

EBEM Commentator
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Noninvasive Positive Pressure Ventilation in Acute Chronic Obstructive Pulmonary Disease

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SYSTEMATIC REVIEW SOURCE

This is a systematic review abstract, a regular feature of the *Annals'* Evidence-Based Emergency Medicine (EBEM) series. Each features an abstract of a systematic review from the Cochrane Database of Systematic Reviews and a commentary by an emergency physician knowledgeable in the subject area.

The source for this systematic review abstract is: Ram FSF, Lightowler JV, Wedzicha JA. Non-invasive positive pressure ventilation for treatment of respiratory failure due to exacerbations of chronic obstructive pulmonary disease. In: *The Cochrane Library*. Issue 3. Oxford, United Kingdom: Update Software; 2003.

The *Annals'* EBEM editors helped prepare the abstract of this Cochrane systematic review as well as the Evidence-Based Medicine Teaching Points.

OBJECTIVE

To determine the effectiveness of noninvasive positive pressure ventilation in the management of patients with respiratory failure resulting from an exacerbation of chronic obstructive pulmonary disease.

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DATA SOURCES

An initial search was performed using the Cochrane Airways Group trials register (composed of MEDLINE, EMBASE, CINAHL, and UK Research Register standardized searches) and other relevant electronic databases. The reviewers searched the bibliographies, contacted noninvasive positive pressure ventilation trialists, and searched conference proceedings for additional published and unpublished studies. The review is considered updated to July 2002.

STUDY SELECTION

Randomized controlled trials comparing noninvasive positive pressure ventilation plus usual medical care versus usual medical care alone were selected. Trials needed to recruit adult patients admitted to the hospital with respiratory failure resulting from an exacerbation of chronic obstructive pulmonary disease and with Paco₂ greater than 45 mm Hg.

DATA EXTRACTION AND ANALYSES

Two reviewers independently selected articles for inclusion, evaluated methodological quality of the studies, and abstracted the data. Continuous variables were reported as weighted mean difference, and dichotomous variables were reported as relative risk (RR), both with associated 95% confidence intervals (CIs).

MAIN RESULTS

Eight studies were included in the review, involving 546 enrolled patients from a variety of countries. Noninvasive positive pressure ventilation resulted in decreased mortality (RR 0.41; 95% CI 0.26 to 0.64), fewer intubations (RR 0.42; 95% CI 0.31 to 0.59), and fewer treatment failures (RR 0.51; 95% CI 0.39 to 0.67). Noninvasive positive pressure ventilation also resulted in improvements in acidosis within the first hour (weighted mean difference increased pH 0.03; 95% CI 0.02 to 0.04), Paco₂ (weighted mean difference -0.40 kPa; 95% CI -0.78 to -0.03 kPa), and respiratory rate (weighted mean difference -3.08 beats/min; 95% CI -4.26 to -1.89 beats/min). Finally, common complications associated with treatment (RR 0.32; 95% CI

0.18 to 0.56) and length of hospital stay (weighted mean difference -3.24 days; 95% CI -4.42 to -2.06) were also reduced in the noninvasive positive pressure ventilation group.

CONCLUSION

This evidence suggests that noninvasive positive pressure ventilation, coupled with usual medical care, should be used as a first-line intervention in all suitable patients with respiratory failure resulting from an exacerbation of chronic obstructive pulmonary disease. A trial of noninvasive positive pressure ventilation should be considered early in the course of respiratory failure, and before severe acidosis ensues, as a means of avoiding endotracheal intubation, reducing mortality, and avoiding treatment failure.

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COMMENTARY: CLINICAL IMPLICATION

Chronic obstructive pulmonary disease is one of the few major chronic disease in which mortality has been increasing over the past decade.¹ Patients with this disease commonly present to the emergency department (ED) with exacerbations, and disease severity is often high. For example, in a recent North American study of patients presenting to the ED with chronic obstructive pulmonary disease symptoms, the proportion of patients admitted was greater than 59%, ED length of stay was nearly 6 hours, and mechanical ventilation was higher than in other acute respiratory presentations such as asthma.² Despite advances in treatments³ (eg, corticosteroids, antibiotics) and the creation of guidelines,⁴⁻⁶ the acute management of these patients is complicated and results in a rather "shotgun" ED approach.

