Atrial Septal Defects
Patent Ductus Arteriosus

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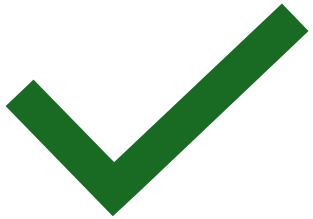
Principles of Blood Flow

Qp:Qs

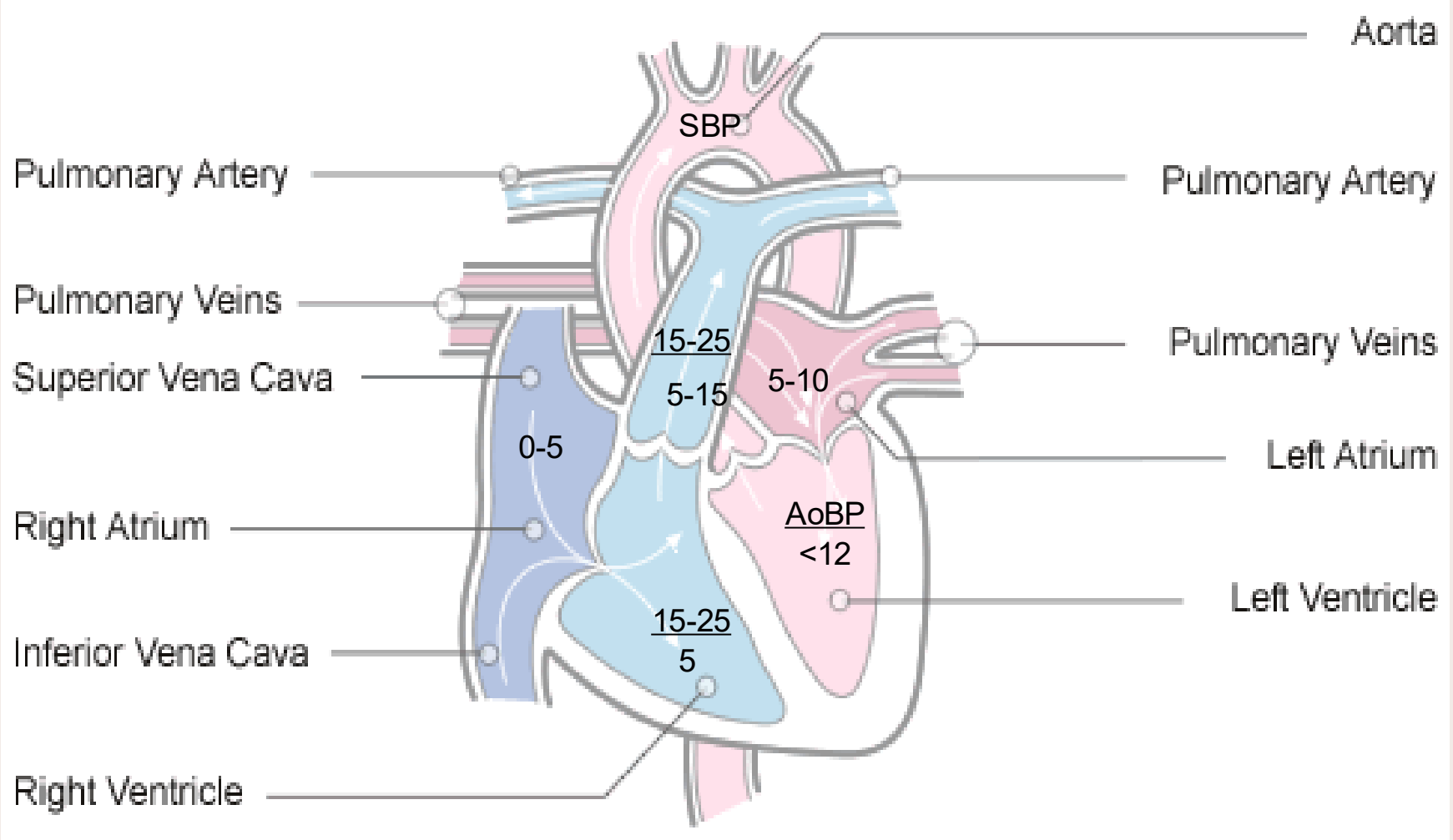
Qp= Systemic artery-systemic vein

Qs= Pulmonary vein- pulmonary artery

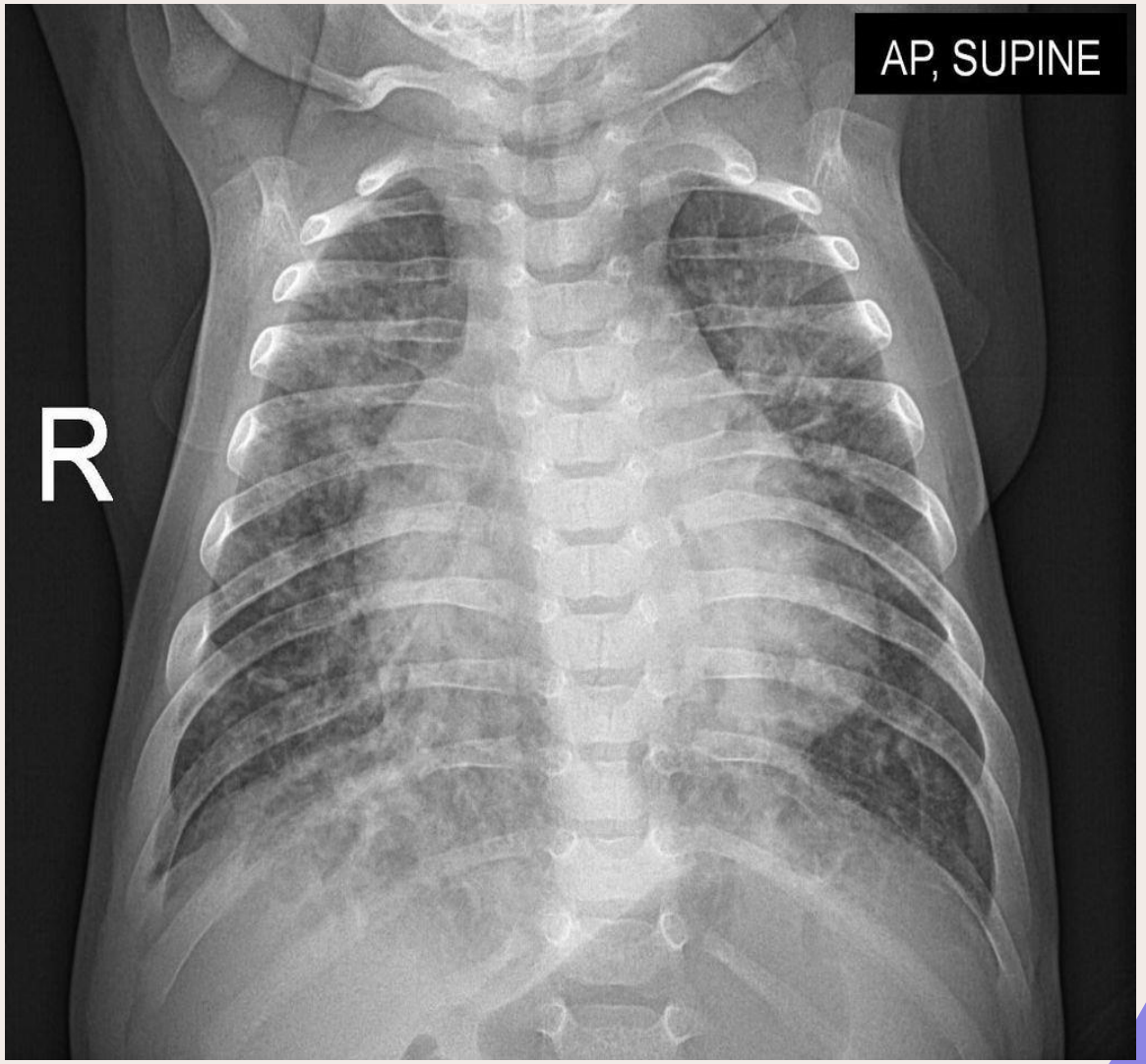
Normal heart 1:1 but how do we get that??



