

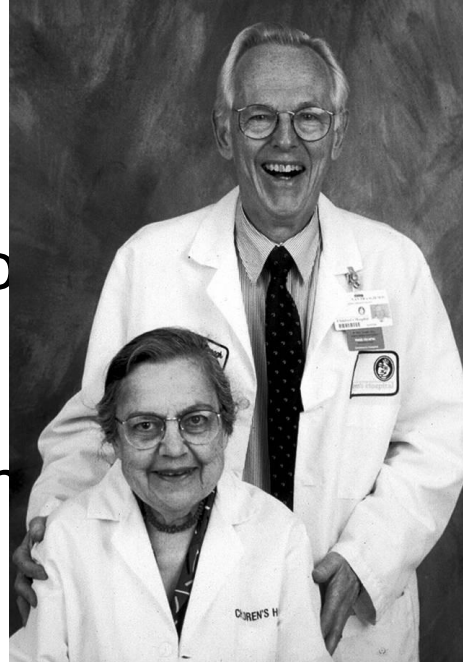
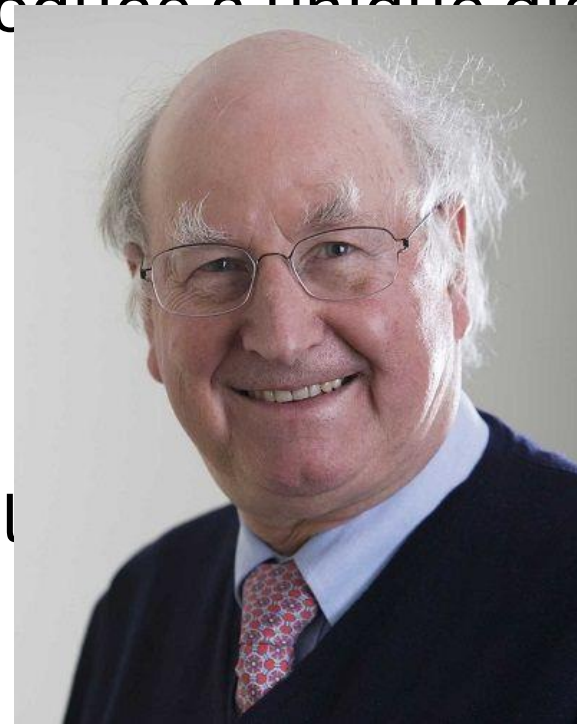
Segmental cardiac anatomy

Mirela Dugulescu, RDCS(PE,FE)

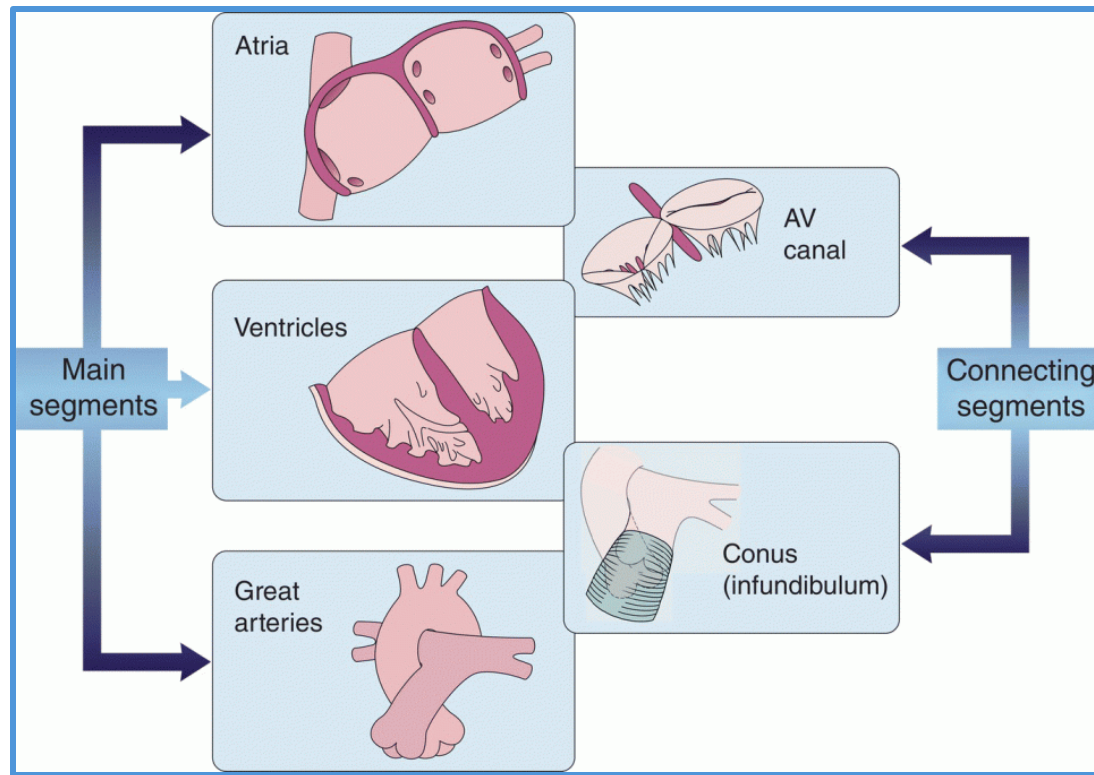
Priya Bhaskar. M.D,

Cardiac morphology

- Understanding the segmental configuration vital to understand CHD
- Consistent nomenclature on readily available anatomic/morphologic features
- Devise a systematic analytical approach to produce a unique diagnosis for each malformation
- To be accessible to all
- Understand and exchange among clinicians and researchers



Building blocks

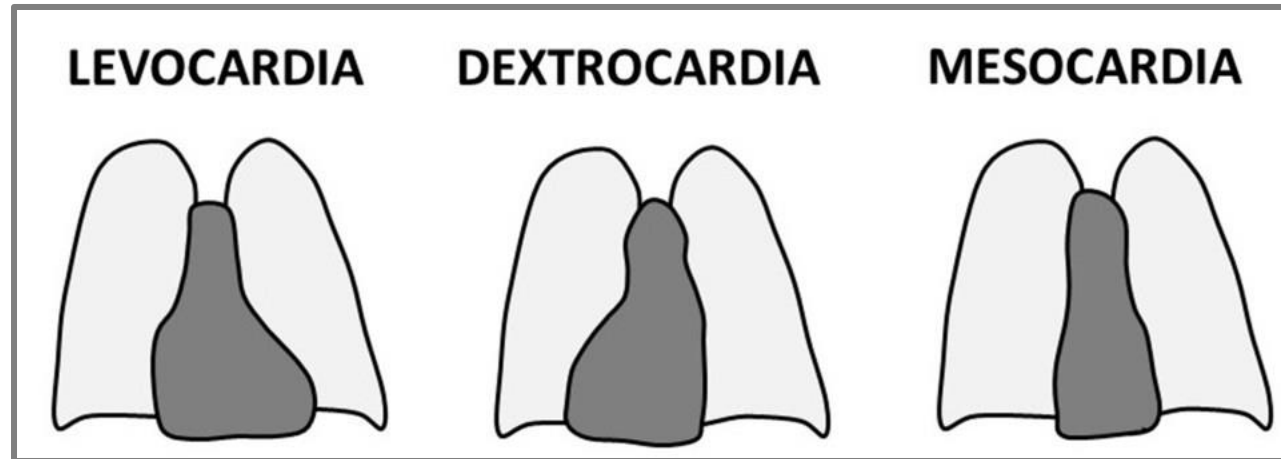


- Based on recognizable anatomy
- 3 facets of cardiac components
 - Morphological description
 - Joined/not joined
 - Relationship between them

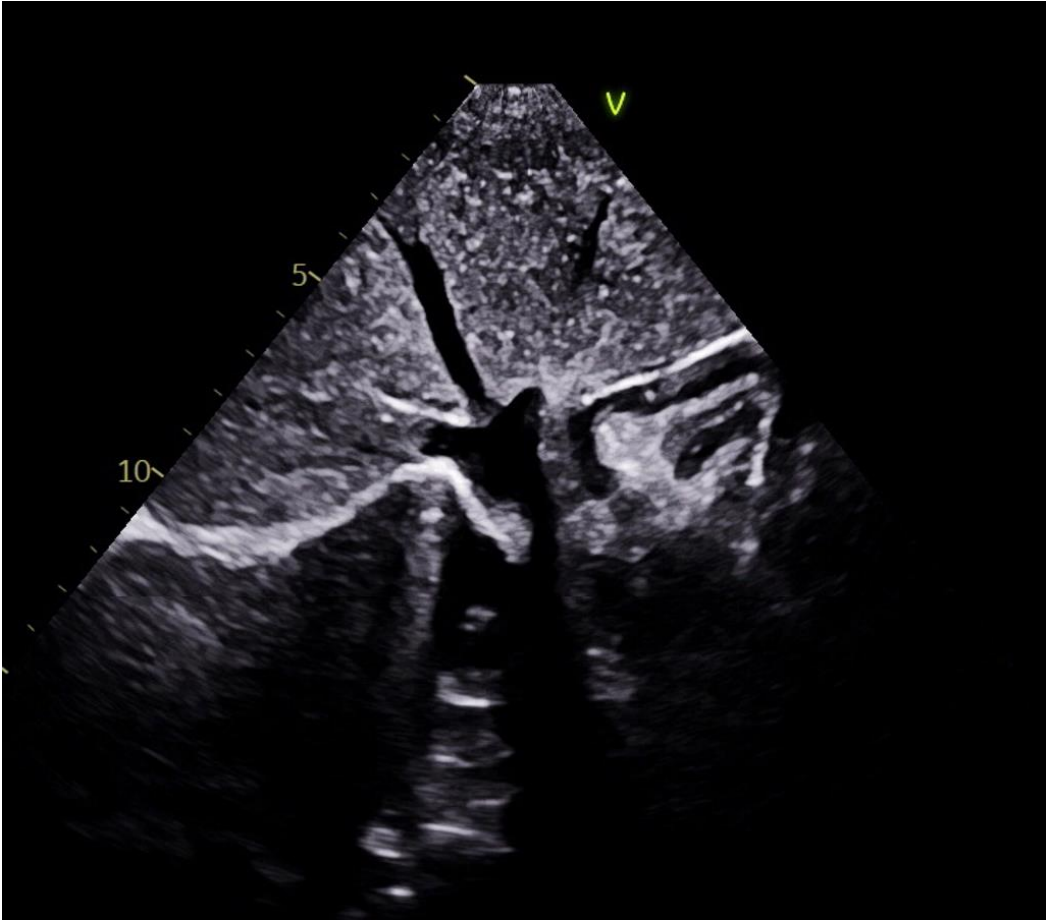
Principles

- Cardiac components
 - Identification based on a constant characteristic feature
 - Determine its location and arrangement
- Junctions
 - Presence/absence of connection between different components
 - Describe valvular morphology and connection

