Bronchiolitis: Current Treatment and Management

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Disclosures

• Nothing at this time
• Except I love making children better
Clinical Practice Guideline: The Diagnosis, Management, and Prevention of Bronchiolitis

Abstract
This guideline is a revision of the clinical practice guideline, “Diagnosis and Management of Bronchiolitis,” published by the American Academy of Pediatrics in 2006. The guideline applies to children from 1 through 23 months of age. Other exclusions are noted. Each key action statement indicates level of evidence, benefit-harm relationship, and level of recommendation. Key action statements are as follows: Pediatrics 2014;134:e1474–e1502

Key Words
bronchiolitis, infants, children, respiratory syncytial virus, evidence-based, guideline
Resources

Key articles reviewed for this presentation

• AAP Subcommittee, Diagnosis and Management of Bronchiolitis, Diagnosis and Management of Bronchiolitis. Pediatrics, 2006;118;1774 DOI 10.1542/peds 2006-2223

• Zorc JJ, Hall CB. Bronchiolitis: recent evidence on diagnosis and management. Pediatrics 2010;125:342-9
Bronchiolitis: Definition

Viral infection of the lower respiratory tract characterized by acute inflammation, edema, and necrosis of epithelial cells lining small airways, and increased mucus production.
Bronchiolitis

- A disorder most commonly caused in infants by viral lower respiratory tract infection.
- The most common lower respiratory infection in children 1 month – 2 years of age.
- Most common cause of hospitalization in infants during the first 12 months of life.
- Approximately 100,000 bronchiolitis admissions occur in the United States annually.
- Estimated annual cost of $1.73 billion in 2014.
Bronchiolitis

- Characterized by
  - Acute inflammation of the bronchioles
  - Edema and necrosis of epithelial cells lining in the small airways
  - Airway plugging with sloughed necrotic epithelial cells causing partial to total obstruction of air flow
    - Resulting in rapidly clinically changing signs
  - Increased mucus production
  - “Ball Valve” effect resulting in air trapping, atelectasis and ventilation to perfusion mismatch, resulting in hypoxemia
  - Smooth muscle constriction has little role in pathologic process
Signs and Symptoms

- Runny nose
- Decreased appetite
- Tachypnea
- Wheezing
  - Inflammation
  - Mucus plugging
- Cough
- Crackles, rales
- Nasal flaring
- Use of accessory muscles
- Decreased Appetite
- Decreased activity
- Fever
- Cyanosis of hands or feet
Respiratory Syncytial Virus

RSV

- Most common etiologic agent for Bronchiolitis
- Highest incident of infection occurring between November and April
- 90% of children infected within first 2 years of life
  - up to 40% of them will have lower respiratory infection
- Infection with RSV does not grant permanent or long-term immunity
- Reinfections are common
Viral causes of Bronchiolitis

- Respiratory Syncytial Virus (RSV): 50-80%
- Human Metapneumovirus (HMPV) 3-19%
  - Newly identified paramyxovirus
  - Similar seasonality and course to RSV
- Parainfluenza 3
- Influenza A or B 10-20%
- Adenovirus
- Rhinovirus
- Coronavirus
- Often Confections 10-30% mostly RSV with HMPV or Rhinovirus
Single/Multi-Viral - FilmArray

- Viral testing Nasal wash or Nasal Brush

- Viral **cultures** or genetic respiratory virus testing may sometimes be used to help track RSV outbreaks and to identify other viral infections that may cause clinical symptoms similar to RSV.
RSV/Bronchiolitis - in Adults

Symptomatic RSV infections may occur in adults, particularly in healthcare workers or caretakers of small children.

• Duration - less than 5 days,
• Symptoms
  o Consistent with an upper respiratory tract infection
  o Runny nose (rhinorrhea)
  o Sore throat (pharyngitis)
  o Cough
  o Headache
  o Fatigue
  o Fever
  o High-risk adults, such as those with certain chronic illnesses or immunosuppression, may have more severe symptoms consistent with a lower respiratory tract infection, such as pneumonia.
Post Infection

- Children who present with severe disease
  - persistently increased respiratory effort, apnea,
  - need for intravenous hydration, supplemental oxygen, or mechanical ventilation

These patients are more likely to present with respiratory problems as older children (recurrent wheezing)
Clinical Course of Bronchiolitis

- Incubation period: 2-8 days
- Upper respiratory infection: 1-3 days
- Worsening lower airway disease: 3-5 days
- Full recovery: 2-8 weeks

