CLINICAL PATHWAY:
High Flow Nasal Cannula Use in Patients Outside of the Intensive Care Unit

THIS PATHWAY SERVES AS A GUIDE AND DOES NOT REPLACE CLINICAL JUDGMENT.

Inclusion Criteria:

- High Flow Nasal Cannula (HFNC) support indicated for acute respiratory illness
- Maximum flow rate ≤3 LPM/kg (max 45 LPM); flow rates above 45 LPM require discussion with/approval by the attending physician
  Note: Patients receiving continuous albuterol may not receive flow rates in excess of 1 LPM/kg
- Maximum FiO2 of 50% to maintain SpO2 of ≥92%; FiO2 >50% requires discussion with/approval by the attending physician

Exclusion Criteria:

Consider PICU consultation when initiating HFNC support in high risk populations (eg., intermittent apnea, significant neuromuscular weakness)

When support is initiated in the ED:

- Patients will be observed for at least 1 hour prior to transfer to the medical/surgical unit. PEWS should be documented prior to initiating support and reassessed 1 hour later. Scores >10 on a maximum of 3 LPM/kg at the 1 hour reassessment should prompt consultation with the PICU team.
- Responders typically demonstrate improvements in RR, HR, and accessory muscle use within an hour of initiating therapy and are appropriate for the medical/surgical units. Lack of improvement in these parameters warrants consultation with the PICU.

OXYGEN

GOAL:

- Maintain SpO2 of 92%

WEANING:

- Oxygen should be weaned for SpO2 >92%

Physicians, Advanced Practice Providers, Nurses, and Respiratory Therapists may titrate O2

FLOW

INITIATION/TITRATION:

- Initial flow of 2 LPM/kg is recommended. Flow rate may be increased based on work of breathing to a maximum of 3 LPM/kg (max 45 LPM). Flow rates above 45 LPM require approval by the attending physician. Significant work of breathing despite this level of support warrants evaluation by the PICU team. Most patients will not benefit from flows significantly greater than 2 LPM/kg.
- RTs, physicians, and advanced practice providers may increase the flow as needed. HFNC orders must be updated after any change (if RT increases, page resident to update order) and the bedside nurse notified.
- RT must be notified immediately of increases in flow to assess whether prongs are the proper size

WEANING:

Initiate decreases in flow when:

- WOB is improved; HR/RR may be elevated for age but are stable

Weaning strategy:

- Many patients only need high flow support for 24 hrs.
  - For mild-moderate WOB, trial off of flow entirely and observe for changes in work of breathing and vital signs to assess readiness to discontinue.
  - Patients who have increased WOB after several minutes should remain on high flow but may tolerate a lower flow rate.
- Always update the HFNC order after any change (if RT weans, page resident to update order accordingly) and communicate with the bedside nurse.
- RTs, physicians, and advanced practice providers may wean flow.
- When discontinuing high flow remember to place an order for oxygen via nasal cannula for any residual O2 demands.

TREATMENTS

- Consider the following respiratory treatments based on clinical condition:
  - Aerosolized hypertonic saline
  - Chest physiotherapy
  - Deep suctioning

*Recommend cluster care of CPT, Nebs, suctioning to allow for periods of rest

MONITORING

- "Watcher" status until flow rates are being weaned
- Continuous CR monitoring
- Continuous pulse ox monitoring (alarm for SpO2 <92%)
- Document PEWS score prior to starting HFNC and 1 hour after initiating HFNC support.
  - Subsequent scoring occurs at 4 hour intervals per hospital protocol (see below: When To Call a MET)

FEEDING

- Initiate PO/NG feeds once patient demonstrates improved WOB
- Enteral feeds are generally appropriate once the patient has been on a stable flow rate for at least 2 hours with only mild-moderate work of breathing
- IV hydration may be preferable in patients with significant WOB at risk for aspiration

WHEN TO CALL A MET:

- Team member or family concern about the patient's clinical status
- More than moderate work of breathing on 3 LPM/kg (max 45 LPM)
- PEWS >10 after an hour on maximum flow of 3 LPM/kg (max 45 LPM)

