# Chapter 37: Alterations of Pulmonary Function in Children

## MULTIPLE CHOICE

1. How does chest wall compliance in an infant differ from that of an adult?

𝛼. An adult’s chest wall compliance is lower than an infant’s. 𝗉. An adult’s chest wall compliance is higher than an infant’s.

* 1. An adult’s chest wall compliance is the same as an infant’s. 𝛿. An adult’s chest wall compliance is dissimilar to that of an infant’s.

ANS: A

Chest wall compliance is higher in infants than it is in adults, particularly in premature infants.

PTS: 1 REF: Page 1292

1. Why is nasal congestion a serious threat to young infants?

𝛼. Infants are obligatory nose breathers.

𝗉. Their noses are small in diameter.

* 1. Infants become dehydrated when mouth breathing.

𝛿. Their epiglottis is proportionally greater than the epiglottis of an adult’s.

ANS: A

Infants up to 2 to 3 months of age are obligatory nose breathers and are unable to breathe in through their mouths. Nasal congestion is therefore a serious threat to a young infant. This selection is the only option that accurately describes why nasal congestion is a serious threat to young infants.

PTS: 1 REF: Page 1290

1. The risk for respiratory distress syndrome (RDS) decreases for premature infants when they are born between how many weeks of gestation?

𝛼. 16 and 20 c. 24 and 30 𝗉. 20 and 24 d. 30 and 36

ANS: D

Surfactant is secreted into fetal airways between 30 and 36 weeks. The other options are not true regarding the timeframe when the risk for RDS decreases.

PTS: 1 REF: Page 1292

1. Which type of croup is most common?

𝛼. Bacterial c. Fungal

𝗉. Viral d. Autoimmune

ANS: B

In 85% of children with croup, a virus is the cause, most commonly parainfluenza. However, other viruses such as influenza A or respiratory syncytial virus (RSV) also can cause croup.

PTS: 1 REF: Pages 1295-1296

1. What is the chief predisposing factor for respiratory distress syndrome (RDS) of the newborn?

𝛼. Low birth weight

𝗉. Alcohol consumption during pregnancy c. Premature birth

𝛿. Smoking during pregnancy

ANS: C

RDS of the newborn, also known as hyaline membrane disease (HMD), is a major cause of morbidity and mortality in premature newborns. None of the other options are considered the chief predisposing factors for RDS.

PTS: 1 REF: Page 1301

1. What is the primary cause of respiratory distress syndrome (RDS) of the newborn?

𝛼. Immature immune system c. Surfactant deficiency

𝗉. Small alveoli d. Anemia

ANS: C

RDS is primarily caused by surfactant deficiency and secondarily by a deficiency in alveolar surface area for gas exchange. None of the other options are related to the cause of RDS.

PTS: 1 REF: Page 1301

1. What is the primary problem resulting from respiratory distress syndrome (RDS) of the newborn? 𝛼. Consolidation c. Atelectasis 𝗉. Pulmonary edema d. Bronchiolar plugging

ANS: C

The primary problem is atelectasis, which causes significant hypoxemia and is difficult for the neonate to overcome because a significant negative inspiratory pressure is required to open the alveoli with each breath. None of the other options are considered a primary problem associated with RDS.

PTS: 1 REF: Page 1301

1. Which option shows the correct sequence of events after atelectasis develops in respiratory distress syndrome of the newborn?

𝛼. Increased pulmonary vascular resistance, atelectasis, hypoperfusion 𝗉. Hypoxic vasoconstriction, right-to-left shunt hypoperfusion c. Respiratory acidosis, hypoxemia, hypercapnia

𝛿. Right-to-left shunt, hypoxic vasoconstriction, hypoperfusion

ANS: B

Atelectasis results in a decrease in tidal volume, causing alveolar hypoventilation and hypercapnia. Hypoxia and hypercapnia cause pulmonary vasoconstriction, which increases intrapulmonary resistance and shunting. This results in hypoperfusion of the lung and a decrease in effective pulmonary blood flow. This selection is the only option that identifies the correct sequence of events.

PTS: 1 REF: Page 1301

1. Which statement about the advances in the treatment of respiratory distress syndrome (RDS) of the newborn is *incorrect*?

𝛼. Administering glucocorticoids to women in preterm labor accelerates the maturation of the fetus’s lungs.

𝗉. Administering oxygen to mothers during preterm labor increases their arterial oxygen before the birth of the fetus.

* 1. Treatment includes the instillation of exogenous surfactant down an endotracheal tube of infants weighing less than 1000 g.

𝛿. Using continuous positive airway pressure (CPAP) supports the infant’s respiratory function.

