

Optimizing Therapy for Moderate Respiratory Distress

CEA SYMMETRY

Christopher Baugh, MD, MBA
Department of Emergency Medicine
Associate Professor of Emergency Medicine,
Harvard Medical School

Brigham and Women's Hospital
brighamandwomens.org

Educational Objectives

After participating in the educational activity, you should be able to:

1. Identify what is true heated, humidified nasal high flow therapy.
2. Successfully identify patients that are candidates for HHNF Therapy.
3. Initiate therapy with appropriate settings through the engagement of all appropriate resources.

CEA SYMMETRY

Disclosure of Conflict of Interest

The following table of disclosure information is provided to learners and contains the relevant financial relationships that each individual in a position to control the content disclosed to Amedco. All of these relationships were treated as a conflict of interest, and have been resolved. (C7 SCS 6.1-6.2, 6.5)

All individuals in a position to control the content of CE are listed below. If their name is not listed below, they disclosed that they had no financial relationships with a commercial interest.

Name	Commercial Interest: Relationship
Christopher Baugh, MD	Abbott Laboratories, AstraZeneca, Bristol Myers Squibb, InCarda, Pfizer, Roche, Salix, Torus Biosystems: Scientific/Medical Advisory Board Member
Robert Batte	NA

This activity is supported by an educational grant from Fisher & Paykel Healthcare

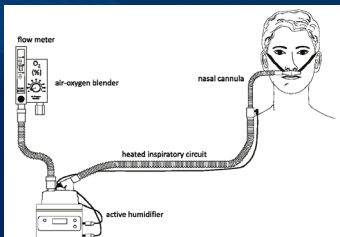


Introduction to Heated Nasal High Flow Therapy and its Use in the ED

CE SYMMETRY

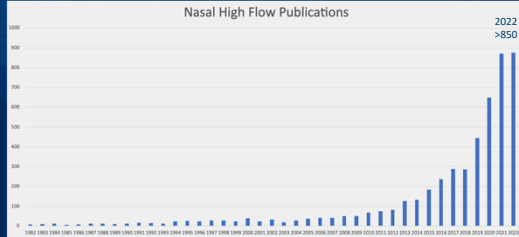
High Flow Nasal Cannula (HFNC) – What is in a name

Heated, humidified air with titratable FiO_2 (0.21 to 1), typically delivered at flows >4L/minute, up to 70L/minute



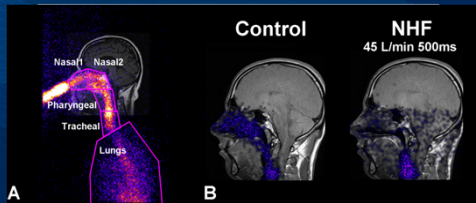
Interest in HHNF Therapy is on the Rise

PubMed Citations by Year



Dead space ventilation

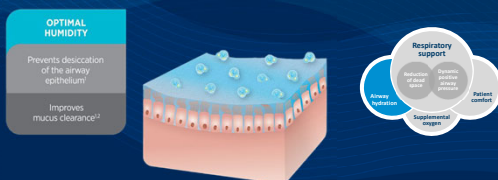
Allows for effective pharyngeal dead space wash-out of CO₂



Waller JR, Hong S, D'Amico M, Li Y, Franks A, Goh S, Bartlett J et al. Nasal high flow reduces dead space. *J Appl Physiol* (2022). 2022 Jan 12;132(1):101-107.

Importance of warm humidification

- Humidifies airways, which assists mucociliary function and thus, secretion clearance
- Heats gas to 37°C with 100% relative humidity and can deliver 0.21 – 1.00% FiO₂
- Reduced caloric expense



1. Williams et al. *Crit Care Med* 1994.
2. Hsu et al. *Chest* 1998; 113: 1336.

Enhanced patient comfort versus BiPAP

- Reduced aspiration risk
- Patients can eat
- Enhanced communication
- Improved patient compliance



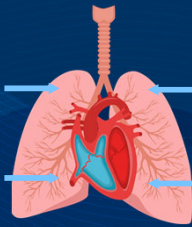
Positive end-expiratory pressure: PEEP

Lung:

