Editorial

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Extravascular lung water measurement and airway pressure release ventilation: Is this the final answer for ARDS/ALI patients?

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The acute respiratory distress syndrome (ARDS) and acute lung injury (ALI), are common multi-causal clinical conditions that affect many patients in intensive care units (ICU), with an estimated incidence of 75 per 100,000 population. (1) Traditionally ARDS/ALI are defined by clinical and radiological criteria; these being acute onset of hypoxemia (determined by PaO2/FiO2 ratio) and radiological infiltrates corresponding to pulmonary edema as described by the American-European Consensus Conference (AECC). (2) It's been suggested that new definitions might be necessary to avoid inclusion of an heterogeneous group of patients within a single category and recently an attempt to redefine ARDS was done with "The Berlin Definition". (3) The recent international consensus' new definition would eliminate ALI and classify ARDS into mild, moderate and severe categories. (4) Regardless of the definition used, both are conditions that can be deadly, as they tend to be progressive, with mortality estimates between 30-60% and an expected reduction in quality of life for survivors. (3,5) In order to avoid significant mortality and long-term morbidity, the correct management of these patients requires aggressive, but yet appropriate assisted mechanical ventilation (AMV), as well as a careful consideration of the volume status.

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In an effort to provide such life-saving therapies to patients with ARDS/ALI, a variety of techniques to guide proper ventilator settings have been employed throughout the past 4 decades. From settings including high tidal volumes, PEEP and FiO2 to the most recent ARDSNet trial recommendations (low tidal volume) which successfully reduced mortality by 22% and increased ventilator-free days by reducing stretch induced lung injury, clinicians have been struggling to obtain a reasonable bedside clinical tools to ascertain the effects of AMV in these critically ill patients. (6) Several ventilatory modes are used for these patients. Of them, airway pressure release ventilation (APRV) is gaining clinical interest.

The measurement of extravascular lung water (EVLW) provides insight into the pathophysiological processes that lead to non-cardiogenic pulmonary edema in patients with acute respiratory failure. (7,8) This technique is sometimes used at the bedside in ICUs and requires the application of a thermodilution method, or new non-invasive monitoring technology not widely available and to which most medical personal are not familiar with. (9,10)

The measurement of EVLW can help monitor and adjust AMV settings and identify potential outcomes by measuring the difference between the original EVLW (measured before initiating a particular mode of ventilation) and the resulting changes. (11) In addition, an increasing EVLW and intra-abdominal pressure provide indication of a poor prognosis in these patients. (12)

In this issue of *Critical Care and Shock*, Daoud and coworkers at The Cleveland Clinic Foundation, report the results of an elegant pilot study in which 6 patients with ARDS/ALI underwent measurements of their EVLW at different times during APRV. (11) Using this mode of ventilatory support, these investigators were able to reduce EVLW considerably and improve the PaO2/FiO2 ratio by 47% in just 6 hours of therapy. The authors attributed this significant improvement to increased mean airway pressures. Since all of the patients

survived, the effects on mortality were not assessed.

Those proponents of APRV as a mode of therapy in patients with ARDS/ALI will certainly find the present study interesting. Adding to APRV measurements of EVLW seems to provide according to the present study, an estimation of efficacy of AMV. The authors have shown that simply switching to APRV while on AMV reduced the patient's extravascular lung water index (EVLWI) considerably within the first hour and mPaw was increased which lead to better oxygenation, prevention of lung de-recruitment and consequently led to a better hemodynamic status and lung perfusion, all this independent of fluid management. (11) It would be of interest to see the effects on EVLW when other modes of AMV are utilized.

The measurement of EVLW in this setting is not without flaws. Different assumptions and errors can occur due to the nature of the thermodilution method and lung physiology. Most notable is that the indicator used does not always reach all portions of the lung. This can be secondary to perfusion inequality of the lungs in these patients. It's been estimated that errors in calculations can be over 50% from the actual EVLW depending on lung perfusion, which can lead to serious misinterpretation of the actual condition of the patient. Correlation with other clinical parameters can, however, eliminate some of these assumption errors; for this EVLW measurements are useful in the clinical setting. (13)

We applaud the efforts by Daoud and coworkers in helping us understand the potential use of EVLW measurements when managing patients with ARDS/ALI. Further studies will help elucidate whether or not these measurements will help us reduce mortality as well as long-term pulmonary disability.

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