Site Applicability

This guideline provides recommendations for the initiation, ongoing management, and discontinuation of High Flow Nasal Cannula (HFNC) therapy in infants ages 29 days to 1 year diagnosed with bronchiolitis for use at BC Children's Hospital in the Emergency Department and in-patient wards excluding PICU.

Practice Level

Set-up and management of high flow therapy is a basic foundational competency for Registered Respiratory Therapists (RRT).

At BC Children's Hospital, monitoring a patient on high flow therapy is considered an advanced competency for Registered Nurses (RN) and practiced after the RN has had the required education, including completion of Learning Hub course: "High Flow Oxygen Therapy"; completed his/her learning validated document by the appropriate clinical support person. (i.e. Clinical Nurse Educator, Clinical Resource Nurse or RRT)

Guideline Statements

Bronchiolitis is one of the most common pediatric diagnoses contributing to admission to hospital, characterized by first episode wheeze before 12 months of age with a preceding viral prodrome progressing to tachypnea, wheeze, crackles, and variable respiratory distress. The mainstay of treatment is supportive, including hydration, secretion management, and supplemental oxygen as needed.

Infants at higher risk of developing respiratory failure are excluded from this guideline (See Appendix A)

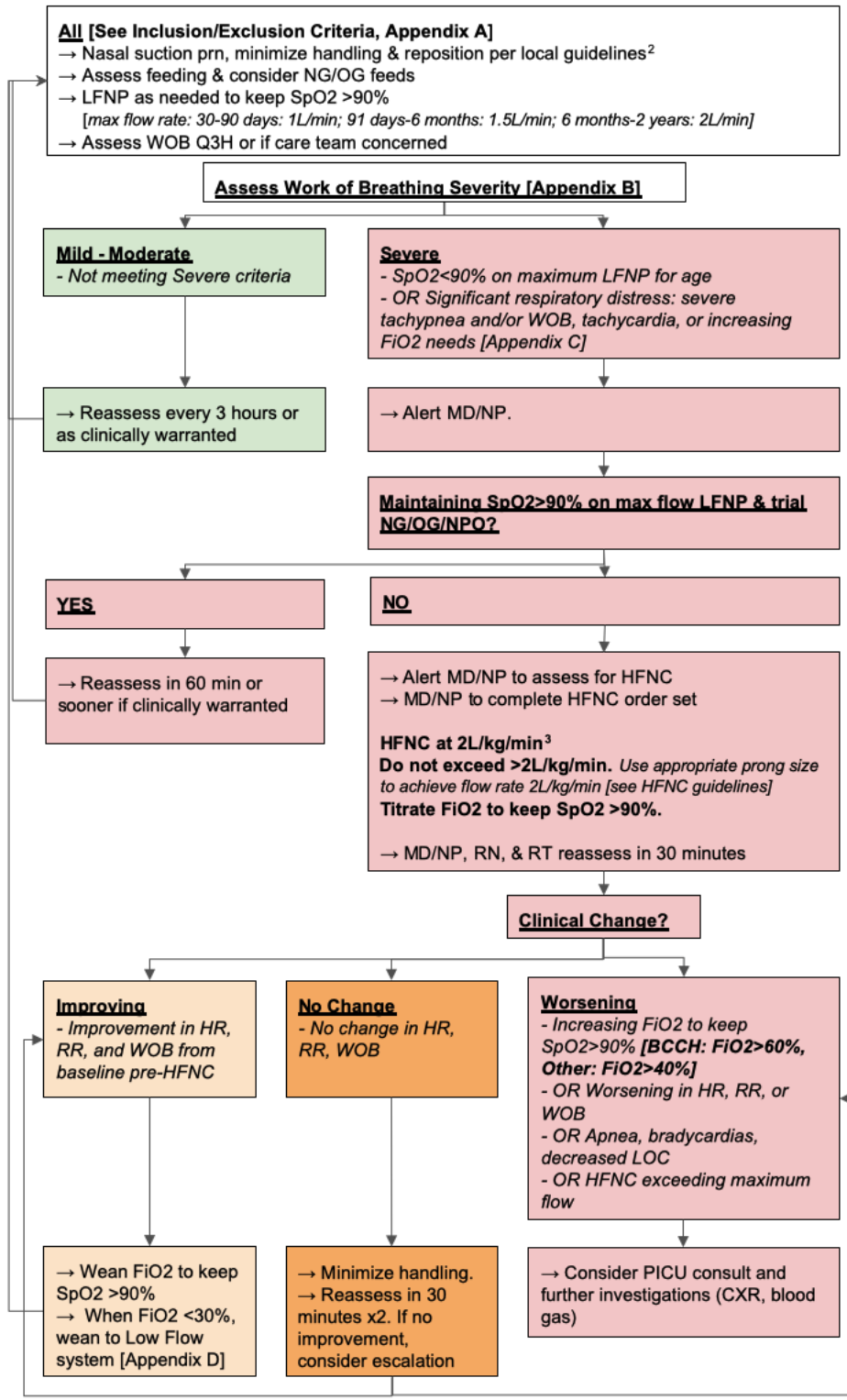
High flow nasal cannula (HFNC) is an alternative to LFNP in respiratory distress as it allows higher flow rates of humidified air at a higher FiO2 than LFNP.

