Chapter 03
Respiratory Distress and Respiratory Failure

Objectives

- Identify key anatomical and physiological characteristics of infants and children and their implications in the patient with respiratory distress or respiratory failure.
- Define respiratory distress, respiratory failure, and respiratory arrest.
- Describe the physiologic progression of respiratory distress, failure, and arrest.
- Discuss the assessment findings associated with respiratory distress and respiratory failure in infants and children.
- Differentiate between upper airway obstruction and lower airway disease.
- Describe the general approach to the treatment of children with upper airway obstruction or lower airway disease.

Anatomic and Physiologic Considerations
The Head

- Head is large in proportion to body with a larger occipital region
- Large occiput
  - Airway flexion when child in supine position

Place a thin layer of padding under the shoulders of a child younger than 3 years to obtain a neutral position.

Place a folded sheet under the occiput of a child older than 3 years to obtain a sniffing position (if no trauma is suspected).

Head

- Muscles that support the head are weak
  - Head bobbing often occurs when the child experiences respiratory distress
Nose
- Nares are narrow and have little supporting cartilage
- Infants younger than 6 months are obligate nose breathers
  - Obstruction can result in:
    - Respiratory difficulty
    - Problems with feeding

Tongue
- Tongue is large in relation to the mouth
  - Rapid upper airway obstruction possible
  - Proper head/airway positioning essential

Larynx and Trachea
- Adult larynx
  - Opposite 4th and 7th cervical vertebrae
- Pediatric larynx
  - More anterior and superior in the neck
- Cricoid ring
  - Narrowest portion of upper airway in infant and young child
Larynx and Trachea

- Trachea
  - Small, short
    - Tracheal tube movement may occur with changes in head position
    - Right primary bronchus intubation or inadvertent extubation common
    - Tracheal rings susceptible to compression with improper positioning of neck

Larynx and Trachea

- Small change in airway size results in significant resistance to air flow

Larynx and Trachea

- Adult epiglottis is broad and flexible
- Infants and toddlers:
  - Epiglottis is long, floppy, and narrow
Chest and Lungs

- Diaphragm is primary muscle of inspiration
- Intercostal muscles not fully developed
  - Fatigue easily from work of breathing

Chest and Lungs

- Chest wall composed of more cartilage than bone
  - Pliable
  - Less protection to underlying organs
  - Significant internal injury can be present without external signs
- Resistant to rib fractures, but force of injury is transmitted to lung tissue
  - Pulmonary contusion
  - Hemothorax
  - Pneumothorax

Chest and Lungs

- Thin chest wall allows for easily transmitted breath sounds
  - Easy to miss a pneumothorax or misplaced tracheal tube
Airway Diameter

- Narrowest part of upper airway
  - At level of vocal cords in older child
  - At level of cricoid cartilage in young child and infant

Airway Diameter

- Upper airway susceptible to obstruction:
  - Foreign bodies
  - Congenital anomalies
  - Infection
  - Flexion or hyperextension
  - Soft-tissue swelling due to injury or inflammation

- Lower airway vulnerable to obstruction:
  - Edema
  - Mucus plugging
  - Spasm
  - Tumor

Metabolic Rate

- Oxygen requirements of infants and children approximately twice those of adolescents and adults

- Smaller functional residual capacity
  - Smaller oxygen reserve
  - Hypoxia develops rapidly
Respiratory Distress, Failure, and Arrest

Definitions

- Respiratory distress
  - Increased work of breathing (ventilatory effort)

- Respiratory failure
  - A clinical condition in which there is inadequate blood oxygenation and/or ventilation to meet the metabolic demands of body tissues

- Respiratory arrest
  - Absence of breathing

Causes of Respiratory Distress in Children

- Asthma/reactive airway disease
- Aspiration
- Foreign body
- Congenital heart disease
- Infection (e.g., pneumonia, croup, epiglottitis)
- Medication or toxin exposure
- Trauma
Signs of Respiratory Distress

Respiratory Failure

- Respiratory failure
  - Most common cause of cardiopulmonary arrest in children
  - Often preceded by respiratory distress

Causes of Respiratory Failure in Children

- Infection
- Foreign body
- Asthma/reactive airway disease
- Smoke inhalation
- Submersion syndrome
- Pneumothorax, hemothorax
- Congenital abnormalities
- Neuromuscular disease
- Medication or toxin exposure
- Trauma
- Congestive heart failure
- Metabolic disease with acidosis
Signs of Respiratory Failure

