BRONCHIOLITIS

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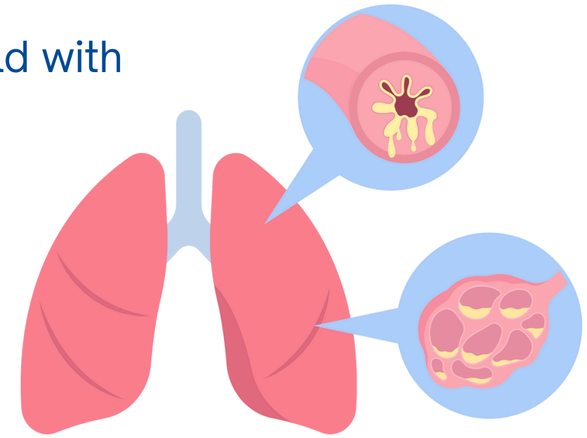
What is Bronchiolitis?

Bronchiolitis is a viral lower respiratory tract infection, characterized by obstruction of the small airways (bronchioles). This obstruction is caused by acute inflammation, edema, and necrosis of the epithelial cells lining the small airways, as well as increased mucous production.

- Typically caused by the Respiratory syncytial virus (RSV)
- Occurs most frequently in the late fall and winter months
- Usually affects infants and children younger than 2 years of age
- Most common reason for admission to hospital in the first year of life
- Primary infection does not confer protective immunity - reinfections continue to occur
- Huge variation in clinical management of bronchiolitis in Canada and around the world with significant use of unnecessary tests and ineffective therapies



Symptoms

Initial cold symptoms - bronchiolitis usually develops following 2-3 days of common cold (upper respiratory tract) symptoms which typically include:

- Nasal congestion & discharge
- Mild cough
- Fever (>38 degrees)
- Decreased appetite

Progression of symptoms - as the lower respiratory tract becomes affected, may see:

- Tachypnea (rapid breathing)
- Increased work of breathing ranging from mild to severe
- Wheezing
- Persistent coughing
- Decreased feeding

Up To Date (2024). *Bronchiolitis in Infants and Children: Clinical Features and Diagnosis.* https://www.uptodate.com/bronchiolitis-in-infants-and-children-clinical-features-and-diagnosis

Diagnosis

Bronchiolitis is a **clinical diagnosis** based on the patient's history and physical exam.

- Typically presents as a first episode of wheezing < 12 months of age in the fall/winter months
- Wide range of symptoms & severity - anywhere from mild to impending respiratory failure
- Exposure to an individual with a URTI
- Physical exam findings might include: tachypnea, accessory muscle use (suprasternal, intercostal, subcostal), crackles & wheezing on auscultation.
- Oxygen saturation often decreased
- Signs of dehydration may be present if respiratory distress has been sufficient to interfere with feeding

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CPS (2021). *Bronchiolitis: Recommendations for Diagnosis, Monitoring and Management of Children One to 24 Months of Age.* https://cps.ca/en/documents/position/bronchiolitis

Investigations

Diagnostic studies are not indicated for most children presenting with bronchiolitis. Tests are often unhelpful and lead to unnecessary admissions, further testing, and ineffective therapies.

- CXR - non-specific hyperinflation and atelectasis with bronchiolitis, often misinterpreted as consolidation. Not recommended.
- NPA swab for RSV - not helpful from a diagnostic perspective, does not impact management. May be done for inpatient admissions.
- CBC/Blood cultures - Not recommended if afebrile. Bloodwork may be done in febrile babies < 3 months of age to rule out concomitant bacterial infections (incidence is low).
- Blood gas - Only if concerned about respiratory failure. Otherwise unhelpful.

