When is Risky to Apply Oxygen for Congenital Heart Disease

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The Korean Society of Cardiology

COI Disclosure

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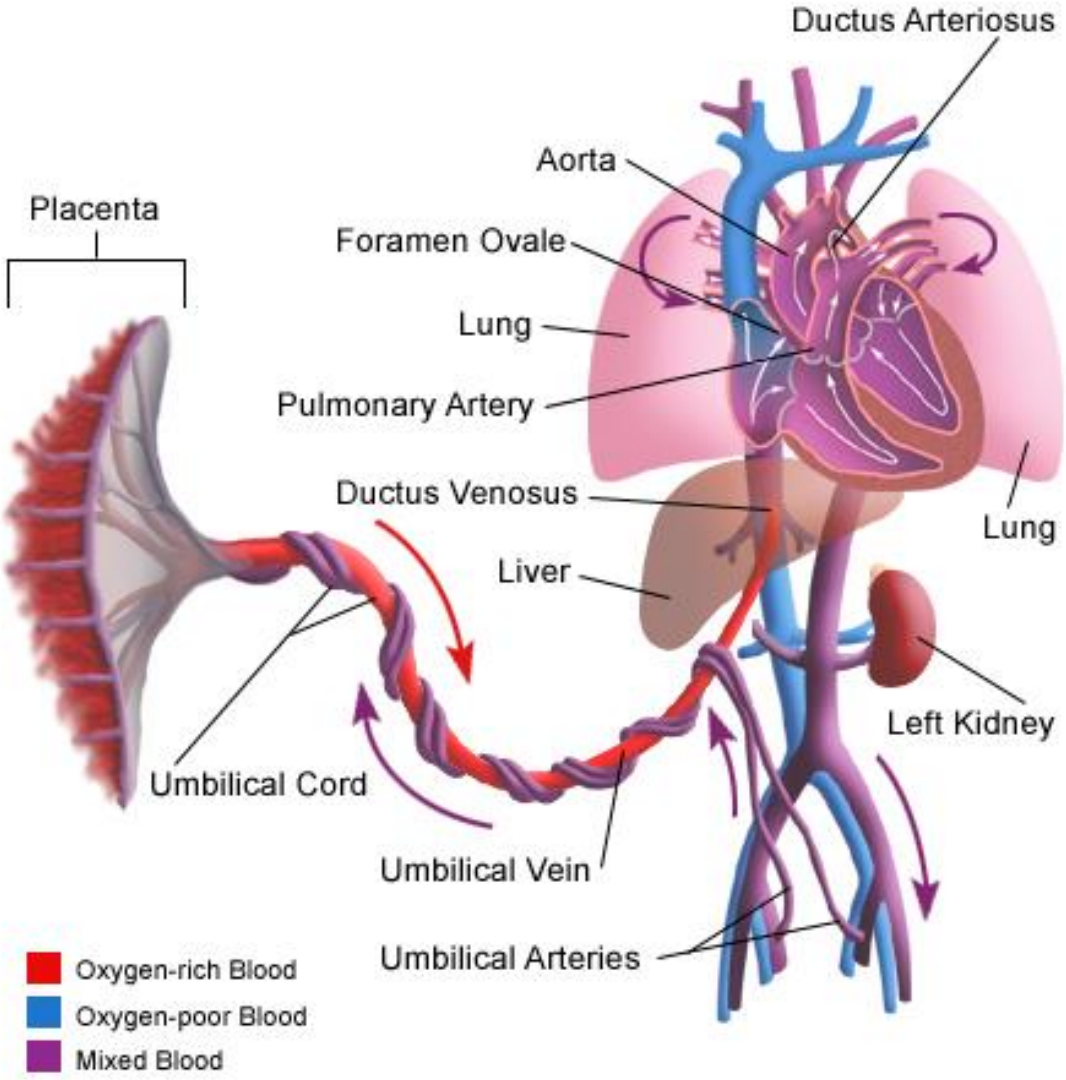
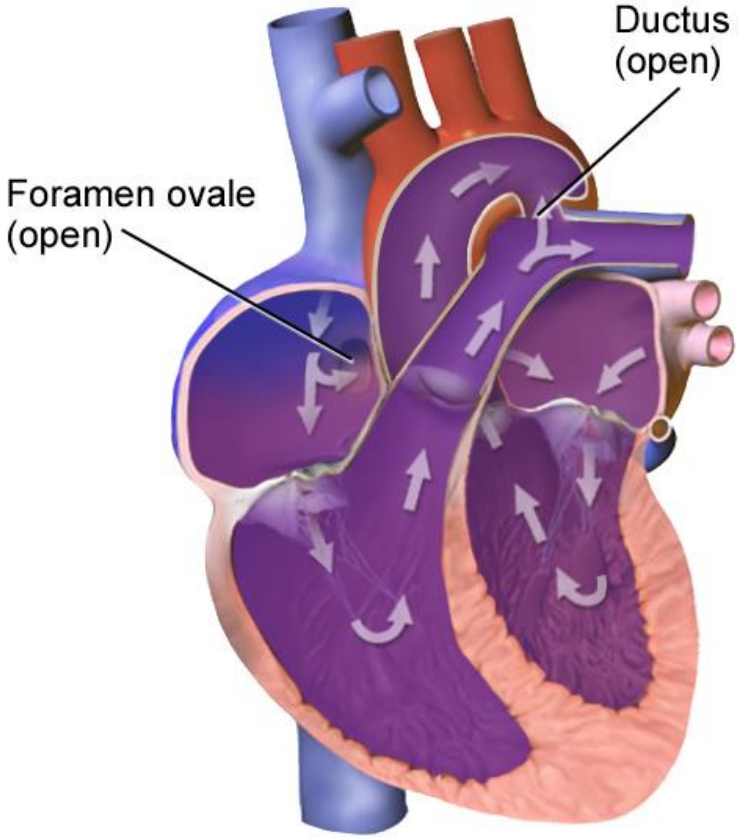
The author have no financial conflicts of interest to disclose concerning the presentation

