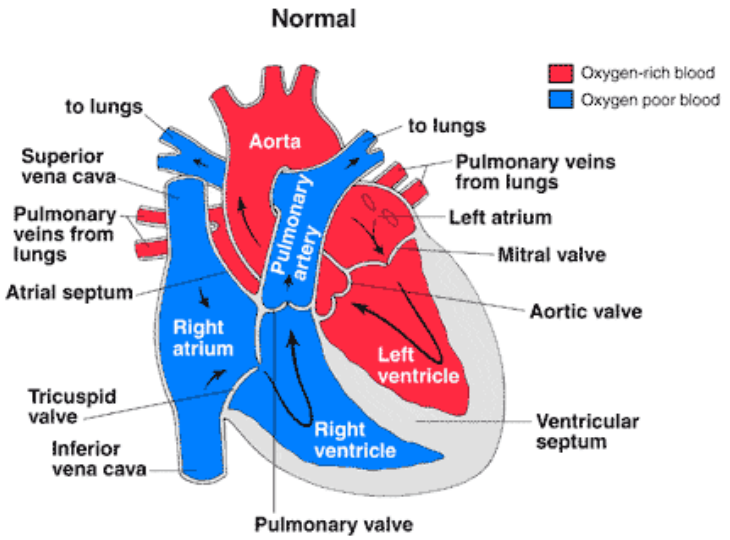
CARDIOVASCULAR ANOMALIES IN THE FETUS
Structural and Rhythm

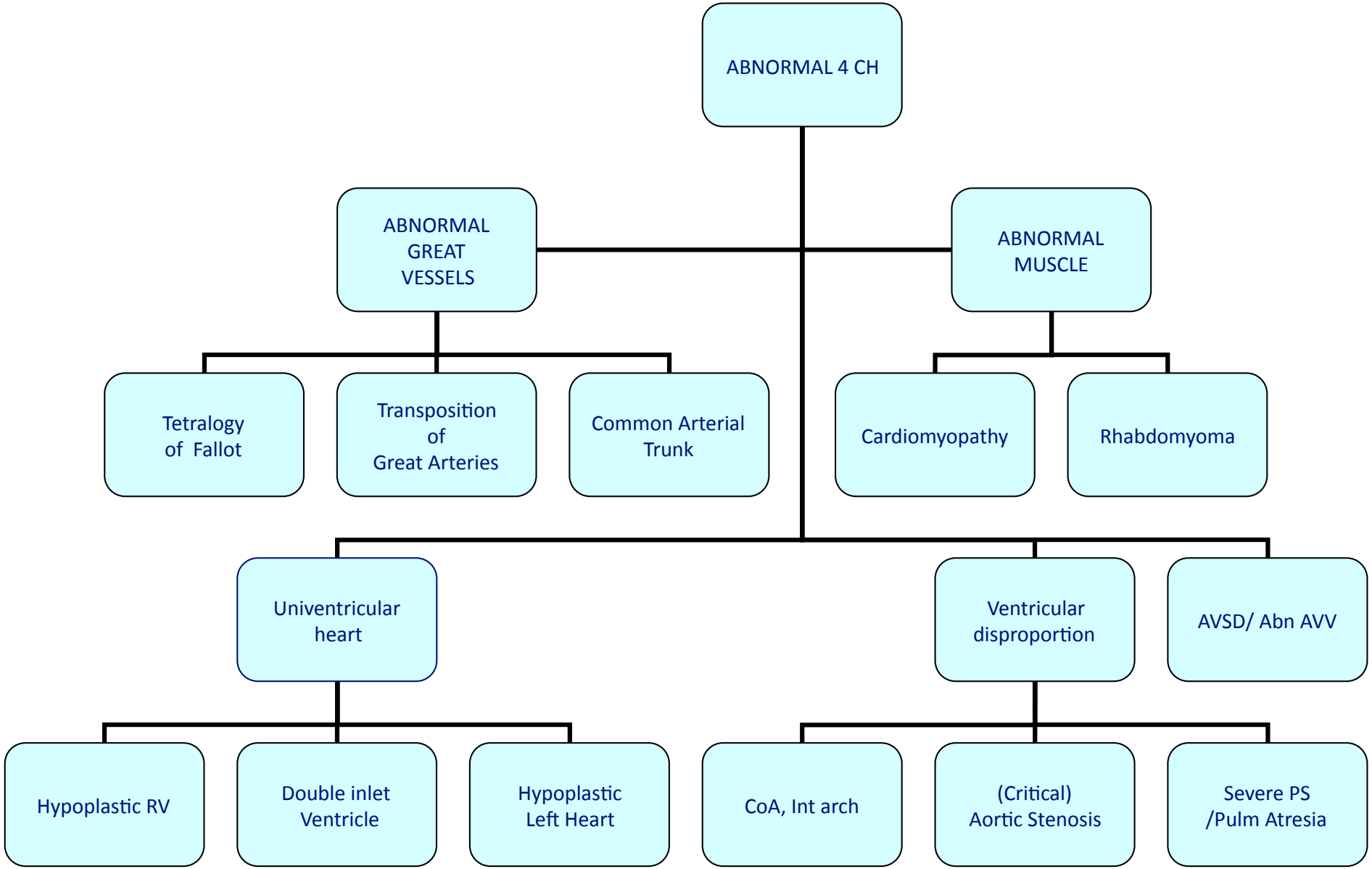
Identification of CHD

Sequential Segmental Analysis

- Pulmonary & Systemic veins
- Interatrial septum
- Atrio-ventricular connections
- Interventricular septum
- Ventriculo-Arterial connection
- Great Artery arrangement



