



DAYTON CHILDREN'S HOSPITAL
CLINICAL PRACTICE GUIDELINES

DISCLAIMER: This Clinical Practice Guideline (CPG) generally describes a recommended course of treatment for patients with the identified health needs. This CPG is not presented and should not be used as a substitute for the advice of a licensed independent practitioner, as individual patients may require different treatments from those specified, and guidelines cannot address the unique needs of each patient. Dayton Children's shall not be liable for direct, indirect, special, incidental or consequential damages related to the use of this CPG.

Bronchiolitis Clinical Practice Guideline 2018

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Bronchiolitis Clinical Practice Guidelines

Emergency Department Management

- If initial examination demonstrates life threatening symptoms (apnea, cyanosis, Severe retractions, lethargy) implement emergency management.
- Give O₂ if SpO₂ on R.A. is \leq 91-94%. Patients presenting in acute respiratory distress should be placed on oxygen until respiratory status can be stabilized.
- Perform Naso-pharyngeal suction to clear secretions.
- Assess the following: Oxygen dependency, respiratory distress level, ability to feed, hydration status, fever, parent/social situation, pre-existing conditions, exposure to tobacco.

NOTE: If above findings are within normal limits, observation should be continued and discharge preparations considered.

If patient at risk, continue monitoring:

- Consider: RSV EIA or Respiratory Infectious Disease Panel, only if admission is likely. These test should not be ordered on routine patients who are being discharged from the ED. An RSV-EIA may be ordered for a repeat patient or complex patient where the etiology could help determine prognosis.
- Electrolytes, CBC (only if secondary infection suspected)
- CBG/CXR, if patient exhibits significant respiratory distress or at physician discretion in borderline cases.
- Reassess respiratory status, repeat SPO₂ in room air. If patient is being evaluated for discharge or admission with the diagnosis of bronchiolitis, the oxygen saturation goal shall be 91% with oxygen weaning accordingly.

Aerosol Trial: Routine bronchodilator trials are no longer being recommended as very few infants respond. Bronchodilator treatments have been shown to create hypoxemia in infants with bronchiolitis as the medication causes tachycardia (increased cardiac output) and tremors while doing little for improving ventilation. This can result in increased shunting and hypoxemia. Much of the improvement seen with aerosols can be attributed to the suctioning that occurs pre and post treatment and the moisture from the aerosol. If the physician believes the level of respiratory distress in the infant warrants a trial:

- 0.5 cc (2.5 mg.) albuterol is the medication of choice. Infants with history of wheezing and night time coughing not associated with an URI, eczema, atopy or strong family history of asthma are most likely to respond.
- Only one treatment should be ordered to gauge response; if the infant improves, additional aerosols may be ordered.
- Duoneb is not indicated, ipratropium bromide is not effective with viral wheezing.

CONSIDER AEROSOL RESPONSE WHEN DETERMINING CONTINUED CARE, ADMITTING DIAGNOSIS AND ORDERS.

Criteria for Consideration of Hospitalization

- Persistent Respiratory Distress
- Hypoxia
- Need for IV fluid
- Co-morbidity
- Apnea

Patient Placement:

All non- ICU admissions are placed in observation care as the normal length of stay is less than 2 days. If a patient requires a longer length of stay, the attending can the patient's status to inpatient later in the course of care.

ADMIT ICU (For any of the following criteria)

- Witnessed apnea
- CO₂ retention per blood gas
- High flow cannular oxygen or O₂ requirement > 40-50%
- Severe respiratory distress
- High risk co-morbidity (severe BPD, cyanotic CHD)

ED Discharge criteria (All must be met)

- RR < 60
- Adequate PO intake
- Supportive social environment
- Minimal respiratory distress
- SaO₂ \geq 91%
- No co-morbidity factors
- If obtained, pCO₂ < 45

If applicable, family members should be counseled to not use tobacco products around infant.

Inpatient/Observation Management**Clinical Respiratory Assessment:**

- History of upper respiratory symptoms and/or rhinorrhea.
- Respiratory rate, heart rate
- Color/Oxygen saturation
- Degree of wheezing/air entry
- Degree of retractions
- Level of consciousness

These symptoms should be evaluated and the patient assigned a score using the Bronchiolitis scoring system. This allows for an objective evaluation of the patient's condition that can be compared to later scores, indicating improvement or worsening of the patient's clinical condition.

BRONCHIOLITIS SCORING SYSTEM

	0 - NORMAL	1 – MILD	2 – MODERATE	3 - SEVERE
Resp Rate	< 40	40-50	50-60	>60
Color O2 Sat on RA Cap Refill	Normal >97% <2 sec.	Normal 94-96% on RA < 2 sec.	Normal 90-93% < 2 sec. Normal color on O2 ≤ 1 lpm	Dusky, Mottled < 90% => 3 sec. Normal color on O2 > 1 lpm
Retractions / WOB	None	Subcostal	Intercostal and Subcostal when Quiet	Supraclavicular Sternal Paradoxical Respiration
Air Entry Wheezing	Breath Sounds Clear/ Good	Good Entry End Exp. Wheeze +/- Rales	Fair Air Entry Insp and Exp Wheeze +/- Rales	Poor/ Grunting Insp and Exp wheeze +/- Rales
LOC	Normal/ Alert	Mild Irritability	Restless When Disturbed- Agitated	Lethargic Hard to Arouse

Other factors used in evaluation of infants with suspected bronchiolitis:

- Signs of dehydration/difficulty feeding.
- Parental ability to provide necessary care for child during acute infection.
- Pre-existing condition contributing to increased possibility of respiratory failure, i.e., prematurity, previous intubation, CHD, cystic fibrosis, etc.

Laboratory and Radiologic Assessments:

RIDP is recommended for admitted patients for a variety of reason. (See teaching document). Chest X-rays, blood work, and blood gases should be order *only* when clinical conditions of patient warrants the test.

Management:

Isolation: All patients in respiratory distress due to viral illness will be placed in “Droplet/Contact” isolation with or without viral confirmation.

Cardio-respiratory monitoring: This should be applied during the acute phase of the disease because of the risk of apnea and bradycardia. Continuous pulse oximetry is not recommended for patients in general care.

Oxygen per protocol: All patients should be placed on Oxygen per protocol upon admission but will not be actively weaned for first 24 hours. In protocol the patient will be set up on the appropriate oxygen delivery device with the FiO₂ titrated to maintain an adequate saturation. The patient will be reassessed Q30 minutes until stable then Q4 and PRN until the patients is on room air.

Aerosol Protocol: This allows the patients to be evaluated by a respiratory therapist at a frequency based on their Bronchiolitis severity score. Since aerosols very rarely improve the symptoms in bronchiolitis and have been shown to cause worsening hypoxemia, bronchodilator trials should be limited to those who present with moderate to severe distress.

