HIGH FLOW NASAL CANNULA - NON-INVASIVE VENTILATION

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The HFNC system is comprised of an air/oxygen blender, flowmeter(s), active heated humidifier, a single limb heated circuit and a specialized nasal cannula.
What is HFNC?

- HFNC is a oxygen therapy solution for all patient populations.
- Offers the comfortable delivery of a broad range of oxygen concentrations and flows.
- HFNC makes it possible to comfortably deliver a wide range of flows directly into the nares.
- Matching the natural balance of temperature and humidity that occurs in healthy lungs promotes greater patient comfort and improves tolerance to treatment while optimizing mucociliary clearance.
Key benefits of HFNC

- Optimal humidity
- Comfort
- Accurate Oxygen delivery
- Washout of Anatomical Deadspace
- Low level of pressure
HFNC has been shown to be successful for patients with an increased work of breathing or air hunger (nasal flaring, tachypnea, retractions, accessory muscle use). Typical infants with Bronchiolitis are prime candidates for HFNC.
Potential Hazards

- Abdominal distention
- Pulmonary Infection
- Nasal Trauma
- Pneumothorax
• HFNC is more than simple oxygen therapy, close monitoring is essential.
• Patient assessment is key for determining effectiveness.
• Identifying and initiating early has shown to be beneficial in the decrease of respiratory failure.
HFNC-monitoring

• Look at your patient, do they look more comfortable?
• Has their WOB decreased?
• Has their O2 requirements decreased?
• Monitoring HR, RR, SpO2, WOB and breath sounds should tell you if your on the right path.
• Good communication between care team is essential.
• Weaning begins with oxygen percentage
  – Reducing O2 % to under 50% is usual priority
  – Titrate O2 % per Spo2

• Weaning continues with flow reduction
  – Reduce flow rate by 2-5 lpm then monitor
  – Titrate flow rate based on WOB
• HFNC is used as a midway point between low flow oxygen devices and non-invasive positive airway pressure ventilation (NIPPV).

• If O2 and WOB requirements cannot be met with HFNC then NIPPV in the ICU should be your next step.
NON INVASIVE POSITIVE PRESSURE VENTILATION

NIPPV

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In the past decade, the use of noninvasive positive pressure ventilation as an alternative to intubation and conventional ventilation has become a standard of care.

- Intubation is avoided
- A bed in the intensive care unit may not be needed
- It is non-invasive (lower risk of infection)
- Shorter hospital stays
- Mortality rates are lower
- It can be used at home.
Contraindications

- Apnea
- Respiratory Arrest
- Cardiac Arrest
- Coma
- Facial Trauma
- Uncontrolled vomiting
Benefits

- Improving respiratory mechanics and assisting in work of breathing, allows the respiratory muscles to rest.
- Decreasing work of breathing, decreases total oxygen consumption.
- Decreases PaCo\textsubscript{2} and increases the V\textsubscript{t} through the IPAP.
- Prevents atelectasis: Increases functional residual capacity (FRC) and end-expiratory lung volume (EELV) through both EPAP and CPAP.
- Helps maintain upper airway stability.
- Decreases the symptoms of respiratory insufficiency, by normalizing respiratory frequency and decreasing dypsnea.
- Improve the patient’s comfort (subjective sensation of respiratory insufficiency)
- The patient can stay awake and sedation is not necessary.
- Has been shown to decrease resource utilization and to avoid the myriad of complications associated with ETI
  - upper airway trauma, laryngeal swelling, post extubation vocal cord dysfunction, and nosocomial infections
• Continuous Positive Airway Pressure (CPAP)
  – A constant level of pressure is applied to the airways throughout inspiration & exhalation
  – The patient breaths spontaneously

• Oxygenation
  – improved by manipulating
    • FIO$_2$
    • Mean airway pressure (MAP)
NIPPV (aka BiPAP)

- Two levels of pressure are applied to the airways
  - Higher pressure during inspiration
  - Lower pressure during exhalation
    - Patient breaths spontaneously
    - Patient effort triggers inspiratory pressures, & cycles to expiratory pressure.

- Ventilation
  - Improved by manipulating
    - Minute Ventilation
    - RR
    - VT
• A major drawback in the use of NPPV in pediatric patients is the availability of appropriately sized interfaces.

• Leaks and tolerance in pediatric patients continue to present major problems.

• A significant leak may lead to patient-ventilator asynchrony because the device may be incapable of differentiating a leak from patient effort.
• Respiratory insufficiency:
  – the respiratory system fails in one or both of its gas exchange functions: oxygenation and carbon dioxide elimination.

• Patients with respiratory failure may be classified into two groups:
  – hypoxemic respiratory failure and hyper-capnic respiratory failure
Types of Respiratory Failure

• Hypoxemic respiratory failure (type I) can be associated with virtually all acute diseases of the lung, such as bronchiolitis and pneumonia.

• The predominant mechanism is uneven or mismatched ventilation and perfusion (intrapulmonary shunt) in regional lung units.
• The primary treatment of type I respiratory failure in children is to give them some oxygen.
  – to greater than 94%.
• In this setting, CPAP may be considered.
Hypercapnic respiratory failure (type II) can occur in conditions that affect the respiratory pump:

- depressed neural ventilatory drive
- acute or chronic upper airway obstruction
- neuromuscular weakness
- marked obesity
- rib-cage abnormalities.
• Administration of oxygen alone is not an appropriate treatment for hyper-capnic respiratory failure.
  – In addition to supplemental oxygen, therapies to reduce the load on the respiratory muscles and increase the level of alveolar ventilation should be instituted.
  – In this setting, NIPPV may be considered.
Can use different modes depending on the needs of the patient:
- CPAP/PS
  - PEEP
  - PS
- PCV plus assist
  - RR
  - PIP
  - PEEP
  - I Time
Assess your patient to determine settings

- Has their WOB decreased?
- Has their O2 requirements decreased?
- Has their Co2 levels normalized?
  - VBG’s are ok to use along with Spo2.
- Monitoring HR, RR, SpO2, WOB and breath sounds should tell you if your on the right path.
Resources

- http://www.myoptiflow.com/#gsc.tab=0
- http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3224494/