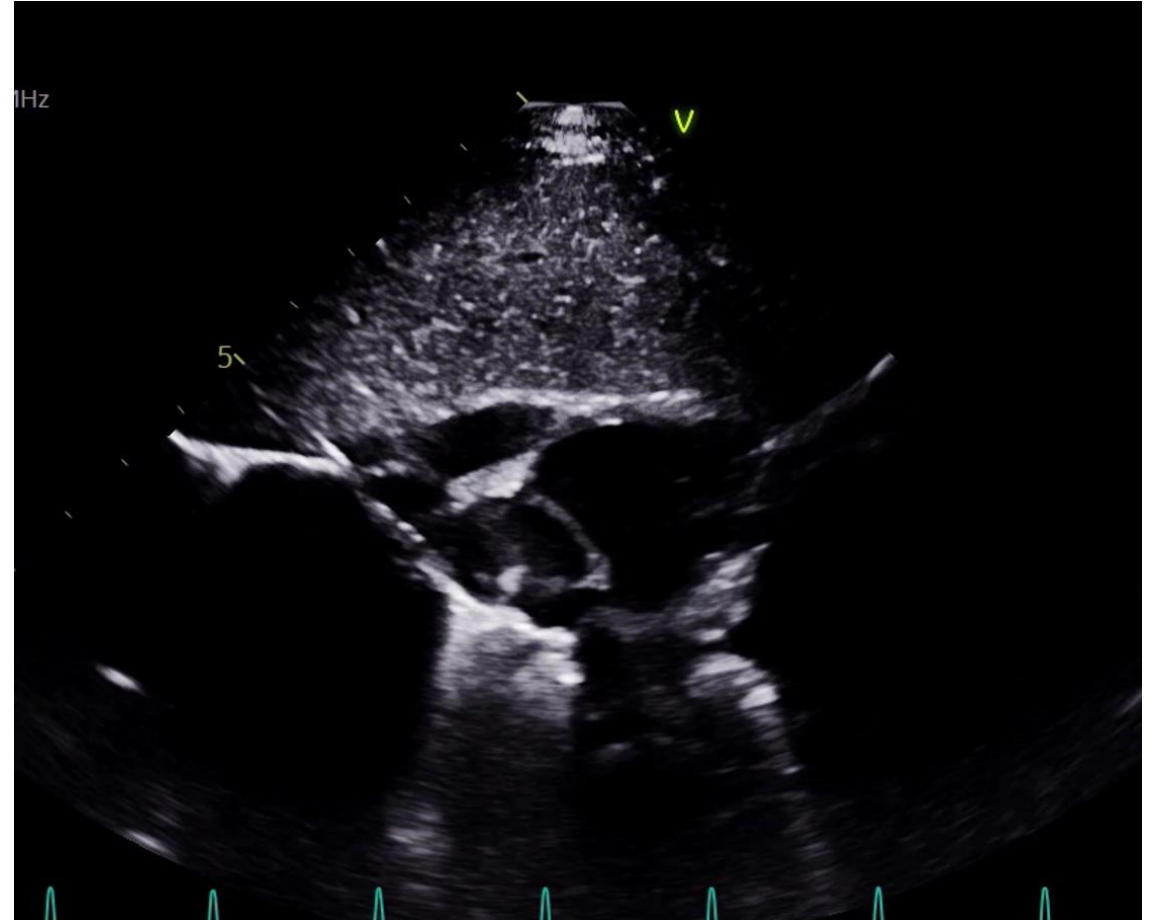
Cardiac position



Cardiac Position: Echo



Levocardia



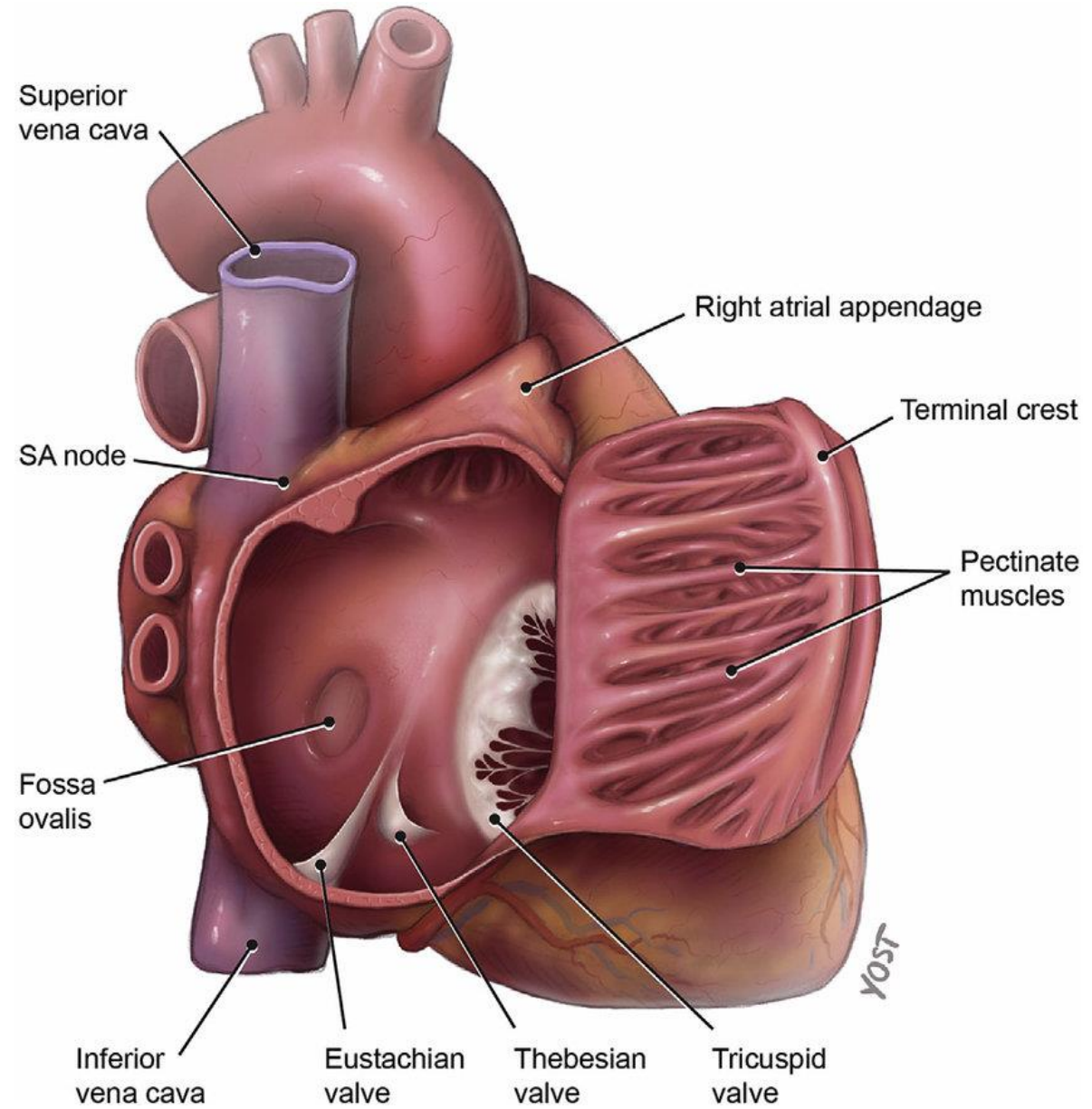
Dextrocardia

Atria

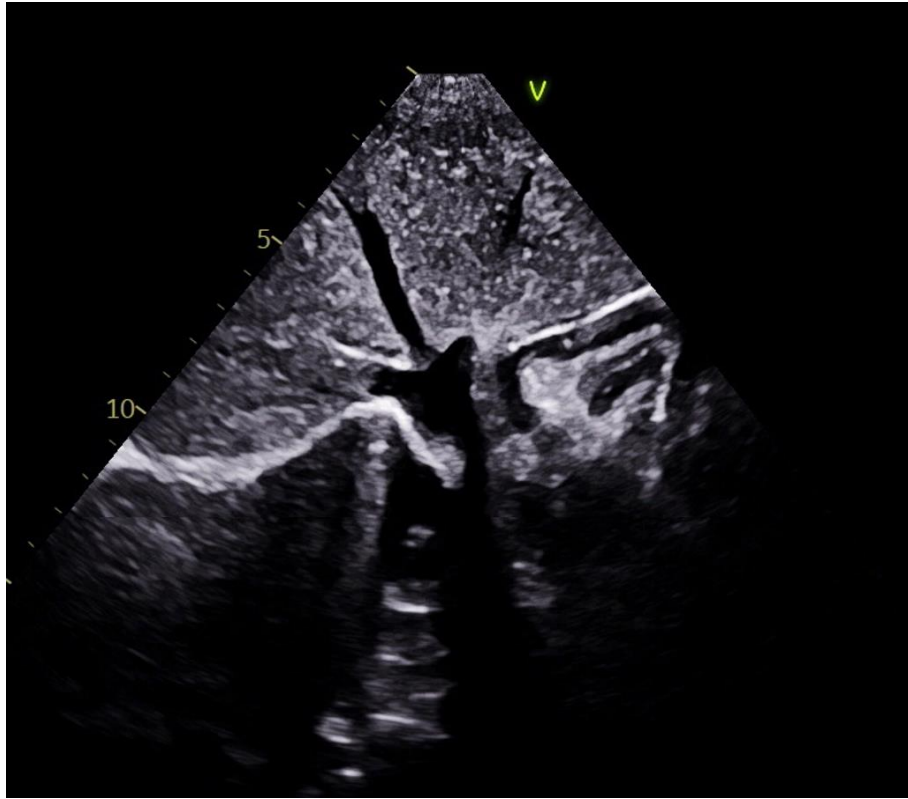
- Atrial body
- Appendages- most consistent feature
- Venous drainage
- Vestibule
- Septal surface

Morphological right atrium

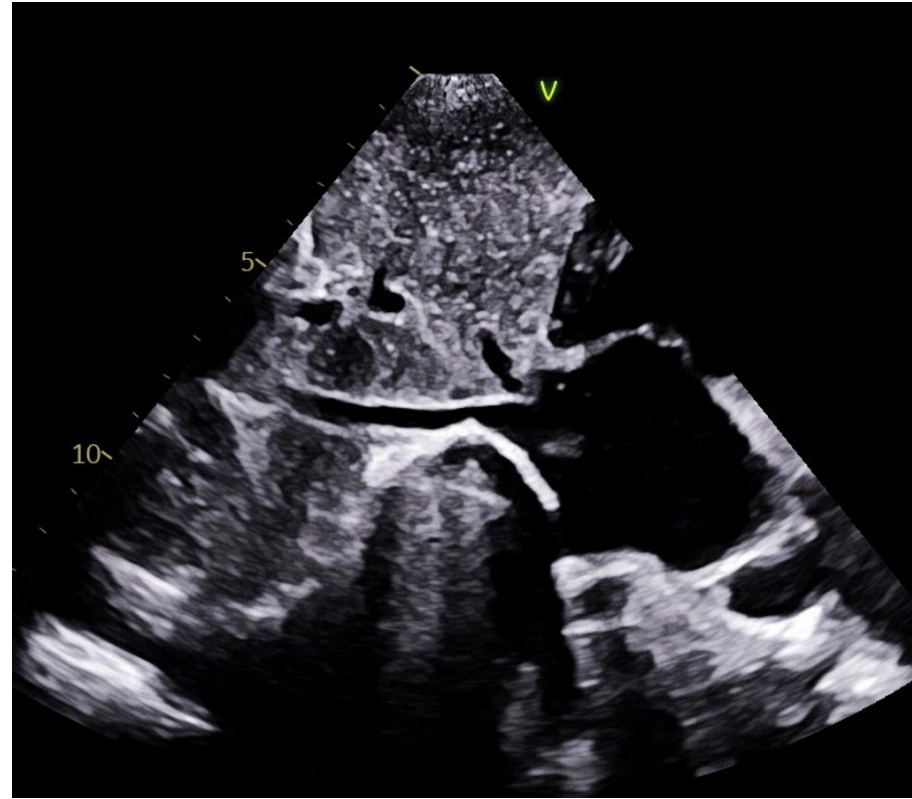
- Right atrium
 - Triangular appendage with broad base, Snoopy nose appearance
 - Pectinate muscle extending into vestibule of right AV valve
 - Crista terminalis