Incredibly Simple Classification of CHD



NB Classification modified by Dr S Barwick

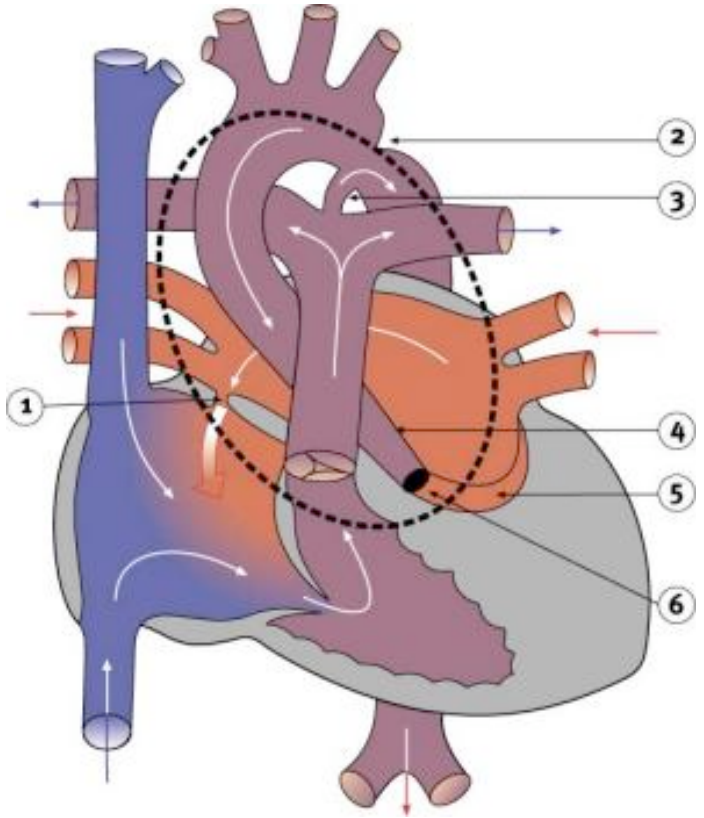
Hypoplastic Left Heart Syndrome

- 5-10% of major CHD in infants
- Overrepresented in Fetal Series due to TOP, IUD, NND
- Readily detectable in 4 chamber view
- Diagnosis at $^{16\text{-}18}/_{40}$ or earlier
- Can be spectrum/progressive

Features of HLHS

- Disproportion
  - LA << RA; LV << RV; Ao<< PA

- No forward flow through MV
- No forward flow through AV
- Reversal of flow in Ao Arch
- Reversal of flow at FO
  - ie. L to R

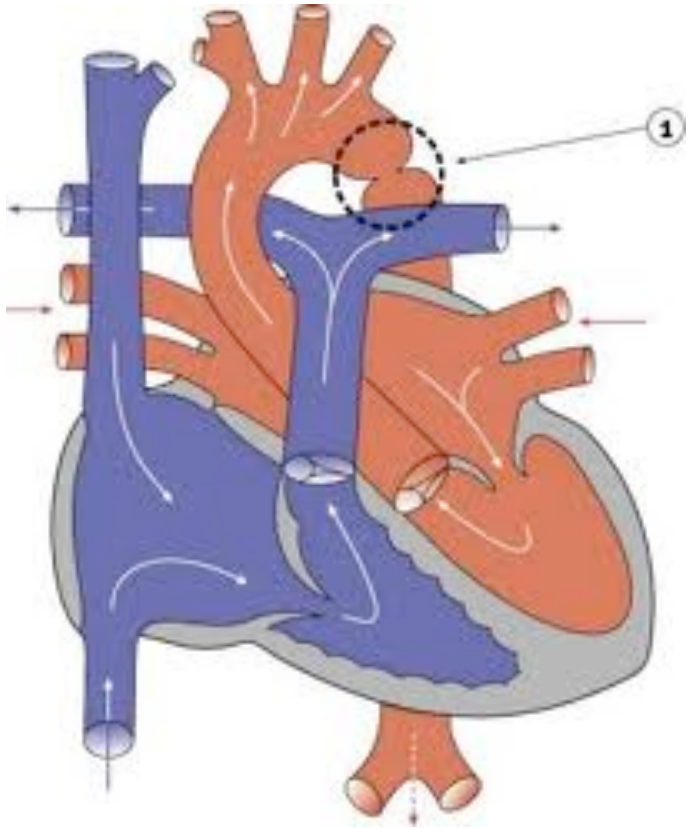


Abnormalities of the Aorta

- Coarctation of Aorta
- Interruption of Aortic arch
- Right Aortic arch
- AP window
  - ±Ventricular Septal defect
  - ±Ventricular Disproportion
  - Great vessel disproportion

