Standard therapy was as effective as CPAP for acute hypoxemic nonhypercapnic respiratory insufficiency

Delclaux C, L'Her E, Alberti C, et al. **Treatment of acute hypoxemic nonhypercapnic respiratory insufficiency with continuous positive airway pressure delivered by a face mask. A randomized controlled trial.** JAMA. 2000 Nov 8;284:2352-60.

QUESTION

In patients with acute hypoxemic nonhypercapnic respiratory insufficiency caused primarily by acute lung injury, is treatment with continuous positive airway pressure (CPAP) delivered by a face mask as safe and effective as standard oxygen alone for improving clinical outcomes?

DESIGN

Randomized {allocation concealed*}†, unblinded,* controlled trial with follow-up to hospital discharge.

SETTING

6 hospitals in France, Spain, Tunisia, and Italy.

PATIENTS

123 consecutive adults (median age 60 and 56 y in the 2 groups, 65% men) with respiratory insufficiency secondary to pulmonary edema ($PaO_2/FIO_2 \leq 300$ mg Hg after breathing oxygen ≥ 10 L/min for 15 min) and bilateral lung infiltrates. Exclusion criteria were age < 18 years, intubation refused or contraindicated, history of chronic obstructive pulmonary disease, acute respiratory acidosis, life-threatening hypoxia, systolic blood pressure < 90 mm Hg, ventricular arrhythmias, use of epinephrine or norepinephrine, coma, seizures, cardiogenic pulmonary edema, or inability to clear airway secretions. Follow-up was 100%.

INTERVENTION

Randomization was stratified on the basis of underlying heart disease. All patients received standard oxygen therapy through a face mask to achieve $SaO_2 > 90\%$. 61 patients received no additional respiratory interventions, and 62 received CPAP for 6 to 12 h/d until they no longer required it or they needed intubation and mechanical ventilation.

MAIN OUTCOME MEASURES

Improvement in PaO_2/FIO_2, endotracheal intubation, adverse events, duration of hospital stay and ventilation, and intensive care unit (ICU) and hospital mortality.

MAIN RESULTS

1 hour after starting treatment, patients in the CPAP group had greater improvements in PaO_2/FIO_2 ($P = 0.02$) and a greater subjective response to treatment than did patients in the control group ($P < 0.001$). The groups did not differ for any other outcomes at any time point: respiratory indices, need for intubation (34% in the CPAP group vs 39% in the oxygen group, $P = 0.5$), median duration of ventilation, median ICU stay (6.5 vs 6.0 d, $P = 0.4$), ICU mortality (21% vs 26%, $P = 0.6$), and hospital mortality (31% vs 30%, $P = 0.9$). More adverse effects occurred in the CPAP group (18 vs 6, $P = 0.01$).

CONCLUSIONS

Despite some early improvement in oxygenation and symptoms, continuous positive airway pressure was no more effective than standard oxygen therapy for the eventual need for intubation, duration of ventilation, length of hospital stay, or mortality in patients with acute hypoxemic nonhypercapnic respiratory insufficiency primarily caused by acute lung injury. More adverse effects occurred with CPAP.

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*See Glossary.

†Information provided by author.

COMMENTARY

Noninvasive positive pressure ventilation requires careful application in appropriate patients. It is most likely to benefit patients who are expected to improve rapidly, particularly those with acute exacerbations of chronic obstructive pulmonary disease. However, all forms of noninvasive ventilation, including CPAP, require scrupulous clinical monitoring so that endotracheal intubation and mechanical ventilation are instituted promptly before life-threatening respiratory failure becomes imminent and to avoid emergency intubation or cardiopulmonary arrest.

Patients with acute lung injury who were chosen for the trial by Delclaux and colleagues might represent a group for whom many clinicians would avoid using CPAP because rapid improvement is not expected and previous evidence of effectiveness in this population is lacking. Patients with acute hypoxemic nonhyercapnic respiratory insufficiency may benefit from maintaining CPAP as continuously as possible, given the potential for rapid deterioration after the decrease or removal of positive end-expiratory pressure. This trial tests the limits of face-mask CPAP for some of the most severely ill patients in the ICU, and the current results clearly show no sustained clinical benefit.

Particularly troublesome were the adverse events: 4 stress ulcers among experimental-group patients (who did not receive prophylaxis for stress-related mucosal damage as the control group did), 3 cardiac arrests that occurred just before intubation, and 1 cardiac arrest after discontinuation of CPAP in a patient who was apparently dependent on CPAP. Although it may be true that studies done by expert physicians may reflect optimal use of noninvasive ventilation (1), poor outcomes may be obtained in the "real world" in any setting.

Perhaps the time spent off CPAP in the study by Delclaux and colleagues and the remarkable incidence of cardiac arrest warn us that even in centers with much experience, this technology can be dangerous, particularly if it is not applied and monitored carefully. On the basis of this study, CPAP cannot be recommended for most patients with hypoxemic nonhypercapnic failure.

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Reference

1. **Keenan SP.** Noninvasive positive pressure ventilation in acute respiratory therapy [Editorial]. JAMA. 2000;284:2376-8.

