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Acute Hypoxemic Respiratory Failure in Acquired Immune Deficiency Syndrome: Effects of Noninvasive Ventilation: The Highest PEEP May Not Be Best

Acquired immune deficiency syndrome (AIDS) is a severe health problem, and, acute hypoxemic respiratory failure (AHRF) a major complication.[1] Early noninvasive ventilation (NIV) may improve gas exchange and outcome in selected patients during AHRF.[2]

Anjos CF et al[3] describe noninvasive PEEP effects on gas exchange and clinical variables in 30 AIDS patients during AHRF, in randomized sequence. They observed that oxygenation improves linearly with increasing levels of PEEP. We read with great interest the paper and their results. The study confirms previous concepts about NIV effects in AHRF. That is, implementation of incremental PEEP may improve oxygenation, irrespective of causative factors and related with PEEP level (Fig. 2A in Anjos et al[3]). We don't understand what is the authors' expectancy about the application of "sequential PEEP" as it is described. Some issues are very interesting to analyze for their practical implications related to PEEP effects during NIV in AIDS patients with ARDS criteria.

First, the periods during which PEEP is applied may be too short to achieve a complete and effective alveolar recruitment, and zero end-expiratory pressure periods doesn't allow for a sequence effect. It could then be that there is no real "sequential effect" of PEEP with this protocol, and so it is hard to analyze their results.

Second, as the authors describe in Figure 2B, 2C, and 2D, there was a slight elevation of P_{CO_2} levels, with a simultaneous increase in tidal volume and respiratory rate when increasing levels of PEEP. The more reasonable explanation for this finding would be the Haldane effect and the changes in the ventilation/perfusion ratio secondary to improvement in P_{aO_2}.[4]

Third, another interesting aspect not addressed would have been to determine the hemodynamic impact of each level of PEEP. In a recent publication, Lukácsovits et al[5] suggest that, in patients with stable COPD treated with NIV, the application of inspiratory positive airway pressure of 25 cm H_2O and 4 cm H_2O of PEEP allowed for the best arterial blood gas results, but was simultaneously associated with a substantial reduction of the cardiac output, so the hemodynamic effects of PEEP levels of 10–15 cm H_2O are important additional issues and probably have a prognostic value in this group of patients.

We agree that a PEEP strategy clearly improve oxygenation indexes in AHRF in AIDS patients, in relation to the level of PEEP applied. Further studies should take into account these potential effects in selected patients, and it is necessary for a prudent practice recommendation of best PEEP during NIV.

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The authors respond:

We thank Dr Esquinas et al for the interest in our study[1] and for the questions raised. They questioned our expectancy over the application of sequential higher PEEP in AIDS patients with hypoxemic respiratory failure. When applying a stepwise alveolar recruiting maneuver in ARDS patients, the mass of collapsed lung tissue and the oxygenation improve substantially higher than a single 40 cm H_2O/40 second recruiting maneuver.[2] Our explanation for this fact is the alveolar overdistention in some areas in the heterogeneously injured lungs, causing alveolar collapse through the different compliance alveolar interactions.[3-5] Furthermore, there is the possibility of time-dependent alveolar recruitment using low pressures.[6] Moreover, we hypothesized that a stepwise elevation of noninvasive applied relative low PEEPs could be effective in improving hypoxemia.

Dr Esquinas et al also addressed the insufficient time to achieve the complete and effective alveolar recruitment. We agree with Dr Esquinas et al, and, furthermore, complete alveolar recruitment in patients presenting such severe acute hypoxemia will probably be reached after the application of higher pressures than those applied in our study. However, the goal of noninvasive ventilation in this setting is not to reach the complete alveolar recruitment, but the necessary alveolar patency to improve the severe hypoxemia and the patient's respiratory distress. In this way, our result allows the conclusion that improvement of the patient's hypoxemia seems to occur faster when applying a stepwise progressive elevation of PEEP. A given patient undoubtedly can improve the hypoxemia receiving a higher and static PEEP for more than 20 min.

Their next question concerned the absence of a real sequence effect of progressively higher PEEPs applied with a washout period of 20 min. The rationale for this step, in our study, was that, in spite of massive alveolar derecruitment that happens in ARDS patients when suddenly lowering high pressures in the presence of $F_{IO_2} = 1.0$,[2] when lowering PEEP from 14 to 5 cm H_2O using an F_{IO_2} of 0.6, even using low tidal volumes, the loss of aeration is minimal within an interval of 30 min in ARDS patients.[7] We used extrinsic PEEP values $\leq$ 15 cm H_2O alternated with PEEP = 0 cm H_2O through the native airway (keeping the natural expiratory pressurization of the trachea). In this situation, the loss of aeration is not expected to be high in a 20-min interval.

Regarding the P_{aCO_2} rising during the PEEP elevation, they suggest that a more reasonable explanation of this fact is the Haldane effect and the changes in the ventilation/perfusion ratio secondary to the oxygenation improvement. We congratulate Dr Esquinas and co-authors for the idea, and totally agree that such physiological considerations are one of the factors contributing to the P_{aCO_2} rising in this situation.

Their final comment was on the hemodynamic impact of each level of PEEP. The available data about hemodynamics of our study were shown in our Table 2,[1] in which we can observe the stability of mean arterial pressure and the fall of the heart rate during the exposure to progressively higher PEEPs. Therefore, the double product was felt, showing the possibility of a reduction in myocardial consumption of oxygen. The hemodynamic safety of noninvasive support in our study seems similar to other physiological studies about noninvasive mechanical ventilation.[8,9]

Our study was designed to explore relevant pulmonary physiological characteristics of AIDS patients with hypoxemic respiratory failure at bedside, creating the possibility of noninvasive respiratory support optimization.

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