

Bronchiolitis

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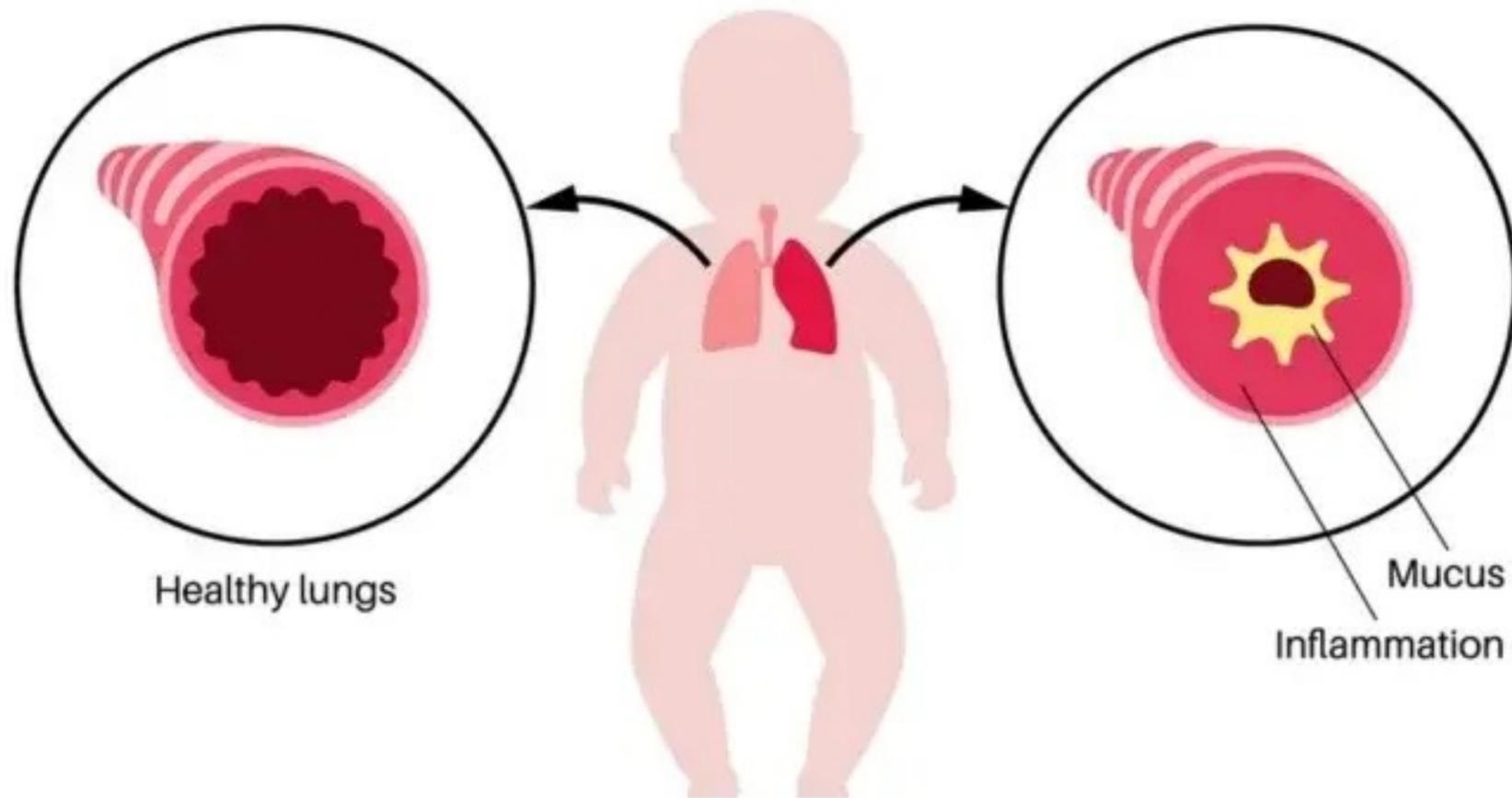


Objectives:

- Review causes & symptoms of bronchiolitis
- Discuss diagnostics
- Discuss how to classify severity
- Review when to admit a patient with bronchiolitis
- Review clinical management
- Review respiratory distress, failure and arrest
- Discuss discharge criteria



What is Bronchiolitis?



