

Heart Diseases in Children: An Overview

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LU7 - Interns Pediatrics Rotation

1. Outpatient

2. Inpatient

- Emergency room**
- Ward**
- Newborn unit**

LU7 - Interns

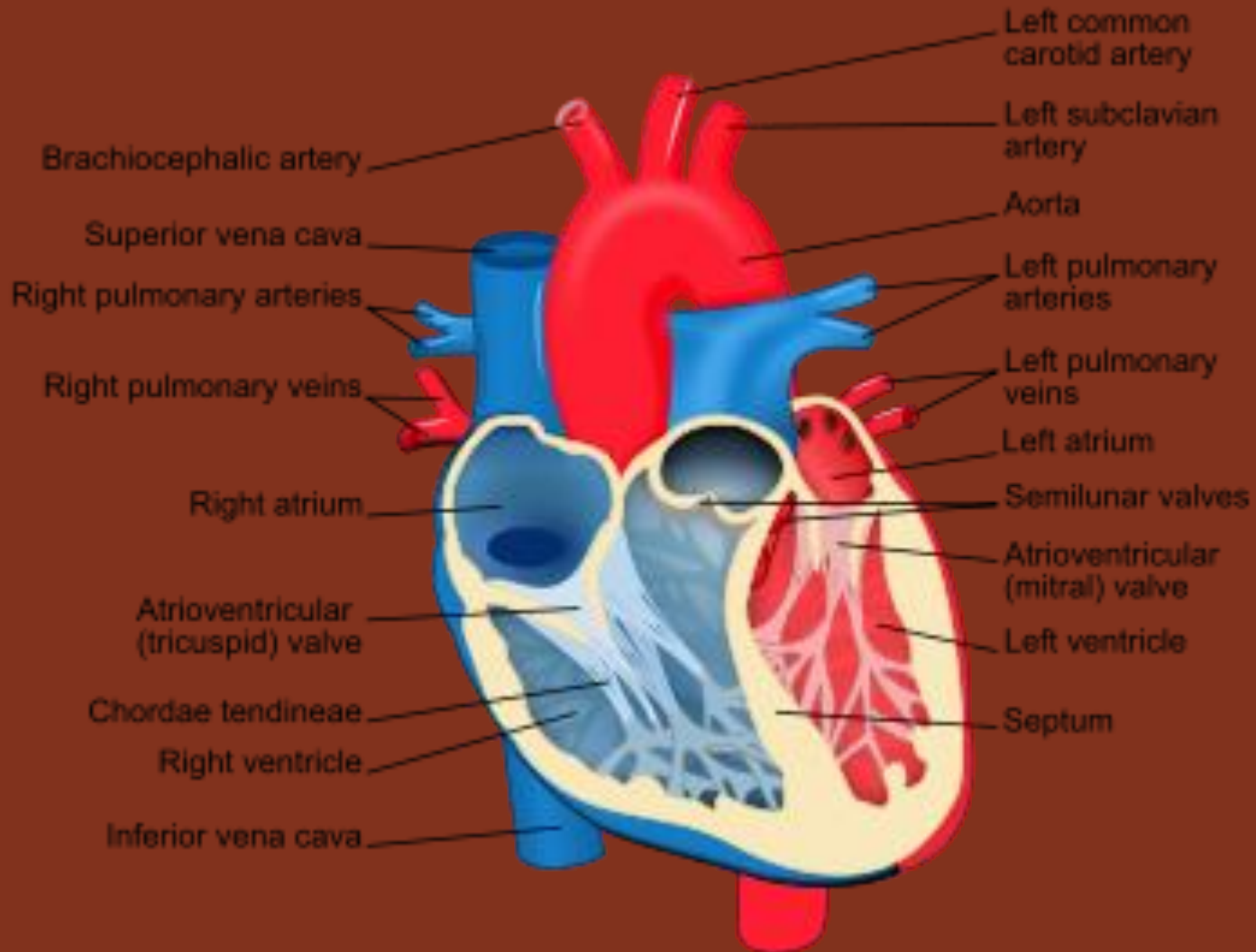
Pediatrics CVS module

- 1. Handouts - PDF on CVS disorders and conditions**
- 2. Lecture : Overview on HD**
- 3. Video demo on Pediatric CVS examination**

