

Identifying and managing bronchiolitis

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ABSTRACT

Bronchiolitis is a common viral illness that affects the lower respiratory tract of infants and young children. The disease is characterized by wheezing and increased mucus production and can range from mild to severe in terms of respiratory distress. This article reviews the epidemiology, clinical presentation, and treatment of bronchiolitis.

Keywords: bronchiolitis, respiratory syncytial virus, nebulized hypertonic saline, albuterol, corticosteroids, pediatric

Learning objectives

- Understand the risk factors and clinical presentation associated with severe bronchiolitis.
- Explain the appropriate management of bronchiolitis.

Bronchiolitis, a lower airway tract disease, involves swelling of the bronchioles and impaired expiratory airflow. It typically affects children under age 2 years.¹ Between 2006 and 2010, an average of 4.3% of visits each year to the ED were for bronchiolitis.¹ The disease generally follows a mild course, yet 1% to 3% of patients have severe enough disease to require hospital admission.² Bronchiolitis is a costly disease, with children under age 2 years incurring \$1.7 billion worth of inpatient costs.³ Because of this expense, and because relatively few useful therapies are available, medical professionals are looking for new treatments. This article discusses the causes, patient presentation, and treatment of this disease.

EPIDEMIOLOGY

Bronchiolitis is caused by a variety of viruses, the most common being respiratory syncytial virus (RSV), a single-stranded RNA virus of the *Paramyxoviridae* family.⁴

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RSV accounts for nearly 70% of bronchiolitis infections.⁵ RSV has two major subtypes, RSV A and RSV B.⁶ Studies have looked at whether subtypes and subsequent genotypes could be predictors of a more severe disease course, but such studies have been conflicting or inconclusive.^{7,8}

Other causes that have been isolated in respiratory samples of children are human rhinovirus, parainfluenza virus, human metapneumovirus, coronavirus, adenovirus, influenza virus, and enterovirus.⁹ As many as 30% of children have been found to have more than one of these viruses at admission.⁹ Rarely, bronchiolitis has been found to be caused by *Mycoplasma pneumoniae*.¹⁰ Concomitant bacterial infection is uncommon.⁹

PATHOGENESIS

Although the exact mechanism is unknown, small airway cells die and are sloughed off, mixing with mucus, which leads to obstruction of the bronchioles, resulting in lower respiratory tract infection symptoms.¹¹

CLINICAL PRESENTATION

After incubation, children start to show signs of an upper respiratory tract infection, such as cough, rhinorrhea, and fever.⁹ After 1 to 3 days, lower respiratory tract signs become apparent.⁹ Wheezing (inspiratory and expiratory) may be audible.⁹ Patients also may have increased respiratory rate, crackles, increased work of breathing, grunting, nasal flaring, or retractions.⁹ Of more grave concern is the associated risk of apnea in infants suffering from

Key points

- RSV accounts for more than two-thirds of bronchiolitis cases.
- Pharmacologic treatments such as albuterol, corticosteroids, nebulized epinephrine, nebulized hypertonic saline, and antibiotics have shown little to no benefit in patients with bronchiolitis.
- Consider obtaining a urinalysis in a febrile infant even if bronchiolitis is strongly suspected, as urinary tract infection is the most common serious bacterial illness associated with non-RSV bronchiolitis.

bronchiolitis.^{12,13} Infants at high risk for apnea include those with a corrected age of less than 2 weeks, birth weight less than 2.3 kg (5.1 lb), respiratory rate less than 30 or greater than 70 at presentation, and SpO₂ of 90% or less at presentation.¹³

SEVERITY RISK FACTORS

Risk factors that may lead to a more severe disease course include low birth weight, congenital heart disease, exposure to secondhand smoke, male sex, prematurity, young maternal age, immunocompromised state, and family history of asthma.^{9,14,15}

UNNECESSARY INTERVENTIONS

Bronchiolitis is largely a clinical diagnosis and little, if any, workup is necessary in immunocompetent children. In straightforward cases of bronchiolitis, chest radiographs are not indicated.¹⁶ Treatments such as bronchodilators and corticosteroids have shown no benefit to children with bronchiolitis, and in some cases have been shown to increase their length of stay if they are admitted to the hospital.¹⁷⁻¹⁹ Nebulized epinephrine is not recommended in routine cases and combining nebulized epinephrine with corticosteroids also has not been shown to be effective in reducing rates of admission or length of stay.^{20,21}

A more recent treatment, nebulized hypertonic saline, was studied to see if it would improve outcomes in children with bronchiolitis, but appears ineffective.²²⁻²⁷ Administering a dose of furosemide was studied, as theoretically it would reduce the amount of fluid in the lungs of children in respiratory distress.²⁸ However, furosemide was not shown to improve tachypnea or hypoxia for children in the ED nor did it have any effect on rate of ICU admission or length of overall hospital stay between the two study groups.²⁸

Antibiotics should not be used routinely in patients with bronchiolitis.²⁹ Macrolides can be effective against bacterial bronchiolitis sources such as *M. pneumoniae* and contain potential antiviral properties; however, they still have not been proven to improve outcomes.^{30,31}

