

## Commentary

# Noninvasive mechanical ventilation during the weaning process: facilitative, curative, or preventive?

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## Abstract

To avoid the complications associated with endotracheal intubation, noninvasive positive-pressure ventilation (NPPV) has been proposed in the management of ventilator weaning in patients with acute respiratory failure (ARF) of various etiologies. Several studies have been performed to assess the benefit of NPPV in various weaning strategies, including permitting early extubation in patients who fail to meet standard extubation criteria (facilitation use), avoiding reintubation in patients who fail extubation (curative use), and preventing extubation failure in nonselected and selected patients (preventive use). NPPV has been successfully used in facilitating early extubation, particularly in patients with chronic obstructive pulmonary disease. In contrast, applying curative NPPV to treat postextubation ARF in nonselected populations may not be effective and could even be deleterious. Early use of NPPV was successful in preventing ARF after extubation, and decreased the need for reintubation in selected patients at risk of developing postextubation ARF. It is important that caregivers clearly differentiate among these application modalities of NPPV. The skills and expertise of both medical and nonmedical personnel are crucial predictive factors for the success of NPPV in the ventilator weaning process.

In the present issue of *Critical Care*, the use of noninvasive positive-pressure ventilation (NPPV) as a facilitative weaning technique has been clinically assessed by Trevisan and colleagues [1]. Sixty-five patients on invasive mechanical ventilation for >48 hours and with T-piece weaning trial failure were randomly assigned to receive bilevel NPPV by facemask or to continue the weaning process with invasive ventilation. Chronic obstructive pulmonary disease (COPD) aggravation, postoperative acute respiratory failure (ARF), and heart disease were the most frequent causes for the use of invasive ventilation support in both groups. The results of the trial showed that patients of the two groups had similar gas measurements throughout the study. The length of stay in the intensive care unit, the duration of mechanical ventilation after

randomization, and the mortality were not statistically different when comparing the groups. Furthermore, the percentage of complications in the NPPV group was lower (28.6% versus 75.7%), with a lower incidence of pneumonia (3.6% versus 45.9%) and tracheotomy (0% versus 18.9%), than in the invasive ventilation group. These results led the authors to conclude that early extubation and NPPV is a valid alternative for ventilation in a group of heterogeneous patients that initially failed weaning.

NPPV is increasingly being proposed in the management of the ventilator weaning process, to avoid the complications of endotracheal intubation [2], and thereby to potentially lower morbidity and mortality rates in selected patients with ARF [3,4].

The first report to assess the role of NPPV as a weaning technique dates back to 1992, when NPPV was successfully used in assisting the return of spontaneous breathing in a small group of 22 patients with chronic respiratory insufficiency and weaning difficulties [5]. Several trials have been performed thereafter to further determine the benefit of NPPV in permitting early extubation in patients who fail to meet standard extubation criteria [6-9] (facilitation technique), in avoiding reintubation in patients who fail extubation [10-13] (rescue or curative technique), and in preventing extubation failure in nonselected patients [14] and selected patients [15,16] (preventive or prophylactic technique).

A recent meta-analysis of five studies enrolling a total of 171 patients was performed to investigate the role of NPPV in facilitating early extubation [17]. Compared with weaning strategies that involved invasive mechanical ventilation alone, noninvasive weaning was associated with a significant decrease in mortality, in the incidence of ventilator-associated

ARF = acute respiratory failure; COPD, chronic obstructive pulmonary disease; NPPV = noninvasive positive-pressure ventilation.

pneumonia, and in the total duration of mechanical ventilation. In a subgroup analysis, the mortality benefit of NPPV was found to be greatest among patients with COPD.

Earlier trials on postextubation ARF in COPD patients [10] and in postoperative patients after lung resection [11] showed a significant decrease in the need for reintubation using NPPV compared with standard medical treatment. Despite these encouraging results, two subsequent studies evaluating the effectiveness of NPPV as a curative or rescue technique to treat the occurrence of postextubation ARF in nonselected populations failed to show improved outcomes [12,13].

A number of trials have investigated the preventive or prophylactic use of NPPV immediately after extubation in avoiding extubation failure in comparison with standard medical therapy. In one early study on the indiscriminate use of NPPV in extubated patients, no significant difference in the rate of reintubation for either strategy was found [14]. In two subsequent studies, NPPV was found to prevent ARF after extubation and to decrease the need for reintubation in selected patients at risk of developing postextubation ARF [15,16], especially those patients with hypercapnia during their spontaneous breathing trial [16]. It is important that caregivers clearly differentiate among these application modalities of NPPV (facilitative, curative and preventive) in the management of patients with tracheal intubation in clinical practice, and be aware of the benefit that each of these modalities can provide.

Trevisan and colleagues have made an important contribution to the continually evolving research on the use of NPPV in the management of weaning from mechanical ventilation. Their results extend the conclusions of other authors that NPPV can be a useful adjunct to conventional weaning strategies [6-9].

In their study, Trevisan and colleagues aim to assess the NPPV benefits in the weaning process of a heterogeneous group of patients. Despite the great interest of these findings for all practicing clinicians, the number of patients enrolled in the study was small, hence limiting the generalizability of its conclusions.

Currently available data suggest that the potential effectiveness of NPPV for facilitating ventilator weaning and early extubation varies across patient population, and that the benefit seems greatest for COPD patients [17]. Further studies are needed to better identify those subcategories of patients with non-COPD ARF who are most likely to benefit from NPPV during the weaning process and those who are at highest risk of adverse consequences.

The skills and expertise of both medical and nonmedical personnel represent some of the most important factors for

the success of NPPV in the ventilator weaning process. It is crucial that caregivers can identify patients who are likely to benefit from early extubation with NPPV and exclude those patients for whom this approach would be unsafe. Once the decision to institute NPPV has been taken, an interface and ventilatory mode must be chosen, and close monitoring in an appropriate hospital location must be provided. Finally, when indicated, endotracheal intubation must be rapidly accessible.

## Competing interests

The authors declare that they have no competing interests.

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