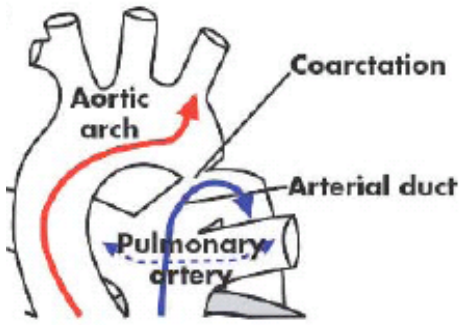
Coarctation of the Aorta in the Fetus

- Ventricular Disproportion
  - ie LV < RV
- Great vessel disproportion
  - ie Ao < PA
- "Isthmus of arch" < Arterial Duct

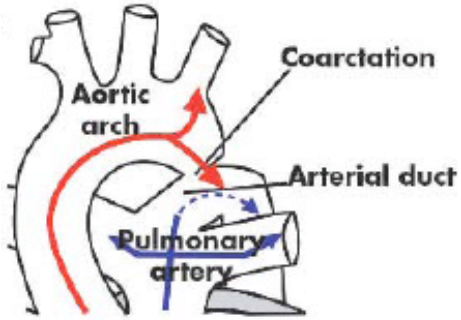


Coarctation of the Aorta

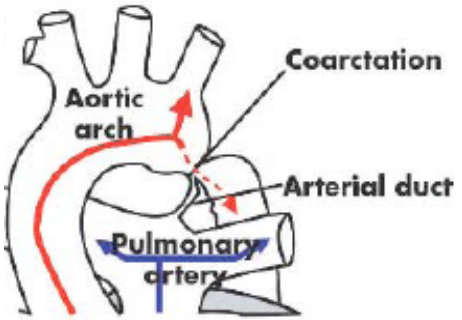
- Before birth fetal circulation able to cope with coarctation/ interruption



Coarctation in utero does not affect the fetal blood flow pattern



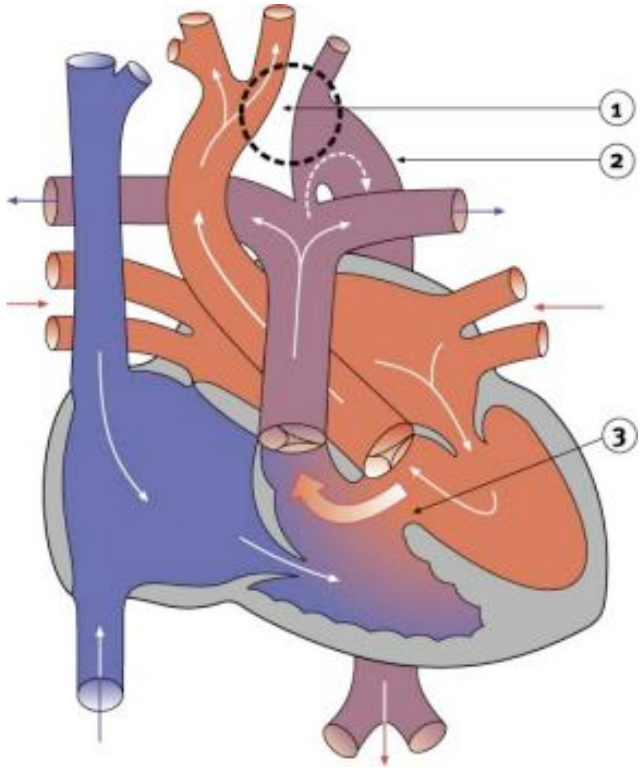
Fall in PVR with increased PBF and forward flow from aortic arch to dAo



Duct constricts
Ao narrowing ↑
Increasing obstruction leads to gradient

Interruption of the Aorta in the Fetus

- No Ventricular Disproportion
  - ie LV = RV
- Great vessel disproportion
  - ie Asc Ao << PA
- Have to have ventricular septal defect