- Mottling; peripheral and central cyanosis
- Unresponsive to voice or touch
- Absent chest wall motion
- Absent respirations
- Weak to absent pulses
- Bradycardia or asystole
- Limp muscle tone

Respiratory Arrest

- Mottling; peripheral and central cyanosis
- Unresponsive to voice or touch
- Absent chest wall motion
- Absent respirations
- Weak to absent pulses
- Bradycardia or asystole
- Limp muscle tone

Respiratory Assessment
Respiratory Assessment

- Scene survey
- General impression
- Primary survey
- Secondary survey
  - Focused history
  - Physical exam

Physical Exam

- Adequate breathing requires:
  - A patent airway
  - An adequate tidal volume
  - An acceptable age-appropriate ventilatory rate

Physical Exam

- Is the airway patent?
- Assess for signs of airway obstruction
  - Foreign body airway obstruction (FBAO) maneuvers, if necessary
Physical Exam

- If the child is breathing spontaneously:
  - Assess work of breathing
  - Evaluate central color at lips, tongue, and oral mucosa
  - Inspect for chest trauma
  - Auscultate breath sounds
  - Count the ventilatory rate

Physical Exam

- Assess oxygen saturation
  - A pulse oximeter provides information about oxygenation
  - It does not reflect the adequacy of ventilation

Physical Exam

- If ventilation is adequate with signs of respiratory distress:
  - Approach promptly, but work at a moderate pace
  - Permit the child to assume a position of comfort
  - Correct hypoxia by giving oxygen without causing agitation
  - Provide further interventions based on assessment findings
Physical Exam

- If signs of respiratory failure are present:
  - Move quickly
  - Open the airway and suction if necessary
  - Correct hypoxia by giving supplemental oxygen
  - Begin assisted ventilation if the patient does not improve
  - Provide further interventions based on assessment findings

Physical Exam

- If respiratory arrest is present:
  - Move quickly
  - Check pulse; if no pulse, begin chest compressions
  - If pulse present:
    - Immediately open the airway
    - Suction if necessary
    - Begin assisted ventilation with supplemental oxygen
    - Reassess for return of spontaneous ventilation

Physical Exam

- Assess circulation and perfusion
- Monitor the cardiac rhythm
  - Tachycardia common with respiratory distress
  - Bradycardia
    - Seen with severe hypoxemia and acidosis
    - Warning of imminent cardiopulmonary arrest
Physical Exam

- Assess disability (mental status)
  - Agitation/irritability may indicate hypoxemia
  - Lethargy and decreased responsiveness may signal severe hypoxemia and/or carbon dioxide retention

Common Pediatric Upper Airway Emergencies

Croup (Laryngotracheobronchitis)

- Respiratory infection that affects upper respiratory tract
  - Viral in origin
- Area below glottis is most commonly affected
- Hoarseness
- Inspiratory stridor
- Bark-like cough
Croup

- A) Normal larynx
- B) Obstruction and narrowing resulting from edema of croup

Croup—Epidemiology and Demographics

- Primarily affects children ages 6 months to 3 years
  - Peaks at age 2 years
- Predominance in fall
- Spread via person to person contact, or by large droplets and contaminated nasopharyngeal secretions
- Incubation period
  - 2 to 4 days

Croup—History

- Typical history of symptoms of URI for 1 to 2 days
  - May be spasmodic (usually wakes from a nap or sleep)
  - Usually worse at night
- Obtain a thorough history to narrow diagnosis
  - Trauma
  - Cough or choking after playing with small toys
Croup—Physical Exam

- Vital signs
  - Increased ventilatory rate
  - Increased heart rate
  - Low-grade fever
- Loud stridor with hoarse voice and barking (seal-like) cough
- Nasal flaring
- Retractions

Westley Croup Score

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Points</th>
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<tbody>
<tr>
<td>Retractions</td>
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<td>Severely decreased</td>
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<td>Stridor</td>
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<tr>
<td>At rest, without stethoscope</td>
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<tr>
<td>Cyanosis</td>
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<td>Alert</td>
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<td>Restless, anxious</td>
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<tr>
<td>Altered mental status</td>
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</table>

- Croup score less than 3, mild croup; croup score 3 to 6, moderate croup; croup score 7 or higher, severe croup

