



## Evidence-Based Medicine Journal Club

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Journal club critique

# An ounce of prevention: Noninvasive ventilation to prevent postextubation respiratory failure

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## Expanded Abstract

### Citation

Nava S, Gregoretti C, Fanfulla F, Squadrone E, Grassi M, Carlucci A, Beltrame F, Navalesi P: Noninvasive ventilation to prevent respiratory failure after extubation in high-risk patients. *Crit Care Med* 2005, 33:2465-2470. [1]

### Objective

Compared with standard medical therapy (SMT), noninvasive ventilation (NIV) does not reduce the need for reintubation in unselected patients who develop respiratory failure after extubation. The goal of this study was to assess whether early application of NIV, immediately after extubation, is effective in preventing postextubation respiratory failure in an at-risk population.

### Methods

**Design and setting:** Multicenter randomized controlled study in three intensive care units (ICUs)

**Patients:** Ninety-seven consecutive patients with similar baseline characteristics requiring >48 hours of mechanical ventilation and considered at risk of developing postextubation respiratory failure (i.e., patients who had hypercapnia, congestive heart failure, ineffective cough and excessive tracheobronchial secretions, more than one failure of a weaning trial, more than one comorbid condition, and upper airway obstruction).

**Intervention:** After a successful weaning trial, the patients were randomized to receive NIV for ≥8 hrs a day in the first 48 hrs or SMT. Primary outcome was the need for reintubation according to standardized criteria. Secondary outcomes were ICU and hospital mortality as well as time spent in the ICU and in hospital.

**Measurements and main results:** The trial was stopped early after interim analysis. Compared with the SMT group, the NIV group had a lower rate of reintubation (four of 48 (8.3%) vs. 12 of 49 (24.5%);  $p = .027$ ). The need for reintubation was associated with a higher risk of mortality ( $p < .01$ ). The use of NIV resulted in a reduction of risk of ICU mortality (-10%,  $p < .01$ ), mediated by the reduction in the need for reintubation.

### Conclusion

NIV was more effective than SMT in preventing postextubation respiratory failure in a population considered at risk of developing this complication.

### Commentary

Postextubation acute respiratory failure (ARF) is a common event, leading to reintubation in as many as 24% of patients [2,3] and increasing cost, length of stay, and mortality. NIV has been used to manage ARF in patients with chronic obstructive pulmonary disease (COPD) and acute cardiogenic pulmonary edema, leading others to suggest that it might be useful for patients with postextubation ARF. However, two recent randomized controlled studies failed to show a benefit of NIV in treating *established* postextubation ARF in heterogeneous patient populations [4,5]. In fact, the results from one study suggested that NIV is harmful [4].

An ancient proverb proposed that "an ounce of prevention is worth a pound of cure." It is precisely this approach that Nava and coworkers [1] take in the current study. In this multicenter randomized control trial, the authors used NIV to *prevent*, rather than to treat, postextubation ARF, focusing their efforts on a select patient population at high risk of failure. The trial was stopped early at a planned interim analysis when it was found that NIV significantly lowered reintubation rates. The authors concluded that NIV may play

a role in the prevention of postextubation ARF in select high-risk patients groups.

In the setting of postextubation ARF, the concept of prevention has significant face validity. Application of NIV prior to the onset of respiratory muscle fatigue or before there is significant atelectasis might avert a "vicious cycle" of increasing dyspnea, dysfunctional respiratory pattern and mechanics, and weakness culminating in overt respiratory failure.

As is often the case, there are limitations to this study that deserve consideration. Foremost among these is that the study was stopped early. Though this decision occurred at a planned interim analysis, it resulted in a relatively small sample size that may have weakened the strength of the results and obscured a clear effect on mortality. By design, the investigators studied a select patient population. The study cohort included a high proportion of COPD patients, and NIV is known to be quite effective in this population. The results of this study, therefore, should not be extended to patient populations differing from those of the study.

The application and titration of NIV can be a complicated endeavor. One cannot simply put a NIV mask on the patient, turn on the ventilator, and walk away. The authors have significant experience in the use of this technique, which accounts for the very high tolerance of NIV in the study and which might partially explain the observed difference in outcome. Although it is impossible to provide a single, uniform "prescription" for effectively applying NIV, recent clinical investigations suggest that close attention to patient-ventilator interaction can substantially improve tolerance of NIV. Elements of this interaction include the magnitude of the mask leak, the point at which the ventilator terminates inspiratory pressure application, and the rate at which the circuit is pressurized [6-9]. Interestingly, automatic adjustment of key parameters may some day be possible [10].

## Recommendation

These results, in context with a wealth of physiological data and clearly demonstrated utility in other settings, suggest that "prophylactic" postextubation NIV, properly applied, might prove to be a valuable adjunctive measure in select high-risk patients. Further study and confirmation are warranted.

## Competing interests

The authors declare no competing interests.

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