

Critical Appraisal Topic

Non-Invasive Positive Pressure Ventilation in Obstructive Lung Disease

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Case Presentation

A 63 year old male patient presents to the local emergency department via Basic Life Support ambulance, with complaint of increased dyspnea for 2 days, and history of COPD. The patient is routinely on oxygen 2 LPM/NC and was saturating 78% on that level of oxygen upon EMS arrival. They increased her oxygen, first to 6 LPM/NC, then to 15 LPM via Non-Rebreather Mask with an increase in SpO₂ to 84%. The patient has increased use of Albuterol MDI, as well as using his prescribed LABD and steroid combination inhaler as directed. The patient presents in frank respiratory failure.

Clinical Question

In adult patients with Obstructive Lung Disease, is Non-Invasive Positive Pressure Ventilation (NIPPV) as effective as usual medical care in managing acute respiratory failure.

Articles:

Study 1

Lim, W.J., Mohammed Akram, R., Carson, K.V., Mysore, S., Labiszewski, N.A., Wedzicha, J.A., Rowe, B.H., Smith, B.J. (2012). Non-invasive positive pressure ventilation for treatment of respiratory failure due to severe acute exacerbations of asthma. *Cochrane Database of Systematic Reviews* 2012, Issue 12. Art. No.: CD004360. DOI:10.1002/14651858.CD004360.pub4.

Study 2

Ram, F.S.F., Picot, J., Lightowler, J., Wedzicha, J.A. (2009). Non-invasive positive pressure ventilation for treatment of respiratory failure due to exacerbations of chronic obstructive pulmonary disease. *Cochrane Database of Systematic Reviews* 2004, Issue 3. Art. No.: CD004104. DOI: 10.1002/14651858.CD004104.pub3.

Summary and Appraisal of Key Evidence

In **Study 1**, Lim et.al., (2012) performed a systematic review of available literature looking for randomized, controlled trials investigating the use of NIPPV in patients with acute exacerbation of asthma, presenting in respiratory failure. The systematic review included six studies, five contributing data and 1 contributing abstract information only. All were single center trials and all used pre- and post test control groups. A total of 203 participants, all being over the age of 18 years, were included in the five studies contributing data. With the small number of studies and enrolled patients, and issues with potential or reported bias in all studies, this systematic review would have a Level 2 of evidence and strength of recommendation of Grade B.

Randomly assigned patients in each study received either usual medical care or usual medical care plus either Continuous Positive Airway Pressure (CPAP) or Bi-Level Positive Airway Pressure (BiPAP), which are both forms of NIPPV. Usual medical care

includes, but is not limited to; supplemental oxygen administration, antibiotics, bronchodilators, and systemic corticosteroids. Primary outcomes were endotracheal intubation and mortality during hospital admission. Secondary outcomes included: respiratory rate, ABG's and pH, lung function measurements, length of hospital stay, length of ICU admission, treatment failures, symptoms scores, and complications.

In **Study 2**, Ram et.al., (2009) also performed a systematic review, searching for randomized-controlled trials that looked at use of NIPPV in patients with Chronic Obstructive Pulmonary Disease (COPD), and presenting in respiratory failure. This systematic review included 14 studies, with a total of 758 adult patients included, all with a history of COPD, and all with PaCO₂ of greater than 45 mmHg on admission. The evidence is considered to be Level 1, with strength of recommendation of Grade A.

Management of randomly assigned patients in all of the studies was with either usual medical care; including oxygen therapy, bronchodilators, corticosteroids, theophylline, antibiotics, doxapram (a respiratory stimulant), diuretics or heparin in any combination, or usual medical care plus NIPPV in some form (CPAP or BiPAP). Primary and secondary outcomes are substantially the same as in Study 1.

Results

Both studies are Cochrane Reviews and look at the same intervention (NIPPV) when used in two different forms of obstructive lung disease, COPD and asthma. In study 1 looking at NIPPV in asthma, some benefit was seen in the use of NIPPV in addition to usual medical care as compared to the control group, however, a low number of included studies and patients, as well as potential for bias calls results in to question. Study 2 showed clear benefit in primary outcomes when NIPPV, in conjunction with usual medical care, was administered to COPD patients, with a high level of evidence and strength of recommendation.

Clinical Bottom Line

As the estimated incidence of asthma nears 300 million persons worldwide, and the disease process of COPD continues to plague approximately 15 million person in the US alone, prompt efficacious management of these patients is critical. Non-Invasive Positive Pressure Ventilation, in conjunction with usual medical care is effective in reducing the mortality associated with respiratory failure in acute exacerbations of COPD, as well as reducing the need for endotracheal intubation and mechanical ventilation. The benefit of NIPPV in acute exacerbation of asthma is less clear, and additional clinical research is required.

Implications for Practice

I would absolutely recommend utilization of NIPPV for patients presenting in acute respiratory failure as a result of exacerbation of COPD, in conjunction with traditional medical therapeutics. I would also likely give a trial of NIPPV to the acute asthma patient in respiratory failure, all the while being prepared to manage the patient's airway more aggressively should the clinical situation dictate (worsening hypercapnia, altered LOC).

References

- Lim, W.J., Mohammed Akram, R., Carson, K.V., Mysore, S., Labiszewski, N.A., Wedzicha, J.A., Rowe, B.H., Smith, B.J. (2012). Non-invasive positive pressure ventilation for treatment of respiratory failure due to severe acute exacerbations of asthma. *Cochrane Database of Systematic Reviews* 2012, Issue 12. Art. No.: CD004360. DOI:10.1002/14651858.CD004360.pub4.
- Ram, F.S.F., Picot, J., Lightowler, J., Wedzicha, J.A. (2009). Non-invasive positive pressure ventilation for treatment of respiratory failure due to exacerbations of chronic obstructive pulmonary disease. *Cochrane Database of Systematic Reviews* 2004, Issue 3. Art. No.: CD004104. DOI: 10.1002/14651858.CD004104.pub3.