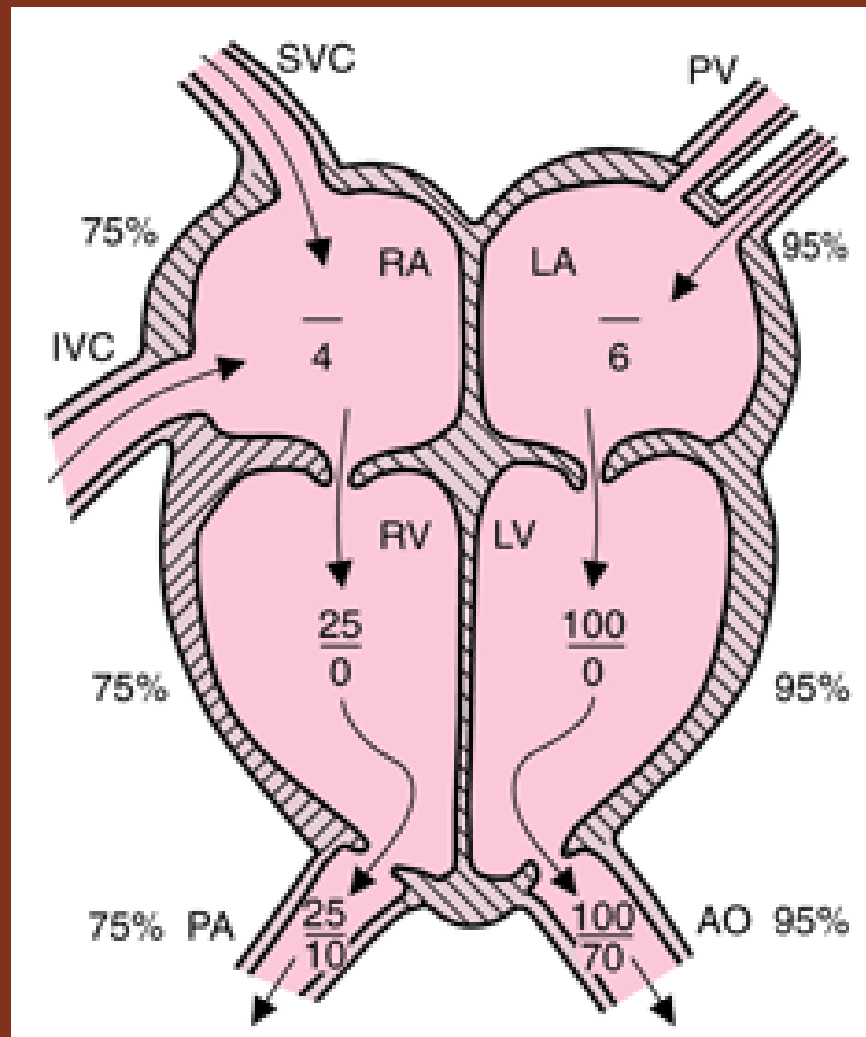
Heart Diseases in Children

- **The normal heart**
- **Transitional circulation**
- **Types & Incidences**
- **Common presentations**
- **Common reasons for cardiac evaluation**

Normal Heart - Anatomy



Normal Heart - Pressures & Saturation



Changes in Fetal Circulation After Birth (Transitional Circulation)

- **Gas exchange from placenta to lungs**
- **Interruption of umbilical cord**
 - **↑ SVR due to removal of placenta**
 - **Closure of ductus venosus**
- **Expansion of the lungs**
 - **↓ PVR, ↓ PAP , ↑ PBF**
 - **Functional closure of foramen ovale due to ↑ LAP;
RAP ↓ after closure of ductus venosus**
 - **PDA closes with ↑ O₂ saturation**

Types of Heart Diseases in Children

- **Congenital heart disease**
 - **Acyanotic : VSD, PDA, ASD, PS**
 - **Cyanotic : TOF, TGA, PVA**
- **Acquired heart disease**
 - **Rheumatic fever/rheumatic heart disease**
 - **Kawasaki disease**
 - **Myocarditis**
 - **Pericarditis**
 - **Infective endocarditis**

INFANT MORTALITY: TEN (10) LEADING CAUSES
Number, Rate/1000 Livebirths & Percent Distribution
Philippines, 2010

CAUSE	Number	Rate	Percent*
1. Bacterial sepsis of newborn (P36)	3,608	2.0	16.1
2. Pneumonia (J12-J18)	2,628	1.5	11.7
3. Respiratory distress of newborn (P22)	2,526	1.4	11.2
4. <u>Congenital malformations of the heart (Q20-Q24)</u>	1,572	0.9	7.0
5. Disorders related to short gestation and low birth weight, not elsewhere classified (P07)	1,487	0.8	6.6
6. Congenital pneumonia (P23)	1,095	0.6	4.9
7. Neonatal aspiration syndromes (P24)	1,079	0.6	4.8
8. Intrauterine hypoxia and birth asphyxia (P20-P21)	950	0.5	4.2
9. Other congenital malformations (Q10-Q18, Q30-Q89)	941	0.5	4.2
10. Diarrhea and gastroenteritis of presumed infectious origin (A09)	900	0.5	4.0

* Percent share from total number of infant deaths (22,476), all causes, Philippines

Table 34

INFANT MORTALITY: TEN (10) LEADING CAUSES
Number, Rate/1000 Livebirths & Percent Distribution
Philippines, 2014

	CAUSE	Number	Rate	Percent*
1	Pneumonia, organism unspecified (J18)	2,809	1.6	13.3
2	Bacterial sepsis of newborn (P36)	2,451	1.4	11.6
3	Respiratory distress of newborn (P22)	2,156	1.2	10.2
4	Disorders related to short gestation and low birthweight, not elsewhere classified (P07)	1,607	0.9	7.6
5	<u>Other congenital malformations of heart (Q24)</u>	1,168	0.7	5.5
6	Neonatal aspiration syndromes (P24)	887	0.5	4.2
7	Other septicemia (A41)	798	0.5	3.8
8	Diarrhea and gastroenteritis of infectious origin (A09)	796	0.5	3.8
9	Congenital pneumonia (P23)	712	0.4	3.4
10	Birth asphyxia (P21)	653	0.4	3.1