Morphologic Right Atrium: Echo

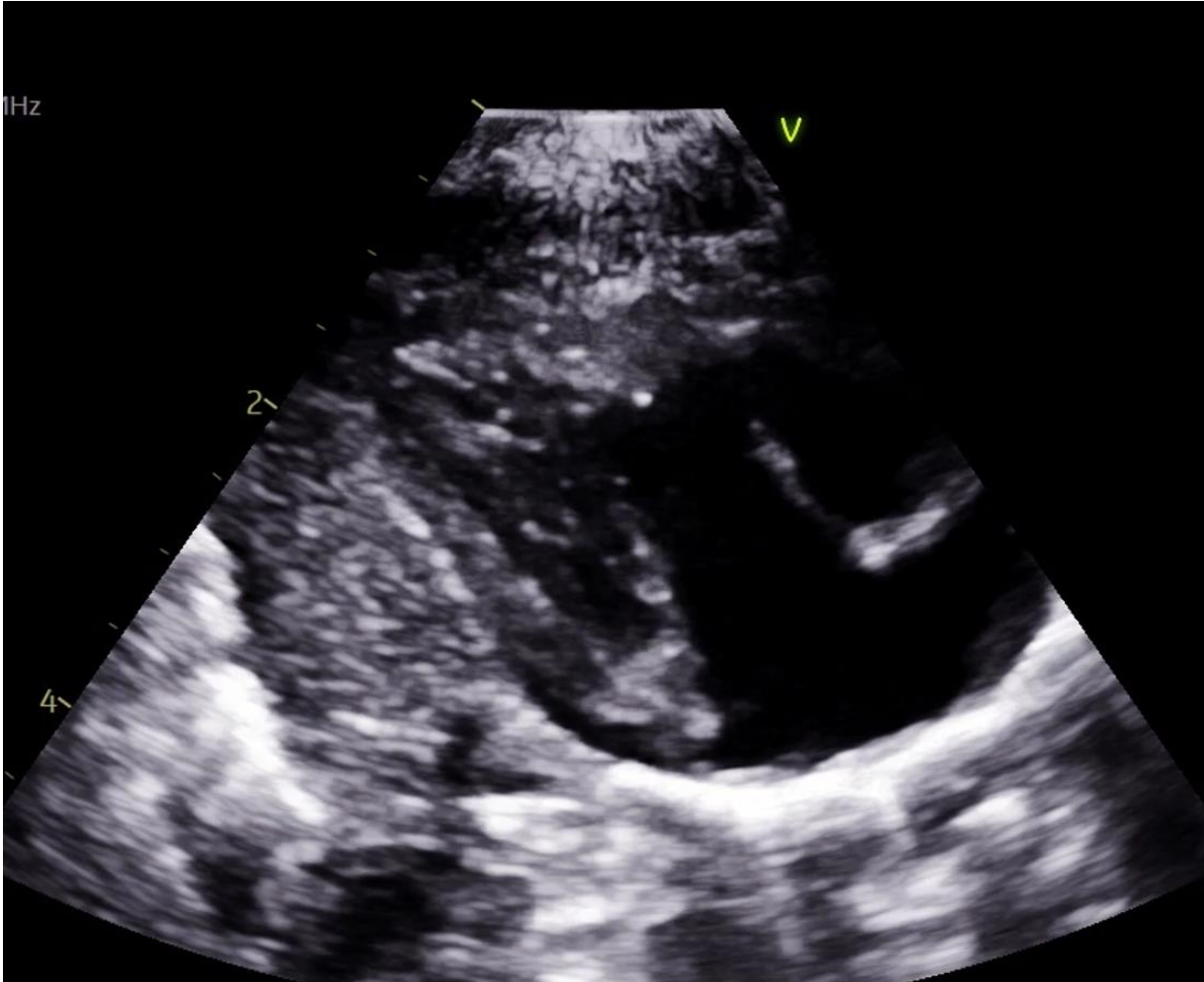


Levocardia with Situs Solitus (IVC to RA)



IVC to RA

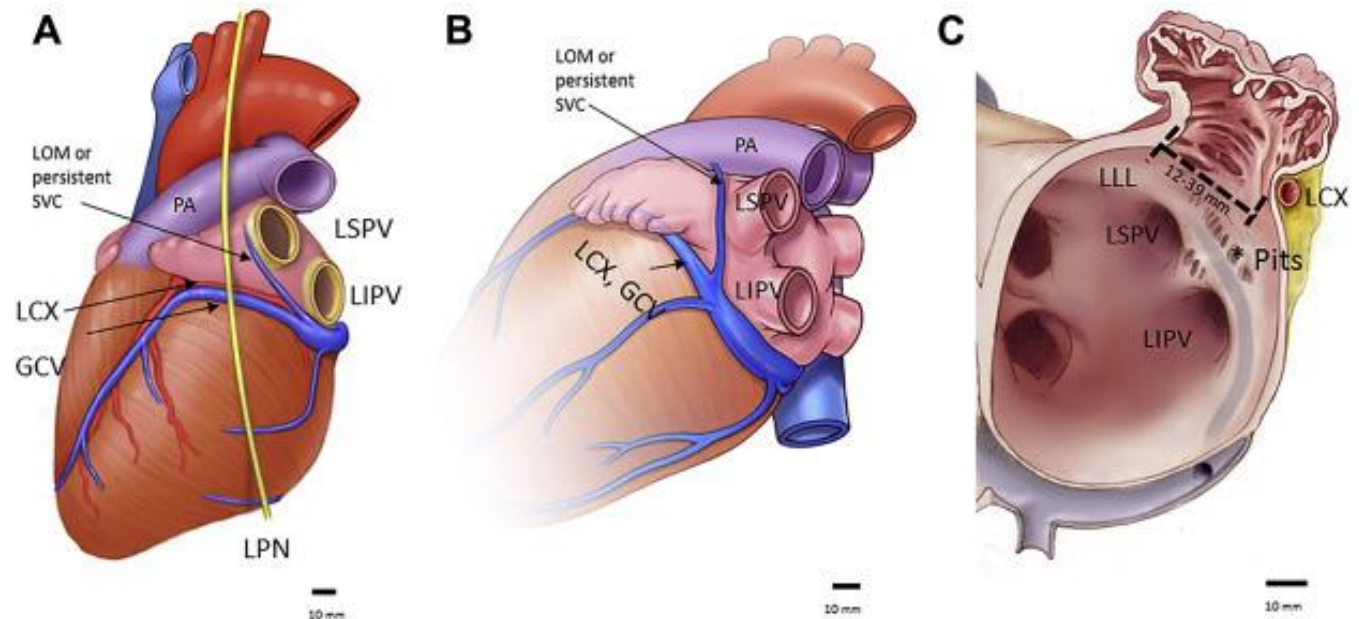
Morphologic Right Atrium

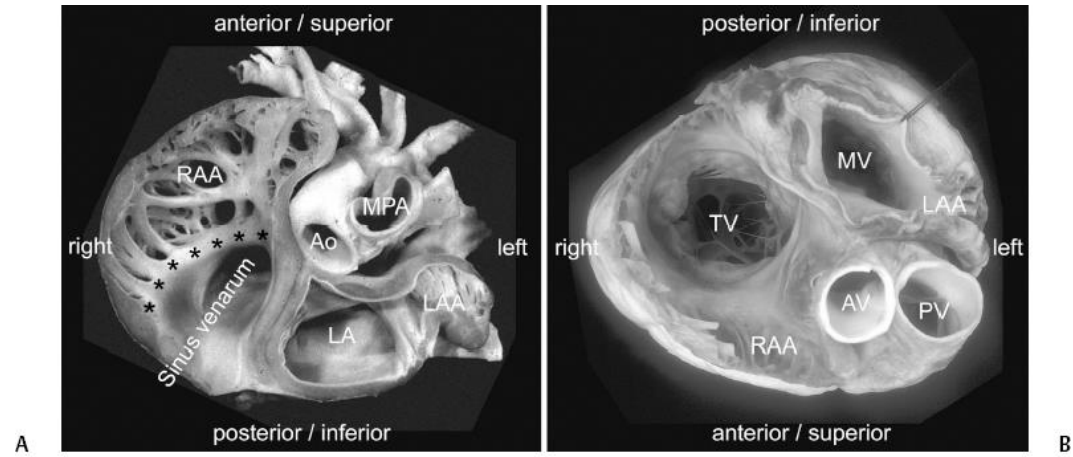
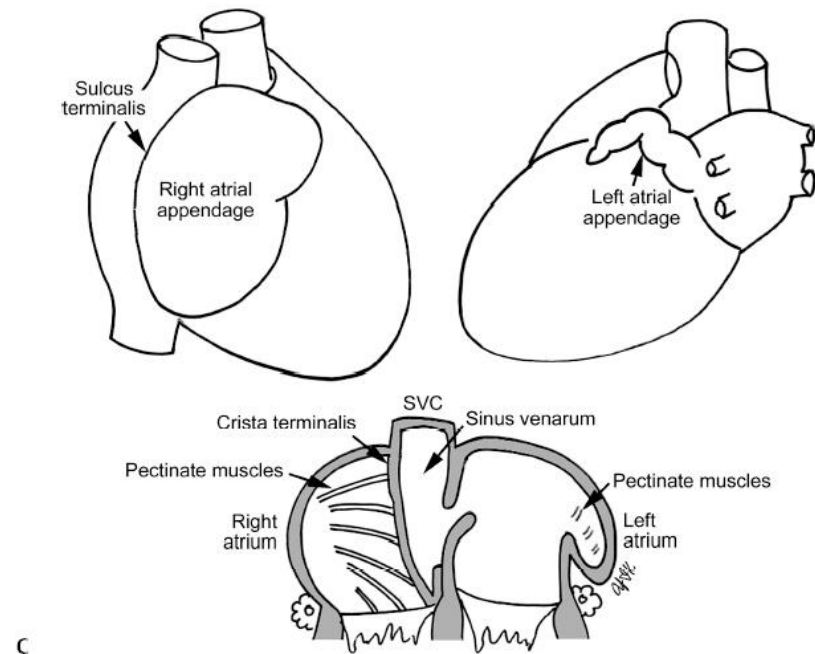


Right ventricular inflow view with right atrial appendage (RAA)

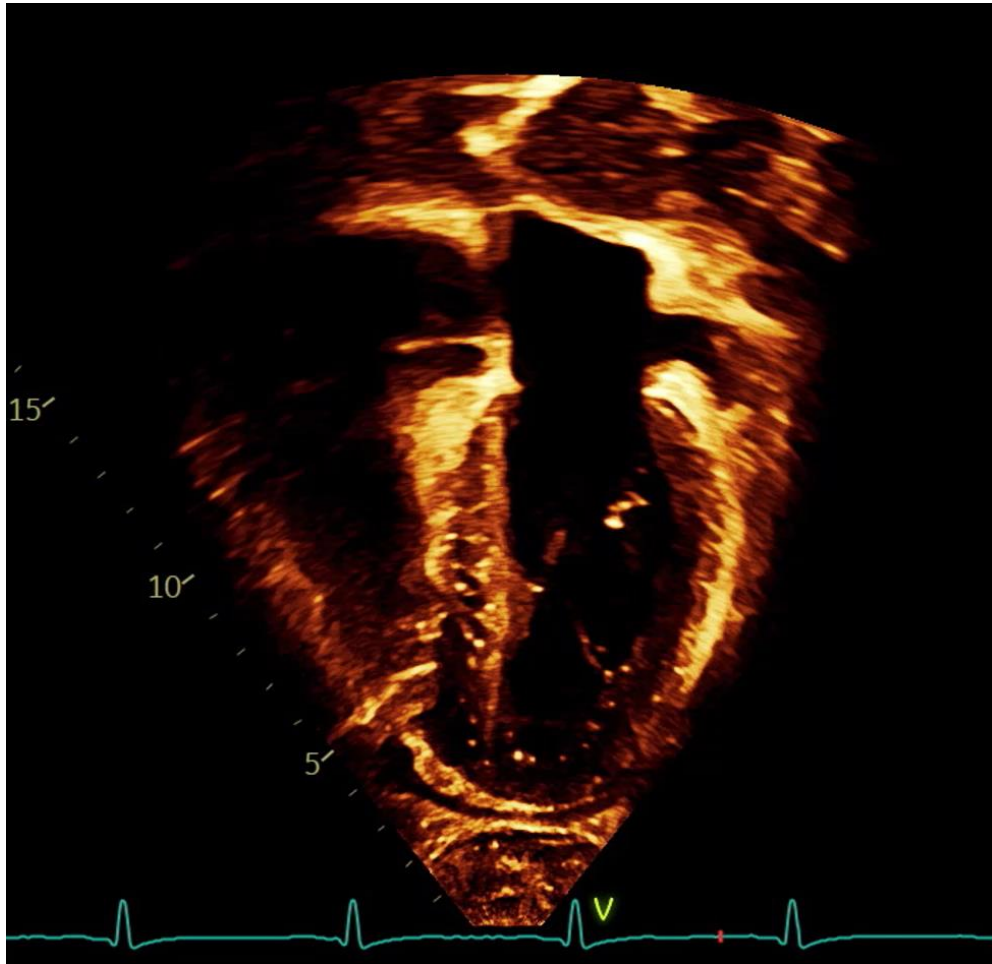
Left atrium

- Narrow appendage with narrow base, finger like appearance
- Pectinate muscles limited to appendage
- The septum secundum

