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Extracorporeal cardiopulmonary resuscitation for out-of-hospital cardiac arrest and in-hospital cardiac arrest with return of spontaneous circulation: be careful when comparing apples to oranges

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Extracorporeal membrane oxygenation (ECMO) is a resource-intensive and costly form of life support that is increasingly being applied to complex patients with cardiac arrest, now referred to as extracorporeal cardiopulmonary resuscitation (ECPR) [1]. The decision to use ECPR in patients with cardiac arrest is still made on a case-by-case basis, but initiation criteria vary among clinicians, institutions, and regions. Neurological outcomes after ECPR are among the most important outcomes, and a tool that is simple, quick, and utilizes readily available clinical information to predict the likelihood of various neurological outcomes could be extremely beneficial in the care of potential ECPR candidates [2]. However, current tools for predicting neurologic outcomes lack sufficient evidence for use in individual patients and need to be validated in patients with cardiac arrest [3-6].

In this issue of *Acute and Critical Care*, Lee et al. [7] investigated the ability of the respiratory quotient (RQ) measured within the first 24 hours after ECPR to predict neurological outcomes. The study included a relatively large and mixed population of in-hospital and out-of-hospital cardiac arrest (IHCA and OHCA) ECPR cases (a total of 155 participants) from a tertiary referral hospital in South Korea, spanning a period of 17 years. The research incorporated clinical variables collected within 24 hours following ECPR. Although the RQ was higher than the normal value in ECPR patients, it was not found to be associated with poor neurological outcomes.

The primary strengths of this study include its relatively large cohort of ECPR patients, the simplicity and ease of collecting variables, the inclusion of any patient on ECPR regardless of indication, and the more detailed data on RQ, which has been studied in many other fields, but not in this context. The significant risk factors associated with poor neurological outcomes in this study were age, CPR to pump-on time, and serum lactate levels above 7.1 mmol/L. Interestingly, initial lactate levels were lower than those reported in the largest randomized population to date, which may reflect the high percentage of patients who achieved return of spontaneous circulation before ECMO cannulation [3]. The authors hypothesized that

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patients with ECPR and poor neurological outcomes would tend to be older, have longer CPR to pump-on times, have a higher proportion of OHCAs, have more comorbidities such as hypertension and coronary artery disease, and have higher initial Sequential Organ Failure Assessment (SOFA) scores. However, this may not be true for different types of ECPR populations, particularly when comparing OHCA and IHCA cases. Among hypoxia parameters (e.g., RQ, venous-arterial difference in CO_2 tension, and serum lactate), lactate had the highest predictive power, which may warrant further discussion. The authors correctly emphasized that RQ was inferior to lactate in predicting poor neurological outcomes in patients who received ECPR in this study. They explained this finding by noting that blood gas measurements may be influenced by sweep gas and ECMO flow rates. The study incorporated data gathered over an extended period and did not include a group of patients who received support without ECMO, which may limit the study's power. Additional limitations encompass selection bias, the retrospective observational study design, and the exclusion of other centers from the study. A notably high percentage of patients (approximately 60%) experienced poor neurological outcomes, corroborating the earlier observation that this population does not constitute a true ECPR cohort, defined as those receiving implantation during ongoing chest compressions. As a result, the findings of this study may not be directly applicable to all ECPR patients.

The study by Lee et al. [7] identified several risk factors associated with poor neurological outcomes in patients undergoing ECPR, regardless of the underlying disease. Although the authors investigated a relatively novel variable (RQ) in ECPR patients, it was found to be less predictive than serum lactate levels. Nevertheless, the authors should be commended for providing a valuable stepping stone for predicting neurological outcomes, as their work helps to objectively quantify the risks and benefits of initiating ECMO versus continuing conventional care for individual patients.

CONFLICT OF INTEREST

No potential conflict of interest relevant to this article was reported.

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