* Percent share from total number of infant deaths (21,108), all causes, Philippines

MORTALITY AMONG LOWER AGE GROUP : TEN (10) LEADING CAUSES
by Age Group & Sex
Number & Rate / 100,000 Population
Philippines, 2010

Cause	10-14 Years			
	Male	Female	Both Sexes	Rate*
1 Pneumonia (J12-J18)	233	195	428	4.4
2 Accidental drowning and submersion (W65-W74)	212	140	352	3.6
3 Other diseases of nervous system (G04-G12,G23-G25,G31-G37, G41-G98)	150	116	266	2.7
4 Transport accidents (V01-V99)	172	77	249	2.5
5 Congenital anomalies (Q00-Q99)	130	114	244	2.5
6 Dengue Fever and Dengue-hemorrhagic fever (A90-A91)	111	102	213	2.2
7 Chronic rheumatic heart disease (I05-I09)	86	106	192	2.0
8 <u>Leukemia (C91-C95)</u>	94	82	176	1.8
9 Septicemia (A40-A41)	92	78	170	1.7
10 Nephritis,nephrotic syndrome and nephrosis (N00-N07, N17-N19, N25-N27)	95	67	162	1.7

* rate per 100,000 population of corresponding age-group

MORTALITY AMONG LOWER AGE GROUP : TEN (10) LEADING CAUSES
by Age Group & Sex
Number & Rate / 100,000 Population
Philippines, 2014

Cause	10-14 Years			
	Male	Female	Both Sexes	Rate*
1 Neoplasms	254	216	470	4.4
2 Remainder diseases of the nervous sytem	204	150	354	3.3
3 Pneumonia	191	158	349	3.3
4 Accidental drowning and submersion	214	102	316	3.0
5 All other external causes	177	73	250	2.3
6 Congenital malformations, deformations and chromosomal abnormalities	105	102	207	1.9
7 Leukemia	119	85	204	1.9
8 Transport accident	139	56	195	1.8
9 Other heart diseases	89	76	151	1.4
10 <u>Acute rheumatic fever and chronic rheumatic heart diseases</u>	61	80	141	1.3

Excludes ill-defined and unknown causes of mortality (n= 151, 9th rank)

* rate per 100,000 population of corresponding age-group

**Philippine Pediatric Society
ICD-10 Registry - Ward Discharges
5/1/06 - 2/29/16**

**Total: 2,829,655 Died: 96,420 (3.4 %)
Top 10 Cardiovascular Diseases**

ICD-10 and Diagnosis	Total #	# Died	% Died
1. Q24.9 Congenital malformation of heart, unspecified	5,782	801	17.3
2. M30.3 Mucocutaneous lymph node syndrome (Kawasaki disease)	4,626	3	0.06
3. Q21.0 Ventricular septal defect	3,848	299	7.7
4. I09.9 RHD, unspecified	3,661	344	9.3
5. Q21.3 Tetralogy of Fallot	3,328	315	9.4
6. Q25.0 Patent ductus arteriosus	2,952	154	5.2
7. Q24.0 Dextrocardia	2,065	375	18.1
8. B33.2 Viral carditis	1,910	13	0.6
9. I00 RF without mention heart involvement	1,537	23	1.4
10. Q21.1 Atrial septal defect	1,355	79	5.8

Congenital Heart Diseases

Acquired Heart Diseases

Types of Heart Diseases	2011	2012	2013	2014	2015	total	%
CHD, ACYANOTIC	1595	1464	1250	1198	1232	6739	52.9%
CHD, CYANOTIC	609	546	518	546	538	2757	21.6%
RF/RHD	334	355	341	343	321	1694	13.3%
OTHER CASES (CARDIAC AND REFERRAL FOR EVALUATIONS)	345	320	283	250	349	1547	12.1%
TOTAL # OF CONSULTATIONS	2883	2685	2392	2337	2440	12737	100%

Table 1. UP-PGH Pediatric Cardiology OPD Census 2011-15: Types of Heart Diseases, Numbers & Percentages

ADMISSIONS	2011	2012	2013	2014	2015	TOTAL	%
CHD, ACYANOTIC	413	444	436	361	412	2066	25.9%
CHD, CYANOTIC	267	397	376	366	295	1701	21.3%
RF/RHD	134	143	131	90	105	603	7.5%
OTHER CASES (CARDIAC AND REFERRALS FOR CARDIAC EVALUATION)	660	586	730	954	687	3617	45.2%
TOTAL ADMISSIONS	1474	1570	1673	1771	1499	7987	100%

Table 2. UP-PGH Pediatric Cardiology Admissions & Referrals 2011-15 : Types of heart diseases, Numbers & Percentages

MORTALITY	2011	2012	2013	2014	2015	Total	%
CHD, ACYANOTIC	36	31	33	34	39	173	29.3%
CHD, CYANOTIC	41	47	44	36	37	205	34.7%
RF/RHD	25	9	8	11	7	60	10.2%
OTHER CASES	30	44	27	35	16	152	25.6%
TOTAL	132	131	112	116	99	590	

