# Chapter 34: Alterations of Cardiovascular Function in Children

## MULTIPLE CHOICE

1. Most cardiovascular developments occur between which weeks of gestation?
   1. Fourth and seventh weeks c. Twelfth and fourteenth weeks
   2. Eighth and tenth weeks d. Fifteenth and seventeenth weeks

ANS: A

Cardiogenesis begins at approximately 3 weeks’ gestation; however, most cardiovascular development occurs between 4 and 7 weeks’ gestation.

PTS: 1 REF: Page 1194

1. The function of the foramen ovale in a fetus allows what to occur?
   1. Right-to-left blood shunting c. Blood flow from the umbilical cord
   2. Left-to-right blood shunting d. Blood flow to the lungs

ANS: A

The nonfused septum secundum and ostium secundum result in the formation of a flapped orifice known as the *foramen ovale*, which allows the right-to-left shunting necessary for fetal circulation. The foramen ovale is not involved in the blood flow described by the other options.

PTS: 1 REF: Pages 1195-1196

1. At birth, which statement is *true*?
   1. Systemic resistance and pulmonary resistance fall.
   2. Gas exchange shifts from the placenta to the lung.
   3. Systemic resistance falls and pulmonary resistance rises.
   4. Systemic resistance and pulmonary resistance rise.

ANS: B

From the available options, the only change that takes place in the circulation at birth is the shift of gas exchange from the placenta to the lungs.

PTS: 1 REF: Page 1197

1. When does systemic vascular resistance in infants begin to increase?
   1. One month before birth
   2. During the beginning stage of labor
   3. One hour after birth
   4. Once the placenta is removed from circulation

ANS: D

The low-resistance placenta is removed from circulation, which causes an immediate increase in systemic vascular resistance to approximately twice of that before birth.

PTS: 1 REF: Page 1197

1. Which event triggers congenital heart defects that cause acyanotic congestive heart failure?
   1. Right-to-left shunts c. Obstructive lesions
   2. Left-to-right shunts d. Mixed lesions

ANS: B

Congenital heart defects that cause acyanotic congestive heart failure usually involve left-to-right shunts (see Table 33-4). Acyanotic congestive heart failure does not involve any of the other options.

PTS: 1 REF: Pages 1201-1202 | Table 33-4

1. Older children with an unrepaired cardiac septal defect experience cyanosis because of which factor?
   1. Right-to-left shunts c. Obstructive lesions
   2. Left-to-right shunts d. Mixed lesions

ANS: A

Older children who have an unrepaired septal defect with a left-to-right shunt may become cyanotic because of pulmonary vascular changes secondary to increased pulmonary blood flow. None of the other options accurately describe the process that results in cyanosis.

PTS: 1 REF: Page 1202

1. Which congenital heart defects occur in trisomy 13, trisomy 18, and Down syndrome?
   1. Coarctation of the aorta (COA) and pulmonary stenosis (PS)
   2. Tetralogy of Fallot and persistent truncus arteriosus
   3. Atrial septal defect (ASD) andNdUeRxStrINocGaTrBd.iCaOM
   4. Ventricular septal defect (VSD) and patent ductus arteriosus (PDA)

ANS: D

Congenital heart defects that are related to dysfunction of trisomy 13, trisomy 18, and Down syndrome include VSD and PDA (see Table 33-2). The other defects are not associated with dysfunction of trisomy 13, trisomy 18, and Down syndrome.

PTS: 1 REF: Page 1200 | Table 33-2

1. An infant has a continuous machine-type murmur best heard at the left upper sternal border throughout systole and diastole, as well as a bounding pulse and a thrill on palpation. These clinical findings are consistent with which congenital heart defect?
   1. Atrial septal defect (ASD) c. Patent ductus arteriosus (PDA)
   2. Ventricular septal defect (VSD) d. Atrioventricular canal (AVC) defect

ANS: C

If pulmonary vascular resistance has fallen, then infants with PDA will characteristically have a continuous machine-type murmur best heard at the left upper sternal border throughout systole and diastole. If the PDA is significant, then the infant also will have bounding pulses, an active precordium, a thrill on palpation, and signs and symptoms of pulmonary overcirculation. The presentations of the other congenital heart defects are not consistent with the described the symptoms.

