



Best Evidence Statement (BEST)

Date October 4, 2011

Clinical Question	P (population)	Among neonates experiencing respiratory distress
	I (intervention)	does continuous positive airway pressure
	C (comparison)	compared to high flow nasal cannula
	O (outcome)	decrease the work of breathing and the use of oxygen?

Target Population: Neonates 1500 grams and less

Inclusion: neonates recognized as having difficulty breathing including increased respiratory effort and oxygen requirement.

Exclusions: neonates in respiratory or cardiac arrest, or with agonal respirations, pneumothorax, or inability to maintain airway patency.

Recommendation There is insufficient evidence and lack of consensus to recommend the use of continuous positive airway pressure (CPAP) rather than high flow nasal cannula (HFNC) to decrease the work of breathing or oxygen use.

Discussion/Summary of Evidence related to the recommendation

Three studies demonstrate that there is no difference in the incidences of work of breathing, death, bronchopulmonary dysplasia (BPD), ventilator days or blood infections with the use of CPAP or HFNC (Campbell, 2006 [2a], Saslow 2006 [4a], Shoemaker 2007 [4a]). A recent systematic review of randomized controlled trials also found no significant difference in the work of breathing when comparing CPAP to HFNC. The interventions and primary outcomes were varied therefore no recommendation regarding CPAP or HFNC could be made (Wilkinson 2011, [1a]). Because CPAP and HFNC are distinct and different modalities not completely interchangeable, each must be used in accordance with the practitioner's assessment of the clinically relevant data. HFNC has the capability to deliver heated and humidified flow with inconsistent and variable pressure levels. Only in the very low birth weight infants with their mouths closed can the flow be stabilized for a variable pressure reading (Kubicka 2008 [5a]).

Health Benefits, Side Effects and Risks: Side effects of CPAP are discomfort from the prongs and mask because they can be irritating to the nose and can increase nasal secretions that can lead to an increased risk of nasal infection. The portion of the nose between the nostrils (columella) must be carefully monitored for pressure indentations to prevent breakdown as well. Some infants may become agitated to the point that sedation is required to maintain the prongs in the nose. The head gear/ bonnet that is used to secure tubing that secures the nasal prongs or mask is also an area of concern that must be closely monitored for the presence of skin break down. Gastric distension and feeding intolerance are also possible side effects (Con Sreenan 2001 [4a]).

HFNC delivers higher flows of oxygen at a flow rate of 1 to 8 LPM (liters per minute). It provides a set flow with an unknown and inconsistent pressure reading in comparison to CPAP. HFNC is a system that warms

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and humidifies high flows of air/oxygen to the patient delivered through a nasal cannula. This allows for better patient comfort and access from the medical team and family. Compared to CPAP, HFNC does not automatically regulate flow, based on patients needs, nor is it able to provide an interface to allow readings of back pressure (Shoemaker 2007 [4a]).

Reference List :

1. Campbell, D., Shah, P., Shah, V., & Kelly, E. (2006). Nasal continuous positive airway pressure from high flow cannula versus infant flow for preterm infants. *Journal of Perinatology*, 26(9), 546-549, [2a].
2. Con Sreenan, Lemke, R. P., Hudson-Mason, A., & Osioovich, H. (2001). High-flow nasal cannulae in the management of apnea of prematurity: A comparison with conventional nasal continuous positive airway pressure. *Pediatrics*, 107(5), 1081-1083, [4a].
3. Dani, C., Pratesi, S., Migliori, C., & Bertini, G. (2009). High flow nasal cannula therapy as respiratory support in the preterm infant. *Pediatric Pulmonology*, 44(7), 629-634, [5a].
4. de Klerk, A. (2008). Humidified high-flow nasal cannula: Is it the new and improved CPAP? *Advances in Neonatal Care*, 8(2), 98-106, [5a].
5. Kubicka, Z.J.; Limauro, J.; Darnall, R.A. (2008). Heated, humidified high-flow nasal cannula therapy: yet another way to deliver continuous positive airway pressure? *American Academy of Pediatrics*, 121(1), 82, [5a].
6. Lampland, A. L., Plumm, B., Meyers, P. A., Worwa, C. T., & Mammel, M. C. (2009). Observational study of humidified high-flow nasal cannula compared with nasal continuous positive airway pressure. *The Journal of Pediatrics*, 154(2), 177-182.e2, [4a].
7. Saslow, J., Aghai, Z., Nakhla, T., Hart, J., Lawrysh, R., Stahl, G., et al. (2006). Work of breathing using high-flow nasal cannula in preterm infants. *Journal of Perinatology*, 26(8), 476-480, [4a].
8. Shoemaker, M., Pierce, M., Yoder, B., & DiGeronimo, R. (2007). High flow nasal cannula versus nasal CPAP for neonatal respiratory disease: A retrospective study. *Journal of Perinatology*, 27(2), 85-91, [4a].
9. Wilkinson, D., Anderson, C., O'Donnell, CPF, De Paoli, AG. (2011). High flow nasal cannula for respiratory support in preterm infants (Review). *Cochrane Database of Systematic Reviews*, 2011, Issue 5. Art.No.: CD006405. DOI: 10.1002/14651858.CD006405, [1a].

