Murmurs

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NEMOURS
CHILDREN'S HEALTH

Financial Disclosures:

None

Learning Objectives

Describe the relationship of heart murmurs to the cardiac cycle

Identify the pathophysiology of common heart murmurs

Have FUN !!!

Heart Murmur

Definition: sound of blood flowing through the heart, due to physiologic flow or turbulent blood flow from a heart abnormality.

CLICK TO EDIT PRESENTATION TITLE

Parks's Pediatric Cardiology For Practitioners 7th Edition

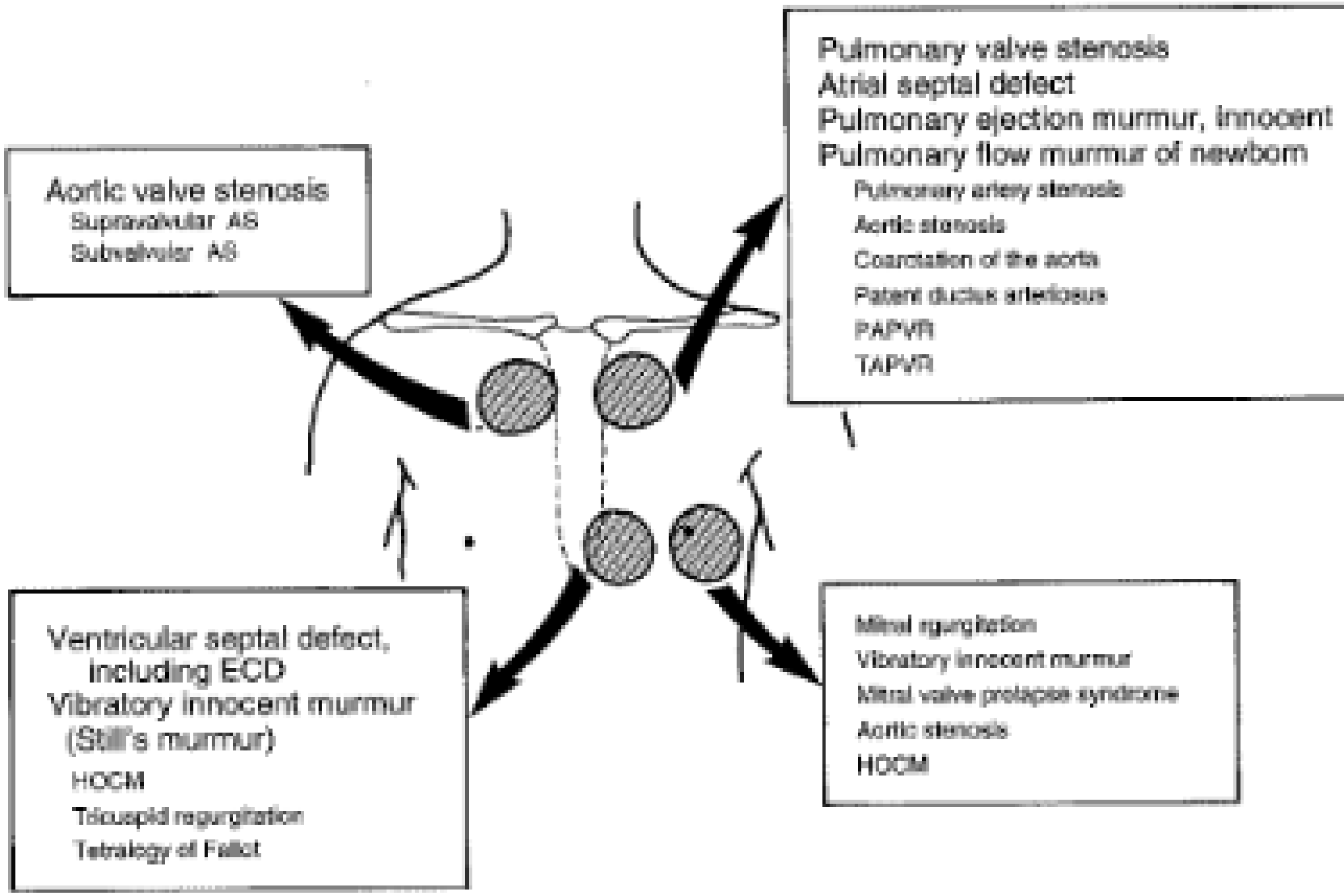
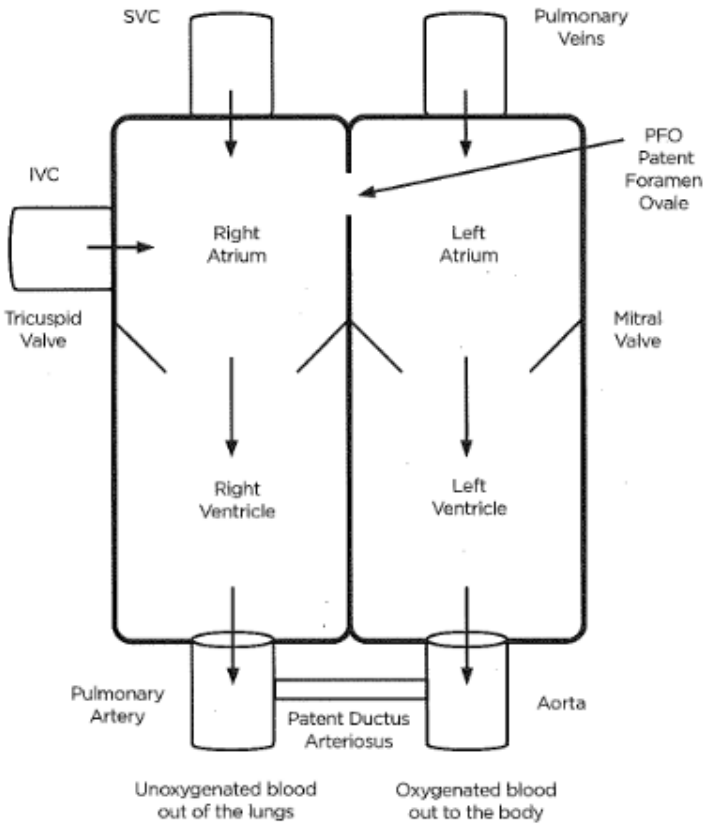
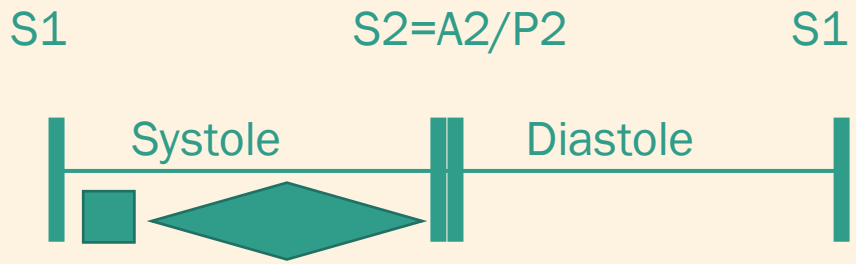