Viral lower respiratory tract infection characterized by obstruction of the small airways (bronchioles).

Obstruction is caused by:

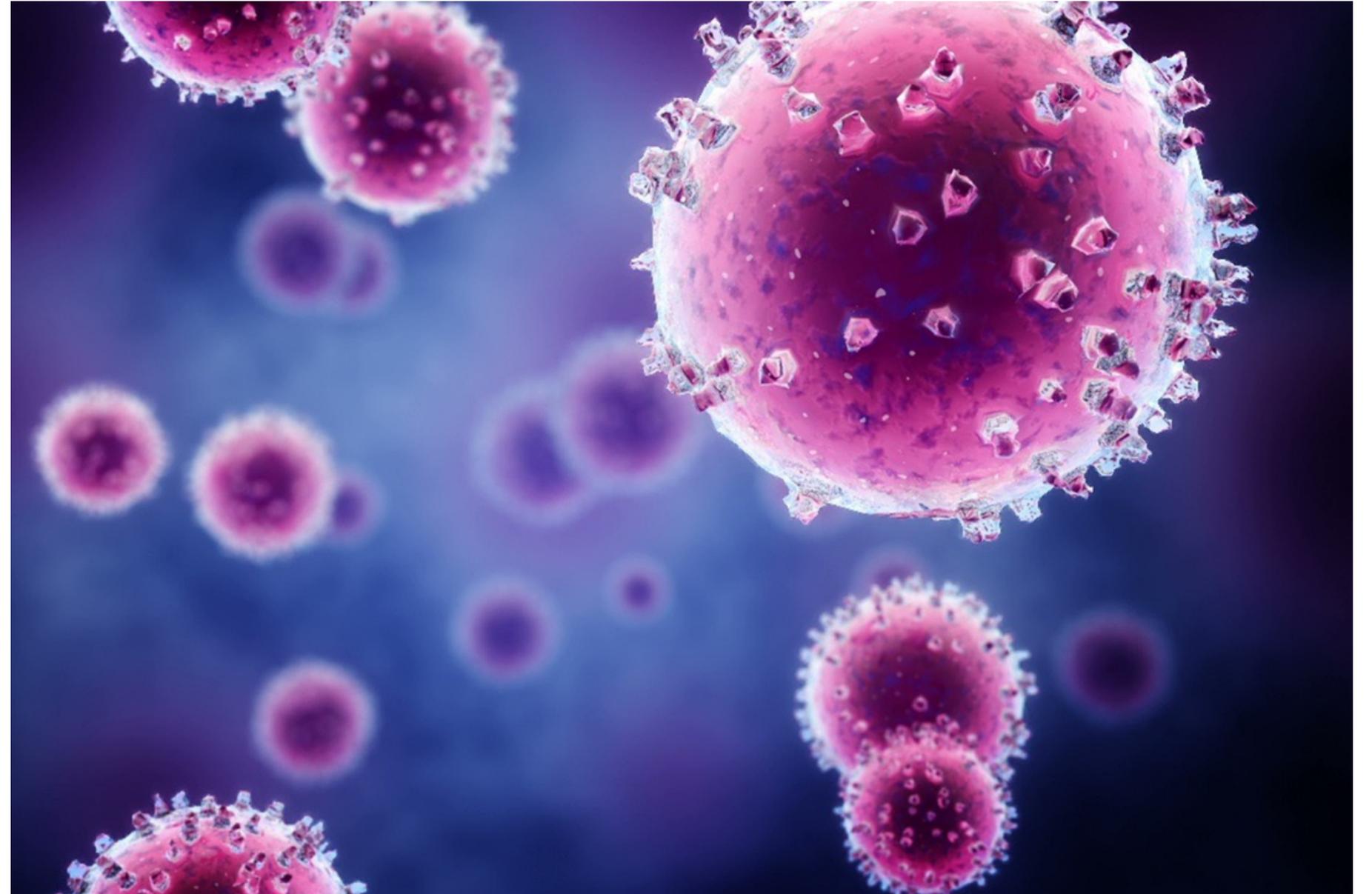
- acute inflammation
- edema
- necrosis of the epithelial cells lining the small airways
- increased mucous production

Usually affects infants and children younger than 2 years of age. Most common reason for admission to hospital in the first year of life.



