

JOHNS HOPKINS ALL CHILDREN'S HOSPITAL

Bronchiolitis Clinical Pathway

Bronchiolitis Clinical Pathway

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This pathway is intended as a guide for physicians, physician assistants, nurse practitioners and other healthcare providers. It should be adapted to the care of specific patient based on the patient's individualized circumstances and the practitioner's professional judgment.

Bronchiolitis Clinical Pathway

Rationale

This protocol was developed by a consensus group of ACH hospitalists, EC physicians, and pediatric intensivists to standardize the management of children diagnosed with acute bronchiolitis. It addresses the following clinical questions or problems:

1. Decrease routine use of unnecessary diagnostic testing
2. Decrease routine use of unnecessary interventions
3. Initiate the use of a bronchiolitis specific respiratory score
4. Adhere to AAP endorsed clinical management practices

Diagnosis of Bronchiolitis

Bronchiolitis is a disorder commonly caused by a viral infection of the lower respiratory tract, inducing inflammation of the bronchioles. This results in edema, increased mucus production and small airway epithelial cell death. Clinical presentation typically begins with rhinitis and cough however may progress to tachypnea, increased work of breathing, wheezing, rales and/or nasal flaring.

Bronchiolitis will be considered in patients with the following inclusion criteria: age greater than or equal to one month but less than two years, the presence of upper and lower respiratory tract symptoms that may include increased work of breathing, cough, feeding difficulty, tachypnea, wheeze and fever.

Children with the following comorbidities will be excluded from this pathway: cardiac disease requiring baseline medication, anatomic airway defects, neuromuscular disease, immunodeficiency, chronic lung disease, and prematurity defined by born at less than or equal to thirty-four weeks gestational age and current age under less than or equal to six months of age.

Management of Bronchiolitis

Management of bronchiolitis, as reflected in this pathway, is in agreement with AAP endorsed evidenced-based best practice guidelines. Per these guidelines (Ralston 2014), clinicians should:

Diagnose bronchiolitis and assess disease severity on the basis of history and physical examination (Evidence Quality: Moderate; Recommendation Strength: Strong Recommendation).

Assess risk factors for severe disease, such as age less than 12 weeks, a history of prematurity, underlying cardiopulmonary disease, or immunodeficiency, when making decisions about evaluation and management of children with bronchiolitis (Evidence Quality: Moderate; Recommendation Strength: Moderate Recommendation).

Not routinely obtain radiographic or laboratory studies (Evidence Quality: Moderate; Recommendation Strength: Moderate Recommendation).

-At the individual patient level, the value of identifying a specific viral etiology causing bronchiolitis has not been demonstrated

Not routinely administer albuterol (or salbutamol) (Evidence Quality: Moderate; Recommendation Strength: Strong Recommendation).

Not routinely administer epinephrine (Evidence Quality: Moderate; Recommendation Strength: Strong Recommendation).

Not routinely administer nebulized hypertonic (Evidence Quality: Moderate; Recommendation Strength: Moderate Recommendation).

Not administer systemic corticosteroids (Evidence Quality: High; Recommendation Strength: Strong Recommendation).

Not administer antibacterial medications unless there is a concomitant bacterial infection, or a strong suspicion of one (Evidence Quality: Moderate; Recommendation Strength: Strong Recommendation).

Administer nasogastric or intravenous fluids for infants who cannot maintain hydration orally (Evidence Quality: Exceptional situation; Recommendation Strength: Strong Recommendation).

Inquire about the exposure of the infant or child to tobacco smoke when assessing infants and children for bronchiolitis (Evidence Quality: Low; Recommendation Strength: Moderate Recommendation).

Counsel caregivers about exposing the infant or child to environmental tobacco smoke and smoking cessation when assessing a child for bronchiolitis (Evidence Quality: Moderate; Recommendation Strength: Strong).

Encourage exclusive breastfeeding for at least 6 months to decrease the morbidity of respiratory infections. (Evidence Quality: Moderate; Recommendation Strength: Moderate Recommendation).

Educate personnel and family members on evidence-based diagnosis, treatment, and prevention in bronchiolitis. (Evidence Quality: Low; observational studies; Recommendation Strength: Moderate Recommendation).

