

Chapter 15

Bronchiolitis



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Name and Synonyms

Formally known as Respiratory Syncytial Viral (RSV) pneumonia, but many other viruses (such as metapneumovirus, adenovirus, parainfluenza virus) may cause the same clinical disease.

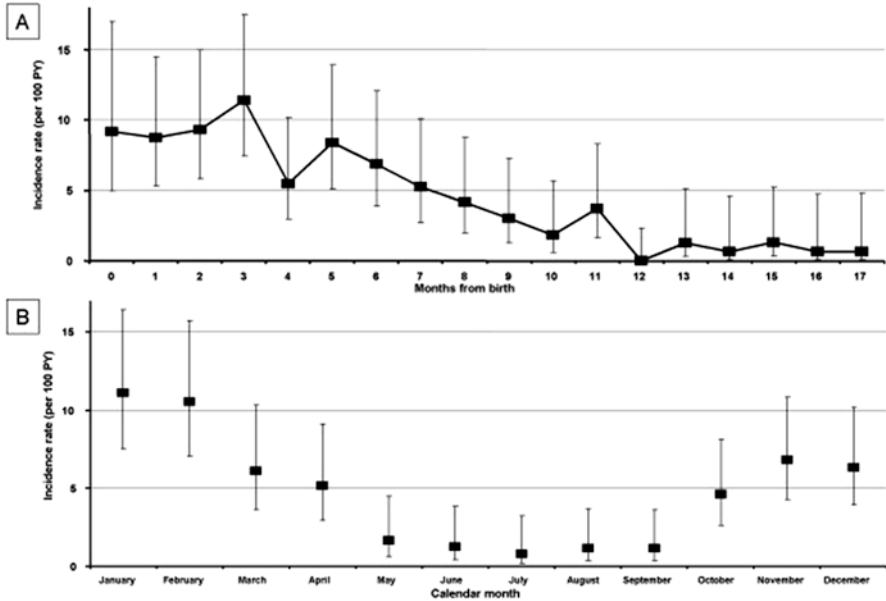
Incidence/Epidemiology

- Typically affects infants under 2 years of age.
- Reported peak incidence between 2 and 6 months.
- Seasonal peaks during fall and winter.
- Bronchiolitis is the leading cause of hospitalization in young children.

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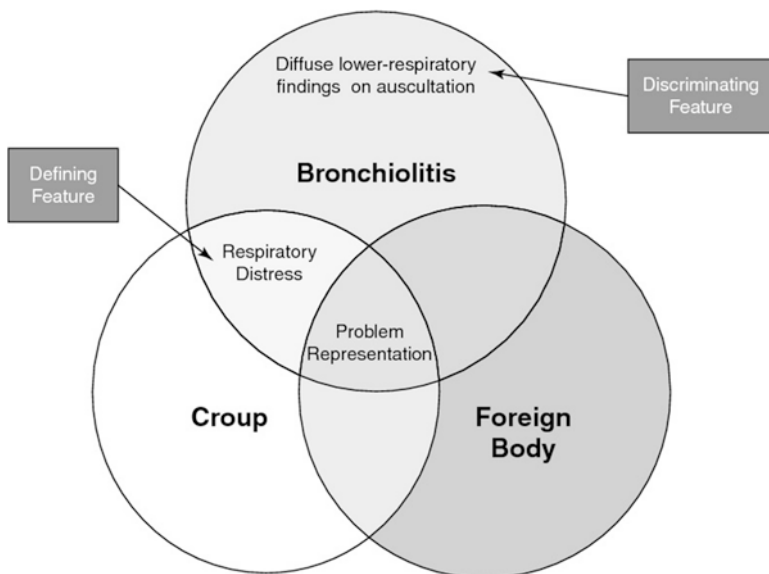


Incidence rates of hospitalizations for bronchiolitis by age (in months) (section A) and by calendar month (section B) in pre-term infants; Rome, Italy 2000-2006. [From article: Incidence and risk factors of hospitalization for bronchiolitis in pre-term children: a retrospective longitudinal study in Italy. *BMC Pediatrics*. 2009 Sept 10; 9:56; <https://doi.org/10.1186/1471-2431-9-56>, at <http://bmcpediatr.biomedcentral.com/articles/10.1186/1471-2431-9-56>; by Patrizio Pezzotti, Jessica Mantovani, Nicoletta Benincori, Eleonora Mucchino, Domenico Di Lallo, © Pezzotti et al; licensee BioMed Central Ltd. 2009; licensed under Creative Commons Attribution License BY 2.0 <http://creativecommons.org/licenses/by/2.0>] *Caption from original*

Differential Diagnosis

The typical affected infant presents with fever and wheezing, and as such initially prompts these differential considerations:

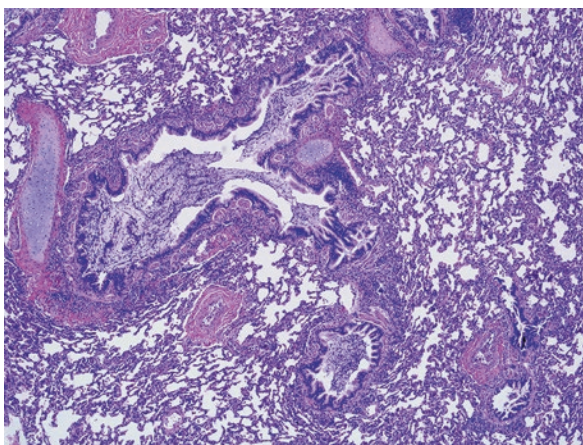
- Bacterial pneumonia
- Chlamydial pneumonia
- Foreign-body aspiration
- Reactive airway disease/asthma
- Aspiration pneumonia
- Congenital heart disease
- Vascular rings



The problem representation allows identification of three illness scripts that fit the defining features of this toddler with respiratory distress case. Diffuse lower respiratory findings on auscultation is the key discriminating feature, which allows a diagnosis of bronchiolitis [Mutnick A, Barone M. Assessing and Remediating Clinical Reasoning. In: Kalet A, Chou CL, editors. Remediation in Medical Education [Internet]. New York, NY: Springer New York; 2014 [cited 2016 Jul 28]. p. 85–101. Available from: http://link.springer.com/10.1007/978-1-4614-9025-8_6] *Caption from original*

Pathophysiology and Etiology

- Viral infiltration of terminal bronchioles results in edema, increased mucous production, and sloughing of respiratory epithelial cells.



Influenza virus infection. Like other forms of respiratory viral infection, influenza may cause a lymphocytic or necrotizing bronchiolitis, in this case associated with mucus stasis in the bronchioles (H&E, 40×). Autopsy examination following fatal influenza viral infection typically shows a necrotizing bronchitis and bronchiolitis with pulmonary edema and diffuse alveolar damage in the background (not shown) [Shah KK, Dishop MK. Infantile Viral Illnesses. In: Fraire AE, Woda BA, Welsh RM, Kradin RL, editors. *Viruses and the Lung* [Internet]. Berlin, Heidelberg: Springer Berlin Heidelberg; 2014 [cited 2016 Jul 28]. p. 143–58. Available from: http://link.springer.com/10.1007/978-3-642-40605-8_17] *Caption from original*

- Lymphocytic infiltration causes the typical pattern of peribronchial cuffing seen on plain chest radiographs.
- Known causative viruses include RSV, metapneumovirus, rhinovirus, parainfluenza virus, and adenovirus.

Presentation

Typical/“Classic”

- There is often a 2 to 4-day prodrome consisting of cough and rhinorrhea.
- Infants present after the prodrome with fever, increasing cough, and variable degrees of respiratory distress.
- Patients manifest a wide range of work of breathing, characterized by tachypnea, expiratory prolongation, retractions, and in more severe cases, grunting.

Atypical

- In infants less than 6 weeks of age, apneic episodes may be the first sign of bronchiolitis.

Primary Differential Considerations

- Early diagnostic consideration should also be given to:
 - Asthma
 - Pneumonia
 - Croup

- Congenital heart disease
- Aspiration pneumonitis

History and Physical Exam

- Historically an infant with a mild URI (prodrome, as above) will develop a progressively worsening cough.
- At initial presentation, most infants will have signs of lower respiratory disease.
- Most infants will be febrile, increasing insensible fluid losses.
- Excessive work of breathing may severely impair the ability to feed, resulting in variable degrees of dehydration.
- Cough, retractions, tachypnea, and grunting may be present.
- Auscultation will reveal expiratory prolongation, impairment of air entry, and ronchi/wheezing.

Findings That Confirm Diagnosis

- The typical clinical syndrome, when seasonally encountered (fall and winter) makes the diagnosis obvious.
- Viral testing will further identify the particular etiologic agent.

Factors That Suggest Diagnosis

- As mentioned previously, bronchiolitis is a seasonal epidemic, providing the caregiver with obvious signs.

Factors That Exclude Diagnosis

- The presence of tachycardia with a gallop or cardiomegaly points towards congenital heart disease.
- Toxic appearance, hyperthermia, and lobar infiltrates suggest bacterial pneumonia.

