Post-Operative Respiratory Management: the Case for Non-Invasive Ventilation

Discussion
Post-operative pulmonary complications pose a major challenge in the PACU. As a result of baseline disease, surgical exposure and anesthetic management, pulmonary complications are common and are associated with significant post-operative morbidity and mortality. Non-invasive ventilation (CPAP and BIPAP) has emerged as a widely available treatment strategy for patients in respiratory distress. In this presentation, we will present a brief review of acute respiratory failure and discuss recent data examining the potential uses for non-invasive ventilation in the post-operative period.

Learning Objectives
1) Discuss physiology and goals for non-invasive ventilation (NIV)
2) Discuss the patient interfaces and various modes for NIV
3) Outline the risks and benefits of NIV and describe the predictors of success and failure
4) Examine the specific indications and supporting literature for post-operative NIV
   a) COPD
   b) Pulmonary edema
   c) Pneumonia, Asthma, DNI
   d) Prevention of post-operative respiratory failure
   e) Treatment of post-operative respiratory failure

Outline

I. History of NIV
   a. 1700s bellows devices used for resuscitation of drowning victims
   b. Early 1900s “Iron Lung” for treatment of Polio
   c. Modern NIV developed in 1980s and in common use in 1990s

II. Risk and Benefits of NIV
   a. Benefits – Avoids Intubation, decreased infection, decreased need for sedation/analgesia, decreased length of stay and mortality, easier to wean, reduces afterload and increases CO
   b. Risks – Delayed Intubation, decreased clearance of secretions and risk of aspiration

III. Goals and Physiology of NIV
   a. Improve Oxygenation - decreased atelectasis and improved FRC
   b. Improve Ventilation and Respiratory Acidosis - improved compliance and increased tidal volume
   c. Decrease Work of Breathing - unload respiratory muscles and improve dyspnea

IV. Patient Interfaces
   a. Facemask – improved oxygenation and ventilation
b. Nasal Mask – improved acceptance (less claustrophobia and improved communication) and improved clearance of secretions

V. Modes – CPAP vs BIPAP
  a. CPAP
     i. Uniform pressure during inspiration and expiration
     ii. May be better tolerated by patients
     iii. Similar improvement in oxygenation, but decreased improvement in ventilation and WOB compared to BIPAP
  b. BIPAP
     i. Biphasic pressure (higher during inspiration, lower during expiration)
     ii. May be less well tolerated compared to CPAP
     iii. Similar improvement in oxygenation, but improved ventilation and WOB compared to CPAP as above

VI. Predictors of Success/Failure
  a. Improvement in O2/CO2 within 2 hours
  b. Decreased respiratory rate
  c. Small air leak
  d. Good coordination/cooperation with NIV

VII. Indications for NIV
  a. COPD – best evidence to date, Grade IA
  b. Cardiogenic Pulmonary Edema – very strong evidence, Grade IA
  c. Pneumonia – results conflicting, possible harm
     i. Likely related to volume, viscosity, and ability to clear secretions
  d. Asthma – limited evidence, but likely beneficial given strong COPD benefit
  e. DNI – valuable adjunct for strict DNI or DNR patients
  f. Post-operative Respiratory Failure
     i. Occurs in 5-10% of high risk thoracic and abdominal surgery cases
     ii. Most commonly related to atelectasis
     iii. Prevention of Respiratory Failure – moderate level of evidence to support use of prophylactic NIV in high-risk postoperative patients
     iv. Treatment of Respiratory Failure- moderate level of evidence to support use in multiple patient populations (cardiac, thoracic, abdominal surgery)

VIII. Indicators of Failed NIV
  a. No improvement or stabilization of O2/CO2 in 2 hours
  b. Worsening tachypnea or increased work of breathing
  c. Declining mental status or agitation
  d. Inability to clear secretions
  e. Inability to tolerate mask or ventilator