Croup—Therapeutic Interventions

- Neck radiograph may reveal laryngeal narrowing 5 to 10 mm below the vocal cords
- Classic “steeple sign” associated with viral croup
Croup—Therapeutic Interventions

- Observe closely
- Reassess frequently
- Avoid agitating the child
- Initiate pulse oximetry
  - Maintain oxygen saturation of 94% or higher

Moderate Croup

- Toddler with moderate upper airway obstruction caused by croup
  - Suprasternal and subcostal retractions
  - Anxiousness due to mild hypoxia confirmed by pulse oximetry

Moderate to Severe Croup—Therapeutic Interventions

- Nebulized epinephrine
  - Administer with supplemental oxygen
  - Cardiac monitoring required
  - Observe for at least 3 to 4 hours after treatment to monitor for “rebound” symptoms
- Systemic steroids (e.g., dexamethasone) are often used for anti-inflammatory effects
Epinephrine
- Relaxes smooth muscle of bronchioles
  - Reduces tissue swelling of related structures
- Inhaled epinephrine may be used for the child with:
  - Stridor at rest
  - Associated reduced air entry
  - And/or for those with retractions

In anaphylaxis, epinephrine is given by SubQ or IM injection
- Adverse reactions:
  - Transient, moderate anxiety
  - Apprehensiveness
  - Restlessness, tremor
  - Weakness, dizziness
  - Sweating, palpitations
  - Pallor, nausea and vomiting

Epiglottitis
- Bacterial infection of the upper airway
- Diagnosis often based on history and observation of child from a distance
Epiglottitis—Epidemiology and Demographics
- Can occur at any age
  - Typically affects children 2 to 7 years of age
- Decreased incidence in children because of widespread use of HiB vaccine
  - Increasing prevalence in adolescents and adults
- No seasonal preference

Epiglottitis—History
- Absence of a cough is an important diagnostic clue
- Sudden onset of high fever
- Typically, no other family members are ill with an acute upper respiratory illness

Epiglottitis—Physical Exam
- Vital signs
  - Increased ventilatory rate
  - Increased heart rate
  - Elevated temperature, usually 102° to 104° F
- Difficulty swallowing, sore throat, drooling
- Muffled ("hot potato") voice
- Shallow breathing
- Prefers to sit up and lean forward (tripod position) with mouth open
- Child appears acutely ill ("toxic")
Peds Pearl

- The “three Ds” are considered the classic clinical findings of acute epiglottitis:
  1. Drooling
  2. Dysphagia
  3. Distress

Epiglottitis

- 3-year-old with epiglottitis
  - Child seen a few hours after the onset of symptoms
  - Anxious and still, but had no positional preference or drooling

- 5-year-old with epiglottitis
  - Symptomatic for several hours
  - Holds his neck extended with head held forward
  - Mouth breathing and drooling
  - Shows signs of tiring
2-year-old with epiglottitis

- Severe distress
- Too exhausted to hold his head up

In the operating room, the epiglottis was visualized and appears intensely red and swollen

- May retain its omega shape or resemble a cherry

Never force a child with respiratory distress to lie down.

This may compromise the airway and cause immediate obstruction.
Epiglottitis—Therapeutic Interventions

- Defer attempts to visualize the epiglottis, lab tests, and IV placement until diagnosis of epiglottitis is confirmed and the airway is secured
- Observe closely
- Reassess frequently
- Keep the child calm and as comfortable as possible
- Administer supplemental oxygen as discreetly as possible
- Allow the child to assume a position of comfort and disturb the child as little as possible
- Do not administer anything by mouth

Epiglottitis—Therapeutic Interventions

- If the child is unstable (unresponsive, cyanotic, bradycardic):
  - Clinician most skilled in pediatric intubation should emergently intubate
  - Tracheal intubation should be performed using a tracheal tube 0.5 to 1 mm smaller than that calculated for age

Epiglottitis—Therapeutic Interventions

- If the child is stable with a high suspicion of epiglottitis:
  - Perform endoscopy and intubation under general anesthesia
  - Escort patient with an epiglottitis team
    - Senior pediatrician
    - Anesthesiologist
    - Critical care intensivist
    - Otolaryngologist
Epiglottitis—Therapeutic Interventions