- Decrease extra-vascular lung water
- Decrease work of breathing

Preload:

- Decrease venous return
- Increase PVR
- Decrease hypoxic vasoconstriction



Afterload:

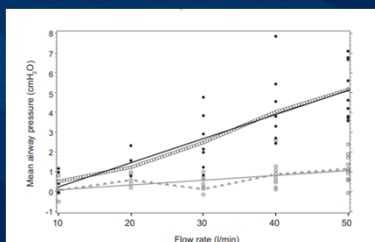
- Increase intrathoracic pressure
- Increase transmural pressure

Heart:

- Decrease O_2 demand
- Increase O_2 delivery

Parke RL, Eckstein ME, McGarvey DL. Nasal high-flow therapy delivers low level positive airway pressure. *Br J Anaesth*. 2008 Dec;102(6):885-90.

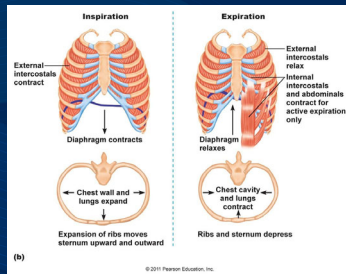
Oxygen flow rate: PEEP impact



Butler J, Williams AB, Gerard C, Hickey H. Evaluation of a humidified nasal high-flow oxygen system, using esophageal, esophageal and measurement of upper airway pressures. *Anaesth Intensive Care*. 2011 Nov;99(1):103-10.

Decrease work of breathing

- Respiratory rate
- Accessory muscle use
- Prolong window for therapeutic response
- Avoid escalation in care



Maart T, Turner C, Ezzamel N, Grasselli G, Wells CA, Bellani G, et al. Physiologic effects of nasal high-flow cannula therapy in acute hypoxemic respiratory failure. *Am J Respir Crit Care Med*. 2017;195(10):1207-1215.

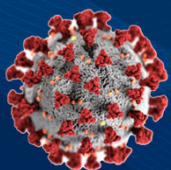
Risks of HFNC are Low

- Risk of air leak is very low, even when using higher flows (importance of correctly sizing nasal cannula size)
- Recent large (~1,500) patient RCT did not demonstrate any air leak
- HFNC can decrease preload by increasing intra-thoracic pressure, again another feature commonly attributed to PEEP



Franklin D, Bala T, F, Schepelash, L, J, Oakley E, Craig S, Neuman, J, et al. (2020). A Randomized Trial of High-Flow Oxygen Therapy in Infants with Bronchiolitis. *The New England Journal of Medicine*. 382(25), 1102-1111.

HFNC and COVID



"Overall, the available evidence shows that HFNC is no worse than conventional oxygen delivery devices or NIV in terms of dispersion of a patient-generated bioaerosol"

Ensure proper nasal prong sizing

Coxon C, Pearson P, Benda V, Piant L, Carlisle A. High-Flow Nasal Cannula and COVID-19: A Clinical Review. *Respir Care*. 2022;166(7):2217-2240. doi: 10.4187/jrcare.00056. Epub 2023 Sep 14. PMID: 36511763.

Utility/Implementation of HNHF Therapy in the Emergency Department

The Approach to Respiratory Distress in the ED

ABCs, rapid assessment of history (including baseline, prior episodes)

Early recognition of patients who may benefit from an escalation in respiratory therapy in addition to other therapies (e.g., positioning, epi, nitro, etc.)

Understanding pathophysiology, trajectory of work of breathing, and goals of care



When to Reach for Various Therapies



When to Reach for Various Therapies

NC, Mask, NRB	HFNC	NIV/BiPAP/CPAP	ETT & Surgical Airway
FiO ₂ estimated	FiO ₂ controlled		
Well tolerated	Tolerable	Uncomfortable	Medicated
Cheap, simple	Intermediate cost	Expensive, resource intense	
No PEEP, no pressure support	PEEP (low level)	PEEP +/- pressure support	
Cooperation not needed		Cooperation needed	Not needed
Simple to give medications		Nebulization complex	
Patient clears secretions		Assisted secretion clearance	

Robert K. Gossens, T. Fraser, Jr. How to use humidified high-flow nasal cannula in breathless adults in the emergency department. *Emerg Med Australas*. 2019 Oct;31(10):810-808. doi: 10.1111/1742-6732.13372. Epub 2019 Aug 6. PMID: 31490171.



