

Non Invasive Ventilation; PROs and CONs

A.F. van der Sluijs

Department of Intensive Care, Academic Medical Center, Amsterdam, The Netherlands

Correspondence

A.F. van der Sluijs – e-mail: a.f.vandersluijs@amc.uva.nl

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Introduction

Mechanical ventilation is required for patients with acute or acute-on-chronic respiratory failure that does not respond to standard therapeutic interventions such as administration of antibiotics, diuretics, bronchodilators and – not to be forgotten – oxygen. The majority of patients requiring ventilatory support are intubated and ventilated invasively. Actually we do regard this as conventional mechanical ventilation. Although initiating invasive mechanical ventilation can be a life-saving intervention, it is just supportive rather than curative and gives us the chance to treat underlying disease. In contrast, conventional mechanical ventilation is associated with several complications, related to the intubation as well as to the risk of developing a ventilator-associated pneumonia (VAP). In order to avoid these risks, an alternative to conventional mechanical ventilation was invented in the nineteen-eighties known as Non Invasive Ventilation (NIV). With NIV, a nasal or face mask is used to deliver ventilatory support to the patient instead of an endotracheal tube. Since its introduction, NIV has been applied in different ventilator modes to many different patient categories with acute, acute-on-chronic and even chronic respiratory failure, both within and outside the Intensive Care environment.

To determine the value of a certain therapy, one has to consider its advantages and disadvantages and, if possible compare it with conventional treatment. In the text below I would like to focus on the disadvantages of Non Invasive Mechanical Ventilation for acute or acute-on-chronic respiratory failure within the Intensive Care Unit.

Disadvantages of Non Invasive Ventilation

One of the issues associated with NIV is that it is not appropriate for all patients. Cooperation of the patient is paramount which means that timely referral to the Intensive Care Unit is essential and this is exactly where the rub is. Patients with imminent respiratory failure are kept in general wards as long as they do not meet the criteria for admittance to the Intensive

Care Unit. It is therefore very hard to predict which patients will make it without ventilator support and which patients will eventually deteriorate. In my experience, many patients who would have been candidates for NIV are transferred to the ICU when intubation and invasive mechanical ventilation is the only remaining option. NIV is not appropriate for patients with: respiratory arrest, haemodynamic instability or multiple organ failure, recent upper airway- or upper gastrointestinal surgery or bleeding, excessive sputum production or a diminished cough reflex or swallowing impairment. As mentioned above, uncooperative or agitated patients are not eligible for NIV. Some authors suggest the use of sedation in mildly agitated or anxious patients, although this may increase the risk of aspiration and potentially worsen hypoventilation.

A well-known disadvantage of NIV is leakage. Although most ventilators have NIV modes with adapted alarm settings, it remains unclear how much ventilation we actually deliver to our patients. End-tidal carbon dioxide measurement is unreliable and adjustments to the ventilator setting might as well improve ventilation as worsen it by an increase in the amount of leakage. Frequent arterial blood sampling is mandatory and therefore most patients on NIV will have an arterial line inserted. Leakage on the top side of nasal or full face masks may result in dry eyes and conjunctivitis.

Patients on NIV have an increased risk of aspiration. Compared with intubated patients they do not have a secured airway and as a result of alternating positive pressures in the nasal- and oropharyngeal cavity, gastric distension may occur, herewith increasing the risk of aspiration. Insertion of a nasogastric tube reduces the risk of gastric distention and aspiration, but may adversely affect the problem of leakage.

Many patients experience discomfort when they are intubated and mechanically ventilated and this argument is often used as highlighting the benefit of NIV; also, there would be no need for sedation. However, NIV may lead to substantial discomfort as well, particularly as a result of pressure, which may even lead to ulcers.



Finally, an important disadvantage of NIV in the ICU is the burden for the caregiver, in particular the nurse. Patients on NIV need a lot of attention and specific care which is not a problem as long as the attending nurse is experienced and not occupied with other patients. Insufficient attention for patients on NIV may lead to inadequate treatment with the risk of deterioration of the patient's condition.

Literature

We do live in a time of evidence based medicine, so what does the literature teach us about the value of NIV? During the nineteen-nineties a lot of papers about NIV appeared in medical journals and in 1998 Sean Keenan and David Brake reviewed.¹ the available data and posed the following question:

What level of evidence is available in the literature to support the use of Noninvasive Positive Pressure Ventilation (NPPV) in the various causes of acute respiratory failure? In 1997, both authors conducted a meta-analysis on this subject which was published in *Critical Care Medicine*.² In summary, the general conclusion was that beyond the COPD population, there was, at that time, insufficient evidence to support the use of NPPV in acute respiratory failure. The reviewed randomized controlled trials were generally small and in most studies NIV was compared with conventional therapy, meaning administration of supplemental oxygen. Endpoints in the studies differed from the need for intubation, ICU and hospital length of stay and mortality. During the first decade of this century, more RCTs were conducted and NIV seems to be beneficial in more patient categories³: patients with severe or mild exacerbations of COPD, patients with cardiogenic pulmonary oedema, immunocompromised patients and patients with failure to wean (NIV after extubation). However, in 2011, Girault et al. found no benefit of NIV in different weaning strategies.⁴ Moreover, NIV was used as a rescue strategy when acute post-extubation respiratory failure occurred in the invasive weaning and supplemental oxygen group and was successful in 45 and 58% respectively.

Discussion

Non Invasive Ventilation is used to treat acute respiratory failure without the insertion of an endotracheal tube. In this context NIV is an excellent alternative for patients with “do not intubate” orders. There are, however, various other reasons why doctors prefer not to intubate a particular patient and in a lot of studies on NIV the need for intubation is a primary endpoint. An objection against many studies is that NIV is compared with “standard medical treatment” and I found only one RCT with NIV compared to invasive ventilation. Imagine one hundred patients with acute (or acute-on-chronic) respiratory failure starting with NIV. 40 of these patients deteriorate and meet the criteria for intubation. The question is how to describe this result: was NIV successful in 60%, because the ultimate goal was to avoid intubation? Or was there a 40% failure of the initiated therapy (NIV)?

The use of NIV has proven to be beneficial in some patients but even considering this, we need strict inclusion and exclusion criteria. In general we should apply NIV only for short-term respiratory failure, when we are able to treat the underlying disease within hours. On the ICU, I frequently see patients with acute respiratory failure, transferred from general wards, where NIV would have been an option a few hours earlier. Too often we are simply too late.

Patients who are actually treated with NIV should be strictly monitored, including frequent blood sampling and it is questionable whether or not this can be done on general pulmonary wards. The effect of the NIV treatment should be

closely monitored and if there is no improvement patients have to be intubated before they are completely exhausted. The disadvantages of NIV vary from leakage, which makes the treatment less reliable, to discomfort and pressure ulcers. The main disadvantage of NIV is that the therapy is not suitable for all patients and can be applied for only a limited period (hours). These issues should be weighed against the risks and complications of invasive mechanical ventilation, but what we actually need are large multicenter randomized trials where non-invasive and invasive ventilation are compared with hospital mortality as a primary endpoint.

References

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Disclaimer

The author reports no conflicts of interest and was invited to focus on the CONs of Non Invasive Ventilation. The statements above do not necessarily represent the author's opinion.