- If the child is stable with a moderate or low suspicion of epiglottitis and no evidence of obstruction:
  - Some clinicians prefer to obtain a radiograph of the nasopharynx and upper airway before direct visualization of the pharynx

- A lateral radiograph of the upper airway reveals a swollen epiglottis
  - “Thumb” sign

- In many patients, lateral neck film may not be diagnostic

- After the airway is secured:
  - Establish IV
  - Administer fluids
  - Obtain blood cultures, cultures of the epiglottis and supraglottic surfaces, and other tests
  - Begin antibiotic therapy
  - Monitor in ICU
Bacterial Tracheitis

- Also called membranous tracheitis or pseudomembranous croup
- Acute bacterial infection of subglottic area of upper airway
- Can cause a life-threatening airway obstruction
- Diagnosis based on:
  - Evidence of bacterial upper airway disease
  - High fever
  - Purulent airway secretions
  - Absence of classic findings of epiglottitis

Bacterial Tracheitis—Epidemiology and Demographics

- Can occur at any age and in any season
- No clear gender differences in incidence or severity
- This life-threatening illness is now more common than epiglottitis

Bacterial Tracheitis—History

- Several day history of viral upper respiratory symptoms, similar to croup
- May be followed by a rapid onset of high fever, respiratory distress, and a toxic appearance
- Drooling usually absent
- Frequently have concurrent sites of infection; pneumonia most common
**Bacterial Tracheitis—History**

- Associated with swelling of the mucosa at the level of the cricoid cartilage
- Swelling is complicated by copious thick, purulent secretions
- Child may decompensate quickly due to airway obstruction from a purulent membrane that has loosened

**Bacterial Tracheitis—Physical Exam**

- Inspiratory stridor with or without expiratory stridor
- Bark-like or brassy cough
- Hoarseness
- Variable degrees of respiratory distress
- Sore throat (minimal)
- Dysphonia
- Typically, no drooling
- Worsening or abruptly occurring stridor or respiratory distress

**Bacterial Tracheitis—Therapeutic Interventions**

- Avoid agitating the child.
- Initiate pulse oximetry.
- Maintain an oxygen saturation of 94% or higher.
- Assist ventilation using a bag-mask device if indicated.
- After the airway is secured, establish IV access and begin antibiotic therapy.
Foreign Body Airway Obstruction (FBAO)

- FBAO may be seen at any age, but children younger than 5 years are especially vulnerable.

FBAO—Etiology

- Common causes of FBAO in children:
  - Nuts
  - Raisins
  - Sunflower seeds
  - Popcorn
  - Grapes
  - Hot dogs
  - Raw carrots

Peds Pearl

- Suspect FBAO in any previously well, afebrile child with a sudden onset of respiratory distress and associated coughing, choking, stridor, or wheezing.
FBAO

- *Left image:* Normal inspiratory chest radiograph in a toddler with a peanut fragment in the left main bronchus.
- *Right image:* Expiratory radiograph of the same child showing the classic obstructive emphysema (air trapping) on the involved (left) side. Air leaves the normal right side, allowing the lung to deflate. The mediastinum shifts toward the unobstructed side.

FBAO

- Occurs most often in children younger than 5 years
- In infants and children, most episodes of choking occur during eating or play
- Occasionally, poor supervision by adults or older siblings is a contributing factor

FBAO—History

- Fewer than 50% of children will have a history of witnessed or suspected foreign body aspiration or a choking spell
- Child often presents after sudden episode of coughing or choking while eating with subsequent wheezing, coughing, or stridor
Foreign body (fragment of sea shell) in the larynx of a 2-year-old child treated for “croup” 6 days before the object was suspected. A tracheotomy was not required despite the presence of moderately severe laryngeal edema.

Peds Pearl

- The symptoms, physical findings, and complications produced by a foreign body depend on:
  - Size and composition of material aspirated (e.g., inert, caustic, organic)
  - Location of foreign body (i.e., esophagus, larynx, trachea, bronchus)
  - Degree and duration of obstruction

FBAO—Physical Exam

- General signs and symptoms
  - Sudden onset of respiratory distress
  - Abnormal respiratory sounds including wheezing, inspiratory stridor, or decreased breath sounds
  - Coughing or gagging
  - Agitation
  - Possible cyanosis
  - Facial petechiae may be present because of increased intrathoracic pressure
FBAO—Therapeutic Interventions

