Heart and Circulatory System II

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Outline

- Primitive Ventricular Septum
- Atrioventricular Canal/Endocardial Cushions
- Conotruncal Septation
  - Great Arteries
  - Semi-lunar valves
- Ventricular septation
  - Primitive Ventricular Septum
  - Endocardial Cushion
  - Conotruncal Septum
- Congenital Heart Defects

Heart Development: 26 days
From Primitive Heart Tube to Four Chambers: External View

Formation of Primitive Ventrictles

Endocardial Cushions

- Atrioventricular Canal: Divide between the atria and ventricles
- Endocardial Cushions: Four tissue expansions found in periphery of AV canal
  - Atrial septation
  - Atrioventricular valve formation: Mitral and Tricuspid Valves
  - Ventricular septation
Endocardial Cushions

- Superior-Inferior cushions
  - Septum Intermedium
  - Inferior atrial septum
  - Posterior/superior ventricular septum
- Right and Left Cushions
  - Ventricular myocardium
  - Mitral valve
  - Tricuspid valve

Atrial Septation: 3 Septums
Primum, Secundum, Intermedium

Atrioventricular Valve Formation

- Left and Right Endocardial Cushions
Endocardial Cushion: 80 days

Congenital Heart Defect: Endocardial Cushion Defect

Normal
Endocardial Cushion Defect

From Primitive Heart Tube to Four Chambers: External View
Ventricular Outflow Tracts and Great Arteries

- **Truncus Arteriosus**: common arterial trunk from the primitive ventricle
- **Conus (Bulbus) Cordis**: outflow portion of the primitive ventricle
- **Bulbar Ridges**: Tissue ridges at junction of the conus and truncus
  - Conotruncal septum
  - Semi-lunar valves (aortic and pulmonic)
- **Truncal Ridges**: Within Truncus
  - Septation of the Aorta and Pulmonary arteries

Formation of the Conotruncal Septum

Semilunar Valve Formation
Formation of the Aorta and Pulmonary Artery

- Conotruncal Septation
  - Persistent Truncus Arteriosus
    - Failure of conotruncal septation
  - Transposition of the Great Arteries
    - Failure of helical twisting during truncal septation
  - Tetralogy of Fallot
    - Malalignment of conoventricular septum
Persistent Truncus Arteriosus

- Failure of helical twisting during truncal septation
- Aorta arises from RV
- Pulmonary artery arises from LV
- VSD in 20% of cases

Transposition of the Great Arteries

- Failure of helical twisting during truncal septation
- Aorta arises from RV
- Pulmonary artery arises from LV
- VSD in 20% of cases
Tetralogy of Fallot

- Malalignment of conoventricular septum
  1. Ventricular septal defect
  2. Aortic valve override
  3. Pulmonary stenosis
  4. Right ventricular hypertrophy

Ventricular Septum

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<tr>
<th>Primitive Septum</th>
<th>Conotruncus</th>
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<td>Endocardial Cushion</td>
<td>Membranous</td>
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Ventricular Septal Defect (VSD)
Multiple Defects: Bilateral Left-Sidedness

- **Systemic Veins**
  - Interrupted IVC
  - Bilateral SVC
- **Common Atrium**
- **Common Ventricle**
  - VSD: endocardial cushion, supracristal
- **Pulmonary veins:**
  - Ipsilateral
- **Pulmonary Stenosis**

Fetal Circulation

- Placenta supplies oxygenated blood via ductus venosus
- Pulmonary blood flow minimal
- Foramen ovale directs blood to left atrium
- Ductus arteriosus allows flow from PA to descending aorta
Transition from Fetal to Neonatal Circulation

- Increase pulmonary blood flow
- Closure of foramen ovale
- Closure of ductus arteriosus
- Arterial pO₂

Neonatal Circulation

- Separation of maternal and fetal circulations
- Increase pulmonary blood flow
- Closure of foramen ovale
- Closure of ductus arteriosus