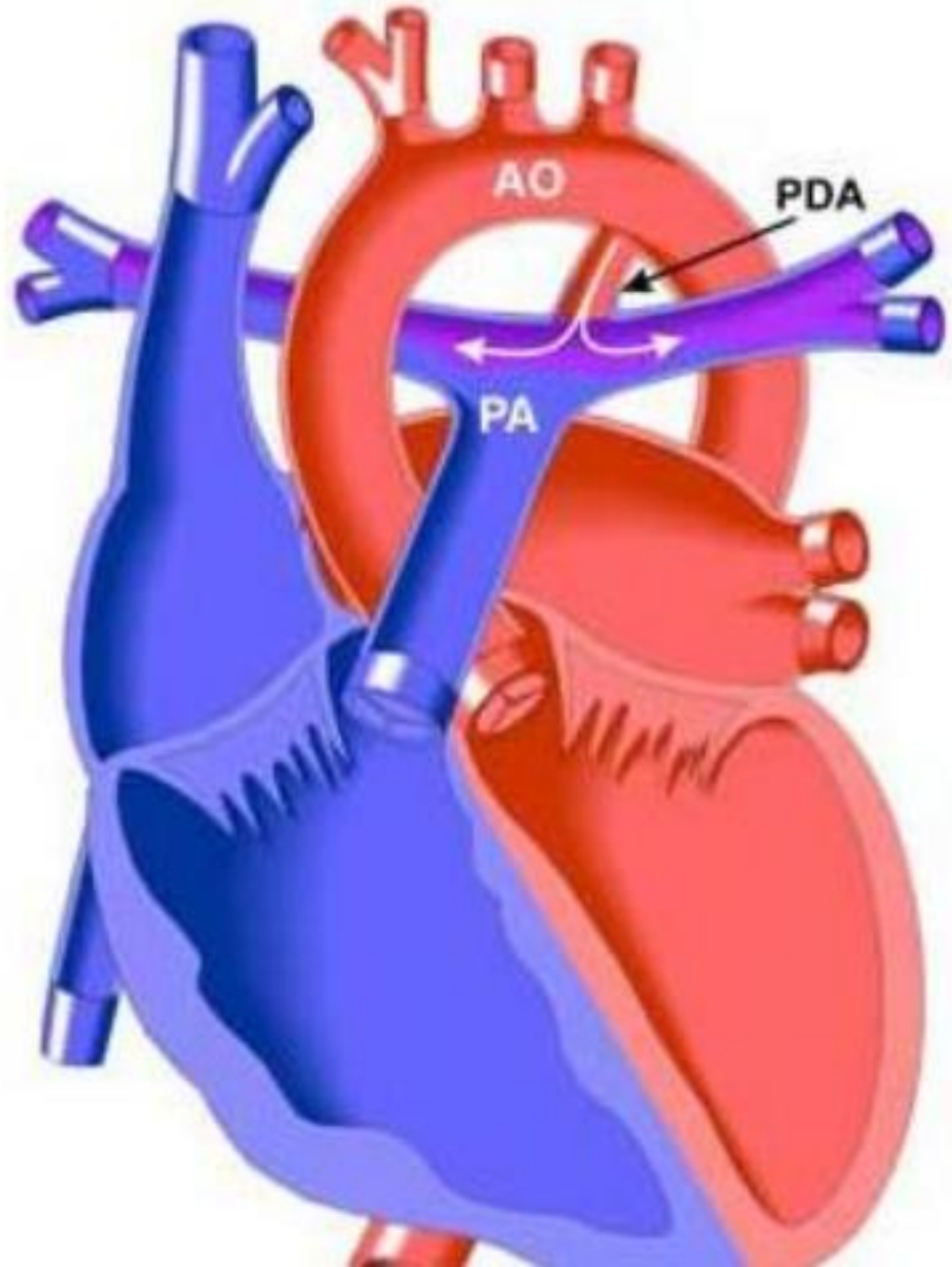
A hole of significant size will equalize pressure between chambers



Preoperative Clinical Assessment



- Tachypnea
  - Due to CHF
  - Increased pulmonary volume and pressure
  - Increased PBF
- Pulmonary edema
- Respiratory distress
- Diaphoresis with feeds/activity
- Fatigue
- Poor weight gain/poor feeding
- Primarily in left to right shunt



Patent Ductus Arteriosus

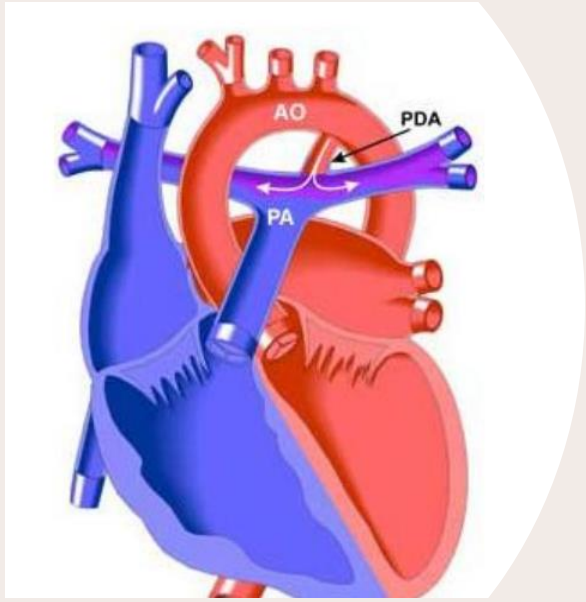
children's health®

Clinical scenarios ("buckets") for babies with PDA

- 1. Preemie with isolated PDA
- 2. Infant with isolated PDA
- 3. Neonate with critical CHD who needs PDA for systemic or pulmonary blood flow

PDA

Located at junction of the main Pulmonary Artery (PA) & origin of the Left Pulmonary Artery (LPA) and the Proximal Descending Aorta



Stays open in utero

- Fetal Blood Flow: R → L (PA → Ao)

