
Respiratory Distress

Background:

- Respiratory distress accounts for nearly 10 percent of pediatric emergency department visits and 20 percent of hospitalizations.
- Rapid deterioration may occur in pediatric patients given their smaller airways, increased metabolic demands, decreased respiratory reserve, and poor compensatory mechanisms.

1. Bronchiolitis

Background:

- Bronchiolitis is an illness most often caused by a viral lower respiratory tract infection which results in acute inflammation, edema, and necrosis of epithelial cells lining the small airways (bronchioles), increased mucus production, and bronchospasm.
- The most common pathogens are respiratory syncytial virus (RSV) and rhinovirus.
- The peak incidence for bronchiolitis is during the fall and winter months.
- Bronchiolitis is the leading cause of hospitalization in infants less than 1 year of age in the U.S.
- Risk factors for severe disease include history of prematurity, cardiopulmonary disease, airway anomalies, immunodeficiency, and neurologic disease.

Signs and Symptoms:

- Infants typically present to medical care with fever, 1 to 3 days of upper respiratory tract symptoms (nasal congestion and/or discharge) and evolving lower respiratory tract symptoms (tachypnea, cough, nasal flaring, retractions).
- Apnea, cyanosis, lethargy, poor oral intake, dehydration.

Evaluation:

- Physical exam: General appearance, respiratory status (tachypnea, nasal flaring, intercostal and subcostal retractions, coarse inspiratory and expiratory breath sounds, expiratory wheezing), cardiovascular status, neurologic status (decreased activity level may signal hypercarbia and impending respiratory failure).
- Labs for patients with moderate to severe distress: CBC with differential, blood culture, UA and urine culture, CXR (hyperinflation, peribronchial cuffing), blood gas.
- Viral testing is not necessary, but is associated with decreased utilization of antibiotics.

Management:

- Supplemental oxygen to maintain oxygen saturation >90%.
- Nasal suctioning, IVF hydration, NPO status until respiratory status normalizes.
- Trial of nebulized racemic epinephrine (0.5 mL of 2.25% solution in 3 mL of 0.9% NS) **AND/OR** nebulized albuterol (2.5 mg/dose) over 15 minutes and evaluate response to therapy.
- Steroids, antibiotics, and chest physiotherapy are NOT typically indicated.

2. Status Asthmaticus

Background:

- Status asthmaticus is an acute condition of progressively worsening bronchospasm, airflow obstruction and airway inflammation resulting from asthma, unresponsive to conventional therapy.
- Asthma is the most frequent cause of pediatric hospitalization in the U.S.
- Risk factors for severe disease include past history of sudden severe asthma exacerbations, prior intubation for asthma, prior admission to an intensive care unit, 2 or more hospitalizations or 3 or more emergency care visits for asthma in past 1 year, emergency care visit or hospitalization for asthma in the past 1 month, current or recent use of systemic corticosteroid, difficulty perceiving airflow obstruction, chronic cardiopulmonary disease, psychosocial problems, low socioeconomic status and urban residence, illicit drug use.

Signs and Symptoms:

- Tachypnea, dyspnea, shortness of breath, chest tightness, cough, wheezing.

Evaluation:

- Physical exam: General appearance, respiratory status (tachypnea, wheezing, accessory muscle use, increased work of breathing, retractions), cardiovascular status, neurologic status (decreased activity level may signal hypercarbia and impending respiratory failure).
- Hypoxemia secondary to ventilation-perfusion (V/Q) mismatch.