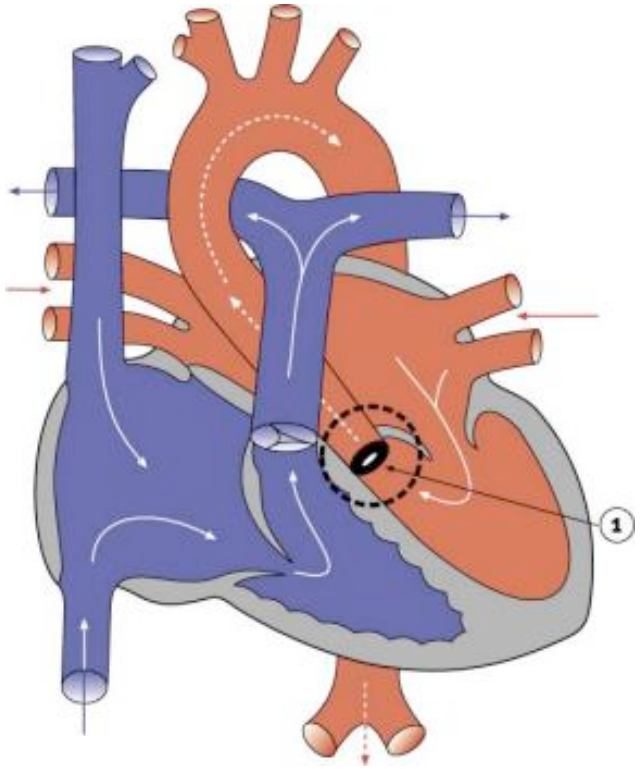
Aortic Valve abnormalities

Common in children

Less common in fetus

Aortic atresia/stenosis most commonly encountered aortic valve abnormality in fetal life

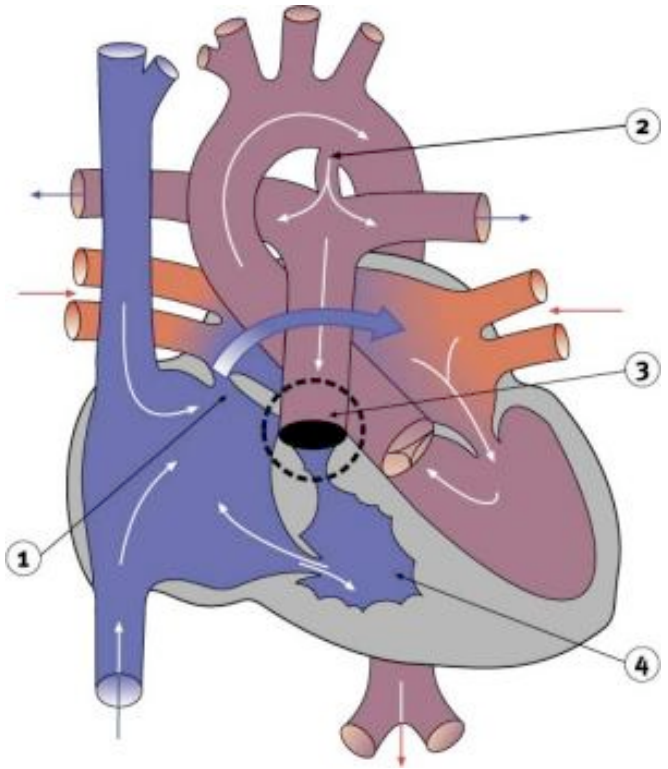
Assessed by Doppler (normal 30-100 cm/sec)



Pulmonary atresia

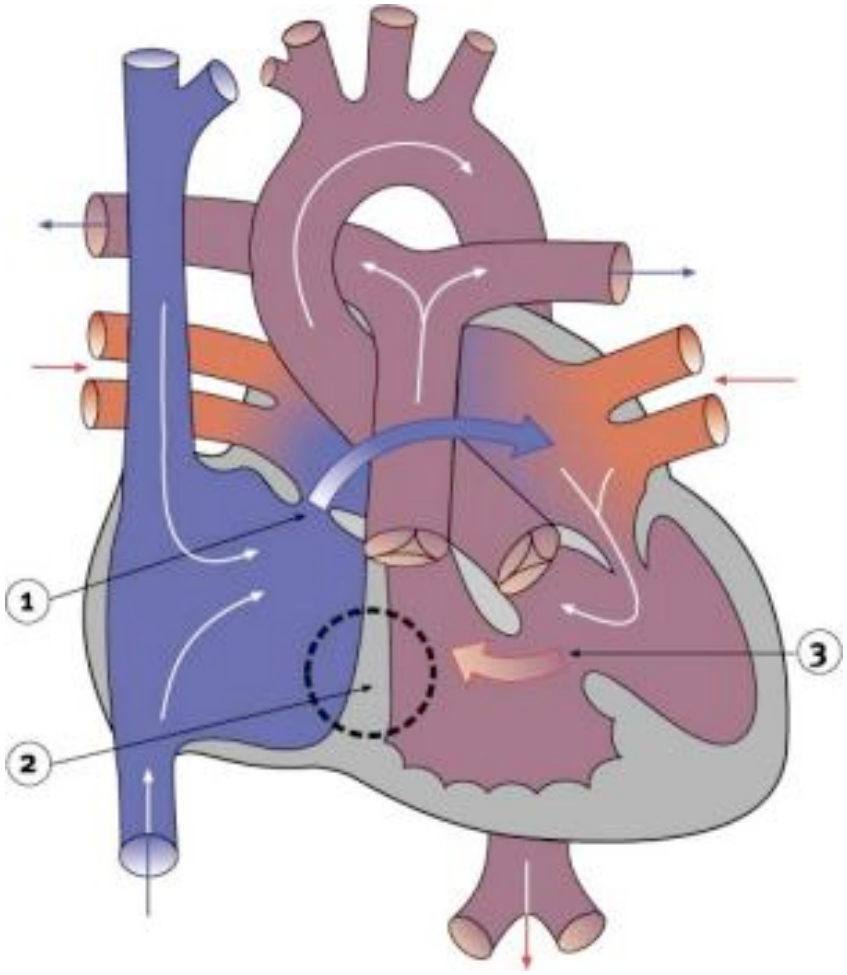
- Wide spectrum of disorders
- ± VSD
- ± Abnormal four chamber

