

LETTER

Open Access



# Confounding variables impacting the association between duration of veno-arterial extracorporeal life support and mortality

Jesse Kiefer<sup>1</sup> and Robert E. Freundlich<sup>2\*</sup>

See related research by Smith et al., <https://ccforum.biomedcentral.com/articles/10.1186/s13054-017-1633-1>

## Main Text

We read with great interest the analysis by Smith et al. [1] on the correlation between duration of veno-arterial extracorporeal life support (VA-ECMO) and outcomes, using data from the extracorporeal life support organization (ELSO). We note their finding that decannulation at day four of VA-ECMO is associated with the highest percentage of patients surviving.

While this is the largest analysis of VA-ECMO duration to date, it is limited by use of a retrospective database that appears to offer inadequate detail on cannulation strategies. As with any multivariate logistic regression performed on an observational dataset, the results need to be interpreted in the context of availability of adequate data on confounding variables. We would argue that cannulation site,

whether central cannulation or peripheral cannulation, is a significant confounding variable when assessing survival on VA-ECMO [2]. Similarly, strategies to decompress the left ventricle are critical in optimizing survival on VA-ECMO. Techniques such as left ventricular venting, intra-aortic balloon pump placement, or the Impella<sup>®</sup> (Abiomed, Danvers, MA) are commonly employed in this setting and should be accounted for in the statistical analysis [3].

We would encourage the ELSO group to work to improve data collection around the use of these techniques, to facilitate improved statistical analysis and a better understanding of the implications of placing patients on VA-ECMO for prolonged periods of time.

## Authors' response

Myles Smith<sup>1</sup>, Daniel Brodie<sup>4</sup>, Ravi Thiagarajan<sup>2</sup> and Hergen Buscher<sup>2,3</sup>

<sup>1</sup>St Vincent's Hospital, Department of Intensive Care Medicine, Sydney, Australia

<sup>2</sup>Extracorporeal Life Support Organization (ELSO), Ann Arbor, USA

<sup>3</sup>University of New South Wales, Sydney, Australia

<sup>4</sup>Columbia University Medical Center/NewYork-Presbyterian Hospital, New York, USA

We thank Drs. Kiefer and Freundlich, who correctly comment that any retrospective analysis of a database, such as the ELSO registry, is limited by the persistence of confounding variables. We agree that cannulation

strategy, as well as other techniques mentioned, such as left ventricular venting and intra-aortic balloon pump placement, may have an impact on both treatment duration and survival.

While the ELSO registry allows for collection of many disease-, patient-, and treatment-related variables [4], we had to focus on key covariates that were anticipated to occur commonly and influence duration and survival.

\* Correspondence: [Robert.e.freundlich@vanderbilt.edu](mailto:Robert.e.freundlich@vanderbilt.edu)

<sup>2</sup>Department of Anesthesiology, Division of Anesthesia Critical Care, Vanderbilt University Medical Center, 1211 21st Avenue South, MAB Suite 526, Nashville, TN 37232, USA

Full list of author information is available at the end of the article



While cannulation site data may be available from the data collected, use of other devices to “vent” the left ventricle or facilitate weaning is not (other than a statement on whether the patient was “converted to other support”). There is a challenge for data collection to be both complete and standardized. Currently, there is no agreed upon standard of care for the use of venting, new approaches to venting are reported frequently, and new devices are being introduced. We agree that this should be a focus of further research, in particular to delineate the role of left ventricular decompression for which a variety of strategies are reported with only few reports to date on their effect on duration and outcome [5, 6].

#### Abbreviations

ELSO: Extracorporeal life support organization; VA-ECMO: Veno-arterial extracorporeal life support

#### Acknowledgements

None.

#### Funding

Departmental support.

#### Availability of data and materials

Not applicable.

#### Authors' contributions

Substantial contributions to the conception or design of the work : REF and JJK. Drafting the work: JJK. Revising the work critically for intellectual content: REF. Final approval of the version to be published: REF and JJK. Agreement to be accountable for all aspects of the work related to integrity and accuracy: REF and JJK. All authors read and approved the final manuscript.

#### Ethics approval and consent to participate

Not applicable.

#### Consent for publication

Not applicable.

#### Competing interests

The authors declare that they have no competing interests.

#### Publisher's Note

Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

#### Author details

<sup>1</sup>Department of Anesthesiology, Division of Anesthesia Critical Care, Vanderbilt University Medical Center, Nashville, TN, USA. <sup>2</sup>Department of Anesthesiology, Division of Anesthesia Critical Care, Vanderbilt University Medical Center, 1211 21st Avenue South, MAB Suite 526, Nashville, TN 37232, USA.

Published online: 01 August 2017

#### References

- Smith M, Vukomanovic A, Brodie D, Thiagarajan R, Rycus P, Buscher H. Duration of veno-arterial extracorporeal life support (VA ECMO) and outcome: an analysis of the Extracorporeal Life Support Organization (ELSO) registry. *Crit Care*. 2017;21(1):45.
- Jayaraman AL, Cormican D, Shah P, Ramakrishna H. Cannulation strategies in adult veno-arterial and veno-venous extracorporeal membrane oxygenation: techniques, limitations, and special considerations. *Ann Card Anaesth*. 2017;20(Supplement):S11–8.

- Pujara D, Sandoval E, Simpson L, Mallidi HR, Singh SK. The state of the art in extracorporeal membrane oxygenation. *Semin Thorac Cardiovasc Surg*. 2015;27(1):17–23.
- Extracorporeal Life Support Organization. ECMO and ECLS Registry. 2017. <https://www.elseo.org/Registry.aspx>. Accessed 19 May 2017.
- Truby LK, Takeda K, Mauro C, Yuzefpolskaya M, Garan AR, Kirtane AJ, Topkara VK, Abrams D, Brodie D, Colombo PC, Naka Y, Takayama H. Incidence and implications of left ventricular distention during venoarterial extracorporeal membrane oxygenation support. *ASAIO J*. 2017;63(3):257–65.
- Alkhouli M, Narins CR, Lehoux J, Knight PA, Waits B, Ling FS. Percutaneous decompression of the left ventricle in cardiogenic shock patients on venoarterial extracorporeal membrane oxygenation. *J Card Surg*. 2016;31(3):177–82.