Clinicians may:

Administer nebulized hypertonic saline to infants and children hospitalized for bronchiolitis (Evidence Quality: Moderate; Recommendation Strength: Weak Recommendation [based on randomized controlled trials with inconsistent findings])

Choose not to administer supplemental oxygen if the oxyhemoglobin saturation exceeds 90% in infants and children with a diagnosis of bronchiolitis (Evidence Quality: Very Low; Recommendation Strength: Weak Recommendation [based on low level evidence and reasoning from first principles]).

Choose not to use continuous pulse oximetry for infants and children with a diagnosis of bronchiolitis (Evidence Quality: Very Low; Recommendation Strength: Weak Recommendation [based on low level evidence and reasoning from first principles]).

Respiratory Score

A respiratory score will be performed to monitor patient response to interventions and disease progression.

This bronchiolitis respiratory score was adapted from an asthma score used in Seattle Children's (Zaman 2017) and is described below:

Variable	0 points	1 points	2 points	3 points
<u>RR</u>				
≤ 2 mo		≤ 60	61-69	≥70
2-12 mo		≤ 50	51-59	≥60
1-2 yr		≤ 40	41-44	≥45
<u>Retractions</u>				
	None	Subcostal or Intercostal	2 of the following: Subcostal, Intercostal, Substernal, OR nasal flaring	3 of the following: Subcostal, Intercostal, Substernal, Suprasternal, Supraclavicular OR nasal flaring/head bobbing
<u>Dyspnea</u>				
	Normal feeding, vocalizations, activity	1 of the following: Difficulty feeding, decreased vocalization, or agitated	2 of the following: Difficulty feeding, decreased vocalization, or agitated	Stops feeding, no vocalization, or drowsy and confused
<u>Auscultation</u>				
	Normal breathing, no wheezing	End-expiratory wheeze only	Expiratory wheeze only(greater than end expiratory wheeze)	Inspiratory and expiratory wheeze OR diminished breath sounds

***Other**

We recognize that patients with bronchiolitis can have other adventitious breath sounds such as crackles and/or diminished air entry. We will have respiratory therapy chart any other findings during their assessments. This data will help us determine if changes need to be made to the Seattle Respiratory Score as above.

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Emergency Center Bronchiolitis Pathway

Does patient meet all inclusion and exclusion criteria?

Exclusion Criteria:

- Cardiac disease requiring baseline medication
- Anatomic airway defects
- Neuromuscular disease
- Immunodeficiency
- Chronic lung disease
- Prematurity (GA < 34 weeks and < 6 months of age)

Inclusion Criteria:

- Age >1 mo and <2 years
- Upper and lower respiratory tract symptoms present that may include: *Increased WOB, Cough, Feeding difficulty, Tachypnea, Wheeze, Fever*

NO

OFF PATHWAY:
Consider Other Diagnoses

YES

Assess, perform respiratory score, and determine disease severity

Mild (suggested score of 1-4)

- No routine continuous pulse oximetry
- Instruct family in non-invasive suctioning

Moderate (suggested score of 5-8)

- Instruct family in non-invasive suctioning, consider invasive suctioning
- Consider LFNC 2-4 Liters and reassess in 30 min-1 hr
- If no improvement in RR, HR or hypoxia, consider HFNC (Vapotherm) *

Severe (suggested score of 9-12)

- Continuous pulse oximetry
- Consider performing and instructing family in non-invasive, bulb suctioning
- Consider invasive suctioning
- Consider HFNC (Vapotherm) *

Reassess, rescore, determine disease severity and intervene as appropriate

Consider Disposition

Discharge Criteria:

- Oxygen saturation >90% on room air awake
- Adequate oral intake
- No more than mild/moderate work of breathing
- Reliable caretaker
- Able to obtain follow-up care
- MDI/spacer teaching if response to albuterol

Admit if discharge criteria are not met

Admission Criteria (based on):

Repeated assessments
 Response to therapy
 Stage of illness

*** HFNC (Vapotherm) Guidelines**

- Start patient on highest floor maximum dose for age (see [Appendix I](#) at the end of the guideline)
- In 60 minutes, RT to rescore
- If there is clinical improvement OR reduction in score, RT may wean as tolerated. If no improvement, increase HFNC dose.
- If patient's dose is at or below floor maximum for age, and is clinically improved, then patient can be admitted to floor.
- If patient is ill appearing or requires higher dose for age than floor maximum, then admit to IMC/ICU.