- No forward flow out of RV



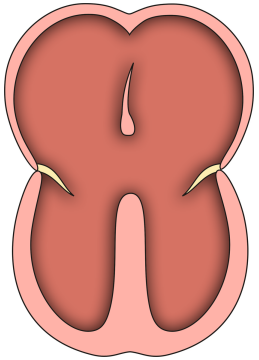
Tricuspid atresia

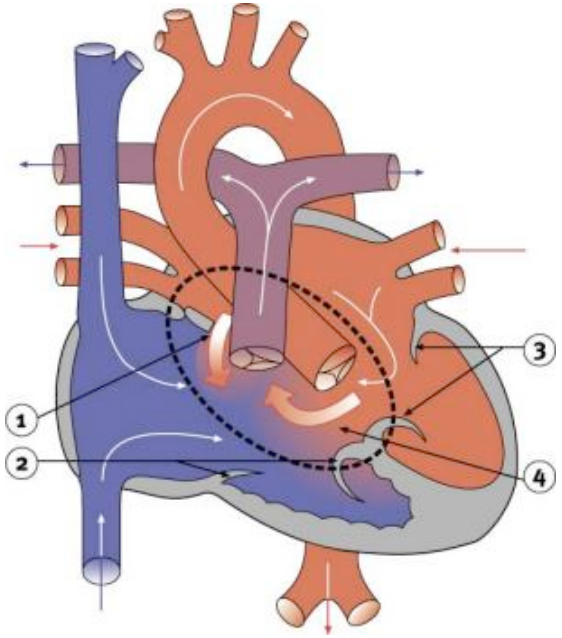
- No forward flow from RA to RV
- Always has VSD
- Abnormal four chamber
- Great arteries normally related OR transposed



Atrioventricular Septal Defect

- 50% of Trisomy 21 have congenital heart disease- 50% of these have AVSD
- ** Look for other features of Chr abnormality**





Cardinal Features

Common AV valve

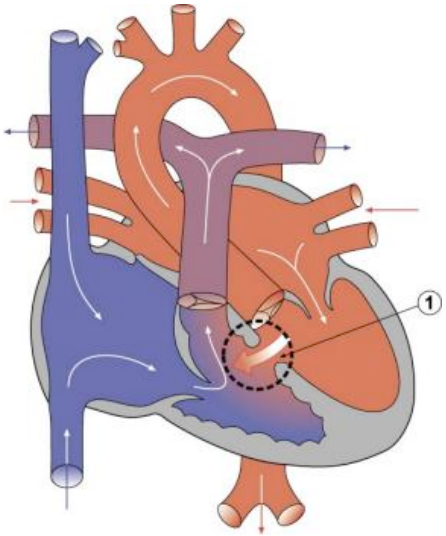
Loss of offset of AV valves

Absence of "primum septum"

Can be assoc with "laterality defects" so check abdominal situs

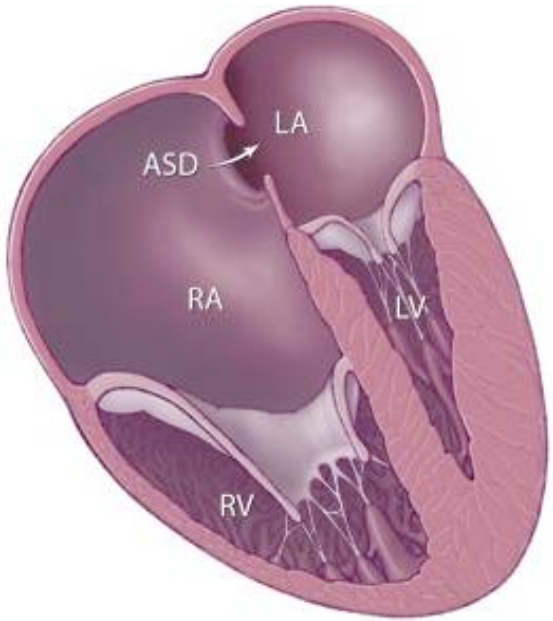
Ventricular Septal Defects

- Commonest form of CHD in infancy- 20% of all CHD
- Usually on only moderate sized/large seen in fetus
- Isolated/Associated with complex CHD
- Highly associated with extracardiac / chromosomal abnormalities
  - Perimembraneous (inlet/outlet)
  - Muscular
  - (Juxta-arterial)



