No more, no less: just the right one

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Dear Sir,

We have read with great interest the article published by Gattinoni et al [1] called "Less is More in Mechanical Ventilation". Unfortunately, we do not agree with their generic recommendation to "avoid using high PEEP levels". In mechanical ventilation of ARDS, very poor oxygenation has a very high mortality [2] and the use of PEEP aims to maintain acceptable arterial oxygenation, as stated by the authors. The adequate programming of the ventilator for ARDS patients should be based on improving oxygenation but, at the same time, must be directed towards avoiding damage associated with the ventilator (VILI).

In trying to overcome the refuted theories of barotrauma, volutrauma or atelectrauma, other hypotheses have been proposed which can predict with greater precision the factors involved in the production of VILI. Thus, Amato proposed the use of "driving pressure" (DP) [DP = Pplat - PEEPtotal] as the main objective to reduce VILI and mortality. DP greater than 15 cmH2O has been associated with an increase in mortality in patients with ARDS [3]. On the other hand, *ergotrauma theory*, based on rheology and material science, attempts to explain VILI and "Self-Induced Lung Injury" (SILI) as a fatigue phenomenon of a viscoelastic material. For this hypothesis the concepts of stress, strain and strain rate are relevant. And, in addition to DP and PEEP, dynamic magnitudes such as respiratory rate and flow would be involved. It does not seem so surprising that in the analysis of the Lung Safe cohort the respiratory rate independently marked mortality. Within this conceptual framework, Gattinoni proposes "mechanical power" [MP] as the most relevant variable, since it integrates the main parameters involved into a single measurement. The higher the MP, the higher the mortality [4].

It is important to understand that PEEP plays a relevant role in both paradigms. Since the compliance curve has a sigmoid shape, PEEP can place the lung in the zone of maximum compliance. Thus, high PEEP values correspond to DP of lesser magnitude, which would reduce mortality according to the first theory. On the other hand, according to the rheological theory, PEEP manages to increase the lung volume at the end of expiration (EELV), reducing the strain and the strain rate and therefore reducing the global stress that the lung tissue supports. In some animal experiments the use of PEEP was able to minimize VILI and mortality [5]. And according to the MP formula, only if we set high PEEP and low Tidal Volume to move within the area of perfect lung elasticity, the use of low respiratory rates (permissive hypercapnia) can minimize the MP, since using low flow the peak pressure decreases much like the DP.

Therefore, in mechanical ventilation of ARDS as regards PEEP "less is NOT more". Personalising treatment should be advocated according to the pulmonary characteristics of each patient, improving their oxygenation but minimizing the damage that this produces. In conclusion PEEP programming cannot be carried out based on a generic algorithm or protocol. No more, no less: just the right one.

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Conflicts of interest
The authors declare that they have no competing interests.