

Physician Owners: Dr. Snow & Dr. Noronha

PRIMARY OBJECTIVE

Develop a pathway to guide the initiation, escalation, and weaning for patients on heated high flow (HHF).

CLINICAL CARE GUIDELINES

Intended for patients:

- Age 40 weeks post conceptual age to less than 2 years
- Patients with any of the following
 - o Respiratory distress
 - o Hypoxemia (need for > 1L NCO₂ if 30-90 days, > 1.5 L for 91-6 months, > 2L for 6 months – 2 years)
 - o Clinical respiratory score (CRS) ≥ 5

Exclusion criteria (If using HHF, manage the following patients off this pathway):

- Medically complex patients such as:
 - o Cardiac disease requiring baseline medication
 - o Anatomic airway disease
 - o Neuromuscular disease
 - o Immunodeficiency

CLINICAL MANAGEMENT

Prior to Heated High Flow Initiation:

- Obtain CRS, suction, repeat CRS
- Call licensed provider to order HHF
- Place PIV (consider normal saline bolus and/or IV fluids)
- Order NPO status

Initiate Heated High Flow:

- Place order for Intermediate Care Status
- Initiate HHF at a flow rate of 0.5 FiO₂ at ½ L/min/kg up to 15L. A study¹ of bronchiolitis infants titrated the flow rate from 1L/min to 7 L/min. The infants' respiratory effort was found to decrease once 7 L/min had been delivered, which in their patient cohort equaled approximately to 1.6 L/kg/min.
- Obtain vital signs and CRS. Suction patient, then repeat CRS and vital signs within 30 mins. The bedside nurse to then notify provider of patient status to determine if patient is clinically worsening or improving.
 - a. Clinically improving
 - i. Vital signs per Pediatric Early Warning System (PEWS) policy with suctioning as needed
 - ii. Place NG/OG if anticipated NPO > 1 day (recommend OG for ≤ 5kg patient)
 - iii. Wean flow rates as tolerated
 - iv. [May orally feed when patient is clearly clinically improving.](#)
 - b. Clinically worsening
 - i. Escalate flow up to 2L/min/kg, up to 15L. Some studies^{2,5} have found benefit from a flow rate at 2L/min/kg. The maximum flow is not based on any clinical or physiological rationale², the maximum flow of 15L was chosen based on what other Children's Hospitals are currently using but not yet available in the literature.
 - ii Obtain CRS, suction, repeat CRS, obtain vital signs every 30 mins x2 until a huddle takes place.
- Care team huddle within 60 minutes after increasing flow rate with the RN, RT, resident/senior resident/advanced practice provider. One study² found infants responding to HHF treatment showed a decreased heart rate within the first hour of initiation and a decreased respiratory rate at 180 mins. Those infants that did not respond to HHF showed no change in HR or RR within the first 60 mins of observation.

- i. If patient continues to clinically worsen despite escalation, notify PICU and arrange for patient transfer. May increase respiratory support with HHF or other therapies while waiting for transfer, with ICU guidance. These patients should be managed off this pathway.

Weaning Heated High Flow:

- FiO₂ should be weaned by RN and/or RT to maintain saturations $\geq 90\%$
- Flow rate should be weaned quickly in improving patients, including at night. RT should call provider to wean patient's flow rate by at least 1L every 2 hours as long as patient is clinically improving (respiratory distress, respiratory rate) and requiring less than 30% FiO₂
- When flow is stable at 2L for 2 hours, discontinue heated high flow³. Place low flow nasal cannula O₂ if needed to keep saturations $\geq 90\%$
- Weaning by conducting a trail directly off heated high flow to room air (from any rate) is also possible, as patient's condition allows

Criteria For Transfer:

- Criteria for transfer to the ICU
 - o Clinically worsening on HHF trial
 - o Reoccurring apnea > 20 seconds requiring intervention
 - o Reoccurring desaturations with increased FiO₂ needs
 - o Altered mental status (irritability, lethargy) poor perfusion (cool extremities, capillary refill > 3 seconds)
- Criteria for transfer from the ICU to the floor
 - o Meets pathway criteria, stable on flow rate at or below 2L/min/kg up to 15L (floor maximum) for >12 hours AND respiratory score < 8 prior to transfer

RATIONALE

- **Safety** Will be maintained by close communication between bedside nurse, charge nurse, RT, and providers.
- **Quality:** Will be improved by reducing unnecessary variation in initiation, escalation, and weaning of therapy.
- **Cost:** Will be reduced by reducing variation in treatment which leads to potential delays, adverse events, and readmissions.
- **Engagement:** Is created and supported by involvement of nursing, respiratory therapy, and providers who care for HHF patients.
- **Patient/Family Satisfaction:** Shall be improved by providing the highest quality care based on established guidelines and the latest evidence available in the literature.

IMPLEMENTATION ITEMS

- Bronchiolitis Protocol, Oxygen/Oximetry Protocol, HHF Equipment Policy, IMC Policy

METRICS PLAN

- Pathway order set usage
- Decrease length of stay for patients requiring heated high flow during admission
- Decrease duration of heated high flow therapy when ordered for a patient
- Decrease the rate of transfers to the PICU

TEAM MEMBERS

Dr. Jay Snow, Dr. Luke Noronha, Rachel Shirk RT, Mike Haskins RT, Melisa Paradis RN, Stephanie Johnson RN, Stacy Salcedo RN, Dr. Jason Burrows.

EVIDENCE

1. Milesi C, Balenine J, Matecki S, Durand S, Combes C, Novais AR, Cambonie G. Is treatment with a high flow nasal cannula effective in acute viral bronchiolitis? A physiologic study. *Intens Care Med.* 2013; 39: 1088-1094.
2. Seattle Children's Hospital, Wilson L, Beardsley E, Chen T, Crotwell D, Ford R, Foti J, Leu M, Magin J, Ringer C, Roberts J, Slater A, 2015 November. Bronchiolitis Pathway. Available from: <http://www.seattlechildrens.org/pdf/bronchiolitis-pathway.pdf>
3. Mayfield S, Bogossian F, O'Malley L, Schibler A. High-flow nasal cannula oxygen therapy for infants with bronchiolitis: Pilot study. *J Paediatrics Child Health.* 2014; 50: 373-378. doi: 10.1111/jpc.12509
4. Bressan S, Balzani M, Krauss B, Pettenazzo A, Zanconato S, Zanconato S. High-flow nasal cannula oxygen for bronchiolitis in a pediatric ward: a pilot study. *Eur J Pediatr.* 2013; 172: 1649-1656.
5. Pham TMT, O'Malley L, Mayfield S, Martin S, Schibler A. The effect of high flow nasal cannula therapy on the work of breathing in infants with bronchiolitis. *Pediatr Pulmonol.* 2015; 50: 713-720.