Early noninvasive ventilation prevents extubation failure in at-risk patients

Synopsis


Question: For patients at high risk of respiratory failure after extubation, does the early implementation of non-invasive positive pressure ventilation (NPPV) avert respiratory failure and reduce mortality? Design: Randomised, controlled trial with concealed allocation. Setting: Participants were recruited from two intensive care units. Patients: Patients intubated for at least 48 hours who tolerated a spontaneous breathing trial were eligible if they had at least one of the following risk factors for post-extubation respiratory failure: age over 65 years; cardiac failure as the cause of intubation; an Acute Physiology and Chronic Health Evaluation (APACHE)-II score greater than 12 on the day of extubation. Exclusion criteria were contraindications to NPPV and orders against resuscitation. Eight eligible patients refused to participate. The remaining 162 were randomised to intervention (n = 79) or control (n = 83) groups. Interventions: Immediately after extubation, the intervention group received NPPV for 24 hours, followed by oxygen via a Venturi mask. The control group received oxygen via a Venturi mask after extubation. Both groups were otherwise managed according to the clinical protocols of each unit. Outcomes: Respiratory failure in the first three days, mortality in the intensive care unit, and 90-day survival. Respiratory failure was defined as at least two of the following: respiratory acidosis; hypoxaemia at an inspired oxygen fraction of 0.5 or more; respiratory rate > 35/minute; decreased consciousness, agitation or diaphoresis; and respiratory muscle fatigue or increased work of breathing. A subgroup analysis was performed based on the presence of hypercapnia during the spontaneous breathing trial. Results: Compared with the control group, respiratory failure was less frequent (Relative Risk 0.5, 95% confidence interval (CI) 0.3 to 0.9). This indicates that the number of patients that needed to be treated (NNT) with early NPPV to prevent one case of respiratory failure was 6 (95% CI 3 to 36). Mortality in the intensive care unit was significantly lower in the NPPV group, with the NNT to prevent one death being 8 (95% CI 5 to 30). In the subgroup analysis of those with hypercapnia during the spontaneous breathing trial, this benefit was greater (NNT 6, 95% CI 3 to 61). Survival to 90 days showed no significant difference between the NPPV and control groups overall. Among the subgroup with hypercapnia during the spontaneous breathing trial, however, the difference in survival was significant (NPPV 85% vs control 50%, p = 0.006). Conclusion: NPPV for 24 hours post-extubation in patients at high risk of respiratory failure reduced the risk of early respiratory failure and mortality. [Relative Risk and NNT calculated by CAP Editor from data in paper.]

Commentary

Non-invasive ventilation (NIV) has become standard treatment for patients with acute hypercapnic exacerbations of COPD. Improved survival is attributed predominantly to the avoidance of prolonged endotracheal intubation, reducing the risk of infective complications and organ dysfunction. Furthermore, recent literature demonstrates improved survival when NIV is used to facilitate early extubation in patients weaning from mechanical ventilation, although a significant proportion of patients included in these trials had chronic respiratory disease.

More recently, studies have evaluated NIV as a potential therapy to prevent re-intubation and its associated complications following extubation failure. The largest trial (Esteban et al 2004) used NIV as a recovery strategy in patients who developed respiratory failure within 48 hours after extubation. Results showed increased mortality in NIV treated patients compared to those treated with standard medical care. This was linked to a longer time between the development of respiratory failure and re-intubation in the NIV group. However, a secondary analysis revealed a trend towards improved survival in NIV-treated patients with COPD.

The current study applied NIV immediately after extubation in patients with an increased risk of developing respiratory failure. NIV was associated with reduced risk of respiratory failure and improved ICU mortality but did not affect 90-day survival. However, NIV reduced ICU and 90-day mortality in those patients who developed hypercapnia during their spontaneous breathing trial. Unsurprisingly, 98% of this group had chronic respiratory disease. Rightly the authors recommend further confirmatory studies, but given its proven benefit in avoiding and facilitating early liberation from invasive mechanical ventilation, it should probably not surprise us that early NIV is beneficial in this patient group.

There is however some room for caution. In such studies, NIV is applied in a ‘standardised’ fashion, in centres with significant NIV experience or following extensive educational programs. This ‘structure’ is a crucial component of the therapy, and needs to be put in place if potential benefits are to be realised by individual centres.

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Reference