Table 3. UP-PGH Pediatric Cardiology Admissions Mortality Census 2011-15: Types of Heart Disease, Numbers & Percentages

Heart Diseases in Children: Problems & Complications

- Congestive heart failure
- Cyanosis
- Pulmonary hypertension, pulmonary vascular obstructive disease & eisenmengerization
- Infective endocarditis
- Cerebrovascular accident & brain abscess
- Arrhythmia
- Sudden Death

Common Presentations of Heart Diseases in Children

- Cardiac murmur
- Cyanosis
- Congestive heart failure

Non-common presentations

- Abnormal chest x-ray
- Arrhythmia
- Chest pain

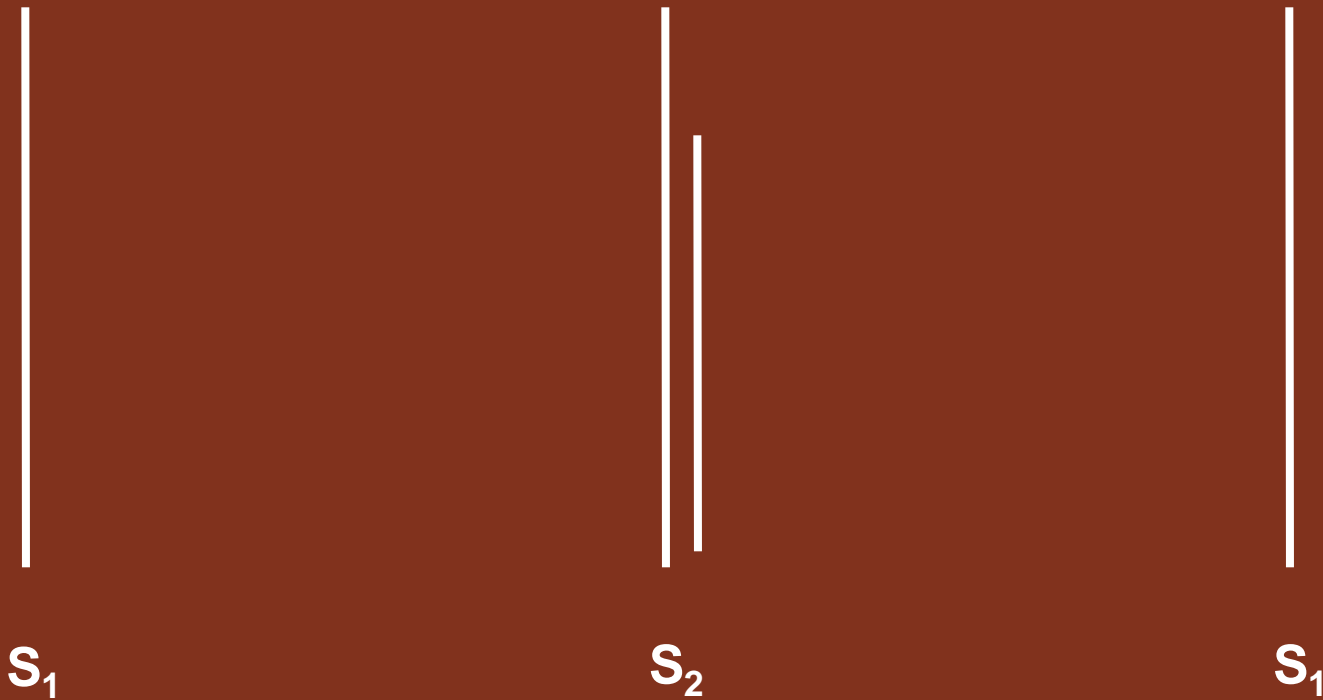
Cardiac Murmur

- Produced by turbulence of blood flow from high to low pressure chambers in the heart
- Intensity related to amount of blood flow & body position
- Grading of loudness: 1 – 6
- Characteristic: systolic, diastolic & continuous

Cardiac Murmur

- **Noted usually during early infancy**
- **Usually asymptomatic**
- **Common diagnosis:**
 - **Innocent murmur**
 - **Congenital heart disease – VSD, PDA, PS**
 - **RF/RHD in older children**

Heart Sound / Cardiac Cycle

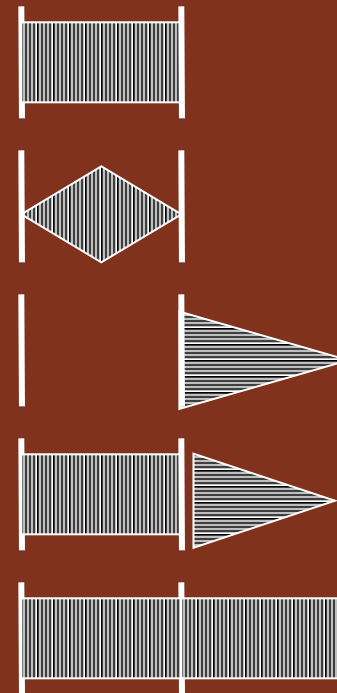


Systole

Diastole

Types of Murmur

- **Systolic**
 - Pansystolic
 - Ejection
- **Diastolic**
- **Systolic/Diastolic**
- **Continuous**



