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Conclusions from Inverse Ratio Ventilation Studied at a Respiratory Rate of Six Breaths per Minute

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To the Editor:

I read with interest the findings on the influence of inspiration to expiration ratio on cyclic recruitment and derecruitment of atelectasis in a saline lavage model of acute respiratory distress syndrome (ARDS) (1). The main conclusion of this study is that “inverse ratio ventilation minimizes cyclic recruitment and derecruitment of atelectasis in an experimental model of surfactant-depleted pigs”.

The experiments were conducted at a respiratory rate of 6 breaths per minute (or even 5 according to Figure 2). Here, for example, the expiratory phase of the respiratory cycle could last up to 8 s when inspiration to expiration ratio is 1:4 (or 8 s inspiration could be observed in I:E of 4:1). These settings were chosen in order “to provoke maximal cyclical recruitment and derecruitment”. According to Table 3 and to the average weight of the piglets, the tidal volume used ranged between 17 (ARDS I:E 1:1) and 22 ml/kg (Baseline).

An $F_{I}O_2$ of 1.0 was used for all measurements “for the direct comparison of PaO_2 oscillations between the different I:E ratios”. As can be seen in Figure 3B, at an I:E of 1:1, this $F_{I}O_2$ led to a mean $PaO_2/F_{I}O_2$ greater than 300 Torr in 6 of the 8 animals studied, and in 2 of these $PaO_2/F_{I}O_2$ was even greater than 400 Torr; average $PaO_2/F_{I}O_2$ was 318 Torr in this condition (Table 1), not fulfilling the diagnostic criteria for mild ARDS (2).

Exploring very low respiratory rates is interesting at a proof of principle level (3, 4), but for the study of the influence of I:E ratios on atelectasis in ARDS, more clinically relevant conditions should be used (5), or the conclusions drawn may be of little clinical relevance. In the experimental conditions considered in this article (1) lung mechanics and physiology would inevitably be very different from a clinical scenario, where greater respiratory rates,

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lower tidal volumes, lower airway pressures, lower mean $\text{PaO}_2/\text{F}_\text{I}\text{O}_2$ would be used. It is possible that the oscillating PaO_2 signal may not be detectable when all these parameters are set to more clinical or physiological values; if so, the interest in inverting the I:E ratio to reduce atelectasis may not be as exciting, especially considering its associated known costs of reducing cardiac output, overdistending the lung and increasing the risk of inflammation.

Of note, and based on my personal experience in using the PaO_2 sensor employed in the study, I find hard to understand the remarkably constant standard deviation values presented in Table 1 (17.3 Torr for PaO_2 oscillations, and 21.1 Torr for mean $\text{PaO}_2/\text{F}_\text{I}\text{O}_2$).

Despite the above limitation, the study (1) presents interesting results on the dependency of cyclical recruitment and derecruitment on ventilation timing in ARDS, which deserve further attention.

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