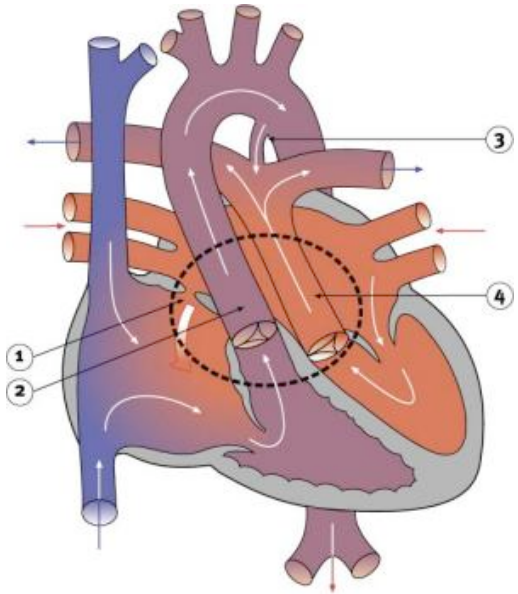
Ebstein's Anomaly/Dysplastic TV

- Displacement of Tricuspid valve leaflets of towards apex
- Worst end of the spectrum detected in the fetus,
- Significant Tricuspid regurgitation
  - RV volume load
  - Cardiomegaly- "Wall to wall heart"
  - Lung hypoplasia
  - Reduced PA flow
  - Atrial stetch- arrhythmia



Transposition of Great Arteries

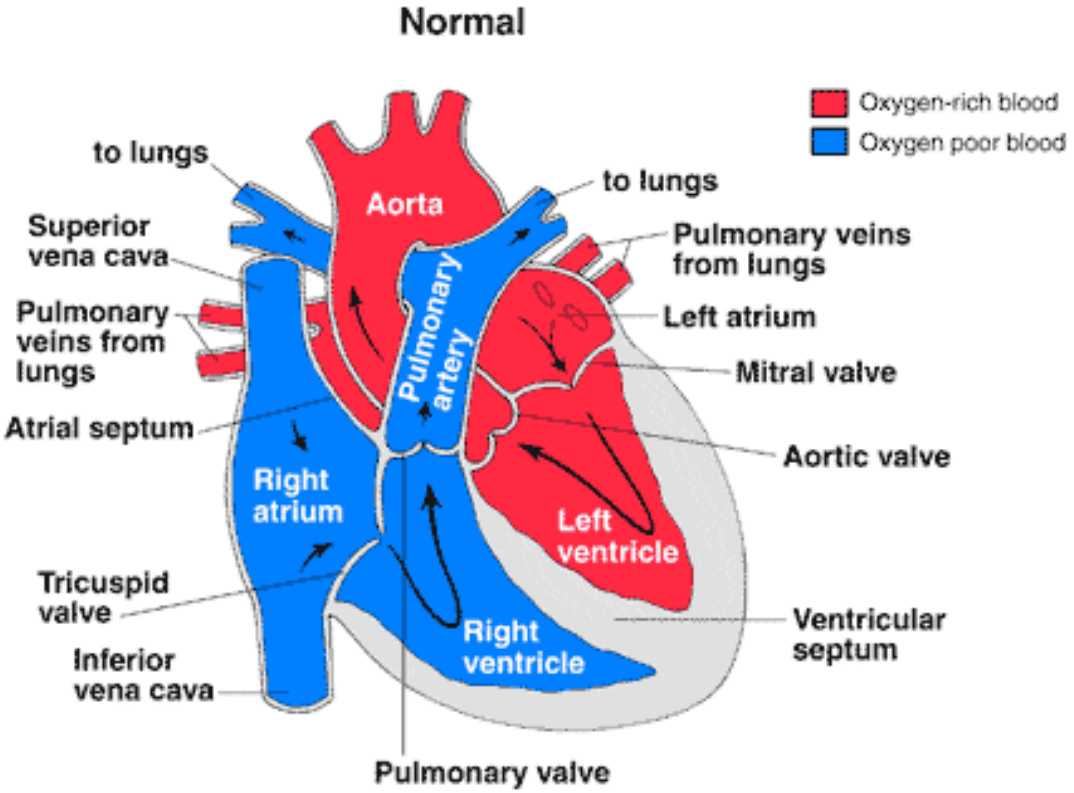
- SVC/IVC ➔ RA ➔ RV ➔Aorta
- Pulm veins ➔ LA ➔LV ➔Pulm artery
- Great arteries arise in parallel arrangement
- Deoxygenated blood around body
- Up to 20% need urgent intervention
- Strong indication for delivery in Centre