Innocent Murmur

- **Not associated with any anatomic or physiologic abnormality**
- **Other names: normal, physiologic, functional, or benign murmur**
- **40 – 60% of children**
- **Always with normal heart sounds, ECG, & CXR**
- **Usually early systolic, brief, soft, localized, parasternal border**

Innocent Murmur in Neonates

- 50% of fullterm in 1st week of life
- Types:
 - Transient murmur of PDA – closing PDA; located LUSB
 - Pulmonic flow murmur – disproportion of size and angulation of MPA to PA branches; located LUSB; (+) weeks to months
 - Transient murmur of tricuspid regurgitation – secondary to high PVR; LLSB similar to VSD; disappears in days

Innocent Murmur in Children

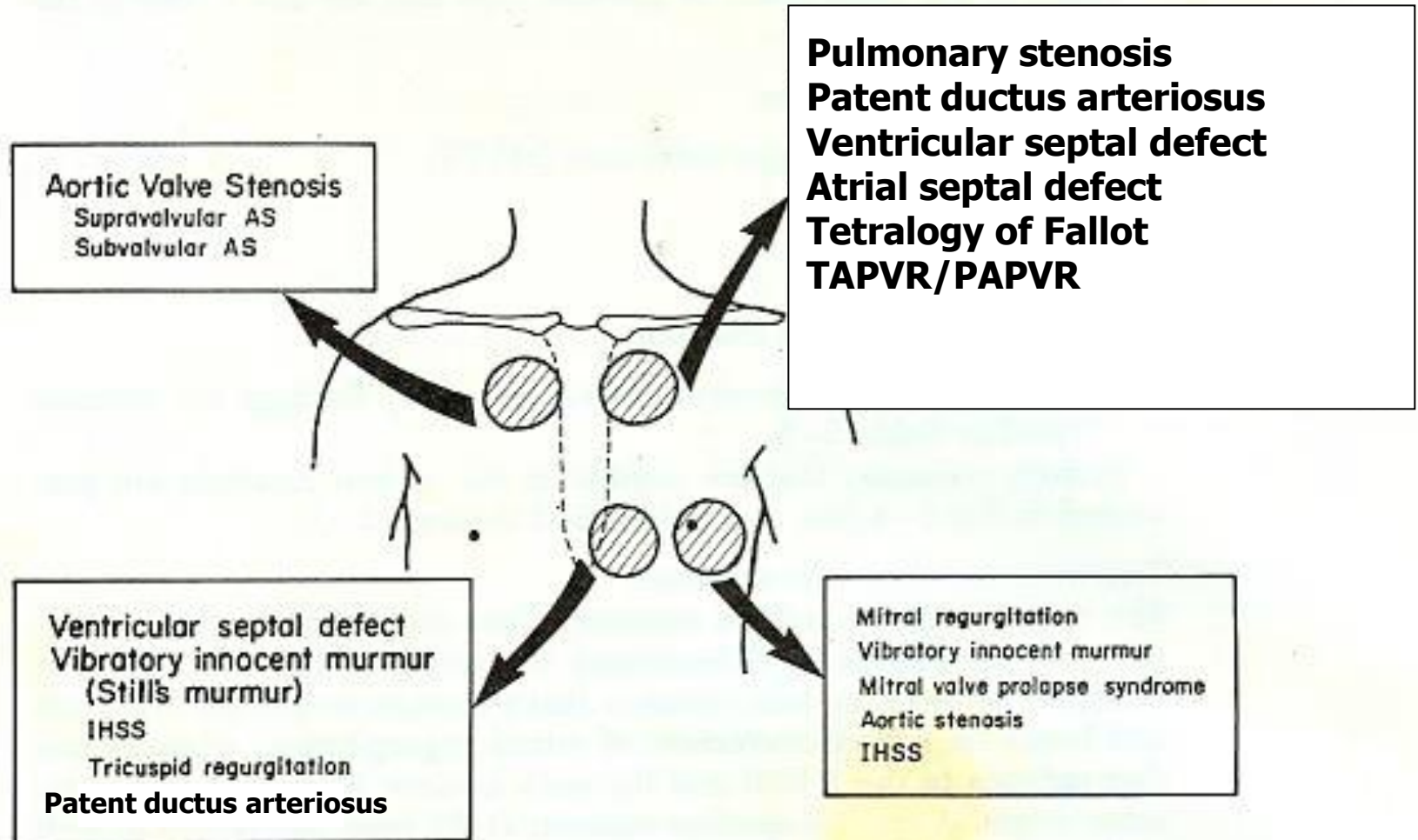
- **Vibratory Still's murmur**
 - Children 2 – 7 years old
 - Grade 1 – 2/6 vibratory, twanging, honky , groaning SM
 - Loudest 3rd ICS, between LLSB & apex
 - Louder on supine position, exercise, & fever
 - May be due to small ascending aortic diameter
- **Innocent pulmonic murmur**
- **Venous hum**
- **Supraclavicular arterial bruit**

Cardiac Murmur & CHD

- **Murmur heard**
 - **1st 24 hours** - risk of CHD **1/12**
 - **1st 6 months** - **1/7**
 - **12th month** - **1/50**
- **Patients at 2 years with CHD - only 20% have audible murmur during 1st week of life**