Inpatient

- Requires floor-appropriate HFNC (Vapotherm)* dose
- Requires oxygen or progression expected.

Risk factors for progression:

- GA <34 weeks,
- Age <3 months
- RR >70

ICU

- Apnea
- Severe distress
- Requires ICU-appropriate HFNC (Vapotherm)*

Emergency Center Pathway

If inclusion and exclusion criteria are met, patient should be evaluated and a respiratory score assigned. Patient should be classified as having mild, moderate or severe bronchiolitis and the following interventions performed accordingly. Score is not an absolute indicator of disease severity, the final designation of mild, moderate or severe disease is based on physician assessment. However, typical scores that correspond with disease severity have been included.

For mild bronchiolitis (score of 1-4), pulse oximetry should not be continuously performed. Perform and instruct family in non-invasive, bulb suctioning and re-score. If patient remains well-during brief observation, is well-hydrated and tolerating feeds, consider discharge* from the Emergency Center.

For moderate bronchiolitis (score 5-8), Perform and instruct family in non-invasive, bulb suctioning and re-score.

If additional improvement needed, consider invasive suctioning, re-score if performed.

If patient remains well-during brief observation, is well-hydrated and tolerating feeds, consider discharge* from the Emergency Center.

If no improvement, consider low flow nasal cannula (LFNC) 2-4 Liters and reassess in 30 min-1 hr

If no improvement in respiratory rate (RR), heart rate (HR) or hypoxia, consider High-flow nasal cannula (HFNC, also referred to as Vapotherm) and inpatient admission if appropriate

For severe bronchiolitis (score 9-12), pulse oximetry should be continuously performed.

Consider performing and instructing family in non-invasive, bulb suctioning and re-score.

If additional improvement needed, consider invasive suctioning, re-score if performed.

Consider High-flow nasal cannula (HFNC) and inpatient admission if appropriate

Consider PICU admission if appropriate based on disease severity

*Consider discharge from the Emergency Department if oxygen saturation >90% on room air while awake, patient displaying adequate oral intake, no more than mild/moderate work of breathing, there is a reliable caretaker, able to obtain follow-up care and MDI/spacer teaching if response to albuterol.

Other Management Considerations

Additional considerations are included below:

Supplemental Oxygen

If at any time during care, patient pulse oxygen saturation is performed and sustained below 90%, nasal cannula oxygen will be started at 0.5L per minute, to a maximum of 4L per minute and titrated as needed. Documentation of the pulse oximetry read on room air is important prior to initiating supplemental oxygen.

Albuterol Use

A trial of albuterol may be considered in children greater than 12 months of age with wheeze and risk factor of atopy, history of recurrent wheeze, or family history

If improvement achieved, which is defined as a decrease in score of 2 points, consider changing to asthma pathway

Racemic Epinephrine

Similar to the aforementioned use of albuterol, nebulized racemic epinephrine can be considered in severe cases.