Closes (usually) after birth

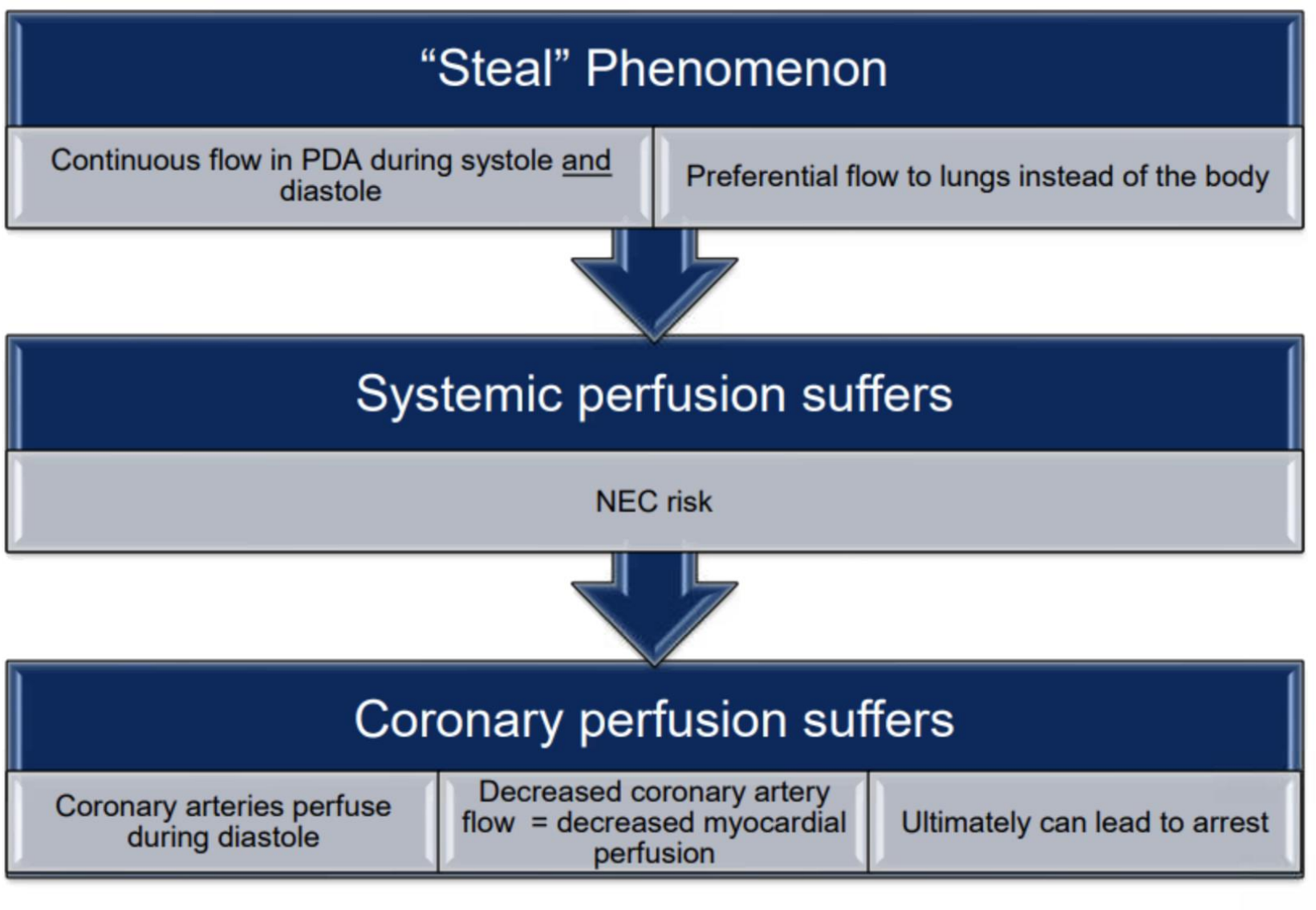
- Postnatal Blood Flow: L → R (Ao → PA)

Clinical assessment- varies based on PVR

PDA blood flow occurs continuously through systole and diastole

- "Steal phenomenon"

Why is a PDA problematic?