Causes

- Typically caused by the respiratory syncytial virus (RSV)
- Can also be caused by adenovirus, influenza, parainfluenza, rhinovirus & HMPV
- Late fall and winter months
- Primary infection does not confer protective immunity - reinfections continue to occur
- Huge variation in clinical management across Canada



Symptoms



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

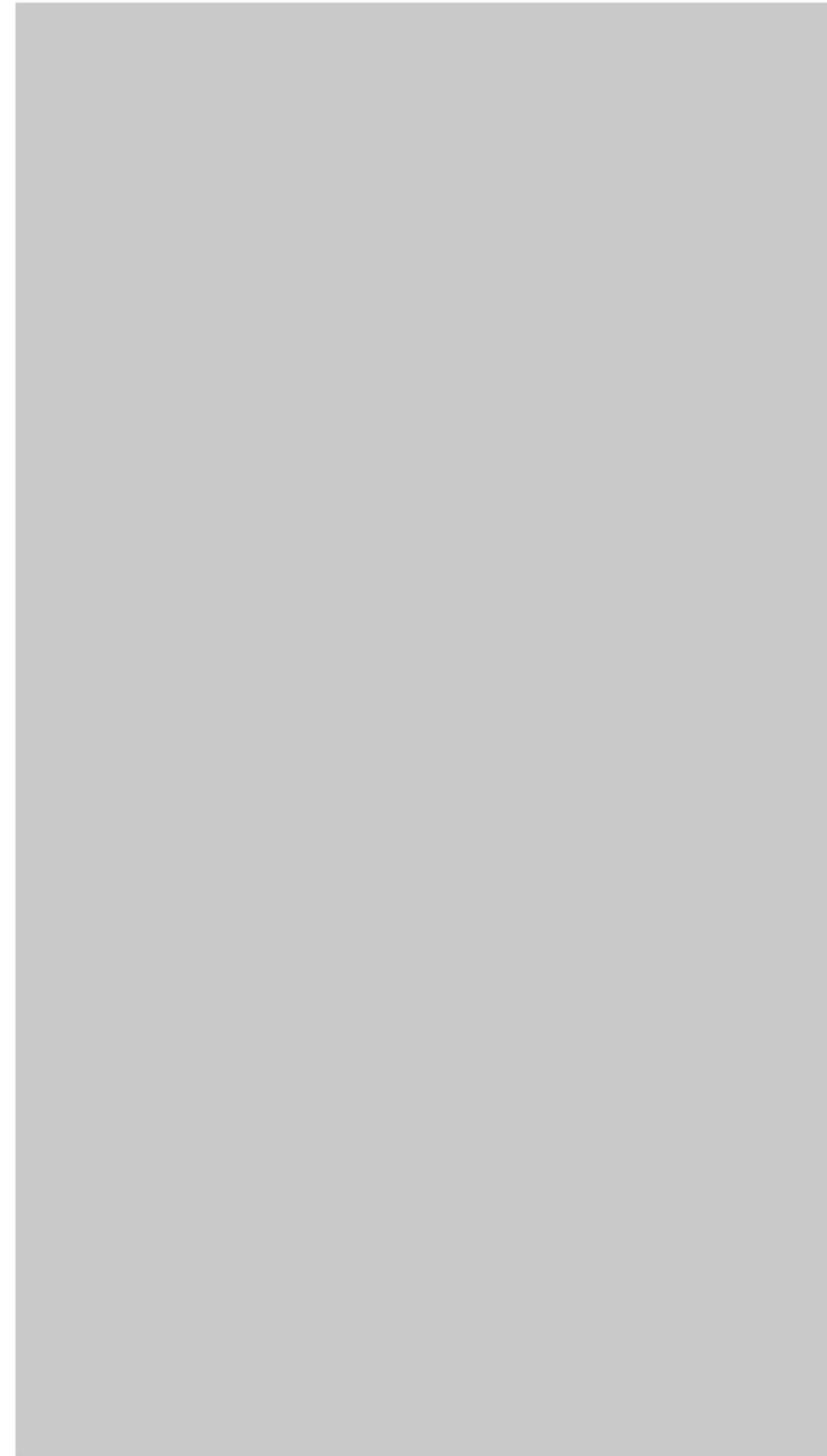
- Nasal congestion and discharge
- Mild cough
- Fever (< 38 degrees)
- Decreased appetite



