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LETTER TO THE EDITOR

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Incorporating ventilatory support parameters into the PaO_2/FiO_2 ratio in ARDS patients

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To the Editor,

We read with great interest the study by Palanidurai et al. in which the authors compare the predictive validity for hospital mortality of a new oxygenation index (P/FP) ($P/FP = 10 \times PaO_2/(FiO_2 \times PEEP)$) versus the classical P/F ratio and evaluate changes in severity classification of ARDS from the use of the P/FP rather than the P/F ratio [1]. We totally concur with the notion that the P/F ratio can be significantly improved for superior reflection of ARDS severity and prediction of intensive care unit survival/mortality by incorporating mechanical ventilatory support variables into the P/F ratio. The authors argued that "in general for the same P/F ratio, a patient on a higher PEEP has more severe ARDS than a patient on a lower PEEP" which makes perfect sense. For that reason, they elected to incorporate PEEP to the P/F ratio. However, we can further argue that for the same P/F ratio, a patient on a higher mean airway pressure ($\overline{Paw}$) has more severe ARDS than a patient on a lower $\overline{Paw}$ even when PEEP levels are the same or even irrespective of the PEEP levels. $\overline{Paw}$ not only reflects the applied PEEP during mechanical ventilation but also takes into consideration other important mechanical ventilatory support variables such as inspiration:expiration ratio (I:E) and peak inspiratory and alveolar pressures [2].

Previously, we have described a new oxygenation index, termed oxygenation factor (OF) that incorporates $\overline{Paw}$ and is expressed as:

$$OF = \frac{P/F}{\overline{Paw}} = \frac{P_aO_2}{F_iO_2 \times \overline{Paw}}.$$

As such, the oxygenation factor (OF) will normalize the P/F ratio to the mean airway pressure. Our study showed that the OF is more reliable than the P/F ratio in reflecting intrapulmonary shunt in patients undergoing coronary artery bypass grafting and with no underlying lung diseases [3]. Recently, we published a study in which we compared our oxygenation (OF) to the P/F ratio in 50 ARDS patients with $P/F \leq 100$ mm Hg, 50 ARDS patients with 100 mm Hg $< P/F \leq 200$ mm Hg, and 50 ARDS patients with $200 < OR \leq 300$ mm Hg. Our results showed that the OF is superior to the P/F ratio in reflecting oxygenation in ARDS and results in a different patients' classification for ARDS severity [3].

The study by Palanidurai et al. incorporated only PEEP in the P/F ratio and overlooked other important mechanical ventilatory support parameters such as I:E ratio, and peak inspiratory and alveolar pressures and subsequently the driving pressure. The advantage of incorporating the mean airway pressure ($\overline{Paw}$) rather than PEEP into the P/F ratio such as in our OF index is that $\overline{Paw}$ can be considered a more appropriate modifier for the P/F ratio since it better reflects the mean alveolar pressure and as such reflects not only the applied PEEP but rather most of the mechanical ventilation parameters and settings such as I:E ratio, tidal volume, and/or peak alveolar and driving pressures [4]. Another concern with the Palanidurai

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et al. P/FP ratio is the use of a correction factor of 10. Although the authors provided several justifications for this approach, it remains unclear why the authors did not keep their P/FP index as is [i.e., $P/FP = PaO_2/(FiO_2 \times PEEP)$] and proceeded to assess and evaluate their index for superior reflection of ARDS severity and prediction of survival/mortality without the use of the correction factor. Furthermore, Palanidurai et al. used the Berlin definition's thresholds of ≤ 100, 101–200, and 201–300 to differentiate severe, moderate and mild ARDS, respectively, for both the P/F (mmHg) and the P/FP (mmHg/cmH_2O) ratios. This makes sense only when PEEP is 10 cmH_2O because in such case the P/FP ratio will always be equal to P/F ratio due to the presence of the correction factor 10. What about ARDS patients with different levels of PEEP (i.e., PEEP is not 10 cmH_2O) and will the same thresholds applied in the Berlin definition remain applicable for the new P/FP ratio.

Nevertheless, Palanidurai et al. deserve to be commended for conducting such a valuable study and providing data on a highly needed subject [1]. Both their results and our recently reported results clearly support the concept that multifactorial oxygenation indexes such as the P/FP and OF ratios that incorporate mechanical ventilatory support parameters into the classical P/F ratio are superior indexes to use in mechanically ventilated ARDS patients, particularly for assessing the oxygenation status and the classification of ARDS severity and that these indexes have a greater predictive validity for hospital mortality in ARDS than the P/F ratio [1, 4]. In ARDS patients, oxygenation indexes should be multifactorial and should reflect not only the true illness severity, but also the applied mechanical ventilation strategies.

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