ANS: B

Administering oxygen to the mother is not a valid treatment of RDS. The other statements provide correct information regarding RDS.

PTS: 1 REF: Pages 1301-1303

1. Bronchiolitis tends to occur during the first years of life and is most often caused by what type of infection?

𝛼. Respiratory syncytial virus (RSV) c. Adenoviruses

𝗉. Influenzavirus d. Rhinovirus

ANS: A

The most common associated pathogen is RSV, but bronchiolitis may also be associated with adenovirus, rhinovirus, influeNnUzRaS, IpNaGraTiBn.fCluOeMnza virus (PIV), and *Mycoplasma pneumoniae*.

PTS: 1 REF: Page 1305

1. Which immunoglobulin (Ig) is present in childhood asthma?

𝛼. IgM c. IgE

𝗉. IgG d. IgA

ANS: C

Included in the long list of asthma-associated genes are those that code for increased levels of immune and inflammatory mediators (e.g., interleukin [IL]–4, IgE, leukotrienes), nitric oxide, and transmembrane proteins in the endoplasmic reticulum. None of the other options are associated with childhood asthma.

PTS: 1 REF: Pages 1308-1309

1. Which T-lymphocyte phenotype is the key determinant of childhood asthma?

𝛼. Cluster of differentiation (CD) 4 T-helper Th1 lymphocytes 𝗉. CD4 T-helper Th2 lymphocytes c. CD8 cytotoxic T lymphocytes 𝛿. Memory T lymphocytes

ANS: B

Asthma develops because the Th2 response (in which CD4 T-helper cells produce specific cytokines, such as interleukin [IL]–4, IL-5, and IL-13) promotes an atopic and allergic response in the airways. This selection is the only option that accurately identifies the appropriate T-lymphocyte phenotype.

PTS: 1 REF: Page 1309

1. Which cytokines activated in childhood asthma produce an allergic response?

𝛼. Interleukin (IL)–1, IL-2, and interferon-alpha (IFN-𝛼) 𝗉. IL-8, IL-12, and tumor necrosis factor-alpha (TNF-𝛼) c. IL-4, IL-10, and colony-stimulating factor (CSF) 𝛿. IL-4, IL-5, and IL-13

ANS: D

Related to asthma, IL-4 and IL-13 are particularly important for B-cell switching to favor immunoglobulin E (IgE) production, and IL-5 is crucial for local differentiation and enhanced survival of eosinophils within the airways. This selection is the only option that accurately describes how cytokines produce a childhood asthmatic response.

PTS: 1 REF: Page 1309

1. Which statement accurately describes childhood asthma?

𝛼. An obstructive airway disease characterized by reversible airflow obstruction, bronchial hyperreactivity, and inflammation

𝗉. A pulmonary disease characterized by severe hypoxemia, decreased pulmonary compliance, and diffuse densities on chest x-ray imaging

* 1. A pulmonary disorder involvinNgURanSIaNbGnToBrm.CaOlMexpression of a protein, producing viscous mucus that lines the airways, pancreas, sweat ducts, and vas deferens

𝛿. An obstructive airway disease characterized by atelectasis and increased pulmonary resistance as a result of a surfactant deficiency

ANS: A

Asthma is an obstructive airway disease characterized by reversible airflow obstruction, bronchial hyperreactivity, and inflammation. This selection is the only option that accurately describes childhood asthma.

PTS: 1 REF: Page 1308

1. Which criterion is used to confirm a diagnosis of asthma in an 8-year-old child?

𝛼. Parental history of asthma

𝗉. Serum testing that confirms increased immunoglobulin E (IgE) and eosinophil levels

* 1. Reduced expiratory flow rates confirmed by spirometry testing 𝛿. Improvement on a trial of asthma medication

ANS: C

Confirmation of the diagnosis of asthma relies on pulmonary function testing using spirometry, which can be accomplished only after the child is 5 to 6 years of age. Reduced expiratory flow rates that are reversible in response to an inhaled bronchodilator would be characteristic abnormalities. For younger children, an empiric trial of asthma medications is commonly initiated. The remaining options are major historical and physical factors that contribute but do not confirm the diagnosis of asthma in children.