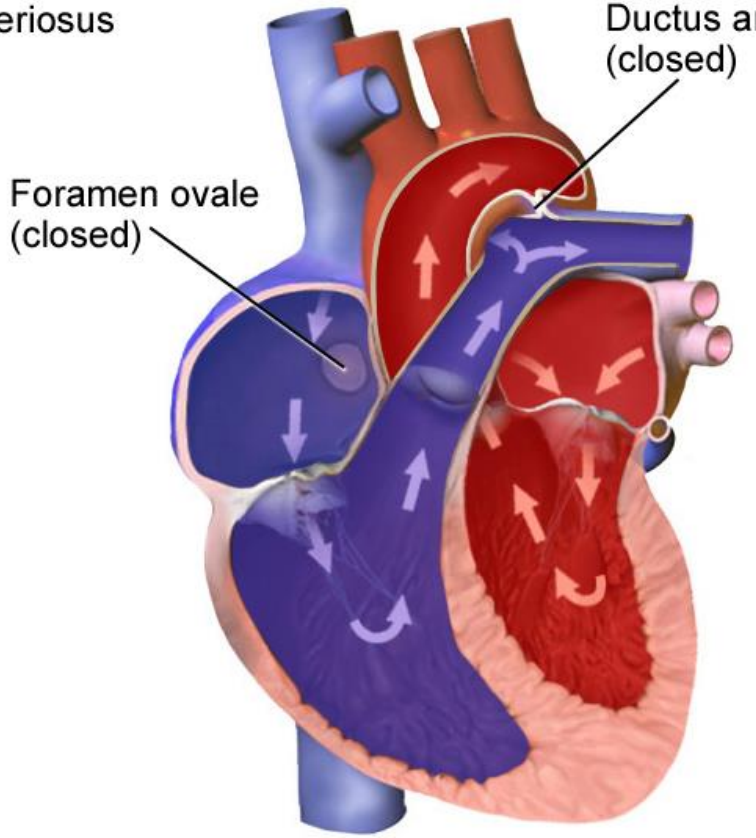
Fetal Circulation

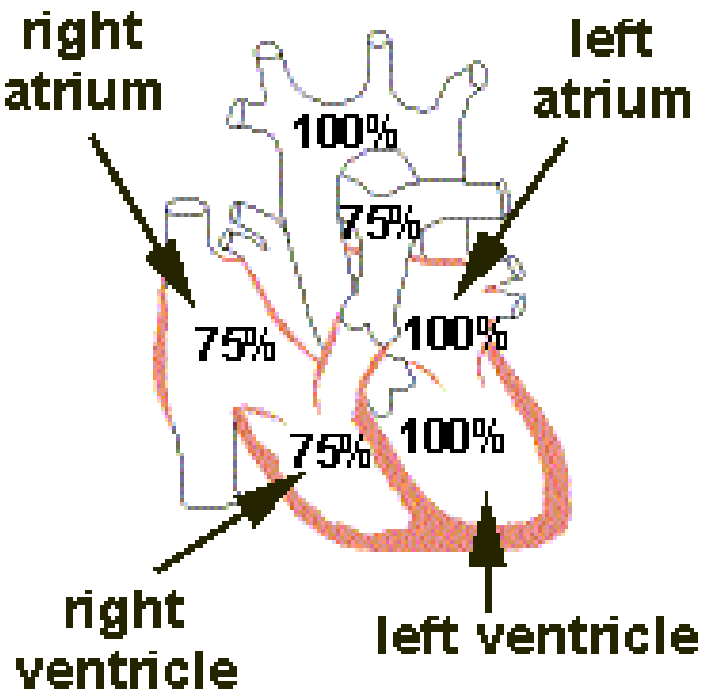


Fetal Heart



Newborn Heart





Normal Values	
pH	7.35-7.45
CO_2	35-45
pO_2	80-100
HCO_3	22-26
O_2 Sat	95-100%

Cause and clinical findings of central cyanosis

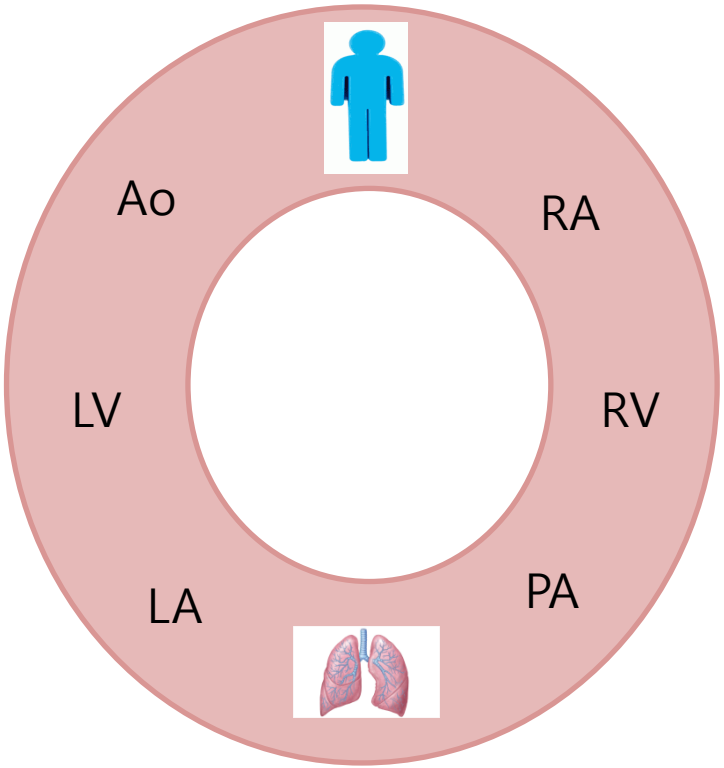
Systems	Causes	Clinical Findings
CNS depression	Perinatal asphyxia Heavy maternal sedation Intrauterine fetal distress	Shallow irregular respiration Poor muscle tone Cyanosis disappears when the patient is stimulated or oxygen is given
Pulmonary disease	Parenchymal lung disease Pneumothorax Pleural effusion Diaphragmatic hernia PPHN	Tachypnea and respiratory distress with retraction and expiratory grunting Crackles and/or decreased breath sounds Abnormal chest X-ray Oxygen administration may improve or abolish cyanosis
Cardiac disease	Cyanotic CHD with right to left shunt	Tachypnea usually without retraction Lack of crackles or abnormal breath sounds Heart murmurs may be absent in seriours forms of cyanotic CHD Cardiomegaly, abnormal cardiac shadow, increased or decreased pulmonary vascular markings Little or no increase in PO2 with oxygen administration