Swingler et al. 2000

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Summary of the RSV Season


Week 46 to 13

Week 48 to 17
RSV Data Trends - Iowa

[Graph showing RSV data trends over time with bars and line chart for 3-week average]
American Academy of Pediatrics (AAP) Guidelines for Bronchiolitis -
Not intended as sole source for treatment, Not intended to replace clinical judgement or established protocols

• Initial AAP-recommendations released 2006- Revised 2014
• Applying to infants 1 – 23 months of age
• Excluding children with respiratory illnesses, recurrent wheezing, chronic neonatal lung disease (BPD), neuromuscular disease, Cystic Fibrosis or heart disease. Children with HIV, organ or hematopoietic stem cell transplants.
American Academy of Pediatrics (AAP): Guidelines for Bronchiolitis

**FIGURE 2**
Integrating evidence quality appraisal with an assessment of the anticipated balance between benefits and harms leads to designation of a policy as a strong recommendation, moderate recommendation, or weak recommendation.
American Academy of Pediatrics (AAP): Guidelines for Bronchiolitis

<table>
<thead>
<tr>
<th>Statement</th>
<th>Definition</th>
<th>Implication</th>
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</thead>
<tbody>
<tr>
<td>Strong recommendation</td>
<td>A particular action is favored because anticipated benefits clearly exceed harms (or vice versa), and quality of evidence is excellent or unobtainable.</td>
<td>Clinicians should follow a strong recommendation unless a clear and compelling rationale for an alternative approach is present.</td>
</tr>
<tr>
<td>Moderate recommendation</td>
<td>A particular action is favored because anticipated benefits clearly exceed harms (or vice versa), and the quality of evidence is good but not excellent (or is unobtainable).</td>
<td>Clinicians would be prudent to follow a moderate recommendation but should remain alert to new information and sensitive to patient preferences.</td>
</tr>
<tr>
<td>Weak recommendation (based on low-quality evidence)</td>
<td>A particular action is favored because anticipated benefits clearly exceed harms (or vice versa), but the quality of evidence is weak.</td>
<td>Clinicians would be prudent to follow a weak recommendation but should remain alert to new information and very sensitive to patient preferences.</td>
</tr>
<tr>
<td>Weak recommendation (based on balance of benefits and harms)</td>
<td>Weak recommendation is provided when the aggregate database shows evidence of both benefit and harm that appear similar in magnitude for any available courses of action.</td>
<td>Clinicians should consider the options in their decision making, but patient preference may have a substantial role.</td>
</tr>
</tbody>
</table>
Diagnosis bronchiolitis and assess disease severity on the basis of history and physical examination.

**Evidence Quality B- Recommended Strength- Strong**

2. Assess risk factors for severe disease, <12 wks premature, underlying cardiopulmonary disease, or immunodeficiency. When making decisions on evaluation and management.

**Evidence Quality B- Recommended Strength- Strong**

3. Diagnosis bronchiolitis on the basis of history and physical examination, radiographic or laboratory studies should not be obtained routinely.

**Evidence Quality B- Recommended Strength- Moderate**
2014 AAP Bronchiolitis Guidelines
Treatment

1. Inhaled Albuterol should not be administered to infants or children - Evidence Quality B - Recommended Strength - Strong

2. Inhaled Racemic Epinephrine should not be administered to infants or children - Evidence Quality B - Recommended Strength - Strong

3. Nebulized Hypertonic saline should not be administered to infants or children in the emergency department - Evidence Quality B - Recommended Strength - Moderate

4. Nebulized Hypertonic saline should not be administered to infants or children in the hospital - Evidence Quality B - Recommended Strength - Weak (based on randomized controlled trial with inconsistent findings.)

5. Routine use of systemic corticosteroids - hospital - Evidence Quality A - Recommended Strength - Strong
6. Supplemental oxygen in **not** be administered if the Pox exceeds 90% - **Evidence Quality D** - **Recommended Strength** - **Weak** - low level of evidence and reasoning.

7. Continuous Pulse Oximetry may **not** be used - **Evidence Quality D** - **Recommended Strength** - **Weak** - low level of evidence and reasoning.

