

# Bronchiolitis

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## **Preface**

Bronchiolitis is a lower respiratory tract infection that causes significant illness in the United States. It is the leading cause of hospitalization in infants less than one-year-old. The total cost of those admissions is more than \$500 million annually. In addition to these infants, many more patients are managed on an outpatient basis. These guidelines are designed to assist practitioners caring for patients with bronchiolitis in both an inpatient and outpatient setting.

## **Definitions, Assessment and Diagnosis**

### **Definition of bronchiolitis**

- American Academy of Pediatrics definition: “A constellation of clinical symptoms and signs including a viral upper respiratory prodrome followed by increased respiratory effort and wheezing in children less than 2 years of age.”
- Respiratory syncytial virus (RSV) is the most common viral etiology of bronchiolitis. Other viral causes include influenza, parainfluenza, rhinovirus, adenovirus, and human metapneumovirus.

### **Pathophysiology**

- Infection begins in the upper airway and then spreads to the lower respiratory tract in the first few days.
- Epithelial cells lining the bronchioles are initially affected, leading to inflammation, edema, and necrosis of those cells.
- The sloughed necrotic epithelium and fibrin build up in the small airways, leading to obstruction of the airway. This leads to trapping of air distal to the obstruction and a

ventilation/perfusion mismatch.

- Smooth muscle contraction and bronchospasm have little role in the process.

## Assessment

- Patient history
  - History of present illness: Physicians should assess for history of apnea, signs of respiratory distress, and diet/feeding difficulties. Signs of dehydration such as decreased urine output, decreased tear production, and altered sensorium should also be assessed.
  - Past medical history: Factors in the patients' past medical history that increase their risk of severe disease include age less than 12 weeks, history of prematurity (<36weeks), underlying cardiopulmonary disease, immunodeficiency, congenital airway abnormalities, and neuromuscular disease.
  - Social history: Infants who are exposed to cigarette smoke, attend daycare, and/or have siblings less than five-years-old have an increased incidence of bronchiolitis. Although associated with increased incidence, these factors have not been correlated with increased severity of disease.
- Physical examination
  - Typical exam findings may include tachypnea, increased work of breathing, fine inspiratory crackles, expiratory wheezing, dehydration, and listlessness.
  - Tachypnea (RR >70bpm) has been correlated with more severe disease in some studies.
  - Pulse oximetry can be a helpful adjunct to the physical exam, although it does have some limitations. Motion artifact and loose probes can lead to false readings. Before reacting to a low pulse oximetry reading, the patient should be suctioned and the probe should be repositioned.
  - Hydration status should be carefully assessed, including such findings as capillary refill time, mucous membranes, and mental status.
  - The exam of an infant with bronchiolitis can vary greatly over time, requiring serial evaluations.

## Diagnosis

- Bronchiolitis is primarily a clinical diagnosis.
- Many viruses can cause the constellation of symptoms that defines bronchiolitis.
  - While testing (antigen, PCR, culture) is available for several of these viral etiologies, it is not recommended since it does not change the management of the disease.
  - However, individual hospitals may request antigen or PCR testing in order to better cohort patients with similar illnesses.
- Chest radiography is not recommended in routine cases of bronchiolitis.
  - Typical x-ray findings include atelectasis or signs of air-trapping
  - Positive x-ray findings are not correlated with more severe disease and should not change patient management.
- Laboratory tests such as a complete blood count or electrolytes are not recommended in routine cases of bronchiolitis.
- Patients with severe bronchiolitis and signs of severe respiratory distress or impending respiratory failure may require further testing, such as a blood gas, to assist in their management.

## Management

## Supportive care

- Airway clearance
  - Nasal suctioning with normal saline nose drops is encouraged
  - Suctioning alone can improve a patient's respiratory status enough that no other intervention is required.
  - Chest physiotherapy (CPT) is not recommended.
    - A 2009 Cochrane review showed that CPT does not reduce hospital length of stay or improve patients' respiratory scores on a standard Respiratory Distress Assessment Instrument.
    - In addition, some adverse events such as rib fractures have been reported in patients receiving CPT.
  - Nasal decongestants such as neosynephrine or phenylephrine are not efficacious and are not recommended in patients with bronchiolitis.
- Hydration
  - In patients who are unable to tolerate oral feeding because of respiratory distress or vomiting, maintenance of hydration can be accomplished through intravenous fluids or nasogastric or transpyloric feeding.
  - Intravenous hydration is preferred in patients with severe respiratory distress in whom further deterioration is possible.
- Oxygen
  - Supplemental oxygen is frequently required in the treatment of infants with bronchiolitis.
  - The point at which supplemental oxygen is started varies between institutions, but is generally between 90% and 94% spO<sub>2</sub>. The American Academy of Pediatrics recommends use of supplemental oxygen with oxygen saturations of less than 90%.
  - Heated and humidified oxygen is recommended to improve hydration of secretions and aid in airway clearance.
  - Patients with increasing oxygen requirement or worsening respiratory distress may benefit from nasal continuous positive airway pressure. This increased pressure may open the smaller airways and improve air exchange.
- Parental education
  - Parents should be instructed on appropriate hand hygiene.
  - Parents should demonstrate ability to use bulb suction and nasal saline drops to clear the infant's airway.
  - Parents should be educated on signs of respiratory distress and reasons to seek further care.