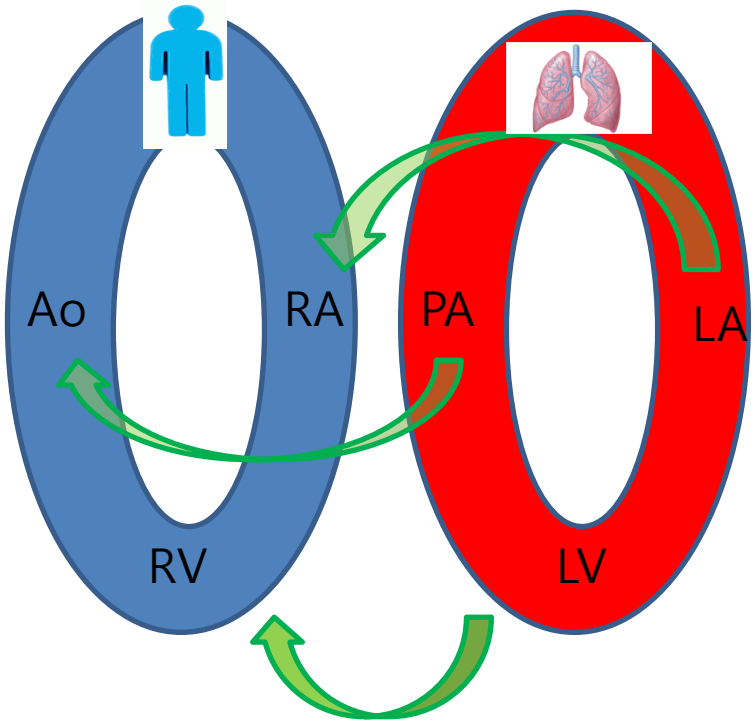
Central Cyanosis secondary to CHD

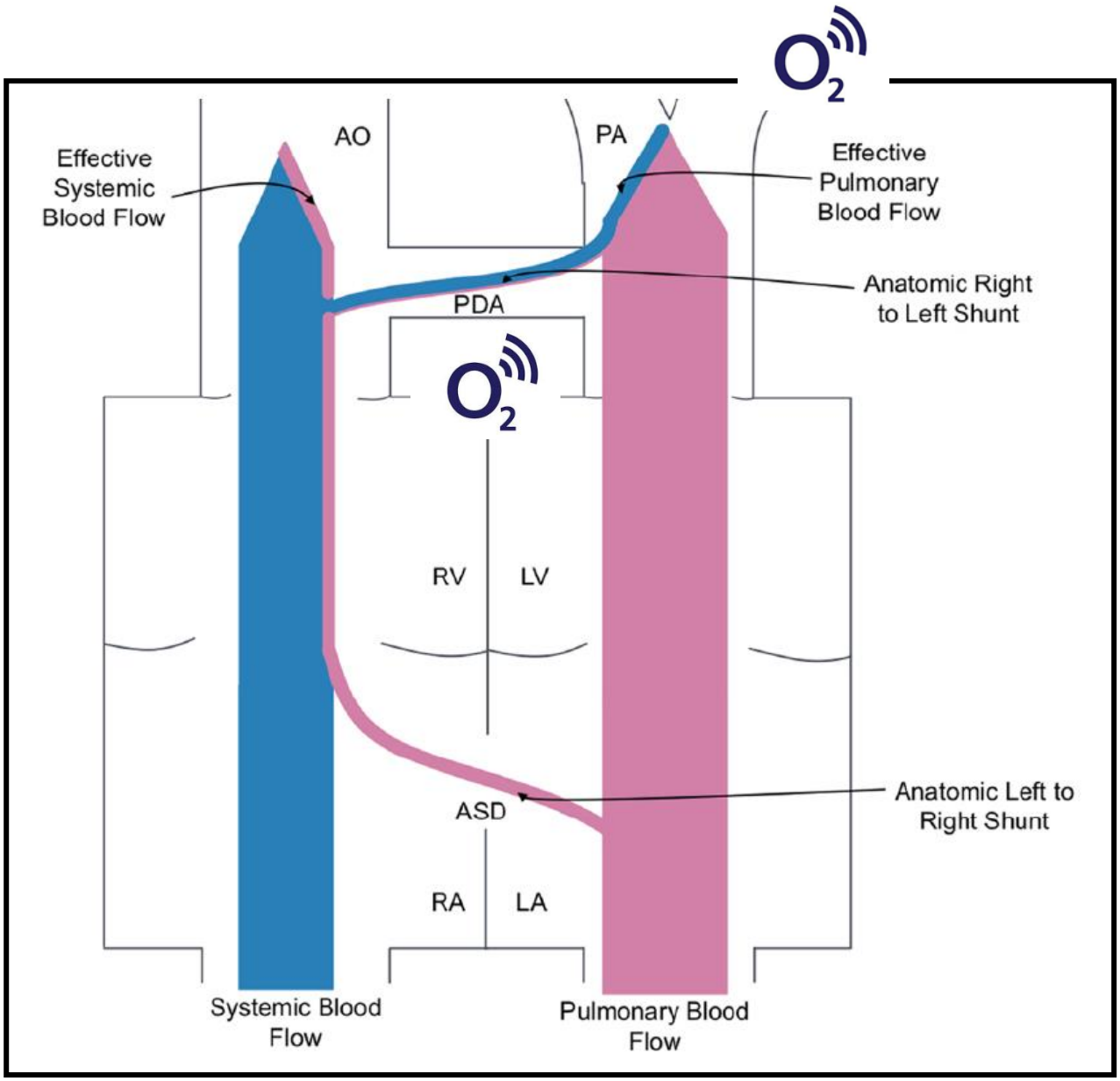
- Right to left shunt
  - Ebstein malformation with ASD
  - Tetralogy of Fallot
  - Severe pulmonary stenosis with ASD
  - Pulmonary atresia with intact ventricular septum
- Common mixing lesion
  - Total anomalous pulmonary venous connection
  - Univentricular heart variants
  - Truncus arteriosus (Common arterial trunk)
  - Common atrium
- Complete TGA

The presence of associated pulmonary stenosis makes the hypoxia more severe.

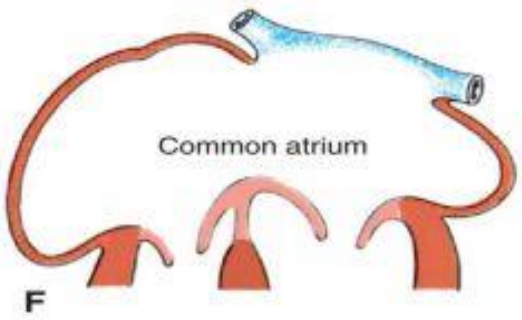
Complete TGA

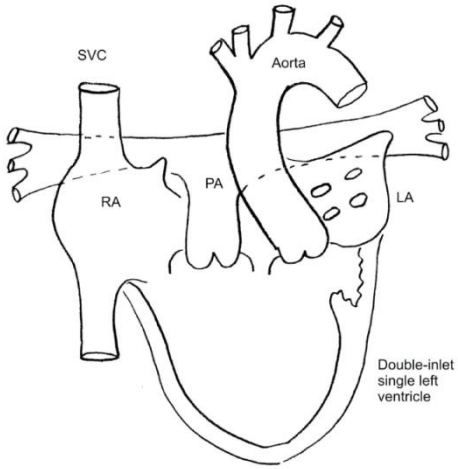


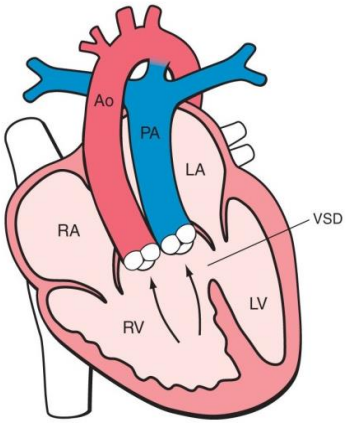


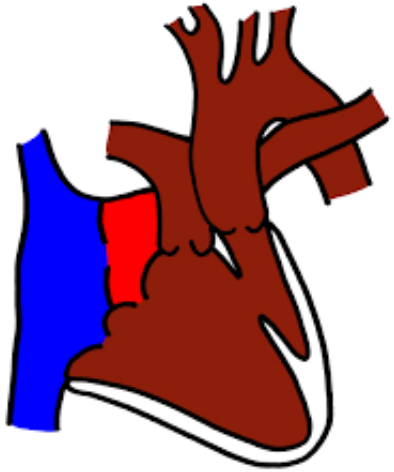

O_2
AO
PA
Effective
Systemic
Blood Flow
Effective
Pulmonary
Blood Flow
Anatomic Right
to Left Shunt
PDA
O_2
RV
LV
Anatomic Left to
Right Shunt
ASD
RA
LA
Systemic Blood
Flow
Pulmonary Blood
Flow

