Review: adding non-invasive positive pressure ventilation to usual care reduces treatment failure in respiratory failure


In patients with respiratory failure precipitated by an acute exacerbation of chronic obstructive pulmonary disease (COPD), is non-invasive positive pressure ventilation (NPPV) plus usual care more effective than usual care alone for reducing rates of treatment failure, all cause mortality, and endotracheal intubation?

METHODS

DATA SOURCES
- Cochrane Airways Group randomised controlled trials (RCTs) register, Medline, CINAHL, EMBASE/Excerpta Medica, and online respiratory journal databases (all up to April 2004); bibliographies of selected RCTs; and researchers in the field.

STUDY SELECTION AND ASSESSMENT
- RCTs that compared usual care (including supplemental oxygen, antibiotics, bronchodilators, steroids, and respiratory stimulants) plus NPPV (applied by nasal or face mask) with usual care alone in adults with respiratory failure precipitated by an acute exacerbation of COPD. Exclusion criteria included studies of weaning, patients with pneumonia, or where continuous positive airway pressure or endotracheal intubation preceded enrolment. Study quality was assessed on the basis of concealment of allocation and the Jadad criteria.

OUTCOMES
- Treatment failure (a composite of all cause mortality, endotracheal intubation, and intolerance to the allocated treatment), mortality during the hospital episode of respiratory failure, and endotracheal intubation.

MAIN RESULTS

14 RCTs (758 patients, mean age 63–76 y) met the selection criteria. 13 RCTs used pressure cycled ventilation for NPPV, and 1 RCT used volume cycled nasal pressure ventilation. Where reported, 5 RCTs used face masks only, 4 used nasal masks only, and 2 used a combination of face masks and nasal masks for delivery of NPPV. Meta-analyses were done using a fixed effects model. Rates of treatment failure, all cause mortality, and endotracheal intubation were lower in the NPPV plus usual care group than in the usual care alone group (table).

CONCLUSION

Non-invasive positive pressure ventilation plus usual care is more effective than usual care alone for reducing rates of treatment failure.

TREATMENT

<table>
<thead>
<tr>
<th>Outcomes at 7.6–35 days</th>
<th>Number of trials (n)</th>
<th>Non-invasive positive pressure ventilation (NPPV) plus usual care</th>
<th>Usual care alone</th>
<th>RRR (95% CI)</th>
<th>NNT (CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Treatment failure</td>
<td>8 (541)</td>
<td>19.7%</td>
<td>41.7%</td>
<td>52% [37 to 63]</td>
<td>5 (4 to 7)</td>
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<tr>
<td>All cause mortality</td>
<td>10 (622)</td>
<td>10.8%</td>
<td>20.8%</td>
<td>48% [24 to 65]</td>
<td>10 (7 to 25)</td>
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<tr>
<td>Endotracheal intubation</td>
<td>14 (758)</td>
<td>16.5%</td>
<td>40.5%</td>
<td>59% [47 to 67]</td>
<td>5 (4 to 6)</td>
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</tbody>
</table>

*Treatment failure = a composite of all cause mortality, endotracheal intubation, and intolerance to the allocated treatment. Other abbreviations defined in glossary; weighted event rates, RRR, and CI calculated from data in article using a fixed effects model.

Commentary

The review by Ram et al confirms generally accepted medical practice for management of respiratory failure precipitated by an acute exacerbation of COPD by summarily evaluating 14 RCTs. The effectiveness of externally assisted ventilation in reducing minute respiratory rate, increasing tidal volumes, and decreasing the work of breathing has been well documented. These interventions markedly reduce PaCO2 concentrations and arterial pH and increase oxygen uptake from the alveoli. Achieving these outcomes without resorting to invasive ventilation circumvents the complications associated with invasive ventilation.

The authors identified study differences in patient selection, pressure settings, types of masks, and episodic duration of NPPV. For practitioners, the next step should be the establishment of a best practice algorithm to facilitate guided clinical decisions. Such an algorithm would need to address pressure settings (dependent on patient body mass index), appropriate types of mask, mask fitting, and accurate oxygen titration. It would also need to establish patient eligibility criteria, the most effective duration of ventilator episodes over the first 72 hours, monitoring of arterial blood gases, and the most cost effective and safe nursing environment for care.2 Providing nursing care to some patients with acute exacerbation of COPD with non-invasive ventilation on wards appears to be cost effective and safe when nursing staff are adequately trained and supported.3

Karen Stevens, RN, AdDisN
Auckland District Health Board
Auckland, New Zealand