

Reply to “Materials engineering, mechanical power, protective ventilation and a parachute”[☆]



Respuesta a «Ingeniería de materiales, mechanical power, ventilación protectora y una de paracaídas»

Dear Editor:

We have read with great interest the letter sent by Escudero-Acha et al.¹ on our paper² published in your journal. We could not agree more with the authors.

After years of cumulative wisdom in his productive life, Bertrand Russell,³ Nobel prize laureate, recommended the scientists of future generations to: “Look only and surely at what are the facts”. When it comes to the use of mechanical ventilation for the management of acute respiratory distress syndrome (ARDS), the facts derived from human experimentation confirm that mortality drops⁴ only if:

1. The patient is intubated and, after being on NIV for an hour, never achieves proper lung recruitment (measured as $\text{PaO}_2/\text{FiO}_2 > 175$).
2. The patient is ventilated under supervision and medication is withdrawn during the first two days.
3. The patient is administered 6–7 mL/kg of tidal volume.
4. The patient is administered oxygen at $\text{FiO}_2 < 0.6$.
5. Negative fluid balance is measured.
6. End-expiratory atelectasis and end-inspiratory overdistension is avoided during mechanical ventilation by using initial PEEP levels between 12 and 17 cmH₂O and by adjusting the PEEP levels to achieve proper lung recruitment (maximum compliance and $\text{PaO}_2/\text{FiO}_2 > 160$).
7. The prone position is used in patients with severe derecruitment ($\text{PaO}_2/\text{FiO}_2 < 160$).
8. No inhaled nitric oxide is used except in the presence of intracardiac shunt or impaired hypoxic pulmonary vasoconstriction reflex.
9. Mechanical ventilation-induced pneumonia is avoided.
10. Respiratory ECMO is used when all strategies implemented for 24–72 h have failed.

This lung-protective strategy has proven cost-effective too.⁵ Other than this, the rest is just unfounded speculation.

The letter sent by Escudero-Acha et al. insists on the importance of making a case for the science of the technique, an issue extremely well developed by Richard Feynman in his famous CalTech conference on the “cargo cult science”.⁶ Basically we agree with them in that to cure our patients we don’t need to always use the latest medical-surgical technology available to us, but

instead implement this technology adequately. If we don’t guide ourselves by the knowledge generated from rigorous experimentation we will remain as unable to predict the future as the shamans from the ancient world with their curve handle canes or animal bowels.⁷ If we don’t do this it won’t matter how much more advanced, sophisticated, and expensive our modern tools are (ultrasound, positron-emission tomography, high flow nasal cannulas, high frequency ventilators, robotic surgeons, CAR-T cells modified through genetic engineering, monoclonal antibodies, etc.).

Please let us state here that the goal of our papers was no other than to find one undisputed theory on mechanical ventilation-induced lung injury (MVILI), that is, a system with conceptual relations capable of explaining both the facts of former studies and the new facts that former theories were unable to explain. For the time being rheology seems to be meeting the expectations.

Using the same example proposed by the authors, it is not about jumping off the plane without the parachute,⁸ but using it at the right time during the fall.⁹ It is all about using this very expensive technique, ECMO, with maximum expertise and excellence. Science has to actually tell us what the optimal moment is in the progression of ARDS for ECMO to reduce mortality and with costs falling within the limits of efficiency. Anything else is cargo cult science.¹⁰

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