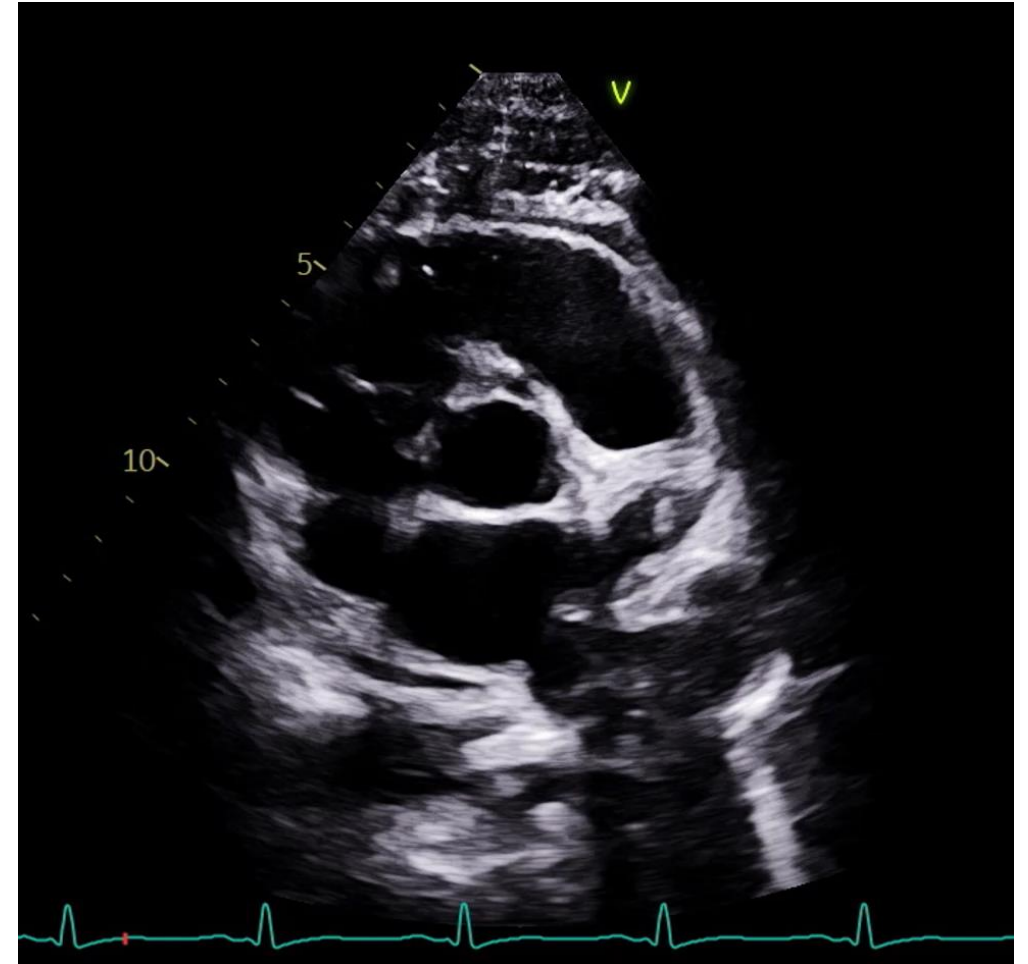




Morphologic Left Atrium



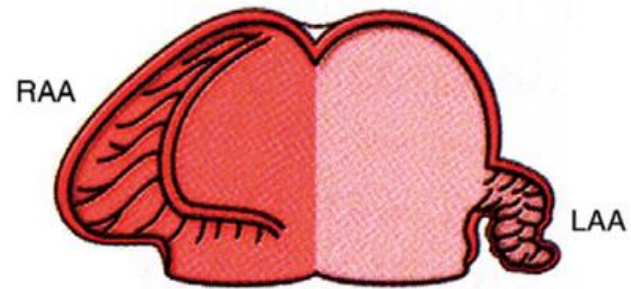
Apical 2 Chamber view



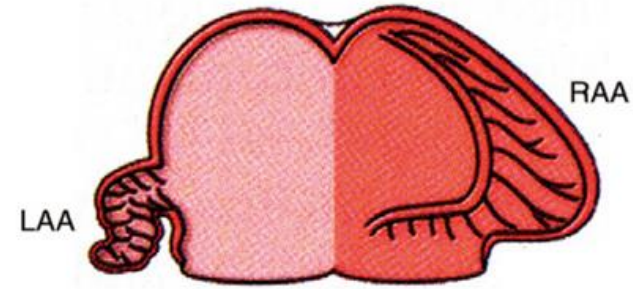
Parasternal Short Axis view

Right and left atria

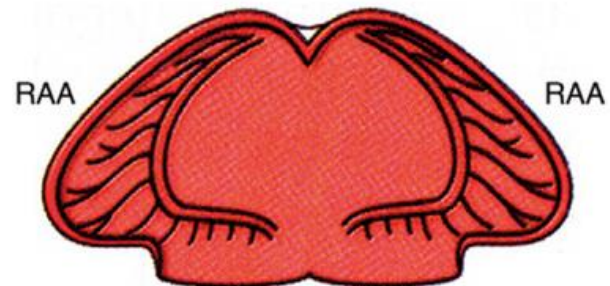
Atrial situs solitus



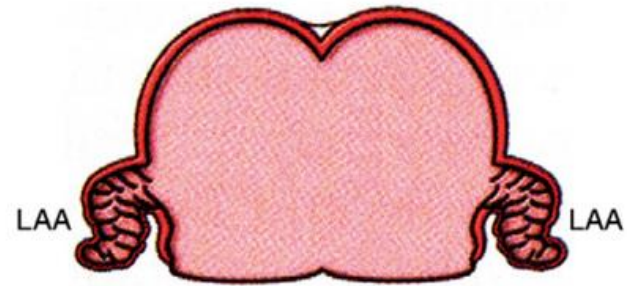
Atrial situs inversus



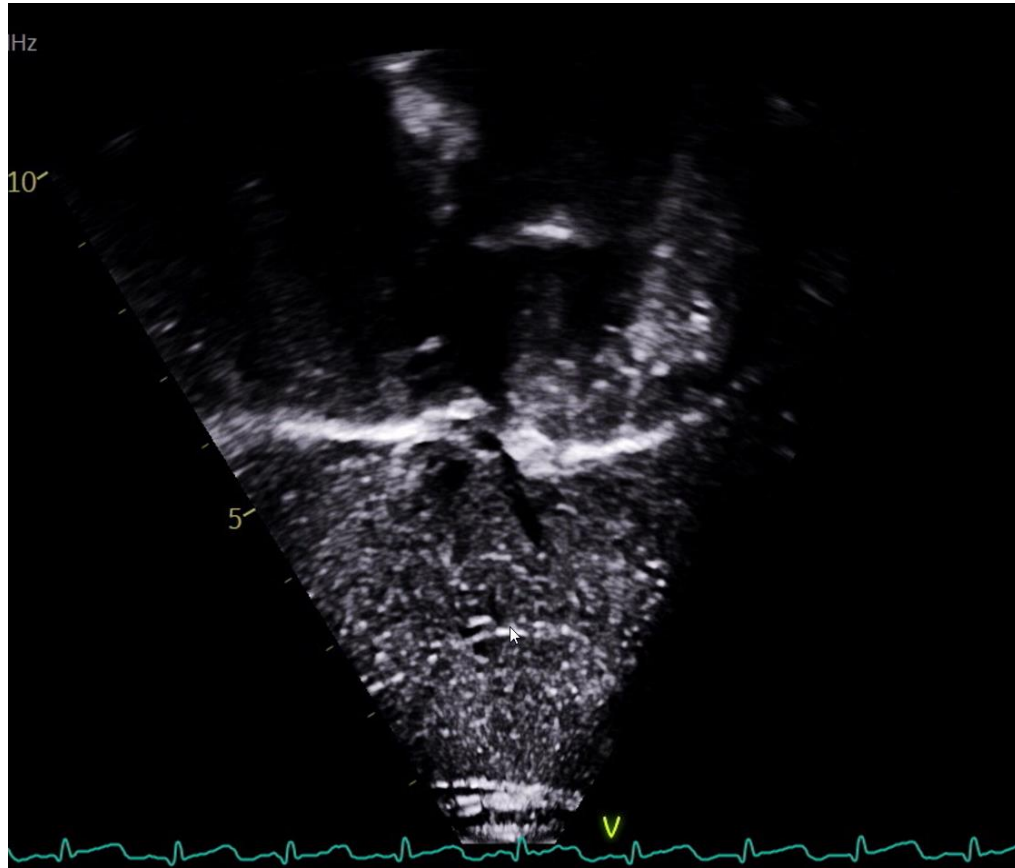
Right atrial isomerism



Left atrial isomerism



Cardiac Position: Echo



Levocardia with Situs Solitus

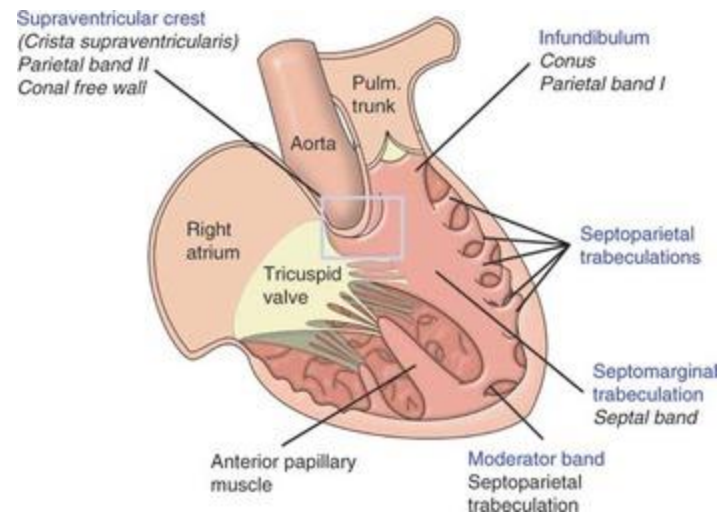
Systemic and pulmonary veins

- Superior and inferior vena cava drain into morphological right atrium
- 4 pulmonary veins drain into morphological left atrium

Morphological right ventricle

- Trapezoid shape
- Coarse trabeculations
- Body, outflow or infundibulum
- Tricuspid valve with chordal insertions on ventricular septum
- Tricuspid valve – pulmonary valve discontinuity due to infundibulum

Morphological Right ventricle cont..