Aerosol Trial: For patients who score 8 or higher, an aerosol trial will be considered. The respiratory therapist will notify the medical team when a patient scores ≥ 8 and an aerosol is being considered. For the trial, patients will be suctioned if necessary, scored, given aerosol and scored again. A positive response is defined as a decrease of the patient’s post aerosol bronchiolitis score by 2 or more (decrease wheezing, WOB, RR, increased aeration). Vaponephrine (0.5 cc) is generally the recommended aerosol medication to be trialed in hospitalized patients, unless patient responded to albuterol in the ED.

- **Normal – Bronchiolitis Score 0-4** Assess Q6
- **Mild Symptoms – Bronchiolitis Score 5-7** Assess Q4
- **Moderate Symptoms – Bronchiolitis Score 8-10**

Vaponephrine trial X1. If the patient responds continue aerosols Q4 hrs for scores ≥ 8 , if no response to first medication, consider trial with albuterol. Continue to assess the patient Q2.

- **Severe Symptoms – Bronchiolitis Score 11-15**

Vaponephine trial X1. Evaluate response. Consider trial with albuterol. If no response and severity persists, call PRT and consider PICU transfer.

Hypertonic Saline: Hypertonic saline aerosols may be considered for those infants with documented copious secretions, after the second day of inpatient care. TID would be an appropriate frequency for 3% Saline aerosols.

Airway Clearance: It is recommended that patients be suctioned PRN and prior to therapies and feedings. BBG suctioning may be utilized to clear nasal passages. Nasopharyngeal suctioning is recommended when secretions are obstructive and causing respiratory distress. Chest percussion is contraindicated for patients with bronchiolitis.

Intravenous Fluids: The need for an intravenous line and fluid management should be based on clinical assessment of hydration and the patient's ability to feed orally. Intravenous fluids are recommended for the first day of hospitalization for those with hydration needs.

Nutrition: Nasogastric feeding is recommended for those requiring fluid support on the second day. NG feedings are recommended for infants on HFNC.

Antibiotics: Are not recommended unless patient exhibits indication of bacterial infection.

High Flow Nasal Cannula (HFNC): This high humidity, high flow oxygen therapy should be considered for infants with significant respiratory distress with rising PCO₂ who require more than 1 – 1.5 lpm oxygen per nasal cannula. HFNC therapy can significantly reduce the infant's work of breathing. (See attached protocol.)

Parent Education: Parents should be educated on:

- Bronchiolitis pathophysiology and duration of illness.
- Proper techniques for airway clearance and suctioning.
- Handwashing and infection control.
- When to call their health care provider by explaining the signs of worsening symptoms.
- The value of continuing breastfeeding up to six months of age, when applicable.

Tobacco Counseling:

Clinicians should counsel caregivers/family about exposing the infant to environmental tobacco smoke and offer smoking cessation counseling and information on the Ohio Quit Line. Family at the bedside will be offered free nicotine replacement therapy to reduce nicotine cravings during their infant's hospitalization, assuming no contraindications.

Discharge Criteria:

- Respiratory Rate < 60 breaths per minute.
- Adequate P.O. intake.
- Patient SpO2 adequate on room air or is on supplemental oxygen consistent with previous home therapy.
- Parents are proficient with all necessary therapies for home, especially, secretion clearance using a bulb syringe.

INPATIENT/OBSERVATION MANAGEMENT PROTOCOL

SCORE	<u>Respiratory Treatment</u>	<u>Other Therapy</u>
0-4 NORMAL	Assess Q6	Suction PRN Bulb Syringe suction for home
5-7 MILD	Assess Q4	Oxygen per Protocol Suction PRN
8-10 MODERATE	Aerosol Trial X1 with Vaponephrine. If the patient responds continue aerosols Q4 hrs. for scores ≥ 8 , If not responsive consider a trial with an alternate bronchodilator. Assess Q2	IV fluids Oxygen per Protocol Consider Chest X-ray Capillary Blood Gas Suction PRN Consider HFNC if meets criteria Place on "watcher" list
11-15 SEVERE	Aerosol Trial X1 with Vaponephrine. If response is positive, continue aerosol Q2. Call PRT and consider PICU transfer	On "watcher" list IV fluids Oxygen per Protocol Chest X-Ray Capillary Blood Gas HFNC if meets criteria Excessive PCO2/acidosis warrants transfer to PICU



Clinical Practice Guidelines Management of RSV (Viral) Bronchiolitis

Background:

RSV bronchiolitis is an acute, infectious and inflammatory disease of the upper and lower respiratory tract resulting in mucosal edema, increased airway secretions, and airway obstruction. Bronchospasm is rarely present, and when it does occur its effect is small in relation to the total disease process. Although bronchiolitis occurs in all age groups, it is the small infant who presents with the most severe symptoms requiring medical attention. Bronchiolitis is most often from RSV, however many other infectious agents cause the disease as well.

In our region, RSV season typically begins in mid December, peaks in February, and subsides by late March. During the busiest four months, we routinely see over 700 patients managed in the Emergency Department only and another 700+ patients managed as inpatients or in observation care. The medical literature documents that 50% of hospitalizations occur in children 1-3 months of age; the average age of Dayton Children's inpatient bronchiolitis population has been consistently 2.4 months.

Clinical Manifestation:

Profuse coryza, congestion, and low grade fever initially characterize the clinical syndrome. Sixty-percent of primary RSV infections are confined to the upper airway. During a period of 2-5 days the disease may progress into the lower airways causing cough, dyspnea, wheezing, and feeding difficulties. Typically, fever has subsided by the time the infant is brought to medical attention. Severe cases progress to tachypnea, nasal flaring, retractions, irritability, and hypoxemia. Smaller infants are unable to clear respiratory secretions effectively.

Hypoxia is the best predictor of severity of illness and correlates with tachypnea. Wheezing or retractions correlate poorly with hypoxia. Clinical predictors of admission in infants with acute bronchiolitis include duration of symptoms, respiratory rate, heart rate, oxygen saturation and age. ¹

Recent publications have determined the incidence of apnea in hospitalized infants with RSV varies from 23.8% in the preterm infant or infant with co-morbidities to 1.2% in previously healthy infants.² It occurs early in the course of the disease and may be the presenting symptom, before the onset of rhinorrhea or wheeze. Apnea is more frequent in an infant less than 4 weeks of age. If apnea occurs, it lasts for no more than a few days, but a few will be severe enough to require intensive care admission and assisted ventilation.

Medical Management:

The management of bronchiolitis is largely supportive. It should focus on therapies to ensure that the patients remain safe and clinically stable during the acute phase of the disease. The benefit of hospitalization in these infants is to provide careful monitoring of clinical status, adequate oxygenation, airway patency through secretion clearance, adequate hydration, and parental education on home management.

