

# Review: Noninvasive ventilation reduces mortality in acute respiratory failure

Peter JV, Moran JL, Phillips-Hughes J, Warn D. Noninvasive ventilation in acute respiratory failure— a meta-analysis update. *Crit Care Med.* 2002 Mar;30:555-62.

## QUESTION

In patients with acute respiratory failure (ARF), is noninvasive ventilation (NIV) more effective than standard medical therapy for reducing mortality?

## DATA SOURCES

Studies were identified by searching MEDLINE (1966 to 2000) with the terms respiratory failure or insufficiency, obstructive lung disease, ventilation, intermittent positive pressure ventilation, and mechanical ventilation; hand searching 6 leading respiratory journals and abstracts of scientific meetings; scanning the bibliographies of reviews and retrieved studies; and contacting the manufacturers of BiPAP (bi-level positive airway pressure).

## STUDY SELECTION

Studies were selected if they were randomized controlled trials (RCTs) comparing NIV with standard medical therapy in patients with ARF and if they assessed mortality, need for mechanical ventilation, or length of hospital stay. Trials of cardiogenic pulmonary edema, weaning and extubation, postoperative NIV, specialized subgroups of patients, or those comparing NIV with mechanical ventilation were excluded. Trials were grouped into those containing patients with ARF secondary to chronic obstructive pulmonary disease (COPD) exacerbations (COPD subgroup) and those containing patients with

ARF secondary to non-COPD parenchymal processes (mixed subgroup).

## DATA EXTRACTION

Data were extracted on allocation concealment, inclusion and exclusion criteria, criteria for intubation, co-interventions, follow-up, complication rates, and intention-to-treat analysis. The main outcome measure was mortality.

## MAIN RESULTS

15 RCTs (793 patients) were included. Mortality was reduced in patients receiving NIV (Table). When patient subgroups were analyzed, the mortality reduction with NIV was seen in COPD-group patients but not in mixed-group patients (Table). The need for mechanical ventilation was reduced in NIV recipients (number needed to treat [NNT] 6, 95% CI 4 to 12 in all patients; NNT 6, CI 4 to 34 in COPD-group patients; and NNT 5, CI 4 to 13 in mixed-group

patients). Hospital stay was reduced overall (weighted mean difference [WMD]  $-2.74$  d, CI  $-4.59$  to  $-0.89$ ) and in the COPD group (WMD  $-5.66$  d, CI  $-10.10$  to  $-1.23$ ) but not in the mixed group (WMD  $-0.74$  d, CI  $-2.78$  to  $1.30$ ).

## CONCLUSIONS

In patients with acute respiratory failure, noninvasive ventilation reduces mortality, need for mechanical ventilation, and length of hospital stay. The effects of noninvasive ventilation are most apparent in patients with acute respiratory failure secondary to chronic obstructive pulmonary disease exacerbations.

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## Noninvasive ventilation (NIV) vs standard medical therapy for death from acute respiratory failure\*

Patient groups	Number of trials	Weighted event rates		RRR (95% CI)	NNT (CI)
		NIV	Standard		
All	14	15%	23%	45% (21 to 62)	13 (7 to 97)
COPD subgroup	8	10%	23%	61% (39 to 76)	8 (5 to 17)
<b>NNH</b>					
Mixed subgroup	7	23.6%	23.4%		Not significant

\*COPD = chronic obstructive pulmonary disease. Other abbreviations defined in Glossary; RRR, NNT, NNH, and CI calculated from data in article using random effects.

## COMMENTARY

The use of NIV for patients with ARF provides a noninvasive alternative to endotracheal intubation (ETI) as a form of ventilatory support. The meta-analysis by Peter and colleagues is an update of that by Keenan and colleagues in 1997 (1). This update includes 8 new studies in addition to the 7 previously summarized by Keenan and colleagues, for a total of 793 patients. The overall efficacy of NIV with respect to mortality and need for ETI does not substantially differ from the original meta-analysis, despite the inclusion of more studies and a larger sample size. The benefit of NIV is once again predominantly found in patients with COPD, as is apparent in the subgroup analysis.

Although the meta-analysis is methodologically rigorous, a few limitations merit comment. Peter and colleagues specified the inclusion and exclusion criteria and assessed the validity of the individual trials. The authors did not include 2 potentially relevant abstracts (2, 3) (1 of which was published after the specified search date cutoff), nor did they describe whether they contacted the authors of the primary studies to determine the availability of any important unpublished studies. The COPD subgroup analysis included a quasirandomized

study (4) in which allocation to NIV was based on availability of the technology. Furthermore, the analysis of the COPD subgroup did not include relevant data from the 4 published studies that were included in this meta-analysis before subgroup analysis.

For clinicians treating acutely ill patients with ARF, this meta-analysis update substantiates the fact that current best evidence does not support the use of NIV in patients with ARF from non-COPD causes. NIV should be used with caution until further rigorous randomized trials are available.

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