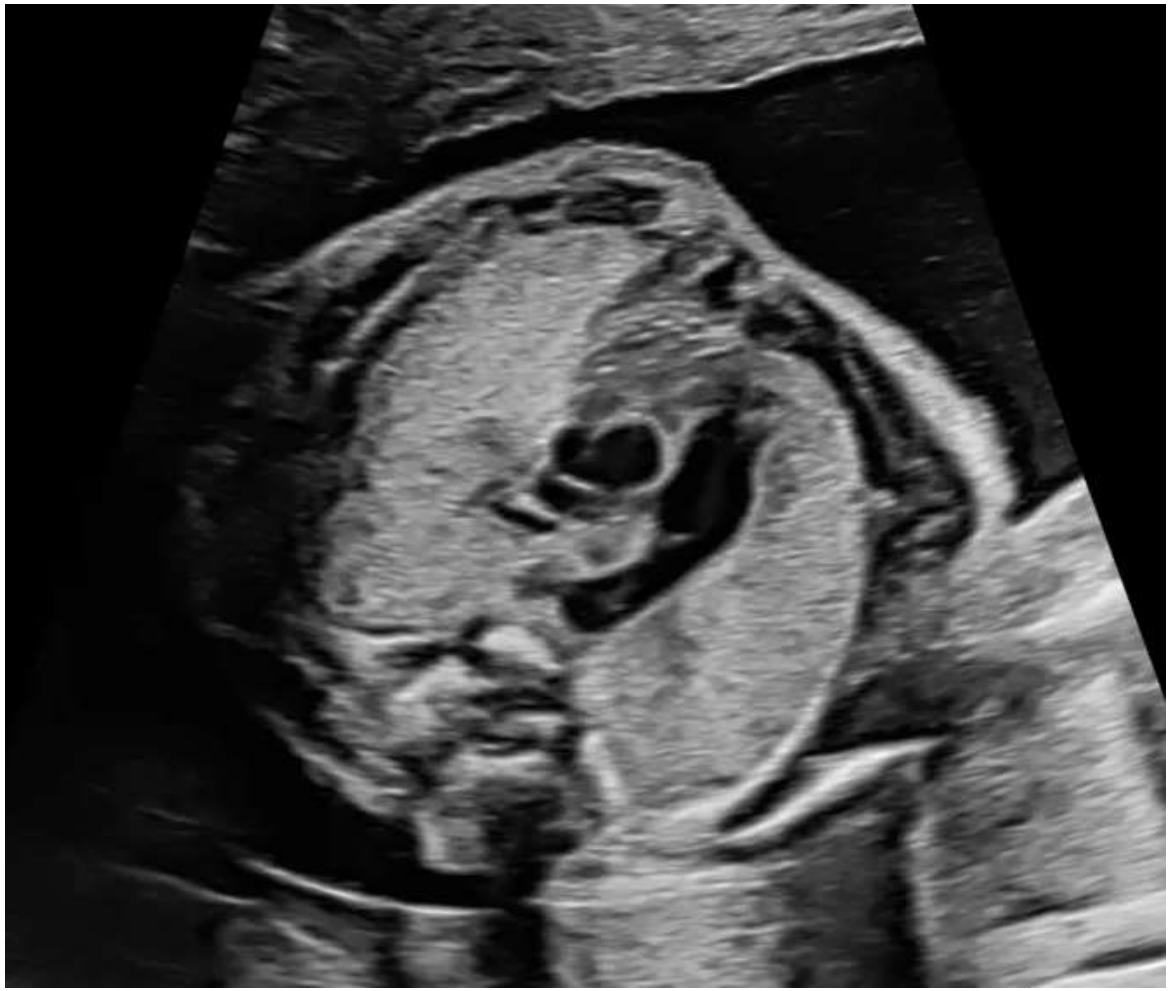
RVOT/3VV

- Three vessels from left to right
  - Pulmonary artery - Aortic Arch - Superior Vena Cava (SVC)
- P A S
- Relative decrease in size, can be very subtle