When Intubation ISN'T the Answer

Certain conditions best treated by **AVOIDING** intubation if possible

- Status asthmaticus
- Severe metabolic acidosis
- Requires ongoing good patient effort, oxygenation, and airway protection



Common ED Conditions for HNHF

Adult:
COPD, Asthma, COVID, CHF, pneumonia, undifferentiated dyspnea, acute hypoxemic respiratory failure, pre-intubation, and post-extubation respiratory support

Pediatric:
Bronchiolitis, respiratory distress, asthma, sleep apnea, pneumonia, transport of a critical patient, and post-extubation respiratory support



HNHF Therapy in the ED – Additional Impact

- Potential to Reduce Obs Unit Time and/or patient volume
- Potential to Avoid ICU admission
 - Reduce ED Boarding related to lack of ICU beds
 - Lower morbidity/mortality associated with extended ED stays

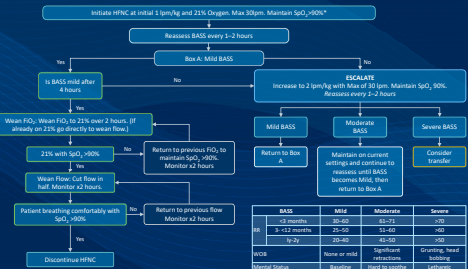
NOTE – Make sure to engage the RT resources. They provide a wealth of experience and can be a tremendous asset.

Strength of Recommendations

When should high flow nasal cannula (HFNC) be used in the clinical setting?			
Hypoxemic respiratory failure (moderate certainty)	Following extubation (moderate certainty)	Postoperative HFNC in high risk and/or obese patients following cardiac or thoracic surgery (moderate certainty)	Peri-intubation period (moderate certainty)
Strong recommendation	Conditional recommendation	Conditional recommendation	No recommendation

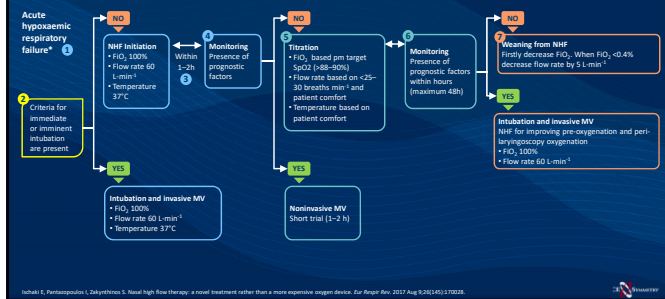
Ruchwing S, et al. The role for high flow nasal cannula as a respiratory support strategy in adults: a clinical practice guideline. *Intensive Care Med*. 2020 Dec;65(12):2226-2237. doi: 10.1007/s00134-020-06312-y. Epub 2020 Nov 17. PMID: 33032131; PMCID: PMC7670262

Pediatric Algorithm:
Pediatric HFNC ED and Inpatient Bronchiolitis ≤2yo



*Consider admission to Pediatrics
American Heart Association. 2015. *Handbook of Emergency Cardiovascular Care for Healthcare Providers*, November 2015. American Heart Association ISBN 978-1-61059-087-6. Page 83. Pediatric Advanced Life Support Provider Manual, American Heart Association, October 2015, ISBN 978-1-61059-112-7, pages 49-49.

Adult respiratory distress (AHRF) treatment algorithm



Summary

Respiratory support should be customized to the patient

HNHF therapy has a role in multiple scenarios commonly encountered in the ED

After stabilizing the patient, choose the appropriate dispo location



 cbaugh@bwh.harvard.edu

 @DrChrisBaugh

Additional Educational Content

- 7 Accredited Lectures over numerous topics
- Resources
 - Algorithms
 - Flowcharts
 - Publications
- No cost to register or claim credit