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Clinical Severity Assessment

The following clinical parameters are assessed to determine the severity of bronchiolitis:

- Respiratory rate
- Respiratory effort (retractions/accessory muscles, grunting, nasal flaring)
- Oxygen saturation
- Episodes of apnea lasting > 10 seconds
- Heart rate
- Hydration status
- Peripheral perfusion (pulses, warm/cool to touch, cap refill)
- Mental status (agitation/responsiveness)

Numerous scoring tools are available though very few have been validated. All have limitations in clinical practice - they are very subjective and often do not capture the full clinical picture (many scoring tools do not take apneas into account).

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Up To Date (2025). *Bronchiolitis in Infants and Children: Treatment, Outcome, and Prevention*. https://www.uptodate.com/contents/bronchiolitis-in-infants-and-children-treatment-outcome-and-prevention

Clinical Severity Assessment

Mild bronchiolitis - little to no respiratory distress and have a normal mental status and activity level. May have transient self-resolving oxygen desaturations.

Moderate bronchiolitis - usually tachypneic with moderate respiratory distress (ie, mild to moderate retractions without grunting or head bobbing), no apnea, and normal level of alertness. They may have hypoxemia (SpO_2 <90 percent) on room air.

Severe bronchiolitis - persistent tachypnea, considerable respiratory distress (ie, retractions, grunting, nasal flaring, head bobbing), and hypoxemia. Other findings that indicate severe illness include agitation, apnea, and/or poor responsiveness. Apnea occurs most commonly in preterm infants and those <2 months of age.

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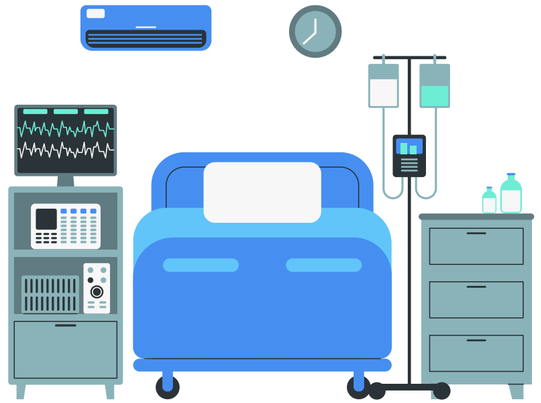
Clinical Course

- Typical course of bronchiolitis begins with upper respiratory tract symptoms (nasal congestion, cough) followed by lower respiratory tract symptoms (wheezing, crackles).
- Most children do well and can be managed with supportive care at home.
- Illness tends to peak around day 3-5.
- Cough can persist for 3-4 weeks.
- Approximately 2% of infants will develop severe disease requiring respiratory support or PICU care.



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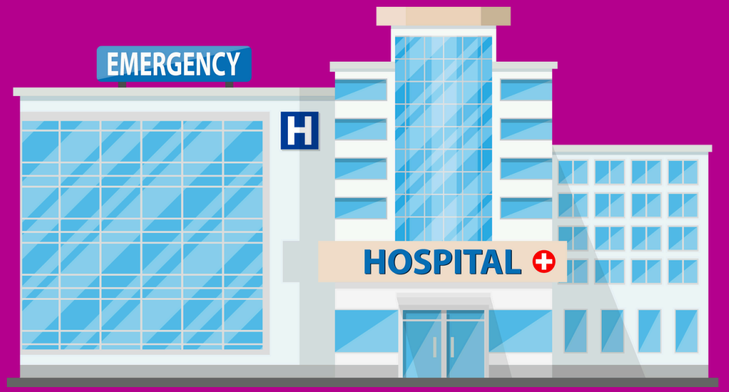
TREKK (2023). *Bottomline Recommendations: Bronchiolitis*. https://cms.trekk.ca/wp-content/uploads/2023/11/2023_07_26_Bronchiolitis_BLR_FINAL_v4.1.pdf

Decision to Admit

The decision to admit a patient with bronchiolitis is based on clinical judgement, respiratory status, the patient's ability to maintain adequate hydration and the family's ability to cope. It should also be taken into consideration that illness tends to peak around day 3-5 when considering admission.

