Comments on "Post severe COVID-19 infection lung damages study. The experience of early three months multidisciplinary follow-up" by De Michele *et al.*

Cardiopulmonary impairment related to the ARDS-COVID-19: insights about monitoring post-infection recovery

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Dear Editor,

We read the original study by De Michele *et al*. titled "Post severe COVID-19 infection lung damages study. The experience of early three months multidisciplinary follow-up" with great interest [1]. The authors evaluated the survivors of COVID-19 acute respiratory distress syndrome (ARDS) requiring noninvasive respiratory support admitted to a Respiratory Intensive Care Unit. Despite the limitations mentioned by the authors, we consider this a very interesting study. However, there are some variables in this study that needs to be analyzed.

1. It is necessary to have a better definition for the terminology "critical time to measurement" to understand the "cut-off pressure" of 11 cm of water and pulmonary artery pressure in the long term effect. The authors consider that a cut-off pressure of 11 cm of water of expiratory positive airway pressure or continuous positive airway pressure applied at the airways during admission correlated to the increase in the main pulmonary artery diameter. This association is very original and interesting, but more information is required here about other factors that could contribute to the critical period and need to be evaluated [2].
   Briefly, we suggest the following parameters which also needs to be analyzed:
   a) Association with the duration of this continuous positive airway pressure/expiratory positive airway pressure setting and if we know in clinical practice that the pressure setting could change during almost the first two days.
   b) Duration of treatment with this pressure setting in terms of days or hours during first-time admission in the respiratory intensive care unit.
   c) Best time for measurement and graduate the severity of hypoxemia (PaO2/FiO2 ratio).
   d) Presence of other pulmonary disorders that can contribute to pulmonary hypertension: 7 patients were obese, 19 patients were overweight, 5 had chronic heart failure, 3 had obstructive sleep apnea syndrome, 1 had asthma and 1 had chronic obstructive pulmonary disease. All these conditions are potentially associated with the development of pulmonary hypertension, especially during a viral exacerbation.
   e) Role of transmural pressure in the pathophysiology. The authors mentioned that this mechanism has a great role to increase in pulmonary vascular pressure/resistance and indirectly on right ventricular function. In this sense, it would be advisable to know the measurement of tidal volume during this study.
   f) Echocardiographic follow-up and impact on right heart overload. This is further confirmed by the increased right atrium area which significantly correlated to the maximal expiratory positive airway pressure or continuous positive

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airway pressure (p-value = 0.09). It is not clear if the findings were reversible or static.

g) Pulmonary embolism. The subgroup of patients with pulmonary embolism and increased pulmonary hypertension would require meticulous analysis. From table 1 all patients at the time of hospitalization had Prothrombin Time and International Normalized Ratio (mean ± standard deviation) of 3.98 ± 16.43. This value is over a standard range to treat a pulmonary embolism and could be influenced the results of this study.

These aspects could allow a better understanding of this complex pathophysiology and time-precision about the best "critical period" to perform prevention and treatment.

2. Usefulness of lung-ultrasound. The authors consider the reliability of lung-ultrasound for a correct evaluation of severity [3]. The authors performed a new computerized tomography pulmonary angiography to better assess the level of pulmonary vascular involvement. This information could be more sensible than lung-ultrasound and would change 3 months from the admission.
3. ARDS severity-grading and cardiopulmonary findings. In this line, the subgroup of patients with the highest severity of ARDS-moderate and severe in this study is a group that may present with greater cardiopulmonary deterioration (main pulmonary artery diameter + cut-off of expiratory or continuous positive pressure of 11 cm of water). In the discussion, it is not clear if the deterioration persists, or this finding persists after 3 months of evaluation.
4. Dermatology findings: The authors described severe alopecia in COVID-19 survivors and their relationship with the interface used. However, knowing that there is a diversity of face, face mask interface models, or helmets, it would be advisable to know the type of interface and the nursing care protocol applied for the tight mask head support in this study. No mention is made of the head areas most affected by alopecia and whether these correspond to the areas of pressure exerted by the mask head support. The type, amount, and location of the hair loss are poorly investigated in adult survivors of critical illness and especially in those that are treated with noninvasive ventilation. Further research is warranted.
5. Other information such as respiratory function, exercise capacity, and a psychological evaluation is also important and is of interest to understand the situation holistically.

Further clinical trials need to evaluate these interesting observations.

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