Asthma: Child/Adolescent

Description/Etiology
Asthma, a chronic respiratory disorder characterized by reversible airflow obstruction secondary to inflammation and narrowing of the airways, is the most common chronic disease in childhood and adolescence worldwide. The exact cause of asthma is unknown; both genetic and environmental components are thought to be involved in its pathogenesis (for details, see Risk Factors below). Asthma is a major cause of childhood morbidity and is associated with school absenteeism, emergency department (ED) and acute care visits, and hospitalizations.

Asthma in both adults and children is classified based on symptom frequency and severity as intermittent, mild persistent, moderate persistent, and severe persistent. Status asthmaticus (i.e., a severe prolonged asthma attack) is a medical emergency because it can cause respiratory failure and death (for more information, see Quick Lesson About ... Status Asthmaticus).

Treatment of asthma in children is similar to that in adults and consists of an individualized regimen of short- and long-acting corticosteroids and β₂-agonists. Children and family members are educated on the importance of strict adherence to the prescribed treatment regimen, frequent medical surveillance, daily in-home monitoring of symptoms, correct use of nebulizers/inhalers and symptom monitoring devices, and avoidance of asthma triggers. The treatment team might include specialty clinicians in internal medicine, pulmonology, allergy, and respiratory therapy. (For more information regarding asthma, including the importance of having a physician-prescribed action plan for handling acute exacerbations, see the series of related Quick Lessons, Evidence-Based Care Sheets, and Nursing Practice & Skills.)

Facts and Figures
In the United States, asthma affects nearly 7 million children, or about 10% of the pediatric population. Between 50% and 80% of children with asthma developed the condition before 5 years of age. Boys are affected more often than girls; this difference disappears during adolescence. Black, American Indian, Alaska Native, Puerto Rican, and Filipino children have a higher prevalence of asthma than White children. About 50% of persons who have asthma in childhood will be asymptomatic by adulthood.

Risk Factors
Children living in urban areas and from low-income families are more likely to develop asthma. Risk factors for asthma include parental history of asthma, obesity (for details, see Food for Thought below), low birthweight, and some medical conditions (e.g., rhinitis, sinusitis, and gastroesophageal reflux disease [GERD]). Triggers of asthma include allergic reactions (e.g., to pollen, mold, dust mites, cockroaches, or animal dander), hypersensitivity (e.g., allergic rhinitis), respiratory infection (e.g., influenza, colds, pneumonia, bronchiolitis), exercise, medications (e.g., NSAIDs), and exposure to environmental factors (e.g., mold; secondhand smoke; fumes from household cleaning agents, paint, cedar pollen and dust, formaldehyde, and scented products; air pollution; ozone; cold temperatures; high humidity).
Signs and Symptoms/Clinical Presentation

Signs and symptoms of asthma in childhood and adolescence are intermittent dry coughing, wheezing, intermittent nonfocal chest pain in younger children, chest tightness and shortness of breath in older children, tachypnea, tachycardia, hypoxia, fatigue, and difficulty keeping up with the activity level of peers.

Assessment

› Patient History
  • Ask about family history of asthma; assess risk factors and ask about patient history of asthma attacks, hospitalizations, medication use, and coexisting medical conditions

› Physical Findings of Particular Interest
  • Tachypnea, dry cough, wheezing, mucus production, and tachycardia are usual

› Laboratory Tests That May Be Ordered
  • CBC with differential showing an increased number of immature leukocytes (left shift) can indicate bacterial infection
  • Sputum culture can indicate bacterial infection
  • Increased eosinophil count and serum IgE levels are indicative of allergic reaction
  • ABGs: Oxygen saturation, CO₂ content, and pH levels determine asthma severity. Mild asthma is characterized by ↓ PaO₂, ↓ PaCO₂, and ↑ pH; moderate asthma by normal PaCO₂ and pH and ↓ PaO₂; and severe asthma by ↓ PaO₂, ↓ pH, and ↑ PaCO₂
  • Exhaled nitric oxide (FeNO) test can indicate the extent of airway inflammation
    –Routine monitoring is not recommended in children per Canadian Thoracic Society guidelines; Australian guidelines state that using FeNO to adjust corticosteroid dosage is of limited use and might lead to higher doses

› Other Diagnostic Tests/Studies
  • Pulmonary function tests identify peak expiratory flow rate (PEFR), forced expiratory volume in 1 second (FEV₁), and forced vital capacity (FVC); PEFR is based on weight, height, gender, and age and is appropriate for testing children ≥ 6 years of age
  • Radioallergosorbent test (RAST) can be performed to identify allergens
  • Pulse oximetry typically indicates hypoxia during acute attacks
  • Chest X-rays might show thoracic hyperinflation and peribronchial thickening