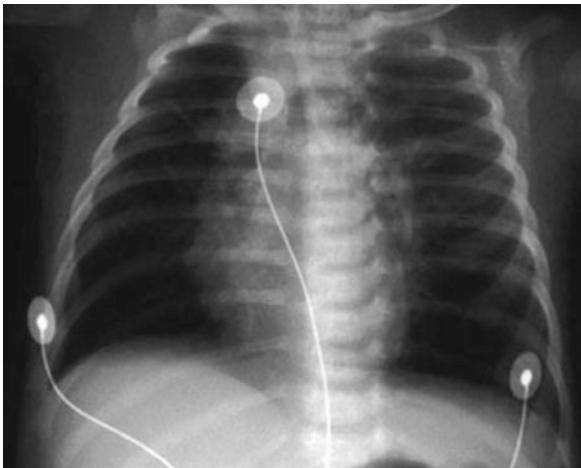
Ancillary Studies

Laboratory Studies

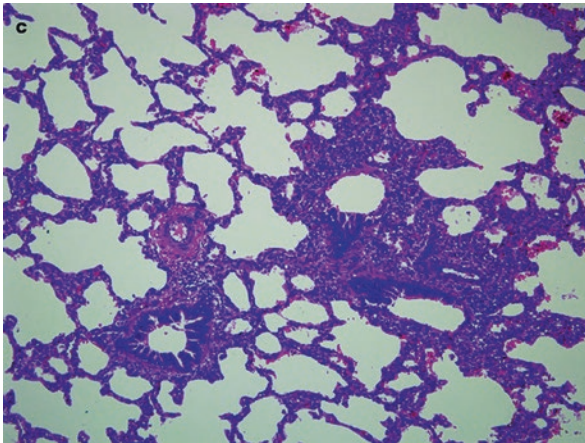
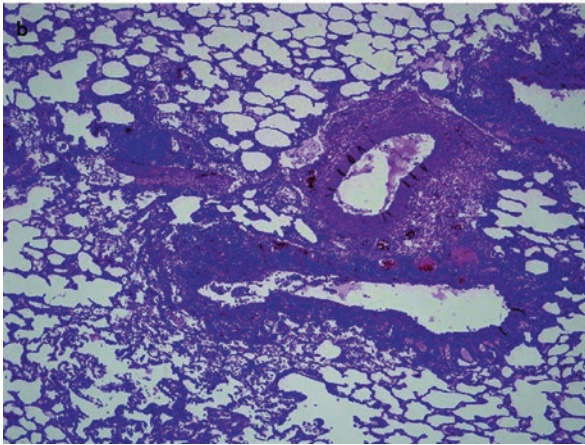
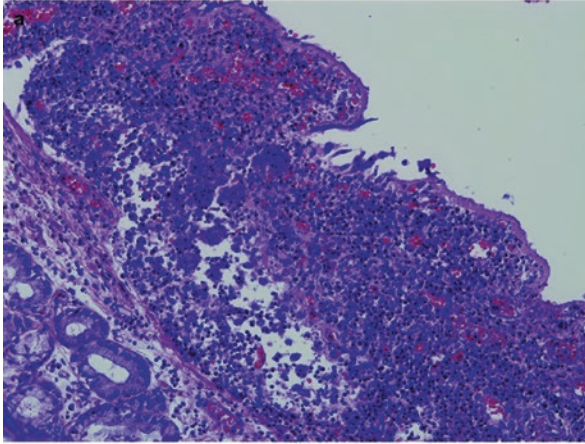
- Viral testing is optional in atypical cases (specifically infants who present only with apnea) and in facilities that have co-bedding of pediatric inpatients.
- Blood work is not indicated.

Imaging

- Chest radiographs will demonstrate hyperinflation, interstitial disease, and peribronchial cuffing; in some instances, variable degrees of atelectasis may be present.



RSV-bronchiolitis. Markedly hyperinflated lungs with flattening of the diaphragm and peribronchial hilar infiltrates are demonstrated on the chest radiograph. [Staatz G. Bronchitis and Bronchiolitis in Childhood. In: Baert AL, editor. Encyclopedia of Diagnostic Imaging [Internet]. Berlin, Heidelberg: Springer Berlin Heidelberg; 2008 [cited 2016 Jul 28]. p. 203–5. Available from: http://www.springerlink.com/index/10.1007/978-3-540-35280-8_337] *Caption from original*



Respiratory syncytial virus infection in an infant. The prototypic infantile respiratory virus, RSV, causes a lymphocytic bronchitis and bronchiolitis. (a) This bronchus demonstrates a cuff of lymphocytes in the submucosa (H&E, 200×). (b) Circumferential lymphocyte infiltrates are also noted in the small airways (H&E, 100×). (c) Bronchiolitis may be accompanied by an interstitial pneumonitis, characterized by interstitial widening by lymphocyte infiltrates. Syncytial-type multinucleate cells are absent or rare in lung tissues from otherwise healthy infants but are characteristic of the viral cytopathic effect seen in culture in the diagnostic virology laboratory (H&E, 100×) [Shah KK, Dishop MK. Infantile Viral Illnesses. In: Fraire AE, Woda BA, Welsh RM, Kradin RL, editors. *Viruses and the Lung* [Internet]. Berlin, Heidelberg: Springer Berlin Heidelberg; 2014 [cited 2016 Jul 28]. p. 143–58. Available from: http://link.springer.com/10.1007/978-3-642-40605-8_17] *Caption from original*



