MATTERS ARISING

Analysis of static parameters in retrospective studies: limitations and interpretation

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To the Editor,

We read with great interest the recent study [1] by Dr. McGuigan et al. A total of 32,349 patients after cardiac arrest were included, and both the lowest and highest mean arterial pressure (MAP) and systolic blood pressure (SBP) were analyzed. According to the results from restricted cubic splines analysis, they reported nonlinear associations between MAP and mortality: the lowest MAP within the 60–63 mmHg range had the lowest mortality and the highest MAP within the 95–104 mmHg range had the lowest mortality. A similar pattern was also found for SBP.

The strength of the current study is the large sample size and statistically stable non-linear associations using restricted cubic splines analysis. This study is well designed. However, several limitations should be noted. First, unlike laboratory indexes, physiological parameters such as MAP, heart rate, and respiratory rate are recorded continuously in critical care, and some extreme values are very susceptible to interference by various factors. For instance, some common procedures in the critical care unit, such as sputum aspiration or various catheter catheterizations, often lead to transit but rapid increases in blood pressure. Meanwhile, other situations, such as artery catheter distortion and excessive use of

sedatives, can also lead to transit but low blood pressure records. Therefore, static extreme MAP values (both lowest and highest) are not enough to accurately reflect the actual "long-term" blood pressure in critically ill patients. This may be the main difference between randomized trials [2] and retrospective studies, as blood pressure is often not under intensive control, and the variability is often large in retrospective design, which may also be the reason for these different findings [1, 2]. However, for critically ill patients, blood pressure during most of the time, rather than some extreme static MAP, may be more relevant to prognosis.

Second, in the current study, the lowest and highest MAP were analyzed using restricted cubic splines analysis, and both the lowest MAP in the range of 60–63 mmHg and the highest MAP in the range of 95–104 mmHg had the lowest associated mortality. The statistical results were stable. However, the interpretation is a little confusing. For instance, according to the result of the lowest MAP, the lowest MAP higher than 63 mmHg was associated with high mortality. However, according to the result of the highest MAP, the highest MAP lower than 95 mmHg was also associated with high mortality. Then for a patient with MAP ranging from 75 to 80 mmHg, what should we do [3]? Of course, we agree with the authors' opinion that due to the retrospective nature, the causal relationship cannot be inferred. We suggest more trials are needed to explore the "real" threshold of MAP in patients after cardiac arrest [4].

Finally, this study contributed greatly to the threshold of MAP in patients after cardiac arrest, and this work is very much appreciated!

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Author contributions
Y.S. raised the question and wrote the letter.

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Not applicable.

Declarations

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Not applicable.

Consent for publication
Not applicable.

Competing interests
None.

References
1. McGuigan PJ, Giallongo E, Blackwood B, Doidge J, Harrison DA, Nichol AD, Rowan KM, Shankar-Hari M, Skrifvars MB, Thomas K, et al. The effect of blood pressure on mortality following out-of-hospital cardiac arrest: a retrospective cohort study of the United Kingdom Intensive Care National Audit and Research Centre database. Crit Care. 2023;27(1):4.
2. Ameloot K, De Deyne C, Eertmans W, Ferdinande B, Dupont M, Palmers PJ, Petit T, Nuyens P, Maeremans J, Vundelinckx J, et al. Early goal-directed haemodynamic optimization of cerebral oxygenation in comatose survivors after cardiac arrest: the Neuroprotect post-cardiac arrest trial. Eur Heart J. 2019;40(22):1804–14.
3. Skrifvars MB, Ameloot K, Aneman A. Blood pressure targets and management during post-cardiac arrest care. Resuscitation. 2023;189: 109886.
4. Abuelazm M, Ali S, Mahmoud A, Mechi A, Kadhim H, Katamesh BE, Elzeftawy MA, Ibrahim AA, Abdelazeem B. High versus low mean arterial pressure targets after out-of-hospital cardiac arrest: A systematic review and meta-analysis of randomized controlled trials. J Crit Care. 2023;78: 154365.