Systolic Murmur in Children

Location & Diagnosis



Heart Diseases with Soft or Absent Murmur

- CHD – TGA, ASD,CAVSD
- RF/RHD with mild valvular regurgitation
- Myocarditis
- Dilated cardiomyopathy
- Pericardial effusion

Cyanosis

- **Greek: “kuanosis” = blueness**
- **Bluish color of skin, nailbeds & mucus membrane; deoxygenated blood w/in capillary network**
- **5 gm% of reduced Hb in blood (Lundsgaard & Van Slyke, 1923)**
- **Types:**
 - ***Peripheral* - acrocyanosis; vasoconstriction**
 - ***Central* – hypoventilation; cardiac structural & physiological abnormalities**



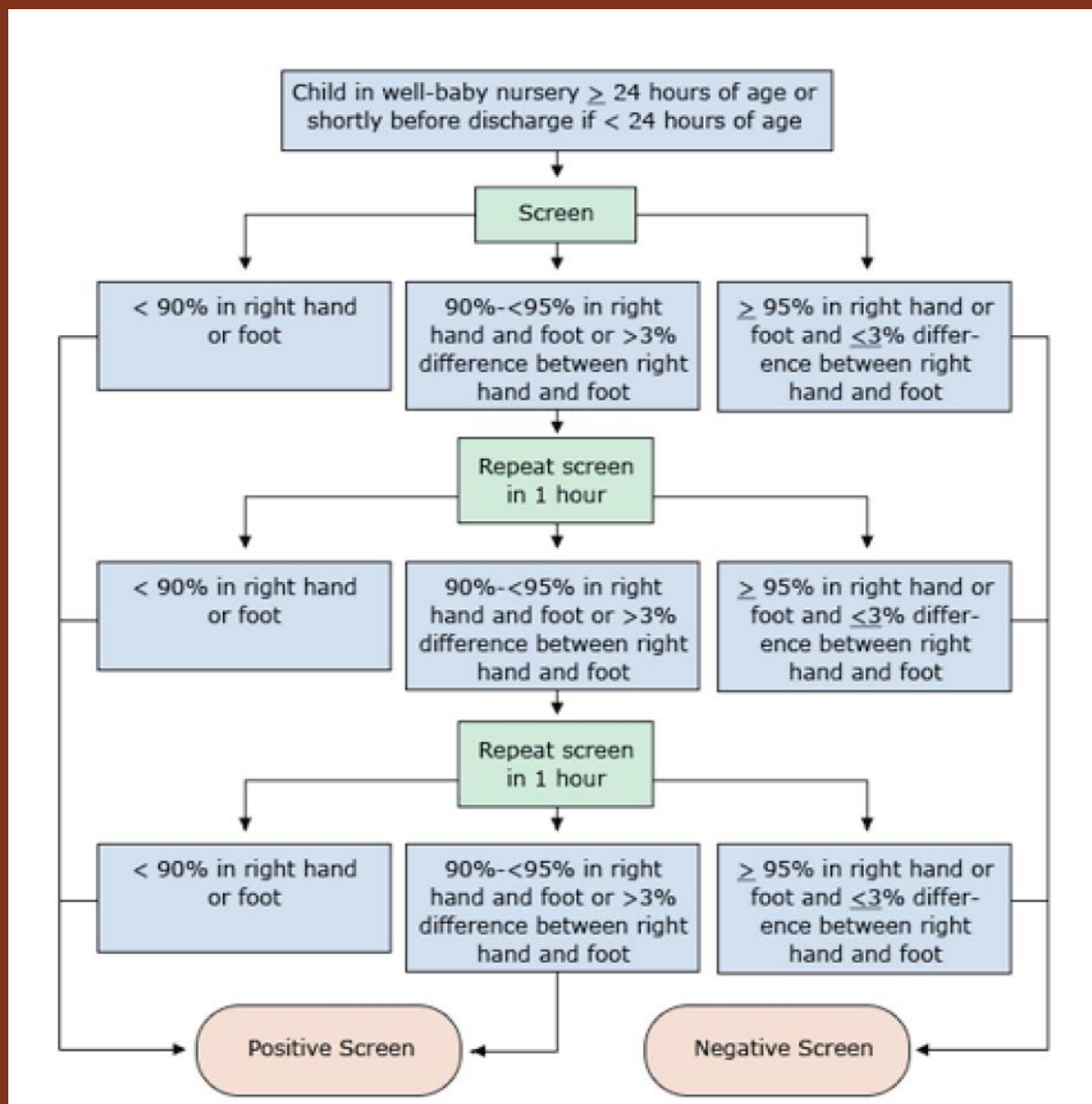
Cyanosis



Cyanosis in Newborn

- **Cardiac – CHD, PFC/PPHN**
- **Pulmonary**
 - **Intrapulmonary – RDS, pneumonitis**
 - **Extrapulmonary – Pneumothorax, TEF, cysts, sequestration, diaphragmatic hernia, airway obstruction**
- **Hematologic – methemoglobinemia, polycythemia**
- **CNS – drugs during labor, IC bleed**
- **Sepsis**
- **Hypothermia; Hypoglycemia**