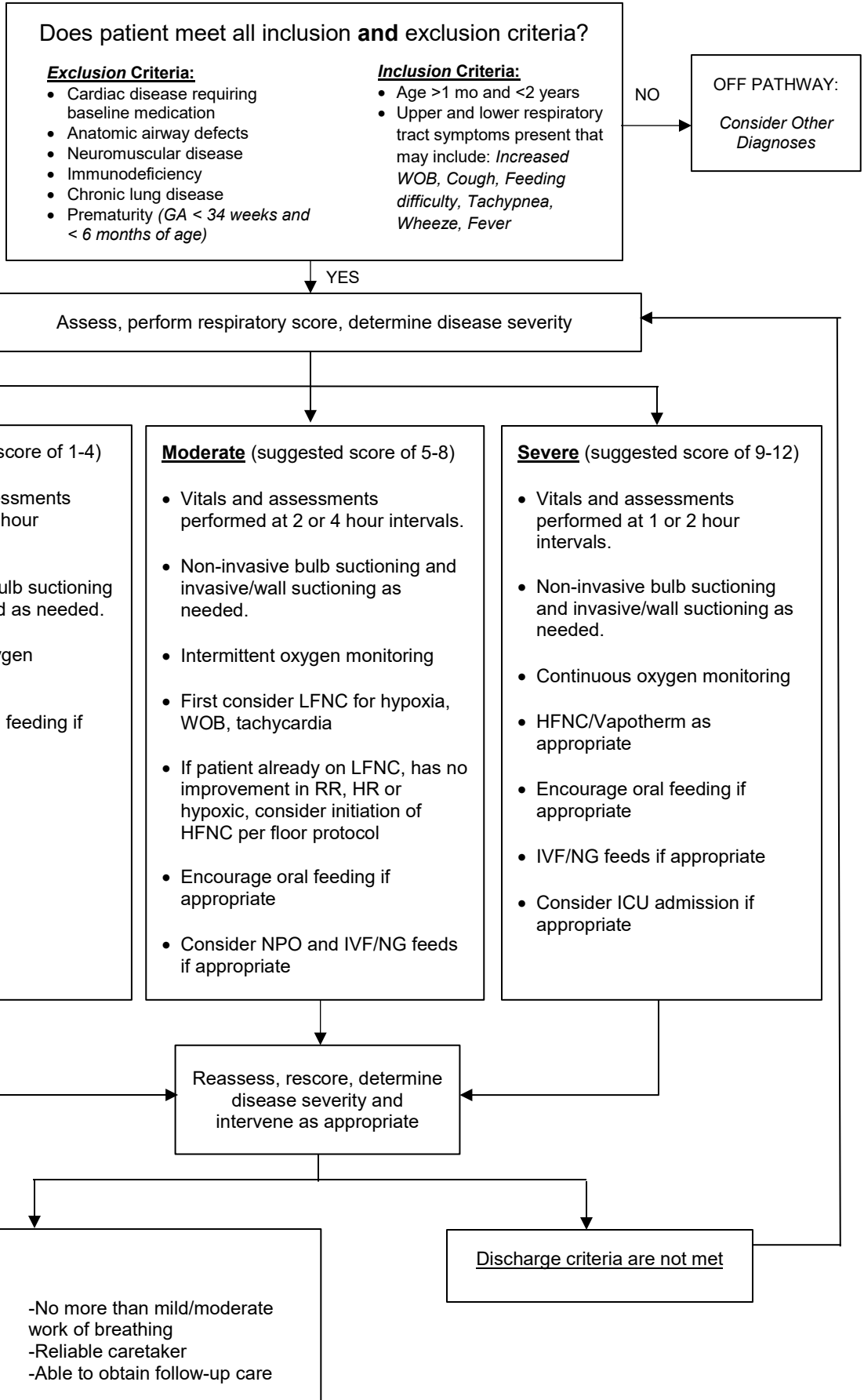
Low Flow Nasal Cannula (LFNC)

Consider a trial of LFNC at 2-4 liters for patients with moderate bronchiolitis

High Flow Nasal Cannula (HFNC or Vapotherm)

Refer to current hospital HFNC (Vapotherm) guideline, see Appendix I.

Johns Hopkins All Children's Hospital
Inpatient Bronchiolitis Pathway



Inpatient Pathway

If admitted inpatient, interventions are similarly based on disease severity and response to previous intervention.

For mild bronchiolitis, vitals and assessments performed at four hour intervals, non-invasive bulb suctioning to be performed as needed, pulse oximetry can be performed intermittently, and oral feeding should be permitted if appropriate.

For moderate bronchiolitis, vitals and assessments performed at two to four hour intervals. Non-invasive bulb suctioning should similarly be performed as needed. Pulse oximetry can be performed intermittently. Consider LFNC and, if no improvement, HFNC/Vapotherm as appropriate for the inpatient ward. Encourage oral feeding if appropriate and perform nasogastric feeding if appropriate, but consider NPO status and implement intravenous fluids or nasogastric feeding if appropriate.