HFNC is effective in bronchiolitis in decreasing rates of escalation of care and PICU admissions; however, this is only true when it is used as a rescue for patients who remain hypoxemic despite maximum LFNP therapy. The overall rate of ICU admissions or more invasive ventilation strategies beyond HFNC are equivalent between those that receive HFNC immediately versus those receiving it as rescue. There is no difference in the length of stay, rate of intubation, or duration of oxygen therapy received between LFNP and HFNC.

HFNC should be delivered at 2L/kg/min.

HFNC is considered an aerosolizing generating medical procedure by the BC-CDC, increasing the risk of transmission for pathogens including the novel Coronavirus, COVID-19. Providers should don personal protective equipment (PPE) including N-95 respirators when providing care to patients on HFNC. For more information, see:
http://www.bccdc.ca/Health-Professionals-Site/Documents/AGMPs_requiring_N95.pdf

Algorithm



LFNP - low flow nasal prong system; SpO2 - oxygen saturation; WOB - work of breathing; FiO2 - fraction inspired oxygen ; NG - nasogastric; OG - orogastric ; NPO - nil per os; HFNC - high flow nasal cannula system; MD - physician; NP – Nurse Practitioner; RN - bedside nurse ; RT - Respiratory Therapist; HR - heart rate; RR - respiratory rate; LOC - level of consciousness; PICU - Pediatric Intensive Care Unit; CXR - chest x-ray; CHD - congenital heart disease; CLD - chronic lung disease; GA - gestational age; VLBW - very low birth weight.

Criteria for Use

Inclusion Criteria

- Age 29 days to 1 year AND
- Clinical diagnosis of bronchiolitis: first episode wheeze before 12mo age, with a preceding viral prodrome progressing to tachypnea, wheeze, crackles, and variable respiratory distress. Evidence of RSV+ not required.

In children ages 1-2 yrs, consider assessment for asthma[1]

Exclusion Criteria

- Comorbidities at risk of respiratory failure (<32wk GA, VLBW, CLD, hemodynamically significant CHD, genetic disorder, neuromuscular disease, anatomic airway/lung abnormalities, craniofacial abnormalities, immunodeficiency)

Note: may have more severe course.

-Acute complications of disease process (significant apneas, pneumothorax)
- High risk for intubation (history of intubation or PICU admission)
- Uncertain diagnosis (query bacterial pneumonia or asthma)

NOT Recommended

- Salbutamol
- Corticosteroids
- Antibiotics
- Antivirals
- 3% hypertonic saline or epinephrine nebulizers
- Chest physiotherapy
- Cool mist therapies
- Escalating therapy based only on presence of wheeze

Guideline

Prior to starting HFNC

Supportive measures:	*Supportive measures include nasal suctioning as needed, minimizing handling in keeping with institutional-specific policies for in-patient management, and low flow nasal prongs (LFNP) oxygen therapy to maintain saturation of greater than 90%*
Assess feeding and fluid status:	*Patients with mild to moderate respiratory distress are candidates for enteral feeding, including nasogastric (NG) or oral gastric (OG) feeds if significant tachypnea.* *Patients with worsening respiratory distress should be trialed on NG/OG feeds, if appropriate, prior to initiation of HFNC. If the patient has risk factors for severe course or concerns for non-invasive positive pressure ventilation (NIPPV) or intubation, consider nil per os (NPO). HFNC is not a contraindication to enteral feeds.*
Confirm diagnosis:	*For patients over one year of age presenting with respiratory symptoms and wheeze, consider assessment and management for asthma.*

For oxygen set up at BCCH, see:
http://policyandorders.cw.bc.ca/resource-gallery/Documents/BC%20Children's%20Hospital/C-05-13-60134%20Oxygen%20Therapy.pdf)