Emergency management of acute chronic obstructive pulmonary disease is aimed at relieving bronchospasm, treating infection and inflammation, maintaining adequate oxygenation, and identifying the cause or causes of the exacerbation. This is usually achieved with diagnostic workup and concomitant treatment with bronchodilators, corticosteroids, antibiotics, and low-dose oxygen ther-

apy. Noninvasive positive pressure ventilation is a treatment approach available to many emergency physicians; however, until now, evidence was conflicting with respect to its benefit. This systematic review examined the highest-quality evidence from 8 randomized controlled trials examining noninvasive positive pressure ventilation use in acute chronic obstructive pulmonary disease associated with respiratory failure that met the authors' inclusion criteria. The pooled evidence demonstrates statistically significant and clinically meaningful reductions in mortality, intubations, lengths of stay, and deterioration in status. Moreover, complications associated with treatment and length of hospital stay were also reduced in the group receiving noninvasive positive pressure ventilation.

Considering the evidence presented in this review, it appears that noninvasive positive pressure ventilation offers important advantages in terms of avoiding intubation and reducing ICU admissions. Noninvasive positive pressure ventilation uses a full facial or nasal mask that administers ventilatory support from a flow generator. It enhances ventilation by unloading fatigued respiratory muscles and keeps collapsed alveoli open to improve ventilation-perfusion matching. Despite some variation, trials reported use for at least 6 hours per day. The expiratory pressure setting was kept constant and ranged from 2 to 6 cm H₂O, and the inspiratory pressure ranged from 9 to 30 cm H₂O. It is worth noting that all patients in these studies were treated in hospital settings and received aggressive medical management for their condition. In addition, the recent worldwide severe acute respiratory syndrome outbreak and its apparent spread after nebulization, noninvasive positive pressure ventilation, and mechanical ventilation has discouraged noninvasive positive pressure ventilation use in some centers.⁷

TAKE HOME MESSAGE

In summary, the evidence presented here suggests that clinicians should strongly consider the use of noninvasive positive pressure ventilation early in the course of severe respiratory distress in acute chronic obstructive pulmonary disease. This approach will require a coordinated collaboration between EDs and their affiliated pulmonary, respiratory therapy, and ICU programs. In the future, additional research will clarify the role of noninvasive positive pressure ventilation in patients with less severe acute chronic obstructive pulmonary disease presentations. Until that time, however, emergency physicians should

EBEM/SYSTEMATIC REVIEW ABSTRACT

strive to implement this treatment option in patients with respiratory failure associated with chronic obstructive pulmonary disease.

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EBEM TEACHING POINT

Blinding. Because of the nature of the intervention (applying a mask to the patient), double-blinding of treatment assignment was not possible for the noninvasive positive pressure ventilation studies. Double-blinding is considered an important methodological marker of quality in randomized controlled trials, and empirical research suggests that unblinded studies overestimate the treatment effect.⁸ Some quality assessment scoring systems evaluate clinical trials by assessing the presence or absence of blinding. The trials in this review were scored using one of these scoring systems⁹ and received somewhat lower scores because of their lack of blinding. Many researchers have difficulty defining the term blinding, and agreement on the meaning of “double-blinding” has been shown to be poor.¹⁰ Consequently, many authors now report on the levels of blinding used in a trial. For example, double-blinding typically refers to the patient and treating physician being unaware of the assigned intervention. Other levels of blinding in a trial can be applied to outcome assessment, data entry, data analysis, and even interpretation of results; efforts can be made so that researchers will not be influenced by the knowledge of assignment. The importance of issues such as blinding, randomization, and concealment of allocation is that they reduce the bias associated with evidence generated from clinical trials; trials that pay close attention to these methodological issues provide a more valid estimate of treatment effect.

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