Common Mixing Lesion

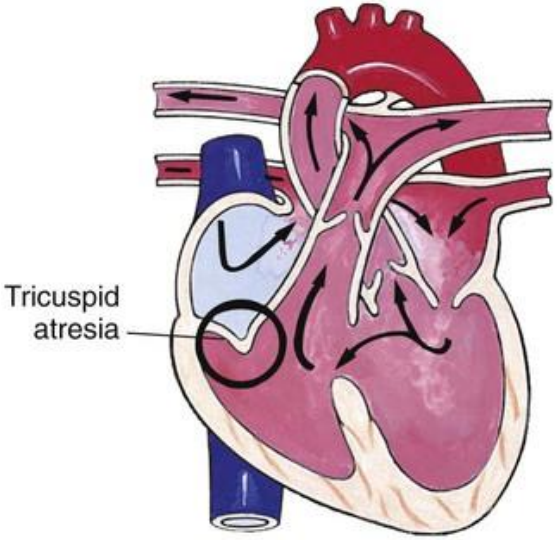


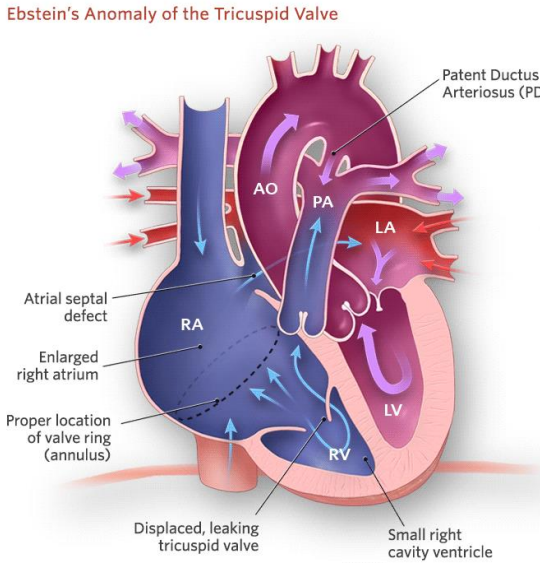


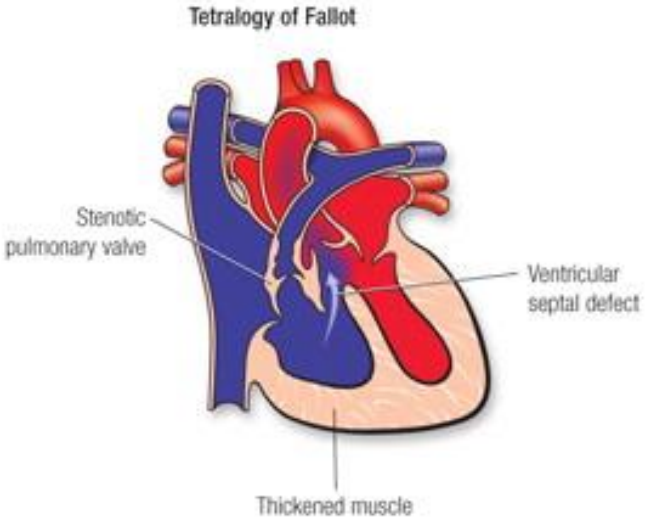




Right to Left shunt lesion



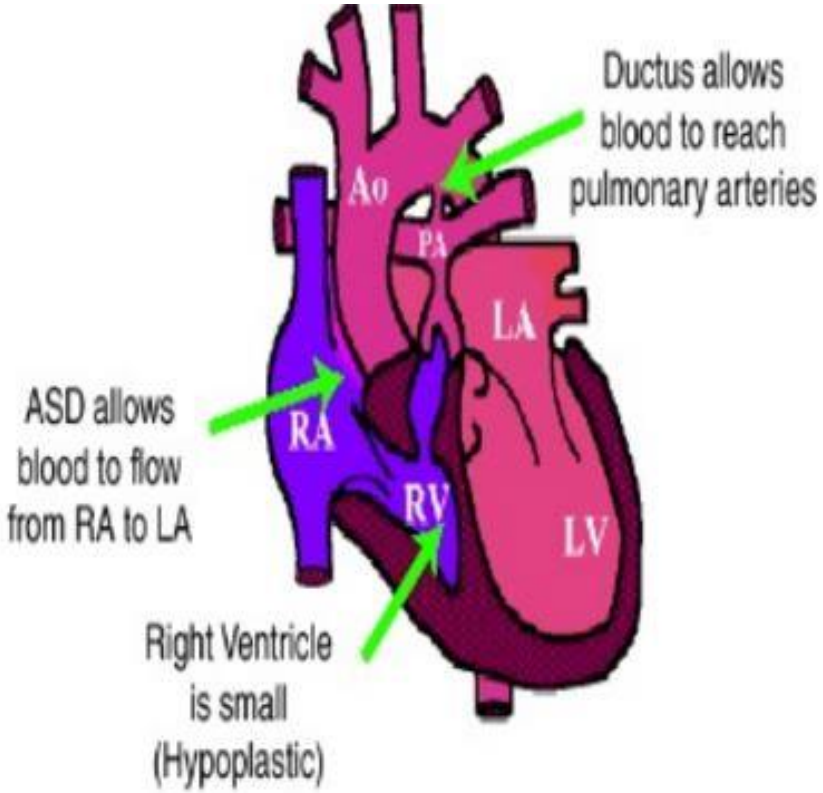


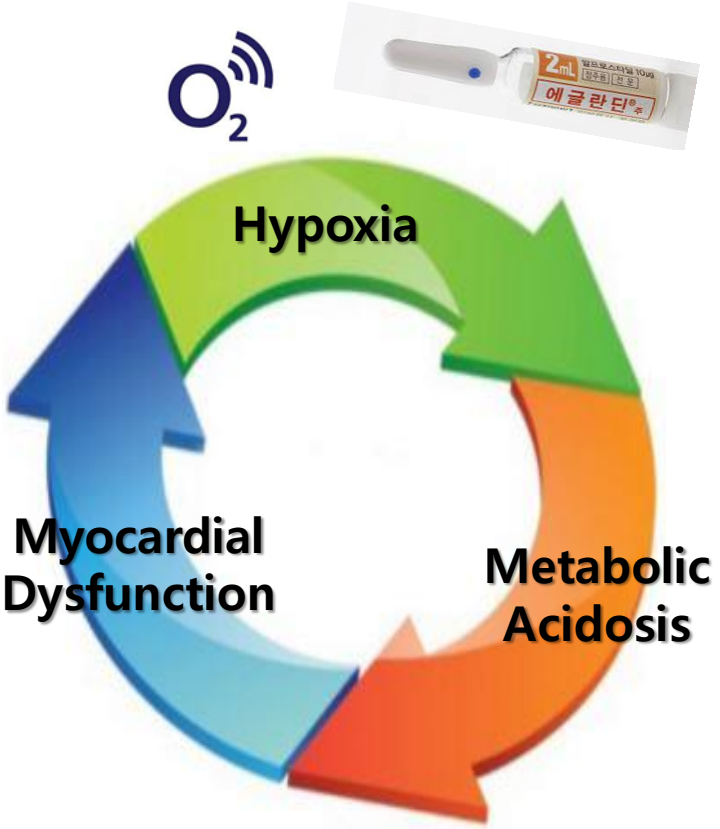


Ductal Dependent Pulmonary blood flow

- Tetralogy of Fallot with severe pulmonary stenosis or atresia
- Other examples of pulmonary atresia with VSD
- Pulmonary atresia with intact ventricular septum
- Critical pulmonary stenosis
- Complete AVSD with severe pulmonary stenosis or atresia
- 'Single' ventricle variants with severe pulmonary stenosis or atresia
- Tricuspid atresia
- Double inlet left ventricle
- Transposition or DORV with severe pulmonary stenosis or atresia