Patients with bronchiolitis require supportive care and monitoring in the inpatient setting with any of the following:

- Toxic appearance or lethargy
- Moderate to severe respiratory distress
- Apnea
- Persistent hypoxemia requiring supplemental oxygen therapy
- Poor feeding and/or dehydration
- Caregivers who are unable to care for the patient at home



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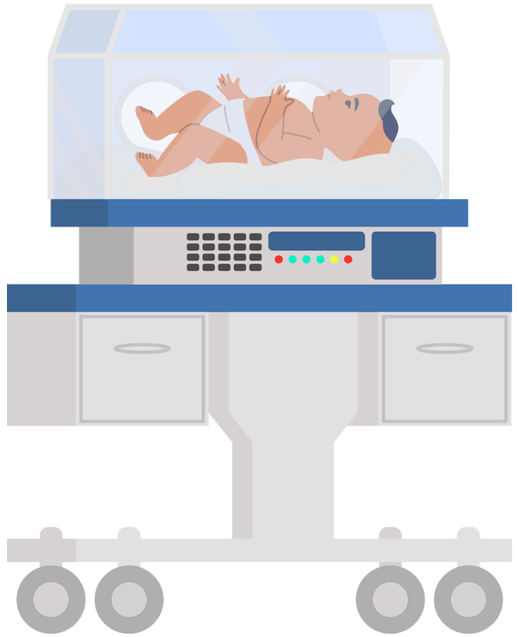
High Risk Groups

Groups at higher risk for severe disease include:

- Infants born prematurely (< 35 weeks gestation)
- < 3 months of age at presentation
- Hemodynamically significant cardiopulmonary disease
- Immunodeficiency



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Monitoring

Monitoring of an admitted patient with bronchiolitis includes:

- Heart rate, respiratory rate and oxygen saturation. These can be monitored intermittently for moderate bronchiolitis. Continuous monitoring is appropriate for severe bronchiolitis, those on supplementary oxygen, documented apnea or at risk for apnea (preterm infants, infants < 2 months). Continuous monitoring is particularly important for patients receiving advanced respiratory support such as high flow nasal cannula (HFNC) or non-invasive ventilation (CPAP/BiPAP).
- Respiratory status - work of breathing, increasing tachypnea, findings on auscultation
- Fluid intake and output

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Management

For patients requiring admission, supportive care with assisted feeding, minimal handling, gentle nasal suctioning, and supplemental oxygen therapy forms the mainstay of treatment.

There are only two therapies recommended, based on evidence:

- Hydration
- Oxygen

No evidence to support the use of these treatments in bronchiolitis.
Not Recommended:

- Salbutamol
- Corticosteroids
- Antibiotics
- Antivirals
- 3% Hypertonic saline neb
- Chest physiotherapy
- Cool mist therapies or saline aerosols

There is equivocal evidence for the use of Epinephrine nebs. Not routinely recommended.

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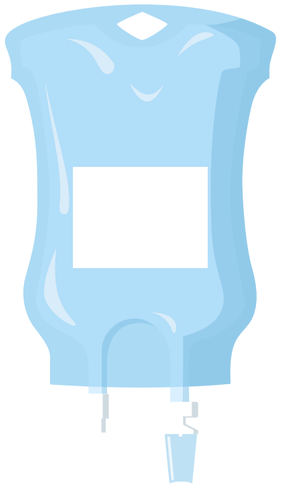
Hydration



Infants and children with bronchiolitis may have difficulty maintaining adequate hydration due to increased needs (fever, tachypnea) and poor oral intake (tachypnea/respiratory distress).

- Small, frequent oral feeds should be encouraged and breastfeeding supported.
- If respiratory distress is severe enough to make oral feeding unsafe, consider IV fluids or NG rehydration.
- For IV rehydration use isotonic fluids (NS) at maintenance. Monitor serum electrolytes.
- NG and IV routes equally effective.
- As work of breathing improves, oral feeds can be introduced gradually as tolerated.

