Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

anonymously through the Qualtrics survey system of New York University Langone Health. The survey was distributed two more times and was closed on May 28, 2020. This survey study was exempted by the institutional review board.

The results from 165 respondents are presented in Table 1; 91.2% of respondents had a preoperative anesthesia testing clinic (PAT). Only 3.9% of institutions had sex-specific workup algorithms prior to cardiac surgery; in 13.2% of all institutions, women were sent to a PAT clinic as they were considered high risk. Sex-incorporating scoring systems such as the European System for Cardiac Operative Risk Evaluation, Society of Thoracic Surgeons Score and CHA_2DS_2-VASc score were used at 20.5%, 57.6%, and 21.2%, respectively, although 32.4% of all centers did not use any scoring system. A total of 17.2% of the results of screening studies likely led to additional steps to optimize the patients. Although 78.7% of anesthesiologists deferred surgery <25% of the time, 21.3% of them had ≥25% postponement rate. The main reason (88.8%) for canceling surgery was not the need of further testing.

This survey also allowed respondents to leave comments regarding additional testing and optimization strategies for female cardiac surgical patients at their centers. From most of the responses, there were no differences of preoperative evaluation and preparation between sex; surprisingly, large numbers of anesthesiologists mentioned that they were not aware of the impact risk of sex in cardiovascular surgery. Some institutions also bypassed a PAT clinic according to their protocols since screening was done by cardiologists and surgeons.

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Danop Nanegrungsunk, MD*,†
Shayna Patel, MD*
Thomas Jan, MD/MPH*
Jennie Y. Ngai, MD*

*Department of Anesthesiology, Perioperative Care, and Pain Medicine at NYU Grossman School of Medicine, New York, NY
†Department of Anesthesiology at the University of Illinois College of Medicine, Chicago, IL

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Right Ventricular Dysfunction in COVID-19 ECMO—A Red Herring or the Real Deal?

To the Editor:

The morphologic and functional changes to the right ventricle seen in patients with coronavirus disease 2019–related acute respiratory distress syndrome (COVID-19 ARDS) requiring venovenous extracorporeal membrane oxygenation (VV-EMCO) are not well-understood. We read with interest the recent study by Lazzeri et al.[1] describing a single-center case series of 35 consecutive patients requiring VV-ECMO for COVID-19 ARDS. We commend the authors for describing the temporal course of right ventricular dysfunction during VV-ECMO therapy for COVID-19 ARDS. A key strength of their study was the use of serial echocardiograms performed before, during, and after VV-ECMO implantation. The study provided important insight to evolution of right ventricular dysfunction in COVID-19 ARDS with and without VV-ECMO.

Our group's own pilot study[2] also explored this same phenomenon. We found that performing point-of-care ultrasound examinations to evaluate right ventricular function in COVID-19 ARDS patients on VV-ECMO is feasible and reproducible. As noted by Lazzeri et al., our study was limited by the lack of serial echocardiographic assessments. However, the authors' own study also had an important limitation; namely, only using three echocardiographic parameters to describe the right ventricle: right ventricular end-diastolic area, right ventricular-to-left ventricular end-diastolic area ratio, and tricuspid annular plane excursion (TAPSE). Considering the extensive list of echocardiographic indices for right ventricular function, the question arises which measurements yield the most predictive information in a given clinical setting. Recommended right ventricle size evaluation includes right ventricle basal, mid-chamber, and longitudinal end-diastolic diameters obtained from the four-chamber right ventricle–focused view; however, the right ventricular-to-left ventricular end-diastolic area ratio is not routinely used.[3] Additionally, TAPSE is only one of the currently recommended measurements used to describe right ventricular function. The cutoff TAPSE value of 15 mm used in the study was inconsistent with the current guideline recommendation of 17 mm.[3] As a result, the authors may have underreported less severe right ventricular dysfunction by choosing a lower-than-recommended TAPSE cutoff value. The authors could have validated their limited data by including fractional area change, systolic velocity of the lateral tricuspid annulus, three-dimensional right ventricular ejection

