See Article page 212.

Commentary: Respiratory failure in patients with Coronavirus Disease 2019 infection: Can extracorporeal membrane oxygenation help?

Victor A. Ferraris, MD, PhD

In the current issue of the *Journal*, Hayanga and colleagues¹ describe evolving approaches to the use of extracorporeal membrane oxygenation (ECMO) for treatment of advanced Coronavirus Disease 2019 (COVID-19) infections in patients with respiratory failure. ECMO can be used to treat patients with severe, refractory adult respiratory disease syndrome (ARDS) from viral pneumonia and a variety of infectious agents. However, the exact role and timing of ECMO for COVID-19 patients with respiratory failure remain unclear. ECMO may improve survival in certain patients with COVID-19 with intractable respiratory failure, but patient selection and procedure outcomes need better definition. Clinical findings suggest that ARDS from influenza is different than ARDS associated with COVID-19. In one study, crude in-hospital mortality was significantly higher in a COVID-19 cohort with respiratory failure compared with a patient cohort with influenza-related respiratory failure (65.6% [n = 21/32] vs 36.3% [n = 11/28], $P = .041$).² The adjusted hazard ratio over 60 days for patients with COVID-19 was 2.81 (95% confidence interval [CI], 1.07-7.35) after adjusting for age, race, ECMO-associated organ failure, and Charlson Comorbidity Index. These preliminary findings with a fairly large patient cohort suggest that COVID-19 respiratory failure may have some unique features that portend worse outcomes from ARDS compared with other infectious agents.

From the Division of Cardiothoracic Surgery, Lexington VA Medical Center & University of Kentucky, Lexington, Ky.

Disclosures: The author reported no conflicts of interest.

The *Journal* policy requires editors and reviewers to disclose conflicts of interest and to decline handling or reviewing manuscripts for which they may have a conflict of interest. The editors and reviewers of this article have no conflicts of interest.

Received for publication Nov 2, 2021; revisions received Nov 2, 2021; accepted for publication Nov 3, 2021; available ahead of print Nov 8, 2021.

Address for reprints: Victor A. Ferraris, MD, PhD, Lexington VA Medical Center & University of Kentucky, Department of Surgery, Room B504, 1101 Veterans Dr, Lexington, KY 40502-0284 (E-mail: ferraris@uky.edu or Victor.Ferraris@va.gov).

J Thorac Cardiovasc Surg 2023;165:219-20
0022-5223/\$36.00

Copyright © 2021 by The American Association for Thoracic Surgery
<https://doi.org/10.1016/j.jtcvs.2021.11.003>

COVID-19 image.

CENTRAL MESSAGE

ECMO is an established supportive adjunct for patients with severe refractory ARDS from infectious pneumonia. However, the exact role and timing of ECMO for patients with COVID-19 and respiratory failure remain unclear but are evolving.

To be fair, not all studies suggest differences in patient outcomes from respiratory failure between influenza and COVID-19 infections. In one study, 35 patients with ARDS were selected for venovenous ECMO support out of 1849 adult patients in the intensive care unit with COVID-19 infection (1.9% incidence; 95% CI, 1.3-2.6).³ This represents 46 (95% CI, 34-61) expected patients on venovenous ECMO per 100,000 patients with COVID-19 and respiratory failure.⁴ In this study, there was no significant difference in survival between patients with COVID-19-related ARDS and influenza-related ARDS. It is likely that the criteria for ECMO in this study differed significantly compared with other reports of the use of ECMO for COVID-19 respiratory failure. For example, another contemporary study evaluated ECMO outcomes in patients with refractory ARDS associated with COVID-19 compared with respiratory failure from non-COVID-19 causes.⁵ This study found no differences in outcomes between COVID-19-related respiratory failure treated with ECMO compared with patients without COVID with refractory respiratory failure from multiple causes. This study emphasized the early use of ECMO in refractory respiratory failure in patients with COVID-19, especially because delay in institution of ECMO was nearly always fatal in this study.

It seems likely that as more experience with refractory COVID-19 respiratory failure is gained, then other advanced supportive options beyond venovenous ECMO

will be used. As experience with ECMO in patients with COVID-19 expands, there is a suggestion that venovenous ECMO may not provide the best supportive option in some patients with COVID-19. One study found that 14 patients with COVID-19 and respiratory failure out of a cohort of 78 patients with COVID-19–related ARDS required conversion of venovenous ECMO to venoarterial ECMO or to hybrid ECMO.⁶

Likewise, there may be other non-ECMO interventions that will modify COVID-19 infections and improve outcomes associated with advanced interventions like ECMO. For example, there is a trial ongoing that will evaluate the efficacy of cytokine adsorption in patients with COVID-19 as an adjunct to limit progressive organ damage from advanced COVID-19 infections.⁴ This type of adjunctive therapy during ECMO support may limit organ damage during aggressive support with other measures like ECMO. It seems likely that better definition of indications for, and choice of, supportive options for complicated COVID-19 respiratory failure will surface as experience evolves.

Given the current state of our knowledge of the treatments for respiratory failure in patients with COVID-19, it seems

likely that better treatment algorithms and possibly better use of advanced supportive options will surface as the pandemic progresses. At present, further critical well-designed studies are needed to supplement existing knowledge.

References

1. Hayanga JWA, Chatterjee S, Kim BS, Merritt-Genore HM, Milewski RCK, Haft JW, et al. Venovenous extracorporeal membrane oxygenation in patients with COVID-19 respiratory failure. *J Thorac Cardiovasc Surg.* 2023;165:212-7.
2. Raff LA, Reid TD, Johnson D, Raff EJ, Schneider AB, Charles AG, et al. Comparative outcomes between COVID-19 and influenza patients placed on veno-venous extracorporeal membrane oxygenation for severe ARDS. *Am J Surg.* April 20, 2021 [Epub ahead of print]; <https://doi.org/10.1016/j.amjsurg.2021.04.004>
3. Jackel M, Rilinger J, Lang CN, Zotzmann V, Kaier K, Stachon P, et al. Outcome of acute respiratory distress syndrome requiring extracorporeal membrane oxygenation in Covid-19 or influenza: a single-center registry study. *Artif Organs.* 2021;45:593-601.
4. Bergman ZR, Wothe JK, Alwan FS, Dunn A, Luszczek ER, Lofrano AE, et al. The use of venovenous extracorporeal membrane oxygenation in COVID-19 Infection: one region's comprehensive experience. *ASAIO J.* 2021;67:503-10.
5. Kurihara C, Manerikar A, Gao CA, Watanabe S, Kandula V, Klonis A, et al. Outcomes after extracorporeal membrane oxygenation support in COVID-19 and non-COVID-19 patients. *Artif Organs.* October 25, 2021 [Epub ahead of print]; <https://doi.org/10.1111/aor.14090>
6. Suwalski P, Staromlynski J, Braczkowski J, Bartczak M, Mariani S, Drobinski D, et al. Transition from simple V-V to V-A and hybrid ECMO configurations in COVID-19 ARDS. *Membranes (Basel).* 2021;11:434.