CPS (2021). *Bronchiolitis: Recommendations for Diagnosis, Monitoring and Management of Children One to 24 Months of Age.* https://cps.ca/en/documents/position/bronch

Oxygen

Supplementary oxygen is only necessary if oxygen saturations are **persistently** < 90%. Transient mild desaturations during sleep are to be expected and don't always require oxygen.

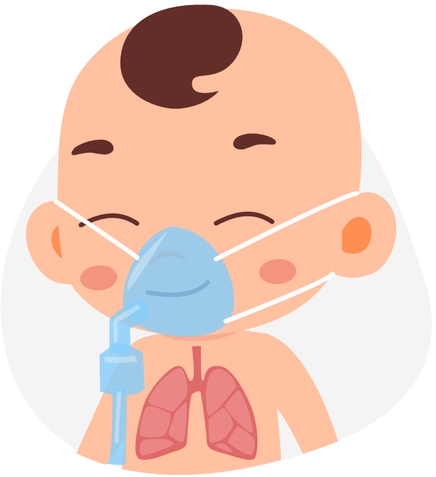
Most patients do well with low-flow oxygen therapy via nasal cannula or simple face mask. Be mindful of flow rates:

Nasal Cannula

- Newborn: max 1L/min
- Infant (< 5kg): max 2L/min
- Peds (< 20kg): max 4L/min
- Peds/Teens (> 20kg): max 6L/min

Simple Face Mask

- 6 - 10L/min to prevent rebreathing of CO2



High Flow Nasal Cannula (HFNC)

HFNC is indicated for patients with bronchiolitis with moderate to severe work of breathing and/or hypoxemia that persists or worsens despite initial suctioning and standard low flow oxygen therapy.

- Heated and humidified oxygen is easier on the nasal mucosa; patients can tolerate much higher flow rates.
- Can deliver higher Fi02 than low flow oxygen therapy.
- HFNC works by minimizing or eliminating the inspiration of room air (and the subsequent dilution of your supplemental high Fi02 gas) by using flow rates that “wash out” anatomic dead space.
- This also helps eliminate C02 from the upper airways.
- Typical starting flow rate 2L/kg/min. MAX rate 50L/min.

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CPS (2018). Use of High-Flow Nasal Cannula Oxygen Therapy in Infants and Children. https://cps.ca/en/documents/position/nasal-cannula

High Flow Nasal Cannula

After starting HFNC, the patient's respiratory status should be monitored closely. A positive response to therapy is indicated by:

- Improved oxygen saturations
- Improved tachypnea
- Improved work of breathing

If the patient continues to have significant distress and/or hypoxemia, adjust the flow and Fi02 settings as needed. Important to note: Sp02 alone is a poor indicator of success or failure of HFNC as patients with impending respiratory failure can have adequate Sp02 despite inadequate ventilation. May need further escalation of care - this is when a blood gas may be helpful.

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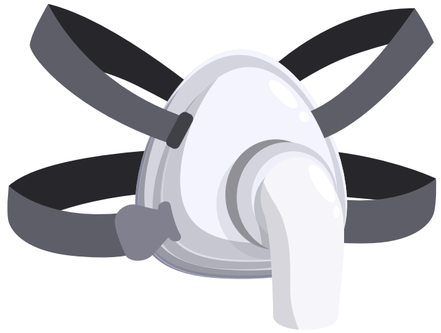
Non-Invasive Ventilation

NIV modalities that are used in the management of bronchiolitis are CPAP and BIPAP. They are a higher level of respiratory support than HFNC, and are used to reduce work of breathing, improve gas exchange, and avoid endotracheal intubation.

- Typically used when patients have failed to show improvement with HFNC but can also be used as the initial mode of respiratory support particularly if patients present with impending respiratory failure.
- Avoids adverse effects of intubation - laryngeal injury, ventilator-induced lung injury, ventilator-associated pneumonia, narcotic dependence/withdrawal.



