

High Flow

Why should it work?

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Disclosures

VTA 2019

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- Comer Children's Hospital, University of Chicago Medicine, Biologic Sciences Division, The University of Chicago

- I'm Canadian!!



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BIOLOGICAL SCIENCES

Dedication

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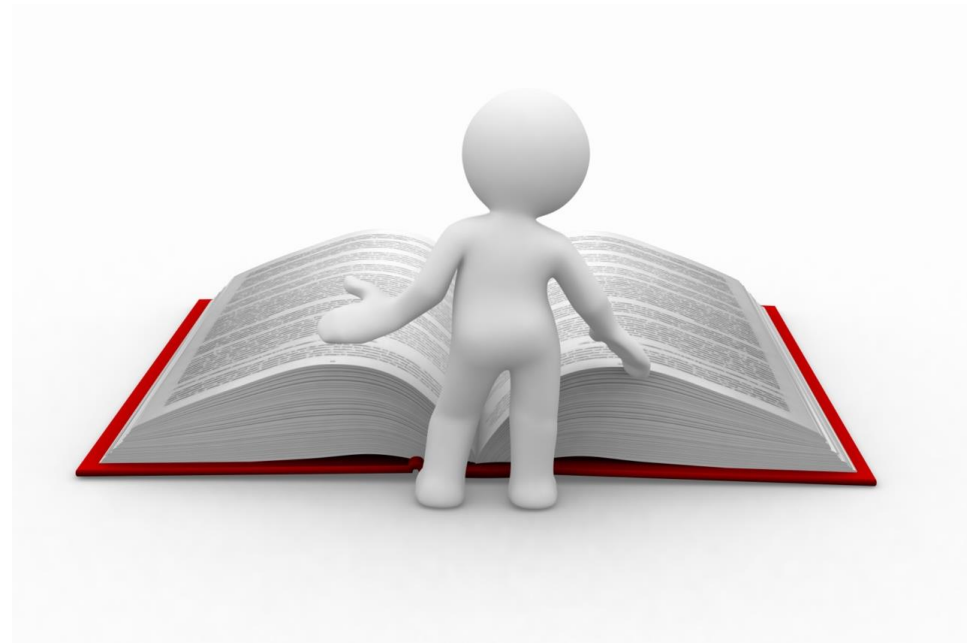


Dr. Tamara O'Neal

Objectives

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- Define HFNC
- Understand the mechanism(s) of HFNC
- Why should it work?