Ductal Dependent Pulmonary blood flow





Ductal Dependent Pulmonary blood flow

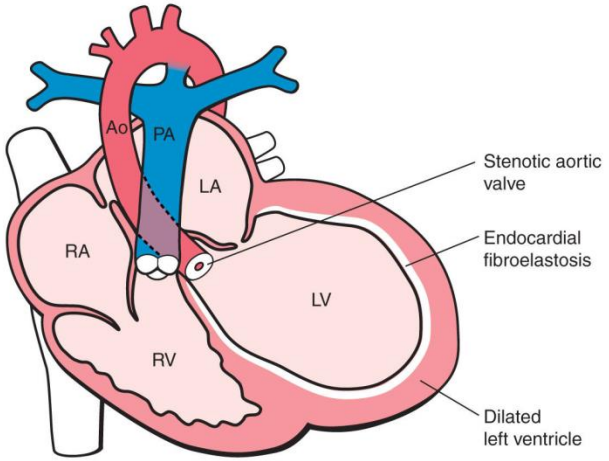
- As a consequence of spontaneous closure of the duct soon after birth, severe hypoxia, and consequent metabolic acidosis will result in early neonatal death.

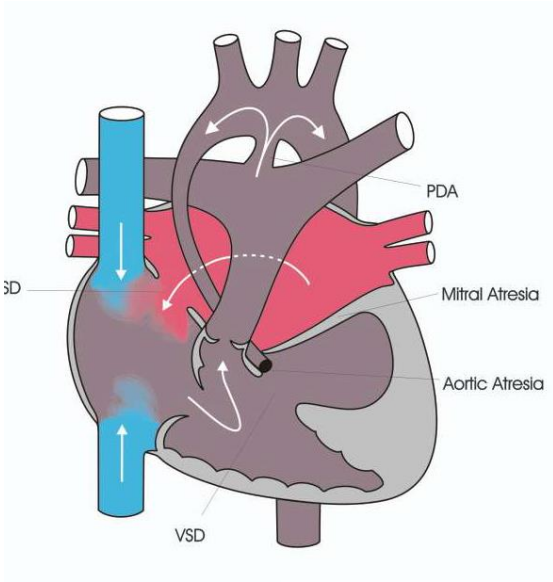
- The administration of intravenous prostaglandin will maintain ductal patency or cause a small duct to dilate allowing urgent palliative or even 'corrective' surgery to be performed within hours or days.

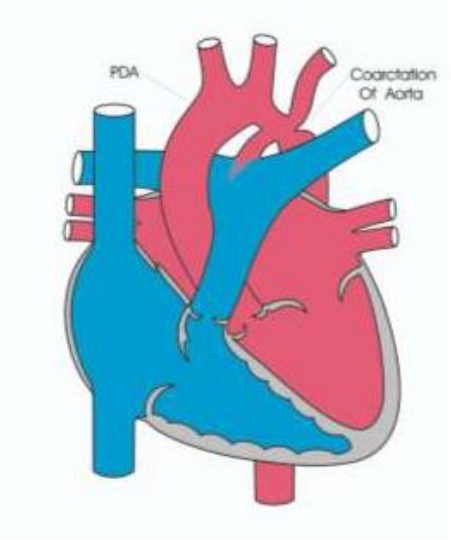
Ductal Dependent Systemic blood flow

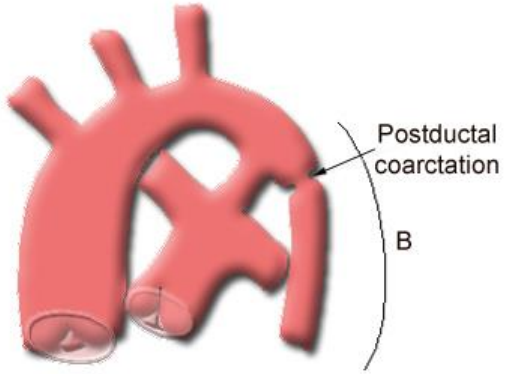
- Hypoplastic left heart syndrome
- Coarctation of the aorta
- Aortic interruption (usually with VSD)
- Critical Aortic stenosis
- Aortic atresia
- Severe mitral stenosis

