period covering a larger geographic area are needed in the future to further explore these relationships between care fragmentation and COPD exacerbations.

In summary, we found that care fragmentation is associated with a greater chance of experiencing COPD exacerbations. These findings emphasize the importance of sharing data across healthcare systems and improving the primary care provider–patient relationship so that patients can benefit from a more continuous healthcare relationship. ■

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References

1. Liu CW, Einstadter D, Cebul RD. Care fragmentation and emergency department use among complex patients with diabetes. *Am J Manag Care* 2010;16:413–420.
2. Frandsen BR, Joynt KE, Rebitzer JB, Jha AK. Care fragmentation, quality, and costs among chronically ill patients. *Am J Manag Care* 2015;21: 355–362.
3. Walunas TL, Jackson KL, Chung AH, Mancera-Cuevas KA, Erickson DL, Ramsey-Goldman R, *et al.* Disease outcomes and care fragmentation among patients with systemic lupus erythematosus. *Arthritis Care Res (Hoboken)* 2017;69:1369–1376.
4. Rinne ST, Resnick K, Wiener RS, Simon SR, Elwy AR. VA provider perspectives on coordinating COPD care across health systems. *J Gen Intern Med* 2019;34:37–42.
5. Swanson JO, Vogt V, Sundmacher L, Hagen TP, Moger TA. Continuity of care and its effect on readmissions for COPD patients: a comparative study of Norway and Germany. *Health Policy* 2018;122:737–745.
6. Kho AN, Hynes DM, Goel S, Solomonides AE, Price R, Hota B, *et al.*; CAPriCORN Team. CAPriCORN: Chicago area patient-centered outcomes research network. *J Am Med Inform Assoc* 2014;21:607–611.
7. Kho AN, Cashy JP, Jackson KL, Pah AR, Goel S, Boehnke J, *et al.* Design and implementation of a privacy preserving electronic health record linkage tool in Chicago. *J Am Med Inform Assoc* 2015;22:1072–1080.
8. Yayan J, Rasche K. Asthma and COPD: similarities and differences in the pathophysiology, diagnosis, and therapy. In: Pokorski M, editor. Respiratory medicine and science: advances in experimental medicine and biology. Switzerland: Springer International Publishing; 2016. pp. 31–38.
9. Ko FW, Chan KP, Hui DS, Goddard JR, Shaw JG, Reid DW, *et al.* Acute exacerbation of COPD. *Respirology* 2016;21:1152–1165.
10. Halpin DMG, Criner GJ, Papi A, Singh D, Anzueto A, Martinez FJ, *et al.* Global Initiative for the Diagnosis, Management, and Prevention of Chronic Obstructive Lung Disease: the 2020 GOLD Science Committee report on COVID-19 and chronic obstructive pulmonary disease. *Am J Respir Crit Care Med* 2021;203:24–36.
11. Eisner MD, Blanc PD, Omachi TA, Yelin EH, Sidney S, Katz PP, *et al.* Socioeconomic status, race and COPD health outcomes. *J Epidemiol Community Health* 2011;65:26–34.
12. Woo H, Brigham E, Allbright K, Ejike C, Galiatsatos P, Jones M, *et al.* Racial segregation and respiratory outcomes among urban black residents with and at risk of chronic obstructive pulmonary disease. *Am J Respir Crit Care Med* 2021;204:536–545.

Transvenous Phrenic Nerve Stimulation in Patients Who Are Difficult to Wean

To the Editor:

This letter is in response to a *Journal* article by Dres and colleagues (1). The authors have done a commendable study to evaluate the role of phrenic nerve stimulation in patients with presumed diaphragmatic dysfunction. However, I have a few concerns and suggestions related to the methodology and interpretation of the finding of this study.

The exhaustive exclusion criteria did not rule out clinicopathologic factors other than diaphragmatic dysfunction, which could have hindered liberation from the mechanical ventilation (2). The differential distribution of lung collapse, atelectasis, lung fibrosis, diastolic dysfunction, and pulmonary hypertension in the control and treatment arm could have affected the outcomes. Lung ultrasound-based aeration score and diastolic dysfunction parameters can help predict failed weaning (3). Assessment of ventilation, perfusion, and regional variation in aeration by electrical impedance tomography could have led credential to this study. Of note, in this study population, there were several risk factors for diastolic dysfunction present, including old age, smoking, hypertension, diabetes, hypercholesteremia, and coronary artery disease. In the study design, patients with overt congestive heart failure were to be excluded; however, the authors reported congestive heart failure in 9% of patients and valvular heart disease in 19% of patients in the treatment arm. The extent and severity of valvular heart disease and congestive heart failure in the treatment and control arm could have affected the weaning from ventilation. The exclusion of congenital heart disease and inclusion of valvular heart disease in this study is indeed surprising. In fact, both these cardiac diseases may lead to congestive lung pathology because of congestive heart failure, volume overload, elevated pulmonary capillary wedge pressure, or excessive pulmonary blood flow (4).

