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.

Letter to the Editor

Patterns of Use of Temporary Mechanical Circulatory Support as a Bridge to Transplant During the Coronavirus Disease 2019 Pandemic

To the Editor:

Since the implementation of the new donor heart allocation system in October 2018, the proportion of patients bridged with temporary mechanical circulatory support has increased drastically.[1] In particular, the use of extracorporeal membrane oxygenation (ECMO) and intra-aortic balloon pump (IABP) as a bridge to transplant (BTT) has nearly quadrupled. However, in January 2020, the first case of coronavirus disease 2019 (COVID−19) was reported in the United States and has since given rise to an unprecedented pandemic.[2] Notably, this pandemic has had a substantial impact on all aspects of heart transplantation,[3] with the use of active waitlist status for those in most dire condition. We sought to elucidate the temporal patterns of ECMO and IABP use as a BTT after the implementation of the new donor heart allocation system and the emergence of the COVID−19 pandemic.

The United Network for Organ Sharing database was queried for all adult single-organ first-time heart transplants occurring between January 2014 and May 2020. An interrupted time-series analysis was performed to evaluate trends concerning ECMO and IABP as a BTT. ECMO and IABP were considered a BTT if the recipient was supported by the device at the time of transplantation. Four time periods were defined as (1) the system before the publication of the new system in August 2016 ($n = 5673$); (2) publication of the new system before the implementation in October 2018 ($n = 5407$); (3) implementation of the new system before the appearance of COVID−19 in January 2020 ($n = 3097$); and (4) COVID−19 ($n = 880$). Months with significant events were included as transition periods. This study was deemed exempt from institutional review board review because the United Network for Organ Sharing database is publicly available and contains deidentified data. Analysis was performed using the Stata version 16 (College Station, TX) ITSA command to quantify the effect of significant events on the percentage of patients bridged to transplant with ECMO and IABP.[4] A P value of $<.05$ was considered statistically significant.

The percentage of patients bridged with ECMO increased from 4.42% in November 2018 to 5.94% in December 2019, whereas the percentage decreased from 3.39% in February 2020 to 1.92% in May 2020. Before publication of the new allocation system, the percentage of patients bridged with ECMO was increasing at 0.02% per month (95% confidence interval [CI] −0.003% to 0.04%, $P = .082$) with minimal decrease in slope of 0.001% per month (95% CI −0.03% to 0.03%, $P = .963$) after the publication. The slope increased significantly by 0.24% per month (95% CI 0.08%−0.41%, $P = .004$) after implementation compared with the publication period. After the beginning of the COVID−19 pandemic, the slope decreased by 0.62% per month (95% CI −0.72% to −0.51%, $P < .001$) (Fig. 1A).

The percentage of patients bridged with IABP increased from 21.0% in November 2018 to 31.5% in December 2019, and the percentage decreased from 33.1% in February 2020 to 11.5% in May 2020. Before the publication of the new allocation system, the percentage of patients supported by IABP was increasing at 0.04% per month (95% CI −0.03% to 0.11%, $P = .234$), followed by a slight decrease in slope of 0.06% per month (95% CI −0.19% to 0.06%, $P = .302$) after the new allocation system publication. The slope increased significantly after implementation of the new system by 1.15% per month (95% CI 0.58% to 1.71%, $P < .001$) compared with the period after publication. The slope decreased significantly by 5.85% per month (95% CI −7.14% to −4.55%, $P < .001$) after the beginning of the COVID−19 pandemic (Fig. 1B).

Although the percentage of patients bridged with ECMO and IABP increased as expected after the implementation of the new allocation system, these trends have reversed sharply after the emergence of the COVID−19 pandemic. The change we observe during the COVID−19 pandemic may be reflective of intensive care unit space and resource diversion toward care of patients with COVID−19 as opposed to those supported by temporary mechanical circulatory support, limited access to rapid COVID−19 testing for those supported by temporary mechanical circulatory support, and patient apprehension surrounding hospital visits during the COVID−19 pandemic, reflected in decreased rates of heart failure hospitalization with potential increase in waitlist mortality.[5,6] We expect bridging patterns to normalize after loosening of COVID−19 restrictions in line with heart failure hospitalization rates.[7]

This study contains limitations inherent to a retrospective analysis. Patterns of ECMO and IABP use in potential recipients who were listed with these devices but did not make it to transplant remain unknown. In addition, the COVID−19 pandemic has had an unequal impact on varying regions of the country, which is not reflected in this study.