Background / Purpose of BEST Development

CPAP provides support for the pulmonary system by maintaining physiologic ventilation. This is done by manipulating the airway pressure for the purpose of improving the efficiency of ventilation and oxygenation while simultaneously decreasing the work of breathing. Since neonates are obligate nose breathers, nasal CPAP is appropriate. This is accomplished by fitting nasal prongs, or a nasal mask to the patient's nose. CPAP functionally delivers pressure, which is often used with neonates who are breathing well enough on their own that they do not need mechanical ventilation, but who need the added pressure support that CPAP offers. CPAP is also used to deliver higher concentrations of oxygen to neonates who are not able to maintain adequate oxygen levels in their blood (Campbell 2006 [2a], Lampland 2009 [4a], Kubicka 2008 [4a], Con Sreenan 2001 [4a], Dani 2009 [5a], de Klerk 2008 [5a]).

High flow nasal cannula (HFNC) is constructed of plastic tubing with two prongs that are placed in the patient's nose. It is connected to an oxygen source and can deliver high flows of oxygen, unlike ordinary nasal cannula which can only carry oxygen at a flow rate of .01 to 2 LPM (liters per minute) in the neonatal population (Campbell 2006 [2a], Lampland 2009 [4a], Kubicka 2008 [4a], Con Sreenan 2001 [4a], Dani 2009 [5a], de Klerk 2008 [5a]).

Outcome or Process Measures

The outcomes of decreased work of breathing and use of oxygen are measured by visual inspection of the patients breathing effort, the presence of atelectasis/collapse on chest x-ray, oxygen percentage, reintubation, and cardiopulmonary stability (absence of apnea, normal heart rate and rhythm) (Campbell 2006 [2a], Con Sreenan 2001 [4a]).

Search Strategy

Databases searched: Medline, CINAHL, and Google Scholar

Search Terms: CPAP/continuous positive airway pressure, high flow nasal cannula, work of breathing, humidified high flow nasal cannula, neonates less than 1500 grams

Filters: English language

Retrieved: February 1, 2011- August 30, 2011

Relevant CCHMC Evidence-Based Documents

Cincinnati Children's Hospital policy Respiratory care Policy IV 420 Continuous Positive Airway Pressure.
Last reviewed 08/21/08

Cincinnati Children's Hospital policy Respiratory care Policy IV 430 High Flow Nasal Cannula.

Group/Team Members

Team Leader: Tonie Perez, BHS, RRT III-NPS, NICU

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Conflicts of Interest were declared for each team member and:

- No financial conflicts of interest were found.
- The following financial conflicts of interest were disclosed:

Note: Full tables of evidence grading system available in separate document:

- [Table of Evidence Levels of Individual Studies by Domain, Study Design, & Quality](#) (abbreviated table below)
- [Grading a Body of Evidence to Answer a Clinical Question](#)
- [Judging the Strength of a Recommendation](#) (abbreviated table below)

Table of Evidence Levels (see note above)