For severe bronchiolitis, consider ICU admission if appropriate. Vitals and assessments should be performed at one to two hour intervals. Non-invasive bulb suctioning should be performed as needed. May consider invasive/wall suctioning as needed for severe cases. Pulse oximetry should be performed continuously. Consider LFNC and, if no improvement, HFNC/Vapotherm and titrate as appropriate. Encourage oral feeding if appropriate and perform nasogastric feeding if appropriate, but consider NPO status and implement intravenous fluids or nasogastric feeding if appropriate.

Decisions for admission and ICU versus inpatient disposition are based on clinical assessments of disease severity. Though the score is one tool to understand and describe disease severity, the entire clinical picture and resources needed to care for the child with bronchiolitis must also be considered to decide the appropriate disposition.

While most interventions have not been shown to be of any benefit in bronchiolitis, many of these same studies excluded the most severe cases. For this reason, if ICU admission is considered at any time it is not unreasonable to consider additional medical interventions, such as bronchodilators or racemic epinephrine. If considering ICU admission, consider escalating therapy, while monitoring and re-scoring for improvement. Additionally, if considering ICU admission, consider NPO status and appropriate supplementation.

Admission Criteria

The decision to admit, and the decision to where they should be admitted is to be based on repeated assessments, the patient's response, or lack thereof, to therapy, and the stage of illness.

If discharge criteria cannot be met, patients are to be admitted. Patients may be appropriate for admission to the inpatient ward if disease progression is expected, they require oxygen or ward-appropriate HFNC/Vapotherm.

Patients should be considered for ICU admission if significant apnea, severe respiratory distress, or they exceed ward-appropriate HFNC/Vapotherm levels.

The determination of inpatient versus observation status is more complex than will be described below. However, the use of the respiratory scoring tool can be helpful in determining correct disposition.

Observation status is appropriate when patient lacks significant risk factors or complexity. A patient that has increased respiratory rate and saturations less than 91% without additional disease burden or complexity will meet observation criteria, regardless of whether they are requiring oxygen. They will require intermittent pulse oximetry and respiratory assessment, which can be achieved by scoring, every four hours.

As for inpatient status, this should be considered in patients with at least one of the following: Documented saturations less than 89%, cyanosis, increased work of breathing as documented by accessory muscle use, dyspnea, mental status change, or increased respiratory rate for age group. The scoring tool can simplify this process, as a patient with one of the following: retractions score of greater than or equal to one, dyspnea score greater than or equal to two, respiratory rate score or greater than or equal to two can be said to meet the criteria for inpatient status.

For observation and inpatient status, respiratory monitoring must be performed at least every 4 hours. This can be accomplished by use of the use of pulse oximetry in conjunction with the respiratory score; pulse oximetry alone would not be sufficient.

Admission Diagnoses

With respect to admission diagnoses for patients with acute bronchiolitis, there are several other considerations that may result in additional diagnoses. If intravenous fluid supplementation is required, consider dehydration. If hypoxemia is noted, it should be considered as a diagnosis.

Acute Respiratory Failure Use of LFNC, HFNC (Vapotherm), CPAP, BiPAP etc. When medical treatment fails to stabilize the infants, non-invasive and invasive ventilation may be necessary to prevent and support respiratory failure.

Congenital/Chronic Lung Diseases BPD, Chronic Lung Disease of Prematurity – Be explicit

Hypoxemia Determined by pulse oximetry if not evident by clinical exam

Dehydration Treatment with IV fluids

Lower Respiratory Tract Acute Bronchiolitis is the most common lower respiratory tract condition necessitating hospital admissions among infants

Discharge Criteria

Patients will be considered appropriate for discharge if they are maintaining oxygen saturation greater than 90% on room air while awake, taking adequate oral intake, experiencing no more than mild to moderate work of breathing, and have a reliable caretaker able to obtain follow-up care.

Caretaker teaching on bronchiolitis should be performed. This includes the nature of bronchiolitis as a viral illness, treated by hydration. They should be instructed that patient may take more frequent, smaller feeds. Instruction on signs and symptoms of respiratory illness should be provided as well as non-invasive suctioning teaching. They should be instructed to avoid tobacco, over-the-counter cough and cold remedies.

