



Case 210: Difficulty Breathing

- **Chief complaint**
 - 7-month-old female presents with respiratory distress
 - Case occurs in late fall to early winter
- **Vital signs**
 - **HR: 175** BP: 88/58 RR: 70 Sat: 89% on RA T: 38°C (must ask: axillary) Wt: 8 kg
- **Patient appearance**
 - Infant is in her mother's arms and appears alert and responsive, but visibly tachypneic
- **Primary survey**
 - Airway: crying vigorously
 - **Breathing:** tachypneic with intermittent grunting and nasal flaring
 - Circulation: cool, dry skin. Cap refill 3 seconds
 - Disability: moves all extremities spontaneously
 - **Exposure:** deep subcostal retractions noted when infant undressed
- **Action**
 - Place patient on the monitor
 - Oxygen by NC
 - Obtain rectal temperature (**39.5°C**)
 - Order nasal suctioning
 - Order antipyretic
 - Acetaminophen 15 mg/kg or ibuprofen 10 mg/kg
- **History**
 - Source: Mother
 - HPI: 7-month-old previously healthy female infant with a 4 day history of clear rhinorrhea and occasional cough. She has been fussy and febrile at home to 38.5°C, but mom became more concerned starting yesterday when she noticed "breathing fast" and wheezing. Since yesterday she has not been feeding well and today she is refusing all PO. She only had 1 wet diaper today. Her 4 year old brother recently started preschool and has a nonfebrile upper respiratory infection. ROS otherwise negative.
 - PMHx: None. No prior history of wheezing or intubations. Up to date on vaccinations. Breast fed until 6 months old.
 - Birth Hx: Uncomplicated pregnancy and SVD at 39 weeks.
 - PSHx: none

- Allergies: none
- Meds: none.
- Social: Lives with her mother and older brother. Mother is a smoker, but does not smoke in the home.
- FHx: no significant history
- **Physical Exam**
 - General: cried during vitals assessment, calms easily in mother's lap and is otherwise non toxic appearing
 - **HEENT:** anterior fontanelle open and flat, moderate rhinorrhea, moist mucous membranes, TMs normal, posterior pharynx normal
 - Neck: normal
 - **Heart:** tachycardic, no murmurs or abnormal sounds, pulses 2+ throughout, cap refill 3 seconds
 - **Lungs:** RR = 65 (if suctioned), deep subcostal retractions, nasal flaring, shifting crackles and scattered non focal wheezes bilaterally. No stridor. No grunting (if suctioned).
 - Abdomen: soft, non tender, no organomegaly
 - GU: normal
 - Extremities: warm and dry
 - Back: normal
 - Neuro: alert, good strength and tone, moving all extremities
 - Skin: normal without mottling or rash
- **Instructor Prompt:** learners should discuss differential diagnosis
- **Response/Results**
 - Patient spit up PO antipyretic
 - Crying because nasal suctioning made her mad
 - **HR: 170 BP 90/55 RR: 64 Sat: 97% on 2 L NC Temp: 39.5°C**
- **Action**
 - Order antipyretic per rectum
 - Order Labs
 - Respiratory viral panel
 - Consider POC VBG, CBC, electrolytes, UA/urine culture
 - May consider CXR if concern for pneumonia, but not necessary in this case
 - PO challenge vs IV access with NS 20 cc/kg bolus
- **Response/Results**
 - Patient reevaluation and repeat vitals:
 - Vitals after supplemental O2 and antipyretic:
 - **HR: 140 BP: 88/56 RR: 50 Sat: 99% on 2 L NC T: 37.8°C**
 - Vitals if supplemental O2 and antipyretic not given:

- **HR: 175** BP: 88/56 **RR: 70** **Sat: 88% RA** **T: 39°C** (Prompt: give supplemental O2 and antipyretic)
 - Case 210 Lab Results (if ordered, verbal report)
 - POC H&H, electrolytes normal, UA normal, CBC normal
 - Respiratory viral panel: **positive for respiratory syncytial virus**, otherwise negative
 - CXR (if ordered, verbal report: normal)
- **Action**
 - Update family of presumed diagnosis and plan for admission due to need for respiratory support and monitoring
 - Admit to Pediatrics (or transfer to facility with Pediatrics floor)
- **Diagnosis**
 - Primary Diagnosis: Acute bronchiolitis
 - Secondary Diagnosis: Respiratory Syncytial Virus (RSV)
- **Critical actions**
 - Rectal Temperature
 - Suctioning
 - Antipyretics
 - Supplemental oxygen
 - PO or IV hydration
 - Admission for respiratory monitoring
- **Instructor Guide**
 - This is a case of respiratory distress in an infant < 1 yo with fever, shifting crackles and scattered wheezes suggestive of acute bronchiolitis. Important early actions include rectal temperature, nasal suctioning, treatment of fever, and supplemental oxygen for mild hypoxia. Ensuring adequate hydration status is important due to the infant's hypermetabolic state and can be accomplished with PO or IV fluids as the infant tolerates. There is no evidence to support the routine use of bronchodilators (ie: albuterol, racemic epinephrine), steroids, chest radiography, or laboratory testing (including respiratory viral panel). However, there remains a great deal of variability in local practice patterns and these may be considered based on the clinical scenario. Febrile infants < 4-6 weeks of age, children in higher risk categories or who are toxic appearing would require more aggressive workup.
- **Case Teaching Points**
 - The differential diagnosis for a child < 1 yo with respiratory distress should include congenital heart disease, congestive heart failure, myocarditis, foreign body aspiration, bronchiolitis, URI, pneumonia, sepsis, reactive airway disease, mucus plugging, vascular ring or sling, and profound acidosis from ingestion or other metabolic process.

- **What is acute bronchiolitis and how does it present?**

- Acute bronchiolitis is a disorder commonly caused by viral lower respiratory tract infection in infants.
 - Characterized by acute inflammation, edema and necrosis of small airway epithelial cells with increased mucus production.
 - Hallmark early symptoms include rhinorrhea and cough, which may progress to tachypnea, wheezing, use of accessory muscles or nasal flaring.
 - Symptoms tend to peak over the first 3-5 days and then decrease over the following week.
 - Most commonly caused by Respiratory syncytial virus (RSV), but also caused by rhinovirus, influenza, coronaviruses, metapneumovirus, parainfluenza and adenoviruses .
 - RSV infection does not result in permanent or long-term immunity and reinfections are common
 - Late fall and early winter are peak seasons
- Acute bronchiolitis is the **most common cause of hospitalization in children < 12 months of age**.
 - 90% of children are infected within their first 2 years of life
 - Approximately 100,000 bronchiolitis admissions occur annually in the US at a cost of 1.73 billion USD

- **How should physicians diagnose bronchiolitis and assess disease severity?**

- Physicians should diagnose acute bronchiolitis and assess disease severity based on the history and physical examination.
 - Main goal of history and physical examination is to differentiate infants with probable viral bronchiolitis from those with other disorders.
 - In addition, an estimate of disease severity (increased respiratory rate, work of breathing or decreased oxygen saturation) should be made.
 - Important factors to consider include the effects of respiratory symptoms on mental status, feeding and hydration as well as the ability of the family to care for the child and return for further treatment if needed.
 - Full assessment may require serial observations over time. Suctioning and positioning to relieve upper airway obstruction may decrease work of breathing and improve the clinical exam.
- When physicians diagnose acute bronchiolitis on the basis of history and physical examination, radiographic or laboratory studies should not be obtained routinely.

- **Are there factors that can predict progression to severe disease?**

- Underlying conditions that may be associated with increased risk include:
 - Prematurity
 - Age < 12 weeks with highest risk of apnea in age < 4 weeks
 - Hemodynamically significant congenital heart disease