DISCHARGE CRITERIA:

- SpO2 in room air >90% for greater than 4 hrs
- Tolerating PO intake/no need for IV fluids or NGT support
- Age appropriate RR with comfortable WOB
- Caregiver education complete, appropriate follow up in place

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Practice Guideline
High Flow Nasal Cannula Use in Patients Outside of the Pediatric Intensive Care Unit
Original 7/14/17; rev. 11/2018, 1/2020, 1/2021, 1/2022, 12/2022

I. Purpose
Create a standardized approach to providing heated high flow nasal cannula (HFNC) support to pediatric patients outside of the Pediatric Intensive Care Unit (PICU).

II. Background
High flow systems are designed to heat and humidify gas mixtures for safe delivery at flow rates that meet or exceed a patient's inspiratory flow demands, thereby decreasing work of breathing in the setting of respiratory illness. In addition to the benefits of avoiding more invasive modes of ventilatory support, HFNC therapy has the potential to decrease metabolic demands and facilitate safe enteral nutrition earlier in the disease course.

III. Inclusion Criteria
Patients who meet the following criteria may be appropriate candidates for HFNC therapy outside of the PICU setting:
- i. HFNC therapy prescribed for an acute respiratory illness
- ii. Support does not exceed 3 LPM/kg flow (max 45 LPM- flow rates above 45 LPM require discussion with/approval by the attending physician). Note: Most patients do not benefit from flow rates exceeding 2 LPM/kg.
- iii. Patients receiving continuous albuterol should not exceed 1 LPM/kg flow (max 45 LPM)
- iv. Oxygen demand does not exceed 50% FiO2 to maintain SpO2 of 92% and above (FiO2 above 50% requires discussion with/approval by the attending physician).

IV. Exclusion Criteria
Some patients receiving high flow support *may* be more appropriate for the ICU setting. For example, patients with intermittent apnea or significant neuromuscular weakness require a degree of vigilance that may not be possible outside of the ICU environment. When there is doubt or questions arise, consultation with the PICU team is advised.

V. Management Guidelines
- a. *Initiation/titration of support*
  - i. Supplemental oxygen is the treatment for hypoxemia and therefore should be titrated to maintain a minimum SpO2 of 92%. Patients with an oxygen demand that exceeds 50% FiO2 require discussion with/approval by the attending physician.
  - ii. Increased flow rates are the treatment for increased work of breathing. Initial flow rates of 2 LPM/kg are recommended. The flow rate may be increased as needed based on the patient's work of breathing to a maximum of 3 LPM/kg or 45 LPM, whichever is less. Flow rates above 45 LPM require discussion with/approval by the attending physician. Patients with significant work of breathing despite this level of support warrant evaluation by the PICU team.
    Respiratory Therapy must be notified immediately any time flow rates are increased to ensure that the patient is fitted with the appropriate sized nasal cannula to support the desired flow. Patients who respond well to HFNC

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support typically demonstrate improvements in respiratory rate, heart rate, and accessory muscle use within an hour of initiating therapy. Lack of improvement in these parameters despite support with flow rates of 3 LPM/kg (max 45 LPM) signals the need for more support with CPAP/BiPAP or mechanical ventilation. Most patients will not benefit from flow rates in excess of 2 LPM/kg.

iii. When support is initiated in the ED, patients will be observed for at least an hour to evaluate the response to therapy and determine whether disposition to the medical/surgical units v. PICU is appropriate. The PEWS score should be documented prior to initiating support and reassessed 1 hour later. PEWS >10 on a maximum of 3 LPM/kg (max 45 LPM) at the 1 hour reassessment should prompt consultation with the PICU team.

b. *Feeding*
   i. Oral/NGT feeds may be initiated once improvements have been demonstrated in work of breathing with a stable level of support. Avoidance of enteral feeding is advised when initiating HFNC support until there is sufficient confidence that other modes of positive pressure ventilation will not be necessary. This is in order to avoid the aspiration risks associated with initiating CPAP/BiPAP or endotracheal intubation in a patient with a full stomach. Enteral feeds are generally appropriate once the patient has been on a stable flow rate for at least 2 hours with mild to moderate work of breathing.