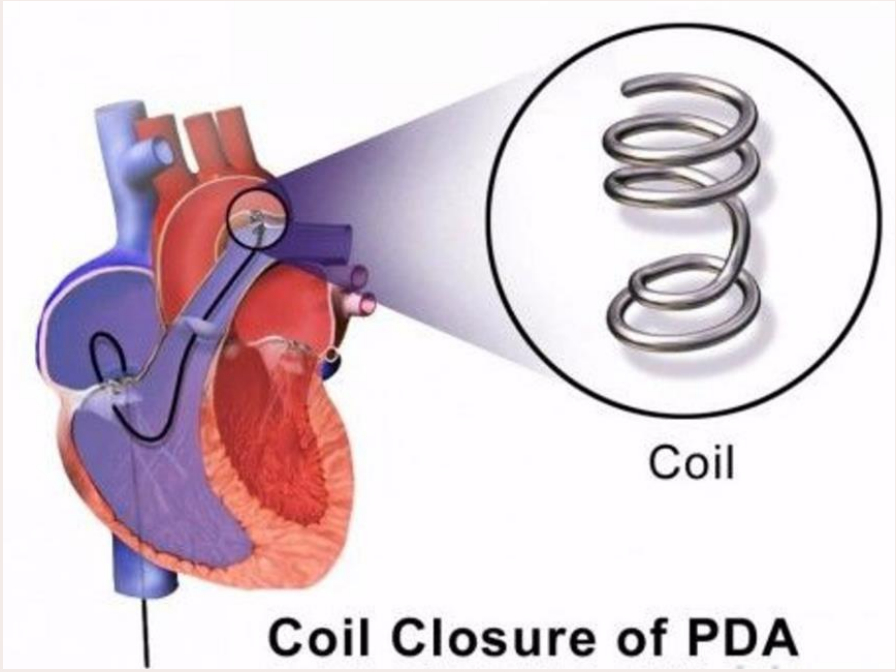


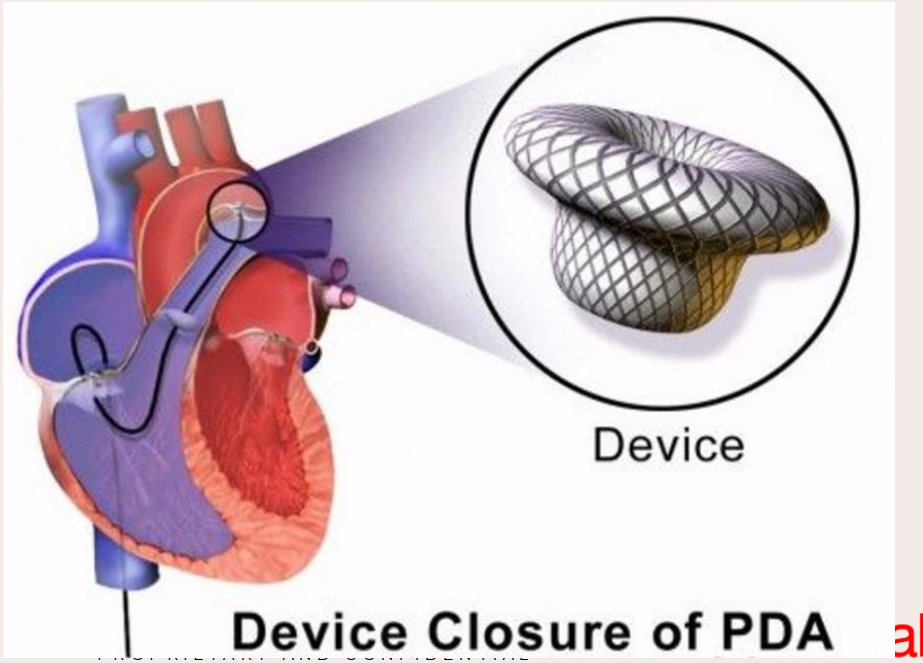
Clinically, we see:
Low DBP

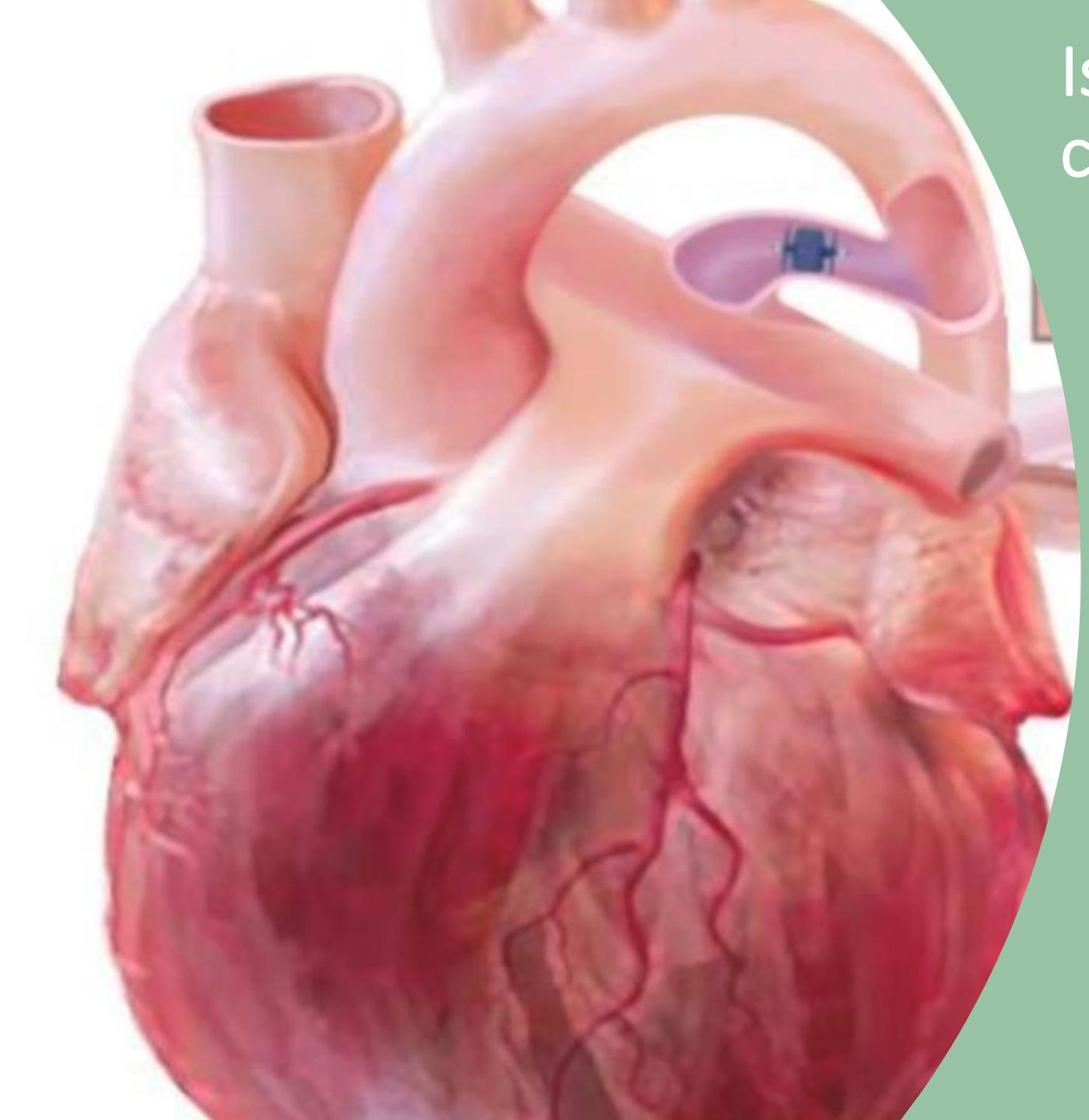
PDA- Interventions

Coil device closure in the Cath Lab

Surgical ligation/clip through thoracotomy







Isolated PDA in older infants: closure

Surgical Management

- Surgical ligation & division
- Left thoracotomy
- No bypass required
- Duct is clamped, ligated & tied
- Usually no vasoactive meds
- Laryngeal nerve damage → VC paralysis
- Thoracic duct injury → Chylothorax(absorption of enteral fats)