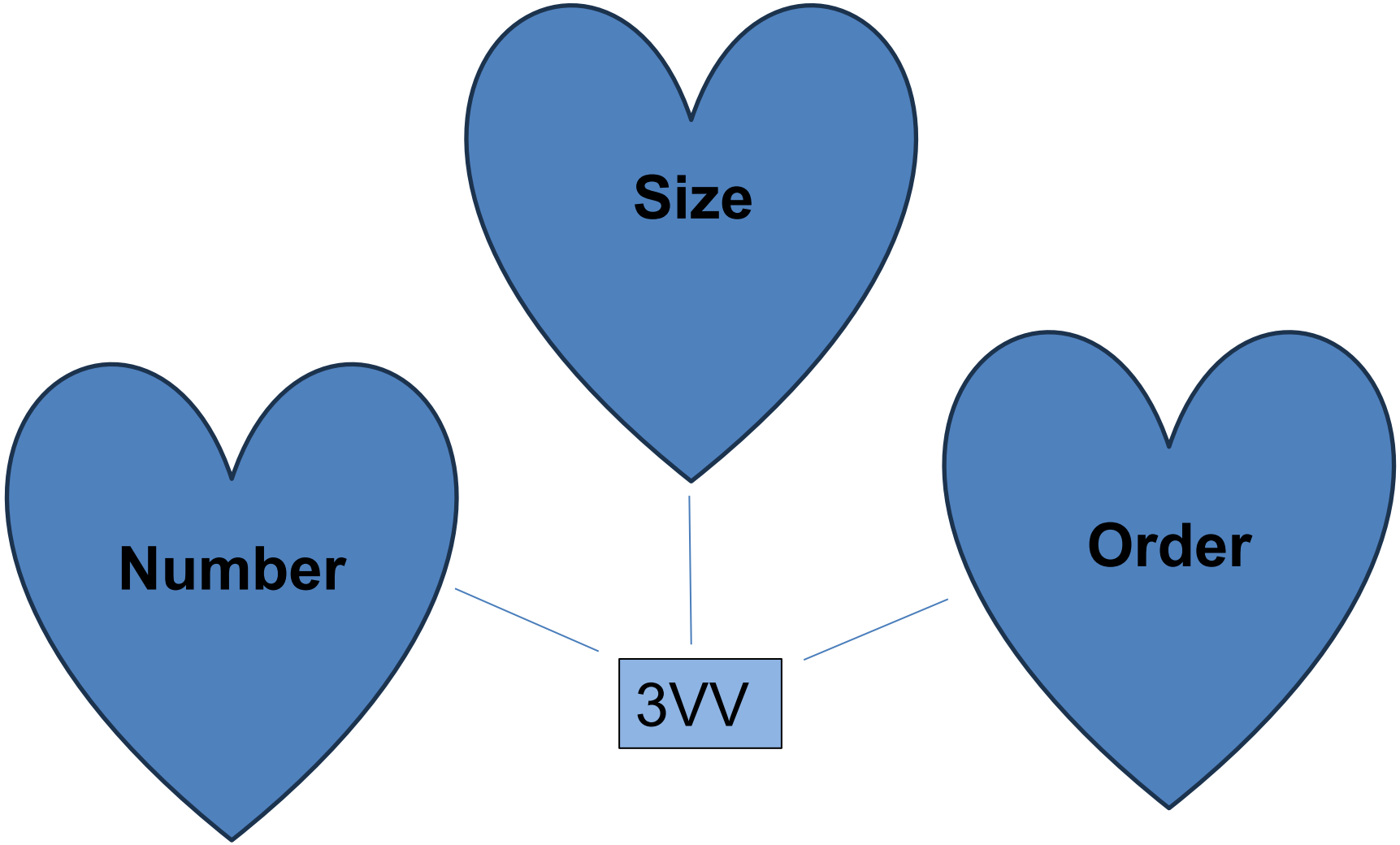
Colour Flow Doppler



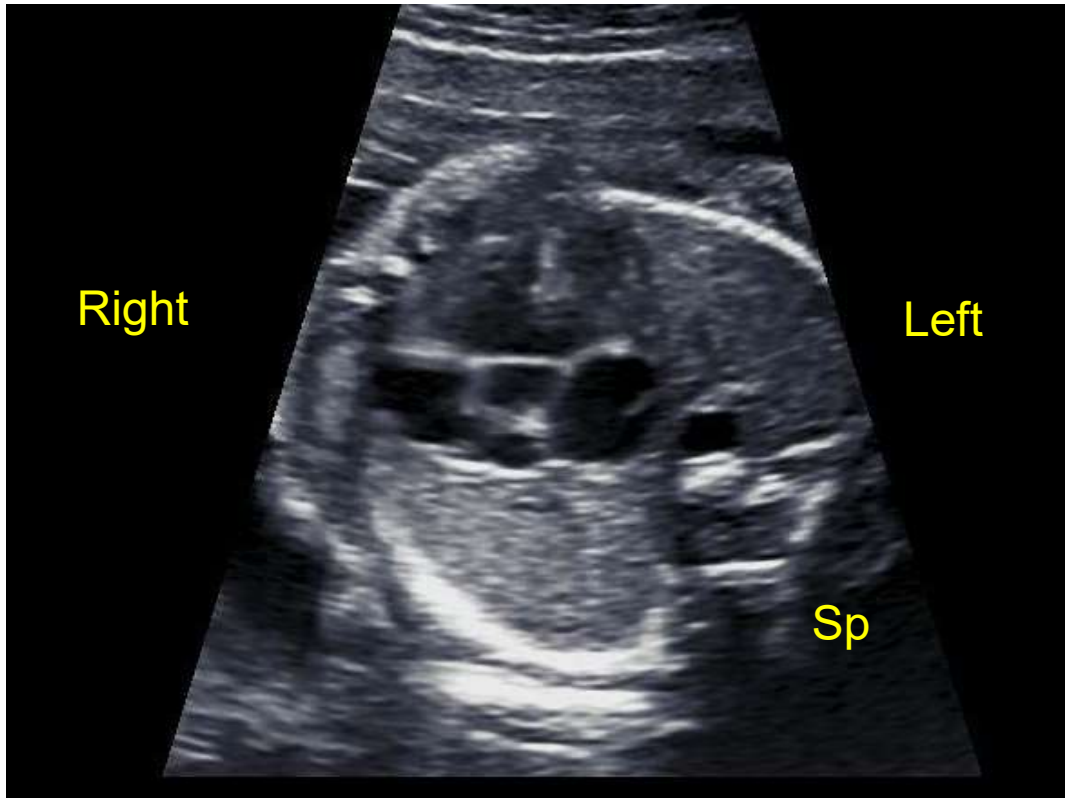
- **P A S**
- Antegrade flow in both the pulmonary artery and the aorta
  - Retrograde filling of either would be abnormal
- No colour flow aliasing across the pulmonary valve
- No pulmonary regurgitation



- Do not normally see both PA branches at the same time.
- Most commonly the arterial duct and right PA branch