Quality level	Definition
1a [†] or 1b [†]	Systematic review, meta-analysis, or meta-synthesis of multiple studies
2a or 2b	Best study design for domain
3a or 3b	Fair study design for domain
4a or 4b	Weak study design for domain
5a or 5b	General review, expert opinion, case report, consensus report, or guideline
5	Local Consensus

†a = good quality study; b = lesser quality study

Table of Recommendation Strength (see note above)

Strength	Definition
It is strongly recommended that... It is strongly recommended that... not...	There is consensus that benefits clearly outweigh risks and burdens (or visa-versa for negative recommendations).
It is recommended that... It is recommended that... not...	There is consensus that benefits are closely balanced with risks and burdens.
There is insufficient evidence and a lack of consensus to make a recommendation...	

Dimensions for Judging the Strength of the Recommendation

Reflecting on your answers to the dimensions below and given that more answers to the left of the scales indicates support for a stronger recommendation, complete one of the sentences above to judge the strength of this recommendation.

(Note that for negative recommendations, the left/right logic may be reversed for one or more dimensions.)

1. Grade of the Body of Evidence*	<input type="checkbox"/> High	<input checked="" type="checkbox"/> Moderate	<input type="checkbox"/> Low
2. Safety / Harm* (Side Effects and Risks)	<input checked="" type="checkbox"/> Minimal	<input type="checkbox"/> Moderate	<input type="checkbox"/> Serious
3. Health benefit to patient*	<input type="checkbox"/> Significant	<input checked="" type="checkbox"/> Moderate	<input type="checkbox"/> Minimal
4. Burden on patient to adhere to recommendation	<input checked="" type="checkbox"/> Low	<input type="checkbox"/> Unable to determine	<input type="checkbox"/> High
5. Cost-effectiveness to healthcare system	<input checked="" type="checkbox"/> Cost-effective	<input type="checkbox"/> Inconclusive	<input type="checkbox"/> Not cost-effective
6. Directness of the evidence for this target population	<input type="checkbox"/> Directly relates	<input type="checkbox"/> Some concern of directness	<input checked="" type="checkbox"/> Indirectly relates
7. Impact on morbidity/mortality or quality of life	<input type="checkbox"/> High	<input checked="" type="checkbox"/> Medium	<input type="checkbox"/> Low

Comments on Dimensions (optional):

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Copies of this Best Evidence Statement (BEST) and related tools (if applicable, e.g., screening tools, algorithms, etc.) are available online and may be distributed by any organization for the global purpose of improving child health outcomes.

Website address: <http://www.cincinnatichildrens.org/svc/alpha/h/health-policy/best.htm>

Examples of approved uses of the BEST include the following:

- copies may be provided to anyone involved in the organization's process for developing and implementing evidence based care;
- hyperlinks to the CCHMC website may be placed on the organization's website;
- the BEST may be adopted or adapted for use within the organization, provided that CCHMC receives appropriate attribution on all written or electronic documents; and
- copies may be provided to patients and the clinicians who manage their care.

Notification of CCHMC at EBDMinfo@cchmc.org for any BEST adopted, adapted, implemented, or hyperlinked by the organization is appreciated.

Please cite as: Cincinnati Children's Hospital Medical Center: CPAP vs. HFNC, <http://www.cincinnatichildrens.org/svc/alpha/h/health-policy/best.htm>, BEST number, pages 1-5, October 4, 2011.

This Best Evidence Statement has been reviewed against quality criteria by 2 independent reviewers from the CCHMC Evidence Collaboration.

For more information about CCHMC Best Evidence Statements and the development process, contact the Evidence Collaboration at EBDMinfo@cchmc.org.

Note

This Best Evidence Statement addresses only key points of care for the target population; it is not intended to be a comprehensive practice guideline. These recommendations result from review of literature and practices current at the time of their formulation. This Best Evidence Statement does not preclude using care modalities proven efficacious in studies published subsequent to the current revision of this document. This document is not intended to impose standards of care preventing selective variances from the recommendations to meet the specific and unique requirements of individual patients. Adherence to this Statement is voluntary. The clinician in light of the individual circumstances presented by the patient must make the ultimate judgment regarding the priority of any specific procedure.