Effect of noninvasive positive pressure ventilation on mortality in patients admitted with acute respiratory failure: a meta-analysis


Authors' objectives
The objectives were three-fold:

- to determine whether the addition of noninvasive positive pressure ventilation to standard therapy affects hospital mortality in patients admitted with acute respiratory failure;
- to determine the effect of noninvasive positive pressure ventilation on the need for endotracheal intubation in patients presenting with acute respiratory failure; and
- to determine whether the effect of noninvasive positive pressure ventilation was influenced by the underlying disease associated with the acute respiratory failure.

Searching
MEDLINE was searched from 1966 to September 1995 using the search terms provided in the paper. Key references were searched forward using the Scientific Citation Index, and the bibliographies of the retrieved papers were examined. Authors of all selected articles and review articles were contacted for additional published and unpublished studies.

Study selection
Study designs of evaluations included in the review
Randomised controlled trials (RCTs) were included.

Specific interventions included in the review
The addition of noninvasive positive pressure ventilation to standard inpatient care. Specific types of noninvasive positive pressure ventilation included volume cycled with nasal mask, pressure cycled with nasal mask, and pressure support with nasal or face mask. No details were given of the interventions received by the control groups.

Participants included in the review
Patients with acute respiratory failure, with or without chronic obstructive pulmonary disease (COPD), were included.

Outcomes assessed in the review
The outcomes assessed were mortality (primary outcome) and/or the need for endotracheal intubation.

How were decisions on the relevance of primary studies made?
Two reviewers independently selected the articles for inclusion, and any disagreements were resolved by consensus. The degree of inter-observer agreement was estimated using a kappa test.

Assessment of study quality
Validity was assessed on the basis of the following: randomisation concealment; the use of objective criteria for study population; the use of objective criteria for need for intubation; completeness of follow-up; description of potential confounders; mention of cointervention standardisation; and the use of intention to treat analysis. Two reviewers independently assessed the included studies, and any disagreements were resolved by consensus. The degree of inter-observer agreement was estimated using a kappa test.

Data extraction
Two authors independently extracted the data. The odds ratios (ORs), along with associated 95% confidence intervals (CIs), were calculated for each individual trial for the outcomes of mortality and the need for endotracheal intubation.

**Methods of synthesis**

*How were the studies combined?*
Summary ORs with 95% CIs were calculated for the outcomes of mortality and the need for endotracheal intubation, using the Mantel-Haenszel test.

*How were differences between studies investigated?*
A test for homogeneity was conducted. In addition, sensitivity analyses were performed to:

- assess the effects of noninvasive positive pressure ventilation on patients with and without COPD;
- examine any differences in the results between trials published as full reports and those published as abstracts.

**Results of the review**

Seven RCTs (n=286), of which 4 were published as full reports and 3 as abstracts, were included.

**Effect of noninvasive positive pressure ventilation on mortality**

5 RCTs: 4 full reports and 1 abstract; the summary OR demonstrated a statistically-significant greater survival benefit in favour of the treatment, (OR 0.29, 95% CI: 0.15, 0.59); the test for heterogeneity was non-significant.

**Effect of noninvasive positive pressure ventilation on need for endotracheal intubation**

5 RCTs: 3 full reports and 2 abstracts: the summary OR for treatment was 0.20 (95% CI: 0.11, 0.36); the test for heterogeneity was non-significant.

Sensitivity analysis - influence of underlying disease: when 3 RCTs of patients with COPD and 2 trials of non-COPD patients were analysed separately, a statistically-significant effect was seen in favour of treatment for COPD patients (summary OR 0.12, 95% CI: 0.05, 0.29), whilst a non-significant benefit was observed in non-COPD patients (summary OR 0.77, 95% CI: 0.23, 2.55).

Sensitivity analysis - influence of publication status of trials: the inclusion or exclusion of full reports or abstracts did not influence any of the above results.

**Authors’ conclusions**

The addition of noninvasive positive pressure ventilation to standard therapy in patients with acute respiratory failure improved survival and decreases the need for endotracheal intubation. However, this effect was restricted to patients whose cause of acute respiratory failure was an exacerbation of COPD.

**CRD commentary**

Overall, this was a well-presented and rigorously conducted review. The research questions, the inclusion and exclusion criteria for the primary studies, and the validity assessment were clearly explained. In addition, the statistical techniques used for pooling the data were appropriate. Details of the studies were provided in tabular format and in the text; however, information on the interventions used with the control groups would also have been of interest. The literature search was described in detail, and included a strategy to locate unpublished material. The use of other electronic databases in addition to those listed may have resulted in the identification of further eligible trials. The authors’ definition of an unpublished study is a little unclear, as it appears from the bibliography that those trials described as unpublished in the review, have in fact been published, albeit in abstract form. Finally, it would have been useful if the authors had reflected the paucity of evidence concerning the effect of noninvasive positive pressure ventilation in non-COPD patients in their conclusions, as they rightly did earlier in the paper.

**Implications of the review for practice and research**
The authors state that further research is warranted to determine whether noninvasive positive pressure ventilation confers benefit in patients without COPD who have acute respiratory failure.

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**Other publications of related interest**

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This is a critical abstract of a systematic review that meets the criteria for inclusion on DARE. Each critical abstract contains a brief summary of the review methods, results and conclusions followed by a detailed critical assessment on the reliability of the review and the conclusions drawn.