High Flow Nasal Cannula Therapy

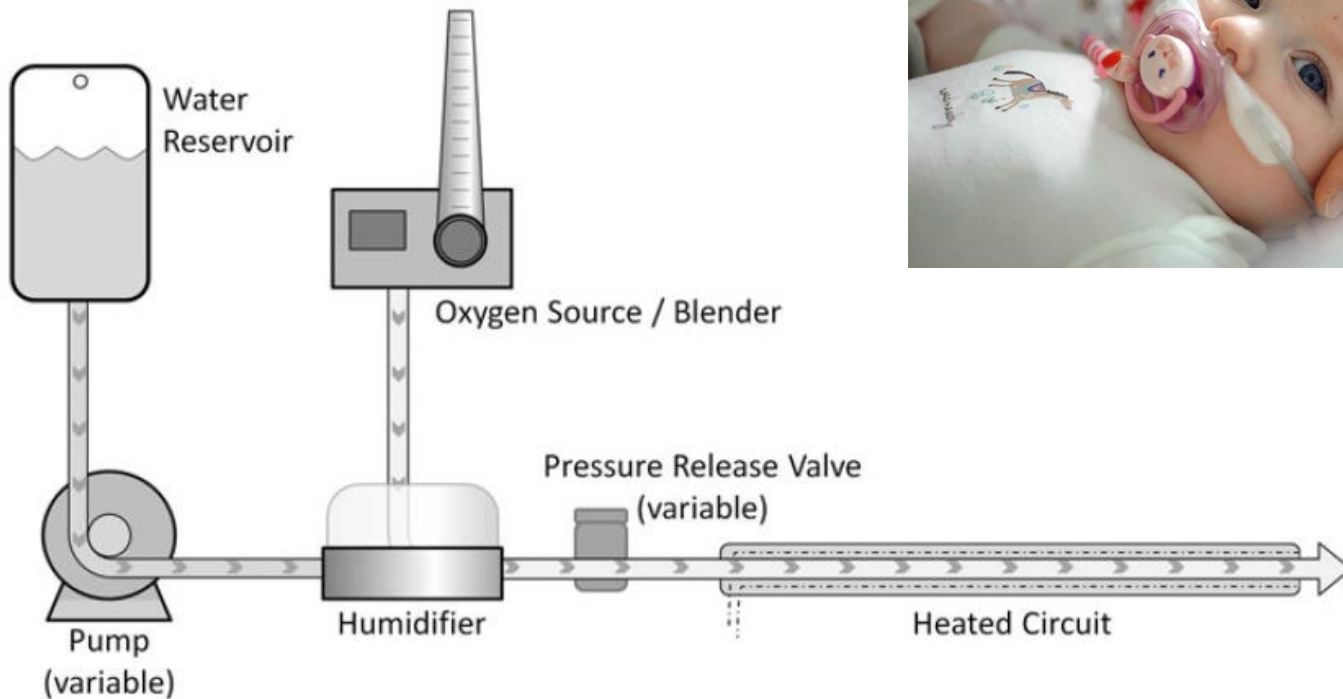
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- Heated (body temperature)
- Humidified (>99%)
- Air/oxygen mixture
- Flow rates exceed patients inspiratory flow rate



This is a form of non-invasive respiratory support

Basic setup



- > Decade use in NICU
 - NPCPAP
 - Post extubation
 - Flow rate ≥ 2 lpm
- More recent use in Pediatric & Adult ICU's
 - Bronchiolitis
 - Asthma
 - Hypoxemic respiratory failure
- Paucity of RCT
 - Current studies ongoing



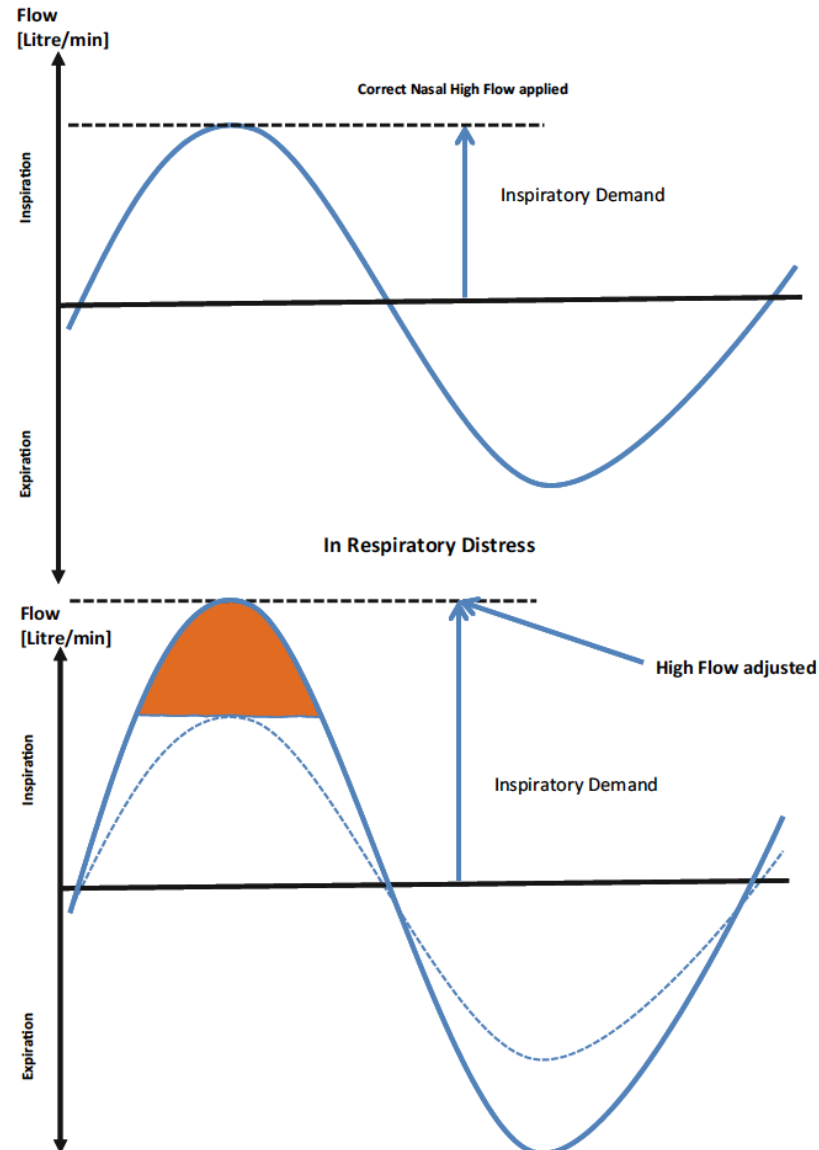
How does this work?