PTS: 1 REF: Pages 1203-1204

1. An infant has a crescendo-decrescendo systolic ejection murmur located between the second and third intercostal spaces along the left sternal border. A wide fixed splitting of the second heart sound is also found. These clinical findings are consistent with which congenital heart defect?
   1. Atrial septal defect (ASD) c. Patent ductus arteriosus (PDA)
   2. Ventricular septal defect (VSD) d. Atrioventricular canal (AVC) defect

ANS: A

Because most children with ASD are asymptomatic, diagnosis is usually made during a routine physical examination by the auscultation of a crescendo-decrescendo systolic ejection murmur that reflects increased blood flow through the pulmonary valve. The location of the murmur is between the second and third intercostal spaces along the left sternal border. A wide fixed splitting of the second heart sound is also characteristic of ASD, reflecting volume overload to the right ventricle and causing prolonged ejection time and a delay of pulmonic valve closure. The presentations of other congenital heart defects are not consistent with the described symptoms.

PTS: 1 REF: Pages 1204-1205

1. An infant has a loud, harsh, holosystolic murmur and systolic thrill that can be detected at the left lower sternal border that radiates to the neck. These clinical findings are consistent with which congenital heart defect?
   1. Atrial septal defect (ASD) c. Patent ductus arteriosus (PDA)
   2. Ventricular septal defect (VSD) d. Atrioventricular canal (AVC) defect

ANS: B

On physical examination, a loud, NhaUrRshS,INhGolToBs.yCsOtoMlic murmur and systolic thrill can be detected at the left lower sternal border. The intensity of the murmur reflects the pressure gradient across the VSD. An apical diastolic rumble may be present with a

moderate-to-large defect, reflecting increased flow across the mitral valve. The presentations of the other congenital heart defects are not consistent with the described symptoms.

PTS: 1 REF: Page 1205

1. Where can coarctation of the aorta (COA) be located?
   1. Exclusively on the aortic arch
   2. Proximal to the brachiocephalic artery
   3. Between the origin of the aortic arch and the bifurcation of the aorta in the lower abdomen
   4. Between the origin of the aortic arch and the origin of the first intercostal artery

ANS: C

COA can occur anywhere between the origin of the aortic arch and the bifurcation of the aorta in the lower abdomen. The other options do not accurately describe the location of a COA.

PTS: 1 REF: Page 1210

1. Classic manifestations of a systolic ejection murmur heard at the left interscapular area, cool mottled skin on the lower extremities but hypertension noted in the upper extremities, and decreased or absent femoral pulse are indicative of an older child with which congenital defect?
   1. Tetralogy of Fallot c. Ventricular septum defect (SD)
   2. Aortic stenosis d. Coarctation of the aorta (OA)

ANS: D

Clinical manifestations of coarctation of the aorta include hypertension noted in the upper extremities with decreased or absent pulses in the lower extremities. Children may also have cool mottled skin and occasionally experience leg cramps during exercise. A systolic ejection murmur, heard best at the left interscapular area, is also considered a classic clinical manifestation of this disorder. The other options are not initially associated with these symptoms.

PTS: 1 REF: Pages 1210-1212

1. What is the initial manifestation of aortic coarctation observed in a neonate?
   1. Congestive heart failure (CHF) c. Pulmonary hypertension
   2. Cor pulmonale d. Cerebral hypertension

ANS: A

Initially, the newborn usually exhibits symptoms of CHF. The other options are not initially associated with aortic coarctation.

PTS: 1 REF: Page 1212

1. Which compensatory mechanism NisUsRpSoInNtGanTeBo.CuOslMy used by children diagnosed with tetralogy of Fallot to relieve hypoxic spells?
   1. Lying on their left side c. Squatting
   2. Performing the Valsalva maneuver d. Hyperventilating

ANS: C

Squatting is a spontaneous compensatory mechanism used by older children to alleviate hypoxic spells. Squatting and its variants increase systemic resistance while decreasing venous return to the heart from the inferior vena cava. The other options would not result in these changes.