Progression of Symptoms

As the lower respiratory tract becomes affected may see:

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



Diagnosis



Clinical diagnosis based on the patient's history and physical exam.

- Typically presents as 1st episode of wheezing < 12 months of age during the fall and winter months
- Exposure to an individual with a URTI
- Physical exam findings may include:
 - tachypnea
 - accessory muscle use (suprasternal, intercostal, subcostal)
 - crackles
 - wheezing
- Oxygen saturation often decreased
- Signs of dehydration may be present if respiratory distress sufficient enough to interfere with feeding

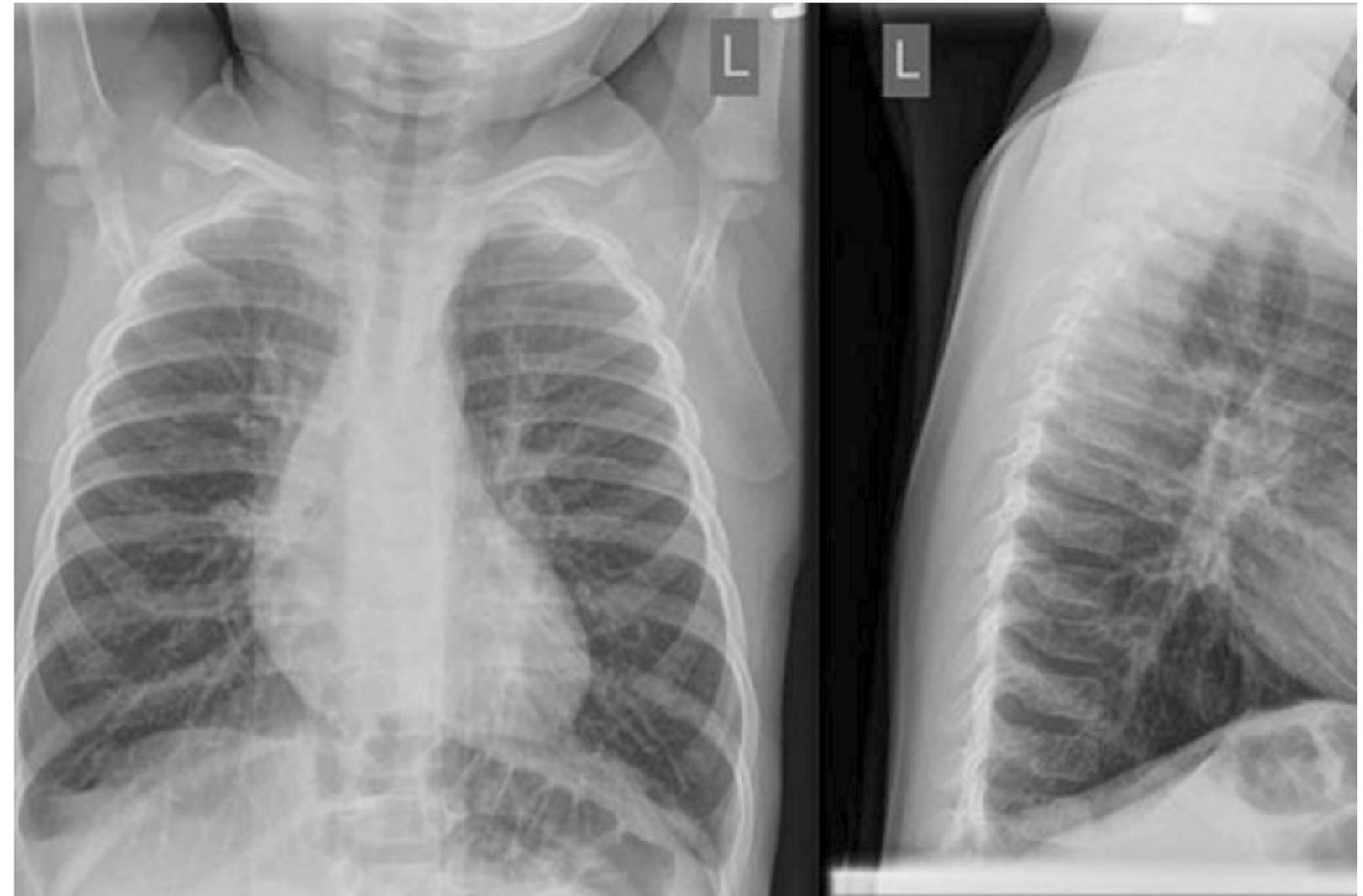
*Wide range of symptoms and severity - anywhere from mild to impending respiratory failure!