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Outcome Measures:

Vitals: Heart rate, Blood pressure, Respiratory Rate, Oxygen Saturation

Oxygen Support (Nasal Cannula, Vapotherm, CPAP, BiPAP, Intubation)

Medications administered

Emergency Center Length of Stay

Hospital Length of Stay

Laboratory Evaluation

Disposition: Discharge, admission to floor, admission to ICU

Admission and Discharge diagnoses

Respiratory Scores

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Bronchiolitis Clinical Pathway
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Disclaimer

Clinical Pathways are intended to assist physicians, physician assistants, nurse practitioners and other health care providers in clinical decision-making by describing a range of generally acceptable approaches for the diagnosis, management, or prevention of specific diseases or conditions. The ultimate judgment regarding care of a particular patient must be made by the physician in light of the individual circumstances presented by the patient.

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APPENDIX I:

High Flow Nasal Cannula (HFNC) Therapy for Patients with Bronchiolitis on Pediatric Ward

Inclusion:

- Age >1 mo and <2 years
- Clinical Diagnosis of Bronchiolitis

Exclusion:

- Unrepaired Congenital Heart Disease with Mixing Lesion
- Repaired Congenital Heart Disease with Residual Mixing Lesion
- Chronic Lung Disease and Prematurity (Hx of \leq 34 weeks GA) not corrected to term
- Home oxygen therapy
- Neuromuscular disease
- Congenital Diaphragmatic Hernia

***At the discretion of the physician:**

- certain immunodeficiencies (SCID) or anatomic airway defects (laryngeal web, choanal atresia, tracheal stenosis, subglottic stenosis)

Guidelines for use:

- Use VAPOTHERM (non-ICU) order set in choosing nasal cannula size and settings (prong diameter should be half of nostril)
- Flow rate is determined by age and weight. Therapeutic doses of flow rate are maximally achieved between 1.5-2 liters/kg/min. Suggested initial settings to be started in the ER or floor and patients:
 - 1-6 months of age = max 8 L/m, 50%
 - 6-12 months of age = max 10 L/m, 50%
 - 12-24 months of age = max 12 L/m, 50%
- After admission, PO nutrition may be considered if there is clinical improvement & adequate suck-swallowing mechanics at the discretion of the physician provider.
- Place patient on continuous pulse ox
- Vitals at least q 4 hours
- Bronchiolitis Severity Score to be assessed q2 hours for 12 hours, then spaced to q4 hours to follow during HFNC use.

Guidelines for weaning:

- Once child has shown clinical stability or improvement, wean flow by 2 L/m if q4h
 - For patients 1 -6 months, RR <60
 - For patients 6 mo-12 mo, RR <55
 - For patients 12 mo-24 mo, RR <45
- Concurrently with Flow weans described above, wean FiO₂ to goal of 21% as tolerated to maintain target FiO₂ >90%.

-Encourage wean of Flow and FiO₂ at the same time or independently. One type of wean does not preclude the other.

When to consider consultation for transfer to PICU:

- Persistent increased work of breathing noted by abdominal breathing, retractions, or head-bobbing despite max flow rate described above applied for 60-90 minutes.
- Persistent tachycardia despite treatment of fever, volume resuscitation, and maximum flow rate for age described above.
- Persistent hypoxia (SaO₂ <90%) despite application of FiO₂ at 50% via floor careplan described above.
- Persistent Hypercapnia noted on arterial or capillary blood gas, pCO₂ > 60
- Persistent Metabolic or respiratory acidosis noted on arterial or capillary blood gas pH <7.3
- Altered mental status or declining GCS.
- Persistent apnea spells resulting in hypoxia (SaO₂ <90%) or bradycardia for age.

When to order / call in a PICU consultation:

- If at maximal flow rate for age for >12 hours with inability to successfully wean
- If a PICU consultation is placed, a CXR, blood gas, and hospitalist attending evaluation can be completed / ordered to assist in thorough evaluation.

Disclaimer: *If at any point a patient has acute changes, then a Rapid Response or Code Blue can be called at the discretion of the general floor team and/or hospitalist

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