Isolated PDA: assessment findings

Premature Neonate

Isolated PDA is common

Murmur

- Continuous / loud / “washing machine”
- LUSB, above the clavicles

Respiratory distress

Difficulty weaning ventilatory support

- Pulmonary edema / Decreased lung compliance

Wide pulse pressure

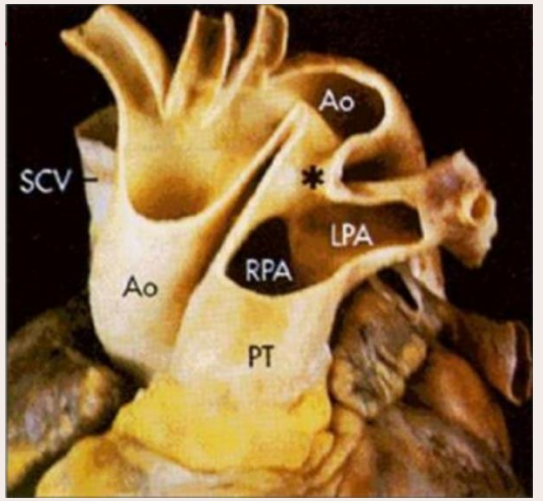
Infant

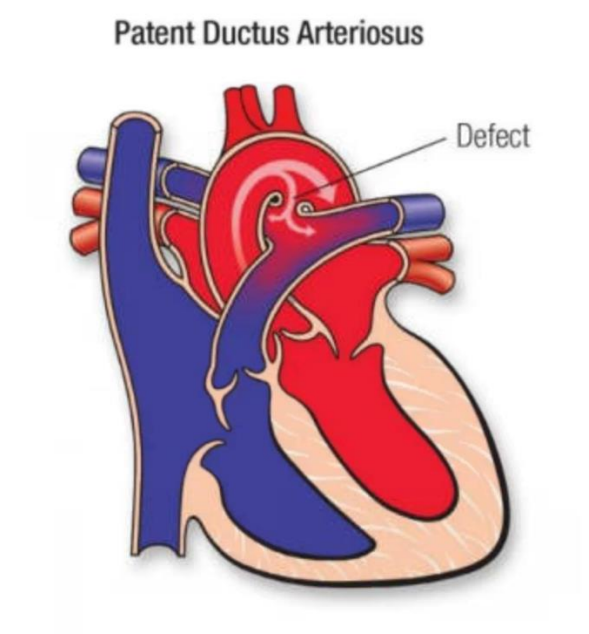
Symptoms depend on size of PDA and PVR

May be asymptomatic

Murmur

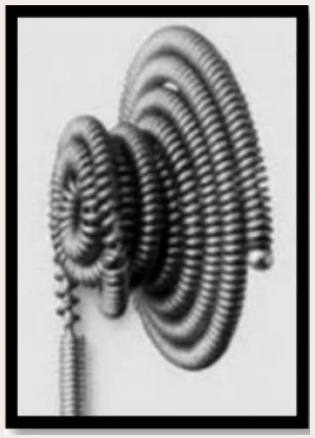
Possible CHF

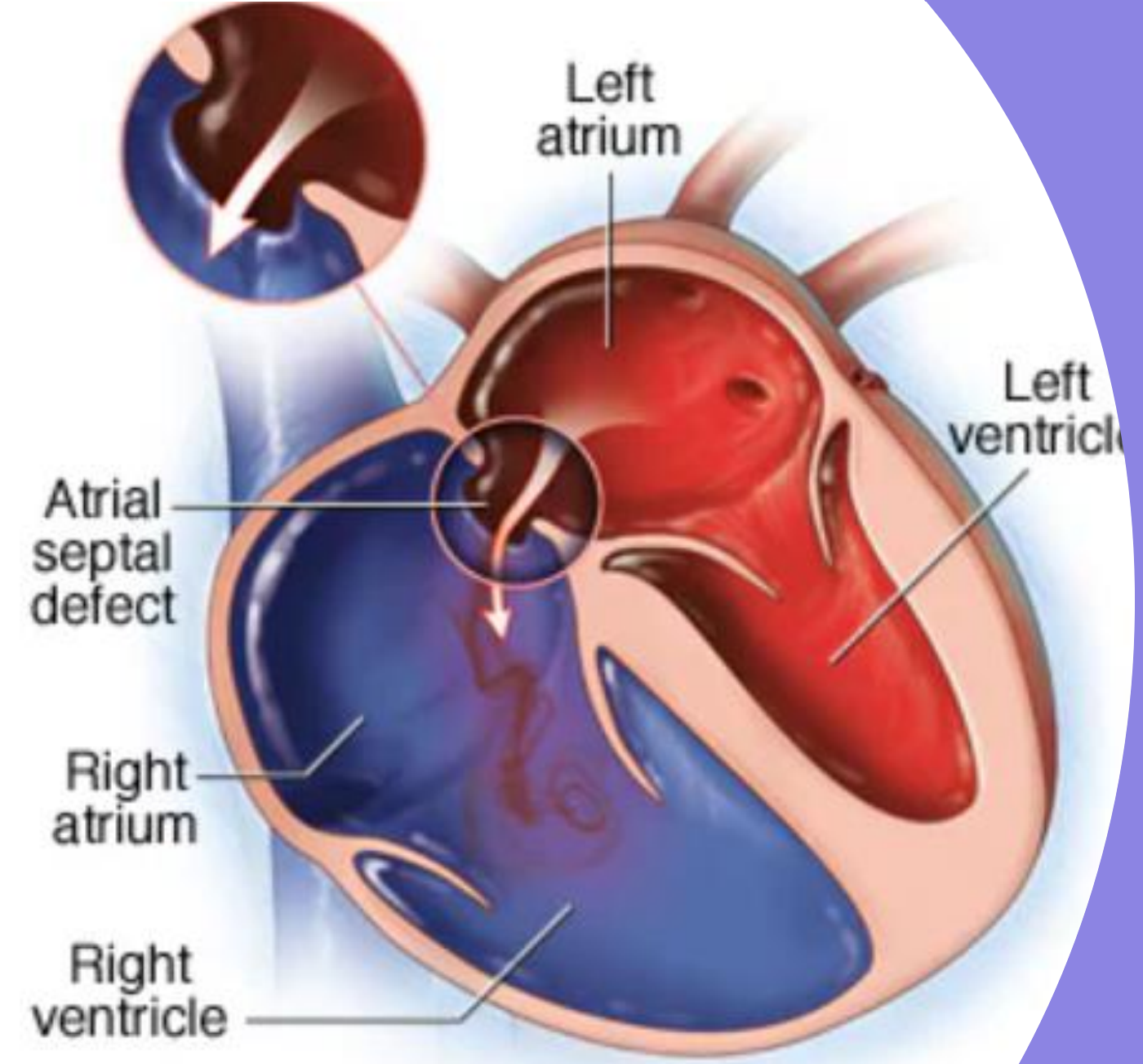




Nursing consideration post PDA closure

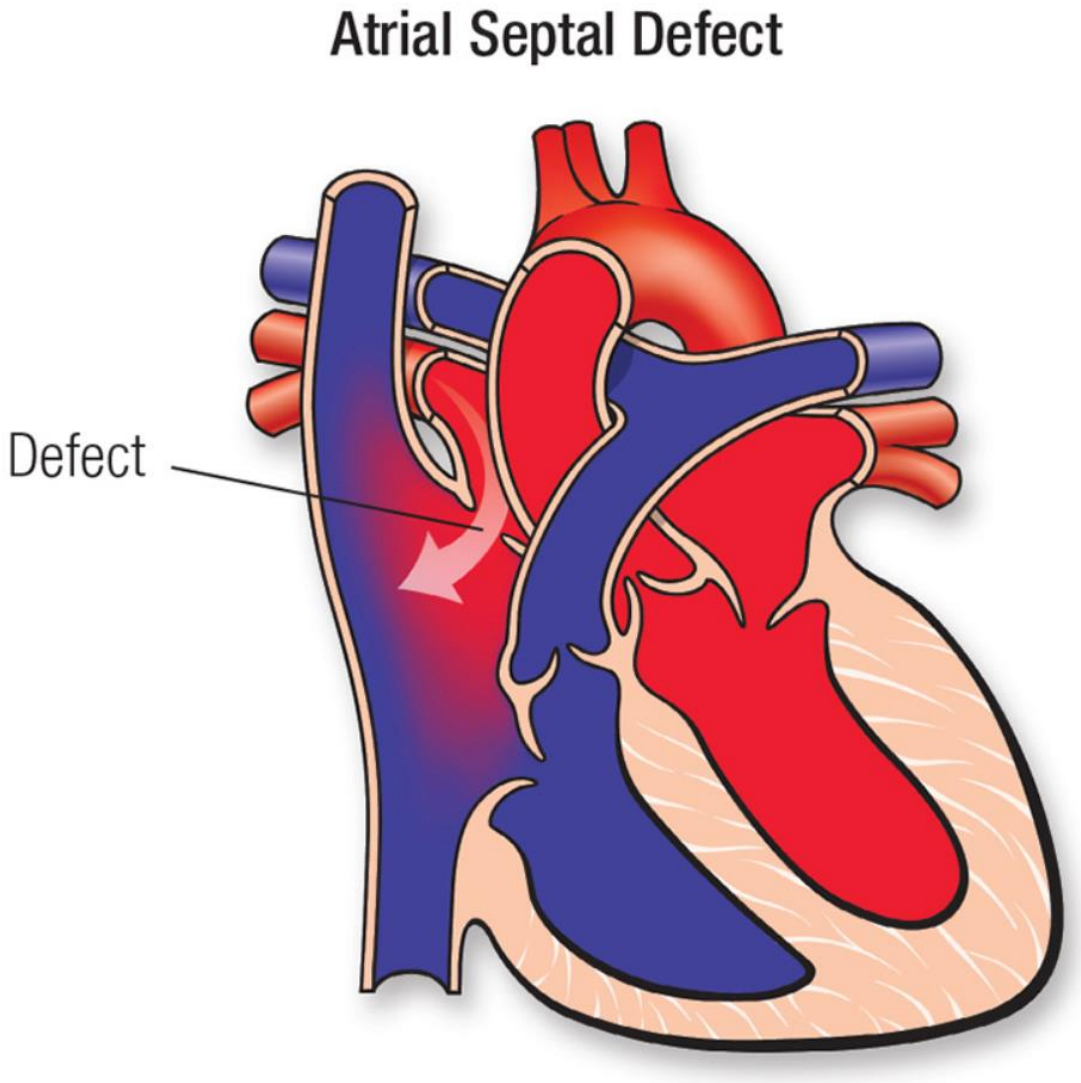
- **Device migration, vascular injury, partial obstruction of Ao or LPA**
- **Post cath:**
  - **Check: Site + Pulses + Perfusion**
  - **Know when the “Flat Time” is over (usually 4-6hrs)**
  - **Know the site and which vessels were accessed**
  - **Arterial bleed (pressure above site)**
  - **Venous bleed (pressure below site)**