For BC Asthma Guidelines and PRAM scoring, see:
http://policyandorders.cw.bc.ca/resource-gallery/Documents/BC%20Children's%20Hospital/CC.09.27%20PRAM%20(Pediatric%20Respiratory%20Assessment%20Measure)%20Score%20Assessment%20for%20Asthma.pdf

http://policyandorders.cw.bc.ca/resource-gallery/Documents/BC%20Children's%20Hospital/C-05-13-60418%20Pediatric%20Asthma%20Emergency%20Department%20Nurse%20Initiated%20Protocol%20(NIP).pdf

Starting HFNC

Components of assessment:	*Clinical assessment based on tachypnea and work of breathing should guide decision-making. Clinicians can use a validated scale to assist in rating the observation of breathing as mild, moderate, and severe (See Appendix B).* *Severe work of breathing or oxygen saturations below 90% on appropriate low flow O2 therapy is evidence of severe respiratory distress (See Appendix C).*
Timing of assessment:	*Patients should be assessed for respiratory distress using clinical measures every 3 hours, or more if clinical concerns (see algorithm).*
Indications for starting HFNC:	***HFNC should be used as a rescue following treatment failure on LFNP - defined as hypoxemia (oxygen saturations less than 90%) despite age-directed maximal LFNP flow and other supportive measures.*** *Consider HFNC for prolonged severe work of breathing if there is concern for impending respiratory fatigue.*

Ordering HFNC:	***Provide HFNC at 2 litres per kilogram per minute**, with fraction of inspired oxygen (FiO2) titrated to keep oxygen saturations greater than 90%. Clinical changes are not expected beyond 2L/kg/min HFNC.*

For HFNC set up at BCCH, see:
http://policyandorders.cw.bc.ca/resource-gallery/Documents/BC%20Children's%20Hospital/C-05-12-60341%20High%20Flow%20Humidified%20Nasal%20Prong%20Oxygen%20Therapy.pdf

Reviewing clinical status once on HFNC

Timing of re-evaluation after starting HFNC:	*Patients should be re-evaluated within 30 minutes after initiation of HFNC to access need for escalation of care.*
Components to assess:	*Review feeding status and amount of handling, and consider minimal handling and discontinuing PO feeds.* *Use clinical assessment of breathing as outlined above (Appendix B & C).*
Indications for escalation of care:	*After 30 minutes on HFNC, worsening vital signs or a FiO2 requirement greater that 40% in peripheral hospitals, should trigger review by the MRP and consideration of a PICU consult (Earlier if concerns about impending respiratory failure).* *Consider CXR and blood gas at this point.* *If no improvement after 90 minutes of HFNC, consider escalation as patient is at risk of respiratory fatigue.*

Weaning HFNC

Criteria for weaning FiO2:	*Weaning of FiO2 should be done as soon as possible to titrate oxygen saturations greater than 90% so long as there is not significant tachycardia, tachypnea, or work of breathing (See Appendix D).*
Criteria for transition to LFNP:	*Do not wean flow rate of HFNC.* *Transition to LFNC should be considered once the patient is stable and consistently meeting HFNC therapy targets at a FiO2 of less than or equal to 30%. The disease process should be improving as indicated by decreased work of breathing, near normal respiratory rate, and near normal cardiovascular parameters (See Appendix D).*
Procedure for transition to LFNP:	*Patients should be transitioned back to a low flow system at age appropriate flow rates to maintain saturations greater than 90% (See Appendix D). High flow systems should be on stand-by for 6 hours after transitioning off of HFNC, in case of deterioration.*

Documentation:

Nursing: Document on appropriate records q4h and PRN (daily flow sheet, nursing notes):

- method of high flow delivery
- high flowrate and O2%
- HR, RR and effort, SpO2 readings hourly
- BP, Temp, air entry and breath sounds q4h and PRN
- site to source check
- patient's response to treatment
- date and time RRT and/or physician consulted
- date and time RRT and/or physician assess patient
- patient/family teaching
- any other pertinent actions or observations
- changes in patient status

Respiratory Therapy: Document on appropriate records q3h and PRN (RT flow sheet):

- date and time high flow therapy is initiated
- flowrate and O2%
- clinical findings (breath sounds, HR, RR, SpO2 readings)
- site to source check
- patient response to therapy
- any changes in patient status
- patient progress

Related Documents

High Flow Nasal Prong Oxygen Therapy
http://policyandorders.cw.bc.ca/resource-gallery/Documents/BC%20Children's%20Hospital/C-05-12-60341%20High%20Flow%20Humidified%20Nasal%20Prong%20Oxygen%20Therapy.pdf

References

1. BC Centre for Disease Control. Aerosol generating medical procedures (AGMP). 2020.

2. Friedman JN, Rieder MJ, Walton JM, Canadian Paediatric Society, Drug Therapy and Hazardous Substances Committee, Acute Care Committee. Bronchiolitis: Recommendations for diagnosis, monitoring and management of children one to 24 months of age. *Paediatrics & child health*. 2014;19(9):485-491.