Infection Control:

RSV (Respiratory Syncytial Virus) is highly contagious. Viral shedding in nasal secretions continues for up to 21 days after the development of symptoms. Transmission of infection has been documented to occur in up to 46% of family members, 42% of hospital staff, and 45% of previously uninfected hospitalized infants. Infection is spread by contact with secretions, it is not airborne. RSV can live up to 6 hours on surfaces. To prevent the spread of RSV, staff should gown, glove, and mask when having patient contact and practice meticulous handwashing. Eye protection should be worn with suctioning. All patients admitted with respiratory distress due to a suspected viral illness will now be placed in "Droplet/Contact Isolation."

Diagnosis:

The diagnosis of RSV bronchiolitis is best based on seasonal occurrence, clinical findings, and infant age (80% of bronchiolitis occurs under 2 years of age). Historically, a rapid screen has been made by RSV-EIA in the outpatient and emergency environments. (This test is run in the lab 24 hours per day 7 days a week with a 1 hour turnaround time. The recent AAP Guidelines (October 2014) now discourages this diagnostic testing for any patients well enough to go home from the ED and whose treatment will not vary based on the viral etiology. More complex patients or repeat patients may warrant an RSV-EIA. A more definitive test is the Respiratory Infectious Disease Panel (RIDP) by PCR. (At Dayton Children's, this test is performed during the day shift, seven days a week. The RIDP tests for other viruses, such as influenza A and B, H1N1, seasonal flu, parainfluenzas, adenovirus, rhinovirus/enterovirus, human metapneumovirus, coronavirus, as well as, RSV; it also tests for mycoplasma pneumoniae. Turnaround time is less than 1 day.) Again, the recent AAP guidelines discourages use of the RIDP test, however, it should be considered for infants who are hospitalized for the following benefits: To identify the influenza virus which could be treated with Tamiflu; to identify

the presence of multiple viruses which can predict severity of illness or slower recovery; to identify RSV as the infection in patients receiving Synagis to negate further need for treatment; to identify viruses when co-horting is necessary; to provide evidence of RSV infection which could explain future reactive airways disease; to provide epidemiologic data for public health reporting.

Clinical Course:

At Dayton Children's, the average hospital stay for patients with bronchiolitis is generally 2 days. Predicting length of stay for bronchiolitis has been difficult as the infant's recovery depends on disease severity, co-infections and where he/she is in the course of the disease when medical attention is sought. When care is sought late in the disease, the patient may exhibit more severe symptoms, e.g., dehydration and hypoxemia, but recovery may ensue quickly with supportive care. For those seen early in the course of the disease, symptoms may be mild, but worsen over 3-5 days, resulting in repeated visits to the office, ED, or readmission.

Premature infants or children with congenital heart disease, pulmonary hypertension, cystic fibrosis, or bronchopulmonary dysplasia, are high-risk populations that may require intensive care. At Dayton Children's, less than 8% of hospitalized patients with RSV bronchiolitis required intensive care over the last five years. In that same time period, less than 3% required mechanical ventilation; intubation was required primarily for repeated apnea or respiratory failure, some with co-morbidities.

Patient Disposition upon Admission:

Patients hospitalized under general care will be placed in observation status as length of stay for the average bronchiolitic patient is 2 days or less. PICU admission is considered for patients presenting with apnea, or patients with significant work of breathing with cardiac co-morbidities, prematurity, or history of intubation. Patients requiring HFNC in ED or transport, CPAP, NIV or intubation and mechanical ventilation will be placed in PICU. Patients who require HFNC in general care may be kept in general care if they do not require more than 40% oxygen and 8 lpm flow to meet their SpO2 and WOB goals. All HFNC patients must be on central monitoring.

Specific Therapies:

Hydration, oxygenation, and upper airway suctioning are the mainstay of treatment for most infants hospitalized with bronchiolitis. The use of clinical practice guidelines for the management of infant bronchiolitis have shown a reduction in unnecessary resource utilization with a streamlining of medical care. Data from both here at Dayton Children's and elsewhere have been presented demonstrating this benefit. Dayton Children's implemented its Bronchiolitis Clinical Practice Guideline in the winter of 1996-97.³

Monitoring:

Cardio-respiratory monitoring is indicated in the acute hospitalized patient with bronchiolitis to assist in the detection of worsening clinical respiratory status, apnea, or bradycardia. However, frequent periodic assessments by trained health care professionals (physicians, respiratory therapists, and nurses), are the most important part of hospital observation or inpatient care. Premature infants, infants with underlying chronic conditions, and infants less than three months of age are particularly at risk for apnea or progression to more severe respiratory distress.

Capillary blood gases (CBG's) should be obtained when an infant presents with significant respiratory distress, requires significant oxygen to reach SPO₂ goals, has an apneic or bradycardic episode, or is slow to improve with aggressive care. Capillary blood gases are generally sufficient to assess pH and PCO₂ with SPO₂ in infants with adequate circulation, as opposed obtaining to an arterial blood gas. Any patient who is being considered for PICU transfer should have a CBG to document the patient's respiratory status, impending failure or failure, as determined by the medical team.

Hydration and Feeding Guidelines:

The AAP guidelines recommends addressing hydration and initiation of IV fluids when work of breathing places patient at an increased risk of aspiration; if an infant's RR is > 60, an IV should be used for hydration. Intravenous or nasogastric fluids are recommended for those with hydration needs.⁴ Our policy is to begin isotonic IV fluids on the first day of hospitalization. Since, bronchiolitic infants are also in a catabolic state in need of nutrition; nasogastric feeding is recommended for those requiring fluid support on the second day to reduce hunger. Small boluses are recommended to avoid aspiration, suctioning the infant before boluses are given. NG feeding is recommended when in infant is on a HFNC with a flowrate greater than 4 lpm.

Oxygen Therapy and Pulse Oximetry:

At Dayton Children's, oxygen is ordered (administered) in accord with an established oxygen protocol. This requires the respiratory therapist to assess the patient's SpO₂ upon admission and administer oxygen as indicated if SpO₂ is ≤ 90%. The goal is to maintain oxygen saturation above 91% with clinical goal range of SpO₂ 91-94%.⁵ The SpO₂ is checked q4 hours and PRN to assure adequate oxygenation. The resident is notified if the patient has an initial oxygen requirement, when oxygen is adjusted upward, or when the patient has a requirement that exceeds 40% (or 1-1.5 l per nasal cannula). Oxygen is routinely administered by nasal cannula.

The RCP will avoid aggressive weaning of oxygen during periods of respiratory distress, i.e., first day of admission. The patient will then be actively weaned to room air, at which time the SpO₂ checks will be reduced to q8. To avoid multiple caregivers adjusting the oxygen with every contact, only the RCP will be responsible for oxygen weaning with the oxygen protocol. Nursing and medical staff can increase oxygen for acute deterioration with communication to the RCP. Nursing has agreed to not wean oxygen with VS checks; if they believe the patient is ready to wean, they should contact the patient's RCP. Discharge criteria is an oxygen saturation of 91% or higher.

