Noninvasive Positive Pressure Ventilation

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Objectives

- Define NIPPV
- Review criteria for use and contraindications of NIPPV
- Outline parameters for use and monitoring
- Review clinical applications in specific populations
- Use of case presentations

Noninvasive Positive Pressure Ventilation- NIPPV

- Multiple RCT support the use of NIV in COPD exacerbations
- More rapid improvements in VS and gas exchange
- Reduction in intubation
- Decreased mortality
- Decreased hospital length of stay
  - Brochard et al NEJM 1990
  - Kramer et al AJRCCM 1995
  - Ram et al Cochrane analysis
NIPPV

- Positive pressure ventilation delivered by noninvasive means
- In contrast to an invasive connection with the patient via ETT or trach
- Three main categories for mechanical ventilatory support
  - Ventilation
  - Oxygenation
  - Airway protection??
    - Be careful how this is defined!

Indications for NIPPV

- Consider a trial in most diseases that do not require emergent intubation
- Supporting data varies with each scenario
  - COPD exacerbation
  - CHF
  - Respiratory acidosis- mild to mod
  - Hypoxemic respiratory failure
  - Post extubation failure
  - Other: NM disease, obesity hypoventilation

Contraindications for NIPPV

- Cardiac or respiratory arrest
- Inability to cooperate, protect airway or clear secretions
- Severe alteration in mental status
- Facial surgery or trauma
- High risk for aspiration
- Prolonged duration of mechanical ventilation anticipated
- Recent surgical procedures: head/neck/abdomen
Initiation of NIPPV

- Thinking about it? Start it immediately!
- Discuss with RT what you want to achieve
  - Ventilation and oxygenation goals
- Ventilator type and Modes of Support
  - Can use a standard vent
  - Portable machines- Numerous systems on the market
  - Bilevel positive airway pressure
    - BIPAP is specific tradename for Respironics
  - AC, SIMV, PAV and other modes can be used
  - Define what your goal is for each specific patient.

Patient-Mask Interface

- NUMEROUS types of masks on the market
- Familiarize yourself with what your hospital has in stock
- Sample masks on the following slides for demonstration of interface with the patient

Nasal Mask  Full Face Mask  Nasal Pills
Usually Start w/Full Face Mask

- It is less comfortable, but
- lowers PCO2 better than nasal mask
- Helpful if the patient is a mouth-breather
- Difficult to expectorate secretions
- Difficult to talk
- Difficult to monitor for aspiration
- May cause skin necrosis
- Causes gastric distension

NIPPV Set Up: Bilevel

- Set an inspiratory and expiratory pressure
- Pressure Support and PEEP
- Usually start at 8/5 or 10/5
- O2 to maintain sats >90%
- Don't set it and forget it!
- Watch for pt comfort, tolerance and synchrony
- Assess frequently...
Monitoring Patients on NIPPV

- How do you know it's working?
  - Clinical signs
  - ABG
    - Should see some improvement in 30-60 min
- Is the patient comfortable?
  - Try a different mask, slow ramp up on pressure, humidification, fan, careful administration of Ativan
- Watch for complications
  - Aspiration, mental status changes, gastric distension, skin necrosis

Troubleshooting NIPPV

- If persistent hypercapnia:
  - Increase IPAP by 2 cmH₂O
- If persistent hypoxemia:
  - Increase IPAP and EPAP by 2 cm H₂O

- FIO₂ at 1.0 and adjust to lowest level with an acceptable pO₂
- Maximal IPAP limited to 20-25 cm H₂O
- Maximal EPAP limited to 10-15 cm H₂)

When do you decide to intubate?

- Failure to improve
- Worsening encephalopathy
- Inability to clear secretions
- The patient can’t tolerate interface
- Hemodynamic instability
- Decreased oxygenation
COPD

- Meta-analysis
- NIPPV decreased mortality 11 vs. 21%
- Intubation rate 16 vs. 33%
- Treatment failure 20 vs. 42%
- Hospital LOS and complications also lower
- Severe exacerbations (arterial pH <7.35) respond better than mild exacerbations
  - Ram Cochrane 2004
  - Keenan Ann Int Med 2003
  - Keenan CMA 2011

- RCT with subgroup of patients with COPD and community acquired pneumonia
- Use of NIPPV reduction in intubation
- 0/12 vs. 5/12 in control arm; p= 0.0005

- Confalonieri AJ RCM 1999

Congestive Heart Failure

- NIPPV reduces intubation rates
- Improves respiratory parameters
  - Dyspnea, gas exchange, acidosis
- Systematic reviews showed reduction in endotracheal intubation with both bilevel and CPAP
  - Winck CC 2006
- Reduction in mortality
  - Masip JAMA 2005
### Congestive Heart Failure

- Beneficial with hypercarbia and reduces intubation rate
- 130 pt w/acute respiratory failure RCT O2 vs. NIPPV
- NIPPV improved physiologic parameters
- Similar intubation rate, hosp mortality and LOS
  - Nava AJRCCM 2003
- CPAP reduced mortality and need for intubation but not incidence of new MI
- Bilevel reduced the need for intubation but did not reduce mortality or new MI
  - Weng Ann Int Med 2010

### Congestive Heart Failure

- 1069 pt randomized to CPAP, BiPAP, or O2
- Primary end point was death w/in 7 days
- Different in that patients allowed to cross over to NIPPV if treatment failure occurred
  - No significant diff in mortality O2 group vs. NIPPV 9.8 vs. 9.5%
  - No sig diff in combined end point of death or intubation w/in 7 days CPAP vs. BiPAP
  - Gray NEJM 2008

### Summary of NIPPV in CHF

- NIPPV either Bilevel or CPAP for cardiogenic pulmonary edema and respiratory failure
- Clinical use in the absence of shock or acute coronary syndrome requiring urgent revascularization
  - Keenan CMAJ 2011
After Planned Extubation

- 4 RCTs suggest benefit for patients at high risk of deterioration (defined differently)
- Decrease in the rate of reintubation
  - (RR 0.42, 95% CI 0.25-0.70)
- Decrease in ICU mortality
  - (RR 0.35, 95% CI 0.16-0.78)
- Less benefit for hospital mortality
  - (RR 0.66, 95% CI 0.42-1.04)

High risk patients
- >65 yoa
- APACHE II >12
- >1 of the following
  - failure of consecutive SBT, CHF, PaCO2 >45, weak cough or stridor
  - Acute COPD exacerbation
  - Chronic respiratory disease with ventilation >48 hours and hypercapnia w/SBT

Do Not Intubate Patients

- Emerging use in clinical practice
- Prolong the dying process?
- Palliative measure?

What is your goal?
- Patients with a reversible process (COPD, CHF) had a better than even chance of surviving; lower likelihood in patients with pneumonia or cancer

Levy CCM 2004
NIPPV in Palliative Setting

- Careful discussion of the goals of care
- Parameters for success and failure

Curtis CCM 2007

NIPPV: Conclusions

- Reduces work of breathing and improves gas exchange
- Decrease in nosocomial infections
  - if the patient is never intubated, no VAP
- Reduces intubation rates in variety of diseases
- Know what you want the NIPPV to do for you
- **Don't set it and forget it!**
- Closely monitor clinically and objectively for comfort and improvement