PTS: 1 REF: Page 1209

1. An infant diagnosed with a small patent ductus arteriosus (PDA) would likely exhibit which symptom?
   1. Intermittent murmur c. Need for surgical repair
   2. Lack of symptoms d. Triad of congenital defects

ANS: B

Infants with a small PDA usually remain asymptomatic; the other options are incorrect.

PTS: 1 REF: Pages 1203-1204

1. What is the most common cause of chronic sustained hypertension observed only in a newborn?
   1. Renal parenchymal disease c. Renal artery stenosis
   2. Primary hypertension d. Congenital renal malformation

ANS: D

Congenital renal malformation is a cause of chronic sustained hypertension in a newborn. Although renal artery stenosis is observed in newborns, it is also observed in older children. Renal parenchymal disease and primary hypertension are commonly observed in older children diagnosed with chronic sustained hypertension.

PTS: 1 REF: Page 1220 | Table 33-8

1. Which condition is consistent with the cardiac defect of transposition of the great vessels?
   1. The aorta arises from the right ventricle.
   2. The pulmonary trunk arises from the right ventricle.
   3. The right ventricle pumps blood to the lungs.
   4. An intermittent murmur is present.

ANS: A

Transposition of the great arteries refers to a condition in which the aorta arises from the right ventricle and the pulmonary artery arises from the left ventricle. A transposition of the great vessels is not associated with any of the other options.

PTS: 1 REF: Pages 1214-1215

1. Which scenario describes total anomalous pulmonary venous return?
   1. The foramen ovale closes after birth.
   2. Pulmonary venous return is to the right atrium.
   3. Pulmonary venous return is to the leftatrium.
   4. The left atrium receives oxygenated blood.

ANS: B

Total anomalous pulmonary venous return occurs when the pulmonary veins abnormally connect to the right side of the heart either directly or through one or more systemic veins that drain into the right atrium. None of the other options accurately describe the presentation of a total anomalous pulmonary venous return.

PTS: 1 REF: Page 1216

1. Which heart defect produces a systolic ejection murmur at the right upper sternal border that transmits to the neck and left lower sternal border?
   1. Coarctation of the aorta c. Aortic stenosis
   2. Pulmonic stenosis d. Hypoplastic left heart syndrome

ANS: C

Blood flow through the stenotic area of the aorta produces a systolic ejection murmur at the right upper sternal border that transmits to the neck and left lower sternal border. None of the other options produce the described assessment findings.

PTS: 1 REF: Page 1212

1. Which heart defect produces a systolic ejection click at the upper left sternal border with a thrill palpated at the upper left sternal border?
   1. Coarctation of the aorta (COA) c. Aortic stenosis
   2. Pulmonary stenosis (PS) d. Hypoplastic left heart syndrome

ANS: B

PS results in a systolic ejection murmur at the left upper sternal border, reflecting an obstruction to flow through the narrowed pulmonary valve. A variable systolic ejection click is present in some children, as well as valvular stenosis at the upper left sternal border. PS also produces a thrill that may be palpated at the upper left sternal border. None of the other options produce the described assessment findings.

PTS: 1 REF: Page 1213

1. Which heart defect results in a single vessel arising from both ventricles, providing blood to both the pulmonary and systemic circulations? a. Coarctation of the aorta
   1. Tetralogy of Fallot
   2. Total anomalous pulmonary connection
   3. Truncus arteriosus

ANS: D

Truncus arteriosus is the failure of the large embryonic artery, the truncus arteriosus, to divide into the pulmonary artery and the aorta, which results in a single vessel arising from both ventricles, providing blood flow to the pulmonary and systemic circulations. None of the other options produce the described structural malformation.