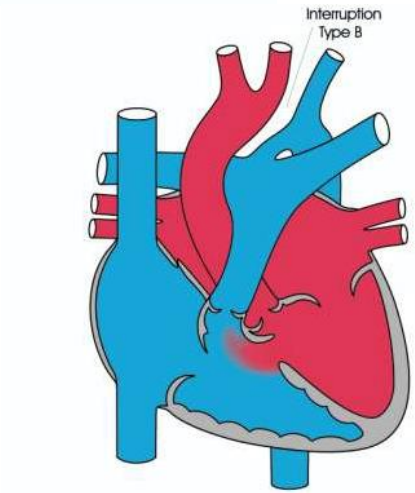
Ductal Dependent Systemic blood flow





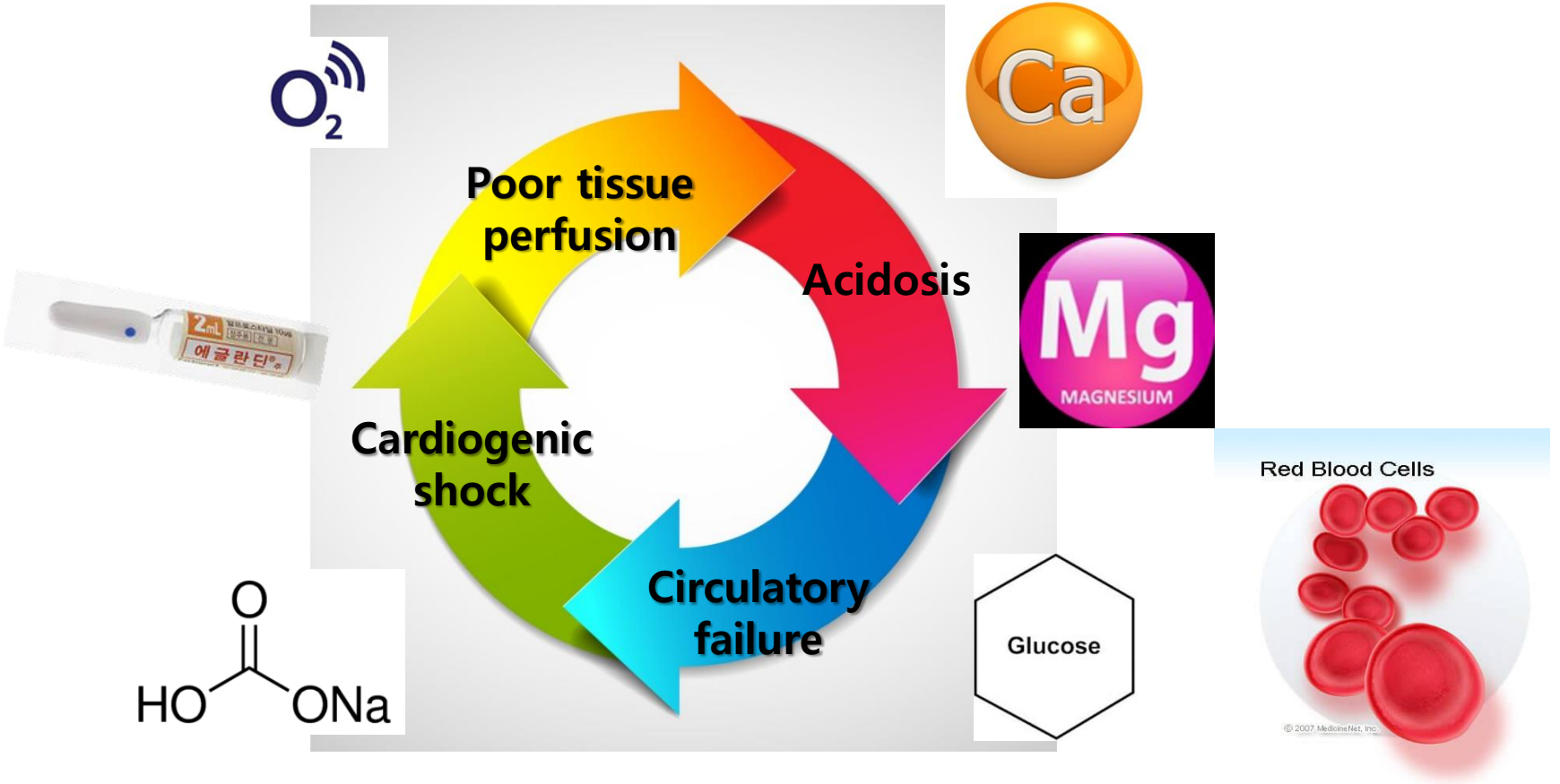




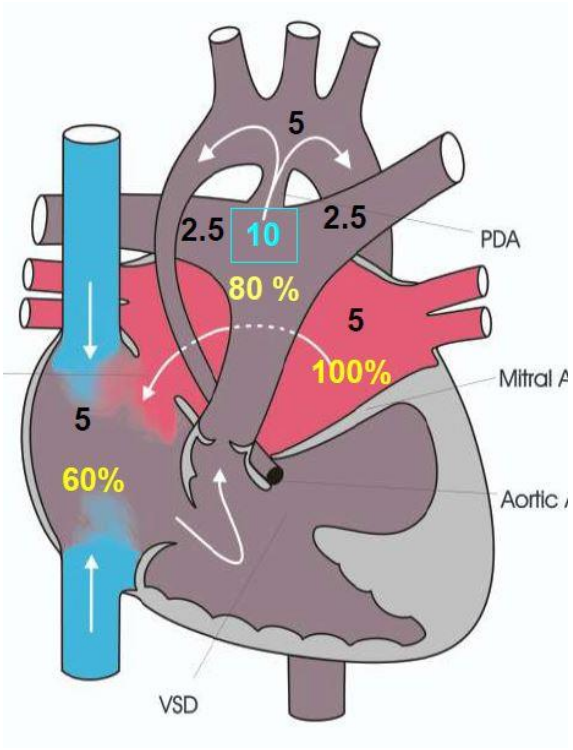


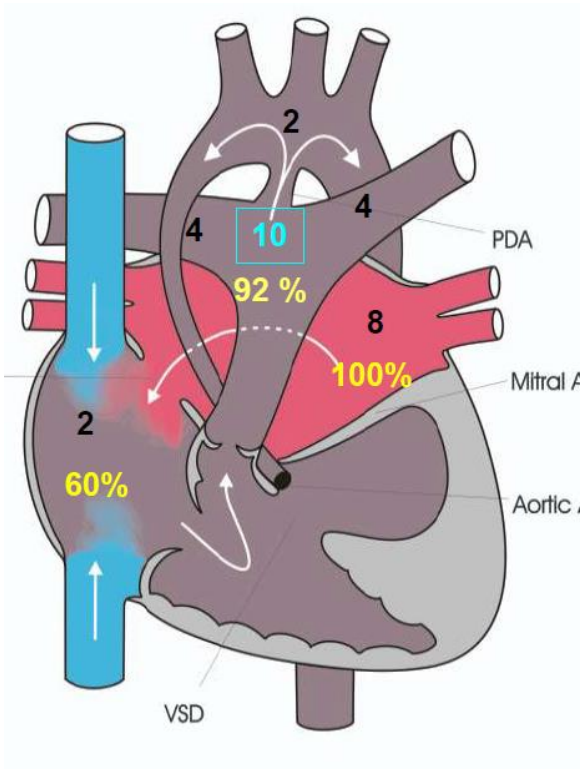
Ductal Dependent Systemic blood flow

- Blood flow to the aorta and coronary arteries is essential to maintain cardiac, cerebral, renal, intestinal and liver function.



Hypoplastic Left Heart Syndrome





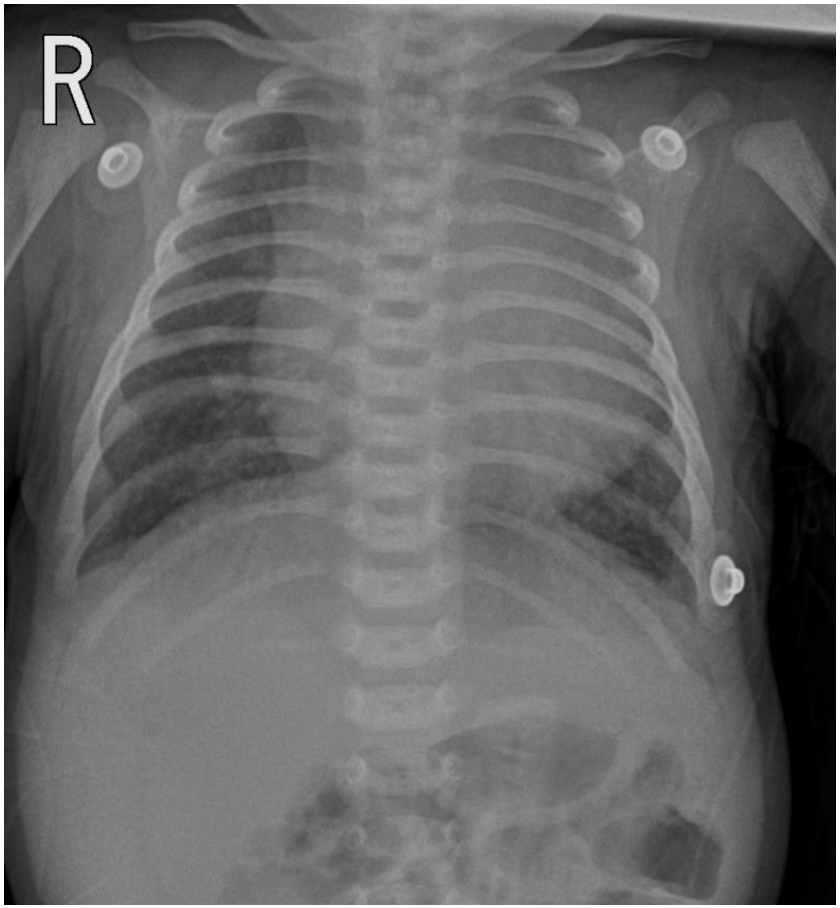
Preoperative management of patients with HLHS depends on balancing parallel circulations, which entails maintaining adequate but not excessive pulmonary blood flow while ensuring optimal systemic perfusion.