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, often interpreted as consolidation. Not recommended
- NPA 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. BW 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



Clinical Severity Assessment



Clinical parameters assessed to determine the severity:

- 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, cap refill)
- Mental status (responsiveness, agitated)
- Numerous scoring tools available, very few validated



Clinical Severity Assessment



Mild bronchiolitis

- Little to no respiratory distress
- 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
- May have hypoxemia (O₂ sats < 90% on room air)

Severe bronchiolitis

- Persistent tachypnea
- Considerable respiratory distress (ie. retractions, grunting, nasal flaring, head bobbing) and hypoxemia
- +/- apnea, agitation and poor responsiveness



Clinical Course

- URTI symptoms followed by lower respiratory tract symptoms (wheezing/crackles)
- Most managed with supportive care at home
- Illness peaks around day 5
- Cough can persist 3 - 4 weeks
- Approx. 2% of infants will develop severe disease requiring respiratory support or PICU care



When to Admit?



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
- Poor feeding and/or dehydration
- Caregivers who are unable to care for the patient at home



High Risk

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



Monitoring

Monitoring of an admitted patient with bronchiolitis includes:

- Heart rate
- Respiratory rate
- Oxygen saturation
- Respiratory status - WOB, increasing tachypnea, findings on auscultation
- Fluid intake/output

Vitals can be monitored intermittently for moderate bronchiolitis (q1-4h)



Continuous Monitoring



Appropriate for:

- Severe bronchiolitis
- Documented apnea or at risk for apneas (preterm infants, infants < 2 months of age)
- Important for patients receiving advanced respiratory support such as high flow nasal cannula (HFNC) or non-invasive ventilation (CPAP/BiPAP)



Management

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

There are only 2 therapies recommended based on evidence:

- Hydration
- Oxygen



Management



No evidence to support the use of these treatments in bronchiolitis:

- Salbutamol
- Corticosteroids
- Antibiotics
- Antivirals
- 3% hypertonic saline neb
- Chest physiotherapy
- Cool mist therapies
- Saline aerosols

Equivocal evidence for the use of Epi nebs, not routinely recommended



Hydration

May have difficulty maintaining adequate hydration due to increased needs (fever, tachypnea) and poor oral intake (tachypnea/respiratory distress). Recommendations:

- Small, frequent oral feeds
- If respiratory distress is severe enough to make oral feeding unsafe (aspiration), consider IV fluids or NG rehydration
- For IV - use isotonic fluids (NS) at maintenance. Monitor serum electrolytes
- NG and IV routes are equally effective
- As WOB improves, oral feeds introduced gradually, as tolerated



Oxygen

Only necessary if oxygen saturations are *persistently* < 90%. Transient mild desaturations during sleep are to be expected and do not require supplementary oxygen.

