Is there a role for noninvasive ventilation in acute respiratory distress syndrome: a meta-analysis? A meta-analysis

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CRD summary
The review determined the efficacy of noninvasive ventilation (NIV) in patients with acute respiratory syndrome (ARDS). The authors concluded that evidence suggests NIV added to standard therapy is unlikely to have significant benefits in patients with ARDS. Robust conclusions were difficult given the clinical and methodological differences between the studies, in addition to the small number of included studies and the small data sets used.

Authors’ objectives
To assess the efficacy of noninvasive ventilation (NIV) on rate of endotracheal intubation and intensive care (ICU) mortality in patients with acute respiratory distress syndrome (ARDS).

Searching
MEDLINE was searched from 1980 to September 2005 without language restriction; search terms were reported. References of all relevant articles and all personal files were checked.

Study selection
Randomised controlled trials (RCTs) were eligible for inclusion in the review. All the trials were prospective RCTs and included one multicentre study and two single-centre studies. Studies that compared NIV and standard therapy with standard therapy alone were eligible for inclusion in the review. All of the included studies used a full face mask (one study also used a nasal mask if the full face mask was not tolerated), two studies used noninvasive pressure support ventilation (NIPSV) and one study used continuous positive airway pressure (CPAP). Studies of patients with ARDS (for example, acute onset bilateral pulmonary infiltrates, PaO₂/FiO₂<200 on room air, and no clinical evidence of cardiac cause for pulmonary infiltrates) were eligible for inclusion in the review. No restrictions were placed on the proportion of patients with ARDS in a specific study. The ARDS populations included immunocompetent and immunosuppressed patients with pulmonary and extrapulmonary causes of ARDS; no study specifically included patients with ARDS. The primary outcomes of interest were need for endotracheal intubation and ICU mortality (or, if unavailable, hospital mortality).

The authors stated neither how the papers were selected for the review nor how many reviewers performed the selection.

Assessment of study quality
The studies appear to have been assessed in terms of allocation concealment and blinding. The authors did not state how many reviewers performed the validity assessment.

Data extraction
Two reviewers extracted data independently for the review. Differences in opinion were resolved by consensus or after consultation with a third reviewer. Risk difference (RD) and 95% confidence intervals (CI) were calculated for the clinical outcomes. Number needed to treat (NNT) was calculated.

Methods of synthesis
Studies were combined in a meta-analysis using a random-effects model. Summary estimates for the clinical outcomes were presented as risk reduction (RR) and absolute risk reduction (ARR) with their corresponding 95% CI. Statistical heterogeneity was assessed using the I² statistic (<50%), the X² test (p>0.05) and visual inspection of the forest plot.

Results of the review
Three RCTs were included in the review (n=111). Two studies used concealed randomisation; no studies were blinded.
No significant between-group differences were found for need for endotracheal intubation (RR -0.17; 95% CI: -0.38, 0.04; ARR 13.5%, 95% CI: -5.2%, 31.3%) or ICU survival (RR -0.04; 95% CI: -0.2, 0.12; ARR 4.8%, 95% CI: -12.8, 22.1%). NNT was eight (95% CI: -20, 4) for need for endotracheal intubation and 21 (95% CI: -8, 5) for ICU survival. No evidence of significant statistical heterogeneity was found.

**Authors' conclusions**
Current evidence suggests that NIV added to standard therapy is unlikely to have significant benefits on outcome in patients with ARDS.

**CRD commentary**
The review question was supported by clear inclusion criteria. Only one electronic database was searched, although the search was not restricted by language and so minimised the possibility of language bias. No attempt was made to locate unpublished data. The method undertaken to extract data from the included studies was likely to have minimised the possibility of reviewer error or bias. The authors did not report whether similar methods were used for the study selection or validity assessment. Standard methods were used to pool the data and statistical heterogeneity was assessed. Variation in the case mix, use of different interfaces and modes of NIV, as well as methodological differences between the studies, in addition to the small number of included studies and the small data sets suggests that results should be interpreted with caution.

**Implications of the review for practice and research**
Practice: the authors stated that NIV should only be tried under trial conditions and as early as possible in patients with ARDS not responding to standard medical therapy. The authors advise caution to recognise failure with NIV early in order to proceed with the next level of treatment in these patients.

Research: the authors stated that further RCTs are required to determine the role of NIV in ARDS.

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