High Flow Nasal Cannula (HFNC) in Bronchiolitis: Managing Care Outside the ICU

Wednesday, November 2, 2022
11 a.m.
Faculty

• Estevan Garcia, MD, DPH, MPA, FAAP, Chief Medical Officer, Massachusetts Department of Public Health
• Alla Smith, MD, Attending Physician, Division of Medical Critical Care, Boston Children's Hospital
The webinar is tailored to clinicians who are managing patients with bronchiolitis on HFNC outside the ICU – in both community hospitals and sites where there may be a pediatric ICU that is currently at capacity.

Participants should expect to achieve the following learning objectives through this webinar:

- Summarize the physiologic mechanism for HFNC in bronchiolitis;
- Identify patients with bronchiolitis who may benefit from HFNC;
- Discuss a weight-based approach for initiation, escalation, and weaning of HFNC; and
- Assess how a pathway for management of HFNC in bronchiolitis might be implemented in your health system
HFNC in Bronchiolitis:
Managing Care Outside the ICU
Alla Smith, 11/2/2022
High Flow Nasal Cannula Pathway

HFNC in Bronchiolitis Pathway guides management of patients with bronchiolitis on HFNC using optimal flows and incorporates aggressive weaning.

Goal:
- Bring this pathway back to your facility- adapt it to that environment
- Improve staff comfort with this patient population
- Shorten duration of critical illness/time on HFNC
HFNC: What is it?

- Heated, humidified air with titratable FiO2 (0.21 to 1), typically delivered at flows >4L/minute
HFNC: How does it help?

- Allows for effective dead space wash-out\(^1\)
- Humidifies airways, which assists with secretion clearance\(^1\)
- Provides (small) PEEP in patients with bronchiolitis\(^1\)
- Improves tachypnea and dyspnea in patients with bronchiolitis\(^2\)


HFNC: Who should get it?

- Hospitalized patients with moderate to severe bronchiolitis who have failed standard therapies

- Patients with bronchiolitis (<2yo) who have
  - Hypoxia requiring >2L/minute LFNC
  - OR
  - Persistent moderate to severe dyspnea or tachypnea

HFNC: What flows are best?

- Most pediatric inpatient units in US use fixed liter limit flows that are low (<8LPM)\(^4\)
- Weight-Based Flows
  - 2L/kg/minute are optimal\(^5\)


HFNC: Weaning is Important

- Higher flows are associated with longer LOS\(^5\)
- Aggressive weaning protocols can shorten LOS\(^6\)
  - Regularly turn down flows and assess how patients respond


HFNC: What to do when it fails

- Some studies suggest reduction in ICU need- but a proportion of children on HFNC (15-50%) will require ICU transfer\(^7-11\)
- Building in institution-specific transfer criteria is key to pathway success
- NIV with CPAP or BIPAP is a reasonable next step for most patients


HFNC in Bronchiolitis Pathway

Inclusion Criteria
- Age < 2 years with diagnosis of bronchiolitis
- Hypoxia requiring >2L/min LFNC or 35% FiO2 OR Persistent increased work of breathing
*Patients with significant hypercarbia or apneic episodes will likely require NIPPV or intubation

Weaning Pathway

Initiate @ 1L/kg/min
adjust FiO2 to goal SpO2 > 90%

Clinical Improvement?
(improved WOB, HR, RR, and hypoxia)

Weaning Considerations
*After attempted wean, if patient has increase in WOB, RR, HR, or hypoxia, then re-escalate HFNC to test flow rate at which patient was "captured" and restart weaning pathway (i.e. wait for an additional 4 hours before attempting to wean)
*Please continue with intermittent suctioning, at least every 4 hours, ideally prior to feeding

Escalation Pathway

Escalate to 2 L/kg/min

Reassess hourly

Clinical Improvement?

Escalation Considerations
*May escalate HFNC more slowly to facilitate tolerance but with same goal of 2 L/kgmin
*Consider transition to NIPPV if patient shown to have hypercarbia
*Medical team needs to be involved in decision to escalate HFNC or initiate NIPPV

Weaning Pathway

Wait until patient has achieved 4hr period of stability on current flow rate* and FiO2 has been weaned to 21-30%
*init tachypnea or mild dyspnea is not a contraindication to weaning

Is current support 1 L/kg/min?

Decrease flow to 1 L/kg/min

4 hour period of stability?

Turn HFNC off and transition to LFNC if still requiring FiO2

Monitor patient in setting that can restart HFNC for 8-12 hours after HFNC discontinued

Consider escalation to previous flow rate vs continuing on current flow rate
Average Hours on HFNC and LOS by Arm Group

- Standard HFNC Arm
- Weight-Based HFNC Arm

**HFNC (hours)**
- Standard HFNC Arm: 40.1
- Weight-Based HFNC Arm: 24.0

**LOS (hours)**
- Standard HFNC Arm: 77.4
- Weight-Based HFNC Arm: 50.6

*p < 0.001*
HFNC Pathway at BCH

Compared with Standard Practice at BCH:

- Reduction in Time on HFNC
- Reduction in Hospital and Critical Care LOS
- Decrease in the percentage of patients who require escalation to NIV or IMV*

*preliminary data
HFNC: What are the risks?