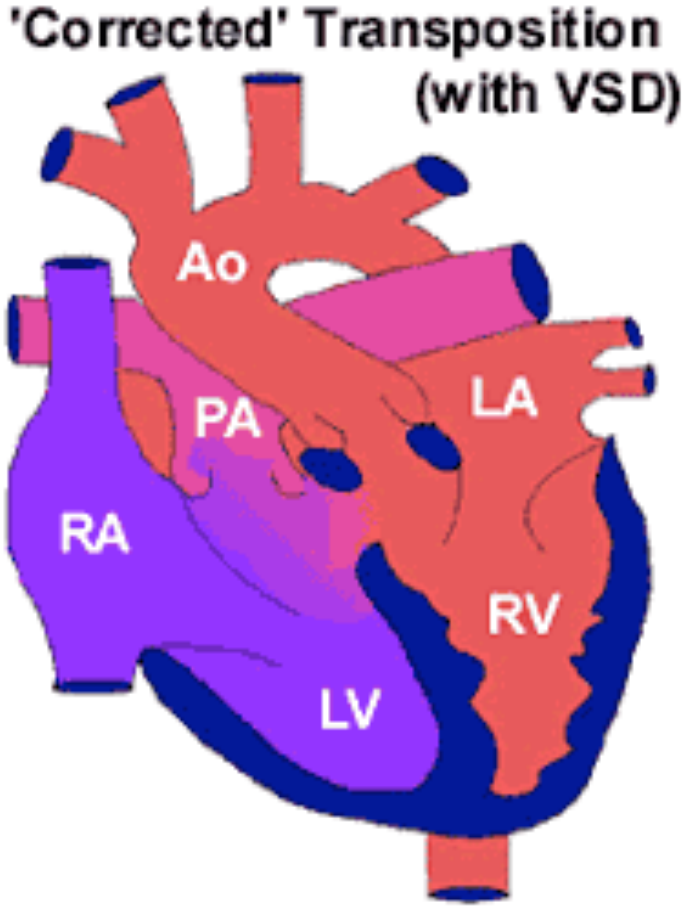


Congenitally corrected Transposition of Great Arteries

- Rare
- "Double discordance" / Ventricular Inversion
- SVC/IVC → RA →LV →Pulm Artery
- Pulm veins →LA → RV → Aorta
  - Often have VSD
  - Association with Complete Heart Block
  - Assoc with valve abnormalities- pulmonary stenosis/ atresia, Ebstein's anomaly

Congenitally corrected Transposition of Great Arteries





Tetralogy of Fallot ,Common Arterial Trunk, Double outlet RV

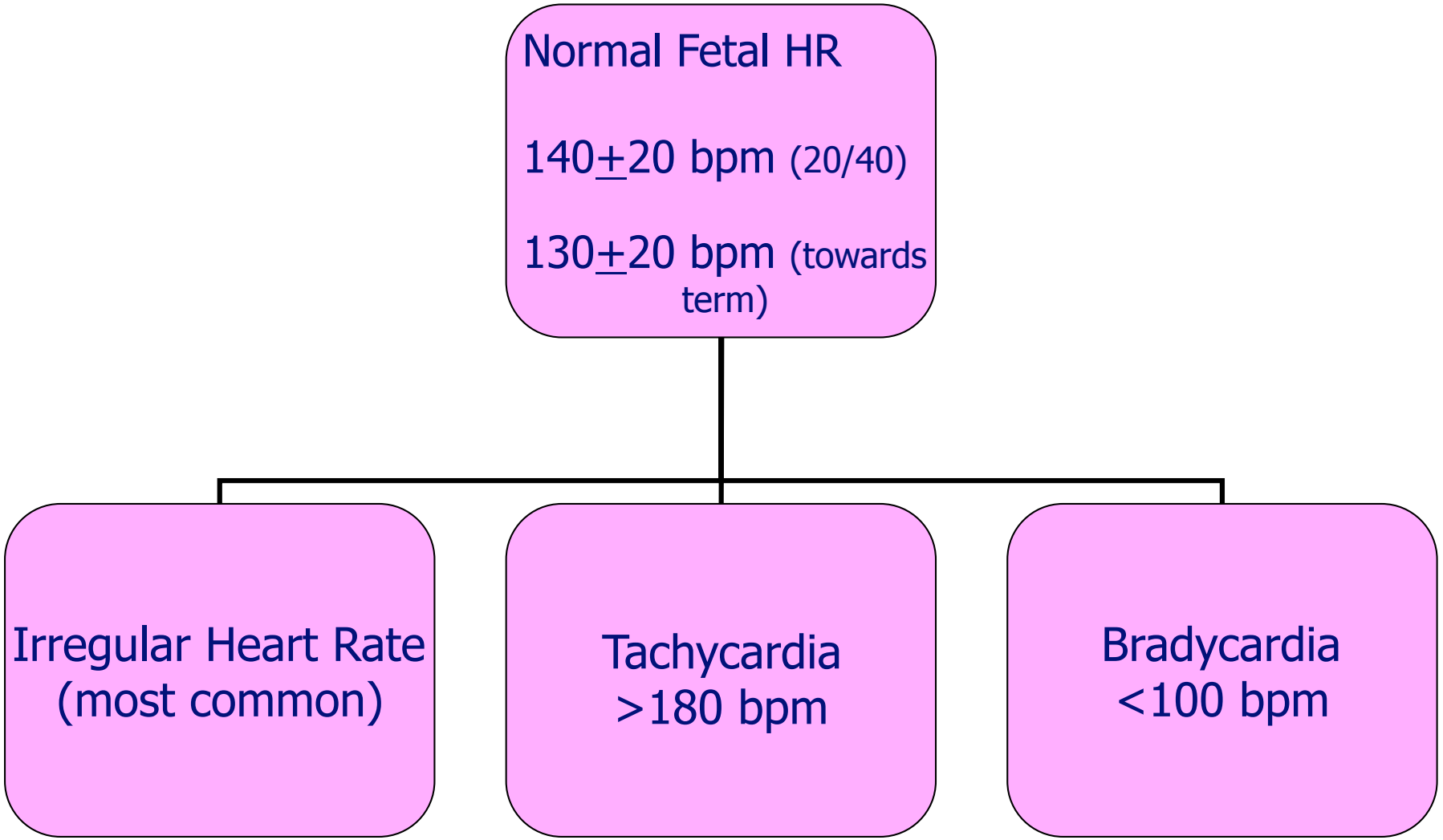
- "Conotruncal abnormalities" (also Pulm atresia)
- 30-40% association with 22q11 micordeletion "DiGeorge Syndrome"
  - Learning difficulties, skeletal abn, Cleft lip/palate, absent thymus
- Ventricular septal defect, Deviation of outlet septum, Aortic override