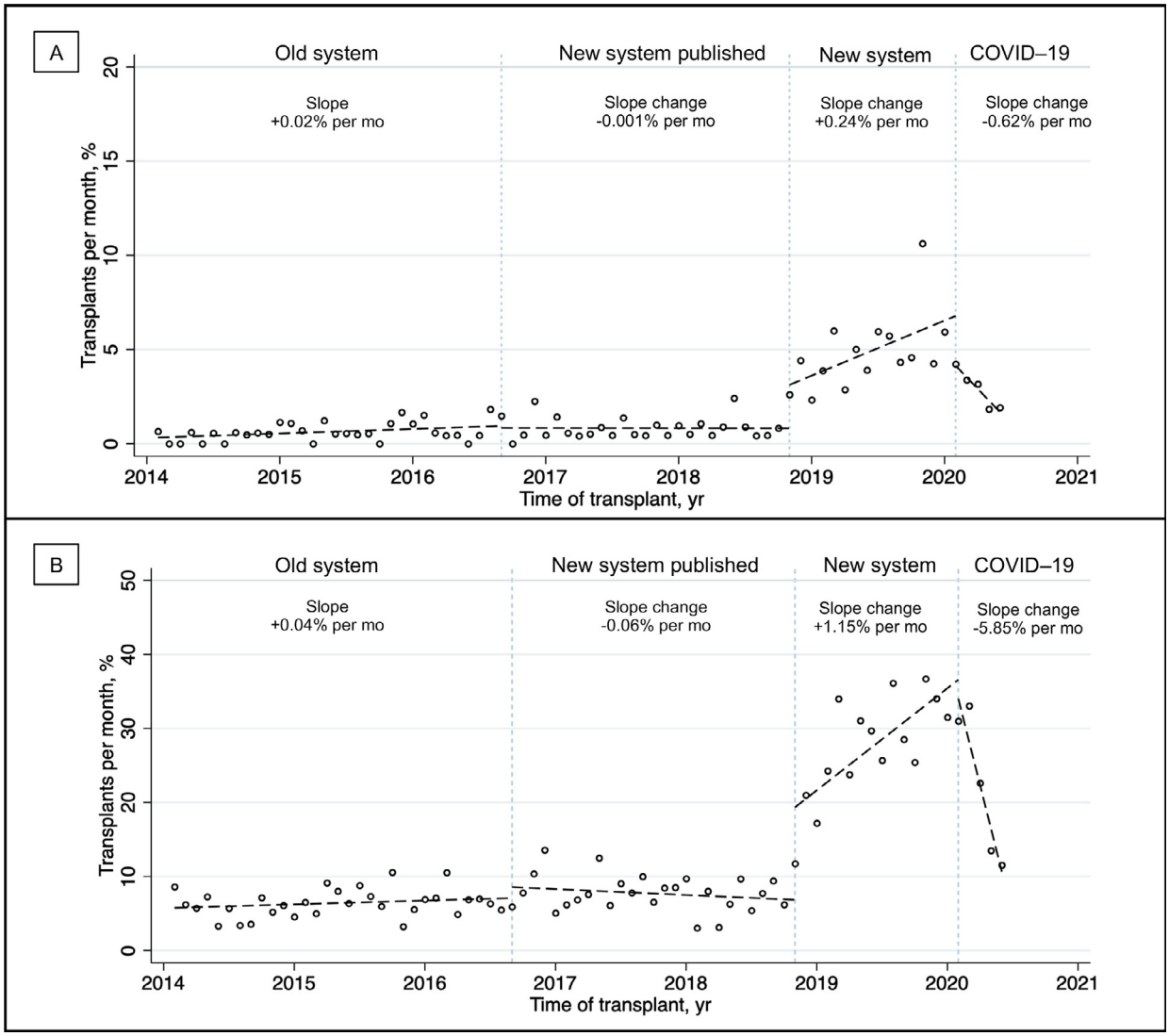

Fig. 1. Each dot represents the percentage of patients supported by ECMO (**A**) or IABP (**B**) at the time of transplant from January 1, 2014 through May 31, 2020. The monthly change in percentage of patients transplanted is displayed under the time period denoted "old system," followed by the change in monthly percentage ("slope") relative to the antecedent period for time periods denoted "New System Published," "New System," and "COVID−19." ECMO, extracorporeal membrane oxygenation; IABP, intra-aortic balloon pump; COVID−19, coronavirus disease 2019.

Disclosures

None.

Taylor Nordan, BS[1]
Gregory S. Couper, MD[1]
Frederick Y. Chen, MD, PhD[1]
Amanda Vest, MBBS, MPH[2]
David DeNofrio, MD[2]
Masashi Kawabori, MD[1]
[1]*Department of Cardiac Surgery, CardioVascular Center, Tufts Medical Center, Boston, Massachusetts*
[2]*Department of Cardiology, CardioVascular Center, Tufts Medical Center, Boston, Massachusetts*

References

1. Jawitz OK, Fudim M, Raman V, Bryner BS, DeVore AD, Mentz RJ, et al. Reassessing recipient mortality under the new heart allocation system: an updated UNOS registry analysis. JACC Heart Fail 2020;8:548–56. https://doi.org/10.1016/j.jchf.2020.03.010.
2. Holshue ML, DeBolt C, Lindquist S, Lofy KH, Wiesman J, Bruce H, et al. First case of 2019 novel coronavirus in the United States. N Engl J Med 2020;382:929–36. https://doi.org/10.1056/NEJMoa2001191.
3. DeFilippis EM, Sinnenberg L, Reza N, Givertz MM, Kittleson MM, Topkara VK, et al. Trends in US heart transplant waitlist activity and volume during the coronavirus disease 2019 (COVID-19) Pandemic. JAMA Cardiol 2020. https://doi.org/10.1001/jamacardio.2020.2696. Jul 22 [Epub ahead of print].

4. Linden A, Arbor A. Conducting interrupted time-series analysis for single-and multiple-group comparisons. Stata J; 2015;15: 480–500.
5. Lange SJ, Ritchey MD, Goodman AB, Dias T, Twentyman E, Fuld J, et al. Potential indirect effects of the COVID-19 pandemic on use of emergency departments for acute life-threatening conditions — United States, January−May 2020. MMWR Morb Mortal Wkly Rep 2020;69:795–800. https://doi.org/10.15585/mmwr.mm6925e2.
6. Hall ME, Vaduganathan M, Khan MS, Papadimitriou L, Long RC, Hernandez GA, et al. Reductions in heart failure hospitalizations during the COVID-19 pandemic. J Card Fail 2020;26:462–3. https://doi.org/10.1016/j.cardfail.2020.05.005.
7. Ling H, Fudim M, Egolum UO. Lifting COVID-19 shelter-in-place restrictions: impact on heart failure hospitalizations in northeast Georgia. J Card Fail 2020. https://doi.org/10.1016/j.cardfail.2020.07.017. Aug 2 [Epub ahead of print].

https://doi.org/10.1016/j.cardfail.2020.09.004