3. O'Brien S, Craig S, Babl FE, Borland ML, Oakley E, Dalziel SR; Paediatric Research in Emergency Departments International Collaborative (PREDICT) Network, Australasia. 'Rational use of high-flow therapy in infants with bronchiolitis. What do the latest trials tell us?' A Paediatric Research in Emergency Departments International Collaborative perspective. J Paediatr Child Health. 2019 Jul;55(7):746-752. doi: 10.1111/jpc.14496. PMID: 31270867.

4. Schibler A, Pham TMT, Dunster KR, et al. Reduced intubation rates for infants after introduction of high-flow nasal prong oxygen delivery. *Intensive Care Med*. 2011;37(5):847-852.

5. Sochet AA, McGee JA, October TW. Oral nutrition in children with bronchiolitis on high-flow nasal cannula is well tolerated. *Hospital pediatrics*. 2017;7(5):249-255. https://www.ncbi.nlm.nih.gov/pubmed/28424245. doi: 10.1542/hpeds.2016-0131

Appendices:

- Appendix A: Guideline Exclusion Criteria
- Appendix B: Clinical Assessment
- Appendix C: Signs of Severe Respiratory Distress
- Appendix D: Weaning HFNC

Developed By

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Version History

DATE	DOCUMENT NUMBER and TITLE	ACTION TAKEN
6-Jul-2021	C-05-07-62542 High Flow Nasal Cannula In Bronchiolitis (< 1 Year) Guideline	Approved at: C&W Best Practice Committee

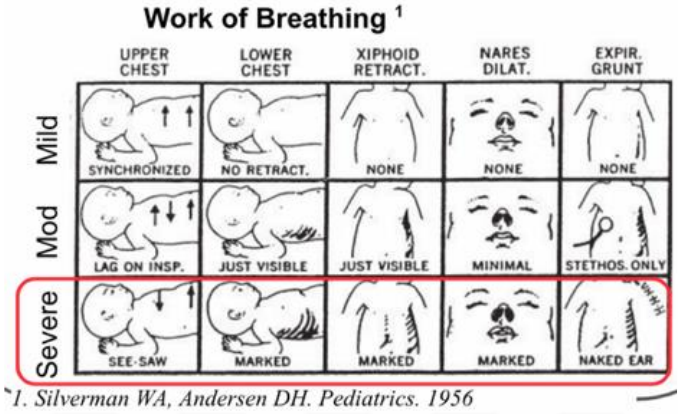
Disclaimer

Appendix A: Guideline Exclusion Criteria

Suitability for HFNC and other respiratory supports should be on a case-by-case basis and clinicians should consider these infants at risk of rapid deterioration	
Comorbidities at risk of respiratory failure	*Prematurity less than 32 weeks gestational age* *Very low birth weight* *Chronic lung disease* *Hemodynamically significant congenital heart defects* *Genetic disorders* *Neuromuscular disease* *Anatomical airway/lung abnormalities* *Craniofacial abnormalities* *Immunodeficiency*
Acute complications of disease process	*Significant apneas* *Pneumothorax*
High risk for intubation	*History of intubation* *History of Pediatric Intensive Care Unit admission*
Uncertain diagnosis	*Suspicion of bacterial pneumonia or asthma if over 1 year old*

Appendix B: Clinical Assessment

Respiratory Rate by Age				
Severity	**Age**	**Mild**	**Moderate**	**Severe**
Respiratory Rate (breath per minute)	< 3 months	30-60	61-80	>80
	3-12 months	25-50	51-70	>70
	1-2 years	20-40	41-60	>60



Appendix C: Signs of Severe Respiratory Distress

Criterion	Clinical signs
Hypoxemia despite maximum LFNP	*SpO2<90% on LFNP greater than:* • *30-90 days: 1L/min* • *31 days-6 months: 1.5 L/min* • *6 months-2 years: 2L/min*
Significant respiratory distress	*Severe tachypnea (Appendix B)* *Tachycardia* *Severe work of breathing (Appendix B)* *Apneas, bradycardia, or decreasing level of consciousness*

Appendix D: Weaning HFNC