Bronchiolitis and pneumomediastinum. Frontal chest radiograph in a patient with RSV infection demonstrates a combination of bilateral perihilar atelectasis and hyperexpanded lungs. Note the presence of pneumomediastinum (arrow) with gas tracking up the neck soft tissues [Krol JJ, von Herrmann PF, Challa HR, Dillon JE. *Imaging of Pediatric Emergencies*. In: Singh A, editor. *Emergency Radiology* [Internet]. New York, NY: Springer New York; 2013 [cited 2016 Jul 28]. p. 361–73. Available from: http://link.springer.com/10.1007/978-1-4419-9592-6_26] *Caption from original*

Special Populations

Age

- Children older than 3 may contract viral infections that present identically to bronchiolitis, though RSV titers will be negative.

Co-morbidities

- Risk factors for the development of apnea include:
 - History of prematurity (less than 35 weeks)
 - Age less than 2 months
 - Presence of congenital heart disease
 - Presence of marked atelectasis

Pitfalls in Diagnosis

- Most patients present with typical symptomatology.
- Not considering bronchiolitis in infant apneic spells would be unwise.

Critical Steps Not to Miss

- Obtaining a careful birth history is mandatory.
- There is usually an older child in the home with a simple cold.

Mimics

- As previously mentioned, bacterial pneumonia may present with similar findings.
- New onset CHF will often present with respiratory distress and wheezing.

Time-Dependent Interventions

- Supplemental oxygen is often necessary.
- In dehydrated infants, IV fluids are indicated.

- Nasopharyngeal suctioning may dramatically lessen the work required to breathe.
- The use of albuterol has recently been discouraged in the literature; many practitioners, however, still favor a single albuterol treatment in an attempt to identify the rare patient with reversible bronchospasm.
- Steroids are NOT recommended.
- Severe cases may respond to aerosolized racemic epinephrine.

Overall Principles of Treatment

- Simple correction of hypoxemia and fluid deficits are important first steps.
- Unfortunately, most infants will not respond to bronchodilators.
- Hospital admission is often the only option.

Disease Course

- Studies have demonstrated that this is a 14-to-21-day illness with vacillating degrees of respiratory compromise.
- The cough may take 2 weeks to resolve

Related Evidence

Papers of particular interest have been highlighted as:

*** Of key importance*

Practice Guideline

Ralston SL, Lieberthal AS, Meissner HC, Alverson BK, Baley JE, Gadomski AM, Johnson DW, Light MJ, Maraqa NF, Mendonca EA, Phelan KJ, Zorc JJ, Stanko-Lopp D, Brown MA, Nathanson I, Rosenblum E, Sayles S 3rd, Hernandez-Cancio S; American Academy of Pediatrics. Clinical practice guideline: the diagnosis, management, and prevention of bronchiolitis. *Pediatrics*. 2014 Nov;134(5):e1474-502. <https://doi.org/10.1542/peds.2014-2742>. PMID: 25349312. <http://www.ncbi.nlm.nih.gov/pubmed/25349312> **

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Physician. 2008 Jun;37(6 Spec No):6-13. PMID: 19142264. <http://www.ncbi.nlm.nih.gov/pubmed/19142264> **

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Review

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Papiris SA, Malagari K, Manali ED, Kolilekas L, Triantafillidou C, Baou K, Rontogianni D, Bouros D, Kagouridis K. Bronchiolitis: adopting a unifying definition and a comprehensive etiological classification. *Expert Rev Respir Med*. 2013 Jun;7(3):289-306. <https://doi.org/10.1586/ers.13.21>. PMID: 23734650. <http://www.ncbi.nlm.nih.gov/pubmed/23734650> **

Garibaldi BT, Illei P, Danoff SK. Bronchiolitis. *Immunol Allergy Clin North Am*. 2012 Nov;32(4):601-19. <https://doi.org/10.1016/j.iac.2012.08.002>. PMID: 23102068. <http://www.ncbi.nlm.nih.gov/pubmed/23102068> **

Williams C, Bartram T. Towards evidence based emergency medicine: best BETs from the Manchester Royal Infirmary. BET 4: Chest x-rays in bronchiolitis. *Emerg Med J*. 2012 Jun;29(6):514-5. <https://doi.org/10.1136/emered-2012-201374.5>. PMID: 22635392. <http://www.ncbi.nlm.nih.gov/pubmed/22635392> **

Use PubMed Clinical Queries to find the most recent evidence. Use this search strategy:

“Bronchiolitis”[Mesh] OR “Bronchiolitis”