Management:

- Supplemental oxygen to maintain oxygen saturation >92%.
- Albuterol INH (2.5-5 mg/dose) combined with ipratropium bromide INH (0.5 mg/dose) nebulized every 15 minutes PRN (wheezing, dyspnea) up to three doses.
- Methylprednisolone (2 mg/kg/dose; max 60 mg) IV once over 15 minutes.
- For continued distress:
 - Consult Pediatric Critical Care.
 - Albuterol INH (10 mg/hr) nebulization.
 - Consider magnesium sulfate (75 mg/kg/dose; max 2 gm/dose) IV once over 30 minutes.
- For distress refractory to above interventions:
 - Consider increase albuterol INH to 20 mg/hr.
 - Consider utilizing heliox (helium:oxygen 80:20 or 70:30).
 - Consider terbutaline (10 mcg/kg IV loading dose, then 0.4 mcg/kg/min infusion).
 - Consider epinephrine [0.01 mg/kg/dose IM/SQ; 0.01 mL/kg/dose of 1:1000 solution (1 mg/mL); max 0.5 mg].
- Consider endotracheal intubation if elevated carbon dioxide or altered mental status
 - *High risk procedure given significant changes in cardiopulmonary interactions.
 - Fluid bolus (20 mL/kg 0.9% NS IV once) prior to intubation to optimize preload.
 - Code medication (epinephrine, atropine, sodium bicarbonate) and chest tubes should be available.
 - See Supplemental Oxygen & Airway Management section in Preparing to Transport.
 - Ketamine (2 mg/kg/dose; max 50 mg/dose) IV once for sedation/analgesia may provide additional benefit given the drug's intrinsic bronchodilatory properties.

3. Upper Airway Infections

Background:

- Croup (laryngotracheitis) is a respiratory illness characterized by inspiratory stridor, cough, and hoarseness resulting from inflammation in the larynx and trachea, and may extend to the bronchi.
- Croup most commonly occurs in children 6 to 36 months of age in the fall and winter months, with Parainfluenza being the most common cause.
- Approximately 5% of children with the diagnosis of croup require hospitalization, but less than 1% ultimately require endotracheal intubation.
- Bacterial tracheitis is a rare (<1 case per 100,000 children) invasive exudative bacterial infection of the soft tissue of the trachea which usually follows a viral infection.
- Epiglottitis is a rare (<1 case per 100,000 children) but potentially life-threatening invasive bacterial or viral infection of the epiglottis and supraglottic structures.
- Other etiologies of upper airway obstruction include peritonsillar or retropharyngeal abscess, foreign body aspiration, upper airway trauma and thermal injury.

Signs and Symptoms:

- Croup: Nasal drainage and congestion, which progresses to include fever, barking cough, and stridor.
- Bacterial tracheitis: Fever, respiratory distress, stridor, exudative cough.
- Epiglottitis: Rapid onset of fever, stridor, drooling, tripod positioning.
- The degree of tachypnea and respiratory distress worsen with progressive airway inflammation/obstruction.

Evaluation:

- Physical exam: General appearance, respiratory status (relationship of stridor to activity level, degree of distress), hydration, vital signs and pulse-oximetry, neurologic status.
- Westley croup score:
 - Level of consciousness: Normal, including sleep = 0; disoriented = 5
 - Cyanosis: None = 0; with agitation = 4; at rest = 5
 - Stridor: None = 0; with agitation = 1; at rest = 2
 - Air entry: Normal = 0; decreased = 1; markedly decreased = 2
 - Retractions: None = 0; mild = 1; moderate = 2; severe = 3
 - Croup score ≤ 2 = mild (no stridor at rest).
 - Croup score 3-7 = moderate (stridor at rest).
 - Croup score ≥ 8 = severe (significant stridor at rest).
- CXR and/or lateral neck XR not typically required unless diagnosis is in question.
- Consider viral testing, CBC with differential, CRP and blood culture for severe cases.