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- Reduces the work of breathing
- Improve efficiency of ventilation
 - Washout of naso-pharyngeal dead space
 - Improve alveolar ventilation
 - Reduce inspiratory resistance
 - Improve conductance & pulmonary compliance
 - Heated/humidified
 - Lung recruitment
 - Positive distending pressures
 - Improved muco-ciliary clearance



Supporting inspiratory flow



What do you see?

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- Improved respiratory rate (lowers)
- Improved heart rate (lowers)
- Reduces EtCO₂
- Reduces work of breathing
- Reduces need for intubation
- Improved patient comfort

When should HFNC be used?

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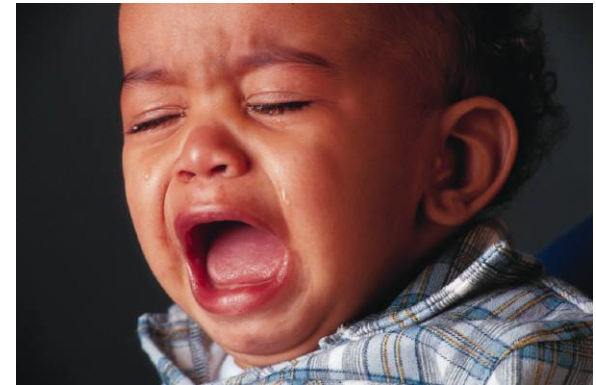
- Indications
 - Neonate
 - Instead of NPCPAP
 - Post extubation
 - Pediatrics
 - Bronchiolitis
 - Asthma
 - Pneumonia
 - Other
 - Adult
 - Acute respiratory failure
 - Neuromuscular weakness
- Essentially – any etiology that increases WOB**



When should I not use HFNC

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- Contraindications are minimal
 - No “real” contraindications
 - Nasal trauma (but not much pressure)
 - Not tolerated



What are the risks

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- Complications are minimal
 - ~ 1% reported risks
 - Air leak (some reports of pneumothorax)
 - Nasal trauma
 - Abdominal distension