Fig. 2.12 Diagram showing systolic murmurs audible at various locations. Less common conditic
shown in smaller type (see Tables 2.5 to 2.8). *AS*, Aortic stenosis; *ECD*, endocardial cushion defect; *H*
ypertrophic obstructive cardiomyopathy; *PAPVR*, partial anomalous pulmonary venous return; *TAPV*
anomalous pulmonary venous return.


SVC
Pulmonary Veins
PFO Patent Foramen Ovale
IVC
Right Atrium
Left Atrium
Tricuspid Valve
Mitral Valve
Right Ventricle
Left Ventricle
Pulmonary Artery
Patent Ductus Arteriosus
Aorta
Unoxygenated blood out of the lungs
Oxygenated blood out to the body

Cardiac Cycle



S1 = closure of the mitral and tricuspid valves

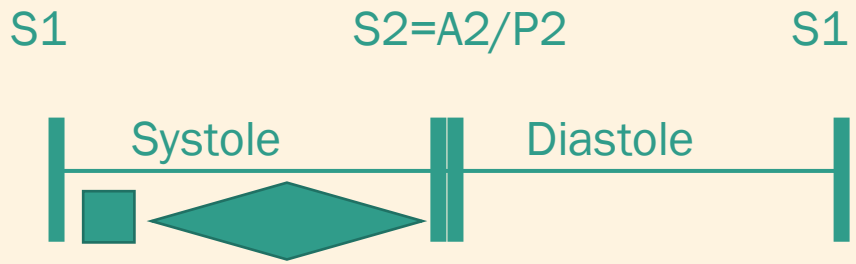
= isovolumetric contraction

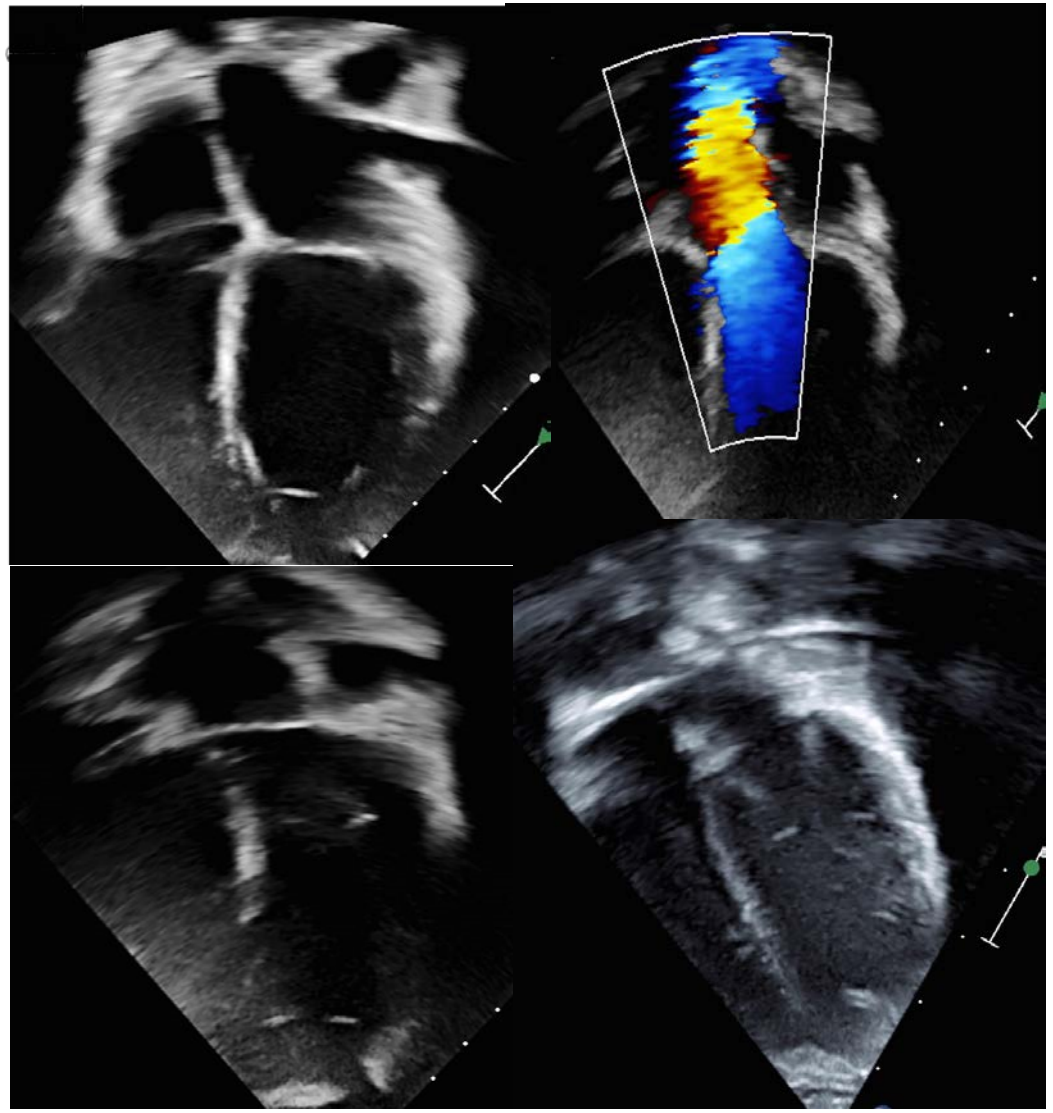
= ejection of blood through the aortic and pulmonary valves

S2 = closure of the aortic (A2) and pulmonary valves (P2). Aortic valve closes earlier. Physiologic splitting means that during normal respiration: during expiration the A2 and P2 sound as a single sound; but during inspiration more blood enters the heart and the pulmonary valve takes longer to close creating the splitting.

Diastole = the aortic and mitral valves are closed and the mitral and tricuspid valves are open with filling of the ventricles.