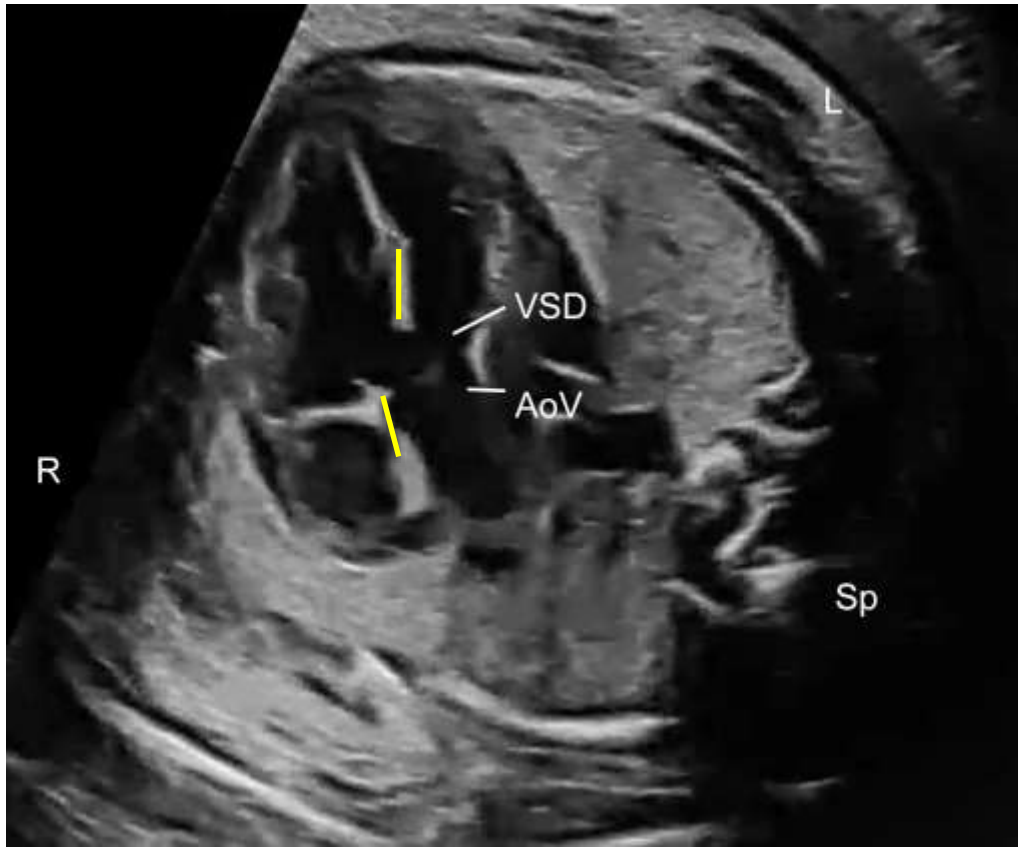

Size
Number
Order
3VV

Tetralogy of Fallot

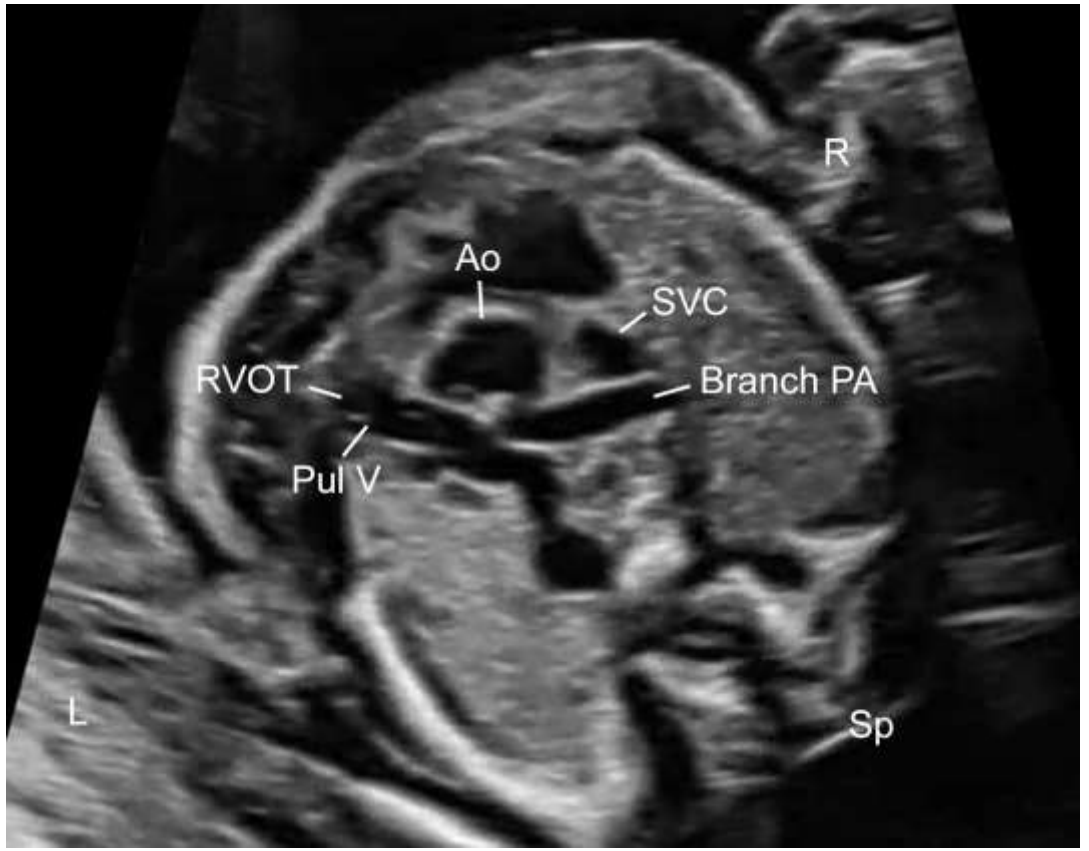


- 0.4/1,000 live births
- Most common cyanotic CHD
- Outlet VSD/overriding the ventricular septum
  - Lack of continuity of the ventricular septum
- Abnormal 3VV
- Large aorta and smaller PA

