Early View

Correspondence

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HFNC and non-invasive ventilation: effects on alveolar recruitment-overdistention

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To the Editor

We have read with great interest a study recently published in the European Respiratory Journal Open Research that analyzed the ability of high flow nasal cannula (HFNC) and non-invasive ventilation (NIV) to induce pulmonary expansion in acute hypoxemic respiratory failure (1). We would like to congratulate the authors for their interesting observation using end-expiratory electrical lung impedance as a measuring tool. NIV certainly affects both dependent and non-dependent lung regions, which could increase tidal volume (V\text{T}) >9.5 mL/kg predicted body weight and potentially exacerbate acute hypoxemic respiratory failure. The authors concluded that compared to NIV, HFNC contributes to lower risk of overdistention and fewer deleterious effect on global and regional V\text{T}, because the end-expiratory electrical lung impedance does not increase in non-dependent regions. Other studies, however, argue that HFNC may have similar negative effects to NIV, supported by four well known determinants:

1. V\text{T} and flow rate have relative proportional inter-relationships. Despite the respiratory rate and primary patient modality (mouth versus nose breathing) as possible confounders, V\text{T} still proportionally increases to gas flow under HFNC with p-values as low as 0.001 (2, 3). As such, one can presume that higher amounts of V\text{T} and flow rate may induce overdistention and barotrauma.

2. While HFNC could have a protective effect compared to NIV, the negative swings in pleural pressure secondary to spontaneous inspiratory efforts can contribute to patient self-inflicted lung injury (4). In this paper, the HFNC setting was delivered at a constant flow rate of 50 L per minute. However, previous studies considered an optimal HFNC rate of 60 L per minute, given that there were reduced indices of respiratory effort in adult patients recovering from acute hypoxemic respiratory failure (5).

3. During spontaneous breathing both the V\text{T} and inspiratory flow vary, and when HFNC flow is less than patient inspiratory flow, the patient will inspire atmospheric air. Alternatively, when HFNC flow is sufficiently high, the absolute humidity of inspired gas is unlikely to be a problem. Conditioning of the gas minimizes airway constriction, reduces work of breathing, improves mucociliary function, facilitates secretion clearance, and decreases the incidence of atelectasis, thereby improving the ventilation/perfusion ratio and overall oxygenation (6).

4. The Pendelluft phenomenon also has an effect on V\text{T}. The phenomenon is defined as the displacement of gas from a more recruited non-dependent lung region to a less recruited dependent lung region. Gas flow from the dependent to the non-dependent region is essential in Pendelluft, but the severity of this phenomenon is not always proportional to gas flow. The severity increases as differences in plateau pressure levels increase between the non-dependent and dependent regions, and amplified by differences in their lung mechanics (7).

Flow rate, negative pleural pressure swing, spontaneous inspiratory effort, and the Pendelluft phenomenon are important determinants in HFNC complications. We are not fully convinced that HFNC...
has a greater protective effect compared to NIV relative to lung injury and suggest that more research is needed to confirm the findings reported by Artaud-Macari and co-workers.

References