PTS: 1 REF: Pages 1309-1310

1. Which statement best describes acute respiratory distress syndrome (ARDS)?

𝛼. An obstructive airway disease characterized by reversible airflow obstruction, bronchial hyperreactivity, and inflammation

𝗉. A pulmonary disease characterized by severe hypoxemia, decreased pulmonary compliance, and the presence of bilateral infiltrates on chest x-ray imaging

* 1. A respiratory disorder involving an abnormal expression of a protein producing viscous mucus that lines the airways, pancreas, sweat ducts, and vas deferens

𝛿. A pulmonary disorder characterized by atelectasis and increased pulmonary resistance as a result of a surfactant deficiency

ANS: B

ARDS is a condition that can result from either a direct or indirect pulmonary insult. It is defined as respiratory failure of acute onset characterized by severe hypoxemia that is refractory to treatment with supplemental oxygen, bilateral infiltrates on chest x-ray imaging, and no evidence of heart failure, as well as decreased pulmonary compliance. This selection is the only option that accurately describes ARDS.

PTS: 1 REF: Page 1310

1. When considering the signs and symptoms of acute respiratory distress syndrome (ARDS), the absence of which condition is considered characteristic?

𝛼. Progressive respiratory distress c. Decreased pulmonary compliance 𝗉. Bilateral infiltrates d. Heart failure

ANS: D

ARDS is characterized by progressive respiratory distress, severe hypoxemia refractory to treatment with supplemental oxygen, decreased pulmonary compliance, bilateral infiltrates on chest x-ray imaging, and no evidence of heart failure.

PTS: 1 REF: Page 1310

1. Examination of the throat in a child demonstrating signs and symptoms of acute epiglottitis may contribute to which life-threatening complication? 𝛼. Retropharyngeal abscess c. Rupturing of the tonsils

𝗉. Laryngospasms d. Gagging induced aspiration

ANS: B

Examination of the throat may trigger laryngospasm and cause respiratory collapse. Death may occur in a few hours. This selection is the only option that accurately identifies the life-threatening complication that can result from an examination of the throat of a child who demonstrates the signs and symptoms of acute epiglottitis.

PTS: 1 REF: Page 1297

1. Which statement best describes cystic fibrosis?

𝛼. Obstructive airway disease characterized by reversible airflow obstruction, bronchial hyperreactivity, and inflammation

𝗉. Respiratory disease characterized by severe hypoxemia, decreased pulmonary compliance, and diffuse densities on chest x-ray imaging

* 1. Pulmonary disorder involving an abnormal expression of a protein-producing viscous mucus that obstructs the airways, pancreas, sweat ducts, and vas deferens

𝛿. Pulmonary disorder characterized by atelectasis and increased pulmonary resistance as a result of a surfactant deficiency

ANS: C

Cystic fibrosis is best described as a pulmonary disorder involving an abnormal expression of a protein-producing viscous mucus that obstructs the airways, pancreas, sweat ducts, and vas deferens. This selection is the only option that accurately describes cystic fibrosis.

PTS: 1 REF: Pages 1310-1311

1. Cystic fibrosis is caused by which process?

𝛼. Autosomal recessive inheritance c. Infection

𝗉. Autosomal dominant inheritance d. Malignancy

ANS: A

Cystic fibrosis is an autosomal recessive inherited disorder that is associated with defective epithelial ion transport. None of the other options cause cystic fibrosis.

PTS: 1 REF: Page 1310

1. What are the abnormalities in cytokines found in children with cystic fibrosis (CF)? 𝛼. Deficit of interleukin (IL)–1 and an excess of IL-4, IL-12, and interferon-alpha

(IFN-𝛼

𝗉. Deficit of IL-6 and an excess of IL-2, IL-8, and granulocyte colony-stimulating factor (G-CSF)

* 1. Deficit of IL-10 and an excess of IL-1, IL-8, and TNF-𝛼

𝛿. Deficit of IL-3 and an excess of IL-14, IL-24, and colony-stimulating factor (CSF)

ANS: C

Abnormal cytokine profiles have been documented in CF airway fluids, including deficient IL-10 and excessive IL-1, IL-8, and TNF-𝛼, all changes conducive to promoting inflammation. This selection is the only option that accurately identifies the abnormalities in cytokines observed in children with CF.

PTS: 1 REF: Pages 1311-1312

1. Between which months of age does sudden infant death syndrome (SIDS) most often occur?

𝛼. 0 and 1 c. 5 and 6 𝗉. 2 and 4 d. 6 and 7

ANS: B

The incidence of SIDS is low during the first month of life but sharply increases in the second month of life, peaking at 2 to 4 months and is unusual after 6 months of age.

PTS: 1 REF: Page 1313

1. Where in the respiratory tract do the majority of foreign objects aspirated by children finally lodge?

𝛼. Trachea c. Bronchus

𝗉. Left lung d. Bronchioles

ANS: C

Approximately 75% of aspirated foreign bodies lodge in a bronchus. The other options are not locations where children aspirate the majority of foreign objects.