Simple Left to Right shunt lesion

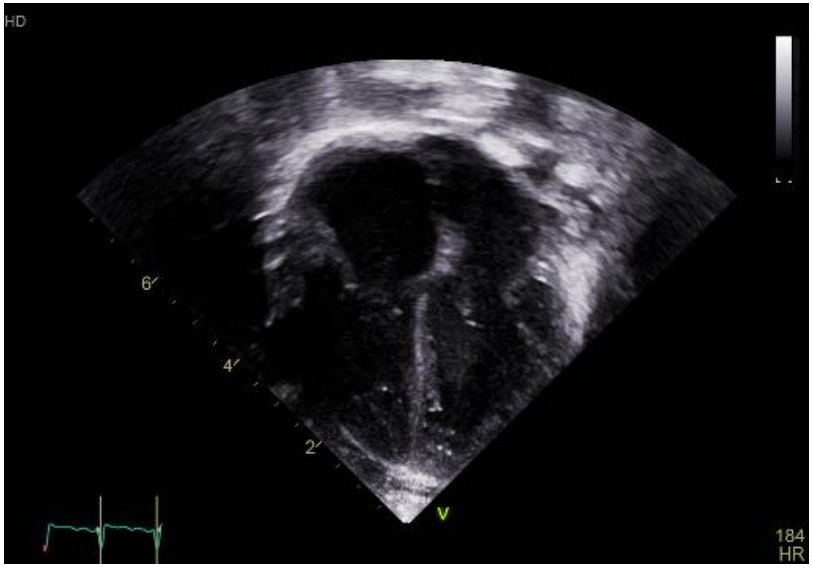
- VSD, ASD, PDA, AVSD, etc.
- Heart murmur, tachypnea, respiratory infection, feeding intolerance, cardiomegaly, cyanosis…

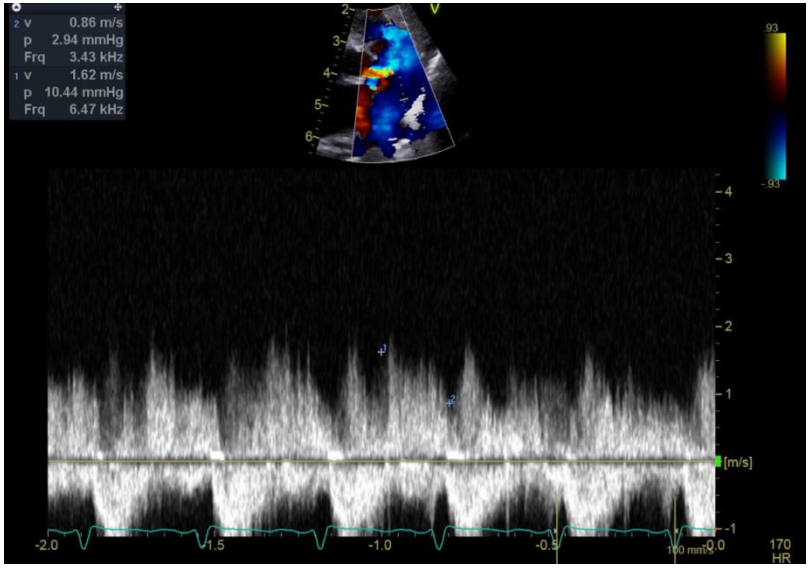
Simple Left to Right shunt lesion

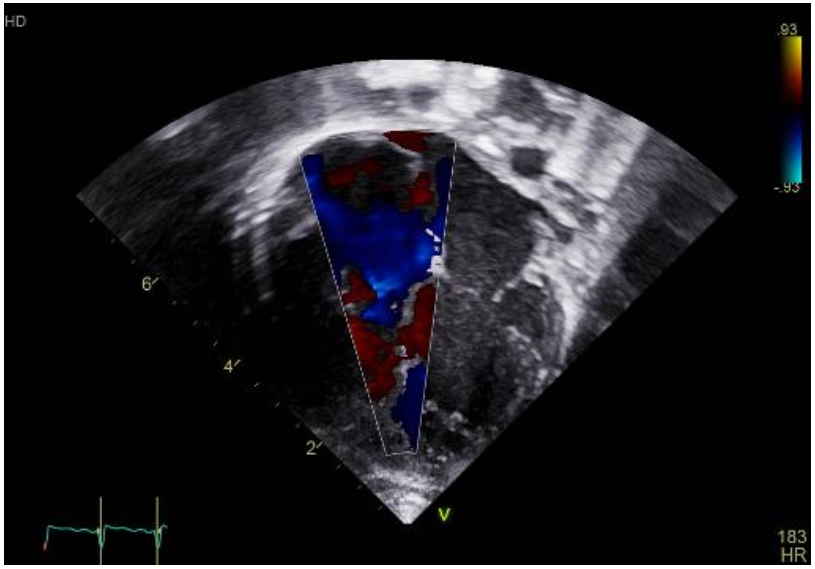
- 생후 11일 된 여아.
- 39+5주, C/S with 3.78kg.
- 출생직후 부터 murmur
- 생후 11일 경 갑자기 빈호흡이 생겨 O_2 공급하면서 전원됨.