Cardiac Cycle





Scenario 1:

You are covering the newborn nursery and are called to examine a 2 day old infant with a heart murmur. The vital signs are stable with RR45, heart rate 140 bpm, Pox 98%. The murmur is a soft 2/6 systolic ejection murmur heard best at the upper left sternal border and radiates to the axilla bilaterally.

Question 1:

What is the most likely physiological cause of this murmur:

1. Aortic valve stenosis
2. Patent foramen ovale
3. Peripheral pulmonary stenosis
4. Coarctation of the aorta

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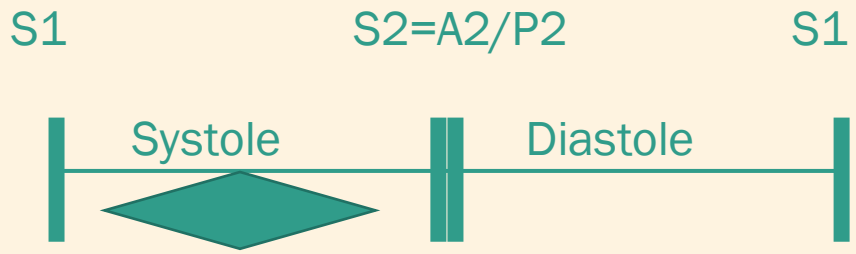
Peripheral pulmonary stenosis



Peripheral pulmonary stenosis - is an innocent murmur - as the patent ductus arteriosus closes after birth the flow across the pulmonary arteries advances from 10-15% of the cardiac output while in the womb to 100% upon ductal closure. This creates turbulent flow in the branched pulmonary arteries in upto or greater than 30% of normal healthy newborns. Best heard in the upper left sternal border and radiates to axillae. Typically a grade 1 or 2. This typically resolves in 3-6 months as the infant doubles in size the pulmonary arteries grow.