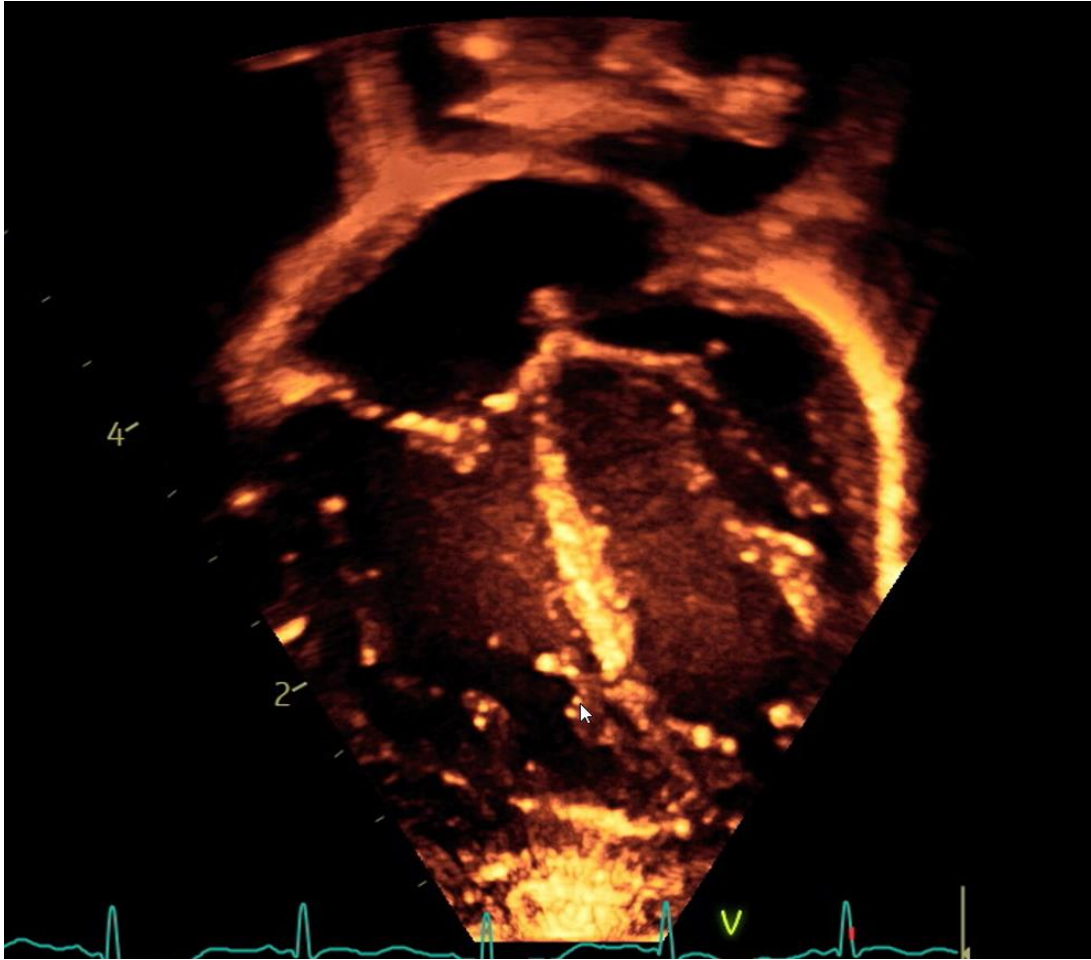


Morphological left ventricle

- Ellipsoidal shape
- Fine trabeculations on the free wall
- Adjacent inflow and outflow tracts
- Absence of septal insertion of mitral valve
- Fibrous continuity between mitral and aortic valve

Right ventricle	Left ventricle
Large apical trabeculations	Small apical trabeculations
Coarse septal surface	Smooth septal surface
Septal and parietal bands	none
Receives tricuspid valve	Receives mitral valve
Tricuspid pulmonary discontinuity	Continuity between mitral and aortic valve
Muscular outflow tract	Fibromuscular
Crescentic in cross section	Circular
Thin free wall (3-5mm)	Thick free wall (12-15 mm)

