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Noninvasive ventilation in acute respiratory failure

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Keywords

BiPAP, noninvasive ventilation, respiratory failure

Introduction

Noninvasive positive pressure ventilation (NPPV) has been suggested as an alternative to conventional endotracheal intubation and mechanical ventilation to reduce morbidity and to prevent admission to, or reduce length of stay in, an ICU. Several studies have suggested a benefit in using NPPV to manage acute exacerbations of COPD and in hypercarbic respiratory failure. Studies of NPPV in hypoxaemic respiratory failure have shown less obvious benefit and have been limited in scope. The hypotheses in this randomised study were that NPPV would reduce the need for endotracheal intubation and the length of stay in an ICU in patients with hypercarbic or hypoxaemic respiratory failure from various causes.

Comments

Noninvasive ventilation (NIV) is becoming more widely practised as the benefits of avoiding endotracheal intubation and conventional mechanical ventilation are established. These benefits include reduced risk of nosocomial infection, reduced incidence of barotrauma and either avoidance of the need for admission to an intensive care unit (ICU) or shortening of ICU stay. Initial concerns about poor patient acceptance and increased workload in the ICU seem to have been unfounded as the technology has improved and familiarity with the techniques increased. Several studies have shown considerable benefit in the management of exacerbation of chronic obstructive pulmonary disease (COPD) for reducing or avoiding ICU admission and reducing complications. Case series showing the advantages of NIV in the management of acute pulmonary oedema, acute severe asthma and community-acquired pneumonia have also been published. This study is one of the first prospective randomised studies looking at the role of noninvasive ventilation in all causes of respiratory failure (see methods for exceptions). The results suggest that NIV reduces the need for intubation in patients with respiratory

failure, but the numbers are too small to show a survival advantage. The increasing body of evidence favouring noninvasive management in the initial or overall management of respiratory failure suggests that this is likely to become an established tool for the emergency medicine and intensive care practitioner in the future.

Methods

Prospective, randomised study in patients with acute respiratory failure not needing urgent endotracheal intubation as a lifesaving manoeuvre

Patients were excluded if they were deemed to be 'DNR' (do not resuscitate), had arterial pH < 7.20, could not protect airway or cough to clear secretions adequately, were in septic shock, or could not cooperate with NPPV

Patients were assigned to a diagnostic subgroup and then randomised to NPPV or conventional management

NPPV was provided by the BiPAP S/T-D system (Respironics, Murrysville, PA) set initially at an inspiratory positive airway pressure (IPAP) & expiratory positive airway pressure (EPAP) of 5 cm H₂O. IPAP was progressively increased to improve tidal volume and reduce respiratory rate

Conventional management included endotracheal intubation and mechanical ventilation once standard support had failed

Outcome variables included need for intubation, ICU mortality and length of stay, and complications related to ventilation

Results

Sixty one patients were enrolled, 32 in the NPPV group and 29 in the conventional management group. Demographic details, severity of illness score, type of respiratory failure and disease subgroup were matched. Nine of 32 patients (28%) in the NPPV group required intubation as opposed to 17 of 29 (59%) in the conventional group. The rate of intubation in the NPPV group was 6.38 per 100 ICU days, which was significantly lower than the conventional management rate of 21.25 per 100 ICU days ($P = 0.002$). Intubation in both groups was precipitated by progressive respiratory failure, although five patients in the NPPV group and one in the conventional group required intubation for procedures or haemodynamic compromise due to gastrointestinal bleeding. Although the mortality rate in the group treated with NPPV was approximately half that of the conventional group, this did not reach statistical significance (2.39 vs 4.27 per 100 ICU days; $P = 0.21$). Subgroup analysis showed that NPPV managed patients, with hypoxaemic respiratory failure, required intubation much less frequently than those managed conventionally (7.46 vs 22.64 intubations per 100 ICU days, $P = 0.026$). This difference was

not as marked in the patients with hypercarbic respiratory failure. There was no difference in mortality rates between the two types of respiratory failure. Median length of stay was similar between the two groups.

Additional information

References

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