Preface for the special series on "Management of COVID-19 in ICU: What's New A Year Later?"

In 2020, the coronavirus pandemic brought about dramatic changes to our daily lives. Millions of people were infected with severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), the pathogenic agent of coronavirus disease 2019 (COVID-19). Some patients required hospital admission, and the most severe cases required admission to the intensive care unit (ICU). Hospitals needed to reorganize their wards, and at the peak of pandemic many ICUs experienced bed shortages (1). In this preface, we would like to comment on the three articles published in *Journal of Public Health and Emergency* discussing the management of COVID-19 patients in the ICU.

In the first manuscript, Dr. Divella investigates the mechanisms underlying acute and chronic pain in COVID-19, and stresses how systemic inflammation and cytokine storm were critical players in its pathophysiology, especially in patients with moderate to severe symptoms (2). Dr. Divella also emphasizes that pain was reported across the entire disease spectrum, with headache, myalgia, and arthralgia being the most frequent symptoms in the acute phase of COVID-19. At the height of the pandemic, the number of people in the population suffering from chronic pain also increased due to the pandemic's impact on healthcare systems, which had to postpone or cancel all elective surgical procedures, including pain management services and surgical procedures such as total joint arthroplasty. Other forms of non-COVID-19-related chronic pain also increased during the pandemic due to the impact of COVID-19 on the healthcare systems, which had to postpone or cancel all elective surgical procedures, including pain management services and surgical procedures such as total joint arthroplasty. Pain suffered in the ICU also had negative impacts on patient quality of life, as was recently demonstrated by our group (3). Moreover, the pandemic demonstrated that a significant number of patients contracting COVID-19 went on to exhibit long-term effects, known as post-COVID conditions (PCC) or long-COVID. The symptoms, which cannot be explained by other causes, (usually) start within three months of infection and generally last for months (4). At the present time, with the bulk of the pandemic behind us, evidence shows that being fully vaccinated reduces the risk of developing long-COVID (5).

The second manuscript addresses the use of prone positioning as a critical rescue maneuver in the fight against COVID-19. As described by Dr. Lassola, prone position proved to be essential for improving oxygenation and reducing mortality in COVID-19 acute respiratory distress syndrome (C-ARDS). It improves resting lung volume in the dorso-caudal regions by reducing the superimposed pressure of the heart and the abdomen (6). The prone position also improves ventilation/perfusion mismatch, with perfusion remaining preferentially distributed in the dorsal lung regions with more homogeneous aeration of the alveolar units. A PaO_2/FiO_2 value below 150 mmHg, measured with a positive end-expiratory pressure (PEEP) level of at least 5 mmH_2O, represents a reasonable criterion for prone positioning in C-ARDS, with the goal of minimizing ventilation damage in the early phase. In cases of severe hypoxemia, this maneuver is unanimously considered a life-saving therapy, especially when performed by expert and standardized teams. Indeed, the most recent trials revealed a positive relationship between longer durations of pronation and favorable outcomes (PROSEVA study) (7). Other promising results suggest that the prone position can even be used in patients suffering from acute hypoxemic respiratory failure due to COVID-19 and in those receiving non-invasive respiratory support, such as high-flow nasal cannula and helmet non-invasive ventilation (NIV), for at least eight hours a day (8).

Finally, the third article addresses the use of ultrasound in COVID-19. Maringelli *et al.* explored the role of lung, heart, vascular, and diaphragm ultrasound in COVID-19 patients with cardiovascular instability and assessed the associated complications (9). The benefits offered by ultrasound during the pandemic were enormous, with lung ultrasound quickly identifying COVID-19 interstitial pneumonia at home. It was also a valuable tool for monitoring patient complications in the ICU. Although lung ultrasound cannot replace the computed tomography (CT) scan, its use was fundamental during the height of the pandemic. For instance, Dr. Roberto Cosentini, head of the Emergency Department at the main hospital in Bergamo, Italy (the Province of Bergamo was one of the most stricken by the epidemic), mentioned that they were receiving up to 60–80 COVID-19 admissions per day, most of which were concentrated in afternoon (10). It was, therefore, impossible to obtain a CT scan for each patient. By consequence, ultrasound became the most used diagnostic tool for COVID-19. Cardiac ultrasound was used in COVID-19 patients to look at the direct involvement of cardiac function, myocardial depression and pericardial effusion, or in patients with prolonged ventilation to demonstrate ventilator-induced diaphragm dysfunction after prolonged mechanical ventilation and weaning failure (11-14). Furthermore, due to the thrombotic

tendency of COVID-19 patients, vascular ultrasound was used to exclude deep venous thrombosis.

We would like to conclude this editorial by honoring one of the authors of this last article, who sadly passed away last September. Prof. Nicola Brienza was an esteemed colleague and great friend. He will be deeply missed. Critical care medicine has lost one of its true leaders.

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