Complications of Noninvasive Ventilation

Noninvasive positive-pressure ventilation (NPPV) has gained wide acceptance as an effective modality in the management of patients with acute respiratory failure due to chronic obstructive pulmonary disease exacerbations.\(^1\)\(^-\)\(^4\) For this indication, it rapidly alleviates respiratory distress, greatly reduces the need for intubation,\(^2\) and in some studies reduces morbidity, mortality,\(^1\)\(^,\)\(^3\) and hospital length of stay.\(^3\)\(^,\)\(^4\) For other indications, the evidence is not quite as strong, but recent controlled trials suggest that NPPV can bring about similar benefits in patients with a variety of nonchronic obstructive pulmonary disease types of respiratory failure,\(^5\) including hypoxic respiratory failure and community-acquired pneumonia.\(^6\) In general, NPPV is considered safe, with most complications related to mask intolerance or air insufflation. Major complications have been reported relatively infrequently, although the caveat is always given that patients must be carefully selected.\(^7\)

In this issue of Respiratory Care, a patient is reported who developed a life-threatening upper airway obstruction, caused by a large desiccated concretion of mucus and blood lodged in the posterior oral pharynx, after using NPPV for 6 days.\(^8\) Fortunately, the obstruction was promptly removed and the patient did well, but the incident raises a number of issues regarding the management of noninvasive ventilation.

First is the issue of patient selection. When selecting patients for noninvasive ventilation, clinicians must identify those in need of ventilatory assistance and screen out those with mild respiratory insufficiency who can be managed with medical therapy alone. The clinician must then exclude, among those needing ventilatory assistance, those in whom noninvasive ventilation would be unsafe and who should be promptly intubated. The patient’s ability to protect the airway is one of the most important considerations when making this determination. Unquestionably, the patient described in the case report had problems with airway protection and was clearly not an ideal candidate for noninvasive ventilation. He had an aspiration pneumonia and atelectasis, and had recently had major abdominal surgery that would have impaired his cough mechanism. In addition, he was severely hypoxic, presumably related to retained secretions from his pneumonia. Had he not been so reluctant, most reasonable clinicians probably would have intubated the patient and foregone noninvasive ventilation altogether.

Another issue raised by the case regards the use of untested ventilator techniques. In this case, the patient was treated with 40 L/min of oxygen bled into the ventilator circuit to maintain oxygen saturation > 90%, even though the manufacturer recommends flows not exceeding 15 L/min. The concerns are that flows this high might interfere with ventilator triggering and cycling, leading to patient-ventilator asynchrony, and expose the patient to high volumes of dry gas that would be highly desiccating. In view of these considerations, the complications of secretion desiccation and retention that occurred in the reported case are hardly surprising.

What lessons can be drawn from this case? The authors infer that the duration of NPPV should be limited. I take strong issue with this inference. Are we to abandon NPPV and intubate patients after some arbitrary time limit like 3 days if ventilatory assistance is still required? I hardly think so. Although NPPV is ideally used for periods of a few hours to a few days in patients with reversible causes for their acute respiratory failure, there are many examples of patients who have had favorable outcomes after longer durations of NPPV, including the present one, the reported complication notwithstanding. Further, patients with underlying chronic respiratory failure might be discharged using long-term NPPV.

One lesson I extract from this case is that the importance of proper patient selection cannot be overemphasized. Patients like the one reported, who have an impaired ability to protect the airway, should be treated with invasive mechanical ventilation unless there are mitigating considerations. In this case, the patient was reluctant to undergo intubation. When patients decline intubation, it is reasonable to try noninvasive ventilation in less-than-ideal candidates, as long as the patient and/or family is informed that they are using a form of life support, albeit noninvasive, and if there is some expectation of reversibility. In this circumstance, a higher risk of complications such as secretion retention or plugging must be assumed.

Another lesson I draw from this case is that we must be very careful when using techniques that are not routine or ignore the manufacturer’s recommendations. In this case, the use of higher than recommended oxygen flow increased the risk of secretion desiccation in a patient already at risk.
for secretion retention. This practice cannot be condoned without further testing of the effects of ventilator triggering and performance. I concur with the authors’ advice, however, that when noninvasive ventilation is used for longer periods (ie, more than a day or two), particularly in patients at risk for secretion retention or using unorthodox oxygen flows, inspired air should be adequately humidified using a heated humidifier.

This case report does not change the contention that NPPV used in appropriately selected patients is generally safe and effective. However, we must be sensitive to the fact that many recipients are less than ideal candidates, often for justifiable reasons, and we must anticipate and try to prevent the potential complications.

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