- Interventions depend on whether the patient is an infant or a child, and whether he or she is conscious or unconscious
  - Infant: Back blows (back slaps)/chest thrusts
  - Child: Abdominal thrusts
  - Reassess

Common Pediatric Lower Airway Emergencies

Asthma/Reactive Airway Disease

- Most common pediatric chronic disease
  - Swelling of bronchial mucosa
  - Bronchospasm
  - Cellular infiltration
  - Mucus plugging
Asthma

- Factors influencing asthma development and factors that trigger asthma symptoms (some do both):
  - Personal or family history of asthma or allergy
  - Viral respiratory infections
  - Indoor allergens (domestic mites, furred animals)
  - Outdoor allergens (pollens, fungi, molds, yeasts)
  - Occupational sensitizers
  - Tobacco smoke
  - Air pollution
  - Diet

Asthma—History

- Recurrent respiratory symptoms that are often worse at night
- Wheezing, chest tightness, or cough after exposure to airborne allergens or pollutants

Asthma—Physical Exam

- Wheezing (most common finding)
- Dry cough
- Chest tightness
- Shortness of breath with exertion
- Retractions
- Tachypnea
- Poor air entry
- Prolonged expiratory phase
Peds Pearl

- Wheezing is an unreliable sign when evaluating the degree of distress in an asthmatic patient.

Asthma—Therapeutic Interventions

- Permit the child to assume a position of comfort
- Apply pulse oximeter
  - Titrates oxygen therapy to maintain an oxygen saturation of 95% or higher
- Cardiac monitor
- Obtain vascular access if signs of severe respiratory distress, respiratory failure, or respiratory arrest

Asthma—Therapeutic Interventions

- If the patient shows signs of respiratory distress or respiratory failure with clinical evidence of bronchospasm or a history of asthma:
  - Give an inhaled rapid-acting beta-2 agonist continuously for 1 hour
  - Watch for tachycardia and vomiting
Albuterol (Proventil, Ventolin)
- Sympathomimetic bronchodilator
- Onset of action within 5 minutes
- Duration of action in severe asthma unknown
  - May vary with severity of the disease
- Continuous cardiac monitoring is essential
  - May cause tachycardia and other dysrhythmias
- After administration:
  - Reassess pulse, respiratory rate, oxygen saturation, and peak expiratory flow rate

Peak Flow Meters
- Requires a cooperative patient (who can make a maximal respiratory effort) and coaching
- Used to assess the severity of an episode and the response to therapy in children older than 5 years

Asthma—Therapeutic Interventions
- If the patient is experiencing a moderate episode give:
  - Oxygen
  - Inhaled beta-2 agonist and inhaled anticholinergic every 60 minutes
  - Oral glucocorticosteroids
- Continue for 1 to 3 hours, provided there is improvement
Ipratropium bromide (Atrovent)

- Blocks contraction of bronchiolar smooth muscle and increase in mucous secretion resulting from increased vagal activity
- Continuous cardiac monitoring is essential
- After administration:
  - Reassess pulse, ventilatory rate, oxygen saturation, and peak expiratory flow rate

Asthma—Therapeutic Interventions

- If the patient is experiencing a severe episode give:
  - Oxygen
  - Inhaled beta-2 agonist and inhaled anticholinergic
  - Systemic glucocorticosteroids
  - IV magnesium

Respiratory Syncytial Virus/Bronchiolitis

- Bronchiolitis
  - Inflammation of the smaller bronchioles
  - Caused by a virus
  - Characterized by thick mucus
  - Occurs primarily in winter and early spring
  - Uncommon in children older than 3 years

- Respiratory syncytial virus (RSV)
  - Primary cause of bronchiolitis and pneumonia in children younger than 1 year
RSV/Bronchiolitis

- RSV is highly contagious
  - Incubation period from exposure to first symptoms is about 4 days
  - Spread from respiratory secretions
  - In the healthcare setting, RSV is often spread from child to child on the hands of caregivers
  - The virus is readily inactivated with soap and water and disinfectants

RSV/Bronchiolitis

- In the Northern hemisphere, epidemics usually peak in January, February, or March
  - Peaks have been recognized as early as December and as late as June
- RSV most common in infants <1 year
- 50% of all infants will be infected with RSV by the end of the first year of life
- Infants 1 to 4 months of age are at particular risk of severe infection and hospitalization

RSV/Bronchiolitis—History

- Upper respiratory infection with rhinorrhea and cough for several days
  - Low-grade fever common
  - Increasingly productive cough
  - Increasing respiratory distress
- Otitis media common
- Contact with older siblings or children at day care who have viral respiratory symptoms
- Family history of asthma or allergies
Because asthma and bronchiolitis present similarly, it may be difficult to distinguish between these conditions.

