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EDITORIAL

Can regional lung mechanics evaluation represent the next step towards precision medicine in respiratory care?

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Over the last few decades, many randomized clinical trials (RCTs) focused on critically ill patients undergoing mechanical ventilation have showed negative results.[1, 2] This is true for both RCTs testing different mechanical ventilation strategies[3, 4] or pharmacological interventions.[5, 6] Some authors advocate the heterogeneity in patients' responses to intervention as one of the main confounding factors leading to negative RCT.[1, 2] An accurate prediction of individual patient therapeutic responses is necessary to overcome the challenge of patient heterogeneity. In this issue of *Minerva Anestesiologica*, Zhao *et al*.[7] investigated the response to a combination of inhaled corticosteroid and β_2 agonist on patients undergoing mechanical ventilation due to acute exacerbation of obstructive lung disease or severe asthma. The rationale behind the study was that conventional global lung function could not correctly address the response to therapy due to spatial inhomogeneity. Patients were monitored with the electrical impedance tomography (EIT), a non-invasive monitoring tool which allows a breath-to-breath bedside evaluation of pulmonary ventilation. One of the main advantages given by EIT is the ability to evaluate continuously the mechanical properties of different lung regions, otherwise unrecognizable by global respiratory mechanics. Indeed, the assessment of the respiratory system as a whole does not take into account the regional mechanism behavior and may fail to recognize co-existing over inflation and atelectasis.[8-11] This concept is essential in interpreting the results of Zhao *et al.* The authors used EIT-derived parameters to assess the regional end-expiratory flow (EEF), a surrogate of regional air trapping, and they found that the sum of regional flows was comparable to global flow, indirectly proving that regional EEF is a reliable measure. The regional distribution of EEF was characterized by high spatial heterogeneity in both COPD and asthma patients, whereas inhaled corticosteroid and β_2 agonist improved their global EEF in asthmatic but not in COPD patients. Interestingly, the administration of corticosteroids and β_2 agonist in COPD patients leaded to a substantial tendency toward less heterogeneity in regional expiratory flows even without increasing their global expiratory flow. Assuming the concept that physiologic responsiveness should guide the inclusion in clinical trial,[2] patients with high EEF heterogenicity could represent the right COPD population target to test the effect of inhalation therapy. New clinical studies will be performed starting from these new physiological observations.

Additionally, the method proposed by Zhao *et al.* gives the opportunity to monitor the regional

expiratory flow limitation. Expiratory flow limitation (EFL) is a pathological condition characterized by a sharp reduction of expiratory flow associated with worse outcomes both in critically ill patients[12] or in patients undergoing general anesthesia.[13] In mechanically ventilated patients, EFL is usually defined by the lack of increasing in the expiratory flow when PEEP is decreased, also called PEEP test;[13] nonetheless, as stated above for lung mechanics, the PEEP test investigates the lung as a whole, whereas spatial inhomogeneity in air trapping distribution can lead to inhomogeneity of EFL distribution as well. Given that EFL is a condition at least partially reversable, its correct regional assessment represent another potential target to guide therapy, such as PEEP titration, use of bronchodilators and diuretics. One of the limitations of the study was that all measurements were performed at the same tidal volume (8 mL/kg) and PEEP level (5 cmH_2O); thus, future studies are needed to describe whether different mechanical ventilation strategy can affect regional air trapping and regional EFL distribution.

In conclusion, new insights useful for a deeper comprehension of pathophysiology in mechanically ventilated COPD patients are continuously required. Nonetheless, the real challenge is to couple the monitoring precision with personalized and successful treatments. In the future, the spread of EIT-guided regional mechanics evaluation will be strictly related to its ability of carry some benefits in clinical outcomes when compared to classic approaches.

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