The difference in maximum inspiratory pressure (MIP) despite similar diaphragmatic thickening fraction in both the arms suggests extradiaphragmatic pathologies. The change in MIP reflects the

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cumulative pathologies of the lung, pleura, diaphragm, chest wall, and abdomen. The MIP is effort-dependent, and it represents the combined power generated by the inspiratory muscles, including diaphragmatic contraction. Therefore, MIP measurement as a tool to assess and follow diaphragmatic contractility is limited (5). The diaphragmatic muscle weakness could be best assessed by the regional (subdiaphragmatic) change in inspiratory pleural pressure. Moreover, twitch transdiaphragmatic pressure (difference in gastric and esophageal pressures) in response to electrical or magnetic phrenic nerve stimulation can best assess the extent of diaphragmatic dysfunction.

Half of the patients were tracheostomized, and liberation from mechanical ventilation in these patients could be less challenging than in those who were intubated (6). And weaning from ventilation in patients who are endotracheally intubated involves both liberation from ventilation and successful extubation. Moreover, respiratory load and work of breathing have been reported to be lower in patients who are tracheostomized than endotracheally intubated. The clinical predictors and severity of pathologies are generally different between patients who are tracheostomized and endotracheally intubated. Therefore, these two clinical phenotypes require a separate analysis to assess the effect of phrenic nerve stimulation. In conclusion, considerable heterogeneity in the study population seemed to influence the finding and interpretation of this study. ■

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References

1. Dres M, de Abreu MG, Merdji H, Müller-Redetzky H, Dellweg D, Randerath WJ, *et al.*; RESCUE-2 Study Group Investigators. Randomized clinical study of temporary transvenous phrenic nerve stimulation in difficult-to-wean patients. *Am J Respir Crit Care Med* 2022;205:1169–1178.
2. Wawrzeniak IC, Regina Rios Vieira S, Almeida Victorino J. Weaning from mechanical ventilation in ARDS: aspects to think about for better understanding, evaluation, and management. *BioMed Res Int* 2018; 2018:5423639.
3. Haji K, Haji D, Canty DJ, Royse AG, Green C, Royse CF. The impact of heart, lung and diaphragmatic ultrasound on prediction of failed extubation from mechanical ventilation in critically ill patients: a prospective observational pilot study. *Crit Ultrasound J* 2018;10:13.
4. Adamo M, Alos B, Metra M, Lefèvre T, Swaans MJ, Gheorghe L, *et al.* Patient with heart failure: importance to treat valvular diseases. *Eur Heart J Suppl* 2020;22:P38–P41.
5. Aldrich TK, Spiro P. Maximal inspiratory pressure: does reproducibility indicate full effort? *Thorax* 1995;50:40–43.
6. Lin WC, Chen CW, Wang JD, Tsai LM. Is tracheostomy a better choice than translaryngeal intubation for critically ill patients requiring mechanical ventilation for more than 14 days? A comparison of short-term outcomes. *BMC Anesthesiol* 2015;15:181.

Reply to Jha

From the Authors:

We thank Dr. Jha for his reading of our study (1) and for his valuable and insightful comments. We wish to address some of the comments made by Dr. Jha.

First, Dr. Jha points out that our exclusion criteria did not mention risk factors for failure of liberation from mechanical ventilation. However, we would like to stress that patients with overt congestive heart failure at the time of liberation from mechanical ventilation could not be enrolled until clinicians estimated that another reason might explain weaning failure. In our study, we purposely did not select patients on the basis of the presence of diaphragm function, for two reasons: first, it has been established that diaphragm dysfunction is present in a majority of patients at the time of liberation from mechanical ventilation (2), and second, liberation from ventilation depends on the balance of respiratory muscle load and capacity, and any improvement in diaphragm function is likely to facilitate safe extubation despite the lack of severe diaphragm dysfunction. Dr. Jha mentions that "differential distribution of lung collapse, atelectasis, lung fibrosis, diastolic dysfunction and pulmonary hypertension in the control and treatment arm could have affected the outcomes." In addition, Dr. Jha notes that in our study, there were several risk factors for diastolic dysfunction. We completely agree with this comment, and we believe that the randomization process was the best way to allocate equal proportions of patients with lung and cardiac diseases to the treatment and control groups. We also agree with Dr. Jha that lung ultrasound–based aeration score and echocardiography are interesting tools in this context, as reported in a recent study from our group (3). However, in our multicenter study, it was not deemed feasible to ask investigators to perform echocardiography and lung ultrasound. Regarding the assessment of regional variation in aeration by electrical impedance tomography, only a few centers in the world possess this technology.

Second, Dr. Jha underlines that "patients with overt congestive heart failure were to be excluded, however, the authors reported congestive heart failure in 9% of patients and valvular heart disease in 19% of patients in the treatment arm." We would like to clarify that only patients with overt congestive heart failure at the time of eligibility screening were not enrolled, but if clinicians could deal with fluid overload, patients were reassessed and eventually included despite the presence of chronic heart disease. We do not see any reason that would have required the exclusion of patients with chronic heart disease from our study. Indeed, we believe that the opposite would have been unethical.

Third, we appreciate the Dr. Jha's physiological description of maximum inspiratory pressure. We share his interpretation regarding the recruitment of extradiaphragmatic inspiratory muscles in the generation of maximal inspiratory pressure. As reported in several

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