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fraction, and right ventricle free-wall longitudinal strain. When comparing the echocardiographic findings between our two high-volume COVID-19 ARDS ECMO centers, an abnormal TAPSE was associated more strongly with right ventricular dysfunction in Lazzeri's study than it was in ours. Interestingly, we found right ventricular free-wall longitudinal strain and fractional area change to be more sensitive than TAPSE in patients with COVID-19 ARDS on VV-ECMO. Given the propensity for right ventricular dysfunction in ARDS, predominantly secondary to high right ventricular afterload, right ventricular free-wall longitudinal strain is perhaps a better modality for assessing myocardial contractility and systolic function in this patient population, considering that it is relatively load-independent.[4]

The results of Lazzeri et al. bring us closer to understanding right ventricular pathology in patients with COVID-19 ARDS requiring VV-ECMO. The authors provided much-needed data on right ventricular function over the course of VV-ECMO therapy. They convincingly illustrated that one-half of the patients who died exhibited concomitant right ventricular failure, while survivors had reductions in pulmonary artery pressures. Additionally, as illustrated before the COVID-19 pandemic[5] and by the authors, initiation of VV-ECMO tends to improve right ventricular function, as it did in one-third of patients in this cohort within the first 24 hours of VV-ECMO therapy. Furthermore, protracted therapy with ECMO in patients with COVID-19 increases the risk of right ventricular failure development, which likely has a negative effect on mortality. The questions that remain for future study are (1) how is right ventricular function affected by prolonged VV-ECMO therapy for COVID-19 ARDS? and (2) how does right ventricular failure effect the mortality in these patients?

Conflict of Interest

None of the authors has any conflicts of interest to report.

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Rafal Kopanczyk, DO*
Nicolas Kumar, BS†
Manoj H. Iyer, MD*
Amar M. Bhatt, MD*
*Department of Anesthesiology, The Ohio State University Wexner Medical Center, Columbus, OH
†The Ohio State University College of Medicine, Columbus, OH

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The Clinical Role of Right Ventricle Changes in COVID-19 Respiratory Failure Depends on Disease Severity

To The Editor:

We read with great interest the paper by Paternoster et al.[1] addressing the prognostic role of right ventricle (RV) dysfunction in patients with COVID-19 respiratory failure. We agree with Paternoster et al.[1] that growing evidence (and the experience of our center)[2,3] indicate that the right ventricle (RV) should be the main target of the echocardiographic assessment in COVID-19 disease, including accurate measurements of its dimensions, function, and estimation of systolic pulmonary arterial pressures (sPAP). The relationship between RV dysfunction and mortality in patients with COVID-19 seems to be dependent on the severity of disease. While papers selected in the meta-analysis by Paternoster et al.[1] included heterogeneous populations, studies including only critically ill patients with COVID-19 failed to document a relationship between mortality and RV dysfunction.[4,5] Bearing in mind the complex relationship among RV dysfunction, COVID-19 disease severity, and mortality, it is important to define the clinical significance of RV changes in COVID-19 infection.

Serial echocardiography and an appreciation of the characteristic features of COVID-19–induced respiratory failure may provide insights. As discussed by Dandel[2,6] and others,[7,8] RV dilatation and dysfunction reflect and follow COVID-19–induced pulmonary thrombotic microangiopathy, a feature recognized as a characteristic pattern of COVID-19.[9,10] Thus, RV dilatation and dysfunction may be considered a marker of COVID-19 disease severity but may not fully explain why these changes are not directly related to mortality, especially in critically ill patients.[4,5] In contrast, RV dilatation is known to adversely affect prognosis in adult respiratory distress syndrome resulting from other causes.[11,12]

COVID-19–related respiratory changes also demonstrate atypical heart-lung interactions. The relationship between the RV and the pulmonary vasculature in COVID-19 respiratory failure is emphasized by the role of echocardiographic indices of coupling between RV function and pulmonary circulation as prognostic indicators, such as the tricuspid annular plane

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