In bronchiolitis, continuous pulse oximetry is not necessary and is problem prone as staff will tend to adjust supplemental oxygen to every natural, non-pathologic fluctuation in SpO₂.⁶ Some note that its use can increase the duration of hospitalization through the inappropriate continuation of oxygen. If a provider has a specific reason to want continuous monitoring of SpO₂, they can specifically order continuous pulse oximetry or an oxygen desaturation study which will document the patient's SpO₂ in a report format.

Airway Clearance with Suctioning:

In bronchiolitis, after oxygen, the mainstay of respiratory treatment is airway clearance with suctioning. One third of an infant's total airway resistance derives from the nose. Suctioning alone can improve the patient's respiratory status by decreasing the resistance to airflow through the nares. Hospitalized patients are to be suctioned before feeding and PRN. When secretions obstruct the infant's airway, nasopharyngeal suctioning with a lubricated, size appropriate suction catheter is necessary to clear the nasal passages, stimulate cough above the vocal cords and remove secretions. Control of the infant's head during suctioning and use of the proper angle for catheter entry can improve the utility of suction and reduce potential trauma to the nasal passages. Staff will document suction frequency and volume of secretions to aide medical staff in determining infant's readiness for discharge. BBG suction catheters (short catheters with an olive-shaped tip) allow for gentle suctioning of nasal secretions by family, non-licensed caregivers and clinical staff when appropriate. On discharge to home, bulb suction is most often appropriate. Past audits showed that 50% of the suction machines dispensed for home use with bronchiolitis were returned to our home care company unopened.

Medicated Aerosol Therapy:

The recent AAP guidelines recommend that albuterol and racemic epinephrine should not be administered to infants with bronchiolitis.⁷ The AAP panel noted that the harm of exposure outweighs the potential benefit. In fact, these aerosolized drugs often result in significant tachycardia, irritability and result in hypoxemia, due to an increase in cardiac output with little, if any, improvement in ventilation. Several randomized

controlled trials and two meta-analyses have not shown clinically significant effects on clinical scores or hospitalization rates from treatment with nebulized albuterol. The overwhelming evidence in the meta-analysis literature suggests that neither albuterol nor racemic epinephrine is highly effective.

The use of beta-agonist aerosols (e.g. albuterol), effective in treating the bronchospasm characteristic of asthma, are not efficacious for treating the airway edema typical of bronchiolitis. As of 2015, trials of a bronchodilator aerosol are being limited to those patients with significant respiratory distress, those who score a bronchiolitis score of 8 or higher, or an occasional patient with a history of wheezing and night time coughing not associated with a URI, atopy or strong family history of asthma.

Anti-cholinergics (ipratropium bromide) have demonstrated no clinical effect in bronchiolitis.⁸ Duoneb is not indicated in bronchiolitis. Studies have shown a reduction in airway resistance with the nebulization of racemic epinephrine due to its alpha-adrenergic effect on mucosal edema; several clinical trials have demonstrated a clinically significant effect in many, but not all patients.^{9,10}

Emergency Room Care: If a trial is considered, current practice among the CHA hospitals has shifted toward using albuterol in all outpatient and ED aerosol trials, as a bronchiolitic infant with underlying reactive airways disease will improve with albuterol.¹¹ A single trial of an albuterol aerosol should demonstrate improvement or lack of improvement. Multiple treatments should never be ordered on infants with viral wheezing.

Aerosol Therapy per Protocol:

The Dayton Children's protocol for bronchiolitis management includes a trial of aerosols and continued aerosol delivery if the patient demonstrates a positive clinical response.¹² An aerosol trial includes first suctioning of the upper airway, scoring the patient's clinical symptoms using the Dayton Children's bronchiolitis score, delivering the chosen medicated aerosol, and a reassessment of clinical symptoms with a post-score. A positive response is defined as an improvement of two points or more in the post score. The patients who do not improve will be placed on an assessment schedule of Q2, Q4, or Q6 hours based on their bronchiolitis severity score. Those who do respond positively will be placed on a schedule of Q2, Q4, or Q6 hours aerosols if their bronchiolitis score exceeds 8. Racemic epinephrine is the drug used for the inpatient trial and treatment as ordered. The occasional patient who respond to the bronchodilator trial significantly will be placed on hourly albuterol treatments and will be removed from the protocol.

Historically, since the implementation of Dayton Children's bronchiolitis clinical practice guideline in 1997, we have seen the number of inpatient aerosol treatments per admission drop from an average of sixteen in 1996 to 0.4 aerosols, as many have their

aerosol trials in the ED. This has occurred *without* an increase in the bronchiolitis population's 1) length of stay; 2) transfers to the critical care unit; 3) returns to ED; 4) readmission rates.

Other medications:

“Little Noses” is a nasal neosynephrine solution prescribed with some regularity in bronchiolitis. Its alpha effect shrinks swollen nasal passages. There is no evidence that it has an impact on outcome, only short-term relief. It is ordered for up to 3 days only as there is the concern for “rebound” swelling of the mucosa with continued use. Oral decongestants, atrovent nasal spray and anti-histamines are not recommended.

Hypertonic saline (3%) aerosols may be considered for those infants with documented copious secretions, after the second day of inpatient care. TID would be an appropriate frequency for 3% saline aerosols. The mechanism of hypertonic saline benefit includes: inducing an osmotic flow of water into the mucus layer, rehydrating the airway surface liquid and improving mucus clearance; breaking ionic bonds within the mucus gel, lowering viscosity and elasticity; stimulating ciliary beats; and by absorbing water from the mucosa and sub-mucosa, reducing edema of the airway.¹²

Steroid therapy given by inhalation, IV, orally, or IM is not recommended due to a lack of efficacy in numerous clinical trials.¹³

Antibiotics are not recommended in the absence of an identified bacterial infection.

Palivizumab (Synagis®, MedImmune) is a monoclonal antibody against a viral coat antigen. It is used as a preventive medication in infants with a history of prematurity <29 weeks, chronic lung disease, or congenital heart disease.¹⁵ Dayton Children’s provides for the outpatient administration of this medication to these high risk infants. If an infant is receiving Synagis® monthly and the RSV infection is confirmed, the treatment should be discontinued.¹⁴

Other Respiratory adjuncts:

Chest physiotherapy (postural drainage and percussion) is contraindicated in the management of bronchiolitis. The patient agitation that percussion produces may exacerbate the effects of non-reversible small airway obstruction.¹⁵ Cool mist or normal saline aerosols delivered by hand-held nebulizer, tent or hood are not recommended. In some clinical studies, they have been implicated as bronchospastic agents.