8. Chest Physiotherapy should **not** be used - **Evidence Quality B** - **Recommended Strength** - **Moderate**

9. Antibiotics should not be used, **unless there is a present bacterial infection or a strong suspicion of one** (ex- Otis Media common complication) - **Evidence Quality B** - **Recommended Strength** - **Strong**

10. Administration of nasogastric or intravenous fluids, for patients that cannot maintain hydration orally. - **Evidence Quality X** - **Recommended Strength** - **Strong**
2014 AAP Bronchiolitis Guidelines
Prevention

1. **Synergist**-palivizumab *should not* be administered to infants with a gestational age >29 wks.
   Evidence Quality B- Recommended Strength- Strong

2. **Synergist**-Palivizumab should be administered to infants during the 1st year of life with hemodynamically significant heart disease or chronic lung disease of prematurity defined as preterm infants <32 wks who require >21% oxygen for at least the first 28 days of life.
   Evidence Quality B- Recommended Strength- Moderate

3. Maximum of 5 monthly doses of **Synergist** should be administered during RSV season to infants that qualify.
   Evidence Quality B- Recommended Strength- Moderate

4. All peoples should disinfect hand before and after direct contact with patients, after contact with inanimate objects in the direct vicinity of the patient and after removing gloves.
   Evidence Quality B- Recommended Strength- Strong
5. All people should use alcohol based rubs for hand decontamination when caring children. If unavailable they should wash their hands with soap and water.  
Evidence Quality B- Recommended Strength- Strong

6. Inquiring about exposure of the patient to tobacco smoke when assessing.  
Evidence Quality C- Recommended Strength- Moderate

7. Counseling caregivers about exposing the patient to environmental tobacco smoke and smoking cessation. 
Evidence Quality B- Recommended Strength- Strong

8. Encourage exclusive breastfeeding for at least 6 months to decrease the morbidity of respiratory infections. 
Evidence Quality B- Recommended Strength- Moderate

9. Educate personnel and family members on evidence-based diagnosis treatment and prevention in bronchiolitis. 
Evidence Quality C- Recommended Strength- Moderate
Treatment
Supportive Care

• Administer oxygen if indicated
• Nasal suctioning to clear upper airway
• Monitor for apnea, hypoxemia, and impending respiratory failure
• Normalize body temperature
• Rehydrate with oral or intravenous fluids
  o NPO if WOB in increase
• Monitor hydration status
• Monitor Vitals, RR, HR, WOB and Pulse Oximetry
Bronchiolitis Orders - Inhaled Medication

- Bronchodilators should not be used routinely for management of Bronchiolitis
  - Optional trial of β-agonist should be continued only if objective evaluation indicates a clinical response
  - Most studies show transient improvement of unclear clinical significance
  - Ventilation to perfusion mismatch by overinflating airways and decreasing blood flow, with ongoing atelectasis

- Side Effects are common: tachycardia, Hypoxemia
  - No impact on the overall course of the disease in inpatients

- Bronchodilator have variable effects on infants with bronchiolitis
  - Some improve.. some get worse.. and the some just stay the same....
Contact Isolation- Isolate Early!!!

Protect yourself and other patients

• RSV spreads easily from person to person through direct contact with respiratory secretions. Spread within families is very high.

• RSV is a major nosocomial threat in hospitals, causing appreciable morbidity in infants and elderly

• The two primary modes of transmission for RSV include direct contact with large droplets of secretions and self-inoculation touching your eyes or nose after touching contaminated objects.

• RSV frequently is shed for prolonged periods, which increases its contagious nature. RSV Shedding occurs from 1-21 days with mean of 6.7 days.
Contact Isolation

SPREAD OF INFECTION

- Transmission by small-particle aerosol is not significant; thus, the risk of acquiring infection decreases with increasing distance from the patient.
- RSV-infected nasal secretions remain infectious on countertops/stethoscopes for more than 6 hours. On hands for 25 mins/ gloves for 1.5 hrs.
- Viral shedding from asymptomatic patients does occur.
- In the immunocompromised host, viral shedding can extend beyond 6 weeks.
- Transmission among infants may not be as important as transmission between infants and staff.
- Visitors are another potential source of spread.
- **Significant cause of illness in elderly.**
- Healthcare workers risk of contacting and spreading.
Assessment Severity of Bronchiolitis

Mild Severity
• Normal ability to feed
• Little or no respiratory distress
• No requirement for oxygen (oxygen saturation >92%)

Treatment – Educate Parents
• Parent are able to suction patient with bulb syringe
• Treat at home, if parents capable and informed and have transport
• Parent capable for watching respiratory status for deterioration- Increased RR and WOB
• Parents monitor feeding and wet diapers for dehydration
Assessment Severity of Bronchiolitis

