

January 2015 Phoenix Pulmonary Journal Club: Noninvasive Ventilation In Acute Respiratory Failure

Noninvasive positive pressure ventilation has expanded its role in the treatment of both chronic and acute respiratory failure. Its initial use in conditions such as obstructive sleep apnea, neuromuscular disease and tracheobronchomalacia, have been shown to improve quality of life and reduce mortality. Over the past 20 years studies have looked at using noninvasive ventilation in the management of acute respiratory failure from pulmonary edema, asthma and COPD exacerbations. During this month's journal club we reviewed 3 articles evaluating the efficacy of noninvasive ventilation in acute respiratory failure.

Gupta D, Nath A, Agarwal R, Behera D. A prospective randomized controlled trial on the efficacy of noninvasive ventilation in severe acute asthma. *Respir Care*. 2010;55(5):536-43. [\[PubMed\]](#)

This was a small unblinded randomized controlled trial (RCT) looking at the efficacy using noninvasive ventilation (NIV) in acute asthma. A total of 53 patients were included and divided into 2 groups of 28 patients (NIV) and 25 patients (standard). Both groups were treated with oxygen, intravenous corticosteroids and nebulizer treatments. Patients randomized to the NIV arm were then placed on Bilevel positive airway pressure (BiPAP) 8/4 cm H₂O and pressure was titrated to maximum of 20/10 based on serial spirometry and arterial blood gases (ABG) taken at 1, 2, and 4 hrs. The primary outcome was an improvement in forced expiratory volume in 1 second (FEV1) by 50% and length of hospital stay. The results showed that there was no statistical difference in within the 2 groups with regards to improvement in FEV1. There was a small decrease in length of ICU stay by 14 hours and a reduction in hospital stay by 16 hours. A secondary outcome did show that there were lower doses of salbutamol and ipratropium required within the NIV group. The study showed that the role of NIV in asthma has little benefit over usual therapy alone. A Cochran review of 5 studies evaluating the role of NIV in asthma was done in 2013 (1). The aggregate size was 203 patients. The review showed no reduction in mortality or need for intubation when NIV is used in the treatment of asthma. The role of NIV in asthma remains unproven and should be considered as non-standard therapy.

Gray A, Goodacre S, Newby DE, Masson M, Sampson F, Nicholl J; 3CPO Trialists. Noninvasive ventilation in acute cardiogenic pulmonary edema. *N Engl J Med*. 2008;359(2):142-51. [\[CrossRef\]](#) [\[PubMed\]](#)

This was a large prospective RCT looking at the effect of NIV in the acute treatment of cardiogenic pulmonary edema. The primary endpoint was mortality and need for intubation within 7 days. 1069 patients were enrolled and divided among three arms: 1. Standard therapy with oxygen (367 patients); 2. CPAP (346 patients); and 3. NIV (356 patients). Inclusion criteria included radiographic pulmonary edema on chest x-ray, pH < 7.35 and respiratory rate > 20. The average continuous positive airway pressure (CPAP) was 10 cm H₂O and average BiPAP pressure was 14:7 cm.

The results showed that there was no difference in mortality rates or need for intubation among the 3 groups. There was an improvement in dyspnea, acidosis, and hypercapnia in the groups receiving CPAP or BIPAP. The study was well done and presented a large sample size. The results did not show any short term benefit in mortality, however, a Cochrane review in 2013 further analyzed a total of 32 studies with > 2000 patients and did show that use of either CPAP or BIPAP resulted in lower rates of intubation and mortality (2). In addition, it reduced ICU length of stay by 1 day. The role of CPAP or BIPAP in the treatment of cardiogenic pulmonary edema may be of benefit and offers little downside. CPAP has been advocated to be more beneficial in the management of systolic heart failure.

Brochard L, Mancebo J, Wysocki M, et al. Noninvasive ventilation for acute exacerbations of chronic obstructive pulmonary disease. N Engl J Med. 1995;333(13):817-22. [\[CrossRef\]](#) [\[PubMed\]](#)

This was a prospective RCT looking at the management of acute COPD exacerbations by standard treatment with antibiotics, steroids and oxygen verses standard therapy + NIV. A total of 85 patients were divided in 2 groups of 43 patients (standard treatment) and 42 patients (NIV). Inclusion criteria were shortness of breath, diagnosis of COPD by PFTS, pH < 7.35, respiratory rate > 30, and PaO₂ < 45. Primary outcomes were need for intubation, mortality and length of hospital stay. Patients in the noninvasive NIV group received at least 6 hours per day of inspiratory pressure of 20 cm H₂O. The results showed that the use of noninvasive ventilation reduced the need for intubation from 74% (3 patients in standard arm) to 26% (11 patients in NIV arm). The use of NIV also resulted in reduced mortality, 29% (12 patients in Standard Arm) vs 9% (4 patients in NIV arm). Other clinical parameters such as respiratory rate, encephalopathy, and blood gas results were also improved at a greater level with the use of NIV. The length of stay was reduced in the NIV group regardless of whether the patient required intubation or not. Although this was a smaller study the results were compelling for the benefits of using NIV in acute COPD exacerbation. Subsequent studies looking at the role of NIV both in acute COPD exacerbation as well as chronic stable COPD have also been positive. Although there are no optimal pressures outlined for NIV settings, this study showed that a higher pressure of 20 cm H₂O of Inspiratory pressure was a good starting point. The use of NIV in acute COPD exacerbations has been shown to be beneficial and should be used with other standard pharmacological therapies.

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References

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2. Vital FM, Ladeira MT, Atallah AN. Non-invasive positive pressure ventilation (CPAP or bilevel NPPV) for cardiogenic pulmonary oedema. *Cochrane Database Syst Rev.* 2013 May 31;5:CD005351. [\[CrossRef\]](#) [\[PubMed\]](#)