Atrial Septal Defect
ASD

Atrial Septal Defect (ASD)



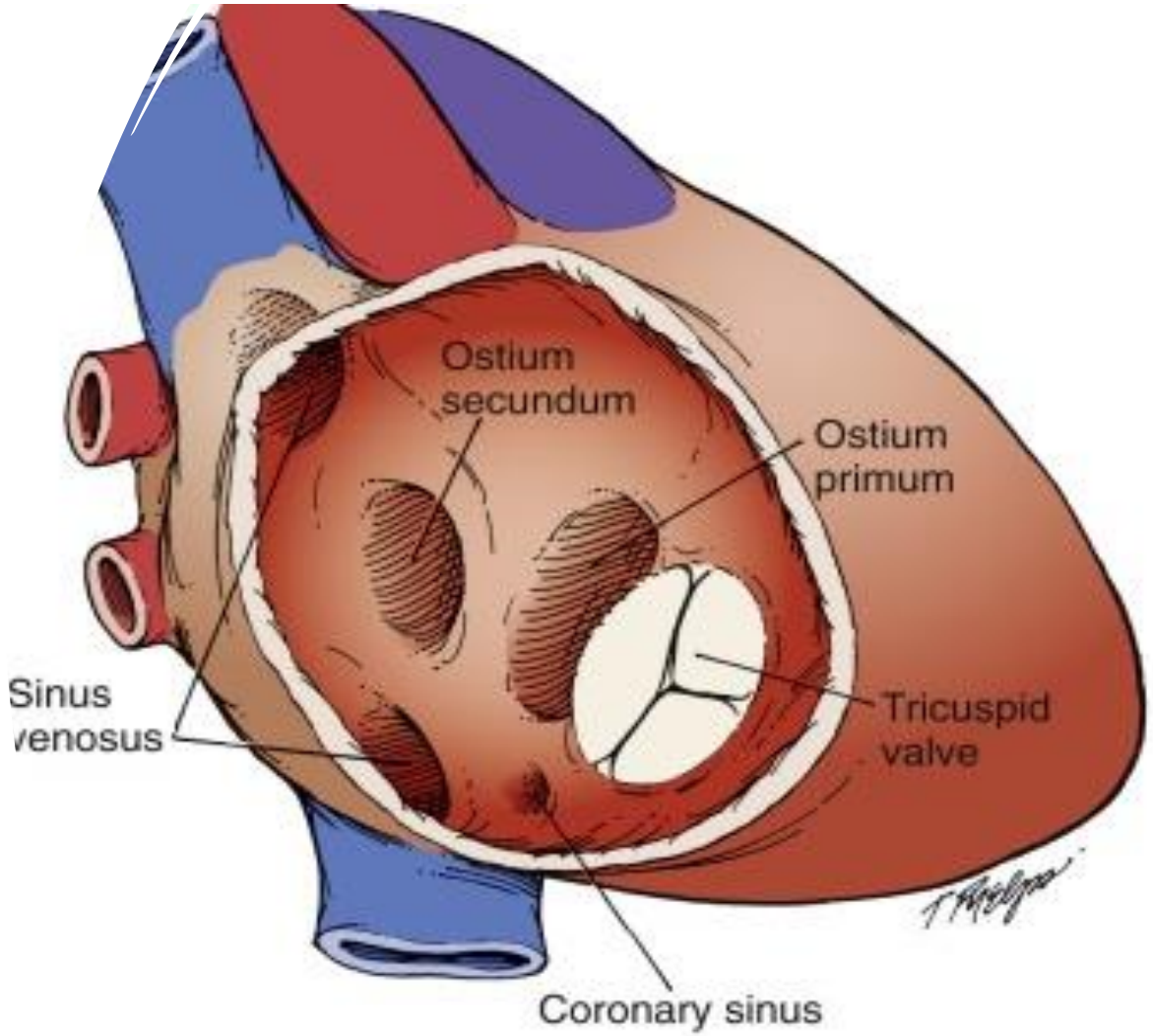
Atrial septum forms as fusion of several structures

After birth increased left atrial pressures (LAP) causes fusion and creates atrial septation

ASD Types

- Secundum ASD- occur in central portion of the septum and most common type (50-70%)
- Primum ASD- partial endocardial cushion defect, in the lower part of the septum (~30%)
- Sinus venosus- near entrance of SVC to the RA (common with PAPVR, ~10%)
- IVC Atrial Septal Defect (Inferior Sinus Venosus ASD) – the IVC may appear to drain partially to LA, best diagnosed with TEE (~20%)
- Unroofed coronary sinus- Coronary sinus transverses the LA, often associated with LSVC

Types of ASDs



Associated Lesions

Pulmonary vein stenosis (10%)

Partial anomalous pulmonary venous return (PAPVR,7%)

Ventricular septal defects (5%)

Patent ductus arteriosus (3%)

Mitral valve disease (2%)

ASD- Preoperative signs/symptoms

Age Dependent

- Infants: Often asymptomatic
  - Murmur

Late symptoms

- Poor feeding/weight gain
- Tachypnea
- Tachycardia (atrial arrythmias in late life)
- Irritability

Why do we care?

- Increased RA pressure=Increased right heart workload
- Increased pulmonary blood flow= pulmonary vascular bed changes
- Incidence of PAH increases with age
- Systemic cardiac output can be maintained at rest during light exercise but become increasingly intolerant
- RA and RV dilation
- Pulmonary Vascular Obstructive Disease (PVOD)