c. *Weaning support*
   i. Supplemental oxygen should be weaned to the lowest FiO2 needed to maintain SpO2 of 92%. Physicians, advanced practice providers, nurses, and respiratory therapists may titrate FiO2.
   ii. Once the patient's work of breathing has improved and HR/RR have stabilized, flow may be decreased. Many patients will only require HFNC support for 12-24 hours, and the best way to determine ongoing need is to assess changes in vital signs and work of breathing in response to a decrease/discontinuation of flow. A suggested approach for patients with mild-moderate work of breathing is to trial the patient off of flow entirely and observe for changes in work of breathing and vital signs; the need for ongoing support is generally clear after only a few minutes of monitoring. Orders should be updated and if discontinuing high flow an order for supplemental oxygen via nasal cannula should be placed for any residual oxygen demand. Respiratory therapists, physicians, and advanced practice providers may perform these bedside weans.

d. *Monitoring*
   i. Patients receiving HFNC therapy will have "Watcher" status until their condition stabilizes and flow rate is being actively weaned.
   ii. Patients receiving HFNC therapy mandate continuous pulse oximetry and full cardiorespiratory monitoring.
   iii. Patients will frequently have a PEWS score of 7 or more because all HFNC patients are on more than 4 LPM of support and therefore automatically start with a minimum of 4 points assigned. The PEWS score should be documented just before starting HFNC support and reassessed one hour

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later. Scores >10 on a maximum of 3 LPM/kg (max 45 LPM) after the one hour reassessment should prompt a MET activation. Subsequent PEWS scores should be obtained at 4 hour intervals per hospital policy.

iv. MET activations are indicated for: any concern that a patient is experiencing a decline in cardiorespiratory or neurological status; more than moderate work of breathing on 3 LPM/kg (max 45 LPM); PEWS >10 after an hour on maximum support of 3 LPM/kg (max 45 LPM).

e. *Deep suctioning technique*
Nasotracheal suctioning is necessary when a patient is unable to effectively mobilize pulmonary secretions and does not have an artificial airway.

i. Open suction kit or catheter using aseptic technique. Do not allow the suction catheter to touch nonsterile surfaces.
ii. Secure catheter to tubing aseptically. Coat distal 2-3 inches of catheter with water-soluble lubricant (K-Y Jelly/Lubricant).
iii. Without applying suction and using the dominant thumb and forefinger, gently, but quickly insert the sterile catheter into either naris during inhalation with a slight downward slant. Do not force the catheter. Try the other naris if insertion meets resistance or is difficult to insert. Estimate depth of insertion based on the distance from the patient's nose to the base of the earlobe and then down to the thyroid cartilage as a guide. Remember that the epiglottis is open during inspiration and facilitates insertion of the catheter into the trachea.
iv. Apply intermittent suction by placing and releasing non-dominant thumb over the vent of catheter. Slowly withdraw the catheter while rotating it in a circular motion with suction on for as long as 10-15 seconds.
v. Assess the need to repeat suctioning procedure. Allow adequate time between suction passes for ventilation and oxygenation. Keep oxygen readily available in case the patient exhibits signs of hypoxemia. Administer oxygen to the patient between suctioning attempts.
vi. When the pharynx and trachea are cleared of secretions, perform oral suctioning to clear the mouth of secretions. Do not suction the nose or trachea after suctioning the mouth.
vii. Deep suctioning may cause trauma and/or edema to the mucosa. Discontinue deep suctioning if bleeding occurs until discussed with the physician/practitioner.

VI. Key References

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2. Nolasco S, Manti S, Leonardi S, Vancheri C, Spicuzza L. High-Flow Nasal Cannula Oxygen Therapy: Physiological Mechanisms and Clinical Applications in Children. Front Med (Lausanne). 2022 Jun 3;9:920549. doi: 10.3389/fmed.2022.920549. PMID: 35721052; PMCID: PMC9203852.

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