VI. Process Map

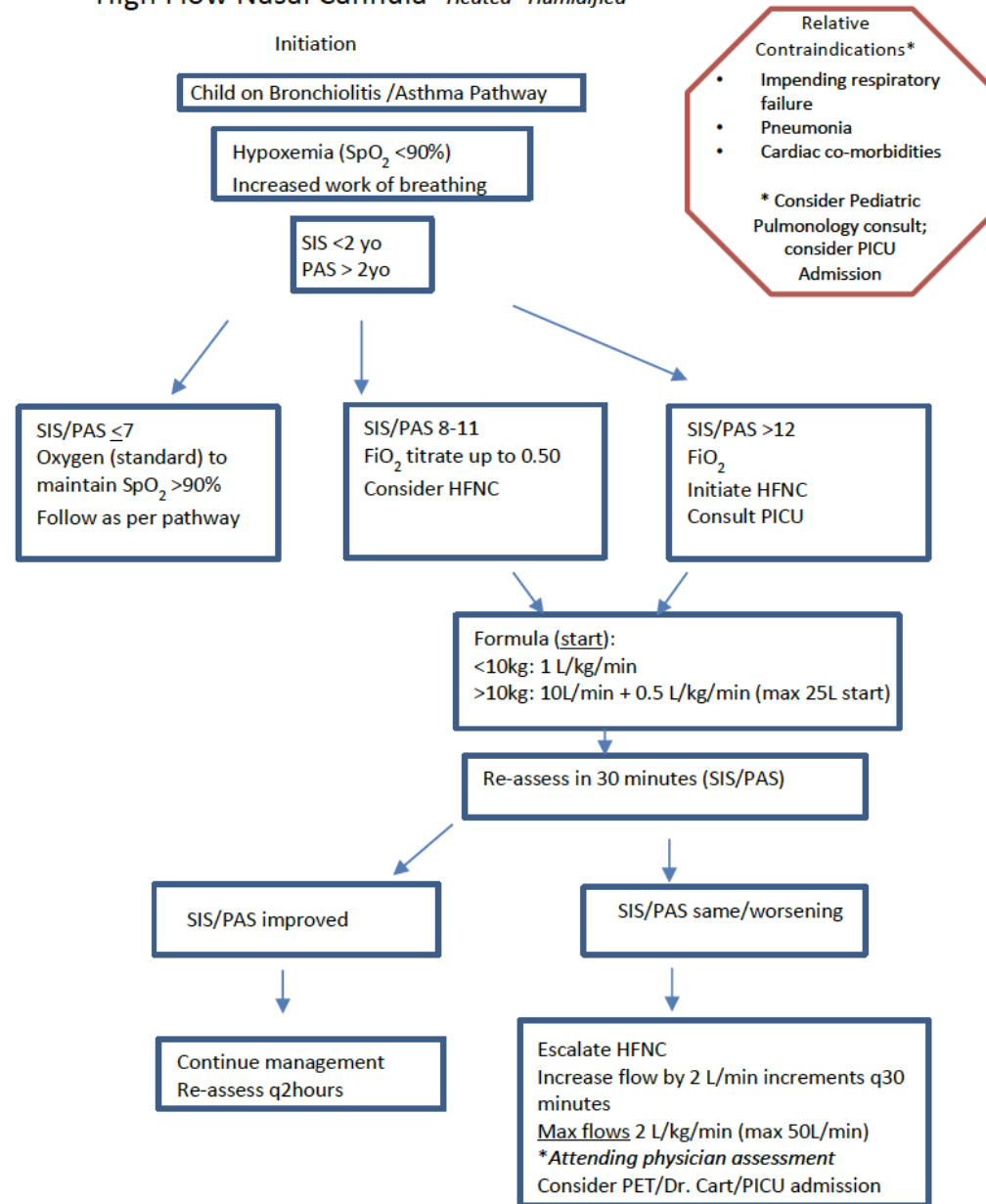
PET/Dr. Cart/ PICU Admission
 Impending respiratory failure
 SIS/PAS ≥ 12
 Cardiac co-morbidities
 $FiO_2 > 0.50$
 HFNC at max flow

Documentation
 SIS/PAS as per pathway
 Response to HFNC
Monitoring:
 As per pathway

Eating/Drinking
 -IVF for hydration if NPO
 -NG placement: continuous feeds recommended
 -May attempt oral feeding if stable on HNC, *must be supervised by RN

Orders
 FiO_2 to keep $SpO_2 \geq 90\%$
 HFNC (use formula)