Pulse Oximetry Screening for Critical Congenital Heart Defects

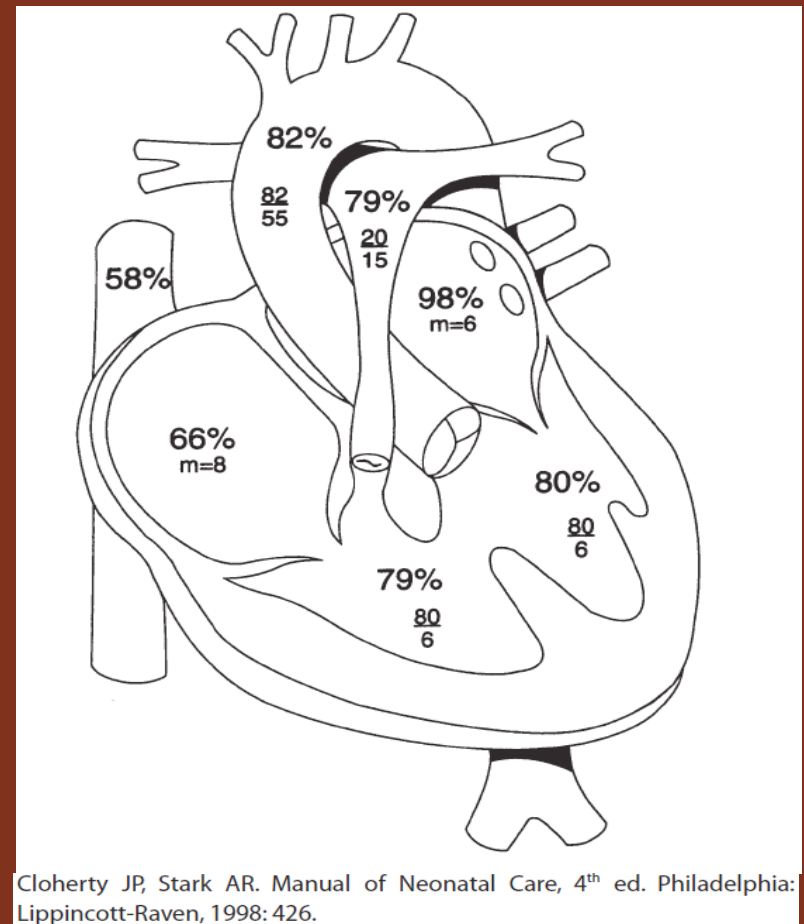


Hyperoxia Test

	100% FiO₂
Cyanotic heart disease	PaO₂ < 150
Noncardiac cyanosis	> 150

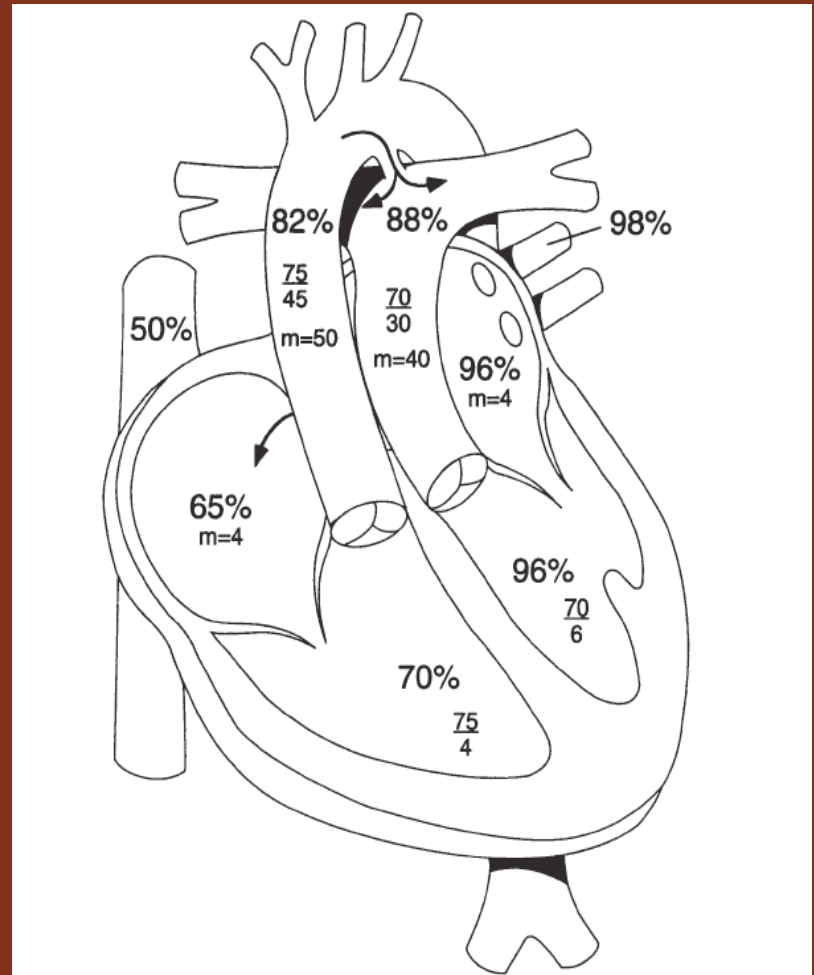
Mechanisms of Cardiac Cyanosis

1. **R - L shunt thru PFO/ASD, VSD or PDA** – PPHN, R-sided obstructive heart dis.
2. **Decrease pulmonary blood flow** – TOF, PVA