High Flow Nasal Cannula (HFNC):

Several recent articles have demonstrated that infants with bronchiolitis benefit from the high humidity and higher gas flow provided with HFNC therapy. HFNC therapy provides a constant flow that washes out the infant's anatomic deadspace, decreasing inspiratory resistance, providing positive pressure during the respiratory cycle to decrease air trapping by stenting swollen airways and providing increased humidity to retained secretions. The articles by Lee, et al and Milesi, et al concluded that:

- HFNC application is effective in reducing respiratory distress in bronchiolitis.
- The benefits of HFNC are seen within 60-90 minutes of application.
- The level of support for providing a positive pharyngeal pressure in infants with bronchiolitis was around 6lpm, with maximum benefit seen at 2 lpm/kg. ^{16,17,18}

The Respiratory Care Department has had a protocol for the implementation of HFNC on general care inpatients who meet specific criteria with the concurrence of the general pediatric medical team. Use of this protocol has resulted in quicker implementation of HFNC and has reduced the number of patients needing to advance to CPAP, NIV or ventilation.

Criteria for HFNC initiation includes:

- Infants with viral bronchiolitis, with IV fluids, and respiratory distress (i.e. retractions, tachypnea, coarse breath sounds) that does not improve with conventional therapy. (Generally, Bronchiolitis score ≥ 8 , but not absolute)
- Must have Oxygen requirement of > 1 lpm nasal cannula < 4 mo. of age. Or > 1.5 lpm > 4 mo. of age

If patient is exhibiting significant respiratory distress with high oxygen requirement but does not have $pCO_2 > 50$, a PRT should be called for the PICU team to evaluate.

Exclusion Criteria:

- Patient exhibiting signs of respiratory failure (i.e. $pCO_2 > 60$ with acidosis, severe respiratory distress, decreased level of consciousness, lethargy, apnea or bradycardia) requires a PRT or Code called for emergency management and transfer to the PICU immediately

Smoking Counseling:

Parental smoking is a risk factor for bronchiolitis hospitalization. Parents should be counseled to not smoke around their infant and offered support for quitting their smoking habit.¹⁹ The respiratory care and nursing staff are trained to conduct bedside

assessment and counseling to parents who smoke. Dayton Children's will provide follow-up counseling and information on the Ohio Quit Line for continued support as requested. Family at the bedside will be offered free nicotine replacement therapy to reduce nicotine cravings during their infant's hospitalization, assuming no contraindications.

Parent Education:

The primary focus of parent/family education should be basic pathophysiology (why their child is ill, in lay terminology) and the expected clinical course. The median duration of illness for infants less than 2 years is 12 days; 18% will remain ill after 21 days, and 9% will remain ill after 28 days. These figures refer to illness, not hospitalization.²⁰ Infection prevention should be emphasized; this includes hand washing and surface cleaning. Parents need to be taught how to use a bulb syringe to assist in airway clearance at home. The parents should be instructed to call the primary care physician if the infant's respiratory status worsens (increased respiratory rate and/or increased work of breathing non-responsive to suctioning), the infant is unable to feed, or there is worsening of the infant's general appearance. Mothers who are breastfeeding should be encouraged by nursing staff to continue breastfeeding for the first six months of their infant's life.²¹

Discharge Criteria:

Respiratory Status: RR < 60 and without distress. The patient is stable on room air. For those with chronic O2 requirements, the patient is on their baseline oxygen requirement. Parents demonstrate appropriate use of bulb suction to clear the airway.

Nutrition/Hydration Status: The patient is able to adequately feed orally.

Treatment: The patient is on oral medications or regular medications, as appropriate to the clinical condition or comorbid diagnoses.

Social: Home resources are adequate to support continued home therapies, parents are proficient in care, parents agree to recommended care plans, smoking cessation and avoidance is reinforced.

Follow-up: When indicated durable medical equipment agencies have confirmed equipment and services. Follow-up is arranged with identified primary care provider.

References

1. Marlais, M., Evans J. Abrahamson E. Clinical predictors of admission in infants with acute bronchiolitis. Arch Dis Child. 2011;96:648-652

2. Ralston S., Hill V. Incidence of apnea in infants hospitalized with respiratory syncytial virus bronchiolitis: a systematic review. *J Pediatr*. 2009 Nov;155(5):728-33
3. Ciarlariello S, Cohn R C. The Outcome of a Clinical Practice Guideline for RSV Bronchiolitis at a Children's Hospital. Abstract Presented at ATS International Convention. May 1998.
4. **Key Action Statement 9:** *Clinicians should administer nasogastric or intravenous fluids to infants with a diagnosis of bronchiolitis who maintain hydration orally.* The American Academy of Pediatrics: Clinical Practice Guideline: The Diagnosis, Management and Prevention of Bronchiolitis. *Pediatrics* 2014;134:e1487.

Kugelman A, et al. Intravenous Fluids versus Gastric-Tube Feeding in Hospitalized Infants with Viral Bronchiolitis: A Randomized, Prospective Pilot Study. *J Pediatr* 2013;162:640-2.

5. **Key Action Statement 6a:** *Clinicians may choose to not administer supplemental oxygen if the oxyhemoglobin saturation exceeds 90% in infants and children with a diagnosis of bronchiolitis.* The American Academy of Pediatrics: Clinical Practice Guideline: The Diagnosis, Management and Prevention of Bronchiolitis. *Pediatrics* 2014;134:e1483-4
6. **Key Action Statement 6b:** *Clinicians may choose to not use continuous pulse oximetry for infants and children with the diagnosis of bronchiolitis.* The American Academy of Pediatrics: Clinical Practice Guideline: The Diagnosis, Management and Prevention of Bronchiolitis. *Pediatrics* 2014;134:e1484-5
7. **Key Action Statements 2 and 3:** *Clinicians should not administer albuterol to infants and children with a diagnosis of bronchiolitis. Clinicians should not administer epinephrine to infants and children with bronchiolitis.* The American Academy of Pediatrics: Clinical Practice Guideline: The Diagnosis, Management and Prevention of Bronchiolitis. *Pediatrics* 2014;134:e1480-82.

Gadomski AM, Brower M. Bronchodilators for bronchiolitis. *Cochrane Database of Systematic Reviews* 2010, Issue 12. [DOI: 10.1002/14651858.CD001266.pub2]

8. Anticholinergic agents such as ipratropium have not been shown to alter the course of viral bronchiolitis. Although a minority of individual patients may show a positive clinical response to anticholinergic agents, studies have shown that the groups as a whole showed no significant improvement. At this point there is no justification for using anticholinergic agents, either alone or in combination with beta-adrenergic agents, for viral bronchiolitis

Wang EE, Milner R, Allen U, Maj H. Bronchodilators for treatment of mild bronchiolitis: a factorial randomized trial. *Arch Dis Child*. 1992;67:289–293

9. Although different nebulized bronchodilators such as albuterol sulfate (salbutamol), ipratropium bromide, and epinephrine are being used in the treatment of bronchiolitis, research to date supports epinephrine as the bronchodilator of choice. Along with the beta-adrenergic effects of bronchodilation, epinephrine adds alpha-adrenergic properties and is believed to offer the supplemental benefits of vasoconstriction in the bronchiolar vasculature. Along with others, Wohl and Chernick have suggested that this vasoconstriction may reduce edema and mucous production, hallmarks in the pathology of acute viral bronchiolitis.