PTS: 1 REF: Page 1217

1. What is the suggested mean bloodNpUrResSsINurGeTfBo.rCaOnM8- to 9-year-old child?
   1. 104/55 mm Hg c. 112/62 mm Hg
   2. 106/58 mm Hg d. 121/70 mm Hg

ANS: B

The suggested mean blood pressure for an 8- to 9- year-old child is 106/58 mm Hg. For a child of 6 to 7 years old, 104/55 mm Hg is appropriate; for a 12- to 13-year-old child, 112/62 mm Hg is appropriate, and for a 16- to 18-year-old young man, 121/70 mm Hg is appropriate.

PTS: 1 REF: Page 1220 | Table 33-6

## MULTIPLE RESPONSE

1. What congenital heart defects are associated with intrauterine exposure to rubella?

*(Select all that apply.)*

* 1. Pulmonary stenosis (PS)
  2. Cardiomegaly
  3. Patent ductus arteriosus (PDA)
  4. Coarctation of aorta (COA)
  5. Ventricular septal defect (VSD)

ANS: A, C, D

PS, PDA, and COA are congenital heart defects associated with intrauterine exposure to rubella. Cardiomegaly and VSD are associated with maternal diabetes.

PTS: 1 REF: Page 1199 | Table 33-1

1. Which symptoms meet the diagnostic criteria for Kawasaki disease in a child? *(Select all that apply.)* 
   1. Fever for 5 days or longer
   2. “Strawberry tongue”
   3. Peripheral edema
   4. Inguinal lymphadenopathy
   5. Bilateral conjunctival infection

ANS: A, B, C, E

The child must exhibit five of the following six criteria: (1) fever for 5 days or longer, (2) bilateral conjunctival infection without exudation, (3) changes in oral mucus such as strawberry tongue, (4) a polymorphous rash, (5) cervical lymphadenopathy, and (6) changes in the extremities such as peripheral edema.

PTS: 1 REF: Page 1218 | Box 33-3

1. Which statements related to the ambulatory blood pressure monitoring (ABPM) system with children are *true*? *(Select all that apply.)* 
   1. ABPM monitors blood pressure for a 24-hour period.
   2. ABPM assists in identifying children with *white coat hypertension*.
   3. ABPM is effective in identifying children at risk for target organ damage
   4. ABPM assists in identifying children who demonstrate *masked hypertension*.
   5. ABPM is effective in determining blood pressure load or hypertension for at least 48 hours.

ANS: A, B, C, D

ABPM records blood pressure over a 24-hour period to help identify those children with white coat hypertension and masked hypertension. ABPM is useful in documenting the *blood pressure load*, which is the total amount of time the blood pressure is elevated above normal limits during a 24-hour period. By measuring blood pressure load, the ABPM may be able to identify those children who are at greatest risk for target organ damage.

PTS: 1 REF: Page 1221 | What's New box

## MATCHING

*Match the phrases with the corresponding terms.*

1. Causes atrial separation
2. Gap between the septum primum and the septum secundum
3. Conal portion of the ventricular septum
4. Abnormal communication between the atria
5. Allows right-to-left shunting
6. Atrial septal defect
7. Foramen ovale
8. Septum secundum
9. Ostium primum
10. Bulbus cordis

1. ANS: D PTS: 1 REF: Page 1196

MSC: An atrial septal defect is an abnormal communication between the atria.

1. ANS: E PTS: 1 REF: Pages 1195-1196

MSC: The nonfused septum secundum and ostium secundum result in the formation of a flapped orifice known as the foramen ovale, which allows the right-to-left shunting necessary for fetal circulation.

1. ANS: A PTS: 1 REF: Pages 1195-1196

MSC: The septum secundum is also a fenestrated, membranelike structure located anteriorly that grows toward the endocardial cushions. During fetal development, this structure does not completely fuse with the endocardial cushions, which results in atrial separation.

1. ANS: B PTS: 1 REF: Page 1195

MSC: The septum primum forms along the posterior wall of the common atrium and grows downward toward the septum secundum. The gap between the two structures, known as the ostium primum, normally closes by extensions from the endocardial cushions.

1. ANS: C PTS: 1 REF: Page 1196

MSC: The conal portion of the ventricular septum that separates the aorta from the pulmonary artery forms from the bulbus cordis.