RSV/Bronchiolitis—Physical Exam

- RSV begins with signs and symptoms of upper respiratory infection
- Cough, sneezing and low-grade fever appear within 1 to 3 days
- Wheezing develops soon after the cough appears

Airway obstruction is usually gradual

- Caused by inflammation, secretions, and edema in small bronchi and bronchioles
- Areas of hyperinflation may exist with air trapping
RSV/Bronchiolitis—Therapeutic Interventions

- Permit the child to assume a position of comfort
- Apply pulse oximeter
  - Titrate oxygen therapy to keep the oxygen saturation 94% or higher
- Mild dehydration is often present
  - Careful fluid replacement

Pneumonia

- Caused by a viral, bacterial, parasitic, or fungal organism
- Lobar pneumonia: localized to one or more lobes of the lung
- Bronchopneumonia: inflammation around medium-sized airways
- Interstitial pneumonia: inflammation of lung tissue between air sacs

Pneumonia

- Pneumonia is most prevalent in the winter months
- Responsible organism varies with age of child
Pneumonia—Physical Exam

- Fever
  - Less prominent in viral pneumonia
  - High in bacterial pneumonia
- Chills
- Malaise
- Headache
- Lethargy
- Anorexia or poor feeding in infants
- Grunting
- Tachypnea
- Tachycardia
- Crackles, possible wheezes
- Retractions
- Pleuritic chest pain
- Apnea spells

Pneumonia—Therapeutic Interventions

- Permit the child to assume a position of comfort
- Apply pulse oximeter
  - Titrate oxygen therapy to keep O2 saturation at 94% or higher
- Obtain vascular access for hydration or medication administration, if necessary
- Antibiotics for bacterial pneumonia
- Antipyretics may be used to control fever

Bronchopulmonary Dysplasia (BPD)

- BPD is a chronic lung disease
  - Occurs most commonly in children who were born as premature infants with respiratory problems in the first few days after birth
Bronchopulmonary Dysplasia (BPD)

- Most important risk factor for BPD is prematurity
- Complications associated with BPD include:
  - Recurrent respiratory infections
  - Increased airway resistance
  - Trapping of air in the lungs
  - Exercise-induced bronchospasm

BPD—Physical Exam

- Very low birth weight
- Tachypnea
- Tachycardia
- Increased work of breathing
  - Retractions, nasal flaring, grunting
- Poor weight gain
- See-saw breathing
- Wheezing

BPD—Therapeutic Interventions

- Treatment for BPD is primarily supportive
  - Mechanical ventilation and supplemental oxygen
  - Bronchodilators
  - Corticosteroids
  - Diuretics
  - Antibiotics
  - Chest physiotherapy
Cystic Fibrosis (CF)

- CF is an inherited multi-system disease
  - A defective gene causes the body to produce abnormally thick, sticky mucus that affects multiple organs, most commonly the lungs, pancreas, liver, and small intestine.

Cystic Fibrosis (CF)

- CF most often presents in early childhood with:
  - Persistent respiratory illness (50%)
  - Malnutrition and poor growth (40%)
  - Diarrhea (30%)
  - A combination of these

Cystic Fibrosis (CF) — Physical Exam

- Nasal congestion
- Chronic cough
- Increased anterior-posterior diameter of the chest
- Use of accessory muscles for respiration
- Poor weight gain
- Steatorrhea (fat in stools)
- Digital clubbing from chronic hypoxia
- Thin extremities
- Muscle wasting
- Salty-tasting skin
  - Usually noticed by caregiver when kissing the child
Cystic Fibrosis (CF)

- Permit the child to assume a position of comfort
- Apply pulse oximeter and titrate oxygen therapy to keep O2 saturation at 94% or higher
- Obtain vascular access for hydration or medication administration, if necessary
- Decongestants and/or bronchodilators
- Corticosteroids
- Antibiotics
- Chest physiotherapy
- Pancreatic enzymes
- Vitamins and other dietary supplements

Questions?