Nasal Mask Ventilation in Acute Respiratory Failure

To the Editor:

I read with great interest in the September 1992 issue of Chest the data reported by Benhamou and colleagues concerning nasal mask ventilation (NMV) in acute respiratory failure (ARF). Intermittent positive-pressure ventilation by nasal mask was assessed as first-line therapy in order to avoid endotracheal intubation in very elderly patients or as the therapeutic last resort. The patients were ventilated with a volumetric respirator, and artificial ventilation was performed in the controlled mode (volume-cycled ventilation). Although reported data seem relatively encouraging, several points have to be discussed. Nine of 30 patients had an immediate deterioration, resulting in 5 deaths. Cases of poor tolerance were related to poor adaptation to the ventilatory mode. Correction of hypercapnia required several hours (and was probably related to the severity of buccal leaks), whereas PaO2 improved early. Finally, conjunctivitis was observed in poorly adapted patients as a consequence of air leaks.

Merely using a nasal mask is not sufficient to ensure optimal tolerance of artificial ventilation. The second crucial condition is the use of a ventilatory mode allowing synchronization between the patient and the machine, by using a specific respirator for noninvasive ventilation. Recently published data2 have shown that using a flow-triggering system (vs a pressure-triggering system) with a decelerated inspiratory flow (vs a constant inspiratory flow) appears to be the best way to decrease the work load during assisted ventilation. Decelerated inspiratory flow is obtained by application of a constant positive airway pressure synchronized with spontaneous inspiration (pressure support). Initiation of inspiratory flow being a major determinant of respiratory work, early application of pressure and stable inspiratory airway pressure (inspiratory positive airway pressure [IPAP]) provides optimal matching of the patient's needs. Assessing the effects of noninvasive partial ventilatory assistance with constant positive pressure, either one-level (ie, IPAP) or two-level (ie, bilevel positive airway pressure [Bi-PAP]), in ARF, these recent studies2 have shown a good clinical tolerance with better patient comfort, reduction of respiratory rate, and rapid improvement of blood gas values.

Although several recent studies have reported successful use of noninvasive pressure-support ventilation via facial mask (less potential risk of air leaks than with a nasal mask) and conventional respirator,3 it is probable that optimal noninvasive ventilation requires a specific respirator with an inspiratory flow-triggering system, early and stable inspiratory pressure support (servo-controlled loop), a compensatory system of air leaks, an inspiratory flow-triggering system (eg, triggered by a percentage of inspiratory peak flow), and passive exhalation through a low-resistance device (eg, Whisper Swivel, Respiromics, Murrysville, Pa). This spontaneous mode of ventilation is flow-cycled and includes a security system relative to the switch from inspiration to expiration (detection of expiratory effort, duration of inspiration), so that the patient never exhales against the pressure support. Furthermore, with a compensatory system of air leaks, specific ventilators allow speech and feeding without removal of the nasal mask.3 Using a conventional ventilator with a nasal mask may be difficult because of the absence of a compensatory system for air leaks and the potential importance of extra work involved in breathing.

Ideal NMV in ARF involves the maintenance of spontaneous breathing, with the machine supporting the patient's efforts by an appropriate mode of assistance. The clinical tolerance is the crucial point, and as Benhamou et al themselves said: "This good general tolerance . . . is the only factor that was found to have a prognostic value in our study." It is possible that Benhamou et al are using a "good wheel" (the nasal mask) but not a "good motor" (the ventilatory mode) and that clinical tolerance (with fewer air leaks and earlier correction of hypercapnia) could be better yet with a synchronized mode of ventilation.

References

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support system administered with a nasal mask in patients with respiratory failure. Chest 1991; 100:1371-76

To the Editor:

I read with great interest the article by Benhamou et al., which appeared in the September 1992 issue of Chest. The authors describe NMV as an effective means of providing ventilatory support to patients in ARF whose age or condition contraindicates more aggressive support. Seven of 17 surgical ICU patients in their study failed to improve with NMV, and 9 died. Thus, 10 of 17 patients who presumably required, and would have died without, NMV survived (although 2 of the patients died of “unrelated causes”). This result is laudable.

The other group studied was 13 patients in whom endotracheal intubation was appropriate but was postponed in favor of NMV as the first-line therapy for ventilatory failure. Of these 13 patients, 5 (38 percent) failed to improve: 4 were intubated, and 1 died. The cause of the one death in this group is not discussed, so the deferral of intubation cannot be ruled out as a contributory factor. The treatment failures also are not discussed in detail. This information is important because it helps define the morbidity associated with deferring intubation in favor of NMV. Would any of the study patients have had shorter courses of respiratory failure or less morbidity if they had been intubated promptly, rather than after a trial of NMV? The presented data provide no insight into this important question.

Although NMV has been effective in maintaining oxygenation and ventilation in some groups of patients, as the authors correctly note, it has not been demonstrated to be as effective in preventing morbidity and mortality in patients in impending respiratory failure as endotracheal intubation is. It concerns me that indicated therapy (endotracheal intubation) was not provided to patients who would have had it if not included in the study. Before NMV is used in other patients who both require and desire intubation, more work is needed to assess the morbidity associated with delaying the definitive therapy.

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REFERENCES

To the Editor:

We thank Dr. Sottiaux for his letter. We agree with him about the need to improve the efficiency and tolerance of the respirator. However, the optimal “motor” remains to be found. The choice of the type of respirator by itself will not solve the problem of leaks; it may only reduce the flow. Tolerance is related, not only to the shape of the flow and pressure curves, but also to the “wheel,” that is, the kind of connection used between the patient and the machine (ie, nasal or facial mask, nasal cannula, use of a mouth strap).

Dr. Sottiaux’s theoretical arguments are accurate, but no prospective study in elderly patients with ARF of homogeneous etiology treated by noninvasive nasal ventilation has compared pressure-support ventilation with conventional volume-cycled mechanical ventilation. Previous studies have shown that inspiratory aid is feasible in ARF, but it is also important in ARF to reset the ventilatory command by controlled mechanical ventilation, flow-triggering systems being difficult to use in patients with ARF and polynnea. Furthermore, new respirators allow flow compensation in conventional controlled mechanical ventilation.

We also thank Dr. DeVita for his letter because he emphasizes an important question: Is it dangerous for the patient to try to avoid endotracheal ventilation (ETV) by beginning management with NMV?

First, the deferral of intubation for the one patient who died (a 79-year-old man with an initial pulmonary embolism) was probably not responsible for his death, which occurred after a collapse on day 8. The cause of the failure in the four other patients for whom ETV was deferred was worsening of the respiratory status, which indicated a secondary intubation.

Second, if we consider our proposed course of action (intubation after an NMV trial) in patients who would normally receive ETV, the mortality rate is 7.7 percent (1/13), which is near the overall mortality rate for patients admitted to an ICU and less than that for patients requiring endotracheal mechanical ventilation. Nevertheless, the comparison of different data about mortality and mechanical ventilation is not easy because the selection of patients for mechanical ventilation, except in extreme emergencies, is very subjective.

It is difficult to know whether the course of the respiratory failure episode is impaired by this treatment plan. Only a randomized study can answer this question. Brochard et al. report a more transient need for ventilatory assistance and a shorter stay in the ICU for patients treated by facial mask ventilation compared with a historical control group treated by ETV. Nasal mechanical ventilation may impair the course of secondarily intubated patients because of selection of cases with a poorer prognosis.

Therefore, if some guidelines are followed (immediate intubation in very severe patients, follow-up in an ICU, and the possibility of intubation at any time), NMV may be tried with the goal of decreasing the morbidity of mechanical ventilation without increasing the mortality.

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