Non-Invasive Ventilation

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Objectives

- Understand and be able to apply indications and contraindications for noninvasive ventilation techniques
- Recognize your scope of practice and possible changes in the future
- Describe the differences and different applications of noninvasive modalities (i.e CPAP, BiPAP, HFNC, HVNI)
- Recognize complications and troubleshoot changes in status and intolerance to therapy

Case 1

79 y/o M with history of COPD, CHF calls EMS for shortness of breath, leg swelling.

- BP: 180/100, HR 88, Respirations 28, tripod position, Saturations 78% on room air. EtCO2 78
- Lungs with wheezing, noted to have JVD, pitting edema to the legs

Indications/Contradindications for Non-invasive Ventilation

Indications: Respiratory Distress- Hypoxic or Hypercapneic, work of breathing

- COPD/Asthma
- Pneumonia
- Heart Failure/Pulmonary Edema
- Chronic sleep apnea or obesity hypoventilation

Contraindications:

- Respiratory arrest. Hypotension (CPAP/BPAP)
- Inability to protect airway: vomiting or significantly diminished mental status
- Pneumothorax without decompression
- Intolerance/anatomic considerations

Scope of Practice

13 years or older: CPAP- EMT, AEMT, PM, CCP. Likely Pediatric restriction to go away

13 years or older: BPAP- PM, CCP

Modalities of Non-invasive Ventilation

CPAP- Continuous Positive Airway Pressure

BiPAP- Bilevel Positive Airway Pressure

HFNC- High Flow Nasal Cannula- traditional, RAM cannula

HVNI- High velocity nasal insufflation- Vapotherm

CPAP VS BiPAP

- Oxygenation (CPAP) vs oxygenation+ventilation (BiPAP). Both can be delivered through full face as well as RAM cannula (peds traditionally)
- BiPAP is the treatment of choice for hypoventilatoin
- CPAP is excellent for pure hypoxic respiratory failure
  - Pulmonary edema
  - Pneumonia
  - Pulmonary embolism
  - CO poisoning
- BiPAP advantages
  - COPD exacerbation, Severe Obesity hypoventilation, combination hypoxia/hypoventilation such as pneumonia with confusion, overdose, pre-oxygenation for intubation.

“High Flow”

Better tolerated by patients than CPAP/BPAP mask. More preferred if some aspiration risk and in pediatrics.

High flow nasal Cannula (HFNC)- Optiflow, RAM cannula

- Gives flows typically of 40-60 L
- No significant CO2 washout
- Up to 5-6mmHg PEEP
- RAM cannula can give CPAP, BiPAP in pediatric patients if hooked to appropriate device

High velocity nasal insufflation (HVNI)- Vapotherm

- Lower flows, 20-40 typically. Pediatrics under 8 usually start around 1Lpm/kg
- Similar PEEP
- Additional ventilation assistance due to high velocity with some dead space washout for COPD exacerbation
- Overall preferred

AVAPS- Average Volume Assured Pressure Support

- Similar to PRVC but for BiPAP
- Choose target tidal volume (6-8ml/kg IBW) and range of IPAP
- Excellent for patients with obesity hypoventilation, patients who are encephalopathic, patients with significant variability in tidal volumes

BiPAP Setup

Set IPAP and EPAP

- The gap is your ventilatory support.
- EPAP is CPAP
- 10/5 is standard

Set FiO2- Depending on patients actual needs.

Set Backup rate- 10-12 is reasonable. Most patients won't need this

Case Continued

You initially placed patient on BiPAP, 15/5 at 100% FiO2. The patient has been very anxious and agitated, and wants to take the mask off though saturations are now in the mid 90s and breathing improved slightly with an inline duoneb treatment and sublingual nitroglycerin that was place prior to putting the patient on BiPAP.

What next?

Managing Agitation

- Sedation with benzo or ketamine (subdissociative doses) if pt can not be verbally de-escalated.
- Consider lower settings

Adjusting Settings

- Escalate early. Monitor EtCO2. Pay attention to tidal volumes.
- Increase IPAP/EPAP gap for sleepiness in CO2 retention. 14/6, 16/8
- Increased CPAP/EPAP for pure hypoxia such as CHF or Pneumonia
- FiO2 titration is important, too!
- If pt is becoming hypotensive, consider Hs/Ts, fluid bolus, pressors etc, or consider decreasing EPAP/CPAP if respiratory status can sustain this. High Flow Nasal Cannula is preferred.
- High pressure alarms: DOPE, consider agitation/compliance, bronchospasm, pneumothorax, tubing issues. May need to discontinue if decompensating.
- Always consider need for escalation to intubation or BVM, airway basics.

Case Resolution

We decreased our pressure settings to 10/5, started a NTG infusion at 10 mcg/min, and pt was given 5mg IV diazepam and able to tolerate the BPAP better along with verbal de-escalation.

YAY

Questions?