Treatment Goals

› Promote Optimal Respiratory Status and Reduce Risk for Complications
  • Monitor vital signs (particularly respiration), pulse oximetry, pulmonary function test results, and ABG results; administer prescribed treatment for asthma severity level
    – Intermittent asthma
      - Patients ≤ 5 years of age: Administer a short-acting β₂-agonist (SABA) by face mask with spacer/holding chamber or nebulizer or an oral β₂-agonist as needed
      - Patients > 5 years of age: Daily medication might not be necessary and a SABA is prescribed as needed
    – Mild persistent asthma
      - Patients ≤ 5 years of age: Administer daily low-dose inhaled corticosteroids (ICS; e.g., a metered dose inhaler [MDI]) with holding chamber with or without a dry powdered inhaler (DPI) or face mask; alternative treatment is a leukotriene inhibitor (also called leukotriene modifier and leukotriene receptor antagonist) or MDI with holding chamber or nebulizer of cromolyn
      - Patients > 5 years of age: Administer daily low-dose ICS; alternative treatment is a leukotriene inhibitor, cromolyn, theophylline, or nedocromil
    – Moderate persistent asthma: Daily medium-dose ICS or long-acting inhaled β₂-agonist combined with ICS; alternative treatment is low-dose ICS with theophylline or a leukotriene inhibitor
    – Severe persistent asthma: Daily long-acting β₂-agonist (LABA), high-dose ICS, and systemic corticosteroid if necessary
      - Patients ≤ 5 years of age with a viral respiratory infection receive a bronchodilator
  • Frequently assess treatment effectiveness and for adverse drug effects

› Provide Emotional Support and Educate
  • Assess patient/parent anxiety level and coping ability; provide emotional support and encourage rest and promote calmness to reduce anxiety, which can further compromise breathing during an acute attack
• If developmentally appropriate, teach diaphragmatic and pursed-lipbreathing and coughing techniques to promote more effective respiratory effort (for more information on patient education, see *What Do I Need to Tell the Patient/Patient's Family?* below)

• Request referral to a mental health clinician for counseling on strategies for coping with having a potentially life-threatening condition, if appropriate

**Food for Thought**

› Evidence suggests that children are less likely to develop asthma if exposed to infections (e.g., *Mycobacterium tuberculosis, measles, or hepatitis A*), experience rural living, are exposed to older children (e.g., older siblings, and early daycare), have less frequent antibiotic use, or if fish is introduced to their diet from a young age (Sharma, et al, 2017)

› Although breastfeeding is recommended for primary prevention of atopic disorders, the evidence from individual studies of the association between breastfeeding and risk of asthma is inconsistent. However, investigators who performed a systematic review and meta-analysis of 117 studies reported that longer duration of breastfeeding was associated with reduced risk for asthma in childhood (Dogaru et al., 2014)

› Obesity is an established risk factor for childhood asthma. Researchers who studied 10,981 school-aged children found a linear relationship between body mass index (BMI) and asthma risk, but a U-shaped relationship between body fat percentage and asthma risk such that asthma risk is highest in children who are in either the lowest or highest category of body fat percentage (Yiallouros et al., 2013)

› Outdoor air pollution is known to exacerbate pre-existing asthma, but its role in the development of asthma is less clear. Researchers in a study of 762 children in Cincinnati, Ohio found that children exposed to traffic-related air pollution (TRAP) during infancy were at increased risk for persistent wheezing, but only those exposed to high TRAP levels from birth through 7 years of age were at increased risk for asthma (Brunst et al., 2015)

**Red Flags**

› Closely monitor growth patterns in children receiving high doses of inhaled corticosteroid because of the possibility that the medication will slow growth

› Children with asthma are at increased risk for emotional and social distress and for being bullied by peers; adolescents with asthma might deny having asthma, underreport symptoms, and/or fail to adhere to the prescribed treatment regimen

**What Do I Need to Tell the Patient/Patient’s Family?**

› Educate the patient (as age-appropriate) and parents on the importance of adherence to the prescribed treatment regimen, the correct use of nebulizers/inhalers and peak flow home monitoring devices, daily symptom monitoring to prevent emergencies, maintaining adequate hydration to help loosen secretions, and keeping scheduled appointments for clinician visits

› Educate regarding avoiding triggers (e.g., smoking and secondhand smoke, cold air, aspirin, and intense exercise) and controlling household pollutants (e.g., cockroaches, pet dander, mold, dust mites) through the use of humidifiers/HEPA filters, covering upholstered furniture and vents, and keeping air ducts, carpets, and bedding clean

› Educate about the importance of monitoring for signs of an impending asthma attack (e.g., cough, fever, irritability, decreased appetite, anxiety, dry mouth, circles under or around the eyes) and talking with the treating clinician about the development of an individualized action plan for handling acute exacerbations

› Encourage joining a support group for contact with other children or adolescents with similar health challenges, and recommend obtaining information from the Asthma and Allergy Foundation of America at [http://www.aafa.org/](http://www.aafa.org/)