Chest physiotherapy should be avoided because it has not been shown to be effective in reducing the severity of

bronchiolitis and in some cases has led to adverse reactions such as vomiting.³²

APPROPRIATE MANAGEMENT

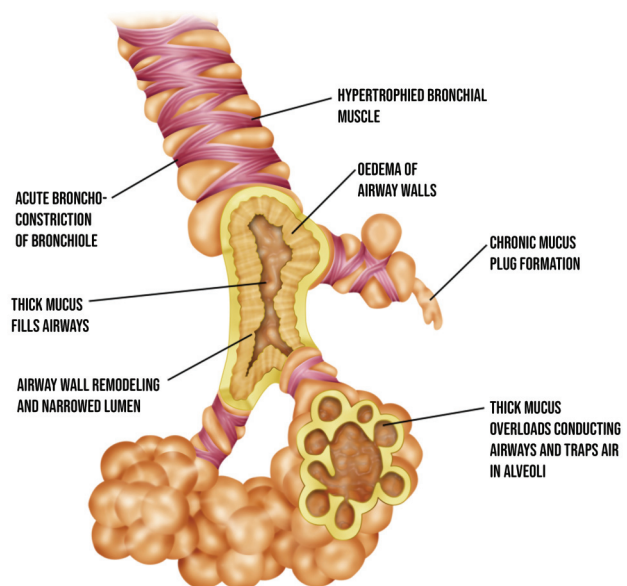
For the purpose of cohorting children during admission, respiratory viral panels can be used to identify the cause of bronchiolitis and reduce secondary transmission.^{33,34}

Although chest radiographs are not indicated for patients with clear-cut cases of bronchiolitis, one should be obtained if there is concern for pneumonia.¹⁶ The radiographs range from normal to findings of peribronchial thickening, hyperinflation, and/or atelectasis.^{35,36} Studies are being conducted on lung ultrasound, which thus far has shown to be a useful alternative to chest radiographs, providing radiation-free imaging that is helpful in determining the severity of the bronchiolitis.³⁷ Lung ultrasound may be especially helpful in serial monitoring during treatment, as it has been shown to have high sensitivity in finding pleural effusions, small consolidations, and interstitial changes.³⁸

Pulse oximetry can determine if the patient needs oxygen supplementation, and should be used in conjunction with history and physical examination to determine the gravity of the bronchiolitis.^{39,40} A target SpO₂ of 94% or greater does not appear to be necessary. In the Bronchiolitis of Infancy Discharge Study (BIDS), it was found that children with an oxygen saturation at or above 90% but below 94% had similar clinical outcomes.⁴¹ This also provided fiscal savings; children who remained admitted, despite the similar outcomes, had higher healthcare costs due to admission costs, supplemental oxygen, and pulse oximetry.⁴¹

A febrile presentation, especially in neonates, usually warrants a sepsis workup, even if the patient has a clear-cut case of bronchiolitis. Although associated serious bacterial illness is rare with bronchiolitis, the most common cause

FIGURE 1. Bronchiole in a patient with bronchiolitis



MAURIZIO DE ANGELIS/SCIENCE SOURCE

is urinary tract infection (UTI).⁴² Consider obtaining a urinalysis in febrile infants with bronchiolitis, especially cases not caused by RSV, because UTIs have been associated with bronchiolitis.⁴³

Maintaining hydration in a patient with bronchiolitis is of the utmost importance. In the United States, IV hydration is the dominant route; however, evidence supports nasogastric rehydration in place of IV hydration, as more nourishing fluids, such as formula, are an option.^{44,45}

Children with an oxygen saturation below 90% should receive supplemental oxygen via noninvasive ventilation such as high-flow nasal cannula or continuous positive airway pressure.^{39,46}

PREVENTION

To prevent RSV-associated bronchiolitis in children born at 29 weeks or less, children with chronic lung disease or significant congenital heart disease, prescribe palivizumab prophylaxis.⁴⁷ Advise families to follow simple steps, such as handwashing, using alcohol-based hand sanitizers, and avoiding contact with sick persons.⁴⁸

A maternal vaccination in development is showing promise for RSV.

The global disease burden of RSV-related mortality is held primarily in the developing world, where an estimated 99% of deaths from RSV occur.⁴⁹ Most of those deaths occur within the first 6 months of life.⁵⁰ Development of a vaccine is key to preventing RSV in those areas.⁵¹ Direct immunization of infants may still result in a gap period, because a vaccine may not be able to be administered safely before a certain patient age. Given that the greatest risk of morbidity and mortality from RSV infection is to infants under age 6 months, this could render the vaccine less than ideally effective.⁵¹ To address this issue, a maternal vaccination in late stage development is showing promising progress, and could provide neonates with antibodies against RSV.⁵²

BRONCHIOLITIS AND ASTHMA

Several studies have shown a correlation between bronchiolitis and development of asthma later in life.⁵³⁻⁵⁵ Whether bronchiolitis leads to the development of asthma or if it simply indicates that a child is susceptible to developing asthma later in life is unclear.⁵

CONCLUSION

Bronchiolitis is a common respiratory disease process that affects young children. Many treatments have been posited and studied, including albuterol, corticosteroids, and nebulized hypertonic saline. These have not been shown to be

effective. Supportive care, such as supplemental oxygen and maintaining hydration, continues to be the mainstay of treatment. Clinicians should consider obtaining a urinalysis and chest radiograph in a febrile infant, despite the presentation of straightforward bronchiolitis. A maternal vaccine could provide antibodies against RSV for infants. Correlation has been seen between bronchiolitis and asthma; however, the exact relationship remains unclear. **JAAPA**

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