PTS: 1 REF: Page 1298

1. What is the most common predisposing factor to obstructive sleep apnea in children?

𝛼. Chronic respiratory infections c. Obligatory mouth breathing 𝗉. Adenotonsillar hypertrophy d. Paradoxic breathing

ANS: B

In otherwise healthy children, the most common predisposing factor is adenotonsillar hypertrophy, which causes physical impingement on the nasopharyngeal airway. The other options are not associated with obstructive sleep apnea in children.

PTS: 1 REF: Page 1300

## MULTIPLE RESPONSE

1. Which statement is *true* regarding alveoli? *(Select all that apply.)* 𝛼. The number of functioning alveoli is determined by birth. 𝗉. The alveoli begin to increase in size starting at 8 years of age. c. The complexity of the alveoli increases into adulthood.

𝛿. These structures produce surfactant.

. Capillaries are the origin of alveoli.

ANS: B, C, E

Capillaries grow into the distal respiratory units that keep subdividing (alveolarization) to maximize the surface area for gas exchange. The number of alveoli continues to increase during the first 5 to 8 years of life, after which the alveoli increase in size and complexity. Surfactant is a lipid-protein mix that is produced by type II alveolar cells.

PTS: 1 REF: Page 1291

1. Children diagnosed with chronic asthma are likely to exhibit which symptoms? *(Select all that apply.)*

𝛼. Nasal flaring

𝗉. Musical expiratory wheezing

c. Clubbing of fingers and toes

𝛿. Substernal retractions . Diaphoresis

ANS: A, B, D, E

On physical examination, expiratory wheezing that is often described as high pitched and musical is exhibited, along with prolongation of the expiratory phase of the respiratory cycle. Hyperinflation is sometimes visible. The respiratory rate is elevated, as is the heart rate. Nasal flaring and accessory muscle use are evident, with retractions in the substernal, subcostal, intercostal, suprasternal, or sternocleidomastoid areas. Infants may appear to be “head bobbing” because of sternocleidomastoid muscle use. Pulsus paradoxus may also be present. The child may appear anxious or diaphoretic, which are important signs of respiratory compromise. Clubbing of fingers and toes is not typically associated with asthma.

PTS: 1 REF: Page 1309

1. Which symptom is *not* a clinical manifestation of croup?

𝛼. Rhinorrhea

𝗉. Sore throat

c. Low-grade fever

𝛿. Barking cough

. Coarse rhonchi

ANS: E

Typically, a prodrome of rhinorrhea, sore throat, and low-grade fever is exhibited for a few days with croup. The child then develops the characteristic harsh (seal-like) barking cough, hoarse voice, and inspiratory stridor. Rhonchi are associated with lower respiratory diseases.

PTS: 1 REF: Page 1295

1. What are the clinical manifestations of bacterial pneumonia in children? *(Select all that apply.)*

𝛼.Fever with chills 𝗉. Productive cough c. Dyspnea

𝛿. Respiratory alkalosis

. Malaise

ANS: A, B, C, E

The clinical presentation of bacterial pneumonia, particularly pneumococcal, may include a preceding viral illness, followed by fever with chills and rigors, shortness of breath, and an increasingly productive cough. Auscultation usually reveals such abnormalities as crackles or decreased breath sounds. Other less specific findings may include malaise, emesis, abdominal pain, and chest pain. Respiratory alkalosis is not usually associated with bacterial pneumonia in children.

PTS: 1 REF: Page 1306

## MATCHING

*Match the sound of stridor with the location of the problem.*

A. Sonorous snoring

1. Muffled voice
2. High-pitched inspiratory sound, voice change, hoarse
3. Expiratory stridor or monophonic wheeze
4. Inspiratory wheezes
5. Tracheal problems
6. Laryngeal problems
7. Upper trachea obstruction
8. Nasopharyngeal obstruction, such as adenotonsillar hypertrophy.
9. Supralaryngeal obstructions

1. ANS: D PTS: 1 REF: Page 1293

MSC: Expiratory stridors or monophonic wheezes suggest tracheal problems.

1. ANS: C PTS: 1 REF: Page 1294

MSC: Abnormalities of voice or cry (weak or hoarse) suggest problems at the larynx.

1. ANS: E PTS: 1 REF: Page 1298

MSC: Foreign bodies lodged in the upper trachea typically produce inspiratory stridor.

1. ANS: A PTS: 1 REF: Page 1293

MSC: Sonorous snoring is associated with nasopharyngeal obstruction, such as adenotonsillar hypertrophy.

1. ANS: B PTS: 1 REF: Page 1294

MSC: Muffling of the voice, especially in an acute condition, suggests supralaryngeal obstruction, such as epiglottitis or retropharyngeal abscess.