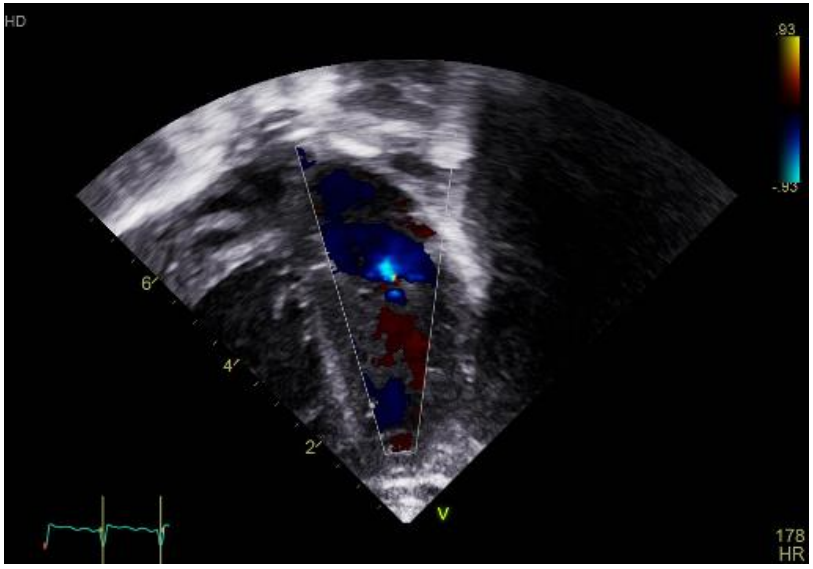


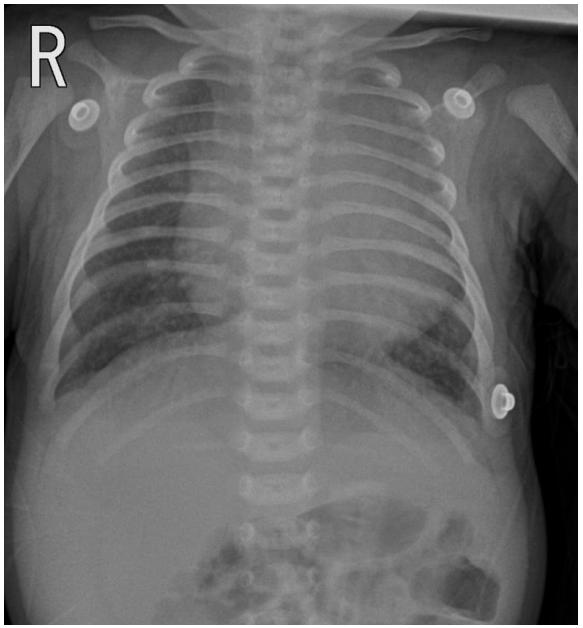
- RR 70-80회/min
- SpO_2 90-94%
- Gr II systolic murmur at LUSB
- Mild subcostal chest retraction
- Severe sweating


HD
6
4
2
V
184
HR


v 0.86 m/s
p 2.94 mmHg
Frq 3.43 kHz
v 1.62 m/s
p 10.44 mmHg
Frq 6.47 kHz
93
-93
[m/s]
-2.0
-1.5
-1.0
-0.5
0.0
170
HR

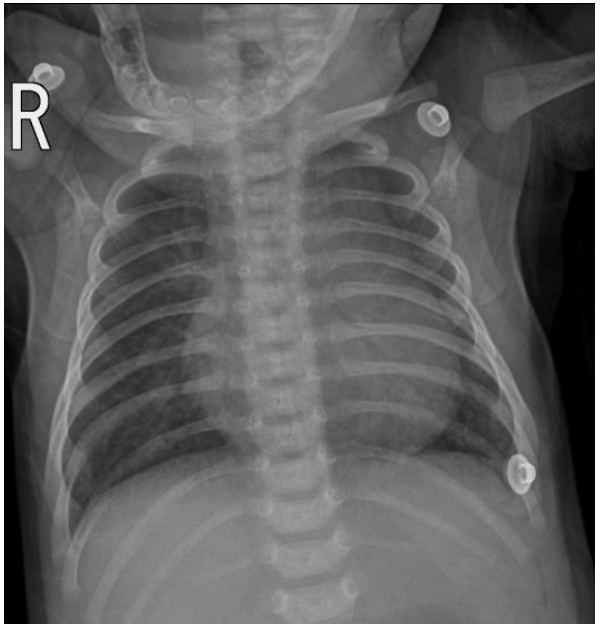

HD
93
-93
6
4
2
V
183
HR

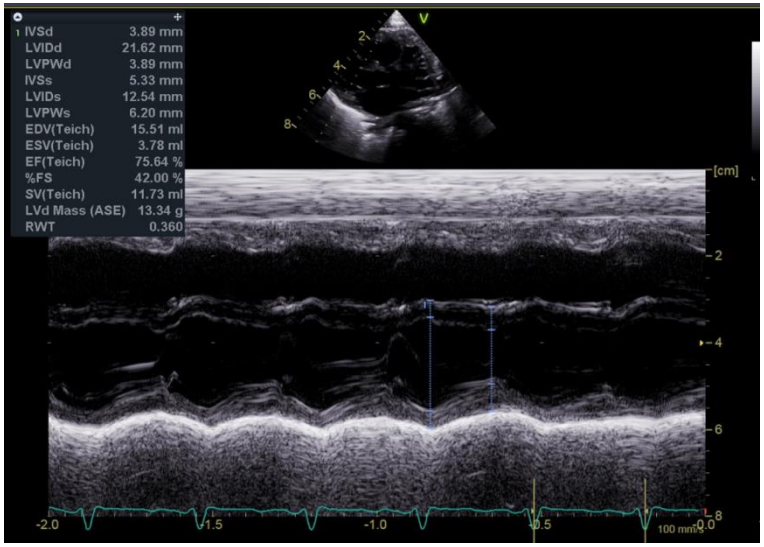

HD
93
-93
6
4
2
V
178
HR

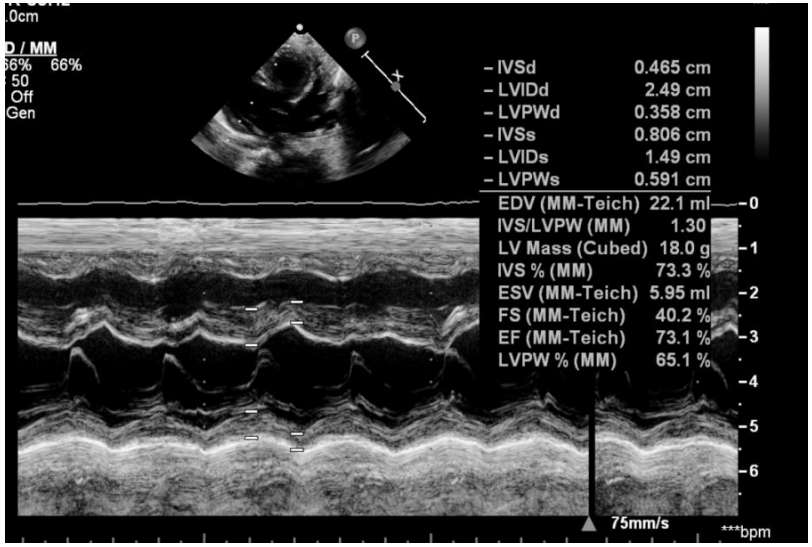


O_2 stop

Diuretics







Take Home massage

1. If there is severe hypoxia and hypo-perfusion findings, do not hesitate to administer oxygen.
2. In the presence of ductal dependent pulmonary blood flow, PGE_1 should be administered with oxygen.
3. Ductal dependant systemic circulation usually results in tissue hypoperfusion. Therefore, it is necessary to make efforts to maintain patent ductus arteriosus.
4. In the case with simple left and right shunt lesions, too much oxygen administration can lead to bad results.

O_2

thank you!