Flow rates for low flow oxygen therapy:

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 re-breathing of CO₂
- Do NOT wean



High Flow Nasal Cannula



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 FiO_2 than low flow therapy
- Minimizes or eliminates the inspiration of room air (and the subsequent dilution of supplemental high FiO_2 gas)
- Washes out anatomic dead space
- Helps with CO_2 clearance
- Typical starting flow rate of 2L/kg/min. Max 50L/min



High Flow Nasal Cannula



Patient's respiratory status should be closely monitored after starting HFNC. 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 FiO₂ settings as needed.

Note: SpO₂ alone is a poor indicator of success or failure of HFNC as patients with impending respiratory failure can have adequate SpO₂ despite inadequate ventilation. May need further escalation of care - this is when a blood gas may be helpful.



Non-Invasive Ventilation

CPAP and BiPAP are used in the management of bronchiolitis.

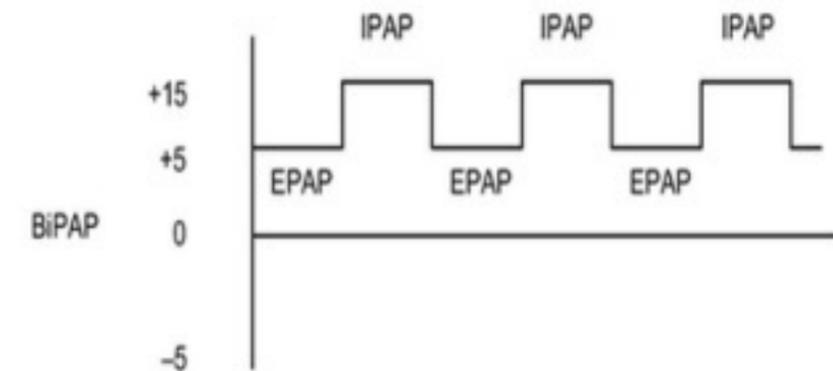
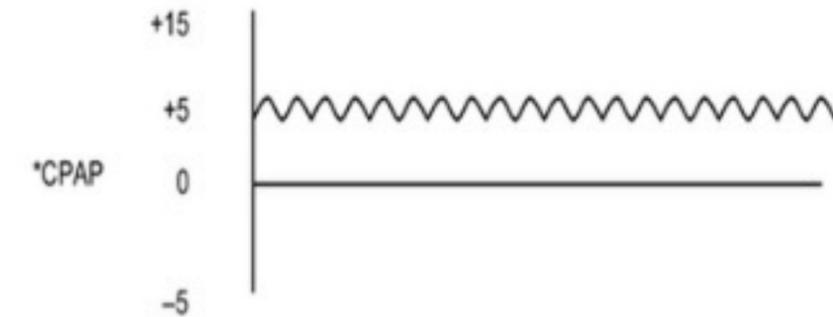
- Higher level of respiratory support than HFNC
- Reduces WOB, improves gas exchange
- Typically used when patients have failed to show improvement with HFNC but can also be used as the initial mode of respiratory support particularly if patients present with impending respiratory failure.
- Avoids adverse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



Non-Invasive Ventilation

CPAP - Continuous Positive Airway Pressure. Provides a constant, steady pressure throughout the respiratory cycle (inspiration/expiration). Physiologically 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.



Non-Invasive Ventilation

Monitoring

Continuous cardiorespiratory and pulse oximetry monitoring.
Hourly visual assessment includes:

- 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 the mask
- C - circuit is not causing traction on the face
- H - headgear or hat is properly in place

Assess skin integrity hourly. Auscultate lungs and assess WOB. Ongoing monitoring of ventilation (serial blood gasses)



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 or 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: $PCO_2 > 60\text{mmHg}$



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



Thank you!