- Minimal.
  - Risk of air leak is very low, even when using higher flows
    - Recent large (~1500) patient RCT did not demonstrate any air leak\(^7\)

---

HFNC Pathway: RN/RT Staffing

- HFNC does not obviate or reduce the need for RN and RT support
  - Patients generally staffed at 1:2 to 1:3 for nursing
  - RT supports vary - but they are often involved in assessments/flow changes
PIMCU Network

- Interested in high-acuity care outside the ICU?
  - Join the PIMCU Network! Email me or the network administrator* for an invitation to the group’s website. Post questions/share pathways etc. Over 150 members nationally
  - Join the new AAP Sub-committee on Pediatric Intermediate Care (under SOHM and SOCC)

* alla.smith@childrens.harvard.edu or peter.hopkins@childrens.Harvard.edu
Acknowledgements

- Network Team
  - Debra Banville
  - Mark Waltzman
  - Karen Gruskin
  - Jesslyn Lenox

- BCH Team
  - Michael Agus
  - Christiana Russ
  - Elyse Jones
  - Daria Donelly

And many others!
HFNC in Bronchiolitis Pathway

Initiate @ 1L/kg/min
adjust FiO2 to goal SpO2 > 90%

Reassess hourly

Clinical Improvement?
(Improved WOB, HR, RR, and hypoxia)

Weaning Pathway

Wait until patient has achieved 4hr period of stability on current flow rate* and FiO2 has been weaned to 21-30%.
*Need is hypoxemia or mild dyspnea or not a contraindication to weaning.

Is current support 1 L/kg/min?

Yes

Decrease flow to 1 L/kg/min

Turn HFNC off and transition to LFNC if still requiring FiO2

Monitor patient in setting that can restart HFNC for 8-12 hours after HFNC discontinued

Consider escalation to previous flow rate vs continuing on current flow rate

NO

If increased WOB, consider escalation

Escalation Pathway

Escalate to 2 L/kg/min

Reassess hourly

Clinical Improvement?

Yes

Advance to weaning pathway

NO

Consider transition to NIPPV

Inclusion Criteria
- Age < 2 years with diagnosis of bronchiolitis
- Hypoxia requiring >2L/min LFNC or 35% FiO2
- OR
- Persistent increased work of breathing

* Patients with significant hypercarbia or apneic episodes will likely require NIPPV or intubation.

*Weaning Considerations*
- After attempted wean, if patient has increase in WOB, RR, HR, or hypoxia, then re-escalate HFNC to last flow rate at which patient was “captured” and restart weaning pathway (i.e. wait for an additional 4 hours before attempting to wean).
- Please continue with intermittent suctioning, at least every 4 hours, ideally prior to feeding.

*Escalation Considerations*
- May escalate HFNC more slowly to facilitate tolerance but with same goal of 2 L/kg/min.
- Consider transition to NIPPV if patient shown to have hypercarbia.
- Medical team needs to be involved in decision to escalate HFNC or initiate NIPPV.
High Flow Nasal Cannula - trends

HFNC Study: Weight Based Protocol

Initiate HFNC @ Initial 1 lpm/kg and 21% Oxygen

Does the patient have a BASS score of mild bronchiolitis after 2 hours?*

**MAINTAIN:**
Initiate 4 hours of observation

- **YES**
  - Already on max settings?
    - **YES**
      - Consider wean after 4 hours.
    - **NO**
      - Escalation to Moderate or Severe Bronchiolitis @ any time?
        - **YES**
          - **ESCALATE:**
            - Increase to max flow rate.
            - Maintain SpO2 >90%
        - **NO**
          - **WEAN FIO2:**
            - Wean FIO2 to 21% over 2 hours.
              - **YES**
                - 21% With SpO2 >90%
              - **NO**
                - Return to previous FIO2 to maintain SpO2 >90%. Monitor x2 hours
            - **WEAN FLOW:**
              - Cut flow in half
              - Monitor x2 hours.
              - Patient breathing comfortably with SpO2 >90%

- **NO**
  - Consider wean after 4 hours.

**TRANSFER CRITERIA:**
- HR: unchanged or increased, compared with HR at HFNC initiation.
- RR: unchanged or increased, compared with RR at HFNC initiation.
- WOB: unchanged or increased, compared with WOB at HFNC initiation.
- Oxygen requirement >40% to maintain SpO2 >90%
  - * Consider earlier transfer in the setting of sustained clinical worsening on maximum flow.

**CONSIDER TRANSFER**

**BASS Tracking Table**

<table>
<thead>
<tr>
<th>Date &amp; Time</th>
<th>Score</th>
<th>Flow</th>
<th>FIO2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* consider escalating sooner if patient is decompensating
Standard Pediatric HFNC

Initiate HFNC @ Initial 4 lpm and FiO2 to maintain SpO2 ≥92%

Patient exhibits decreased WOB and stable SpO2 ≥92%

YES

After a period of stability, begin wean. Decrease FiO2 by 10% down to 30% as tolerated to maintain SpO2 ≥92%

NO

Increase flow to a max of 8 lpm and FiO2 to max 60% as needed to reduce WOB and maintain SpO2 ≥92%

Patient stable on 30%?

NO

Return to previous settings and monitor.

YES

Return to previous settings and monitor.

Patient Improved??

YES

Transfer

NO

Decrease flow rate as tolerated down to 1 lpm.

SpO2 ≥92% and stable WOB on 1 lpm?

NO

NO

NO

Remove
Follow Up & Next Steps

• Patricia Noga, PhD, RN, MBA, NEA-BC, FAAN, Vice President, Clinical Affairs, MHA
  – pnoga@mhalink.org

• Adam Delmolino, Director, Virtual Care & Clinical Affairs, MHA
  – adelmolino@mhalink.org

• Steve Defossez, MD, EMHL, CPE, Vice President, Clinical Integration, MHA
  – sdefossez@mhalink.org