Management:

- Croup: Dexamethasone PO/IV/IM once (0.6 mg/kg/dose; max 10 mg/dose).
- For moderate to severe croup: Nebulized racemic epinephrine (0.05 mL/kg/dose of 2.25% solution in 3 mL of 0.9% NS) over 15 minutes, evaluate response and repeated as needed.
- A lack of improvement following dexamethasone and racemic epinephrine should increase suspicion for a secondary bacterial infection of the upper airway.
- Supplemental oxygen to keep oxygen saturation $>92\%$.
- Ensure adequate hydration.
- Croup with signs of impending respiratory failure (fatigue, significant retractions, diminished breath sounds, depressed level of consciousness, cyanosis):
 - See Supplemental Oxygen & Airway Management section in Preparing to Transport.
 - Endotracheal intubation with ETT 0.5-1 mm smaller than typical size for age.
- For suspected bacterial tracheitis, epiglottitis, or severe upper airway obstruction:
 - Consult Pediatric Critical Care and/or Pediatric Anesthesiology.
 - Minimize interventions leading to patient agitation.
 - A physician with advance airway skills should monitor the patient at all times.
 - Transport to the operating room in order to secure a definite airway (surgically, if necessary).
 - Vancomycin (15 mg/kg/dose; max 1 gm/dose) **AND** Ceftriaxone (50 mg/kg/dose; max 2 gm/dose).

4. Pneumonia

Background:

- Approximately 50% of children younger than 5 years of age with community-acquired pneumonia (CAP) require hospitalization.
- Risk factors include lower socioeconomic status, underlying cardiopulmonary disease (congenital heart disease, cystic fibrosis, asthma), sickle cell disease, neuromuscular disorders, immunodeficiency, cigarette smoke exposure.

- Infective agents most commonly spread via droplets which initially colonize the nasopharynx and progress to infect the lower respiratory tract.
- *S. pneumonia*, *H. influenza*, *M. catarrhalis*, *S. aureus* and *Streptococcus pyogenes* are the most common bacterial agents.
- Viruses are the agent in up to 35% of cases, and up to 50% of cases in young children.
- *M. pneumoniae* and *C. pneumonia* are more common in children older than 5 years of age.
- Patients with cystic fibrosis are also often infected by *P. aeruginosa*, *B. cepacia* and *S. maltophilia*.

Signs and Symptoms:

- Cough, fever, tachypnea, increased work of breathing, accessory muscle use.

Evaluation:

- Physical exam: General appearance, vital signs including pulse-oximetry, respiratory status (inspiratory crackles, decreased breath sounds, rhonchi), degree of distress, cardiovascular and hydration status.
- Labs: BCx, CBC, CRP, electrolytes, nasopharyngeal viral testing.
- Imaging: CXR.

Management:

- Ensure adequate hydration and perfusion.
- Consider endotracheal intubation if signs of impending respiratory failure (fatigue, significant retractions, diminished breath sounds, depressed level of consciousness, cyanosis).
 - See Supplemental Oxygen & Airway Management section in Preparing to Transport.
- Antibiotic guidelines for Community Acquired Pneumonia (CAP):

AGE:	IMMUNIZATIONS:	ANTIMICROBIAL:
< 3 months	<i>Guideline not applicable</i>	Cefotaxime (50 mg/kg/dose; max 2 gm)
> 3 months	UTD (<i>Up-to-date</i>)	Ampicillin (50 mg/kg/dose; max 2 gm)
> 3 months	NOT (<i>not up-to-date</i>)	Ceftriaxone (50 mg/kg/dose; max 2 gm)
	<ul style="list-style-type: none"> • if > 3 months AND complicated PMHx / infection: 	Ceftriaxone (50 mg/kg/dose; max 2 gm)
	<ul style="list-style-type: none"> • if atypical pneumonia suspected (typically > 5 yrs): 	ADD Azithromycin (10 mg/kg/dose; max 500 mg)
	<ul style="list-style-type: none"> • if severe symptoms / suspected MRSA pneumonia: 	ADD Vancomycin (15 mg/kg/dose; max 1 gm)
	<ul style="list-style-type: none"> • if Cystic Fibrosis (CF) patient (suspected pseudomonas): 	Piperacillin/Tazobactam (75 mg/kg/dose; max 3.375 gm) OR Ceftazidime (50 mg/kg/dose; max 2 gm)