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See Article page XXX.

Commentary: Coronavirus disease 2019 (COVID-19): The long (term) and short (term) of it

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As the coronavirus disease 2019 (COVID-19) pandemic rages onward and providers become more facile with management of these complex and critically ill patients, we have had an increasing number of patients survive their acute insult. However, the natural history of these patients on discharge from the hospital remains unknown, with limited data on long-term outcomes for survivors, especially those requiring extracorporeal membrane oxygenation (ECMO). Postintensive care syndrome (PICS) refers to the new or worsening physical, cognitive, or mental health impairments arising beyond the acute hospitalization in survivors of critical illness.¹ With the widespread effects of COVID-19 and high rate of critical illness, it is important we characterize and address the possible need for supportive care in the months following hospital discharge.

Taylor and colleagues,² through formation of the Outcomes and Recovery After COVID-19 Leading to ECMO (ORACLE) collaboration, have done just that by analyzing a multitude of outcomes among intensive care unit (ICU) COVID-19 survivors post-hospital discharge. This multi-institutional, retrospective study identified 308 patients with COVID-19 acute respiratory distress syndrome during the first wave of the pandemic. In total, 262 patients required solely mechanical ventilation, with 46 requiring venovenous (VV)-ECMO. Uniquely, post-hospitalization



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CENTRAL MESSAGE

Severe COVID-19 infection is associated with high rates of neurocognitive, psychiatric, and physiologic decline in the months following hospital discharge regardless of need for ECMO.

outcomes were measured up to 120 days following discharge via specialized post-ICU recovery clinics. The investigators used validated instruments for measuring anxiety, depression, cognitive dysfunction, and post-traumatic stress disorder to best characterize the psychological, cognitive, and emotional effects of their prolonged ICU course.

When analyzing groups, the authors found that patients cannulated for VV-ECMO were significantly younger, with fewer comorbidities than those patients receiving only ventilator support. These patients also traveled farther and, on presentation, had a significantly lower partial pressure of oxygen. In short, the ECMO cohort had more severe disease but perhaps given their relative health before intervention, they may have possessed a larger reserve for recovery from their critical illness. In addition, there may have been an earlier trigger for VV-ECMO use or transfer to an ECMO capable facility in younger patients, as they would likely demonstrate the most benefit from cannulation based on Extracorporeal Life Support Organization recommendations.³

ECMO, although life-saving, is not without risks. Those cannulated experienced significantly more complications such as bleeding or thrombotic events, which are common in patients receiving ECMO and patients with

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COVID-19.⁴ They also spent a longer time intubated, developed significantly more superimposed bacterial infections, and had a longer length of stay. Yet, despite all of this, patients receiving ECMO had similar survival to discharge. The overall survival of nearly 70% in the ECMO cohort is also impressive, as previous studies have demonstrated worse outcomes in VV-ECMO use in COVID-19 and other etiologies of acute respiratory distress syndrome.⁵⁻⁷

What about the long of it? The authors hypothesized that, long term, ECMO survivors would have worse post-hospitalization outcomes. To our surprise, they fared similarly to patients only requiring mechanical ventilation despite more in-hospital complications and a longer length of stay. However, the rate of cognitive dysfunction, depression, anxiety, or post-traumatic stress disorder was astonishingly high in both groups, and possibly an underestimate, given test administration via clinician discretion. Physiologically, one quarter of patients still required supplemental oxygen, and one nearly half of those with incentive spirometer testing had an abnormal result. It is evident that survivors of COVID-19 critical illness face a myriad of complications after leaving the hospital. Conceivably, the use of post-ICU recovery clinics may be the key to identifying and mitigating these complications from PICS.

This paper gives us a glimpse into the recovery these patients face after hospital discharge and the ensuing

neurocognitive and psychological aspects of ICU COVID-19 survivors, a metric not commonly addressed. The institutions involved in the ORACLE collaboration uniquely possessed a post-ICU recovery clinic of multidisciplinary providers to best identify PICS. All patients with COVID-19 surviving a prolonged ICU stay may benefit from comprehensive follow-up to identify and address these long-term complications.

References

1. Colbenson GA, Johnson A, Wilson ME. Post-intensive care syndrome: impact, prevention, and management. *Breathe (Sheff)*. 2019;15:98-101.
2. Taylor L, Rove JY, Jolley A, Ramani C, Mayer K, Etchill A, et al. Early post-hospitalization recovery after extracorporeal membrane oxygenation in survivors of COVID-19. *J Thorac Cardiovasc Surg*. XXX, 2021 [Epub ahead of print].
3. Badulak J, Antonini MV, Stead CM, Shekerdemian L, Raman L, Paden ML, et al. Extracorporeal membrane oxygenation for COVID-19: updated 2021 guidelines from the Extracorporeal Life Support Organization. *ASAIO J*. 2021;67:485-95.
4. Ripoll B, Rubino A, Besser M, Patvardhan C, Thomas W, Sheares K, et al. Observational study of thrombosis and bleeding in COVID-19 VV ECMO patients. *Int J Artif Organs*. 2021:391398821989065.
5. Combes A, Hajage D, Capellier G, Demoule A, Lavoue S, Guervilly C, et al. Extracorporeal membrane oxygenation for severe acute respiratory distress syndrome. *N Engl J Med*. 2018;378:1965-75.
6. Rozenecwajg S, Pilcher D, Combes A, Schmidt M. Outcomes and survival prediction models for severe adult acute respiratory distress syndrome treated with extracorporeal membrane oxygenation. *Crit Care*. 2016;20:392.
7. Barbaro RP, MacLaren G, Boonstra PS, Iwashyna TJ, Slutsky AS, Fan E, et al. Extracorporeal membrane oxygenation support in COVID-19: an international cohort study of the Extracorporeal Life Support Organization Registry. *Lancet*. 2020;396:1071-8.