**Moderate Severity**

- Moderate respiratory distress, with some chest wall retractions, nasal flaring
- Mild hypoxemia, corrected by oxygen, patient may appear short of breath then feeding
- May have brief apnea episodes
- Dehydration- monitor Capillary refill, blood pressure- eating <50% of normal feeds, not having normal wet diapers
Assessment Severity of Bronchiolitis

Treatment - Moderate Severity

- Admit to hospital
- Give Oxygen to maintain Saturation >90%,
  - Nasal Cannula preferred - not over 2 lpm infants, max 4 lpm larger child, (decrease WOB, flushes dead space ventilation, supports fragile airways)
- Consider giving intravenous fluids, evaluate dehydration monitor I/O closely
- Nasal suction as needed - with Nasal aspirator (first choice), Catheter (as needed) - use Normal Saline -thins secretions- Patient needs to suck, swallow and breath to eat
- Observe closely for deterioration
- Chest X-ray
- Respiratory Viral Test - nasal wash or swab
Assessment Severity of Bronchiolitis

- **Severe**
  - Transport to Peds Critical Care or Consult Tertiary Care Hospital for transport by a Pediatric qualified Transport Team before Respiratory Status deteriorations
  - Unable to feed
  - Severe respiratory distress, with marked chest wall retractions, nasal flaring, head bobbing and grunting
  - Hypoxemia, which may not be corrected by extra oxygen
  - May have increasingly frequent or prolonged apnea episodes
  - Altered level of consciousness, patient tired - not crying for suctioning, IV sticks, child lethargic
Assessment Severity of Bronchiolitis

Treatment Severe
- Consultation with Intensive Care or Pediatric Transport Services
- Give oxygen to maintain saturation >90%
- Nasal suction as needed - with Nasal aspirator (first choice), Catheter (as needed) - use Normal Saline - thins secretions - baby has to breath
- Observe closely to anticipate the possible need for intubation and positive pressure ventilation - other options NIV (Non-invasive ventilation, High Flow High Humidity Therapy)
- Nothing by mouth
- Give intravenous fluids bolus - IV, IO
- Cardiorespiratory monitoring
- Chest X-ray
- Respiratory Viral Test - nasal wash or swab
- Consider monitoring arterial blood gases (venous or capillary) Evaluate pH - looking for 7.35-7.45, if less patient having Respiratory Distress
Suctioning

- Types available - use with Normal Saline
  - Bulb - home use, prior to discharge
  - Home devices
  - Suction before Feedings
Suctioning

- **Nasal Aspirators** used with Hospital suction
  - Less traumatic than a catheter
  - Use with Normal Saline (NS)
  - Follow up with oral suction PRN
What device do we use next?
What is High Flow Therapy (HFT)?

High Flow Therapy is defined as flow rates that exceed patient inspiratory flow rates at various minute volumes.
High Flow Therapy (HFT)

How does HFT help?

• HFT delivers high humidity to the airways preventing drying of the mucus membranes- preventing a humidity deficit

• HFT provides inadvertent **Continuous Positive Airway Pressure (CPAP)** to our patients. Research shows measurable CPAP level at flow rates > 2 lpm in infants.

• High gas flow helps to support unstable small airways.

• HFT can enhance respiratory efficiency by flushing nasopharyngeal anatomical dead space and supporting respiratory work. Physiologic deadspace is approximately 30% of the inspired tidal volume. Helping the patient to work less to breath better.
Vapotherm-Current Practices at Blank Children’s Hospital

Indications for use-

Used on patients in Respiratory Distress and not responding to conventional therapy. Start flow within acceptable range for patient size and increased flow based upon patient’s WOB-8-10 lpm and increasing based on WOB

Initiated

• General Peds or PICU with Physician’s order
• ER with admission bed pending.