Question 2:

An echocardiogram is performed in this child and demonstrates normal newborn intracardiac anatomy with a patent foramen ovale, small patent ductus arteriosus and mild peripheral pulmonary stenosis. In discussing these findings with the mother, when would you tell her that the PDA typically closes.

1. Within 24 hours
2. Within 72 hours
3. Within 1 week
4. Within 1 year

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Answer

Dynamic Changes of Pulmonary Arterial Pressure and Ductus Arteriosus in Human Newborns From Birth to 72 Hours of Age

Chunmiao Kang, MD, Enfa Zhao, MD, Yinghua Zhou, MD, Huayun Zhao, MD, Yunyao Liu, BS, Ningning Gao, BS, Xiaoxin Huang, MD, and Baomin Liu, MD

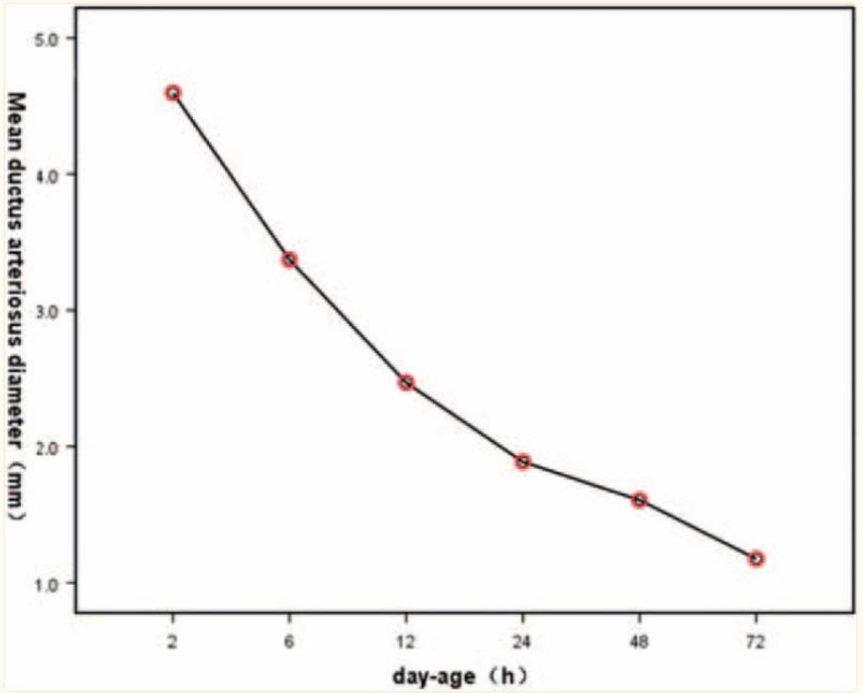

FIGURE 2

The line graph between day-age and mean value of ductus arteriosus diameter indicated that with the increasing of neonatal day-age, ductus arteriosus diameter decreased gradually.

"Our study results indicated that a gradual decrease in normal newborns ductus arteriosus diameter after birth, and 95% of them spontaneous closed within 24 to 72 h."

Scenario 2:

A two week old baby comes for normal newborn follow-up. Your partner examined the child in the newborn nursery and no murmur was present. Today the vitals are reassuring with RR 50, heart rate 150 bpm, and Pulse ox 100%, but a 2/6 holosystolic murmur is heard at the lower left sternal border.

Question 1:

What is the most likely cause of the holosystolic murmur in this newborn

1. Ventricular septal defect
2. Atrial septal defect
3. Patent ductus arteriosus
4. Ebstein’s anomaly with tricuspid regurgitation

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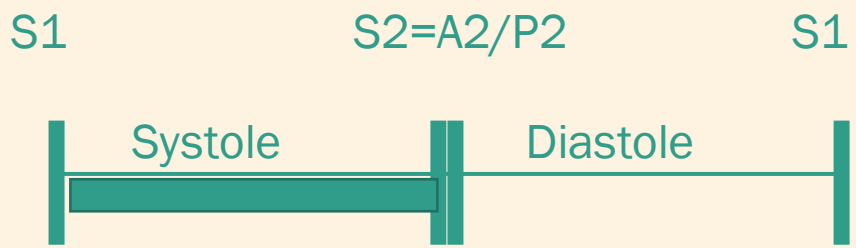
VSDs

J Am Coll Cardiol. 1995 Nov 15;26(6):1545-8. doi: 10.1016/0735-1097(95)00358-4.

High prevalence of muscular ventricular septal defect in neonates

N Roguin [1], Z D Du, M Barak, N Nasser, S Hershkowitz, E Milgram



VSDs are the most common form of congenital heart disease.

Conclusions: There is a prevalence of muscular ventricular septal defect in neonates of 53.2/1,000 live births. The patients were asymptomatic, and 88.9% had defects that closed spontaneously within 1 to 10 months.

