Should I wheel out the Heliox with non-invasive ventilation?

Heliox is a mixture of helium and oxygen; the most common combination in the UK is oxygen 21%, helium 79%. The substitution of helium for nitrogen produces a gas that is significantly less dense than air; this provides improved gas flow characteristics when turbulent flow might be encountered. Gas flow is said to be turbulent only in the larger airways and thus there is a logical use for heliox in upper airway obstruction.

Over the past decade significant efforts have been devoted to evaluating the efficacy of heliox in exacerbations of asthma and chronic obstructive pulmonary disease (COPD). The rationale is that during an exacerbation, increased secretions, inflammation and respiratory rate produce considerably more turbulent flow in the airways.

Case scenario

An 84-year-old woman is admitted with an acute exacerbation of COPD. Arterial blood gases taken on arrival show a pH = 7.21, arterial partial pressure of oxygen (PaO_2) = 5.1 kPa, arterial partial pressure of carbon dioxide ($PaCO_2$) = 10.3 kPa. She is conscious, but with a respiratory rate of 35 breaths per minute. She has been on BiPAP (bilevel ventilation specifically for non-invasive ventilation), with an inspiratory pressure of 20 and an expiratory pressure of 5, with a good seal for 30 minutes but is not improving. Will heliox help?

Discussion

Helium is an inert gas, so the use of heliox would only be a temporizing measure while definitive treatment is given time to work. While one may take the view that such a measure is simply delaying the inevitable, it should be remembered that there are several temporizing treatments that have established themselves in clinical practice such as left ventricular assist devices and extracorporeal membrane oxygenation. Furthermore, unlike the most commonly used temporizing measure – positive pressure ventilation – heliox has no known deleterious effects.

Heliox initially showed promise in small randomized controlled trials and case studies in both asthma and COPD. However, two published systematic reviews in asthma (Ho et al, 2003; Rodrigo et al, 2003) and one in COPD (Rodrigo et al, 2002) have failed to show conclusive benefit. This is all the more surprising as there is a wealth of data to show that physiological parameters are consistently improved using heliox. It undoubtedly reduces work of breathing, peak airway pressures, and intrinsic positive end expiratory pressure in ventilated and non-ventilated patients, as well as reducing dyspnoea subjectively.

So why is the evidence so equivocal? The major factor must be still the paucity of data. The review looking at COPD included only a total number of 75 patients, enrolled in just two studies, one of which focused on heliox as an adjunct to non-invasive ventilation (NIV), the other using it as a driving gas for nebulizers. Since this review, more encouraging retrospective data have been published, with dramatic falls in intubation and mortality rates and duration of stay (Gerbeaux et al, 2001). How does one reconcile startling retrospective data with a systematic review based on very little data and inhomogeneous studies? It is important not to view the publication of a systematic review as the definitive answer but merely as a synopsis of work in progress.

The combination of heliox and NIV is an attractive one. There are robust data that show that NIV reduces mortality; however, failure of NIV puts the patient in a poor prognostic category (Wood et al, 1998). If heliox can further reduce the NIV failure rate or even reduce the requirement for any type of ventilation as suggested by Gerbeaux et al (2001) then it will certainly be a useful tool.

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Conclusions

Heliox is certainly safe and in the above scenario it would be attractive to allow the patient one last chance at NIV. The proviso should be: try it early but stop early if there is no improvement. It is a satisfying therapy as the patient should feel a rapid improvement. BJHM

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