Klassen TP. Recent advances in the treatment of bronchiolitis and laryngitis. *Pediatr Clin North Am*. 1997;44:249-261.

Wohl MEB, Chernick V. State of the art: bronchiolitis. *Am Rev Respir Dis*. 1978; 118:759-781.

10. Only 1 study evaluated pulmonary mechanics among 24 patients randomized to receive epinephrine or albuterol. Significant differences between pre-treatment and post-treatment values were noted in inspiratory, expiratory, and total pulmonary resistance in the epinephrine group, but not the albuterol group.

Sanchez I, De Koster J, Powell RE, Wolstein R, Chernick V. Effect of racemic epinephrine and salbutamol on clinical score and pulmonary mechanics in infants with bronchiolitis. *J Pediatr*. 1993;122:145-151.

11. Childrens Health Association Respiratory Directors Survey 2013

12. **Key Action Statement 4a and 4b:** *Nebulized hypertonic saline should not be administered to infants with bronchiolitis in the ED. Clinicians may administer nebulized hypertonic saline to infants and children hospitalized for bronchiolitis.* The American Academy of Pediatrics: Clinical Practice Guideline: The Diagnosis, Management and Prevention of Bronchiolitis. *Pediatrics* 2014;134:e1482-3

Zhang L, Mendoza-Sassi RA, Wainwright C, et al. Nebulized hypertonic saline solution for acute bronchiolitis in infants. *Cochrane Database Syst Rev* 2008;CD006458.

13. **Key Action Statement 5:** *Clinicians should not administer systemic corticosteroids to infants and children with a diagnosis of bronchiolitis in any setting.* The American Academy of Pediatrics: Clinical Practice Guideline: The Diagnosis, Management and Prevention of Bronchiolitis. *Pediatrics* 2014;134:e1483

Systematic review and meta-analyses of RCTs involving close to 1200 children with viral bronchiolitis have not shown sufficient evidence to support the use of steroids in this illness.

Patel H, Platt R, Lozano JM, Wang EE. Glucocorticoids for acute viral bronchiolitis in infants and young children. *Cochrane Database Syst Rev.* 2004;(3):CD004878

Garrison MM, Christakis DA, Harvey E, Cummings P, Davis RL. Systemic corticosteroids in infant bronchiolitis: a metaanalysis. *Pediatrics.* 2000;105(4).

14. **Key Action Statement 10 C:** *Clinicians should administer a maximum 5 monthly doses of palivizumab (15 mg/kg per dose intramuscularly) during the RSV season to infants who qualify in the first year of life. Continuation of monthly prophylaxis for an infant or young child who experiences breakthrough RSV hospitalization is not recommended.* The American Academy of Pediatrics: Clinical Practice Guideline: The Diagnosis, Management and Prevention of Bronchiolitis. *Pediatrics* 2014;134: e1488-90.
15. **Key Action Statement 7:** *Clinicians should not use chest physiotherapy for infants and children with a diagnosis of bronchiolitis.* The American Academy of Pediatrics: Clinical Practice Guideline: The Diagnosis, Management and Prevention of Bronchiolitis. *Pediatrics* 2014;134:e1485-86
16. Lee J, et al. Use of high flow nasal cannula in critically ill infants, children, and adults: a critical review of the literature. *Intensive Care Med* (2013) 39:247–57
17. Milesi C., et al. Is treatment with a high flow nasal cannula effective in acute viral bronchiolitis? A physiologic study. *Intensive Care Med* (2013) DOI 10.1007/s00134-013-2879-y
18. Schibler A, Pham T, Dunster K, et al. Reduced intubation rates for infants after introduction of high-flow nasal prong oxygen delivery. *Intensive Care Med* (2011) 37:847–852 DOI 10.1007/s00134-011-2177-5
19. **Key Action Statements 12a and 12b:** *Clinicians should inquire about the exposure of the infant or child to tobacco smoke when assessing infants and children with bronchiolitis. Clinicians should counsel caregivers about exposing the infant or child to environmental tobacco smoke and smoking cessation when assessing the infant or child with bronchiolitis.* The American Academy of Pediatrics: Clinical Practice Guideline: The Diagnosis, Management and Prevention of Bronchiolitis. *Pediatrics* 2014;134:e1485-86
20. Median duration of symptoms was 15 days; 25% of the infants remained symptomatic after 21 days. Subjects with a history of eczema trended toward a longer median

duration of symptom when compared to those that did not. Symptom duration may be influenced by a propensity toward atopy. Clinicians may use this information for counseling families. Petruzella, F.D., Gorelick, M. Duration of illness in Infants with Bronchiolitis Evaluated in the Emergency Department. *Pediatrics* 2010;126:e285-e290.

21. **Key Action Statement 13:** *Clinicians should encourage exclusive breastfeeding effort at least 6 months to decrease the morbidity of respiratory infections.* The American Academy of Pediatrics: Clinical Practice Guideline: The Diagnosis, Management and Prevention of Bronchiolitis. *Pediatrics* 2014;134:e1485-86



Bronchiolitis Clinical Practice Guideline:

High Flow Nasal Cannula Initiation in General Pediatrics

High flow nasal cannula is an accepted treatment modality in infants with respiratory distress due to viral bronchiolitis.

HFNC therapy helps by:

- Washing out anatomic dead space
- Decreasing inspiratory resistance
- Providing positive pressure during the respiratory cycle
- Decreasing air trapping by stenting swollen airways
- Providing increased humidity to moisten retained secretions

Patients exhibiting significant hypoxemia or respiratory distress can be successfully treated with high flow nasal cannula. HFNC can prevent respiratory failure and the need for more advanced support, such as CPAP, NIV and mechanical ventilation.

Inclusion Criteria:

- Infants with viral bronchiolitis, IV fluids, and respiratory distress (i.e. retractions, tachypnea, coarse breath sounds) that does not improve with conventional therapy (generally a Bronchiolitis score of 8 or higher) who have an oxygen requirement of > 1 lpm nasal cannula < 4 mo. of age or > 1.5 lpm > 4 mo. of age.

Exclusion Criteria:

- Patient exhibiting signs of respiratory failure (i.e. $pCO_2 > 60$, severe respiratory distress decreased level of consciousness, lethargy, apnea or bradycardia) should be transferred to the PICU immediately. A PRT should be called.