Question 2:

Is your partner a bad doctor because they missed the murmur in the newborn nursery?

1. Yes
2. No
3. Maybe

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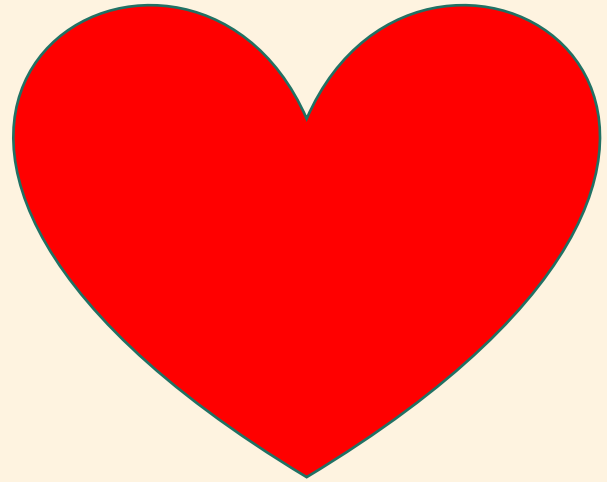

Answer:

Dynamic Changes of Pulmonary Arterial Pressure and Ductus Arteriosus in Human Newborns From Birth to 72 Hours of Age

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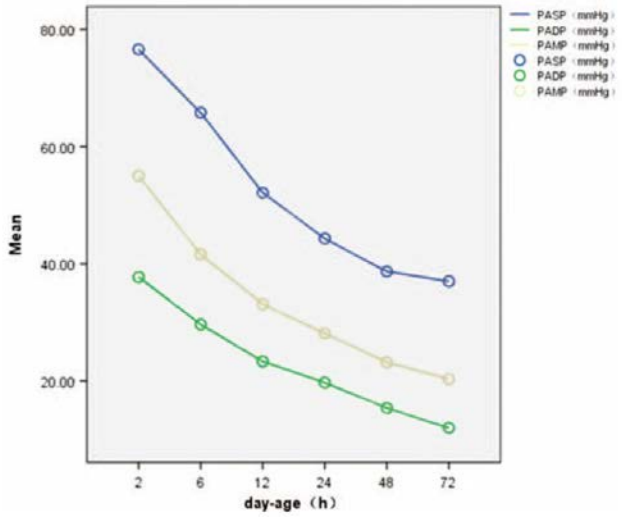
Your partner did not hear a murmur in the newborn nursery because the pulmonary vascular resistance was still high and now you are seeing the child at two weeks of life the pulmonary pressures have dropped so a ventricular septal defect can now shunt left to right.

FIGURE 3



The line graph between day-age and PASP, PADP, PAMP indicated that with the increasing of neonatal day-age, PASP, PADP, PAMP decreased gradually. PASP=pulmonary artery systolic pressure, PADP=pulmonary artery diastolic pressure, PAMP=mean pulmonary artery pressure.

Normal newborns pulmonary arterial pressure gradually decreased with increasing age, especially decreased sharply within 24 h, and then decreased gradually. And to 72 h after birth, newborns pulmonary artery systolic pressure (PASP: 37±4.97 mm Hg) was still higher than that of adult (PASP<30 mm Hg).

Scenario 3:

You are working in a clinic for migrant farm workers. An 8 year old child comes to the clinic for the first time after recently migrating to the United States. Mother states that as a younger child she has had multiple febrile episodes. Today on exam she has a RR 24, heart rate 80 bpm, and pulse ox 99%. There is a 3/6 holosystolic murmur that is audible at the apex and radiates to the back.

Question 1

What disease process is the most likely cause of her heart murmur?