Echogenic Foci

- Also know as “golf balls”, “peas”
- First described in mid 80’s
- Echogenicity similar to bone
- Incidence 3-8%
- Single, multiple, usually single focus LV
- Assoc with chromosomal abn-

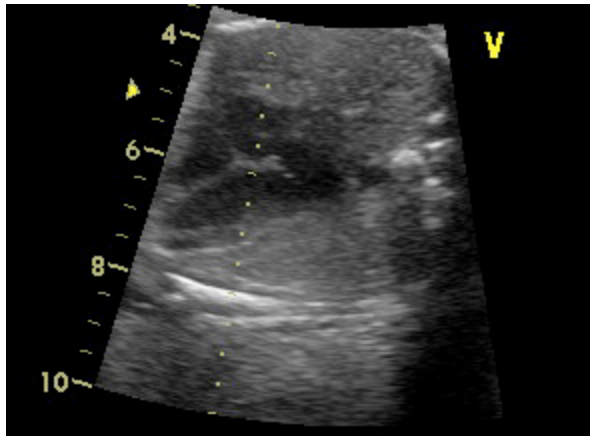
Simpson, Prenat Diag 1999

Fetal Arrhythmias

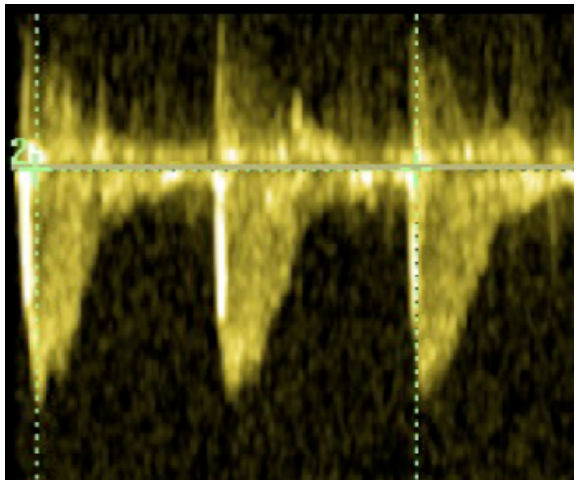


Evaluation of Arrhythmias

- M-mode Echocardiography
  - Atrial Wall contraction
  - Ventricular Systole



- Doppler interrogation of valves



Irregular Heart Rhythm/ Ectopics beats

- Most common “arrhythmia” esp in late pregnancy
- 1.7% of fetuses 36-41 weeks
- Atrial and Ventricular Extrasystoles
- Not associated with fetal hypoxia, distress or adverse perinatal outcome

Irregular Heart Rhythm -2

- Infrequent ectopic beats benign
  - 2% progress to tachy, 13% if blocked atrial ectopics
  - > 1 in 10 ectopics higher risk of arrhythmias

  - DON'T NEED REFERRAL TO CARDIOLOGY

- Monitor FHR 2 weekly by auscultation

Fetal Tachycardia

- Most commonly Supraventricular Tachycardia
- Also Atrial Flutter
- Ventricular Tachycardia incredibly rare
- Important cause of fetal morbidity and mortality
  - hydrops, cardiac failure, neurological, IUD
- Management
  - Transplacental (ie.maternal oral therapy)
  - Direct Fetal injection
  - Early delivery?

Fetal Bradycardia

- Most commonly due to CHB

  Maternal connective tissue disease- SLE
- Prolonged sinus brady –may be sign of fetal distress
- Structural heart disease
- Long QT Syndrome

In Summary…

- Identify High risk groups
- 4 Chamber + Outlet views- 80% abnormalities
- Don't have to make diagnosis of complex CHD
- "Say what you see"
- Don't be afraid to ask opinion
- ** Echogenic Foci and Atrial Ectopics BENIGN