RCP Protocol:

Prior to initiation of HFNC the RCP should consult with the respiratory supervisor and the medical team managing the patient. The hospitalist team should come to the bedside to evaluate the patient. A capillary blood gas should be done to evaluate the infant's degree of respiratory compromise.

As of winter 2017-18, patients placed on HFNC can be managed in PICU or in general care, based on the following criteria:

HFNC patients who will be placed in PICU:

- Patients who exhibit hypercarbia >50 mm Hg
- Patients with cardiac co-morbidities
- Patients with history of intubation
- Patients placed on HFNC in ED or on transport
- Patients who require > 40% oxygen and HFNC flowrates >8 lpm to meet SpO₂ of 91%-94%. and/or reduce work of breathing

The managing medical team must notify the PICU medical staff of all patients set up on high flow therapy at the time a decision is made to initiate therapy on patients who are known or suspected to be transferring to PICU.

HFNC patients who may stay in general care on central monitoring:

- Patients who require HFNC with ≤ 40% oxygen to meet SpO₂ of 91-94%.
- Patients who remain normocarbic or hypocarbic
- Patients whose work of breathing improves with HFNC flowrates ≤ 8lpm

HFNC initiation –first hour:

- Patient will be set up on Vapotherm Precision Flow at 4-6 lpm. Flow can be adjusted to a maximum of 8 lpm based on improvement of symptoms.
- O₂ will be adjusted for SpO₂, starting at 30% and increased as needed.
- Patient will be continuously monitored for HR, RR and SpO₂.
- Patient will be scored prior to initiation of therapy and scored after the first hour of therapy.
- CBG will be obtained prior to initiation of therapy and after 1 hour of therapy.

Patients who demonstrate no response will require evaluation by medical staff; call PRT for immediate transfer to PICU. Those who improve will remain in general care.

General Pediatrics :Patient Assessment and Care

- HFNC patients will remain in general care on continuous central monitoring with HR, RR and SpO₂..
- Nursing will assign staffing based on a goal of 1 RN: 3 Patient ratio
- NG tube feeding will be implemented during HFNC
- After the first hour of HFNC, respiratory therapy will assess patients Q2 hrs x 2, then Q4, documenting all vital signs and bronchiolitis scores and suctioning.
- All staff will observe for signs of worsening respiratory distress; any worsening of symptoms will be called to the medical team, i.e., ↑WOB, ↑ Respiratory Rate, ↑ HR, decreasing saturations.
- Patient to remain on watcher list until stable. Status will then be changed to high risk until HFNC is discontinued.

Contact PICU Medical Staff Immediately (PRT/Code)

- Consistently rising O₂ (>50%) to maintain desired SpO₂
- Deteriorating blood gases
- Worsening respiratory distress or impending respiratory failure.
- Apnea and bradycardia requiring manual ventilation or other interventions

Post-acute care:

PICU HFNC transfers to general care for weaning: In 2016-17, the PICU typically weaned all HFNC patients to 2 lpm wall gas for transfer out of the PICU. This year we are requesting that the PICU send out their HFNC patients on high flow not wall gas, to continue high humidity until the oxygen requirement is gone. HFNC transfers must meet this criteria:

- O₂ < 40%
- Stable for >24 hours on current therapy
- Stable or improving CBG
- Patients will be “High Risk” when they leave PICU until the HFNC is discontinued.

General Care HFNC weaning: HFNC Weaning should not begin until the patient has been stable on current care for 24 hours. Adjustment of flowrate and O₂ should be primarily limited to the RCP. If the RN or provider increases O₂ or flow, they should immediately notify the RCP assigned via Vocera.

- Maintain the established flowrate and wean O₂ to the lowest concentration tolerated (< 30%), while maintaining target saturations.
- After O₂ is less than 30%, wean flow rate watching work of breathing and respiratory rate.
- An order is not needed to wean flow or FiO₂

Patients may not need to go to a low flow cannula unless there is an oxygen need. If there is, give just enough flow to maintain target SpO₂ levels, not the same flow on HFNC.

Any increase in O₂ or flow during the weaning process should be called immediately to the medical team.