- Discontinuity of the ventricular septum

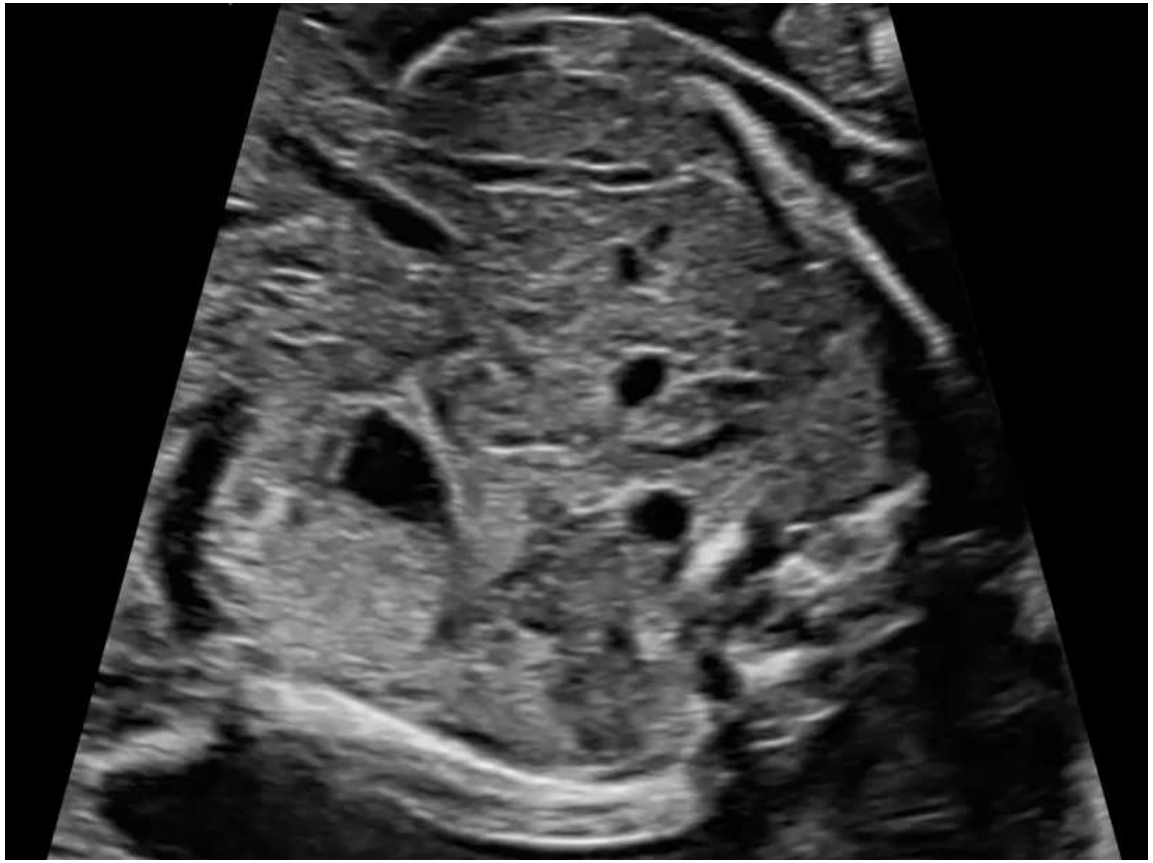


- Abnormal 3VV – smaller PAs



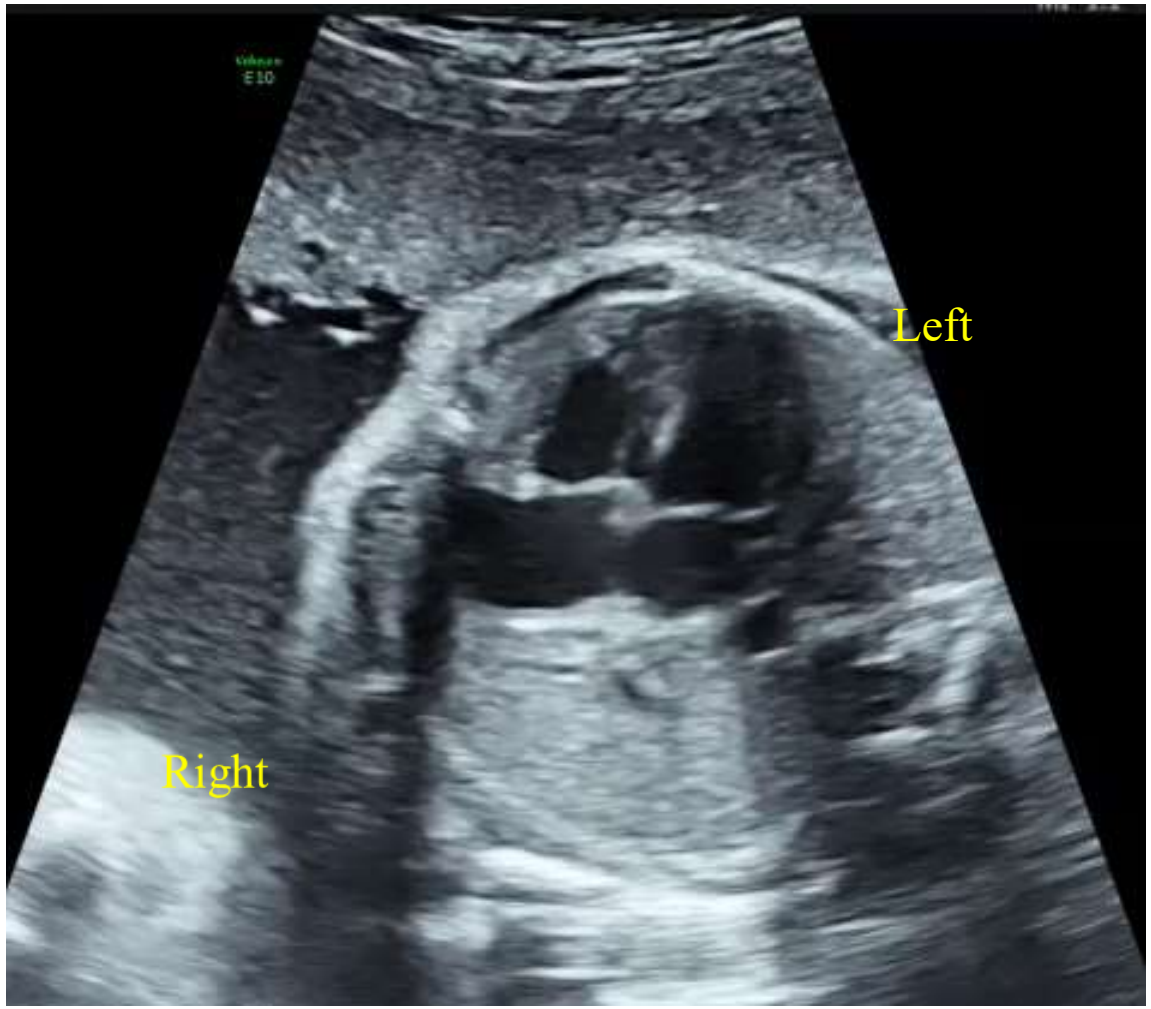
Tetralogy of Fallot

- Crossing Great Arteries
- Discontinuity of the ventricular septum – VSD
- Abnormal 3VV – smaller pulmonary arteries