  Seen in 3rd decade of life if untreated

Eisenmenger's complex

PVR>SVR- Reversing the shunt and causing cyanosis

Increases risk of death 10-12 fold and carries 42% 10 yr survival

ASD-Diagnostics

Chest x-ray

- Enlarged right side
- Pulmonary vasculature changes

EKG

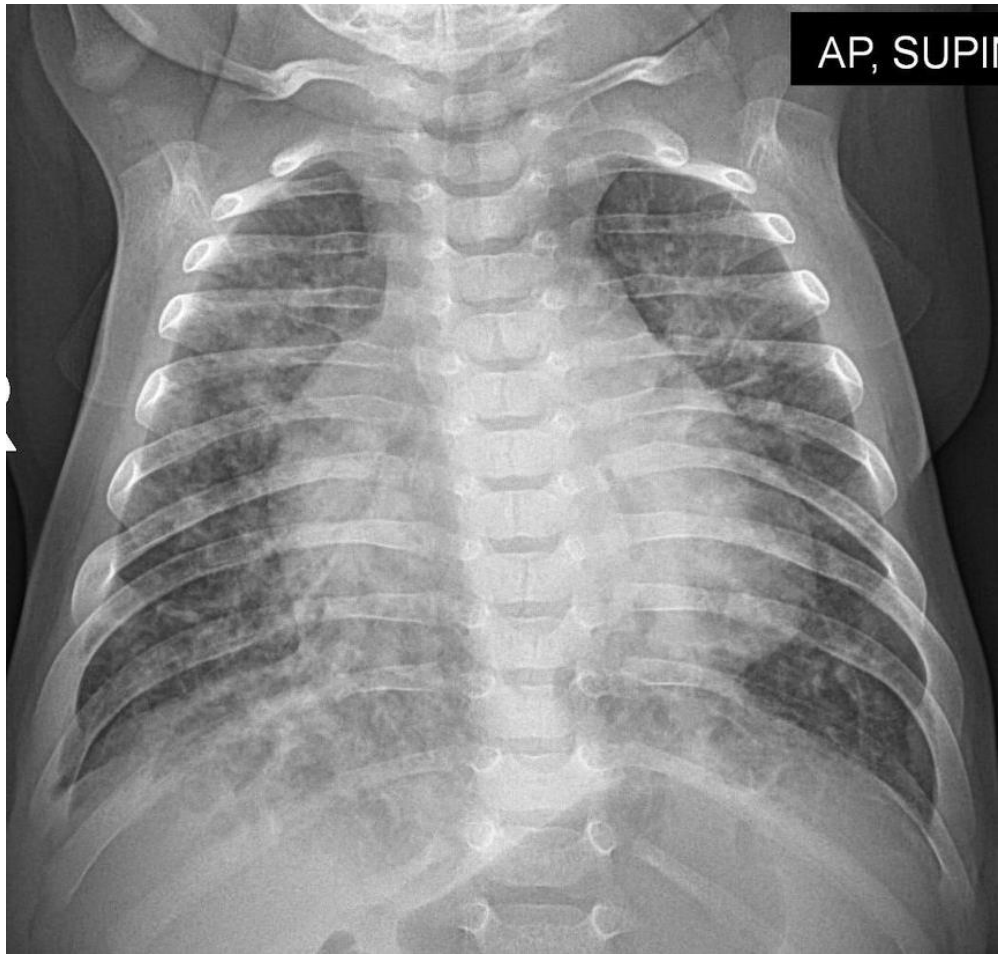
- Right atrial dilation
- Right ventricular hypertrophy

ECHO

- Pattern of blood flow through septal opening, how large is opening, and how much blood flow through it

Cardiac catheterization

- Degree of left to right shunting (Qp: Qs)
  - If elevated PVR, but administration of iNO or 100% FiO2 decreased below 6 Woods units, closure generally safe
- Diagnosis/possible closure of ASD



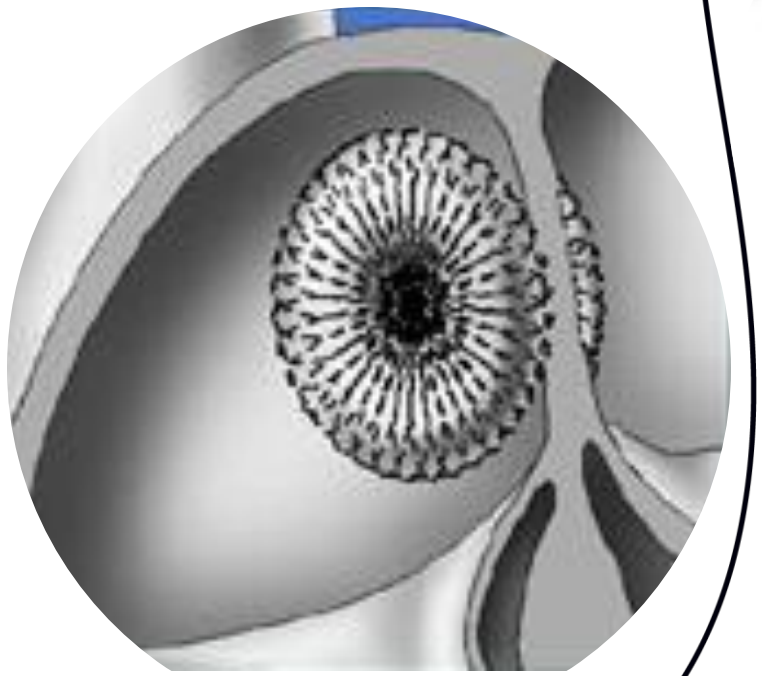
Medical Management

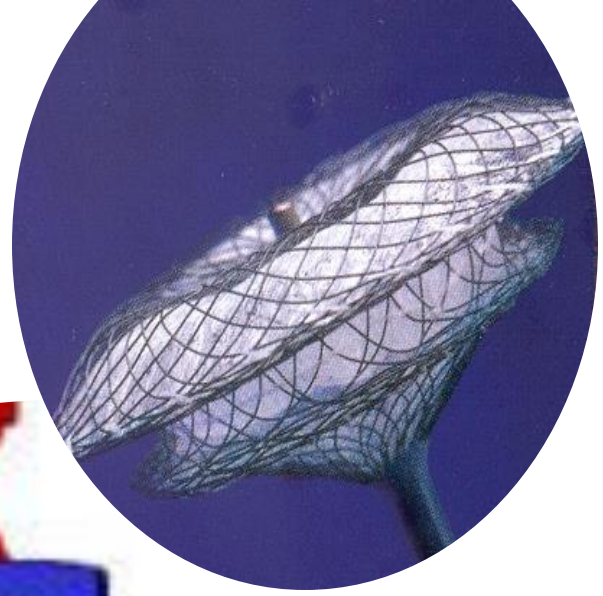
**If symptomatic

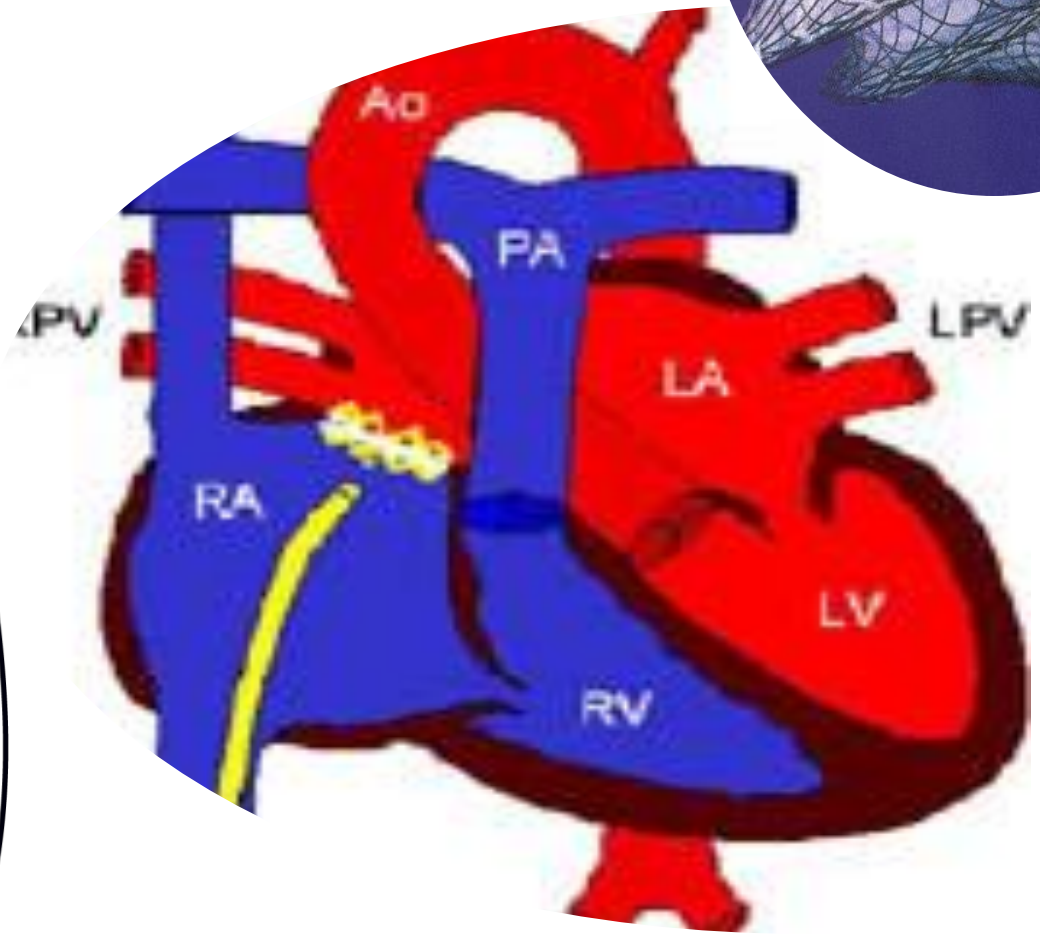
- Goal is to increase heart function while right side is under additional strain
  - Digoxin
  - Diuretics
- Nutrition: maximize calories
- Spontaneous closure: ~80% of time if <8mm
- Device closure in catheterization lab
- Surgical repair- Qp:Qs 1.5:1
  - Patch closure
  - Suture closure