Morphologic Right and Left Ventricles: Echo

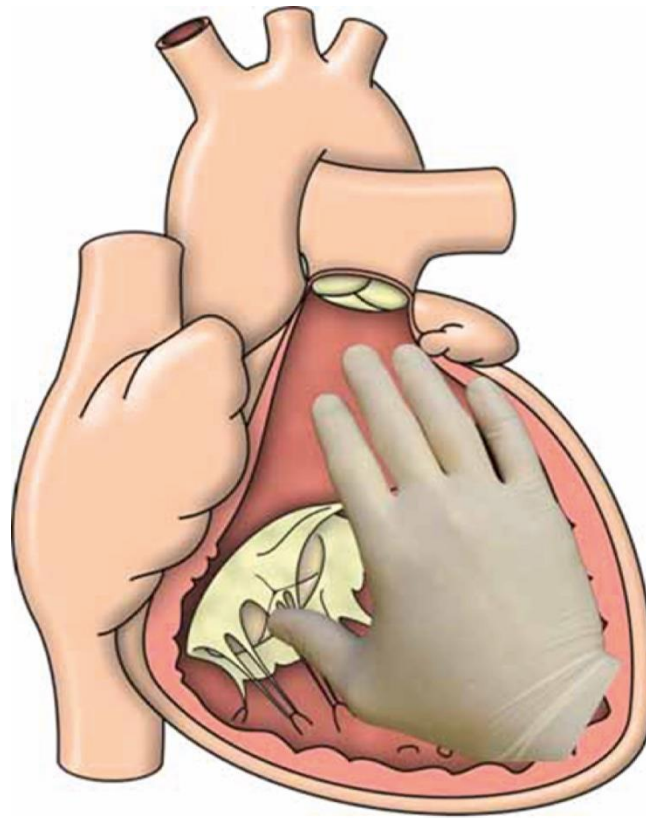


Tricuspid Valve (TV) always follows RV



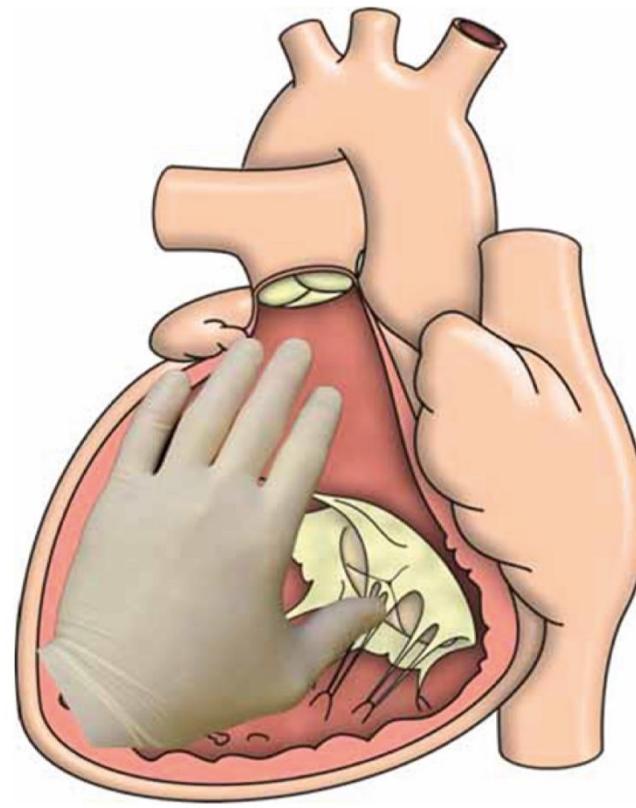
Mitral Valve (MV) always follows LV

Ventricular topology



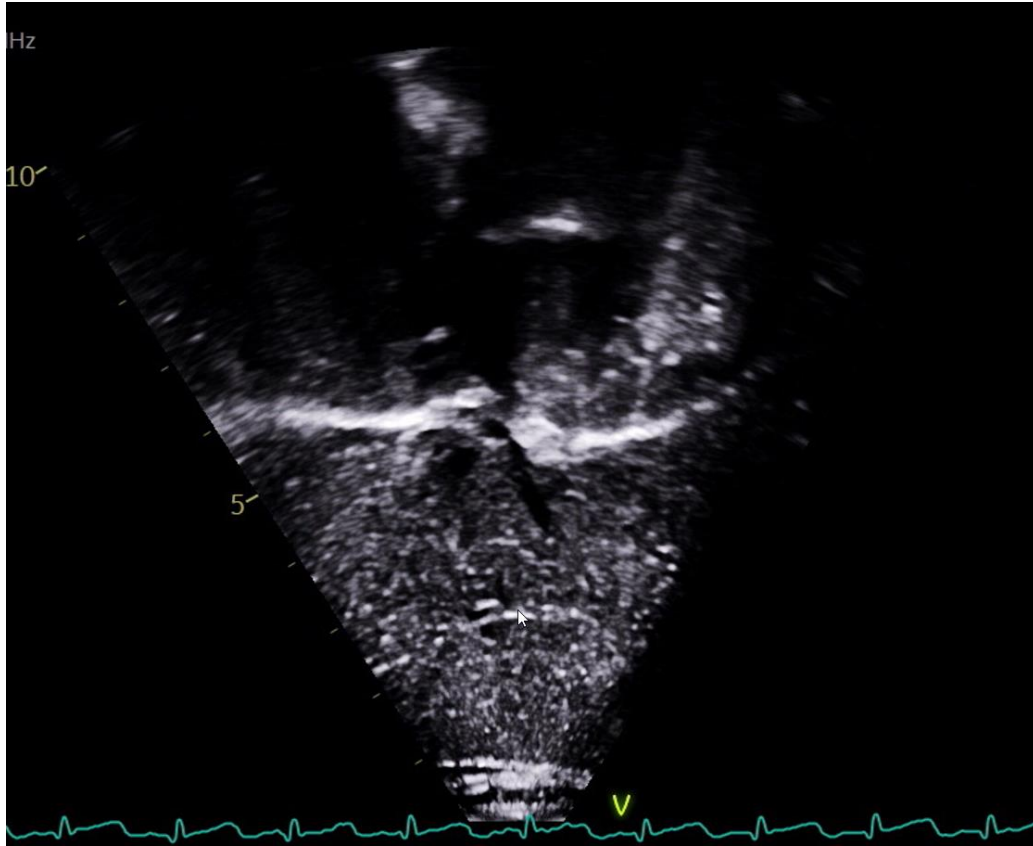
A

*Jenna Price
© 2005*



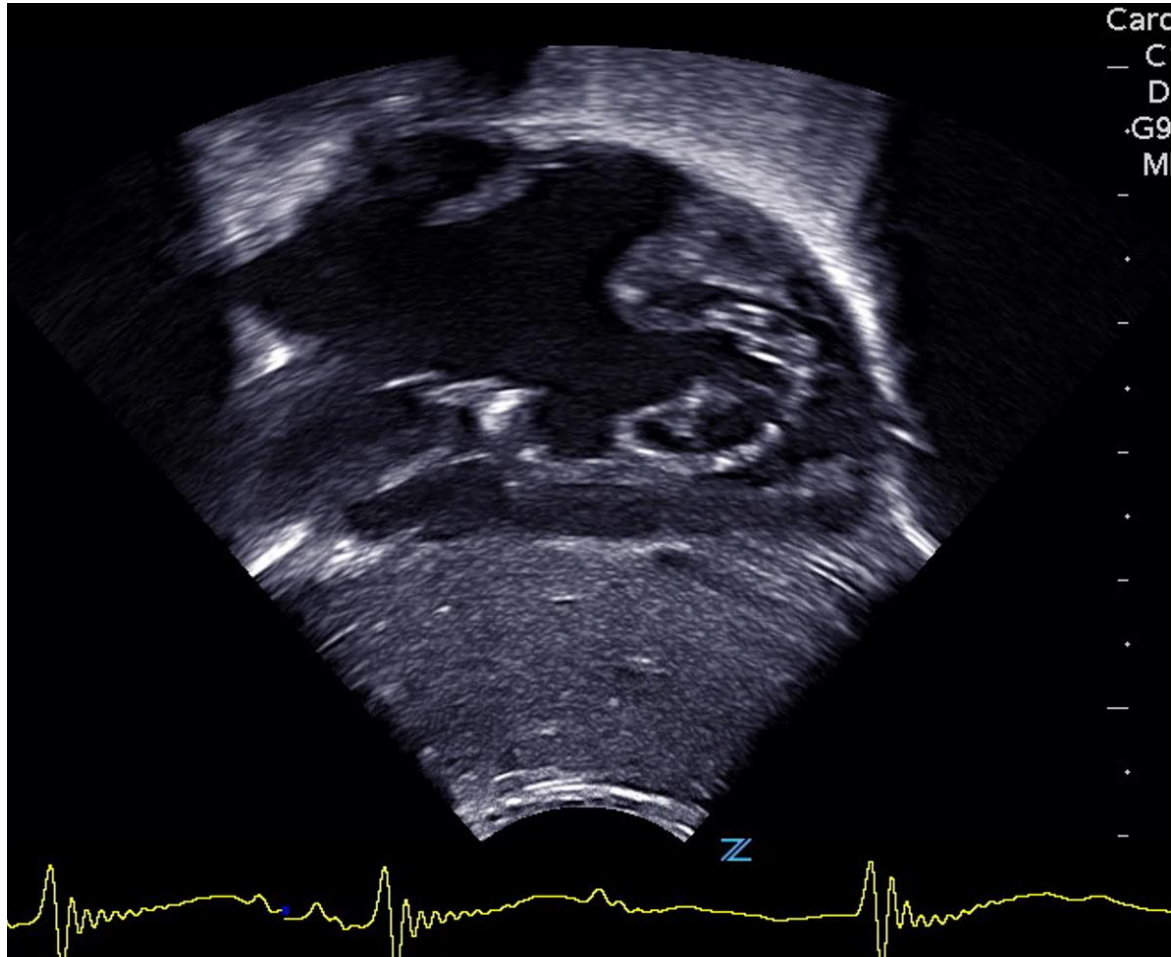
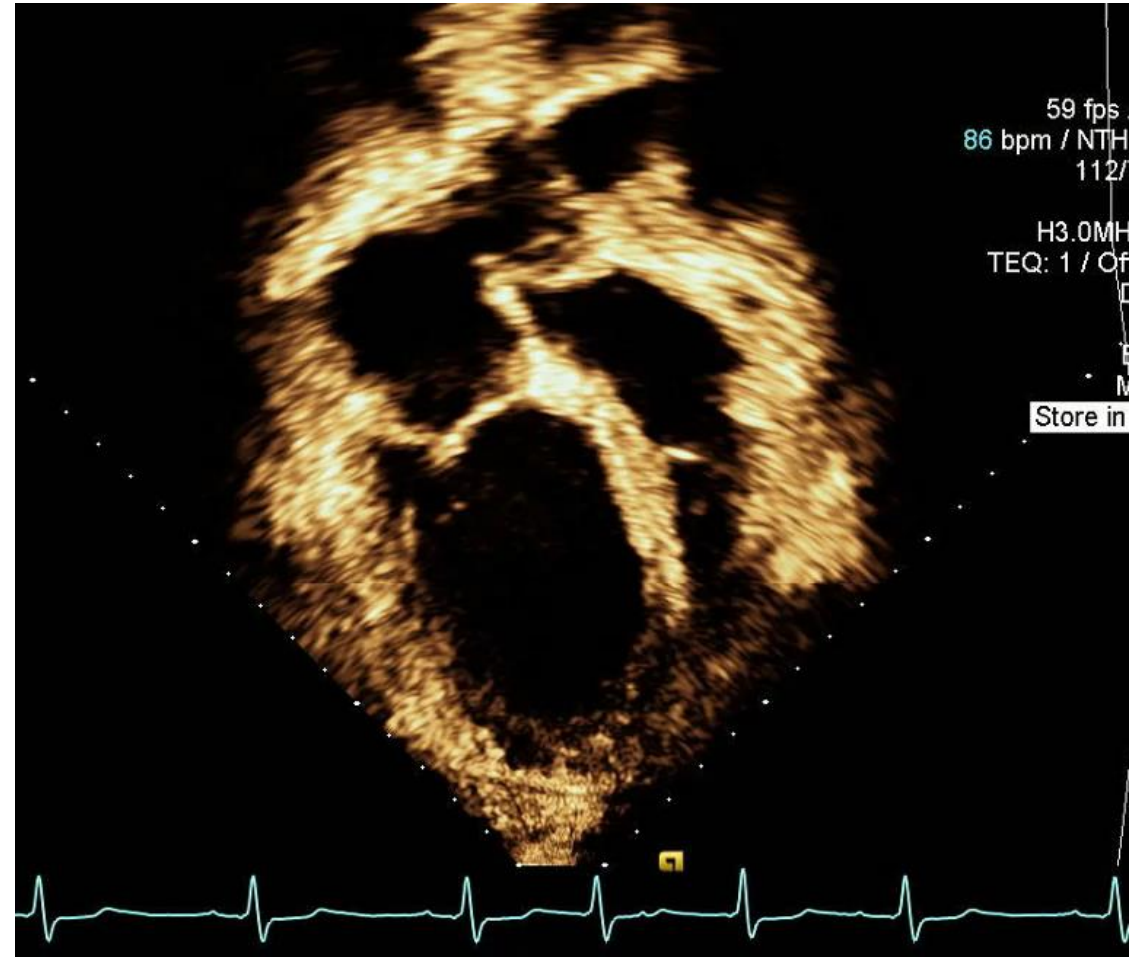
B

Ventricula Looping: Echo



D-Loop Ventricles in normal heart

Ventricular Looping: Echo



L-Looped Ventricle in CC-TGA

Usual atrial arrangement

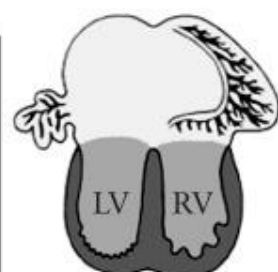


Concordant



Discordant

Mirror-imaged atrial arrangement



Concordant

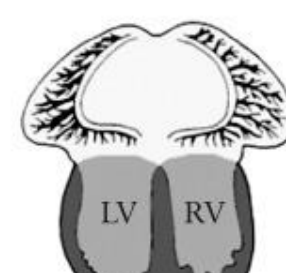


Discordant

Isomeric right appendages

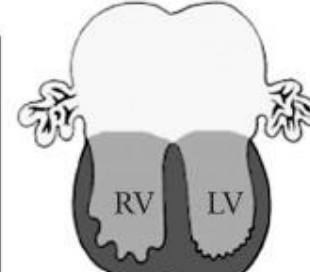


RV to the right

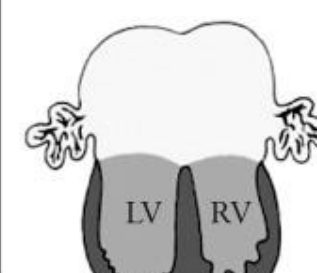


RV to the left

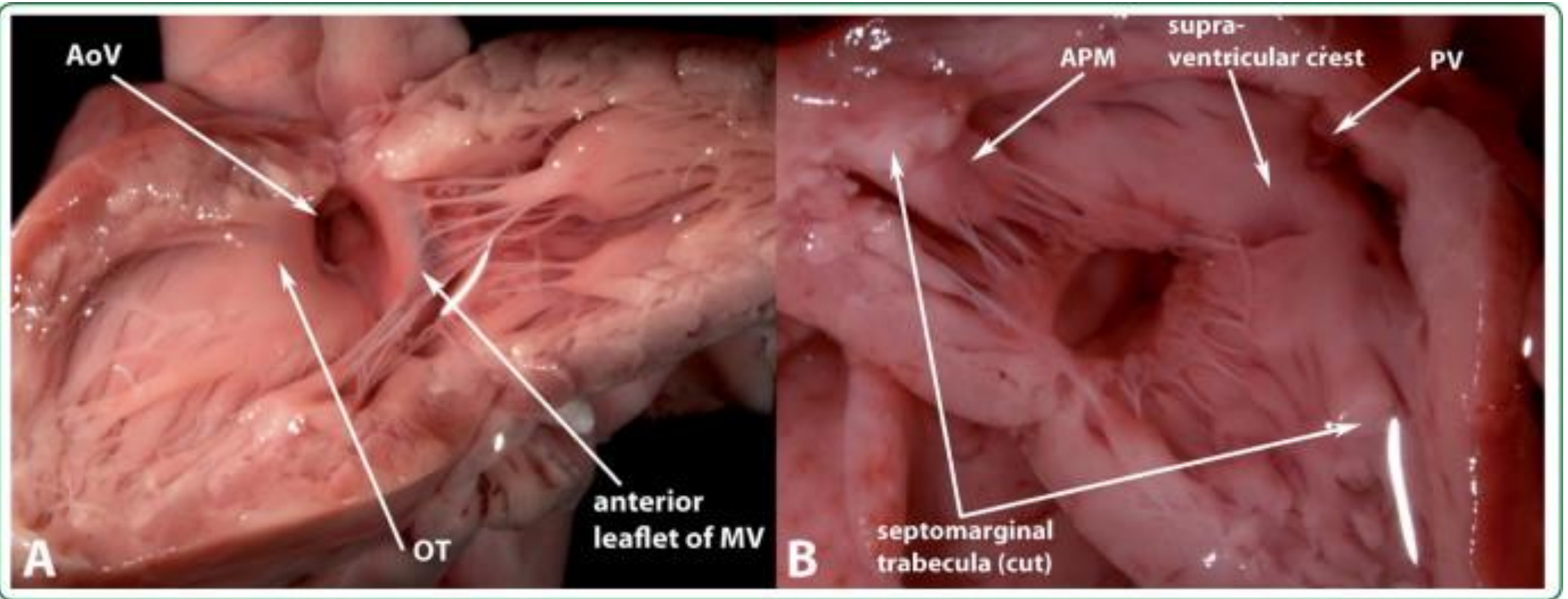
Isomeric left appendages



RV to the right



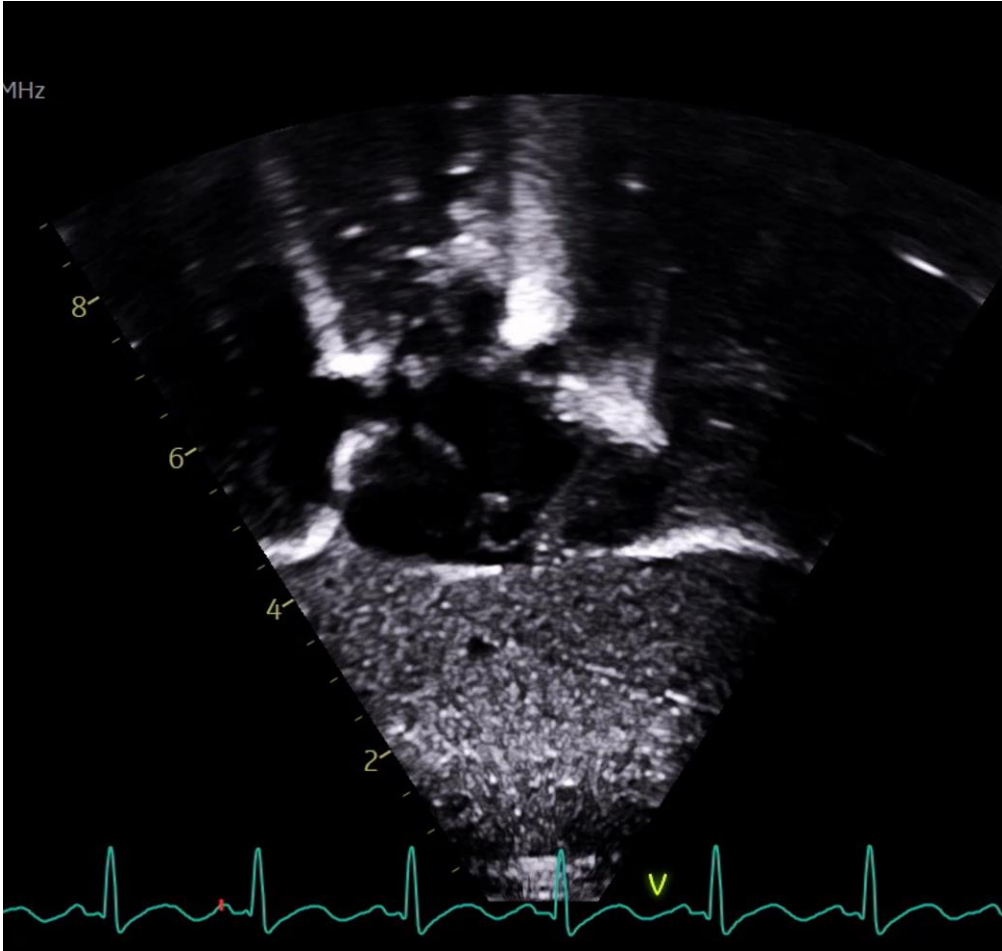
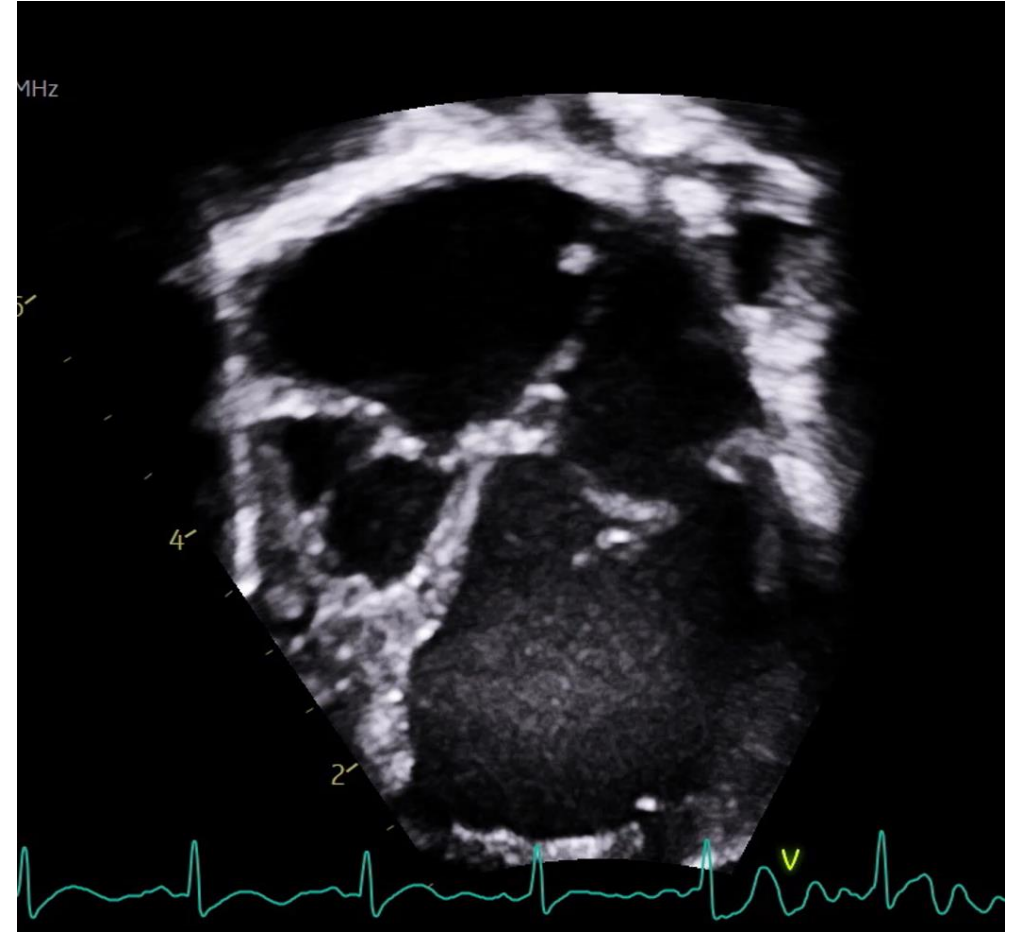
RV to the left