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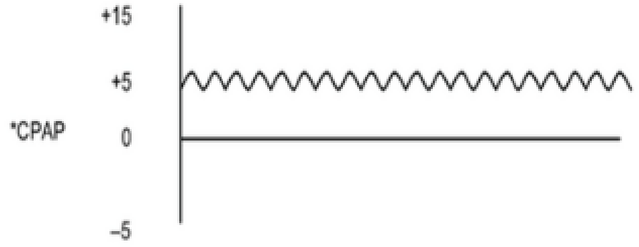
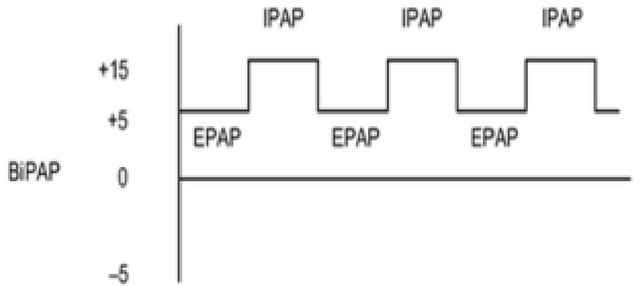
CPAP & BiPAP

CPAP: Continuous Positive Airway Pressure. Provides a constant, steady pressure throughout the respiratory cycle (inspiration/expiration). Physiologically, it is the equivalent of PEEP (positive end expiratory pressure).

BiPAP: Bilevel Positive Airway Pressure. Delivers two set levels of positive airway pressure, one during inspiration (IPAP) and one during expiration (EPAP). The inspiratory pressure is higher than the expiratory pressure.





Up To Date (2024). *Noninvasive Ventilation for Acute and Impending Respiratory Failure in Children*. https://www.uptodate.com/contents/noninvasive-ventilation-for-acute-impending-respiratory-failure-in-children?topic

Monitoring NIV Patients

Continuous cardiorespiratory & pulse oximetry monitoring.

Hourly visual assessment

P: Patient is positioned to prevent pressure on face
I: Interface is in the proper position and is neither too tight nor too loose (both can cause leaks)
N: Nares are not obstructed by mask
C: Circuit is not causing traction on the face
H: Headgear or hat is properly in place

Assess skin integrity during hourly checks. Auscultate lungs, assess work of breathing.
Ongoing monitoring of ventilation (blood gas).

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Endotracheal Intubation

Patients who have ongoing or worsening severe distress or impending respiratory failure despite NIV may require endotracheal intubation and mechanical ventilation. Intubation may also be necessary in patients with frequently recurring episodes of apnea.

Signs of impending respiratory failure in patients with bronchiolitis include:

- Marked retractions
- Decreased of absent breath sounds
- Fatigue
- Severe agitation
- Poor responsiveness to stimulation (weak or no cry)

Venous blood gas samples obtained from patients with impending respiratory failure often reveal significant respiratory acidosis - PCO_2 > 60mmHg

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Distress, Failure, Arrest

Respiratory Distress - the body is working really hard to breath leading to inadequate gas exchange.

Respiratory Failure - the body is no longer able to maintain adequate gas exchange (ventilation) or adequately deliver oxygen to the body's tissues (oxygenation). In children, often the precipitating factor to respiratory failure is fatigue.

Respiratory Arrest - The cessation of breathing altogether. Progressive respiratory failure is the most common cause of cardiopulmonary arrests in children.

Discharge

Discharge from the hospital is based on clinical judgement, but the patient should exhibit:

- Improved tachypnea and work of breathing
- Oxygen saturations > 90% on room air
- Adequate oral feeding

Provide families education on signs of deterioration/when to return to hospital

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Respiratory Resources

OPENPediatrics Recognizing Respiratory Distress

OPENPediatrics Recognizing Respiratory Failure

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The Pediatric Pulse

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