1. Anomalous left coronary artery
2. Dilated cardiomyopathy
3. Ventricular septal defect
4. Rheumatic fever

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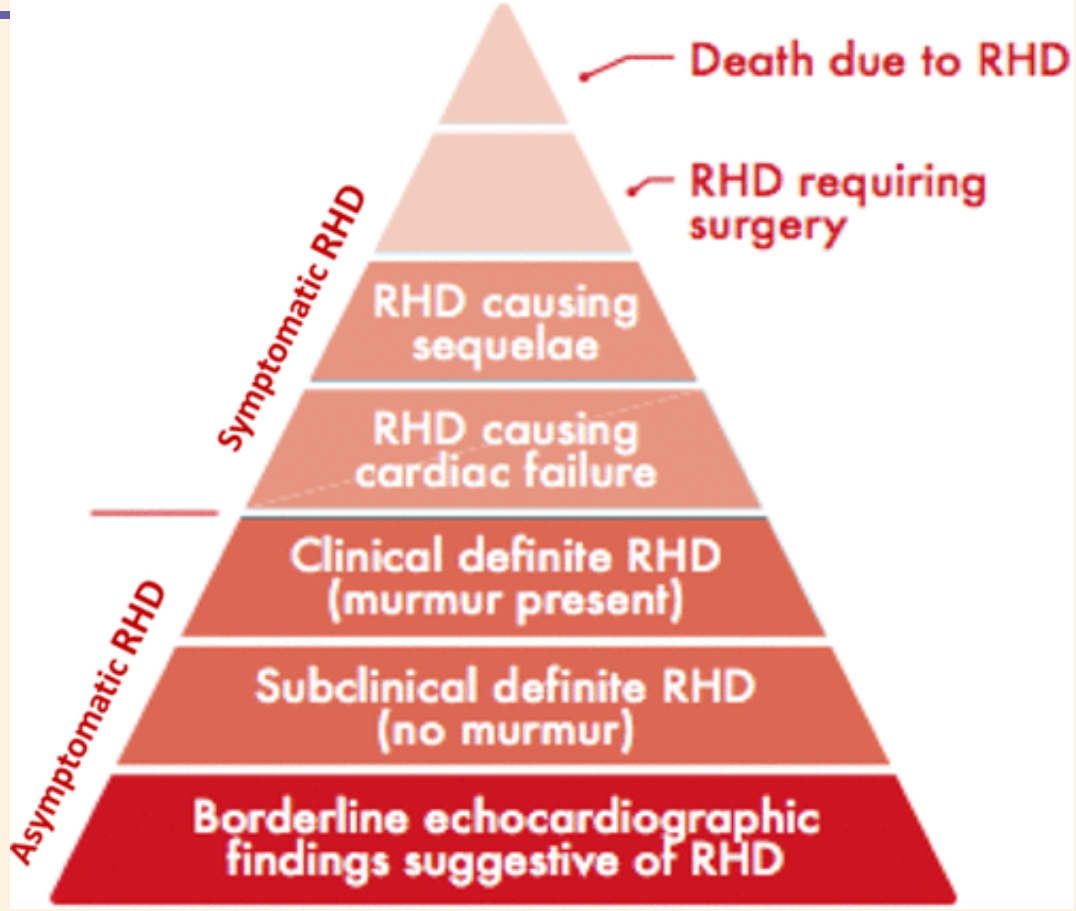


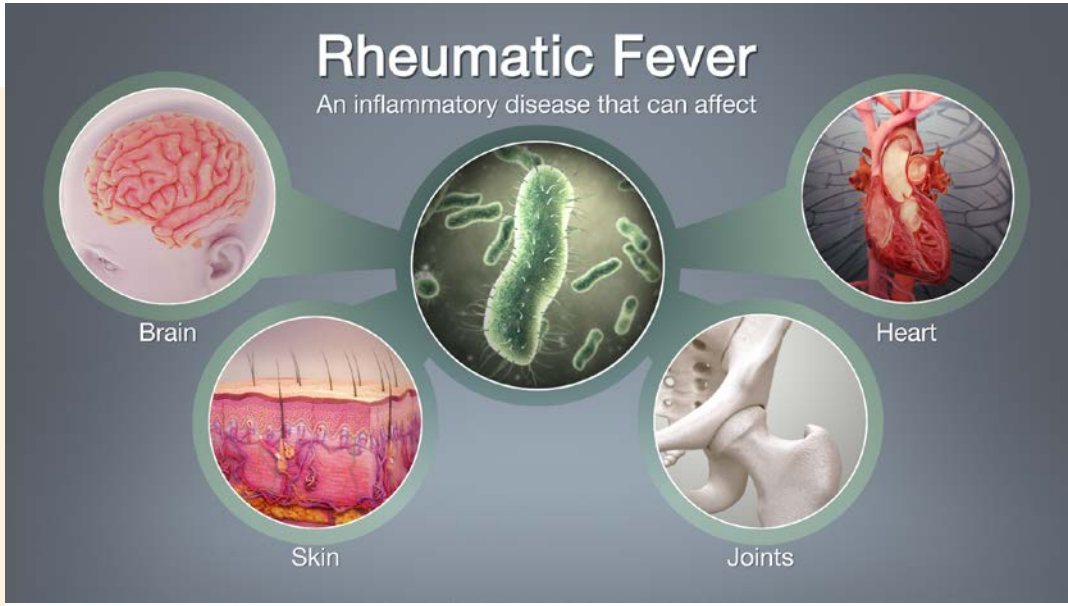
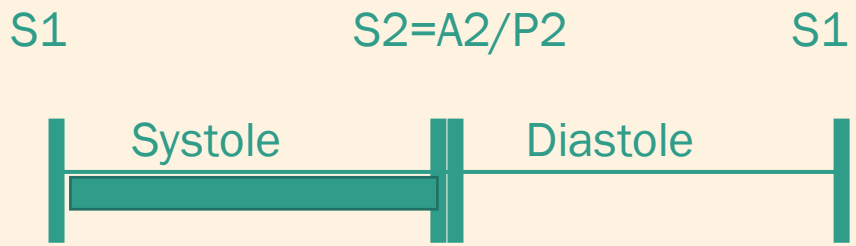