Helps prevent the patient from going to the PICU- decreased intubations if initiated appropriately and promptly.
GOAL-Prevent Intubation

Non Invasive CPAP/ BIPAP Support- New Advancements

• Non invasive Mask or Prongs
  o RAM Cannula-Can be used to with ventilator
  o Full Face Mask -Performax –XXS /XS
  o Nasal Mask- Gel nasal mask- Pixie Mask
Bronchiolitis
CXR View

- Diffuse interstitial pneumonitis most common in all lobes
- Hyperaeration > 50%
- Peribronchial thickening
- Lobar or segmental consolidation 20–50%; RUL, RML most common involve lobes
Case Presentation

- JV - previously healthy 4 Month- presented to ED
  - Rhinovirus, tachypnea, for the last 4 days, fever developed over night that prompted mom to bring him to the ED
  - Interview- JV has not been drinking or eating well for the past 1-2 days
    - minimal wet diapers that morning
    - No vomiting or diarrhea
    - No cough- but when he breaths he sounds “funny”/ chest looks funny
  - Recently exposed to other sick children at his daycare
  - JV general wellness- was born 34 wks./5days. Birth weight 2.6kg (5.3 lbs.)
    - in special care nursery of 1 week with oxygen for several days.
    - usually consumes 30oz. Breast milk/day.
    - 4-6 wet diapers/day. Normal stools
    - Patient rolls from back to front. Weight, height and head Circumference at 50%
    - Immunizations are up to day. Didn’t receive Synagis
  - JV lives with married parents, 4 yo sister and pet in apartment. He and sister attend daycare 5 days/week. No smokers at home, although neighbors smoke. Mom has history of asthma
Physical Examination Finding

• Vital Signs- Temp-38.6C (101.48F) axillary: pulse 152/min, Resp Rate 54 BPM: BP 74/48: SpO2 91% on room air
• General- Tachypneic infant with Respiratory Distress
• HEENT- Anterior fontanel slightly sunken, conjunctiva slightly injected, rhinorrhea, bilateral tympanic membranes with mid erythema, lips pink with tacky mucous membranes.
• Respiratory: Bilateral lung sounds coarse with fair aeration: wheezing, WOB with mild to moderate subcostal and intercostal retractions, nasal flaring
• Cardiac: Tachycardia with regular rhythm, no murmur noted, pulses and perfusion are adequate
• GI- belly soft, no tenderness or distention, normoactive bowel sounds, tanner 1 circumcised male with bilateral descended testes
• Musculoskeletal skin: Hot, pale, range of motion intact tenting skin turgor; no deformities
• Neurologic: Sleepy infant. Pupils equal and reactive to light (PERL) and brisk: moves all extremities: normal tone
Treatment based on finding- ED

- Oxygen 2 lpm to treat desaturation and WOB
- Placement of IV- followed by fluid bolus for dehydration
- Albuterol nebulizer for wheezing
- Respiratory Viral Panel

After fluid bolus- infant physical findings unchanged
- Bolus repeated- with improvement
- Oxygen brings SP02 up to 93%
- Wheezing unchanged, but WOB appears slightly improved post Albuterol and suctioning
- CXR- perihilar, streaky opacities, hyper expansion and no focal consolidation

- Infant admitted with Diagnosis of Bronchiolitis-while waiting for a bed JV’s requires increased Oxygen
Evaluation- moderate WOB, poor aeration, wheezing
  - Discussed bronchodilator to improve wheezing, informed that ED albuterol tx didn’t improve wheezing, Racemic Epinephrine given instead, with limited improvement

- Respiratory Viral Panel available- RSV positive
- Therapeutic plan- IV for hydration, NPO, Oxygen support, cardiac and respiratory monitoring, antipyretics for fever and Contact isolation for decreased spreading of RSV.

Approximately 2 hrs. after admission (day 4 illness)
  - JV experiences increased RR 75 bpm, pulse 182, WOB, and fever 39.4c (102.92F). He is given antipyretics. After 1 hr fever persists and WOB, RR, HR remain elevated. His SP02 falls to 90%. O2 is increased and a call to the Rapid Response team is made.
• Infant placed on High Flow NC at flow of 10 lpm and quickly increased to 14 lpm

• Transported to PICU - After 6 hrs on Vapotherm

• Placed on Non- invasive Ventilation with Ram Cannula – RR 25, PIP 24, PEEP 7, Ti 0.7

• Weaned to NIV CPAP +7 after 2 days (Day 6 of illness)

• Improved and remained in the PICU 2 more days on CPAP
Transitioned Care

• Weaned off supportive therapies and returned to NC on Day 4 of PICU (day 8 of illness)
• Transferred to the general Pediatric floor.
• Day 5 weaned off supplemental oxygen and prepared for discharge.
• Suction is being done only with a bulb syringe
• Feeding are all PO
Questions?

Thank you for all you do!!!!

UnityPoint Health Des Moines
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