- Bronchopulmonary dysplasia or other chronic lung disease
 - Immunocompromised
 - In utero or household smoking exposure
 - Certain genetic or congenital abnormalities
- Exclusive breast feeding x 6 months has been shown to decrease morbidity of respiratory infections
- **What diagnostic measures should be considered?**
 - Pulse oximetry use has been associated with prolonged hospitalization (1 in 4) due to perceived need for supplementary O₂
 - Transient desaturation is a normal phenomenon in healthy infants
 - Routine virologic testing is not recommended
 - Exception: hospitalized infants who have been receiving monthly prophylaxis with palivizumab, as this medication should be stopped in the event of a breakthrough infection
 - Routine chest radiography is not supported by current evidence.
 - Studies suggest that when radiography was performed in infants with suspected lower respiratory tract infection, they were more likely to receive antibiotics without notable differences in outcomes
 - Initial radiographs should be reserved for cases where work of breathing is severe enough to warrant ICU admission or where the presentation is not classic and signs suggestive of another airway complication are present
 - Febrile neonates (< 4-6 weeks of age) should undergo full septic workup as per standard institutional protocols
 - Toxic appearing infants and children: CBC, metabolic studies, UA, blood and urine cultures and CSF studies/cultures should be considered.
- **What treatment options are available?**
 - Suctioning is generally the first therapeutic intervention if the child is alert
 - Nasal suctioning may temporarily improve nasal congestion and upper airway obstruction.
 - Deep suctioning has been associated with a longer LOS. Insufficient data exists to make a formal recommendation, but routine use may not be beneficial.
 - Supplemental oxygen therapy
 - Should be administered if oxyhemoglobin saturation is < 90% on room air.
 - May elect not to provide supplemental O₂ if oxyhemoglobin saturation remains > 90% as large elevations in arterial partial pressure of oxygen are required to affect further increases in saturation and no data exist to suggest such increases result in any clinically significant outcomes.
 - Humidified high flow nasal cannula (HFNC) should be considered if the child requires additional respiratory support or remains in respiratory distress despite initial O₂ therapy, however, should not be routinely used if the patient's hypoxia improves with supplemental oxygen via nasal cannula.

- Generates positive airway pressure
 - Pneumothorax may be a complication
- Intubation must be considered for worsening respiratory distress or mental status despite HFNC
- Nasogastric or intravenous fluids should be administered for infants who cannot maintain adequate hydration
 - Feeding may be compromised when copious nasal secretions are present and respiratory rate exceeds 60-70 breaths per minute and increased risk of aspiration may exist
 - 1/3 of infants hospitalized with bronchiolitis require fluid replacement and this can safely be done via NG or IV routes
- Routine use of albuterol is not recommended.
 - Most randomized controlled trials have failed to demonstrate a consistent benefit from alpha or beta adrenergic agonists.
 - In some cases, albuterol may improve clinical symptom scores, but these do not correlate with a change in need for hospitalization, LOS or disease resolution.
 - Given the greater strength of evidence showing no benefit, the most recent AAP guideline no longer recommends a trial of albuterol.
- Racemic epinephrine should not be administered routinely.
 - Exception: Rescue treatment of rapidly deteriorating patients
- Nebulized hypertonic saline should not be administered in the ED but may be considered in hospitalized children.
 - 2013 Cochrane review found no effect on hospitalization rates
 - Further evidence suggests nebulized hypertonic saline may improve symptoms and decrease LOS in settings where duration of stay typically exceeds 3 days.
- Systemic corticosteroids should not be administered routinely.
 - While evidence shows benefit in other respiratory conditions such as asthma and croup, evidence on use in bronchiolitis is negative.
 - No reduction in admissions or LOS
 - May prolong viral shedding
- Antibiotics should not be administered unless there is a concomitant bacterial infection.
 - Antibiotics continue to be overused because of concern for undetected bacterial infection.
 - Children with distinct viral syndromes have very low risk (<1%) of bacterial infection of the CSF or blood.
 - Routine screening for bacteria infection in febrile infants > 30 days is not justified.
 - Abnormal WBC is not useful
 - Asymptomatic bacteriuria may explain the approximately 1% observed rate of concomitant findings on urinalysis.
 - Antibiotic administration may be considered in some children with bronchiolitis that require intubation and mechanical ventilation

- Hospitalization should be considered for any infants unable to maintain adequate hydration or oxygenation status without additional support. Level of care will be determined by the patient's specific needs.

- **Attributions**

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