## Bronchodilators

- Bronchodilators have not been shown to benefit patients with bronchiolitis. Any improvements in respiratory status are short-lived. The cost and adverse effects usually outweigh any benefits to the patient.
- However, the use of bronchodilators in bronchiolitis remains controversial. Bronchodilators may be of more benefit in patients with a history of wheezing, atopy, or strong family history of asthma.
- The use of bronchodilators in children with severe disease has not been studied and the trial of albuterol for infants with severe disease as a rescue medicine could be considered.

## Epinephrine

Routine use of nebulized epinephrine in patients with bronchiolitis has not been shown to improve

hospital length of stay or other inpatient outcomes. As with bronchodilators, the use of epinephrine has not been studied adequately in patients with severe disease and it may show some promise as a rescue medication in those patients with severe respiratory distress.

## **Corticosteroids**

- Corticosteroids (oral, intravenous, intramuscular, and inhaled) should not be used routinely in bronchiolitis.
- Multiple randomized controlled trials have shown no statistically significant improvement in clinical score or hospital length of stay when corticosteroids are used.

## **Ribavirin**

- An antiviral medication, ribavirin is not recommended for the treatment of bronchiolitis.
- The minimal benefits to a small number of patients are outweighed by the high cost and difficult delivery mechanism.

## **Antibiotics**

- Antibiotics should be reserved for patients with evidence of a secondary bacterial infection. In those cases, an appropriate evaluation for bacterial infection, such as blood and urine cultures, should be done prior to antibiotic administration.
- Rates of secondary bacterial infections in patients with bronchiolitis have been shown to be quite low. Serious bacterial infection, when present, is most likely a urinary tract infection.
- Infants who are less than 28-days-old with fever may need further evaluation. Rates of bacterial infections in febrile neonates less than 28-days-old are not statistically different between RSV-positive and RSV-negative patients.
- Bacterial pneumonia in bronchiolitis patients is unusual. Chest radiographs in bronchiolitis patients often show evidence of atelectasis that is often misinterpreted as a possible bacterial infection.

## **Future therapies**

- Nebulized hypertonic saline has been shown in limited studies to decrease hospital length of stay compared to nebulized albuterol or epinephrine. However, more studies are needed to clarify the role this might play in future treatments.
- Use of both surfactant and helium/oxygen are being studied for use in critically ill infants with bronchiolitis.

## **Prevention**

### **Palivizumab**

- Palivizumab (Synagis<sup>®</sup>) is a humanized mouse monoclonal antibody.
- High-risk infants receive a dose (15mg/kg) IM once every 30 days through RSV season (November-March).
- The American Academy of Pediatrics Committee on Infectious Diseases has developed the following guidelines for administration of palivizumab.
  - Infants born at <29 weeks gestation who are <12 months at the beginning of RSV season should receive palivizumab prophylaxis.
  - Infants who are <12 months at the beginning of RSV season with hemodynamically significant heart disease or chronic lung disease of prematurity (defined as infants born

at <32 weeks gestation who required >21% FiO<sub>2</sub> for at least the first 28 days of life should receive palivizumab prophylaxis.

- Palivizumab can be considered in infants who are <24 months of age with profound immunocompromise.
- Palivizumab can be considered in infants with neuromuscular disease or congenital anomaly that impairs the ability to clear secretions from the upper airway.

## Vaccine

- An inactivated RSV vaccine developed in the mid-1960s led to an increased incidence of developing severe bronchiolitis rather than preventing infection.
- Further vaccine studies have included heightened safety evaluations following this experience.
- Other RSV vaccines are currently in development, including two live attenuated vaccine candidates.

## Summary

- Bronchiolitis is a significant cause of respiratory illness in infants and toddlers.
- Diagnosis is primarily clinical.
- Viral testing, chest radiography and other laboratory testing is not routinely recommended.
- The mainstays of treatment remain good airway clearance with suctioning, appropriate hydration and supplemental oxygen as needed.
- Specifically, routine use of corticosteroids, antibiotics and/or bronchodilators is not recommended.
- Emerging therapies such as use of hypertonic saline are still being evaluated.
- Prevention of bronchiolitis with appropriate hand hygiene and use of palivizumab in high-risk infants are also strongly recommended.

*This guideline was developed to improve health care access in Arkansas and to aid health care providers in making decisions about appropriate patient care. The needs of the individual patient, resources available, and limitations unique to the institution or type of practice may warrant variations.*

## References

## References

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