TABLE 74.2 2015 AHA-Revised Jones Criteria for Diagnosis of Rheumatic Fever*

MAJOR CRITERIA	
Low-Risk Populations	**Moderate- and High-Risk Populations**
Carditis (clinical or subclinical†)	Carditis (clinical or subclinical)
Arthritis (polyarthritis only)	Arthritis (including polyarthritis, monoarthritis, or polyarthralgia‡)
Chorea	Chorea
Erythema marginatum	Erythema marginatum
Subcutaneous nodules	Subcutaneous nodules
MINOR CRITERIA	
Low-Risk Populations	**Moderate- and High-Risk Populations**
Polyarthralgia	Monoarthralgia
Fever (≥38.5°C)	Fever (≥38°C)
ESR ≥60 mm in the first hour and/or CRP ≥3.0 mg/dL	ESR ≥30 mm in the first hour and/or CRP ≥3.0 mg/dL§
Prolonged PR interval, after accounting for age variability (unless carditis is a major criterion)	Prolonged PR interval, after accounting for age variability (unless carditis is a major criterion)

Rheumatic Heart Disease Causing Mitral Regurgitation



Contemporary Diagnosis and Management of Rheumatic Heart Disease: Implications for Closing the Gap: A Scientific Statement From the American Heart Association

Raman Krishna Kumar, Manuel J. Antunes, Andrea Beaton, Mariana Mirabel, Vuyisile T. Nkomo, Emmy Okello, Prakash Raj Regmi, Boglarka Reményi, Karen Sliwa-Hähnle , Liesl Joanna Zühlke, Craig Sable and ... See all authors

"The global burden of rheumatic heart disease continues to be significant although it is largely limited to poor and marginalized populations. In most endemic regions, affected patients present with heart failure."

Mitral and aortic regurgitation are most common and later in life stenosis may develop.

Scenario 4:

You are back working in a newborn nursery and a fullterm infant is born. Today on exam she has a RR 44, heart rate 130 bpm, and pulse ox 99%. There is a HARSH 3/6 systolic ejection murmur over the precordium with radiation to the axillae.

Question 1:

Your differential diagnosis could include all of the following except:

1. Tetralogy of Fallot
2. Critical pulmonary valve stenosis
3. Transposition of the great arteries

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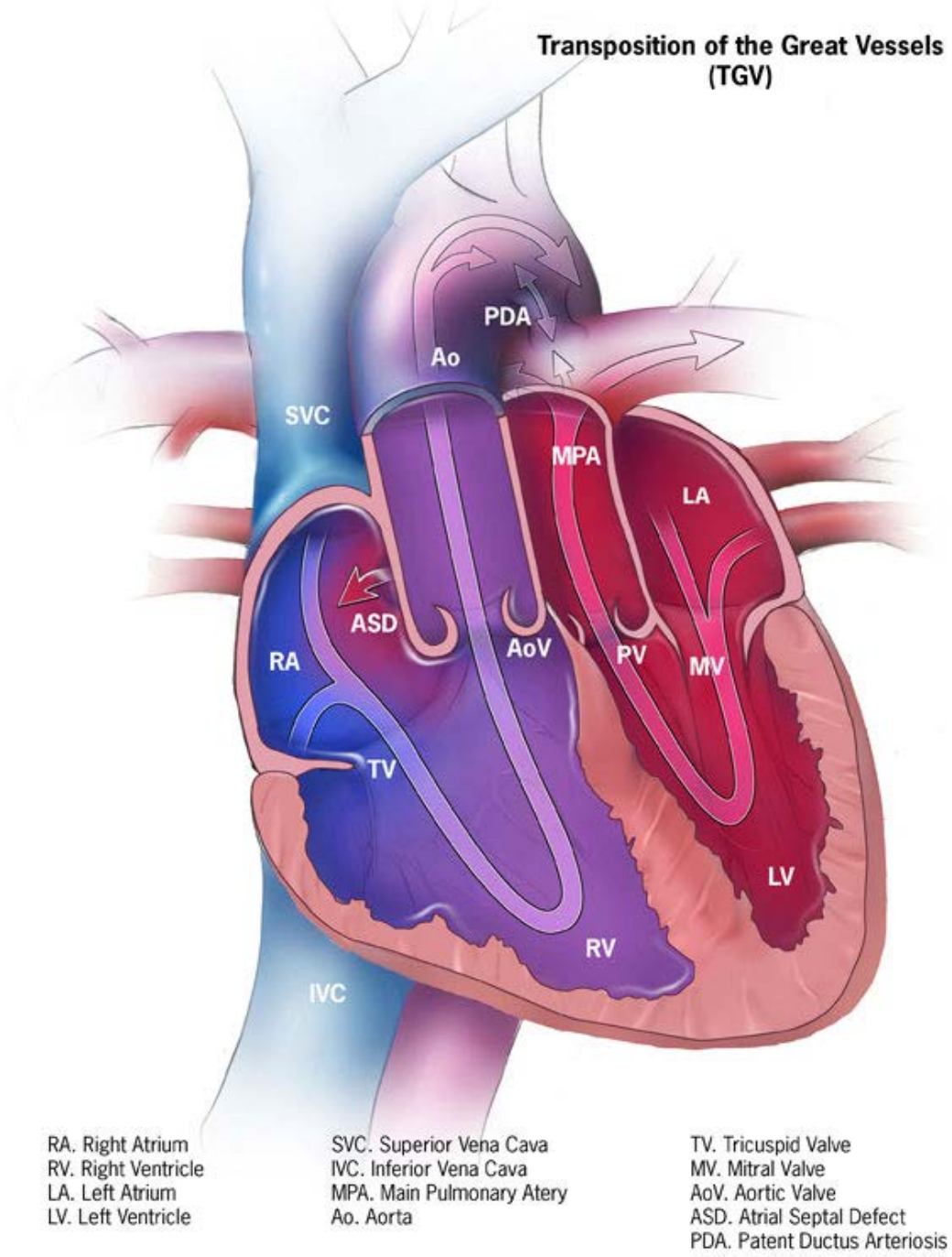
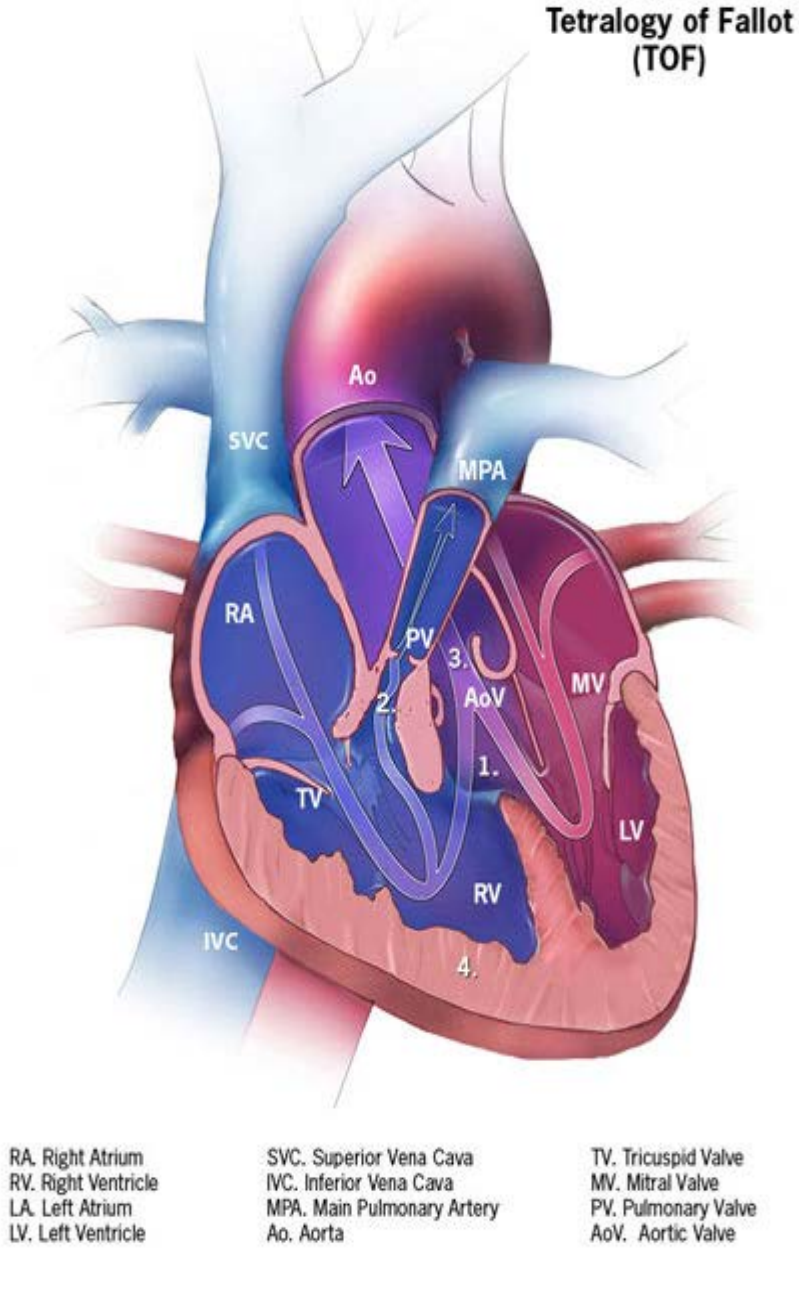
Answer

Images are courtesy of:

Centers for Disease Control and Prevention, National Center on Birth Defects and Developmental Disabilities





The END !

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