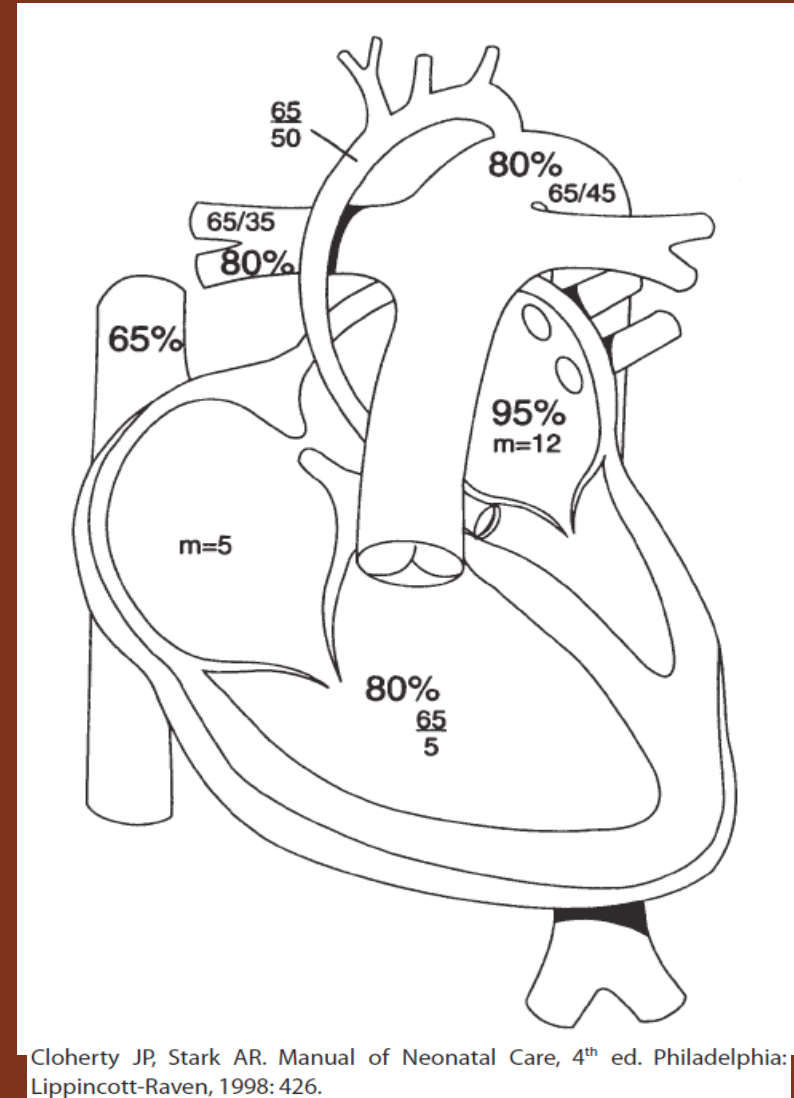
Mechanisms of Cardiac Cyanosis

3. *Ventriculo-arterial discordance* – TGA



Mechanisms of Cardiac Cyanosis

**4. *Low cardiac output* –
PDA dependent CHD
(TAPVR, IAA, HLHS),
cardiogenic shock
(myocardial dysfunction,
severe valvular
regurgitation)**



Cyanosis during the 1st 2 weeks of Life

- **Always an emergency**
- **ECG & CXR – not always helpful**
- **Echocardiography – provides useful anatomic & physiologic information**

Cyanosis in Older Children

- ***Tetralogy of Fallot & its variants*** - systolic ejection murmur & clubbing
- ***Cor pulmonale*** - severe chronic pulmonary disease; pulmonary hypertension; RV hypertension & failure; right to left shunting thru PFO
- ***Breathholding*** - precipitated by anger or frustrations; apnea then cyanosis; normal respiration returns; good prognosis

CONGESTIVE HEART FAILURE IN CHILDREN

Pathophysiologic components:

- 1. Pulmonary congestion**
- 2. Low cardiac output**
- 3. Myocardial dysfunction**
- 4. Systemic congestion**

CHF in Children: Manifestations

- Tachypnea
- Dyspnea
- Retractions
- Wheezing
- Rales
- Cough
- Cyanosis
- Diaphoresis
- Tachycardia
- Gallop rhythm
- Cardiomegaly
- Hepatomegaly
- Edema
- Hypotension

Congestive Heart Failure in Children



Subcostal retraction & Harrison's groove



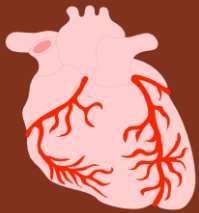


Common Reasons or Indications for Cardiac Evaluation in Children

- **Cardiac murmur**
- **Chest pain**
- **Cyanosis**
- **Dizziness or syncope**
- **Congestive heart failure**
- **Arrhythmia**
- **Obesity & hypertension**
- **Kawasaki disease & suspect**
- **Sports preparticipation screening & evaluation**

THANK YOU

Heart Diseases in Children: An Overview



THANK YOU

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