The new Breathe *feature where we give you an expert and a topic, and you have the chance to ask them any questions you wish via breathe@ersj.org.uk*

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Ask the expert: noninvasive ventilation (NIV)



M.W. Elliott

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Q1. a) I would like to know your opinion on the correct pH range when starting patients with acute exacerbations of chronic obstructive pulmonary disease (COPD) on NIV. Which patients are insufficiently acidotic to treat, and which are too acidotic to treat with NIV?

N. Charokopos (Patras, Greece)

A. The first point to make is that approximately 20% of patients who are acidotic at the time of arrival in the emergency room will correct their pH completely into the normal range just with standard medical therapy including, most importantly, properly controlled oxygen therapy [1]. This applies even to patients with very severe acidosis. In most patients, therefore, NIV should not be started until an hour or two has elapsed. At that stage arterial blood gas tensions should be measured and if the pH is less than 7.35 and the patient is hypercapnic, NIV should be initiated [2]. It is important to note that in the pH range 7.30–7.35, 80% of patients will get better without NIV, but only 10 patients need to receive NIV to avoid one intubation [3]. If a patient is tolerating NIV poorly and does not want to use it, it is reasonable not to push it, but to continue to monitor the patient carefully. Once the pH is less than 7.30 the outcome without NIV is much worse and these patients should be encouraged very strongly to continue, even if they don't like it very much.

With regard to being too acidotic for NIV, there is no lower limit. However it should be appreciated that the more severe the acidosis the greater the chance that NIV will not be successful [4]. Conti *et al.* [5] showed that in patients with an average pH of 7.20, randomised to immediate intubation and ventilation or to NIV, there was no difference in outcome and indeed some advantages in those patients who could be managed successfully with NIV. Diaz *et al.* [6] used NIV successfully in very sick comatose patients.

b) When using bilevel positive airway pressure therapy in COPD what starting pressures do you use, and what is your interface of choice?

A. There is no absolute rule about this, but generally I would suggest starting with an inspiratory positive airway pressure (IPAP) of 10 cmH_2O and an expiratory positive airway pressure (EPAP) of 5 cmH_2O and then increasing the IPAP depending upon response over the next hour or so to 15–20 cmH_2O. If necessary, patients can be persuaded to tolerate high pressures, though it is certainly true that once IPAP gets above 20 cmH_2O there may be a marked increase in leak [7]. It is advisable to have some EPAP to counterbalance intrinsic positive end-expiratory pressure (PEEP), reduce carbon dioxide rebreathing and in some cases to stabilise the upper airway during sleep. It is not usually necessary to increase the EPAP but occasionally, particularly in severely hyperinflated patients receiving pressure support ventilation, increasing the EPAP to counterbalance intrinsic PEEP may improve ventilator–patient synchrony. I would very seldom go above 8 cmH_2O unless the patient had clear evidence of upper airway obstruction during sleep and higher levels were needed to stabilise the airway. With regard to interface, most patients with an acute exacerbation of COPD mouth breathe and I would usually advocate a full-face mask. Ideally, the exhalation port should be built into the mask over the bridge of the nose as this has been shown to reduce carbon dioxide rebreathing, particularly in the presence of EPAP [8].

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Q2. In the surgical hospital where I work, various methods of NIV are beginning to be established in the intensive care unit. What are your opinions on the use of NIV for surgical patients in the post-operative period, *e.g.* those with post-extubation respiratory failure or for weaning; and are there robust protocols for these indications I could use?

L. Nazyrova (Tashkent, Uzbekistan)



A. The evidence base for the use of NIV in post-extubation respiratory failure is much less robust than that for use in acute exacerbations of COPD. Indeed large randomised controlled trials raised the possibility that it may actually be harmful, primarily by delaying the time to endotracheal intubation [9, 10]. However in the first of these studies [9], once the study was under way, it was decided that patients with COPD should be excluded because of the emerging evidence of benefit from NIV in other situations in this patient group. In the second study [10] while overall NIV appeared to be harmful there was some evidence of benefit in the subgroup with COPD. It is also important to note that a significant proportion of the control group received NIV, successfully, as rescue therapy. With regard to difficult weaning there is evidence that NIV can be used to liberate patients from mechanical ventilation and again this is strongest in patients with COPD [11–13].

At this time NIV should not be used for the generality of patients with either post-extubation respiratory failure or for weaning. However, there is evidence of benefit in patients with COPD and logically it would also seem likely to be useful in patients known to do well with chronic NIV, for example those with neuromuscular disease, chest wall deformity and obesity.

Q3. How do you manage the patient with tracheostomy who has hypercapnic respiratory failure due to an acute exacerbation of COPD? Can NIV be used in patients with a tracheostomy?

R. Norvaisiene (Klaipeda, Lithuania)

A. There is no reason in principle why ventilators designed primarily for noninvasive use cannot be used for patients with a tracheostomy. However a number of manufacturers state specifically that their ventilator should not be used in this way. This usually relates to the provision of adequate alarm systems. Because the patient is breathing through a closed circuit, they are at much greater risk should there be a ventilator malfunction or problem with the circuit than a patient receiving NIV. Furthermore, some tracheostomised patients are very severely disabled and are not able to summon assistance through an alarm that they themselves would have to activate if they get into trouble. In summary, there is no problem ventilating patients through a tracheostomy using a noninvasive machine, provided that the ventilator has alarms, which are carefully set and reacted to appropriately.

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