

Noninvasive Ventilation: Who Benefits? William Fox, MD

Airway and ventilation management in the emergency setting is an essential skill for any practitioner working in an ED. The expression “if you only have a hammer, everything is a nail” is relevant if the only process available to practitioners facing different types of respiratory failure is sedation, intubation, and mechanical ventilation. However, the development of continuous positive airway pressure (CPAP) in the 1980s and its subsequent evolution into other forms of noninvasive ventilation (NIV), including noninvasive positive pressure ventilation utilizing positive end expiratory and inspiratory pressures (NIPPV) and adoption in EDs, wards, and ICUs have enabled practitioners to deliver a higher level of care with satisfactory outcomes all without aggressive interventions. It is imperative for ED practitioners to understand which patients can benefit from NIV and which patients may require alternative airway and ventilation management strategies.

Berg, Clardy, and Donnino (2012) review the use of NIV in different forms of acute respiratory failure. They note multiple studies showing improved outcomes (lower mortality/intubation rates, shorter hospitalization durations) in patients with **COPD**. Per a cited Cochrane Database review, studies also found a 60% reduction in need for intubations (with a NNT=4) and a 50% reduction in mortality (NNT=5) in these patients. Chebbo, Tfaili, and Jones (2011) provide an in-depth discussion of COPD types and the effects NIV has. Briefly, the destruction of alveolar septa and airway narrowing is considered nonreversible. These two pathological mechanisms lead to increased collapsibility and/or obstruction of small airways (bronchioles, alveoli) and decreased ventilation and efficient gas exchange. NIV **decreases the work of breathing and helps maintain the patency of these airways**. The authors note the importance of recognizing the contraindications to NIPPV use, such as **poor mask fit, altered mental status, and inability to “cooperate” with ventilation**.

The review then goes on to describe the use of NIV in **cardiogenic pulmonary edema**, with early studies showing mixed results, with some studies showing no mortality benefits and increased risk of myocardial infarction (MI), whereas later studies showing the opposite (mortality benefit without any increased risk of MI). The conclusion the authors reached was that there is a place for CPAP and NIPPV in patients with evidence of respiratory distress secondary to cardiogenic pulmonary edema. Hypoventilation related to obesity is another common cause of respiratory distress. Though the paper notes a need for more “aggressive” titration of settings (obese patients may require higher positive end-expiratory pressures), an elevated PCO₂ can be normalized and patients can benefit from this intervention.

NIV, specifically NIPPV, in asthma is limited at best, and a more recent Review Snapshot by Landry, Foran, and Koyfman (2013) restates the impression described by Berg, Clardy, and Donnino (2012) that **more research is required before endorsement of NIV/NIPPV as a treatment for asthma exacerbations**. Landry, Foran, and Koyfman (2013) go on to comment that in the 5 studies reviewed, there was no benefit seen in the primary outcome of mortality and intubation rates in patients who received NIPPV for respiratory failure secondary to severe asthma exacerbation. In patients with hypoxemic respiratory failure, examinations of the aggregate results of studies are similarly muddled. A number of studies reveal contradictory

information, with some studies showing mortality benefits when compared to intubations, whereas other studies showing higher mortality related to delay in intubation. The review concludes that it is important to determine which patients would benefit from NIV (particularly as a way to reduce complications from endotracheal intubation) versus patients who would suffer from the delay in intubation due to the trial of NIV, but that making this determination is difficult without any clear, well-defined clinical indicators available. Finally, the review goes on to comment on the lack of clear data showing the benefit of NIV on postextubation respiratory failure and that reintubation should be a primary consideration if patients are in respiratory distress during the post-intubation period.

Based on these recommendations, it can be concluded that NIV can be **beneficial in COPD exacerbations and cardiogenic pulmonary edema due to high resistance. For asthma, obesity, hypoxemic and post-extubation respiratory failure, the results are less clear**, and more conventional approaches (i.e. intubation) are more appropriate. It is important to remember these indications in addition to contraindications (AMS, mask fit, vomiting/aspiration risk) and the utility of close monitoring to evaluate for decompensation.

References / Further Reading

- Berg, K.M., Clardy, P, and Donnino, M.W. (2012). Noninvasive ventilation for acute respiratory failure: a review of the literature and current guidelines. *Intern Emerg Med*, 7, 539-545
- Chebbo, A., Tfaili, A., and Jones, S.F. (2011). Hypoventilation Syndromes. *Med Clin N Am* 95, 1189-1202
- Landry, A., Foran, M., and Koyfman, A. (2013). Does Noninvasive Positive-Pressure Ventilation Improve Outcomes in Severe Asthma Exacerbations? *Ann Emerg Med*, 62, 594-596