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Restrictive lung disease: Low EPAP – Good ventilation. Is it real?

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Dear Editor,

Despite many previously published studies on non-invasive ventilation (NIV), it is still difficult to draw any conclusions about an optimal ventilation strategy in thoracic restrictive diseases.[1] Most studies include only a small sample of patients, analyse only single effects of NIV or investigate different types of diseases, while other authors do not mention ventilation parameters or application time at all. The optimal level of applied expiratory positive airway pressure (EPAP) in most mechanically ventilated patients is still unknown.

We have read with interest Kinnear et al.'s[2] work where they studied the effect of increasing EPAP during pressure-controlled modes of NIV in 30 long-term ventilator users (scoliosis, obesity hypoventilation or neuromuscular disorders) with well-fitting masks and no apparent leaks. EPAP does, however, appear to reduce tidal volume (Vt). In the short time while maintaining the same inspiratory positive airway pressure (IPAP), addition of 5 cm H_2O of EPAP reduced the mean Vt by 167 ml; 10 cm H_2O reduced Vt by 367 ml. The authors in their work did not report the kind of mask and the specific exhalation ports used, with leaks measured at the different pressure values.

Restrictive patients are a non-homogenous population where the use of EPAP is different. In published series, EPAP settings of less than 5 cm H_2O are typically used in neuromuscular and scoliosis patients to mitigate end-expiratory alveolar collapse and to influence atelectasis.[1] In patients with the obesity hypoventilation syndrome, the most common use of EPAP of around 10 cm H_2O overcomes upper airway obstruction. In more severe obesity, IPAPs are more variable, within the range of 15–25 cm H_2O, probably reflecting the need for higher pressures.[1]

We think it is important to consider basal breathing pattern and neural drive in these three restrictive diseases for patient management. The author does not indicate about patient in supine or setting position during the short trial and whether it is the habitual position especially for long-term NIV, neuromuscular and scoliosis patients. Both conditions have an impact on lung compliance and Vt response. It is also important to consider the effect of ventilation on short and long changes in compliance. Simonds et al.[3] demonstrated a positive effect of intermittent positive-pressure hyperinflation 2–3 times a day for 5 minutes with pressures of 25–30 cm H_2O on lung volume over 3 months in patients with restrictive chest wall diseases and found that improvement in vital capacity (VC), but not in blood gas parameters, was correlated with the degree of hyperinflation.

In Kinnear et al.'s work, there is a lack of information regarding the level of hypercapnic baseline

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and trends during different EPAP settings. Sinha and Bergofsky[4] demonstrated that the only application of intermittent positive pressure over 5 minutes increased lung compliance and also led to a decrease in $PaCO_2$. During pressure support ventilation, a decrease in respiratory compliance involves a reduction in Vt due to a decrease of inspiratory flow.

NIV is generally used as a pressure-targeted mode of ventilation, and with modern volume-assured ventilators, it has been noted that IPAPs tend to have to be increased in order to achieve an adequate Vt, commonly targeted at around 10 ml/kg ideal body weight (IBW). In these restrictive diseases, there is not a clear direct and solid associations with Vt, positive pressure setting and IBW. The assessment of IBW in the neuromuscular or kyphoscoliosis patient is different from highly obese patient.

Decreasing EPAP is an alternative to increasing IPAP if measurements of gas exchange during NIV indicate that ventilation is inadequate, but modern NIV ventilators are sufficiently sophisticated to produce estimates of Vt and leak measurement.

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