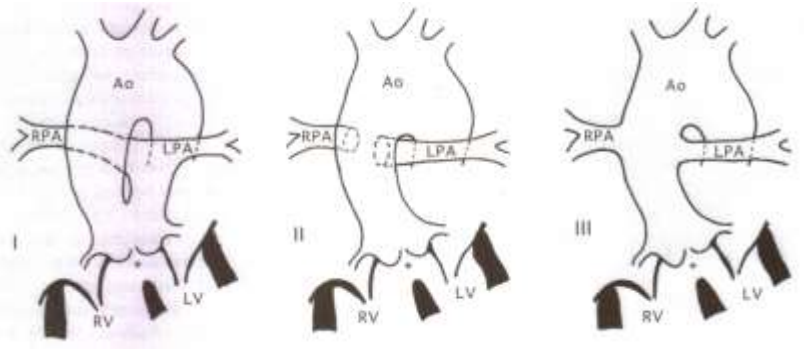
Associated Cardiac Abnormalities

- VSD
- Overriding aorta
- **4 Vessels in the 3VV**
- **Right Aortic Arch**



Common Arterial Trunk

- Discontinuity of the ventricular septum – VSD
- Single great outlet – great arteries not crossing
- Dysplastic (thickened) semilunar valve
- Abnormal 3VV – 2VV



Transposition of the Great Arteries

- 4 chamber view usually normal
- Pulmonary artery (branching) arises from LV
- PA is the first artery seen moving cranially from 4CV
- Aorta arises from RV
- Parallel arrangement of great arteries
- Abnormal 3 vessel view - only 2 vessels seen