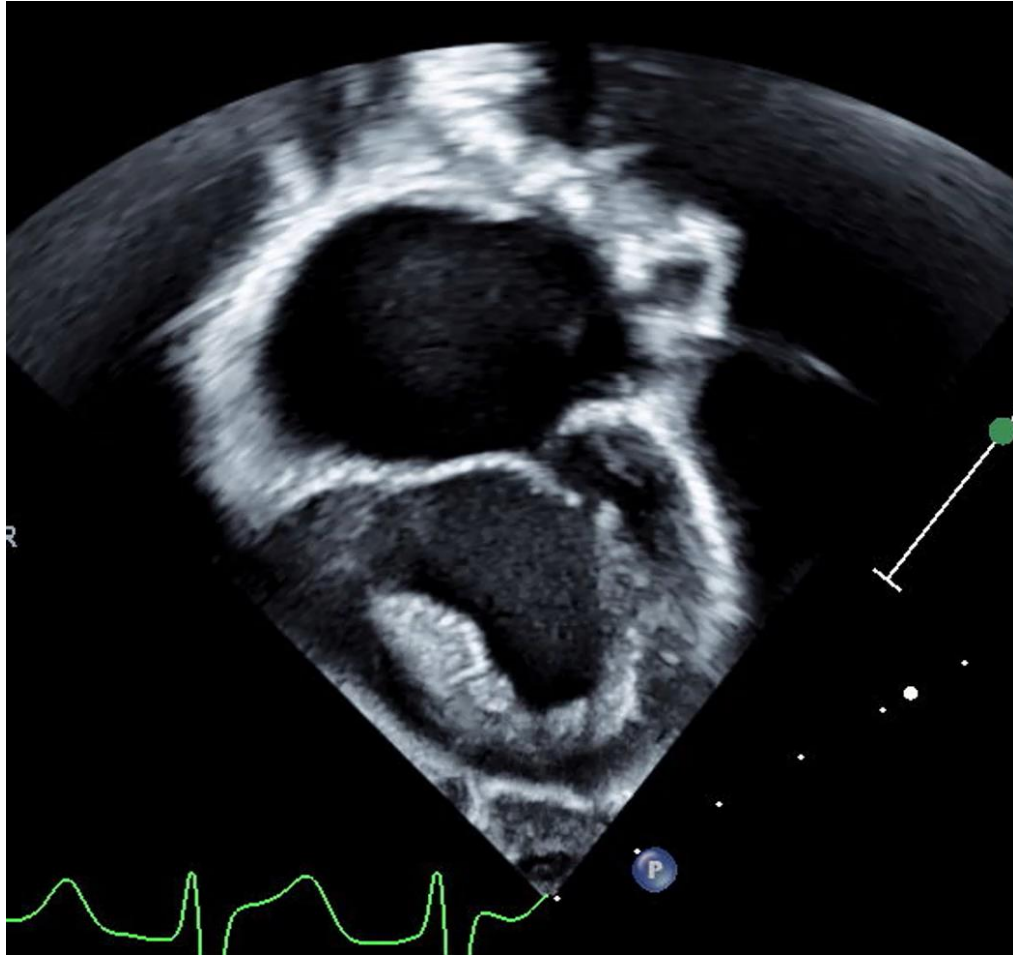
Complete/Incomplete ventricles

- Ventricles have
 - Inlet
 - Apical trabeculated part
 - Outlet
- Incomplete ventricles when one component is underdeveloped
- Incomplete ventricle is described in terms of dominant ventricle

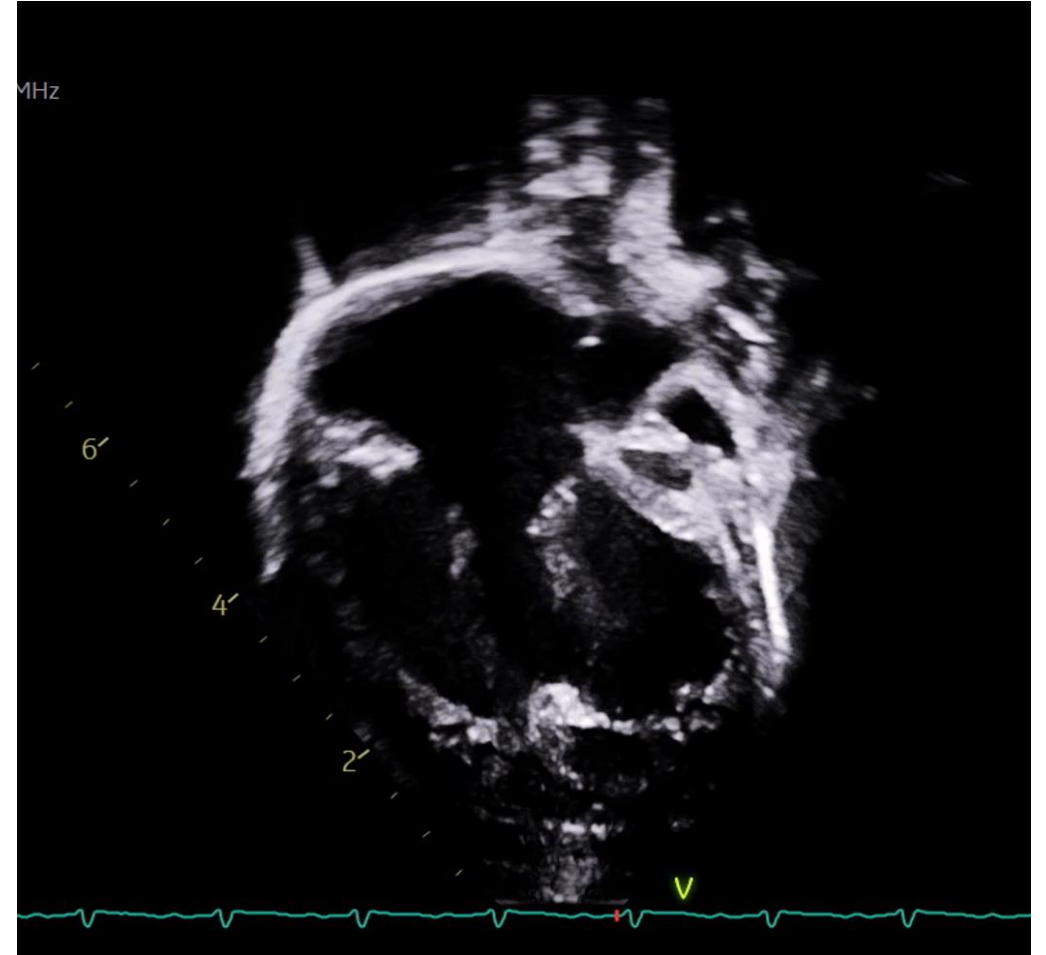
Complete/Incomplete ventricles: HRHS



Complete/Incomplete ventricles: HLHS



No distinguishable LV

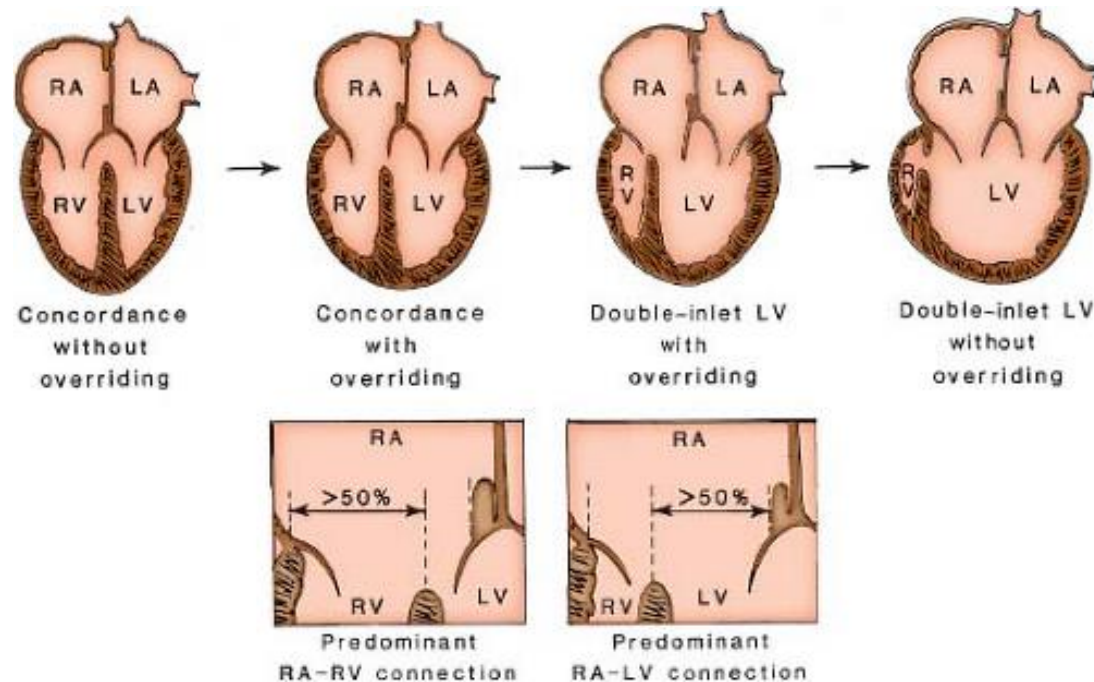


Severely hypoplastic LV without an outflow tract

Atrioventricular connections

Atria	2	2	1
Ventricle	2	1	1
Connection	Biatrial BiV	Double inlet ventricle	Uniatrial univentricular
Types	Both patent valves One imperforate Common valve Straddling valve Overriding valve	Patent and committed Straddling valve Overriding valve	