Formulated 12/2013

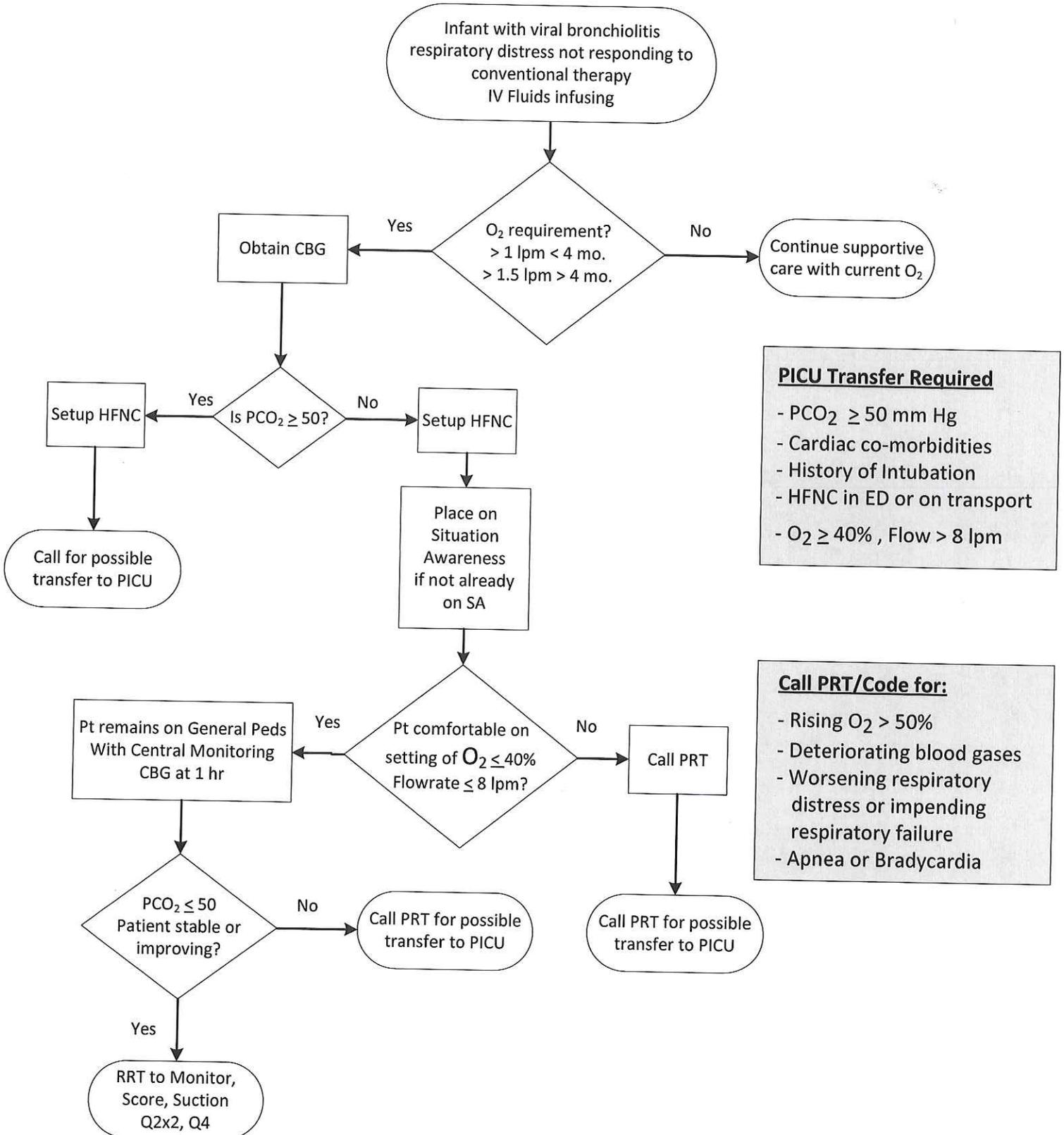
Revised: 1/2015, 11/2017



EXCLUSION CRITERIA FOR HFNC PROTOCOL

- $PCO_2 > 60$, Acidosis
- Severe respiratory distress
- Lethargy
- Apnea
- Bradycardia

**General Care
HFNC Protocol Setup**



PICU Transfer Required

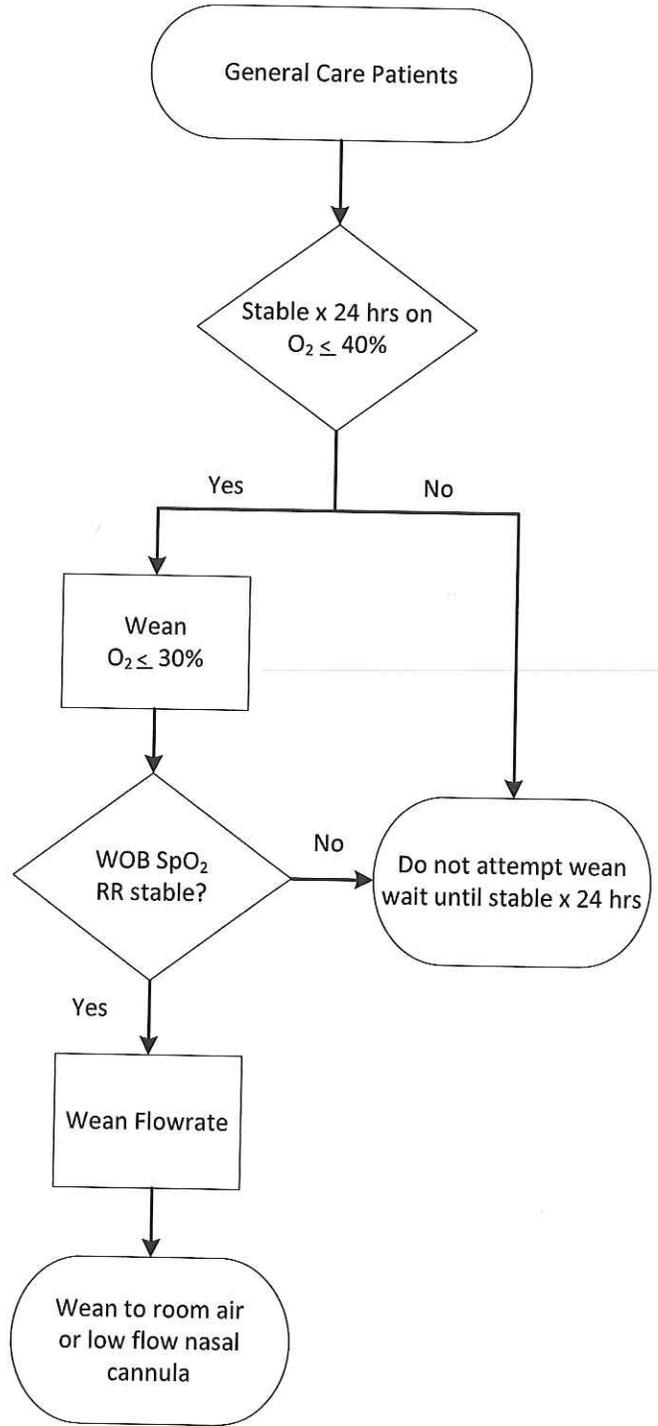
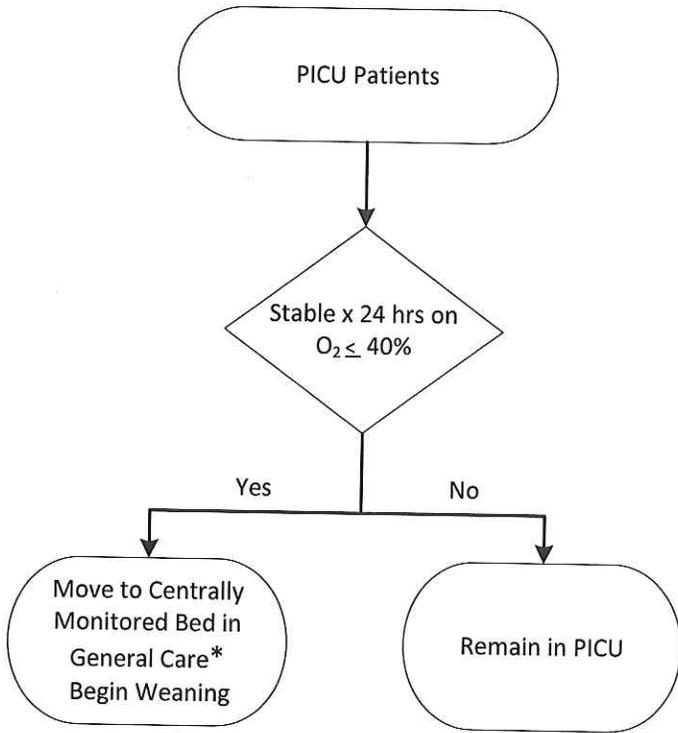
- $PCO_2 \geq 50$ mm Hg
- Cardiac co-morbidities
- History of Intubation
- HFNC in ED or on transport
- $O_2 \geq 40\%$, Flow > 8 lpm

Call PRT/Code for:

- Rising $O_2 > 50\%$
- Deteriorating blood gases
- Worsening respiratory distress or impending respiratory failure
- Apnea or Bradycardia



HFNC Weaning



Note:
 Any increase in O₂ or flow must be called to the medical team. Suctioning should be performed whenever oxygen is increased and secretions are present, RRT's will assume primary role in weaning.

* Preferred Location: 3 West pending census