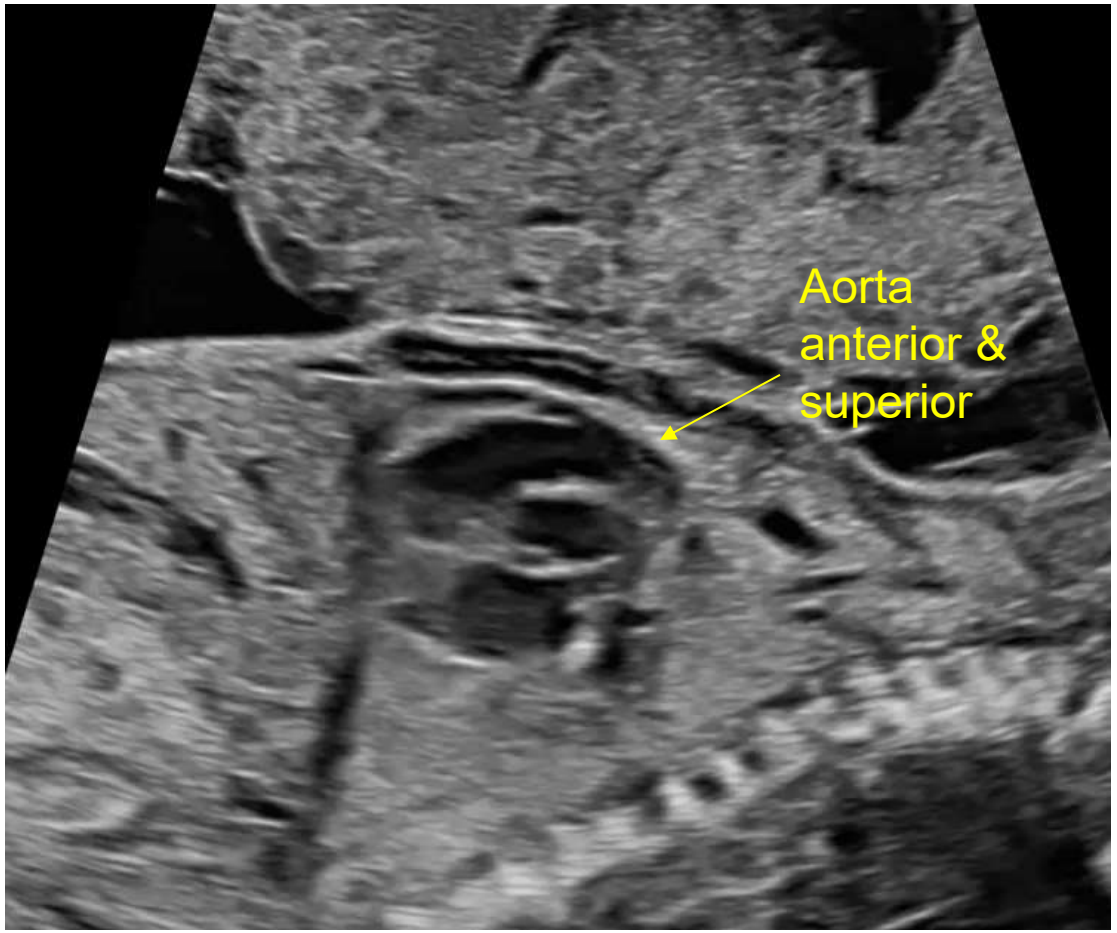
2 Vessel View of TGA

Transposition of the Great Arteries

- Normal 4 chamber view
- Branching pulmonary artery arises first from LV
- Aorta arises from RV anteriorly
- Abnormal 3 vessel view - only 2 vessels seen

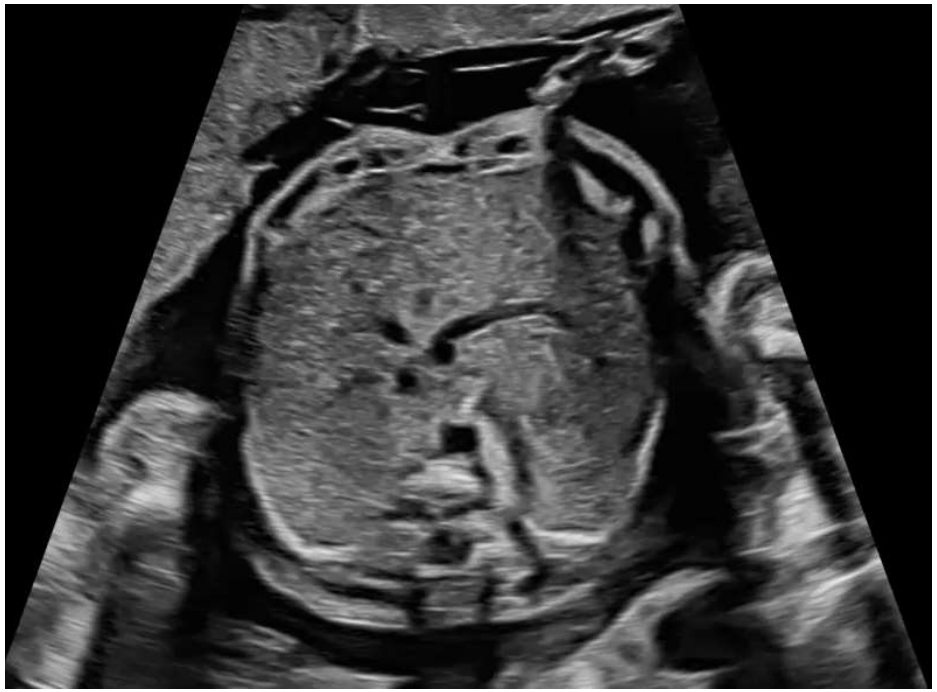
Sagittal Views of the Great Arteries

- Balanced great arteries
- Flow should be laminar and antegrade flow through the valves
- Semilunar valves seen simultaneously
- Parallel great arteries
- Aorta anterior and superior



Great Artery Summary Checklist

- ✓ The LVOT and aortic valve arise from the centre of the heart
- ✓ Only one valve should be seen at a time
- ✓ Great arteries cross over each other
- ✓ Thin leaflets of the valves
- ✓ Pulmonary valve/RVOT from the front of the chest
- ✓ Normal colour flow Doppler – no aliasing (turbulence)
- ✓ Antegrade flow in both vessels
- ✓ 3 Vessel View



Thank you