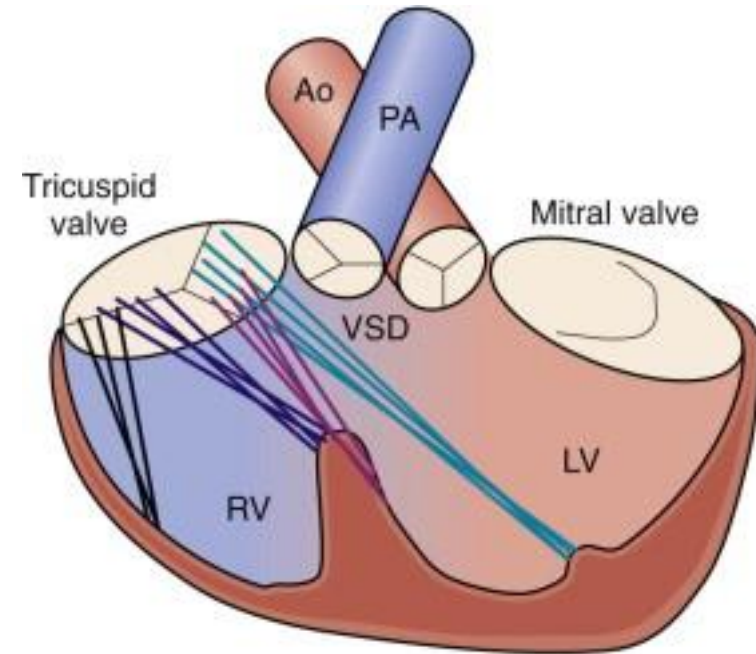
Overriding valves



- BiVentricular draining of AV valve
- Biventricular opening of a semilunar valve
- Its always due to the valve annulus and VSD is present

Straddling valves

- Anomalous insertion of chordae or papillary muscle into contralateral ventricle



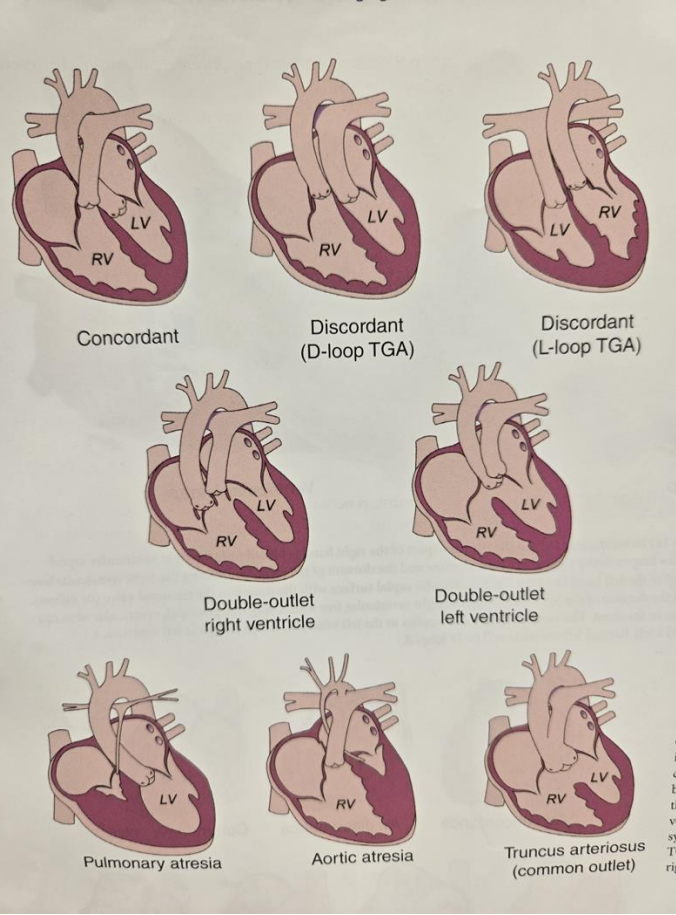
- Type A ———
Septal attachment at the VSD
- Type B ———
Septal attachment in the contralateral ventricle
- Type C ———
Attachment on the contralateral free wall

Ventriculo arterial connections

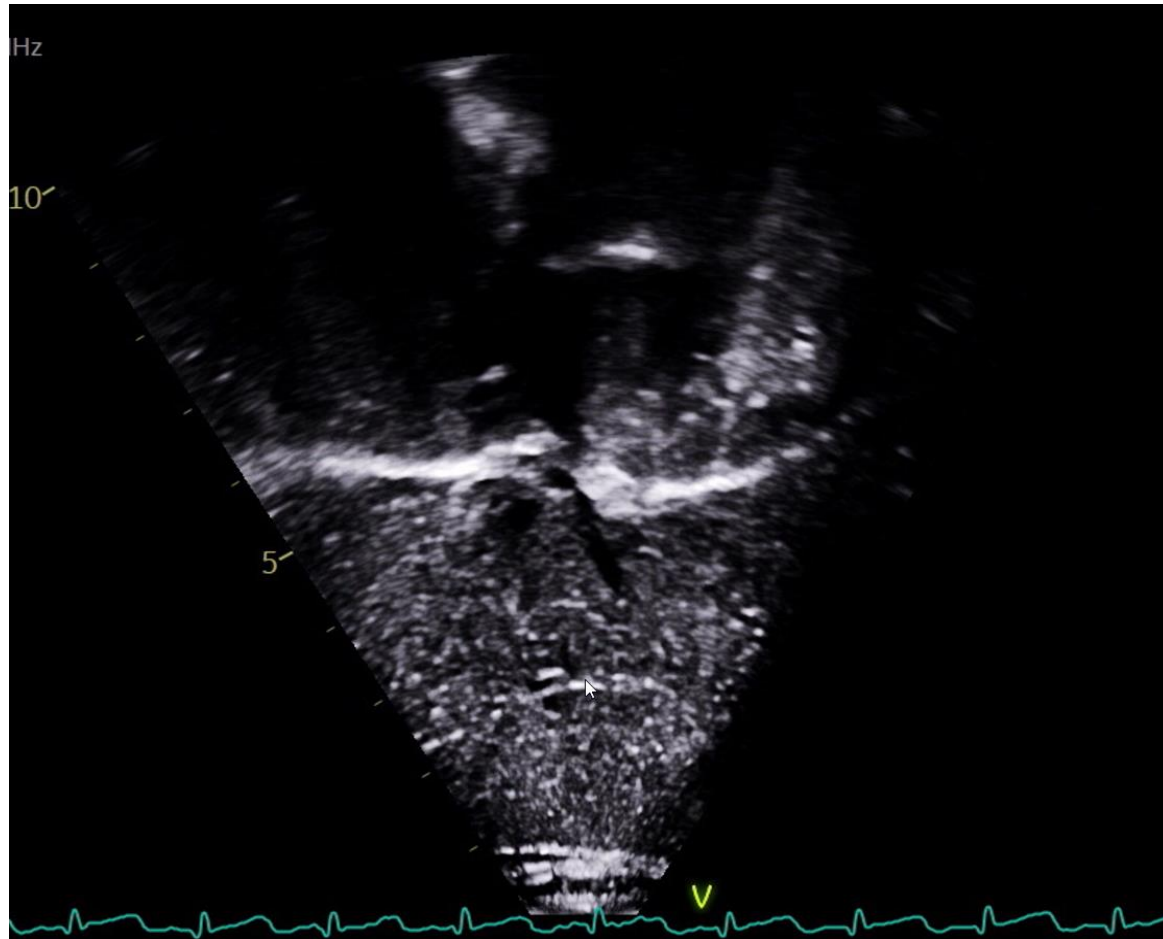
- **Concordant connection:** aorta from left ventricle, pulmonary artery from right ventricle
- **Discordant connection:** aorta from right ventricle, pulmonary artery from left ventricle
- Great vessel considered committed if related to a ventricle by **≥50%** of its dimension
- No specific imaging view defines the ventriculo-arterial relationship

- Relation described at ventriculoarterial valve level
- Aorta positioned relative to pulmonary trunk as center
- Normal aorta position: posterior and right of pulmonary trunk
- Pulmonary artery normally spirals around aorta
- Parallel ascent of great vessels linked to DORV or discordant ventriculoarterial connection
- Right aortic arch passes to the right of the trachea

Ventricle	Right handed or left handed topology		
Van Pragh	D/L		
Great vessels	2 vessels connected to 2 ventricles	2 vessels connected to Single ventricle	Single vessel connected to one or both ventricles
Type	Concordant Discordant	Double outlet ventricle	Common trunk Aortic root with pulmonary atresia Pulmonary root with Aortic atresia

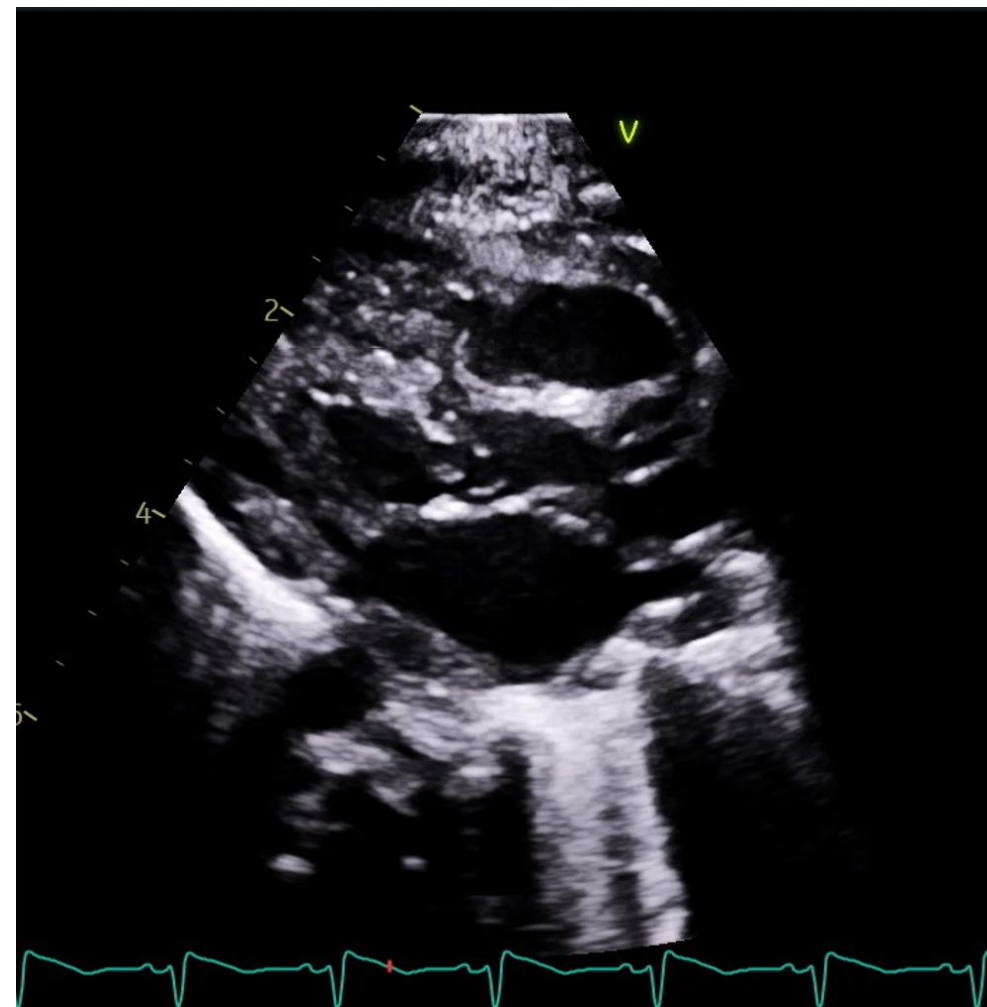


Ventriculoarterial Connections: Echo



Normal ventriculoarterial connections

Ventriculoarterial Connections: Echo (D-TGA)



Ventriculoarterial Connections: Echo (L-TGA)