High Flow Nasal Cannula *Heated *Humidified



Relative Contraindications*

- Impending respiratory failure
- Pneumonia
- Cardiac co-morbidities

* Consider Pediatric Pulmonology consult; consider PICU Admission

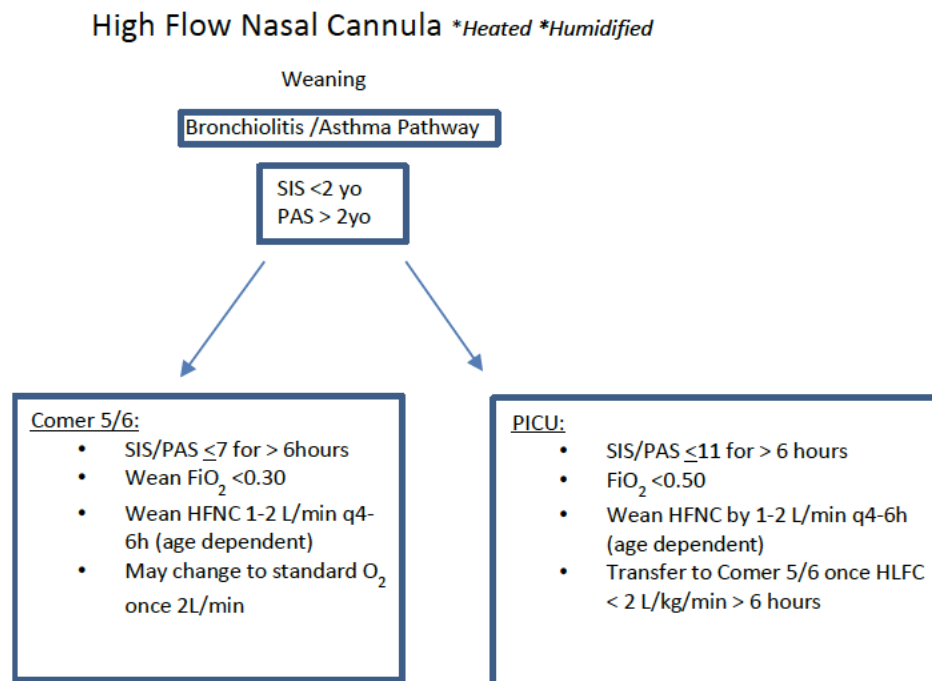
Weaning HFNC

NOT STUDIED!!

