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Caring for patients at risk of ARDS: the role of driving pressure

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Lung-protective strategies in patients with ARDS on mechanical ventilation (MV) are associated with reduced mortality.[1-3] Adherence to these strategies has improved progressively over the last two decades, because increasing numbers of physicians and respiratory therapists have come to recognize lung protection as the cornerstone of supportive therapy.[4] Lung-protective strategies represent a bundle of interventions to reduce lung injury aggravated by MV itself, known as ventilator-induced lung injury. These strategies usually aim to apply low tidal volumes (4-6 mL/kg of predicted body weight), low plateau pressures (< 30 cmH_2O), and enough PEEP to reach oxygenation goals. The rationale is to avoid lung overdistension and to minimize the mechanical stress imposed on the lungs, which are the primary pathophysiological mechanisms of ventilator-induced lung injury.[5] Recently, airway driving pressure (expressed as the difference between plateau pressure and PEEP) has been proposed as the primary variable that can be targeted in order to avoid lung injury. The idea is that limiting driving pressure can be safer in patients with injured lungs. In such patients, the size of the functional aerated lung can be considerably small, a baby lung, to borrow the term coined by Gattinoni et al.[6] The application of tidal volumes normalized to predicted body weight takes into account the size of the patient but not the size of the baby lung, which ends up being overdistended and overstressed.[7] Driving pressure is nothing more than tidal volume normalized to respiratory system compliance, which has been shown to follow closely the size of the functional lung.[8] A patient-level meta-analysis of trials involving patients with ARDS showed that lower driving pressures were associated with improved survival.[9] More importantly, the survival benefit of protective MV strategies was mediated by driving pressures, not by tidal volume or PEEP.[9]

The role of lung-protective strategies in patients without ARDS is less conclusive.[10] In this issue of the *Jornal Brasileiro de Pneumologia*, Bastos-Netto et al.[11] provide important data regarding the impact of lung-protective strategies in patients without ARDS at baseline who presented with risk factors for the disease. In a cohort of 116 patients on MV, the authors found that patients with maximum distending pressures < 15 cmH_2O had a lower 28-day mortality rate. Maximum distending pressure, a surrogate for driving pressure, was defined as the difference between maximum airway pressure and PEEP. In patients under strictly controlled MV, the difference between maximum distending pressure and driving pressure is simply the resistive pressure. As a result, this difference tends to be small, especially when airway resistance is low or when inspiratory and expiratory flows are both close to zero. In the presence of inspiratory or expiratory effort, maximum distending pressure can considerably underestimate driving pressure. In this scenario, end-inspiratory and end-expiratory airway occlusion maneuvers can be used in order to assess the degree of effort.[12] Interestingly, even when considering these limitations in the use of maximum distending pressures, lung protection was better defined when based on distending pressures than when based on tidal volumes: there was no survival benefit with tidal volumes < 8 mL/kg of predicted body weight. This finding is similar to what was found in patients with ARDS by Amato et al.[9] and suggests that, even in patients without ARDS, attention should be paid to distending pressures, especially in those with risk factors for ARDS.

Bastos-Netto et al.[11] have taken an important step toward a better understanding of the determinants of poor outcomes in patients under MV. As new evidence reveals the importance of driving pressure, we should be able to see more of its effects in unforeseen scenarios.

> *What a man sees depends both upon what he looks at and also upon what his previous visual-conception experience has taught him to see.*
>
> - Thomas S. Kuhn

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