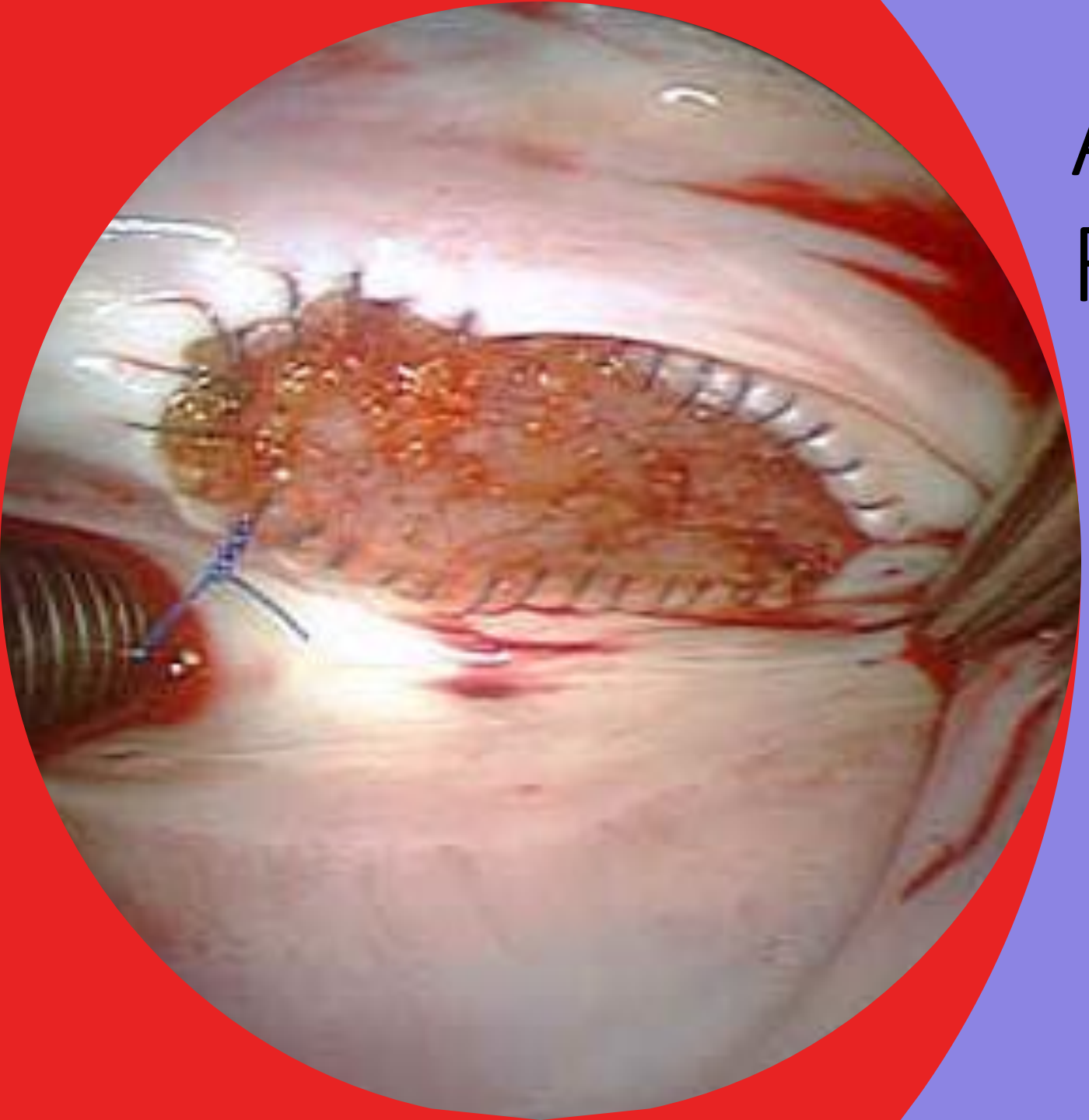
ASD-Device Closure

Transcatheter delivery of device through femoral vein
Device becomes endothelialized over time
Antiplatelet therapy (Aspirin)- 6mo









ASD Surgical Repair

Patch closure or suture closure

May be done via sternotomy, mini sternotomy, or thoracotomy

Through the right atrium on cardiopulmonary bypass

ASD Post-operative

- **Low incidence for complications**
  - Post pericardiotomy syndrome
- **Short hospital stay**
- **Normal activity level within a few weeks**
  - May tire quickly
  - Avoid chest blows
  - Play with supervision
  - Monitor for/report: Low grade fever, chest pain, irritability, joint pain, decreased appetite, N&V

Post pericardiotomy syndrome

- Febrile illness with pericardial and pleural reactions-
- Onset ~4 weeks but may be up to months after
- Low grade fever, chest pain, irritability, joint pain, decreased appetite, N&V
- Treatment- ASA, Ibuprofen, or steroids

- Labs- Elevated CRP and ESR, leukocytosis with left shift
- CXR with enlarged heart and pleural effusions
- Echo- confirm presence and amt of pericardial effusion
- EKG- ST segment elevation and/or flattened or inverted T waves

ASD
Post Surgical Intervention Discharge Teaching

May tire more quickly

Pain management:

- Use OTC for pain management

Discharge Teaching

Monitor for Post-pericardiotomy syndrome

Follow up appointments (at Children's Health):

Contact information for reporting complications

Infant (0-6 months of age, older if delayed developmentally)

Activity Restriction: yes Specify: sternal precautions
Sternal Precautions: Sternal precautions for *** weeks ending on ***.
Additional Information:

- Please maintain sternal precautions through ***.
- Sternal precautions include:
  - No lifting *** up under *** arms.
  - No holding *** up by *** arms.
- *** may do tummy time, play or do whatever *** wants (except for the restrictions above) because if it hurts, *** will not do it.
- *** may take a bath or shower, clean incision and chest tube sites with clean soapy water, rinse and pat dry until completely healed.
- Do NOT submerge *** incision under water until completely healed (usually 4-6 weeks).
- Please keep *** incision covered from the sun for two summers with bathing suit, T-shirt, clothing, etc to prevent Keloid scarring.

Outcomes

Morbidity

- Atrial arrhythmias, pericarditis, and pericardial effusion

Mortality

- Close to zero in infancy and childhood
- Elevated PVR and RV dysfunction increased risk

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