- Wean O₂ component
- Wean flow
- Interrupt flow

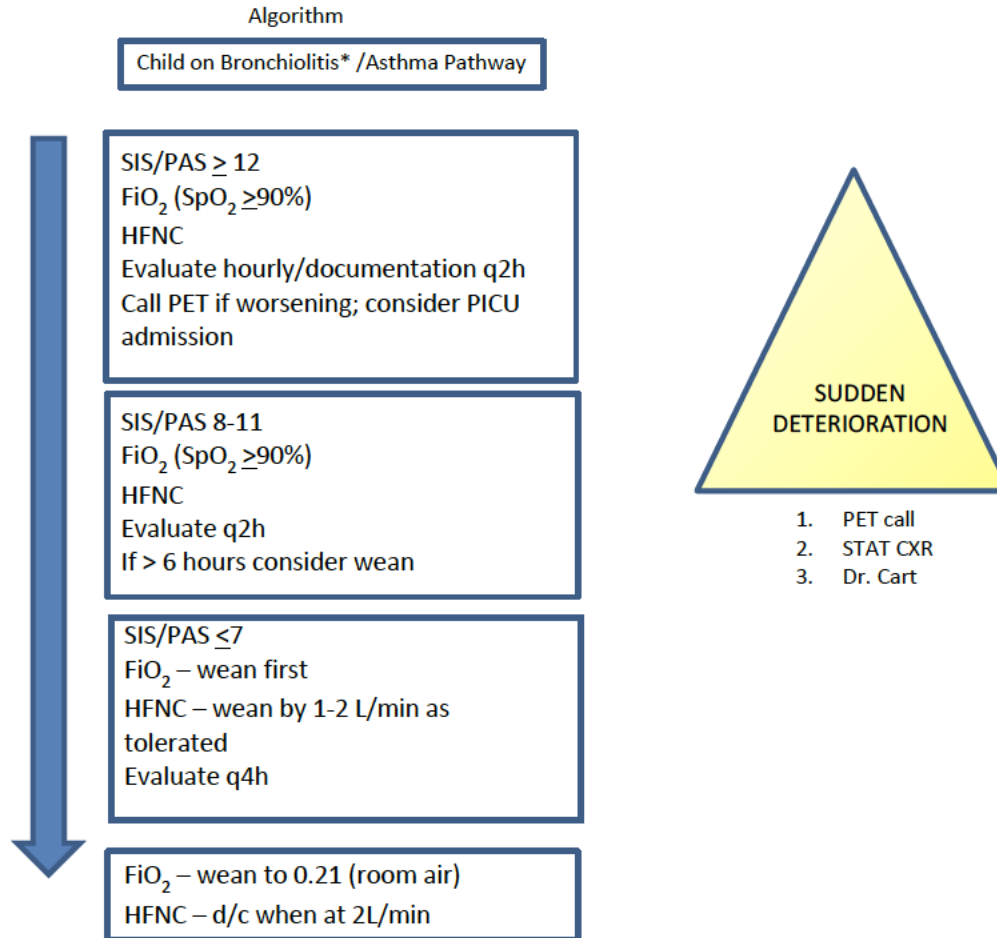


So we decided to come up with a plan



HFNC Algorithm

High Flow Nasal Cannula *Heated *Humidified



So what do I suggest?

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- Full review of literature... now have Guidelines for our institution!!
- Infants/Pediatrics – start for increased WOB (e.g. bronchiolitis, asthma)
- Important to think outside the box



To summarize...

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- Heated, humidified air/oxygen at high flow rates
- Physiologic mechanisms not yet fully understood
- Risks are minimal yet real
- Need for ongoing studies and evidence



SIS and PAS

Appendix 1: Severity Index Score: The initial assessment will be made at admission (Resident, nursing & RT). The highest rating will indicate the severity in which the child is placed in the care-map.

POINTS	1	2	3
RR*	< 3months	<30	30-60
	3-12 months	<25	25-50
	1-2 years	<20	20-40
WOB	None	Intercostal retractions	Nasal flaring, head bobbing, grunting
Oxygen	>94%	90-94%	<90%
Breath sounds	Normal, mild end-expiratory wheeze	Expiratory wheeze	Inspiratory, expiratory wheeze, diminished breath sounds
Suctioning	Bulb	Bulb/wall	Wall
Mental status	Normal	Fussy, anxious	Inconsolable, lethargic

* Respiratory rate must be counted over 1 minute

CLASSIFICATION of Bronchiolitis severity is based on the Severity of Index score:

MILD: ≤ 7

MODERATE: 8-11

SEVERE: ≥ 12

Appendix 2: Modified Pediatric Asthma Score, amended for Comer Children's Hospital inpatient services

	1 Point	2 Points	3 Points
Respiratory Rate			
Age 2-3	<34	35-39	>40
Age 4-5	<30	31-35	>36
Age 6-12	<26	27-30	>31
Age >12	<23	24-27	>28
O2 saturation*	>95% on room air	90-95% room air	<90% on room air
<i>PICU</i>	<i>On LFNC <4L</i>	<i>On HFNC >4L</i>	<i>On BiPAP</i>
<i>Floor</i>		>95% on O2	<95% on O2
Auscultation	Normal to mild expiratory wheeze	Expiratory wheeze	Inspiratory and expiratory wheeze or diminished
Retractions	None or intercostal	Intercostal and substernal	Intercostal, substernal, supraclavicular
Dyspnea	Speaks in sentences, coos and babbles	Speaks in partial sentences, short cries	Speak in single words Grunts

Total Score 5-15

*Room air score preferred, if safe for patient to be checked on room air. If patient not safe to be removed from O2, adjust score as listed.

